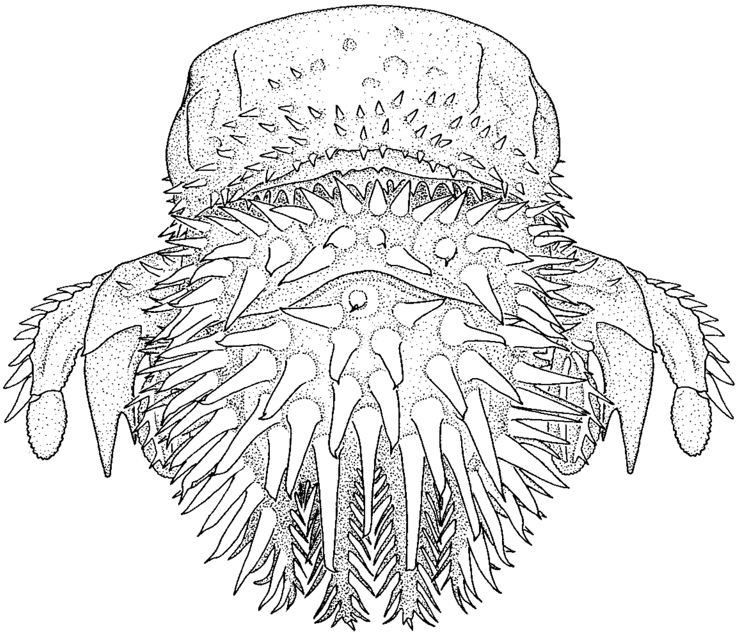

Revision of the Australian Stomatopod Crustacea

by

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ABSTRACT. The Australian Stomatopod fauna is comprehensively revised. Two new genera, *Belosquilla* and *Quollastria*, are recognized. Seventy-two species are newly reported from Australia, of which 26 are described as new. Bathysquilloidea is represented by 2 genera and 3 species; Erythrosquilloidea by 1 genus and species; Eurysquilloidea by 5 genera and 8 species; Gonodactyloidea by 15 genera and 46 species; Lysiosquilloidea by 13 genera and 26 species; Parasquilloidea by 2 genera and 3 species; and Squilloidea by 25 genera and 59 species. Harpiosquillidae is synonymized with Squillidae. *Gonodactylinus* is synonymized with *Gonodactylellus, Keijia* with *Carinosquilla, Raoulius* with *Odontodactylus, Laevosquilla* with *Siamosquilla* and *Toshimitsu* with *Lophosquilla*. The results of the present study double the known stomatopod fauna of Australian waters, now totalling 146 species and 63 genera, in 7 superfamilies and 14 families—about 50% of species and almost 74% of genera from the Indo-West Pacific. Forty-six species (32% of the Australian fauna) are presently known only from Australia. Species richness and abundance of the Australian fauna is likely to be much greater than that implied by the composition of existing collections. Many habitats remain to be specifically targeted for stomatopods and future sampling will likely yield many more species from Australia. All Australian species are illustrated and diagnosed. Keys to the world genera and all species in Australian genera are provided.

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Table of Contents

Introduction

The stomatopods, or mantis shrimps, are a group of at least 450 marine, predatory species. Stomatopods occur in a wide range of habitats and are common and conspicuous inhabitants of coral reefs. The common name, "mantis shrimp", is derived from the large and powerful raptorial appendages. Prey is captured by "spearing" or "smashing", depending on whether the dactyl is extended or held folded during the strike. The two methods of prey capture distinguish two broad functional groups—the "smashers" and the "spearers" (Caldwell & Dingle, 1976).

Stomatopods are commercially exploited in several parts of the world. The most important fisheries are in the Mediterranean for *Squilla mantis* (Linnaeus, 1758) and in Japan for *Oratosquilla oratoria* (de Haan, 1844). Recently, stomatopods have been found to be useful bioindicators of marine pollution stress on coral reefs (Erdmann & Caldwell, 1997; Erdmann & Sisovann, 1998), adding impetus to understand the taxonomy and systematics.

Like most other invertebrate groups, the diversity of the stomatopod Crustacea is highest in the Indo-West Pacific region. Australia is uniquely positioned at the centre of the Indo-West Pacific, being flanked by the Indian Ocean in the west, the Pacific Ocean in the east, the Southern Ocean in the south, and the islands of the Indo-Malay Archipelago to the immediate north. Consequently, a substantial proportion of the Indo-West Pacific stomatopods occur around Australia. The foundations of the study of the Indo-West Pacific Stomatopoda were laid by Kemp (1913) who recognized 139 species worldwide, and 98 from the Indo-West Pacific. Studies of the Indo-West Pacific fauna since then have more than doubled the number of known species. In particular, the revisionary studies of the late Raymond B. Manning have made the most important inroads into our understanding of the Indo-West Pacific fauna through numerous works culminating in a monograph of the Vietnamese fauna (Manning, 1995). Despite the many studies of the Indo-West Pacific stomatopods of the past three decades, the fauna still cannot be considered well characterized in the same manner as the Atlantic (Manning, 1969c, 1977a) and eastern Pacific (Reaka & Manning, 1980; Hendrickx & Salgado-Barragán, 1991). Several large studies have been conducted on various regional faunas in the Indo-West Pacific (e.g., Kemp, 1913; Holthuis, 1967a; Moosa, 1986, 1991; Manning, 1995), but few studies based on large collections have treated the Australian fauna. The central position of Australia in the Indo-West Pacific region, coupled with relatively large available collections means that revision of the Australian fauna is critical to revision of the Indo-West Pacific Stomatopoda as a whole.

Previous studies of the Australian Stomatopoda. Historically, the Australian Stomatopoda has received relatively little attention. Hess (1865), Miers (1880), Tate (1883), Brooks (1886), Pocock (1893), Alexander (1916a,b), Hale (1924, 1927a) and Serène (1952) each treated small collections made in Australian waters. The most important studies of the Australian stomatopods are those of Stephenson (1952, 1953a,b, 1955, 1960, 1962, 1967), Stephenson & McNeill (1955) and Manning (1966). Stephenson & McNeill (1955) summarized what was then known about the mainland Australian stomatopod fauna, and Manning (1966) provided a complementary taxonomic study based on collections made by the 1909–1914 FIS Endeavour Expedition. Although Kemp (1913) reported only 16 species from mainland Australia, Stephenson & McNeill (1955) reported 41 species, and the number of species was expanded to 48 by Manning (1966). Additionally, stomatopods from two Australian Territories in the

Indian Ocean, Christmas Island and the Cocos-Keeling Islands, were reported by Tweedie (1950), Gordon (1935) and Stephenson (1962). Since 1966, the following studies listed, or included stomatopods from Australia bringing the number of known Australian species to 74: Stephenson (1967), Manning (1967c, 1969b, 1970c), Kunze (1981), Manning (1984a), Bruce (1985, 1986), Reaka & Manning (1987), Bruce (1988), Graham *et al*. (1993a,b), Ahyong & Norrington (1997), Ahyong (1998), Ahyong & Manning (1998), Ahyong *et al*. (1998), Erdmann & Manning (1998), Ahyong (2000a), Ahyong, Chan & Liao (2000), Ahyong, Manning & Reed (2000), Ahyong & Naiyanetr (2000).

Unfortunately, major Australian collections have not been studied since Stephenson & McNeill (1955) and Manning (1966). Taxonomic revision of the Australian stomatopods has long been required, and is initiated here.

The Australian stomatopod fauna comprises at least 146 species in 63 genera, constituting more than half of the Indo-West Pacific species and approximately 74% of the Indo-West Pacific genera. Revision of the Australian fauna has necessitated re-evaluation of the majority of Indo-West Pacific species including those not represented in the study area. Therefore, the present study serves not only as a revision of the Australian fauna, but also as a partial revision of the Indo-West Pacific genera and an identification guide to a major proportion of the known species in the region.

Phylogeny and classification. The classification used here differs from recently published classifications (e.g., Manning, 1980b, 1995). The most important differences between the present and previous classifications are to the families and superfamilies as proposed by Ahyong & Harling (2000). Two families previously placed in the Gonodactyloidea, Eurysquillidae and Parasquillidae, were each referred to separate superfamilies, and Heterosquillidae was synonymized with Tetrasquillidae. Additionally, Harpiosquillidae is synonymized with Squillidae based on a cladistic analysis of all squilloid genera (Ahyong, in prep.). Relationships between the extant families of the Stomatopoda based on the results of Ahyong & Harling (2000) are shown in Fig. 1.

Materials and methods

All stomatopod species known from Australian territorial waters, including Christmas Island and the Cocos-Keeling Islands, are described and illustrated using Australian material (except for the holotype of *Erythrosquilla hamano* from Japan). The colour in life or preserved pattern is described if known for Australian material. The present study includes keys to all extant stomatopod genera, and as a minimum, keys to all species of genera represented in Australian waters. In all keys, taxa known from Australian waters are marked in bold. Synonymies are necessarily incomplete and are generally restricted to original citations, primary synonyms, major revisions and pertinent regional works. Under the account of each genus, a list of included species and their respective authors is given. Therefore, species authorities are not generally given elsewhere during discussion. New or poorly known species are diagnosed and fully described. Physical limitations preclude inclusion of full descriptions of other species; these are treated by an expanded diagnosis. In the case of monotypic genera, a brief diagnosis is given for the genus followed by a supplementary diagnosis under the species account. Inasmuch as the present work is fundamentally taxonomic and directed towards identification of taxa, descriptive accounts include a combination of apomorphies and plesiomorphies.

Sources of specimens. Stomatopods in the collections Australian museums were comprehensively or near comprehensively studied in addition to material held overseas. Where possible, type or topotypic specimens were also studied. Of special note are large collections of Stomatopoda from the Gulf of Carpentaria and New South Wales made by Ted Wassenberg (CSIRO, Cleveland) and Ken Graham (NSW Fisheries) respectively; these collections both contributed numerous new distribution records and new species. Specimens collected by Graham and Wassenberg are deposited in the collections of the Australian Museum and Queensland Museum. More than 4000 specimens were examined for the present study and they are deposited in institutions listed below.

AM	Australian Museum, Sydney
BNM	Beijing Natural History Museum, Beijing, China
CAS	Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China
CUMZ	Chulalongkorn University Museum of Zoology, Bangkok
MM	Macleay Museum, University of Sydney, Sydney
MNHN	Muséum national d'Histoire naturelle, Paris
MZC	University Museum of Zoology, Cambridge, England
NHM	Natural History Museum, London
NMV	Museum Victoria, Melbourne
NNM	National Natuurhistorisch Museum, Leiden
NSMT	National Science Museum, Tokyo
NTM	Northern Territory Museum of Arts & Sciences, Darwin
NTOU	National Taiwan Ocean University, Keelung
QM	Queensland Museum, Brisbane
RLC	R.L. Caldwell Collection, University of California, Berkeley
SAM	South Australian Museum, Adelaide
SMF	Natur-Museum und Forschungsinstitut Senckenberg, Frankfurt am Main.
TM	Tasmanian Museum, Hobart
USNM	National Museum of Natural History, Smithsonian Institution, Washington D.C.
WAM	Western Australian Museum, Perth
ZMA	Zoologisch Museum, Amsterdam
ZMB	Zoologisches Museum an der Humboldt-Universität, Berlin
ZMH	Zoologisches Institut and Zoologisches Museum, Hamburg
ZMUC	Zoological Museum, University of Copenhagen, Copenhagen
ZRC	Zoological Reference Collection, Raffles Museum, National University of Singapore, Singapore

Measurements. All measurements are in millimetres (mm). Size descriptors are based on those used by Manning (1969c, 1978d) and Ahyong (1998), and summarized below. The

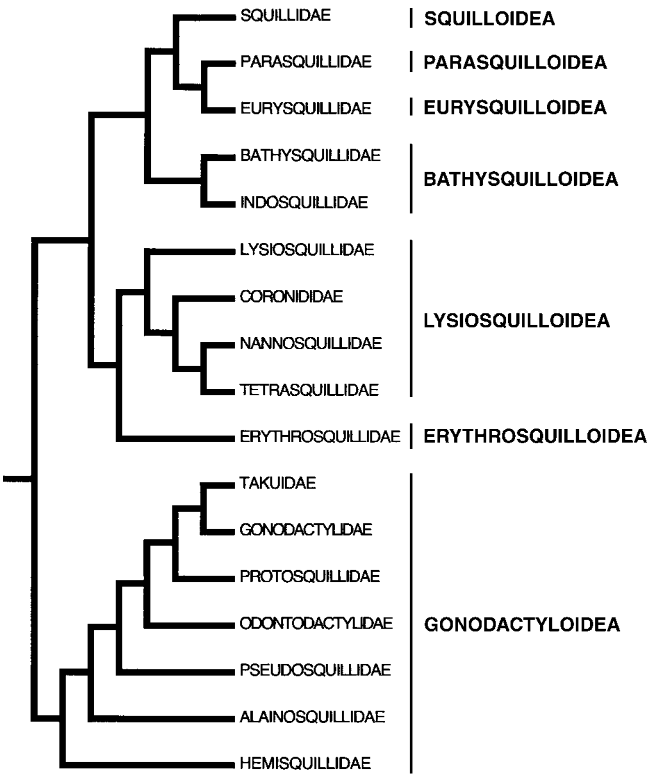

Figure 1. Phylogenetic relationships of the families of the Stomatopoda.

relative lengths of the uropodal exopod segments are useful in diagnosing some species. Measurements of the uropodal exopod segments are made along the dorsal midline between the points of articulation. The relative proportions of the uropodal endopod are measured for some lysiosquilloids and gonodactyloids. The length and width of the uropodal endopod are the greatest length and width respectively.

AW	abdominal width, measured at the widest point of the fifth abdominal somite
AWCLI	abdominal width-carapace length index, given as 100AW/CL
CI	corneal index, given as 100CL/CW
CL	carapace length, the median length of the carapace excluding the rostral plate
CW	cornea width, measured as the maximum width of the cornea
PI	propodal index, given as 100CL/PL
PD	propodus depth, where PD is the greatest depth of the propodus
PL	propodus length, measured along the opposable margin where it meets the carpus, to its distal end
PLDI	propodus length-depth index, given as 100PL/PD
TL	total length, measured from the apex of the rostral plate to the apices of the submedian teeth of the telson

Terminology. Morphological terminology generally follows Manning (1969c, 1995) and Ahyong (1998). For convenience, generalized morphological terms used in this study are illustrated in Figs. 2–4. In descriptive accounts, a "normal complement" of carinae on the carapace means that median, intermediate, lateral, marginal and reflected marginal carinae are all present on the carapace. A normal complement of carinae on the abdomen means that the first five abdominal somites (AS1–5) each bear submedian, intermediate, lateral, and marginal carinae, and on the sixth abdominal somite (AS6), submedian, intermediate and lateral carinae are present. Morphological structures are abbreviated below.

A1	antennule
A2	antenna
AS	abdominal somite
TS	thoracic somite
MXP	maxilliped
PLP	pleopod

In descriptive accounts, dorsal carinae, primary telson teeth and telson denticles are abbreviated. These abbreviations, indicated below, are used only in connection with specific morphological structures and are not equivalent to what may be connoted by more generalized or adjectival usage, e.g., "rostral plate with median spine" or "lateral lobe" on the male pleopod.

IM	intermediate
LT	lateral
MG	marginal
MD	median
SM	submedian

Spination of abdominal carinae follows a standard structure, for instance, SM 5–6, IM (2)3–6, LT 1–6, MG 1–5. This indicates that the submedian carinae are posteriorly spined on AS5–6; the intermediate carinae may or may not be spined on AS2, but are all spined on AS3–6; the lateral carinae are spined on AS1–6; and the marginal carinae are spined on AS1–5.

In squilloids, the number of denticles on the posterior margins of the telson follows a standard formula. For example, a denticular formula, SM 4, IM 5–9, LT 1, indicates that on either side of the midline there are 4 submedian denticles, 5–9 intermediate denticles, and 1 lateral denticle.

The "basal prolongation of the uropod" of Manning (1969c) is herein referred to as the uropodal protopod.

Most stomatopods bear three pairs of large teeth on the telson (submedian, intermediate, lateral) that are each intervened by rows of small denticles. The submedian, intermediate and lateral teeth of the telson are distinct in both late larvae and adults, and are collectively termed primary teeth. In some lysiosquilloids and protosquillids, an additional spine or large process may be present which is of similar size and shape to the intermediate and lateral teeth, but is derived as an outgrowth of the base of the first intermediate denticle. Thus, in taxonomic accounts, the term "primary teeth" is applied to all large teeth or processes of the telson margin despite the fact that they may not have been derived in the same way.

The denticles between the submedian and intermediate teeth of the telson are usually termed intermediate denticles. In some cases, however, incorrect homologies may be implied by applying the same term to superficially similar structures. For instance, as determined by ontogeny, lysiosquilloids and gonodactyloids have two true intermediate denticles whereas squilloids have four or more. Some lysiosquilloids (e.g., *Heterosquilloides*), however,

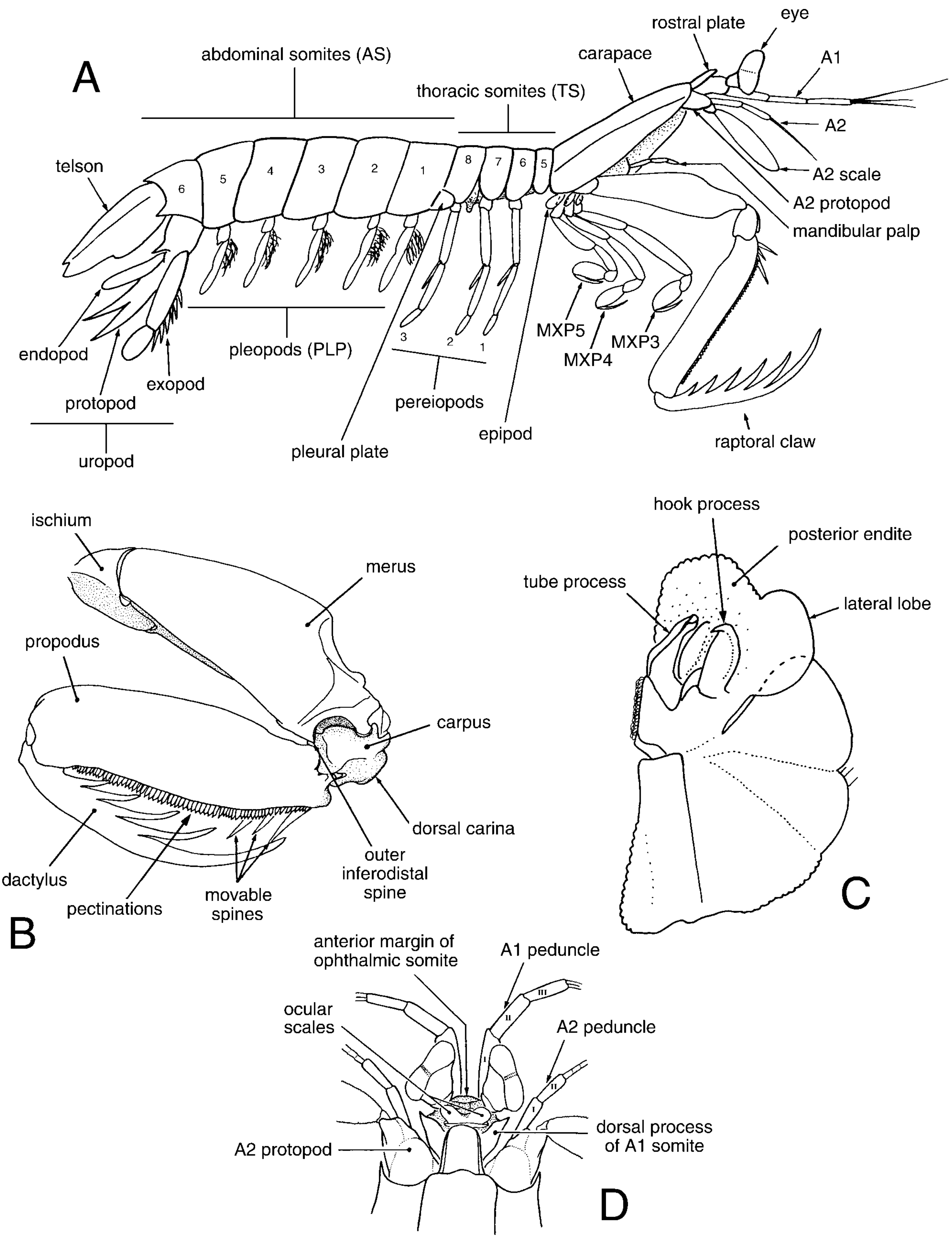

Figure 2. Morphological terms used in descriptive accounts. A, a generalized stomatopod. B, raptorial claw. C, endopod of PLP1. D, anterior cephalon.

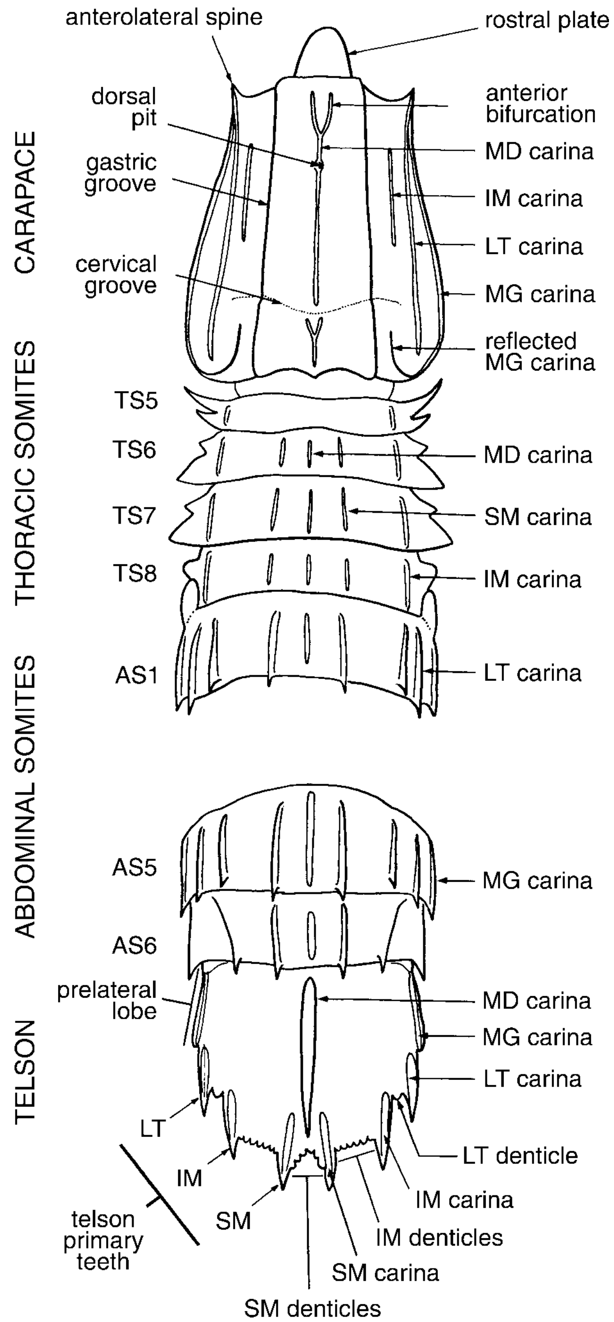

Figure 3. Carinal terminology used in descriptive accounts, principally applicable to squilloids.

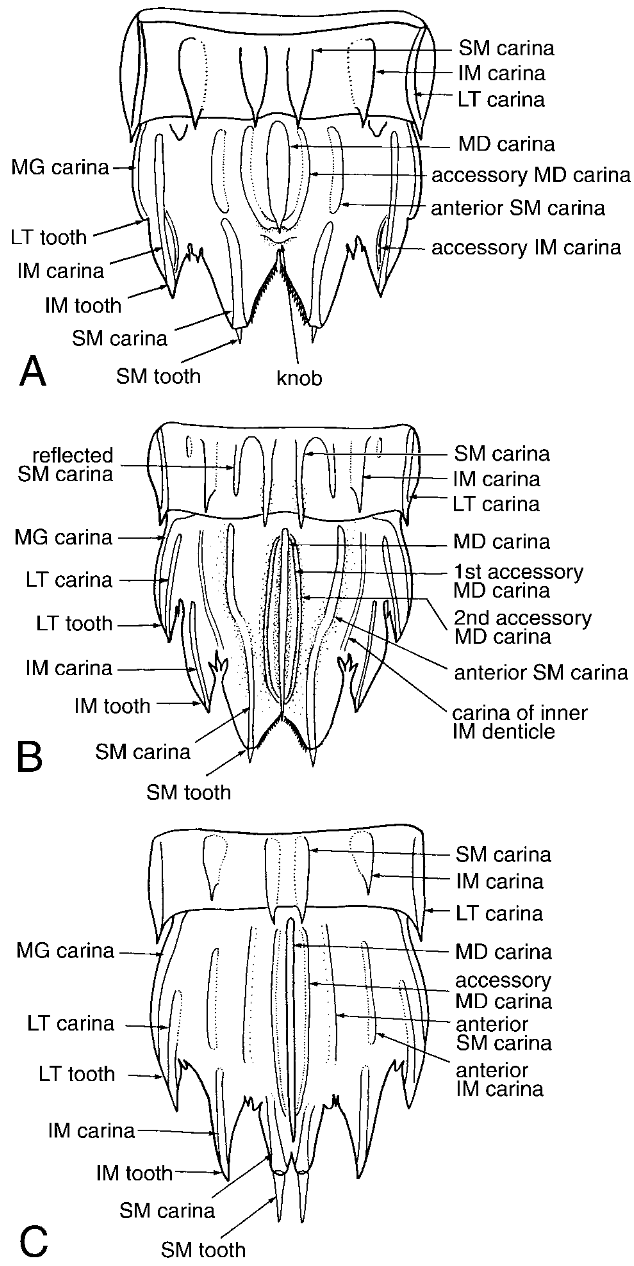

Figure 4. Terminology used in descriptive accounts for AS6 & telson. A, Gonodactylidae. B, Odontodactylidae. C, Eurysquillidae, Parasquillidae, Pseudosquillidae, Alainosquillidae and Hemisquillidae.

appear to have four intermediate denticles as in the squilloids, and one gonodactyloid (*Siamosquilla hyllebergi* Naiyanetr, 1989) appears to have three. In both cases, the additional denticles are derived from the base of the two true intermediate denticles, and are actually homologous with the additional "primary tooth" alluded to earlier, not with the squilloid condition. Consequently, in the cases where incorrect homologies may be implied, the term, intermediate denticles, is placed in inverted commas (i.e., "intermediate denticles").

Several studies (Brooks, 1886; Ingle, 1963; Ahyong, 1997a; Cappola & Manning, 1999; Ahyong & Harling, 2000) have emphasized the systematic importance of the morphology of the modified endopod of pleopod 1 in adult males—the petasma (Fig. 2C). Therefore, where males of Australian specimens were available, the petasma has been illustrated. The most important features of the petasma are flattened and elongate "tube process", a facing "hook process" and the flap-like "posterior endite". The role of the tube process is uncertain, but the hook process appears to function as a clasping device for orientation of the penes during copulation (Tirmizi & Kazmi, 1984).

Systematic account

Key to superfamilies of the Stomatopoda

1 Propodi of MXP3–4 ovate, always without distal ribbing. Point of hook on hook process of petasma acute 3

— Propodi of MXP3–4 subquadrate, broader than long, with distal ribbing (except in some genera of the Coronididae [Lysiosquilloidea]). Point of hook on hook process of petasma rounded 2

2 Telson with sharp, slender, MD carina. A1 somite dorsal processes short, anteriorly compressed, rounded laterally .... **Erythrosquilloidea**

— Telson without sharp MD carina, at most with low, median boss or swelling. A1 somite dorsal processes spiniform or dorso ventrally flattened, not anteriorly compressed and rounded laterally .... **Lysiosquilloidea**

3 All primary teeth of telson with movable apices .... **Bathysquilloidea**

— At most, SM teeth of telson with movable apices 4

4 Telson with 4 or more closely spaced intermediate denticles arranged in regular row .... **Squilloidea**

— Telson with no more than 3 (usually 2) "intermediate" denticles 5

5 Body depressed. Outer IM denticle and LT denticle of telson arising ventrally. Dactylus of raptorial claw with 4 or more well formed spearing teeth .... **Eurysquilloidea**

— Body subcylindrical, strongly convex. IM and LT denticles of telson arising marginally. Dactylus of raptorial claw without teeth, with small, triangular teeth, or with no more than 3 well formed spearing teeth 6

6 Uropodal protopod with three primary spines. Cornea asymmetrically bilobed, with outer margin of eye longer than inner margin; with 2 or 3 rows of hexagonal ommatidia in the midband .... **Parasquilloidea**

— Uropodal protopod with one or two primary spines. Cornea subglobular or symmetrically bilobed, with 6 rows of rectangular ommatidia in midband .... **Gonodactyloidea**

BATHYSQUILLOIDEA Manning, 1967b

Diagnosis. Cornea without rows of midband ommatidia. Corneal facets hexagonal, but poorly defined. MXP3–4 ovate, not ribbed or beaded distally. Body depressed, articulation compact. Raptorial claw with ischiomeral articulation terminal, dactylus uninflated basally; propodus with 4 proximal movable spines. Telson with distinct MD carina; all primary teeth with movable apices; IM denticles absent. Uropodal protopod with two primary spines; articulation of exopod segments terminal or distal segment separated from proximal segment by diaeresis.

Included families. Two: Bathysquillidae Manning, 1967b and Indosquillidae Manning, 1995.

Remarks. Bathysquilloids are unique among extant stomatopods in having movable apices on all primary teeth of the telson, in having an inner and outer row of fixed spines on the opposable margin on the propodus of the raptorial claw and in lacking midband rows of ommatidia on the cornea. Four movable spines are typically present on the proximal margin of the propodus of the raptorial claw. Occasionally, the distal movable spine may become fused or partially fused to the propodus. One family, Bathysquillidae, is known from Australia.

Key to families of Bathysquilloidea

1 AS5 with long, posteriorly directed, median spine. Telson longer than broad. Segments of uropodal exopod separated by an indistinct suture; distal segment much shorter than proximal .... Indosquillidae

— AS5 without long, posteriorly directed median spine. Telson broader than long. Segments of uropodal exopod fully articulated; distal segment longer than proximal .... **Bathysquillidae**

BATHYSQUILLIDAE Manning, 1967b

Bathysquillidae Manning, 1967b: 238 (type genus *Bathysquilla* Manning, 1967b).

Diagnosis. AS5 without long, posteriorly directed median spine. Telson broader than long, with rugose, tuberculate dorsum. Segments of uropodal exopod fully articulated; distal segment longer than proximal.

Included genera. Two: *Altosquilla* Bruce, 1985 and *Bathysquilla* Manning, 1967b.

Remarks. Both bathysquillid genera are known from Australia; all species occur in relatively deep, outer shelf, waters.

Key to genera of Bathysquillidae

1 Telson with 5 pairs of movable primary teeth on posterior margin. PLP1 endopod in adult ♂♂ without lateral lobe on posterior endite .... ***Altosquilla***

—— Telson with 4 pairs of movable primary teeth on posterior margin. PLP1 endopod in adult ♂♂ with lateral lobe on posterior endite .... ***Bathysquilla***

Altosquilla Bruce, 1985

Altosquilla Bruce, 1985: 468. Type species *Altosquilla soelae* Bruce, 1985, by monotypy. Gender feminine.

Diagnosis. Carapace with cervical groove indicated laterally, indistinct mid-dorsally. PLP1 endopod in adult males without lateral lobe on posterior endite. Telson with 5 pairs of movable primary teeth on posterior margin.

Included species. One, the type species.

Remarks. *Altosquilla* differs from all other stomatopod genera in bearing five pairs of articulated primary teeth on the posterior margin of the telson.

Altosquilla soelae Bruce, 1985

Fig. 5

Altosquilla soelae Bruce, 1985: 468–475, figs. 1–5 (type locality: Northwest Shelf, Western Australia, 17°59.7'S 118°19.0'E); 1988: 94, fig. 5.–Manning *et al*., 1990: 312–313, fig. 1.–Manning, 1991: 13; 1995: 18.
Altosquilla sp.–Jones & Morgan, 1994: 42.

Type material. (All Western Australia) HOLOTYPE: NTM Cr00612A, ♂ (TL 125 mm), Northwest Shelf, 17°59.7'S 118°19.0'E, 400 m, A. Bruce, 27 Jan 1984. ALLOTYPE: NTM Cr00612B, ♀ (TL 122 mm), Northwest Shelf, 17°59.7'S 118°19.0'E, 400 m, A. Bruce, 27 Jan 1984.

Australian material. WESTERN AUSTRALIA: NTM Cr002787, 2♀♀ (TL 49–87 mm), Northwest Shelf, S0184–21, 446 m, T. Ward, 1 Feb 1984; NTM Cr012184, 1♀ (TL 91 mm), S0184–5, 18°00.25'S 118°00.00'E, 404 m, T. Ward, 28 Jan 1984; NTM Cr009453, 1♂ (TL 125 mm), trawled NW of Fremantle, 31°17.0'S 114°52.6'E, 475–512 m, D. Evans, Jan–Feb 1991; NTM Cr012182, 1♀ (TL 125 mm), S0184–4, 17°59.7'S 118°19.05'E, 399 m, T. Ward, 27 Jan 1984; NTM Cr009452, 1♂ (TL 102 mm), W of Exmouth Gulf, 22°59.9'S 113°14.3'E, 400–600 m, trawled, D. Evans, Jan–Feb 1991; NTM Cr003439, 2♂♂ (TL 97–114 mm), Northwest Shelf, WH85–16, 430 m, trawled, W. Housten, 2 Nov 1985; NTM Cr012186, 1♂ (TL 118 mm), 1♀ (TL 103 mm), Northwest Shelf, S0184–26, 18°08.01'S 118°06.0'E, 498 m, T. Ward, 2 Feb 1984; NTM Cr012185, 1♂ (TL 108 mm), 3♀♀ (TL 103–130 mm), Northwest Shelf, S0184–16, 18°37.4'S 117°02.4'E, 506 m, T. Ward; WAM C23541, 1♂ (TL 174 mm), NW of Cape Leveque, 14°43.1–44.9'S 121°31.6–33.1'E, 408–410 m, engel trawl, soft substrate, 12 Feb 1984; 1♀ (TL 117 mm), Northwest Shelf, 17°52'S 118°28'E, 410 m, D. Evans, 9 Feb 1990; NTM Cr007464, 1♀ (TL 117 mm), Northwest Shelf, 17°52'S 118°28'E, 410 m, D. Evans, 9 Feb 1990; AM P57941, 1♀ (TL 150 mm), near Impereuse Reef, 17°43'S 118°31'E, 450 m, V. Wadley, 31 Jan 1992; AM P57942, 2♂♂ (TL 117–118 mm), 1♀ (TL 122 mm), Northwest Slope, 17°58'S 118°12'E, 500 m, V. Wadley, 2 Feb 1992.

Supplementary diagnosis. Carapace with cervical groove distinct laterally, indistinct medially. Raptorial claw dactylus with 13–16 teeth, carpus with slender, distal spine directed anteriorly; propodus opposable margin with clusters of small spines and an inner row of 6–9 longer erect spines. Mandibular palp 3-segmented. MXP1–5 with epipod. Female gonopore anteriorly with broad, articulated triangular plate, apex small, soft, bulbous; posteriorly with 2 large, rounded tubercles, hollow posteromedially. TS6–8 with IM carinae. AS1 with 0–4 small spines on posterolateral margin. AS2–4 posterolateral margin with 1–9 small spines, increasing in number posteriorly. AS5 with 16–24 posterior spines. Abdominal carinae spined as follows: SM 6, IM (5), LT 5, MG 1–5. Telson broader than long; with 5 pairs of primary teeth, with long, slender, movable apices; dorsal surface with distinct MD carina, accessory MD, anterior SM and MG carinae. Uropodal protopod terminating in 2 slender spines; dorsally armed with 1–2 erect spines proximally and spine above proximal exopod articulation; with short, ventral spine anterior to endopod articulation. Uropodal exopod proximal segment dorsally with 2 erect slender spines; outer margin with 6–8 movable spines.

Colour in life. Overall dorsal colour pale brownish cream. Raptorial claw with carpus, articulation with propodus and merus light brown.

Measurements. Male (n = 10) TL 97–174 mm, female (n = 13) TL 49–150 mm. A1 peduncle 0.81–0.88CL. A2 scale 0.73–1.09CL. Uropodal endopod 3.30–3.93 breadth. The present series includes the largest known specimen of the species.

Remarks. The non-type specimens agree well with the type series and description (Bruce, 1985).

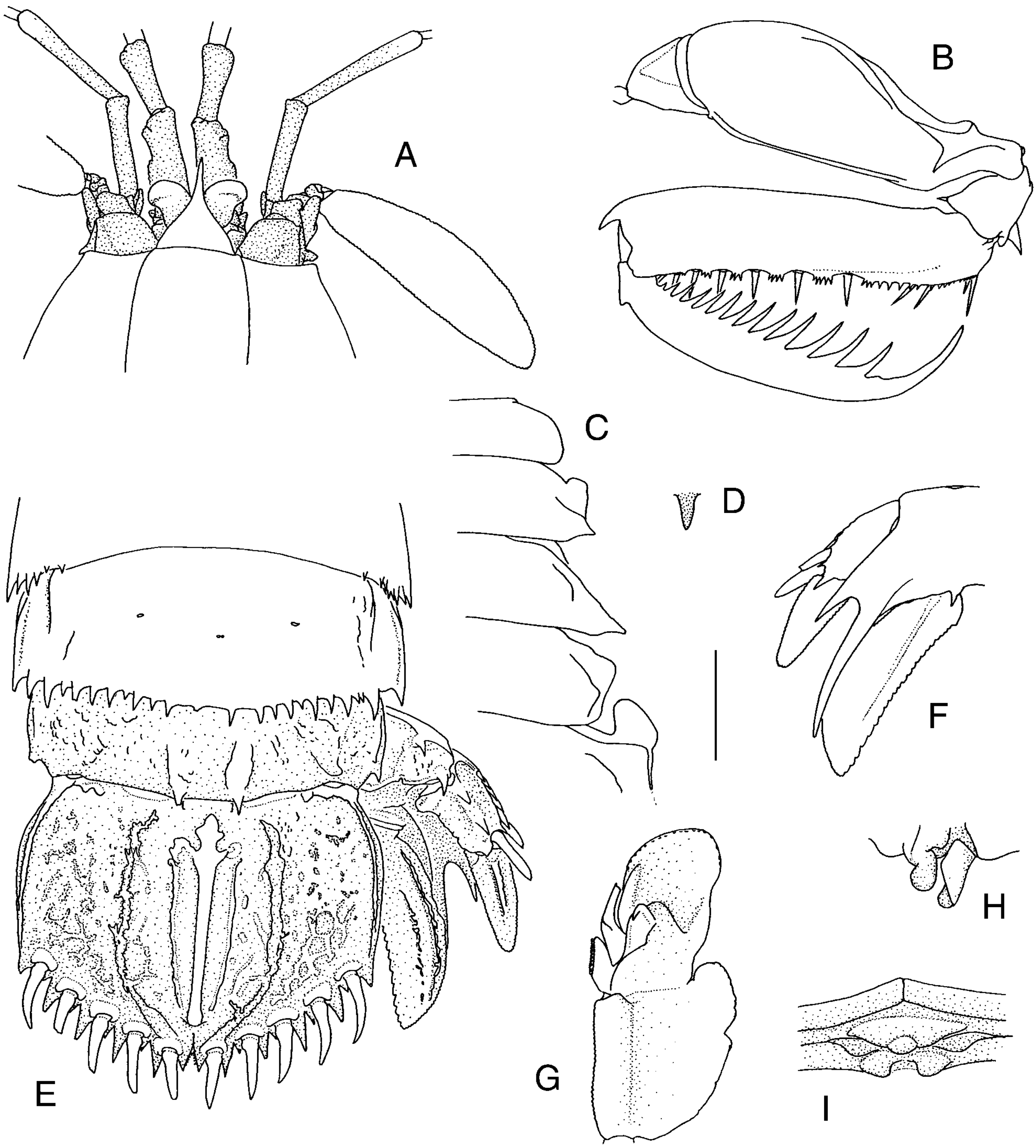

Figure 5. *Altosquilla soelae* Bruce. A–G, ♂ TL 97 mm (NTM Cr03439). H,I, ♀ TL 91 mm (NTM Cr012184). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS5–8 and AS1, right dorsal. D, TS8 sternal keel, right lateral. E, AS4–6, telson & uropod. F, right uropod, ventral. G, ♂ PLP1 endopod, right anterior. H, ♀ gonopore, right lateral. I, ♀ gonopore, ventral. Scale A–C, E, F = 10 mm; D, G = 6 mm; H, I = 3 mm.

Habitat. Soft substrates in depths between 399 m and 400–600 m.

Distribution. The Australian Northwest Shelf and now south to the vicinity of Fremantle, Western Australia.

Bathysquilla Manning, 1963b

Bathysquilla Manning, 1963b: 323–324; 1969c: 94–95. Type species *Lysiosquilla microps* Manning, 1961a, by original designation. Gender feminine.

Diagnosis. Carapace with cervical groove distinct across dorsum. PLP1 endopod in adult males with lateral lobe on posterior endite. Telson with 4 pairs of movable primary teeth on posterior margin.

Included species. Two: *B. crassispinosa* (Fukuda, 1909); and *B. microps* (Manning, 1961a).

Remarks. Both species of *Bathysquilla* were first reported from Australia by Bruce (1988).

Key to species of *Bathysquilla*

1 Rostral plate longer than broad, apical spine long. Eyes large, pigmented. Posterior margin of AS2–5 without posterior spinules .... ***B. crassispinosa***

—— Rostral plate broader than long, apical spine short. Eyes very small, cornea at most faintly pigmented. Posterior margin of AS2–5 with spinules .... ***B. microps***

Bathysquilla crassispinosa (Fukuda, 1909)

Fig. 6

Lysiosquilla crassispinosa Fukuda, 1909: 61, pl. 5 (type locality: off Atami, Sagami Bay, Shizuouka Prefecture, Japan, restricted by present neotype selection); 1910: 146–149, pl. 4, fig. 4.–Barnard, 1950: 859–860, fig. 3b.

Bathysquilla crassispinosa.–Manning, 1969c: 95, 98.–Ingle & Merrett, 1971: 197.–Manning & Struhsaker, 1976: 440–443, figs. 1, 2.–Bruce, 1985: 474–475, fig. 4.–Moosa, 1986: 371, pl. 1.–Bruce, 1988: 87–89, figs. 2–5.–Manning *et al*., 1990: 312–313, fig. 1; 1991: 1–3, 13, figs. 1, 2; 1995: 18, 28.

Type material. NEOTYPE: AM P60098, ♂ (TL 248 mm), off Atami, Sagami Bay, Shizuouka Prefecture, Japan, trawl, Y. Maihara, 10 Jan 1979.

Australian material. QUEENSLAND: W11302, 1♀ (TL 195 mm), E of One Tree I., 23°33'S 152°23'E, 240 m, trawled, P. Davie, 1 Dec 1984; QM W24194, 1♂ (TL 232 mm), Coral Sea, 18°00.4'S 147°04.1'E, 260–264 m, trawled, continental slope, 30 Jan 1986.

Other material. AM P60099, ♂ (TL 283 mm), off Atami, Sagami Bay, Shizuouka Prefecture, Japan, trawl, Y. Maihara, 10 Jan 1979; USNM 124103, ♂ (TL 285 mm), Shikoku I., Tosa Bay, Japan, 1965.

Diagnosis. Eye large, cornea subglobular, pigmented. Rostral plate longer than broad; dorsally with broad median sulcus. Carapace anterolateral margin broadly rounded. Raptorial claw dactylus with 10 or 11 teeth; carpus dorsal margin with 2 slender spines, directed anteriorly; propodus opposable margin with inner row of 9–11 large erect spines, outer row with 32–39 short spines. Female gonopore anteriorly with a broad, articulated triangular plate; posteriorly with a transverse median process bearing a pair of long, slender, curved, processes. AS1–5 with indistinct IM carinae; MG carinae distinct; unarmed except for posterior spine of MG carinae. Abdominal carinae spined as follows: SM 6, LT 6, MG 1–5. Telson accessory MD carina indistinct, indicated by line of tubercles; anterior SM carinae short, low, indicated anteriorly, subparallel to MD carina. Uropodal protopod dorsally with tuberculate carina; outer margin with short ventral spine anterior to exopod articulation. Uropodal exopod proximal segment outer margin with 10 or 11 movable spines, distal margin with dorsal spine and 3 ventral spines, inner longest.

Colour in life. Reddish orange dorsally. Propodus and dactylus of raptorial claw, pereiopods, uropodal exopod and endopod pale. Eyes with metallic grey cornea.

Measurements. Male (n = 4) TL 232–285 mm, female (n = 1) TL 195 mm. A1 peduncle 0.70–0.76CL. A2 scale 0.98–1.17CL. Uropodal endopod 2.66–2.99 breadth. Manning *et al*. (1990) reported specimens to 297 mm TL.

Remarks. The Australian specimens agree in most respects with the Japanese material and account of the holotype (Fukuda, 1909, 1910), but differ in having the mid-dorsal carina of the proximal uropodal exopod segment strongly serrated and tuberculate instead of relatively smooth. The specimen from the Philippines figured by Moosa (1986: pl. 1) also appears to lack the serrated dorsal carina on the uropodal exopod as do the Japanese specimens examined here. Whether or not these differences are significant requires further study of additional specimens of *B. crassispinosa* from Australia and other localities.

The holotype of *B. crassispinosa* was lost during the Second World War (Ingle & Merrett, 1971). In view of the wide distribution of *B. crassispinosa*, coupled with minor but possibly significant differences between the Japanese and Australian material, a neotype is herein selected to fix the identity of the species. Therefore, the 248 mm TL male specimen from Sagami Bay, Japan, is herein selected as a neotype. Fukuda’s (1909) original holotype of *B. crassispinosa* was collected in the “Sagami Sea”, Japan.

Habitat. Soft substrates at depths between 240 m and 260–264 m. Manning (1991) reports a depth range between 170–200 m and 350–420 m.

Distribution. Indo-West Pacific from Japan, Madagascar, South Africa, the Philippines, the South China Sea, and Australia. The present specimens represent a southern record for Australia.

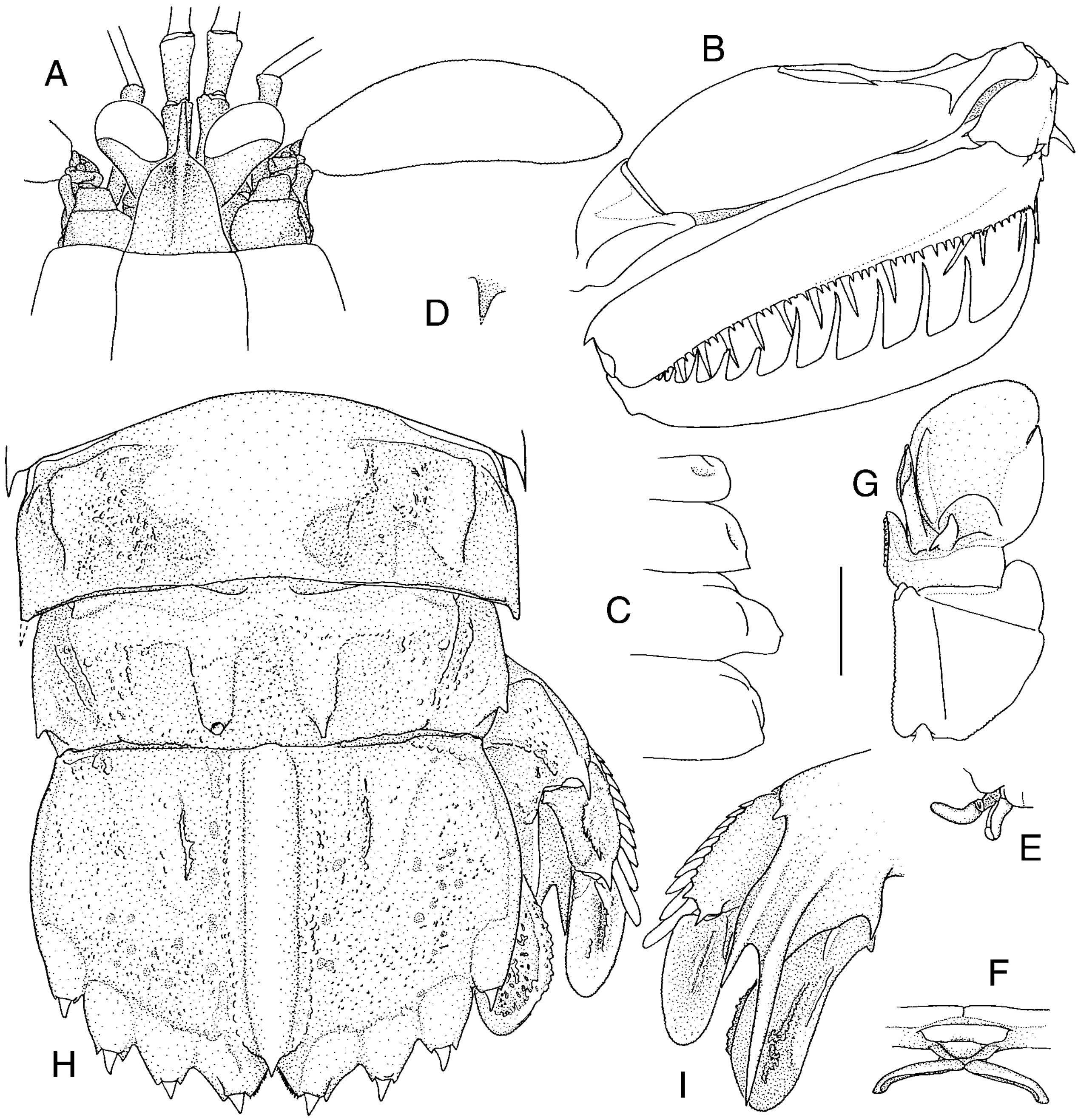

Figure 6. *Bathysquilla crassispinosa* (Fukuda). A–F, H–I, ♀ TL 195 mm (QM W11302). G, ♂ TL 232 mm (QM W24194). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS5–8 and AS1, right dorsal. D, TS8 sternal keel, right lateral. E, ♀ gonopore, right lateral. F, ♀ gonopore, ventral. G, ♂ PLP1 endopod, right anterior. H, AS4–6, telson & uropod. I, right uropod, ventral. Scale A–D,H,I = 10 mm; E–G = 6 mm.

Bathysquilla microps (Manning, 1961a)

Fig. 7

Lysiosquilla microps Manning, 1961a: 693–696, figs. 1–5 (type locality: SE of Tortugas, Florida Straits, 24°11.0'N 83°21.5'E).
Bathysquilla microps.–Manning, 1969c: 95–99, figs. 26–28.–Manning & Struhsaker, 1976: 443–408, figs. 1, 2.–Moosa, 1986: 371–373, fig. 1.–Bruce, 1988: 90, figs. 1, 5.–Manning *et al*., 1990: 313–314, fig. 1; 1991: 13; 1995: 18.

Type material. HOLOTYPE: USNM 104109, ♂ (TL 198 mm), SE of Tortugas, Florida Straits, 24°11.0'N 83°21.5'E, 728 m, H.R. Bullis Jr., 8 Jun 1959.

Australian material. QUEENSLAND: SAM C5746, 1♀ (TL 216 mm), 41 km E of Stradbroke I., 27°13.55'S 154°01.00'E, 710–730 m, trawled, P. Briggs, Sep–Oct 1988; AM P38496, 1♂ (TL 221 mm), 1♀ (TL 116 mm), E of Brisbane, 700–900 m, trawled, May 1988; AM P49776, 1♂ (TL 145 mm), E of Burleigh Head, 28°06'S 163°06'E, 1051 m, beam trawl, 5 May 1988; QM W15314, 1♀ (TL 187 mm), Coral Sea, 17°49.45'S 148°39.51'E, 990–1006 m, FRV Franklin, beam trawl, 5°C, Cidaris Expedition, 8 May 1986; QM W24198, 1♂ (TL 153 mm), Coral Sea, 17°30.1'S

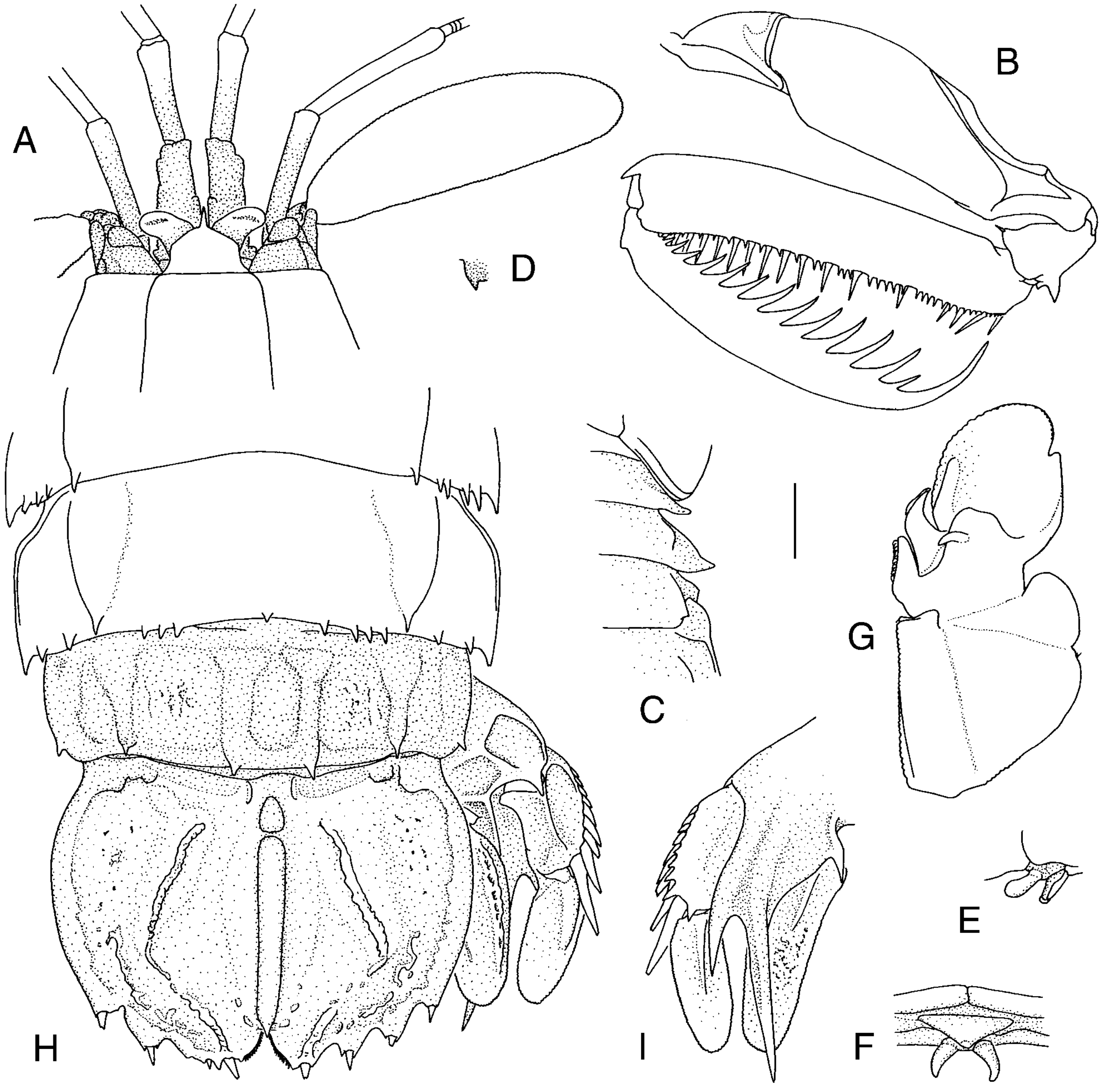

Figure 7. *Bathysquilla microps* (Manning). A–F, H–I, ♀ TL 116 mm (AM P38496). G, ♂ TL 153 mm (QM W24198). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS5–8 and AS1, right dorsal. D, TS8 sternal keel, right lateral. E, ♀ gonopore, right lateral. F, ♀ gonopore, ventral. G, ♂ PLP1 endopod, right anterior. H, AS4–6, telson & uropod. I, right uropod, ventral. Scale A–D,H,I = 5 mm; E–G = 3 mm.

149°00.4'E, 900–908 m, trawled, continental slope, RV *Soela*, P. Davie, 2 Dec 1985. NEW SOUTH WALES: AM P52745, 1♀ (TL 173 mm), E of Broughton I., 32°38'S 152°54'E, K89–17–02, 814–850 m, K. Graham, 15 Aug 1989; AM P57883, 1♂ (TL 109 mm), off Kiama, 34°48–45'S 151°14–15'E, 730–790 m, trawl, bottom temperature 7.5°C, K89–14–02, K. Graham, 4 Jul 1989.

Diagnosis. Eye small, cornea subglobular, unpigmented. Rostral broader than long; with short apical spine; at most with very shallow median sulcus opening anteriorly. Carapace anterolateral angle blunt, obtusely angled. Raptorial claw dactylus with 12–15 teeth; carpus dorsal margin with slender, acute distal spine; propodus opposable margin with inner row of 10–13 large erect spines, outer row with 34–40 short spines. Female gonopore anteriorly with a broad, articulated triangular plate; posteriorly with a transverse median process bearing a pair of short, broad, curved, processes, directed posteroventrally. AS1–5 with distinct IM and MG carinae. AS2–4 posterolateral margins with 0–6 spinules. AS5 posterior margin with 7 or 8 spinules on either side of midline. Abdominal carinae spined as follows: SM 6, IM (1)2–5(6), LT 6, MG 1–5. Telson with 12–23 SM denticles; accessory MD carina absent; anterior SM carina uninterrupted divergent. Uropodal protopod outer margin without ventral spine anterior to exopod articulation. Uropodal exopod proximal segment unarmed dorsally except for dorsal spine above exopod articulation; outer margin with lower row of short, fixed teeth corresponding to upper row of 6–9 movable spines.

Colour in life. Almost entirely red. Cornea of eye unpigmented. A1 peduncle, A2 protopod and peduncle, carpus and distal portion of merus of raptorial claw translucent white.

Measurements. Male (n = 5) TL 109–221 mm, female (n = 4) TL 116–216 mm. A1 peduncle 0.90–1.02CL. A2 scale 0.95–1.14CL. Uropodal endopod 3.03–3.62 breadth.

Remarks. The present specimens agree well with the holotype and published accounts (Manning, 1961a, 1969c; Manning & Struhsaker, 1976; Moosa, 1986; Bruce, 1988). Variation between Hawaiian and Western Atlantic material reported by Manning & Struhsaker (1976) is fully encompassed by the Australian specimens: the intermediate carinae of AS1 are armed in the largest male, unarmed in other specimens. The specimen from Kiama, New South Wales, represents the southernmost record of *B. microps*.

Habitat. Soft substrates at depths of 728 m to 990–1006 m. Manning (1991) reported a bathymetric range of 604–769 m to 1245–1519 m. The bottom temperature at which one specimen (AM P57883) was taken was 7.5°C.

Distribution. The Caribbean region and the Indo-West Pacific: Hawaii, the Philippines and eastern Australia south to Kiama, southern New South Wales.

INDOSQUILLIDAE Manning, 1995

Indosquillidae Manning, 1995: 28 (type genus *Indosquilla* Ingle & Merrett, 1971).

Diagnosis. AS5 with long, posteriorly directed median spine. Telson longer than broad, with smooth dorsum between carinae. Segments of uropodal exopod separated by an indistinct suture; distal segment much shorter than proximal.

Included genera. One: *Indosquilla* Ingle & Merrett, 1971.

Remarks. Indosquillidae includes only the type genus and species, *I. manihinei* Ingle & Merrett, 1971. Indosquillids are not yet known from Australian waters.

ERYTHROSQUILLOIDEA Manning & Bruce, 1984

Diagnosis. Cornea with hexagonal facets; number of mid band rows unknown. A1 somite dorsal processes short, anteriorly compressed, rounded laterally. MXP3–4 with propodi subquadrate, ribbed distally. Body flattened. Raptorial claw with ischiomeral articulation terminal, dactylus uninflated basally; propodus with 3 or 4 proximal movable spines. Telson with distinct MD carina; SM teeth with movable apices; with 2 true IM denticles, arising marginally. Uropodal protopod with two primary teeth; articulation of exopod segments terminal.

Included families. One: Erythrosquillidae Manning & Bruce, 1984.

Remarks. Erythrosquilloidea includes a single family, Erythrosquillidae. Erythrosquilloids share the subquadrate, distally ribbed propodi of MXP3–4 with other lysiosquilloids, but differ in bearing a distinct median carina on the telson. In addition, the dorsal processes of the antennular somite in lysiosquilloids are present as a slender curved spine or dorsoventrally flattened lobe, whereas in erythrosquilloids, the dorsal processes are short, anteriorly compressed and laterally rounded.

Species of *Erythrosquilla* closely resemble species of several genera of the Tetrasquillidae (Lysiosquilloidea) in the ovate pereiopodal endopods and uropod structure. As in the tetrasquillid genera *Acaenosquilla*, *Heterosquilla*, *Heterosquillopsis* and *Tetrasquilla*, the terminal spines of the uropodal protopod in *Erythrosquilla* are flattened with the outer spine longest and with a short spine adjacent to the endopodal articulation. The similarities between erythrosquillids and tetrasquillids suggest a possible close relationship between the two groups and warrants further investigation. The most recent phylogenetic studies, however, suggest that the erythrosquilloids are the sister to all lysiosquilloids (Ahyong, 1997a; Ahyong & Harling, 2000).

ERYTHROSQUILLIDAE Manning & Bruce, 1984

Erythrosquillidae Manning & Bruce, 1984: 332 (type genus *Erythrosquilla* Manning & Bruce, 1984).

Diagnosis. As for superfamily.

Included genera. One: *Erythrosquilla* Manning & Bruce, 1984.

Remarks. Erythrosquillidae includes only the type genus.

Erythrosquilla Manning & Bruce, 1984

Erythrosquilla Manning & Bruce, 1984: 329. Type species *Erythrosquilla megalops* Manning & Bruce, 1984, by monotypy. Gender feminine.

Diagnosis. As for the superfamily.

Included species. Two: *Erythrosquilla hamano* n.sp.; and *E. megalops* Manning & Bruce, 1984.

Remarks. A second species of *Erythrosquilla* is described below. One species of *Erythrosquilla* is known from Australian waters.

Key to species of *Erythrosquilla*

1 Raptorial claw with 5 teeth on dactylus; propodus shorter than carapace, with 3 proximal movable spines. A2 protopod with dorsal spine and 1 ventral papilla. Telson without accessory MD carinae; MD carina terminating in spine. Pereiopods 1–3 basal segment each with rounded posterior lappet .... *E. megalops*

—— Raptorial claw with 8 or 9 teeth on dactylus; propodus longer than carapace, with 4 proximal movable spines. A2 protopod without dorsal spine; with 2 ventral papillae. Telson with accessory MD carinae flanking MD carina, each terminating in blunt lobe. Pereiopods 1–3 basal segment each with angular posterior projection .... ***E. hamano***

Erythrosquilla hamano n.sp.

Fig. 8

Type material. HOLOTYPE: AM P60244, ♂ (TL 27 mm), East China Sea, Japan.

Australian material. WESTERN AUSTRALIA: WAM 215–96, 1♀ (damaged, TL less than 27 mm), W of Rottnest I., 32°00'S 115°16'E, CSIRO stn 225, 137–142 m, beam trawl, 12 Oct 1963.

Diagnosis. Ocular scales produced as short triangular lobes, directed anteriorly. A2 protopod without dorsal spine; with 2 ventral papillae. Raptorial claw dactylus with 8 or 9 teeth; propodus longer than carapace, with 4 proximal movable spines. Pereiopods 1–3 basal segment with posterior, ventrally directed, angular projection. AS6 with slender spine and broad, blunt, triangular projection anterior to uropodal articulation. Telson with 4 "intermediate" denticles; dorsal surface with slender MD carina flanked either side by one accessory MD carina, each with blunt apex.

Description. Eye large, cornea set transversely on stalk, extending beyond A1 peduncle segment 2; CI 142. Ophthalmic somite anterior margin rounded. Ocular scales short triangular, inclined anteriorly. A1 peduncle 0.80CL. A1 somite dorsal processes short, anteriorly compressed, rounded laterally, inclined ventrally. A2 scale length 3.0 width and 0.50CL. A2 protopod without dorsal spine; with ventrodistal tooth and 2 ventral papillae. Rostral plate triangular; broader than long; apex slightly deflexed ventrally. Carapace anterolateral angles rounded; posterior margin unarmed. Raptorial claw dactylus with 8 or 9 teeth; outer margin evenly curved, with shallow proximal notch; carpus dorsal margin terminating in short spine; propodus longer than carapace, with 4 proximal movable spines; PI 070. Mandibular palp 3-segmented. MXP1–5 with epipod. MXP5 basal segment without ventrally directed spine; merus with broad, evenly convex flange on inner margin. Pereiopods 1–3 basal segment with posterior, ventrally directed, angular projection; endopod distal segment ovate. TS5 lateral process obsolete. TS6–8 lateral process rounded. TS8 sternal keel small, rounded. AS1–5 flattened dorsally; without posterolateral spine; articulation compact. AS6 smooth medially; with submedian spines on posterior margin; armed IM and LT carinae; with 1 slender spine and 1 broad, blunt, triangular projection anterior to uropodal articulation; sternum posterior margin unarmed. Telson broader than long with 13–15 minute SM denticles on either side of midline, in transverse row; with 4 "intermediate" denticles, first and third shorter than second and fourth; lateral denticle spiniform. Dorsal surface with slender MD carina flanked on either side by single accessory MD carina, each with blunt apex; SM carinae entire, unarmed. Uropodal protopod with two flattened, ventrally carinate terminal spines; inner spine exceeding ½ length of inner margin of outer spine; with slender ventral spine anterior to endopod articulation. Uropodal exopod with 7 movable spines on outer margin, distalmost exceeding midlength of distal segment; distal margin with slender ventral spine; distal segment longer than proximal segment.

Colour in alcohol. Faded.

Etymology. Named for Tatsuo Hamano, who kindly made the holotype available for study, and for his substantial contributions to the study of Japanese stomatopods. Used as a noun in apposition.

Measurements. Male (n = 1) TL 27 mm, female (n = 1) TL less than 27 mm. Other measurements of holotype: CL 5.4 mm, A1 peduncle 4.3 mm, A2 scale 2.7 mm.

Remarks. *Erythrosquilla hamano* n.sp. represents the second known species of the genus and resembles *E. megalops* in the large eyes, short, triangular rostral plate, reduced dorsolateral processes of the antennular somite and ovate pereiopodal endopods. The new species differs from *E. megalops* in bearing 8 or 9 instead of 5 teeth on the dactylus of the raptorial claw, 4 instead of 3 movable spines on the propodus of the raptorial claw, triangular instead of rounded to subtruncate ocular scales, the antennal protopod lacks the dorsal spine and bears 2 instead of 1 ventral papillae, the posterior lobe on basal segment of the pereiopods is angular instead of rounded, AS6 bears a spine anterior to the uropodal articulation, the telson bears accessory median carinae and four instead of two "intermediate" denticles. As with *E. megalops*, *E. hamano* bears two true intermediate denticles. In *E. hamano*, however, the lobe adjacent to each intermediate denticle is triangular instead of rounded as in *E. megalops*, giving the appearance of four denticles.

The presence of three mid-dorsal carinae on the telson in *E. hamano* resembles that of the lysiosquilloid, *Kasim insuetus* Manning, 1970c. As remarked under the account of *K. insuetus*, however, the median carina of the telson is distinctly higher in *E. hamano* and probably represents convergence.

The holotype is a subadult male—the penes have not reached full length and the endopod of pleopod 1 is not yet sexually modified. The specimen otherwise shows adult "facies". Unfortunately, the Australian specimen is badly damaged: the telson is crushed, the anterior cephalon is absent and the dactylus of the single remaining raptorial claw is damaged distally. The dactylus of the single remaining raptorial claw is bears at least seven teeth, but based on the conformation of the dactylus with the propodus, it appears that 8 teeth were originally present. Nine teeth are present on the dactyli of the raptorial claws in the holotype. Aside from the difference in the number of

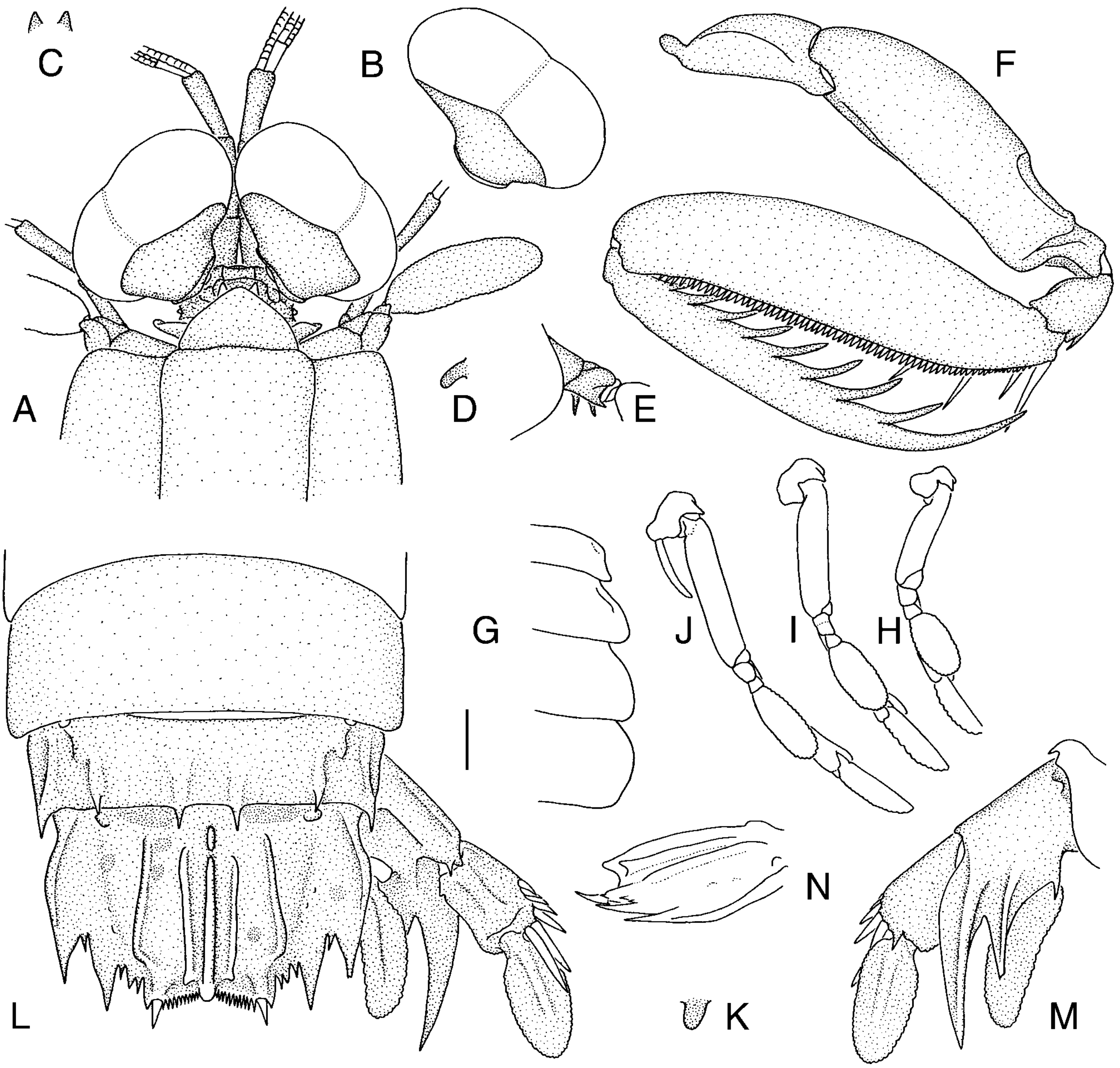

Figure 8. *Erythrosquilla hamano* n.sp., ♂ holotype TL 27 mm. A, anterior cephalon, dorsal. B, eye, right dorsal. C, ocular scales, dorsal. D, lateral process of A1 somite, right anterior. E, A2 protopod, right lateral. F, raptorial claw, right lateral. G, TS5–8, right dorsal. H–J, pereiopods 1–3, right posterior. K, TS8 sternal keel, right lateral. L, AS5–6, telson & uropod, dorsal. M, uropod, right ventral. N, telson, right lateral. Scale A–J, L–N = 1 mm; K = 0.5 mm.

teeth on the raptorial claw, the two specimens agree well. In view of the widely distant collecting localities of the two specimens, and the degree of damage to the Australian specimen, the type series is restricted to the holotype.

Harling (2000) remarked that the holotype of *E. megalops* appeared to lack distinct rows of midband ommatidia. Similarly, the cornea of *E. hamano* also appears to lack a distinct midband and will require sectioning to determine the presence or absence of an ommatidial midband.

Curiously, the known distribution of *E. hamano* parallels that of *Pseudosquillopsis dofleini* (Balss, 1910), which is also known only from Japan and southwestern Australia. Additional sampling from intermediate localities is required to test the reality of these apparently disjunct distributions.

Habitat. The Australian specimen was taken between 137 and 142 m, presumably on a soft substrate. The habitat of the holotype is unknown.

Distribution. Known from the East China Sea and near Rottnest Island, Western Australia.

EURYSQUILLOIDEA Manning, 1977a

Diagnosis. Cornea with two or six rows of hexagonal midband ommatidia. MXP3–4 with propodi ovate, not ribbed or beaded ventrally. Body depressed; loosely articulated or compact. Raptorial claw with ischiomeral articulation terminal; dactylus with 4 or more teeth, uninflated basally; propodus with 3 proximal movable spines. Telson with distinct MD carina; SM teeth with movable apices; at most with 2 IM denticles, outermost arising ventrally. Uropodal protopod with two primary spines; articulation of exopod segments terminal.

Included families. One: Eurysquillidae Manning, 1977a.

Remarks. Recent phylogenetic and other morphological studies of the Stomatopoda show that Gonodactyloidea sensu Manning (1980b, 1995) is not monophyletic (Ahyong, 1997a; Hof, 1998; Harling, 2000; Ahyong & Harling, 2000). Ahyong & Harling (2000) recognized Eurysquilloidea and Parasquilloidea for families previously placed in Gonodactyloidea. Gonodactyloidea was restricted to those families having six rows of rectangular ommatidia in the corneal midband: Hemisquillidae, Alainosquillidae, Pseudosquillidae, Odontodactylidae, Gonodactylidae, and Takuidae. Although eurysquilloids show considerable variation in dorsal telson ornamentation, members of the superfamily are united by the presence of ventrally recessed outer-intermediate and lateral denticles of the telson. Note that in *Eurysquilla maiaguesensis* (Bigelow, 1901) and in *Eurysquilloides sibogae* (Hansen, 1926), the bases of the outer IM and LT denticles are less distinctly ventrally recessed than in other eurysquilloids.

Eurysquilloids differ from members of the Gonodactyloidea in lacking a dorsal spine or articulated plate on the antennal protopod, in having hexagonal instead of rectangular facets on the corneal midband, in having a depressed or flattened instead of subcylindrical body form, and in having ventrally recessed, outer IM and LT denticles on the telson. Eurysquilloids differ from members of the Parasquilloidea in having more than three teeth on the dactylus of the raptorial claw, in having a depressed or flattened instead of subcylindrical body form, in having two instead of three terminal primary spines on the uropodal protopod, and in having ventrally recessed, outer IM and LT denticles on the telson.

EURYSQUILLIDAE Manning, 1977a

Eurysquillidae Manning, 1977a: 22 (type genus *Eurysquilla* Manning, 1963b).

Diagnosis. As for superfamily.

Included genera. Six: *Coronidopsis* Hansen, 1926; *Eurysquilla* Manning, 1963b; *Eurysquilloides* Manning, 1963b; *Manningia* Serène, 1962; *Raysquilla* Ahyong, 2000a; and *Sinosquilla* Liu & Wang, 1978.

Remarks. Eurysquillidae includes six genera of which five are represented in Australian waters.

Key to genera of the Eurysquillidae

1 A1 somite greatly elongate, extending anteriorly well beyond apex of rostral plate .... ***Eurysquilloides***

—— A1 somite short, covered by rostral plate 2

2 Dactylus of raptorial claw with 4 teeth. Cornea asymmetrically bilobed, with outer margin of eye longer than inner 3

—— Dactylus of raptorial claw with 5 or more teeth. Cornea subglobular, broadened or symmetrically bilobed 4

3 Rostral plate bispinous. Carpus of raptorial claw with a single dorsal tooth .... ***Coronidopsis***

—— Rostral plate not bispinous. Carpus of raptorial claw with two dorsal teeth .... ***Manningia***

4 Rostral plate a long slender spine .... ***Sinosquilla***

—— Rostral plate not a long slender spine 5

5 Raptorial claw propodus closely pectinate proximally, becoming sparsely pectinate distally. Abdominal articulation compact. AS6 without spines dorsally or on posterior margin. Uropodal protopod with outer spine longer than inner .... ***Raysquilla***

—— Raptorial propodus evenly pectinate for entire length. Abdominal somites loosely articulated. AS6 with 6 or more spines along upper posterior margin (including posterolateral spines). Uropodal protopod with inner spine longer than outer .... *Eurysquilla*

Coronidopsis Hansen, 1926

Coronidopsis Hansen, 1926: 19. Type species *Coronidopsis bicuspis* Hansen, 1926, by monotypy. Gender feminine.

Diagnosis. A1 somite short, not exceeding anterior margin of rostral plate. Cornea asymmetrically bilobed; with two rows of midband ommatidia. Rostral plate bispinous. Dactylus of raptorial claw with 4 teeth; carpus with a single dorsal tooth; propodus evenly pectinate for entire length, with 3 movable spines proximally. Mandibular palp 3-segmented. MXP1–5 each with epipod. Abdominal articulation compact. AS6 with 6 or more dorsal spines along posterior margin (including posterolateral spines). Telson without upright lobes at base of IM and LT teeth; ventral surface with recessed, outer IM and LT denticles. Uropodal protopod with inner primary spine longer than outer; inner margin lined with spines.

Included species. Two: *C. bicuspis* Hansen, 1926; and *C. serenei* Moosa, 1973.

Remarks. The bispinous rostral plate distinguishes *Coronidopsis* from other eurysquillid genera. *Coronidopsis* is most closely related to *Manningia*, differing only in the form of the rostral plate and having one instead of two dorsal teeth on the carpus of the raptorial claw. Manning (1995) recognized *C. andamanensis* Makarov, 1976, as distinct from *C. bicuspis*, but apparently overlooked the study by Moosa & Cleva (1984a) that synonymized the two species. *Coronidopsis andamanensis* is regarded as a junior synonym of *C. bicuspis* following of Moosa & Cleva (1984a).

Key to species of *Coronidopsis*

1 Ventral surface of telson with patch of spinules on either side of midline .... ***C. serenei***

—— Ventral surface of telson with a curved carina on either side of anal pore .... *C. bicuspis*

Coronidopsis serenei Moosa, 1973

Fig. 9

Coronidopsis serenei Moosa, 1973: 2, 5, fig. 1 (type locality: off Elat Bay, Tjut I., Kai Is, Indonesia, 5°40'S 132°59'E, 70 m).–Manning & Garcia, 1982: 595, figs. 1e,f, 2, 3.–Moosa, 1986: 373–374.–Manning, 1995: 19, 31, 32.

Coronidopsis bicuspis.–Blumstein, 1974: 124, fig. 9 (not *Coronidopsis bicuspis* Hansen, 1926).

Coronidopsis nudus Blumstein, 1974: 124–126, fig. 10 (type locality: Gulf of Tonkin, Vietnam, 20°00'N 108°13'E).

Coronidopsis gurjanovae Makarov, 1978: 181, fig. 3 (type locality: Tonkin Bay, Vietnam, 20°14'N 111°12'E).

Type material. HOLOTYPE: LIPI S647, ♂ (TL 39 mm), off Elat Bay, Tjut I., Kai Is, Indonesia, 5°40'S 132°59'E, 70 m, dredged, mud & shells, 13 Jun 1970.

Australian material. QUEENSLAND: AM P56186, 2♀♀ (TL 30–36 mm), Arafura Sea, 11°32.7'S 138°41.8'E, 53 m, SS0390 85, T. Wassenberg, 9 Dec 1990; AM P56187, 1♀ (TL 36 mm), Arafura Sea, 11°58.6'S 138°41.8'E, 51 m, SS0390 86, T. Wassenberg, 9 Dec 1990; AM P56188, 1♂ (TL 32 mm), Gulf of Carpentaria, 12°56.4'S 139°41.7'E, 60 m, SS0390 78, T. Wassenberg, 8 Dec 1990; AM P56189, 1♂ (TL 30 mm), 1♀ (TL 33 mm), Gulf of Carpentaria, 12°00'S 139°14.3'E, 53 m, dredge, SS0390 31, T. Wassenberg, Nov–Dec 1990; AM P56190, 1♀ (TL 40 mm), Gulf of Carpentaria, 12°26.7'S 139°11.7'E, 55 m, dredge, SS0390 32, T. Wassenberg, Nov–Dec 1990; AM P56191, 1♀ (TL 30 mm), Gulf of Carpentaria, 14°58.9'S 139°12.1'E, 56 m, SS0390 37, T. Wassenberg, Nov 1990; AM P56192 (to QM), 2♀♀ (TL 35–41 mm), N of Wellesley Is, Gulf of Carpentaria, 15°31.4'S 139°11.6'E, 45 m, SS0390 38, T. Wassenberg, 29 Nov 1990; AM P56193, 1♂ (TL 34 mm), NE Gulf of Carpentaria, 11°29.2'S 140°41.5'E, dredge, SS0390 61, T. Wassenberg, Nov–Dec 1990; AM P56194, 1♀ (TL 33 mm), Gulf of Carpentaria, 10°58.5'S 140°21.0'E, SS0591 58, T. Wassenberg, 1991; AM P56890, 1♂ (TL 33 mm), Arafura Sea, 10°58.1'S 138°41.8'E, 52 m, SS0390 084, T. Wassenberg, 9 Dec 1990.

Diagnosis. Ocular scales fused, flattened. AS4 with posterolateral spine. AS6 IM spine with 1–4 accessory spinules basally; posterior margin with up to 4 short spines between SM and IM teeth. Telson ventral surface with cluster of 5–10 spines lateral to anal pore. Uropodal protopod inner margin with 4–6 slender spines; exopod proximal segment outer margin with 6 or 7 movable spines.

Colour in life. Base colour pale grey-brown. Carapace with dark brown pigment on posterior margin, gastric grooves, across position of cervical groove and with mottling mid-dorsally. Thoracic and abdominal somites with dark brown posterior margins; anteromedial and posterolateral regions with diffuse brown pigmentation. Uropodal exopod and endopod dark brown distally.

Measurements. Male (n = 5) TL 30–39 mm, female (n = 9) TL 30–41 mm. A1 peduncle 0.85–1.03CL. A2 scale 0.45–0.52CL. The present series includes the largest known specimen of the species.

Remarks. *Coronidopsis serenei* differs from *C. bicuspis* by bearing a group of spinules on the ventral surface of the telson either side of the midline. In Philippine specimens of *C. serenei*, Manning & Garcia (1982) reported variation in the arrangement of the ventral telson spinules, the number of dorsal spinules flanking the intermediate and lateral carinae on AS6, and the number of spinules (if present) flanking the distal dorsal spine on the uropodal protopod. Australian specimens of *C. serenei* vary in the number of spinules flanking the submedian, intermediate and lateral spines on AS6, but lack spinules flanking the distal dorsal spine on the uropodal protopod.

Habitat. Sandy-mud substrates at depths of 45–60 m. Moosa (1986) reported a bathymetric range of 16–89 m.

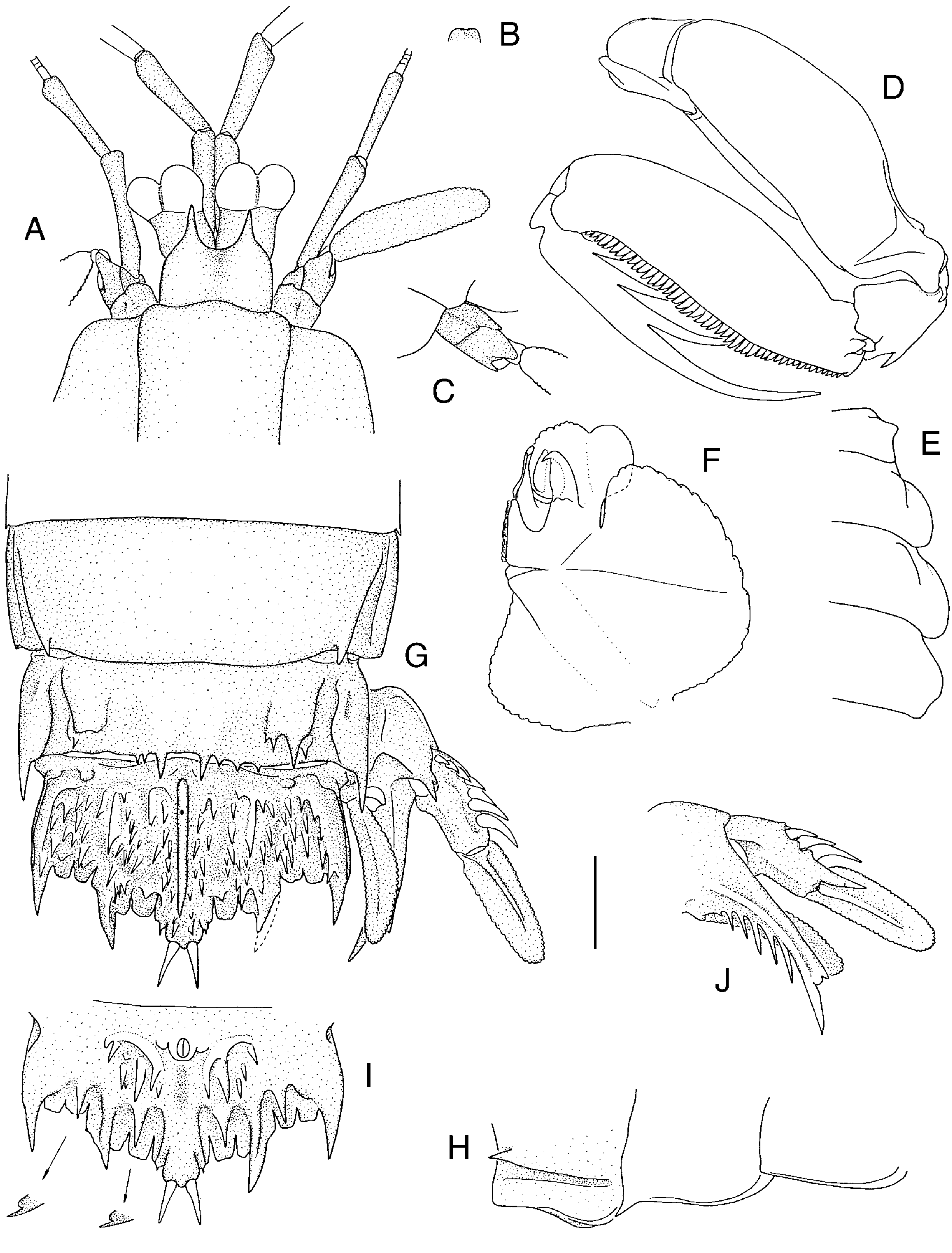

Figure 9. *Coronidopsis serenei* Moosa. A–E, G–J, ♀ TL 35 mm (AM P56192). F, ♂ TL 34 mm (AM P56193). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS5–8, right dorsal. F, ♂ PLP1 endopod, right anterior. G, AS4–6, telson & uropod, dorsal. H, AS3–5, right lower lateral. I, telson, ventral. J, right uropod, ventral. Scale A–E, G–J = 2 mm; F = 1 mm.

Distribution. Northern South China Sea, Indonesia, the Philippines and for the first time from Australia.

Eurysquilloides Manning, 1963b

Eurysquilloides Manning, 1963b: 315; 1995: 32. Type species *Squilla sibogae* Hansen, 1926, by original designation and monotypy. Gender masculine.

Diagnosis. Cornea broadened; with six rows of midband ommatidia. A1 somite greatly elongate, extending anteriorly well beyond apex of rostral plate. Rostral plate short, rounded, unarmed anteriorly. Raptorial claw dactylus of with 8–10 teeth; propodus closely pectinate proximally, becoming sparsely pectinate distally, with 3 movable spines proximally. Abdominal articulation compact. AS6 with SM, IM and LT carinae each with posterior spine. Uropodal protopod with inner spine longer than outer; protopod inner margin crenulate.

Included species. One: *E. sibogae* (Hansen, 1926).

Remarks. *Eurysquilloides* differs from all other eurysquilloids in the strongly elongate antennular somite. Contrary to previous accounts of *Eurysquilloides* (e.g., Manning, 1963b; Hansen, 1926, for *Squilla sibogae*), low reflected marginal carinae and intermediate carinae are present on the posterior portion of the carapace, supporting a close relationship between eurysquilloids, squilloids and parasquilloids.

Eurysquilloides sibogae (Hansen, 1926)

Fig. 10

Squilla sibogae Hansen, 1926: 15, pl. 1: figs. 6a–c (type locality: Timor Sea, Indonesia, 9°0.3'S 126°24.5'E).
Eurysquilloides sibogae.–Makarov, 1978: 185.–Moosa & Cleva, 1984b: 74.–Moosa, 1986: 377; 1991: 153.–Manning, 1995: 19, 32.

Type material. HOLOTYPE: ZMA De 103.017, ♂ (TL 47 mm), Indonesia, 9°00.3'S 126°24.5'E, 112 m, mud, sand & shells, Siboga Expedition St. 289, M. Weber, 20 Jan 1900.

Australian material. QUEENSLAND: QM W24213, 1♀ (TL 46 mm), Coral Sea, 18°00.6'S 147°01.5'E, 224–228 m, continental slope, trawled, RV *Soela*, 9 Jan 1986.

Supplementary diagnosis. Eye large; cornea broadened anteriorly but not bilobed. Ocular scales spiniform, directed anterolaterally. A1 somite greatly elongate, exceeding 0.5CL; dorsal processes short, blunt, directed anterolaterally. A2 protopod without ventral papillae. Carapace with faintly indicated reflected MG carina and LT carina posteriorly. Raptorial claw dactylus with 8–10 teeth; carpus dorsally unarmed; propodus opposable margin evenly pectinate proximally, sparsely pectinate distally, with 3 movable spines proximally. Mandibular palp absent. MXP1–3 each with epipod. MXP5 basal segment unarmed. Body depressed; loosely articulated. TS6–8 each with distinct IM carinae. AS1–5 each with distinct IM, LT and MG carinae. AS6 with distinct SM, IM and LT carinae, each armed posteriorly. Abdominal carinae spined as follows: SM 6, IM 5–6, LT (4–5)6, MG (3–4)5. Telson with 3 pairs of primary teeth, each without upraised rounded lobes on margin; dorsal surface with MD, anterior IM and MG carinae; SM denticles present in adults; with 2 IM and 1 LT denticle; inner IM denticle on margin; outer IM and LT denticle ventrally recessed. Uropodal protopod terminating in 2 slender spines, inner longer; protopod inner margin crenulate. Uropodal exopod proximal segment outer margin with 6 or 7 movable spines.

Colour in alcohol. Largely faded—with scattered chromatophores on pereiopods, along dorsal midline and along posterior margins of thoracic and abdominal somites. Telson with scattered chromatophores dorsally, with a dark concentration distally around base of median carina. Uropodal protopod with some scattered chromatophores on outer margin and around exopod articulation; exopod distal segment dark on outer ⅓. Proximal segment of uropodal exopod with scattered chromatophores around points of articulation.

Measurements. Male ($n = 1$) TL 47 mm, female ($n = 1$) TL 46 mm. A1 peduncle 0.89–0.96 CL. A2 scale 0.37–0.41 CL. PI 075 (male), 074 (female). Moosa (1986) reported specimens to 56 mm TL.

Remarks. The Australian specimen agrees in most respects with the holotype and accounts given by Moosa (1986, 1991). The holotype of *E. sibogae* differs from the Australian specimen in having fewer armed abdominal carinae and less distinct carinae on the posterior portion of the carapace. Hansen (1926) reported the presence of a slender spine on the opposable distal margin of the propodus of each raptorial claw adjacent to the articulation with the dactylus in the holotype. Close examination of this propodal "spine" on the holotype shows that it is actually a slender fragment of cuticle that has become detached from base of the dactyli, probably following manipulation of the specimen. Moosa (1991) reported a specimen bearing 11 teeth on the dactylus of the raptorial claw.

Habitat. Muddy sand or shelly substrate between 112 m and 124–228 m. Moosa (1986) reported a bathymetric range of 22–209 m.

Distribution. New Caledonia, Indonesia, Vietnam, the Philippines and now Australia.

Manningia Serène, 1962

Manningia Serène, 1962: 20. Type species *Pseudosquilla pilaensis* de Man, 1888b, by original designation and monotypy. Gender feminine.

Diagnosis. A1 somite short, not exceeding anterior margin of rostral plate. Cornea asymmetrically bilobed; with two rows of midband ommatidia. Rostral plate not bispinous. Dactylus of raptorial claw with 4 teeth; carpus with two dorsal teeth; propodus evenly pectinate for entire length, with 3 movable spines proximally. Mandibular palp 3-segmented. MXP1–5 each with epipod. Abdominal articulation compact. AS6 with 6 or more dorsal spines posteriorly (including posterolateral spines). Telson without

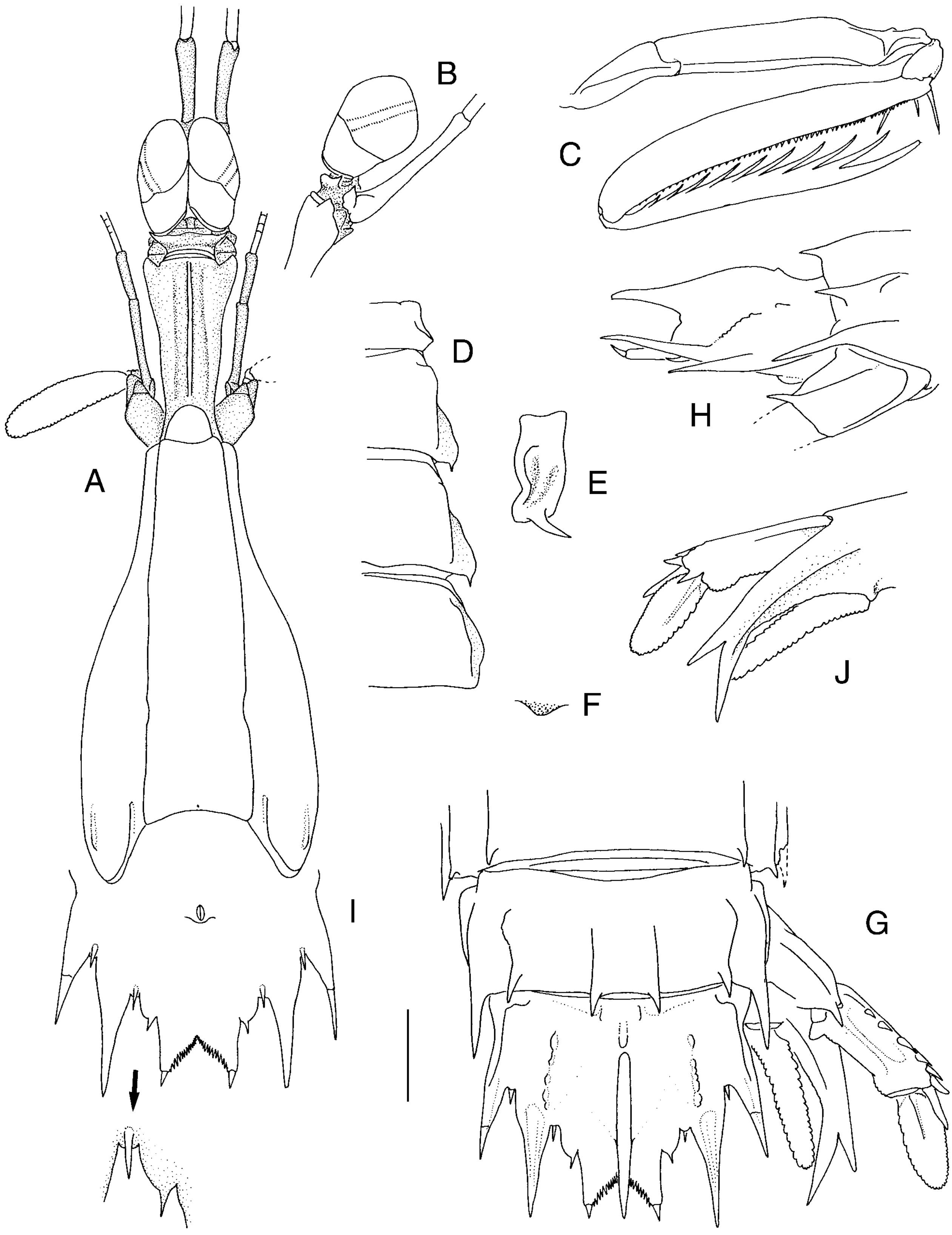

Figure 10. *Eurysquilloides sibogae* (Hansen), ♀ TL 46 mm (QM W24213). A, Carapace & anterior appendages, dorsal. B, eye & adjacent structure, right lateral. C, raptorial claw, right lateral. D, TS5–8, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–5, telson & uropod, dorsal. H, AS6 & telson, right lateral. I, telson ventral. J, right uropod, ventral. Scale A–E, G–J = 2.5 mm; F = 1.25 mm.

upright lobes at base of IM and LT teeth; ventral surface with recessed, outer IM and LT denticles. Uropodal protopod with inner primary spine longer than outer; inner margin lined with spines.

Included species. Eleven: *M. amabilis* Holthuis, 1967b; *M. andamanensis* Ghosh, 1975; *M. australiensis* Manning, 1970c; *M. arabica* Manning, 1990a; *M. pilaensis* de Man, 1902; *M. posteli* Manning, 1977a; *M. notialis* Manning, 1966; *M. misool* Ahyong, 1997b; *M. raymondi* Bruce, 1986; *M. wilsoni* n.sp.; and *M. zehntneri* Manning, 1974.

Remarks. *Manningia* is characterized by the asymmetrically bilobed cornea, compact abdominal articulation, presence of four teeth on the dactylus and two dorsal teeth on carpus of the raptorial claw. Several species groups in the genus may be distinguished on the basis of rostral plate morphology as outlined by Ahyong (1997b). *Coronidopsis*, distinguished from *Manningia* chiefly by its bispinous rostral plate, may be considered to represent one such group. Whether *Manningia* should be synonymized with *Coronidopsis* (the older name), or *Manningia* further subdivided requires further study.

Four epipods and fused ocular scales were attributed to *M. arabica* in its type description (Manning, 1990a). Re-examination of the type material of *M. arabica* at the USNM, however, revealed the presence of five epipods and separate ocular scales as in other species of *Manningia*. Four species of *Manningia* are known from Australia, of which one is newly described.

Key to species of *Manningia*

1 Rostral plate with long apical spine, extending beyond cornea 2

—— Rostral plate without long apical spine 3

2 AS5 with posterolateral spine and unarmed IM carina. Merus of raptorial claw with outer inferodistal spine .... *M. pilaensis*

—— AS5 without posterolateral spine and armed IM carina. Merus of raptorial claw unarmed .... *M. posteli*

3 Rostral plate pentagonal or cordiform, apex pointed or sharp 4

—— Rostral plate broad with anterior margin flattened, broadly rounded or emarginate 7

4 Rostral plate cordiform, with lateral margins rounded .... ***M. australiensis***

—— Rostral plate pentagonal, with lateral margins distinctly angled 5

5 Telson with 2 dorsal carinae between accessory MD and MG carinae .... *M. misool*

—— Telson with 3 dorsal carinae between accessory MD and MG carinae 6

6 Dorsal carina of LT tooth of the telson sinuous, with distinct angle or bend posteriorly .... *M. arabica*

—— Dorsal carina of LT tooth of the telson straight .... ***M. notialis***

7 Rostral plate distinctly broadened, anterior margin emarginate, usually appearing bilobed dorsally 8

—— Rostral plate anteriorly flattened or broadly rounded. AS6 with unarmed carina between SM and IM carinae; telson with three longitudinal dorsal carinae between accessory MD and MG carinae .... *M. amabilis*

8 AS5 with armed IM carina 9

—— AS5 with unarmed IM carina .... *M. andamanensis*

9 Telson with numerous ventral spines in addition to recessed IM and LT denticles 10

—— Telson without ventral spines in addition to recessed IM and LT denticles. AS6 without carina between SM and IM carinae .... *M. zehntneri*

10 Telson ventral surface with V-shaped row of spinules posterior to anal pore. AS6 with unarmed carina between SM and IM carinae .... ***M. raymondi***

—— Telson ventral surface with V-shaped carina posterior to anal pore. AS6 with posteriorly armed carina between SM and IM carinae .... ***M. wilsoni***

Manningia australiensis Manning, 1970c

Fig. 11

Manningia australiensis Manning, 1970c: 78–81, fig. 1 (type locality: off Gillett Cay, Swain Reefs, Australia, 21°40'S 152°15'E).–Makarov, 1978: 183.–Moosa, 1991: 154.–Manning, 1995: 19, 34.–Ahyong, 1997b: 331, 332.–Debelius, 1999: 291.
Manningia vinogradovi Makarov, 1978: 183, fig. 4 (type locality: Gulf of Tonkin, Vietnam, 20°11.5'N 113°02'E).
Manningia thorsoni Naiyanetr, 1987: 239, figs. 2, 3 (type locality: Phuket, Thailand, 8°00'N 98°22'E).

Type material. HOLOTYPE: AM P16288, ♀ (TL 32 mm), off Gillett Cay, Swains Reefs, Queensland, Australia, 63–72 m, dredged, Australian Museum party, Oct 1962.

Australian material. WESTERN AUSTRALIA: AM P43210, 1♂ (TL 27 mm), 43 km NNE of Dampier, 20°14.6'S 116°50.6–50.9'E, 40–41 m, beam trawl, on sand, S 0583, 27 Oct 1983; NTM Cr012366, 2♀♀ (TL 17–21 mm), 19°56.4–56.8'S 117°53.4–53.7'E, 42 m, beam trawl, S 0283 B2, 22 Apr 1983; NMV J37811, 1♂ postlarva (TL 11 mm), 1♂ late larva (TL 13 mm), 1♀ late larva (TL 12 mm), Northwest Shelf between Port Hedland & Dampier, 20°1'S 117°11'E, 48 m, crinoids & sandy shell, epibenthic sled, G. Poore & H. Lew Ton, 11 Jun 1983; NMV J37816, 1♀ (TL 23 mm), Northwest Shelf between Port Hedland & Dampier, 20°29'S 117°20'E, 30 m, coarse shell, epibenthic sled, G. Poore & H. Lew Ton, 11 Jun 1983; NMV exJ37818, 1♀ (TL 29 mm), Northwest Shelf between Port Hedland & Dampier, 20°17'S 116°38'E, 42 m, coarse sandy shell, with crinoids, epibenthic sled, G. Poore & H. Lew Ton, 10 Jun 1983.

Other material. NNM S1042, 1♂ (TL 20 mm), Airport Beach, Phuket, 20 m, grab, J. Hylleberg, 15 Dec 1980 (holotype of *Manningia thorsoni* Naiyanetr).

Diagnosis. A2 protopod with 1 ventral papilla; with blunt dorsal tooth and anteriorly directed ventral spine. Rostral plate cordiform to subpentagonal; apex acute; rounded laterally. Raptorial claw merus without outer inferodistal spine. TS6–8 without carinae. AS1–5 with MG carina and submarginal sulcus; unarmed posterolaterally. AS6 with armed SM, IM, and LT carinae. Telson dorsolateral surface with distinct MD carina and 3 longitudinal carinae in addition to MG carina as follows: accessory MD carinae interrupted, composed of 4 or 5 posteriorly directed spines; anterior IM carina uninterrupted, armed posteriorly; LT carina sinuous and recurved proximally terminating in 1 or 2 spines. Telson posterior margin with 3 broad horizontal lobes between SM and IM teeth, inner lobe with inner IM denticle on margin; with 2 broad horizontal lobes between IM and LT teeth. Telson ventral surface with recessed, outer IM and LT denticles only. Uropodal protopod inner margin with 8–10 slender spines; exopod outer margin with 6 or 7 movable spines; endopod without carinae.

Colour pattern in alcohol. Completely faded.

Measurements. Male (n = 2) TL 20–27 mm, female (n = 5) TL 17–32 mm, male postlarva (n = 1) TL 11 mm, male late larva (n = 1) TL 13 mm, female late larva (n = 1) TL 12 mm. A1 peduncle 0.84–0.97 CL. A2 scale 0.44–0.52 CL. The present series includes the largest known specimen of the species.

Remarks. *Manningia australiensis* is unique in the genus in bearing a cordiform rostral plate. As in species of *Coronidopsis*, *M. australiensis* and *M. andamanensis* retain the inner intermediate denticle in adults. Adults of other species of *Manningia* lack inner intermediate denticle.

The present series of *M. australiensis* agrees well with holotype. Variation resembles that reported by Moosa (1991) in the number of spines on the inner margin of the uropodal protopod and outer margin of the uropodal exopod.

Comparison of respective holotypes of *M. thorsoni* and *M. australiensis* supports Manning's (1995) decision to synonymize the two species. The holotype of *M. thorsoni* agrees in all respects with the adult Australian specimens, differing only in bearing small submedian denticles on the telson, features typical of juveniles of *Manningia* and *Coronidopsis*.

Habitat. Sand or coarse sand and shell substrates in depths of 30–72 m in Australia. The holotypes of *M. thorsoni* and *M. vinogradovi*, both synonyms of *M. australiensis*, were collected at 20 m and 93 m respectively.

Distribution. Vietnam, Thailand, New Caledonia, Papua New Guinea and Australia.

Manningia notialis Manning, 1966

Fig. 12

Manningia notialis Manning, 1966: 103–105, fig. 6 (type locality: Yirrkala, Northern Territory, Australia, 12°15'S 136°53'E).–Manning, 1995: 19, 33.–Ahyong, 1997b: 331, 332.
Pseudosquilla pilaensis.–Stephenson, 1953a: 44.–Stephenson & McNeill, 1955: 245 (not *P. pilaensis* de Man, 1888b).

Type material. HOLOTYPE: AM P14788, ♀ (TL 63 mm), Yirrkala, NW of Cape Arnhem, Northern Territory, Australia, ironstone reef, emulsifiable rotenone, R. Miller *et al*., Arnhem Land Expedition, 6 Aug 1948. PARATYPES: USNM 112436, 1♂ (TL 53 mm), Weipa, Gulf of Carpentaria, Queensland, Australia, 9 m, silt, dredged, G. Webster, 9 Jul 1961; QM W1782, 1♂ (broken, CL 10.5 mm), Bowen, Queensland, Australia, J. MacGregor, Feb 1934.

Australian material. QUEENSLAND: AM P52722, 1♂ (TL 69 mm), 3♀♀ (TL 51–59 mm), E Gulf of Carpentaria between Weipa & Karumba, T. Wassenberg, 14 Feb 1976; AM P52731, 1♂ (TL 56 mm), 10°11.6'S 141°35.7'E, T. Wassenberg, Dec 1991; QM W19320, 5♂♂ (TL 32–47 mm), 1♀ (TL 50 mm), Sabina Point, 22°24'S 150°18'E, 0–0.5 m, littoral rocky shore, sandy pool with rocks & macrophytes, rotenone, J. Johnson, 15 Sep 1993; NTM Cr008849A, 1♀ (TL 51 mm), W of Booby I., Torres Strait, 10°25'S 141°46.4'E, 10.4 m, dredge, SS0591 63, A. Bruce, 29 Nov 1991.

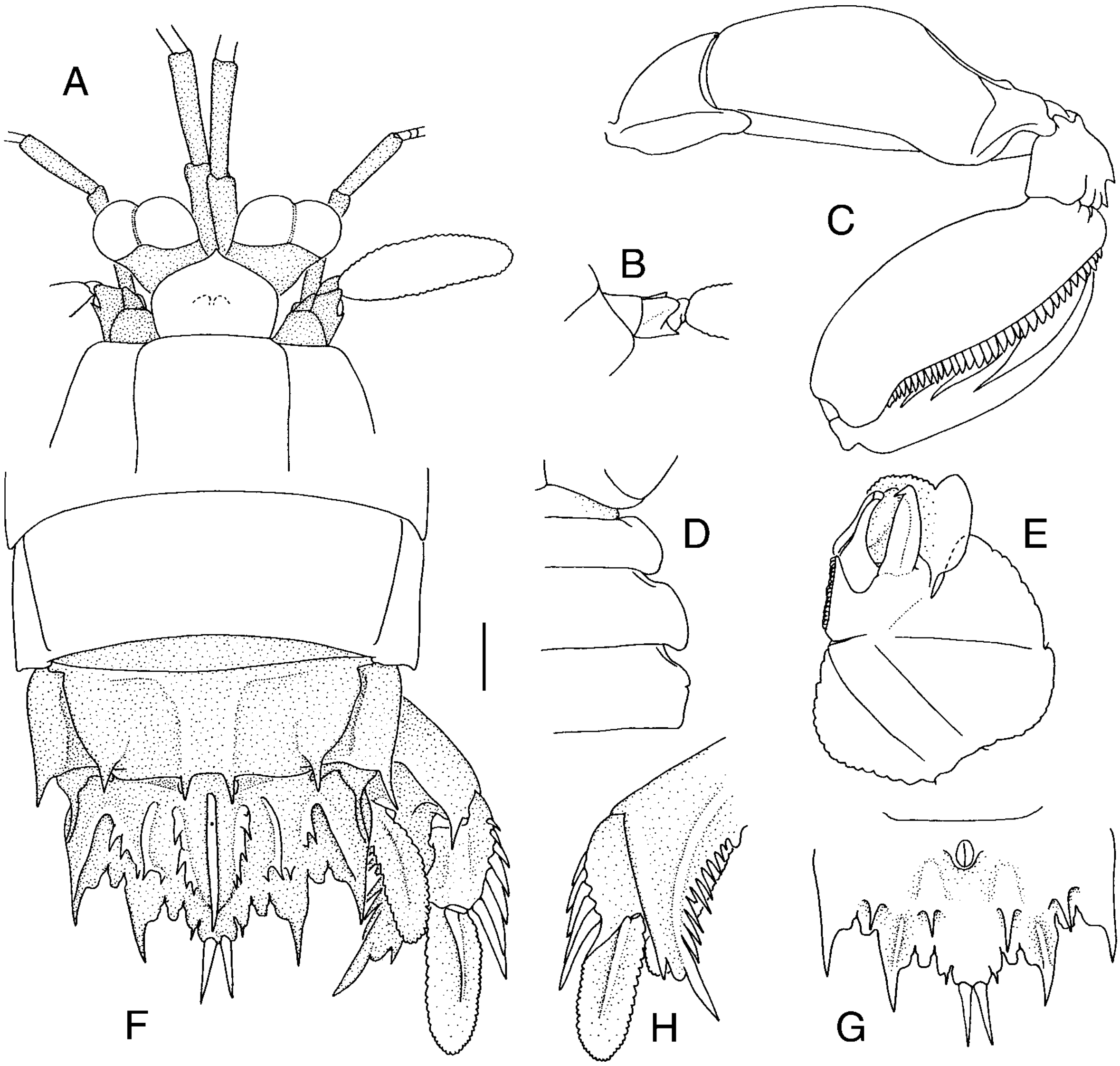

Figure 11. *Manningia australiensis* Manning, ♂ TL 27 mm (AM P43210). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, posterolateral margin of carapace, TS5–8, right dorsal. E, PLP1 endopod, right anterior. F, AS4–6, telson & uropod, dorsal. G, telson, ventral. H, right uropod, ventral. Scale A–D, F–H = 1 mm; E = 0.5 mm.

NORTHERN TERRITORY: NTM, 1♀ (TL 46 mm), Dudley Point, Darwin, muddy reef flat pools, A. Bruce, 17 Sep 1981.

Diagnosis. A2 protopod dorsally unarmed; with ventral papilla and anteriorly directed ventral spine. Rostral plate pentagonal; apex acute, anterolateral margins obtusely angled. Raptorial claw merus without outer inferodistal spine. TS6–8 with distinct IM carinae. AS1–5 with submarginal sulcus and MG carina; AS4–5 with posterolateral spine. AS5 laterally with 4 longitudinal carinae as follows: unarmed IM carina; unarmed LT carina; short, unarmed carina between IM and LT carinae; and MG carina. AS6 with armed SM, IM, and LT carinae. Telson dorsal surface with distinct MD carina and 4 longitudinal carinae in addition to MG carina as follows: accessory MD carinae interrupted, composed of 3 or 4 posteriorly directed spines; anterior IM carina uninterrupted, armed posteriorly; short carina between anterior IM and LT carinae usually uninterrupted, armed posteriorly; LT carina straight or faintly sinuous. Telson posterior margin with 2 broad horizontal lobes between SM and IM teeth; with 1 broad horizontal lobe between IM and LT teeth; ventral surface with recessed IM and LT denticles only. Uropodal protopod inner margin with 5–7 slender spines. Terminal spines of uropodal protopod without lobes between spines. Uropodal exopod proximal segment outer margin with 8 or 9 movable spines; endopod with median sulcus.

Colour in life. Overall dorsal colour light brown. Raptorial claw and pereiopods white. Setae on uropodal exopod and endopod maroon.

Measurements. Male (n = 9) TL 32–69 mm, female (n = 7) TL 46–63 mm. A1 peduncle 0.85–90 CL. A2 scale 0.52–0.60 CL. The present series includes the largest known specimen of the species.

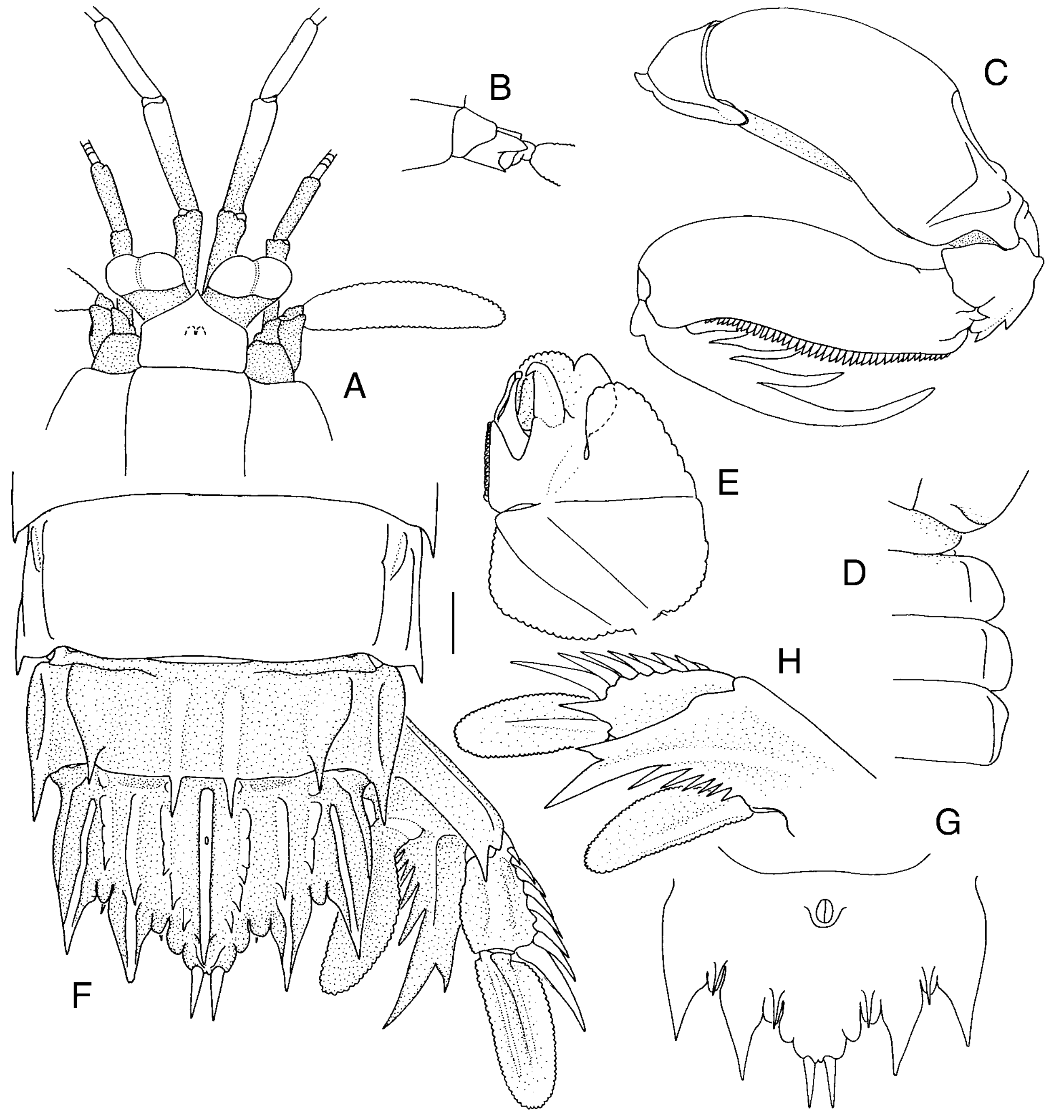

Figure 12. *Manningia notialis* Manning, ♂ TL 56 mm (AM P52731). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, posterolateral margin of carapace, TS5–8, right dorsal. E, PLP1 endopod, right anterior. F, AS4–6, telson & uropod, dorsal. G, telson, ventral. H, right uropod, ventral. Scale A–D, F–H = 2 mm; E = 1 mm.

Remarks. The present specimens of *M. notialis* agree in most respects with the type series, but vary in the shape of the anterior margin of the rostral plate and telson ornamentation. The apex of the rostral plate varies between being obtusely pointed as in the type series, to forming a short acute point as in *M. arabica*. The lateral carina of the telson varies from straight to slightly sinuous and the carina mesial to the lateral carina may be entire or subdivided into two or three short carinae.

Manningia notialis, *M. misool* and *M. arabica* closely resemble each other and differ from all other congeners in the trapezoid rostral plate. *Manningia misool* differs from *M. notialis* in lacking a carina mesial to the lateral carina of the telson and in lacking the short oblique carina between the intermediate and lateral carina on AS5. *Manningia notialis* differs from *M. arabica* in bearing two instead of three rounded lobes on the telson margin between the submedian and intermediate teeth, and in bearing a straight or slightly sinuous instead of distinctly sinuous lateral carina of the telson.

Manningia notialis is one of the few species of the genus known from littoral or shallow sublittoral habitats. Many specimens in the present series were collected from sandy or muddy intertidal pools among rocks and macrophytes; two lots (QM W19320, NTM Cr008849A) were collected with *Gonodactylaceus graphurus* (Miers).

Habitat. Muddy or sandy intertidal pools under rocks and macrophytes, or soft level substrates; intertidal to 10.4 m.

Distribution. Australia, from Arnhem Land, the Gulf of Carpentaria and northeast Queensland.

Manningia raymondi Bruce, 1986

Fig. 13

Manningia raymondi Bruce, 1986: 17–21, figs. 1–3 (type locality: Gulf of Carpentaria, off Groote Eylandt, Northern Territory, Australia, 13°30.0'S 136°30.0'E).–Ahyong, 1997b: 331, 332.–Manning, 1995: 19, 33.

Type material. HOLOTYPE: NTM Cr001306, ♂ (TL 85 mm), off Groote Eylandt, Gulf of Carpentaria, 13°30.0'S 136°30.0'E, J. Elder, 15–16 Jul 1976. PARATYPES: NTM Cr001308, 1♀ (TL 83 mm), Arafura Sea, 12°58'S 132°10'E, 27 m, H. Larson, 19 Oct 1981; NTM Cr001374, 1♂ (TL 82 mm), Arafura Sea, 12°58'S 132°10'E, 27 m, H. Larson, 19 Oct 1981; NTM Cr001526, 1♀ (TL 91 mm), Arafura Sea, 11°00.0'S 132°04.5'E, J. Elder, Sep 1974.

Australian material. QUEENSLAND: AM P21658, 2♂♂ (TL 60–69 mm), SE Gulf of Carpentaria, 17°35.9'S 140°18.5'E, 2.7 m, trawled, J. Yaldwyn & D. McMichael, 17 Dec 1963; AM P56957, 1♂ (TL 52 mm), E of Duyfken Point, Gulf of Carpentaria, 12°29.9'S 141°14.7'E, SS0591 046, T. Wassenberg, Nov–Dec 1991; AM P56955, 1♀ (TL 97 mm), NE Gulf of Carpentaria, 12°17.4'S 139°55.9'E, SS0591 41, T. Wassenberg, 25 Nov 1991; AM P56956, 1♀ (TL 43 mm), Shelburne Bay, 11°35.08'S 142°58.8'E, dredge, dredge crust stn II 033, GBR 0192, T Wassenberg, 21 May 1992; AM P56885 (to QM), 1♀ (TL 53 mm), Gulf of Carpentaria, 11°03.5'S 139°54.8'E, SS0591 57, T. Wassenberg, Nov 1991. WESTERN AUSTRALIA: AM P52744, 1♂ (TL 63 mm), Northwest Shelf, 19°00.3–00.4'S 118°01.0–01.1'E, 116–120 m, beam trawl, 29 Oct 1983. NORTHERN TERRITORY: AM P56954, 1♂ (TL 69 mm), Arafura Sea, 10°S 137°E, 60–80 m, trawl.

Diagnosis. A2 protopod with small mesial tooth and 1 ventral papilla; with anteriorly directed ventral spine. Rostral plate broader than long; emarginate and sulcate anteriorly, appearing bilobed dorsally. TS6–8 with indistinct IM carinae. AS1–5 with MG carinae and submarginal sulcus. AS5 laterally with 5 longitudinal carinae. AS6 with posteriorly armed SM, unarmed reflected SM, armed IM and LT carinae. Telson dorsal surface with MD carina, anterior IM carinae and LT carina in addition to numerous erect spines over dorsolateral surface; posterior margin with 2 or 3 subquadrate horizontal lobes between SM & IM teeth; with 1 or 2 broad horizontal lobes between IM & LT teeth; ventral surface with recessed IM and LT denticles, V-shaped row of postanal spines, opening proximally, and cluster of 4 or 5 spines lateral to anal pore. Uropodal protopod inner margin with 7–9 slender spines; protopod terminal spines with narrow rounded lobe on outer distal margin of inner spine; exopod proximal segment outer margin with 9 or 10 movable spines; endopod with 2 dorsal carinae.

Colour in life. Overall dorsum pale grey with broad longitudinal dark brown band extending from anterolateral angle of carapace along outside of gastric groove, and along lateral portion of thoracic and abdominal somites. Thoracic and abdominal somites each with dark brown mid-dorsal patch, diffuse anteriorly. Telson with apices of primary teeth red. Uropodal exopod with distal segment black.

Measurements. Male (n = 7) TL 52–85 mm, female (n = 5) TL 43–97 mm. The 97 mm TL female reported here is the largest known eurysquillid.

Remarks. *Manningia raymondi* most closely resembles *M. wilsoni*, newly described below. Characters distinguishing *M. raymondi* from *M. wilsoni* and other congeners are discussed under the account of the latter.

Habitat. Soft substrates at depths of 27–120 m.

Distribution. Northern Australia: from Shelburne Bay, Queensland, to the Northwest Shelf, Western Australia.

Manningia wilsoni n.sp.

Fig. 14

Type material. HOLOTYPE: AM P56817, ♂ (TL 65 mm), Shelburne Bay, Queensland, Australia, 11°30'S 14°30'E, 21 m, sandy-mud, dredged, T. Wassenberg, 15 Jan 1993.

Diagnosis. Rostral plate distinctly broadened, anterior margin emarginate. Telson with numerous ventral spines in addition to recessed IM and LT denticles; with V-shaped carina posterior to anal pore. AS6 with posteriorly armed carina between SM and IM carinae.

Description. Eye not extending beyond A1 peduncle segment 1. Ophthalmic somite anterior margin rounded. Ocular scales narrow, separate. A1 peduncle 0.96 CL. A1 somite dorsal processes low, angular. A2 protopod with mesial and ventral papilla; with anteriorly directed ventral spine. A2 scale length 0.59 CL; entire margin setose. Rostral plate broader than long; subquadrate; faintly emarginate and sulcate anteriorly. Mandibular palp 3-segmented. MXP1–5 with epipod. MXP5 basal segment unarmed; merus with broad flange on inner margin, distally produced as a blunt triangular lobe. Pereiopods 1–3 basal segment with posterior angled lappet; endopod 2-segmented; distal segment slender; outer and distal margin setose. TS6–8 with distinct IM carinae. TS5 lateral process obsolete; ventral lobe blunt, low. TS6–7 lateral processes broadly rounded. TS8 anterolateral margin triangular, apex blunt; sternal keel a low tubercle. AS1–5 with IM, LT and MG carinae, and submarginal sulcus. AS5 with IM carina armed posteriorly and with accessory sculpture. AS3–5 with posterolateral spine. AS5 laterally with 5 longitudinal carinae as follows: with posteriorly armed IM carina; unarmed LT carina; 1 armed carina between IM and LT carina; 1 unarmed carina between LT and MG carina; and MG carina. AS6 with distinct, posteriorly armed SM, reflected SM, IM and LT carinae, and several intervening spinules and short, irregular

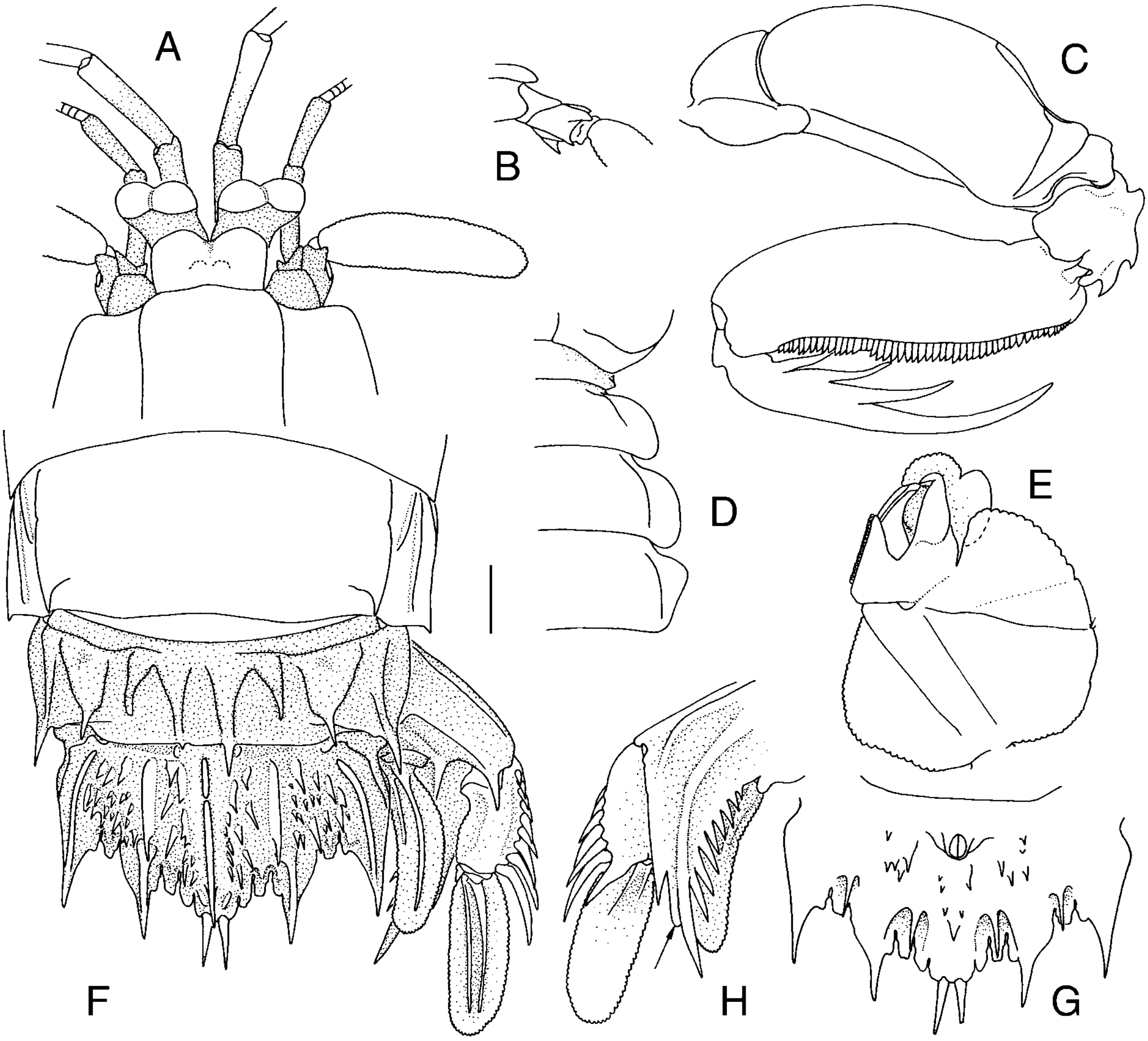

Figure 13. *Manningia raymondi* Bruce, ♂ TL 63 mm (AM P52744). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, posterolateral margin of carapace, TS5–8, right dorsal. E, PLP1 endopod, right anterior. F, AS4–6, telson & uropod, dorsal. G, telson, ventral. H, right uropod, ventral (lobe on inner spine indicated by arrow). Scale A–D, F–H = 2.5 mm; E = 1.25 mm.

carinae; with 1 small ventrolateral spine and blunt triangular lobe anterior to uropodal articulation; sternum posterior margin unarmed. Telson dorsal surface with MD carina, anterior IM carina, and LT carina in addition to numerous erect spines over entire dorsolateral surface. Telson posterior margin with 1 subquadrate horizontal lobe each between SM & IM teeth, and IM & LT teeth; ventral surface with recessed IM and LT denticles, a V-shaped postanal carina opening proximally and cluster of 3 or 4 slender spines lateral to anal pore. Uropodal protopod terminating in 2 slender spines, inner much longer; unarmed dorsally excepting dorsal spine above proximal exopod articulation; with short, flattened ventral lobe anterior to endopod articulation. Protopod inner margin armed with 8 or 9 spines. Terminal spines of uropodal protopod with narrow rounded lobe on outer distal margin of inner spine; proximal margin faintly concave. Uropodal exopod proximal segment unarmed dorsally; inner margin with short proximal concavity, without rounded distal or proximal lobe; outer margin with 9 movable spines, distalmost slightly exceeding midlength of distal segment; distal margin with slender ventral spine; endopod with 2 dorsal carinae.

Measurements. Male holotype TL 65 mm. Other measurements of holotype: CL 14.0, A1 peduncle 13.4 mm, A2 scale 7.9 mm, raptorial claw propodus 13.3 mm.

Colour in life. Base colour light grey. Antennules with dark brown banding. Eyestalk and A2 protopod dark brown. Raptorial claws with dark brown patches concentrated on the carpus extending onto the outer face of the merus and propodus; dactylus white. A2 scales and rostral plate dark brown proximally. Carapace with irregular dark brown patches anteriorly, around the position of the gastric groove and posterolateral margin. Abdominal and thoracic somites with dark brown patch along posterior margin of each somite in submedian, intermediate and lateral positions giving

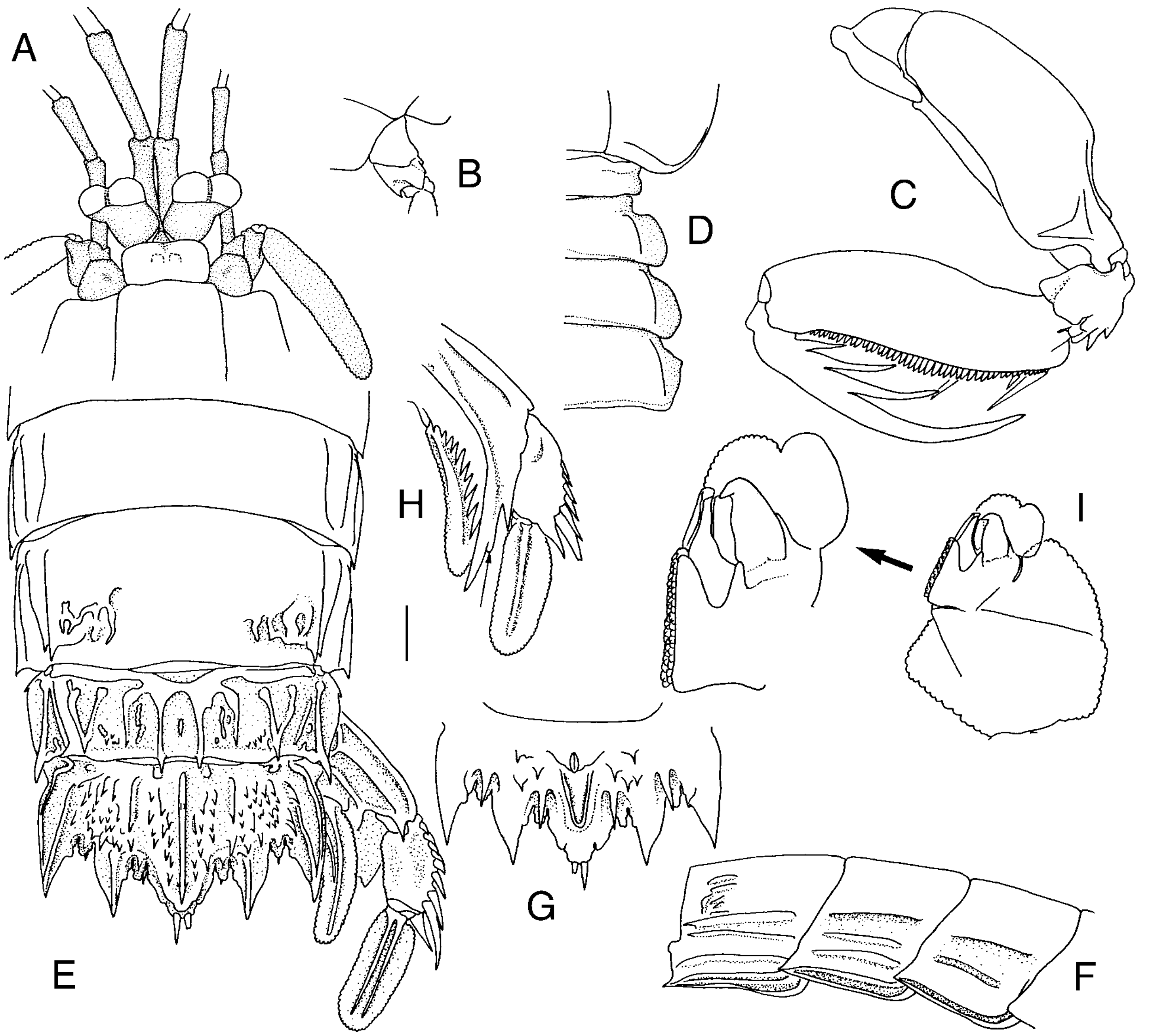

Figure 14. *Manningia wilsoni* n.sp. ♂ holotype TL 65 mm. A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, posterolateral margin of carapace, TS5–8, right dorsal. E, AS4–6, telson & uropod, dorsal. F, TS3–5, right lateral. G, telson, ventral. H, right uropod, ventral (lobe on inner spine indicated by arrow). I, PLP1 endopod, right anterior. Scale A–G = 2.5 mm; I = 1.25 mm.

impression of a "block pattern". Telson primary teeth dark basally with orange-red apices. Uropodal protopod-exopod articulation dark brown; exopod distal segment inner ⅔ dark brown; exopod with outer movable spines light orange.

Etymology. Named in honour of George "Buz" Wilson, Australian Museum, for his encouragement and assistance with my stomatopod studies.

Remarks. The spinulose ventral surface of the telson and the outer, distal lobe on the inner spine of the uropodal protopod distinguishes *M. raymondi* and *M. wilsoni* n.sp. from all others in the genus (Figs. 13H, 14H). Unlike the rounded lobe between the terminal spines of the uropodal protopod in species such as *M. australiensis* that disappears with age (Manning, 1990a), the lobe on the outer margin of the inner spine in *M. wilsoni* and *M. raymondi* remains in adults.

Manningia wilsoni differs from *M. raymondi* in colour pattern, in bearing distinct intermediate carinae on all abdominal somites and many more carinae on AS4–6. The V-shaped postanal carina in *M. wilsoni* is replaced by a V-shaped row of spines in *M. raymondi*. *Manningia wilsoni* belongs to the species group in the genus characterized by a broad, short, medially emarginate rostral plate (Ahyong, 1997b). In the spinulose ventral surface of the telson, *M. wilsoni*, like *M. raymondi*, resembles species of *Coronidopsis*.

Habitat. Sandy-mud at 21 m depth.

Distribution. Known only from the type locality, Shelburne Bay, Queensland.

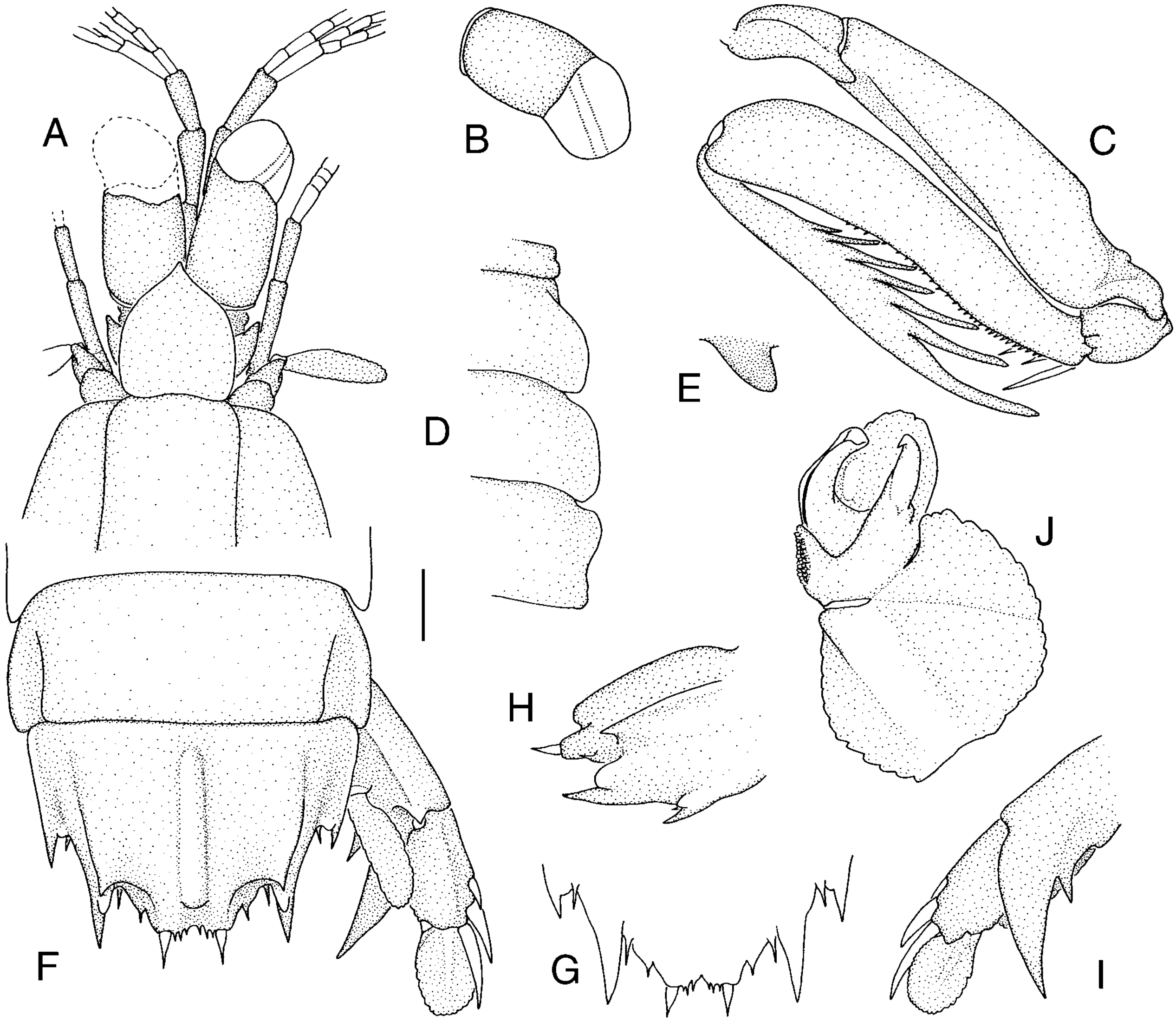

Figure 15. *Raysquilla manningi* Ahyong, ♂ paratype TL 15 mm (NMV J39295). A, anterior cephalon, dorsal. B, eye, right lateral. C, raptorial claw, right lateral. D, TS5–8, right dorsal. E, TS8 sternal keel, right lateral. F, AS5–6, telson and right uropod, dorsal. G, telson, ventral. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–D, F–I = 0.5 mm; E, J = 0.25 mm.

Raysquilla Ahyong, 2000a

Raysquilla Ahyong, 2000a: 37–38. Type species *Raysquilla manningi* Ahyong, 2000a, by monotypy. Gender feminine.

Diagnosis. Eye elongate; cornea subglobular, set obliquely on stalk; with six rows of midband ommatidia. A1 somite short, not exceeding anterior margin of rostral plate; dorsal processes short with blunt apices. Rostral plate subpentagonal. Raptorial claw dactylus with 6 or 7 teeth; propodus with 3 movable spines proximally. Mandibular palp absent. MXP1–2 each with epipod. Body depressed; articulation compact. TS5–8 without dorsal carinae. AS1–5 with indistinct MG carinae only. AS6 without spines on dorsal surface or posterior margin. Telson with SM denticles in adults. Uropodal protopod inner margin smooth; terminating in 2 broad flattened spines, outer spine longer.

Included species. One, *R. manningi* Ahyong, 2000a.

Remarks. *Raysquilla* differs from all other eurysquilloids in lacking spines on the dorsal surfaces or posterior margin of AS6. A full account of the genus is given by Ahyong (2000a).

Raysquilla manningi Ahyong, 2000a

Fig. 15

Raysquilla manningi Ahyong, 2000a: 37–41, fig. 1 (type locality: Northwest Shelf, between Port Hedland & Dampier, Western Australia).

Type material. (All Western Australia) HOLOTYPE: NMV J37789, ♂ (TL 16 mm), Northwest Shelf, between Port Hedland & Dampier, 18°41.00'S 118°39.00'E, 134 m, muddy sand, epibenthic sled, G. Poore & H. Lew Ton, 4 Jun 1983. PARATYPES: NMV J39294, 1♂ (TL 11 mm), type locality; NMV J39295, 1♂ (TL 15 mm), type locality.

Supplementary diagnosis. A2 protopod without ventral papilla. Rostral plate subpentagonal. Carapace MG carina at most faintly indicated. Raptorial claw propodus opposable margin closely pectinate proximally, becoming sparsely pectinate distally, with 3 movable spines proximally; carpus without dorsal carina or distal tooth; merus outer inferodistal angle rounded. AS1–5 unarmed posterolaterally. AS6 smooth; dorsal surface with indistinct, unarmed IM carinae only; posterolateral angles unarmed; sternum posterior margin unarmed. PLP1 endopod in adult males with apex of hook process not exceeding apex of tube process; posterior endite with outer margin non-setose but without lateral lobe. Telson with 3–7 spiniform SM denticles; IM teeth slender, with apices extending posteriorly beyond base of SM teeth; inner margin of IM teeth with dorsally deflected, broadly rounded lobe; with 2 spiniform IM denticles, outer arising ventrally; LT teeth slender, with low dorsally deflected rounded lobe on inner margin and 1 spiniform lateral denticle arising ventrally. Telson dorsal surface with MD and IM carinae; MD carina low, uninterrupted proximally, apex blunt; IM carina uninterrupted extending anteriorly almost to anterior margin of telson, produced to a short spine at level of IM tooth; MG carina indistinct. Uropodal protopod terminating in 2 broad flattened spines, outer longer; protopod inner margin smooth. Uropodal exopod proximal segment with 3 movable spines on outer margin.

Measurements. Male (n = 3) TL 11–15 mm. A1 peduncle 0.63–0.74 CL. A2 scale 0.23–0.27 CL. Uropodal endopod length 2.96–3.20 breadth. PI 085–091. The present series includes the largest known specimen of the species.

Habitat. Muddy sand at 134 m depth.

Remarks. A full account of this species is given by Ahyong (2000a).

Distribution. Known only from the type locality, the Australian Northwest Shelf.

Sinosquilla Liu & Wang, 1978

Sinosquilla Liu & Wang, 1978: 89, 93. Type species *Sinosquilla sinica* Liu & Wang, 1978, by original designation. Gender feminine. (Published January 1978).

Eurysquillopsis Makarov, 1978: 185. Type species *Eurysquillopsis angustirostris* Makarov, 1978, by monotypy. Gender feminine. (Published February 1978).

Diagnosis. Cornea strongly bilobed, lobes equal; with six rows of midband ommatidia. Rostral plate a long slender spine, medially carinate. A1 somite short, not exceeding anterior margin of rostral plate. Dactylus of raptorial claw with 8 or more teeth; carpus with single dorsal spine; propodus evenly pectinate for entire length, with 3 movable spines proximally. Abdominal somites loosely articulated. AS6 with 6 or more spines on dorsally or posteriorly. Telson covered by numerous small spinules; without SM denticles in adults; IM and LT teeth each with rounded vertical lobe dorsally, and larger, blunt, horizontal lobe laterally. Uropodal protopod with inner margin lined with spinules; terminating in two primary spines, inner longer.

Included species. Two: *S. sinica* Liu & Wang, 1978; and *S. hispida* Liu & Wang, 1978.

Remarks. The long, slender rostral plate in combination with the spinulose dorsal surface of AS6 and the telson distinguishes *Sinosquilla* from all other eurysquillids. As reported by Moosa (1986), *Eurysquillopsis* Makarov, 1978, is indistinguishable from *Sinosquilla* Liu & Wang, 1978, published only one month apart. One species of *Sinosquilla* is known from Australia.

Key to species of *Sinosquilla*

1 Telson with distinct MD carina. AS6 with posteromedian area smooth, without spinules .... ***S. sinica***

— Telson with MD carina replaced by row of spinules. AS6 with posteromedian area spinulose .... *S. hispida*

Sinosquilla sinica Liu & Wang, 1978

Fig. 16

Sinosquilla sinica Liu & Wang, 1978: 89, 90, 94, fig. 1, pl. 1, figs. 1–3 (type locality: South China Sea, off Guangdong Province, China, 21°00'N 113°30'E).–Moosa, 1986: 378–379.–Manning, 1995: 19, 36.

Eurysquillopsis angustirostris Makarov, 1978: 185, figs. 5, 6 (type locality: Tonkin Bay, Vietnam, 18°00'N 110°08'E).

Australian material. QUEENSLAND: QM W24195, 2♂♂ (TL 50–67 mm), 1♀ (TL 60 mm), Coral Sea, 17°59.9'S 147°02.9'E, 250–252 m, trawled, continental slope, RV *Soela*, P. Davie, 29 Nov 1985; QM exW24199, 2♂♂ (TL 57–71 mm), Coral Sea, 17°56.6'S 147°03.4'E, 300–304 m, trawled, continental slope, P. Davie, 29 Nov 1985; QM W24206, 1♀ (TL 63 mm), Coral Sea, 17°59.8'S 147°05.4'E, 260 m, trawl, continental slope, 16 Jan 1986; QM W24211, 1♂ (TL 74 mm), Coral Sea, 18°01.4'S 147°07.9'E, 298–300 m, trawl, continental slope, 20 Jan 1986; QM W24212, 1♀ (TL 82 mm), Coral Sea, 17°59.9'S 147°04.2'E, 260–264 m, trawl, continental slope, 16 Jan 1986; QM W24216, 1♂ (TL 53 mm), 1♀ (TL 49 mm), Coral Sea, 18°02.0'S 147°06.9'E, 260 m, trawl, continental slope, 19 Jan 1986.

Other material. ZRC, 1♀ (TL 46 mm), South China Sea, China, 5°00.32'N 111°16.95'E, 110 m, mud, 14 May 1987; MNHN St 973, 1♀ (TL 77 mm), Philippines, 170–182 m, MUSORSTOM II, sta. 51, 27 Nov 1980.

Diagnosis. Raptorial claw dactylus with 9 or 10 teeth. Mandibular palp 2-segmented. AS5 with spines along posterior margin short, not obscuring articulation with AS6. AS6 with median surface smooth, without spinules; spines along posterior margin short, not obscuring articulation with telson. Telson with margins of horizontal lobes and outer

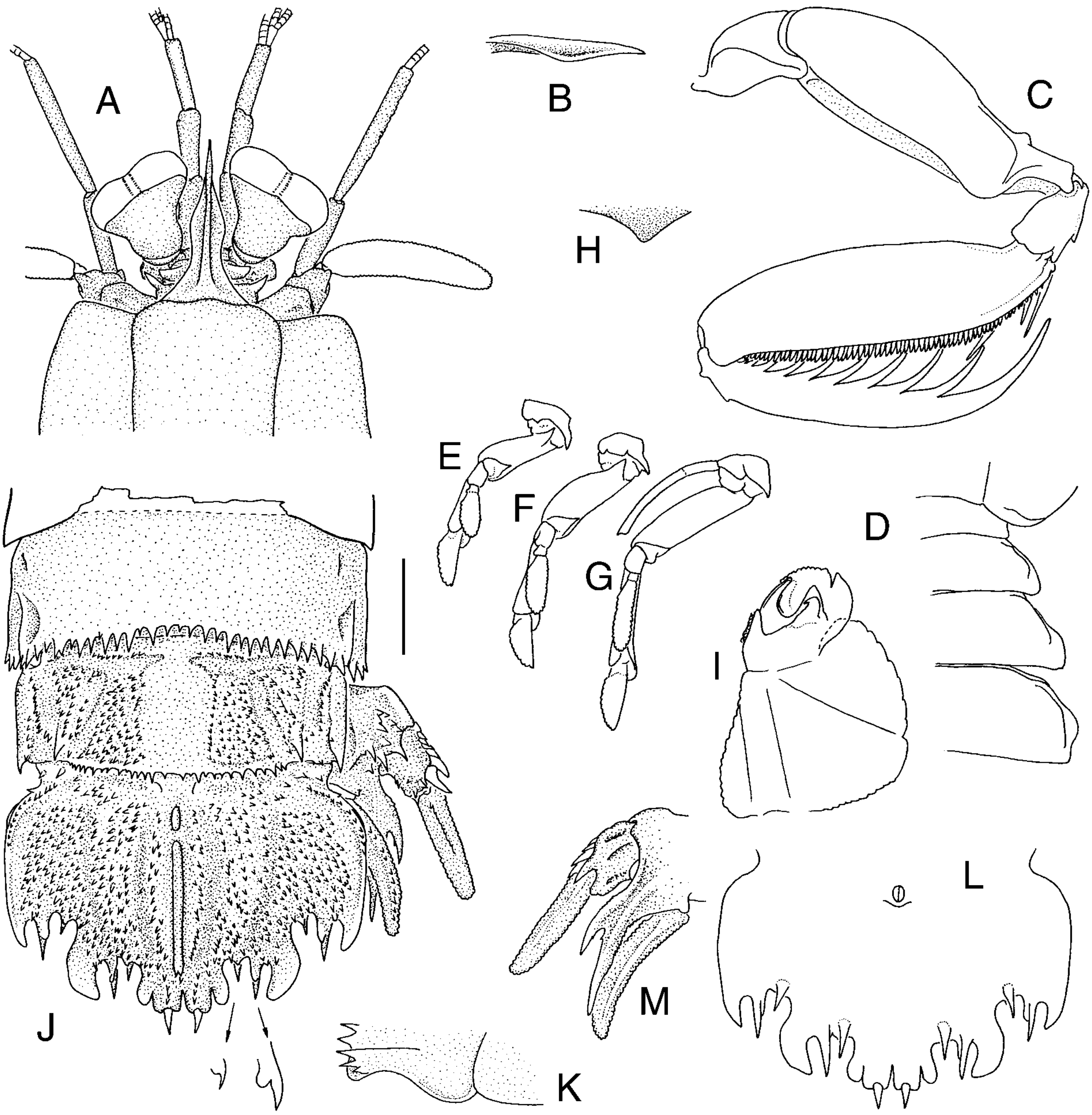

Figure 16. *Sinosquilla sinica* Liu & Wang, ♂ TL 57 mm (QM W24199). A, anterior cephalon, dorsal. B, rostral plate, right lateral. C, raptorial claw, right lateral. D, posterolateral margin of carapace, TS5–8, right dorsal. E–G, pereiopods 1–3, right posterior. H, TS8 sternal keel, right lateral. I, PLP1 endopod, right anterior. J, AS4–6, telson & uropod, dorsal. K, AS4–5, right lower lateral. L, telson, ventral. M, right uropod, ventral. Scale A–G, J–M = 3 mm; H, I = 1.5 mm.

distal margin smooth, without spinules; MD carina smooth, distinct, armed posteriorly. Uropodal protopod inner margin serrate or with short spinules; terminal spines of uropodal protopod with 0–2 spinules on outer margin of inner spine and 1 or 2 spinules on inner margin of outer spine. Uropodal exopod proximal segment outer margin with 4–6 movable spines; exopod distal segment exceeding twice length of proximal segment.

Colour in life. Base colour pale pink-brown dorsally; translucent white ventrally. Raptorial claw with merus and carpus body pale pink-brown, with dark brown patch on posterior border of carpus and inferodistal margin of merus; propodus and carpus translucent white. Pereiopods translucent white. Rostral plate with dark brown proximal patch either side of midline. Carapace with some dark brown pigment along gastric groove; with round dark brown spot mesial to each gastric groove in position of cervical groove; posterolateral margin dark. AS1–5 with dark red-brown spot along posterior margin near articular points. AS6 with median dark red brown quadrate patch, darkest posteriorly.

Measurements. Male (n = 6) TL 49–74 mm, female (n = 6) TL 46–82 mm. CI 232–273. A1 peduncle 0.81–0.96 CL. A2 scale 0.57–0.69 CL. The present series includes the largest known specimen of the species.

Remarks. The Australian specimens agree well with the type description and a specimen from China (ZRC), but differ in bearing sinuous instead of convex rostral plate margins and smaller spines on the inner margin of the uropodal protopod, as in Philippine specimens reported by Moosa (1986) that were re-examined for this study.

Habitat. Continental slope at depths between 250–252 m and 300–304 m. Liu & Wang (1978) reported *S. sinica* from the South China Sea at 58–89 m on sandy mud.

Distribution. South China Sea, Vietnam, the Philippines and now Australia.

GONODACTYLOIDEA Giesbrecht, 1910

Diagnosis. Cornea with of six rows of rectangular ommatidia in the midband. MXP3–4 with propodi ovate, neither ribbed nor beaded ventrally. Body subcylindrical, articulation compact. Raptorial claw with ischiomeral articulation terminal or subterminal; dactylus inflated or uninflated basally. Telson with distinct MD carina or boss; SM teeth with movable apices; at most with 3 "intermediate" denticles, arising marginally. Uropodal protopod with one or two primary spines; articulation of exopod segments terminal or subterminal.

Included families. Seven: Alainosquillidae Moosa, 1991; Pseudosquillidae Manning, 1977a; Hemisquillidae Manning, 1980b; Odontodactylidae Manning, 1980b; Gonodactylidae Giesbrecht, 1910; Protosquillidae Manning, 1980b; and Takuidae Manning, 1995.

Remarks. Recent studies of stomatopod phylogeny (Ahyong, 1997a; Hof, 1998; Ahyong & Harling, 2000) show that Gonodactyloidea sensu Manning (1980b, 1995) is not monophyletic. Ahyong & Harling (2000) removed Eurysquillidae and Parasquillidae to their own superfamilies and Gonodactyloidea was restricted to seven families sharing six rows of rectangular ommatidia in the midband of the cornea, a dorsal spine or articulated plate on the antennal protopod, and a strongly convex, subcylindrical body. The differences between gonodactyloids, eurysquilloids and parasquilloids are outlined under the accounts of the latter two superfamilies.

Most gonodactyloids bear a "smashing claw" and subglobular cornea. Pseudosquillids and alainosquillids are the only gonodactyloids having a "spearing claw", and *Pseudosquillana megalophthalma* is the only gonodactyloid with a bilobed cornea. Six of seven gonodactyloid families are represented in Australian waters.

Key to families of the Gonodactyloidea

1 Ischiomeral articulation of raptorial claw terminal; base of dactylus uninflated or at most slightly thickened 2

—— Ischiomeral articulation of raptorial claw subterminal; base of dactylus strongly inflated into blunt heel 4

2 Dactylus of raptorial claw with 2 or 3 teeth; outer basal margin not inflated 3

—— Dactylus of raptorial claw without teeth; outer basal margin inflated .... **Hemisquillidae**

3 Dactylus of raptorial claw with 2 teeth; propodus with 1 movable spine proximally .... Alainosquillidae

—— Dactylus of raptorial claw with 3 teeth; propodus with 3 (rarely 2) movable spines proximally .... **Pseudosquillidae**

4 Articulation of uropodal exopod segments terminal 5

—— Articulation of uropodal exopod segments subterminal 6

5 Dactylus of raptorial claw with short teeth on inner margin. A2 protopod with articulated plate dorsally. AS6 articulating with telson. Telson with distinct MD carina .... **Odontodactylidae**

—— Dactylus of raptorial claw without teeth on inner margin. A2 protopod with fixed spine dorsally. AS6 fused with telson (demarcation usually indicated by dorsal groove). Telson with median boss .... **Protosquillidae**

6 Distal spines on outer margin of uropodal exopod stout, strongly recurved anteriorly .... **Takuidae**

—— Distal spines on outer margin of uropodal exopod slender, straight or slightly curved, not strongly recurved anteriorly .... **Gonodactylidae**

ALAINOSQUILLIDAE Moosa, 1991

Alainosquillidae Moosa, 1991: 167 (type genus *Alainosquilla* Moosa, 1991).

Diagnosis. Cornea subglobular. Dorsal surface of A2 protopod with flattened, articulated plate. Ischiomeral articulation of raptorial claw terminal; propodus with 1 movable spine proximally, opposable margin evenly pectinate proximally, becoming sparsely pectinate distally; dactylus slender with 2 teeth, basally uninflated. AS6 articulating with telson. Telson with distinct MD carina; SM denticles present in adults. Articulation of uropodal exopod segments terminal; distal spines on outer margin of uropodal exopod slender, straight.

Included genera. One, *Alainosquilla* Moosa, 1991.

Remarks. Alainosquillidae includes a single genus and species, *Alainosquilla foresti* Moosa, 1991. *Alainosquilla* was originally characterized as bearing a fixed dorsal spine on the A2 protopod and subterminally articulated uropodal exopod segments (Moosa, 1991). Restudy of the type material of *A. foresti*, however, shows that the A2 protopod bears an articulated plate and terminally articulating uropodal exopod segments as in Hemisquillidae, Pseudosquillidae and Odontodactylidae. Alainosquillids are not yet known from Australian waters.

GONODACTYLIDAE Giesbrecht, 1910

Gonodactylinae Giesbrecht, 1910: 148 (type genus *Gonodactylus* Berthold, 1827).
Gonodactylidae.–Manning, 1968c: 137.

Diagnosis. A2 protopod dorsally with fixed, anteriorly directed spine. Ischiomeral articulation of raptorial claw subterminal; dactylus of raptorial claw without teeth on inner margin, outer basal margin strongly inflated into blunt heel. AS6 articulating with telson. Telson with distinct MD carina. Articulation of uropodal exopod segments subterminal. Distal spines on outer margin of uropodal exopod slender, straight or slightly curved, not strongly recurved anteriorly.

Included genera. Nine: *Gonodactylaceus* Manning, 1995; *Gonodactylellus* Manning, 1995; *Gonodactyloideus* Manning, 1984a; *Gonodactylolus* Manning, 1970b; *Gonodactylopsis* Manning, 1969d; *Gonodactylus* Berthold, 1827; *Hoplosquilla* Holthuis, 1964; *Hoplosquilloides* Manning, 1978e; and *Neogonodactylus* Manning, 1995.

Remarks. All gonodactylids bear "smashing claws" and are most abundant on coral reefs. The combination of the "smashing claws" with the subterminal articulation of the distal segment of the uropodal exopod and slender, movable, outer spines on the proximal uropodal exopod segment distinguishes Gonodactylidae from other gonodactyloids. Nine genera are recognized here in the Gonodactylidae. Characters distinguishing *Gonodactylinus* from *Gonodactylellus* are too variable to distinguish the genera as originally diagnosed (Manning, 1995). Therefore, *Gonodactylinus* is synonymized with *Gonodactylellus* (see remarks under the account of the latter). Species of most gonodactylid genera (except *Neogonodactylus*) occur exclusively in the Indo-West Pacific. Species of *Neogonodactylus* occur only in the Eastern Pacific and Western Atlantic, and no gonodactylids are known from the Eastern Atlantic. Four genera are represented in Australian waters: *Gonodactylaceus, Gonodactylellus, Gonodactyloideus* and *Gonodactylus*.

Key to genera of Gonodactylidae (based on Manning, 1995)

1 Mandibular palp absent 2

—— Mandibular palp present 3

2 Anterolateral margins of carapace straight or slightly concave, not extending anteriorly beyond base of rostral plate. Rostral plate with slender median spine and broad basal portion, not sharply trispinous .... *Gonodactylolus*

—— Anterolateral margins of carapace convex, extending anteriorly beyond base of rostral plate. Rostral plate not sharply trispinous .... *Hoplosquilla*

3 Rostral plate sharply trispinous 4

—— Rostral plate with slender median spine and short, broad, trapezoid basal portion 5

4 Anus located on dorsal surface of telson. Uropodal endopod with fixed spines on inner margin .... *Hoplosquilloides*

—— Anus located on ventral surface of telson. Uropodal endopod without spines on inner margin .... *Gonodactylopsis*

5 Eye flattened anteriorly, cornea broadened, distinctly broader than stalk .... ***Gonodactyloideus***

—— Eye subcylindrical, cornea not broader than stalk in dorsal view 6

6 Ocular scales large, broader than basal width of rostral spine .... ***Gonodactylus***

—— Ocular scales small, narrower than basal width of rostral spine 7

7 Telson with 5 mid-dorsal carinae. Uropodal protopod with one or two proximal lobes between terminal spines. Opposable margin of propodus of raptorial claw without proximal movable spine in adults .... ***Gonodactylaceus***

—— Telson with 3 or 5 mid-dorsal carinae. Uropodal protopod without lobes between terminal spines. Opposable margin of propodus of raptorial claw with proximal movable spine in adults 8

8 IM carina of telson with accessory longitudinal carina on mesial margin .... *Neogonodactylus*

—— IM carina of telson without accessory longitudinal carina on mesial margin .... ***Gonodactylellus***

Gonodactylaceus Manning, 1995

Gonodactylaceus Manning, 1995: 42–43. Type species *Gonodactylus ternatensis* de Man, 1902, by original designation. Gender masculine.

Diagnosis. Eye subcylindrical, cornea not broader than stalk in dorsal view. Ocular scales small, narrower than basal width of median spine of rostral plate. Rostral plate with slender median spine and short, broad, trapezoid basal portion. Anterolateral margins of carapace convex, extending anteriorly beyond base of rostral plate. Mandibular palp 3-segmented. Opposable margin of propodus of raptorial claw without proximal movable spine in adults. Telson with 5 mid-dorsal carinae; IM carina without accessory longitudinal carina on mesial margin; anus located ventrally. Uropodal protopod with one or two proximal lobes between terminal spines; endopod without spines on inner margin.

Included species. Five: *G. falcatus* (Forskål, 1775); *G. graphurus* (Miers, 1875); *G. glabrous* (Brooks, 1886); *G. randalli* (Manning, 1978a); and *G. ternatensis* (de Man, 1902).

Remarks. *Gonodactylaceus* differs from other gonodactylids by the combination of subglobular corneae, absence of a movable proximal spine on the propodus of the raptorial claw in adults, and the presence of five mid-dorsal carinae on the telson. As in other gonodactylids, postlarval and juvenile *Gonodactylaceus* bear a movable, proximal spine on the propodus of the raptorial claw, but unlike other gonodactylids, the spine is lost in adults.

Previous studies suggested that many species of *Gonodactylaceus* have narrow, restricted distributions (e.g., Manning & Lewinsohn, 1982). The results of this study and others (Barber & Erdmann, 2000; Erdmann, unpubl.), however, show that several nominal species actually comprise a single, widespread species. Consequently, *G. aloha, G. gravieri, G. insularis, G. mutatus, G. siamensis* and *G. takedai* are all regarded as synonyms of *G. falcatus*.

Roxas & Estampador (1930) described two new gonodactylids from the Philippines: *Gonodactylus chiragra* var. *crescentus* and *Gonodactylus bossorotundus*. The two species were based only on their respective holotypes, each of which were asymmetrically deformed. Moreover, Roxas & Estampador's (1930) types are no longer extant (Garcia, 1981; Keenan *et al*., 1998; Ng, pers. comm.) and their descriptions are sufficiently general to be applicable to most gonodactylid species recognized today. Many gonodactylid species have been described since 1930 and their nomenclatural stability is potentially threatened by the ambiguous identities of *Gonodactylus chiragra* var. *crescentus* and *Gonodactylus bossorotundus*. To stabilize the identities of *Gonodactylus chiragra* var. *crescentus* and *Gonodactylus bossorotundus*, the holotype of *Gonodactylaceus glabrous* from the Philippines is designated as the neotype for both of Roxas & Estampador's (1930) species. Therefore, *G. glabrous* Brooks is an objective senior synonym of *Gonodactylus chiragra* var. *crescentus* Estampador and *Gonodactylus bossorotundus* Estampador.

Key to species of *Gonodactylaceus*

1 AS1–5 ornamented dorsally with fine transverse grooves. Rostral plate with sharp anterolateral angles; meral spot on raptorial claw orange in life .... ***G. graphurus***

—— AS1–5 smooth, without fine transverse grooves 2

2 Margin of uropodal endopod with multiple rows of setae, some deflected dorsally. AS6 with median carinule; uropodal protopod with two lobes between terminal spines .... *G. randalli*

—— Margin of uropodal endopod with single row of setae, some deflected dorsally. Uropodal protopod usually with one lobe between terminal spines 3

3 Telson with knob undivided (AS6 without median carinule; meral spot of raptorial claw orange in males, yellow in females .... ***G. ternatensis***

—— Telson with knob bilobed (occasionally indistinctly bilobed) 4

4 Rostral plate with blunt, rounded anterolateral corners. AS6 with or without median carinule. Meral spot of raptorial claw yellow in life in both sexes .... ***G. falcatus***

—— Rostral plate with angular anterolateral corners. AS6 without median carinule. Meral spot of raptorial claw orange in life in both sexes .... ***G. glabrous***

Gonodactylaceus falcatus (Forskål, 1775)

Fig. 17

Cancer falcatus Forskål, 1775: 96 (type locality: Djeddah, Red Sea, by neotype selection [Manning & Lewinsohn, 1981]).
Gonodactylus falcatus.–Stephenson, 1952: 11, 12; 1953a: 47.–Stephenson & McNeill, 1955: 249–250.–Stephenson, 1962: 34.–Holthuis, 1967b: 31, 41.–Manning, 1965: 260; 1966: 109–110; 1967a: 102–103.–McNeill, 1968: 89.–Manning, 1978a: 4, 5, fig. 1, 2a, 9.–Manning & Lewinsohn, 1981: 314–316, fig. 1; 1986: 7.–Moosa, 1989: 224.–Manning, 1991: 3.–Moosa, 1991: 156–157.
Gonodactylus graphurus.–White, 1847: 85 (part, not *G. graphurus* Miers, 1875).
Gonodactylus chiragra var. *mutatus* Lanchester, 1903: 450 (type locality: Furnadu Velu, Miladumadulu Atoll, Maldive Is, 6°00'N 73°10'E).
Gonodactylus glaber var. *rotundus* Borradaile, 1907: 211–212, pl. 22: fig. 2 (type locality: Coetivy, Seychelle Is, 7°08'S 56°16'E, and Zanzibar, 6°10'S 39°12'E).
Gonodactylus mutatus.–Manning, 1978a: 7–9, figs. 4, 5, 11.–Moosa, 1991: 159.
Gonodactylus glabrous.–McNeill, 1926: 316–317.–Hale, 1929a: 33; 1929b: 67.–Moosa, 1991: 157–158.–Manning, 1978a: 5 (not *G. glabrous* Brooks, 1886).
Gonodactylus insularis Manning & Reaka, 1982: 347–351, figs. 1, 2 (type locality: Kidrenen I., Enewetak, 11°22'50"N 162°10'30"E); new synonymy.
Gonodactylus aloha Manning & Reaka, 1981a: 190–200, figs. 1–3 (type locality: Oahu, Hawaiian Is); new synonymy.
Gonodactylus siamensis Manning & Reaka, 1981b: 479–482, fig. 1 (type locality: Sattahip, Gulf of Thailand, 12°40'N 100°52'E); new synonymy.
Gonodactylaceus gravieri Manning, 1995: 42, 43, 46–48, fig. 13 (type locality: Poulo Condore, Vietnam); new synonymy.
Gonodactylaceus falcatus.–Manning, 1995: 19, 42, 43—Ahyong & Norrington, 1997: 98–99.–Debelius, 1999: 275.
Gonodactylaceus mutatus.–Manning, 1995: 48–51, figs. 9g, h, 15, 16.–Gosliner *et al*., 1996: 195; new synonymy.

Type material. NEOTYPE: NNM S874, ♀ (TL 63 mm), Djeddah, Red Sea.

Australian material. QUEENSLAND: AM G5816, 2♂♂ (TL 19–27 mm), 4♀♀ (TL 21–38 mm), Masthead I., 23°32'S 151°44'E, F. Grant; AM P1759, 1♂ (TL 21 mm), Masthead I., 23°32'S 151°44'E, 31 m; AM P3130, 2♂♂ (TL 27–39 mm), 3♀♀ (TL 31–39 mm), Murray I., Torres Strait, 9°56'S 144°04'E, C. Hedley & A. McCulloch, 30 Aug to 3 Oct 1907; AM P4889, 1♂ (TL 55 mm), 1♀ (TL 52 mm), Dunk I., 17°57'S 146°09'E, E.J. Banfield; AM P5214, 1♂ (TL 49 mm), Palm Id, 20°04'S 148°29'E, E.H. Rainford; AM P8582, 1♂ (TL 35 mm), 2♀♀ (TL 45–47 mm), North West I., 23°30'S 152°00'E, reef, G.P. Whitley, Dec 1925; AM P8783, 1♀ (TL 45 mm), Hook Reef, E of Bowen, 20°01'S 148°15'E, L. Lockwood, 1926; AM P12095, 1♀ (TL 15 mm), Bullock Beach Rocks, Caloundra, 26°48'S 153°08'E, J. Hynd, Aug 1945; AM P12099, 1♀ (TL 51 mm), Palm I., 18°40'S 146°33'E, J. Hynd, Jun 1926; AM P12268, 1♀ (TL 57 mm), Myora, Moreton Bay, 27°29'S 153°25'E, H. Darveniza, 19 Jul 1952; AM P12097, 1♂ (TL 52 mm), Heron I., 23°27'S 151°55'E, J. Hynd, Jun 1947; AM P12098, 1♂ (TL 33 mm), 1♀ (TL 39 mm), Myora, Moreton Bay, coral patch, from *Acropora*, 27°29'S 153°25'E, J. Hynd, 8 Mar 1946; AM P14884, 1♀ (TL 46 mm), Heron I., 23°27'S 151°55'E, L. Thomas, Oct 1958; AM P14893, 3♂♂ (TL 43–54 mm), 2♀♀ (TL 22–50 mm), Northwest I., 23°18'S 151°42'E, M. Ward & W. Boardman, Jul 1929; AM P17698–17699, 1♂ (TL 55 mm), 1♀ (TL 37 mm), NW end Gillett Cay, Coral Sea, 21°43'S 152°25'E, reef & sand flats, Oct 1962; AM P17709, 1♀ (TL 47 mm), 400 m N of One Tree I., 23°30'S 152°05'E, 1.3 m, coral heads just inside rubble ridge on reef, F. Talbot *et al*., 11 Oct 1967; AM P17716, 1♂ (TL 52 mm), 1♀ (TL 54 mm), One Tree I., 23°30'S 152°05'E, southern reef crest, under stones, D. Griffin & H. Recher, 12 Oct 1968; AM P17717, 1♂ (TL 26 mm), One Tree I., 23°30'S 152°05'E, reef crest, NW face, in *Halimeda* & mixed weed under stones, M. Cameron & D. Griffin, 9 Oct 1967; AM P17721–17722, 1♂ (TL 53 mm), 1♀ (TL 47 mm), One Tree I., 23°30'S 152°05'E, 1–1.8 m, lagoon, coral heads, F. Talbot *et al*., 27 Sep 1968; AM P17730, 1♂ (TL 32 mm), Cape Point, near Townsville, 19°16'S 146°40'E, reef, under stones, W. Hall, 1963; AM P17731, 1♀ (TL 37 mm), Geoffrey Bay, Magnetic I., 19°08'S 146°50'E, dead coral, low water mark, M. Hines, 12 Apr 1964; AM P56067, 1♀ (TL 32 mm), One Tree I., shallow lagoon, coral rubble, J. Yaldwyn, 19–20 Nov 1966; AM P56812, 1♂ (TL 43 mm), 2♀♀ (TL 24–44 mm), W side Green I., 16°45'S 145°59'E, reef flat, rubble zone, S. Ahyong, 11 Jul 1992; AM P56971, 1♂ (TL 68 mm), 1♀ (TL 49 mm), Dunwich, Stradbroke I., Moreton Bay, 27°30'S 153°24'E, low tide, under & in dead coral clumps, S. Ahyong *et al*., Sep 1998; AM P57000, 2♀♀ (TL 49–57 mm), W side Green I., 16°43'S 146°00'E, reef flat, rubble & *Porites*, S. Ahyong, 11 Jul 1992; NMV J13826, 1♂ (TL 48 mm), 1♀ (TL 45 mm), Masthead Islet, 23°34'S 151°41'E, J. Kershaw, Oct 1910; NMV J14453, 1♂ (TL 31 mm), 1♀ (TL 37 mm), Masthead Islet, 23°34'S 151°41'E, J. Kershaw, Oct 1910; NMV J14454, 1♂ (TL 41 mm), Green I., 16°45'S 145°59'E, A. Tubb, Jan 1955; NMV J37788, 1♂ (TL 21 mm), 1♀ (22 mm), Masthead I., J. Kershaw, Oct 1910; NMV J37797, 1♀ (TL 15 mm), Lizard I. lagoon, between Palfrey & North I., 14°40'S 145°27'E, 4 m, coral rubble, G. Poore, 7 Dec 1987; NMV J37805, 1♀ (TL 11 mm), Britomart Reef

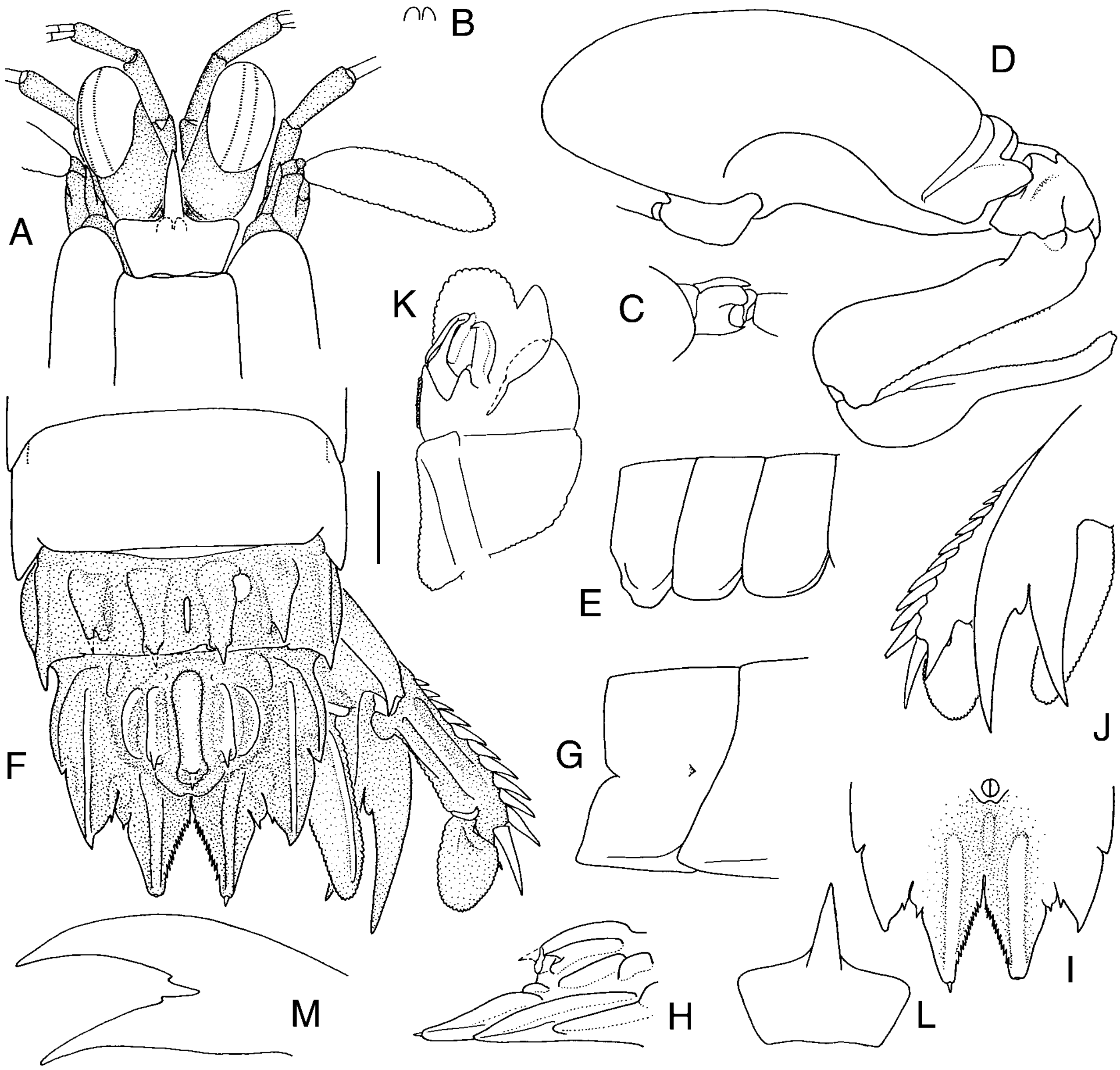

Figure 17. *Gonodactylaceus falcatus* (Forskål). A–K, ♂ TL 37 mm (AM P54457). L, ♀ TL 55 mm (AM P1180). M, ♀ TL 54 mm (AM P1181). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lateral. H, telson, right lateral. I, telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. L, rostral plate, dorsal. M, uropodal protopod, right ventral. Scale A–J, L–M = 1.25 mm; K = 0.6 mm.

bommie, near SE end 18°17'S 146°38'E, 3 m, from encrusted coral heads, G. Poore & H. Lew Ton, 26 Nov 1982; NMV J37809, 1♀ (TL 12 mm), NE of Townsville, 18°43'S 146°45'E, 34 m, muddy sand dredge, G. Poore & H. Lew Ton, 24 Nov 1982; NMV J37817, 1♀ (TL 9 mm), Britomart Reef, 18°17'S 146°38'E, AIMS 11, G. Poore & H. Lew Ton, 1982; NMV exJ37793, 1♀ (TL 15 mm), Lizard I. Reef, 600 m NE of Palfrey I., 14°40'S 145°27'E, 3 m, patch reef, R. Wilson & G. Poore, 9 Dec 1987; NMV J37802, 1♂ (TL 13 mm), near SE end Britomart Reef, bommie, 18°17'S 146°38'E, 8 m, from *Halimeda*, G. Poore & H. Lew Ton, 25 Nov 1982; NMV exJ37807, 1♂ (TL 9 mm), Paul Sammarco's Hole, Britomart Reef, reef fringe, 18°17'S 146°38'E, 5 m, from encrusting algae, G. Poore & H. Lew Ton, 26 Nov 1982; NMV J37833, 1♂ (TL 37 mm), Low I., 22°03'S 150°06'E; NTM Cr008781, 1♀ (TL 19 mm), Gulf of Carpentaria, 10°26'S 141°45.2'E, 10.4 m, R. Williams, 29 Nov 1991; QM W861, 1♂ (TL 42 mm), York I., Torres Strait, 10°41'S 143°32'E, T. Marshall, 16 Aug 1938; QM W1763, 1♂ (TL 37 mm), Brooke I., Pandora Reef, 18°09'S 146°17'E, H. Longman, Oct 1923; QM W1764–1765, 2♂♂ (TL 46–50 mm), Moreton Bay, 27°25'S 153°20'E; QM W3960, 1♂ (TL 49 mm), Heron I., 23°26'S 151°55'E, reef flat, R. Bradbury, 10 Aug 1967; QM W4189, 1♂ (TL 39 mm), Murray I., Torres Strait, G. Ingram, 17 Jul 1974; QM W19343, 1♂ (TL 27 mm), Cliff Point, Freshwater Bay, 22°39'S 150°47'E, 0.5 m, littoral rocky shore, sandy pool with rocks & macrophytes, rotenone, J. Johnson & R. McKay, 18 Sep 1993; QM W21636, 1♀ (TL 49 mm), Myora Reef, North Stradbroke I., Moreton Bay, 27°29'S 153°25'E, patch reef, plate *Acropora*, P. Davie, 14 Apr 1992; QM W21668, 1♂ (TL 22 mm), Myora Reef, North Stradbroke I., Moreton Bay, 27°29'S 153°25'E, 3 m, patch reef, from branching *Acropora* coral, 5 Mar 1996; QM exW22267, 1♂ (TL 56 mm), Polomaise Reef, 6 km W of Masthead Islet, 23°34'S 151°41'E, littoral, under rocks, P. Davie & D. Potter, 10 Feb 1986; QM W22268, 1♀ (TL 43 mm), Polomaise Reef, 6 km W of Masthead Islet, 23°34'S 151°41'E, littoral, under rocks, P. Davie & D. Potter, 10 Feb 1986; QM W22270, 1♀ (broken, CL 9.9 mm), N side Lady Elliot I., 24°07'S 152°43'E, fringing reef, reef flat, B. Sanker, 13 Aug 1985; SAM C1665, 1♀ (TL 27 mm), Flinders I., Princess Charlotte Bay, 14°11'S 144°15'E, H. Hale & N. Tindale, 1927; SAM C5758–5759, 2♂♂ (TL 26–53 mm), 2♀♀ (TL 39–42 mm), Capricorn Group, W. Kimber; SAM C5770, 1♀ (broken, CL 7.5 mm), Capricorn Group, W. Kimber; USNM, 3♂♂ (TL 26–35 mm), 1♀ (TL 31 mm), Lizard I., N. Marshall, 7 Apr 1994; USNM, 1♂ (CL 5.9 mm, broken), Great Barrier Reef, N. Marshall *et al*., 1991; USNM, 1♂ (TL 19 mm), S end Lizard I., 1.0 m, patch reef, rubble, JDT LIZ-3, J. Thomas, 23 Jan 1989; USNM, 1♀ (TL 31 mm), Watson's Bay, Lizard I., 1–2 m, patch reef near SW side where reef meets sand, rubble, JDT LIZ-7, J. Thomas, 25 Jan 1989; USNM, 1♂ (TL 29 mm), 2♀♀ (TL 10–23 mm), Mermaid Beach, Lizard I., 1–2 m, rubble, JDT LIZ-8, J. Thomas, 26 Jan 1989; USNM, 2♂♂ (TL 12–14 mm), 1♀ (TL 12 mm), N side of Palfrey I., patch reef, rubble, JDT LIZ-12, J. Thomas, 27 Jan 1989; USNM, 2♂♂ (TL 13–39 mm), 4♀♀ (TL 14–29 mm), S of Lizard Head Peninsula, Lizard I., rubble zone, JDT LIZ-14, J. Thomas, 29 Jan 1989; USNM, 1♂ (TL 14 mm), 1♀ (TL 22 mm), Lizard Head, Lizard I., rubble zone, JDT LIZ-15, J. Thomas, 31 Jan 1989; USNM, 1♀ (TL 16 mm), Lizard I., 1.5 m, JDT LIZ-17, rubble zone, unconsolidated coral covered rubble, J. Thomas, 1 Feb 1989; USNM, 1♀ (TL 14 mm), Lizard Head, Lizard I., from small rubble pieces on sand, JDT LIZ-19, J. Thomas, 31 Jan 1989; USNM, 2♀♀ (TL 25–32 mm), Palfrey I., 1 m, rubble zone, sandy substrate with heavy algal turf, fine sediment & rubble, JDT LIZ-20, J. Thomas, 4 Feb 1989; USNM, 1♀ (TL 21 mm), Orpheus I., in cove S of resort, 1–2 m, mid-tide level, rubble, JDT OPH-1, J. Thomas, 12 Feb 1989. NEW SOUTH WALES: AM G2450, 1♂ (TL 61 mm), 4♀♀ (TL 40–59 mm), Lord Howe I., 31°33'S 159°05'E, J.B. Waterhouse; AM G2500, 3♂♂ (TL 49–66 mm), 3♀♀ (TL 46–80 mm), Lord Howe I., 31°33'S 159°05'E, Mrs Nicholls; AM G2631, 1♂ (TL 61 mm), Lord Howe I., 31°33'S 159°05'E, Mr Thompson; AM G3861, 2♂♂ (TL 57–61 mm), 2♀♀ (TL 52–54 mm), Lord Howe I., 31°33'S 159°05'E, Mrs Nicholls; AM G3953, 1♂ (TL 65 mm), Lord Howe I., 31°33'S 159°05'E, F. Farnell; AM P1173–1174, 2♀♀ (TL 54–68 mm), Lord Howe I., 31°33'S 159°05'E, Mrs Nicholls, Jan 1907; AM P1176–1181, 1♂ (TL 46 mm), 5♀♀ (TL 52–63 mm), Lord Howe I., 31°33'S 159°05'E, Mrs Nicholls, Jan 1907; AM P1638, 2♀♀ (TL 44–51 mm), Lord Howe I., 31°33'S 159°05'E, E. Waite, 1898; AM P5712, 2♂♂ (TL 32–65 mm), Lord Howe I., 31°33'S 159°05'E, McCulloch & Troughton; AM P5272, 1♀ (TL 57 mm), Lord Howe I., 31°33'S 159°05'E, A.R. McCulloch; AM P15364, 2♀♀ (TL 65–73 mm), Lord Howe I., 31°33'S 159°05'E, Ms Langley; AM P16291, 1♂ (TL 56 mm), Lord Howe I., 31°33'S 159°05'E, lagoon, 14 Feb 1934; AM P38018, 1♀ (TL 47 mm), Middleton Reef, Tasman Sea, 29°28.5'S 159°03.7'E, reef flat near "Runic", coral rubble, J. Lowry & R. Springthorpe, 6 Dec 1987; AM P38019, Middleton Reef, Tasman Sea, 29°27.2'S 159°06.8'E, 10 m, reef front, J. Lowry & R. Springthorpe, 4 Dec 1987; AM P38020, 1♂ (TL 43 mm), 2♀♀ (TL 46–54 mm), Middleton Reef, Tasman Sea, 29°28.8'S 159°07.5'E, reef flat, R. Springthorpe, 7 Dec 1987; AM P53615, 4♂♂ (TL 26–67 mm), 9♀♀ (TL 27–65 mm), Lord Howe I., 31°33'S 159°05'E, J. Booth, 18 Sep 1962; AM P54457, 1♂ (TL 37 mm), Shelly Beach, Manly, 33°49.9'S 151°17.8'E, under stones between tides, M. Ward, 26 May 1926; NMV J13827, 1♂ (TL 32 mm), Lord Howe I., 31°33'S 159°05'E, Jan 1959; NMV J13828, 2♂♂ (TL 36–46 mm), 1♀ (TL 43 mm), Lord Howe & Norfolk I., Giesbrecht; QM W12967, 1♀ (TL 58 mm), Elizabeth Reef, Tasman Sea, intertidal, in coral clump in lagoon, J. Short, 4 May 1987; QM W12968, 1♂ (TL 46 mm), Elizabeth Reef, Tasman Sea, intertidal, under dead coral in lagoon, J. Short, 6 May 1987; QM W12969, 1♀ (TL 52 mm), Middleton Reef, Tasman Sea, in branching coral in moat-like channel in reef flat, J. Short, 8 May 1987; QM W12970, 1♂ (TL 25 mm), 2♀♀ (TL 15–48 mm), Elizabeth Reef, Tasman Sea, subtidal, in branching coral in lagoon, J. Short, 4 May 1987; TM G3835, 1♀ (TL 37 mm), North Reef, Lord Howe I., near low tide level, J. Penprase, 30 Jun 1977; TM G3836, 1♀ (TL 30 mm), Ned's Beach, Lord Howe I., in pools on rocky shelf, near low tide level, J. Penprase, 28 Jun 1977; TM G3837, 1♀ (TL 46 mm), off Dawson Point, Lord Howe I., subtidal, J. Penprase, 11 Nov 1977; TM G3838, 1♂ (TL 65 mm), Dawson Point, Lord Howe I., J. Penprase, Nov 1977; TM G3839, 1♂ (TL 19 mm), 1♀ (TL 17 mm), Dawson Point, Lord Howe I., under subtidal basalt rocks, Mr & Mrs Penprase, Nov 1977. WESTERN AUSTRALIA: AM P14894, 2♂♂ (TL 36–46 mm), Cape Leveque, 16°24'S 122°55'E, intertidal, A. Livingstone, 19 Aug 1929; AM P19330, 3♂♂ (TL 19–40 mm), 3♀♀ (TL 12–38 mm), Exmouth Gulf, N side of Navy Base, rock pool inside Bundagi Reef, 21°53'S 114°22'E, W & J. Ponder, 19 Jan 1972; AM P20260, 1♂ (TL 50 mm), Warroora, S of Point Coates, 3 m, coral reef, N. Coleman, Aug 1972; NTM, 1♂ (TL 22 mm), Vlamingh Head, 21°48'S 114°06'E, limestone shore reef, low tide, R. Hanley, 6 Feb 1988; NTM, 1♀ (TL 40 mm), Cassini I., 13°45'S 126°09'E, coral rubble, rocky intertidal, R. Hanley, 11 Oct 1988; QM W20118, 1♂ (TL 28 mm), Sunday I., Kimberley coast, 16°23.1'S 123°12.6'E, 2 m, limestone terraces, fringing reef, 16 Nov 1994; QM W21081, 1♀ (TL 19 mm), Jones I., N of Vansittart Bay, Kimberley coast, 13°44.5'S 126°22.2'E, reef flat, J. Short, 22 Nov 1995; WAM C7387, 1♀ (TL 50 mm), Cockburn Sound, D. McCockill, Mar 1958. NORTHERN TERRITORY: NTM exCr001117, 1♂ (TL 12 mm), Cobourg Peninsula, 11°10.5'S 132°03.8'E, 4 m, N. Bruce, 17 May 1983; NTM Cr001954, 1♂ (TL 13 mm), Coral Bay, Port Essington, coral reef bank, low tide, A. Bruce, 17 Oct 1981; NTM Cr011989, 1♀ (TL 13 mm), Grose I., Beagle Gulf, 12°30.96'S 130°22.92'E, 9 m, R. Williams, 6 Oct 1993; SAM C5780, 1♂ (TL 54 mm), Northern Territory.

Other material. MNHN St 68, 1♂ (TL 52 mm), Poulo Condore, Vietnam, Dawydoff, 8 Feb 1930 (holotype of *Gonodactylaceus gravieri* Manning); MZC 20.06.1900, ♀ (TL 44 mm), Furnadu Velu, Miladumadulu Atoll, Maldives, J.S. Gardiner (lectotype of *Gonodactylus mutatus* Lanchester); NSMT-Cr9332, holotype ♂ (TL 27 mm), Miyanohama, Chichi-jima, Ogasawara Is, M. Takeda, 1 Jul 1976; SMF 25780, 1♀ (TL 51 mm), Ternate, Indonesia, W. Kükenthal, 1894 (paralectotype of *Gonodactylus ternatensis* de Man); USNM 113724, 1♀ (TL 48 mm), Oahu, Hawaii, coral heads, R. Kinzie III (holotype of *Gonodactylus aloha* Manning & Reaka); USNM 119280, 1♂ (TL 67 mm), 4♀♀ (TL 20–56 mm), Red Sea, Dahlak Archipelago, Eritrea, 0.5–1.5 m, 25 Oct 1962; USNM 135632, 1♀ (TL 33 mm), Kidrenen I., Enewetak, 11°22'50"N 162°10'30"E, 23 m, scattered coral heads on coral sand, C.A. Child, 23 Sep 1969 (holotype of *Gonodactylus insularis* Manning & Reaka); USNM 181673, 1♀ (TL 36 mm), Sattahip, Gulf of Thailand, 12°40'N 100°52'E, coral rubble, intertidal reef flat, M. Reaka & R. Caldwell, Jul 1974 (holotype of *Gonodactylus siamensis* Manning & Reaka).

Diagnosis. Rostral plate with blunt, rounded, anterolateral corners. AS1–5 without fine transverse grooves. AS6 with or without short median carinule. Telson mid-dorsal carinae variously inflated in adult males; MD and accessory MD carinae each usually with short posterior spine; knob bilobed (occasionally indistinctly bilobed); with 8–15 (usually < 13) SM denticles; ventral surface with low carina on each SM tooth and usually with low postanal carina. Terminal spines of uropodal protopod with 1 or 2 (usually 1) lobe between spines; exopod proximal segment outer margin with 10–12 movable spines; endopod outer margin with single row of marginal setae, directed dorsally.

Colour in life. Highly polymorphic varying from uniform or mottled yellow to black green. Raptorial claw with yellow meral spot. Males frequently with rows of dark spots on thoracic and abdominal somites together giving impression of about eight dark longitudinal stripes.

Measurements. Males (n = 85) TL 9–68 mm, female (n = 118) TL 15–80 mm. A1 peduncle 0.51–0.71 CL. A2 scale 0.44–0.58 CL. AWCLI 724–843. The present series includes the largest known specimens of the species.

Remarks. Study of the large series of *Gonodactylaceus* from Australia and elsewhere in the Indo-Pacific, including the Red Sea shows that *G. aloha, G. insularis, G. mutatus, G. siamensis, G. takedai* and *G. gravieri* are synonyms of *G. falcatus* originally described from the Red Sea. With the exception of *G. aloha*, each of these species was established based on few specimens and distinguished by colour pattern, subtle shape differences of the rostral plate, differences in the degree of inflation of the telson carinae, and number of lobes between the terminal spines of the uropodal protopod.

Colour pattern and each of these morphological traits are variable in *G. falcatus*. Colour pattern in *G. falcatus* can change dramatically between moults and differs according to habitat. Thus, living specimens of *G. falcatus* from Australia displayed the full range of colour variations described for *G. aloha, G. insularis, G. siamensis* and topotypic *G. falcatus*. Morphological variation in the present series fully encompasses that present in *G. aloha, G. insularis, G. mutatus, G. siamensis* and *G. gravieri*. The length of the apical spine and shape of the rostral plate (Fig. 17L), the presence or absence of the median carinule on AS6, the relative degree of inflation of the dorsal carinae of the telson, the distinctness of the bilobation of the knob on the telson, and the number of lobes between the terminal spines of the uropodal protopod (Fig. 17M) are all variable. (The number of lobes between the terminal spines of the uropodal protopod are variable also in *G. glabrous* and *G. graphurus*). The rostral plate always has blunt or rounded anterolateral corners, but the lateral margins vary in their degree of divergence. The anterior margins of the rostral plate may be transverse, concave, or slope posteriorly, and the rostral spine may be as long as or longer than the basal portion as already described by Manning & Reaka (1981a) for *G. aloha*. In general, the relative length of the rostral spine, sharpness of telson teeth, spines and carinae decreases with increasing size. Manning & Reaka (1981a) recognized similar morphological variability in the type series of *G. aloha* that parallels that of Australian material. The type series of *G. aloha* included a large series of specimens of different sizes in contrast to the type series of *G. insularis* and *G. siamensis* which all comprised few, relatively small specimens.

Manning (1978a) regarded the presence of the median carinule on AS6 as constant in *G. falcatus*, but this conclusion was based on few specimens. Of the specimens examined here, the median carinule on AS6 is present in 52 of 85 males and 60 of 118 females examined. In total, 55% of specimens examined bear a median carinule on AS6. As already noted by Manning & Reaka (1981a) for Hawaiian material (as *G. aloha*), the median carinule on AS6 may or may not be present. Similarly, a specimen figured from Vietnam (Manning, 1995: fig. 15 c) also bears the median carinule on AS6. The presence of the median carinule on AS6 is variable in *G. falcatus* whereas it is constant in *G. graphurus* and *G. randalli*.

Gonodactylaceus takedai, known only from the holotype, agrees with *G. falcatus* in almost all respects differing in bearing fused ocular scales, faint trace of a median carinule on AS6 and an undivided knob on the telson. The latter two traits are variable in *G. falcatus* but all other specimens studied here bear separate ocular scales. The holotype of *G. takedai* was collected with other specimens of *G. falcatus* and appears to be based on an aberrant specimen of *G. falcatus* in bearing fused ocular scales.

Gonodactylaceus gravieri Manning, 1995, described from two specimens from Vietnam, was distinguished by the presence of two lobes between the terminal spines of the uropodal protopod. As already noted, the number of lobes between the uropodal protopod spines is variable in most species of *Gonodactylaceus*. The holotype of *G. gravieri* with rounded anterolateral corners on the rostral plate is based on *G. falcatus*, whereas the paratype, with angular anterolateral corners on the rostral plate is referable to *G. glabrous*. The paralectotype of *G. ternatensis* identified with *G. glabrous* by Manning (1978a) bears rounded anterolateral angles on the rostral plate and is referable to *G. falcatus*.

Kinzie (1968) postulated that *G. falcatus* was introduced from the Philippines or the South China Sea to Hawaii shortly after the Second World War. Conversely, Manning & Reaka (1981a) considered the Hawaiian population to be a distinct species, naming it *G. aloha*. Recent mitochondrial DNA studies of Indonesian, Hawaiian and Australian *G. falcatus*, as *G. mutatus* and *G. aloha* (see Barber & Erdmann, 2000) suggest that the three populations are conspecific, and that the Hawaiian and Indonesian populations are more closely related thus supporting Kinzie's (1968) hypothesis.

Habitat. Intertidal and shallow subtidal coral and rocky reefs. Usually under boulders and coral rubble or in crevices in rock and sponge.

Distribution. Widely distributed in the Indo-Pacific, from the western Indian Ocean and Red Sea, to Indonesia, Australia, New Caledonia, Japan, Hawaii and French Polynesia.

Gonodactylaceus glabrous (Brooks, 1886)

Fig. 18

Gonodactylus glabrous Brooks, 1886: 22, 64, pl. 14: fig. 5, pl. 15: figs. 7, 9 (type locality: Samboangan reefs, Philippines).–Manning, 1978a: 5–7, figs. 3, 10 (part, holotype only).

Gonodactylus bossorotundus Roxas & Estampador, 1930: 94, 122, pl. 6: figs. 1, 2 (type locality: Samboangan reefs, Philippines, by present neotype designation); new synonym.

Gonodactylus chiragra var. *crescentus* Roxas & Estampador, 1930: 94, 120, pl. 5: fig. 3 (type locality: Samboangan reefs, Philippines, by present neotype designation); new synonym.

Gonodactylaceus glabrous.–Manning, 1995: 19, 42–46, fig. 12.–Ahyong & Norrington, 1997: 99.–Debelius, 1999: 275.

Gonodactylaceus gravieri.–Manning, 1995: 46, fig. 14 (paratype only, not *G. gravieri* Manning, 1995).

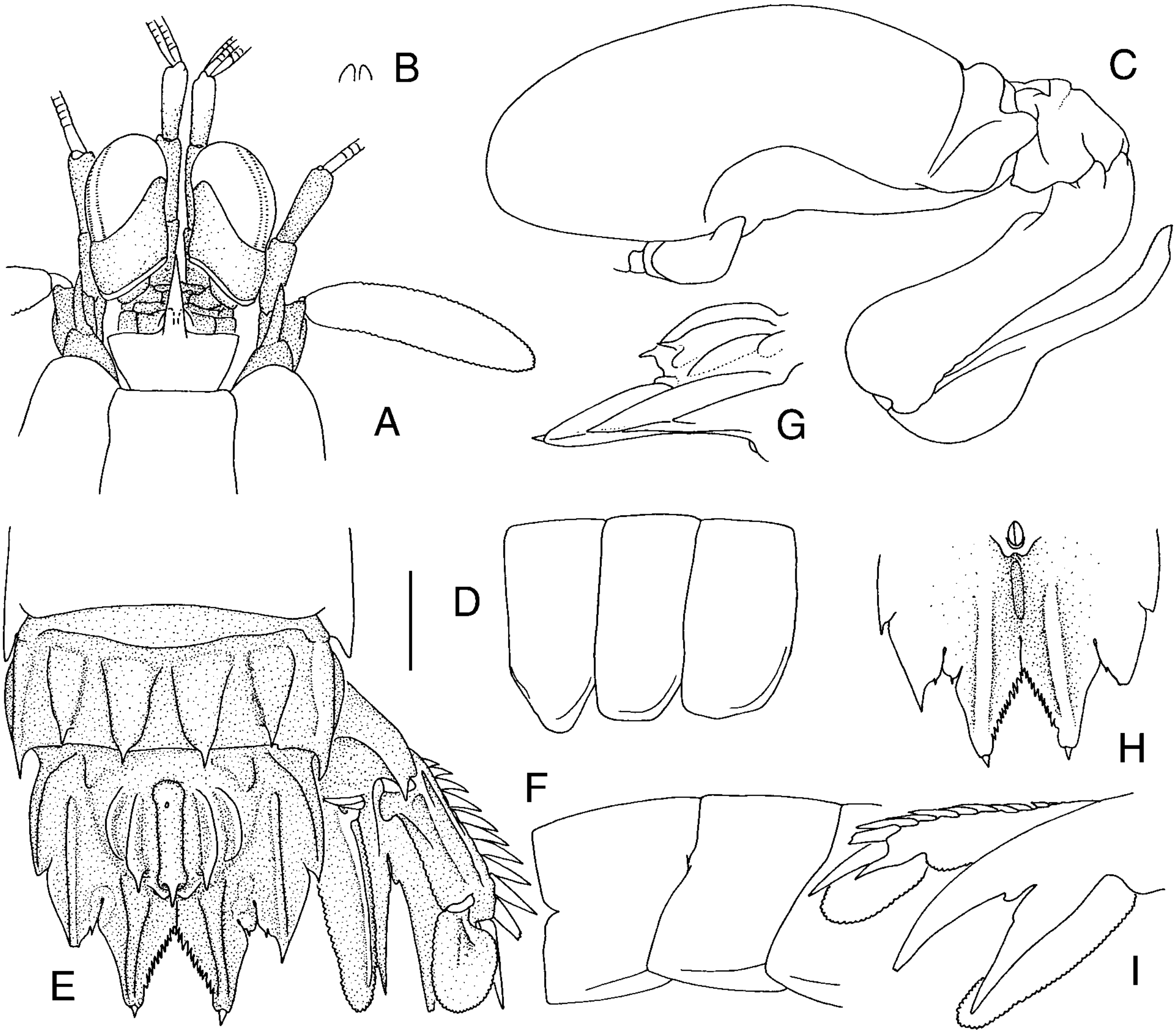

Figure 18. *Gonodactylaceus glabrous* (Brooks), ♀ TL 42 mm (AM P54450). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS3–5, right lateral. G, telson, right lateral. H, telson, ventral. I, uropod, right ventral. Scale = 2 mm.

Type material. HOLOTYPE: NHM 1894.10.17.23, ♀ (TL 50 mm), Samboangan Reefs, Philippine Is, *Challenger*.

Australian material. WESTERN AUSTRALIA: AM P54456, 1♀ (TL 42 mm), SE end of Long I., Goss Passage, 8 m, dead coral substrate under *Acropora* plate covered in coralline algae.

Other material. USNM 266611, 1♀ (TL 43 mm), Pattle I., Paracel Is, Vietnam, 24 Mar 1947 (paratype of *Gonodactylaceus gravieri* Manning).

Diagnosis. Rostral plate with distinctly angular anterolateral corners. AS1–5 without fine transverse grooves. AS6 without median carinule. Telson mid-dorsal carinae relatively uninflated; MD and accessory MD carinae each usually with short posterior spine; knob bilobed; with 11–13 SM denticles; ventral surface with sharp postanal carina and distinct carina on each SM tooth. Terminal spines of uropodal protopod with 1 or 2 (usually 1) lobe between spines; exopod distal segment outer margin with 10 or 11 movable spines; endopod outer margin with single row of marginal setae, directed dorsally.

Colour in alcohol. Faded to mottled olive green.

Measurements. Female ($n = 3$) TL 42–50 mm. A1 peduncle 0.55–0.60 CL. A2 scale 0.53 CL. AWCLI 745–797. Debelius (1999) reported *G. glabrous* to 80 mm TL.

Remarks. The Australian specimen agrees well with the holotype and accounts of *G. glabrous*, but resembles the type material of *G. gravieri* in bearing two lobes between the terminal spines of the uropodal protopod. The paratype of *G. gravieri* is referable to *G. glabrous*, but the holotype, with rounded anterolateral angles on the rostral plate, is referable to *G. falcatus*. As with *G. falcatus* and *G. graphurus*, the number of lobes between the terminal spines of the uropodal protopod is variable in *G. glabrous*. The anterolateral corners of the rostral plate in the holotype are more distinctly angular than figured by Manning (1978a: fig. 6a).

All specimens reported as *G. glabrous* from New Caledonia by Moosa (1991) were re-examined at the MNHN and USNM; they are referable to *G. falcatus. Gonodactylaceus glabrous* is rare in Australian waters, but abundant to the immediate north of Australia. In Australian waters, *G. glabrous* appears to be largely replaced by *G. graphurus*.

As discussed under the account of the genus, the holotype of *G. glabrous* is designated as the neotype of *Gonodactylus chiragra* var. *crescentus* Estampador and *Gonodactylus bossorotundus* Estampador to fix the identities of the latter two species. As such, *G. glabrous* is an objective senior synonym of *Gonodactylus chiragra* var. *crescentus* Estampador and *Gonodactylus bossorotundus* Estampador.

Habitat. Coral reefs; intertidal to shallow subtidal; usually amongst dead coral rubble.

Distribution. The Philippines, Indonesia, Vietnam and now from northwestern Australia.

Gonodactylaceus graphurus (Miers, 1875)

Fig. 19

Gonodactylus graphurus White, 1847: 85 (part, *nomen nudum*).
Gonodactylus graphurus Miers, 1875: 344 (part, White's material only) (type locality: Torres Strait, Queensland, Australia, restricted by lectotype designation [Ingle, 1971]).–Kemp, 1913: 169–170.–Balss, 1921: 5.–Alexander, 1916a: 9.–Stephenson, 1952: 12; 1953a: 47.–Stephenson & McNeill, 1955: 250.–Stephenson, 1962: 35.–Manning, 1966: 108–109; 1978a: 5, fig. 2b.–Cannon *et al*., 1987: 63.
Gonodactylaceus graphurus.–Manning, 1995: 19, 42–43.–Ahyong & Norrington, 1997: 99–100.
Gonodactylus sp.–Jones & Morgan, 1994: 43.

Type material. LECTOTYPE: NHM 1970.202, ♂ (TL 52 mm), Torres Strait, Mrs Campbell. PARALECTOTYPE: NHM 1970.203, ♀ (TL 43 mm), Sir C. Hardy's I., J.B. Jukes Esq.

Australian material. QUEENSLAND: AM E3187, 1♂ (TL 22 mm), 4♀♀ (TL 27–53 mm), 18–22 km NW of Pine Peak, 44–47 m, FIS Endeavour, 1909–1914; AM P1297, 2♂♂ (TL 46–51 mm), Green I. & Goold I., 18°10'S 146°10'E, C. Hedley; AM P4288, 5♂♂ (TL 51–68 mm), 1♀ (TL 56 mm), Port Denison, 20°03'S 148°15'E, E. Rainford; AM P12089, 1♀ (TL 77 mm), Great Sandy Strait, Mary River, 25°20'S 153°00'E, 3 m, from encrusting sponge, J. Hynd, 7 Jun 1946; AM P12271, 3♂♂ (TL 33–52 mm), 1♀ (TL 64 mm), Shoal Point, Mackay, 21°00'S 149°09'E, under rocks, low tide, W. Stephenson, 25 Aug 1953; AM P14891, 1♀ (TL 43 mm), Emberley River, Weipa, Gulf of Carpentaria, intertidal, sand shore with rock outcrops, G. Webster, 29 Jul 1961; AM P16290, 1♂ (TL 31 mm), off Gillett Cay, Swain Reefs, Coral Sea, 64–73 m, Oct 1962; AM P17727, 1♂ (TL 52 mm), Picnic Bay, Magnetic I., J. Yaldwyn & D. McMichael, 1 Nov 1964; AM P17733, 1♀ (TL 35 mm), Geoffrey Bay, Magnetic I., 19°08'S 146°50'E, in dead coral, low water mark, M. Hines, 12 Apr 1964; AM P17736, 1♂ (TL 78 mm), Magnetic I., K. Bryson, Apr 1964; AM P17738, 1♂ (TL 90 mm), between Bundaberg & Gladstone, netted, C. Wright, 1964; AM P19329, 1♂ (TL 68 mm), Bird I., Whitsunday Is, I. Bennett, May 1969; AM P45590, 2♂♂ (TL 44–65 mm), Thursday I., 10°35'S 142°13'E, M. Ward; AM P56810, 1♂ (TL 76 mm), Rat I., Port Curtis, M. Ward & W. Boardman, Jul 1929; QM W19319, 2♀♀ (TL 59–75 mm), Sabina Pt, 22°24'S 150°18'E, 0–0.5 m, littoral rocky shore, sandy pool with rocks & macrophytes, rotenone, J. Johnson, 15 Sep 1993; QM W5581, 1♀ (TL 52 mm), Garden I., Gladstone, in hole under rock, 16 Aug 1951; QM W5584, 1♀ (TL 65 mm), 16 km NE of Bustard Head, 27 Aug 1975; NMV J13881, 1♂ (TL 58 mm), 2♀♀ (TL 74–75 mm), Yeppoon Beach, B. Smith, 15 Sep 1970; QM W21637, 1♀ (TL 85 mm), Myora Reef, North Stradbroke I., Moreton Bay, 27°29'S 153°25'E, patch reef, plate *Acropora*, P. Davie, 14 Apr 1992; QM W21582, 1♂ (TL 72 mm), Myora Reef, North Stradbroke I., Moreton Bay, 27°29'S 153°25'E, 8.9 m, patch reef, QM party, 7 Mar 1996; QM W14505, 1♀ (TL 42 mm), Coconut Beach, W side of Lindeman I., 20°27'S 149°02'E, under dead coral clumps, intertidal, P. Davie & J. Short, 26 Mar 1987; QM W24221, 2♂♂ (TL 80–82 mm), 1♀ (TL 77 mm), off Cairns, 17°00.0'S 146°05.8'E, 35 m, trawled, 25 Apr 1982; TM G2641, 1♂ (TL 47 mm), Picnic Bay, Magnetic I., J. Penprase, 17–18 Aug 1982; TM G2618, 1♀ (TL 73 mm), Cockle Bay or Fish Cove, Magnetic I., J. Penprase, 18–21 Aug 1982; NTM Cr008849B, 1♂ (TL 16 mm), 6♀♀ (TL 22–56 mm), W of Booby I., Torres Strait, 10°25'S 141°46.4'E, 10.4 m, dredge, SS0591 63, A. Bruce, 29 Nov 1991; NTM Cr008848, 2♂♂ (TL 20–27 mm), W of Booby I., 10°41.4'S 141°51.6'E, 10 m, dredge, A. Bruce, 29 Nov 1991; NTM Cr008782, 1♀ (TL 20 mm), Gulf of Carpentaria, 10°26.4'S 141°45.2'E, 10.4 m, R. Williams, 29 Nov 1991; NMV J13822, 1♂ (TL 56 mm), about 32 km NW of Badu I., 14 m, J. Biltell, 12 Dec 1947; NMV J13830, 1♂ (TL 54 mm), about 34 km NW of Badu I., 14.6 m, J. Biltell, 12 Dec 1947; NMV 13832, 1♂ (TL 56 mm), W of Badu, J. Biltell, 12 Dec 1947; AM P56972, 3♂♂ (TL 41–68 mm), 2♀♀ (TL 74–75 mm), Dunwich, Stradbroke I., Moreton Bay, 27°30'S 153°24'E, low tide, under & in dead coral clumps, S. Ahyong *et al*., Sep 1998; AM G4222, 2♀♀ (TL 49–50 mm), Gulf of Carpentaria, C. Hedley; AM P2293, 1♂ (TL 55 mm), Dunk I., 17°57'S 146°09'E, E. Banfield; AM P1286, 2♀♀ (TL 45–47 mm), Green I. & Goold I., C. Hedley; AM P5642, 1♂ (TL 63 mm), Port Denison, 20°03'S 148°15'E, E. Rainford; AM P14882, 2♀♀ (TL 48–49 mm), Lindeman I., 20°27'S 149°02'E, M. Ward, Dec 1928; AM P14883, 1♀ (TL 45 mm), Northwest I., 21°40'S 150°20'E, M. Ward, Dec 1929; AM P15363, 2♂♂ (TL 33–37 mm), 4♀♀ (TL 16–45 mm), Port Denison, 20°03'S 148°15'E; AM P15365, 1♂ (TL 20 mm), Curtis Channel, Port Curtis, 23°55'S 151°23'E, J. Hynd; AM P60247, 2♂♂ (TL 48–73 mm), 2♀♀ (TL 55–71 mm), Keppel Bay, 23°25'S 150°55'E, 46 m or less, T. Garrard, 1964. NEW SOUTH WALES: NMV J13829, 1♂ (TL 55 mm), Lord Howe or Norfolk I. WESTERN AUSTRALIA: AM P1769, 1♂ (TL 53 mm), Western Australia; AM P14887, 2♂♂ (TL 29–36 mm), 3♀♀ (TL 35–48 mm), off Gantheaume Point, Broome, 17°59'S 122°11'E, 7.5 m, dredged, A. Livingstone, Aug 1929; AM P14889, 1♂ (TL 30 mm), 5♀♀ (TL 26–60 mm), near entrance to Roebuck Bay, Broome, 17°59'S 122°15'E, 9–14.5 m, *Lithothamnion* reef bottom, A. Livingstone 26 Sep 1929; AM P14892, 2♂♂ (TL 66–77 mm), Entrance Point, Broome, 18°01'S 122°12'E, intertidal on rocky reef, A. Livingstone, Aug 1929; NTM Cr001255, 1♀ (TL 66 mm), NE of Dampier Archipelago, 20°18'S 117°32'E, 26 m, trawl, NT Fisheries, 22 Oct 1982; NTM Cr001256, 1♀ (TL 41 mm), NE of Dampier Archipelago, Northwest Shelf, 20°19'S 117°29'E, 28 m, trawled, NT Fisheries, 22 Oct 1982; NTM Cr012394, 1♀ (TL 34 mm), Northwest Shelf, T53/84; NTM Cr012397, 1♀ (TL 57 mm), Northwest Shelf, beam trawl, S0183, 10 Feb 1983; NTM, 3♂♂ (TL 27–30 mm), W end Lewis I., Dampier Archipelago, 8 m, associated with yellow bryozoan, D. Low Choy, 1 Sep 1988; NTM, 1♂ (TL 30 mm), W end West Lewis I., Dampier Archipelago, 20°36.2'S 116°35.7'E, 16 m, D. Low Choy, 1 Sep 1988; AM P14885, 1♀ (TL 49 mm), entrance to Roebuck Bay, 17°59'S 122°15'E, A. Livingstone, 15 Aug 1929; AM P14888, 1♀ (TL 25 mm), 8 km off Ninety Mile Beach, between Cape Jaubert & Wallal, 19°20'S 121°15'E, 9 m, dredged, A. Livingstone, Sep 1929; QM, 1♀ (TL 67 mm), Shelburne Bay, 11°37.80'S 143°14.72'E, 20–30 m, dredge, GBR 0192 18/51, T. Wassenberg, 11 May 1992; QM, 1♂ (TL 65 mm), E Gulf of Carpentaria, Pand-3, Feb 1986. NORTHERN TERRITORY: AM P6574, 1♀ (TL 60 mm), Indian I., Bynoe Harbour, near Darwin, 12°37'S 130°30'E, among rocks, W. Paradice; AM P14890, 1♂ (TL 78 mm), 1♀ (TL 56 mm), Chambers Bay, near Darwin, 12°13'S 131°35'E, trawled, V. Wells, 7 Nov 1959; AM P12272, 5♂♂ (TL 36–79 mm), 11♀♀ (TL 33–85 mm), Little Lagoon, Port Langdon, Groote Eylandt, 13°51'S 136°51'15'E, from coral & sponge clusters, J. Wassell, 2 Apr 1952; NTM, 1♀ (TL 21 mm),

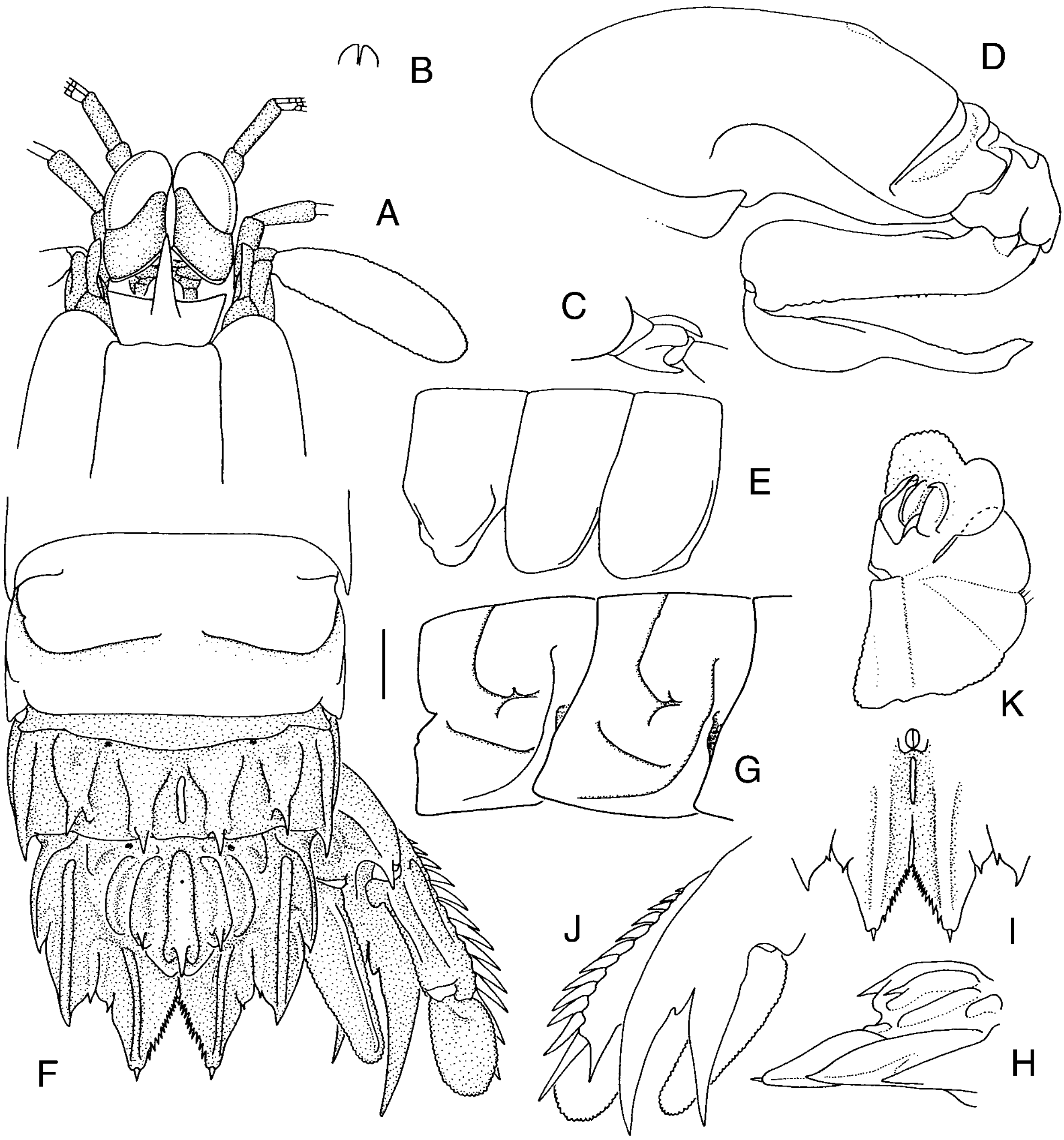

Figure 19. *Gonodactylaceus graphurus* (Miers). A–J, ♀ TL 74 mm (AM P56972). K, ♂ TL 68 mm (AM P56972). M, ♀ TL 54 mm (AM P1181). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lateral. H, telson, right lateral. I, telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A–J = 2.5 mm; K = 1.25 mm.

Nightcliff Beach, Darwin, rockpool, low tide, D. Sachs, 11 Sep 1985; SAM C5772, 1♂ (TL 54 mm), Northern Territory; NMV J13834, 2♂♂ (TL 14–23 mm), W side of Oxley I., 11°0'S 132°49'E, 14 m, on muddy sand, G. Poore on SCUBA, 21 Oct 1982; NTM Cr005581, 1♀ (TL 34 mm), Parry Shoals, 11°11.41'S 129°43.01'E, 18 m, A. Mussig, 13 Aug 1987; NTM, 1♂ (TL 65 mm), Dudley Point, Darwin, muddy reef flat pools, A. Bruce, 17 Sep 1981; NTM, 1♂ (TL 70 mm), 1♀ (TL 51 mm), Shoal Bay, 12°16'S 130°54'E, 13 m, NT Fisheries, 25 Aug 1977; NTM, 1♂ (TL 68 mm), Shoal Bay, 12°16'S 130°54'E, NT Fisheries, 4 Apr 1977; NTM, 1♂ (TL 52 mm), 11 km N of Lee Point, 12°13'S 130°53.5'E, 13 Apr 1977; AM P9477, 1♀ (TL 14 mm), Port Darwin, 12°27'S 130°50'E, L.B. Wilson; AM P9480, 1♂ (TL 35 mm), Port Darwin, 12°27'S 130°50'E, L.B. Wilson; AM P14886, 2♂♂ (TL 43–44 mm), 1♀ (TL 38 mm), Quail I., 56 km W of Port Darwin, 12°31'S 130°26'E, among coral, between tides, A. Livingstone, 7 Jul 1929; AM P16616, 1♂ (TL 59 mm), Fannie Bay, Darwin, 12°27'S 130°50'E, intertidal, E. Pope & J. Boas, 12 Oct 1965; AM P16630, 1♂ (TL 49 mm), Dudley Reef, Darwin, 12°27'S 130°50'E, E. Pope & J. Boas, 24 Oct 1965.

Other material. NEW HEBRIDES: AM G5470, 1♂ (TL 33 mm), 1♀ (TL 24 mm), Anaiteum, New Hebrides, Capt. Braithwaite. INDONESIA: LIPI S869–870, 2♂♂ (TL 34–59 mm), NE of Dobo, Aru, under coral, J. Dieret, Apr–May 1967.

Diagnosis. Rostral plate with distinctly angular anterolateral corners. AS1–5 with fine transverse grooves. AS6 with short median carinule. Telson mid-dorsal carinae often inflated in adult males; MD and accessory MD carinae each usually with short posterior spine; knob bilobed; with 9–15 SM denticles; ventral surface with sharp postanal carina and distinct carina on each SM tooth. Terminal spines of uropodal protopod with 1 or 2 (usually 1) lobe between spines; exopod distal segment outer margin with 10–14 movable spines; endopod outer margin with single row of marginal setae, directed dorsally.

Colour in life. Highly polymorphic from red through pale green to black-green. Raptorial claw with orange meral spot. Males with rows of broad, elongate dark markings on thoracic and abdominal somites together giving impression of about eight dark longitudinal stripes. Uropodal exopod and endopod fringed with blue, green or purple setae.

Measurements. Male (n = 72) TL 14–90 mm, female (n = 76) TL 14–85 mm. A1 peduncle 0.47–0.61 CL. A2 scale 0.45–0.56 CL. AWCLI 717–827. The present series includes the largest known specimen of the species.

Remarks. *Gonodactylaceus graphurus* is readily recognized by the transverse grooves on AS1–5. The coloration and general morphology of *G. graphurus* most closely resembles *G. glabrous*: in both species the anterolateral angles of the rostral plate are angular, the carinae of the telson are relatively slender and the display spot on the merus of the raptorial claw is orange. Sexual dichromatism in *G. graphurus* resembles that of *G. glabrous* and that often displayed by *G. falcatus*: females generally have an overall uniform or speckled pattern whereas males have a regular series of dark blocks on each thoracic and abdominal somite giving the overall impression of dark, broad, longitudinal stripes along the body.

The close similarity in morphology, colour pattern, and habitat preference between *G. graphurus* and *G. glabrous*, coupled with their adjacent distributions suggests that they could be sibling species. *Gonodactylaceus graphurus* is the dominant species of the genus in near shore Australian waters; *G. glabrous* is abundant in similar habitats to the north of Australia, from Indonesia to the Philippines and Vietnam (Erdmann, pers. comm.) but rare in Australia. The present record of *G. graphurus* from the New Hebrides requires verification.

Habitat. *Gonodactylaceus graphurus* is one of the most common inshore gonodactyloids in Australian waters and prefers habitats having substantial coastal influences. *Gonodactylaceus graphurus* is frequently sympatric with *G. falcatus*, and frequently occurs intertidally amongst coral rubble, under boulders and in sponges on nearshore tidal and coral reef flats, under boulders or in sponge on seagrass (*Zostera*) beds. It is frequently collected subtidally to a depth of about 70 m.

Distribution. Tropical Australia to Aru, southern Indonesia and Anaiteum, New Hebrides.

Gonodactylaceus ternatensis (de Man, 1902)

Fig. 20

Gonodactylus glabrous var. *ternatensis* de Man, 1902: 914 (part, type locality: Ternate, Indonesia, 0°48'N 127°20'E).
Gonodactylus falcatus.–Tweedie, 1950: 140.–Serène, 1954: 6, 7, 10, 11, 31, 41, 42, 45, 47, 54, 74, 78, 79, 80, 81, 87, figs. 8, 13–16, pl. 9 (not *G. falcatus* [Forskål, 1775]).
Gonodactylus ternatensis.–Manning, 1978a: 10, figs. 7, 8, 13.
Gonodactylaceus ternatensis.–Manning, 1995: 19, 42, 43, 51–55, pls. 1, 2, figs. 8a,b, 9f, 10d, 11e, 17–19.

Type material. LECTOTYPE: SMF 5779, ♀ (TL 57 mm), Ternate, Indonesia, Kükenthal, 1894.

Australian material. QUEENSLAND: AM P56793, 1♀ (TL 41 mm), near Caloundra, from crevice in live *Goniopora* coral, less than 5 m, S. Collins, 1994; AM P58574, 1♀ (TL 17 mm), GBRMPA Reef 11–102, 11°27.56'S 143°58.12'E, 1–3.5 m, lagoon, Australian Museum party, QLD 662, 14 Jan 1993; AM P58570, 1♀ (TL 10 mm), Ashmore Reef, 10°26.27'S 144°25.78'E, 10 m, from *Halimeda*, S. Keable, 18 Jan 1993. WESTERN AUSTRALIA: NTM Cr012620, 1♀ (TL 9 mm), NW Ashmore Reef, 12°14.0'S 122°59.0'E, reef flat, low tide, R. Hanley, 16 Apr 1987; NTM Cr012627, 1♀ (TL 12 mm), Ashmore Reef, 12°14.0'S 122°59.0'E, low tide, R. Hanley, 15 Apr 1987. COCOS-KEELING ISLANDS: ZRC 1970.10.14.77–86, 9♀♀ (TL 21–74 mm), C.A. Gibson-Hill, 1941; USNM 168619, 1♀ (TL 75 mm), S end Direction I., 12°05'35"S 96°53'10"E, 2–5 m, Smith-Vaniz, 29 Mar 1974.

Diagnosis. Rostral plate longer than broad; basal portion with rounded anterolateral corners; lateral margins strongly divergent anteriorly; apical spine longer than base. AS1–5 without fine transverse grooves. AS6 without short median carinule. Telson dorsal carinae sharp, cristate; MD and accessory MD carinae each with long, slender, posterior spine; knob undivided; with 11–15 SM denticles; ventral surface with low postanal carina and carina on each SM tooth. Terminal spines of uropodal protopod with 1 lobe between spines; exopod proximal segment outer margin with 12 or 13 movable spines; endopod outer margin with single row of marginal setae, directed dorsally.

Colour in life. Female: Overall dorsal colour with transverse light and dark green bands, diffusely demarcated. Carapace grooves and posterior margins of thoracic and abdominal somites red. Carapace and rostral plate green; with scattered white spots. AS6 and telson with paired submedian black spots. Telson pinkish mid-dorsally, with mid-dorsal carinae green. A2 scale yellow, with scattered white spots proximally and red marginal setae. Raptorial claw with dactylus pink; carpus, propodus and merus banded light and dark green; propodus with dark brown spot distally; meral spot yellow. Pereiopods yellow, with orange infusion proximally. Uropodal protopod, exopod and endopod yellow-green, with red setae and outer movable spines on exopod.

Measurements. Female (n = 16) TL 9–75 mm. A1 peduncle 0.53–0.72 CL. A2 scale 0.50–0.62 CL. AWCLI 740–870. Dingle *et al*. (1977) reported specimens to 87 mm TL.

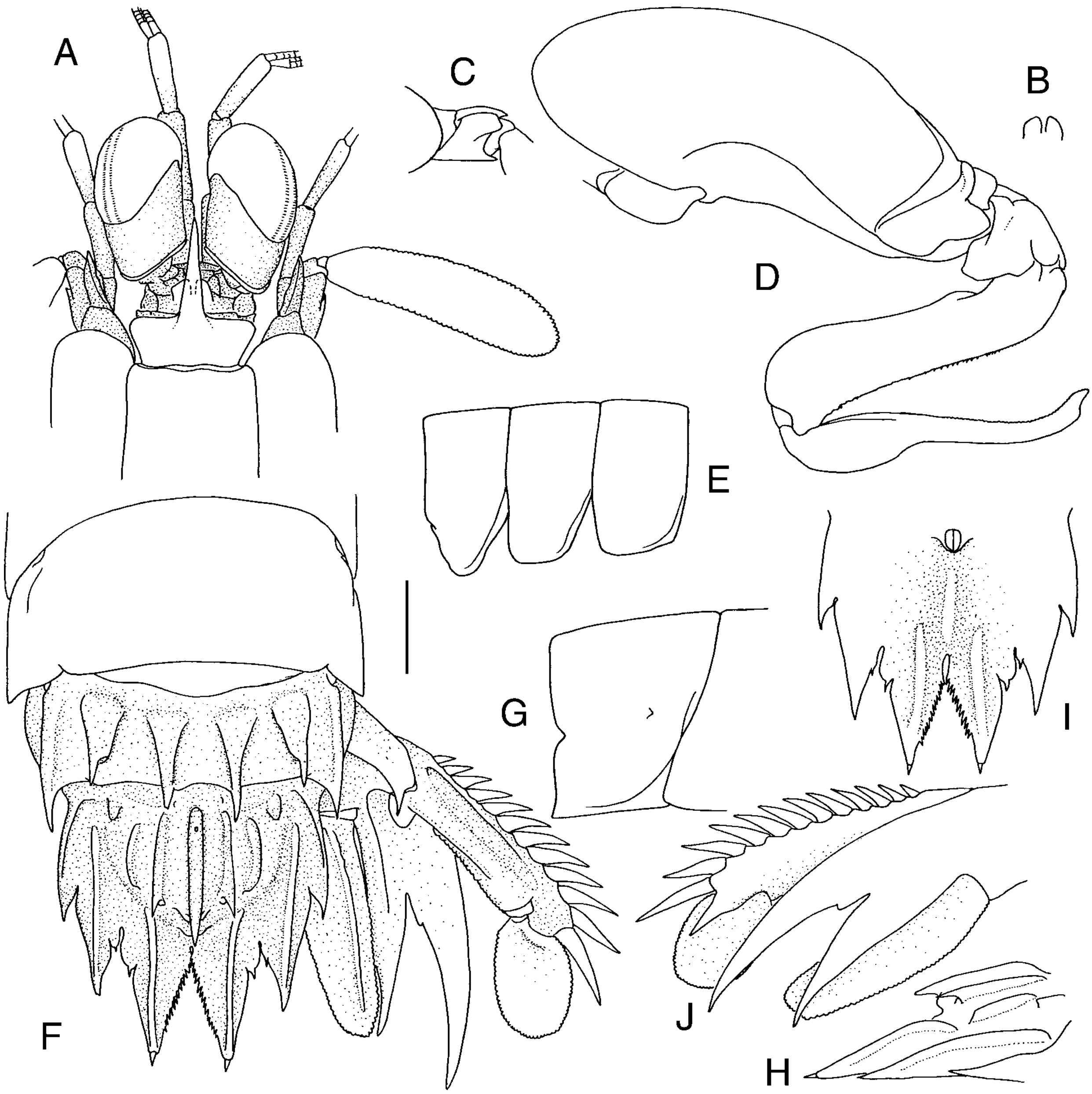

Figure 20. *Gonodactylaceus ternatensis* (de Man), ♀ TL 41 mm (AM P56793). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, A2 protopod. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lateral. H, telson, right lateral. I, telson, ventral. J, uropod, right ventral. Scale = 2 mm.

Remarks. The present specimens agree in most respects with the lectotype and published accounts but show variation in the shape of the knob on the telson, a character that is usually diagnostic for *G. ternatensis*. The knob is usually undivided, but in some specimens from the Cocos-Keeling Islands, the knob is indented dorsally, giving a bilobed appearance; in all other respects, including the slender, elongate telson and carinae, these specimens are "typical" *G. ternatensis*. Aside from the (usually) undivided knob on the telson, *G. ternatensis* differs from its congeners in having a more slender aspect to the telson, more slender dorsal carinae, a lower median carina and longer carinal spines. Additionally, the lateral teeth of the telson have longer apices and are more widely set off from the telson margin than in other species of *Gonodactylaceus.* The largest Queensland specimen was studied live and the colour in life agreed well with that figured by Manning (1995: pl. 2).

Habitat. *Gonodactylaceus ternatensis* usually occurs amongst live coral (Dingle *et al*., 1977) from the intertidal to shallow subtidal zone. The single specimen studied live in this study was collected from a crevice in live *Goniopora* coral.

Distribution. Central Pacific to southern China, Indonesia, Vietnam, Thailand, the Andaman Sea and now from eastern Australia and the Cocos-Keeling Islands.

Gonodactylellus Manning, 1995

Gonodactylellus Manning, 1995: 56–57. Type species *Gonodactylus affinis* de Man, 1902, by original designation. Gender masculine.
Gonodactylinus Manning, 1995: 66. Type species *Gonodactylus viridis* Serène, 1954, by original designation and monotypy. Gender masculine.

Diagnosis. Eye subcylindrical, cornea not broader than stalk in dorsal view. Ocular scales small, narrower that basal width of median spine of rostral plate, usually rounded. Rostral plate with slender median spine and short, broad, trapezoid basal portion. Anterolateral margins of carapace convex, extending anteriorly beyond base of rostral plate. Mandibular palp present. Propodus of raptorial claw with proximal movable spine in adults. Telson with 3 or 5 mid-dorsal carinae; IM carina of telson without accessory longitudinal carina on mesial margin; anus located ventrally. Uropodal protopod without lobes between terminal spines; endopod without spines on inner margin.

Included species. Seventeen: *G. annularis* Erdmann & Manning, 1998; *G. affinis* (de Man, 1902); *G. bicarinatus* (Manning, 1967c); *G. caldwelli* Erdmann & Manning, 1998; *G. choprai* (Manning, 1967c); *G. crosnieri* (Manning, 1967c); *G. demanii* (Henderson, 1893); *G. espinosus* (Borradaile, 1898); *G. incipiens* (Lanchester, 1903); *G. lanchesteri* (Manning, 1967c); *G. erdmanni* n.sp.; *G. micronesicus* (Manning, 1971a); *G. molyneux* n.sp.; *G. rubriguttatus* Erdmann & Manning, 1998; *G. spinosus* (Bigelow, 1893a); *G. snidsvongi* (Naiyanetr, 1987) n.comb.; and *G. viridis* (Serène, 1954) n.comb.

Remarks. Species of *Gonodactylellus* differ from other gonodactylids in bearing narrow ocular scales (fused in some species), subglobular corneae and three (occasionally five) mid-dorsal carinae on the telson. Most species of *Gonodactylellus* bear three mid-dorsal telson carinae but in *G. micronesicus*, *G. rubriguttatus* and *G. affinis*, the accessory median carinae may be relatively long such that there are five longitudinal mid-dorsal carinae. Those species of *Gonodactylellus* having five mid-dorsal carinae may be confused with species of *Gonodactylaceus*, but differ in lacking lobes between the terminal spines of the uropodal protopod.

Manning (1978c) remarked that the *Gonodactylus demanii* group, now *Gonodactylellus*, comprises two broad groups. One group comprised species related to *Gonodactylellus demanii*, in which the primary telson teeth bear dorsal spines or tubercles and in which the setation on the inner margin of the uropodal endopod and exopod is usually reduced or near absent. The second group, comprising the remainder, including the type species, *G. affinis*, lack large spines on the primary telson teeth (or at most a general covering of small spinules) and have full setation on the uropodal endopod and exopod. Those species having additional telson spines and reduced uropodal setation are: *G. bicarinatus*, *G. crosnieri*, *G. demanii*, *G. molyneux* n.sp., and *G. snidsvongi*. The additional spines or tubercles on the telson teeth vary in density with species, but in each of these species, a conical spine or tubercle is present at the base of the submedian and usually intermediate telson teeth, resembling species of *Hoplosquilla* and *Gonodactylopsis*.

The original concept of the *Gonodactylus demanii* group (Manning, 1967c, 1978c, 1995), now known as *Gonodactylellus*, originated with a group species that could be distinguished from the *chiragra* group, now *Gonodactylus* sensu stricto, by their small size (maximum TL < 50 mm vs. maximum TL > 110 mm) and narrow instead of broad ocular scales. Several gonodactylid species, however, some of which have only been recently described, bridge some of the distinctions between *Gonodactylellus* and *Gonodactylus*. *Gonodactylus childi* Manning, for instance, bears broad ocular scales and is a "dwarf" species that does not exceed 45 mm TL, whereas *Gonodactylellus caldwelli* Erdmann & Manning, is now known to attain at least 70mm TL and bears narrow ocular scales (though they are broader than in other congeners). Moreover, the width of the ocular scales shows a range of variation between species in both *Gonodactylus* and *Gonodactylellus*, and thus the distinction between the "narrow" and "broad" condition of the ocular scales is somewhat arbitrary. *Gonodactylellus* will likely prove not to be monophyletic (Barber & Erdmann, 2000) but is retained here pending several studies in progress.

Manning (1995) erected *Gonodactylinus* for *Gonodactylus viridis* Serène, a species with narrow ocular scales and three mid-dorsal carinae on the telson. Although Manning (1995) distinguished *Gonodactylinus* from *Gonodactylellus* by the presence of a "*chiragra*-like" telson and the larger maximum size (TL to 55 mm) than the species of *Gonodactylellus* known at the time, both features are variously present in members of the latter genus. No character is available to distinguish *Gonodactylinus* from *Gonodactylellus* and they are herein synonymized. In view of the probable para- or polyphyly of *Gonodactylellus*, it may seem premature to place *Gonodactylinus* in synonymy. Serène's species, however, falls into the "main" group of *Gonodactylellus* that includes the type species, *G. affinis*, as well as other closely related species such as *G. erdmanni* n.sp., *G. incipiens*, *G. micronesicus* and *G. rubriguttatus*.

The segmentation of the mandibular palp is constant within most stomatopod genera. The mandibular palp three-segmented in most species of *Gonodactylellus*, but two-segmented in *G. choprai* and *G. snidsvongi*.

Gonodactylellus hendersoni is synonymized with *G. demani*, below, and *G. snidsvongi* is removed from the synonymy of *G. hendersoni* (see remarks under account of *G. snidsvongi*). Eleven species of *Gonodactylellus* are known from Australia, of which two are described as new.

Key to species of *Gonodactylellus*

1 AS5 with distinct posterolateral spine .... ***G. caldwelli***

—— AS5 without posterolateral spine 2

2 Inner margin of uropodal endopod smooth, largely or entirely devoid of setae 3

—— Inner margin of uropodal endopod completely fringed with setae, margin serrate for insertion of setae 7

3 Ventral surface of each SM tooth with 2 longitudinal carinae. (IM tooth with 1 ventral carina) .... *G. bicarinatus*

—— Ventral surface of each SM tooth with at most 1 longitudinal carina 4

4 Uropodal endopod with inner margin strongly convex; width about ½ telson width .... *G. crosnieri*

—— Uropodal endopod with inner margin broadly convex; width less than ⅓ telson width 5

5 Inner margin of uropodal endopod with a few setae proximally, adjacent to articulation .... *G. demani*

—— Inner margin of uropodal endopod entirely lacking setae 6

6 Uropodal endopod elongate, width about ⅓ length. LT teeth of telson with angular or sharp apices, distinctly set off from telson. SM denticles of telson spiniform, distinct. Mandibular palp 2-segmented .... ***G. snidsvongi***

—— Uropodal endopod width about ½ length. LT teeth of telson with blunt apices, appressed to margin of telson. SM denticles of telson low, partially fused into inner margin of SM teeth. Mandibular palp 3-segmented .... ***G. molyneux***

7 Dorsal surface of telson and carinae with numerous spines or spinules in addition to posterior spinules of mid-dorsal carinae 8

—— Dorsal surface of telson and carinae without numerous spines or spinules, at most with mid-dorsal carinae armed posteriorly 9

8 IM tooth of telson well formed and extending posteriorly beyond IM denticles; LT tooth distinctly set off from margin or at least separated from margin by a gap .... *G. lanchesteri*

—— IM tooth of telson poorly formed, not extending posteriorly beyond IM denticles; LT tooth appressed to IM tooth .... *G. spinosus*

9 Proximal segment of uropodal exopod without fixed distal spine ventrally .... *G. choprai*

—— Proximal segment of uropodal exopod with fixed distal spine ventrally 10

10 Telson with IM tooth appressed to base of SM tooth. Uropodal endopod with more than one row of marginal setae, dorsal row erect .... ***G. espinosus***

—— Telson with IM tooth distinctly separated from SM tooth. Uropodal endopod with one row of marginal setae, none erect 11

11 Accessory MD carinae long, extending anteriorly to or beyond midlength of MD carina 12

—— Accessory MD carinae, if present, short, not extending anteriorly beyond posterior ⅓ of MD carina 14

12 Telson with accessory MD and anterior SM carinae each with posterior spinule or tubercle (occasionally one or other carina unarmed) .... ***G. affinis***

—— Telson with accessory MD and anterior SM carinae unarmed posteriorly 13

13 Ocular scales fused into V-shaped plate. Raptorial claw with meral spot red in life .... ***G. rubriguttatus***

—— Ocular scales separate, bases transverse. Raptorial claw with meral spot white in life .... ***G. micronesicus***

14 Telson with MD carina of adults strongly inflated, tumid, ovate 15

—— Telson with MD carina of adults elongate 16

15 Emargination between SM and IM telson teeth acute. Anterior SM carinae of telson curved, converging posteriorly. PLP1 endopod in adult ♂♂ with lateral lobe on posterior endite .... ***G. incipiens***

—— Emargination between SM and IM telson teeth approaching a right angle. Anterior SM carinae of telson not converging posteriorly. PLP1 endopod in adult ♂♂ without lateral lobe on posterior endite .... ***G. annularis***

16 Lateral margin of TS6 rounded, as broad as or slightly broader than TS7. Maximum TL 55 mm .... ***G. viridis***

—— Lateral margin of TS6 truncate, distinctly broader than TS7. Maximum TL 31 mm .... ***G. erdmanni***

Gonodactylellus affinis (de Man, 1902)

Fig. 21

Gonodactylus chiragra var. *affinis* de Man, 1902: 912 (type locality: Ternate, Molucca Is, Indonesia, 0°48'N 127°20'E).

Gonodactylus chiragra var. *confinis* de Man, 1902: 912, pl. 27, fig. 66 (type locality: Ternate, Molucca Is, Indonesia, 0°48'N 127°20'E).

Gonodactylus chiragra var. *segregatus* Lanchester, 1903: 448, pl. 23, figs. 6, 7 (type locality: Minikoi, Laccadive Is, restricted by present lectotype designation).

Gonodactylus affinis Manning, 1978c: 2–4, fig. 1.–Moosa & Cleva, 1984a: 423–424, fig. 2; 1984b: 75.–Moosa, 1986: 380–381; 1991: 154–155.

Gonodactylellus affinis.–Manning, 1995: 58–60, figs. 20, 21.–Gosliner *et al*., 1996: 195.

Type material. LECTOTYPE: SMF 5766, ♂ (TL 34 mm), Ternate, Indonesia, Kükenthal, 1894. PARALECTOTYPES: SMF 5766, 1♂ (TL 21 mm), 1♀ (TL 32 mm), type locality.

Australian material. QUEENSLAND: AM P56802, 2♂♂ (TL 10–11 mm), 2♀♀ (TL 9–10 mm), Lizard I., BK 124, B. Kensley, Jan 1982; AM P56803, 1♂ (TL 16 mm), Lizard I., BK 129, B. Kensley, Jan 1982; AM P56805, 3♂♂ (TL 11–13 mm), 2♀♀ (TL 11–13 mm), Lizard I., BK 119, B. Kensley, Jan 1982; AM P56806, 1♂ (TL 27 mm), Lizard I., BK 113, B. Kensley, Jan 1982; AM P56804, 1♂ (TL 18 mm), Lizard I., BK 117, B. Kensley, Jan 1982; NMV J37778, 1♂ (TL 25 mm), Lizard I., 600 m NE of Palfrey I., 14°40'S 145°27'E, NQ 118, 3 m, patch reef, R. Wilson & G. Poore, 9 Dec 1987; NMV J37794, 3♂♂ (TL 12–18 mm), 100 m off Granite Head, Lizard I., 14°40'S 145°27'E, 18 m, sloping granite surface with some coral & sponge, R. Wilson, 11 Dec 1987; USNM, 2♂♂ (TL 18–22 mm), 5♀♀ (TL 18–24 mm), Lizard I., N. Marshall, 7 Apr 1994; USNM, 1♀ (TL 25 mm), Lizard I., N. Marshall, 7 Apr 1994. WESTERN AUSTRALIA: AM P52751, 1♀ (TL 24 mm), 42 km NNE of Dampier, 20°14.6'S 116°50.6–50.9'E, 40–41 m, beam trawl, on sand, S0583, 27 Oct 1983; NMV J37790, 1♂ (TL 10 mm), Northwest Shelf between Port Hedland & Dampier, 19°39'S 116°22'E, 46 m, epibenthic sled, with bryozoans, G. Poore & H. Lew Ton, 7 Jun 1983; NMV J37813, 1♀ (TL 25 mm), Northwest Shelf between Port Hedland & Dampier, 20°24'S 116°12'E, 36 m, shelly sand trawl, G. Poore & H. Lew Ton, 9 Jun 1983; NMV J37814, 1♀ (TL 16 mm), Northwest Shelf between Port Hedland & Dampier, 19°59'S 117°21'E, 48 m, with sponges, trawl, G. Poore & H. Lew Ton, 2 Jun 1983; NTM Cr001550, 1♀ (TL 15 mm), Ashmore Reef, 15 m, coralline algae, B. Russell, 23 Feb 1984; NTM exCr005206, 2♀♀ (TL 13–16 mm), Northwest Shelf, 40–46 m, from coralline rocks, B. Russell, 17 Apr 1985; NTM Cr012362, 1♀ (TL 14 mm), Northwest Shelf, 19°29.4'S 118°51.5–51.8'E, 40 m, beam trawl, 25 Oct 1983; NTM Cr012363, 2♂♂ (TL 16–19 mm), 4♀♀ (TL 14–22 mm), Northwest Shelf, 19°30.9–30.6'S 118°49.2–49.4'E, 38–39 m, beam trawl, 25 Oct 1983; NTM Cr012368, 1♀ (TL 19 mm), Northwest Shelf, 19°29.6–29.9'S 118°51.7–51.0'E, 40–41 m, sled, 25 Oct 1983; NTM Cr012390, 1♀ (TL 25 mm), Northwest Shelf, T 6/3; NTM Cr012392, 1♂ (TL 15 mm), Northwest Shelf, T 10/25; exNTM Cr012399, 2♂♂ (TL 16–24 mm), Northwest Shelf, beam trawl, 10 Feb 1983; NTM, 1♀ (TL 20 mm), Northwest Shelf, 20°04'S 116°37'E, 60–80 m, in sponge *Phoniospongia*, NT Fisheries, 10 Jun 1986.

Other material. SMF 5771, 1♂ (TL 22 mm), Ternate, Molucca Is, Indonesia, Kükenthal, 1894 (holotype of *Gonodactylus chiragra* var. *confinis* de Man).

Diagnosis. Rostral plate basal portion with anterior margins transverse or sloping anteriorly; anterolateral angles rounded or bluntly angular. Mandibular palp 3-segmented. TS6 lateral margin truncate, broader than that of TS7. PLP1 endopod in adult males with lateral lobe on posterior endite. AS1–5 unarmed posterolaterally. Telson IM teeth distinct, apices extending posteriorly well beyond apices of IM denticles; LT teeth indicated by a shallow, narrow notch, at most set off slightly from margin of telson; with 11–14 SM denticles. Telson dorsal carinae strongly inflated in adult males; without spinules over dorsal surface; MD, accessory MD and anterior SM carinae each usually with posterior spinule or tubercle; accessory MD carinae long, extending anteriorly about ½ length of MD carina, but often obsolete or fused with MD carina in adult males. Uropodal exopod

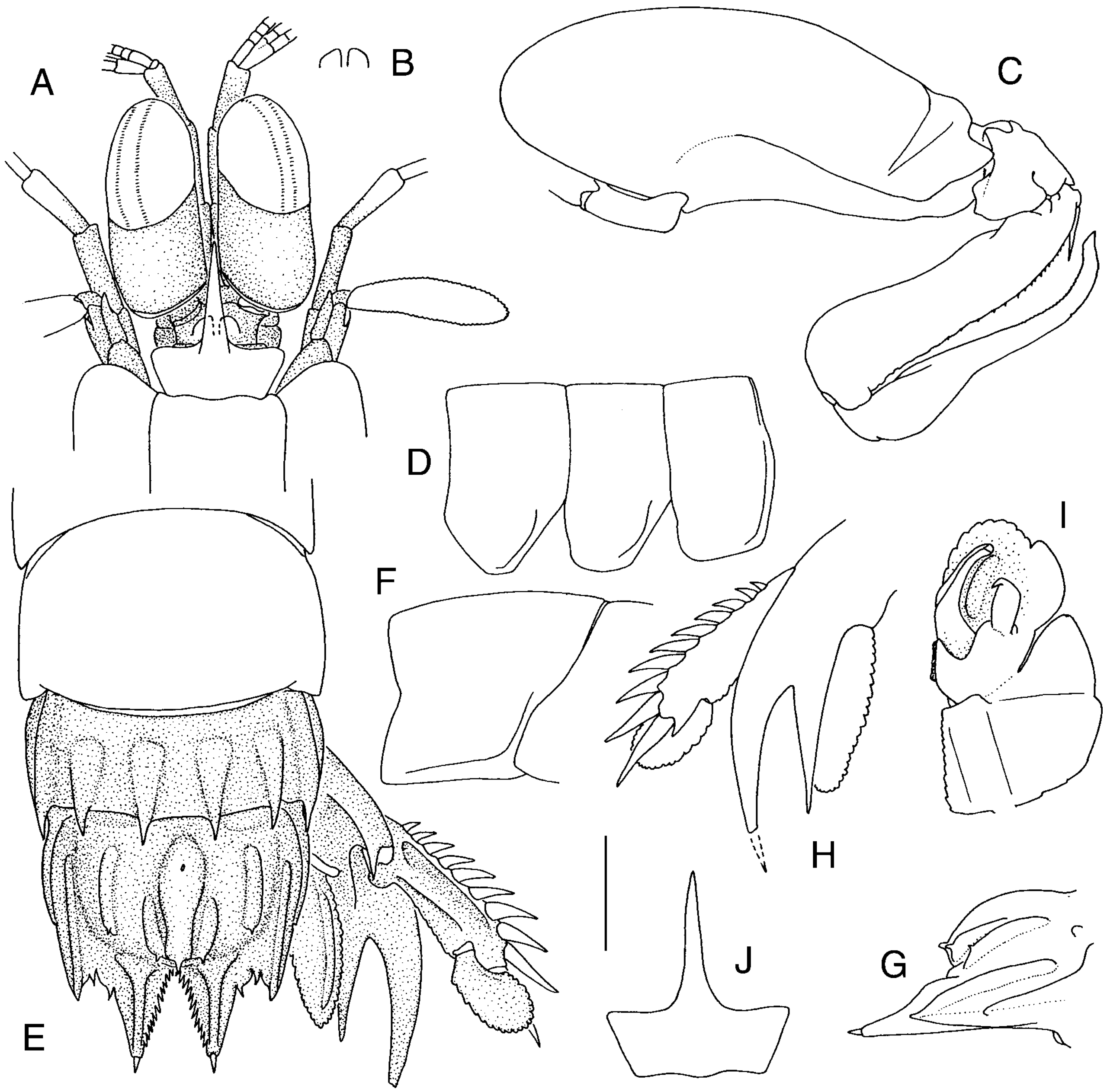

Figure 21. *Gonodactylellus affinis* (de Man). A–I, ♂ TL 18 mm (AM P56804). J, ♀ TL 27 mm (AM P56806). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS5, right lateral. G, telson, right lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. J, rostral plate, dorsal. Scale A–H = 1 mm; I = 0.5 mm.

proximal segment outer margin with 9–11 movable spines and distal, ventral spine; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod slender, length 3.00–4.20 breadth, entire margin with a single row of setae.

Colour in alcohol. Faded, but with scattered chromatophores mid-dorsally on thoracic and abdominal somites.

Measurements. Male (n = 23) TL 10–34 mm, female (n = 25) TL 9–32 mm. A1 peduncle 0.57–0.79 CL. A2 scale 0.31–0.47 CL. AWCLI 676–804. Moosa (1991) reported specimens to 38 mm TL.

Remarks. The Australian specimens of *G. affinis* agree well with type material and published accounts (Manning, 1978c, 1995; Moosa & Cleva, 1984a), exhibiting typical sexual dimorphism in the degree of inflation of the mid-dorsal carinae of the telson. Thus, the Australian material exhibits the full range of morphological variation reported for *G. affinis* and its synonyms (see Manning, 1978c; Moosa & Cleva, 1984a). The anterior margins of the rostral plate are usually transverse or slightly concave, occasionally sloping posteriorly in the smallest specimens, and the anterolateral corners are usually rounded. All mid-dorsal carinae are armed in most specimens, but in several specimens, one or other of the mid-dorsal carinae may lack a spinule or tubercle, usually to be replaced by a small pit. Adult males of *G. affinis* usually bear considerably more strongly inflated dorsal telson carinae than juveniles or size-matched females. Specimens where one or more of the mid-dorsal carinae are unarmed are usually adult males whereby the inflation of the median carina obscures or subsumes the apical spinules and accessory median carinae. The petasma is fully developed in all males exceeding 13 mm TL.

The 21 mm TL male syntype (now paralectotype) of *G. affinis* was figured by Manning (1978c: fig. 1a; 1995: fig. 20a) but inadvertently labelled as a 34 mm TL female. The 34 mm TL male syntype of *G. affinis* is herein selected as the lectotype to fix the identity of the species. Lanchester (1903, pl. 23) figured three lettered "forms" of *G. segregatus*, a, b, c, of which specimens of all forms are therefore syntypes. As shown by Manning (1978c), *G. segregatus* a and b are referable to *G. affinis*. Form c, however, appears to be referable to *Gonodactylus smithii* according to the figure given by Lanchester (1903, pl. 23: fig. 12). Therefore, the 18 mm TL female syntype of *G. segregatus* a figured by Manning (1978c, fig. 1g) is designated lectotype to fix the identity of the species and retain it in the synonymy of *G. affinis*.

A 16 mm TL male (NTM Cr012399) has a parasitic gastropod (*Caledoniella* sp.) attached to the sternum of TS8.

Habitat. Rocky and coral reefs from crevices in rock, coral, sponge or coralline algae from the reef flat to 60–80 m depth.

Distribution. Western Pacific Ocean to the Philippines, Macclesfield Bank, South China Sea, Vietnam, Thailand, Indonesia and Australia.

Gonodactylellus annularis Erdmann & Manning, 1998

Fig. 22

?*Gonodactylus botti*.–Moosa, 1991: 154 (not *Gonodactylus botti* Manning, 1975a).

Gonodactylellus annularis Erdmann & Manning, 1998: 617–618, fig. 1b (type locality: Kapoposang, Spermonde, Indonesia).

Type material. HOLOTYPE: USNM 260908, ♂ (TL 21 mm), Greater Sunda I., Kapoposang, Spermonde Archipelago, Indonesia, 4°41'42"S 110°57'00"E, M. Erdmann, Dec 1993.

Australian material. QUEENSLAND: AM P58571, 1♀ (TL 14 mm), GBRMPA Reef 10–418, 10°59.98'S 144°01.22'E, 6 m, from large brown colonial ascidian, QLD 663, S. Keable, 15 Jan 1993; AM P58572, 2♂♂ (TL 9–14 mm), GBRMPA Reef 11–131, 11°26.96'S 144°04.06'E, 3 m, rubble, QLD 660, S. Keable, 14 Jan 1993; AM P58576, 1♂ (TL 13 mm), 1♀ (TL 13 mm), GBRMPA 11–102, 11°27.56'S 143°58.12'E, 9 m, coral rubble, QLD 651, S. Keable, 13 Jan 1993; QM W22264 (part), 1♂ (TL 15 mm), Wreck Reef, "the bommies" near Porpoise Cay, 22°00'S 152°00'E, 15 m, reef, from live branching corals, J. Short, 8 May 1988; USNM 307238, 1♂ (TL 18 mm), Lizard Head, Lizard I., from small rubble pieces on sand, JDT LIZ-19, J. Thomas, 31 Jan 1989. WESTERN AUSTRALIA: NTM Cr008725, 1♂ (TL 15 mm), Trepang Bay, Cobourg Peninsula, algae crest of reef pools, low tide, A. Bruce & P. Hanley, 15 Oct 1981; QM W17524, 1♀ (TL 8 mm), Cartier Reef, Timor Sea, 12°32.2'S 123°31.9'E, 18 m, western side of reef, reef slope, R. Willan, 4 May 1992. NORTHERN TERRITORY: NMV J13842, 1♀ (TL 13 mm), S side of New Year I., 10°54'S 133°2'E, 14 m, sand & coral with *Padina*, NT 21, G. Poore, 14 Oct 1982.

Diagnosis. Rostral plate basal portion with anterior margins transverse or slightly concave; anterolateral angles acute but blunt. Mandibular palp 3-segmented. TS6 lateral margin truncate, broader than that of TS7. PLP1 endopod in adult males without lateral lobe on posterior endite. AS1–5 unarmed posterolaterally. Telson IM teeth distinct, apices extending posteriorly well beyond apices of IM denticles; emargination between SM and IM teeth approaching a right angle; LT teeth indicated by a shallow notch, slightly but distinctly set off from margin; with 7–12 SM denticles. Telson mid-dorsal carinae strongly inflated; without spinules over dorsal surface; MD carina with posterior tubercle; accessory MD carinae extending anteriorly about ¼ to ½ length of MD carina, unarmed posteriorly and fused posteriorly with MD carina; anterior SM carina unarmed posteriorly. Uropodal exopod proximal segment outer margin with 8 or 9 movable spines and distal, ventral spine; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod slender, length 3.00–3.73 breadth, entire margin with a single row of setae.

Colour in alcohol. Faded.

Measurements. Male (n = 7) TL 9–21 mm, female (n = 4) TL 8–14 mm. A1 peduncle 0.57–0.72 CL. A2 scale 0.37–0.42 CL. AWCLI 598–815. Erdmann & Manning (1998) reported specimens to 21 mm TL.

Remarks. The present series of *G. annularis* agrees well with the type material but displays some apparently size related variation not reported in the original account (Erdmann & Manning, 1998). Specimens smaller than 15 mm TL bear accessory median carinae of the telson that vary from ⅓ to ½ the length of the median carina. In specimens 15 mm TL or larger, the inflation of the median carinae of the telson subsumes the anterior portion of the accessory median carinae reducing their length to about ¼ that of the median carina as in the holotype. Variation is also present in the condition of the ocular scales. The ocular scales are fused in most specimens examined (Fig. 22), but may be partially fused or separate.

Gonodactylellus annularis resembles *G. affinis*, *G. incipiens* and *G. erdmanni*, described herein, in having the lateral margin of TS6 broader than that of TS7. *Gonodactylellus annularis* differs from both *G. incipiens* and *G. erdmanni* in having distinctly shorter submedian telson teeth, the median carina of the telson is higher and more tumid, and the emargination between the submedian and intermediate teeth of the telson approaches a right angle instead of being distinctly acute. The tumid telson morphology of *G. annularis* may also resemble males of *G. affinis* in which the accessory median carinae are subsumed by the inflated median carina of the telson, but *G. affinis* differs in having

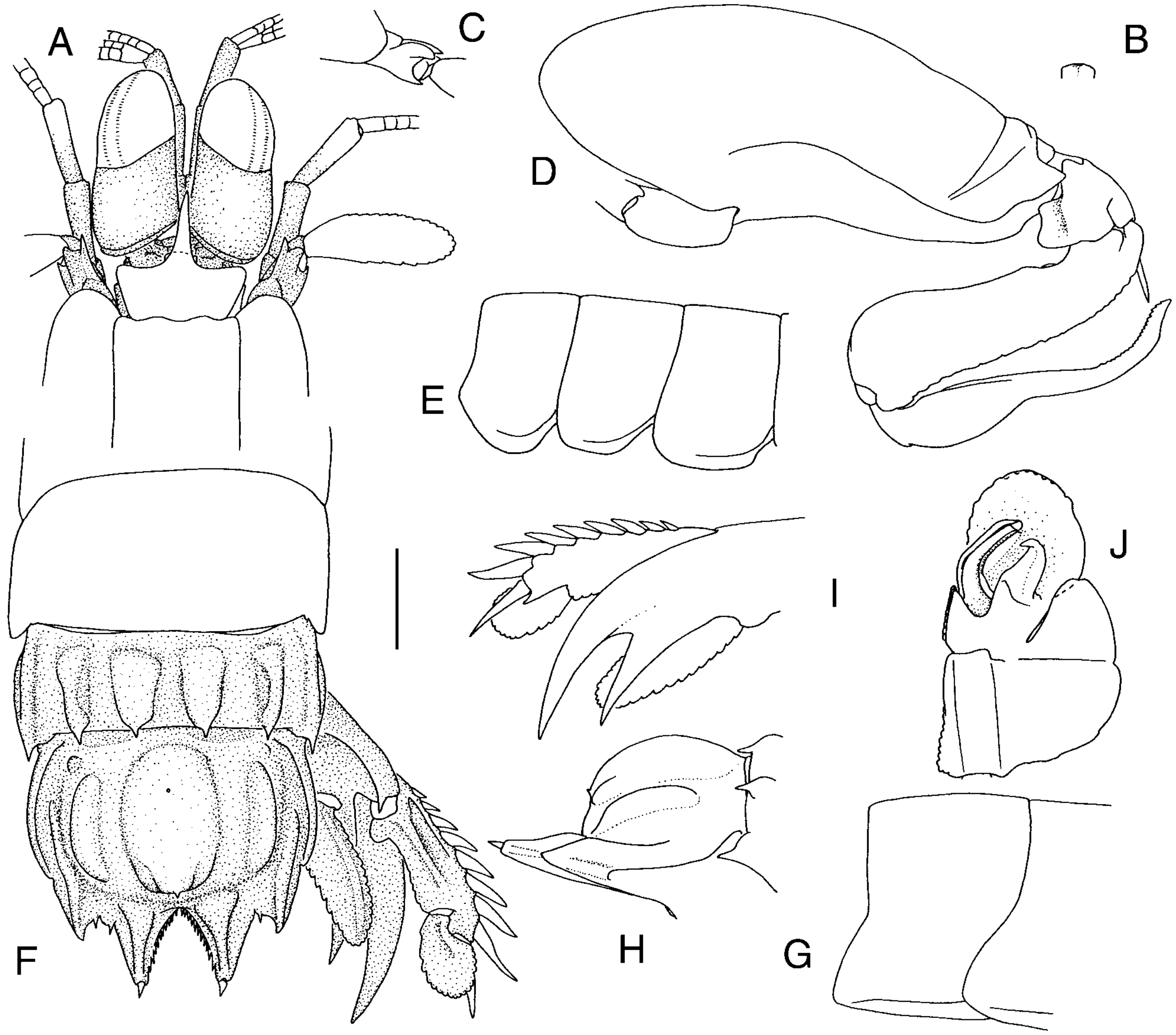

Figure 22. *Gonodactylellus annularis* Erdmann & Manning, ♂ TL 18 mm (USNM 307238). A, anterior cephalon, dorsal. B, ocular scales. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lateral. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 1 mm; J = 0.5 mm.

all or most of the mid-dorsal carinae armed posteriorly and in having a less rounded general appearance to the telson.

An unusual feature of male *G. annularis* is the suppression of the lateral lobe on the posterior endite of the endopod of pleopod 1. In other species of *Gonodactylellus*, the lateral lobe of the posterior endite is clearly demarcated. Therefore, the condition of the endopod of pleopod 1 in male *G. annularis* is a useful diagnostic character. As remarked under the account of *Gonodactylus*, Moosa's (1991) record of *Gonodactylus botti* from New Caledonia is probably based on *G. annularis*.

Habitat. Coral reefs amongst rubble, live corals, and algae to a depth of at least 18 m in Australia. Ahyong & Naiyanetr (in press) reported the species from the Andaman Sea, Thailand at a depth of 20 m.

Distribution. The Andaman Sea, Indonesia and now from northern Australia; possibly from New Caledonia.

Gonodactylellus caldwelli Erdmann & Manning, 1998

Fig. 23

Gonodactylellus caldwelli Erdmann & Manning, 1998: 618–619, fig. 1c (type locality: Bira, Spermonde, Indonesia).–Debelius, 1999: 273.

Type material. HOLOTYPE: USNM 260910, ♂ (TL 30 mm), Bira, Spermonde, Indonesia, M. Erdmann. PARATYPE: AM P58560, ♂ (TL 20 mm), Bird Islet, Lizard I., Australia, 14°40'S 145°28'E, coral rubble, less than 1 m, R. Caldwell.

Australian material. QUEENSLAND: AM P56808, 1♂ (TL 40 mm), Opal Reef, near trinity Passage, off Cairns, A. & D. Banner, 15 Jan 1968; RLC, 1♂ (TL 37 mm), 1♀ (TL 35 mm), Bird Islet, Lizard I., inside reef crest, 1 m, coral rubble, R. Caldwell, Aug 1997. WESTERN AUSTRALIA: NTM, 1♀ (TL 70 mm), from wreck of SS *Mildura*, Exmouth Gulf, 21°56'S 114°07'E, 0.3 m, limestone reef, R. Hanley, 4 Feb 1988.

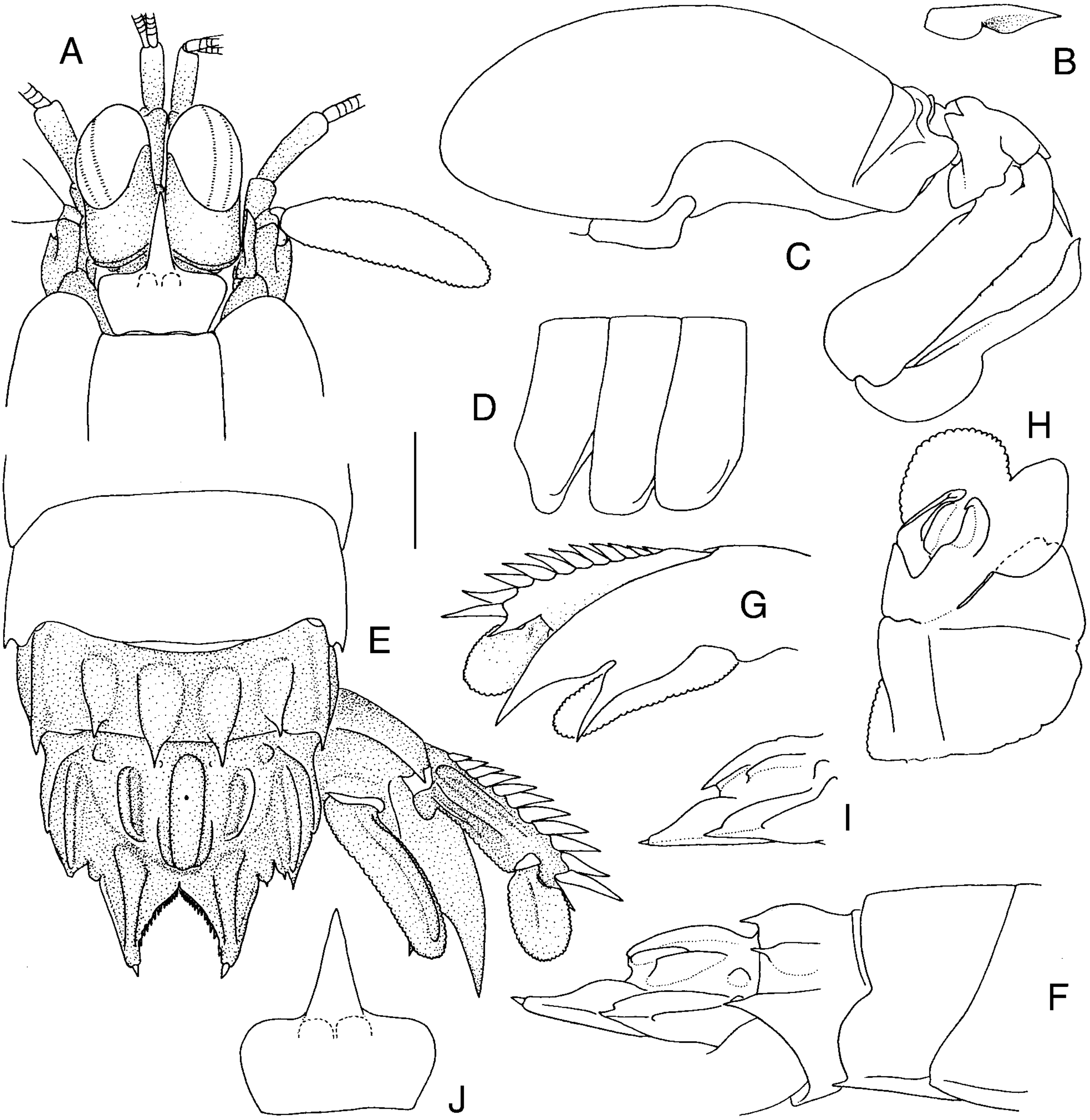

Figure 23. *Gonodactylellus caldwelli* Erdmann & Manning. A–H, ♂ TL 37 mm (RLC). I, ♀ TL 35 mm (RLC). J, ♀ TL 70 mm (NTM). A, anterior cephalon, dorsal. B, rostral plate, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS4–6 & telson, right lateral. G, uropod, right ventral. H, PLP1 endopod, right anterior. I, telson, right lateral. J, rostral plate and ocular scales, dorsal. Scale A–G,I,J = 5 mm; H = 2.4 mm.

Diagnosis. Ocular scales rounded, separate. Rostral plate longer than broad; basal portion with anterior margins transverse; anterolateral angles rounded; lateral margins slightly divergent anteriorly; median spine longer than base. Mandibular palp 3-segmented. PLP1 endopod in adult males with lateral lobe on posterior endite. AS5 with distinct posterolateral spine. Telson with IM teeth distinct, apices extending posteriorly well beyond apices of IM denticles; with 11–16 SM denticles. Telson without numerous dorsal spinules; MD carina with long slender spine, but lost in adult males; accessory MD carinae extending anteriorly almost to midlength of MD carina in adults, unarmed posteriorly; anterior SM carina unarmed, but occasionally angular posteriorly. Uropodal exopod proximal segment outer margin with 10–12 movable spines and distal, ventral spine; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod slender, length 3.57–4.89 breadth; entire margin with single row of setae.

Colour in alcohol. Largely faded, but with numerous chromatophores on dorsal surface, particularly mid-dorsally; carapace with three thin dark longitudinal lines anteromedially.

Measurements. Male (*n* = 4) TL 20–40 mm, female (*n* = 2) TL 35–70 mm. A1 peduncle 0.49–0.72 CL. A2 scale 0.48–0.52 CL. AWCLI 802–896. The present series includes the largest known specimen of the species.

Remarks. *Gonodactylellus caldwelli* differs from all congeners in bearing a distinct posterolateral spine on AS5; it is also the largest species in the genus. The series of *G. caldwelli* reported here show some apparently size related variation: the telson carinae are relatively more inflated in males than in females and the apical spine of the median carina of the telson is suppressed in larger males. Additionally, in specimens exceeding 30 mm TL, the accessory median carinae of the telson are relatively long, extending to about the midlength of the median carina.

The 70 mm TL specimen is notable as the largest known specimen of the species and genus. The median spine of rostral plate in this specimen is considerably broader and the anterolateral margins are more strongly rounded than in smaller specimens (Fig. 23J). Significantly, the ocular scales in the 70 mm TL specimen of *G. caldwelli* are also proportionally broader than in other specimens, approaching, but still narrower than that of species of *Gonodactylus*.

Habitat. Shallow water (1 m or less) on coral reefs exposed to relatively strong wave action.

Distribution. Indonesia and Australia, from north Queensland, and Exmouth Gulf, Western Australia.

Gonodactylellus erdmanni n.sp.

Fig. 24

Gonodactylus incipiens.–Manning, 1967c: 18 (part), not fig. 7; 1991: 3, fig. 3 (not *Gonodactylus incipiens* Lanchester, 1903).
Gonodactylus chiragra.–Manning, 1966: 113–114 [part, not *Gonodactylus chiragra* (Fabricius, 1781)].
Gonodactylellus incipiens.–Manning, 1995: 63–64, fig. 25b (part, not fig. 24) [not *Gonodactylellus incipiens* (Lanchester, 1903)].

Type material. (All Queensland) HOLOTYPE: AM P57028, ♂ (TL 31 mm), near Townsville, coral reef, from crevices in coral rock, less than 5 m, Mar 1995. PARATYPES: AM P57029, 1♂ (TL 23 mm), 1♀ (TL 30 mm), near Townsville, coral reef, from crevices in coral rock, less than 5 m, Mar 1995; AM P17703, 1♂ (TL 16 mm), 1♀ (TL 15 mm), West Cay, Diamond Islets, Coral Sea, intertidal beach rock pools, D. McMichael & J. Yaldwyn, 23 Oct 1964; AM P17732, 1♂ (TL 21 mm), Cockle Bay, Magnetic I., 19°08'S 146°50'E, intertidal, M. Hines, 8 May 1963; AM P56155, 1♂ (TL 13 mm), 1♀ (TL 10 mm), Northeast Cay, Herald Group, Coral Sea, 17°20'S 148°28'E, dead coral, D. McMichael & J. Yaldwyn, 09 Nov 1964; NMV J37807, 1♀ (TL 23 mm), Paul Sammarco's Hole, Britomart Reef, reef fringe, 18°17'S 146°38'E, 5 m, from encrusting algae, G. Poore & H. Lew Ton, 26 Nov 1982; QM W14409, 1♀ (TL 18 mm), S side of Seaforth I., near Lindeman I., 20°28'S 149°02'E, in branching coral, subtidal, P. Davie & J. Short, 24 Mar 1987; QM W14472, 1♀ (TL 27 mm), Coconut Beach, W side of Lindeman I., 20°27'S 149°02'E, in live & dead branching coral, subtidal, P. Davie & J. Short, 26 Mar 1987; QM W22264 (part), 1♀ (TL 19 mm), Wreck Reef, "the bommies" near Porpoise Cay, 22°00'S 152°00'E, 15 m, reef, from live branching corals, J. Short, 8 May 1988.

Australian material. QUEENSLAND: USNM, 1♂ (TL 11 mm), 3♀♀ (TL 10–13 mm), Orpheus I., in cove S of resort, 1–2 m, mid-tide level, rubble, JDT OPH-1, J. Thomas, 12 Feb 1989; USNM, 1♂ (TL 20 mm), 1♀ (TL 21 mm), Cobble Beach, N of Picnic Bay, Orpheus I., 2 m, coral rubble, mostly *Acropora* fragments, JDT OPH-2, J. Thomas, 12 Feb 1989; USNM, 1♂ (TL 13 mm), off point between Anchor Bay & Watson's Bay, Lizard I., rubble, JDT LIZ-5, J. Thomas, 24 Jan 1989. WESTERN AUSTRALIA: NTM exCr009121, 1♂ (TL 7 mm), 2♀♀ (TL 9 mm), Cartier Reef, 12°31.7'S 123°33.5'E, 2.5–6 m, reef flat, R. Hanley *et al*., 5 May 1992; NTM exCr009160, 2♂♂ (TL 11–16 mm), 2♀♀ (TL 8–10 mm), Cartier Reef, 12°32.6'S 123°32.2'E, 8–15 m, R. Hanley & B. Russell, 9 May 1992; NTM Cr009171, 1♀ (TL 14 mm), SW Hibernia Reef, 11°58.8'S 123°21.2'E, 5–26 m, R. Hanley *et al*., 11 May 1992; NTM Cr012606, 2♂♂ (TL 10–18 mm), Ashmore Reef, 12°14.0'S 122°59.0'E, low tide, R. Hanley, 14 Apr 1987; QM W17754, 1♀ (TL 12 mm), Hibernia Reef, Timor Sea, 11°57.8'S 123°22.3'E, 14 m, reef lagoon, from live *Porites cylindrica*, J. Short, 10 May 1992; QM W17577, 1♂ (TL 10 mm), Cartier Reef, Timor Sea, 12°31.8'S 123°33.1'E, 4–6 m, patch reef, branching coral infauna, J. Short, 5 May 1992; QM W17578, 1♀ (TL 17 mm), Cartier Reef, Timor Sea, 12°31.8'S 123°33.1'E, 4–6 m, patch reef, branching coral infauna, J. Short, 5 May 1992; QM W17513, 1♀ (TL 16 mm), Cartier Reef, Timor Sea, 12°32.2'S 123°31.9'E, 18 m, western side of reef, reef slope, dead branching coral infauna, J. Short, 4 May 1992; QM W17932, 1♀ (TL 20 mm), Hibernia Reef, Timor Sea, 11°59'S 123°22'E, 0–0.5 m, SE side of reef, reef flat, rotenoned, B. Russell, 15 May 1992. NORTHERN TERRITORY: AM P16794, 1♀ (TL 14 mm), Yirrkala, NW of Cape Arnhem, coral reef, R. Miller *et al*., 25 Aug 1948; AM P16795, 1♂ (TL 15 mm), Yirrkala, NW of Cape Arnhem, coral reef, R. Miller, 13 Jul 1948; AM P16796, 1♀ (TL 27 mm), Yirrkala, NW of Cape Arnhem, coral reef, R. Miller, 12 Aug 1948; NMV J13836, 1♀ (TL 17 mm), W side of Oxley I., 11°0'S 132°49'E, intertidal pools, G. Poore, 18 Oct 1982; NMV J13838, 2♀♀ (TL 15–17 mm), New Year I., 10°54'S 133°2'E, intertidal coral platform, from red algae NT 65, J. Lowry, 18 Oct 1982; NMV J13841, 1♀ (TL 16 mm), S side of New Year I., 10°54'S 133°2'E, 14 m, sand & coral rubble, NT 26, J. Lowry, 14 Oct 1982; NTM exCr000505, 1♂ (TL 18 mm), New Year I., 10°54.0'S 133°02.2'E, low tide, A. Bruce, 18 Oct 1982; NTM Cr001117, 1♂ (TL 23 mm), 1♀ (TL 28 mm), Cobourg Peninsula, 11°10.5'S 132°03.8'E, 4 m, N. Bruce, 17 May 1983; NTM Cr001632, 1♀ (TL 22 mm), Cobourg Peninsula, 11°11.0'S 132°03.4'E, coral reef edge, 6 m, N. Bruce, 16 May 1983; NTM Cr004117, 1♂ (TL 21 mm), 1♀ (TL 22 mm), Orontes Reef, Port Essington, 11°04.5'S 132°04.8'E, 12 m, coral block cavities, R. Willan & P. Davie, 10 Aug 1986; NTM Cr004171, 1♂ (TL 20 mm), 1♀ (TL 17 mm), Coral Bay, Port Essington, 11°11.2'S 132°02.8'E, C. Johnson & P. Davie, 13 Aug 1986; NTM Cr007660, 1♀ (TL 20 mm), Port Essington, 11°09.0'S 132°08.2'E, 1–2 m, rocky reef, A. Bruce *et al*., 18 Jul 1981; NTM Cr008692, 1♀ (TL 15 mm), Trepang Bay, Cobourg Peninsula, algae crest of reef pools, A. Bruce, 15 Oct 1981; NTM exCr008725, 2♂♂ (TL 21–24 mm), Trepang Bay, Cobourg Peninsula, algae crest of reef pools, low tide, A. Bruce & P. Hanley, 15 Oct 1981; NTM, 1♂ (TL 24 mm), 1♀ (TL 22 mm), Oxley I., Darwin, reef pools at low tide, 19 Dec 1982.

Other material. USNM 156537, 1♀ (TL 17 mm), Funafuti Atoll, Ellice Is, 1.8–7.4 m, F.E. Lewis, 16 Apr 1938; USNM 266615, 1♀ (TL 25 mm), Pecheurs I., Vietnam, 24 Jun 1949; USNM 266617, 1♂ (TL 15 mm), Pattle I., Paracel Is, Vietnam, 20 May 1948; USNM 304388, 2♂♂ (TL 11–14 mm), 4♀♀ (TL 14–22 mm), Spermonde Archipelago, Indonesia, M. Erdmann; AM

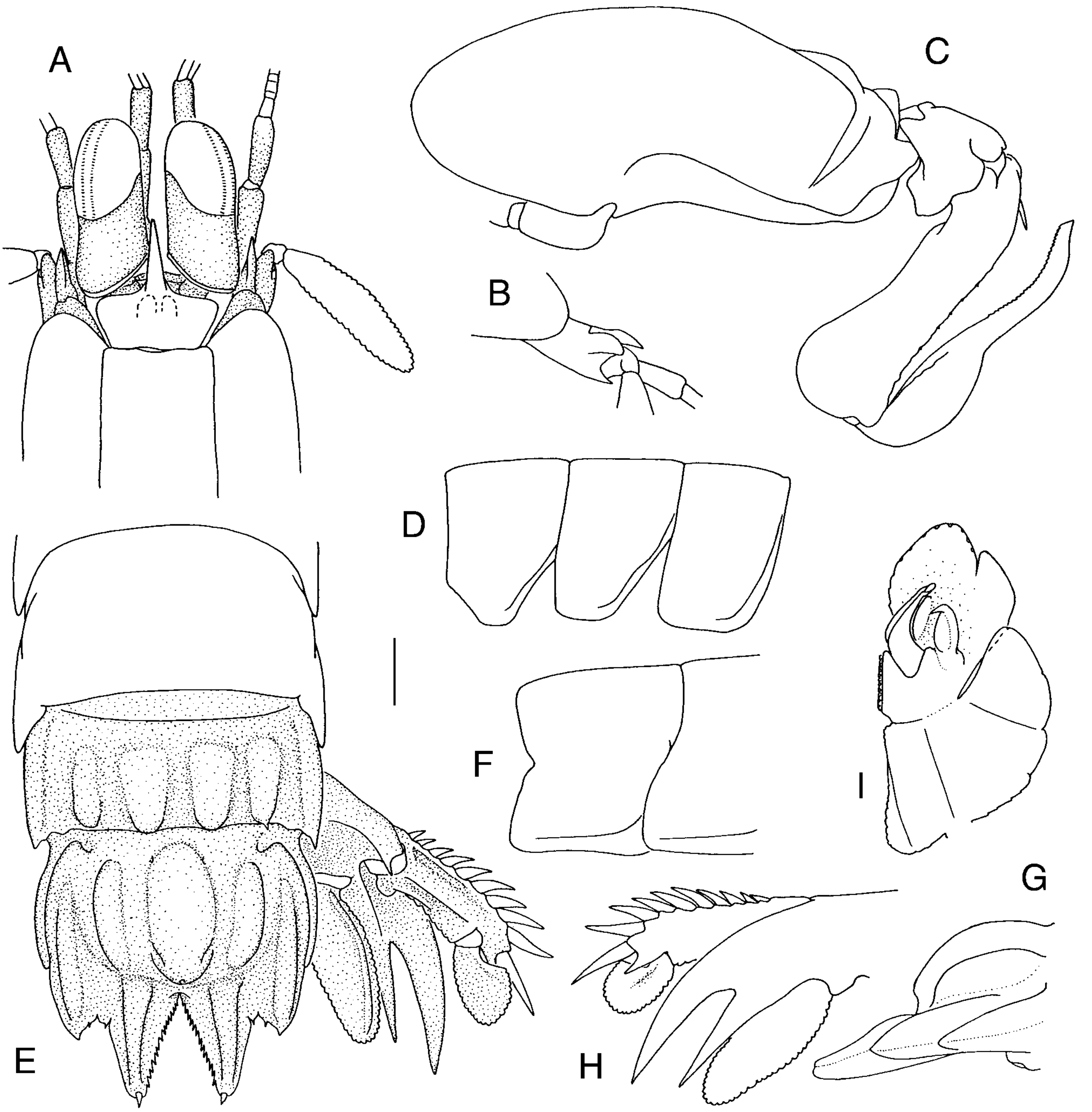

Figure 24. *Gonodactylellus erdmanni* n.sp., holotype ♂ TL 31 mm (AM P57028). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS4–5, right lateral. G, telson, right lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 1 mm; I = 0.5 mm.

P60245, 1♂ (TL 12 mm), E of Lac Temaie, Moorea, French Polynesia, 20 m, reef slope, dead coral, P. Hutchings, 27 Oct 1987.

Diagnosis. Ocular scales separate. Rostral plate with anterolateral angles rounded, anterior margins transverse or sloping posteriorly. Mandibular palp 3-segmented. TS6 lateral process truncate, broader than that of TS7. PLP1 endopod in adult males with lateral lobe on posterior endite. AS1–5 without posterolateral spine. Telson IM teeth distinct, with apices extending posteriorly well beyond apices of IM denticles. Telson without numerous spinules over surface of mid-dorsal carinae; MD carina with or without blunt posterior tubercle; emargination between SM and IM teeth acute; accessory MD carinae short, not extending anteriorly beyond posterior ⅓ of MD carina, unarmed posteriorly; anterior SM carina unarmed posteriorly, inflated but relatively straight, not curved or turning towards MD carina distally. Uropodal exopod proximal segment with distal, ventral spine; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod slender with length about three times breadth; entire margin with a single row of setae.

Description. Ocular scales narrow, rounded, separate, bases transverse. A1 peduncle 0.60–0.77 CL. A2 scale 0.30–0.54 CL. Rostral plate as long as or longer than broad; basal portion with anterior margins transverse or sloping posteriorly; anterolateral angles rounded; lateral margins divergent anteriorly; median spine longer than base. Raptorial claw dactylus without proximal notch. Mandibular palp 3-segmented. TS6 lateral process truncate, broader than that of TS7. TS8 anterolateral margin rounded; sternal keel obsolete. PLP1 endopod in adult males with lateral lobe on posterior endite. AS1–5 unarmed posterolaterally. AWCLI 657–780. Telson broader than long; with 10–15 SM denticles; IM teeth distinct, with apices extending posteriorly well beyond apices of IM denticles; emargination between SM and IM teeth acute; LT teeth indicated by a shallow notch, apex blunt, not projecting well off margin of telson; without numerous dorsal spinules over surface of mid-dorsal carinae; MD carina with or without blunt posterior tubercle; accessory MD carinae short, not extending anteriorly beyond posterior ⅓ of MD carina, unarmed posteriorly; anterior SM carina unarmed posteriorly, inflated but relatively straight, not curved or turning towards MD carina distally; knob absent. Telson ventral surface without carina on each SM tooth. Uropodal protopod terminal spines with outer spine longer. Uropodal exopod proximal segment outer margin with 9–13 movable spines, distalmost reaching apex of distal segment; distal margin with slender ventral spine; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod slender length 3.00–3.51 breadth, entire margin with a single row of setae.

Colour in life. Uniform or mottled olive green to reddish brown. Raptorial claw with meral spot pinkish.

Etymology. It is a pleasure to name this species for fellow stomatopod researcher, Mark Erdmann, University of California, Berkeley.

Measurements. Male (n = 26) TL 7–31 mm, female (n = 39) TL 9–30 mm. Other measurements of holotype: CL 6.7 mm, A1 peduncle 4.0 mm, A2 scale 2.7 mm, AS5 width 4.7 mm.

Remarks. *Gonodactylellus erdmanni* n.sp. resembles *G. incipiens* and *G. viridis*. Differences between *G. erdmanni* and *G. incipiens* are discussed under the account of the latter. *Gonodactylellus erdmanni* differs from *G. viridis* in having a relatively longer rostral spine in adults and a more truncate lateral margin of TS6 that has a generally more angular anterolateral margin; in *G. viridis*, the anterolateral margin of TS6 is rounded. *Gonodactylellus erdmanni*, so far known to attain a maximum size of 31 mm TL, is also a smaller species than *G. viridis* which reaches 55 mm TL. As well as being a smaller species, *G. erdmanni* also appears to mature at a smaller size than *G. viridis*. Based on male *G. erdmanni* examined here, the petasma and penes are fully developed by 11 mm TL, whereas in *G. viridis*, these external reproductive structures do not show similar development until 16–17 mm TL (Ahyong, unpublished). Additionally, the median carina of the telson in males of *G. erdmanni* becomes inflated with a strongly convex profile at a smaller size than in *G. viridis*.

The present specimens of *G. erdmanni* agree well but show allometric variation in rostral plate form and aspects of telson morphology. The slope of the anterior margins of the rostral plate varies with size, sloping posteriorly in the smallest specimens becoming transverse in the largest specimens. The median carina of the telson may or may not bear a posterior spinule or tubercle, but the accessory median and anterior submedian carinae are never armed. As in other gonodactyloids, the mid-dorsal carinae of the telson in males are more strongly inflated than in size-matched females.

The specimens from Vietnam identified as *G. incipiens* by Manning (1995) are referable to *G. erdmanni* except for the figured specimen (fig. 24, female TL 30 mm) which is referable to *G. viridis*.

Habitat. Common in rock and coral crevices and amongst rubble and epiphytes from the reef flat to depths exceeding 30 m.

Distribution. Western Australia to Queensland, Indonesia, and Vietnam to the Central Pacific and Moorea, French Polynesia.

Gonodactylellus espinosus (Borradaile, 1898)

Fig. 25

Gonodactylus espinosus Borradaile, 1898: 35, figs. 5a–b, pl. 5 (type locality: Rotuma, Fiji Is).–Manning, 1967c: 21–23, fig. 8.
Gonodactylus chiragra.–Edmondson, 1923: 36, fig. 3h.–Tweedie, 1950: 139–140 [not *Gonodactylus chiragra* (Fabricius, 1781)].
Gonodactylellus espinosus.–Manning, 1995: 19, 56–57.

Type material. HOLOTYPE: MZC 15.09.1897, ♂ (TL 18 mm), Rotuma, J.S. Gardiner.

Australian material. COCOS-KEELING ISLANDS: AM P56986, 1♂ (TL 17 mm), West I. (Pulo Panjang), reef flat behind settlement, H. Cogger & R. Sadlier, 26 Apr 1979; SAM, 1♀ (broken, CL 7.8 mm), Cocos-Keeling Is, W. Pennifold; ZRC 1970.10.13.16–17, 2♂♂ (TL 31–32 mm), Cocos-Keeling Is, C.A. Gibson-Hill, 1941; ZRC 1970.10.13.7–14, 2♂♂ (TL 28–31 mm), 6♀♀ (TL 30–40 mm), Cocos-Keeling Is, C.A. Gibson-Hill, 1941.

Diagnosis. Ocular scales separate. Mandibular palp 3-segmented. TS6 lateral process truncate, broader than that of TS7. PLP1 endopod in adult males with lateral lobe on posterior endite. AS1–5 unarmed posterolaterally. Telson with IM teeth appressed to margin of SM teeth; with 15 or 16 SM denticles. Telson without spinules over dorsal surface; accessory MD carinae short, not extending anteriorly beyond ⅓ length of MD carina; anterior SM carina unarmed posteriorly. Uropodal exopod proximal segment with 10–12 movable spines and distal, ventral spine; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod slender, length 3.55–4.05 breadth, entire margin setose.

Colour in alcohol. Completely faded.

Measurements. Male (n = 6) TL 17–32 mm, female (n = 7) TL 30–40 mm. A1 peduncle 0.56–62 CL. A2 scale 0.38–0.44

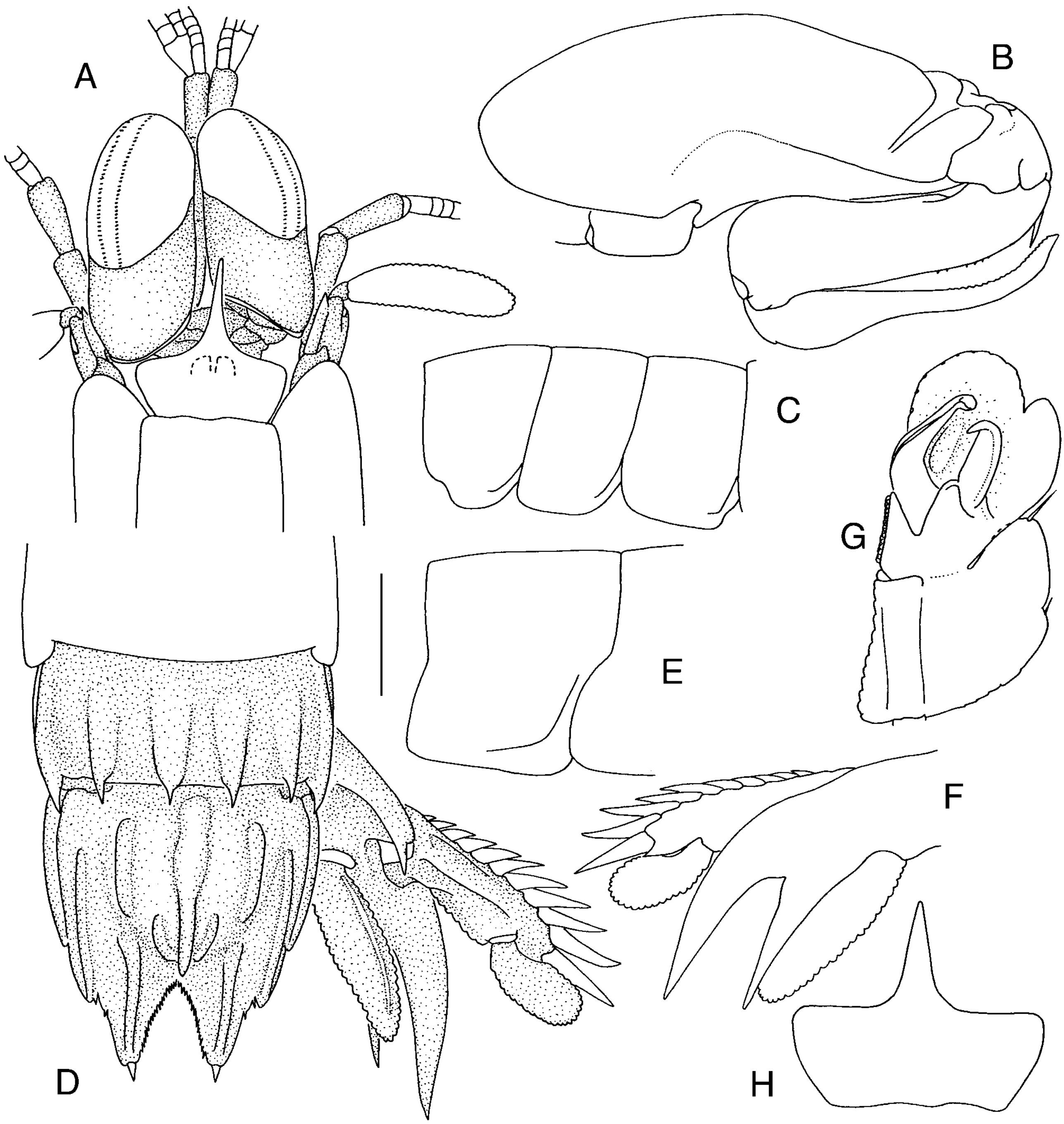

Figure 25. *Gonodactylellus espinosus* (Borradaile). A–G, ♂ TL 17 mm (AM P56986). H, ♂ TL 31 mm (ZRC 1970.10.13.11). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8, right lateral. D, AS5–6, telson & uropod, dorsal. E, AS5, right lateral. F, uropod, right ventral. G, PLP1 endopod, right anterior. H, rostral plate, dorsal. Scale A–F, H–J = 1 mm; G = 0.5 mm.

CL. AWCLI 680–770. Manning (1967c) reported specimens to 45.5 mm TL.

Remarks. *Gonodactylellus espinosus* is distinctive in the genus for having the intermediate teeth of the telson appressed to the margin of the telson and in this respect resembles the eastern Pacific species, *Neogonodactylus zacae* (Manning, 1972c).

The present specimens agree well with the holotype and published accounts (e.g., Borradaile, 1898; Manning, 1967c) and show typical, size-related variation. The anterior margins of the basal portion rostral plate slope posteriorly and the median spine is longer than the basal portion in the smallest specimens whereas the anterior margin becomes transverse and the median spine shortens in the largest specimens. In the smallest male examined, the petasma is fully developed and the penes have reached full length, suggesting that it is sexually mature. The median carina of the telson in males 18 mm TL or larger is strongly inflated, obscuring the accessory median carinae.

Gonodactylellus espinosus has previously been reported only from Pacific localities. Therefore the present records are the first for the Indian Ocean. The absence of records of *G. espinosus* from intervening localities might be related to inadequate sampling effort, but could also reflect paucity of suitable microhabitats for larval settlement on continental northern Australia.

Habitat. Intertidal and shallow subtidal coral reef flats, notably in high-energy surge zones (M. Erdmann, pers. comm.).

Distribution. Central Pacific from Rotuma, Fiji, the Line Islands, French Polynesia and now from the Cocos-Keeling Islands, Indian Ocean.

Gonodactylellus incipiens (Lanchester, 1903)

Fig. 26

Gonodactylus chiragra var. *incipiens* a Lanchester, 1903: 451, pl. 23, fig. 10 (type locality: Funafuti, Ellice Is, 8°31'S 179°13'E, restricted by lectotype designation [Manning, 1967c]).

Gonodactylus chiragra.–Manning, 1966: 113–114 [part, not *Gonodactylus chiragra* (Fabricius, 1781)].

Gonodactylus incipiens.–Manning, 1967c: 18, fig. 7 (part).

Gonodactylus childi Manning, 1971a: 75–77, fig. 1 (most paratypes only, not *Gonodactylus childi* Manning, 1971a).

Type material. LECTOTYPE: MZC 11.01.1897, ♀ (TL 18 mm), Funafuti, Ellice Is, J.S. Gardiner.

Australian material. QUEENSLAND: AM P17701, ♂ (TL 19 mm), Northeast Cay, Herald Group, Coral Sea, 17°20'S 148°28'E, coral rock workings, D. McMichael & J. Yaldwyn, 6 Nov 1964; AM P56177, 1♂ (TL 10 mm), Northeast Cay, Herald Group, Coral Sea, 17°20'S 148°28'E, coral rock workings, D. McMichael & J. Yaldwyn, 6 Nov 1964.

Other material. USNM 135625 (part), 2♂♂ (TL 14–19 mm), Runit (Yvonne) I., Eniwetak Atoll, 11°32'47"S 162°21'56"E, tide pool in rock tide flat, inside reef edge, rotenone, C.A. Child, 8 Oct 1969, (paratypes of *Gonodactylus childi* Manning); USNM 135626, 2♀♀ (TL 15–18 mm), NE Eniwetak (Fred) I., Eniwetak Atoll, 11°21'43"N 162°21'20"E, 0–0.9 m, coral rock channel, C. Dawson. 25 Sep 1969, (paratypes of *Gonodactylus childi* Manning); USNM 120284, 1♂ (TL 19 mm), Hull I., Phoenix Is, L. Schultz, 7–17 Jul 1939.

Diagnosis. Ocular scales rounded separate. Rostral plate with anterolateral angles rounded, anterior margins transverse or sloping posteriorly; median spine distinctly longer than base. Mandibular palp 3-segmented. Lateral margin of TS6 rounded anterolaterally and posterolaterally, rounded or subtruncate on lower margin, slightly broader than TS7. PLP1 endopod in adult males with lateral lobe on posterior endite. AS5 without posterolateral spine. Telson with IM tooth distinctly separated from SM tooth, with emargination between SM and IM teeth acute; with 13–16 SM denticles; telson mid-dorsal carinae unarmed posteriorly or dorsally; MD carinae strongly inflated, tumid, ovate; accessory MD carinae, short, not extending anteriorly beyond posterior ⅓ of MD carina; anterior SM carinae crescent shaped in adults, converging posteriorly. Proximal segment of uropodal exopod with fixed distal ventral spine; outer margin with 11 or 12 movable spines; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod length 2.61–3.10 width, entire margin setose.

Colour in alcohol. Almost completely faded excepting sparsely distributed chromatophores on the median surface of TS6, AS1 and AS4.

Measurements. Male (n = 5) TL 10–19 mm, female (n = 3) TL 15–18 mm. A1 peduncle 0.66–0.74 CL, A2 scale 0.45–0.57 CL, AWCLI 759–842. Reaka & Manning (1987) reported *G. incipiens* to 42 mm TL, but see remarks below.

Remarks. *Gonodactylellus incipiens* most closely resembles *G. erdmanni* and the two species have been confused in the literature (see synonymy). The two species share a broad lateral margin of TS6 and short accessory median carinae on the telson. *Gonodactylellus incipiens* differs from *G. erdmanni* in having rounded margins of TS6, in having a proximal notch on the outer margin of the dactylus of the raptorial claw, and in telson morphology: the median carina is broadly ovate instead of pyriform and the anterior submedian carinae are crescent shaped and converge posteriorly instead of being relatively straight. In males, the accessory median carinae of the telson are subsumed by the inflated median carina whilst in females, the median carina is less strongly inflated such that the accessory median carinae are visible. Adult *G. incipiens* also differ from *G. erdmanni* in having the carinae of the submedian and intermediate teeth of the telson indistinctly demarcated from the telson surface. The 10 mm TL male, being considerably smaller than other specimens, bears less strongly inflated mid-dorsal carinae on the telson, and the anterior submedian carinae are less strongly curved. Unfortunately, Manning's (1967c) figure of *G. incipiens* from the Phoenix Islands is misleading in showing the mid-dorsal carinae of the telson to be elongate (as in *G. erdmanni*) instead of tumid and curved as in the specimen. The petasma is well developed in the smallest specimen examined.

Manning (1991) synonymized *Gonodactylus childi* with *G. incipiens*, but restudy of the types shows that both species are distinct. *Gonodactylus childi* is removed from synonymy below and retained in *Gonodactylus* sensu stricto. Except for two specimens, all paratypes of *Gonodactylus childi* (see account of that species below), including those figured by Manning (1971a), are referable to *G. incipiens*. Reaka & Manning (1987) reported *G. incipiens* to 42 mm TL from Enewetak Atoll, but re-examination of voucher collections in the USNM suggests that these records are almost certainly based on *Gonodactylus childi*.

Moosa (1991) reported *G. incipiens* from New Caledonia in which the ocular scales were fused, and where some bore armed accessory median carinae of the telson. Fused ocular scales are diagnostic of *G. rubriguttatus* and Moosa's (1991) specimens may be referable to that species. Moreover, a series of New Caledonian specimens fitting Moosa's (1991) description was recently forwarded by Alain Crosnier (MNHN); all are referable to *G. rubriguttatus* (see remarks under the account of the species). Most specimens identified

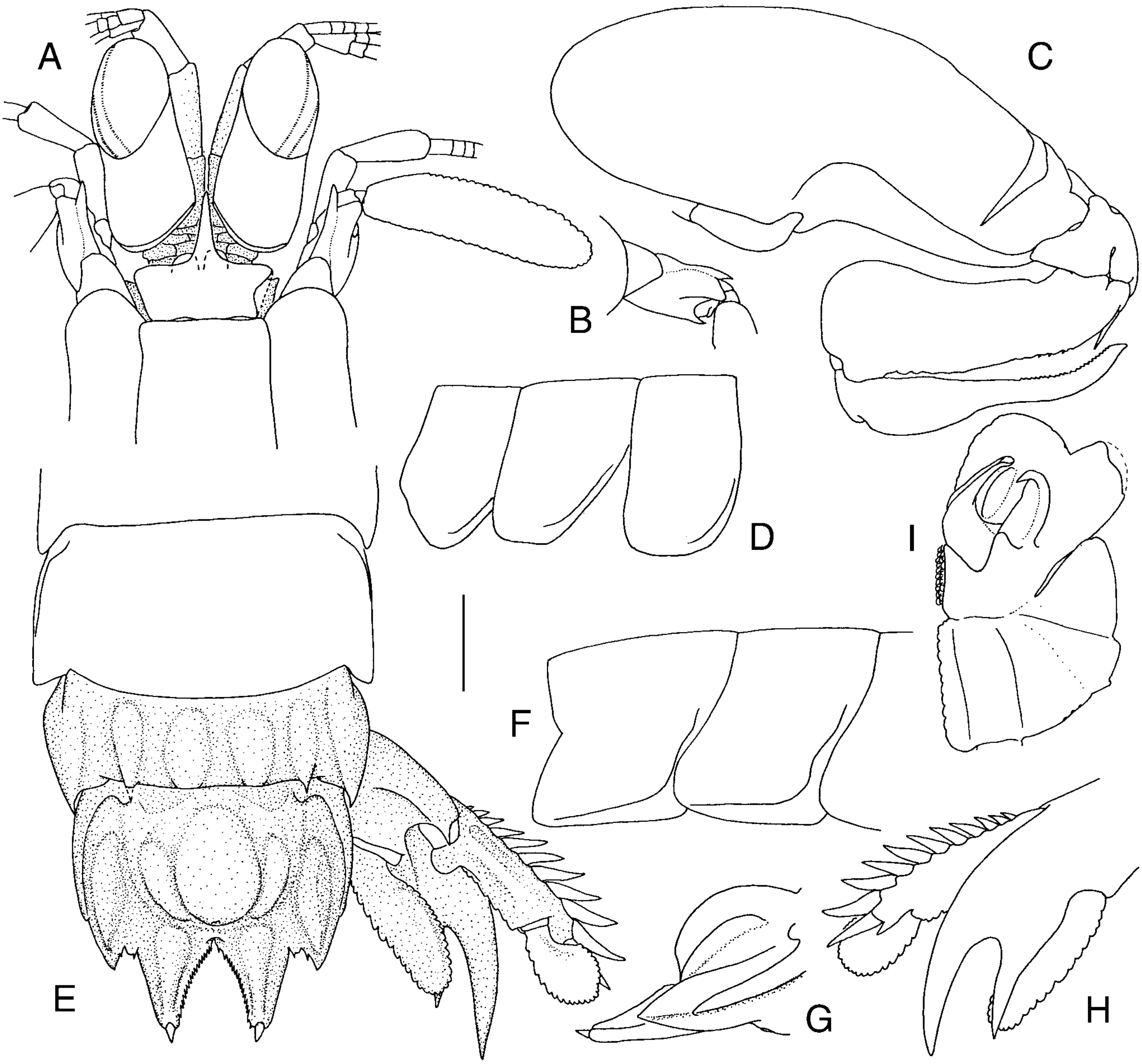

Figure 26. *Gonodactylellus incipiens* (Lanchester), ♂ TL 19 mm (AM P17701). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS4–5, right lateral. G, telson, right lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 1 mm; I = 0.5 mm.

as *G. incipiens* by Manning (1991, 1995) are referable to *G. erdmanni*. The specimen figured as *G. incipiens* by Manning (1995) is referable to *G. viridis*.

All records of *G. incipiens* are from Pacific localities except for Tattersall's (1906) record from Ceylon and Manning's (1990a) record from Oman. Tattersall's specimen appears to have been re-examined by Kemp (1913) and is referable to either *G. affinis* or *Gonodactylus smithii*. Manning's (1990a) specimen from Oman is most likely referable to *G. erdmanni* n.sp. or a juvenile specimen of *G. botti* which is common in the Western Indian Ocean. Presently, therefore, *G. incipiens* is known with certainty only from the Pacific.

Habitat. Coral reef flats amongst rubble and rock.

Distribution. Pacific Ocean, from Australia, Eniwetak Atoll, the Phoenix Islands and French Polynesia.

Gonodactylellus micronesicus (Manning, 1971a)

Fig. 27

Gonodactylus micronesica Manning, 1971a: 77–79, fig. 2 (type locality: W of Parry (Elmer) I., Eniwetak Atoll, 11°24'05"S 162°19'05"E).

Gonodactylellus micronesicus.–Manning, 1995: 19, 56, 57.–Erdmann & Manning, 1998: 620.

Type material. HOLOTYPE: USNM 135628, ♀ (TL 18 mm), W of Parry (Elmer) I., Eniwetak Atoll, 11°24'05"S 162°19'05"E, 24–35 m, coral pinnacle, T. Waller, 25 Sep 1969.

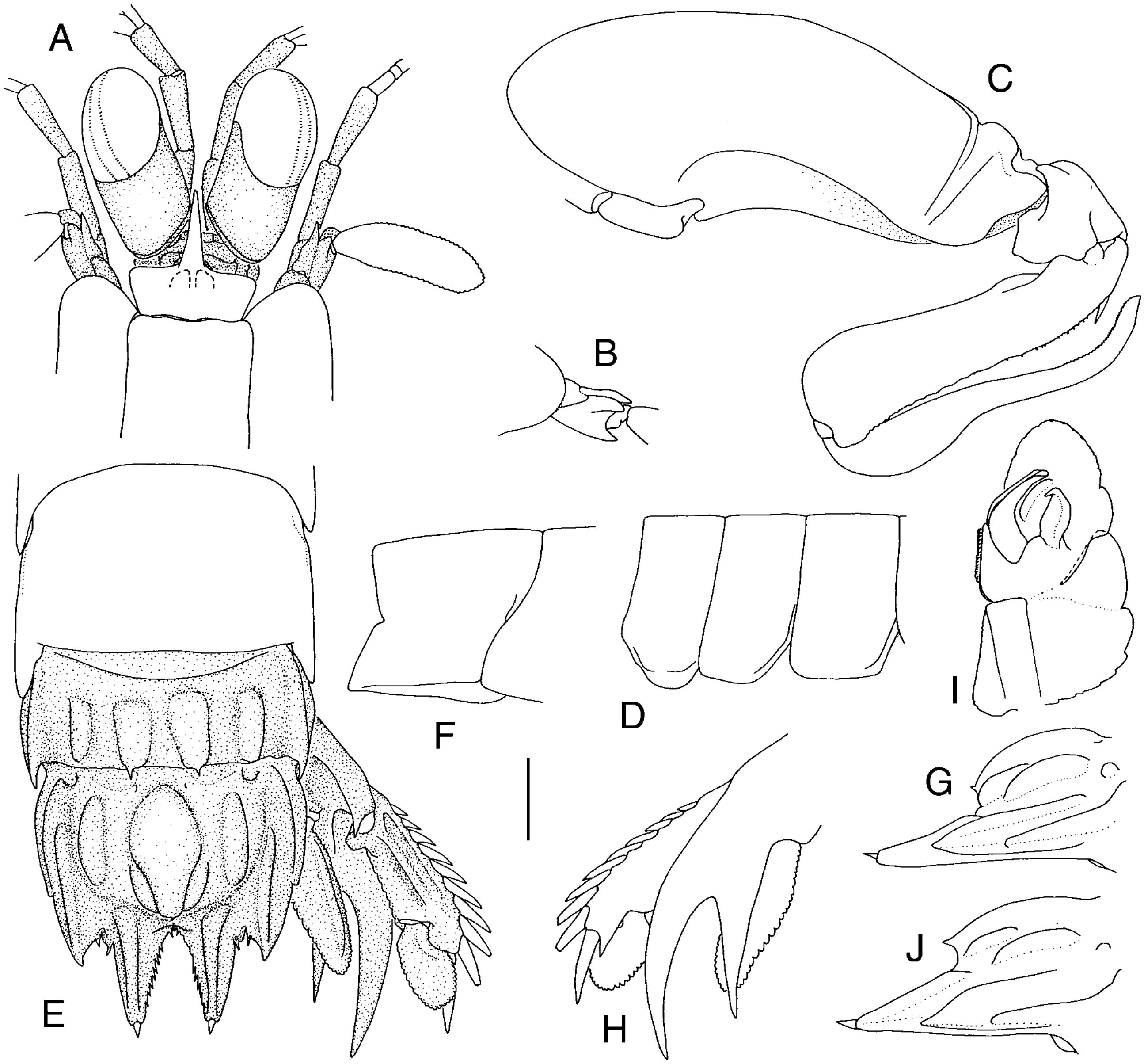

Figure 27. *Gonodactylellus micronesicus* (Manning). A–I, ♂ TL 24 mm (NTM Cr009160). J, ♂ TL 11 mm (AM P56156). A, anterior cephalon, dorsal. B, A2 protopod. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS4–5, right lateral. G, telson, right lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. J, telson, right lateral. Scale A–H = 1 mm; I, J = 0.5 mm.

Australian material. QUEENSLAND: AM P56156, 1♂ (TL 11 mm), 1♀ (TL 13 mm), Northeast Cay, Herald Group, Coral Sea, 17°20'S 148°28'E, dead coral, D. McMichael & J. Yaldwyn, 09 Nov 1964; AM P58569, 1♀ (TL 13 mm), Ashmore Reef, Great Barrier Reef, 10°04.54'S 144°28.56'E, 20 m, rubble, QLD 751, S. Keable, 26 Jan 1993; AM P58573, 1♀ (TL 14 mm), GBRMPA Reef 11–131, 11°26.96'S 144°04.06'E, 3 m, rubble, QLD 660, S. Keable, 14 Jan 1993; AM P58577, 1♀ (TL 15 mm), inside outer barrier, Great Barrier Reef, 10°34.48'S 143°55.28'E, 15 m, rubble, QLD 682, S. Keable, 16 Jan 1993; AM P58578, 1♀ (TL 12 mm), Great Detached Reef, 11°42.17'S 144°01.61'E, 9 m, in front of reef crest, rubble, QLD 637, S. Keable, 12 Jan 1993; USNM, 1♂ (TL 27 mm), Great Barrier Reef, N. Marshall *et al*., 1991. WESTERN AUSTRALIA: NTM exCr009128, 1♂ (TL 16 mm), 1♀ (TL 13 mm), Cartier Reef, 12°32.9'S 123°32.9'E, 4–15 m, from wreck of *Anne Millicent*, R. Kelly *et al*., 6 May 1992; NTM Cr009160, 1♂ (TL 24 mm), Cartier Reef, 12°32.6'S 123°32.2'E, 8–15 m, R. Hanley & B. Russell, 9 May 1992; QM W17753, 1♀ (TL 11 mm), Hibernia Reef, Timor Sea, 11°57.8'S 123°22.3'E, 14 m, reef lagoon, from live *Porites cylindrica*, J. Short, 10 May 1992. COCOS-KEELING ISLANDS: USNM 168618, 1♂ (TL 18 mm), West I., off N reef, 12°07'45"S 96°48'55"E, 9 m, Smith-Vanez, 28 Feb 1976.

Diagnosis. Ocular scales narrow, separate. Rostral plate with rounded anterolateral corners; anterior margins transverse or sloping posteriorly. Mandibular palp 3-segmented. TS6 lateral process truncate, broader than that of TS7. PLP1 endopod in adult males with lateral lobe on posterior endite. AS1–5 without posterolateral spines. Telson IM teeth distinct, apices extending posteriorly well beyond apices of IM denticles; LT teeth indicated by a shallow notch, slightly but distinctly set off from margin; with 11–14 SM denticles. Telson dorsal carinae more inflated in adult males; without spinules over dorsal surface; MD carina with small posterior spine or tubercle; with dorsal margin of median carina distinctly convex; accessory MD carinae long, extending anteriorly to midlength of MD carina, unarmed posteriorly. Uropodal exopod proximal segment with 8–11 movable spines and distal, ventral spine; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod slender, length 2.94–3.65 breadth; entire margin with a single row of setae.

Colour in alcohol. Largely faded to dull green. Raptorial claw dactylus red. AS1 with dark median patch. AS6 with traces of red coloration on SM and IM carinae.

Measurements. Male (n = 5) TL 11–27 mm, female (n = 8) TL 11–18 mm. A1 peduncle 0.59–0.76 CL. A2 scale slender, length 0.36–0.42 CL. AWCLI 680–748. The present series includes the largest known specimen of the species.

Remarks. The present specimens agree well with the holotype but show some size related variation. In the smallest specimens, the median carina of the telson is pyriform and relatively slender, terminating in a distinct spine (Fig. 27J), whereas in larger specimens (Fig. 27E,G), the median carina is inflated and ovate, terminating in a small tubercle as in *G. rubriguttatus*. The original account and figure of *G. micronesicus* attributes a strong posterior spine to the median carina of the telson. Re-examination of the holotype of *G. micronesicus* shows that the median carina of the telson terminates in a small, blunt projection that is intermediate between the spine of the smallest specimens and the small tubercle of the largest specimens.

Gonodactylellus micronesicus closely resembles *G. rubriguttatus* in almost all respects but differs in bearing separate instead of fused ocular scales and a relatively more strongly inflated median carina of the telson in adult males. The best character distinguishing *G. micronesicus* from *G. rubriguttatus* is the colour of the meral spot in life: red or white respectively. Unfortunately, the colour of the meral spot fades rapidly after preservation.

Habitat. Coral reef from coral rubble or live coral to a depth of about 15 m in Australia. The holotype of *G. micronesicus* was collected at a depth between 24 and 35 m.

Distribution. Enewetak Atoll and now from northern Australia and the Cocos-Keeling Islands. The Western Australian and Cocos-Keeling specimens are first records for the Indian Ocean.

Gonodactylellus molyneux n.sp.

Fig. 28

Gonodactylus demanii.–Stephenson & McNeill, 1955: 250 (not *Gonodactylus demanii* Henderson, 1893).
Gonodactylus hendersoni.–Reaka & Manning, 1987: 183 (not *Gonodactylus hendersoni* Manning, 1967c).

Type material. (All Queensland) HOLOTYPE: AM P56159, ♂ (TL 30 mm), Arlington Reef, 16°43'S 146°05'E, less than 5 m, from crevices in coralline rocks, T. Page per D. Molyneux, Jan 1997. PARATYPES: AM P56160, 2♂♂ (TL 19–24 mm), 4♀♀ (TL 18–30 mm), Arlington Reef, 16°43'S 146°05'E, less than 5 m, from crevices in coralline rocks, T. Page per D. Molyneux, Jan 1997; AM P56161, 1♂ (TL 26 mm), Green I., 16°45'S 145°59'E, C. Hedley; AM P56811, 1♂ (TL 24 mm), W side Green I., 16°45'S 145°59'E, reef flat, rubble & *Halimeda*, S. Ahyong, 11 Jul 1992; AM P57030–57032, 1♂ (TL 26 mm), 2♀♀ (TL 25 mm), near Townsville, coral reef, from crevices in coral rock, 0–5 m, Mar 1995.

Diagnosis. Rostral plate with anterolateral angles acute. Mandibular palp 3-segmented. PLP1 endopod in adult males with lateral lobe on posterior endite. AS1–5 posterolateral angles unarmed. Telson SM denticles low, blunt, often fused into margin or indistinct; IM teeth distinct, apices extending posteriorly well beyond apices of IM denticles; LT teeth indicated by a shallow, narrow notch, apex blunt, not projecting well off margin of telson. Telson without numerous spinules over surface of mid-dorsal carinae; mid-dorsal carinae with posterior spinules and base of SM and usually IM carinae with 1 or 2 dorsal spines. Uropodal exopod non-setose on inner margin; endopod broad, length about twice breadth, setose on outer margin only, entire inner margin smooth.

Description. Ocular scales low, flattened, fused or faintly emarginate medially, bases transverse. A1 peduncle 0.56–0.64 CL. A2 scale 0.38–0.43 CL. Rostral plate as long as broad; basal portion with anterior margins slightly concave; anterolateral angles acute; lateral margins divergent anteriorly; apical spine longer than base. Raptorial claw dactylus without proximal notch. Mandibular palp 3-segmented. TS6–7 lateral processes subequal, subtruncate, rounded anterolaterally. TS8 anterolateral margin rounded; sternal keel obsolete. PLP1 endopod in adult males with lateral lobe on posterior endite. AS1–5 posterolateral angles unarmed. AWCLI 709–805. Telson broader than long; with 6–13 low, blunt SM denticles, often fused into margin or indistinct; IM teeth distinct, apices extending posteriorly well beyond apices of IM denticles; LT teeth indicated by a shallow, narrow notch, apex blunt, not projecting well off margin of telson. Telson without numerous spinules over surface of mid-dorsal carinae; MD carina appressed to anterior SM in males, often so inflated as to obscure accessory MD carinae, with 1 or 2 posterior spinules; accessory MD carinae short, extending anteriorly less than ½ length of MD carina, usually obsolete or fused with MD carina, with 1–3 posterior spinules; anterior SM carina usually with 1 or 2 posterior spinules; SM carina armed dorsally with 1 or 2 spines; IM carina usually armed dorsally with 1 dorsal spine; knob absent. Telson ventral surface with distinct carina on each SM tooth and short, indistinct carina on each IM tooth. Uropodal protopod terminal spines with length subequal. Uropodal exopod proximal segment outer margin with 9–11, movable spines, distalmost not exceeding apex of distal segment; inner margin smooth, non-setose; distal margin with slender ventral spine; distal segment setose on outer margin only. Uropodal endopod broad, length 1.87–2.22 breadth; setose on outer margin only, entire inner margin smooth.

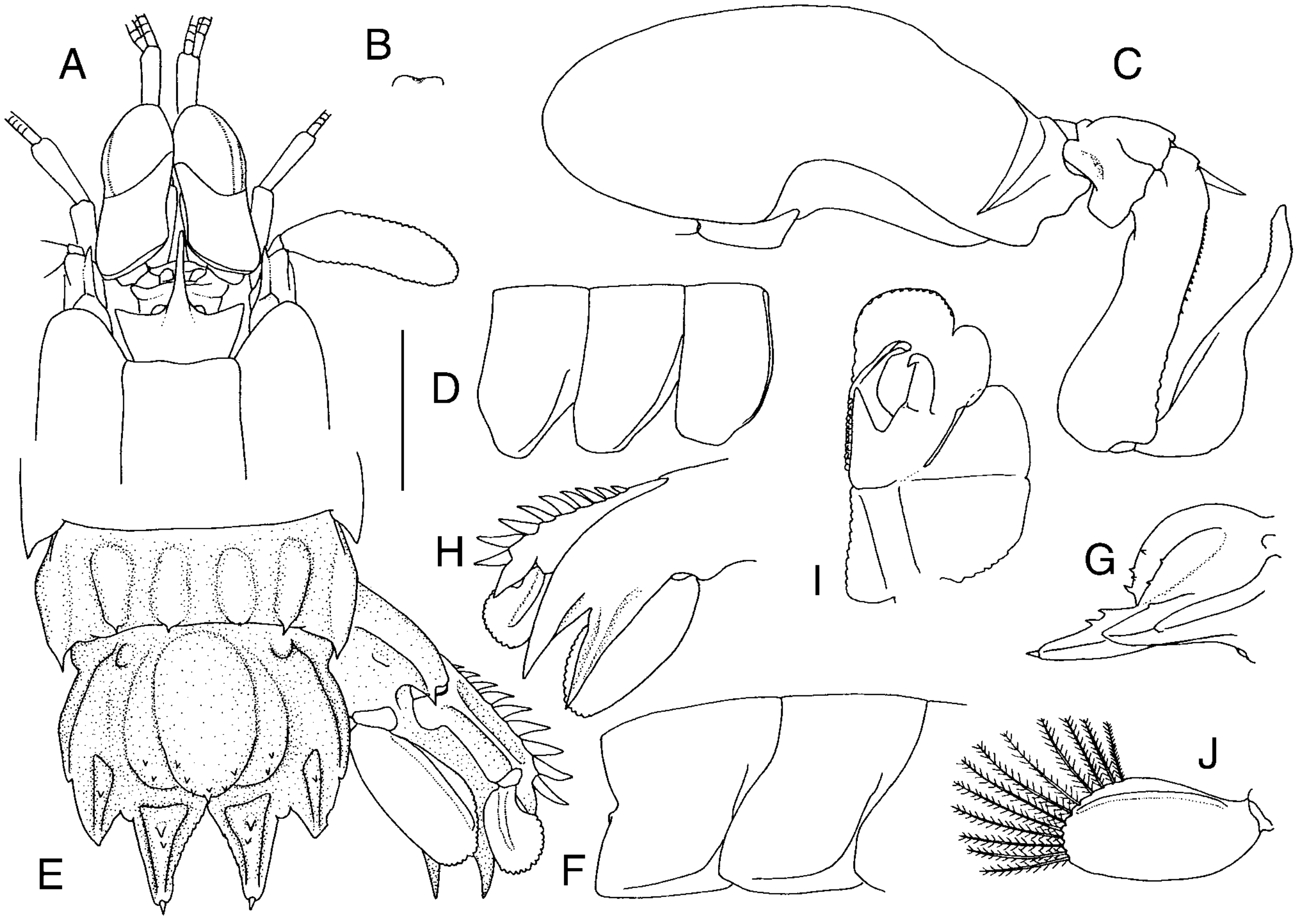

Figure 28. *Gonodactylellus molyneux* n.sp. A–I, ♂ holotype TL 30 mm, setae omitted. J, ♀ paratype TL 18 mm (AM P56160). A, anterior cephalon, dorsal. B, ocular scales. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS4–5, right lateral. G, telson, right lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. J, uropodal endopod showing setae, left dorsal. Scale A–H, J = 2.5 mm; I = 1.2 mm.

Colour in life. Overall mottled pale olive green. TS6 and AS1 with median darker green patch with several iridescent blue spots. Carapace and AS2–5 with 2–3 iridescent blue spots dorsally. AS6 with posterior white band extending onto uropodal protopod.

Measurements. Male (n = 6) TL 19–30 mm, female (n = 6) TL 18–30 mm. Other measurements of holotype: CL 6.7 mm, A1 peduncle 3.9 mm, A2 scale 2.9 mm, AS5 width 4.8 mm.

Etymology. Named for David Molyneux, proprietor of Marine Life Aquariums, Sydney, for his assistance in acquisition of some of the type specimens. The specific epithet is used as a noun in apposition.

Remarks. *Gonodactylellus molyneux* n.sp. most closely resembles *G. snidsvongi* in colour in life, in having angular anterolateral corners of the rostral plate, and in lacking setae on the inner margin of the uropodal exopod and endopod. The new species differs from *G. snidsvongi* in having a distinctly broader endopod (about ½ the length instead of ⅓), in having the lateral teeth of the telson appressed to, rather than being distinctly set off from the margin, in having low and blunt instead of spiniform submedian denticles and a 3- instead of 2-segmented mandibular palp. The dorsal spinulation of the telson in *G. molyneux* is also less pronounced in both the number and size of spines for specimens of similar size. *Gonodactylus hendersoni* reported by Reaka & Manning (1987) are referable to *G. molyneux*.

Habitat. Coral reefs amongst rubble and in cavities in sponge and algae encrusted reef rock from the reef flat to less than 5 m depth.

Distribution. Northeast Queensland, from coral reefs near Townsville and Cairns.

Gonodactylellus rubriguttatus Erdmann & Manning, 1998

Fig. 29

Gonodactylellus rubriguttatus Erdmann & Manning, 1998: 619–620, fig. 1d (type locality: Tanjung Torosie, Komodo, Indonesia).

Type material. HOLOTYPE: USNM 260912, ♂ (TL 17 mm), Tanjung Torosie, Komodo, Indonesia, M. Erdmann.

Australian material. QUEENSLAND: AM P12096, 1♀ (TL 14 mm), Curtis Channel, Port Curtis, 24°15'S 152°25'E, 42 m, J. Hynd, 30 Aug 1946; AM P17700, 1♂ (TL 18 mm), off Gillett Cay, Swain Reefs, Coral Sea, 21°43'S 152°25'E, 45 m, Oct 1962; QM W16239, 2♀♀ (TL 24–26 mm), Flinders Reef, off Cape Moreton, 26°59'S 153°29'E, 6–20 m, P. Davie, J. Short & P. Lawless, 10 Mar 1989. NEW SOUTH WALES: AM P56795, 12♂♂ (TL 13–22 mm), 8♀♀ (TL 11–18 mm), S of Middleton Reef, Tasman Sea, 29°30'S 159°05'E, 55–73 m, triangle dredge, J. MacIntyre, 26 Nov 1960. WESTERN AUSTRALIA: AM P56796, 1♀ (TL 12 mm), Wallaby Group, Abrolhos Is, 28°28.8'S 113°46.20'E, 40 m, gravel, rubble, coralline algae, dredged, WA 541, P. Hutchings, 28 Jun 1994; AM P56797, 2♂♂ (TL 13–14 mm), 4♀♀ (TL 11–26 mm), Abrolhos Is, Wallaby Group, 28°34.65'S 113°46.46'E, 49 m, diverse sponges and rubble, dredged, WA 543, P. Hutchings, 28 Jun 1994; AM P56798, 1♀ (TL 12 mm), SE end Long I., Abrolhos Is, 28°28.80'S 113°46.5'E, 30 m, dead coral embedded in calcareous substrate, WA 524, P. Hutchings, 22 May 1994; AM P56799, 1♀ (TL 9 mm), 1♀ postlarva (TL 8 mm), 28°24.11'S 113°47.39'E, 40 m, dredge, WA 540, P. Hutchings, 28 May 1994; AM P56800, 1♀ postlarva (TL 8 mm), Goss Passage, Beacon I., 28°25.50'S 113°47'E, 10 m, dead branching coral substrate covered by coralline algae, WA 511, P. Hutchings, 18

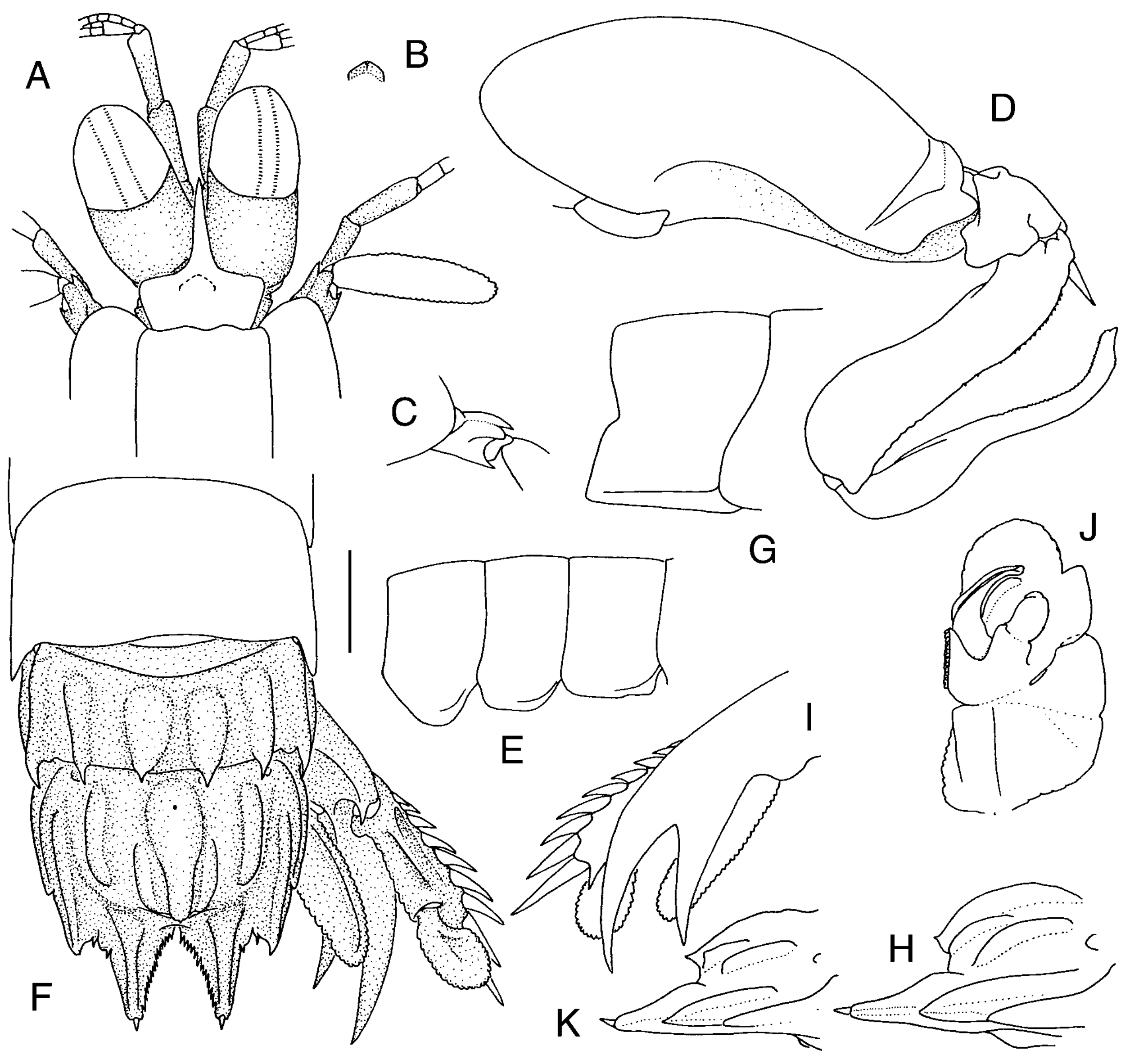

Figure 29. *Gonodactylellus rubriguttatus* Erdmann & Manning. A–J, ♂ TL 18 mm (AM P17700). K, ♀ TL 18 mm (MNHN). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, A2 protopod. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS5, right lateral. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. K, telson, right lateral. Scale A–I, K = 1 mm; J = 0.5 mm.

May 1994; NMV J37812, 1♂ (TL 28 mm), Northwest Shelf between Port Hedland & Dampier, 19°39'S 116°22'E, 46 m, epibenthic sled, with bryozoans, G. Poore & H. Lew Ton, 7 Jun 1983; NMV J13837, 1♀ (TL 20 mm), Northwest Shelf, between Port Hedland & Dampier, 19°24'S 116°51'E, 108 m, silty sand trawl, NWA 32, G. Poore & H. Lew Ton, 7 Jun 1983; NTM Cr012393, 1♂ (TL 26 mm), Northwest Shelf, SO283, T 17/50; WAM 218–96, 1♂ (TL 23 mm), NW of Bunbury, 32°00'S 114°52'E, 115 m, CSIRO, 17 Feb 1964; WAM C17580, 1♀ (TL 25 mm), W of Guilderton, 31°43'S 115°06'E, 106–110 m, HMAS Diamantina, 23 Mar 1972.

Other material. AM P56801, 4♂♂ (TL 12–18 mm), 6♀♀ (TL 11–19 mm), New Hebrides, 20°16'S 169°51'E, 85–100 m, large bottom dredge, HMAS Kimbla, 12 May 1971; NTM, 1♀ (TL 10 mm), Coral Sea, 20°44'S 160°59'E, 69 m, coral rubble & sand, dredge, R. Hanley, 21 Jul 1988; MNHN, 2♂♂ (TL 10–16 mm), 3♀♀ (TL 12–24 mm), Norfolk Rise, New Caledonia, 23°22.9'S 168°05.2'E, 120 m, DW100, B. Richer de Forges, 14 Sep 1989.

Diagnosis. Ocular scales fused into low V-shaped plate. Rostral plate anterolateral angles rounded. Mandibular palp 3-segmented. TS6 lateral process truncate, broader than that of TS7. PLP1 endopod in adult ♂♂ with lateral lobe on posterior endite. AS1–5 without posterolateral spines. Telson IM teeth distinct, apices extending posteriorly well beyond apices of IM denticles; LT teeth indicated by a shallow notch, slightly but distinctly set off from margin; with 11–14 SM denticles. Telson without dorsal spinules over entire dorsal surface; MD carina unarmed or armed with posterior spine or upturned posterior tubercle; with dorsal margin of median carina distinctly convex; accessory MD carinae long, extending anteriorly to midlength of MD carina, unarmed posteriorly. Uropodal exopod proximal segment outer margin with 9–11 movable spines and distal ventral spine; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod slender, length 3.00–3.60 breadth, entire margin with a single row of setae.

Colour in alcohol. Largely faded, but some specimens show traces of the red meral spot on the raptorial claw.

Measurements. Male (n = 25) TL 10–28 mm, female (n = 30) TL 9–26 mm, female postlarva (TL 8 mm). A1 peduncle 0.58–0.74 CL. A2 scale slender, length 0.36–0.40 CL. AWCLI 661–755. The present series includes the largest reported specimen of the species.

Remarks. *Gonodactylellus rubriguttatus* closely resembles *G. affinis* and *G. micronesicus* in having a broad, truncate, lateral margin of TS7 and relatively elongate accessory median carinae on the telson and dorsally convex median carina, but differs from both in having fused, rather than separate ocular scales. The ocular scales are fused even in smallest specimens of *G. rubriguttatus* examined in this study.

The Australian specimens agree well with the type material, but also exhibit variation beyond that originally reported. The median carina of the telson frequently terminates in an upturned tubercle as in the type material, but specimens in the present series may bear a distinct spine or be unarmed. In general, a posterior spine on the median carina of the telson may be present in smaller specimens becoming lost or reduced to an upturned tubercle in adults. In the posterior armature of the median carina of the telson, *G. rubriguttatus* is indistinguishable from *G. micronesicus* which shows similar variation. Occasionally, the accessory median carinae in *G. rubriguttatus* are angular posteriorly and in dorsal view may appear to terminate in a small spinule or tubercle (Fig. 29K). Several specimens of *G. rubriguttatus* examined from New Caledonia have “angular” accessory median carinae. Based on Moosa’s (1991) account of *G. incipiens* from New Caledonia, reported to have fused ocular scales and armed accessory median carinae (in some specimens), it is likely that he was dealing with *G. rubriguttatus.*

Habitat. Coral reefs amongst coral rubble, bryozoans, sponge, live coral in depths between 6–20 m and 120 m.

Distribution. Indonesia, and now from New Caledonia, western and eastern Australia south to Middleton Reef, New South Wales.

Gonodactylellus snidsvongi (Naiyanetr, 1987) n.comb.

Fig. 30

Gonodactylus snidsvongi Naiyanetr, 1987: 237, fig. 1 (type locality: Ko Kangkao, Chonburi Province, Thailand, 12°35'N 101°31'E).
Gonodactylus hendersoni.–Manning, 1967c: 4–8, figs. 1, 2 (part, paratype from Okinawa, not *Gonodactylus hendersoni* Manning, 1967c).
Gonodactylellus hendersoni.–Manning, 1995: 60–62, pl. 3, figs. 9I, 10f, 11f, 22, 23 [not *Gonodactylellus hendersoni* (Manning, 1967c)].

Type material. HOLOTYPE: NNM S1041, ♀ (TL 16 mm), Kangkao, Chonburi Province, Gulf of Thailand, associated with *Porites* coral, 15 Jan 1985.

Australian material. WESTERN AUSTRALIA: NTM, 1♂ (TL 11 mm), Point Samson, 20°38'S 117°11'E, shore reef, R. Hanley, 9 Feb 1988.

Other material. USNM120468, 1♀ (TL 17 mm), Naha, Okinawa, Japan (paratype of *Gonodactylus hendersoni* Manning).

Diagnosis. Ocular scales low, rounded, separate, bases transverse. Rostral plate basal portion with anterior margins transverse; anterolateral corners distinctly angular; lateral margins divergent anteriorly; apical spine longer than base. Mandibular palp 2-segmented. TS6–7 lateral process subequal, rounded to subtruncate. PLP1 endopod in adult ♂♂ with lateral lobe on posterior endite. AS1–5 unarmed posterolaterally. Telson IM teeth distinct, apices extending posteriorly well beyond apices of IM denticles; LT teeth strongly set off from margin of telson. Telson without numerous dorsal spinules over surface of mid-dorsal carinae; MD carina armed with 1 or 2 conical posterior spines; accessory MD carinae short, indistinct, extending anteriorly less than ½ length of MD carina, with 1–3 conical posterior spines (adults with numerous additional spinules); anterior SM carina unarmed or with 1 or 2 posterior spines, and with conical spine near posterior margin (adults with numerous additional spinules); base of SM and IM teeth with large conical spine dorsally (adults usually with additional spinules); knob absent; with 12–14 spiniform SM denticles ventral surface with carina on each SM tooth and

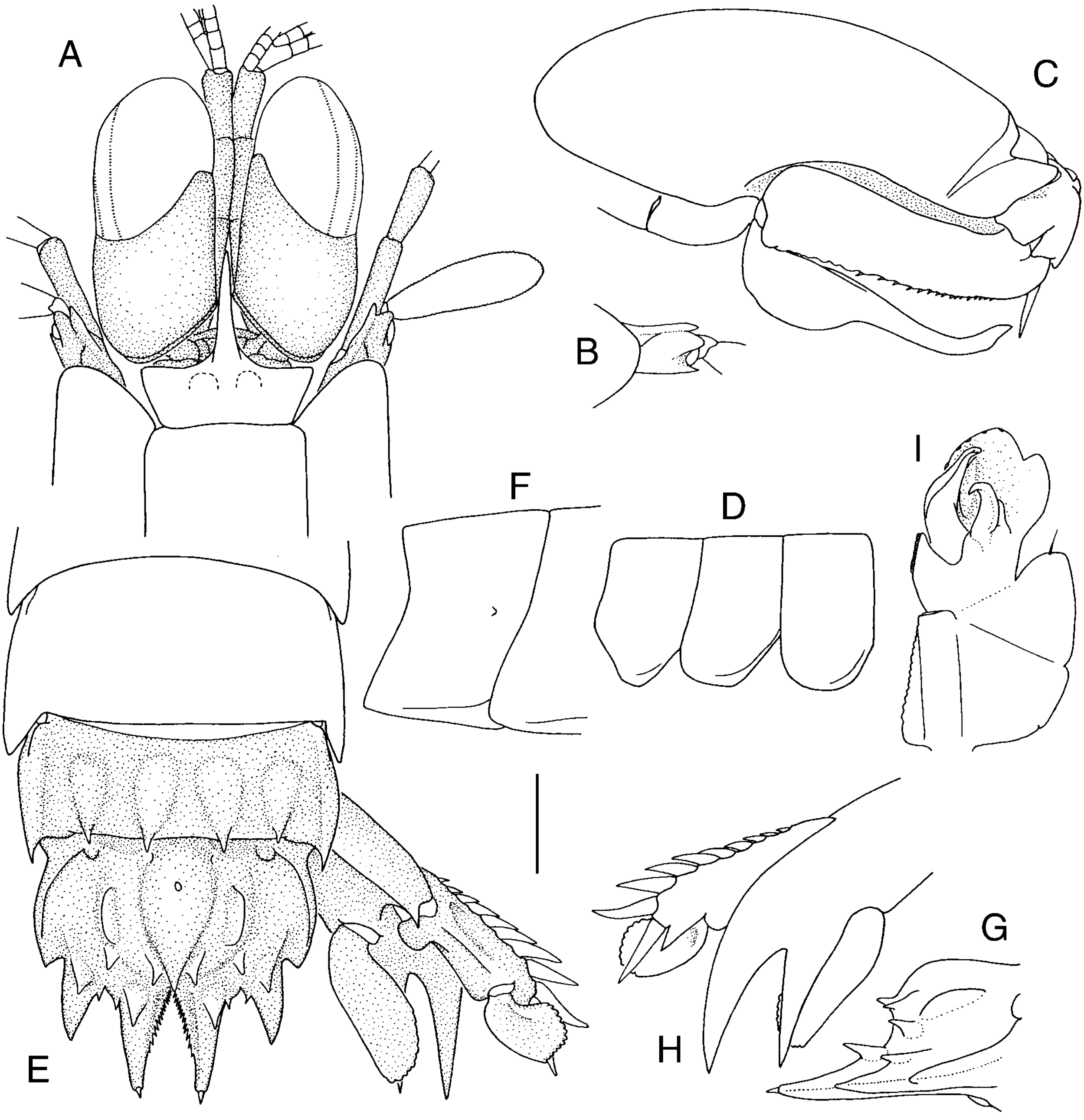

Figure 30. *Gonodactylellus snidsvongi* (Naiyanetr), ♂ TL 11 mm (NTM). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS4–5, right lateral. G, telson, right lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–I = 0.5 mm; J = 0.25 mm.

short, carina on each IM tooth. Uropodal exopod proximal segment with inner margin smooth, without setae, outer margin with 9–11 movable spines and distal, ventral spine; exopod distal segment with inner margin without setae. Uropodal endopod broad, length 2.69–3.00 breadth, setose on outer margin only, entire inner margin smooth.

Colour in alcohol. Completely faded.

Measurements. Male (n = 1) TL 11 mm, female (n = 2) TL 16–17 mm. A1 peduncle 0.62–0.63 CL. A2 scale 0.38–0.39 CL. AWCLI 775–846. The specimen from Okinawa is the largest known of the species.

Remarks. Although Manning (1995) synonymized *G. snidsvongi* with *G. hendersoni*, re-examination of the type material of both species reveals that Naiyanetr's species is distinct. The type series of *G. hendersoni* comprises at least two, possibly three species. The holotype of *G. hendersoni* agrees in all respects with *G. demani*, including the presence of setae on the inner proximal margin of the uropodal endopod. Therefore *G. hendersoni* is herein synonymized with *G. demani*. This finding is surprising in view of the fact that the original account of *G. hendersoni* used the absence of setae on the inner proximal margin of the uropodal endopod as the primary character distinguishing it from *G. demani*. The condition of the uropodal endopod, however, in the holotype of *G. hendersoni* was evidently overlooked, possibly because the inner proximal endopod setae on the right side are damaged leaving only the insertions. Additionally, because the paratypes instead of the holotype were figured in the original account of *G. hendersoni*, the misinterpretation of the holotype could only be detected by re-examination of the type series.

The paratype of *G. hendersoni* from Okinawa bears a relatively broad uropodal endopod without setae on the inner margin, a 2-segmented mandibular palp, and is referable to *G. snidsvongi*. The Hawaiian paratypes of *G. hendersoni* bear a slender uropodal endopod, with the width approximately one quarter of the length. Unfortunately, both Hawaiian paratypes are presently dry, so the mandibular palp could not be examined; they may represent a separate species and require further study.

The single Australian specimen of *G. snidsvongi* agrees in most respects with the holotype and the Okinawan specimen but bears fewer posterior spines on the carinae of the telson with a less rounded aspect in dorsal view. The reduced spination and more rounded telson in the Australian specimen are likely a function of its small size.

Manning (1995) suggested that *G. snidsvongi* may be based on a damaged specimen, but the original figure of the holotype is misleading because it is somewhat stylized (see Naiyanetr, 1987: fig. 1).

Habitat. Shallow water amongst rubble on coral reefs.

Distribution. Western Pacific from the Gulf of Thailand, Vietnam, Indonesia, Japan, Australia and possibly Hawaii.

Gonodactylellus viridis (Serène, 1954) n.comb.

Fig. 31

Gonodactylus chiragra var. *viridis* Serène, 1954: 6, 7, 10, 74, 75, 76, 87, fig. 13–3 (type locality: Cauda Bay, Vietnam).
Gonodactylus viridis.–Manning, 1978c: 4, fig. 2a–c.
Gonodactylellus incipiens.–Manning, 1995: 63: fig. 24 [30 mm female only, not *Gonodactylellus incipiens* (Lanchester, 1903)].
Gonodactylinus viridis.–Ahyong & Norrington, 1997: 100.–Manning, 1995: 66–68, figs. 8c, d, 9c, 10e, 11c, 25a.

Type material. LECTOTYPE: USNM 266628, ♂ (TL 31 mm), Station Cauda, Cauda Bay, Vietnam, R. Serène, 25 Jan 1947.

Australian material. WESTERN AUSTRALIA: NTM Cr012564, 1♂ (TL 37 mm), NE side West Islet, Ashmore Reef, 12°13.5'S 122°58.5'E, intertidal, from sponge, A. Mussig, 29 Jul 1980; NTM Cr012579, 1♀ (TL 19 mm), Ashmore Reef, 12°14.0'S 122°59.0'E, surface over lagoon, plankton net, R. Hanley, 19 Apr 1987.

Diagnosis. Ocular scales separate. Rostral plate as long as or slightly longer than broad; anterolateral angles rounded, anterior margins transverse or slightly concave; median spine as long as or slightly longer than base. Mandibular palp 3-segmented. TS6 lateral process broadly rounded, broader than that of TS7. PLP1 endopod in adult ♂♂ with lateral lobe on posterior endite. AS1–5 without posterolateral spine. Telson IM teeth distinct, with apices extending posteriorly well beyond apices of IM denticles. Telson without numerous spinules over surface of mid-dorsal carinae; MD carina without posterior tubercle or spine; emargination between SM and IM teeth acute; accessory MD carinae short, not extending anteriorly beyond posterior ⅓ of MD carina, unarmed posteriorly; anterior SM carina unarmed posteriorly, inflated but relatively straight, not curved or turning towards MD carina distally. Telson ventral surface without carina on SM teeth; with 10–13 SM denticles. Uropodal exopod proximal segment outer margin with 9–11 (usually 10) movable spines and fixed distal, ventral spine; inner margin of proximal segment and entire margin of distal segment setose. Uropodal endopod slender with length 2.96–3.20 breadth; entire margin with a single row of setae.

Colour in alcohol. Largely faded but with traces of green marbling on the telson and uropods and with row of small dark green spots on posterior margin of thoracic and abdominal somites.

Measurements. Male (n = 2) TL 27–37 mm, female (n = 1) TL 19 mm. A1 peduncle 0.59–0.67 CL. A2 scale slender, length 0.42–0.50 CL. AWCLI 743–840. *Gonodactylellus viridis* attains a maximum size of 55 mm TL (Manning, 1995).

Remarks. *Gonodactylellus viridis* closely resembles *G. erdmanni* n.sp. in almost every respect, rendering the two species difficult to distinguish. The specimen figured by Manning (1995: fig. 24) as *G. incipiens* is referable to *G. viridis*. Adults of *G. viridis* differ from adult *G. erdmanni* in generally having a shorter rostral spine, the basal portion of the rostral plate is relatively longer with transverse or slightly concave anterior margins, the lateral and anterolateral margins of TS6 are more rounded and the maximum known body length is 55 mm TL. In *G. erdmanni*, the basal portion of the rostral plate is relatively shorter than in *G. viridis* with posteriorly sloping or almost transverse anterior margins in the largest specimens; the anterolateral margin of TS6 is truncate, usually with a more distinctly angular anterolateral margin; and the maximum known body length is 31 mm TL. In specimens of *G. viridis* exceeding about 35 mm TL, the lateral margin of TS6 is occasionally somewhat truncate, approaching *G. erdmanni*. In such a situation, body size is the most obvious distinguishing character, but the relatively longer basal portion of the rostral plate is also useful.

The larger Australian specimen of *G. viridis* agrees closely with the lectotype although the rostral plate of the lectotype was missing when examined in October 2000 at the USNM. The rostral plate of the larger Australian specimen, however, agrees well with a figure of the rostral plate of the lectotype (Manning, 1995: fig. 9c). The rostral spine is relatively longer and the telson carinae are less inflated in the 19 mm TL female than in the larger specimens.

The paucity of specimens of *G. viridis* from Australia seems anomalous because the species appears to be an abundant coral reef species throughout Indonesia, Malaysia, Papua New Guinea as well as further north (Moosa, 1991; Erdmann, pers. comm.). In contrast, the similar but smaller species, *G. erdmanni*, is abundant on Australian reefs but uncommon to

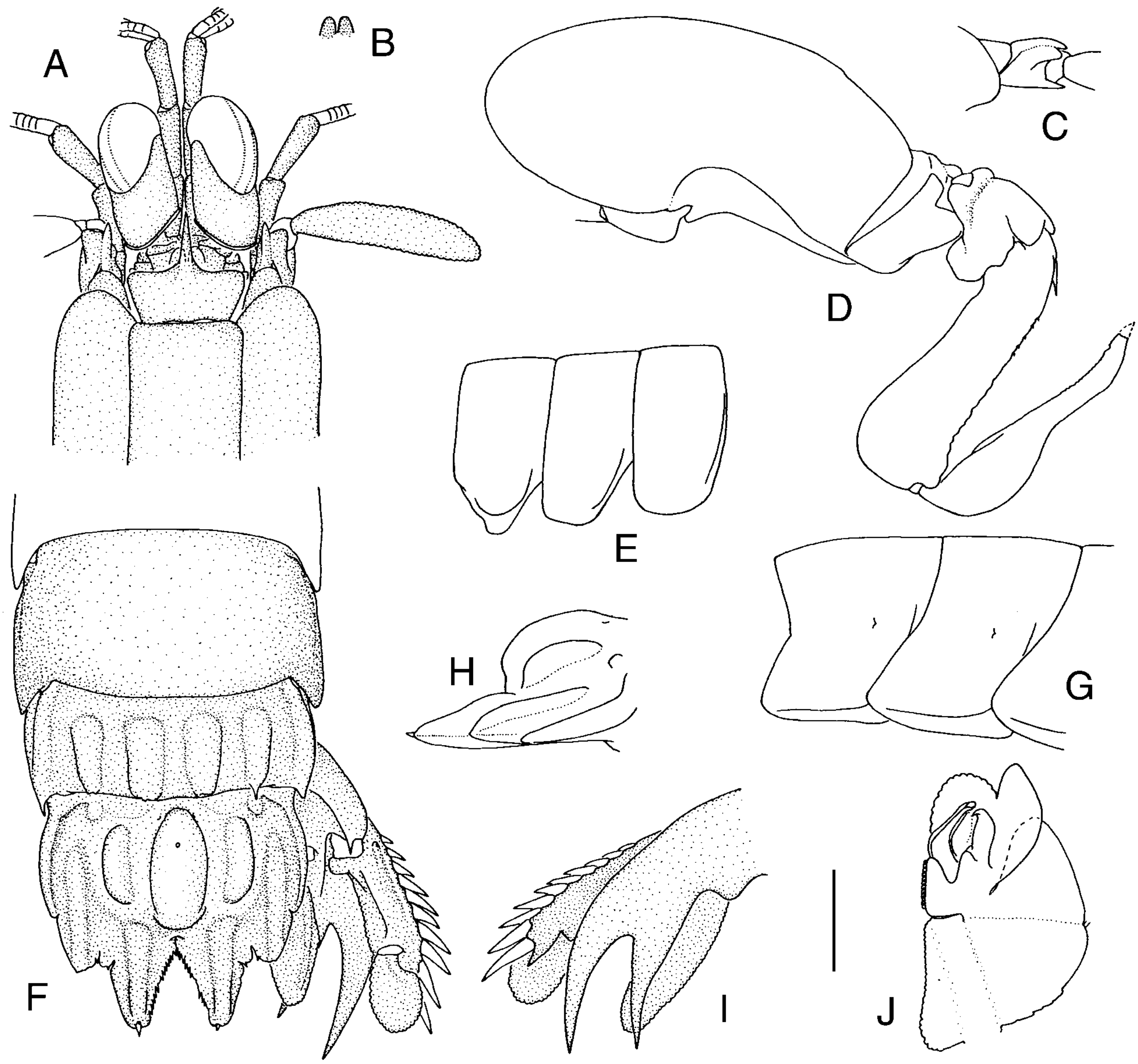

Figure 31. *Gonodactylellus viridis* (Serène), ♂ TL 37 mm (NTM Cr012564). A, anterior cephalon, dorsal. B, ocular scales. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS4–6, telson & uropod, dorsal. G, AS3–5, right lateral. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2 mm; J = 1 mm.

the north of Australia. Thus, the distributions of *G. viridis*/*G. erdmanni* resembles that of *Gonodactylaceus glabrous*/ *Gonodactylaceus graphurus*.

Gonodactylellus viridis is apparently widely distributed, but many records of the species were reported prior to the availability of detailed accounts of the species and recognition of similar species such as *G. incipiens*, *G. erdmanni* and *Gonodactylus childi*. Therefore, most records of *G. viridis* require verification. Poupin (1998) listed *G. viridis* from French Polynesia, but these records are almost certainly based on a *Gonodactylus childi* which is abundant there (R. Caldwell. Pers. comm.).

Habitat. The single Australian specimen was collected on an intertidal reef flat from a cavity in *Spongodes* (Porifera). Dingle *et al*. (1977) reported *G. viridis* as a common intertidal reef species in Phuket, Thailand.

Distribution. Andaman Sea to Malaysia, Indonesia, Vietnam, Japan, the Philippines, New Caledonia, Samoa and now from Australia.

Gonodactyloideus Manning, 1984a

Gonodactyloideus Manning, 1984a: 84. Type species *Gonodactyloideus cracens* Manning, 1984a, by monotypy. Gender masculine.

Diagnosis. Eye flattened anteriorly, cornea broadened, distinctly broader than stalk. Ocular scales small, narrower than basal width of median spine of rostral plate. Rostral plate with slender median spine and short, broad, trapezoid basal portion. Anterolateral margins of carapace convex, extending anteriorly beyond base of rostral plate. Mandibular palp present. Opposable margin of propodus of raptorial claw with proximal movable spine in adults. Telson with 3 or 5 mid-dorsal carinae; IM carina of telson without accessory longitudinal carina on mesial margin; anus located ventrally. Uropodal protopod without lobes between terminal spines; endopod without spines on inner margin.

Included species. One: *G. cracens* Manning, 1984a.

Remarks. *Gonodactyloideus* differs from other gonodactyloid genera in having a flattened instead of subglobular cornea. A single species is known from Australia.

Gonodactyloideus cracens Manning, 1984a

Fig. 32

Gonodactyloideus cracens Manning, 1984a: 83–86, fig. 1 (type locality: Northwest Shelf, Western Australia, 19°50'S 115°34'E).–Moosa, 1986: 379, fig. 3.

Type material. NTM Cr000473, ♀ HOLOTYPE (TL 30 mm), Northwest Shelf, Western Australia, 19°50'S 115°34'E, 80 m, L. Bullwood, 19 Sep 1982.

Diagnosis. Rostral plate longer than broad. Telson mid-dorsal surface with 5 slender carinae (MD; paired accessory MD, and paired anterior SM) each armed posteriorly with tubercle; without numerous dorsal spinules over entire surface; accessory MD carinae as long as MD carina; LT carina extending anteriorly to anterior ¼ of MG carina; knob medially emarginate; with 14 or 15 SM denticles either side of midline. Telson ventral surface with carina on each SM tooth. Uropodal exopod proximal segment outer margin with 10 movable spines.

Colour in alcohol. Largely faded. Sparsely scattered chromatophores over dorsal surface.

Measurements. Female (n = 1) TL 30 mm. A1 peduncle 0.63 CL. A2 scale 0.47 CL. AWCLI 693. Moosa (1986) reported specimens to 42 mm TL from the Philippines.

Remarks. *Gonodactyloideus cracens* could be confused with species of *Gonodactylaceus* and some species of *Gonodactylellus* that also have five mid-dorsal carinae on the telson. *Gonodactyloideus cracens*, however, differs in the anterodorsally flattened instead of subglobular corneae, and in having armed instead of unarmed anterior submedian carinae in the telson. An undescribed species of *Gonodactyloideus* from the Marquesas is currently under study; it differs principally from *G. cracens* in bearing three instead of five mid-dorsal telson carinae.

Habitat. Known from depths of 80 m to 96–107 m.

Distribution. Indonesia and northwestern Australia.

Gonodactylus Berthold, 1827

Gonodactylus Berthold, 1827: 271. Type species *Squilla chiragra* Fabricius, 1781, by subsequent designation by the International Commission of Zoological Nomenclature under its plenary powers in Opinion 785. Name on *Official List* of International Commission on Zoological Nomenclature. Gender masculine.

Diagnosis. Eye subcylindrical, cornea not broader than stalk in dorsal view. Ocular scales large, broader than basal width of median spine of rostral plate, distinctly wider than high, anteriorly truncate or subtruncate. Rostral plate with slender median spine and short, broad, trapezoid basal portion. Mandibular palp present. Opposable margin of propodus of raptorial claw with proximal movable spine in adults. Anterolateral margins of carapace convex, extending anteriorly beyond base of rostral plate. Telson with 3 mid-dorsal carinae; IM carina of telson without accessory longitudinal carina on mesial margin; anus located ventrally. Uropodal protopod without lobes between terminal; endopod without spines on inner margin.

Included species. Six: *G. acutirostris* de Man, 1898; *G. botti* Manning, 1975a; *G. chiragra* (Fabricius, 1781); *G. childi* Manning, 1971a; *G. platysoma* Wood-Mason, 1875; and *G. smithii* Pocock, 1893.

Remarks. *Gonodactylus* differs from other genera in the family in bearing large ocular scales that are truncate and broader than the base of the rostral spine. *Gonodactylus childi* is removed from the synonymy of *Gonodactylellus incipiens* (see remarks under the account of the former) and therefore six species of *Gonodactylus* are recognized here. Four species of *Gonodactylus* are known from Australia. Species of *Gonodactylus*, principally *G. chiragra*, *G. platysoma* and *G. smithii*, are among the most frequently reported coral reef stomatopods. Conversely, *Gonodactylus acutirostris*, *G. botti* and *G. childi* are less well studied. *Gonodactylus acutirostris*, reported from the Mergui Archipelago and the Red Sea, is possibly synonymous with *G. smithii* (see below under account of *G. smithii*). *Gonodactylus childi* has only recently been removed from the synonymy of *Gonodactylellus incipiens* (see Poupin, 1998; Barber & Erdmann, 2000; this study) and is a common Pacific species. *Gonodactylus botti*, described from Jakarta, Indonesia, has otherwise only been reliably reported from the western Indian Ocean. The single record of *G. botti* from the Pacific is that of Moosa (1991) for a 23 mm TL female specimen from New Caledonia. Moosa's (1991) account of the specimen, having a strongly inflated median carina on the telson and without accessory median carinae, suggests that he was dealing with *Gonodactylellus annularis*, a species which was misidentified as *G. botti* by Moosa & Erdmann (1994). Moreover, *G. botti* never displays strongly inflated telson carinae at a TL as small as 23 mm (Ahyong, unpubl.). The disjunct distribution of *G. botti* is anomalous, and despite intensive sampling in Indonesia, the species has not been found there since (Erdmann, pers. comm.). The type material *G. botti* may have originated in the western Indian Ocean rather than the published type locality, Jakarta, Indonesia.

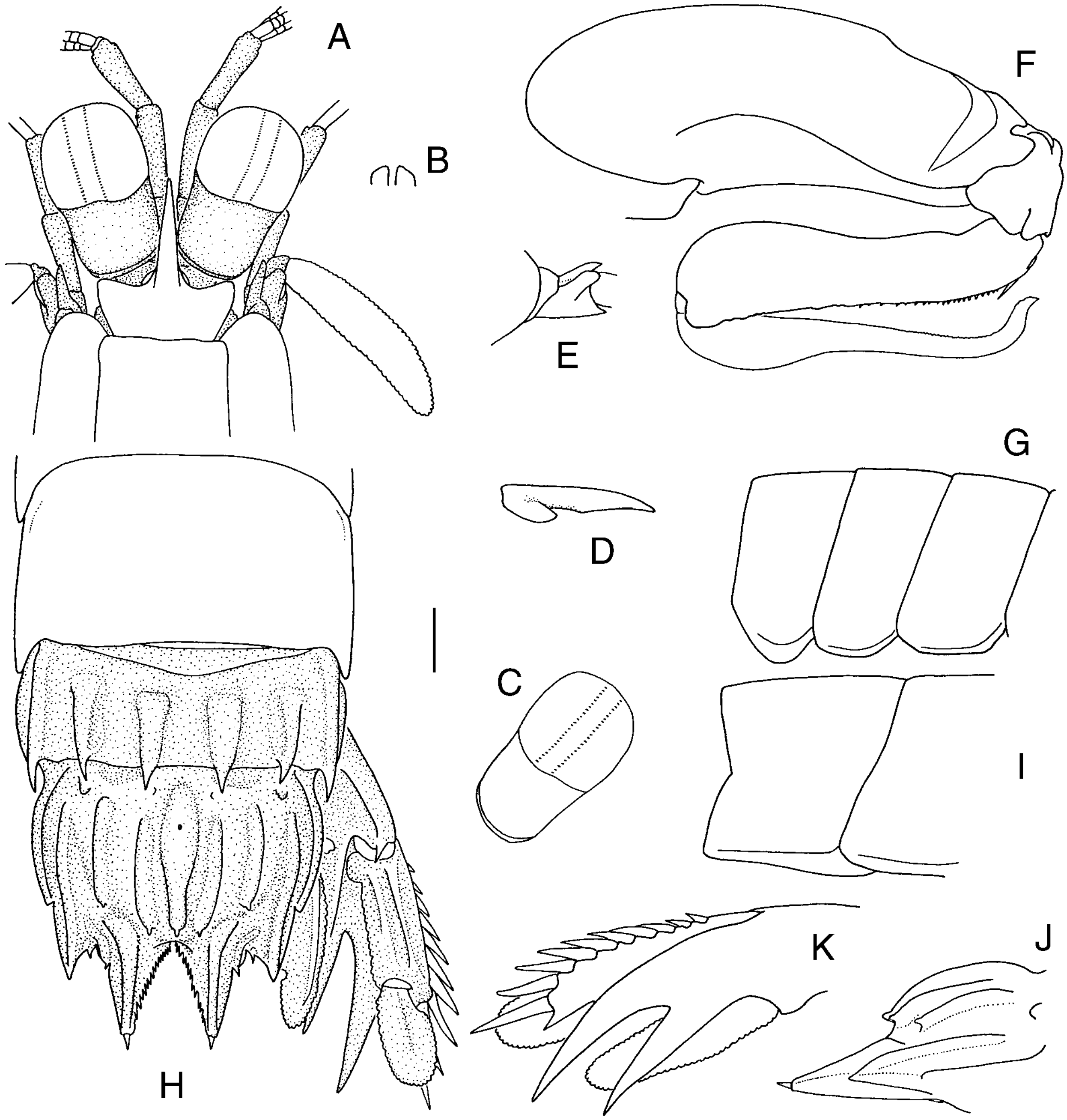

Figure 32. *Gonodactyloideus cracens* Manning, holotype ♀ TL 30 mm. A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, eye, right dorsal. D, rostral plate, right lateral. E, A2 protopod, right lateral. F, raptorial claw, right lateral. G, TS6–8, right lateral. H, AS5–6, telson & uropod, dorsal. I, AS4–5, right lateral. J, telson, right lateral. K, uropod, right ventral. Scale = 1 mm.

Key to species of *Gonodactylus*

1 Telson without LT tooth, with margin of telson between anterolateral angle and apex of IM tooth unbroken. Ocular scales extending laterally almost to anterolateral angle of rostral plate .... ***G. platysoma***

—— Telson with LT tooth, indicated by shallow notch in margin of telson between anterolateral angle and apex of IM tooth. Ocular scales not extending laterally to anterolateral angle of rostral plate 2

2 Lateral margins of rostral plate strongly divergent. “Meral spot” of raptorial claw maroon to dark blue 3

—— Lateral margins of rostral plate subparallel or slightly divergent. “Meral spot” of raptorial claw white 4

3 Apices of anterolateral angles spiniform .... *G. acutirostris*

—— Apices of anterolateral angles blunt or sharp, but not spiniform .... ***G. smithii***

4 Rostral plate with anterior margins distinctly concave .... ***G. chiragra***

—— Rostral plate with anterior margins transverse or slightly concave 5

5 Ocular scales with relatively transverse anterior margins. Telson with blunt IM teeth in adults .... *G. botti*

—— Ocular scales with anterior margins sloping posteriorly. Telson with sharp IM teeth in adults .... ***G. childi***

Gonodactylus childi Manning, 1971a

Fig. 33

Gonodactylus childi Manning, 1971a: 75–77 (type locality: Runit (Yvonne) I., Eniwetak Atoll, 11°32'47"S 162°21'56"E).

Type material. HOLOTYPE: USNM 135624, ♂ (TL 32 mm), Runit (Yvonne) I., Eniwetak Atoll, 11°32'47"S 162°21'56"E, tide pool in rock tide flat, inside reef edge, rotenone, C.A. Child, 8 Oct 1969. PARATYPES: USNM 135625 (part), 2♂♂ (TL 21–22 mm), type locality.

Australian material. QUEENSLAND: AM P17702, 1♂ (TL 20 mm), Northeast Cay, Herald Group, Coral Sea, 17°20'S 148°28'E, dead coral, D. McMichael & J. Yaldwyn, 9 Nov 1964; AM P17706, 1♂ (TL 26 mm), West Cay, Diamond Islet, Coral Sea, 13°11'S 143°43'E, intertidal beach rock pools, D. McMichael & J. Yaldwyn, 23 Oct 1964; AM P17710, 1♀ (TL 28 mm), S side One Tree I., beach rock tide pools, under stones, museum party, 24 Sep 1968; AM P56179, 1♀ (TL 42 mm), North West I., 23°18'S 151°42'E, M. Ward & W. Boardman, Jul 1929; AM P60070, 1♂ (TL 38 mm), 2♀♀ (TL 33–34 mm), One Tree I., 23°30'S 152°05'E; USNM 288436, 1♂ (TL 36 mm), 2♀♀ (TL 29–34 mm), One Tree I., M. Erdmann. WESTERN AUSTRALIA: QM W17738, 2♀♀ (TL 29–31 mm), Cartier Reef, Timor Sea, near wreck of *Anne Millicent*, 12°32.7'S 123°32.9'E, outer reef flat, rotenone, B. Russell, 9 May 1992; QM W17937, 3♂♂ (TL 24–25 mm), SE side Hibernia Reef, Timor Sea, 11°59'S 123°22'E, 0–0.5 m, reef flat, rotenoned, B. Russell, 15 May 1992.

Diagnosis. Ocular scales broad, flattened, separate, together slightly broader than ½ rostral plate width; anterior margins of ocular scales sloping posteriorly. Rostral plate basal portion with anterior margins straight or slightly concave; anterolateral angles rounded; lateral margins divergent anteriorly; apical spine longer than base. Lateral margin of TS6 broader than TS7. Telson appearing short, with LT tooth indicated by shallow notch in margin of telson between anterolateral angle and apex of IM tooth; mid-dorsal carinae blunt, neither sharp nor cristate dorsally; MD carina unarmed posteriorly; accessory MD carinae forming "anchor"; with 12–18 SM denticles. Uropodal exopod distal segment outer margin with 10 or 11 movable spines.

Colour in alcohol. Faded, but with scattered chromatophores dorsally.

Measurements. Male (n = 10) TL 20–38 mm, female (n = 8) TL 29–42 mm. A1 peduncle 0.58–0.69 CL. A2 scale 0.43–0.53 CL. AWCLI 772–818. The present series includes the largest known specimen of the species.

Remarks. *Gonodactylus childi* Manning, 1971a, was regarded as a synonym of *Gonodactylellus incipiens* by both Moosa (1991) and Manning (1991, 1995). Re-examination of the type series of *Gonodactylus childi*, however, shows it to comprise two species in two genera, neither of which are referable to *Gonodactylellus incipiens*. The holotype and two paratypes of *G. childi* bear broad ocular scales and are referable to *Gonodactylus*; the remainder of the paratypes have narrow ocular scales and are referable to *Gonodactylellus incipiens*. The former confusion between *Gonodactylus childi* and *Gonodactylellus incipiens* highlights potential problems in the distinctions between their respective genera where the single distinguishing character is in the breadth of the ocular scales.

Gonodactylus childi is the smallest species of the genus and most closely resembles *G. botti*. Like *G. botti*, the anterior margin of the rostral plate is transverse or slightly concave, instead of distinctly concave as in other congeners. *Gonodactylus childi* differs from *G. botti* in having posteriorly sloping instead of transverse anterior margins of the ocular scales, and a relatively shorter telson with more prominent, sharper, intermediate teeth of the telson. The intermediate teeth of the telson are blunt in adult *G. botti*. *Gonodactylus botti* occurs principally in the Indian Ocean, *G. childi* occurs principally in the central to western Pacific Ocean, and the two species apparently overlap in Indonesia (but see remarks under the account of the genus).

Habitat. Coral reef flats in tide pools and amongst coral rubble.

Distribution. Eniwetak Atoll, Central Pacific Ocean, French Polynesia, Indonesia and now Australia, from Queensland to Western Australia.

Gonodactylus chiragra (Fabricius, 1781)

Fig. 34

Squilla chiragra Fabricius, 1781: 515 (type locality: restricted to Ambon, Indonesia, 3°43'S 128°12'E, by neotype selection [Manning, 1981a: 217]).

Gonodactylus chiragra.–White, 1847: 84.–Kemp, 1913: 4, 11, 147, 155, fig. 2, pl. 9, fig. 107 (part).–McNeill, 1926: 316 (part).–Hale, 1929a: 34.–Stephenson, 1952: 11. —Stephenson & McNeill, 1955: 250–252 (part).–Stephenson, 1962: 34.–Manning, 1966: 108, 113–114 (part).–McNeill, 1968: 89.–Moosa, 1986: 381; 1991: 155–156.–Manning, 1991: 2; 1995: 71–75, pls. 5–8, figs. 8e,f, 9a,b, 10a, 11a, 27a, 28–30.–Gosliner *et al.*, 1996: 195.–Ahyong & Norrington, 1997: 100–101.–Debelius, 1999: 273.

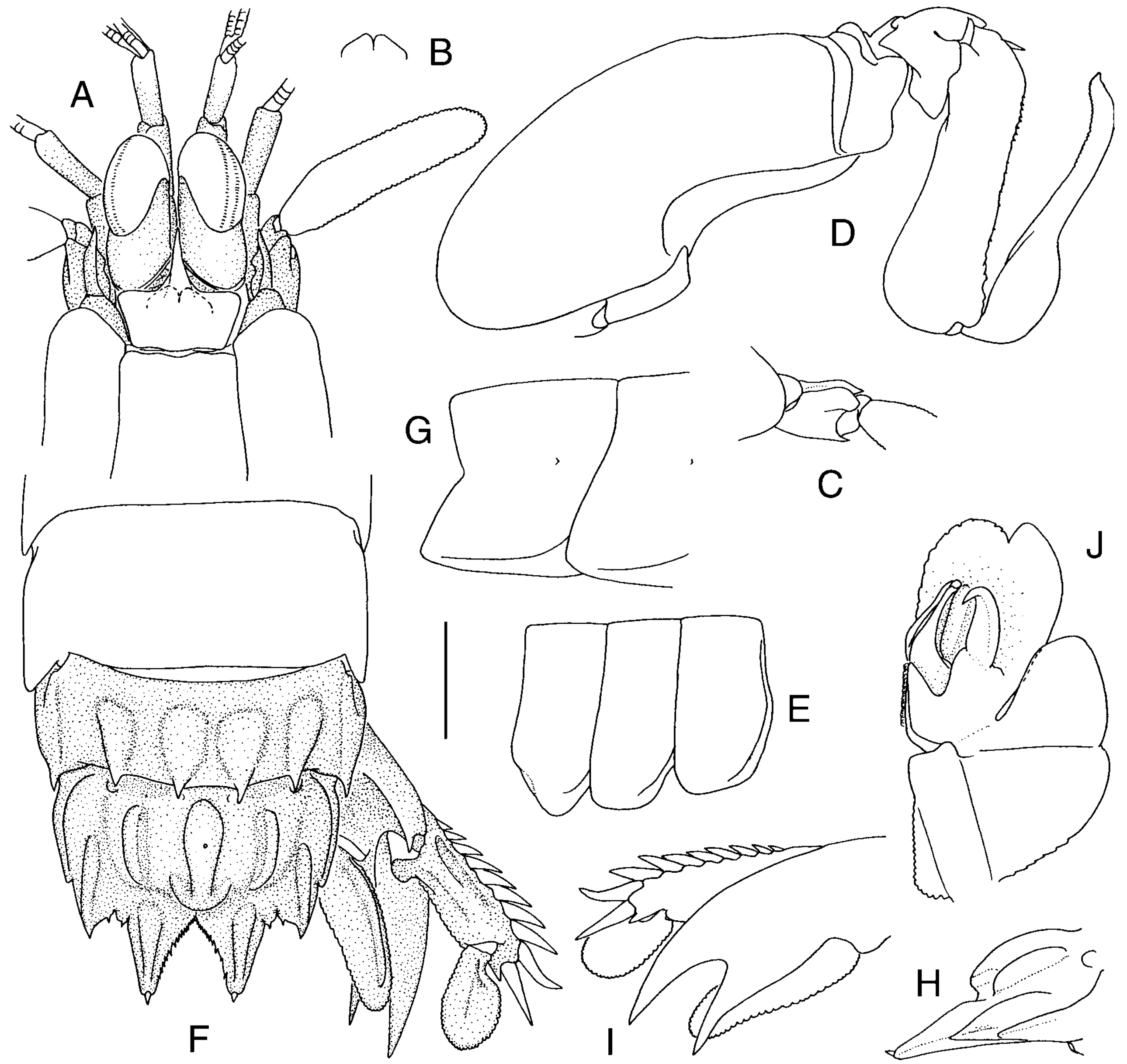

Figure 33. *Gonodactylus childi* Manning. A–I, ♀ TL 42 mm (AM P56179). J, ♂ TL 20 mm (AM P17702). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lateral. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2.5 mm; J = 0.6 mm.

Type material. NEOTYPE: NNM S860, ♂ (TL 44 mm), Ambon, Indonesia, 3°43'S 128°12'E, Snellius Expedition, 11–17 Sep 1930.

Australian material. QUEENSLAND: AM E4504, 1♀ (TL 78 mm), Northwest I., near Rockhampton, 23°22'S 150°32'E, coral crevices, FIS Endeavour, 1909–1914; AM G3277, 1♂ (TL 62 mm), Green I., 16°45'S 145°59'E, C. Hedley; AM P2292, 1♀ (TL 68 mm), Dunk I., 17°57'S 146°09'E, E. Banfield; AM P3133, 2♀♀ (TL 65–71 mm), Murray I., Torres Strait, Hedley & McCulloch, 30 Aug to 3 Oct 1907; AM P4227, 4♂♂ (TL 45–64 mm), 4♀♀ (TL 44–79 mm), Port Denison, 20°03'S 148°15'E, E. Rainford; AM P4888, 1♀ (TL 79 mm), Dunk I., 17°57'S 146°09'E, E. Banfield; AM P8784, 1♂ (TL 76 mm), Hook Reef, E of Bowen, 20°01'S 148°15'E, L. Lockwood, 1926; AM P5605–5606, 2♂♂ (TL 83–88 mm), Saddle Back I., 20°04'S 148°32'E, E. Rainford; AM P7969, 1♂ (TL 86 mm), High I., Frankland Group, 17°11'S 146°04'E, W. Paradice; AM P8580, 1♀ (TL 40 mm), North West I., 23°30'S 152°00'E, reef, G.P. Whitley; AM P12093, 1♀ (TL 75 mm), Heron I., 23°27'S 151°55'E, J. Hynd, Jun 1947; AM P12269, 1♂ (TL 90 mm), Hayman I., 20°03'S 148°53'E, Mackerras, Sep 1946; AM P14901, 3♂♂ (TL 67–70 mm), Murray I., Torres Strait, 9°56'S 144°04'E; AM P17708, 1♀ (TL 64 mm), E side One Tree I., 23°30'S 152°05'E, lagoon, under stones in gutter, low tide, D. & B. Kinsey, 11 Oct 1967; AM P17725, 1♂ (TL 61 mm), Low Isles, 23°30'S 152°05'E, J. Bryan, 16 Aug 1963; AM P17746, 1♂ (TL 68 mm), 3♀♀ (TL 70–89 mm), Low Isles, 16°23'S 145°34'E, reef flat, J. Bryan, 14 Aug 1963; AM P19327, 1♂ (TL 148 mm), One Tree I., 23°30'S 152°05'E, reef crest, low tide, under stones, D. Griffin, 6 Oct 1972; AM P43237, 2♂♂ (TL 63–80 mm), 1♀ (TL 74 mm), High I., reef, M. Ward; AM P57871, 1♀ (TL 66 mm), Murray I., Torres Strait, Hedley & McCulloch, 30 Aug to 3 Oct 1907; AM P57876, 1♀ (TL 56 mm), Saddle Back I., 20°04'S 148°32'E, A. Morton; AM P57877, 2♀♀ (TL 32–40 mm), Murray I., Torres Strait,

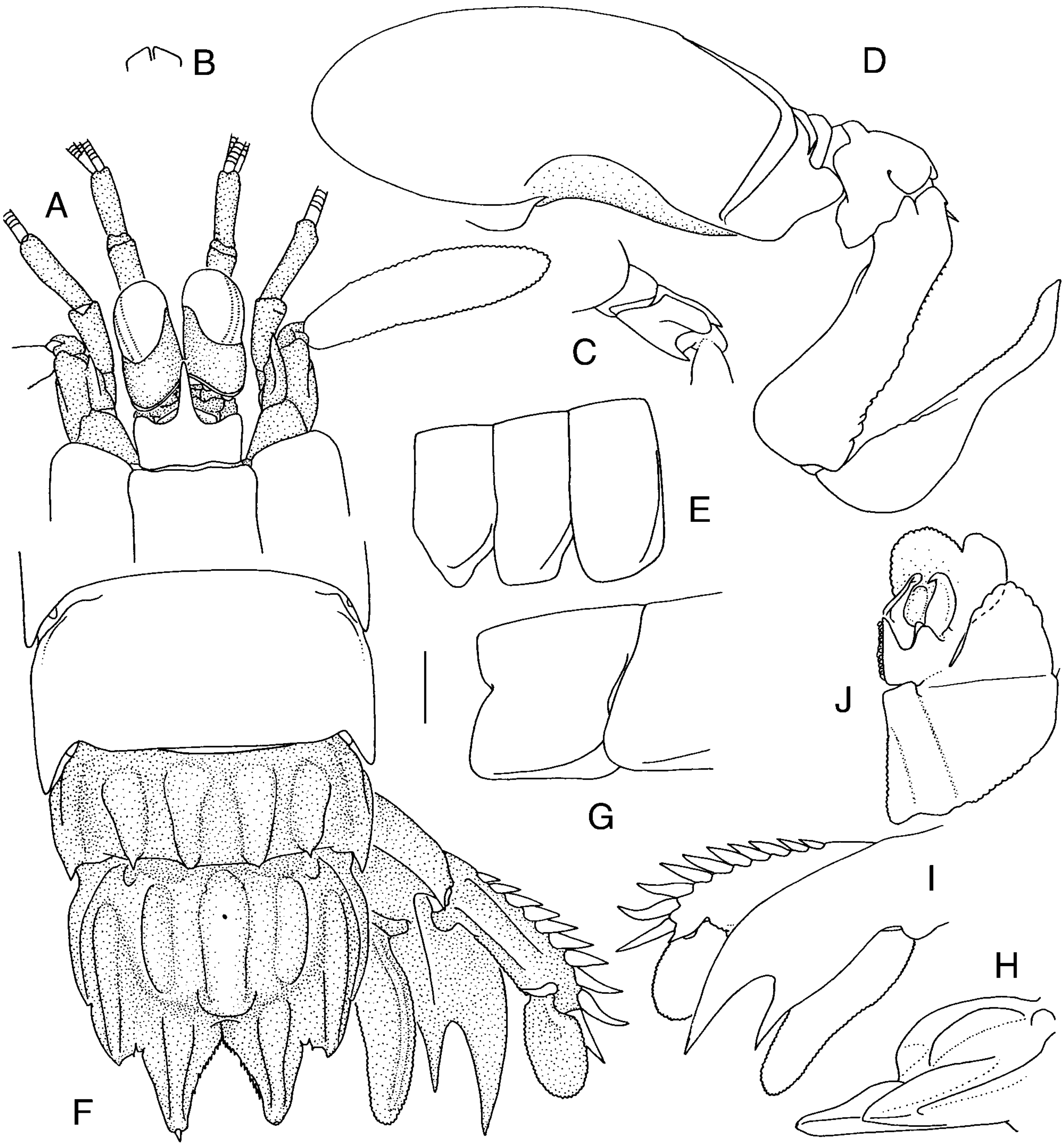

Figure 34. *Gonodactylus chiragra* (Fabricius), ♂ TL 68 mm (AM P17746). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lateral. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2.5 mm; J = 1.25 mm.

Hedley & McCulloch, 1907; AM P60082, 1♀ (TL 68 mm), Yam I., Torres Strait, under rocks on coral rubble area off beach, D. Brown, 6 Jul 1976; QM W14506, 1♂ (TL 82 mm), Coconut Beach, W side of Lindeman I., 20°27'S 149°02'E, under dead coral clumps, intertidal, P. Davie & J. Short, 26 Mar 1987; QM W14523, 1♀ (TL 76 mm), Gap Beach, Lindeman I., 20°27'S 149°02'E, under rock, intertidal, P. Davie & J. Short, 25 Mar 1987; SAM C5753, 1♂ (TL 73 mm), Owen Channel, Flinders I., Princess Charlotte Bay, 1.8 m, in holes in rock, dredged, H. Hale & N. Tindale, 1927; USNM, 3♂♂ (TL 32–48 mm), 3♀♀ (TL 38–58 mm), Coconut Beach, Lizard I., Great Barrier Reef, 0.5–1.2 m, rubble, R. Caldwell, 1 Jul 1987. NEW SOUTH WALES: AM P16797, 1♀ (TL 57 mm), Sydney, 33°51'S 151°16'E, F.D. McCarthy, 21 Mar 1948; MM C82, 1♀ (CL 17.3 mm), Lord Howe I., *Herald Expedition*. WESTERN AUSTRALIA: AM P12378, 1♀ (TL 43 mm), Broome, 17°58'S 122°14'E, K. Sheard, 26 Aug 1952; AM P14899, 1♀ (TL 60 mm), Entrance Point, Broome, 18°01'S 122°12'E, intertidal rocky reef, A. Livingstone, Aug 1929; AM P14906, 1♂ (TL 54 mm), Roebuck Bay, Broome, 18°03'S 122°17'E, intertidal sand flat, A. Livingstone, 8 AM P14907, 2♂♂ (TL 55–73 mm), between cape Bossutt & Broome, A. Livingstone, 11 Sep 1929; AM

P14909, 1♂ (TL 84 mm), between cape Bossutt & Broome, A. Livingstone, 11 Sep 1929; Aug 1929; AM P14915, 1♂ (TL 78 mm), Cape Leveque, 16°24'S 122°55'E, intertidal, A. Livingstone, 19 Aug 1929; AM P19326, 1♂ (TL 77 mm), 2♀♀ (TL 57–65 mm), Exmouth Gulf, 21°53'S 114°22'E, rock pool inside Bundagi Reef, N side of communications base, W. & J. Ponder, 19 Jan 1972; AM P19328, 1♂ (TL 67 mm), Exmouth Gulf, inside Bundagi Reef, N side of Navy base, 21°53'S 114°22'E, rock pool, W. & J. Ponder, 19 Jan 1972; NMV J13819–13820, 2♂♂ (TL 58–70 mm), Broome, R. Blackwood, Aug 1960; NMV J37837, 1♀ (TL 88 mm), Gantheaume Point, Broome, under rock at low tide, R. Hamond, 26 Aug 1976; QM W20057, 1♂ (TL 82 mm), Sunday I., Kimberley coast, 16°21.1'S 123°11.6'E, fringing reef, limestone terraces, under dead coral, J. Short, 15 Nov 1994; QM W20138–20139, 2♂♂ (TL 72– 102 mm), Tallon I., Kimberley coast, 16°24.5'S 123°08.3'E, fringing reef, limestone terraces, J. Short, 17 Nov 1994; QM W20185, 2♂♂ (TL 88–95 mm), Leonie I., Kimberley coast, 16°24.5'S 123°03.2'E, fringing reef, reef flat, J. Short, 18 Nov 1994; QM W20186–20187, 1♂ (TL 56 mm), 1♀ (TL 55 mm), Leonie I., Kimberley coast, 16°24.5'S 123°03.2'E, fringing reef, reef flat, J. Short, 18 Nov 1994; QM W20226, 1♂ (TL 79 mm), Gregory I., Kimberley coast, 16°19'S 123°19'E, fringing reef, reef flat, J. Short, 19 Nov 1994; QM W20259, 1♂ (TL 70 mm), Bedford I., Kimberley coast, 16°08'S 123°18'E, fringing reef, reef flat, J. Short, 19 Nov 1994; QM W20276, 1♀ (TL 44 mm), W side Caparelli I., Kimberley coast, 16°02'S 123°17'E, fringing reef, reef flat under dead coral, J. Short, 20 Nov 1994; QM W20336, 1♂ (TL 73 mm), Irvine I., Kimberley coast, 16°04'S 123°34'E, fringing reef, reef flat, J. Short, 21 Nov 1994; QM W20443, 1♀ (TL 73 mm), Lord I., Kimberley coast, 16°08.9'S 123°27.8'E, fringing reef, reef flat, J. Short, 26 Nov 1994; QM W21077, 1♂ (TL 75 mm), Jones I., N of Vansittart Bay, Kimberley coast, 13°44.5'S 126°22.2'E, reef flat, J. Short, 22 Nov 1995; QM W21128, 1♀ (TL 69 mm), Jar I., N side of Vansittart Bay, Kimberley coast, 14°08.5'S 126°14.6'E, fringing reef, under & in dead coral on silty sand, J. Short, 23 Nov 1995; SAM C245, 1♂ (CL 16.8 mm; dry), Point Samson, Aug 1955; SAM C5752, 1♂ (TL 83 mm), 1♀ (TL 69 mm), Point Samson, Jan 1958. NORTHERN TERRITORY: AM G3811, 1♂ (TL 89 mm), Port Darwin, 12°27'S 130°48'E, Christie & Godfrey; AM P1486–1490, 4♂♂ (TL 65–87 mm), 1♀ (TL 54 mm), Port Darwin, 12°27'S 130°48'E, Christie & Godfrey; AM P9024, 1♂ (TL 47 mm), Nebraska Beach, Port Darwin, 12°27'S 130°50'E, coral reef, L. Wilson, 11 Nov 1927; AM P10740–10741, 1♀ (TL 90 mm), 1♀ (TL 97 mm), Port Darwin, 12°27'S 130°50'E, 5 m, F. Morris, 9 Feb 1936; AM P14905, 1♂ (TL 73 mm), Night Cliff, near Darwin, A. Livingstone, 22 Jul 1929; AM P14910, 1♂ (TL 42 mm), 1♀ (TL 63 mm), Tall Head, Port Darwin, intertidal, A. Livingstone, 24 Jun 1929; AM P14911, 1♂ (TL 65 mm), East Point, Port Darwin, 12°34'S 130°34'E, intertidal, A. Livingstone, 27 Jun 1929; AM P14912, 1♂ (TL 74 mm), 1♀ (TL 77 mm), NW of South Shell I., Port Darwin, 12°30'S 130°53'E, A. Livingstone, 24 Jul 1929; AM P14913, 1♀ (TL 45 mm), W side of Fort Hill, Port Darwin, 22°11'S 144°33'E, intertidal, A. Livingstone, 1929; AM P14914, 1♀ (TL 51 mm), off 3 ½ Mile Reef, Port Darwin, A. Livingstone, 21 Jul 1929; AM P16620–16621, 4♂♂ (TL 60–78 mm), 1♀ (TL 79 mm), Cape Don, Cobourg Peninsula, 11°18'S 131°46'E, on reef, E. Pope, 17 Oct 1965; AM P16628, 1♂ (TL 80 mm), Dudley Reef, Darwin, 12°27'S 130°50'E, E. Pope, 13 Oct 1965; AM P16631, 1♂ (TL 74 mm), Dudley Reef, Darwin, 12°27'S 130°50'E, E. Pope & Boase, 24–25 Oct 1965; AM P16792, 12♂♂ (TL 29–80 mm), 6♀♀ (TL 36–53 mm), Yirrkala, NW of Cape Arnhem, 12°15'S 136°53'E, ironstone reef, emulsifiable rotenone, R. Miller *et al*., 6 Aug 1948; AM P16793, 1♂ (TL 66 mm), 1♀ (TL 63 mm), NW of Cape Arnhem, about 4.8 km S of point E of Yirrkala, ironstone reef at rocky beach, R. Miller & F. Setzler, 18 Jul, 1948; AM P20321, 1♂ (TL 90 mm), West Point, Darwin, 12°26'S 130°46'E, O. Cameron, 8 Oct 1971; AM P43214, 1♂ (TL 64 mm), Conder Point, Melville I., 11°44'S 131°17'E, M. Ward, May 1938; NMV J13823, 1♂ (TL 87 mm), Dudley Pt, East Arm, Darwin, Oct 1968; NTM Cr004163, 1♀ (TL 36 mm), Coral Bay, Port Essington, 11°11.0'S 132°03.4'E, low tide, P. Davie, 12 Aug 1986; NTM Cr005343, 1♀ (TL 13 mm), Dudley Point Reef, Darwin, silty rock pools, low tide, D. Sachs, 16 Jun 1987; NTM Cr008750, 1♂ (TL 77 mm), Channel I., 12°34.9'S 130°55.4'E, rock pool, low water springs, K. Coombes, 16 Apr 1991; NTM, 1♂ (TL 81 mm), Catalina Beach, Gove, NT Fisheries, 5 Nov 1975; NTM, 1♂ (TL 75 mm), Barracuda Reef, Drimmie Bay, Gove, 12°14.4'S 136°41.4'E, intertidal, NT Fisheries, 24 Mar 1976; NTM, 1♂ (TL 78 mm), Barracuda Reef, Drimmie Bay, Gove, 12°14.4'S 136°41.4'E, intertidal, NT Fisheries, 27 Mar 1976; SAM C95, 1♂ (TL 78 mm; dry), Darwin, W. Harmer, Mar 1914; SAM C195, 4♂♂ (TL 70–90 mm), 1♀ (TL 69 mm), Northern Territory; SAM C5761, 2♂♂ (TL 74–92 mm), 1♀ (TL 92 mm); SAM C5802, 2♂♂ (TL 17–58 mm), 1♀ (TL 24 mm), East Point Reef, Darwin, under rocks, W. Zeidler & G. Crook, 1 Oct 1977.

Diagnosis. Ocular scales broad, flattened, separate, together broader than ½ rostral plate width. Rostral plate basal portion with anterior margins strongly concave in adults; anterolateral angles blunt or rounded; lateral margins subparallel or slightly divergent anteriorly; apical spine shorter or longer than base. Lateral margin of TS6 and TS7 subequal. Telson with LT tooth indicated by shallow notch in margin of telson between anterolateral angle and apex of IM tooth; mid-dorsal carinae blunt, neither sharp nor cristate dorsally; MD carina unarmed posteriorly; accessory MD carinae forming “anchor”; with 8–17 SM denticles. Uropodal exopod distal segment outer margin with 10–14 movable spines.

Colour in life. Males: body dark green to brownish; pereiopods yellow, with orange-red dactyl; uropodal exopod distal segment yellow-orange. Females: mottled grey-green and white; pereiopods with distal segment pale yellow.

Measurements. Male (n = 87) TL 17–102 mm, ♀ (n = 55) TL 13–97 mm. A1 peduncle 0.53–0.69 CL. A2 scale 0.53–0.63 CL. AWCLI 770–851. Kemp (1913) reported specimens to 105 mm TL.

Remarks. Australian specimens of *G. chiragra* closely agree with the neotype and published accounts (Manning, 1981a, 1995). The margins of the rostral plate are subparallel or slightly divergent anteriorly, and the rostral spine is usually distinctly longer than the basal portion, being relatively longest in juveniles. The anterior margins of the rostral plate are usually distinctly concave in adult *G. chiragra*, but are occasionally only slightly concave as in *G. childi* and *G. botti*. The relatively short telson of *G. childi* and more strongly inflated mid-dorsal carinae of *G. botti* will also distinguish these species from *G. chiragra*.

Habitat. Common on coral reef flats under boulders or among coral rubble, especially in the upper intertidal zone, but is also common on nearshore or onshore rocky reefs.

Distribution. French Polynesia to Japan, Australia, and the Indo-Malayan region to the western Indian Ocean. Records of *Gonodactylus chiragra* from the Cocos-Keeling Islands (Tweedie, 1950) are based on *Gonodactylellus espinosus*.

Gonodactylus platysoma Wood-Mason, 1895

Fig. 35

Gonodactylus platysoma Wood-Mason, 1895: 11, pl. 3, figs. 3–9 (type locality: restricted to Society Is, French Polynesia, 17°00'S 150°00'W, by lectotype selection [Ghosh & Manning, 1988: 654]).–Manning, 1966: 110–112.–Moosa, 1974: 6.–Manning, 1995: 75–76, pls. 9, 10, figs. 9d, 10b, 11b, 27b, 31.–Gosliner *et al*., 1996: 195.–Ahyong & Norrington, 1997: 101.

Gonodactylus chiragra var. *tumidus* Lanchester, 1903: 447, 456, pl. 23: fig. 1 (type locality: Minikoi, Laccadive Is (= Lakshadweep), 8°17'S 73°02'E).

Gonodactylus chiragra var. *acutus* Lanchester, 1903: 447, 456, pl. 23: fig. 3 (type locality: Minikoi, Laccadive Is (= Lakshadweep), 8°17'S 73°02'E).

Gonodactylus chiragra var. *platysoma*.–Kemp, 1913: 4, 11, 147, 162, fig. 1.–McNeill, 1926: 316.–Holthuis, 1941: 281–282.–Ghosh & Manning, 1988: 654.

Gonodactylus chiragra.–Stephenson & McNeill, 1955: 250–252 [part, not *G. chiragra* (Fabricius, 1781)].

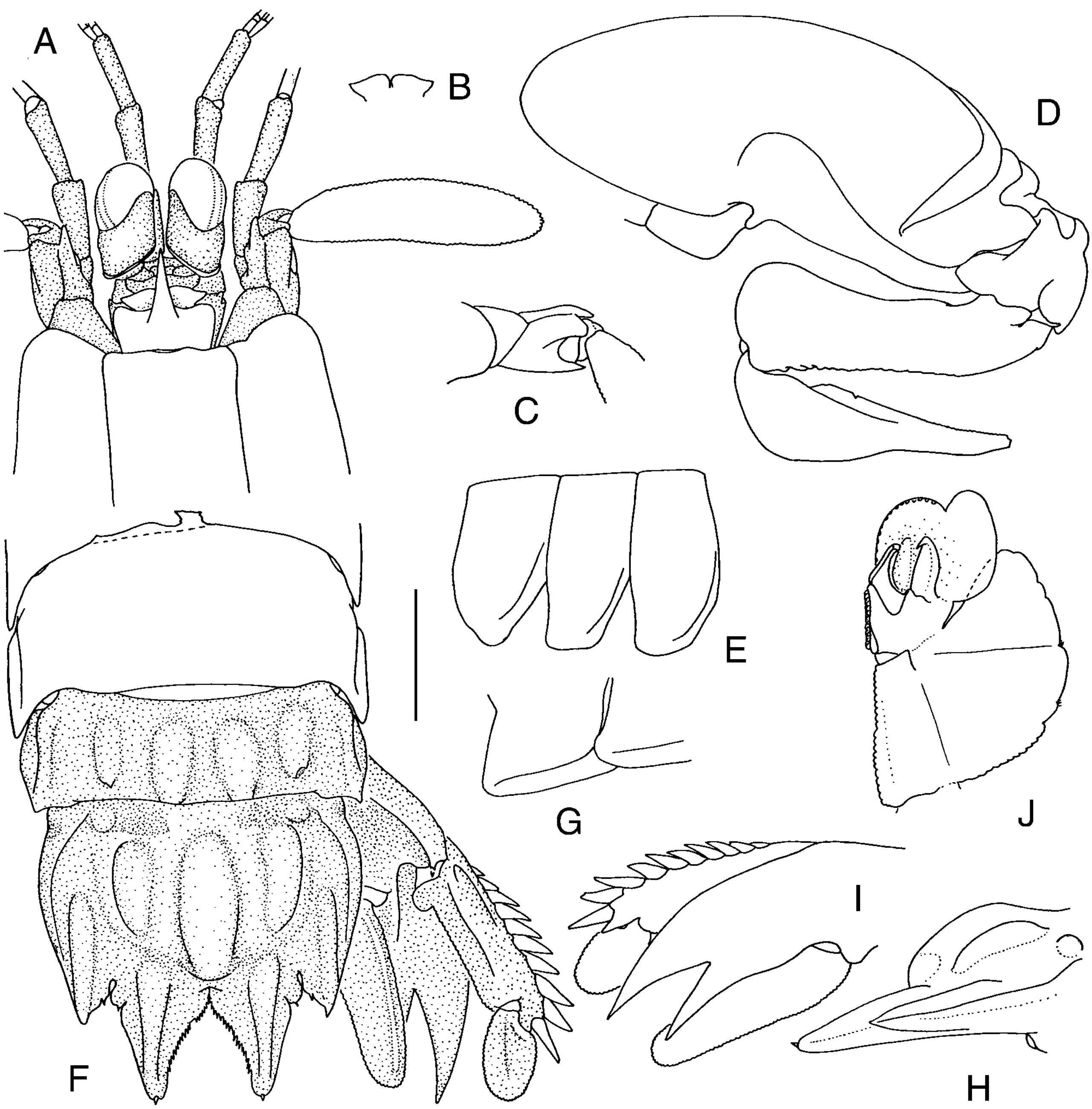

Figure 35. *Gonodactylus platysoma* Wood-Mason, ♂ TL 81 mm (AM P45589). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lateral. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 5 mm; J = 2.5 mm.

Australian material. QUEENSLAND: AM P3131–3132, 1♂ (TL 83 mm), 1♀ (TL 88 mm), Murray I., Torres Strait, Hedley & McCulloch, 30 Aug to 3 Oct 1907; AM P3135, 1♀ (TL 69 mm), Murray I., Torres Strait, Hedley & McCulloch, 30 Aug to 3 Oct 1907; AM P3846, 1♀ (TL 85 mm), Green I., 16°45'S 145°59'E, A. McCulloch, Aug 1913; AM P4272–4275, 4♂♂ (TL 48–80 mm), 2♀♀ (TL 75–78 mm), outer edge St Crispin Reef, off Port Douglas, 16°08'S 145°49'E, A. McCulloch, Aug 1913; AM P4297, 2♂♂ (TL 48–61 mm), outer edge St Crispin Reef, off Port Douglas, 16°08'S 145°49'E, A. McCulloch, Aug 1913; AM P8032, 1♀ (TL 84 mm), Coates Reef, W. Paradice, Apr 1925; AM P8581, 1♂ (TL 88 mm), North West I., reef, G. Whitley, Apr 1926; AM P14903, 1♀ (TL 59 mm), North West I., 23°18'S 151°42'E, reef, M. Ward, Dec 1929; AM P14904, 1♂ (TL 67 mm), 1♀ (TL 72 mm), Cato I., Coral Sea, D. McMichael, 6 Oct 1960; AM P17743, 1♂ (TL 89 mm), Mackay Reef, 13 km E of Cape Tribulation, coral reef, I. Lamb, 19 Jul 1962; AM P45589, 1♂ (TL 81 mm), Thursday I., Torres Strait, 10°35'S 142°13'E, M. Ward; AM P57878, 1♂ (TL 78 mm), 1♀ (TL 70 mm), Murray I., Torres Strait, 9°56'S 144°04'E; NMV J37828, 1♀ (TL 69 mm), North West I., A. Mackenzie, 9 Jul 1930; QM W22262–22263, 2♂♂ (TL 17–69 mm), 1♀ (47 mm), Wreck Reef, near Porpoise Cay, 22°00'S 152°00'E, outer reef flat, under dead coral boulders & base of live coral heads, J. Short & S. Mullens, 14 May 1988; SAM C5747, 1♀ (TL 81 mm), Capricorn Group, W. Kimber. NEW SOUTH WALES: MM C83, 1♀ (CL 16.5 mm), Lord Howe I., *Herald Expedition*. WESTERN AUSTRALIA: QM W17934, 1♀ (TL 64 mm), Hibernia Reef, SE side, Timor Sea, 11°59.0'S 123°22.0'E, reef flat, 0–0.5 m, B. Russell, 15 May 1992. NORTHERN TERRITORY: AM P1761, 1♀ (broken, CL 15.5 mm), North Australia, Dec 1908; AM P1762, 1♀ (TL 78 mm), North Australia, Dec 1908. COCOS-KEELING ISLANDS: ZRC 1970.10.14.29–64, 13♂♂ (TL 46–76 mm), 21♀♀ (TL 28–78 mm), Cocos-Keeling Is, C.A. Gibson-Hill, 1941. CHRISTMAS ISLAND: ZRC 1990.9, 1♂ (TL 85 mm), Christmas I., 1904.

Other material. AM P60120, 1♂ (TL 49 mm), Tikehau I., Tuamotu Archipelago, French Polynesia, 1992.

Diagnosis. Ocular scales broad, flattened, separate, together almost as broad as rostral plate. Rostral plate basal portion with anterior margins strongly concave; anterolateral angles rounded; lateral margins subparallel or slightly divergent anteriorly; apical spine longer than base. Lateral margin of TS6 and TS7 subequal. Telson without LT tooth, margin of telson unbroken between anterolateral angle and apex of IM tooth; dorsal carinae blunt, neither sharp nor cristate dorsally; MD carina unarmed posteriorly; accessory MD carinae indistinct or obsolete; with 14–21 SM denticles. Uropodal exopod distal segment outer margin with 9–13 movable spines.

Colour in life. Dorsally mottled with white, brown and green. TS8 and AS5 with posterolateral “eye-spots”. AS6 and telson with dorsal carinae marbled with blue. A1 flagellae red. A2 scale clear yellow green flecked with white. Raptorial claw with white meral spot; carpus red, propodus reddish proximally, bluish distally; dactylus blue.

Measurements. Male (n = 27) TL 17–89 mm, female (n = 37) TL 28–88 mm. A1 peduncle 0.63–0.76 CL. A2 scale 0.58–0.71 CL. AWCLI 859–1053. Kemp (1915) reported specimens to 110 mm TL.

Remarks. *Gonodactylus platysoma* is distinctive in the genus for having the widest ocular scales (which almost reach the anterolateral corners of the rostral plate), for lacking the lateral tooth on the telson and for having a broader body.

Habitat. Coral reef flats under coral boulders or live coral heads.

Distribution. French Polynesia to Okinawa, Australia, Indo-Malayan region to the western Indian Ocean.

Gonodactylus smithii Pocock, 1893

Fig. 36

Gonodactylus Smithii Pocock, 1893: 475, pl. 20B (type locality: Arafura Sea).
Gonodactylus chiragra var. anancyrus Borradaile, 1900: 395, 397, 401 (type localities: Talili Bay (4°12'S 152°08'E), New Britain and Lifu (20°53'S 167°13'E), Loyalty Is).
Gonodactylus chiragra (Fabricius) var. *smithii* Pocock.–Rathbun, 1914: 664.
Gonodactylus smithii.–Manning, 1966: 112–113.–Moosa, 1974: 6.–Manning, 1991: 4; 1995: 20, 76–80, pls. 11, 12, figs. 9e, 10c, 11d, 27c, 32–35.–Gosliner *et al*., 1996: 195.–Ahyong & Norrington, 1997: 101–102.–Debelius, 1999: 272.
Gonodactylus chiragra.–Stephenson & McNeill, 1955: 250–252 [part, not *G. chiragra* (Fabricius, 1781)].
Gonodactylus minikoiensis Ghosh, 1990: 201, 202, fig. 1 (type locality: Minikoi, Lakshadweep, 8°17'S 73°02'E).
Gonodactylus arabica Ghosh, 1990: 201, 205, figs. 2, 3e (type locality: Kavaratti, Lakshadweep, 10°33'N 72°38'E).
Lyssiosquilla sp. (sic).–Jones & Morgan, 1994: 42.

Type material. LECTOTYPE: NHM 1892.4.18.231, ♂ (TL 28 mm), Arafura Sea, P.W. Bassett-Smith. PARALECTOTYPE: NHM 1892.4.18.232, ♀ (TL 19 mm), type locality.

Australian material. QUEENSLAND: AM P3134, 1♀ (TL 71 mm), Murray I., Torres Strait, Hedley & McCulloch, 30 Aug to 3 Oct 1907; AM P3136, 2♀♀ (TL 34–45 mm), Murray I., Torres Strait, Hedley & McCulloch, 1907; AM P5213, 1♀ (TL 74 mm), Palm Is, 20°04'S 148°29'E, E.H. Rainford; AM P7554–7555, 1♂ (TL 71 mm), 1♀ (TL 75 mm), Cairns Reef, off Cooktown, 15°28'S 145°15'E, A. McCulloch, 1905; AM P7998, 1♀ (TL 60 mm), Frankland Group, 17°11'S 146°04'E, reef, W. Paradice, 1924; AM P8785, 1♀ (TL 67 mm), Hook Reef, E of Bowen, 20°01'S 148°15'E, L. Lockwood; AM P8906, 1♀ (TL 80 mm), Darnley I., Torres Strait, 9°35'S 143°46'E, W. Miller; AM P12087, 1♂ (TL 73 mm), Bird I., Moreton Bay, 27°31'S 153°23'E, J. Hynd, Jan 1938; AM P12094, 1♂ (TL 64 mm), Myora, Moreton Bay, 27°29'S 153°25'E, coral, J. Hynd, Jul 1939; AM P12364, 1♂ (TL 68 mm), 1♀ (TL 73 mm), Palm I., Townsville, 18°40'S 146°33'E, G. Coates, Sep 1953; AM P14902, 2♀♀ (TL 57–65 mm), Northwest I., 23°18'S 151°42'E, M. Ward & W. Boardman, Jul 1929; AM P16817, (exP3135), 1♂ (TL 59 mm), Murray I., Torres Strait, Hedley & McCulloch, 30 Nov 1907; AM P17704–17705, 2♂♂ (TL 17–40 mm), West Cay, Diamond Islets, Coral Sea, 13°11'S 143°43'E, intertidal beach rock pools, D. McMichael & J. Yaldwyn, Oct 1964; AM P17707, 1♀ (TL 52 mm), One Tree I., shallow lagoon, coral rubble, J. Yaldwyn, 19–20 Nov 1966; AM P17714, 1♂ (TL 52 mm), 1♀ (TL 49 mm), One Tree I., coral rubble in shallow lagoon, J. Yaldwyn, 19–20 Nov 1966; AM P17718, 1♂ (TL 58 mm), One Tree I., reef crest, southern face, under stones, low tide, D. & B. Kinsey, 4 Oct 1967; AM P17719, 1♂ (TL 57 mm), One Tree I., reef crest, from beach rock under stones, F. Talbot & D. Griffin, 15 Oct 1968; AM P17720, 1♂ (TL 53 mm), One Tree I., lagoon, from coral heads, 1–2 m, rotenone, F. Talbot *et al*., 27 Sep 1968; AM P17724, 2♂♂ (TL 74–76 mm), 1♀ (TL 39 mm), One Tree I., lagoon, among piecrust and sand, J. Yaldwyn, Dec 1966; AM P17726, 1♂ (TL 73 mm), Mackay Reef, 13 km E of Cape Tribulation, coral reef, I. Lamb, 19 Jul 1962; AM P17739,

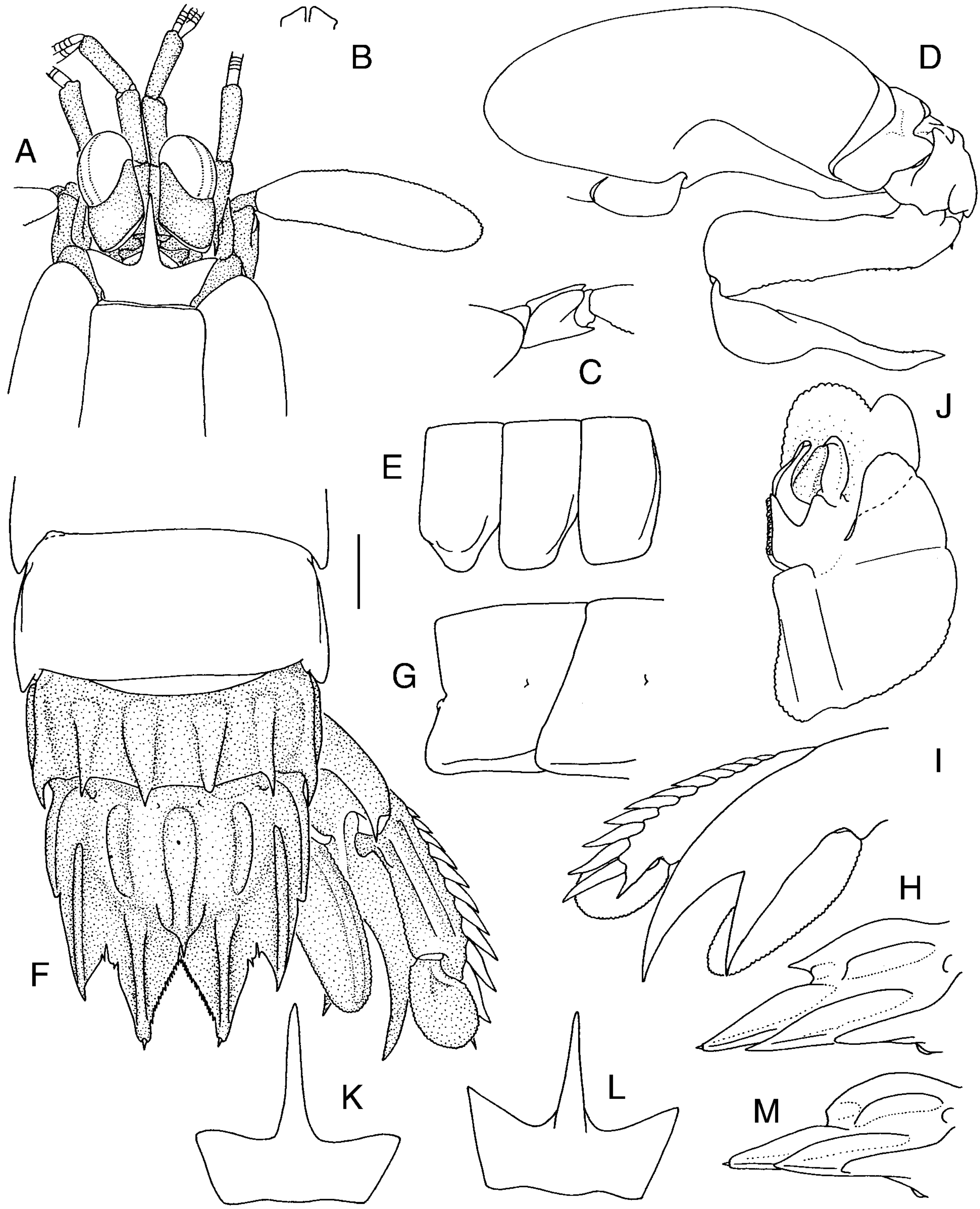

Figure 36. *Gonodactylus smithii* Pocock. A–I, ♀ TL 62 mm (AM P57001). J, ♂ TL 53 mm (AM P17720). K, lectotype ♂ TL 27 mm. L, ♀ TL 70 mm (WAM C10855). M, ♂ TL 64 mm (AM P57001). A, anterior cephalon, dorsal. B, ocular scales, dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lateral. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. K–L, rostral plate. M, telson, right lateral. Scale A–I, M = 2.5 mm; J, L = 1.25 mm; K 0.6 mm.

2♀♀ (TL 70–80 mm), Undine Reef, 16 km E of Cape Tribulation, coral reef, E. Lamb, 17 Jul 1963; AM P19322, 1♀ (TL 64 mm), One Tree I., low tide, intertidal, M. Gregory, 13 Apr 1972; AM P19323, 1♀ (TL 54 mm), One Tree I., lagoon gutter, from *Pavona decussata*, D. Griffin, 9 Oct 1972; AM P19324, 1♀ (TL 67 mm), W side One Tree I., reef crest, low tide, under stones, D. Griffin, 6 Oct 1972; AM P19325, 1♀ (TL 66 mm), Bird I., Whitsunday Is, I. Bennett, May 1969; AM P21794, 1♀ (TL 52 mm), NW of Bird Islet, Lizard I., 2–14 m, from dead coral washings on and off bommie, W. Ponder *et al.*, 6 Dec 1974; AM P21848, 1♀ (TL 50 mm), Lizard I., reef, N. Coleman, 11 Nov 1975; AM P43215, 2♂♂ (TL 64–69 mm), Bird I., Moreton Bay, M. Ward, Jan 1938; AM P43216, 1♂ (TL 60 mm), Heron I., 23°26'S 151°55'E, M. Ward, 30 May 1947; AM P45591, 2♂♂ (TL 33–70 mm), 2♀♀ (TL 50–76 mm), Thursday I., 10°35'S 142°13'E, M. Ward; AM P56035, 2♀♀ (TL 46–61 mm), Possession I., Endeavour Strait, Albany Passage, 10°44'S 142°24'E, M. Ward, 30 Aug 1928; AM P56807, 1♂ (TL 16 mm) Lizard I. lagoon, crest of patch reef, rubble with algal turf, 1.5–2.4 m, BK 127, B. Kensley, 16 Jan 1982; AM P56815, 1♂ (TL 34 mm), Wonga Reef, near Port Douglas, amongst rubble, low tide, S. Ahyong, 7 Jul 1992; AM P57001, 1♂ (TL 64 mm), 2♀♀ (TL 25–62 mm), W side Green I., 16°43'S 146°00'E, reef flat, rubble & *Porites*, S. Ahyong, 11 Jul 1992; AM P57872, 1♀ (TL 45 mm), Northwest I., 23°18'S 151°42'E, reef, M. Ward, Dec 1929; AM P57874, 1♀ (TL 24 mm), Masthead I., 23°32'S 151°44'E, A. McCulloch; AM P57879, 1♀ (TL 61 mm), Murray I., Torres Strait, 9°56'S 144°04'E; AM P60246, 1♀ (TL 74 mm), Keppel Bay, 23°25'S 150°55'E, 46 m or less, T. Garrard, 1964; NMV J13818, 1♂ (TL 64 mm), Fitzroy Range, R. Blackwood; NMV J14452, 1♀ (TL 40 mm), Masthead I., J. Kershaw, Oct 1910; NMV exJ37802, 2 undifferentiated postlarvae (TL 8 mm), Britomart Reef bommie, near SE end 18°17'S 146°38'E, 8 m, *Halimeda*, G. Poore & H. Lew Ton, 25 Nov 1982; NMV exJ37817, 1♂ (TL 10 mm), Britomart Reef, 18°17'S 146°38'E, AIMS 11, G. Poore & H. Lew Ton, 1982; QM W7457, 1♀ (TL 71 mm), Masthead I., Dec 1977; QM W8911, 1♀ (TL 42 mm), Broadhurst Reef, off Townsville, R. McKay, Oct 1973; QM W22261, 1♂ (TL 35 mm), Wreck Reef, near Porpoise Cay, 22°00'S 152°00'E, outer reef flat, under dead coral boulders & at base of live coral heads, J. Short & S. Mullens, 14 May 1988; QM W22267, 2♂♂ (TL 68–84 mm), 1♀ (TL 82 mm), Polomaise Reef, 6 km W of Masthead I., 23°34'S 151°41'E, littoral, under rocks, P. Davie & D. Potter, 10 Feb 1986; SAM C194, 1♂ (TL 60 mm), Cairns, E. Allen; SAM C5751, 2♀♀ (TL 61–82 mm), Darnley I., A. Lea, 1924; SAM C5754, 1♂ (TL 62 mm), Murray I., Torres Straits, A. Lea, 3 Nov 1924; SAM C5760, 1♀ (TL 57 mm), Capricorn Group, W. Kimber; SAM C5771, 1♀ (TL 80 mm), Capricorn Group, W. Kimber; SAM C5782, 1♂ (TL 55 mm), Capricorn Group, W. Kimber; SAM 5801, 1♂ (TL 59 mm), Coconut Beach, Lizard I., intertidal, J. Glover, 17 Aug 1989; TM G1843, 1♀ (TL 90 mm), Alma Bay, Magnetic I., subtidal, J. Penprase, 4–6 Aug 1976; USNM, 1♀ (TL 10 mm), off point between Anchor Bay & Watson's Bay, Lizard I., rubble, JDT LIZ-5, J. Thomas, 24 Jan 1989; USNM, 1♂ (TL 13 mm), Watson's Bay, Lizard I., 1–2 m, patch reef near SW side where reef meets sand, rubble, JDT LIZ-7, J. Thomas, 25 Jan 1989; USNM, 1♂ (TL 13 mm), North Point, Lizard I., JDT LIZ-13, 21 m, vertical cliffs, rubble sample, J. Thomas, 28 Jan 1989; USNM, 2♂♂ (TL 15–66 mm), 3♀♀ (TL 15–44 mm), S of Lizard Head peninsula, Lizard I., rubble zone, JDT LIZ-14, J. Thomas, 29 Jan 1989; USNM, 1 undifferentiated postlarva (TL 9 mm) Lizard Head, Lizard I., rubble zone, JDT LIZ-15 J. Thomas, 31 Jan 1989; USNM, 3♂♂ (TL 19–27 mm), 1♀ (TL 15–16 m), 1 undifferentiated postlarva (TL 7 mm), Lizard Head, Lizard I., small rubble pieces on sand, JDT LIZ-19, J. Thomas, 31 Jan 1989; USNM, 1♀ (TL 18 mm), Palfrey I., 1 m, rubble zone, sandy substrate with heavy algal turf, fine sediment & rubble, JDT LIZ-20, J. Thomas, 4 Feb 1989; USNM, 1♂ (TL 22 mm), Lizard I., N. Marshall, 7 Apr 1994; USNM, 1♀ (TL 37 mm), Great Barrier Reef, N. Marshall, 1991. NEW SOUTH WALES: AM P14991, 1♀ (TL 60 mm), Woody Head, Clarence River mouth, 29°22'S 153°22'E, intertidal rocky reef, A. Cameron, 16 Feb 1965; AM P16289, 1♀ (TL 36 mm), Woody Head, Clarence River mouth, 29°22'S 153°22'E, intertidal rocky reef, A. Cameron, 16 Feb 1965; AM P58553, ♂ (TL 26 mm), Middleton Reef, Tasman Sea, NE to E outer slope, 20°26.1'S 159°08.2'E, site 10, P. Hutchings, 5 Dec 1987. VICTORIA: AM E3140, 1♀ (TL 70 mm), Bass Strait, FIS Endeavour 1909–1914; NMV J13817, 1♀ (TL 63 mm), Bass Strait, SE of Seaspray, 38°39.2'S 147°51.4'E, HMAS Kimbla, Eastern Bass Strait Cruise, K7/73–33, 62 m, 23 Nov 1973. WESTERN AUSTRALIA: AM P14908, 1♂ (TL 66 mm), Cape Leveque, 16°24'S 122°55'E, intertidal, A. Livingstone, 20 Aug 1929; NMV J13821, 1♂ (TL 69 mm), 1♀ (TL 77 mm), Cookaloob, Yampi Sound, R. Blackwood, Aug 1958; QM W17933, 1♀ (TL 37 mm), SE Hibernia Reef, Timor Sea, 11°59.0'S 123°22.0'E, rotenoned, reef flat, 0–0.5 m, B. Russell, 15 May 1992; WAM C10855, 1♀ (TL 70 mm) SE of Elphiks Knob, Dampier Archipelago, R. McKay & J. Stuart, 6 Nov 1971. NORTHERN TERRITORY: AM P16629, 1♀ (TL 64 mm), Dudley Reef, Darwin, 12°27'S 130°50'E, J. Boase, 14 Oct 1965; AM P16798, 2♂♂ (TL 28–60 mm), Yirrkala, NW of Cape Arnhem, 12°15'S 136°53'E, ironstone reef, emulsifiable rotenone, R. Miller *et al*., 6 Aug 1948; AM P57873, 1♀ (TL 67 mm), Nebraska Beach, Port Darwin, 12°27'S 130°50'E, coral reef, L.B. Wilson, 11 Nov 1927; NMV J13835, 1♀ (TL 40 mm), W side of Oxley I., intertidal reef flat, G. Poore, 20 Oct 1982; NMV J13840, 1♀ (TL 10 mm), N side of New Year I., 10°54'S 133°2'E, patch reef, G. Poore, 14 Oct 1982; NMV exJ13836, 1♀ (TL 40 mm), W side of Oxley I., 11°0'S 132°49'E, intertidal pools, G. Poore, 18 Oct 1982; NTM Cr001432, 1♂ (TL 61 mm), 1♀ (TL 64 mm), East Point, Darwin, exposed reef, low water springs, A. Bruce, 01 Jan 1983; NTM Cr003026, 1♀ (TL 50 mm), Oxley I., Port Essington, low water springs, A. Bruce, 19 Oct 1982; NTM, 1♂ (TL 43 mm), 3♀♀ (TL 38–56 mm), Dudley Point, Darwin, muddy reef-flat pools, A. Bruce, 17 Sep 1981; NTM, 1♀ (TL 36 mm), East Point, Darwin, A. Dartnall & B. Smith, 11 Jun 1976; NTM, 2♂♂ (TL 50–62 mm), 1♀ (TL 45 mm), Oxley I., Darwin, reef pools at low tide, 19 Dec 1982; SAM C5781, 1♂ (TL 56 mm), 1♀ (TL 38 mm), East Point, Darwin, reef, under rocks, W. Zeidler, 1 Oct 1977.

Diagnosis. Ocular scales broad, flattened, separate, together as broad as ½ rostral plate width. Rostral plate basal portion with anterior margins concave; anterolateral angles acute but not spiniform; lateral margins strongly divergent anteriorly; apical spine longer than base. Telson with LT tooth indicated by shallow notch in margin of telson between anterolateral angle and apex of IM tooth; dorsal carinae often sharp or cristate dorsally; MD carina usually armed posteriorly with stout spine, but often obsolete in adult ♂♂; accessory MD carinae forming "anchor"; with 11–21 SM denticles. Uropodal exopod distal segment outer margin with 10–13 movable spines.

Colour in life. Body colour varying from uniform or mottled light green to black green. Juveniles usually with small white spots on dorsum. Raptorial claw with meral spot dark red to purple with white outline; propodus blue distally; dactylus pink. Uropodal protopod with bright red dorsal spot basally; setae on exopod and endopod often purple. A2 scale clear yellow.

Measurements. Male (n = 50) TL 10–84 mm, ♀ (n = 67) TL 10–90 mm, postlarvae (n = 4) TL 7–9 mm. A1 peduncle 0.52–0.68 CL. A2 scale 0.49–0.62 CL. AWCLI 719–817. The present series includes the largest known specimen of the species.

Remarks. *Gonodactylus smithii* is distinctive in the genus for the slender telson carinae and strongly divergent lateral margins of the rostral plate. In the large series examined here, the sharpness of the anterolateral corners of the rostral plate varies (Fig. 36A,K,L) and may approach that figured for the holotype of *G. acutirostris* from the Mergui Archipelago (de Man, 1898, pl. 38). Although de Man (1902) distinguished *G. acutirostris* based on differences in telson ornamentation as well as the sharper rostral plate angles, the former difference is based on deformity (Holthuis, 1967b; Manning & Lewinsohn, 1986). Therefore, the single character distinguishing *G. acutirostris* from *G. smithii* is the degree of acuteness of the anterolateral angles of the rostral plate. The acuteness of the anterolateral angles of the rostral plate increases with increasing size and it is noteworthy that the holotype of *G. acutirostris* is about twice the length of the types of *G. smithii* (TL 19–28 mm vs. 56 mm). Thus, *G. acutirostris* is possibly synonymous with *G. smithii*. The holotype of *G. acutirostris*, if extant, should be restudied to settle the issue.

The 26 mm TL male specimen from Middleton Reef, New South Wales, closely agrees with other specimens of *G. smithii* in most respects including slender telson conformation, but is unusual in bearing rounded instead of truncate ocular scales, the lateral margins of the rostral plate are not strongly divergent, and the accessory median carinae of the telson are elongate, extending beyond the midlength of the median carina. The accessory median carinae of the telson in *G. smithii* occasionally extend anteriorly nearly to the midlength of the median carina, but in no other specimens are the accessory median carinae as long as in Middleton Reef specimen. Additional specimens may show that the Middleton Reef specimen belongs to another species, but it is presently regarded as aberrant *G. smithii*.

Manning (1966) questioned a record of *G. smithii* from Bass Strait, Victoria, as an unexpected southern range extension into cool temperate waters. A second specimen of *G. smithii* has since been collected from Bass Strait, corroborating the first record. Like several other tropical species that are occasionally found in temperate southern Australia, the pelagic larvae of *G. smithii* were likely transported there by the East Australian Current.

Holthuis (1967b) designated the male syntype of *G. smithii* as the lectotype.

Habitat. Common on intertidal or shallow subtidal coral reef flats amongst dead coral rubble and live coral, to 62 m.

Distribution. Western Indian Ocean to Vietnam, Australia, New Caledonia and Okinawa.

HEMISQUILLIDAE Manning, 1980b

Hemisquillidae Manning, 1980b: 366, 369 (type genus *Hemisquilla* Hansen, 1895).

Diagnosis. Eye with cornea subglobular to subcuboid, set obliquely on stalk. A2 protopod dorsally with flattened, articulated plate. Rostral plate triangular. Raptorial claw dactylus unarmed; propodus opposable margin with 2 movable spines proximally; ischiomeral articulation terminal. AS1–5 each with marginal carina only. AS6 dorsal carinae unarmed. Telson SM teeth with movable apices; submedian denticles present in adults; dorsal surface with distinct MD carina and anterior SM carina in addition to carinae of primary teeth. Uropodal protopod terminating in a single primary spine; outer margin with strongly convex lobe with at most a minute outer spine; exopod segments with terminal articulation; exopod proximal segment outer margin with straight, movable spines.

Included genera. One: *Hemisquilla* Hansen, 1895.

Remarks. Hemisquillidae differs from all other gonodactyloids in having a terminal ischiomeral articulation of the raptorial claw in combination with an unarmed inner margin of the dactylus.

Hemisquilla Hansen, 1895

Hemisquilla Hansen, 1895: 72. Type species *Gonodactylus styliferus* H. Milne Edwards, 1837, by original designation (a junior subjective synonym of *G. ensiger* Owen, 1832). Gender feminine.

Diagnosis. As for family.

Included species. Four: *H. brasiliensis* (Moreira, 1903); *H. australiensis* Stephenson, 1967; *H. californiensis* Stephenson, 1967; and *H. ensigera* (Owen, 1832).

Remarks. Stephenson (1967) recognized three subspecies for the Australian and American populations of the species then known as *Hemisquilla ensigera*. The Australian and two American populations of *H. ensigera* differed morphometrically, but no “hard” distinguishing characters were found, and colour-in-life data were then unavailable. Therefore, Stephenson (1967) recognized three subspecies of *H. ensigera*. The nominate subspecies was restricted to the Chilean population, the Australian population was designated *australiensis*, and the Californian population designated *californiensis*. Little justification exists, however, for retaining subspecies in *H. ensigera* because each differs morphologically, in colour pattern and have discrete distributions. Based on re-examination of specimens of *Hemisquilla* in Australian collections as well as the entire series of *H. ensigera* in the USNM, each of Stephenson’s (1967) subspecies are herein recognized as distinct species.

Hemisquilla australiensis is the only hemisquillid known from the Indo-West Pacific. *Hemisquilla ensigera* and *H. californiensis* both occur in the eastern Pacific, and *H. brasiliensis* occurs in the western Atlantic.

Species of *Hemisquilla* are restricted to temperate or subtemperate waters, and unlike most gonodactyloids, occupy burrows in sand and mud substrates.

Key to species of *Hemisquilla*

1	Lobes between SM & IM teeth of the telson each usually with spiniform apex in adults; lobe between IM & LT teeth spiniform	*H. brasiliensis*
——	Lobes between SM & IM teeth of the telson rounded, at most with minute point in adults; lobe between IM & LT teeth round or obsolete in adults	2
2	Uropodal exopod with 4 (rarely with 3 on one side) movable spines on outer margin of proximal segment	***H. australiensis***
——	Uropodal exopod with 5 (rarely with 4 on one side) movable spines on outer margin of proximal segment	3
3	Propodus of raptorial claw yellow in life	*H. californiensis*
——	Propodus of raptorial claw blue in life	*H. ensigera*

Hemisquilla australiensis Stephenson, 1967

Fig. 37

Pseudosquilla stylifera.–Whitelegge, 1900: 198–199.–Kemp, 1913: 106, pl. 7: figs. 84–85, fig. 107.–Hale, 1924: 491 (not *P. stylifera* H. Milne Edwards, 1837).

Hemisquilla stylifera.–Schmitt, 1940: 181.–Stephenson, 1953a: 43, 44; 1955: 2, 4.–Stephenson & McNeill, 1955: 253–254.–Guiler, 1956: 3 (not *H. stylifera* H. Milne Edwards, 1837).

Hemisquilla ensigera.–Manning, 1966: 102 [not *H. ensigera* (Owen, 1832)].

Hemisquilla ensigera australiensis Stephenson, 1967: 15, 16 (type locality: 19 km E of Broken Bay, New South Wales, Australia).–Graham *et al*., 1993a: 24, 64; 1993b: 73.

Type material. HOLOTYPE: AM P11695, ♂ (TL 140 mm), 19 km E of Broken Bay, New South Wales, Australia, 33°40'S 151°30'E, seine trawl, H. Arnold, Nov 1946.

Australian material. NEW SOUTH WALES: AM E4503, 1♂ (TL 145 mm), Disaster Bay; AM E2238, 1♂ (broken, CL 26.5 mm), 9.6 km SE of Brush I., 30°35'S 150°30'E, 14 Nov 1911; AM E4508, 1♂ (TL 155 mm), Barren I., 22°02'S 149°59'E, 73 m; AM G2169, 1♀ (TL 134 mm), 6.5–9.5 km offshore, Newcastle Bight, 32°53'S 152°03'E, 51–73 m, fine grey sand, E. Waite, 2 Mar 1898; AM P4437, 1♀ (TL 115 mm), off Wattamolla, 34°08'S 151°14'E, 124 m, 7 Feb 1919; AM P4439–4444, 1♂ (TL 160 mm), 1♀ (TL 130 mm), off Wattamolla, 34°08'S 151°14'E, 124 m, 7 Feb 1919; AM P4794, 1♀ (broken, CL 27.7 mm), off Clarence River, 29°25'S 153°25'E, D. Stead, 12 Feb 1920; AM P4908, 1♀ (TL 122 mm), E of Sydney, 33°50'S 151°43'E, 274 m, trawled, D. Stead, May 1920; AM P5727, 1♀ (TL 93 mm), off Port Macquarie, 31°26'S 153°00'E, 54 m, ejected from mouth of flathead (Platycephalidae); AM P8818, 1♀ (TL 127 mm), 29 km S of Montague I., 36°37'S 150°14'E, 91–109 m, A. Ward, Mar 1927; AM P8425–8426, 2♂♂ (TL 77–145 mm), 17.6 km NE of Port Jackson, 33°44'S 151°28'E, 137 m, trawled, M. Ward; AM P9327, 1♀ (TL 129 mm), off Burrewarra Point, 35°50'S 150°17'E, 91 m, trawled, K. Moller; AM P10755, 1♂ (TL 147 mm), 24 km off Port Jackson, 33°50'S 151°33'E, hook & line, T. Wright; AM P11431, 1♀ (TL 130 mm), southern coast of New South Wales, 35°50'S 150°15'E, 73 m, K. Moller; AM P11896, 1♂ (broken, CL 29.5), Rose Bay, Port Jackson, 33°52'S 151°15.5'E, H. Wright; AM P12324, 1♂ (TL 150 mm), off Newcastle, 32°56'S 151°50'E, A. D'Ombrain; AM P13766, 1♂ (TL 140 mm), off Haycock Point, Merimbula, 36°57'S 149°57'E, 18 m, on hook, 17 Feb 1962; AM P14323, 1♂ (TL 148 mm), Ulladulla, 35°21'S 150°29'E, shallow water on hook & line, Mrs Wilks, 26 May 1963; AM P14896–14897, 2♂♂ (TL 145–155 mm), off Ulladulla, 35°22'S 150°48'E, 183 m, A. Racek, Jun 1959; AM P19496, 1♀ (TL 125 mm), off Wollongong, trawled, N. Lewis, Sep 1968; AM P29447, 1♂ (TL 128 mm), off Norah Head, 33°38'S 151°50'E, K74–15–25/26, 439–476 m, K. Graham, 5 Dec 1974; AM P41786, 4♂♂ (TL 140–165 mm), 1♀ (TL 134 mm), E of Port Hunter, Newcastle, 32°53'S 151°59'E, 68 m, K91–11–15, K. Graham, 26 Jun 1991; AM P54080, 1♂ (TL 145 mm), E of Tathra, 55 m, 36°37'S 150°04'E, K93–05–12, K. Graham, 13 Mar 1993; AM P56794, 1♂ (TL 128 mm), off Sydney Heads, K. Graham, 40 m, trawled, 30 Jun 1995; SAM P303, 1♀ (TL 127 mm), off Broken Bay, W. Baker, 17 Sep 1910. VICTORIA: AM E1315–1317, 2♂♂ (TL 137–143 mm), 1♀ (TL 138 mm), off Cape Everard, 37°48'S 149°16'E, 109 m; AM E2235–2236, 2♂♂ (TL 144–160 mm), off Cape Everard, 37°48'S 149°16'E, 128 m; AM E3537, 1♂ (TL 168 mm), E Bass Strait, Gabo to Gable I., 109–182 m; AM E3541, 1♀ (TL 127 mm), E Bass Strait, Gabo to Gable I., 109–182 m; AM E4794–4796, 3♂♂ (TL 158–159 mm), S of Gabo I., 37°34'S 149°55'E, 191 m; AM E6098, 1♂ (TL 175 mm), SE of Cape Everard, 37°48'S 149°16'E, 128–146 m; AM E6100, 1♂ (TL 168 mm), SSW of Mt. Cann, Gippsland, 128–183 m; AM P3536, 1♀ (TL 152 mm), S of Cape Everard, 37°48'S 149°16'E, 146–218 m, Dec 1912; AM P4796–4797, 2♂♂ (TL 127–146 mm), off Cape Bailey, trawled, D. Stead, 8 Nov 1914; AM P57195, 1♂ (TL 170 mm), off Cape Everard, half way to Tasmania, 101 m, M. Ward; NMV J37785, 2♂♂ (TL 141–159 mm), eastern Australia, Endeavour Collection; NMV J37786, 1♂ (TL 141 mm), 1♀ (123 mm), Endeavour Collection, 15 Oct 1913; NMV J37787, 1♂ (TL 139 mm), Lakes Entrance, H. Newman, Apr 1957; QM W1779–1781, 3♂♂ (TL 143–158 mm), Victorian coast; WAM C435, 1♀ (TL 157 mm), S of Cape Everard, 144–216 m; SAM P2230, 1♂ (TL 151 mm), Bass Strait, W. Baker, 5 Oct 1910; TM G47–49, 2♂♂ (TL 150–160 mm), 1♀ (TL 141 mm), Victorian coast. TASMANIA: E 441–442, 2♂♂ (TL 146–154 mm), E coast of Flinders I., Bass Strait, 40°01'S 148°02'E.

Diagnosis. Rostral plate as long as or longer than broad. Mandibular palp 2- or 3-segmented. Raptorial claw with propodus blue in life. Telson with 2 or 3 rounded, lobes between SM & IM teeth at most with minute point; lateral denticle absent, at most with minute tubercle between IM & LT teeth. Uropodal exopod proximal segment outer margin with 3 or 4 (usually 4) movable spines.

Colour in life. Overall dorsal colour pale blue-grey. A1 peduncle bright blue, flagellae red. A2 scale clear, marginal setae clear red. Raptorial claw with propodus and dactylus pale blue. Pereiopods blue proximally, white distally. Uropodal exopod with proximal segment dark blue extending onto proximal ¼ of distal segment; remainder of distal segment iridescent French blue with red setae.

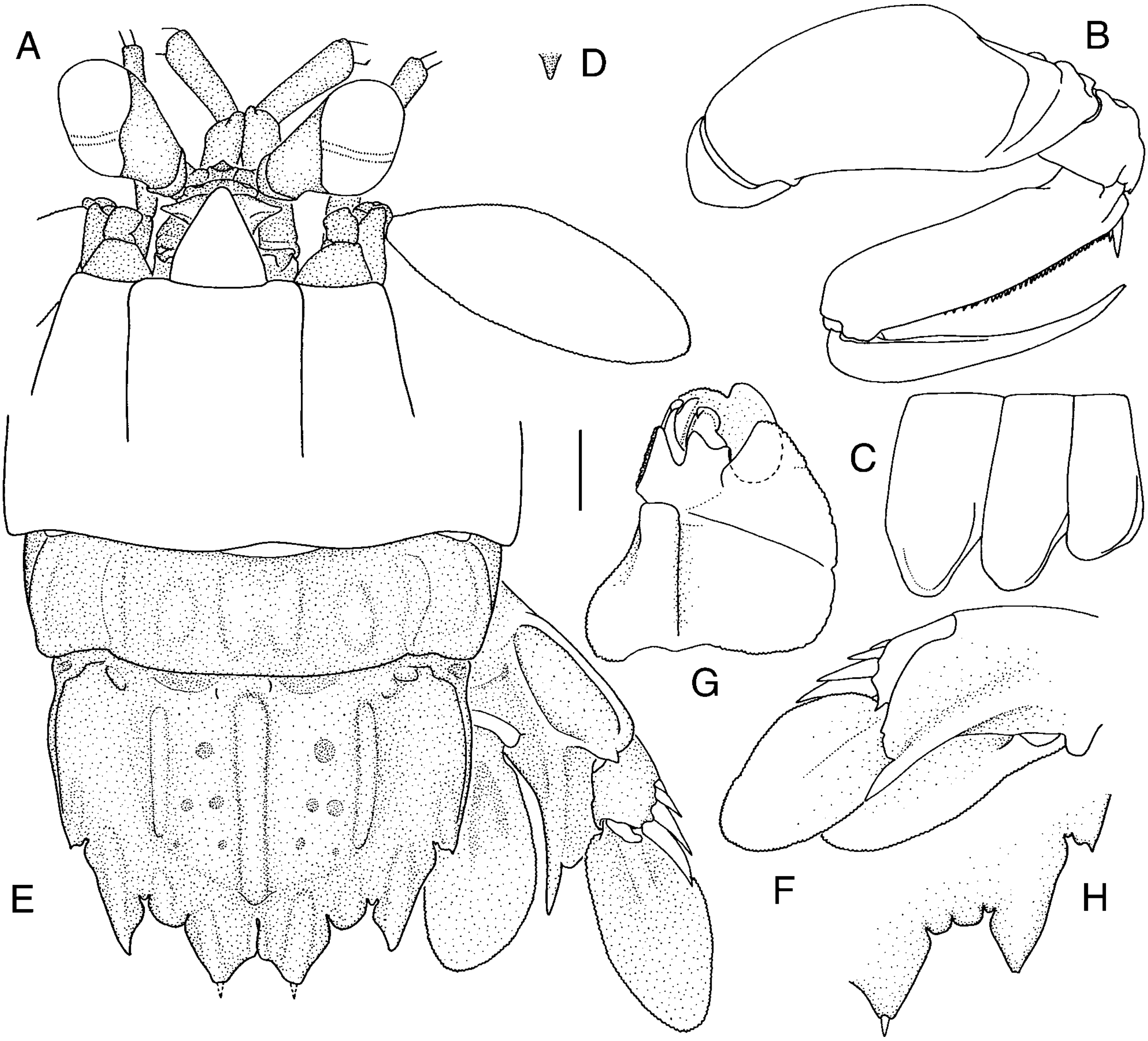

Figure 37. *Hemisquilla australiensis* Stephenson. A–F, ♀ TL 93 mm (AM P5727); G, ♂ TL 148 mm (AM P14323); H, ♂ TL 145 mm (AM P41786). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8, right lateral. D, TS8 sternal keel, right lateral. E, AS5–6, telson & uropod, dorsal. F, uropod, right ventral. G, ♂ PLP1 endopod, right anterior. H, telson posterior margin, right dorsal. Scale = 5 mm.

Measurements. Male (n = 46) TL 77–174 mm, female (n = 18) TL 93–157 mm. CI 301–465. A1 peduncle 0.79–0.94 CL. A2 scale 0.70–0.93 CL. Uropodal endopod length 2.17–2.56 breadth. The present series includes the largest known specimen of the species.

Remarks. Stephenson (1967) provided an account of the differences between American and Australian *Hemisquilla*, and in particular, noted variation in the proportions of the rostral plate, the segmentation of the mandibular palp, form and number of the lobes between the submedian and intermediate teeth of the telson (Fig. 37E,H). Variation similar to that observed by Stephenson (1967) is displayed by the present series. As found by Stephenson (1967), *Hemisquilla australiensis* differs from *H. californiensis* and *H. ensigera* in generally bearing a more elongate rostral plate and relatively larger eyes. Additionally, the intermediate teeth of the telson are usually sharper in the two eastern Pacific species, and the telson is more strongly flattened, than in *H. australiensis*. Each of these differences, however, are difficult to practically use as distinguishing characters without directly comparing specimens. Stephenson (1967), however, also noted that colour in life may prove useful in separating the Australian and American hemisquillids, a view strongly supported here. *Hemisquilla australiensis* differs in colour in life from *H. californiensis* in having blue instead of bright yellow propodi of the raptorial claw, the uropodal endopod is blue-grey instead of yellow, and the body is generally darker. Limited accounts of the colour in life of *H. ensigera* (see Manning, 1963c) suggest that the colour of the raptorial claw and uropodal endopod is blue as in *H. australiensis*. Aside from the colour in life, the best character distinguishing *H. australiensis* from *H. californiensis* and *H. ensigera* is the number of movable spines on the outer margin of the proximal segment of the uropodal exopod. Four movable spines are almost invariably present on the outer margin of each uropodal exopod. In five of the 64 specimens of *H. australiensis* examined, three movable uropodal exopod spines are present on one side, four on the other. In *H. californiensis* and *H. ensigera*, five movable spines are usually present on the outer margin of the uropodal exopod. Rarely, four movable spines on the uropodal exopod may be present on one side, and five on the other.

Habitat. Soft sandy-mud substrates in depths between 18 m and 439–476 m.

Distribution. New Zealand and Australia, from northern New South Wales, south to Victoria and Tasmania.

ODONTODACTYLIDAE Manning, 1980b

Odontodactylidae Manning, 1980b: 366, 369 (type genus *Odontodactylus* Bigelow, 1893a).

Diagnosis. Eye subglobular. A2 protopod with flattened, articulated plate dorsally. Dactylus of raptorial claw strongly inflated into blunt heel basally, with small, short teeth on inner margin; propodus without proximal movable spine or pectinations on opposable margin; ischiomeral articulation subterminal; ischium with ventrally directed, triangular lobe. AS6 articulating with telson. Telson with distinct MD carina and SM denticles in adults. Articulation of uropodal exopod segments terminal; distal spines on outer margin of uropodal exopod straight or slightly curved, not strongly recurved anteriorly.

Included genera. One, *Odontodactylus* Bigelow, 1893a.

Remarks. Manning (1995) recognized two odontodactylid genera: *Odontodactylus* and *Raoulius. Raoulius*, erected by Manning (1995) for *Odontodactylus cultrifer*, was characterized by having the distal segment of the uropodal exopod longer than the proximal. The relative lengths of the uropodal exopod segments, however, vary between species of the "*Odontodactylus brevirostris* complex". Therefore, little justification exists for recognizing *Raoulius* as distinct from *Odontodactylus* and the two genera are herein synonymized.

Odontodactylids differ from other gonodactyloids that have a subterminal ischiomeral articulation of the raptorial claw by having small teeth on the inner margin of the dactylus in addition to the strongly inflated basal "clubs" on the outer margin. Additionally, odontodactylids have an articulated plate on the mesiodorsal margin of the antennal protopod and a ventrally directed, triangular lobe on the ischium of the raptorial claw.

Odontodactylus Bigelow, 1893a

Odontodactylus Bigelow, 1893a: 100. Type species *Cancer scyllarus* Linnaeus, 1758, by subsequent designation by Bigelow (1931: 144). Name on *Official list* of International Commission on Zoological Nomenclature. Gender masculine.

Raoulius Manning, 1995: 86. Type species *Gonodactylus cultrifer* White, 1851, by original designation and monotypy. Gender masculine.

Diagnosis. As for family.

Included species. Eight: *O. brevirostris* (Miers, 1884); *O. cultrifer* (White, 1851) n.comb.; *O. hansenii* (Pocock, 1893); *O. havanensis* (Bigelow, 1893a); *O. hawaiiensis* Manning, 1967d; *O. japonicus* (de Haan, 1844); *O. latirostris* Borradaile, 1907; and *O. scyllarus* (Linnaeus, 1758).

Remarks. Three of the six nominal species regarded as synonyms of *O. brevirostris* by Manning (1967d) are herein removed from synonymy. Cronin *et al*. (1997) remarked on the distinctness of *O. havanensis* from the western Atlantic, which was synonymized by Manning (1967d) with *O. brevirostris*. Restudy of the types of *O. brevirostris*, *O. hansenii* and *O. latirostris*, as well as other specimens from the Indo-West Pacific, strongly suggests that each of these nominal species are distinct. Manning (1967d) reported two postlarval groups ("small" and "large") and Michel (1970) reported two corresponding late pelagic larval series ("16 mm" and "26 mm") both as *O. brevirostris*. In the species with "small" postlarvae, telson carinae are well developed by TL < 25 mm, whereas in species with large postlarvae, full telson carinae are not developed until about 30 mm TL (Ahyong, unpubl.). The holotype of *O. brevirostris* corresponds to the large postlarval group and "26 mm" larval series. *Odontodactylus latirostris*, *O. hansenii* and *O. havanensis* each have "small" postlarvae and show well-developed telson carinae at 25 mm TL or less. My preliminary analysis of characters in the "*O. brevirostris* complex" suggests that the degree of setation of the antennal scale, the presence or absence of a posterolateral spine on AS3, colour in life, the pigmentation and relative length of the proximal segment of the uropodal exopod and are all useful in distinguishing the species. Some of these traits change allometrically, but the pigmentation of the proximal segment of the uropodal exopod, and the presence or absence of a posterolateral spine on AS3 appears to be constant, even in postlarvae and juveniles. Study of the species of the "*O. brevirostris* complex" is ongoing, so the corresponding portion of the following key is preliminary. As remarked under the account of the family, the monotypic genus *Raoulius* is synonymized with *Odontodactylus*. Therefore, *R. cultrifer* is transferred to *Odontodactylus*. Of the seven Indo-West Pacific species of *Odontodactylus* recognized here, four are known from Australia.

Key to species of *Odontodactylus*

1 Ocular scales widely separated. Telson with single accessory MD carina either side of MD carina 2

—— Ocular scales appressed medially. Telson with double accessory MD carinae either side of MD carina 6

2 Uropodal exopod with distal segment length equal to or exceeding 1.5 times distal segment .... ***O. cultrifer***

—— Uropodal exopod with distal segment distinctly shorter than proximal segment or not exceeding 1.2 times length of proximal segment ("*O. brevirostris* complex" 3

3 Proximal segment of uropodal exopod with black patch basally, not extending beyond proximal ⅓. (Distal segment of uropodal exopod always shorter than proximal segment) .... *O. brevirostris*

—— Proximal segment of uropodal exopod entirely or almost entirely black 4

4 AS3–5 each with posterolateral spine 5

—— AS4–5 or only AS5 with posterolateral spine .... ***O. latirostris***

5 Adults with distal segment of uropodal exopod as long as or longer than proximal segment. A2 scale with proximal reddish spot (Western Atlantic) .... *O. havanensis*

—— Adults with distal segment of uropodal exopod shorter than proximal segment. A2 scale without reddish spot (Indo-West Pacific) .... *O. hansenii*

6 AS5 without posterolateral spine in adults. Telson with longitudinal carina extending anteriorly from inner IM denticle .... ***O. japonicus***

—— AS5 with posterolateral spine. Telson without longitudinal carina extending anteriorly from inner IM denticle 7

7 Dactylus of raptorial claw with 2 or 3 teeth on inner margin .... ***O. scyllarus***

—— Dactylus of raptorial claw with more than 5 teeth on inner margin .... *O. hawaiiensis*

Odontodactylus cultrifer **(White, 1851) n.comb.**

Fig. 38

Gonodactylus cultrifer White, 1851: 96, pl. 16: figs. 1, 2 (type locality: China).
Gonodactylus carinifer Pocock, 1893: 478, pl. 20B, fig. 4 (type locality: Holothuria Bank, 13°25'S 126°00'E).
Odontodactylus cultrifer.–Kemp, 1913: 4, 11, 134, 137.–Stephenson, 1952: 10, 11; 1953a: 46.–Stephenson & McNeill, 1955: 248.–Stephenson, 1962: 35.–Manning, 1966: 105–106; 1967d: 18–22, fig. 5.–Moosa, 1986: 382; 1991: 162.–Cannon *et al*., 1987: 63.–Manning, 1991: 5.
Odontodactylus carinifer.–Kemp, 1913: 4, 11, 134, 138.
Odontodactylus mindanaoensis Roxas & Estampador, 1930: 94, 115, pl. 4: figs. 1–3 (type locality: Cotabato, Mindanao, Philippines, 7°13'S 124°15'E).
Odontodactylus cultrifer var. *tridentata* Serène, 1954: 6–8, 72, pl. 6: figs. 7, 8 (type locality: Nhatrang Bay, Vietnam).
Raoulius cultrifer.–Manning, 1995: 86–91, pl. 14, 15, figs. 38c, d, 39–42.

Australian material. QUEENSLAND: AM E3154, 1♂ (broken, CL 23.2 mm), 16 km NW of Bustard Head, 23°55'S 151°23'E, 26 m; AM P3549, 1♀ (TL 118 mm), Platypus Bay, 24°56'S 153°12'E, 28 Jul 1910; AM P12074–12075, 2♀♀ (TL 104–105 mm), E of Woody Point Pier, Moreton Bay, 27°16'S 153°06'E, W. Stephenson, 22 Jul 1951; AM P12275, 1♂ (TL 123 mm), off Peel I., Moreton Bay, 27°30'S 153°21'E, L. Sanders, 6 Sep 1952; AM P12276, 1♀ (TL 74 mm), Magnetic I., 19°08'S 146°50'E, 16 m, R. Bryson, 2 Mar 1953; AM P12279, 1♀ (TL 92 mm), off Townsville, 19°16'S 146°49'E, 37 m, trawled, R. Bryson, Aug 1953; AM P21656, 1♀ (TL 98 mm), SE Gulf of Carpentaria, 16°55'05"S 139°22'20"E, 7.3 m, J. Yaldwyn & D. McMichael, 13 Apr 1964; AM P21657, 1♂ (TL 123 mm), SE Gulf of Carpentaria, 16°57'07"S 140°34'03"E, 16 m, J. Yaldwyn & D. McMichael, 16 Aug 1963; AM P56787, 1♂ (TL 112 mm), off Double I., near Cairns, 16°44'S 145°42'E, muddy sand, trawled, May 1994; AM P56789, 1♂ (TL 98 mm), Mud I., Moreton Bay, 27°20'S 153°15'E, trawled, 15 Nov 1975; AM P56790, 1♀ (TL 101 mm), East I., 11°14.04'S 143°09.68'E, 28 Apr 1993; QM W1468, 1♀ (TL 72 mm), Mud I., Moreton Bay, 27°20'S 153°15'E, V. Collin, 28 Jan 1942; QM W1785, 1♀ (TL 79 mm), Mud I., Moreton Bay, 27°20'S 153°15'E, V. Collin, 28 Jan 1942; QM W1798, 1♀ (TL 87 mm), Redcliffe, Moreton Bay, 27°14'S 153°07'E, trawled, late 1951; QM W3628, 1♂ (TL 121 mm), Moreton Bay, 27°25'S 153°20'E, I. Galloway, 4 May 1970; QM W3961, 1♂ (TL 106 mm), 3.2 km SE of Mud I., Moreton Bay, 27°21'S 153°16'E, A. Jones, 31 Oct 1967; QM W4704, 2♂♂ (TL 105–106 mm), W of Moreton I., Moreton Bay, 27°11'S 153°24'E, 25 m, trawled, R. McKay, 26 Mar 1975; QM W6443, 1♀ (TL 100 mm), near Nassau River, Gulf of Carpentaria, 15°53'S 141°32'E, 22 m, trawled, 8–21 Dec 1976; QM W16532, 1♂ (TL 120 mm), ?Moreton Bay, 6 Apr 1990; QM W19550, 1♂ (TL 101 mm), Moreton Bay, 27°28.6'S 153°20.5'E, trawled, 7.6–10.6 m, P. Davie *et al*., 3 Jun 1993; QM W24220, 2♂♂ (TL 102–111 mm), off Cairns, 17°00.0'S 146°05.8'E, 35 m, trawled, 25 Apr 1982; AM P56788 (to QM), 1♀ (TL 106 mm), Shelburne Bay, 11°24.4'S 142°59.9'E, 20–30 m, GBR 0192 FOD5A, May 1992; AM P56792 (to QM), 2♀♀ (TL 97–102 mm), E Gulf of Carpentaria, between Weipa & Karumba, 1976; WAM C6850, 1♂ (TL 102 mm), 9.6 km NE of Woody Point Pier, Moreton Bay, 10 m, mud & shell, E. Grant, 14 Mar 1951. NEW SOUTH WALES: AM P14322, 1♂ (TL 120 mm), off Wooli, 29°52'S 153°20'E, 36 m, L. Bale, 1953. WESTERN AUSTRALIA: AM P60083, 1♂ (TL 93 mm), between Tent Point and Y I., 21°59'S 114°28'E, Exmouth Gulf, CSIRO Fisheries; NMV J13887, 1♀ (TL 97 mm), Northwest Shelf, between Port Hedland & Dampier, 19°49.00'S 117°52.00'E, 51 m, with sponges, trawled, NWA 10, G. Poore & H. Lew Ton, 2 Jun 1983; NMV J37830, 1♂ (TL 106 mm), Northwest Shelf, between Port Hedland & Dampier, 20°01.00'S

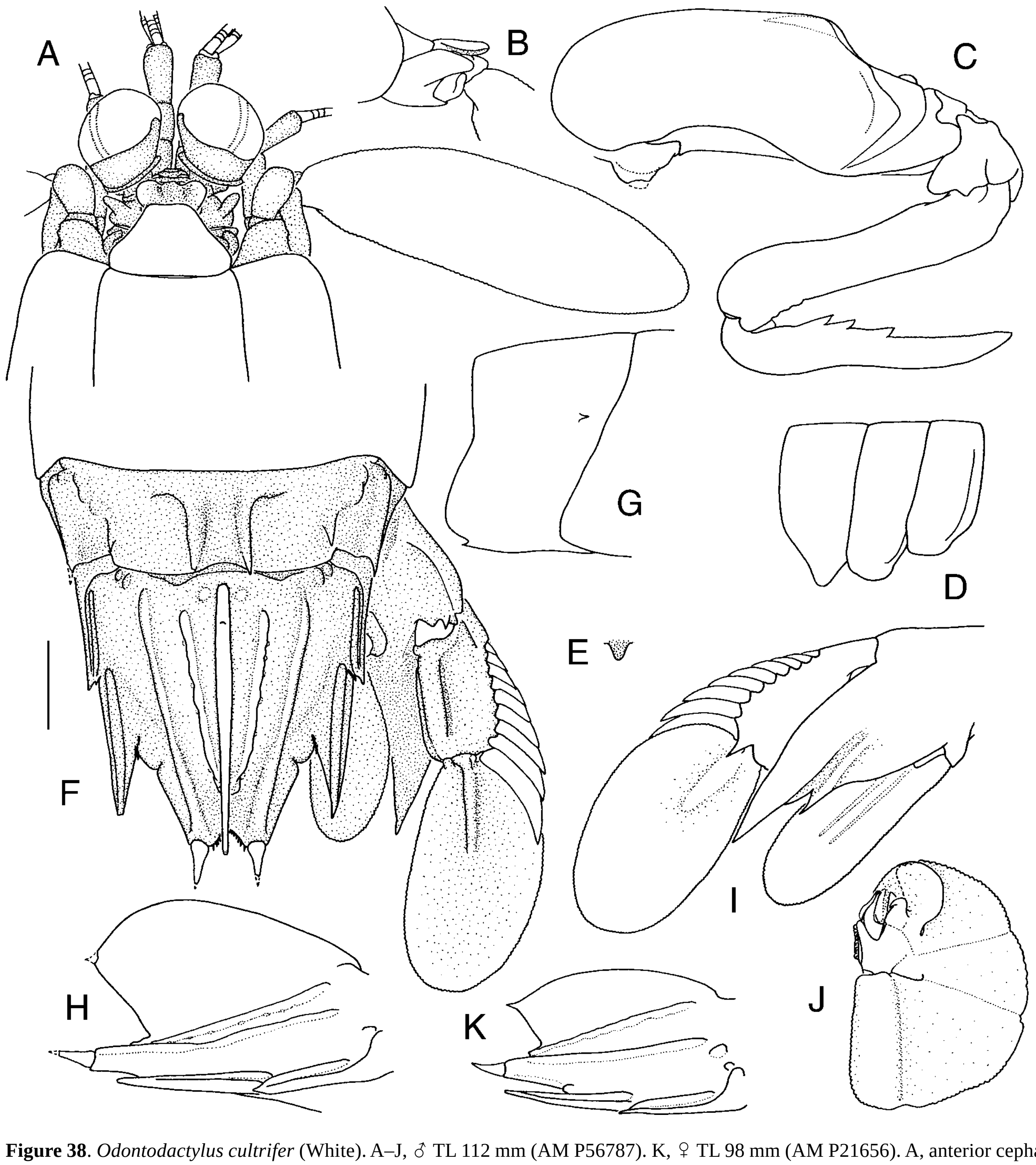

Figure 38. *Odontodactylus cultrifer* (White). A–J, ♂ TL 112 mm (AM P56787). K, ♀ TL 98 mm (AM P21656). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, TS8 sternal keel, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lower lateral. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. K, telson, ♀, right lateral. Scale A–I, K = 5 mm; J = 2.5 mm.

118°09.00'E, 28 m, with sponges, trawled, NWA 3, G. Poore & H. Lew Ton, 1 Jun 1983; WAM C7853, 2♂♂ (TL 73–98 mm), W Exmouth Gulf, trawl, K. Godfrey, 26 Feb 1956. NORTHERN TERRITORY: AM P56791, 1♂ (TL 110 mm), E of Groote Eylandt, 14°00'S 137°11.9'E, 45 m, trawled, SS0390 37, 29 Nov 1990; NTM, 1♂ (TL 103 mm), SW Groote Eylandt, Gulf of Carpentaria, 14°18'S 136°24'E, J. Elder, 19 Jun 1976; NTM, 1♂ (TL 91 mm), Shoal Bay, 12°17'S 130°54'E, 13 m, trawl, 27 Apr 1977; NTM, 1♂ (TL 95 mm), Shoal Bay, 12°17'S 130°54'E, 13 m, 27 Apr 1977; NTM, 1♂ (TL 102 mm), E Van Dieman Gulf, 11°54'S 132°32'E, 13–15 m, trawl, 26 Oct 1977; WAM C9552, 1♂ (TL 102 mm), Beagle Gulf, off Port Darwin, 12°14'S 130°34'E, E. Barker, 4 Sep 1965.

Other material. AM P12154, 1♂ (TL 60 mm), 1♀ (TL 51 mm), off Tré I., Xaca Bay, Vietnam, 12°13'N 109°16'E, 25 m, R. Serène, 26 Sep 1949 (syntypes of *Odontodactylus cultrifer* var. *tridentata* Serène).

Diagnosis. Ocular scales broad, rounded, widely separate. Raptorial claw dactylus with 2 or 3 small teeth on inner margin.

AS5 with small subposterolateral spine. AS6 with distinct SM, IM and LT carinae, armed posteriorly; without reflected SM carina. Telson dorsal surface with MD carina and 2 longitudinal carinae either side of midline (single accessory MD and anterior SM); MD carina thin, high, produced into a crest, height about ⅓ to ½ telson width in males and about ⅕ to ¼ in females; with 10–14 minute SM denticles. Uropodal exopod proximal segment outer margin with 7–10 movable spines; distal segment equal to or greater than 1.5 times length of proximal segment.

Colour in life. Only males examined live. Dorsal surface pastel metallic pink, with grey green medially. Ventral surface white. Telson median crest deep pink. A2 scale pink. Uropodal protopod and endopod off white; exopod distal segment deep pink.

Measurements. Male (n = 26) TL 60–123, female (n = 16) TL 51–118 mm. A1 peduncle 0.56–72 CL. A2 scale length 0.92–1.15 CL. Telson MD crest height 0.27–0.45 telson width in males, 0.20–0.27 in females. Manning (1967d) reported specimens to 125 mm TL.

Remarks. *Odontodactylus cultrifer* may be recognized by the high, thin, median carina of the telson and the large distal segment of the uropodal exopod that is at least 1.5 times as long as the proximal segment. In other species of *Odontodactylus*, the distal segment of the exopod is usually distinctly shorter than the proximal segment, but in *O. havanensis* and *O. latirostris*, the distal segment may be up to 1.2 times longer than the proximal segment.

The Australian specimens agree well with published accounts (Manning, 1967d, 1995). Sexual dimorphism is as reported by Manning (1967d) in which the median carina is distinctly higher in adult males than in females (Fig. 38H,K). Although the ranges of the median telson crest height overlaps in males and females, that of males is always higher than that of size-matched females. In the present series, the relative height of telson crest in smallest male is equivalent to that of the largest female. The two specimens from Vietnam, deposited in the Australian Museum by Serène, are syntypes of *Odontodactylus cultrifer* var. *tridentata* Serène.

Habitat. Level, sandy mud substrates from 7–51 m.

Distribution. The Andaman Sea, China, the Philippines, Vietnam, the Indo-Malayan region to New Caledonia and northern Australia, from Exmouth Gulf, Western Australia to Wooli, New South Wales.

Odontodactylus japonicus (de Haan, 1844)

Fig. 39

Gonodactylus japonicus de Haan, 1844, pl. 51: fig. 7 (type locality: Japan); 1849: 255 (text).–Miers, 1880: 116.

Gonodactylus Edwardsii Berthold, 1845: 48.

Odontodactylus japonicus.–Alexander, 1916b: 10.–Holthuis, 1941: 276.–Stephenson & McNeill, 1955: 248–249.–Stephenson, 1960: 61.–Manning, 1965: 260; 1967d: 7–10, fig. 2.–Graham *et al*., 1993: 73.–Yamaguchi & Baba, 1993: 176–178, fig. 9.–Manning, 1995: 20, 82.–Ahyong & Norrington, 1997: 103.

Australian material. QUEENSLAND: AM P13708–13709, 1♂ (TL 120 mm), 1♀ (TL 125 mm), off Heron I., 23°27'S 151°55'E, trawled, I. Bennett, Aug 1958; NMV J37792, 1♀ (TL 108 mm), off North Stradbroke I., 27°42'S 153°35'E, C. Lu, 6 Nov 1981; QM W12215, 1♂ (TL 116 mm), near Wistari Reef, trawled, I. Bennett, Aug 1958; QM W16566, 1♂ (TL 138 mm), 1♀ (TL 113 mm), off Fraser I., 25°00'S 153°00'E, 30 m, trawled, 16 May 1990; QM W17184, 1♂ (TL 104 mm), 2♀♀ (TL 81 mm; 1 broken, CL 20.0 mm, other), off Noosa, 26°00'S 153°00'E, 54.9 m, trawled, 24 May 1991. NEW SOUTH WALES: AM P41827, 1♂ (TL 146 mm), NE of Brunswick Heads, 28°27'S 153°39'E, 53 m, K. Graham, 25 May 1991; AM P52753, 1♂ (TL 141 mm), off Yamba, 29°18–20'S 153°29'E, 45–48 m, K95–11–19, K. Graham, 23 Aug 1995. WESTERN AUSTRALIA: AM P52752, 1♂ (TL 118 mm), Northwest Shelf, 19°54.4–55.6'S 117°56.0–56.5'E, 43–44 m, beam trawl, S0483 B3, 26 Aug 1983; NMV J13886, 1♂ (TL 110 mm), Northwest Shelf, between Port Hedland & Dampier, 19°40.00'S 118°6.00'E, 51 m, trawl, G. Poore & H. Lew Ton, 12 Jun 1983; NMV J13889, 1♀ (TL 101 mm), Northwest Shelf, between Port Hedland & Dampier, 20°8.00'S 116°48.00'E, 48 m, shelly sand, trawl, G. Poore & H. Lew Ton, 10 Jun 1983; NTM Cr000315, 1♂ (TL 117 mm), Northwest Shelf, 20°01'S 117°32'E, 43 m, trawl, J. Blake, 21 Oct 1982; NTM Cr000767, 1♂ (TL 103 mm), NE of Dampier Archipelago, Northwest Shelf, 20°07'S 117°25'E, 40 m, trawl, 23 Oct 1982; NTM Cr012183, 1♂ (TL 107 mm), Northwest Shelf, 18°40.3'S 117°29.2'E, 304 m, trawl, T. Ward, 1 Feb 1984; NTM Cr012364, 1♀ (TL 21 mm), 1♀ postlarva (TL 19 mm), Northwest Shelf, 19°05.0–04.9'S 118°58.0–58.2'E, 82 m, beam trawl, S0583 B10, 23 Oct 1983; NTM Cr012367, 1♂ (TL 24 mm), 1♀ (broken, TL exceeding 20 mm), Northwest Shelf, 19°04.2–04.4'S 119°00.5–00.7'E, 82 m, beam trawl, S0583 B11, 23 Oct 1983; NTM Cr012371, 1♀ (TL 20 mm), Northwest Shelf, 19°29.1–29.2'S 118°51.9–52.4'E, 38–39 m, sled, S0583 D6, 25 Oct 1983; NTM Cr012396, 1♀ (TL 103 mm), Northwest Shelf, 19°59.2–59.5'S 117°03.6'E, 52 m, beam trawl, S0483, 5 Sep 1983; NTM Cr012405, 1♂ (TL 61 mm), Northwest Shelf, S0682 130, trawled, Dec 1982; WAM C23544, 1♂ (TL 144 mm), off Peron Peninsula, 25°50'S 113°35'E, prawn trawl, I. Vredenbreger, Jun 1976.

Other material. AM P60100, 2♂♂ (TL 135–175 mm), Sea of Japan, off Maebaru City, Fukuoka Prefecture, Japan, 33°34'N 130°10'E, trawl, T. Hamano, 22 Sep 1982.

Diagnosis. Ocular scales oblique to bodyline, appressed medially. A2 scale with anterior margin smooth, without setae in adults. Rostral plate triangular, but appearing trapezoid dorsally; lateral margins sinuous; apex deflexed. Raptorial claw dactylus with 5–8 teeth on inner margin; proximal margin strongly inflated; without basal notch. AS1–5 posterolateral angles rounded, unarmed in adults. Telson mid-dorsal surface with distinct MD carina and 4 longitudinal carinae either side of midline (double accessory MD; anterior SM; carina of inner IM denticle) in addition to carinae of primary teeth. Uropodal exopod proximal distinctly longer than distal segment; outer margin with 10–12 movable spines, distalmost evenly tapering (juveniles) to spatulate with blunt or minute spinular apex (adults), distal segment longer than proximal segment length.

Colour in life. Overall colour salmon. A2 scale salmon proximally, pink distally. Uropods yellow; exopod with outer movable spines yellow orange with blue posterior margin; endopod and distal segment of exopod with red setae.

Measurements. Male (n = 16) TL 24–175 mm, female (n = 10) TL 20–120 mm, female postlarva (n = 1) TL 19 mm. A1 peduncle 0.49–0.64 CL. A2 scale 1.02–1.18 CL. The present

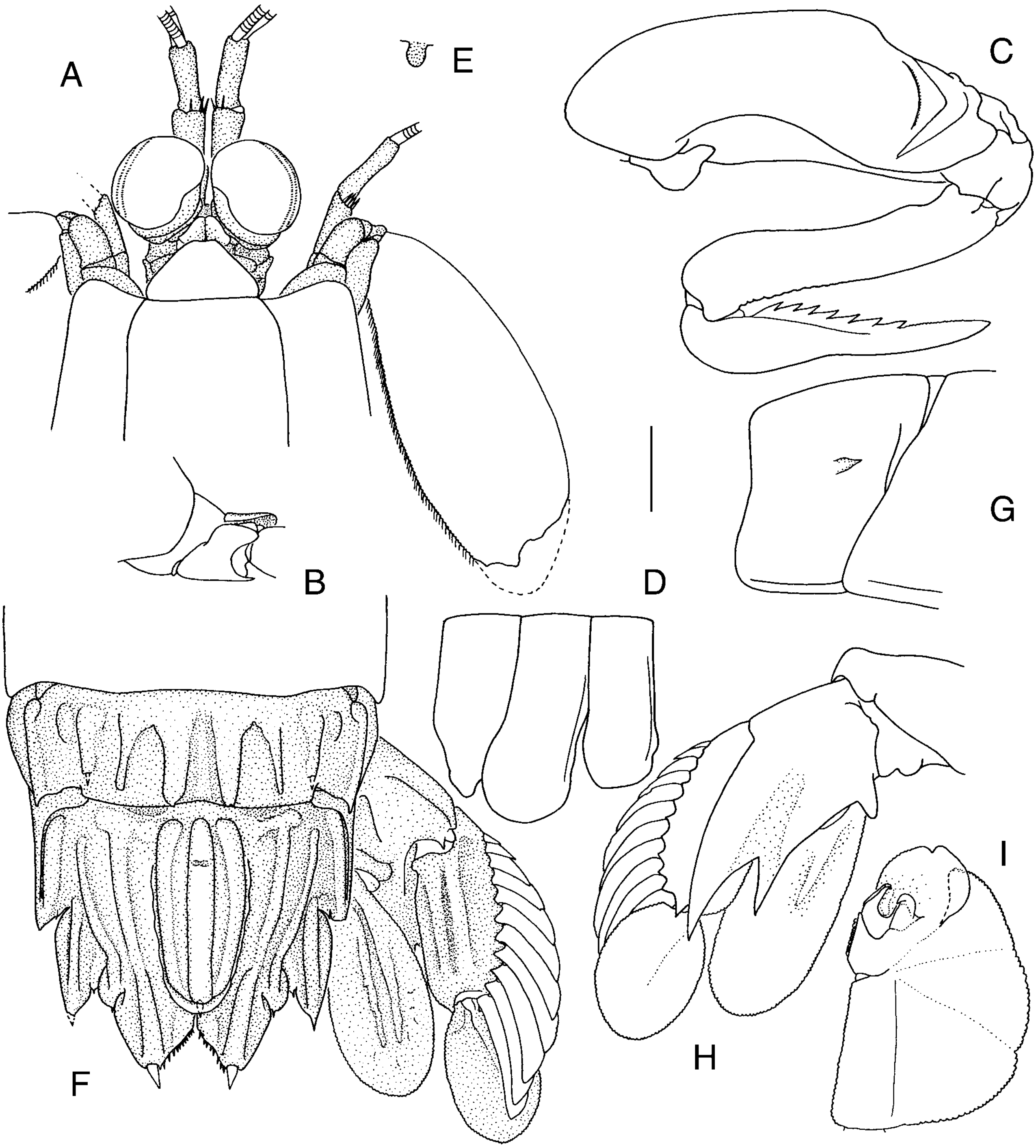

Figure 39. *Odontodactylus japonicus* (de Haan), ♂ TL 107 mm (NTM Cr012183). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, TS8 sternal keel, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 5 mm; I = 2.5 mm.

series includes the largest known specimen of the species.

Remarks. The Australian specimens agree well with Manning (1967d), topotypic specimens and the figures of the types given by Yamaguchi & Baba (1993: fig. 9). Yamaguchi & Baba (1993) designated a female syntype (NNM S 32) as the lectotype.

Odontodactylus japonicus postlarvae apparently settle at 19–20 mm TL, and along with juveniles, differ in several characters diagnostic for adults. The second accessory median carina of the telson is undeveloped (as with juveniles in all species of the genus), AS(3)4–5 bear a posterolateral spine, the distalmost movable spines are slender instead of broadened, and the anterior margin of the antennal scale are setose instead of bare. Therefore, present juvenile specimens resemble *O. hawaiiensis* but are clearly referable to *O. japonicus*—the larger of the juveniles (TL 21, 24 mm) bears the longitudinal carina on the inner intermediate denticle (diagnostic for *O. japonicus*) and the colour pattern resembles adults. In several adult specimens, the posterolateral margin of AS5 bear remnants of a spine or a minute angle in the otherwise rounded margin. Thus, in *O. japonicus*, the posterolateral spines become obsolete in adults, the distal movable spines on the outer margin of the proximal segment of the uropodal exopod are spiniform and taper evenly in juveniles but become increasingly spatulate with increasing size, and the anterior margin of the antennal scale initially bears setae that are subsequently lost in adults. All specimens of *O. japonicus* examined above 60 mm TL show "adult" diagnostic characters. In the largest specimen, a 175 mm male, the carina of inner intermediate denticle is indistinct distally but distinct proximally.

Komai (1927) reported two juveniles of *O. japonicus* from Japan bearing posterolateral spines on AS4–5. Based on the abdominal spination, Manning (1967d) referred Komai's specimens to *O. brevirostris*. In the light of the characters shown by postlarvae and juveniles reported above, Komai (1927) may have correctly identified his material. The specimen reported by Stephenson (1962) as *O. japonicus* from Western Australia is referable to *O. latirostris*.

Habitat. Level sandy or shelly substrates from 30–82 m depth.

Distribution. Indo-West Pacific, from the western Indian Ocean to Australia and Japan (Manning, 1967d).

Odontodactylus latirostris Borradaile, 1907

Fig. 40

Odontodactylus latirostris Borradaile, 1907: 212, pl. 22: figs. 3, 3a (type locality: Amirante Is, Seychelles).–Debelius, 1999:280–281.

Odontodactylus southwelli Kemp, 1911: 94; 1913: 142, pl. 9: figs. 103–106 (type locality: Andaman Is).

Odontodactylus japonicus.–Stephenson, 1962: 35 [not *Odontodactylus japonicus* (de Haan, 1844)].

Odontodactylus brevirostris.–Manning, 1967d: 23 (part).–Moosa, 1991: 161–162 [not *O. brevirostris* (Miers, 1884)].

Type material. LECTOTYPE: MZC 12.11.1907, ♀ (TL 53 mm), Amirante Is, Seychelles, 46–146 m, J.S. Gardiner & M.A. Caius. PARALECTOTYPE: MZC 12.11.1907, ♀ (TL 17 mm), type locality.

Australian material. QUEENSLAND: AM P52754, 1♀ (TL 46 mm), Middle Banks, Great Barrier Reef, 11°39.08'S 143°34.85'E, 20–30 m, dredge, T. Wassenberg, 9 Mar 1994; AM P52756, 1♂ (TL 58 mm), Middle Banks, Great Barrier Reef, 11°42.23'S 143°37.83'E, 20–30 m, T. Wassenberg, 17 Nov 1993; AM P52757, 1♂ (TL 45 mm), Middle Banks, Great Barrier Reef, 11°42.42'S 143°39.41'E, 20–30 m, T. Wassenberg, 28 Oct 1994; AM P52755 (to QM), 1♀ (TL 52 mm), near Middle Banks, Great Barrier Reef, 11°33.65'S 143°36.79'E, 20–30 m, T. Wassenberg, 22 Nov 1993. WESTERN AUSTRALIA: WAM C7826, 1♂ (TL 77 mm), Shark Bay or Exmouth Gulf, trawled, R. McKay, 16 Oct 1958.

Diagnosis. Ocular scales separated by deep concavity, margins truncate. A2 scale posterior and at most anterior distal ⅓ setose in smallest specimens; anterior setae becoming reduced with size, absent in adults. Rostral plate ovoid, apex rounded. Raptorial claw dactylus with 7 or 8 teeth on inner margin. TS6–7 lateral margins rounded, that of TS6 slightly broader and flatter than that of TS7. AS(4)5 with posterolateral spine (AS5 only in largest specimen). Telson mid-dorsal surface with distinct MD carina and 2 longitudinal carinae either side of midline (accessory MD; anterior SM) in addition to carinae of primary teeth. Uropodal exopod proximal segment entirely or almost entirely black, outer margin with 9 or 10 movable spines; exopod distal segment subequal to or longer than proximal segment; endopod with 2 subequal dorsal carinae and 1 ventral carina.

Colour in life. Base mottled light brown on white-cream, with darker brown mid-dorsal surface of TS6–7 white with tan brown mottling dorsally. Uropod with black band across proximal segment of exopod, adjacent protopod and endopod; exopod distal segment pink. A2 scale pink.

Measurements. Male (n = 3) TL 45–77 mm, female (n = 3) TL 46–53 mm, juvenile female (n = 1) TL 17 mm. Measurements of adults: A1 peduncle 0.69–0.87 CL, A2 scale length 0.87–0.98 CL, uropodal exopod distal segment length 1.09–1.38 proximal segment length. Measurements of juvenile: A1 peduncle 0.91 CL, A2 scale 0.70 CL, uropodal exopod segment 0.96 proximal segment length. The present series includes the largest known specimen of the species.

Remarks. Borradaile's (1907) syntypes of *O. latirostris* comprise an adult female (TL 53 mm) and a juvenile female (TL 17 mm). In the 17 mm TL syntype, the gonopores are not fully differentiated, but telson carinae are fully developed. Hence, *O. latirostris* corresponds to those species of the "*O. brevirostris* complex" with a small postlarva (see remarks under account of the genus). The 53 mm TL syntype of *O. latirostris* is herein designated as lectotype to fix the identity of the species.

Odontodactylus latirostris differs from other species in the "*O. brevirostris* complex" in having reduced setation on the anterior margin of the antennal scale in adults, in lacking a posterolateral spine on AS3, in having the proximal segment of the uropodal exopod entirely or almost entirely black, and in having a relatively long distal segment of the uropodal exopod which in adults exceeds the length of the proximal segment. *Odontodactylus latirostris* most closely resembles *O. havanensis* from the Western Atlantic in the reduced setation on the antennal scale, relatively long distal segment of the uropodal exopod in adults. *Odontodactylus latirostris* differs morphologically from *O. havanensis* in lacking a posterolateral spine on AS3.

The Australian specimens agree well with the lectotype and in most respects with Borradaile's (1907) account of the species. The type description is erroneous in attributing seven instead of eight teeth to the inner margin of the dactylus of the raptorial claw and in attributing posterolateral spines to AS5 & 6 instead of AS4 & 5. Borradaile's (1907: fig. 3) figure of the lectotype is stylized and erroneous in showing the two distal spines of equal length on the dactylus of the raptorial claws.

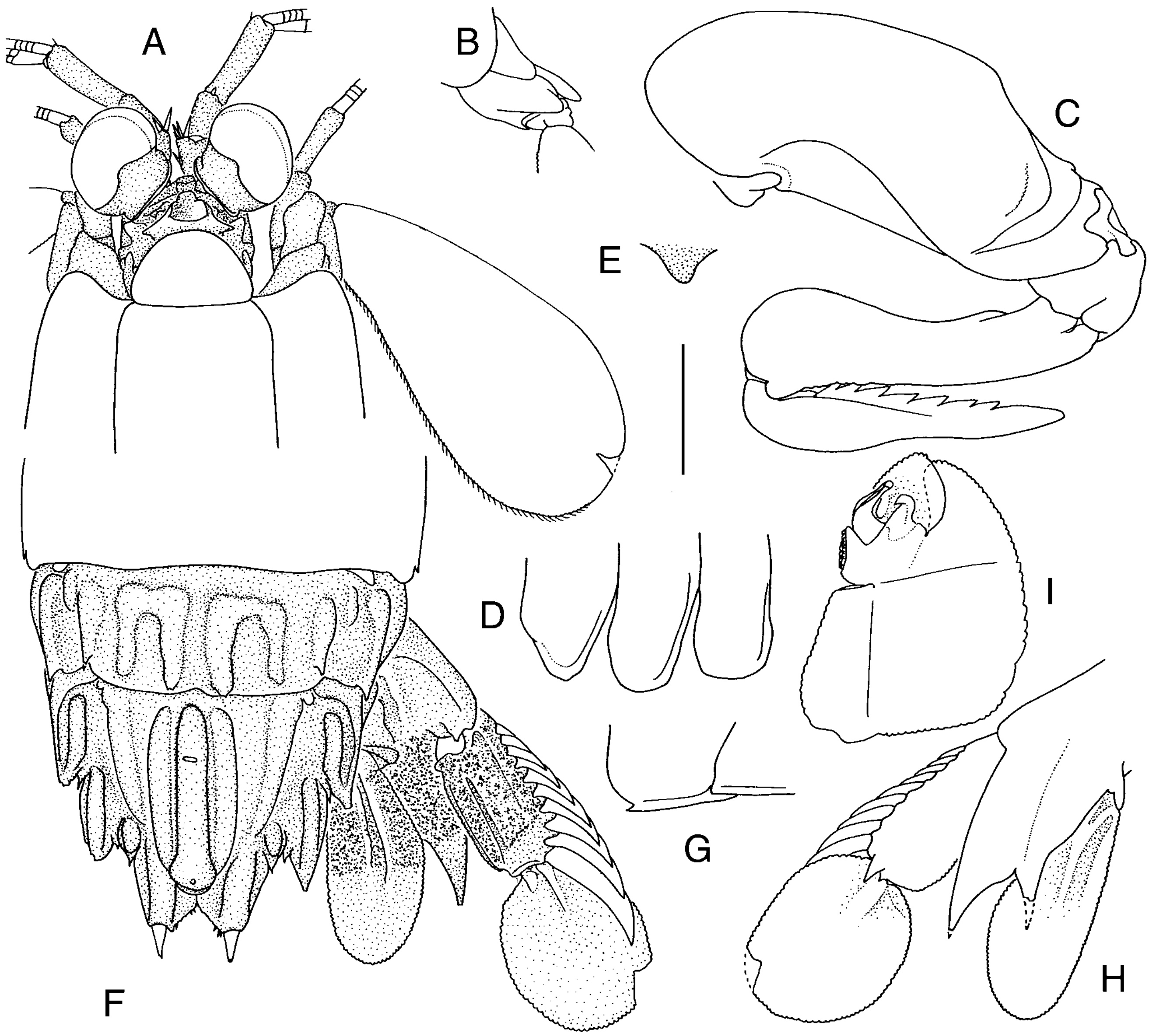

Figure 40. *Odontodactylus latirostris* Borradaile, ♂ TL 77 mm (WAM C7826). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lower lateral. E, TS8 sternal keel, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS4–5, right lower lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–D, F–H = 5 mm; E, I = 2.5 mm.

The present series of *O. latirostris* shows allometric variation in the setation of the anterior margin of the antennal scale (in which the antennal scale is fully setose in the 17 mm TL juvenile female and setose posteriorly only in the largest specimen), the presence of a posterolateral spine on AS4 (absent in the largest specimen) and the relative lengths of the uropodal exopod segments. The distal segment of the uropodal exopod increases in relative length with increasing size, being slightly shorter than the proximal segment in the juvenile female (TL 17 mm), subequal to the proximal segment in the 45 mm TL male, to distinctly longer in the largest specimen. Manning (1967d) noted that the distal segment of the uropodal exopod increases in relative length with increasing size, but in most species of *Odontodactylus*, the distal segment is shorter than the proximal regardless of size.

Odontodactylus southwelli Kemp is a junior synonym of *O. latirostris*. The incomplete setation of the antennal scale in adults, dark proximal segment of the uropodal endopod, unarmed posterolateral margin of AS3 and well-developed telson carinae at a small size (TL 21 mm) reported on and figured by Kemp (1911, 1913: pl. 9, figs. 103–106) for *O. southwelli* agree well with *O. latirostris*. The relatively short distal segment of the uropodal exopod in *O. southwelli* figured by Kemp (1913: pl. 9, fig. 106) is consistent with the small size of the specimen (TL 37 mm).

Habitat. Taken from depths of 20–30 m.

Distribution. Amirante Islands to the Andaman Sea, Indonesia, New Caledonia and now Australia.

Odontodactylus scyllarus (Linnaeus, 1758)

Fig. 41

Cancer Scyllarus Linnaeus, 1758: 633 (type locality: Rinca, Greater Sunda I., Indonesia, by present neotype selection).
Gonodactylus Bleekeri A. Milne-Edwards, 1868: 65, footnote (type locality: Batavia, Indonesia [= Jakarta, 6°10'S 106°48'E]).
Gonodactylus elegans Miers, 1884: 566, 575, pl. 52: fig. b (type localities: Providence I. (9°14'S 51°02'E) and Providence Reef (9°23'S 51°03'E), Seychelles).
Odontodactylus scyllarus.–Kemp, 1913: 4, 11, 134–135.–Holthuis, 1941: 275–276.–Stephenson, 1953a: 46.–Stephenson & McNeill, 1955: 248.–Stephenson, 1962: 35.–Manning, 1967d: 10–15, fig. 3.–Moosa, 1991: 163.–Manning, 1995: 82–85, pl. 13, figs. 35, 37, 38a,b.–Ahyong & Norrington, 1997: 103–104.–Debelius, 1999: 278–279.
Odontodactylus elegans.–Kemp, 1913: 4, 11, 134, 139.

Type material. NEOTYPE: USNM 274325, ♂ (TL 96 mm), Rinca, Greater Sunda I., Indonesia, M. Erdmann, 1993.

Australian material. QUEENSLAND: AM P19920, 1♀ (TL 115 mm), One Tree I., 2.4 m, gutter, hole in coral rubble, B. Russell, 17 Jan 1973; AM P19921, 1♀ (TL 116 mm), One Tree I., 1.2 m, gutter at low tide, on sand and among *Acropora*, B. Russell, 10 Oct 1972; AM P19973, 1♂ (TL 101 mm), One Tree I., NW end of lagoon, 3 Dec 1969; AM P19977, 1♀ (TL 140 mm), One Tree I., 2.4 m, gutter, hole in coral rubble, B. Russell, 11 Jan 1973; AM P56819, 1♀ (TL 103 mm), NNW side Flinders Reef, 26°58'S 153°29'E, coral cave, 10 m, 20 Jan 1978; AM P56786, 1♂ (TL 69 mm), Ashmore Reef, 11°53'S 143°38'E, rubble patch, Jun 1994; AM P57884, 1♀ (TL 70 mm), Arlington Reef, 16°43'S 146°05'E, 10 m, rubble patch, L. Squire, May 1996; NMV J37768, 1♀ (TL 143 mm), Lady Elliot I., front of reef slope, 15 m, under dead coral slab, B. Wilson, 11 Jan 1980; QM W661, 1♂ (TL 75 mm), Townsville, G. Coates; QM W1136, 1♀ (TL 115 mm), Cape Cleveland, G. Coates, 25 Jul 1940; QM W1784, 1♀ (broken, CL 40 mm) Noosaville, W. Wallace, 28 May 1951; QM W9052, 1♂ (TL 163 mm), Flinders Reef, Moreton Bay, 6 m, amongst *Acropora*, J. Barker, 20 Jul 1980; QM W11038, 1♂ (TL 153 mm), off Mooloolaba, the Pinnacles, outer Gneerings, 24 m, under coral ledge, R. Easton, 8 Jan 1984. NEW SOUTH WALES: AM P43218, 1♀ (TL 95 mm), South Solitary I., Coff's Harbour, 30 m, sand, N. Coleman, 27 Sep 1976; AM P56785, 1♀ (TL 133 mm), North Solitary I., 29°55.50'S 153°23.23'E, 21 m, under boulder, I. Takeuchi, 1994. NORTHERN TERRITORY: AM P12117, 1♀ (TL 95 mm), Evans Shoal, Timor Sea, 9°53'S 130°01'E, from fish stomach, G.P. Whitley, 6 Oct 1949. CHRISTMAS ISLAND: WAM C7873, 1♀ (TL 53 mm), 10°30'S 105°35'E.

Diagnosis. Ocular scales oblique to bodyline, appressed medially, margin truncate. A2 scale with entire margin setose, anterior setae shorter. Rostral plate triangular; lateral margins convex; apex deflexed. Raptorial claw dactylus with 2 teeth on inner margin. AS(3)4–5 with posterolateral spine. Telson mid-dorsal surface with distinct MD carina and 3 longitudinal carinae either side of midline (double accessory MD, anterior SM) in addition to carinae of primary teeth. Uropodal exopod proximal distinctly longer than distal segment; outer margin with 10–12 movable spines, apices sharp, evenly tapering.

Colour in life. Overall dorsal colour reddish brown to green, often with diffuse banding and dark lateral spot on each somite. Large males bottle green. Posterior margin of thoracic and abdominal segments orange-red. Carapace with anterolateral and usually posterolateral areas with large dark brown spots outlined in white. A2 scale orange yellow with dark apex; setae red. Ventral surface, dactylus of raptorial claw and pereiopods red. Uropodal protopod pale basally; exopod blue with iridescent blue outline and red marginal setae; endopod dark blue with iridescent blue outline and red marginal setae.

Measurements. Male (n = 6) TL 53–153 mm, female (n = 12) TL 70–143 mm. A1 peduncle length 0.67–0.84 CL. A2 scale length 0.79–0.87 CL. Manning (1967d) reported specimens to 171 mm TL.

Remarks. *Odontodactylus scyllarus* can be recognized by the following combination of characters: the ocular scales are fused, two or three teeth are present on the dactylus of the raptorial claw, AS(3)4–5 are armed posteriorly and there are two accessory median carinae either side of the median carina on the telson. Manning (1967d) reported the presence of 2 or 3 teeth on the inner margin of the dactylus of the raptorial claw in *O. scyllarus*; all specimens examined here bear 2 teeth on the inner margin of the dactylus of the raptorial claw.

The type material of *O. scyllarus* is no longer extant. In view of the increasing number of species of *Odontodactylus* being removed from synonymy (see discussion under account of the genus), that several nominal species are presently included in the synonymy of *O. scyllarus* and the fact that this species is the type of the genus, a neotype is herein selected to fix the identity of the species. The neotype is a 96 mm TL male from Indonesia (USNM 274325).

Habitat. Coral and rocky reefs from the reef flat to the base of rocky or coral reefs where it burrows under coral and boulders to a depth of 30 m.

Distribution. Japan to eastern Africa, New Caledonia and northern Australia south to the Solitary Islands, New South Wales.

PROTOSQUILLIDAE Manning, 1980b

Protosquillidae Manning, 1980b: 366, 369 (type genus *Protosquilla* Brooks, 1886).

Diagnosis. A2 protopod dorsally with fixed, anteriorly directed spine. Ischiomeral articulation of raptorial claw subterminal; propodus with or without movable spine proximally; dactylus of raptorial claw without teeth on inner margin, outer basal margin strongly inflated into blunt heel. AS6 fused with telson. Telson with distinct median boss. Articulation of uropodal exopod segments terminal. Distal spines on outer margin of uropodal exopod slender, straight or slightly curved, not strongly recurved anteriorly.

Included genera. Five: *Chorisquilla* Manning, 1969d; *Echinosquilla* Manning, 1969d; *Haptosquilla* Manning, 1969d; *Protosquilla* Brooks, 1886; and *Siamosquilla* Naiyanetr, 1989.

Remarks. The fusion of AS6 and the telson is unique to the Protosquillidae. Four protosquillid genera occur in the Indo-West Pacific and each is represented in Australia. The type genus, *Protosquilla*, is restricted to the eastern Atlantic.

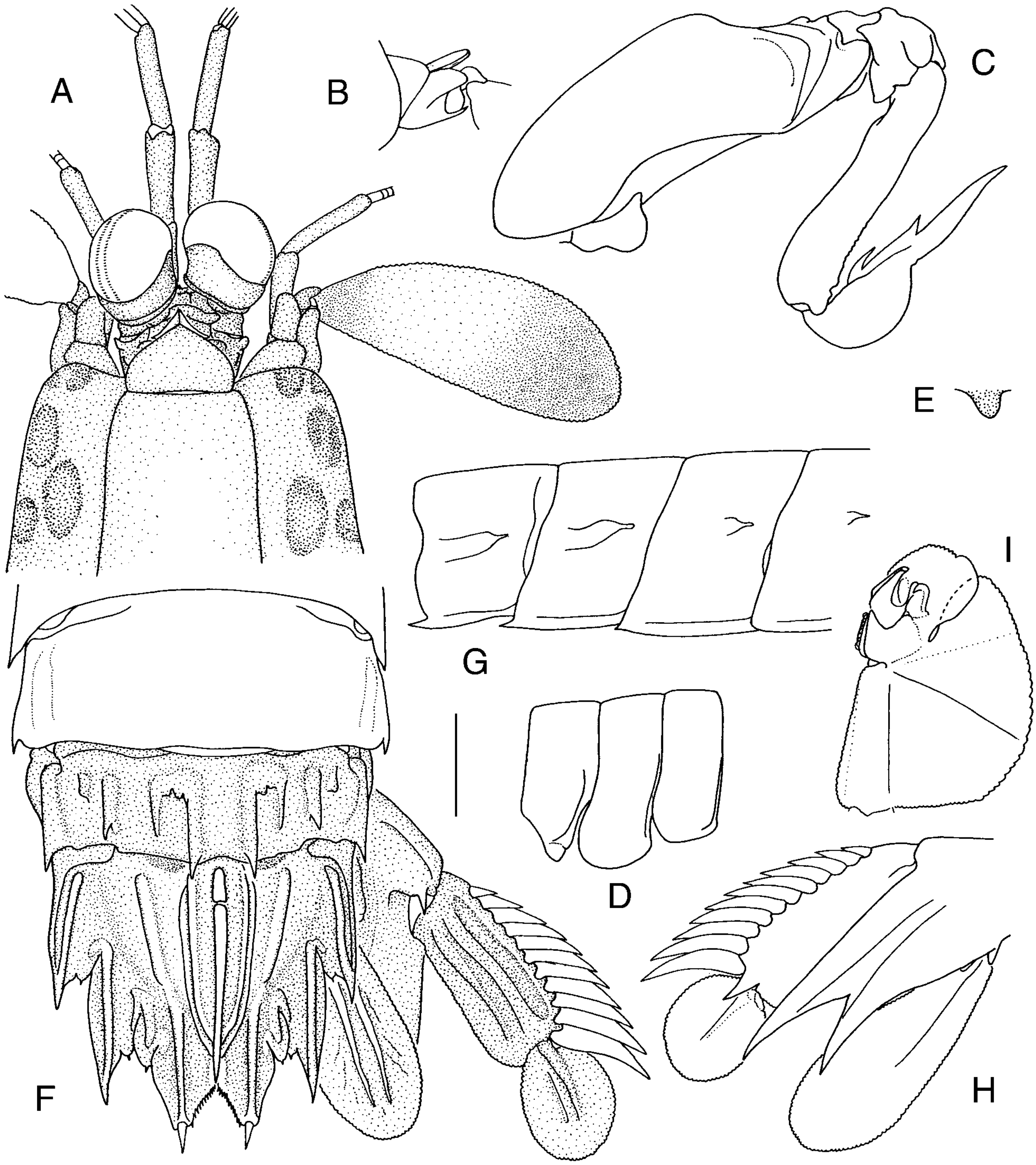

Figure 41. *Odontodactylus scyllarus* (Linnaeus), ♂ TL 68 mm (AM P56786). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, TS8 sternal keel, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS2–5, right lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–D, F–H = 2 mm; E, I = 1 mm.

Key to genera of the Protosquillidae

1 Dorsal groove indicating demarcation of AS6 from telson absent. Telson posterior margin undivided; SM teeth separated by shallow concave or biconvex margin, not by deep emargination or narrow fissure .... ***Siamosquilla***

—— Dorsal groove indicating demarcation of AS6 from telson present. Telson posterior margin divided by narrow fissure or deep emargination 2

2 AS1 without articulated pleural plate anterolaterally .... *Protosquilla*

—— AS1 with articulated pleural plate anterolaterally 3

3 Telson with long dorsal spines, each with soft apex. Uropodal endopod with erect dorsal spines .... ***Echinosquilla***

—— Telson dorsal surface with or without spines. Uropodal endopod without dorsal spines.. 4

4 Cornea flattened. Posterior margin of telson divided into two halves by V- or U-shaped median emargination .... ***Chorisquilla***

—— Cornea cylindrical. Posterior margin of telson divided into two halves by narrow median fissure, with either side appressed .... ***Haptosquilla***

Chorisquilla Manning, 1969d

Chorisquilla Manning, 1969d: 157. Type species *Gonodactylus excavatus* Miers, 1880, by original designation. Gender feminine.

Diagnosis. Cornea flattened dorsally, broadened laterally. Rostral plate trispinous. Mandibular palp 2-segmented. MXP1–5 with epipod. AS1 with small, articulated, pleural plate anterolaterally. AS6 fused with telson but usually demarcated by dorsal groove. Telson posterior margin divided by deep V- or U-shaped median emargination. Uropodal endopod without dorsal spines.

Included species. Thirteen: *C. andamanica* Manning, 1975b; *C. brooksii* (de Man, 1888a); *C. convoluta* n.sp.; *C. excavata* (Miers, 1880); *C. gyrosa* (Odhner, 1923); *C. hystrix* (Nobili, 1899); *C. mehtae* Erdmann & Manning, 1998; *C. pococki* Manning, 1975b; *C. quinquelobata* (Gordon, 1935); *C. spinosissima* (Pfeffer, 1888); *C. trigibbosa* (Hansen, 1926); *C. tweediei* (Serène, 1950); and *C. tuberculata* (Borradaile, 1907).

Remarks. *Chorisquilla* differs from other protosquillid genera by the combination of a broadened cornea, the presence of an articulated pleural plate on AS1 and the presence of a deep, V- or U-shaped posterior median fissure on the telson. *Protosquilla* is most similar to *Chorisquilla* in eye and telson morphology, but differs in lacking the articulated pleural plate on AS1.

Manning (1969d, 1995) regarded *C. tweediei* as a synonym of *C. trigibbosa*, and *C. hystrix* as a synonym of *C. spinosissima*. *Chorisquilla hystrix* and *C. tweediei* are removed from the synonymies of *C. spinosissima* and *C. trigibbosa* respectively. Similarly, *Chorisquilla andamanica* and *C. pococki*, which were synonymized with *C. excavata* by Moosa (1986), are both removed the synonymy. Six species of *Chorisquilla* are known from Australian waters of which one is described as new.

Key to species of *Chorisquilla*

1 Telson with 2 pairs of primary teeth in adults 4

—— Telson with 3 pairs of primary teeth in adults; outermost primary tooth on telson (LT) indicated by short notch 2

2 Telson with 6–10 spines on lateral margin .... *C. mehtae*

—— Telson without spines on lateral margin 3

3 Telson dorsal surface densely setose; SM boss without small, rounded boss proximally.. ***C. tweediei***

—— Telson dorsal surface with sparsely distributed, low spinules; SM boss with small, rounded boss proximally .... *C. trigibbosa*

4 Telson dorsal surface including bosses covered with numerous spines or spinules 5

—— Telson dorsal surface without numerous spines and spinules, but with unarmed longitudinal bosses or ridges 7

5 Telson with short, broad dorsal teeth; lateral margin with 4–6 spines .... ***C. brooksii***

—— Telson and AS6 densely covered with long slender spines on dorsal surface; lateral margin with 7–12 slender spines in adults 6

6 AS5 with mid-dorsal surface smooth, or at most with short, shallow, transverse grooves along posterior margin. Dorsum with uniform or slightly mottled colour pattern .... ***C. spinosissima***

—— AS5 mid-dorsal surface with posterior ½ to ⅓ bearing distinct longitudinal carinae intervened by broad, deep excavations. Dorsum with irregularly banded colour pattern .... ***C. hystrix***

7 Telson dorsal surface with numerous, closely set carinae extending to posterior margin .... *C. gyrosa*

—— Telson dorsal surface with 3 or 5 broad longitudinal bosses 8

8 Telson with SM bosses each extending beyond base of SM teeth .... ***C. quinquelobata***

—— Telson with SM bosses not extending to base of SM teeth 9

9 SM bosses of telson not extending posteriorly beyond apex of median excavation in posterior margin. Surface of all three bosses tuberculate .... *C. tuberculata*

—— SM bosses of telson extending posteriorly beyond apex of median excavation in posterior margin. Surface of all three bosses smooth 10

10 AS6 with posterolateral spine 11

—— AS6 without posterolateral spine .... *C. andamanica*

11 MD and SM bosses of telson with smooth regular margins .... *C. excavata*

—— MD and SM bosses of telson with strongly irregular, eroded or convoluted margins 12

12 MD and SM bosses of telson with convoluted, deeply incised margins; with 2 or 3 carinae lateral to SM bosses, with inner-most carina appressed to margin of boss .... ***C. convoluta***

—— MD and SM bosses of telson with strongly irregular, eroded margins; with 1 carina lateral to SM boss, separated from SM boss by deep, broad, groove .... *C. pococki*

Chorisquilla brooksii **(de Man, 1888a)**

Fig. 42

Protosquilla Brooksii de Man, 1888a, in de Man, 1887–1888: 579, pl. 22a, fig. 8 (type locality: Edam I., Jakarta Bay, Indonesia, 5°58'S 106°50'E).
Gonodactylus brooksi.–Kemp, 1913: 4, 11, 149, 189–190.
Gonodactylus brooksii.–Holthuis, 1941: 290–292.
Chorisquilla brooksii.–Manning, 1969d: 159.–Moosa, 1974: 3.–Sun & Yang, 1998: 145–146, 152, fig. 2.–Manning, 1995: 94–97, pl. 16, figs. 9n, 43a, 44–47.

Type material. LECTOTYPE: ZMG 966, ♂ (TL 28 mm), Edam I., Jakarta Bay, Indonesia. PARALECTOTYPE: ZMG 966, ♀ (TL 24 mm), type locality.

Australian material. WESTERN AUSTRALIA: NTM Cr009121, 1♂ (TL 20 mm), Cartier Reef, 12°31.7'S 123°33.5'E, 2.5–6 m, reef flat, R. Hanley *et al*., 5 May 1992.

Diagnosis. Raptorial claw propodus with movable spine proximally. AS1–3 posterolaterally unarmed. AS4 posterolaterally subacute. AS5 with posterolateral spine. AS5 smooth proximomedially, distomedially with deep, elongate, longitudinal pits; laterally corrugated; posterior margin unarmed. AS6 with blunt dorsal spines in addition to distinct, posteriorly armed, SM, IM and LT bosses. Telson with 2 pairs of primary teeth; dorsal surface with smooth, pyriform MD and SM bosses, each with short spines around margin. SM bosses longer than MD boss, extending beyond midlength but not to posterior margin; with 5–7 spiniform SM denticles either side of midline and 2 spiniform IM denticles; lateral margins with 4 or 5 short spines, subequal in size; ventral surface without postanal carina. Uropodal protopod with short dorsal spine proximally and with dorsal spine above proximal exopod articulation; exopod proximal segment outer margin with 9 or 10 movable spines.

Colour in alcohol. Carapace with anterior margin, median area and junction of gastric and cervical grooves with dark brown chromatophores. Thoracic somites with median posterior margin and abdominal somites with entire posterior margin with dark brown chromatophores. Telson with sparsely scattered chromatophores.

Measurements. Male (n = 2) TL 20–28 mm, female (n = 1) TL 24 mm. A1 peduncle 0.69–0.76 CL. A2 scale 0.47–0.50 CL. Uropodal endopod length 3.25–3.83 breadth. Manning (1995) reported *C. brooksii* to 32 mm TL.

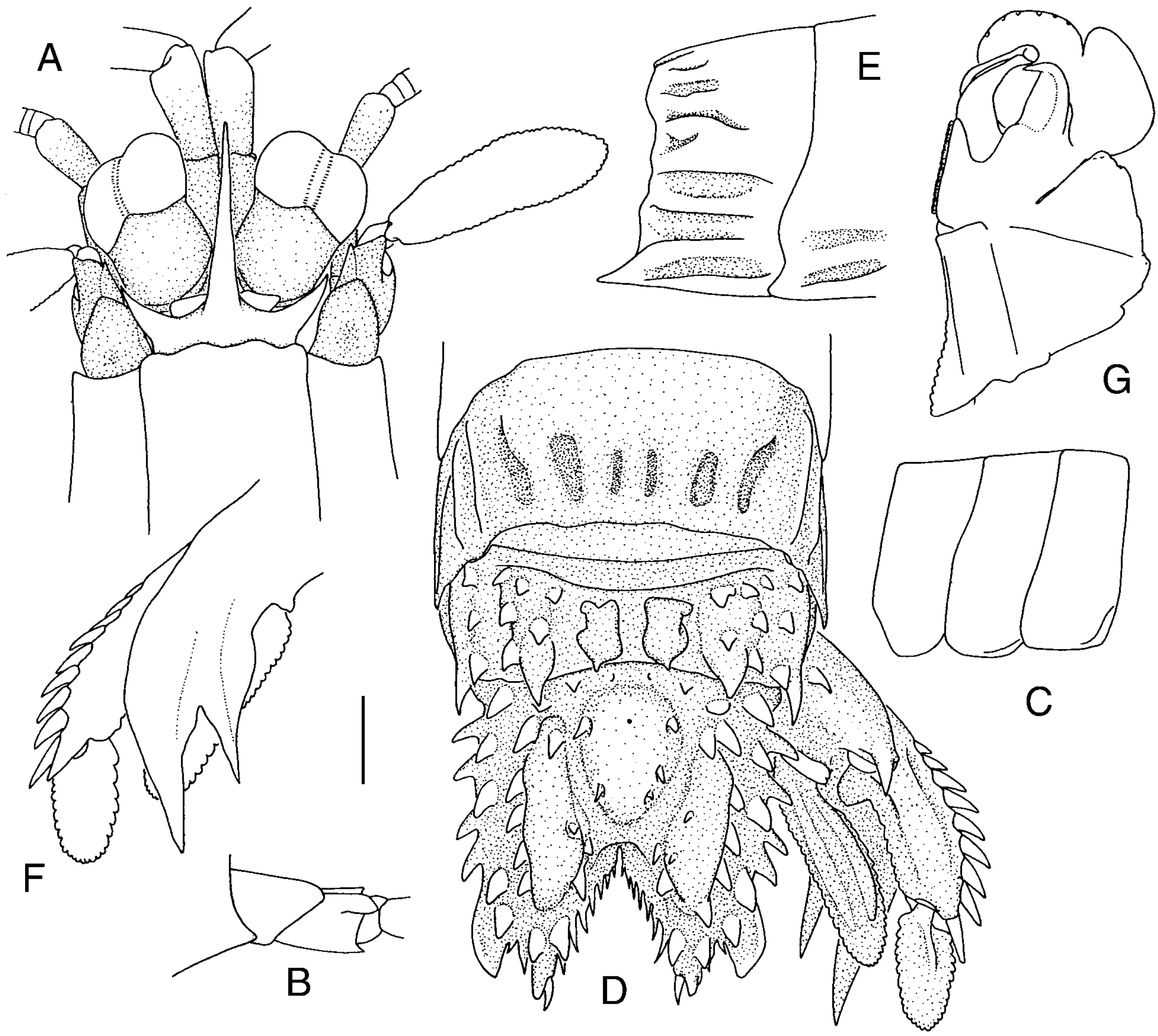

Figure 42. *Chorisquilla brooksii* (de Man), ♂ TL 20 mm (NTM Cr009121).A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, TS6–8, right lateral. D, AS5–6, telson & uropod, dorsal. E, AS4–5, right lateral. F, uropod, right ventral. G, PLP1 endopod, right anterior. Scale = 1 mm.

Remarks. The Australian specimen agrees well with the type material and published accounts (e.g., de Man, 1888a; Kemp, 1913). The male syntype of *C. brooksii* is here selected as the lectotype to fix the identity of the species. In each specimen, including the sexually mature lectotype, sharp, dorsal tubercles or spinules are present on AS6. Manning's (1995) diagnosis of *C. brooksii* is erroneous in suggesting that adults lack such ornamentation.

A trait that could prove to have some phylogenetic significance in the Protosquillidae is the presence of a dorsal spine on the proximal margin of the uropodal protopod. This spine is present in four species of *Chorisquilla* (*C. brooksii, C. hystrix, C. mehtae, C. spinosissima*) as well as *Echinosquilla guerini* and both species of the eastern Atlantic genus *Protosquilla*.

Kemp's (1913) record of *C. brooksii* at 39.5 mm TL is based on Japanese material reported by Fukuda (1910). Fukuda's (1910) Japanese records (re-reported by Komai (1927) as *C. spinosissima*) are based on an undescribed species of *Chorisquilla* presently under study.

Habitat. Coral reef flats amongst rubble.

Distribution. The South China Sea, Vietnam, Indonesia, and for the first time from northwestern Australia.

Chorisquilla convoluta n.sp.

Fig. 43

Type material. (All Western Australia) HOLOTYPE: WAM C7828, ♀ (TL 29 mm), 3.2 km SW of Peek I., *Honolulu* dredge, 18.3 m, B. Wilson, 18 Jun 1960. PARATYPES: NMV J37798, 1♀ (TL 29 mm), Northwest Shelf, between Port Hedland & Dampier, 19°24'S 116°51'E, 108 m, silty sand trawl, G. Poore & H. Lew Ton, 7 Jun 1983; NTM Cr005206, 1♀ (TL 25 mm), Northwest Shelf, 40–46 m, from coralline rocks, B. Russell, 17 Apr 1985; NTM Cr009128, 2♀♀ (TL 20–23 mm), Cartier Reef, 12°32.9'S 123°32.9'E, 4–15 m, from wreck of *Anne Millicent*, R. Kelly *et al*., 6 May 1992.

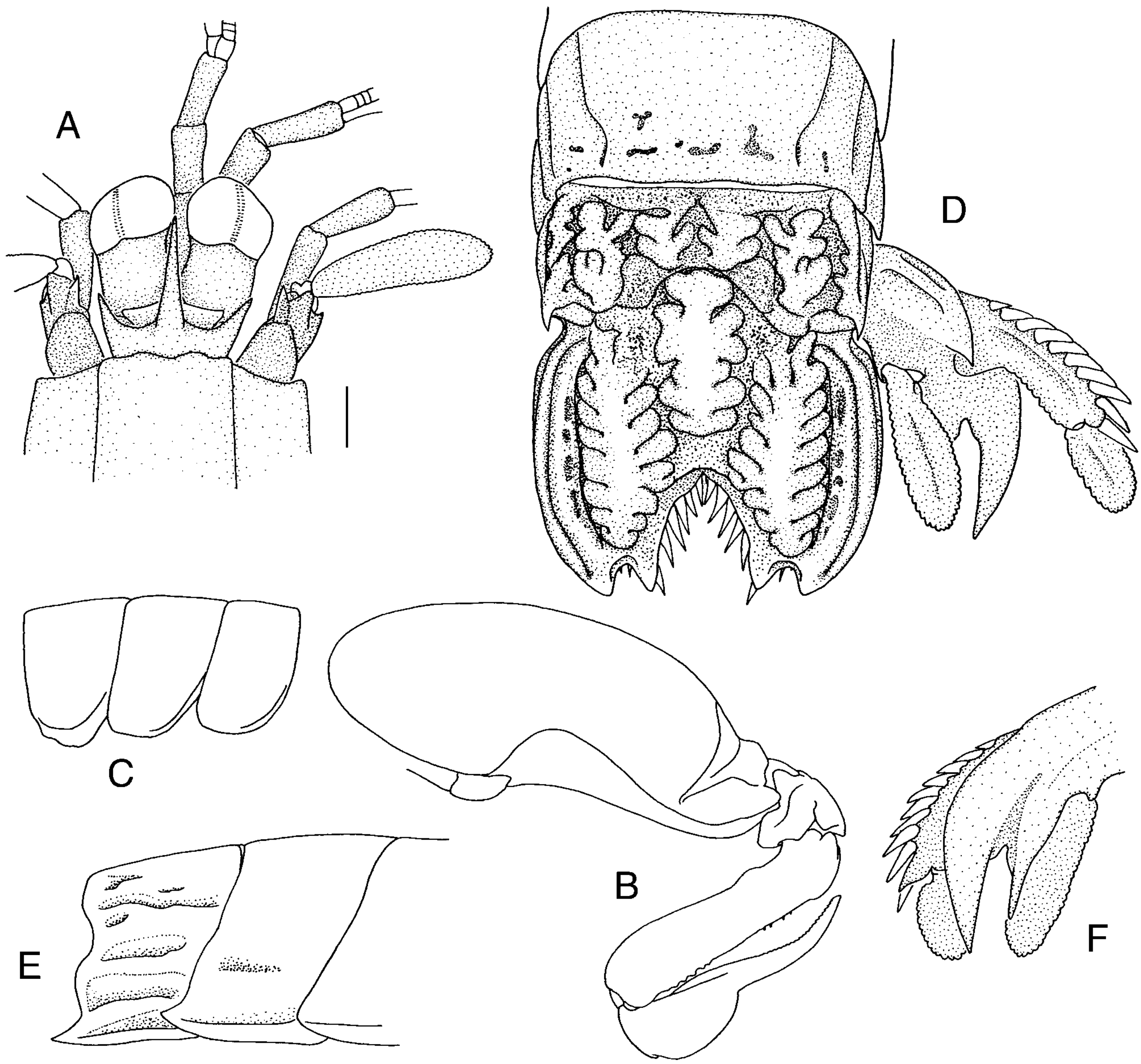

Figure 43. *Chorisquilla convoluta* n.sp., holotype ♀ TL 29 mm (WAM 16–61). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8, right lateral. D, AS5–6, telson & uropod, dorsal. E, AS3–5, right lateral. F, uropod, right ventral. Scale = 1 mm.

Australian material. WESTERN AUSTRALIA: NTM Cr012389, 1 broken specimen (telson only, estimated TL 20 mm), Northwest Shelf, 19°05.0'S 118°57.8–57.2'E, 82–83 m, benthic sled, S0283 B10, 24 Apr 1983.

Diagnosis. Raptorial claw propodus with movable spine proximally. AS4–5 with posterolateral spine. AS5 smooth proximomedially, distomedially with deep, irregular pits in adults; laterally corrugated; posterior margin unarmed. AS6 with SM, IM and LT bosses, strongly fissured and convoluted around margins, smooth dorsally; with posterolateral spine. Telson with 2 pairs of primary teeth; dorsal surface with SM bosses longer than MD boss, irregular in outline, extending posteriorly almost to base of IM denticles; dorsal surface of bosses smooth, fissured and convoluted around margins; with 2 or 3 smooth carinae lateral to SM bosses, inner-most often with several elongate pits; ventral surface without postanal carina. Uropodal protopod unarmed dorsally excepting spine above proximal exopod articulation.

Description. Eye extending beyond A1 peduncle segment 1. A1 peduncle 0.77–0.85 CL. A2 scale 0.47–0.50 CL. Rostral plate with median spine extending anteriorly to level of, but not anteriorly beyond cornea. Carapace with anterior margin of lateral plates concave. Raptorial claw dactylus with indistinct basal notch; propodus with 1 movable spine proximally. Mandibular palp 2-segmented. AS4–5 with posterolateral spine. AS5 smooth proximomedially, distomedially with distinct, irregular pits; laterally corrugated; posterior margin unarmed. AS6 with SM, IM and LT bosses, fissured and convoluted around margins, smooth dorsally; with posterolateral spine. Telson length and breadth subequal, with 2 pairs of primary teeth (SM, IM); with 5–10 spiniform SM denticles; with 2 spiniform IM denticles. Dorsal surface with MD and SM bosses; with 2 or 3 smooth carinae lateral to SM bosses, inner-most with several elongate pits in largest specimens. MD and SM bosses elongate, dorsally smooth, margins deeply fissured and convoluted; SM longer than MD, extending posteriorly almost to base of IM denticles. Telson ventral surface without postanal carina. Uropodal protopod without lobes between terminal spines; protopod unarmed dorsally excepting spine above proximal exopod articulation. Uropodal exopod proximal segment outer margin with 10 or 11 movable spines, distalmost exceeding midlength of distal segment. Endopod with dorsal carina laterally; without ventral carinae; length 3.12–3.87 breadth.

Colour in alcohol. Almost completely faded. A1 flagellae uniformly red. Raptorial claw dactylus pink proximally.

Etymology. Named *convoluta* for the deeply incised, convoluted margins of the dorsal bosses of AS6 and the telson.

Measurements. Female (n = 5) TL 20–29 mm. A1 peduncle 0.77–0.85 CL. Other measurements of holotype: CL 6.2 mm, A1 peduncle 0.79 CL, A2 scale 0.48 CL.

Remarks. Moosa (1986) synonymized *C. andamanica* and *C. pococki* with *C. excavata* based on size related changes in telson morphology displayed by a series from the Philippines. Hence, Moosa (1986) postulated that the median and submedian bosses of the telson are strongly eroded and irregular in the smallest specimens, becoming smoother with increasing size, coupled with a change in the curvature of the telson margins and a reduction in the number of submedian denticles. For Moosa (1986) then, each of the species of the "*C. excavata* complex" represented different developmental stages of *C. excavata*. Although the lateral curvature of the telson margins and number of submedian denticles are size related in *Chorisquilla*, I consider *C. andamanica, C. pococki*, and *C. excavata* to each be distinct species. As already shown by Manning (1975b), *C. andamanica* from the Andaman Sea differs from *C. pococki* and *C. excavata* in lacking the posterolateral spine on AS6, in addition to more subtle differences in telson ornamentation. The large size range of the type series of *C. andamanica* (TL 13–26 mm) shows that the absence of the posterolateral spine on AS6 is not size related. Conversely, all specimens referred to *C. excavata* or *C. pococki* by Manning (1975b) and Moosa (1986) bear the posterolateral spine on AS6.

Manning (1975b) distinguished *C. pococki* from *C. excavata* by the irregular, strongly eroded instead of smooth margins of the median and submedian bosses of the telson, and distally bicarinate instead of singular carina lateral to the submedian bosses, characters that were consistent across a wide size range. The single specimen of *C. excavata* available to Manning (1975b) was the holotype (TL 18 mm). An additional specimen of *C. excavata* from French Polynesia (TL 13 mm) in the collections of the AM agrees well with the figures and account of the holotype (Manning, 1975b: fig. 1a, c): the median and submedian bosses are smooth with even margins, and a single, inflated carina lateral to the submedian bosses is present. Thus, the distinguishing characters of *C. excavata* sensu stricto are uniform morphologically across a wide size range. At 13 mm TL, the specimen of *C. excavata* appears to sexually mature because the penes and the modified endopod of pleopod 1 are fully developed. Similarly, the size range of the type series of *C. pococki* (TL 12–34 mm) suggests that the differences between it and *C. excavata* in dorsal telson ornamentation are not simply size related as suggested by Moosa (1986). Moreover, additional specimens referable to *C. pococki* (TL 10.5–31 mm) from the Ogasawara Islands, Japan, show similar morphological changes in the margins of the dorsal bosses to those reported by Moosa (1986). The margins of the telson bosses are most strongly irregular and eroded in the smallest specimens of *C. pococki*. With increasing size, the margins of the telson bosses become less irregular than the smaller specimens, but are still distinctly eroded in the largest specimens. Additionally, the lateral and marginal carinae are distinct in the smallest specimens becoming fused in the largest specimens. Moosa's (1986) *C. excavata* is referable to *C. pococki*. Thus, both *C. andamanica* and *C. pococki* are distinct from *C. excavata* and Manning's (1975b) contention that Odhner's (1923) *C. excavata* from the Ogasawara (= Bonin) Islands is based on *C. pococki* is corroborated by the present study.

Chorisquilla convoluta most closely resembles *C. pococki* in bearing posterolateral spines on AS6 and irregular telson bosses but differs in the following ways: the dorsal bosses of AS6 and the telson, instead of being strongly eroded, bear deeply convoluted and fissured margins resembling those of *Haptosquilla glyptocercus*; there are two or three carinae lateral to the submedian bosses extending the full length of the telson instead of a single marginal carina and a short distal carina originating from the apices of the intermediate teeth; the distomedial surface of AS5, instead of being entirely smooth, bears a series of deep pits. Additionally, the inner most carina lateral to the submedian telson boss is appressed to the margin of the boss in contrast to other species of the "*C. excavata* complex" in which the carina is separated from the SM boss by a deep, broad groove.

The known distribution of the species of the "*C. excavata* species complex" is as follows: *C. andamanica* is known only from the Andaman Sea, Indian Ocean; *C. pococki* is known from the Ogasawara Islands, Japan, the South China Sea including the Philippines, south to Indonesia; *C. excavata* is presently known with certainty only from French Polynesia; and *C. convoluta* is known only from the Northwest Shelf, Western Australia. Although the type locality of *C. excavata* is unknown, the fact that the only other record of its occurrence is from French Polynesia, suggests that the holotype was collected from a central Pacific locality visited by the HMS *Herald*, probably Fiji.

Habitat. Shallow coral reef habitats amongst rubble to a depth of 108 m on silty sand.

Distribution. Known only from northwestern Australia.

Chorisquilla hystrix (Nobili, 1899)

Fig. 44

Protosquilla hystrix Nobili, 1899: 276 (type locality: Wongat I., Madang, Papua New Guinea, by present neotype selection); 1906: 327.

Gonodactylus spinosissimus.–Hansen, 1926: 38.–Holthuis, 1941: 291–293, fig. 9c (not *Gonodactylus spinosissimus* Pfeffer, 1888).

Protosquilla spinosissima.–McNeill, 1968: 89–90 [not *Protosquilla spinosissima* (Pfeffer, 1888)].

Chorisquilla spinosissima.–Moosa, 1991: 164.–Manning, 1995: 97–98, fig. 48.–Debelius, 1999: 284 [not *Chorisquilla spinosissima* (Pfeffer, 1888)].

Mesacturoides spinosocarinatus.–Gosliner *et al*., 1996: 197 [not *M. spinosocarinatus* (Fukuda)].

Type material. NEOTYPE: AM P58557, ♂ (TL 19 mm), Wongat I., Madang, Papua New Guinea, P. Hutchings, 29 Jun 1987.

Australian material. QUEENSLAND: AM P58564, 1♀ (TL 22 mm), Lizard I., 14°40'S 145°28'E, stn 22–1, P. Hutchings, 1976; AM P58565, 1♂ (TL 12 mm), 1♀ (TL 17 mm), Lizard I., 14°40'S 145°28'E, stn 2–3, P. Hutchings, 9 Nov 1976; AM P58566, 1♀ (TL 12 mm), Lizard I., 14°40'S 145°28'E, stn 24–2, P. Hutchings, 1976; NMV J37793, 1♂ (TL 18 mm), 600 m NE of Palfrey I., Lizard I., 14°40'S 145°27'E, 3 m, patch reef, R. Wilson & G. Poore, 9 Dec 1987; USNM 307239, 7♂♂ (TL 12–23 mm), 3♀♀ (TL 14–24 mm), North Point, Lizard I., JDT LIZ-13, 21 m, rubble sample from vertical cliffs, J. Thomas, 28 Jan 1989; USNM, 1♂ (TL 26 mm), 1♀ (TL 23 mm), Lizard I., N. Marshall 1992; USNM, 1♂ (TL 18 mm), 1♀ (TL 17 mm), Lizard I., N. Marshall, 7 Apr 1994. WESTERN AUSTRALIA: NTM Cr009145, 1♂ (TL 10 mm), 2♀♀ (16–23 mm), N side Cartier Reef, 12°31.4'S 123°33.3'E, 14 m, outer reef, rotenone, B. Russell & J. Hooper, 6 May 1992.

Other material. NTM, 1♀ (TL 24 mm), Chesterfield Reef, Coral Sea, New Caledonia, 19°21'S 158°58'E, 60 m, coral rubble & sand, dredge, RH-88–57, R. Hanley, 23 Jul 1988; NTM, 1♀ (TL 24 mm), Chesterfield Reef, Coral Sea, New Caledonia, 19°06'S 150°26–53'E, 32–60 m, dredge, RH-88–65, R. Hanley, 27 Jul 1988; USNM 265072, 1♀ (TL 26 mm), Vietnam, R. Serène, 12 Oct 1954; USNM 265080, 1♀ (TL 26 mm), Vietnam, R. Serène, 12 Oct 1954.

Diagnosis. Raptorial claw propodus with movable spine proximally. AS(4)5 with posterolateral spine. AS4 smooth medially; laterally corrugated. AS5 laterally carinate and corrugated; smooth proximomedially, distomedially with 4–6 carinae intervened by broad, deep cavities; posterior margin unarmed. AS6 anterior margin with row of short, slender, posteriorly directed spines; dorsally ornamented with numerous long spines. Telson with 2 pairs of primary teeth, apices spiniform; dorsal surface entirely covered with long spines, obscuring MD and SM bosses; MD boss circular to ovate, SM bosses extending posteriorly beyond apex of median excavation; lateral margin with 7–10 slender spines in specimens > TL 10 mm; ventral surface with low, short, postanal carina; with 9–13 (usually 11 or 12) spiniform SM denticles, increasing in length distally and 2 spiniform IM denticles. Uropodal protopod dorsally with slender proximal spine and shorter spine above proximal exopod articulation. Uropodal exopod proximal segment outer margin with 9–11 movable spines.

Colour in alcohol. Body marked with irregular, mottled, brown transverse bands.

Measurements. Male ($n = 13$) TL 10–26 mm, female ($n = 13$) TL 12–26 mm. A1 peduncle 0.79–0.94 CL. A2 scale 0.42–0.53 CL. Uropodal endopod length 3.18–4.80 breadth. The present series includes the largest known specimens of *C. hystrix*.

Remarks. *Chorisquilla hystrix* and *C. spinosissima* have always been considered to be similar according to published accounts (e.g., Nobili, 1906; Kemp, 1913; Holthuis, 1941) and were synonymized by Manning (1995). The holotype of *Chorisquilla hystrix* was described as having 15 carinae present laterally and mid-dorsally on AS5 (Nobili, 1899, 1906). On the basis that specimens from Vietnam believed to be *C. spinosissima* bore a similar number of carinae to *C. hystrix*, Manning (1995) synonymized the two species. Results of the present study, however, suggest that both *C. hystrix* and *C. spinosissima*, are distinct and that Manning (1995) was dealing with *C. hystrix* instead of *C. spinosissima*. As remarked under the account of *C. spinosissima*, that species lacks mid-dorsal carinae on AS5, lacks a posterolateral spine on AS4 and bears a uniform colour pattern whereas *C. hystrix* bears mid-dorsal carinae on AS5, usually bears a posterolateral spine on AS4 and bears a transversely banded colour pattern. The holotype of *C. hystrix* is no longer extant (Manning, 1995) and therefore a specimen from Madang, Papua New Guinea, is herein selected as the neotype to stabilize the taxonomy. Previous records of *C. spinosissima* from Indonesia, Great Barrier Reef, New Caledonia, Japan and Vietnam must now be referred to *C. hystrix*. The single record of *C. hystrix* from French Polynesia is based on a mislabelled figure of an Australian specimen in Gosliner *et al*. (1996) (as *Mesacturoides spinosocarinatus*). Aside from the single record from the South China Sea (Sun & Yang, 1998), other records of *C. spinosissima* are from the Indian Ocean.

Characters distinguishing *C. hystrix* and *C. spinosissima* from other congeners are outlined under the account of the latter. Developmental changes in telson spination in *C. hystrix* are similar to that of *C. spinosissima* and are also outlined under the account of the latter.

Chorisquilla hystrix and *C. spinosissima* are recognizable by the numerous long, slender spines adorning the margins and entire surface of AS6 and the telson. *Chorisquilla spinosissima* appears to be closely related to *C. brooksii* and *C. mehtae*, each of which bear a proximal dorsal spine on the uropodal protopod.

Habitat. Rock or coral crevices on coral reefs, from the reef flat, reef slope, and vertical drop-offs down to approximately 20 m depth. One specimen (NMV J37793) was collected with *Gonodactylaceus falcatus* and *C. tweediei*. Moosa (1991) reported *C. hystrix* (as *C. spinosissima*) from as deep as 65 m.

Distribution. Western Australia, Indian Ocean, and the Western Pacific Ocean from Australia, Papua New Guinea, eastern Indonesia and New Caledonia.

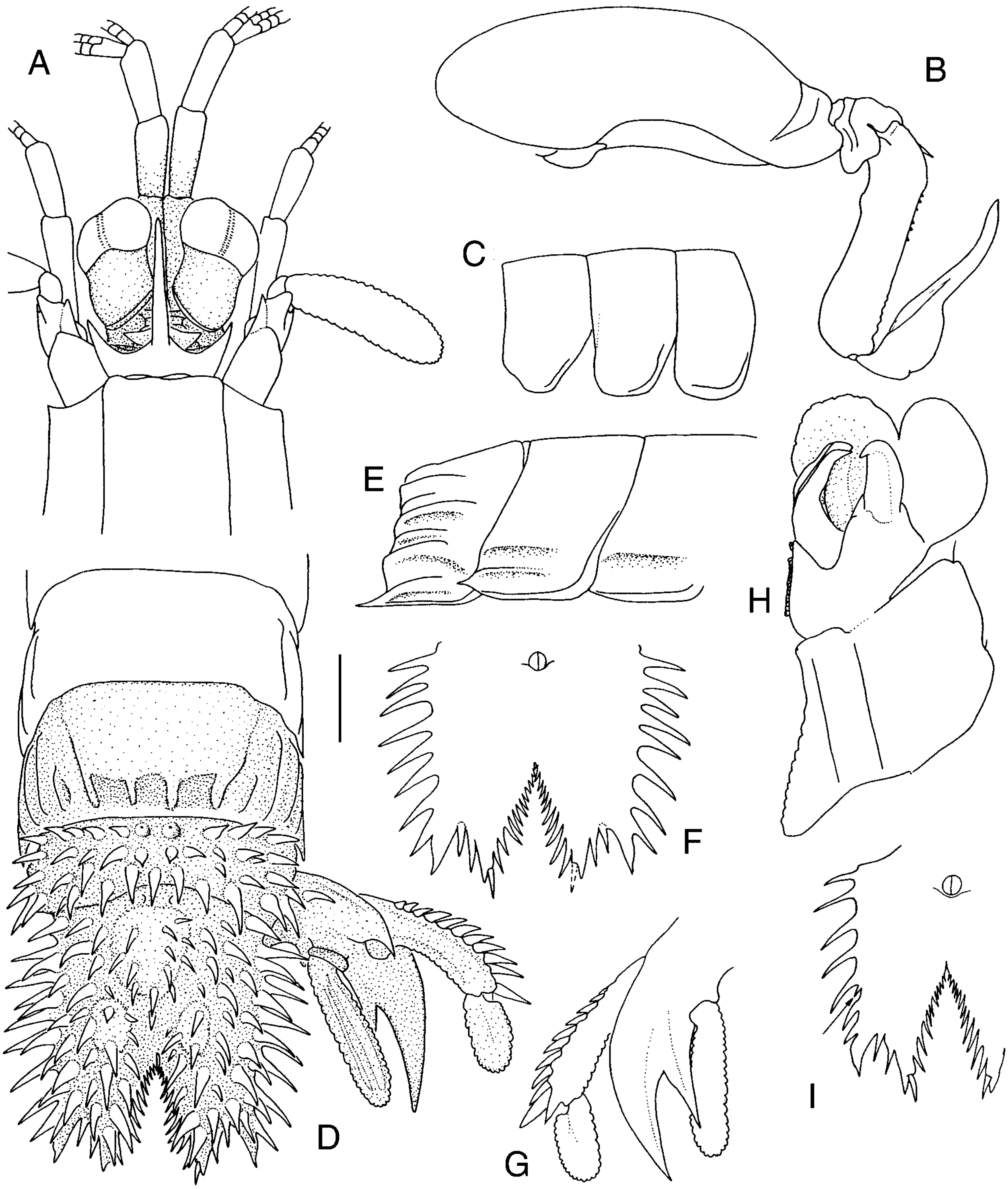

Figure 44. *Chorisquilla hystrix* (Nobili). A–H, ♂ TL 23 mm (USNM 307239). I, ♀ TL 16 mm (NTM Cr009145). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8, right lateral. D, AS4–6, telson & uropod, dorsal. E, AS3–5, right lateral. F, telson, ventral. G, uropod, right ventral. H, PLP1 endopod, right anterior. I, telson, ventral. Scale A–G, I = 0.75 mm; H = 0.25 mm.

Chorisquilla quinquelobata (Gordon, 1935)

Fig. 45

Gonodactylus quinquelobatus Gordon, 1935: 635–637, fig. 3 (type locality: Flying Fish Cove, Christmas I., Indian Ocean).
Chorisquilla quinquelobata.–Manning, 1969d: 159; 1995: 20, 94.

Type material. HOLOTYPE: NHM 1935.8.10.1, ♀ (TL 18 mm), Flying Fish Cove, Christmas I., Indian Ocean, in pilings of pier, Prof. Harms. PARATYPES: NHM 1935.8.10.2–4, 2♂♂ (TL 16–19 mm), 1♀ (TL 17 mm), type locality.

Diagnosis. Raptorial claw propodus with movable spine proximally. Telson with 2 pairs of primary teeth; dorsal surface with 5 broad longitudinal bosses; surface of all five bosses smooth, without setae, tubercles or spines; SM bosses extending beyond base of SM teeth.

Description. Eye extending beyond midlength of A1 peduncle segment 2. A1 peduncle 0.74–0.76 CL. A2 scale 0.45–0.46 CL. Rostral plate with median spine not extending anteriorly beyond base of cornea. Carapace with anterior margin of lateral plates concave. Raptorial claw dactylus

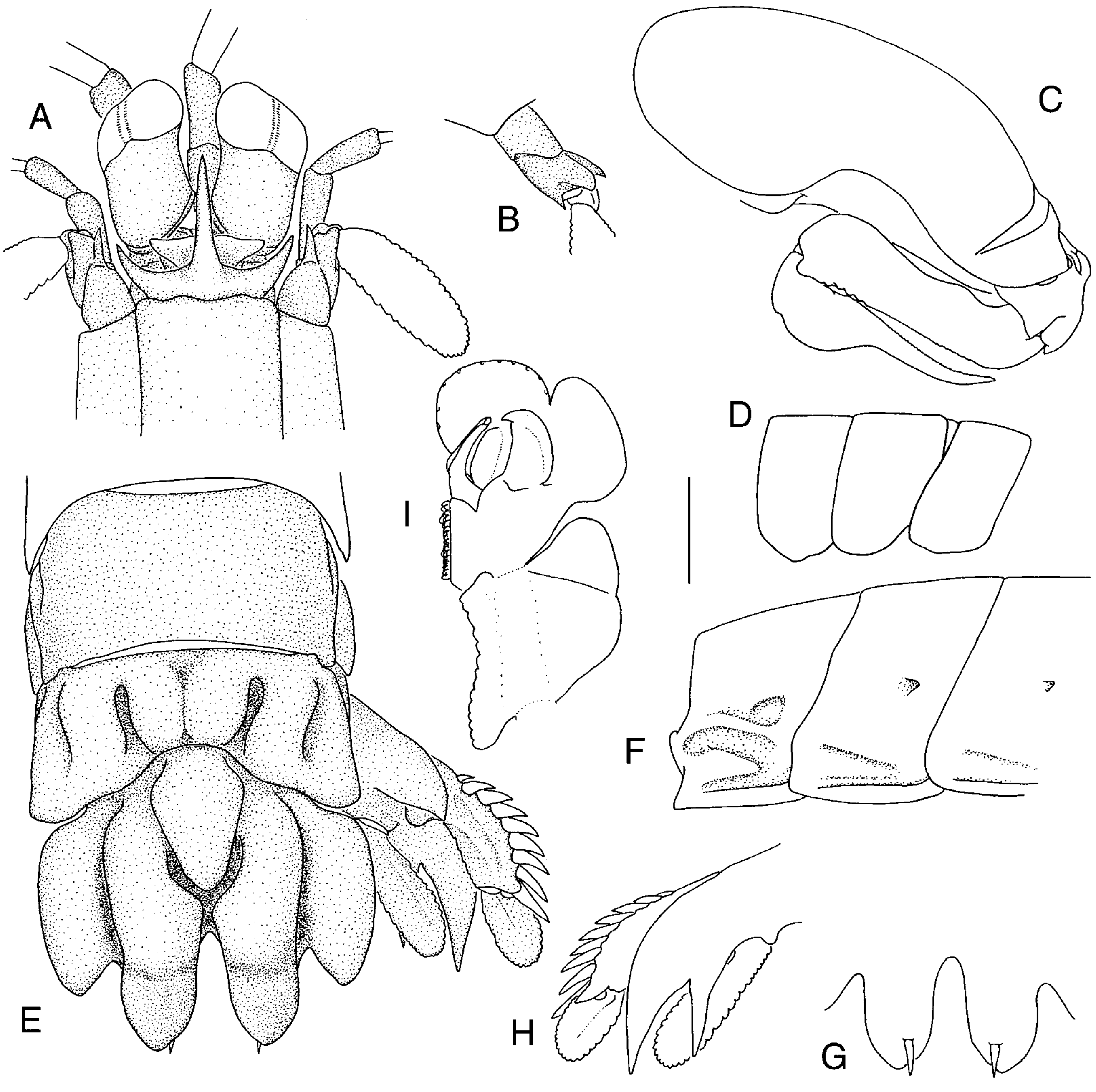

Figure 45. *Chorisquilla quinquelobata* (Gordon), paratype ♂ TL 16 mm (NHM 1935.8.10.2). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS3–5, right lateral. G, telson posterior margin, ventral. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 1 mm; I = 0.5 mm.

with shallow basal notch; propodus with 1 movable spine proximally. AS5 smooth medially; corrugated laterally; posterior margin unarmed; with short posterolateral spine. AS6 with strongly inflated SM, IM and LT bosses, each smooth and unarmed; posterior margin strongly concave, unarmed. Telson broader than long; with 2 pairs of primary teeth; without SM or IM denticles; dorsal surface with strongly inflated MD, SM, and LT bosses, each smooth, unarmed and separated by deep groove; MD boss elongate, pyriform in outline; SM and LT bosses longer than median, elongate, extending to posterior margin of telson; lateral margins unarmed; ventral surface smooth. Uropodal protopod without lobes between terminal spines; protopod unarmed dorsally excepting dorsal spine above proximal exopod articulation. Uropodal exopod proximal segment outer margin with 9 movable spines, distalmost exceeding midlength but not apex of distal segment; endopod with low dorsal carina, length 3.36–3.65 breadth.

Colour in alcohol. Completely faded.

Measurements. Male (n = 2) TL 16–19 mm, female (n = 2) TL 17–18 mm. The present series includes the largest known specimen of the species.

Remarks. The type description of *Chorisquilla quinquelobata* is limited and the species is redescribed above. The distinctive telson morphology of *C. quinquelobata*, in which the submedian bosses overreach the bases of the submedian teeth, is diagnostic for the species.

Habitat. Known only from pier pilings at the type locality.

Distribution. Christmas Island, Indian Ocean.

Chorisquilla spinosissima (Pfeffer, 1888)

Fig. 46

Gonodactylus spinosissimus Pfeffer, 1888: 35 (type locality: Mombasa, Kenya, 4°05'S 39°41'E, by present neotype selection).–Nobili, 1906: 326–327.–Kemp, 1913: 150, 191, pl. 10: figs. 124, 125.–Hansen, 1926: 38.–Holthuis, 1941: 291–293, fig. 9c.
Protosquilla spinosissima.–Manning, 1968b: 55–56.
Chorisquilla spinosissima.–Manning, 1969d: 158, 159.–Manning, 1991: 5.
Chorisquilla longispinosa Sun & Yang, 1998: 143–144, 151–152, fig. 1 (type locality: Sanjiao Reef, Nansha Is, South China Sea, 10°10'N 115°20'E); new synonymy.

Type material. NEOTYPE: ZMUC CRU 3671, ♂ (TL 22 mm), Mombasa, Kenya, 4°05'S 39°41'E, 1–2 m, corals, Galathea stn 256, 22 Mar 1951.

Australian material. NORTHERN TERRITORY: NTM exCr008725, 3♂♂ (TL 14–33 mm), 1♀ (TL 17 mm), Trepang Bay, Cobourg Peninsula, algae crest of reef pools, low tide, A. Bruce & P. Hanley, 15 Oct 1981; NTM Cr000505, 2♂♂ (TL 26–27 mm), 2♀♀ (TL 27–29 mm), New Year I., 10°54.0'S 133°02.2'E, low tide, A. Bruce, 18 Oct 1982; NTM, 1♂ (TL 30 mm), 1♀ (TL 32 mm), Oxley I., Darwin, reef pools at low tide, 19 Dec 1982.

Diagnosis. Raptorial claw propodus with movable spine proximally. AS5 with posterolateral spine. AS4 smooth medially; laterally corrugated. AS5 smooth medially, at most with row of short, narrow, transverse grooves on posterior margin; laterally corrugated and carinate; posterior margin unarmed. AS6 anterior margin with row of short, slender, posteriorly directed spines; dorsally ornamented with numerous long spines. Telson with 2 pairs of primary teeth, apices spiniform; dorsal surface entirely covered with long spines, obscuring MD and SM bosses; MD boss circular to ovate, SM bosses extending posteriorly beyond apex of median excavation; lateral margin with 7–12 short spines; ventral surface with low, short, postanal carina; with 7–10 (usually 8 or 9) spiniform SM denticles, increasing in length distally and 2 spiniform IM denticles. Uropodal protopod dorsally with 1 or 2 slender proximal spines and shorter spine above proximal exopod articulation. Uropodal exopod proximal segment outer margin with 10 or 11 movable spines.

Colour in alcohol. Body uniformly dark green-brown in recently preserved specimens.

Measurements. Male (n = 7) TL 14–33 mm, female (n = 4) TL 17–32 mm. A1 peduncle 0.68–0.82 CL. A2 scale 0.38–0.49 CL. Uropodal endopod length 3.39–4.24 breadth. Cappola & Manning (1995) reported specimens to 39 mm TL.

Remarks. Analysis of the Australian specimens identifiable with *C. spinosissima* according to recently published accounts (e.g., Manning, 1995) show that two forms are present. In specimens of the primarily Pacific form (Queensland and some specimens from Western Australia), the posterior ½ or ⅓ of the mid-dorsal surface of AS5 bears several deep, broad depressions forming distinct carinae, AS4 & 5 usually both bear a posterolateral spine, a single dorsal spine on the uropodal protopod is present proximally, the dorsal spines of the telson and AS6 bear hard apices, the colour pattern of the body is transversely banded and the largest known specimens are 26 mm TL. In the Indian Ocean form (Northern Territory), the mid-posterior margin of AS5 is smooth or bears short, shallow, transverse grooves, AS4 lacks a posterolateral spine, two spines are usually present on the dorsal proximal margin of the uropodal protopod in specimens exceeding 22 mm TL, the dorsal spines on the telson and AS6 are usually soft, the body is uniformly pigmented and the species attains a maximum size of at least 39 mm TL. The second proximal dorsal spine in Indian Ocean form (Fig. 46D) is not always developed in specimens exceeding the maximum known size of the Pacific form and therefore has limited utility as a distinguishing character. Moreover, should the Pacific form attain a larger size than presently known, it is conceivable that a second dorsal uropodal spine may also develop. The specimens of the Pacific form agree well with Nobili's (1899, 1906) accounts and neotype of *C. hystrix*, and are referred to that species. Conversely, the Indian Ocean form is considered to be *C. spinosissima* sensu stricto because it agrees in all respects with the type description (Pfeffer, 1888) and other accounts of the species from the Indian Ocean (Kemp, 1913; Ingle, 1963; Manning, 1968b). The differences in mid-dorsal ornamentation of AS5 are not size related in the present material and even the smallest specimens studied can be distinguished on the presence or absence of mid-dorsal carinae.

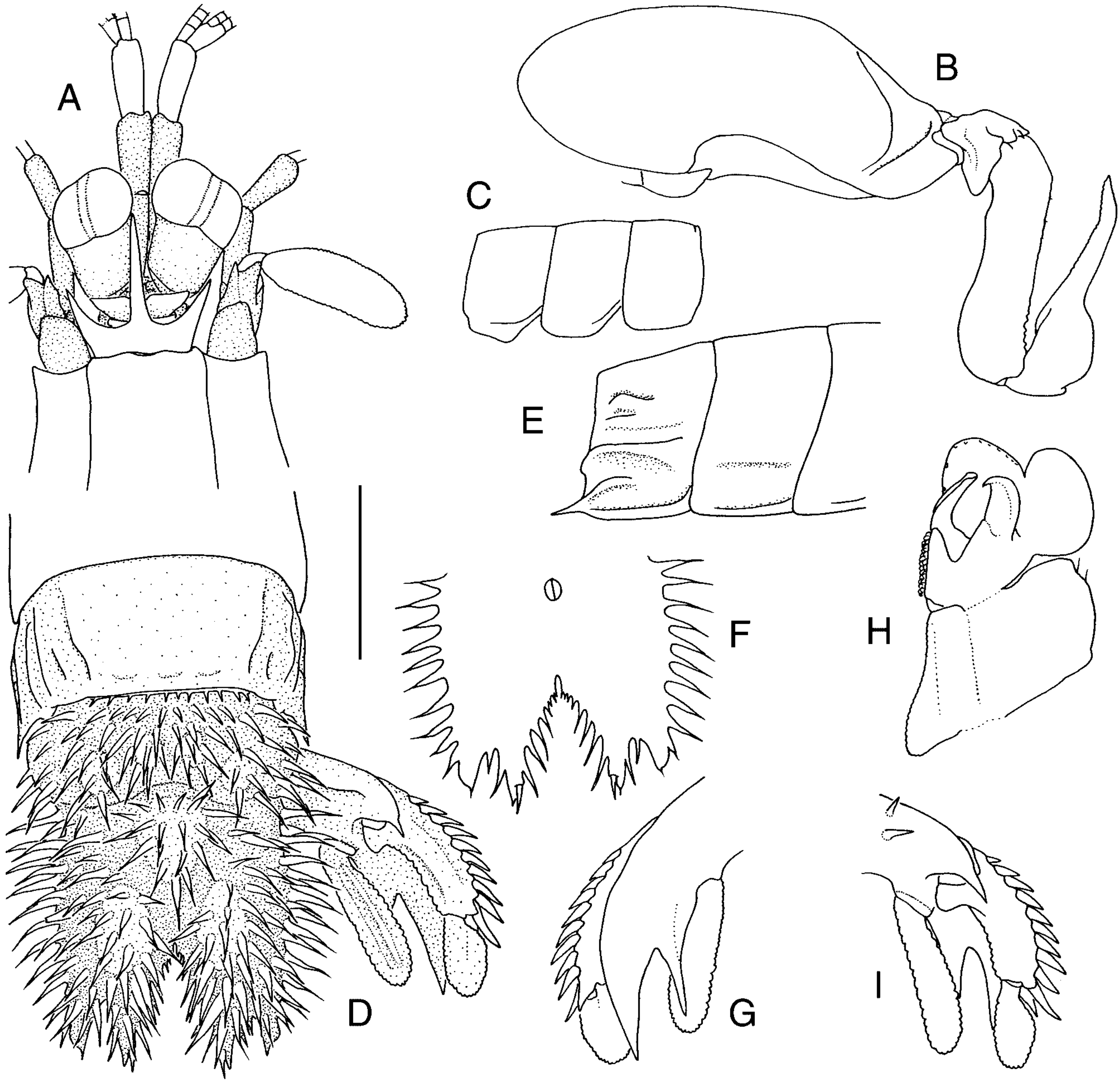

Figure 46. *Chorisquilla spinosissima* (Pfeffer). A–I, ♂ TL 27 mm (NTM Cr000505). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8, right lateral. D, AS4–6, telson & uropod, dorsal. E, AS3–5, right lateral. F, telson, ventral. G, uropod, right ventral. H, PLP1 endopod, right anterior. I, uropod, right dorsal. Scale A–G, I = 1 mm; H = 0.5 mm.

Aside from distinguishing characters already discussed, *C. hystrix* and *C. spinosissima* are so similar that they could prove to be eastern and western populations of a single widespread Indo-West Pacific species. In the absence of intermediate forms, however, both species are provisionally recognized. Previous records of *C. spinosissima* from eastern Indonesia, the Great Barrier Reef, New Caledonia and Vietnam are based on *C. hystrix*. *Chorisquilla hystrix* appears to be primarily a Pacific species and *C. spinosissima* is primarily an Indian Ocean species. The ranges of *C. spinosissima* and *C. hystrix* overlap in northern Australia and the Southeast Asian region, and therefore additional collections should be studied to test the validity of the morphological distinctions observed here. The largely east-west distribution of *C. hystrix* and *C. spinosissima* in Australia, where a different species dominates on either side of the Gulf of Carpentaria, parallels that of *Gonodactylellus molyneux* and *G. snidsvongi*, and *Haptosquilla trispinosa* and *H. corrugata*.

According to personal notes of the late R.B. Manning in the Crustacea Section of the USNM, the holotype of *C. spinosissima* was present at the Zoologisches Museum, Hamburg, in 1971. Searches of the Hamburg collections on at least two occasions, however, have failed to locate the specimen (Angelika Brandt, pers. comm.). Therefore, Pfeffer's (1888) holotype of *C. spinosissima* from Zanzibar must be considered lost. To stabilize the identity of the species, a 22 mm male from Mombasa, Kenya, a locality close to the original type locality is selected as the neotype. It agrees in all respects with the aforementioned published accounts of the species from the Indian Ocean. Like most of the specimens of *C. spinosissima* examined, the apices of the dorsal teeth on the telson are relatively soft.

Development of the ocular scales and telson spines is paralleled by both *C. hystrix* and *C. spinosissima*. The ocular scales increase in width, and the number and thickness of dorsal and lateral telson spines increases with increasing size. In the smallest specimens (TL 10 mm), 4–6 spines are present on the lateral margins of the telson; by TL 12 mm, 7 or 8 spines are present; by 16 mm, 7 or 8 spines are present; and by 24 mm, 9 or 10 spines are present. The penes and petasma are developed by 12 mm, and the lateral denticle of the telson is present in specimens up to 23–24 mm (Fig. 44I). In all specimens of *C. spinosissima* and *C. hystrix* studied, the dorsal telson spines were slender and spiniform, despite the increase in relative thickness, unlike *C. brooksii* in which the dorsal spines are more robust and relatively broad.

Chorisquilla longispinosa Sun & Yang, 1998, from the Nansha Islands, South China Sea, bearing a smooth mid-dorsal surface of AS5 and lacking a posterolateral spine on AS4, is a synonym of *C. spinosissima*. Characters listed by Sun & Yang (1998) that distinguish the two species, namely a slight difference in rostral length, the size of the ocular scales, the convex margin of TS8, and differences in the shape of the telson margin and submedian teeth, are all within the observed range of variation or are normal characters of *C. spinosissima*. Records of *C. spinosissima* from Japan (Komai, 1927) are based on an undescribed species of *Chorisquilla* presently under study.

Habitat. Rock or coral crevices on coral reefs, from the reef flat, reef slope, and vertical drop-offs down to at least 14 m depth.

Distribution. Western Indian Ocean from Zanzibar and the Red Sea to Ceylon, northwestern Australia and the Nansha Islands, South China Sea.

Chorisquilla tweediei (Serène, 1950)

Fig. 47

Gonodactylus tweediei Serène, 1950: 571; 1952: 16–19, fig. 33, pl. 3: figs. 1–5, 8 (type locality: Elizabeth Reef, Tasman Sea, restricted by present lectotype designation).–Stephenson, 1953a: 13.–Stephenson & McNeill, 1955: 252.–Manning, 1969d: 158.

Chorisquilla tweediei.–Moosa, 1991: 164–165.

Type material. LECTOTYPE: AM P10805, 1♂ (TL 22 mm), Elizabeth Reef, Tasman Sea, N of Lord Howe I., 29°58'S 159°13'E, G. Whitley, 15 Apr 1936. PARALECTOTYPES: AM P5273, 2♀♀ (TL 21–26 mm), Lord Howe I., 31°33'S 159°05'E, A. McCulloch; AM P10340, 1♂ (TL 24 mm), Erskine Channel, Lord Howe I., 31°33'S 159°05'E, A. Livingstone, Apr 1932; AM P10070, 1♀ (TL 22 mm), Northwest Islet, Queensland, 23°30'S 152°00'E, T. Iredale & G. Whitley, May 1931.

Australian material. QUEENSLAND: AM P10041, 1♀ (TL 28 mm), North West Islet, 23°30'S 152°00'E, 16 m, A. Livingstone & W. Boardman, 1930; AM P54455, 2♀♀ (TL 24–25 mm), One Tree I., 23°30'S 152°05'E, H. Recher, 6 Oct 1968; AM P58563, 1♀ (TL 10 mm), West Cay, Diamond Islets, Coral Sea, 13°11'S 143°43'E, intertidal beach rock pools, D. McMichael & J. Yaldwyn, 23 Oct 1964; AM P60071, 6♂♂ (TL 16–26 mm), 27♀♀ (TL 18–30 mm), One Tree I., 23°30'S 152°05'E; NMV exJ37793, 1♂ (TL 14 mm), Lizard I. Reef, 600 m NE of Palfrey I., 14°40'S 145°27'E, 3 m, patch reef, R. Wilson & G. Poore, 9 Dec 1987; NMV J37796, 1♀ (TL 11 mm), Lizard I. Reef, 600 m NE of Palfrey I., 14°40'S 145°27'E, 3 m, patch reef, R. Wilson & G. Poore, 9 Dec 1987; QM W1795, 1♀ (TL 23 mm), Heron I., Aug 1948; USNM, 1♀ (TL 16 mm), Lizard I., N. Marshall, 7 Apr 1994; USNM, 1♀ (CL 4.0 mm, broken), Great Barrier Reef, N. Marshall *et al*., 1991; USNM, 1♀ (TL 19 mm), S end Lizard I., 1.0 m, patch reef, rubble, JDT LIZ-3, J. Thomas, 23 Jan 1989; USNM, 1♂ (TL 16 mm), 2♀♀ (TL 13–17 mm), Lizard I., North Point, JDT LIZ-13, 21 m, rubble sample from vertical cliffs, J. Thomas, 28 Jan 1989; USNM, 5♂♂ (TL 13–21 mm), 2♀♀ (TL 12, 1 broken CL 5.1 mm), S of Lizard Head peninsula, Lizard I., rubble zone, JDT LIZ-14, J. Thomas, 29 Jan 1989; USNM, 3♂♂ (TL 18–27 mm; 1 broken, CL 3.1 mm), 2♀♀ (TL 15–16 mm), Lizard Head, Lizard I., rubble zone, JDT LIZ-15, J. Thomas, 31 Jan 1989; USNM, 3♂♂ (TL 13–24 mm), 2♀♀ (TL 13–24 mm), Lizard I., 1.5 m, rubble zone, unconsolidated coral covered rubble, JDT LIZ-17, J. Thomas, 1 Feb 1989; USNM, 2♂♂ (TL 13–14 mm), 1♀ (TL 14 mm), Lizard Head, Lizard I., from small rubble pieces on sand, JDT LIZ-19, J. Thomas, 31 Jan 1989. NEW SOUTH WALES: AM P38027, 1♂ (TL 18 mm), W of SW side Elizabeth Reef, Tasman Sea, 29°57.7'S 159°02.8'E, outer reef slope, site 34E, P. Hutchings, 11 Dec 1987; AM P38028, 1♂ (TL 14 mm), Middleton Reef, Tasman Sea, 29°27.4'S 159°03.7'E, 11 m, coral rubble, coarse sediment, site 8.1c, J. Lowry & R. Springthorpe, 5 Dec 1987; AM P38029, 1♂ (TL 15 mm), W of "Runic", Middleton Reef, Tasman Sea, 29°28'S 159°03.3'E, outer reef slope, site 23A, P. Hutchings, 9 Dec 1987; AM P60238, 1♀ (broken, CL 3.4 mm), NE to E Middleton Reef, Tasman Sea, outer slope, 20°26.1'S 159°08.2'E, site 10, P. Hutchings, 5 Dec 1987; AM P60239, 1♀ postlarva (TL 9 mm), Middleton Reef, 1.5 m, stn 8, P. Hutchings, 5 Dec 1987; AM P60240, 1♀ (TL 15 mm), Middleton Reef, site 8.1, 9–12 m, R. Springthorpe & J. Lowry, 5 Dec 1987; AM P60241, 1♂ postlarva (TL 9 mm), 1♀ postlarva (TL 9 mm), Elizabeth Reef, site 31A; AM P60242, 1♂ (TL 18 mm), 1♀ (TL 16 mm), Elizabeth Reef, site 32, 10 Dec 1987; AM P60243, 1♀ postlarva (TL 9 mm), Elizabeth Reef, hand net off boat, T. Gill & J. Lowry, 12 Dec 1987.

Diagnosis. Raptorial claw propodus with movable spine proximally. AS4 with rounded posterolateral angle. AS5 smooth medially, laterally with 2 low carinae above MG carina; with blunt to acute posterolateral projection. AS6 densely covered with short, fine setae; SM and IM bosses unarmed, LT boss with posterior spine. Telson with 3 pairs of blunt primary teeth; dorsal surface with MD and SM bosses; MD boss circular to trianguloid in outline; SM bosses longer than MD boss, ovate to pyriform in outline, extending posteriorly beyond apex of median excavation; dorsal surface and lateral margins densely covered with short, fine setae; with 10–14 widely spaced SM setae and 2 IM setae; ventral surface without postanal carina. Uropodal protopod unarmed dorsally excepting dorsal spine above proximal exopod articulation; exopod proximal segment outer margin with 9–11 movable spines.

Colour in alcohol. Largely faded, but mottled and irregularly banded with brown chromatophores.

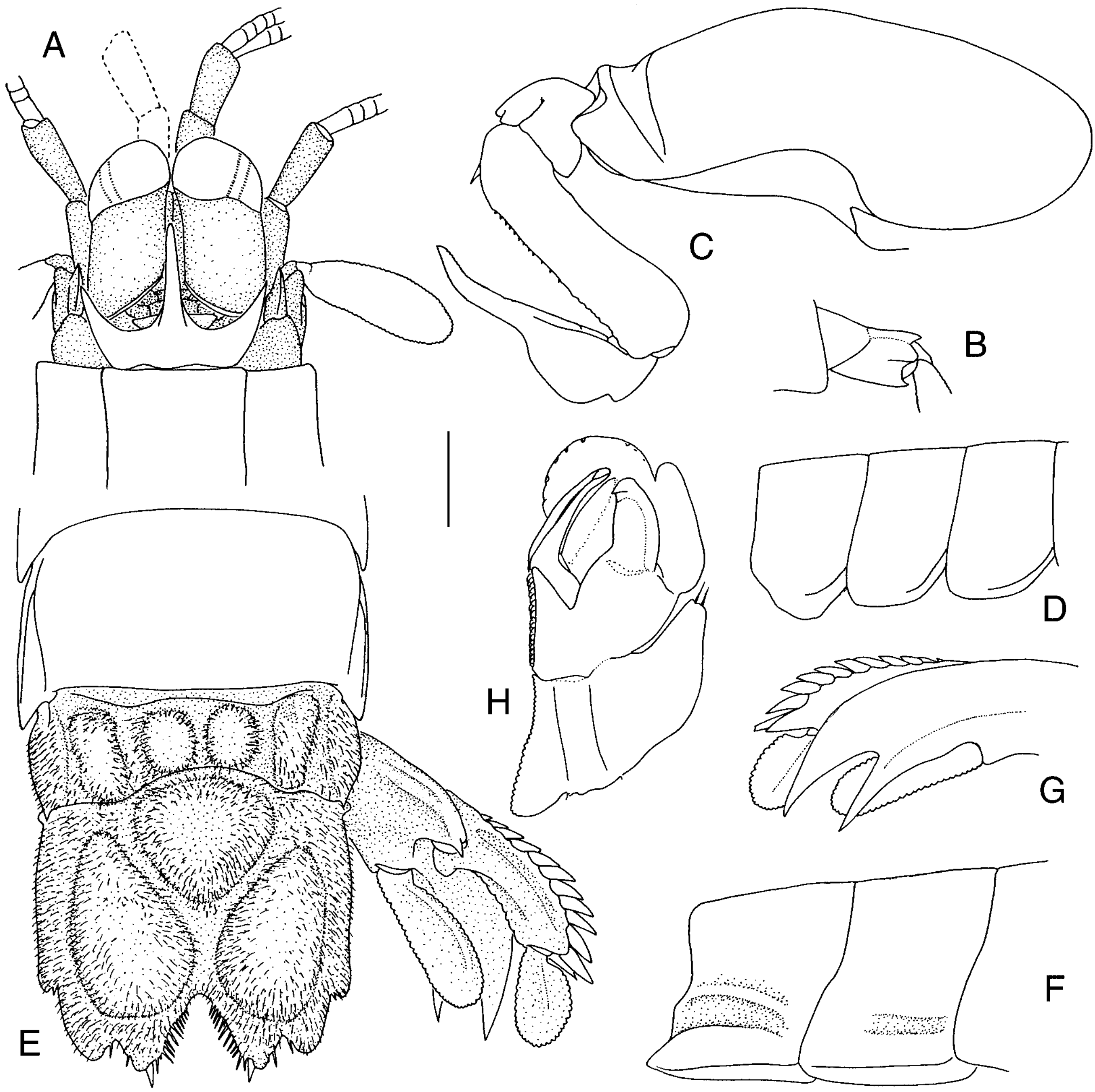

Figure 47. *Chorisquilla tweediei* (Serène), lectotype ♂ TL 22 mm. A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS4–5, right lateral. G, uropod, right ventral. H, PLP1 endopod, right anterior. Scale A–G = 2.5 mm; H = 1.25 mm.

Measurements. Male (*n* = 27) TL 13–27 mm, female (*n* = 51) TL 10–30 mm, female postlarva (*n* = 3) TL 9 mm, male postlarva (*n* = 1) TL 9 mm. A1 peduncle 0.61–0.82 CL. A2 scale 0.29–0.42 CL. Uropodal endopod length 2.53–3.43 breadth. The present series includes the largest known specimen of the species.

Remarks. The validity of *C. tweediei* has been disputed by Manning (1969d) and Moosa (1991). Manning (1969d) synonymized *C. tweediei* with *C. trigibbosa* on the basis that the latter is based on a juvenile, whereas Moosa (1991) considered both species to be distinct. The holotype of *C. trigibbosa* is certainly an early juvenile, as evidenced by the undeveloped lateral spines on the rostral plate and undeveloped gonopore on the sternite of TS6. Comparison of the holotype of *C. trigibbosa* with early juvenile *C. tweediei*, however, shows that the two species are distinct. Early juvenile *C. trigibbosa* differ from early juvenile *C. tweediei* in bearing a small, round boss anterior to each submedian boss on the telson; the dorsal surface of the telson including the bosses is covered with low, sparse spinules (more than figured by Hansen [1926]) instead of a tomentum of long, fine setae; the submedian telson bosses are ovate instead of elongate; the median boss is ovate instead of triangular. Moreover, the early juvenile holotype of *C. trigibbosa* measures 15 mm TL, whereas *C. tweediei* reaches a similar stage of development at 9 mm TL and shows adult morphology including fully developed sexual structures by 13 mm TL. Thus, *C. tweediei* differs from *C. trigibbosa* not only morphologically, but also in size at sexual maturity. Unfortunately, adults of *C. trigibbosa* have not yet been identified in the literature. The 22 mm TL male syntype (AM P10805) of *C. tweediei* is herein designated the lectotype to fix the identity of the species.

Habitat. Coral reef, amongst rubble on sand or silty sand; reef flat down to 16 m.

Distribution. New Caledonia, and eastern Australia.

Echinosquilla Manning, 1969d

Echinosquilla Manning, 1969d: 155. Type species *Gonodactylus guerini* White, 1861, by original designation and monotypy. Gender feminine.

Diagnosis. Cornea flattened, bilobed. AS1 with articulated pleural plate anterolaterally. Mandibular palp 3-segmented. Dorsal groove present, indicating demarcation of AS6 from telson. Telson with long dorsal spines, each with soft, apex; posterior margin divided into two halves by V or U-shaped median emargination. Uropodal endopod with erect dorsal spines.

Included species. One: *E. guerini* (White, 1861).

Remarks. *Echinosquilla* differs from other protosquillids in bearing long spines over the entire surface of the telson, each of which has a soft apex, and in bearing a series of long spines on the dorsal surface of the uropodal endopod in adults. *Echinosquilla* appears to be most closely related to *Chorisquilla* in the broadened corneae and presence of articulated anterior pleural plates on AS1.

Echinosquilla guerinii (White, 1861)

Fig. 48

Gonodactylus guerini White, 1861: 43, pl. 7 (type locality: Fiji).–Kemp, 1913: 11, 149, 192–193.
Gonodactylus Guerini.–Miers, 1880: 43.
Protosquilla guerini.–Brooks, 1886: 75, pl. 16: figs. 1, 6.
Echinosquilla guerini.–Manning, 1969d: 155, fig. 5.
Echinosquilla guerinii.–Manning, 1977c: 280.–Moosa, 1991: 165.–Manning, 1995: 21.

Material. WESTERN AUSTRALIA: NMV J13833, 1♂ (TL 50 mm), Northwest Shelf between Port Hedland & Dampier, 19°5'S 117°26'E, NWA-52, on muddy sand, epibenthic sled, G. Poore & H. Lew Ton, 12 Jun 1983.

Supplementary diagnosis. Eye with cornea bilobed, flattened anteriorly. A1 somite dorsal processes produced to a short spine, concealed by rostral plate. A2 protopod with small ventral papilla; with anteriorly directed dorsal and ventral spine. Rostral plate sharply trispinous. Mandibular palp 3-segmented. MXP1–5 with epipod. Propodus of raptorial claw with movable spine proximally. AS1 with small articulated pleural plate anterolaterally. AS5 posterior ½ covered with short erect spines; posterior margin lined with short, posteriorly directed spines; with posterolateral spine. AS6 and telson dorsal surface entirely covered with long erect spines, apices soft; with 2 pairs of long, slender primary teeth separated by deep U-shaped concavity, inner and outer margins lined with slender spines. Uropodal protopod with 4 or 5 dorsal spines proximally; exopod proximal segment outer margin with 9 movable spines; endopod with 2 dorsal carinae, inner unarmed, outer with 5 erect spines.

Colour in alcohol. Largely faded. Anterior cephalon with diffuse chromatophores. Carapace and merus of raptorial claws with two broad mottled transverse bands. Thoracic and abdominal somites with mottled transverse banding.

Measurements. Male ($n = 1$) TL 50 mm. A1 peduncle length 0.77 CL. A2 scale length 0.50 CL. Uropodal endopod length 2.69 breadth. Moosa (1991) reported specimens to 81 mm TL.

Remarks. *Echinosquilla guerinii* is generally considered to be a coral reef species (Gosliner *et al*., 1996). The single Australian specimen was collected on muddy sand.

Habitat. Reef habitats and level muddy sand. Manning (1969d) reported a bathymetric range of 2 m to over 218 m.

Distribution. Western Indian Ocean to central Pacific and now from Australia.

Haptosquilla Manning, 1969d

Haptosquilla Manning, 1969d: 159; 1995: 98. Type species *Gonodactylus pulchellus* Miers, 1880, by original designation. Gender feminine.

Diagnosis. Eye cylindrical, cornea subglobular. Mandibular palp 2-segmented or absent. MXP1–5 with epipod. AS1 with articulated pleural plate anterolaterally. AS6 fused with telson but demarcated by dorsal groove. Posterior margin of telson divided posteriorly by narrow median fissure, with either side appressed. Uropodal endopod without dorsal spines.

Included species. Fourteen: *H. corrugata* n.sp.; *H. ectypa* (Müller, 1886); *H. glabra* (Lenz, 1905); *H. glyptocercus* (Wood-Mason, 1875); *H. hamifera* (Odhner, 1923); *H. moosai* Erdmann & Manning, 1998; *H. proxima* (Kemp, 1915); *H. pulchella* (Miers, 1880); *H. pulchra* (Hansen, 1926); *H. stoliura* (Müller, 1886); *H. tanensis* (Fukuda, 1911a); *H. togianensis* Erdmann & Manning, 1998; *H. trispinosa* (Dana, 1852); and *H. tuberosa* (Pocock, 1893).

Remarks. Several characters previously used in species diagnoses vary allometrically in protosquillids including the size of the ocular scales, the degree of concavity of the anterolateral margins of the carapace and the presence of a posterior spine on the dorsal bosses of AS6. Two nominal species of *Haptosquilla*, *H. setifera* Manning and *H. philippinensis* Garcia & Manning, are both based on juveniles and appear to be synonyms of *H. pulchella* Miers.

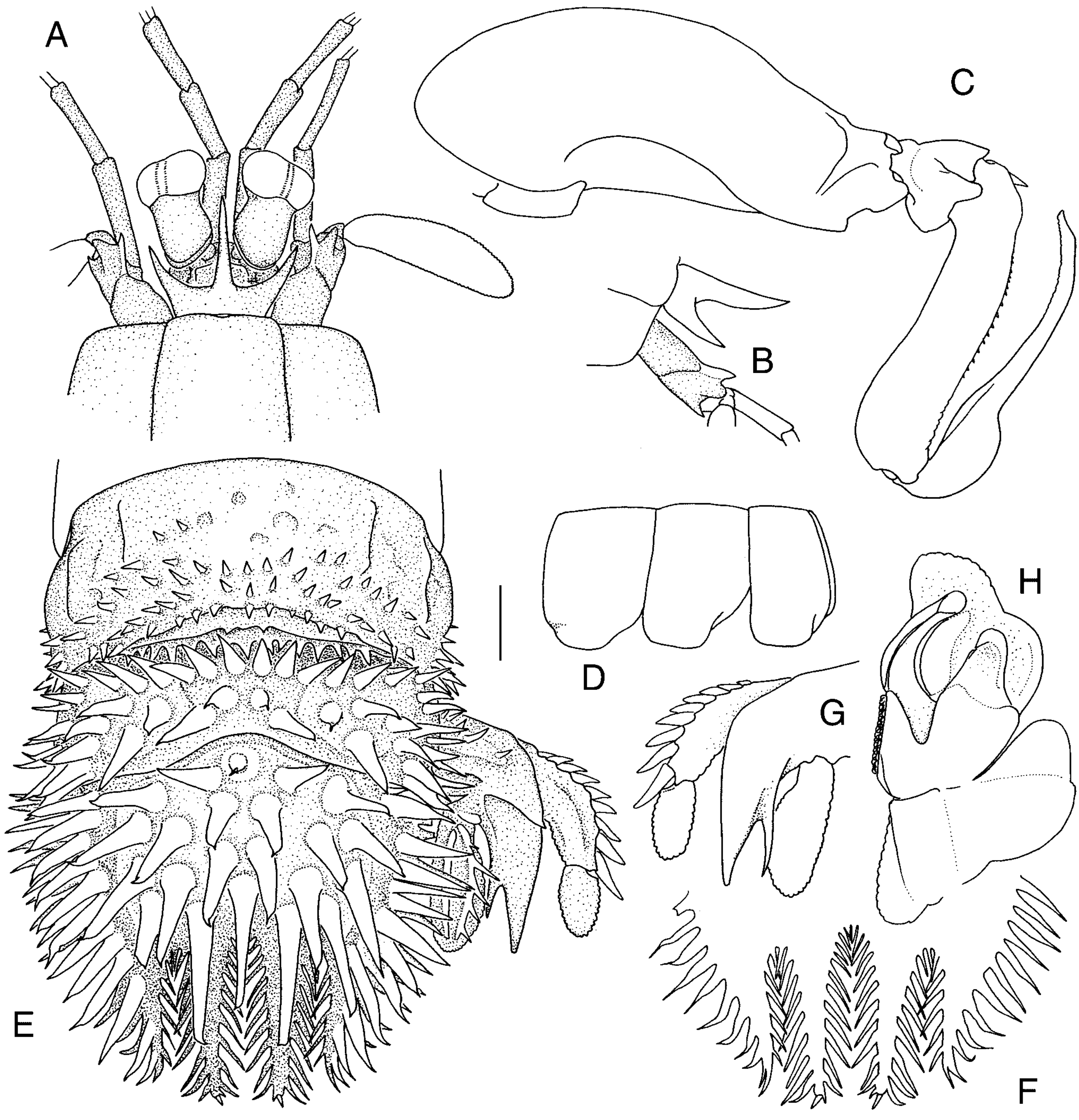

Figure 48. *Echinosquilla guerinii* (White), ♂ TL 50 mm (NMV J13833). A, anterior cephalon, dorsal. B, rostral plate & A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, telson, ventral. G, uropod, right ventral. H, PLP1 endopod, right anterior. Scale A–G = 1 mm; H = 0.5 mm.

Similar conclusions on the status of *H. setifera* and *H. philippinensis* have been drawn by Mark Erdmann (University of California, Berkeley), who has studied extensive series of Indonesian coral reef stomatopods, including large developmental series of *H. pulchella*. However, in view of recent genetic studies that suggest *H. pulchella* could be composite (Barber *et al*., 2000), *H. setifera* and *H. philippinensis* are regarded as *species inquirenda*. No characters are available to distinguish *H. nefanda* from *H. tuberosa*, and the two species are synonymized below. Five species of *Haptosquilla* are known from Australia, of which one is newly described.

Key to species of *Haptosquilla*

1	Telson with 2 or 3 pairs of fixed primary teeth	2
—	Telson with 4 pairs of fixed primary teeth	6
2	Mid-dorsal surface of AS5 with distinct longitudinal corrugations	***H. glyptocercus***
—	Mid-dorsal surface of AS5 smooth	3
3	Proximal segment of uropodal exopod with fixed outer distal spine above articulation of distalmost movable spine. AS5 with distinct, irregular mid-dorsal pitting	*H. moosai*
—	Proximal segment of uropodal exopod without fixed outer spine distally, at most with blunt lobe above articulation of distalmost movable spine. AS5 with smooth mid-dorsal surface	4
4	Dorsal surface of telson with distinct pits between and on surface of bosses	*H. tanensis*
—	Dorsal surface of telson generally smooth between and on surface of bosses	5
5	Submedian denticles absent in adults	*H. ectypa*
—	Submedian denticles present in adults	*H. glabra*
6	AS6 smooth, without dorsal bosses. Telson surface faintly irregular or with shallow longitudinal grooves, with upright, keel-like median process, recurved posteriorly	*H. hamifera*
—	AS6 with dorsal bosses. Telson without upright, keel-like median process	7
7	AS6 with prominent, rounded, SM bosses, but without IM bosses	*H. pulchra*
—	AS6 with submedian and intermediate bosses	8
8	Rostral plate with slender median spine, anterolateral angles short, broad	9
—	Rostral plate sharply trispinous, each spine slender	10
9	SM bosses of telson elongate, extending posteriorly beyond midlength, but not to posterior margin. AS5 mid-dorsal surface with low spinules and deep, irregular corrugations and pits	***H. stoliura***
—	SM bosses of telson not extending posteriorly beyond midlength. AS5 mid-dorsal surface with smooth appearance, at most with shallow pits	***H. tuberosa***
10	AS5 with median surface corrugated	11
—	AS5 with median surface smooth	12
11	AS4–5, occasionally also AS3, with corrugations on median surface. Telson with most of dorsal surface setose; MD boss longer than SM bosses	***H. corrugata***
—	AS5 with corrugations on median surface. AS4 occasionally with some short corrugations or pits medially. Telson without setae except on dorsal bosses and lateral margins. MD boss shorter than SM bosses	***H. trispinosa***
12	Mandibular palp present	*H. pulchella*
—	Mandibular palp absent	13
13	Telson with MD boss pyriform, larger than SM bosses, extending posteriorly to anterior margin of SM bosses	*H. proxima*
—	Telson with MD boss small, ovate, subequal in size to SM bosses, not extending posteriorly to anterior margin of SM bosses	*H. togianensis*

Haptosquilla corrugata n.sp.

Fig. 49

Protosquilla trispinosa.–Rathbun, 1914: 663–664, pl. 2: fig. 11 [not *P. trispinosa* (Dana, 1852)].

Gonodactylus pulchellus.–Stephenson, 1962: 35 (not *G. pulchellus* Miers, 1880).

Gonodactylus trispinosus.–White, 1847: 85 (*nomen nudum*).–Miers, 1880: 44, pl. 3: fig. 10 (part).–Haswell, 1882: 211–212.–Alexander, 1916a: 9.–Balss, 1921: 5.–Stephenson, 1962: 35 (not *G. trispinosus* Dana, 1852).

Type material. (all Western Australia) HOLOTYPE: AM P13544, ♀ holotype (TL 29 mm), off Gantheaume Point, Broome, 7.3 m, dredged, A. Livingstone, Aug 1929. PARATYPES: AM P14196, 1♀ (TL 24 mm), 9 km off Ninety Mile Beach, between Cape Jaubert & Wallal, 19°20'S 121°15'E, 9.2 m, A. Livingstone, Sep 1929; AM P57026, 1♂ (TL 20 mm), off Gantheaume Point, Broome, 7.3 m, dredged, A. Livingstone, Aug 1929; NHM 92.3.26.459, 1♀ (TL 18 mm), NW Australia, 37 m, Bassett-Smith; NTM Cr012373, 1♀ (TL 34 mm), Northwest Shelf, 19°56.7–56.9'S 117°53.6–53.4'E, 40 m, beam trawl, S0583 B2, 26 Oct 1983; NTM Cr012399, 1♂ (TL 20 mm), 1♀ (TL 21 mm), Northwest Shelf, beam trawl, S0183, 10 Feb 1983; WAM C23545, 1♂ (TL 22 mm), NE Malus I., Dampier Archipelago, 18.3 m, *Honolulu* dredge, R. Royce, 31 May 1960; NHM 92.3.26.458, 1♂ (TL 19 mm), Baleine Bank, Bassett-Smith.

Australian material. NORTHERN TERRITORY: AM P58579, 1♂ (TL 15 mm), Lee Point, Darwin, 12°20.0'S 130°53.8'E, 3 m, coral rubble, NT 339, P. Hutchings, 11 Jul 1993; NMV J37836, 1♂ (TL 29 mm), 1♀ (TL 28 mm), Dundas Point Reef, Gove, D. Staples, 17 Oct 1976; NTM Cr001896, 4♂♂ (TL 17–30 mm), Trepang Bay, Cobourg Peninsula, muddy reef flat pools, low water spring, A. Bruce, 16 Oct 1981; NTM Cr004161, 1♀ (TL 36 mm), Coral Bay, Port Essington, 11°11.0'S 132°03.4'E, P. Davie *et al*., 12 Aug 1986.

Diagnosis. A2 protopod with apex of dorsal lobe blunt. Rostral plate sharply trispinous. Mandibular palp 2-segmented. Raptorial claw propodus with movable spine proximally. AS4–5 medially and laterally corrugated in adults. Telson with 4 pairs of primary teeth, separated by deep fissures; anterior ½ or entire dorsal surface densely covered with short fine setae, lateral margin with widely spaced, longer setae; MD boss larger, longer than SM bosses; primary teeth dorsally with broad, median groove, usually obscured by setae.

Description. Eye with cornea not extending beyond A1 peduncle segment 2. A1 peduncle 0.75–0.97 CL. A2 protopod with apex of dorsal lobe produced to a short blunt projection; A2 scale 0.51–0.59 CL. Rostral plate sharply trispinous with median spine not extending anteriorly beyond base of cornea; lateral spines slender, directed anterolaterally; lateral margins straight, divergent anteriorly. Carapace with anterior margin of lateral plates faintly concave; anterolateral margin angular. Raptorial claw dactylus without basal notch; propodus with 1 movable spine proximally. Mandibular palp 2-segmented. PLP1 endopod in adult males with lateral lobe on posterior endite. AS1–3 corrugated laterally. AS3 also with short, submedian corrugations. AS4–5 medially and laterally corrugated in adults. AS4–5 acute but blunt posterolaterally. AS6 with distinct SM, IM and LT bosses, each setose dorsally and armed posteriorly. Telson length and breadth subequal; with 4 pairs of blunt primary teeth, separated by deep fissures, extending anteriorly ⅔ or more distance to SM bosses; anterior ½ or entire dorsal surface covered with short fine setae, lateral margin with widely spaced, longer setae; MD boss ovate and SM bosses circular or slightly ovate in outline, MD boss larger, longer; dorsal surface of telson between SM bosses pitted, primary teeth each with broad, median groove, usually obscured by setae. Uropodal protopod unarmed dorsally excepting dorsal spine above proximal exopod articulation, without lobes between terminal spines; exopod proximal segment outer margin with 9 or 10 movable spines, distalmost exceeding midlength but not apex of distal segment; with short spine lateral to distal movable spine; endopod with dorsal carina laterally; without ventral carinae; length 3.20–3.94 breadth.

Colour in alcohol. Almost completely faded. With dark spots mid-dorsally on the thoracic and abdominal somites.

Etymology. Named *corrugata*, for the corrugated median surface of AS3–4.

Measurements. Male (n = 10) TL 15–30 mm, female (n = 7) TL 18–36 mm. Other measurements of holotype: CL 6.2 mm, A1 peduncle 4.8 mm, A2 scale 3.6 mm.

Remarks. The strongly corrugated dorsal and lateral surface of AS4 distinguishes adult *H. corrugata* n.sp. from all other species in the genus. *Haptosquilla corrugata* closely resembles *H. trispinosa* in rostral plate form, presence of the mandibular palp, corrugated dorsum of AS5 and similar telson organization. The dorsal surface of the telson on *H. corrugata* differs from *H. trispinosa* in generally bearing short fine setae over all or most of surface (not only on the bosses and lateral margins), the submedian bosses are circular or only slightly ovate in outline and slightly shorter than the median, and the grooves on the dorsal surfaces of the primary teeth are broader than in *H. trispinosa*. The relative size and shape of the dorsal bosses on the telson generally vary with size in *Haptosquilla*, but the differences between *H. trispinosa* and *H. corrugata* in relative lengths of the median and submedian bosses is a reliable distinguishing character in all specimens examined.

In smaller specimens (TL < 20 mm) of *H. corrugata*, the median corrugations on AS5 are well developed, but those on AS4 are represented only by a few dorsal pits medially adjacent to the submedian corrugations. At this size, the setose dorsum of the telson is not fully developed in *H. corrugata*, but the shorter submedian bosses of the telson are already apparent in *H. corrugata*. Additionally, specimens of *H. trispinosa* of similar size (TL < 20), show poorly developed mid-dorsal corrugations on AS5, and lack any trace of mid-dorsal pits on AS4. By 21 mm TL, the AS4 corrugations and telson carinae of *H. corrugata* are fully developed.

The present specimens show allometric morphological variation typical of other species of *Haptosquilla*. Thus, the ocular scales are narrowest in the smallest specimen and widest in the largest specimen; the distinctness of the

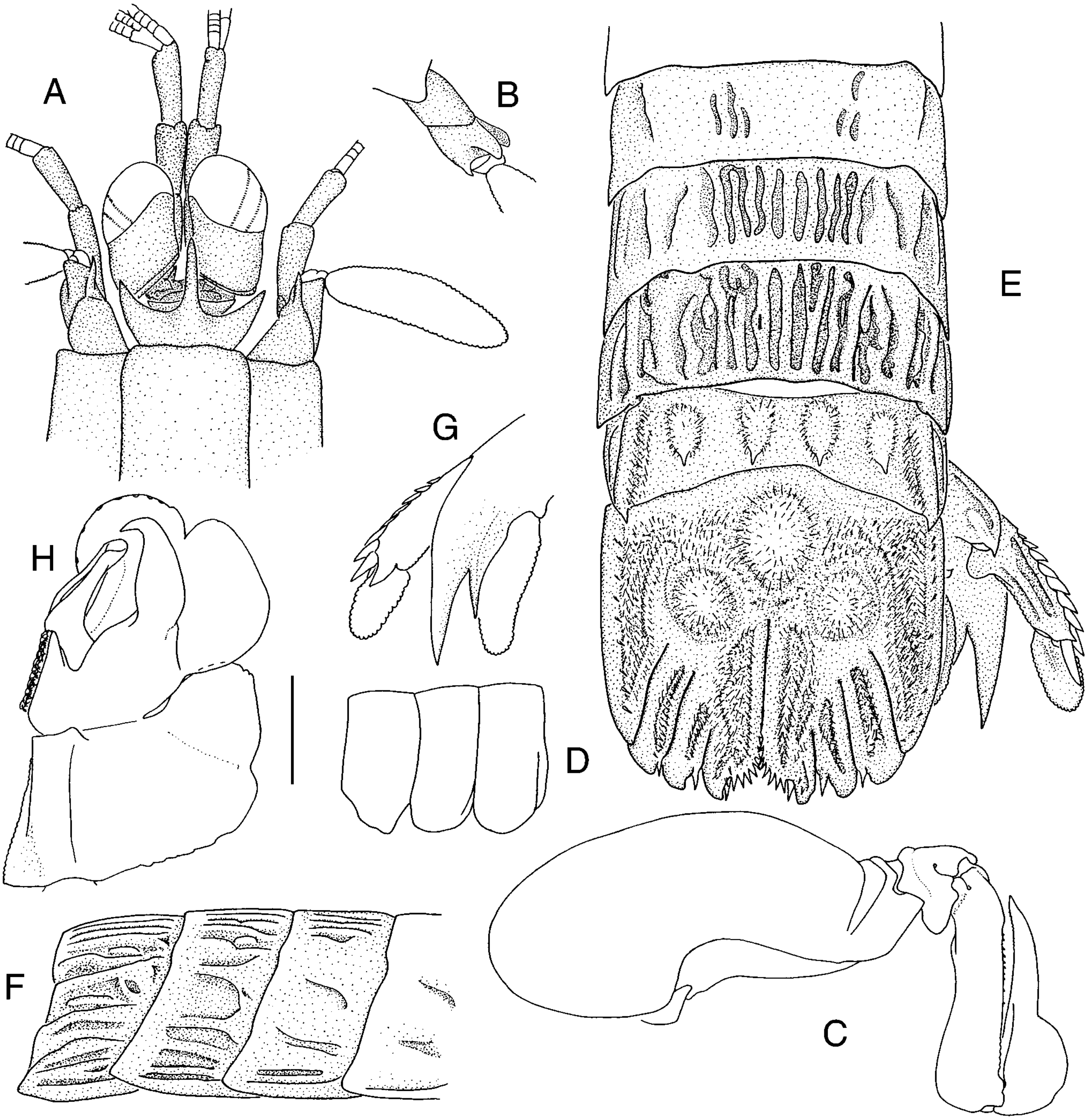

Figure 49. *Haptosquilla corrugata* n.sp. A–G, holotype ♀ TL 29 mm. H, paratype ♂ TL 20 mm (AM P13544). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS3–6, telson & uropod, dorsal. F, AS2–5, right lateral. G, uropod, right ventral. H, PLP1 endopod, right anterior. Scale A–G = 2 mm; H = 0.5 mm.

corrugations of the abdominal somites are most distinct in the largest specimen; the apices of the marginal teeth of the telson are sharpest in the smallest specimen; and the mesial denticle on the outermost primary tooth of the telson is present in the smallest specimen, lost in the two larger specimens.

Previous records of *H. trispinosa* from the Indian Ocean are referable to *H. corrugata*, suggesting that *H. trispinosa* is restricted to the central and western Pacific.

Habitat. Onshore reefs from tide pools and amongst boulders to a depth of 37 m.

Distribution. Known only from Gove, Northern Territory to northern Western Australia.

Haptosquilla glyptocercus (Wood-Mason, 1875)

Fig. 50

Gonodactylus glyptocercus Wood-Mason, 1875: 232 (type locality: Nicobar Is, Andaman Sea, 8°00'N 93°30'E).–Hansen, 1926: 36.–Holthuis, 1941: 289–290.–Stephenson, 1952: 12; 1953a: 47, 48.–Stephenson & McNeill, 1955: 253.

?*Protosquilla cerebralis* Brooks, 1886: 22, 72, pl. 14: figs. 2, 3, pl. 16: figs. 2, 3 (type locality: Levuka, Fiji, 17°42'S 178°50'E).–Manning, 1969d: 160.

Gonodactylus stoliurus.–McNeill, 1926: 317–318, fig. 2 (not *G. stoliurus* Müller).

Haptosquilla glyptocerca.–Moosa, 1973: 9–10; 1974: 6–7.

Haptosquilla glyptocercus.–Manning, 1969d: 160, 161.–Moosa, 1991: 165.–Manning, 1995: 21, 102–104, pl. 18, figs. 9 m, 43b, 52, 53.

Australian material. QUEENSLAND: AM P3137, 3♀♀ (TL 31–40 mm), Murray I., Torres Strait, 9°56'S 144°04'E, C. Hedley & A. McCulloch, Aug 30–Oct 3 1907; AM P8587, 1♂ (CL 4.4 mm, broken), North West I., 23°10'S 152°00'E, reef, G. Whitley, Dec 1925; AM P12165, 1♂ (TL 21 mm), 1♀ (TL 26 mm), Michaelmas Cay, 16°35'S 146°02'E, coral reef, G. Whitley & T. Iredale, Jun 1926; AM P17712, 1♀ (TL 42 mm), S side One Tree I., 22°30'S 150°05'E, under stones in tidal pool with beach rock, 24 Sep 1968; AM P17723, 1♀ (TL 11 mm), One Tree I., 22°30'S 150°05'E, reef crest near island, tide pool, H. Recher, 15 Oct 1968; AM P45586, 1♂ (TL 18 mm), 1♀ (TL 20 mm), near Albany I., Sep 1928; AM P54454, 3♂♂ (TL 20–30 mm), 4♀♀ (TL 25–36 mm), One Tree I., 23°30'S 152°05'E, H. Recher, 6 Oct 1968; AM P56814, 1♀ (TL 28 mm), W side Green I., 16°45'S 145°59'E, reef flat, surface pool in *Porites* wheel, S. Ahyong, 11 Jul 1992; AM P60072, 18♂♂ (TL 17–38 mm), 28♀♀ (TL 17–44 mm), One Tree I., 23°30'S 152°05'E; QM W8912, 1♀ (TL 30 mm), Big Broadhurst Reef, off Townsville, 18°59'S 147°43'E, R. McKay, Oct 1973; QM W1783, 1♀ (TL 38 mm), Murray I., 9°56'S 144°04'E; QM W12223, 4♀♀ (TL 32–43 mm), Lady Musgrave I., 23°55'S 152°24'E, coral pool on reef flat, R. Endean, 28 Nov 1951; QM W12224, 4♂♂ (TL 24–26 mm), 12♀♀ (TL 16–39 mm), Lady Musgrave I., 23°55'S 152°24'E, coral pool, R. Endean, 31 Nov 1951; QM W12225, 4♂♂ (TL 25–34 mm), 16♀♀ (19–46 mm), Lady Musgrave I., 23°55'S 152°24'E, coral pool near reef edge, R. Endean, 30 Nov 1951; USNM 205931, 1♀ (TL 34 mm), Lizard I., R. Caldwell, Aug 1986; USNM, 1♂ (TL 22 mm), 1♀ (TL 29 mm), Lizard I., N. Marshall, 7 Apr 1994; USNM, 1♀ (TL 34 mm), Lizard I., N. Marshall, 7 Apr 1994. WESTERN AUSTRALIA: AM P19318, 3♀♀ (TL 22–26 mm), Exmouth Gulf, 21°53'S 114°22'E, rock pool inside Bundagi Reef, N side of communications base, W. & J. Ponder, 19 Jan 1972; NTM Cr012562, 2♂♂ (TL 20–25 mm), 1♀ (TL 35 mm), NE side West Islet, Ashmore Reef, 12°13.5'S 122°58.5'E, intertidal, from sponge, A. Mussig, 29 Jul 1980; NTM, 1♂ (TL 14 mm), 1♀ (TL 11 mm), Vlamingh Head, 21°48'S 114°06'E, limestone shore reef, low tide, R. Hanley, 6 Feb 1988; NTM, 1♀ (TL 31 mm), Vlamingh Head, 21°48'S 114°06'E, coral rubble, R. Hanley, 6 Feb 1988; NTM, 1♀ (TL 39 mm), wreck of SS *Mildura*, 21°56'S 114°07'E, tidal pool, R. Hanley, 8 Feb 1988; QM W17737, 1♀ (TL 28 mm), Cartier Reef, Timor Sea, near wreck of *Anne Millicent*, 12°32.7'S 123°32.9'E, outer reef flat, rotenone, B. Russell, 9 May 1992; QM W17739, 1♀ (TL 27 mm), Cartier Reef, Timor Sea, near wreck of *Anne Millicent*, 12°32.7'S 123°32.9'E, outer reef flat, rotenone, B. Russell, 9 May 1992; QM W18013, 1♂ (TL 21 mm), 1♀ (TL 22 mm), Hibernia Reef, southeast side, Timor Sea, 11°59.0'S 123°22.0'E, reef flat, 0–0.5 m, rotenone, B. Russell, 15 May 1992; WAM C7391, 1♀ (TL 31 mm), Point Cloates, tide pool on reef, rotenone, N. Wilward, 7 Oct 1957; WAM C7385, 1♂ (broken, CL 3.7 mm), Northwest Cape, 21°47'S 114°10'E, A. Snell, May 1958.

Other material. AM P58293, 1♀ (TL 25 mm), Kalim Beach, Phuket, Andaman Sea, Thailand, coral reef, from hole in reef rock, low tide, S. & R. Ahyong, 26 Nov 1999; NHM 1908.3.5.1, 1♀ (TL 32 mm), Levuka, Fiji, "*Challenger*" (holotype of *Protosquilla cerebralis* Brooks).

Diagnosis. A2 protopod with apex of dorsal process pointed to rounded. Rostral plate sharply trispinous, with lateral spines slender, directed anterolaterally. Mandibular palp 2-segmented. Raptorial claw propodus with or without movable spine proximally. AS1–4 smooth dorsally. AS1–5 unarmed posterolaterally. AS5 wrinkled with fine longitudinal grooves medially and laterally. AS6 wrinkled with fine grooves; with low SM, IM and LT bosses, unarmed posteriorly. Telson with 3 pairs of primary teeth, apices sharp; with MD and SM bosses, fissured and convoluted; MD boss circular to ovate in outline; SM bosses longer than MD boss, extending beyond midlength of telson, but not to posterior margin. Uropodal protopod unarmed dorsally excepting dorsal spine above proximal exopod articulation; exopod proximal segment outer margin with 8–10 movable spines; with blunt angular projection (rarely sharp) above articulation of distal movable exopod spine.

Colour in life. Dark brown to black or with pale mottling, often with white marks laterally on thoracic and abdominal somites. Raptorial claw with dactylus pinkish.

Measurements. Male (n = 39) TL 14–38 mm, female (n = 88) TL 11–46 mm. A1 peduncle 0.62–0.81 CL. A2 scale 0.49–64 CL. Uropodal endopod length 3.30–4.94 breadth. The present series includes the largest reported specimens of the species.

Remarks. The Australian specimens of *H. glyptocercus* generally agree well with published accounts (Wood-Mason, 1875; Kemp, 1913; Manning, 1995) and the specimen from the Andaman Sea. A feature not mentioned in published accounts is the presence of minute sparsely distributed tubercles or spinules on the dorsum of AS6 and the telson. These minute tubercles or spinules on the telson are frequently visible only if the surface is dried and viewed in profile. The majority of Western Australian specimens differ from most Queensland specimens in bearing a movable proximal spine on the propodus of the raptorial claw and in generally bearing fewer minute tubercles scattered over the dorsal surface of the telson. In the presence of the movable propodal spine on the raptorial claw and fewer telson tubercles or spinules, the Western Australian specimens agree with the specimen from the Andaman Sea and by inference also with Wood-Mason's holotype (also from the Andaman Sea). Unfortunately, accounts of the holotype of *H. glyptocercus* do not mention the presence or absence of the movable propodal spine on the raptorial claw or the ornamentation of the telson surface. The morphological differences between the Pacific and Indian Ocean specimens suggest that *H. glyptocercus*, as presently understood, perhaps comprises two or more species.

Protosquilla cerebralis was described by Brooks (1886) from Fiji and is presently regarded as synonymous with *H. glyptocercus*. The holotype of *Protosquilla cerebralis* bears

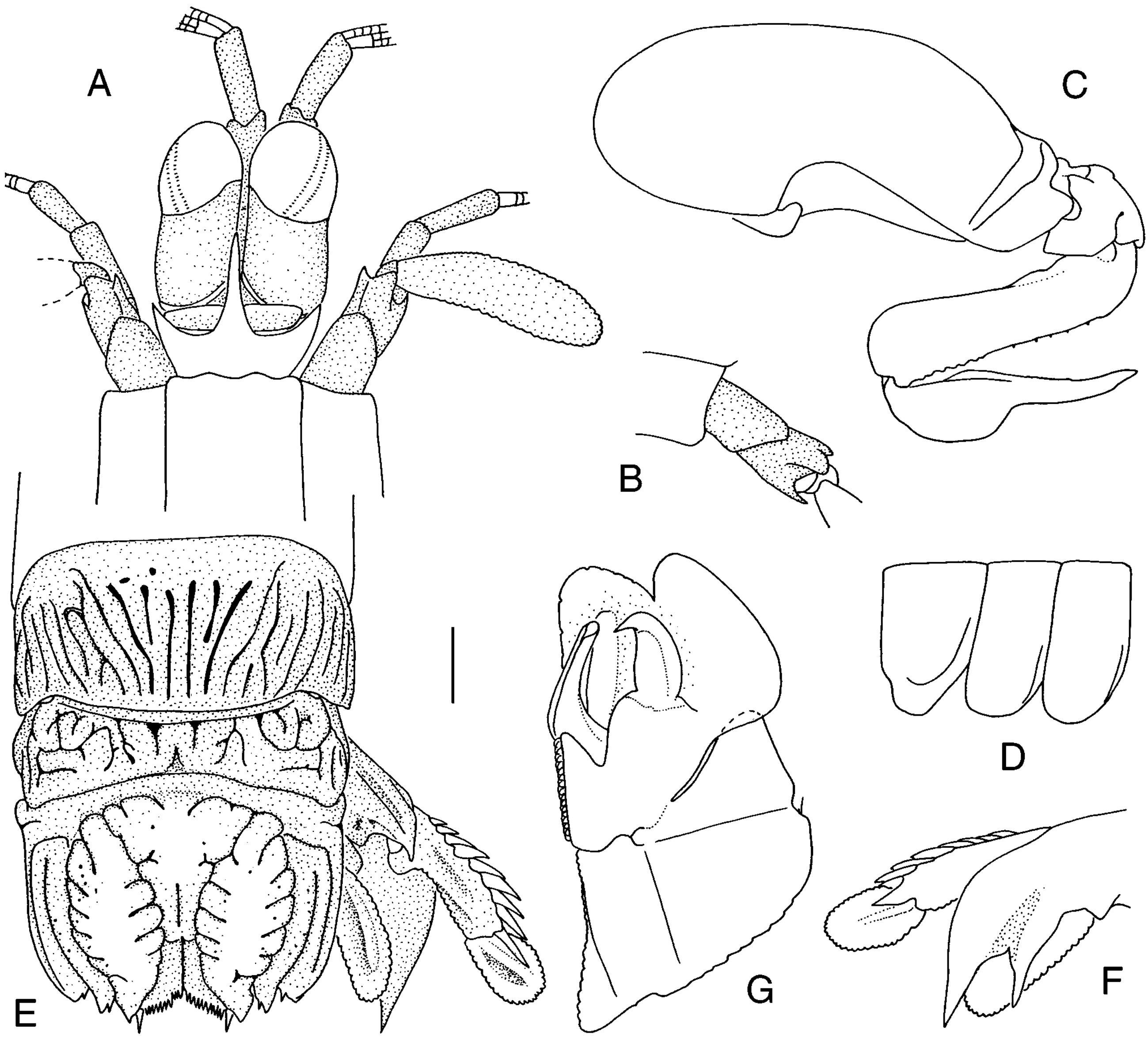

Figure 50. *Haptosquilla glyptocercus* (Wood-Mason), ♂ TL 21 mm (AM P12165). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS4–6, telson & uropod, dorsal. F, uropod, right ventral. G, PLP1 endopod, right anterior. Scale A–G = 1.25 mm; G = 0.45 mm.

more numerous and more distinct dorsal telson tubercles than any Australian specimens and differs from most Queensland specimens in bearing a movable spine on the propodus of the raptorial claw. At present, *H. glyptocercus* is regarded as a widely distributed species pending study of specimens from throughout its reported range.

Haptosquilla glyptocercus is one of the commonest species of the genus in Australian waters, especially on coral reef flats. In the present series, the petasma was well developed in the smallest males examined (TL 14 mm).

Habitat. Coral reef flats in preformed cavities in reef rock.

Distribution. Andaman Sea to Japan, Vietnam, the Philippines, New Caledonia, Fiji, Australia (Manning, 1995), Enewetak Atoll and Guam (Reaka & Manning, 1987).

Haptosquilla stoliura (Müller, 1886)

Fig. 51

Protosquilla stoliura Müller, 1886: 471, 477, pl. 4: fig. 2 (type locality: Amboina, Indonesia, 3°43'S 128°12'E).
Protosquilla trispinosa.–Rathbun, 1914: 663–664, pl. 2: fig. 12 [part; not *P. trispinosa* (Dana, 1852)].
Gonodactylus stoliurus.–Kemp, 1913: 149, 184–185.–Alexander, 1916a: 9.–Holthuis, 1941: 289.–Stephenson & McNeill, 1955: 253.–Stephenson, 1962: 35.
Gonodactylus trispinosus.–Miers, 1880: 122 (part, not *G. trispinosus* Dana, 1852).
Haptosquilla stoliura.–Manning, 1969d: 161; 1995: 21, 99.

Australian material. WESTERN AUSTRALIA: AM P12398, 1♀ (TL 46 mm), Lancelin I., 31°00'S 115°19'E, D. Serventy; AM P19317, 14♂♂ (TL 22–44 mm), 19♀♀ (TL 19–53 mm), Bundagi Reef,

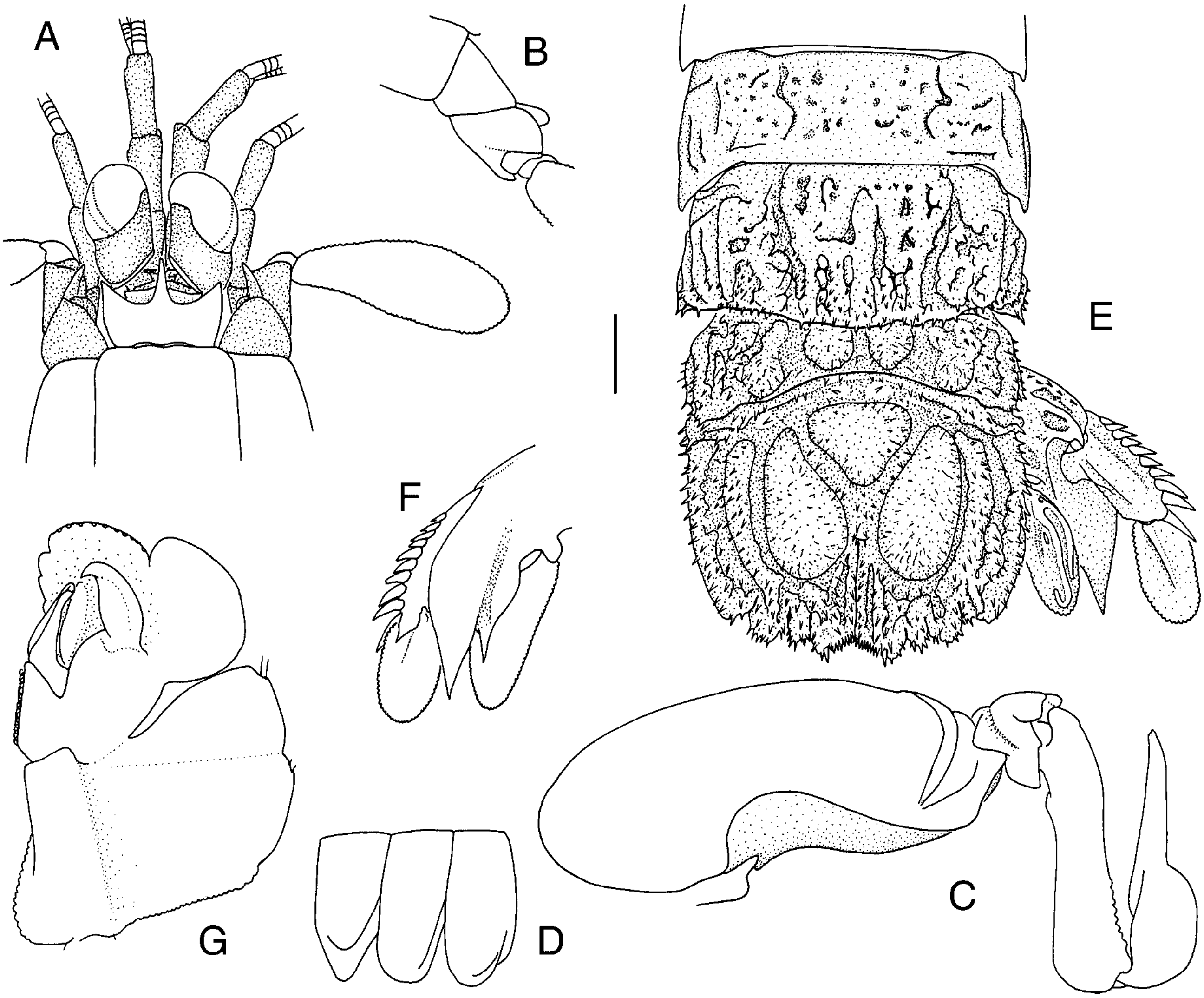

Figure 51. *Haptosquilla stoliura* (Müller). A–F, ♀ TL 53 mm (AM P19317). G, ♂ TL 40 mm (AM P19317). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS4–6, telson & uropod, dorsal. F, uropod, right ventral. G, PLP1 endopod, right anterior. Scale A–F = 2.5 mm; G = 0.6 mm.

Exmouth Gulf, 21°53'S 114°22'E, shallow rock pool, W. & J. Ponder, 19 Jan 1972; WAM C7864, 1♀ (TL 52 mm), Five Mile Fence, S of Northwest Cape, reef, low tide, R. George & P. Cawthorn, 3 Apr 1961.

Other material. USNM 304368, 3♂♂ (TL 39–65 mm), 7♀♀ (TL 35–57 mm), Barrang Lompo, Spermonde Archipelago, Sulawesi, Indonesia, M. Erdmann.

Diagnosis. A2 protopod with apex of dorsal lobe rounded. Rostral plate with slender median spine and broad, triangular lateral spines directed anteriorly. Mandibular palp 2-segmented. Raptorial claw propodus with movable spine proximally. AS1–4 with shallow intermediate and lateral sulcus; posterolateral angles rounded anteriorly, becoming more angular posteriorly. AS4 with irregular submedian pits. AS5 corrugated and pitted, medially and laterally; posterior margin with short spinules. AS6 sparsely covered with short, erect spinules; with distinct, SM, IM and LT bosses, each unarmed posteriorly. Telson with 4 pairs of blunt primary teeth; dorsal surface with MD boss trianguloid in outline; SM bosses pyriform in outline, elongate, longer than MD boss, extending beyond midlength but not to posterior margin; entire dorsal surface of telson sparsely covered with short, erect spinules. Uropodal protopod dorsally with up to 5 spinules proximally in addition to spine above proximal exopod articulation; exopod proximal segment outer margin with 9 or 10 movable spines.

Colour pattern in alcohol. Faded to a mottled brown.

Measurements. Male (n = 17) TL 22–65 mm, female (n = 28) TL 19–57 mm. A1 peduncle 0.82–1.12 CL. A2 scale 0.57–0.68 CL. Uropodal endopod length 2.69–3.07 breadth. The 65 mm TL male is the largest known specimen of *H. stoliura*.

Remarks. The Australian specimens agree well with published accounts (Müller, 1886; Kemp, 1913); Manning (1995) and the series from Indonesia. Apparently, *H. stoliura* has a somewhat western distribution in the Indo-Pacific region. To date, it has not been reported from the island groups of the Central Pacific, or even eastern Australia. The distribution of *H. stoliura* contrasts with that of *H. trispinosa*, which is absent from the Indian Ocean.

Habitat. Shallow coastal or nearshore reefs in tidal pools.

Distribution. Western Indian Ocean, Singapore, the Philippines, Vietnam and Western Australia.

Haptosquilla trispinosa (Dana, 1852)

Fig. 52

Gonodactylus trispinosus White, 1847: 85 (*nomen nudum*, type locality: Swan River, Western Australia).
Gonodactylus trispinosus Dana, 1852: 623 (type locality: Swan River, Western Australia, by present lectotype selection, but see remarks below).–Kemp, 1913: 180.–Hansen, 1926: 35.–Hale, 1929a: 33.–Stephenson & McNeill, 1955: 253.
Gonodactylus pulchellus.–Hale, 1929a: 34.–Stephenson & McNeill, 1955: 252 (not *G. pulchellus* Miers, 1880).
Haptosquilla trispinosa.–Manning, 1969d: 161.–Moosa, 1991: 166–167.–Debelius, 1999: 284.

Type material. LECTOTYPE: NHM 710, ♂ (dry specimen, TL approx. 38 mm), Swan River, Mr Dring (studied from photographs provided by NHM).

Australian material. QUEENSLAND: AM exP7556 (part with *G. chiragra*), 1♂ (TL exceeding 37 mm), Cairns Reef, off Cooktown, 15°28'S 145°15'E, A. McCulloch, 1905; AM P10532, 1♀ (TL 39 mm), Hayman I., Whitsunday Group, 20°03'S 148°53'E, F. McNeill, Jan 1934; AM P12166, 1♀ (TL 27 mm), Michaelmas Cay, 16°35'S 146°02'E, coral reef, G. Whitley & T. Iredale, Jun 1926; AM P17711, 1♂ (TL 43 mm), One Tree I., lagoon near northern reef face, 22°30'S 150°05'E, 6.7–8.3 m, sand & weed bottom, dredge, M. Cameron & D. Griffin, 21 Oct 1968; AM P17713, 1♀ (TL 26 mm), One Tree I., lagoon, 22°30'S 150°05'E, 3–4 m, sand bottom, dredge, J. Yaldwyn, Nov 1966; AM P56158, 3♂♂ (TL 26–28 mm), 2♀♀ (TL 40–43 mm), Arlington Reef, 16°43'S 146°05'E, less than 5 m, coral reef, holes in coralline rock, T. Page, Jan 1997; AM P56813, 1♂ (TL 30 mm), 1♀ (TL 25 mm), W side Green I., 16°45'S 145°59'E, from hole in reef rock, rubble zone, S. Ahyong, 11 Jul 1992; AM P56981, 1♀ (TL 34 mm), W side Green I., 16°45'S 145°59'E, from hole in reef rock, rubble zone, S. Ahyong, Jul 1988; NMV J37806, 1♂ (TL 22 mm), Britomart Reef bommie, near SE end 18°17'S 146°38'E, 8 m, coral rubble, G. Poore & H. Lew Ton, 25 Nov 1982; QM W16674,

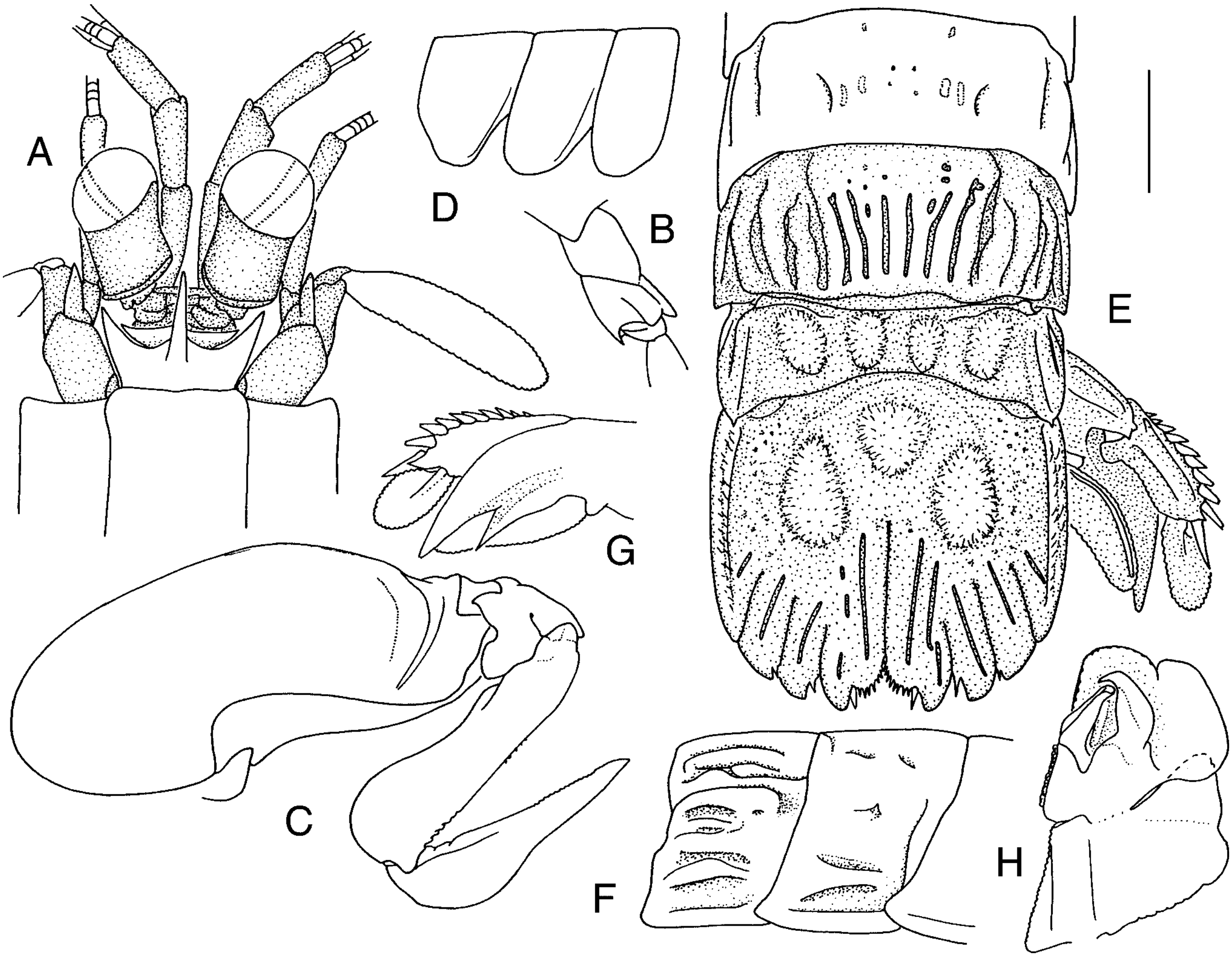

Figure 52. *Haptosquilla trispinosa* (Dana), ♂ TL 32 mm (AM P56158). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS4–6, telson & uropod, dorsal. F, AS4–5, right lateral. G, uropod, right ventral. H, PLP1 endopod, right anterior. Scale A–G = 2 mm; H = 1 mm.

3♀♀ (TL 26–36 mm), Swain Reefs, 21°42.8'S 151°42.7'E, O. McCain, Aug 1990; SAM C1651, 2♀♀ (TL 25–28 mm; dry), Owen Channel, Flinders I., Princess Charlotte Bay, 5.5 m, dredge, holes in stones, H. Hale & N. Tindale, 1927; SAM C1662, 1♀ (TL 14 mm), Owen Channel, Flinders I., Princess Charlotte Bay, 5.5 m, dredge, from hole in stone, H. Hale & N. Tindale, 1927; USNM, 3♀♀ (TL 25–29 mm), Lizard I., N. Marshall, 7 Apr 1994.

Other material. NTM, 1♂ (TL 16 mm), Chesterfield Reef, Coral Sea, New Caledonia, 19°18.5'S 158°33'E, 50 m, coral rubble & coarse sand, dredge, R. Hanley, 23 Jul 1988.

Diagnosis. A2 protopod with apex of dorsal process acute. Rostral plate sharply trispinous, with lateral spines slender, directed anterolaterally. Mandibular palp 2-segmented. Raptorial claw propodus with movable spine proximally. AS4 smooth medially, at most with several widely spaced pits. AS5 medially and laterally corrugated. AS4–5 posterolateral margins acute but blunt. AS6 with distinct SM, IM and LT bosses, each setose dorsally and armed posteriorly. Telson with 4 pairs of blunt primary teeth, separated by deep fissures, extending anteriorly about ½ distance to submedian bosses; lateral margins and surface of MD and SM bosses covered with short fine setae; MD boss ovate in outline; SM bosses pyriform in outline, longer than MD boss, extending beyond midlength but not to posterior margin; surface between SM bosses pitted, posteriorly non-setose, with fine longitudinal grooves. Uropodal protopod unarmed dorsally excepting dorsal spine above proximal exopod articulation; exopod proximal segment outer margin with 8–10 movable spines and short spine adjacent to distal movable spine.

Colour in life. Dorsal surface white with grey to brown mottling, and with sparsely distributed iridescent blue spots mid-dorsally on carapace, TS6–8, and AS 1, 4 and 5. A1 peduncle with flagella banded white and orange or red. MXP1 with propodus iridescent blue.

Measurements. Male (n = 8) TL 16–43 mm, female (n = 16) TL 14–43 mm. A1 peduncle 0.58–0.80 CL. A2 scale 0.51–0.58 CL. Uropodal endopod length 3.23–4.33 breadth. The present series includes the largest known specimen of the species.

Remarks. Dana (1852) was the first to provide a description of *H. trispinosa* (as *Gonodactylus trispinosus*), but he attributed the specific epithet to an account by Adam White that was never published. White (1847) had already referred two specimens to *Gonodactylus trispinosus* but without description. Although authorship of *H. trispinosa* belongs to Dana, his attribution of the specific epithet to White validated the specimens listed by White (1847) as syntypes. Of the two specimens listed by White (1847) under *G. trispinosus*, one is a specimen from Mauritius identifiable with *H. ectypa* (see Kemp, 1913). The second specimen, listed from Swan River (presumably Western Australia) has long been considered to be White's "intended type" (Miers, 1876, 1880; Stephenson, 1962) and agrees well with the species currently known as *H. trispinosa*. Although it could be debated, on the basis of Miers (1876, 1880), that the Mauritius specimen is not a type, and that the Swan River specimen is the holotype, I take the more conservative approach and consider both of White's (1847) specimens to be syntypes. Therefore, the Swan River specimen is designated as the lectotype to fix the identity of the species. The lectotype, a dry male specimen (c. TL 38 mm), is in poor condition, being partially fragmented and with marked dorsal cuticular deterioration. The specimen, however, is sufficiently intact to characterize the species and distinguish it from other species of *Haptosquilla*. The lectotype bears the strongly corrugated median surface of AS5, smooth or sparsely pitted median surface of AS4 as in Fig. 52, and is clearly conspecific with other specimens examined here. The type locality, Swan River, however, is enigmatic because all other specimens of the species are known from the Pacific Ocean. Previous records of *H. trispinosa* from Western Australia are all based on *H. corrugata* n.sp. which bears a strongly corrugated median surface of AS4. Moreover, the temperate environs of the Swan River, Western Australia, are an unlikely habitat for *H. trispinosa* which is typically a coral reef inhabitant. The lectotype of *H. trispinosa* forms part of a larger collection purchased by the Natural History Museum (London) from Mr Dring of South Australia (White, 1847). Two other tropical species in Dring's collection listed by White (1847), also listed from the Swan River, are *Gonodactylus chiragra* and a species of *Uca* (as *Gelasimus*). Neither of these tropical species have otherwise been reported from the Swan River. White's (1847) given type locality must be considered erroneous. Swan River is perhaps an error for Swan Island, Queensland, which is within the known range of *H. trispinosa*. Therefore, the type locality of *Haptosquilla trispinosa* should be corrected to Northeastern Australia.

Haptosquilla trispinosa is most similar to *H. corrugata* n.sp. sharing a sharply trispinous rostral plate, four primary telson teeth and dorsal corrugations on AS5. Characters distinguishing *H. trispinosa* and *H. corrugata* are outlined under the account of the latter. *Haptosquilla trispinosa* is restricted to eastern Indonesia, the central and western Pacific Ocean; other than Miers' (1880) record of *H. trispinosa* from Mauritius which is based on *H. ectypa*, previous records of *H. trispinosa* from the Indian Ocean are referable to *H. corrugata*.

The largest specimens of *H. trispinosa* reported here show previously unreported variation in the dorsal corrugation of the abdominal somites. In the 14 mm TL specimen, the dorsal corrugations on AS5 are undeveloped and presumably on this basis was identified with *Gonodactylus pulchellus* by Hale (1929a). In the 16 mm TL specimen, the mid-dorsal corrugations on AS5 are partially developed. In all other specimens, the mid-dorsal corrugations are well developed on AS5 and some of the largest specimens have some mid-dorsal pits on AS4.

Haptosquilla trispinosa and *H. glyptocercus* are the two commonest species of the genus on northeastern Australian coral reef flats and are frequently sympatric.

Habitat. Coral and rocky reefs in preformed cavities in reef rock to 8 m depth.

Distribution. Central Pacific, New Caledonia, northeastern Australia, and eastern Indonesia.

Haptosquilla tuberosa (Pocock, 1893)

Fig. 53

Gonodactylus tuberosus Pocock, 1893: 476, pl. 20B, fig. 2 (type locality: Macclesfield Bank, South China Sea, 15°50'S 114°20'E).–Kemp, 1913: 5, 11, 149, 181; 1915: 183–186.

Gonodactylus nefandus Kemp, 1911: 93 (type localities: Andaman Is, Cheduba, and the Straits of Malacca); 1913: 179–180, pl. 10: figs. 119, 120; 1915: 184–185.–Kemp & Chopra, 1921: 311.–Hansen, 1926: 33; new synonymy.

Haptosquilla nefanda.–Manning, 1969d: 162.–Moosa, 1973: 10–11; new synonymy.

Haptosquilla tuberosa.–Manning, 1969d: 162.–Moosa, 1973: 12.–Manning, 1995: 21, 99, 105–106, pl. 19, fig. 9k, 43e, 55–58.

Type material examined: LECTOTYPE: NHM 92.8.28.11, 1♂ (TL 31 mm), Macclesfield Bank, South China Sea, 15°50'S 114°20'E, 68 m, P.W. Bassett-Smith. PARALECTOTYPE: NHM 92.8.28.12, 1♀ (TL 37 mm), type locality.

Australian material. WESTERN AUSTRALIA: NMV ex37816, 1♂ (TL 22 mm), 1♀ (TL 11 mm), Northwest Shelf between Port Hedland & Dampier, 20°29'S 117°20'E, 30 m, coarse shell, epibenthic sled, G. Poore & H. Lew Ton, 11 Jun 1983 (with *Manningia australiensis*); NTM Cr000704, 1♂ (TL 19 mm), Northwest Shelf, 19°23.0'S 118°28.0'E, 70 m, S0184, NWS-26; NTM exCr005206, 1♂ (TL 13 mm), Northwest Shelf, 40–46 m, from coralline rocks, B. Russell, 17 Apr 1985; NTM Cr012356, 1♂ (TL 16 mm), 1♀ (TL 23 mm), Northwest Shelf, 19°04.2–04.4'S 119°00.5–00.7'E, 82 m, beam trawl, S0583 B11, 23 Oct 1983; Northwest Shelf, AS0283 115, trawl; NTM Cr012370, 1♂ (TL 17 mm), Northwest Shelf, 19°29.9–29.5'S 118°52.0–52.5'E, 38 m, beam trawl, S0583 D9, 25 Oct 1983; NTM Cr012377, 2♀♀ (TL 13–20 mm), Northwest Shelf, 19°55.2–55.6'S 117°56–55.6'E, 40 m, beam trawl, S0583 B3, 26 Oct 1983; NTM Cr012379, 1♀ (TL 11 mm), Northwest Shelf, trawl, AS0283 126; NTM Cr012380, 1♀ (TL 21 mm), Northwest Shelf, AS0283 69, trawl; NTM Cr012382, 1♀ (TL 23 mm), Northwest Shelf, AS0283 115, trawl; NTM Cr012383, 1♂ (TL 17 mm), Northwest Shelf, trawl, AS0283 132; NTM Cr012388, 1♀ (TL 19 mm), Northwest Shelf, 19°56.4–56.8'S 117°53.4–53.7'E, 42 m, beam trawl, S0283 B2, 24 Apr 1983; NTM Cr12385, 1♀ (TL 13 mm), Northwest Shelf; NTM Cr012387, 1♀ (TL 16 mm), Northwest Shelf, 19°30.8'S 118°48.8–49.3'E, 38–39 m, beam trawl, S0583 D9, 30 Aug 1983; NTM Cr012391, 1♂ (TL 25 mm), Northwest Shelf, trawl, S0283 T/18/53 PB 1; WAM C7830, 1♂ (TL 17 mm), 40 km NW of Angel I., Dampier Archipelago, *Honolulu* dredge, R. Royce, 2 Jun 1960.

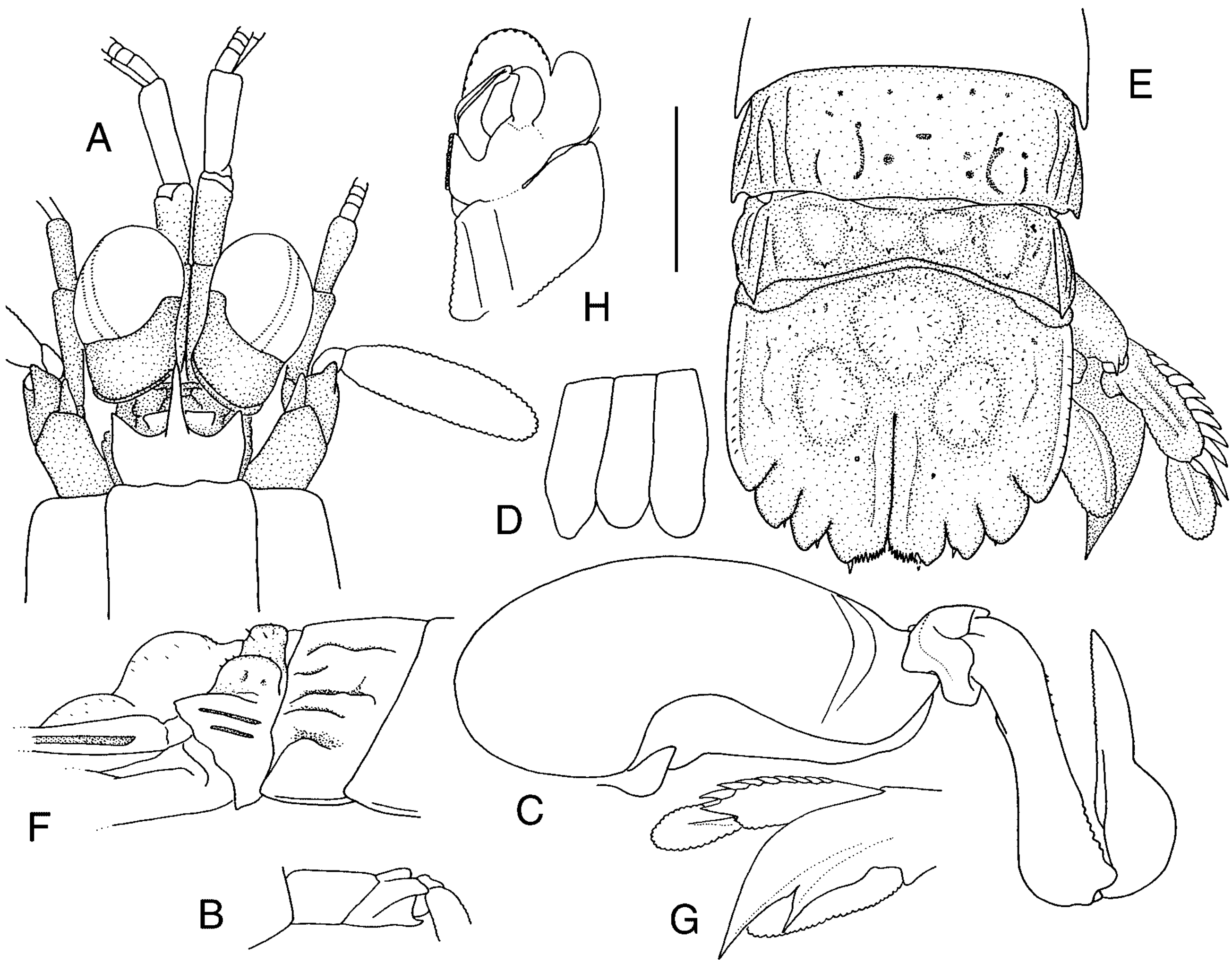

Figure 53. *Haptosquilla tuberosa* (Pocock), ♂ TL 25 mm (NTM Cr012391). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS4–6, telson & uropod, dorsal. F, AS5–6 & telson, right lateral. G, uropod, right ventral. H, PLP1 endopod, right anterior. Scale A–G = 2.5 mm; H = 1.2 mm.

Diagnosis. A2 protopod with apex of dorsal lobe rounded. Rostral plate with slender median spine and broad, triangular lateral spines directed anteriorly. Mandibular palp 2-segmented. Raptorial claw propodus with movable spine proximally. AS1–5 laterally with irregular longitudinal sulcus above margin, unarmed posterolaterally. AS5 smooth or with shallow pits medially; deeply corrugated laterally. AS6 with distinct SM, IM and LT bosses, smooth in adults, wrinkled and armed posteriorly in juveniles, posterior margin unarmed; laterally with 1–2 grooves; unarmed posterolaterally. Telson; with 4 pairs of blunt primary teeth; MD boss circular or subcircular in outline; SM bosses subequal to or smaller than MD boss, circular to ovate in outline, not extending beyond midlength; dorsal surface irregular and tuberculate in juveniles, smoother in adults; surface of bosses in adults smooth or sparsely covered with minute spinules. Uropodal protopod unarmed dorsally excepting spine above proximal exopod articulation; exopod proximal segment outer margin with 9 or 10 movable spines.

Colour in alcohol. Almost completely faded. Carapace, thoracic and abdominal somites with some scattered dark chromatophores, with a darkest on TS6, medially on TS7 and AS1. A1 peduncle reddish.

Measurements. Male (n = 9) TL 13–31 mm, female (n = 11) TL 11–37 mm. A1 peduncle 0.86–1.10 CL. A2 scale 0.49–0.62 CL. Uropodal endopod length 2.62–3.32 breadth. The paralectotype is the largest known specimen of the species.

Remarks. The Australian specimens agree well in most respects with the types, varying in the distinctness of shallow pits on the mid-dorsal surface of AS5 and in having a smoother telson surface that lacks fine setae. The differences in mid-dorsal ornamentation of AS5 and telson setation are likely size related because the types are considerably larger than the largest Australian specimens. In all males exceeding 16 mm TL, the penes and petasma are well developed.

Published keys to *Haptosquilla* (e.g., Manning, 1969d, 1995) have followed Kemp (1913) and attribute mid-dorsal pits and corrugations on AS5 to *H. tuberosa*, implying a similar morphology to *H. trispinosa*. This confusion over the ornamentation of AS5 in *H. tuberosa*, however, stems from omissions in the limited original account of Pocock (1893) that was also inadequately figured. Inasmuch as *H. tuberosa* lacks mid-dorsal corrugations on AS5, according to Kemp (1913) and Manning (1969d, 1995), the species will key out to *H. nefanda*. Comparison of *H. tuberosa* with published accounts and a syntype (AM P3974) of *H. nefanda* shows that the two species are conspecific. In *H. tuberosa*, the mid-dorsal pits, when present, are shallow and in some specimens are visible only if the surface is dried. Variability in the presence mid-dorsal pits on AS5 in *H. tuberosa* was also noted by Hansen (1926) (as *G. nefandus*) and Moosa (1973). The male syntype of *H. tuberosa* (TL 31 mm) is herein designated the lectotype.

Habitat. Known from depths of 30–82 m on sand and rubble or coarse shell substrates.

Distribution. Macclesfield Bank, South China Sea, Vietnam, Indonesia, the Bay of Bengal, Andaman Sea, and now from the Australian Northwest Shelf.

Siamosquilla Naiyanetr, 1989

Siamosquilla Naiyanetr, 1989: 281, 283. Type species *Siamosquilla hyllebergi* Naiyanetr, 1989, by monotypy. Gender feminine.
Laevosquilla Sun & Yang, 1998: 145–147, 153. Type species *Laevosquilla laevicaudata* Sun & Yang, 1998, by monotypy. Gender feminine.

Diagnosis. Eye with cornea slightly broadened. Mandibular palp 2-segmented or absent. MXP1–5 with epipod. Raptorial claw propodus with movable spine proximally. AS1 with articulated pleural plate anterolaterally. AS6 fused with telson, without dorsal groove demarcating segments. Telson posterior margin undivided; SM teeth separated by shallow concave or biconvex margin, not by deep emargination or narrow fissure. Uropodal endopod without dorsal spines.

Included species. Two: *S. hyllebergi* Naiyanetr, 1989; and *S. laevicaudata* (Sun & Yang, 1998).

Remarks. *Siamosquilla* closely resembles *Haptosquilla* but differs in lacking a median fissure between the submedian teeth of the telson, and in lacking the dorsal groove demarcating AS6 from the telson. The original account of *Siamosquilla* was erroneous in attributing fixed apices to the submedian teeth on the telson and a mandibular palp to the type species, *S. hyllebergi* (based on re-examination of type material in NNM and ZRC). *Siamosquilla hyllebergi* lacks a mandibular palp, and both species of the genus recognized here have movable submedian teeth on the telson that articulate submarginally.

Little justification exists for recognizing *Laevosquilla* (Sun & Yang, 1998) as distinct from *Siamosquilla*. The type species of *Laevosquilla*, *L. laevicaudata*, closely resembles the type species of *Siamosquilla*, *S. hyllebergi* and is a senior synonym of *S. sexava* Erdmann & Manning, 1999.

Key to species of *Siamosquilla*

1 Mandibular palp present. Dorsal surface of telson without erosion and pitting between bosses. Apices of primary teeth of telson acute .... *S. hyllebergi*

—— Mandibular palp absent. Dorsal surface of telson with slight erosion and pitting between bosses. Apices of primary teeth of telson blunt .... ***S. laevicaudata***

Siamosquilla laevicaudata (Sun & Yang, 1998) n.comb.

Fig. 54

Laevosquilla laevicaudata Sun & Yang, 1998: 147, 153–156, fig. 3 (type locality: Huanglu Reef, Nansha Is, South China Sea, 6°56'N 113°35'E).

Siamosquilla sexava Erdmann & Manning, 1999: 94–96, fig. 1 (type locality: Moromaho, Tukang Besi, Indonesia); new synonymy.

Type material. PARATYPES: BNM J97014, 1♂ (TL 13 mm), 1♀ (TL 13 mm), Huanglu Reef, Nansha Is, South China Sea, 6°56'N 113°35'E, coral rock, X. Cai, 27 Mar 1994.

Australian material. WESTERN AUSTRALIA: QM W17935, 1♀ (TL 15 mm), SE side Hibernia Reef, Timor Sea, 11°59.0'S 123°22.0'E, 0–0.5 m, reef flat, rotenone, B. Russell, 15 May 1992.

Other material. USNM 260927, ♀ (TL 18 mm), Moromaho, Tukang Besi, Indonesia, M. Erdmann (holotype of *Siamosquilla sexava* Erdmann & Manning).

Diagnosis. Ocular scales broad in adults, acute laterally, extending laterally beyond eyestalk articulation. Carapace with anterior margin of lateral plates concave; anterolateral margins produced as short spines. Raptorial claw dactylus with basal notch. Mandibular palp absent. AS5 with low transverse carina on anterior margin. AS6 with irregular pitting dorsally. Telson broader than long; with lobe above SM tooth round, blunt; with SM denticles in convex row either side of midline; with 2 IM denticles; dorsal surface with shallow groove separating MD and SM bosses, with some irregular pits and erosion; lateral portion of SM bosses with some irregular pitting. Uropodal protopod with small inner spine, less than ½ length of outer spine; exopod proximal segment with 8 or 9 movable spines.

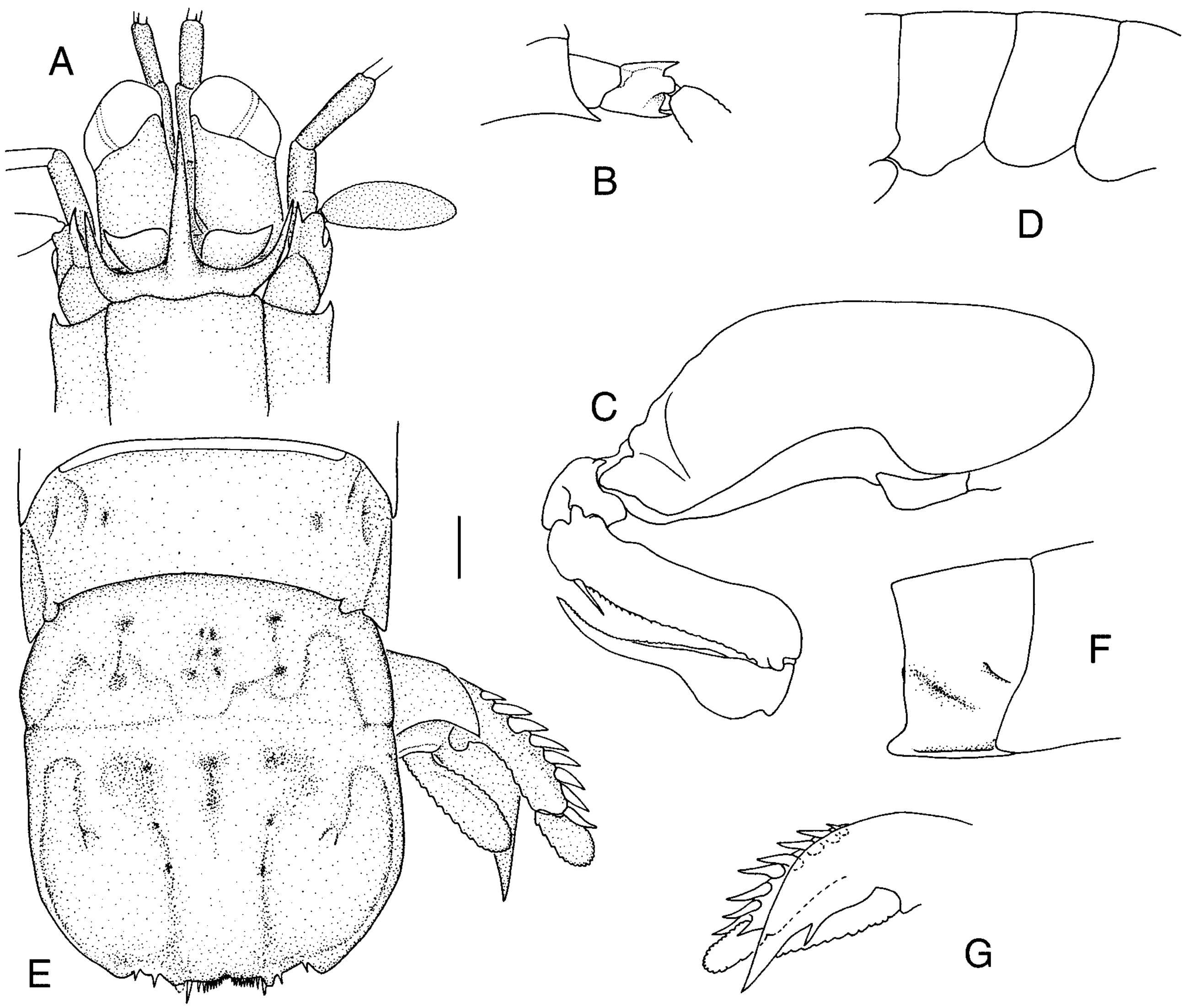

Figure 54. *Siamosquilla laevicaudata* (Sun & Yang) n.comb., ♀ TL 15 mm (QM W17935). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, AS5–6, telson & uropod, dorsal. F, AS4–5, right lateral. G, uropod, right ventral. Scale = 0.5 mm.

Colour in alcohol. Largely faded but with scattered chromatophores over dorsal surface; with a dark band across anterior cephalon.

Measurements. Male (n = 1) TL 13 mm, female (n = 3) TL 13–18 mm. A1 peduncle 0.67–0.80 CL. A2 scale 0.34–0.41 CL. Uropodal endopod length 2.81–3.17 breadth. Erdmann & Manning (1999) reported specimens to 18 mm TL (as *S. sexava*).

Remarks. *Siamosquilla sexava* agrees in all respects with *S. laevicaudata* and the two species must be considered synonymous. Erdmann & Manning (1998) detailed the characters distinguishing *S. hyllebergi* from *S. laevicaudata* (as *S. sexava*). In addition to the characters outlined by Erdmann & Manning (1998), *S. sexava* differs from *S. hyllebergi* in lacking a mandibular palp.

Habitat. Coral reefs flats from cavities in rubble.

Distribution. Known only from Indonesia, the South China Sea and now Australia.

PSEUDOSQUILLIDAE Manning, 1977a

Pseudosquillidae Manning, 1977a: 95 (type genus *Pseudosquilla* Dana, 1852).

Diagnosis. Dorsal surface of A2 protopod with articulated, ventrally carinate plate. Ischiomeral articulation of raptorial claw terminal; propodus opposable margin evenly pectinate proximally, becoming sparsely pectinate distally; dactylus slender with 3 teeth, basally uninflated. Mandibular palp 3-segmented. MXP1–5 with epipod. AS6 articulating with telson. Telson with distinct, slender MD carina; SM denticles absent in adults. Articulation of uropodal exopod segments terminal; distal spines on outer margin of uropodal exopod slender, straight or slightly curved but not strongly recurved anteriorly.

Included genera. Four: *Pseudosquilla* Dana, 1852; *Pseudosquillana* Cappola & Manning, 1995; *Pseudosquillisma* Cappola & Manning, 1995; and *Raoulserenea* Manning, 1995.

Remarks. Pseudosquillids differ from other gonodactyloids in having a spearing claw bearing three dactylar teeth and in having a ventral carina on the articulated dorsal plate of the antennal protopod. According to the results of Ahyong & Harling (2000), *Pseudosquilla* is the sister to all other pseudosquillid genera, bearing plesiomorphic traits such as the narrow eyes and absence of large “eye-spots” on the carapace. Other pseudosquillids bear broadened or bilobed eyes and usually also large “eye-spots” on the carapace—*Pseudosquillana richeri* with a single median “eye-spot”, and species of *Raoulserenea* and *Pseudosquillisma* with paired “eye-spots”. All four genera of the Pseudosquillidae are represented in Australian waters.

Key to genera of Pseudosquillidae

1 Telson with 3 carinae either side of MD carina 2

—— Telson with 4 carinae either side of MD carina 3

2 Cornea subglobular, not broadened anteriorly. Carapace without pair of large dark spots. Uropodal protopod with inner spine longer .... ***Pseudosquilla***

—— Cornea flattened, broadened anteriorly. Carapace with pair of large dark, circular patches. Uropodal protopod with inner spine shorter .... ***Raoulserenea***

3 Rostral plate without anterior spine. Telson with long LT carina .... ***Pseudosquillana***

—— Rostral plate with short anterior spine. Telson with short anterior IM carina .... ***Pseudosquillisma***

Pseudosquilla Dana, 1852

Pseudosquilla Dana, 1852: 615. Type species *Squilla ciliata* Fabricius, 1787, by subsequent designation by the International Commission on Zoological Nomenclature under its plenary powers in Opinion 785. Name on *Official List* of International Commission on Zoological Nomenclature. Gender feminine.

Diagnosis. Eye cylindrical, cornea subglobular, not broadened anteriorly. Rostral plate without anterior spine. Carapace without pair of large dark eye-spots. Raptorial claw propodus with 3 movable spines proximally. AS1–5 with MG carina only. Telson with 3 carinae either side of MD carina. Uropodal protopod terminating in 2 slender, flattened spines, inner spine longer.

Included species. One: *P. ciliata* (Fabricius, 1787).

Remarks. *Pseudosquilla* differs from other genera in the family by having subglobular corneae that are not broadened laterally and in having the inner spine of the uropodal protopod longer than the outer. Additionally, the abdomen in *Pseudosquilla* is relatively broader than that of other pseudosquillids (compare AWCLI under species accounts). A single, widespread species of *Pseudosquilla* is recognized, but see remarks under the account of *P. ciliata*.

Pseudosquilla ciliata (Fabricius, 1787)

Fig. 55

Squilla ciliata Fabricius, 1787: 333 (type locality: Exmouth Gulf, Western Australia, restricted by present neotype selection).
Squilla stylifera Lamarck, 1818: 189 (type locality: unknown).

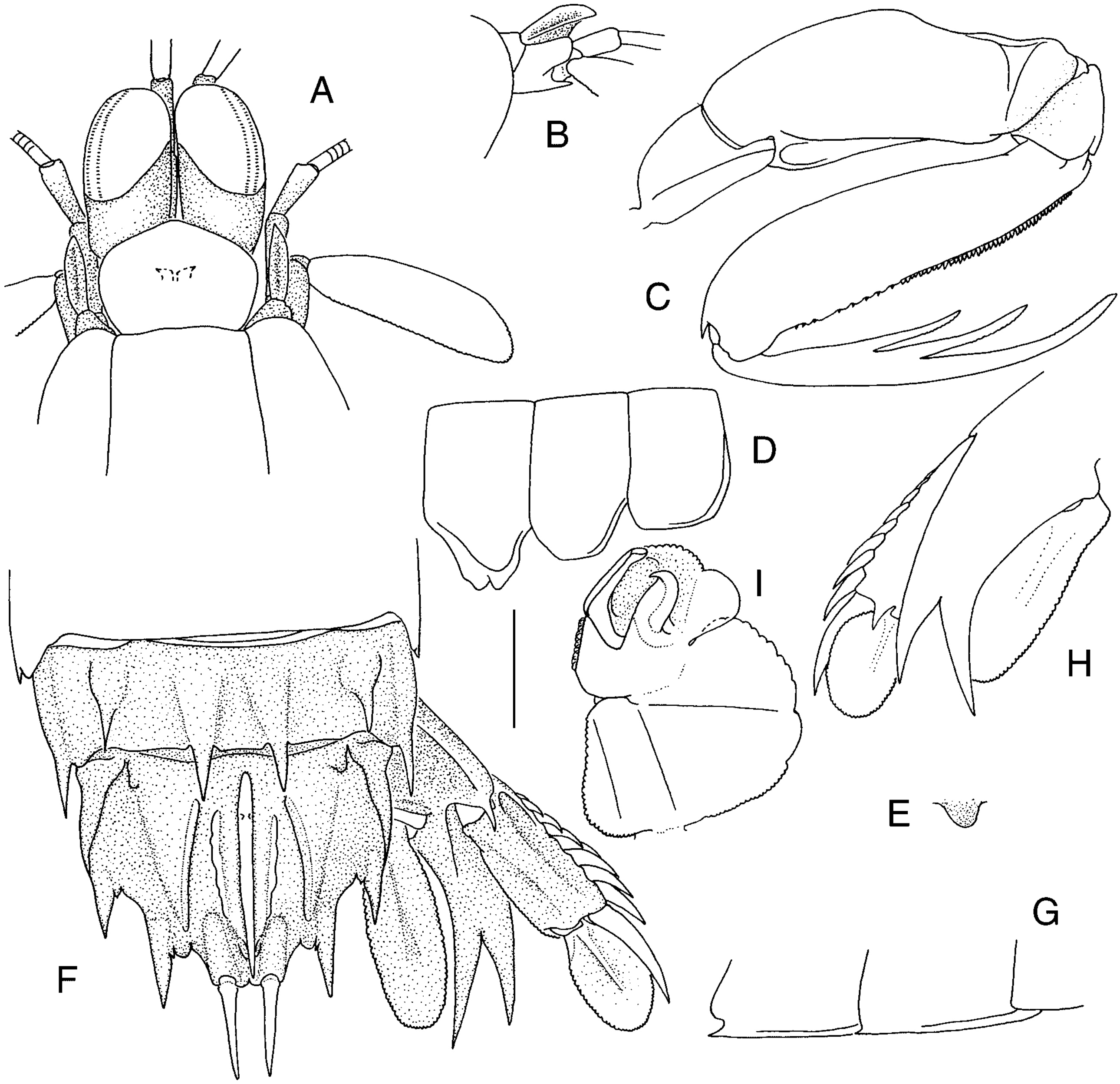

Figure 55. *Pseudosquilla ciliata* (Fabricius), ♂ TL 42 mm (AM P55496). A, anterior cephalon, dorsal. B, A2 protopod, right lateral. C, raptorial claw, right lateral. D, TS6–8, right lateral. E, TS8 sternal keel, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS3–5, right lower lateral. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 2.5 mm; I = 1.2 mm.

Squilla quadrispinosa Eydoux & Souleyet, 1842: 362, pl. 5: fig. 1 (type locality: Sandwich Is (= Hawaii), 24°00'N 167°00'E).

Pseudosquilla ciliata var. *occidentalis* Borradaile, 1900: 398, 402 (type locality: West Indies).

Pseudosquilla ciliata.–Haswell, 1882: 209–210.–Kemp, 1913: 3, 10, 96–100, 196.–Hale, 1929a: 34.–Tweedie, 1950: 140.–Holthuis, 1941: 261–263.–Stephenson, 1952: 9; 1953a: 44.–Stephenson & McNeill, 1955: 245.–Stephenson, 1962: 34.–McNeill, 1968: 88.–Moosa, 1986: 385; 1991: 169–70.–Manning, 1995: 21, 111–116, pl. 20, 21, figs. 59a, 60a,b,e, 61–63.–Gosliner *et al*., 1996: 195.–Ahyong & Norrington, 1997: 104.–Debelius, 1999: 290.

Type material. NEOTYPE: AM P58255, ♂ (TL 50 mm), Exmouth Gulf, 21°53'S 114°22'E, rock pool inside Bundagi Reef, N side of communications base, W. & J. Ponder, 19 Jan 1972.

Australian material. QUEENSLAND: AM P3138, 2♀♀ (TL 68–77 mm), Murray I., Torres Strait, 9°56'S 144°04'E, C. Hedley & A. McCulloch, 30 Aug to 3 Oct 1907; AM P3139–3140, 3♂♂ (TL 52–59 mm), 1♀ (TL 66 mm), Murray I., Torres Strait, 9°56'S 144°04'E, C. Hedley & A. McCulloch, 30 Aug to 3 Oct 1907; AM P4109, 1♀ (TL 60 mm), Caloundra, 26°48'S 153°08'E, T. Johnston; AM P12274, 1♂ (TL 59 mm), Darnley I., Torres Strait, 9°35'S 143°46'E, D. Tranter, 30 Aug 1953; AM P12091, 1♂ (TL 68 mm), Palm I., 18°40'S 146°33'E, J. Hynd; AM P12102, 1♂ (TL 56 mm), Myora, Stradbroke I., Moreton Bay, 27°29'S 153°25'E, J.S. Hynd, 4 Apr 1946; AM P12103, 1♀ (TL 75 mm), Myora, Stradbroke I., Moreton Bay, 27°29'S 153°25'E, on sand banks, J. Hynd, 28 Jul 1946; AM P12273, 1♂ (TL 75 mm), N of Dunwich, Stradbroke I., Moreton Bay, dug in sandy mud on *Zostera* flat, 27°30'S 153°24'E, W. Stephenson, 2 Aug 1952; AM P12366, 1♀ (TL 78 mm), Dunwich, Stradbroke I., Moreton Bay, 27°30'S 153°24'E, T. Marshall, Oct 1953; AM P14898, 1♂ (TL 59 mm), 3♀♀ (TL 68–81 mm), Murray I., Torres Strait, 9°56'S 144°04'E; AM P17697, 1♂ (TL 79 mm), NW Gillett Cay, Swain Reefs, 21°43'S 152°25'E, reef & sand flats, Oct 1962; AM P45587, 1♂ (TL 61 mm), Thursday I., 10°35'S 142°13'E, M. Ward; AM P49777, 1♂ (TL 67 mm), Shelburne Bay, 11°53.72'S 143°43.26'E, 22 m, T. Wassenberg, 24 Mar 1993; AM P49778, 1♀ (TL 71 mm), off Cape York Peninsula, 11°13.09'S 143°26.86'E, 33 m, T. Wassenberg, 9 Apr 1993; AM P49779, 1♀ (TL 90 mm), off Cape Grenville, 11°39.00'S 143°33.34'E, 18 m, T. Wassenberg, 17 Nov 1993; AM P55494, 1♂ (TL 57 mm), 2♀♀ (TL 47–66 mm), off Bird Islet, Lizard I., 24 m, baited trap on *Halimeda*, J. Lowry & R. Springthorpe, 11 Feb 1987; AM P55495, 1♂ (TL 48 mm), 5♀♀ (TL 38–69 mm), E side One Tree I., 0.6 m, low tide, tide pool over compacted dead coral, rotenone, B. Collette & W. Eschmeyer, 22 Nov 1969; AM P55496, 1♂ (TL 42 mm), Green I., 16°45'S 145°59'E, among sea grass, 0.1 m, S. Ahyong, 11 Jul 1992; AM P55502, 1♂ (TL 25 mm), 2♀♀ (TL 24–25 mm), Alexandra Reefs, rubble zone, low tide, S. Ahyong, 9 Jul 1992; AM P55503, 1♀ (TL 64 mm), Shelburne Bay, 11°17.18'S 142°55.7'E, 20–30 m, GBR0192 32/84, T. Wassenberg, 12 Apr 1993; AM P55504, 1♀ (TL 50 mm), 11°33.42'S 143°32.98'E, Middle Banks, Shelburne Bay, 20–30 m, GBR493 028, T. Wassenberg, 21 Nov 1993; AM P55505, 1♀ (TL 33 mm), 11°42.42'S 143°39.41'E, Middle Banks, Shelburne Bay, 20–30 m, T. Wassenberg, 28 Oct 1994; AM P55506, 1♀ (TL 34 mm), 11°40.21'S 143°52.3'E, Shelburne Bay, 20–30 m, T. Wassenberg, 26 Mar 1993; QM W837, 1♀ (TL 63 mm), Goat I., Moreton Bay, low tide under mud & stones, 18 May 1938; QM W1201, 1♀ (TL 68 mm), Myora, Moreton Bay; QM W1741–1742, 2♀♀ (TL 68–77 mm), Murray I.; QM W1744, 1♀ (TL 83 mm), Southport, R. Pohlman; QM W1745, 1♀ (TL 52 mm), Amity Point, Stradbroke I., J. Young, Sep 1924; QM W1801, 1♀ (TL 72 mm), Weyba Creek, Noosaville, H. Jamieson, 4 Mar 1952; QM W21730, 2♂♂ (TL 47–59 mm), 1♀ (TL 50 mm), Polka Point, near Dunwich, North Stradbroke I., Moreton Bay, 27°30'S 153°23'E, 0.5 m, netted in seagrass, Queensland Museum party, 6 Mar 1996; QM W23074, 1♀ (TL 69 mm), Fitzroy Reef, 23°38'S 152°08'E, reef flat, S. Cook, 26 Feb 1998; QM, 1♀ (TL 77 mm), Dunwich, Stradbroke I., Moreton Bay, intertidal flats, P. Davie *et al*., 18–19 Aug 1997; SAM C1652, 1♂ (TL 54 mm), Flinders I., Princess Charlotte Bay, low tide, burrows in mud, H. Hale & N. Tindale, 1927; SAM C1664, 1♀ (TL 48 mm), Flinders I., Princess Charlotte Bay, low tide, burrows in mud, H. Hale & N. Tindale, 1927. NEW SOUTH WALES: TM G3833, 1♀ (TL 50 mm), Long Reef, Collaroy, under rocks, mid-tide level, P. Colman, A. & J. Penprase, 21–23 Jul 1979; WAM 216–96, 1♀ postlarva (TL 22 mm), off Sydney, A. Racek, Oct 1959. WESTERN AUSTRALIA: AM P19331, 6♀♀ (TL 50–57 mm), Exmouth Gulf, 21°53'S 114°22'E, rock pool inside Bundagi Reef, N side of communications base, W. & J. Ponder, 19 Jan 1972. COCOS-KEELING ISLANDS: ZRC 1970.10.22.12, 1♀ (TL 40 mm), C. Gibson-Hill, 1941.

Other material. USNM 266644, 1♀ (TL 75 mm), Station Cauda, Vietnam, 13 Aug 1947.

Supplementary diagnosis. Eye cylindrical, cornea subglobular, not broader than stalk. A1 somite dorsal processes low, truncate. Rostral plate with apex rounded or obtusely angled. A2 scale with anterior margin smooth, non-setose. Carapace dorsum without large circular "eye-spots". AS1–5 with indistinct MG carina. AS(4)5 with postero-lateral spine. Telson dorsal surface with distinct MD carina and 3 longitudinal carinae laterally (accessory MD, anterior SM, MG). Uropodal protopod terminating in 2 slender flattened spines, inner spine longer; exopod proximal outer margin with 7–10 movable spines.

Colour in life. Highly polymorphic, with the background varying from yellow to almost black. The colour pattern may be uniform, mottled or longitudinally striped. A dark patch is often present laterally on TS6, AS1 and on the proximal margin of the telson behind the intermediate spine of AS6. The specimen from the Cocos-Keeling Islands was noted to be "[d]irty white finely blotched and speckled with grey, darkest posteriorly; the fringes of the uropods pink" (Tweedie, 1950: 140).

Measurements. Male (n = 19) TL 34–75 mm, female (n = 44) TL 22–90 mm, postlarva (n = 1) TL 24 mm. A1 peduncle 0.47–0.70 CL. A2 scale slender, 0.42–0.53 CL. PI 092–109 (males), 086–111 (females). PLDI 346–449 (males), 309–475 (females). AWCLI 794–935. The present series includes the largest known specimen of the species.

Remarks. Two morphological forms of *P. ciliata* were recognized by Serène (1951): "forme claire" and "forme foncée". In specimens attributed to "forme claire" the telson is relatively broad, the outer intermediate denticle of the telson is present, and the uropodal endopod is evenly rounded. The "forme foncée" was distinguished by having a more elongate telson, no outer intermediate telson denticle and distally tapered uropodal endopod. Australian specimens best correspond to "forme claire", but the characters used by Serène to distinguish the two forms are variable. Thus, the roundness of the apex of the uropodal endopod, the relative length of the telson and presence of the outer intermediate denticle varies, though the telson usually appears short and the outer intermediate denticle is usually present. Published figures of Serène's "forme foncée" show setae on the anterior margin of the antennal scale (e.g., Manning, 1995: fig. 61b) whereas in the "forme claire" the anterior margin of the antennal scale is non-setose. In all Australian specimens and figures of specimens attributed to the "forme claire" (e.g., Manning, 1995: fig. 61a, 63a), the anterior margin of the antennal scale is non-setose. Re-examination of the figured specimen of Serène's "forme foncée" (USNM 266644) showed that the antennal scale is non-setose anteriorly as in the "forme foncée", and all morphological features are within the range of variation present in Australian specimens. As remarked by Manning, however, with only a single specimen of the "forme foncée" available for study, additional specimens from Vietnam should be studied to more reliably evaluate Serène's observations. Additionally, the near pan-tropical distribution of *P. ciliata* suggests that more than one species may be involved. Presently, however, the Atlantic populations are indistinguishable from the "forme claire" in the Indo-West Pacific but closer scrutiny of these populations may reveal specific differences. Unlike some pseudosquillids, colour pattern in *P. ciliata* has little diagnostic value; specimens may exhibit striking changes in colour and pattern between moults.

Owing to the possibility that *P. ciliata* is composite, that *P. ciliata* is the type species of the genus and the fact that Fabricius' original stomatopod types are no longer extant, a neotype for the species is herein selected to fix the identity of the species. The type locality of *P. ciliata*, Oceano Indico, is quite non-specific. Therefore, an Indian Ocean specimen from Australia that corresponds to Serène's "forme claire" is herein selected as the neotype.

Habitat. Under boulders and coral rubble on coral and rocky reef flats and in burrows in seagrass beds, sand and mudflats, from the shore to at least 33 m in Australia. Moosa (1991) reported *P. ciliata* from New Caledonia to 86 m depth.

Distribution. All tropical oceans except the eastern Pacific. In Australia, *P. ciliata* is known from Exmouth Gulf, Western Australia northwards to Queensland and as far south as Sydney, New South Wales.

Pseudosquillana Cappola & Manning, 1995

Pseudosquillana Cappola & Manning, 1995: 282–283. Type species *Pseudosquilla megalophthalma* Bigelow, 1893a, by original designation and monotypy. Gender feminine.

Diagnosis. Cornea broadened anteriorly or bilobed. Rostral plate without anterior spine. Carapace at most with single median "eye-spot". Raptorial claw propodus with 2 or 3 movable spines proximally. AS1–5 with MG carina only. Telson with 4 carinae either side of MD carina (anterior SM, LT, MG). Uropodal protopod terminating in 2 slender flattened spines, outer spine longer.

Included species. Two: *P. richeri* (Moosa, 1991); and *P. megalophthalma* (Bigelow, 1893a).

Remarks. Cappola & Manning (1995) synonymized *P. richeri* with *P. megalophthalma* in their account of *Pseudosquillana*, but a recent revision of the genus showed both species to be valid (Ahyong, Manning & Reed, 2000). Both species of *Pseudosquillana* are restricted to the Indo-West Pacific and one species, *P. richeri*, is known from Australia.

Key to *Pseudosquillana*

1 Cornea strongly bilobed. AS6 intermediate spine with smaller accessory spine. Carapace without large median spot. AS5 without posterolateral "eye-spot" .... *P. megalophthalma*

—— Cornea broad, but not bilobed. AS6 intermediate spine without smaller accessory spine. Carapace with large dorsal median spot. AS5 with posterolateral "eye-spot" .... ***P. richeri***

Pseudosquillana richeri (Moosa, 1991)

Fig. 56

Pseudosquilla richeri Moosa, 1991: 175–176, fig. 5 (type locality: New Caledonia, 18°27.2'S 163°02.3'E).
Pseudosquilla megalophthalma.–Nobili, 1906: 336–337.–Kemp, 1915: 172, pl. 1, fig. 1.–Holthuis, 1941: 267–268; 1967: 40 (list).–Roxas & Estampador, 1930: 109, pl. 2, figs. 1, 2.–Ingle, 1963: 21–22, figs. 19, 37, 38, 69.–Manning & Lewinsohn, 1986: 12, 15 (list), fig. 4.–Moosa, 1991: 174.–Ahyong & Norrington, 1997: 104–105 (not *P. megalophthalma* Bigelow, 1893a).
Pseudosquillana megalophthalma.–Cappola & Manning, 1995: 283–284, fig. 5, non fig. 4.–Ahyong & Norrington, 1997: 104–105 (not *P. megalophthalma* Bigelow, 1893a).
Pseudosquillana richeri.–Ahyong, Manning & Reed, 2000: 306–310, figs. 2, 3.

Type material. HOLOTYPE: MNHN St 1419, ♂ (TL 27 mm), New Caledonia, lagoon, 18°27.2'S 163°02.3'E, 39–40 m, sand and *Halimeda*, B. Richer de Forges.

Australian material. QUEENSLAND: AM P55616, 1♀ (TL 19 mm), One Tree I., 0–0.6 m, coral head from steep rubble beach, low tide, rotenone, D. Hoese, 28 Sep 1971; NTM Cr010710, 1♂ (TL 13 mm), SE Ashmore Reef, Coral Sea, 10°22.15'S 144°31.36'E, 2–3 m, rotenone, 19 Jan 1993;QM W22265, 1♀ (TL 14 mm), West Islet lagoon, Wreck Flat, Coral Sea, 15 m, in *Tubipora musica* on large bommie, J. Short, 19 May 1988.

Diagnosis. Eye with cornea broadened anteriorly, slightly broader than stalk. Carapace dorsum with median circular patch of dark pigment, often pale in outline, occasionally obscured by transverse band of pigment. Raptorial claw propodus with 3 proximal movable spines in juveniles, 2 in adults. AS1–3 each without posterolateral spine. AS4–5 each with posterolateral spine. AS3–5 sternal keel each produced as a sharp, posteriorly directed spine. AS6 without accessory inner spine at base of IM spine. Telson LT carina not extending anteriorly beyond about ⅔ distance to anterior margin of telson. Terminal spines of uropodal protopod without distinct ventral carina.

Colour in alcohol. Overall appearance uniform or with transverse light and dark bands. Carapace with dark median patch. AS5 with posterolateral black "eye-spot".

Measurements. Male (n = 2) TL 13–27 mm, female (n = 2) TL 14–19 mm. CI 257–357. A1 peduncle 0.73–0.85 CL. A2 scale 0.43–0.54 CL. PI 073–075 (males), 069–070 (females). PLDI 600–743 (males), 700–703 (females). AWCLI 685–714. Ahyong, Manning & Reed (2000) report specimens to 87 mm TL.

Remarks. Despite their diminutive size, all three specimens reported here agree well with the holotype and published accounts of *P. richeri* (see Moosa, 1991; Ahyong, Manning & Reed, 2000). In the smallest specimen, a male (TL 13 mm), the telson carinae are discernible and the penes are well developed. *Pseudosquillana richeri* differs from *P. megalophthalma* chiefly in having a narrower cornea, a circular median "eye-spot" on the carapace and in lacking a spine at the base of the intermediate spine on AS6.

Habitat. Coral reefs amongst rubble and live coral, from the reef flat to at least 15 m.

Distribution. Widely distributed throughout the tropical Indo-West Pacific from the Red Sea, Indonesia, Australia, New Caledonia and Oceania to French Polynesia.

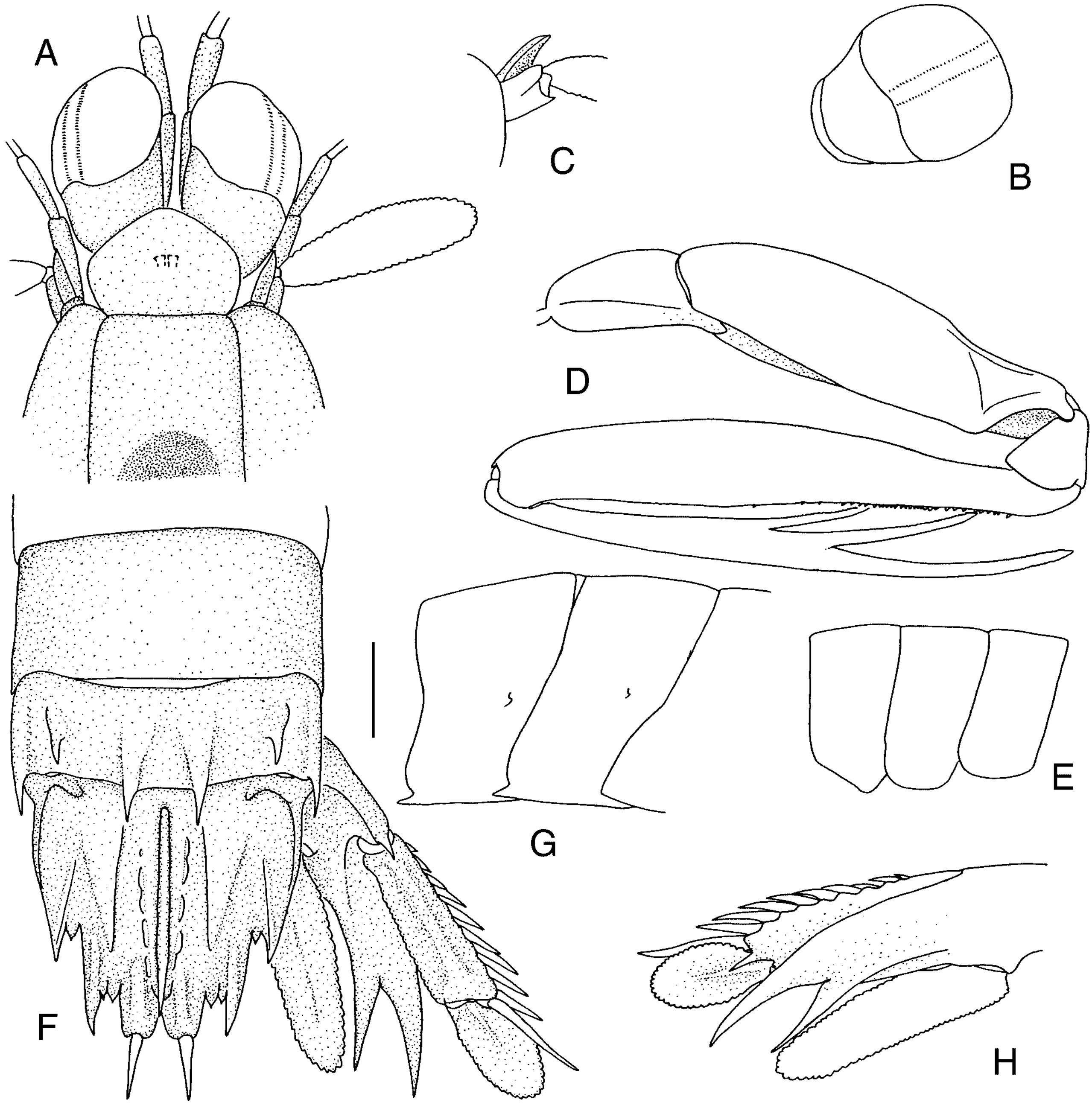

Figure 56. *Pseudosquillana richeri* (Moosa), ♂ TL 19 mm (AM P55616). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, AS5–6, telson & uropod, dorsal. G, AS3–5, right lateral. H, uropod, right ventral. Scale A–H = 1 mm.

Pseudosquillisma Cappola & Manning, 1995

Pseudosquillisma Cappola & Manning, 1995: 284–285. Type species *Squilla oculata* Brullé, 1837, by original designation. Gender feminine.

Diagnosis. Eye with cornea strongly broadened, broader than stalk. Rostral plate ovoid, with short anterior spine. Carapace dorsum with pair of large, dark, circular "eye-spots". Raptorial claw propodus with 3 movable spines proximally. AS1–5 with MG carinae only. Telson dorsal surface with 4 longitudinal carinae lateral to MD carina (accessory MD, anterior SM, anterior IM, MG). Uropodal protopod terminating in 2 slender flattened spines, outer spine longer

Included species. Three: *P. adiastalta* (Manning, 1964); *P. guttata* (Manning, 1972a); and *P. oculata* (Brullé, 1837).

Remarks. Like species of *Raoulserenea*, species of *Pseudosquillisma* bear a pair of large "eye-spots" on the carapace, that, along with general colour pattern can be used to distinguish the species. Two species of *Pseudosquillisma* are recognized in the Indo-West Pacific, and one species, *P. oculata* is known from Australian territorial waters.

Key to species of *Pseudosquillisma*

1 Carapace with pair of large dark circular "eye-spots" not partially obscured by pale spots or diffuse pale patches .... ***P. oculata***

—— Carapace with "eye-spots" partially obscured by pale spots or diffuse pale patches 2

2 Carapace with "eye-spots" surrounded by and often obscured by numerous, small, well defined pale spots .... *P. adiastalta*

—— Carapace with "eye-spots" diffuse, surrounded by irregular, diffuse pale patches .... *P. guttata*

Pseudosquillisma oculata (Brullé, 1837)

Fig. 57

Squilla oculata Brullé, 1837: 18, fig. 3 (type locality: Canary I.).
Squilla monodactyla A. Milne-Edwards, 1878: 232 (postlarva).
Pseudosquilla oculata.–Kemp, 1913: 96, 102.–Holthuis, 1941: 266–267.–Tweedie, 1950: 141 (part).–Manning, 1970a: 1439–1440.–Moosa, 1974: 8.–Manning, 1977c: 285–286.
Pseudosquillisma oculata.–Cappola & Manning, 1995: 285–286, fig. 6.

Material. COCOS-KEELING ISLANDS: ZRC.1970.10.22.14, 1♀ (TL 48 mm), C. Gibson-Hill, 1941.

Diagnosis. Carapace with pair of dark circular "eye-spots" with or without pale outline, but not partially obscured by diffuse, irregular, pale patches or small spots. AS1–3 posterolaterally rounded. AS4–5 with posterolateral spine, that of AS4 minute. Uropodal protopod with distinct step on inner proximal margin; exopod proximal segment outer margin with 11–13 movable spines.

Colour in alcohol. Completely faded to grey brown excepting faint trace of dark circular patches on carapace. However, colour notes taken by the collector: "Fairly uniform light grey, slightly pink at the joints and on the carapace, the spines of the telson bluish green or green".

Measurements. Female ($n = 1$) TL 48 mm. CI 421. A1 peduncle 0.58 CL. A2 scale 0.47 CL. PI 107. PLDI 409. AWCLI 708. Manning (1969c) reported specimens to 124.5 mm TL.

Remarks. Unfortunately, the colour pattern is faded in the present specimen, but is identified with *P. oculata* based on the uniform colour pattern of the specimen as recorded by the collector. *Pseudosquillisma guttata* differs from Indo-West Pacific *P. oculata* in having a mottled instead of uniform background colour pattern, and the "eye-spots" on the carapace are not partially obscured by diffuse, irregular, pale patches.

The distribution of *Pseudosquillisma oculata* parallels that of *Pseudosquilla ciliata* and further study of the material from different regions may reveal specific differences. The relatively uniform body colour of the present specimen, as noted by the collector, is similar to that described for eastern Atlantic specimens of the species (Manning, 1977a); *P. oculata* from the western Atlantic are reportedly maculated (Manning, 1969c). In both eastern and western Atlantic populations of *P. oculata*, the carapace "eye-spots" have a pale outline, whereas the "eye-spots" in Indo-West Pacific specimens do not show a distinct outline. Additionally, comparison of limited accounts of *P. oculata* (e.g., Edmondson, 1921; Townsley, 1953; Manning, 1969c, 1977a) suggests that significant morphometric differences exist between the western Atlantic, eastern Atlantic and Indo-West Pacific populations. Thus, *P. oculata* in the Indo-West Pacific and western Atlantic may each represent distinct species. The status of *P. oculata* in the Indo-West Pacific and western Atlantic is presently under investigation (Ahyong, in prep.).

Habitat. Coral and rocky reefs under boulders and amongst live corals.

Distribution. Known from the both sides of the Atlantic and the Indo-West Pacific from the western Indian Ocean to Hawaii.

Raoulserenea Manning, 1995

Raoulserenea Manning, 1995: 116. Type species *Pseudosquilla ornata* Miers, 1880, by original designation. Gender feminine.

Diagnosis. Eye with cornea broadened, but not bilobed, as broad as or broader than stalk. Rostral plate ovoid, with or without short anterior spine. Carapace dorsum with pair of large, dark, circular "eye-spots". Raptorial claw propodus with 3 movable spines proximally. AS1–5 with MG carinae only. Telson dorsal surface with 3 longitudinal carinae lateral to MD carina (accessory MD, anterior SM, LT, MG). Uropodal protopod terminating in 2 slender, flattened spines, outer spine longer.

Included species. Four: *R. hieroglyphica* (Manning, 1972a); *R. komaii* (Moosa, 1991); *R. ornata* (Miers, 1880); *R. oxyrhyncha* (Borradaile, 1898).

Remarks. Four species are presently recognized in the *Raoulserenea*. A fifth species, *R. pygmaea* Caldwell & Manning, 2000, was recently described, but is synonymized with *R. hieroglyphica* below. The paratype series of *R. pygmaea*, however, includes a dwarf species of *Raoulserenea* that will be described in a separate study.

Colour pattern is particularly important in distinguishing species of *Raoulserenea*. Presently, the two species bearing an anterior spine on the rostral plate, viz. *R. komaii* and *R. oxyrhyncha* can be distinguished only by colour pattern and might prove conspecific. In those species without the

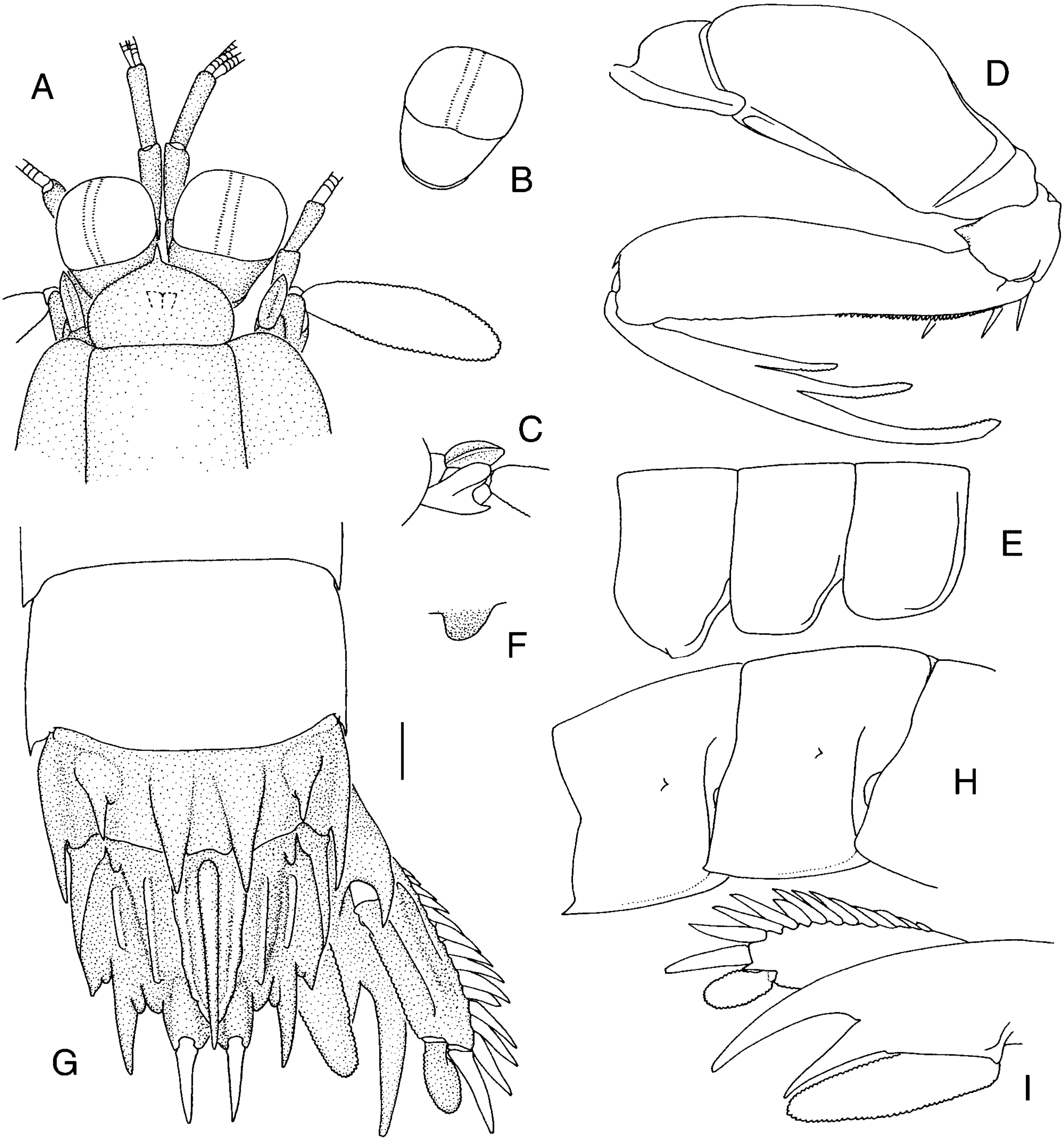

Figure 57. *Pseudosquillisma oculata* (Brullé), ♀ TL 48 mm (ZRC.1970.10. 22. 14). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, TS8 sternal keel, right lateral. G, AS5–6, telson & uropod, dorsal. H, AS3–5, right lateral. I, uropod, right ventral. Scale = 1.25 mm.

anterior spine on the rostral plate, colour pattern is the most reliable distinguishing character, but subtle morphological differences also exist. Hence, the shape of the eye and anterior margin of the rostral plate, whether evenly rounded or obtusely angled may be useful, but must be used with caution owing to allometric changes.

Species of *Raoulserenea* are common on coral reefs amongst rubble and live coral on the reef flat and slope. A feature shared by species of the *Raoulserenea* and *Pseudosquillisma* is the presence of paired "eye-spots" on the carapace; the function is unknown.

Key to species of *Raoulserenea*

1 Rostral plate with short anterior spine 2

—— Rostral plate without anterior spine 3

2 Abdominal colour pattern relatively uniform with subtle mottling or banding; carapace "eye-spots" with diffuse margins, surrounded by several diffuse pale spots or patches .... ***R. oxyrhyncha***

—— Abdomen with reticulated, mottled colour pattern; carapace "eye-spots" surrounded by continuous or near continuous white ring .... ***R. komaii***

3 Propodus of raptorial claw uniformly dark, without pale spots. A2 scale clear, without dark spots. Body and carapace with uniform colour pattern, without numerous spots and reticulations, except occasionally at anterolateral margins of carapace. Outer margin of proximal segment of uropodal exopod with 9–10 (rarely 11) movable spines .... ***R. ornata***

—— Propodus of raptorial claw dark, with distinct pale spots. A2 scale with dark spots. Body and carapace usually with strongly reticulated pattern of pale lines and dark spots but occasionally uniform or diffusely banded. Outer margin of proximal segment of uropodal exopod with 11–12 (rarely 10) movable spines .... ***R. hieroglyphica***

Raoulserenea hieroglyphica (Manning, 1972a)

Fig. 58

Pseudosquilla ornata.–Bigelow, 1894: 500.–Kemp, 1915: 172.–Komai, 1927: 324, pl. 14: fig. 2 (part).–Bigelow, 1931: 160.–Moosa, 1991: 174 (not *P. ornata* Miers, 1880).
Pseudosquilla hieroglyphica Manning, 1972a: 2–6, 9, fig. 1 (type locality: Latoback I., Rongerik Atoll, Pacific Ocean); 1977c: 285.
Raoulserenea hieroglyphica.–Manning, 1995: 21, 116.
Raoulserenea pygmaea Caldwell & Manning, 2000: 101–106, fig. 1 (type locality: Moorea, Society Is, French Polynesia); new synonymy.

Type material. HOLOTYPE: USNM 124096, ♀ (TL 39 mm), Latoback I., Rongerik Atoll, Pacific Ocean, lagoon reef, F. Bayer, 21 Aug 1947. PARATYPES: USNM 64891, 1♀ (TL 69 mm), Apia, Samoa, coral reef, D. Jordan, 1 Jul 1902; USNM 109624, 1♂ (TL 63 mm), Tahiti, Society Is, sand & coral, 12–18 m, R. Watkins, 2 Mar 1962.

Australian material. QUEENSLAND: AM P43207, 1♂ (TL 43 mm), Ashmore Reef, Great Barrier Reef, 10°22.88'S 143°31.63'E, QLD 709, reef flat, rotenone, S. Keable, 19 Jan 1993. WESTERN AUSTRALIA: WAM C23543, 1♂ (TL 39 mm), *Big John* Oil Rig, about 64 km off Barrow I., 133 m, from pilings, L. Harris, Dec 1974.

Other material. USNM 260953, 1♀ (TL 33 mm), Moorea, French Polynesia, 17°32'N 149°50'W, 1 m, rubble, R.L. Caldwell, 15 Nov 1992 (holotype of *Raoulserenea pygmaea* Caldwell & Manning).

Diagnosis. Cornea noticeably broader than stalk, trapezoid in dorsal view. Rostral plate broader than long, without anterior spine. Carapace with dorsum mottled; with dark spots anteriorly; with pair of dark circular "eye-spots" surrounded by pale ring and usually numerous, smaller, pale spots, and irregular lines. A2 scale with dark spots. Raptorial claw propodus covered with pale spots on dark background. Thoracic and abdominal somites uniformly coloured, diffusely banded or covered with reticulated light and dark colour pattern. AS1–3 posterolaterally rounded. AS4 posterolaterally angular. AS5 with posterolateral spine. Uropodal exopod proximal segment outer margin with 11 or 12 (rarely 10) movable spines.

Colour in alcohol. Carapace and dorsum mottled and reticulated, covered with brown spots and pale irregular lines. "Eye-spots" on carapace black, surrounded by entire pale ring. Raptorial claw carpus with black spot on inner surface; merus and propodus brown with numerous pale spots; dactylus brown with red-orange outer margin and with pale spots. TS6–8 sternum with dark-brown spot at base of each pereiopod. Posterior margin of thoracic and abdominal somites dull red; SM spines of AS6 dark brown basally, with dull red apices. Uropodal protopod with dark patch sub-basally; endopod and exopod with broad light and dark bands; exopod with dark red, outer movable spines. Telson with dark red submedian and intermediate teeth.

Measurements. Male (n = 3) TL 39–63 mm, female (n = 3) TL 33–69 mm. CI 332–548. A1 peduncle 0.61–0.72 CL. A2 scale 0.45–0.51 CL. PI 080–085 (males), 083–084 (females). PLDI 553–563 (males) 554–635 (females). AWCLI 643–725. Manning (1977c) reported specimens to 83 mm TL.

Remarks. The colour pattern is largely faded, but the hieroglyphic-like colour pattern characteristic of the holotype of the species is evident in both Australian specimens. *Raoulserenea hieroglyphica* usually bears a distinctively spotted, reticulated colour pattern on the carapace and body, but the body may frequently be uniform or show diffuse transverse banding and the carapace may be almost devoid of light and dark spotting. These "uniform" specimens of *R. hieroglyphica* resemble and may be confused with *R. ornata*, but nevertheless differ from the latter in bearing dark spots around the anterolateral portions of the carapace and on the antennal scales. Although colour

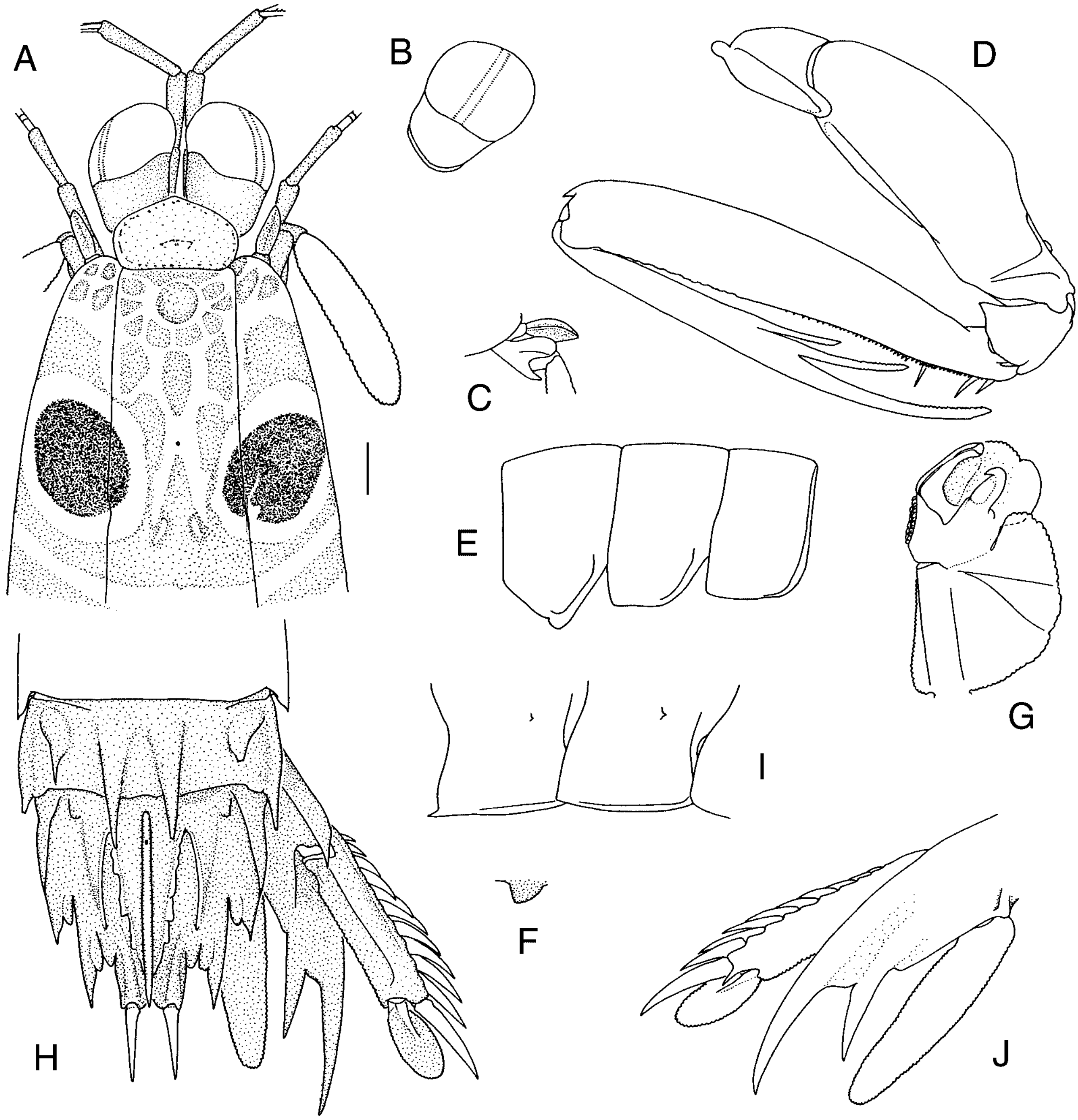

Figure 58. *Raoulserenea hieroglyphica* (Manning), ♂ TL 42 mm (AM P43207). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, TS8 sternal keel, right lateral. G, PLP1 endopod, right anterior. H, AS5–6, telson & uropod, dorsal. I, AS3–5, right lateral. J, uropod, right ventral. Scale A–F,H,I = 1.25 mm; G = 0.6 mm.

pattern is the best feature distinguishing *R. hieroglyphica* from *R. ornata*, subtle morphological differences exist between the species. In both *R. hieroglyphica* and *R. ornata*, the anterior margin of the rostral plate is obtusely angled in juveniles becoming broadly rounded with increasing size. However, the anterior margin of the rostral plate is broadly rounded in *R. ornata* usually by about 40 mm TL in contrast to about 45 mm TL in *R. hieroglyphica*. In *R. hieroglyphica* the eye is trapezoid and 10–12 (but usually 11–12) movable spines are present on the outer margin of the uropodal exopod whereas in *R. ornata*, the eye is more oblong shaped and the uropodal exopod bears 9–11 but usually 9–10 movable spines. Additionally, the propodus of the raptorial claw of *R. hieroglyphica* appears to be more slender and more elongate than in *R. ornata* as measured by the PI and PLDI, the ranges of which show little or no overlap between the present specimens of the two species. A larger series of both species, however, is necessary to evaluate the value of the size of the propodus of raptorial claw as a distinguishing character.

Raoulserenea pygmaea was recently described by Caldwell & Manning (2000) for a dwarf species resembling *R. ornata*. Unfortunately, the type series is composite: the holotype of *R. pygmaea* is a specimen of *R. hieroglyphica*, and the paratypes include *R. ornata, Pseudosquilla ciliata, Pseudosquillana richeri* and the dwarf *Raoulserenea*. The dwarf *Raoulserenea* will be described elsewhere by Ahyong & Caldwell. As remarked under the account of *R. ornata*, Moosa's (1991) record of that species from New Caledonia is based on *R. hieroglyphica*.

Habitat. Coral reefs, from the reef flat to 133 m.

Distribution. French Polynesia to Japan, New Caledonia and the western Indian Ocean; now from Australia.

Raoulserenea komaii (Moosa, 1991)

Fig. 59

Pseudosquilla komaii Moosa, 1991: 171–173, fig. 4 (type locality: Chesterfield Is, New Caledonia, 19°03.00'S 158°53.93'E).

Type material. HOLOTYPE: MNHN St 1411, ♀ (TL 54 mm), Chesterfield Is, New Caledonia, 19°03.00'S 158°53.93'E, 8 m, hard coral substrate, Jul–Aug 1988.

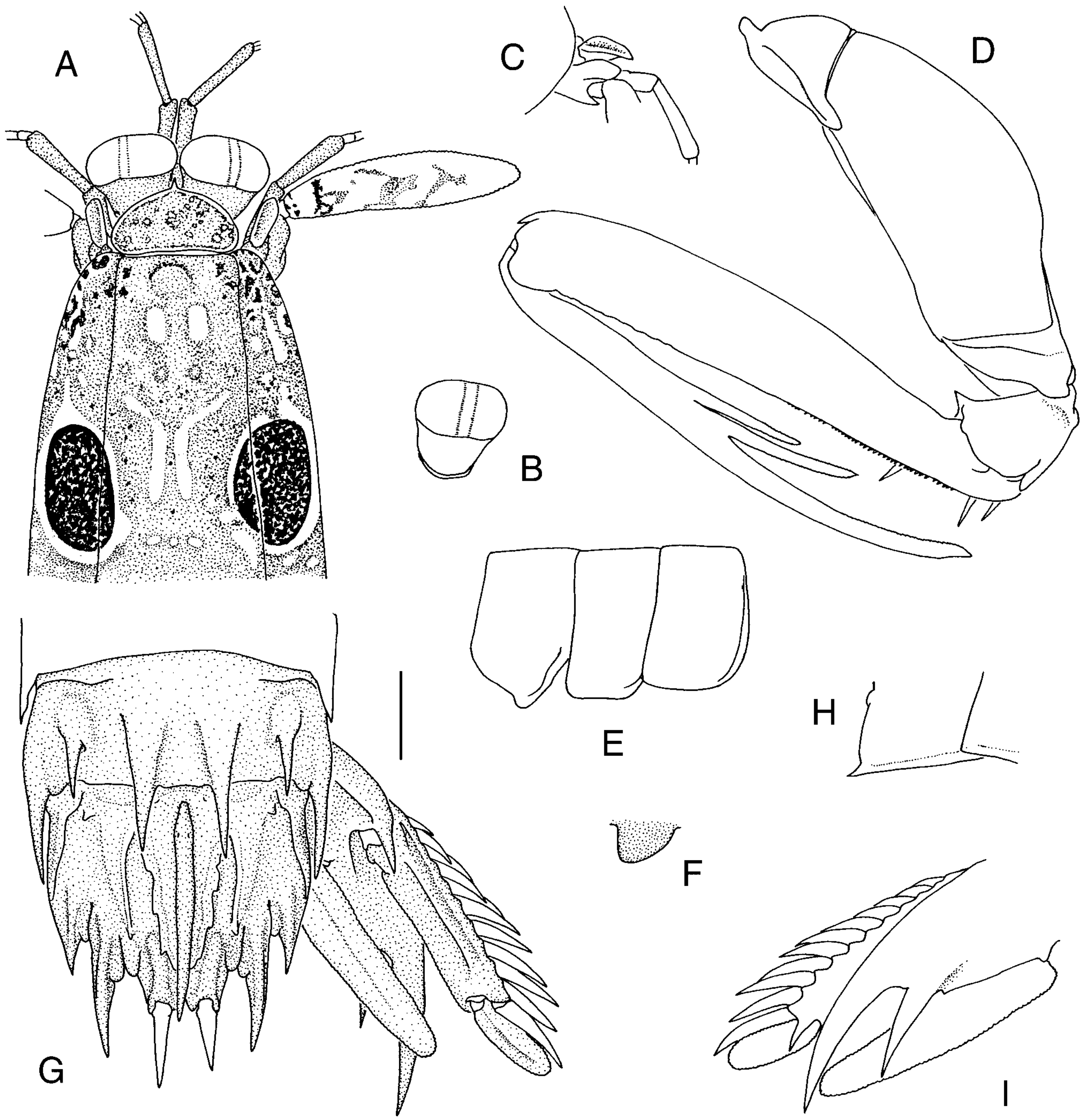

Figure 59. *Raoulserenea komaii* (Moosa), ♀ TL 100 mm (USNM 168617). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, TS8 sternal keel, right lateral. G, AS5–6, telson & uropod, dorsal. H, AS4–5, lower right lateral. I, uropod, right ventral. Scale = 5 mm.

Australian material. COCOS-KEELING ISLANDS: USNM 168617, 1♀ (TL 100 mm), Cocos-Keeling Is, 12°07'15"S 96°51'15"E, coral head, Smith-Vaniz, 28 Feb 1974.

Diagnosis. Cornea noticeably broader than stalk, trapezoid in dorsal view. Rostral plate ovoid, with short anterior spine. Carapace dorsum with pair of dark "eye-spots" surrounded by continuous or near continuous light ring. Raptorial claw propodus with pale spots. Thoracic and abdominal somites with rows of small pale spots and lines. AS1–2 posterolaterally rounded. AS3–4 posterolaterally angular. AS5 with posterolateral spine. Uropodal exopod proximal segment with 11 movable spines on outer margin.

Colour in alcohol. Carapace and rostral plate dusky with numerous small, pale irregularly shaped spots; with pair of large, dark "eye-spots" surrounded by continuous or near continuous pale ring; anterolateral margins of carapace with small dark spots. Antennal scale clear with some irregular, dark markings. Raptorial claw dusky with pale spots; carpus with black spot on inner surface. Thorax and abdomen with diffuse light and dark bands and numerous small, irregular pale spots or short lines. Telson dusky with pale transverse line medially and distally. Uropodal protopod mottled, with large black proximal patch on ventral surface. TS6–8 sterna with black patch at the base of each pereiopod, that of TS7 markedly smaller than those of TS6 & 8.

Measurements. Female (*n* = 2) TL 54–100 mm. CI 446–510. A1 peduncle 0.51–0.53 CL. A2 scale 0.45–0.51 CL. PI 083–091. PLDI 536–620. AWCLI 776–667. The present specimen from Australia is the largest known of the species.

Remarks. The Australian specimen agrees well in morphology and general colour pattern with the holotype from New Caledonia. The pale ring around the "eye-spots" on the carapace of the Australian specimen is not entirely continuous as in the holotype, the spotting on the carapace is less pronounced, and the patterning on the body is less reticulated than in the holotype. Unlike *R. ornata* and *R. hieroglyphica* that bear subtle morphological differences, *R. komaii* differs from *R. oxyrhyncha* by colour pattern alone; the two species may represent colour phases of a single species.

Habitat. Coral reefs amongst rubble and live coral to a depth of at least 8 m.

Distribution. French Polynesia, New Caledonia and now from the Cocos-Keeling Islands, Indian Ocean.

Raoulserenea ornata (Miers, 1880)

Fig. 60

Pseudosquilla ornata Miers, 1880: 4, 111, pl. 3: figs. 5, 6 (type locality: Philippines).–Kemp, 1913: 3, 10, 96, 100.–Holthuis, 1941: 263, fig. 3.–Tweedie, 1950: 141.–Stephenson, 1962: 34.
Raoulserenea ornata.–Manning, 1995: 21, 116, 118, pl. 22, figs. 59b, 60c,d,f, 64.

Australian material. QUEENSLAND: QM W17503, 1♂ (TL 27 mm), W side of Cartier Reef, Timor Sea, 12°32.2'S 123°31.9'E, 18 m, reef slope, dead branching coral infauna, J. Short, 4 May 1992. CHRISTMAS ISLAND: WAM C7872, 1♀ (TL 39 mm), Christmas I., 10°30'S 105°35'E, E. Carr, 1961. COCOS-KEELING ISLANDS: ZRC 1970.10.22.10–11, 1♂ (TL 38 mm), 1♀ (TL 34 mm), C. Gibson-Hill, 1941.

Other material. USNM 307136, 1♀ (TL 35 mm), Palawan, Philippines, 9°44'N 118°45'E, 6–12 m, Schroeder, 2 Jul 1979.

Diagnosis. Cornea not noticeably broader than stalk, oblong in dorsal view. Rostral plate broader than long, without anterior spine. Carapace dorsum uniformly coloured; with pair of dark circular "eye-spots" surrounded by pale ring. A2 scale clear, without dark spots. Raptorial claw propodus uniformly coloured, without pale spots and irregular lines. Thoracic and abdominal somites uniformly coloured, without distinctly reticulated colour pattern. AS1–3 posterolaterally rounded. AS4 posterolaterally angular. AS5 with posterolateral spine. Uropodal exopod proximal segment outer margin with 9 or 10 (rarely 11) movable spines.

Colour in alcohol. Overall colour faded to uniform dark brown-grey. Carapace with pair of black eye-spots surrounded by pale ring. Raptorial claw carpus with dark spot on inner surface; with merus and propodus body colour, dactylus faded to white. TS6–8 sternum with dark spot at the base of each pereiopod. AS6 with submedian spines dark; sternum with dark posterior margin. Uropodal protopod with dark patch sub-basally, across proximal ½ of endopod and anterior ⅓ of proximal segment of exopod. Tweedie (1950: 141) reported the colour of the Cocos-Keeling specimens as follows: "[d]ark grey, almost black, with pair of prominent black eye-spots, outlined with white, on the carapace".

Measurements. Male (*n* = 2) TL 27–38 mm, female (*n* = 3) TL 34–39 mm. CI 347–460. A1 peduncle 0.52–75 CL. A2 scale 0.46–0.51 CL. PI 084–093 (males), 082–095 (females). PLDI 483–537 (males), 469–535 (females). AWCLI 674–760. Kemp (1913) reported specimens to 82 mm TL, but these records require verification for they may be based on *R. hieroglyphica*.

Remarks. *Raoulserenea ornata* resembles *R. hieroglyphica* and differs from *R. komaii* and *R. oxyrhyncha* in lacking a rostral spine. The uniform colour pattern of *R. ornata* differs from the usually strongly reticulated, spotted colour pattern of *R. hieroglyphica*. The anterior margin of the rostral plate in *R. ornata* is angular in juveniles and becomes increasingly rounded with increasing size (Fig. 60A,K,L). The differences between *R. ornata* and *R. hieroglyphica* are outlined under the account of the latter.

The specimen from New Caledonia reported by Moosa (1991) as *R. ornata* is referable to *R. hieroglyphica*. Moosa (1991) noted that the New Caledonian specimen bore spots on the anterolateral and dorsal surfaces of the carapace and twelve movable spines on the outer margin of the uropod, all of which are characteristic of *R. hieroglyphica*.

Habitat. Coral reefs under boulders or amongst live corals; reef flat to at least 18 m.

Distribution. Western Indian Ocean to Vietnam, the Philippines, southern China, French Polynesia and for the first time from near mainland Australia.

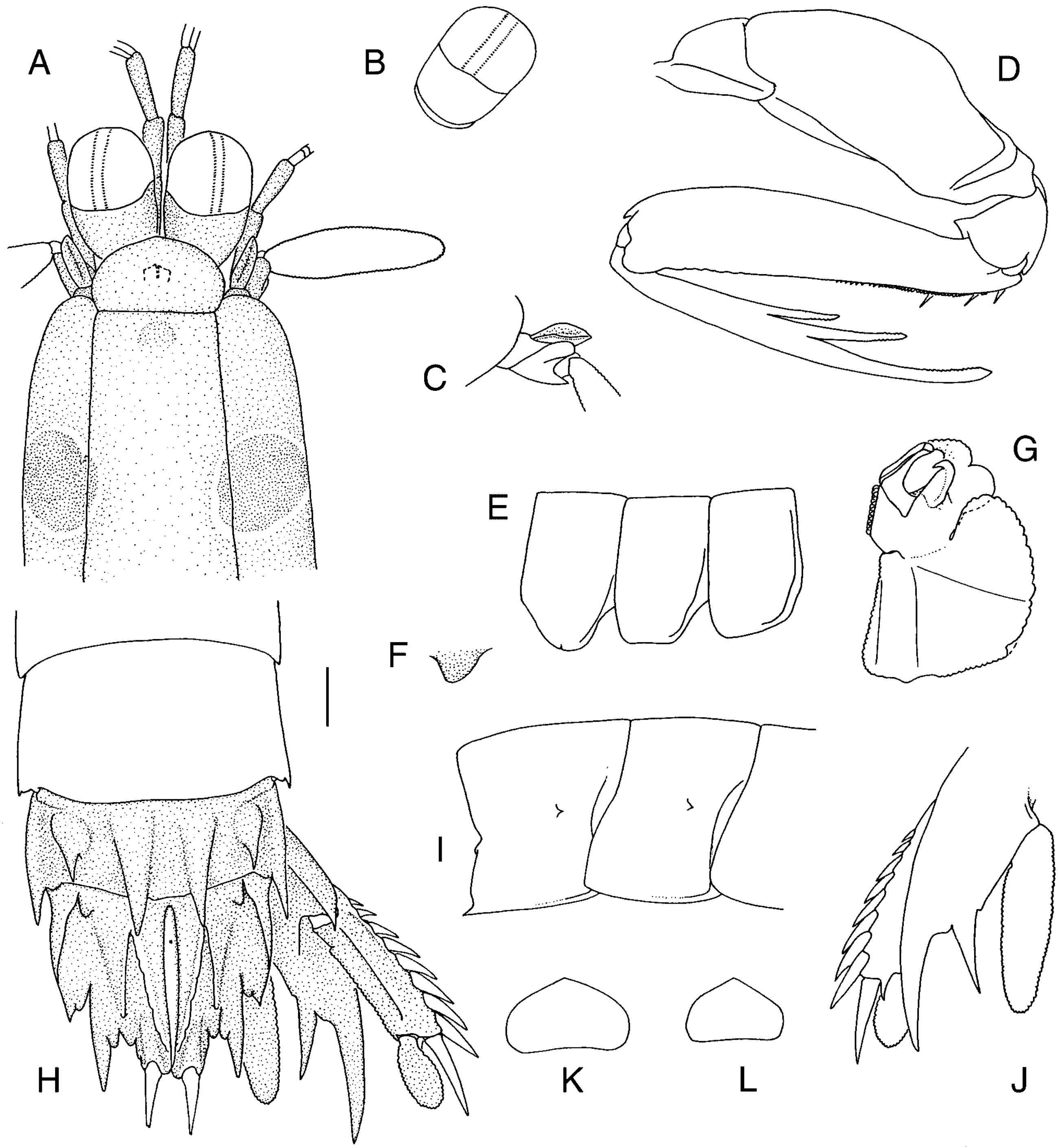

Figure 60. *Raoulserenea ornata* (Borradaile). A–J, ♂ TL 38 mm (ZRC.1970.10. 22.10). K, ♀ TL 34 mm (ZRC.1970.10.22.11). L, ♂ TL 27 mm (QM W17503). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, TS8 sternal keel, right lateral. G, PLP1 endopod, right anterior. H, AS5–6, telson & uropod, dorsal. I, AS3–5, right lateral. J, uropod, right ventral. K–L, rostral plate, dorsal. Scale A–F, H–L = 1.25 mm; G = 0.6 mm.

Raoulserenea oxyrhyncha (Borradaile, 1898)

Fig. 61

Pseudosquilla oxyrhyncha Borradaile, 1898: 37, pl. 6: figs. 9–9d (type locality: Rotuma, Fiji).–Holthuis, 1941: 264–266, fig. 4.
Pseudosquilla oculata.–Tweedie, 1950: 141 [part, not *P. oculata* (Brullé, 1837)].
Raoulserenea oxyrhyncha.–Manning, 1995: 21, 116.–Debelius, 1999: 290.

Type material. HOLOTYPE: MZC 15.09.1897, ♂ (TL 88 mm), Rotuma, J.S. Gardiner.

Australian material. COCOS-KEELING ISLANDS: ZRC.1970. 10.22.15, 1♂ (TL 42 mm), C. Gibson-Hill, 1941.

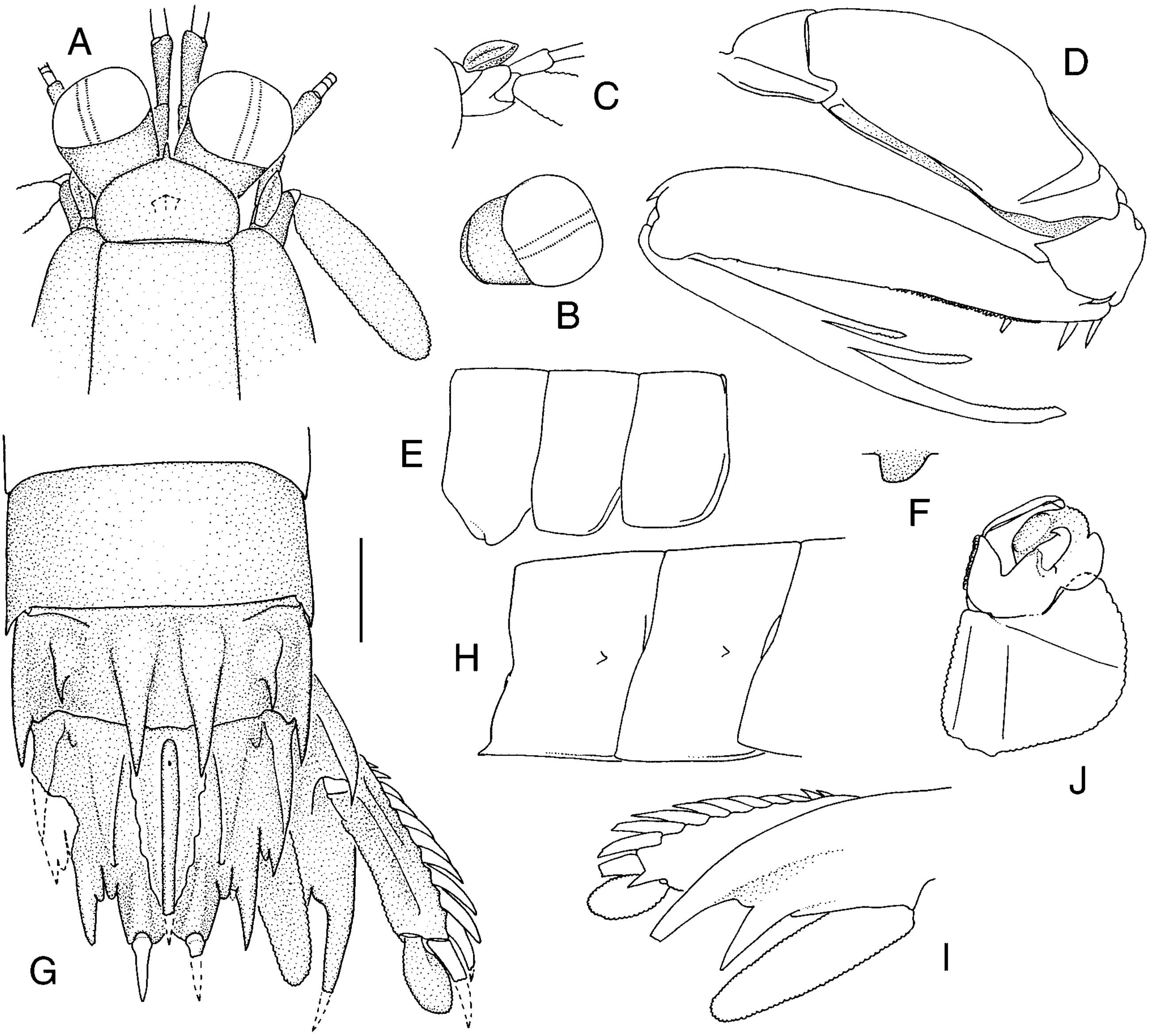

Figure 61. *Raoulserenea oxyrhyncha* (Borradaile), ♂ TL 42 mm (ZRC.1970.10.22.15). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8, right lateral. F, TS8 sternal keel, right lateral. G, AS5–6, telson & uropod, dorsal. H, AS3–5, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2.5 mm; J = 1.2 mm.

Diagnosis. Cornea noticeably broader than stalk, trapezoid in dorsal view. Rostral plate ovoid, with short anterior spine. Carapace dorsum with pair of dark "eye-spots" with diffuse margins surrounded at most by pale spots or diffuse paler patches, not merging to form a continuous light ring. Raptorial claw propodus with pale spots. Thoracic and abdominal somites uniformly coloured, diffusely banded or mottled, without distinctly reticulated colour pattern. AS1–2 posterolaterally rounded. AS3–4 posterolaterally angular. AS5 with posterolateral spine. Uropodal exopod proximal segment outer margin with 11 movable spines.

Colour in alcohol. Completely faded. However, colour notes taken by the collector: "Fairly uniform light grey, slightly pink at the joints and on the carapace, the spines of the telson bluish green or green".

Measurements. Male (n = 2) TL 42–88 mm. CI 404–488. A1 peduncle 0.55–0.68 CL. A2 scale 0.49–0.52 CL. PI 084–090. PLDI 486–499. AWCLI 714–756. The holotype is the largest known specimen.

Remarks. The single known Australian specimen from the

Cocos-Keeling Islands agrees well morphologically with the holotype. *Raoulserenea oxyrhyncha* and *R. komai* appear to be morphologically identical and differ only in colour pattern. The colour pattern is completely faded in the Cocos-Keeling specimen, but colour notes taken by the collector, show that the specimen cannot be identified with *R. komaii*; in *R. komaii* the abdomen bears a mottled and reticulated colour pattern, not relatively uniform as in *R. oxyrhyncha*. Tweedie (1950) reported the Cocos-Keeling specimen as *P. oculata*. Though faded, the colour pattern of the holotype is still evident and agrees well with the rendition given by Borradaile (1898, pl. 6: fig. 9).

Habitat. Coral reefs.

Distribution. Central Pacific from Rotuma (Borradaile, 1898) to Indonesia (Holthuis, 1941), Papua New Guinea (Debelius, 1999) and now the Cocos-Keeling Islands.

TAKUIDAE Manning, 1995

Takuidae Manning, 1995: 119 (type genus *Taku* Manning, 1995).

Diagnosis. A2 protopod dorsally with fixed, anteriorly directed spine. Ischiomeral articulation of raptorial claw subterminal; dactylus of raptorial claw without teeth on inner margin, outer basal margin strongly inflated into blunt heel; propodus without proximal movable spines. AS6 articulating with telson. Articulation of uropodal exopod segments subterminal. Distal spines on outer margin of uropodal exopod strongly recurved anteriorly.

Included genera. Three: *Mesacturus* Miers, 1880; *Mesacturoides* Manning, 1978e; and *Taku* Manning, 1995.

Remarks. All takuids occur in the Indo-West Pacific. One genus, *Taku*, is known from Australia.

Key to genera of Takuidae

1 Telson with long, posteriorly bifurcate median process .... *Mesacturus*

—— Telson without slender, bifurcate median process; with 1 or 2 pairs of distinct primary teeth 2

2 Telson with 9 appressed carinae covering entire dorsal surface; SM teeth well formed; IM teeth appressed to margin of telson .... ***Taku***

—— Telson with 3 mid-dorsal carinae; submedian and intermediate teeth well formed .... *Mesacturoides*

Taku Manning, 1995

Taku Manning, 1995: 119. Type species *Gonodactylus spinosocarinatus* Fukuda, 1909, by original designation and monotypy. Gender masculine.

Diagnosis. Carapace anterolateral angles broadly rounded, extending anteriorly beyond base of rostral plate. Telson broader than long; with 1 pair of well formed primary teeth (SM). IM teeth present, but short, appressed to telson margin. Telson dorsal surface with low, MD carina and 4 pairs of low, appressed longitudinal carinae.

Included species. One: *T. spinosocarinatus* (Fukuda, 1909).

Remarks. The single species of the genus occurs in Australia.

Taku spinosocarinatus (Fukuda, 1909)

Fig. 62

Gonodactylus spinosocarinatus Fukuda, 1909: 54.–Serène, 1952: 14–16, figs. 28–32; 1954: 6, 7, 10, 11, fig. 13 (type locality: Nakamoto, Kuroshima I., Okinawa Prefecture, Japan, 24°19'N 124°05'E, by present neotype designation).
Gonodactylus spinoso-carinatus.–Kemp, 1913: 5, 11, 148, 173.–Stephenson & McNeill, 1955: 249.
Gonodactylus strigatus Hansen, 1926: 31, pl. 2, fig. 2 (type locality: Zuid I., Indonesia, 6°05'S 120°30'E).
Gonodactylus demani var *pruvotae* Gravier, 1930: 214, fig. 1 (type locality: Île de Pins, New Caledonia, 22°37'S 167°30'E).
Mesacturus spinosocarinatus.–Manning, 1969d: 153.
Mesacturoides spinosocarinatus.–Moosa, 1991: 161.
Taku spinosocarinatus.–Manning, 1995: 120–121, pl. 23, figs. 9j, 65, 66.

Type material. NEOTYPE: AM P60104, 1♂ (TL 12 mm), Nakamoto, Kuroshima I., Okinawa Prefecture, Japan, 24°19'N 124°05'E, K. Nomura, 24 Sep 1987.

Australian material. QUEENSLAND: AM P10372, 1♂ (TL 19 mm), 1♀ (TL 17 mm), Northwest Islet, 23°30'S 152°00'E, reef, F. McNeill, Dec 1931; AM P56157, 1♀ (TL 10 mm), Northeast Cay, Herald Group, Coral Sea, 17°20'S 148°28'E, dead coral, D. McMichael & J. Yaldwyn, 9 Nov 1964; AM P56178, 1♂ (TL 9 mm), Northeast Cay, Herald Group, Coral Sea, 17°20'S 148°28'E, coral rock workings, D. McMichael & J. Yaldwyn, 6 Nov 1964; AM P58562, 1♀ (TL 10 mm), West Cay, Diamond Islets, Coral Sea, 13°11'S 143°43'E, intertidal beach rock pools, D. McMichael & J. Yaldwyn, 23 Oct 1964; AM P60073, 3♀♀ (TL 16–19 mm), One Tree I., 23°30'S 152°05'E; QM W22269, 1♀ (TL 24 mm), Polomaise Reef, 6 km W of Masthead I., 23°34'S 151°41'E, littoral, under rocks, P. Davie & D. Potter, 10 Feb 1986; USNM, 1♀ (TL 12 mm), Lizard I., N. Marshall, 1992; USNM, 1♂ (TL 8 mm), S of Lizard Head Peninsula, Lizard I., rubble zone, JDT LIZ-14, J. Thomas, 29 Jan 1989; USNM, 2♀♀ (TL 16 mm), Lizard I., N. Marshall, 7 Apr 1994; USNM, 2♂♂ (TL 7–9 mm), 1♀ (TL 9 mm), Lizard Head, Lizard I., rubble zone, JDT LIZ-15, J. Thomas, 31 Jan 1989; USNM, 4♂♂ (TL 8–11 mm), 2♀♀ (TL 9–12 mm), Lizard I., 1.5 m, rubble zone, unconsolidated coral covered rubble, JDT LIZ-17, J. Thomas, 1 Feb 1989; USNM, 1♀ (TL 13 mm), Lizard Head, Lizard I., from small rubble pieces on sand, JDT LIZ-19, J. Thomas, 31 Jan 1989.

Supplementary diagnosis. Rostral plate with short, trapezoid basal portion and slender median spine. Mandibular palp 2-segmented. MXP1–5 with epipod. MXP5 basal segment unarmed. AS1–5 with MG carina, rounded posterolaterally. AS6 with broad, unarmed SM and IM carinae; LT carina produced posteriorly as a blunt triangular lobe. Telson with 2 pairs of primary teeth (SM, IM), but only SM teeth well formed;

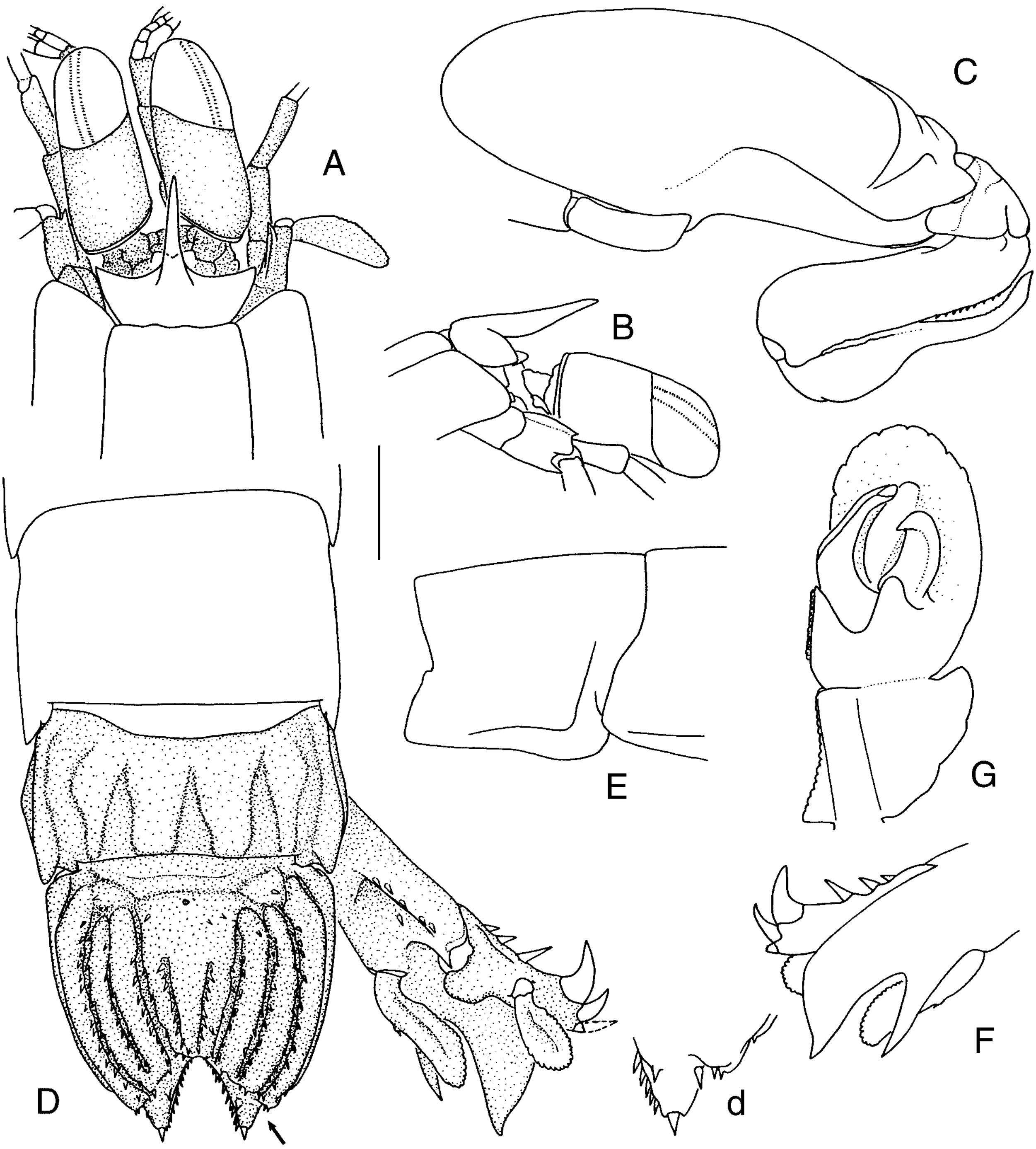

Figure 62. *Taku spinosocarinatus* (Fukuda). A–F, ♀ TL 24 mm (QM W22269). G, ♂ TL 19 mm (AM P10372). A, anterior cephalon, dorsal. B, anterior cephalon, right lateral. C, raptorial claw, right lateral. D, AS5–6, telson & uropod, dorsal; d, enlarged view of arrowed part. E, AS4–5, right lateral. F, uropod, right ventral. G, ♂ PLP1 endopod, right anterior. Scale A–F = 1 mm; G = 0.5 mm.

SM teeth dorsally with 1–3 short spinules, separated by deep V-shaped fissure, with short, movable apices; with 10–14 minute SM denticles; IM teeth short, appressed to margin of SM teeth, with apex set off from margin, but not extending beyond IM denticles; with 2 short, spiniform IM denticles. Telson dorsal surface with low, MD carina and 4 pairs of low, appressed longitudinal carinae; margins of inner 3 carinae lined with short spinules; MD carina low, broad, with proximal pit; distal ⅔ with pair of longitudinal grooves lined with short spinules, but indistinct in juveniles < TL 13–15 mm. Uropodal protopod with row of 3–6 spinules and dorsal spine above proximal exopod articulation. Uropodal proximal segment outer margin with 6 movable spines, proximal 3 straight, distal 3 strongly recurved anteriorly; endopod outer margin fully setose, inner margin at most sparsely setose.

Colour in alcohol. Largest specimen is faded to dull olive green.

Measurements. Male ($n = 10$) TL 7–19 mm, ♀ ($n = 14$) TL 9–24 mm. A1 peduncle 0.50–0.65 CL. A2 scale length 0.18–0.24 CL. AWCLI 652–824. Uropodal endopod length 3.07–4.32 width. The present series includes the largest known specimen of the species.

Remarks. The present specimens agree well morphologically, but show allometric variation in the number of setae on the inner margin of the uropodal endopod. The smallest specimens bear four setae along the inner margin of the uropodal endopod, becoming reduced to one in the 24 mm TL female. In males as small as 8 mm TL, the penes and petasma are well developed.

The holotype of *T. spinosocarinatus* is no longer extant (T. Hamano, S. Kubota, pers. comm.), and two nominal species are presently included in its synonymy. Therefore, a 12 mm TL male from Japan is herein selected as neotype to fix the identity of *T. spinosocarinatus*.

Habitat. Coral reef flats amongst rubble.

Distribution. Western Pacific from Japan, Vietnam, Indonesia, New Caledonia and northeastern Australia.

LYSIOSQUILLOIDEA Giesbrecht, 1910

Diagnosis. Cornea with 6 (rarely 2) rows of hexagonal ommatidia in the midband. A1 somite dorsal processes spiniform or dorsoventrally flattened, not anteriorly compressed and rounded laterally. MXP3–4 with propodi subquadrate, ribbed or beaded distally (smooth in some species of *Neocoronida*). Body flattened, loosely articulated or compact. Raptorial claw with ischiomeral articulation terminal, dactylus inflated or uninflated basally. Telson without distinct MD carina; at most with movable SM teeth. Uropodal protopod with at most two primary spines; articulation of exopod segments terminal.

Included families. Four: Coronididae Manning, 1980b; Lysiosquillidae Giesbrecht, 1910; Nannosquillidae Manning, 1980b; and Tetrasquillidae Manning & Camp, 1993.

Remarks. Ahyong & Harling (2000) synonymized Heterosquillidae with Tetrasquillidae because genera of the latter are nested among genera of the former. Of the four families recognized in the superfamily, three are known from Australia.

Key to families of Lysiosquilloidea

1 Telson entirely covered with closely packed erect spinules, stellate tubercles or spines, or highly sculptured. Raptorial claw dactylus usually inflated basally; if not inflated basally, AS6 & telson entirely covered with erect spinules .... Coronididae

—— Telson not entirely covered with erect spines or stellate tubercles. Raptorial claw dactylus uninflated basally 2

2 Dorsal margin of uropodal endopod with strong dorsal proximal fold. Ischium of raptorial claw exceeding ½ merus length .... **Nannosquillidae**

—— Dorsal margin of uropodal endopod without strong dorsal proximal fold. Ischium of raptorial claw not exceeding ⅓ merus length 3

3 Telson with primary teeth fused into margin, present at most as short projections. Abdominal segments loosely articulated .... **Lysiosquillidae**

—— Telson with primary teeth and denticles distinct, slender. Abdominal articulation compact .... **Tetrasquillidae**

CORONIDIDAE Manning, 1980b

Coronididae Manning, 1980b: 367–368 (type genus *Coronida* Brooks, 1886).

Diagnosis. Raptorial claw with dactylus usually basally inflated into blunt heel (if not inflated basally, telson always entirely covered with erect spinules). Raptorial claw ischium not exceeding ⅓ merus length; propodus with 3 or 4 movable spines proximally. Abdominal articulation compact. Telson either highly sculptured or entirely covered with erect spinules, spines, or stellate tubercles. Proximal margin of uropodal endopod without strong dorsal fold.

Included genera. Five, *Acoridon* Adkison, Heard & Hopkins, 1983; *Coronida* Brooks, 1886; *Paracoridon* Moosa, 1991; *Neocoronida* Manning, 1976a; and *Mortensenenus* Manning, 1990b.

Remarks. Recent study of series of adult and postlarval *Parvisquilla* in the collections of the USNM has revealed that the genus is not a coronidid, but a squillid, as originally postulated by Manning (1973). Manning (1978c) specifically excluded *Parvisquilla* from the Squillidae on the basis of the apparently lysiosquilloid-like maxillipedal propodi, but re-examination of Manning's series of *Parvisquilla*, including the figured specimen used to justify the change, shows that the maxillipedal propodi are ovate and typically squilloid. The figure of the subquadrate maxillipedal propodus in Manning (1978c) was probably inadvertently illustrated from another coronidid. In *Parvisquilla*, the maxillipedal propodi are ovate instead of subquadrate, the hook process of the petasma of the male is elongate with an acute point, more than four intermediate denticles of the telson are present in both postlarvae and adults, and the distal endite of the maxillule bears one instead of two subdistal robust setae. Whereas the first trait is also shared by gonodactyloids, eurysquilloids and parasquilloids, the latter three traits are found only in squilloids (Ahyong & Harling, 2000). Moreover, the cornea of *Parvisquilla* appears to bear two rows of hexagonal midband ommatidia, a feature shared by all squilloids, but also some non-squilloids (Harling, 2000). The correct systematic position of *Parvisquilla* has escaped detection even in the most recent studies (e.g., Manning, 1995; Ahyong, 1997a; Ahyong & Harling, 2000) because of the paucity of specimens available for study and the authority afforded to the otherwise excellent treatment of *Parvisquilla* given by Manning (1978c). Corondids are unusual in the Lysiosquilloidea, not only for the possession of smashing claws (in most species), but also for showing variation in the number of movable proximal spines on the propodus of the raptorial claw and in showing variation in the degree of ribbing on the propodi of maxillipeds 3–4. *Acoridon* and *Paracoridon* both bear distinctly ribbed propodi of the distal margin of third and fourth maxillipeds and four proximal movable spines on the propodus of the raptorial claw. As shown by Ahyong (1997a) and Ahyong & Harling (2000), *Paracoridon* and *Acoridon* are basal coronidids exhibiting the plesiomorphic condition in the aforementioned characters. Conversely, the other coronidid genera bear three proximal movable spines on the propodus of the raptorial claw and ribbing on the propodi of maxillipeds 3 and 4 is absent or reduced to beads. These derivations in maxillipedal and raptorial claw characters, whilst superficially resembling the members of other superfamilies, are independently derived within the Coronididae. *Acoridon*, *Paracoridon* and *Mortensenenus* are each monotypic. *Coronida* includes three species, all from the Atlanto-Eastern Pacific. *Neocoronida* includes three Indo-West Pacific species. Coronidids are yet to be recorded from Australian waters.

Key to genera of Coronididae

1 Dactylus of raptorial claw with 5 teeth; propodus with 4 proximal movable spines. Propodi of MXP3–4 with distal margin distinctly ribbed 2

—— Dactylus of raptorial claw with 4 teeth; propodus with 3 proximal movable spines. Propodi of MXP3–4 with distal margin crenulate, beaded or smooth 3

2 Dactylus of raptorial claw inflated basally. Telson adorned entirely with blunt dorsal tubercles .... *Acoridon*

—— Dactylus of raptorial claw uninflated basally. Telson adorned entirely with short dorsal spinules except for median surface .... *Paracoridon*

3 AS6 and telson with surface sculptured and irregular, without erect spinules or tubercles .... *Mortensenenus*

—— AS6 and telson with surface with erect spines and tubercles 4

4 Uropodal protopod without spines on inner margin. Dorsal surface of AS6 and telson with simple spines .... *Coronida*

—— Uropodal protopod with spines on inner margin. Dorsal surface of AS6 and telson with stellate spines or tubercles .... *Neocoronida*

LYSIOSQUILLIDAE Giesbrecht, 1910

Lysiosquillinae Giesbrecht, 1910: 148 (type genus *Lysiosquilla* Dana, 1852).
Lysiosquillidae.–Manning, 1968c: 109.

Diagnosis. Cornea strongly bilobed, set obliquely on stalk. A2 protopod with 1 mesial and 2 ventral papillae. Raptorial claw with dactylus uninflated basally; propodus with 4 proximal movable spines. MXP1–5 with epipod. Abdominal segments depressed, loosely articulated. Pereiopods 1–3 with slender or ovate endopods. Proximal margin of uropodal endopod without strong dorsal fold. Telson with primary teeth fused into margin, presenting at most appearance of short projections.

Included genera. Three: *Lysiosquilla* Dana, 1852; *Lysiosquillina* Manning, 1995; and *Lysiosquilloides* Manning, 1977a.

Remarks. Members of the Lysiosquillidae are usually characterized as having slender or styliform pereiopodal endopods (Manning & Camp, 1993; Manning, 1995). Several species of *Lysiosquilla*, however, have ovate endopods on pereiopods 1–2 as in many tetrasquillids.

Lysiosquilloides is readily distinguished from *Lysiosquilla* and *Lysiosquillina* by the articulated instead of fixed submedian telson teeth in adults. Distinctions between *Lysiosquilla* and *Lysiosquillina*, however, are less clear owing to intermediate characters in some species of both genera. Whereas all species assigned to *Lysiosquilla* by Manning (1995) bear the "slender" antennal scale, two species, namely *L. campechiensis* and *L. suthersi*, bear a blunt, angular lobe instead of a dorsal spine on the antennal protopod, thus approaching the three then described species of *Lysiosquillina*, which each lack a spine or projection on the antennal protopod and have a "broad" antennal scale. *Lysiosquillina lisa*, however, recently described by Ahyong & Randall (2001), bears the blunt angular lobe on the antennal protopod. The antennal scale in *Lysiosquillina lisa* is relatively broad, but narrower than in other species of the genus. Thus, the distinctions between *Lysiosquillina* and *Lysiosquilla* are narrowing and require further study to assess the validity of the two genera. All three genera of the Lysiosquillidae are represented in Australia.

Key to genera of Lysiosquillidae (based on Manning, 1995)

1 Dorsal processes of A1 somite unarmed. SM teeth of telson with movable apices in adults .... ***Lysiosquilloides***

—— Dorsal processes of A1 somite with sharp apices. SM teeth of telson fixed in adults 2

2 A2 scale slender, length 3.0 or more times greatest width .... ***Lysiosquilla***

—— A2 scale broad, length less than 3.0 times greatest width .... ***Lysiosquillina***

Lysiosquilla Dana, 1852

Lysiosquilla Dana, 1852: 615. Type species *Lysiosquilla inornata* Dana, 1852 [a junior subjective synonym of *Lysiosquilla scabricauda* (Lamarck, 1818)], by subsequent designation by Fowler (1912: 539). Name on Official List of International Commission on Zoological Nomenclature. Gender feminine.

Diagnosis. Eye large, T-shaped, cornea strongly bilobed, mesial lobe rounded. A2 scale slender, length 3.0 or more times width. A2 protopod with mesiodorsal tooth or angled projection. Mandibular palp 3-segmented or absent. Pereiopods 1–3 endopod with distal segment slender. Telson SM teeth with fixed apices in adults; SM denticles fused into smooth margin in adults.

Included species. Eleven: *L. campechiensis* Manning, 1962a; *L. capensis* Hansen, 1895; *L. colemani* n.sp.; *L. hoevenii* (Herklots, 1851); *L. manningi* Boyko, 2000; *L. monodi* Manning, 1977a; *L. panamica* Manning, 1971c; *L. scabricauda* (Lamarck, 1818); *L. sulcirostris* Kemp, 1913; *L. suthersi* n.sp.; and *L. tredecimdentata* Holthuis, 1941.

Remarks. *Lysiosquilla* was recently restricted to lysiosquillids bearing a slender antennal scale and a mesiodorsal tooth or process on the antennal protopod (Manning, 1995). As noted above under the account of Lysiosquillidae, two species of *Lysiosquilla*, namely *L. campechiensis* and *L. suthersi*, bear a blunt, angular lobe instead of a dorsal tooth on the antennal protopod, as in *Lysiosquillina lisa*.

The nomenclature of two Atlantic species of *Lysiosquilla* was recently addressed (Boyko, 2000; Holthuis, 2000). Boyko (2000) showed that the species previously known as *Lysiosquilla desaussurei* (Stimpson, 1857) was an undescribed species, that he named *L. manningi*. Stimpson's (1857) species, on recent rediscovery of the holotype, was found to be referable to the squillid, *Cloridopsis dubia* (H. Milne Edwards, 1837) (Boyko, 2000). Holthuis (2000) suggested that *Lysiosquilla scabricauda* (Lamarck, 1818) is possibly a junior synonym of *Astacus vitreus* Fabricius, 1775, a species described from larvae and for which no types are extant. In the absence of definitive knowledge of the identity of *Astacus vitreus*, and consistent historical use of the name *Lysiosquilla scabricauda*, the latter name is used herein. Moreover, as noted by Holthuis (2000), a strong case could be made for suppression of the specific name *vitrea* Fabricius by the International Commission on Zoological Nomenclature.

Eleven species are recognized worldwide, of which five occur in the Indo-West Pacific. Four Indo-West Pacific species of *Lysiosquilla* are known from Australia, of which two are newly described.

Key to species of *Lysiosquilla*

1 Rostral plate smooth dorsally, without carinae or grooves 2

—— Rostral plate with median carina and/or grooves 3

2 Mandibular palp absent. Dactylus of raptorial claw with 11–14 teeth .... ***L. colemani***

—— Mandibular palp present. Dactylus of raptorial claw with 15–17 teeth .... *L. capensis*

3 Median carina of rostral plate flanked by longitudinal groove 4

—— Median carina of rostral plate not flanked by longitudinal groove 5

4 Raptorial claw with 9 or 10 teeth on dactylus. Uropodal protopod with ventral spine anterior to articulation of endopod. Adult ♂ PLP1 endopod with posterior endite .... *L. monodi*

—— Raptorial claw with 7 or 8 teeth on dactylus. Uropodal protopod without ventral spine anterior to articulation of endopod. Adult ♂ PLP1 endopod without posterior endite .... ***L. sulcirostris***

5 Anterior and posterior margin of AS6, and dorsum of uropodal protopod with small spinules 6

—— AS6 and dorsum of uropodal protopod without small spinules 8

6 TS8 ventral keel produced into posteriorly inclined acute point. Uropodal protopod with distinct spine on ventral surface at articulation of endopod .... *L. manningi*

—— TS8 ventral keel not produced into acute point, at most an erect angular lobe. Uropodal protopod at most with small ventral denticle or spinule adjacent to articulation of endopod 7

7 Telson surface between MD and SM bosses smooth, largely devoid of tubercles .... *L. hoevenii*

—— Telson surface between MD and SM bosses covered with tubercles .... *L. scabricauda*

8 Dactylus of raptorial claw with 6 or 7 teeth. Antennal protopod with low blunt, angular mesiodorsal lobe 9

—— Dactylus of raptorial claw with 10 or more teeth. Antennal protopod with mesiodorsal spine or tooth 10

9 Uropodal protopod with ventral spine adjacent to endopod articulation. Dorsal surface of AS6 and telson with deep, distinct, pitting or wrinkling .... *L. campechiensis*

—— Uropodal protopod without spine adjacent to endopod articulation. Dorsal surface of AS6 and telson relatively smooth, at most with shallow pits and some wrinkling .... ***L. suthersi***

10 TS8 sternal keel produced to a posteriorly directed spine, with sharp apex .... ***L. tredecimdentata***

—— TS8 sternal keel triangular, but with blunt apex .... *L. panamica*

Lysiosquilla colemani **n.sp.**

Fig. 63

Lysiosquilla maculata.–Stephenson & McNeill, 1955: 246 [part, NSW specimen only, not *L. maculata* (Fabricius, 1793)].
Lysiosquilla tredecimdentata.–Coleman, 1987: 92.–(not *L. tredecimdentata* Holthuis, 1941).
Lysiosquilla n.sp.–Graham *et al*., 1993a: 24, 64; 1993b: 73.

Type material. (All New South Wales) HOLOTYPE: AM P42760, 1♂ (TL 105 mm), E of Long Reef, 33°45'S 151°19'E, 280 m, N. Coleman, Dec 1978. PARATYPES: AM P14917, 1♂ (TL 152 mm), 3.2 km off coast between Cronulla & Botany Bay, 34°02'S 151°15'E, 36–58 m, taken on handline, A. Walker, 13 Feb 1960; AM P16227, 1♂ (TL 150 mm), off Cronulla, 34°04'S 151°10'E, taken by fisherman, 5 Jul 1964; AM P16228, 1♂ (TL 170 mm), off Scarborough Beach, near Stanwell Park, 34°16'S 150°58'E, taken on handline, J. Robinson, Aug 1967; AM P12379, 1♂ (TL 110 mm), off Port Jackson, 33°50'S 151°18'E, 37 m, H. Bates, 10 Apr 1954.

Australian material. QUEENSLAND: QM W3148, 1♂ (TL 160 mm), 48–64 km E of Caloundra (Cape Moreton Wide Ground), 137–144 m, mid Sep 1967. NEW SOUTH WALES: AM P14918, 1♂ (TL 160 mm), off Norah Head, 33°17'S 151°35'E, caught on hook & line, W. Willsher, Jan 1958; AM P42754, 1♂ (TL 131 mm), NE of Tuncurry, 31°56'S 152°51'E, 91–94 m, K. Graham, 16 Apr 1991; AM P42755, 1♂ (TL 87 mm), off Tuncurry, 31°52'S 152°54'E, 94 m, K. Graham, 10 Dec 1991; AM P42756–42759, 4♂♂ (TL 111–140 mm), E of Port Hunter, 32°55'S 151°56'E, 71–77 m, K. Graham, 11 Dec 1990; AM P57173, 1♂ (TL 170 mm), off Woody Head, Iluka, 44–46 m, trawled, FV *Trader Horn*, K. Graham, 1999; AM P57172, 1♂ (broken, CL 19.4 mm), SE of Yamba, 29°19'S 153°25'E, 34–37 m, K95–06–20, K. Graham, 29 May, 1995.

Diagnosis. Ocular scales produced as slender spines, directed anteriorly. A1 somite dorsal processes directed anterolaterally. Rostral plate dorsal surface smooth, without carinae or sulcus. A2 protopod with mesiodorsal tooth. Mandibular palp absent. Raptorial claw dactylus with 11–14 (usually 13) teeth; carpus dorsal tooth directed ventrally, slightly recurved mesially. TS8 sternal keel produced as a posteriorly directed spine. Male PLP1 endopod with posterior endite. AS5–6 posterior margin unarmed. Uropodal protopod with short ventral spine anterior to endopod articulation; endopod apex dark.

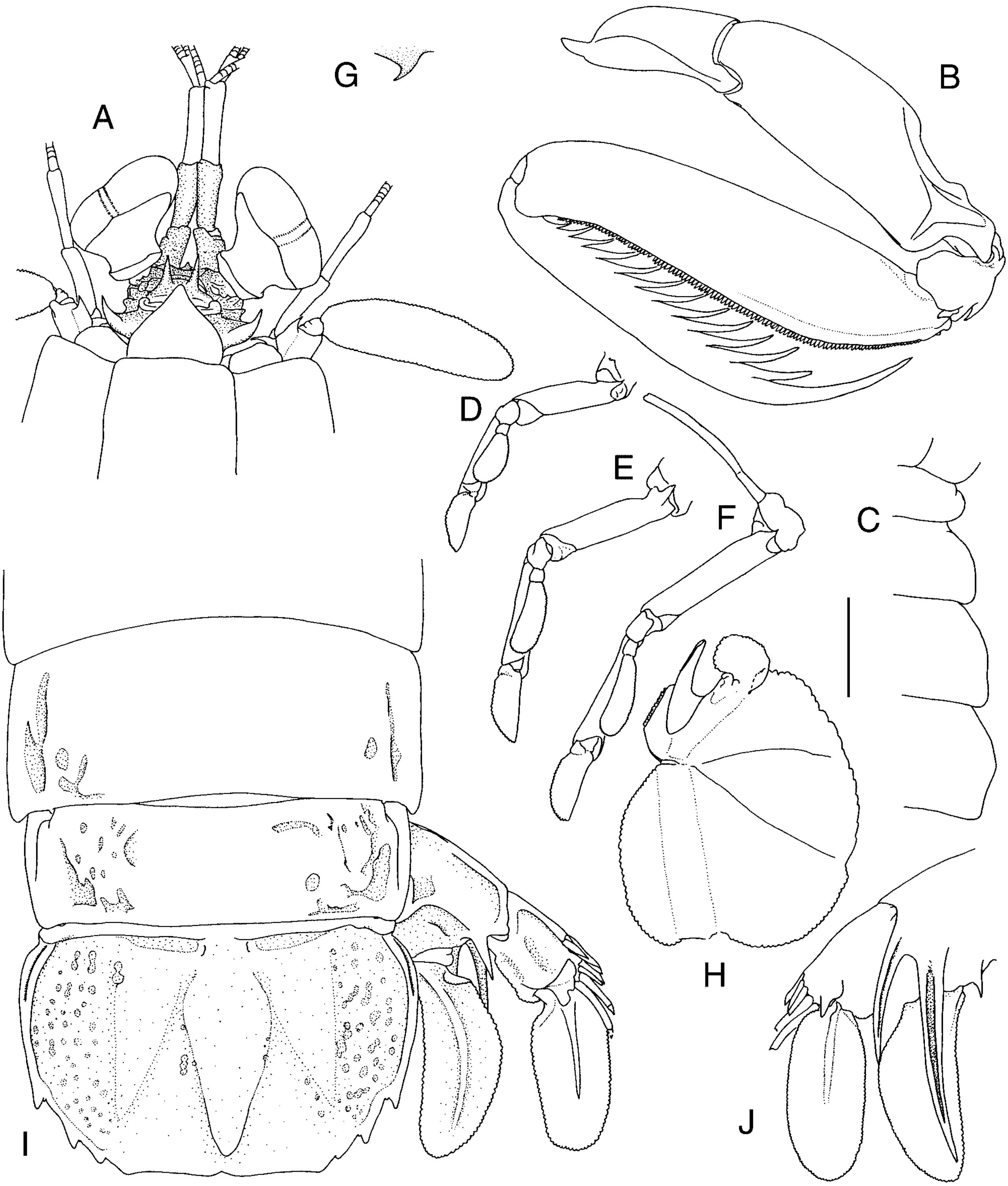

Figure 63. *Lysiosquilla colemani* n.sp., holotype ♂ TL 106 mm. A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS5–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, TS8 sternal keel, right lateral. H, PLP1 endopod, right anterior. I, AS4–6, telson & uropod, dorsal. J, uropod, right ventral. Scale A–G,I,J = 5 mm; H = 2.5 mm.

Description. Eye large cornea set slightly obliquely on stalk, extending beyond A1 peduncle segment 2; CI 266–392. Ophthalmic somite anterior margin with a median spine. Ocular scales produced as slender spines, directed anteriorly. A1 peduncle 0.59–0.71 CL. A1 somite dorsal processes low, broad, trianguloid, apices spiniform directed anterolaterally. A2 scale length 3.17–3.73 width and 0.49–0.58 CL; entire margin setose. A2 protopod with mesiodorsal tooth. Rostral plate cordiform; broader than long or length and breadth subequal; broadest at base; apex slightly deflexed; dorsal surface smooth, without carinae or sulcus; ventral surface smooth. Carapace anterolateral angles rounded; posterior margin unarmed. Raptorial claw dactylus with 11–14 (usually 13) teeth; outer margin at most faintly sinuous, proximal margin without basal notch; carpus dorsal margin terminating in short acute tooth, directed ventrally, slightly recurved mesially; propodus longer than carapace, distal margin unarmed; PI 069–082; ischium approximately ½ merus length. Mandibular palp absent. MXP5 basal segment without ventrally directed spine; merus with broad flange on inner margin, distally truncate. TS5 lateral process obsolete. TS6–7 lateral process broadly rounded. TS8 sternal keel produced as a posteriorly directed spine. PLP1 endopod in adult ♂♂ with posterior endite. AS5 smooth medially; slightly wrinkled laterally; posterior margin unarmed. AS6 smooth medially; with low irregularly sculptured lateral boss, medially sulcate; with 1 acute, triangular ventrolateral projection anterior to uropodal articulation; sternum posterior margin unarmed. Telson SM teeth obsolete; IM and LT teeth blunt; with 1 blunt IM and 1 indistinct LT denticle; lateral margins of telson unarmed; surface around dorsal bosses covered with broad, shallow pits. Uropodal protopod unarmed dorsally excepting spine above proximal exopod articulation; with short ventral spine anterior to endopod articulation. Uropodal exopod proximal segment unarmed dorsally; inner distal margin with broad, round lobe; outer margin with 6–8 (usually 7) movable spines, distalmost not exceeding midlength of distal segment; distal margin with stout ventral spine. Exopod distal segment longer than proximal segment. Endopod elongate, length 2.30–2.70 breadth; apex dark.

Colour in life. Dorsum pale cream with dark brown transverse bands. Carapace with dark spot on gastric groove anteriorly; with diffuse brown band anteriorly (including rostral plate); dark diffuse median patch; and diffuse, dark brown posterior band. TS5–8 and AS1–6 with dark brown transverse band across articulations. Telson dark brown across posterior ¾, excepting pale area between bosses. Uropodal protopod dark brown anteriorly; endopod black; exopod proximal segment with outer spines dark red, distal ½ (including outer spines) black-brown extending onto proximal ⅔ of distal segment; distal segment with distal third light blue. A2 protopod with dark anterior margin. A2 scale with dark brown outline. Raptorial claw dusky; merus with inferodistal margin dark red, distally dark at articulation with carpus; carpus dusky with dark brown posterodistal margin; dactylus and propodus pale orange/tan. Pereiopods with proximal ½ dark brown; distal ½ light blue.

Measurements. Male (*n* = 15) TL 87–170 mm. Other measurements of holotype: CL 18.8 mm, A1 peduncle 12.5 mm, A2 scale 10.2 mm.

Etymology. Named for Neville Coleman, who collected the holotype.

Remarks. *Lysiosquilla colemani* n.sp. is unique in the genus for lacking a mandibular palp, and most closely resembles *L. capensis* from South Africa in bearing anteriorly directed, spiniform ocular scales, the unadorned dorsum of the rostral plate and a distinct spine on the uropodal protopod adjacent to endopodal articulation. Lysiosquilla colemani also differs from *L. capensis* in bearing fewer teeth on the dactylus of the raptorial claw (11–14 instead of 15–17). Like *L. capensis*, *L. colemani* is essentially a temperate water species, but unlike *L. capensis*, it is not known from the shoreline.

Habitat. Soft, level, sandy-mud substrates from 36–280 m depth.

Distribution. Known only from eastern Australia between Caloundra, Queensland and Scarborough, New South Wales.

Lysiosquilla sulcirostris Kemp, 1913

Fig. 64

Lysiosquilla maculata var. *sulcirostris* Kemp, 1913: 4, 10, 110, 116, pl. 8: figs. 92, 93 (type locality: Andaman Is, 12°30'N 92°45'E).–Holthuis, 1941: 272.

Lysiosquilla sulcirostris.–Holthuis, 1967a: 23.–Manning, 1978b: 3, 11–13, figs. 7, 8, 12.–Yamaguchi & Baba, 1993: 188–189, fig, 16.–Manning, 1995: 126–132, figs. 67, 68a, 69a,b,d,e, 70c,d, 71c,d, 72c,d, 73.

Material. WESTERN AUSTRALIA: NTM Cr012384, 1♂ (TL 31 mm), Northwest Shelf, AS0283 126, trawled, 1983.

Diagnosis. Ocular scales triangular, erect, inclined anteriorly. A1 somite dorsal processes directed antero-laterally. Rostral plate triangular, broadest at base; with median carina anteriorly flanked by groove. A2 protopod with mesiodorsal tooth. Mandibular palp present. Raptorial claw dactylus with 7 or 8 teeth; carpus dorsal tooth directed ventrally. Pereiopods 1–2 with oval elongate endopod. TS8 sternal keel produced as a posteriorly directed spine. Male PLP1 endopod without posterior endite. Uropodal protopod without ventral spine anterior to endopod articulation; exopod proximal segment outer margin with 8 movable spines; endopod apex dark.

Colour in alcohol. Faded, but with dark and light transverse bands across dorsum. Uropodal exopod with distal ½ of proximal segment and proximal ⅔ of distal segment black; endopod with distal ⅔ black.

Measurements. Male (*n* = 1) TL 31 mm. CI 233. A1 peduncle 0.69 CL. A2 scale 0.51 CL, length 2.82 width. PI 078. Uropodal endopod length 2.52 breadth. Manning (1978b) reported specimens to 325 mm TL.

Remarks. This juvenile specimen is identifiable with *L. sulcirostris* by the distinctive form of the rostral plate, the number of teeth on the dactylus of the raptorial claw and sharp sternal keel on TS8. It differs from adult *L. sulcirostris* in bearing a relatively undeveloped mesiodorsal process on the antennal protopod and in having a relatively broad antennal scale that resembles species of *Lysiosquillina*. Apparently, the mesiodorsal tooth on the antennal protopod and slender antennal scale develops later in *L. sulcirostris* than in other species of *Lysiosquilla*.

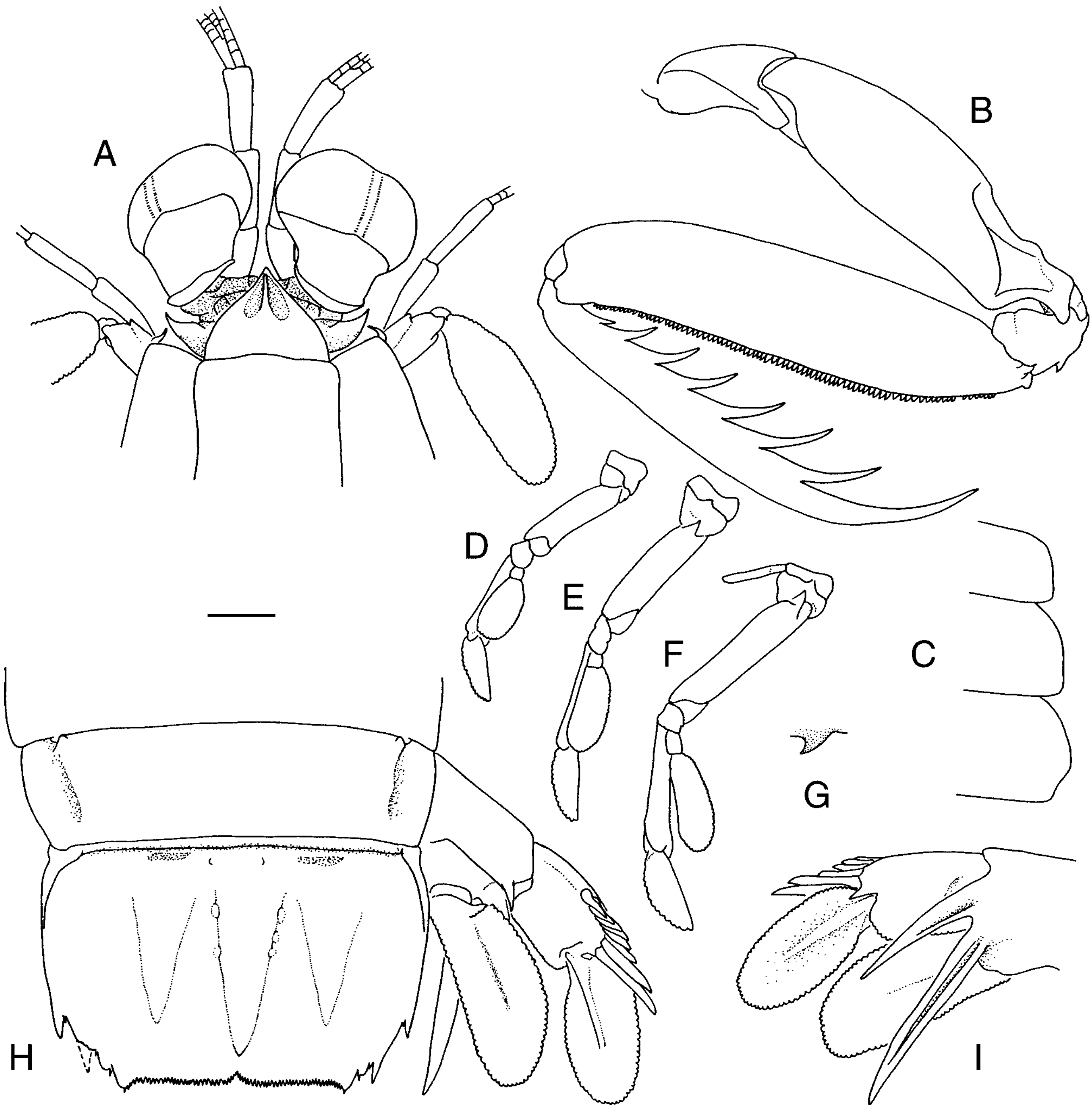

Figure 64. *Lysiosquilla sulcirostris* Kemp, juvenile ♂ TL 31 mm (NTM Cr012384). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, uropod, right ventral. Scale = 1 mm.

Aside from the form of the rostral plate, *L. sulcirostris* differs from all other species of the genus in lacking the posterior endite on the endopod of the first pleopod in adult males. Although the figure of the endopod of the first male pleopod in *L. manningi* given by Boyko (2000: fig. 2F) appears to also lack the posterior endite, the figure is incomplete. The endopod of the first male pleopod in adult male *L. manningi* bears a posterior endite as in most other species of the genus.

Habitat. Soft substrates to a depth of 33 m.

Distribution. Indo-West Pacific from scattered localities between Madagascar and Japan. The present record from the Northwest Shelf is the first for Australia. Bigelow's (1931: 171) records of "Kemp's var. *sulcirostris*" from Hawaii, perpetuated in Manning (1995), are based on *Lysiosquillina maculata*.

Lysiosquilla suthersi n.sp.

Fig. 65

Lysiosquilla cf. *maculata*.–Cannon *et al*., 1987.

Type material. HOLOTYPE: QM W24225, ♂ (TL 150 mm), off Cairns, Queensland, 17°00.0'S 146°24.5'E, 55 m, trawled, Queensland Fisheries Service, 24 Apr 1982.

Other material. ZRC 1999.2089, 1♂ (TL 195 mm), Andaman Sea, Phuket, Thailand, Pi Chai fishing port, trawled, P. Ng, 24 Aug 1999; CUMZ, 1♂ (TL 121 mm), Songkhla Province, Gulf of Thailand, trawled, P. Naiyanetr, Mar 1967.

Diagnosis. Ocular scales low, triangular, separate, inclined anteriorly. A1 somite dorsal processes broad, apices acute, directed anteriorly. A2 protopod with blunt mesiodorsal lobe. Rostral plate cordiform; slightly longer than broad; broadest in advance of base; apex blunt; dorsal surface with low median carina anteriorly, smooth laterally. Mandibular palp present. Raptorial claw dactylus with 6 or 7 teeth. TS8 sternal keel trapezoid. Male PLP1 endopod with posterior endite. AS5 smooth laterally and medially; posterior margin without spinules. AS6 smooth; with low lateral boss, medially sulcate; with acute triangular ventrolateral projection anterior to uropodal articulation. Uropodal protopod without ventral spine anterior to endopod articulation. Uropod endopod with apex dark.

Description. Eye small, cornea set slightly obliquely on stalk, not extending beyond A1 peduncle segment 2; CI 590–629. Ophthalmic somite anterior margin with a median point. Ocular scales low, triangular, separate, inclined anteriorly. A1 peduncle 0.38–0.42 CL. A1 somite dorsal processes broad, apices acute, directed anteriorly. A2 scale length 3.15–3.33 width and 0.45–0.52 CL; entire margin setose. A2 protopod with blunt mesiodorsal lobe. Rostral plate cordiform; slightly longer than broad; broadest in advance of base; lateral margins sinuous; apex blunt; dorsal

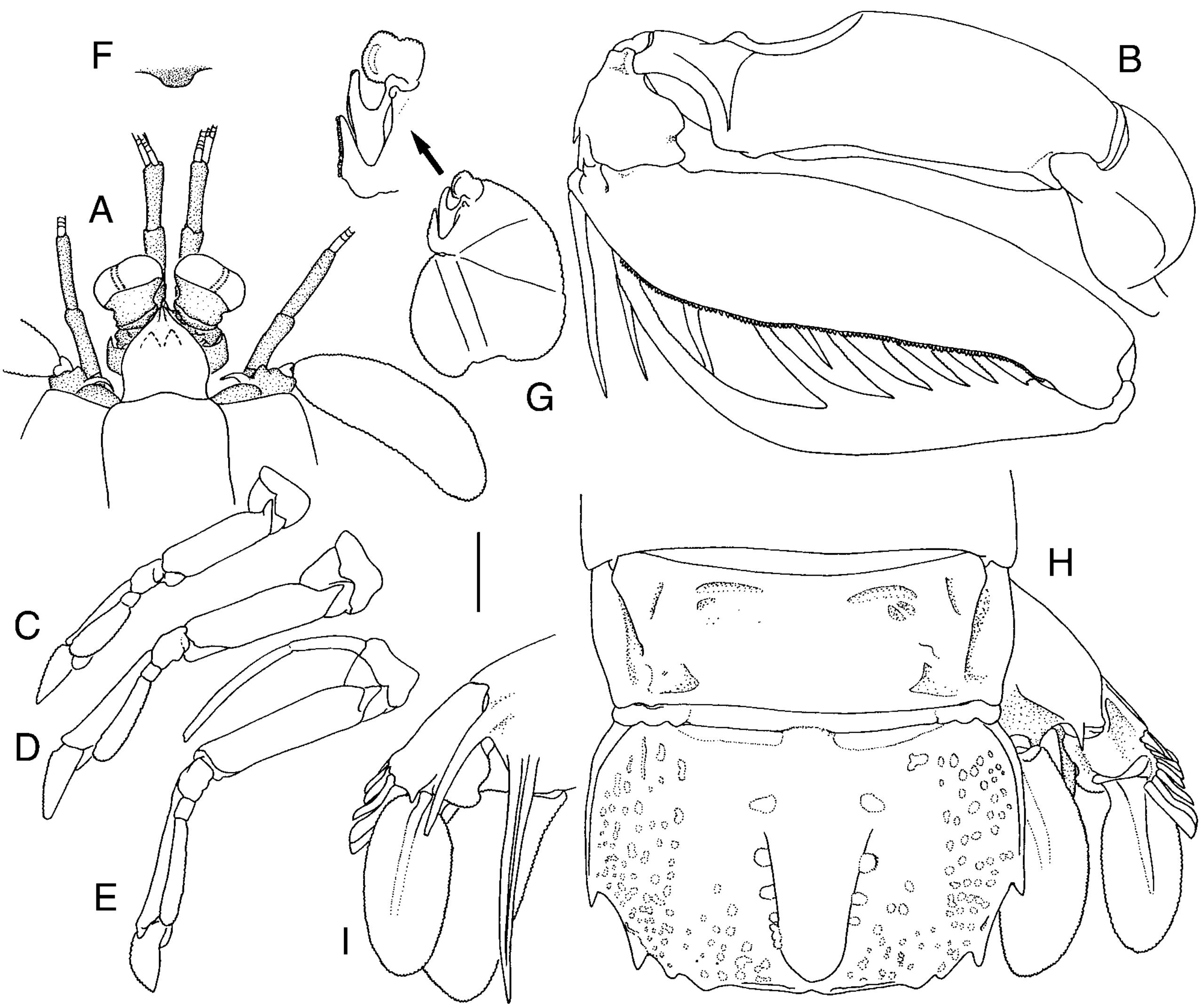

Figure 65. *Lysiosquilla suthersi* n.sp., holotype ♂ TL 150 mm. A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C–E, pereiopods 1–3, posterior. F, TS8 sternal keel, right lateral. G, PLP1 endopod, right anterior. H, AS5–6, telson & uropod, dorsal. I, uropod, right ventral. Scale = 5 mm.

surface with low median carina anteriorly, smooth laterally; ventral surface unarmed, smooth. Carapace anterolateral angles broadly rounded; posterior margin unarmed. Raptorial claw dactylus with 6 or 7 teeth; outer margin sinuous, broadly curved, with shallow basal notch; carpus dorsal margin terminating in short tooth directed ventrally; PI 079–086. Mandibular palp 3-segmented. MXP5 basal segment without ventrally directed spine; merus with narrow flange on inner margin, evenly convex. TS5 lateral process obsolete. TS6–7 lateral process broadly rounded. TS8 sternal keel trapezoid. PLP1 endopod in adult males with posterior endite. AS5 smooth laterally and medially; posterior margin unarmed, without spinules. AS6 smooth; with low lateral boss, medially sulcate; with acute triangular ventrolateral projection anterior to uropodal articulation; sternum posterior margin unarmed. Telson SM teeth obsolete; IM and LT teeth sharp; with blunt IM denticle; margins unarmed; surface around dorsal bosses covered with broad, shallow pits. Uropodal protopod unarmed dorsally excepting spine above proximal exopod articulation; without ventral spine anterior to endopod articulation. Uropodal exopod proximal segment unarmed dorsally; inner distal margin with broad, round lobe; outer margin with 7–9 movable spines, distal 2 spatulate, apices sharp, distalmost not reaching midlength of distal segment; distal margin with short ventral spine. Exopod distal segment longer than proximal segment. Endopod unarmed dorsally, length 2.25–2.46 breadth; apex dark.

Colour in alcohol. Dorsally with dark transverse banding; with three dark bands across carapace and dark band across articulation of each body segment. Uropodal protopod with dark patch basally; exopod with dark patch across articulation of segments; endopod with dark distal ½. A2 scale speckled with dark chromatophores; without dark outline.

Measurements. Male (n = 3) TL 121–195 mm. Other measurements of holotype: CL 26.9 mm, A1 peduncle 11.3 mm, A2 scale 14.0 mm.

Etymology. Named for Iain Suthers, University of New South Wales, for his encouragement and assistance with my stomatopod studies.

Remarks. *Lysiosquilla suthersi* n.sp. can be recognized by the following combination of characters: the raptorial claw bears six or seven teeth on the dactylus, the antennal protopod bears a blunt mesiodorsal lobe instead of a spine or tooth, the TS8 ventral keel is low and angular, AS5–6 are smooth dorsally aside from slight wrinkling or shallow pits on AS6, and the uropodal protopod lacks a spine adjacent to the endopod articulation. *Lysiosquilla suthersi* most closely resembles *L. campechiensis* but differs in bearing a more elongate rostral plate, in bearing generally smooth or lightly pitted instead of strongly wrinkled and pitted dorsolateral surfaces of AS5–6, and in lacking the ventral spine adjacent to the uropodal endopod articulation.

Along with *L. campechiensis* from the western Atlantic Ocean, *Lysiosquilla suthersi* is unusual in the genus because the dorsal projection on the antennal protopod is low and angular, instead of spiniform or sharp as in other congeners. In this regard, *L. suthersi* and *L. campechiensis* resembles *Lysiosquillina lisa*, recently described by Ahyong & Randall (2001).

Habitat. Trawled from level substrates; presumably sand or mud.

Distribution. Known from the type locality, off Cairns, Queensland, the Gulf of Thailand, and the Andaman Sea.

Lysiosquilla tredecimdentata Holthuis, 1941

Fig. 66

Lysiosquilla maculata var. *tredecimdentata* Holthuis, 1941: 273–274, fig. 6 (type locality: Hedjaff, near Aden).
Lysiosquilla maculata.–Kemp, 1913: 111, pl. 8: figs. 87–89 [part, not *L. maculata* (Fabricius, 1793)].
Lysiosquilla tredecimdentata.–Manning, 1968b: 38–41, fig. 13.–Holthuis, 1967a: 23.–Manning, 1978b: 3, 13, 15, fig. 13; 1995: 132–133, pl. 24, figs. 68b, 69c,f.

Material. QUEENSLAND: AM P54452, 1♂ (TL 112 mm), off Townsville, 19°16'S 146°49'E, trawled, 24 Feb 1997; AM P56918, 1♀ (TL 276 mm), off Plantation Creek, Townsville, trawled, Jan 1997; AM P60106, 1♂ (TL 248 mm), Laguna Bay, 10 m, trawl, C. Harper, May 1999; AM P60237, 1♀ (TL 122 mm), Alexandra Reefs, dug from burrow in intertidal sand flat, low tide, S. & R. Ahyong, Dec 1996; QM W1773, 1♂ (TL 200 mm), Stradbroke I., Moreton Bay, T. Welsby 27 Nov 1928; QM W2086, 1♂ (TL 170 mm), Deception Bay, Moreton Bay; QM W8897, 1♀ (TL 241 mm), Moreton Bay, Deception Bay Fisheries Research Station, 13 Apr 1980. NEW SOUTH WALES: AM P12508, 1♂ (TL 143 mm), off Ballina. WESTERN AUSTRALIA: WAM 131–43, 1♂ (TL 200 mm), Port Hedland, G. Grist, Jul 1972; WAM C5580, 1♀ (TL 230 mm), Port Hedland, Jun 1938; WAM C7833, 1♂ (TL 118 mm), Yampi Sound, 16°08'S 123°36'E, low tide, G. Robinson, Oct 1960; WAM C14483, 1♂ (TL 180 mm), Wyndham, G. Deutschman, Nov 1928; WAM C23530, 1♂ (TL 215 mm), off Carnarvon, 24°53'S 113°40'E, W. & W. Poole, Aug–Sep 1967; WAM C23531, 1♀ (TL 103 mm), Kuri Bay, 15°29'S 124°31'E, Mr Sealey, 1 Jul 1965.

Diagnosis. Ocular scales triangular, erect, inclined anteriorly. A1 somite dorsal processes directed anteriorly. Rostral plate cordiform; broadest in advance of base; with median carina anteriorly, not flanked by grooves or carinae. A2 protopod with blunt mesiodorsal tooth. Mandibular palp present. Raptorial claw dactylus with 9–13 teeth (often fewer in very large females); carpus dorsal tooth directed ventrally, recurved mesially. Pereiopods 1–3 with slender endopod. TS8 sternal keel produced as a posteriorly directed spine. Male PLP1 endopod with posterior endite. Uropodal protopod usually with small spine anterior to endopod articulation; exopod proximal segment outer margin with 7–9 movable spines; endopod apex dark.

Colour in life. Dorsum base colour pale yellow, with black transverse bands. Carapace with three dark, broad, transverse bands intervened by narrower pale bands. Uropodal exopod with distal ½ of proximal segment and

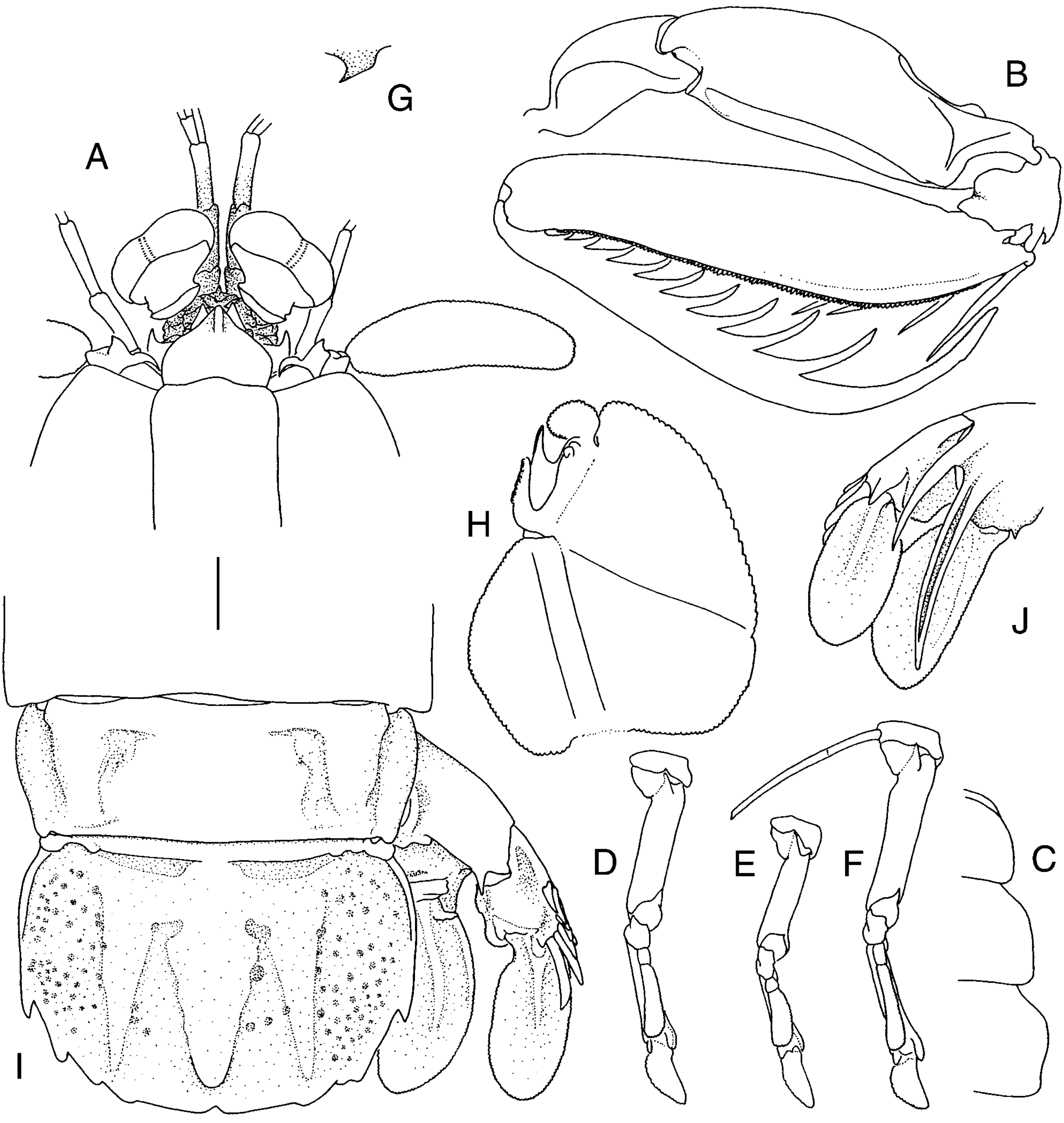

Figure 66. *Lysiosquilla tredecimdentata* Holthuis, ♂ TL 118 mm (WAM C7833). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, TS8 sternal keel, right lateral. H, PLP1 endopod, right anterior. I, AS4–6, telson & uropod, dorsal. J, uropod, right ventral. Scale A–G,I,J = 5 mm; H = 2.5 mm.

proximal ⅔ of distal segment black; outer movable spines dark red. Uropodal endopod with distal ⅔ black. A2 scale with dark-brown outline. Pereiopods with pink setae on distal segment.

Measurements. Male (*n* = 9) TL 112–248 mm, female (*n* = 5) TL 103–276 mm. CI 304–599. A1 peduncle 0.46–0.61 CL. A2 scale length 3.03–4.27 width and 0.52–0.68 CL. PI 069–081 (males), 072–141 (females). Uropodal endopod length 2.20–2.42 breadth. The present series includes the largest known specimen of the species.

Remarks. The Australian specimens agree well with published accounts (Holthuis, 1941; Manning, 1968b, 1978b, 1995), but show allometric variation in the presence of the spinule adjacent to the articulation of the uropodal endopod. The spinule adjacent to the uropodal endopod is present in most specimens up to 180 mm TL. Specimens exceeding 180 mm TL lack the uropodal spinule except in one specimen (TL 200 mm) in which the spinule is present on one side only, and in two other specimens (TL 230 mm, 241 mm) where a low tubercle is present.

One specimen (WAM C23532) had an epizooic bivalve attached under the posterolateral portion of the carapace.

Habitat. *Lysiosquilla tredecimdentata* occupies deep burrows on intertidal sand and mudflats, and level subtidal substrates.

Distribution. Western Indian Ocean to India, Thailand, Vietnam, the central Pacific and now from northwestern and eastern Australia, south to Ballina, New South Wales.

Lysiosquillina Manning, 1995

Lysiosquillina Manning, 1995: 133. Type species *Squilla maculata* Fabricius, 1793, by original designation. Gender feminine.

Diagnosis. Eye large, T-shaped, cornea strongly bilobed, mesial lobe rounded. A2 scale broad, length less than 3.0 times width. A2 protopod without dorsal spine. Mandibular palp present. Pereiopods 1–3 endopod with distal segment slender. Telson SM teeth with fixed apices in adults; SM denticles fused into smooth margin in adults.

Included species. Four: *L. glabriuscula* (Lamarck, 1818), *L. lisa* Ahyong & Randall, 2001, *L. maculata* (Fabricius, 1793), and *L. sulcata* (Manning, 1978b).

Remarks. The broad antennal scale, unarmed antennal protopod and fixed submedian telson teeth distinguish *Lysiosquillina* from *Lysiosquilla* and *Lysiosquilloides*. Four species of *Lysiosquillina* are recognized, one of which, *L. glabriuscula*, occurs in the western Atlantic. *Lysiosquillina maculata* and *L. sulcata* occur in the Indo-West Pacific and both are known from Australia.

Key to species of *Lysiosquillina*

1 Rostral plate with long median carina extending posteriorly ½ to ¾ length of rostral plate. Mandibular palp 2-segmented. A2 protopod with blunt angular mesiodorsal projection .... *L. lisa*

—— Rostral plate with short median carina extending posteriorly not more than ½ length of rostral plate. Mandibular palp 3-segmented. A2 protopod without angular mesiodorsal projection 2

2 Rostral plate with low median carina flanked by longitudinal grooves, or with single shallow median groove. Apex of uropodal endopod pale, unpigmented .... ***L. sulcata***

—— Rostral plate with distinct median carina, not flanked by longitudinal grooves. Apex of uropodal endopod dark, pigmented 3

3 Raptorial claw dactylus with 6 or 7 teeth .... *L. glabriuscula*

—— Raptorial claw dactylus with 8–11 (usually 10 or 11) teeth .... ***L. maculata***

Lysiosquillina maculata (Fabricius, 1793)

Fig. 67

Squilla maculata Fabricius, 1793: 511 (type locality: Manado, Indonesia, by present neotype selection).
Lysiosquilla Miersii De Vis, 1883: 321 (type locality: Moreton Bay, Queensland, Australia, 27°15'S 153°14'E).
Lysiosquilla maculata.–Stephenson, 1953a: 44, 45.–Stephenson & McNeill, 1955: 246 (part, Western Australian specimen only).–McNeill, 1968: 88.–Manning, 1968b: 36–38, fig. 12; 1978b: 3–7, figs. 1–3, 9.–Moosa, 1991: 179.–Manning, 1991: 7.
Lysiosquilla miersi.–Kemp, 1913: 4, 10, 111, 116–117.
Lysiosquillina maculata.–Manning, 1995: 134–137, figs. 68c, 70a,b, 71a,b, 72a,b, 74–77, 78a, 80a.

Type material. NEOTYPE: AM P58558, ♂ (TL 195 mm), Manado, Indonesia, 1°29'N 124°51'E, M. Aw, Oct 1994.

Australian material. QUEENSLAND: AM P14919, 1♂ (TL 162 mm), Hope I., N of Cairns, 15°45'S 145°27'E, M. Betts, 1960; QM W249, 1♂, Stradbroke I., T. Welsby, 27 Nov 1928; QM W273, 1♀ (TL 236 mm), off Moreton I., W. Howard; QM W294, 1♀ (TL 133 mm), Thursday I., J. McNulty, 20 Dec 1930; QM G653, 1♀ (TL 230 mm), Moreton Bay (holotype of *Lysiosquilla miersii* De Vis); QM W701, 1♀ (TL 176 mm), Caloundra, W. Sargent; QM W1014, 1♂ (TL 163 mm), Dunwich, Moreton Bay, Dr St. Vincent Welch, 10 Nov 1939; QM W1722, 1♀ (TL 335 mm), Dunwich, Stradbroke I., C. Hollis; QM W1776–1777, 1♂ (TL 223 mm), 1♀ (TL 154 mm), Thursday I., J. McNulty, 20 Dec 1930; QM W1778, 1♀ (TL 250 mm), Bribie I.; QM W1839, 1♂ (TL 145 mm) Maroochydore, G. Kingston; QM W1986, 1♂ (TL 170 mm), Maroochydore, V. Perren; QM W1987, 1♀ (TL 155 mm), Caloundra; QM W2440, 1♂ (TL 134 mm), Turtle Group, caught swimming at surface of murky water, B. Cummings, 21 Jan 1968; QM W12221, 1♀ (TL 81 mm), The One Mile, Stradbroke I., Moreton Bay, S. Ward, 20 Jun 1954; QM W23112, 1♂ (TL 109 mm), Gulf of Carpentaria, 16°18.8'S 138°25.5'E, 25.7 m, T. Wassenberg, 5 Feb 1997. NEW SOUTH WALES: QM W1668, 1♀ (TL 167 mm), Tweed River, L. Thompson. WESTERN AUSTRALIA: AM P4150, 1♂ (TL 270 mm), northwestern Australia, from burrow in tidal mudflat, J. Cumpston; AM P11692, 1♀ (TL 145 mm), Broome, 17°58'S 122°14'E, B. Bardwell; QM W96, 1♀ (broken, CL 43.2 mm) Boolgin, Cape Leveque, L. Cooling; QM W1774, 1♂ (TL 222 mm) Boolgin, Cape Leveque, L. Cooling; WAM C7409, 1♂ (TL 235 mm), Point Sampson, G. Smith, Mar 1956; WAM C490, 1♂ (TL 235 mm), Derby, 8 Jan 1915; WAM C3971, 1♂ (TL 186 mm), Sunday I., via Derby, D. Drysdale, Aug 1930; WAM C6482, 1♀ (TL 250 mm), Broome, Mar 1950. COCOS-KEELING ISLANDS: ZRC 1970.10.22.1, 1♀ (TL 160 mm), Cocos-Keeling Is, K. Maclean, 7 Jun 1904.

Diagnosis. Rostral plate cordiform (occasionally subtriangular), usually broader than long and broadest in advance of base; with distinct median carina anteriorly, not flanked by

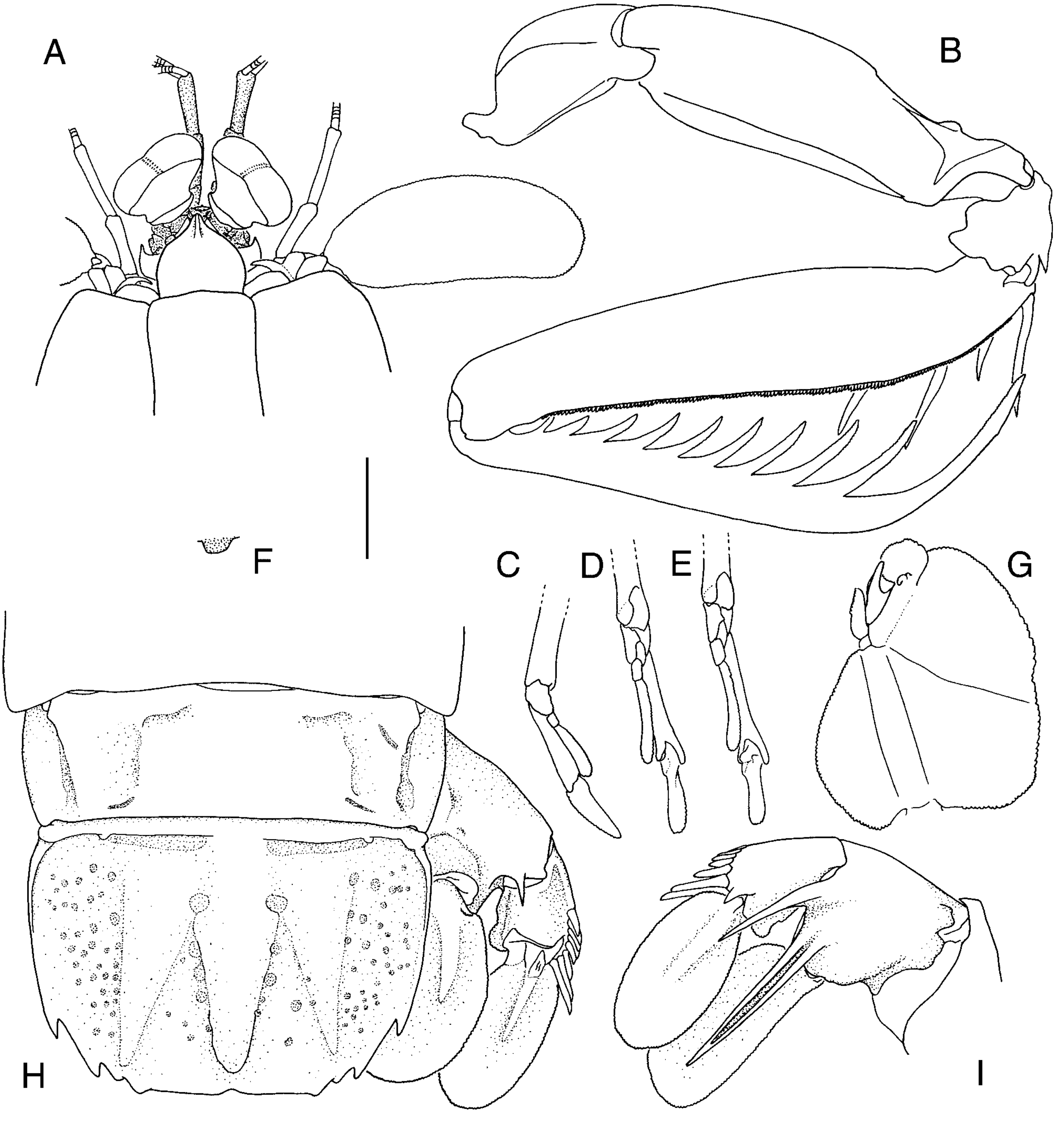

Figure 67. *Lysiosquillina maculata* (Fabricius), ♂ TL 162 mm (AM P14919). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C–E, pereiopods 1–3, posterior. F, TS8 sternal keel, right lateral. G, PLP1 endopod, right anterior. H, AS5–6, telson & uropod, dorsal. I, uropod, right ventral. Scale A–F,H,I = 10 mm; G = 6 mm.

longitudinal grooves or carinae. Mandibular palp 3-segmented. Raptorial claw dactylus with 7–11 teeth (usually 10 or 11). TS8 sternal keel rounded. AS5 smooth dorsally. AS6 smooth medially; with low lateral boss, medially sulcate. Uropodal exopod proximal segment outer margin with 7–9 movable spines; endopod with distal ¾ dark.

Colour in life. Dorsum base colour white to pale yellow, with dark brown to black transverse bands. Carapace with three dark transverse bands intervened by pale bands of about the same width. Uropodal exopod with distal ½ of proximal segment and proximal ⅔ of distal segment black; endopod with distal ⅔ black. A2 scale with diffuse patch of dark-brown chromatophores across central portion.

Measurements. Male (n = 14) TL 109–270 mm, female (n = 14) TL 81–335 mm. CI 349–614. A1 peduncle 0.39–0.56 CL. A2 scale length 1.99–2.43 width and 0.43–0.71 CL; entire margin setose. PI 063–078 (males), 074–124 (females). Uropod endopodal length 1.96–2.40 breadth. Specimens to 385 mm

TL have been reported (Manning, 1978b).

Remarks. The present specimens of *L. maculata* agree well with the neotype and published accounts Manning (1978c, 1995). In all specimens, the rostral plate is cordiform and is broadest slightly in advance of the base instead of subtriangular as reported for some specimens by Manning (1978c). Sexual dimorphism is exhibited by large females as reported by (Manning, 1978c, 1995) and is particularly evident in the relative size and spination of the raptorial claw. Thus, the propodus of the raptorial claw is usually longer than the carapace with 9–11 teeth on the dactylus, but in all females larger than 230 mm, the propodus of the raptorial claw is shorter than the carapace and the number of dactylar teeth is reduced to 7 or 8.

Lysiosquillina lisa closely resembles *L. maculata*. That species differs from *L. maculata* chiefly by bearing a two- instead of three-segmented mandibular palp, in bearing a blunt, low dorsal projection on the antennal protopod, and the presence of a distinct groove flanking the margins of the median carina on the rostral plate. Holthuis (1967a) selected the Indonesian specimen figured by Rumphius (1705) as lectotype for *L. maculata*, simultaneously noting that the specimen was lost. In view of the expanding number of lysiosquillid species being recognized and notably the fact that *L. lisa* closely resembles *L. maculata*, a neotype for Fabricius' species is herein selected to fix the identity of the species. The neotype is a 195 TL male from Manado, Indonesia.

Habitat. *Lysiosquillina maculata* constructs deep burrows in intertidal to shallow subtidal sand and mud flats.

Distribution. Widely distributed in the Indo-West Pacific from the western Indian Ocean to Australia, Japan and Hawaii. Stephenson & McNeill's (1955) records of *L. maculata* from New South Wales are based on *Lysiosquilla colemani*.

Lysiosquillina sulcata (Manning, 1978b)

Fig. 68

Lysiosquilla sulcirostris.–Manning, 1970a: 1438–1439, fig. 2 (not *L. sulcirostris* Kemp, 1913).
Lysiosquilla sulcata Manning, 1978b: 7–10, figs. 4–6, 10 (type locality: Maldive Is, 5°21'30"N 73°25'15"E).
Lysiosquillina sulcata.–Manning, 1995: 133, 134.

Type material. HOLOTYPE: USNM 156253, ♂ (TL 99 mm), between Mafilefuri & Mara I., Fadittolu Atoll, Maldive Is, 5°21'30"N 73°25'15"E, J. Garth *et al*., 23–24 Mar 1964.

Australian material. QUEENSLAND: AM P19919, 1♂ (TL 153 mm), One Tree I., 6 m, near patch reef, sand burrow, J. Randall, 19 Jan 1973.

Diagnosis. Rostral plate subtriangular to subpentagonal; as long as or longer than broad, broadest at base; apex deflexed; with indistinct median carina, flanked laterally by short, shallow longitudinal grooves. Mandibular palp 3-segmented. Raptorial claw dactylus with 7 or 8 teeth. TS8 sternal keel angular to rounded. AS5 smooth dorsally. AS6 smooth medially; with low lateral boss, medially sulcate. Uropodal endopod apex light.

Colour in alcohol. Largely faded, but with transverse light and dark bands across dorsum. Uropodal exopod with distal ½ of proximal segment and proximal ⅔ of distal segment dark; endopod pale.

Measurements. Male (n = 2) TL 99–153 mm. CI 311–361. A1 peduncle 0.52–0.56 CL. A2 scale length 2.29–2.50 width and 0.66–0.74 CL. PI 070–074. Uropodal endopod length 2.11–2.18 breadth. The present series includes the largest known specimen of the species.

Remarks. The Australian specimen agrees well with the holotype and type description (Manning, 1978c). A new record for Australia.

Habitat. Occupies deep burrows in sand, often in association with coral reefs; to a depth of at least 6 m.

Distribution. Western Indian Ocean to Indonesia, West Papua, Saipan, the Gilbert Islands and now from eastern Australia.

Lysiosquilloides Manning, 1977a

Lysiosquilloides Manning, 1977a: 84–85. Type species *Lysiosquilla aulacorhynchus* Cadenat, 1957, by original designation and monotypy. Gender masculine.

Diagnosis. Eye with mesial lobe of cornea rounded or conical. A1 somite dorsal processes broad, low, flattened, unarmed. A2 protopod with blunt anterior projection bearing apical papilla. A2 scale slender or broad. Mandibular palp 3-segmented. Pereiopod 1–3 endopod with distal segment slender. Telson SM teeth with movable apices in adults; with numerous, minute SM denticles

Included species. Two: *L. aulachorhynchus* (Cadenat, 1957) and *L. siamensis* (Naiyanetr, 1980).

Remarks. *Lysiosquilloides* closely resembles *Lysiosquilla* and *Lysiosquillina*, but is readily distinguished by the low, flattened dorsal processes of the antennular somite and movable submedian teeth on the telson in adults. *Lysiosquilloides aulachorhynchus* occurs in the eastern Atlantic; *L. siamensis* is restricted to the Indo-West Pacific.

Key to species of *Lysiosquilloides*

1 Rostral plate triangular. Cornea with mesial ½ conical. A2 scale slender, about, length about 3 times width .... *L. aulacorhynchus*

—— Rostral plate cordiform. Cornea with mesial ½ subglobular. A2 scale broad, length 2.4–2.7 times width .... ***L. siamensis***

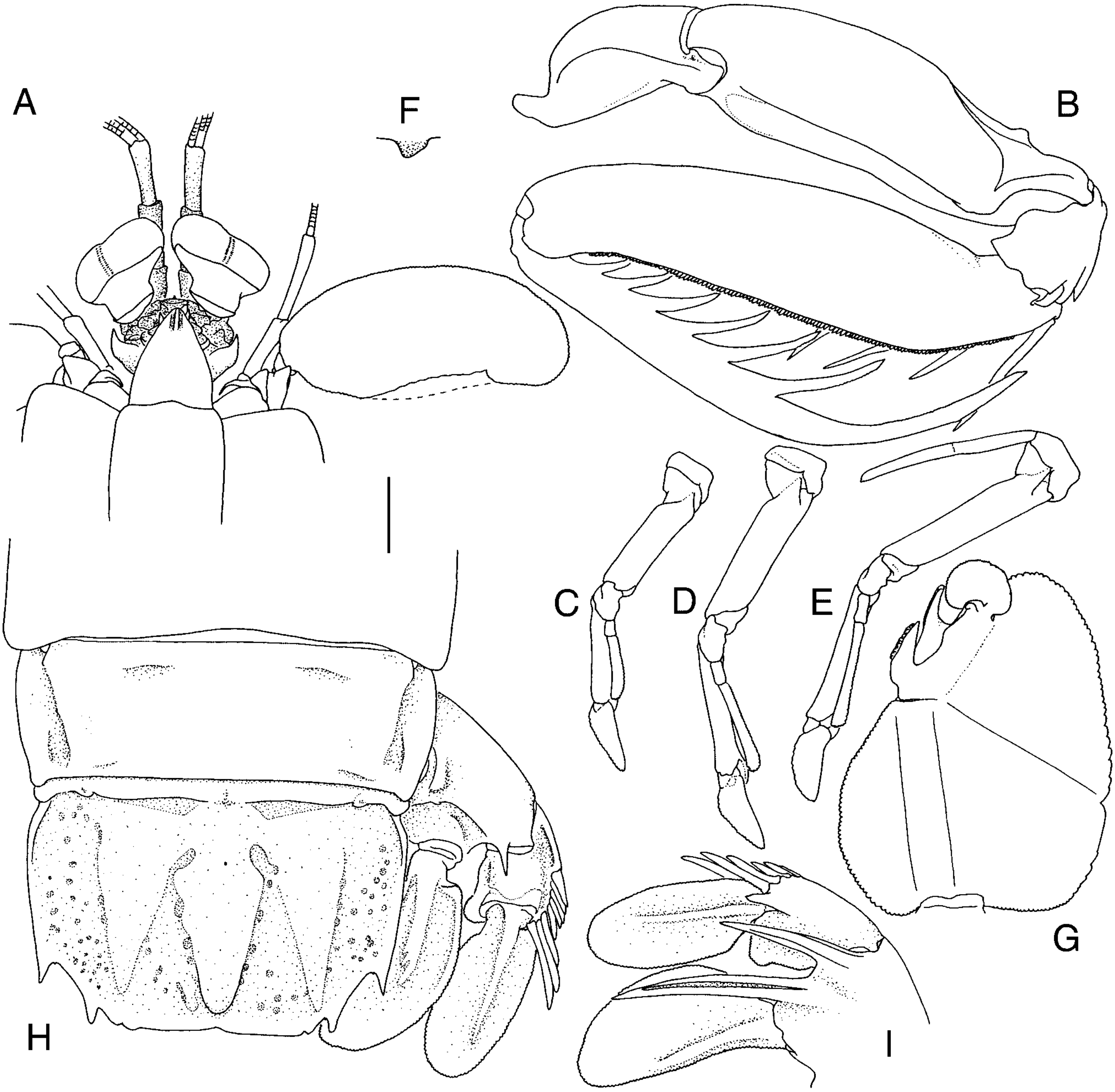

Figure 68. *Lysiosquillina sulcata* (Manning), ♂ TL 153 mm (AM P19919). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C–E, pereiopods 1–3, posterior. F, TS8 sternal keel, right lateral. G, PLP1 endopod, right anterior. H, AS5–6, telson & uropod, dorsal. I, uropod, right ventral. Scale A–F,H,I = 5 mm; G = 2.5 mm.

Lysiosquilloides siamensis (Naiyanetr, 1980)

Fig. 69

Lysiosquilla siamensis Naiyanetr, 1980: 35–37, pl. 34, figs. a–d (type locality: Gulf of Thailand, Thailand).

Lysiosquilloides siamensis.–Naiyanetr, 1983: 393–394, figs. 1, 3.–Manning, 1995: 22.

Type material. HOLOTYPE: SMF 10745, ♂ (TL 114 mm), Gulf of Thailand, Thailand, P. Naiyanetr, 1968.

Australian material. QUEENSLAND: AM P54453, 1♂ (TL 121 mm), Gulf of Carpentaria, between Weipa & Karumba, trawled, T. Wassenberg, 1976; QM, 1♂ (TL 122 mm), Gulf of Carpentaria, between Weipa & Karumba, trawled, T. Wassenberg, 1976. NORTHERN TERRITORY: AM P12520, 1♂ (TL 180 mm), vicinity of Goulburn I., off Arnhem Land, 11°39'S 133°23'E, F. Wells.

Other material. ZRC 1999.2198, 1♂ (TL 81 mm), Sirachai, Ko Sichang seaport, P. Naiyanetr, 11 Jan 1981.

Diagnosis. Cornea with mesial lobe rounded. A2 scale length relatively broad. Rostral plate cordiform, as long as or longer than broad, broadest in advance of base; apex deflexed; with short median sulcus anteriorly, ventral surface unarmed, smooth. Raptorial claw dactylus with 7 or 8 teeth. TS8 anterolateral margin rounded; sternal keel rounded. AS5 smooth. AS6 smooth medially; with low lateral boss, medially sulcate. Telson with median boss terminating in small spine. Uropodal protopod with short,

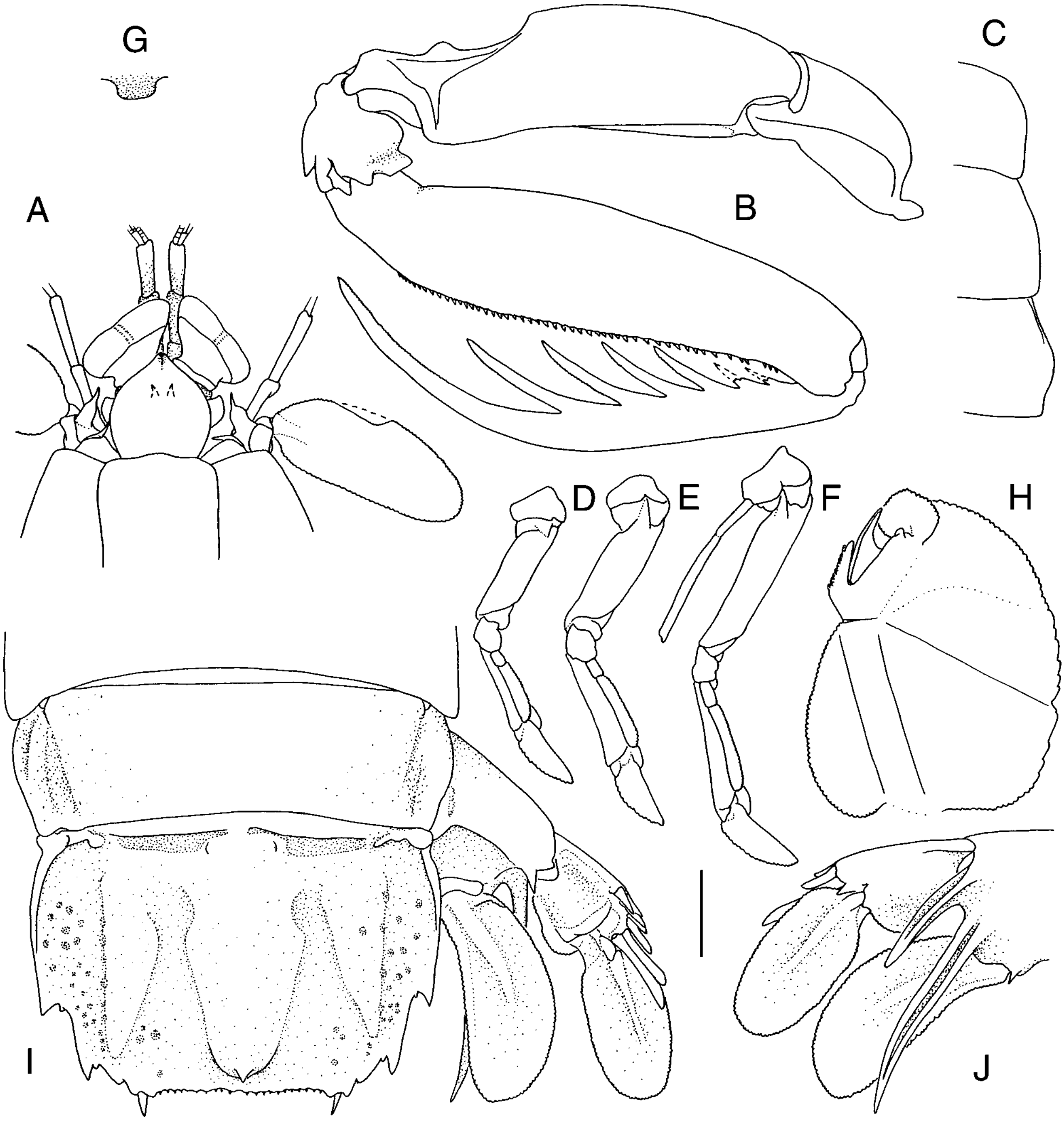

Figure 69. *Lysiosquilloides siamensis* (Naiyanetr), ♂ TL 121 mm (AM P54453). A, anterior cephalon, dorsal. B, raptorial claw, left lateral. C, TS6–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, TS8 sternal keel, right lateral. H, PLP1 endopod, right anterior. I, AS5–6, telson & uropod, dorsal. J, uropod, right ventral. Scale A–G,I,J = 5 mm; H = 2.5 mm.

slender ventral spine anterior to endopod articulation. Uropodal exopod proximal segment outer margin with 7 or 8 movable spines. Endopod with apex dark.

Colour in alcohol. Largely faded, but with dark and light transverse bands across dorsum.

Measurements. Male (n = 5) TL 81–180 mm. CI 377–510. A1 peduncle 0.40–0.44 CL. A2 scale length 2.41–2.69 width and 0.48–0.53 CL. PI 072–078 (males). Uropodal endopod length 2.44–2.72 breadth. The present series includes the largest known specimen of the species.

Remarks. The three Australian specimens agree well with the holotype, published accounts (Naiyanetr, 1980, 1983) and a topotypic specimen of *L. siamensis*.

Habitat. Unknown.

Distribution. The Gulf of Thailand and now from northern Australia.

NANNOSQUILLIDAE Manning, 1980b

Nannosquillidae Manning, 1980b: 368 (type genus *Nannosquilla* Manning, 1963b).

Diagnosis. Cornea subglobular. Raptorial claw dactylus uninflated basally; ischium exceeding ½ merus length; propodus with 4 proximal movable spines. Pereiopods 1–2 with subcircular endopod. Pereiopod 3 with ovate endopod. Abdominal segments loosely articulated. Telson with primary teeth and denticles distinct, slender. Proximal margin of uropodal endopod with strong dorsal fold.

Included genera. Thirteen: *Acanthosquilla* Manning, 1963b; *Alachosquilla* Schotte & Manning, 1993; *Austrosquilla* Manning, 1966; *Bigelowina* Schotte & Manning, 1993; *Coronis* Brooks, 1886; Desmarest, 1823; *Hadrosquilla* Manning, 1966; *Keppelius* Manning, 1978c, *Mexisquilla* Manning & Camp, 1981; *Nannosquilla* Manning, 1963b; *Nannosquilloides* Manning, 1977a; *Platysquilla* Manning, 1967b; *Platysquilloides* Manning & Camp, 1981; and *Pullosquilla* Manning, 1978c.

Remarks. Manning (1980b, 1995) listed the subcircular endopod of pereiopods 1–2 and the strong proximal dorsal fold on the uropodal endopod as diagnostic characters of the Nannosquillidae. The strong dorsal fold on the uropodal endopod is a reliable nannosquillid synapomorphy, but the subcircular pereiopodal endopods are also present in some tetrasquillids. Following Ahyong & Harling (2000), *Allosquilla* Manning, 1977a, is placed in the Tetrasquillidae instead of Nannosquillidae. In *Allosquilla*, the proximal fold on the uropodal endopod is weak, as in other tetrasquillids. Additionally, *Allosquilla* bears a strongly bilobed cornea as in many other tetrasquillids.

Nannosquillidae comprises several generic groups. The first includes those genera allied to *Acanthosquilla*, sharing the “fan-shaped” row of dorsal spines on the telson, and in which the hook process of the petasma is short: *Acanthosquilla, Alachosquilla*, and *Bigelowina*. The second group includes genera in which the hook process of the petasma is relatively elongate. This second group, however, can be further subdivided into the *Platysquilla*-like genera having a broadened cornea (*Platysquilla*, *Platysquilloides* and *Mexisquilla*) and the *Nannosquilla*-like genera, having a narrow, laterally inclined cornea (*Austrosquilla, Coronis, Hadrosquilla, Keppelius, Nannosquilla, Nannosquilloides*, and *Pullosquilla*). Whether or not these generic groups reflect phylogenetic relationships remains to be tested by cladistic analysis.

Five genera, *Acanthosquilla, Austrosquilla, Hadrosquilla, Keppelius* and *Pullosquilla* are represented only in the Indo-West Pacific. *Coronis, Mexisquilla, Nannosquilloides, Platysquilla* and *Platysquilloides* are represented only in the Atlanto-Eastern Pacific. *Alachosquilla, Bigelowina* and *Nannosquilla* are represented in both the Indo-West Pacific and Atlanto-Eastern Pacific. Of the 13 nannosquillid genera, six are known from Australian waters.

Key to genera of Nannosquillidae

1 Rostral plate unarmed anteriorly or with single median spine 3

—— Rostral plate with 3 sharp anterior projections 2

2 AS6 without posterolateral spines; posterior margin of sternum with pair of posteriorly directed spines .... *Keppelius*

—— AS6 with posterolateral spines; posterior margin of sternum unarmed .... ***Alachosquilla***

3 Telson with fan-shaped row of slender, posteriorly directed spines, or with patches of numerous small spinules covering posterodorsal surface 4

—— Telson without fan-shaped row of posteriorly directed spines, at most with short teeth or transverse row of short, close set spines 5

4 Cornea subglobular. A2 protopod with mesial papilla. SM denticles of telson in transverse row .... ***Bigelowina***

—— Cornea broadened or faintly bilobed. A2 protopod without mesial papilla. SM denticles of telson forming inverted V in posterior view .... ***Acanthosquilla***

5 Ischium of raptorial claw with spine on distal, ventral outer margin 6

—— Ischium of raptorial claw unarmed 7

6 AS6 with posterolateral spines .... ***Austrosquilla***

—— AS6 without posterolateral spines .... ***Pullosquilla***

7 Dactylus of raptorial claw with 4–6 teeth .... ***Hadrosquilla***

—— Dactylus of raptorial claw with 8 or more teeth 8

8 MXP1–4 with epipod 9

—— MXP1–3 or MXP1–5 with epipod 10

9 A2 protopod without papillae .... *Nannosquilla*

—— A2 protopod with 1 mesial and 2 ventral papillae .... *Platysquilloides*

10 5 epipods present 11

—— 3 epipods present .... *Mexisquilla*

11 Mandibular palp present. Rostral plate cordiform. Telson posterior margin with paired, movable SM teeth and 1 pair of fixed primary teeth .... *Coronis*

—— Mandibular palp absent. Rostral plate subquadrate with short median spine. Telson posterior margin with paired, movable SM teeth and more than 1 pair of fixed primary teeth 12

12 Raptorial claw with 11–15 teeth on dactylus. AS6 sternum with 2 posteriorly directed spines .... *Platysquilla*

—— Raptorial claw with 8 or 9 teeth on dactylus. AS6 sternum without posteriorly directed spines .... *Nannosquilloides*

Acanthosquilla Manning, 1963b

Acanthosquilla Manning, 1963b: 319. Type species *Lysiosquilla multifasciata* Wood-Mason, 1895, by original designation. Gender feminine.

Diagnosis. Rostral plate with single median spine. Cornea broadened or faintly bilobed. A2 protopod with ventral papilla, without mesial papilla. Mandibular palp three-segmented. MXP1–5 with epipod. Ischium of raptorial claw unarmed distally. AS6 with posterolateral spines; posterior margin of sternum unarmed. Telson posterodorsal surface with fan-shaped row of slender, posteriorly directed spines above marginal armature; with movable SM teeth and 2 or 4 pairs of fixed primary teeth; SM denticles of telson forming inverted V or semicircle in posterior view. Uropodal protopod terminating in 2 slender spines, ventrally carinate, inner longer, without ventral spine anterior to endopod articulation.

Included species. Four: *A. derijardi* Manning, 1970a; *A. multifasciata* (Wood-Mason, 1895); *A. tigrina* (Nobili, 1903); and *A. wilsoni* Moosa, 1973.

Remarks. Schotte & Manning (1993) recognized *Alachosquilla* and *Bigelowina* for some species formerly placed in *Acanthosquilla*. *Alachosquilla* was erected for species having a broad rostral plate with three anterior projections. Species of *Bigelowina* share a quadriform rostral plate, subglobular cornea, presence of a mesial papilla on the antennal protopod and a transverse instead of inverted V-shaped row of submedian denticles on the telson. Species of *Acanthosquilla* share a broadened cornea, a triangular to subpentagonal rostral plate, an inverted V-shaped or semicircular row of submedian denticles on the telson, and lack mesial papillae on the antennal protopod.

Acanthosquilla sirindhorn is indistinguishable from *A. derijardi* and is synonymized below. Holthuis (2000) synonymized *A. acanthocarpus* with *A. phalangium* and his action is supported here. Additionally, *A. humesi* is indistinguishable from *A. phalangium* and the two species are synonymized below. *Acanthosquilla phalangium* (Fabricius, 1798) bears the diagnostic characters of *Bigelowina* and is herein transferred. *Acanthosquilla*, as restricted here, comprises four Indo-West Pacific of which two are known from Australia.

Key to species of *Acanthosquilla*

1 Telson margin with 2 pairs of fixed primary teeth and 4 "intermediate denticles" 2

—— Telson margin with 4 pairs of fixed primary teeth, each with intervening denticle 3

2 Posterodorsal surface of telson with 5 posteriorly directed spines above primary teeth and denticles .... ***A. multifasciata***

—— Posterodorsal surface of telson with 7 or more posteriorly directed spines above primary teeth and denticles .... ***A. derijardi***

3 AS6 dorsally with posterior margin unarmed excepting posterolateral spines; ventral posterior margin with spines .... *A. tigrina*

—— AS6 dorsally with 2–3 spinules along posterior margin adjacent to posterolateral spine; ventral posterior margin unarmed .... *A. wilsoni*

Acanthosquilla derijardi Manning, 1970a

Fig. 70

Acanthosquilla derijardi Manning, 1970a: 1434–1438, fig. 2 (type locality: Grand Recif, Tuléar, Madagascar).–Moosa, 1991: 183.–Manning, 1991: 7, fig. 6; 1995: 141, 143.
Acanthosquilla multispinosa Blumstein, 1974: 113 (type locality: Gulf of Tonkin, Vietnam, 19°00'N 107°30'E).
Acanthosquilla manningi Makarov, 1978: 177, fig. 1 (type locality: Tonkin Bay, Vietnam, 15°58'N 109°22'E).
Acanthosquilla sirindhorn Naiyanetr, 1995: 409–417, pl. 1, figs. 1, 2 (type locality: Pattani, Gulf of Thailand); new synonymy.

Australian material. QUEENSLAND: AM P54463, 1♀ (TL 46 mm), Shelburne Bay, 11°41.4'S 143°00.4'E, 33 m, Jan 1993; AM P54464, 1♂ (TL 38 mm), Shelburne Bay, 11°23.4'S 143°55.8'E, Dec 1991;QM W17462, 1♂ (TL 47 mm), 1♀ (TL 51 mm), Little Trunk Reef, 18°20'S 146°46'E, 9.1–12.2 m, dredged, K. Lamprell, 5 Nov 1990.

Other material. NNM S1155, 1♀ (TL 75 mm), Pattani, Pattani Province, Gulf of Thailand, fishing harbour, B. Wattanatongchai, 8 Aug 1993 (holotype of *Acanthosquilla sirindhorn* Naiyanetr).

Diagnosis. Rostral plate longer than broad, trapezoid to subpentagonal with apical spine of varying length. Raptorial claw dactylus with 5–6 teeth; outer margin with basal notch, distal lobe triangular, distinctly larger than proximal lobe. AS6 without spinules on posterior margin adjacent to posterolateral spine. Telson with 2 pairs of fixed primary teeth; dorsal surface with 7 or more posteriorly directed spines in fan shaped row above marginal armature; with 3–4 SM denticles either side of midline; with 4 "intermediate" denticles in same plane, second and fourth usually slightly larger than first and third. Uropodal protopod with smooth inner margin, without distal spines adjacent to endopod articulation; exopod proximal segment outer margin with 6 movable spines.

Colour in alcohol. Largely faded, but with traces of a dark transverse band on each thoracic and abdominal somite. Telson and uropod with dark, diffuse pigmentation. Uropodal exopod distal segment dark on inner ½.

Measurements. Male (n = 2) TL 46–47 mm, female (n = 3) TL 38–75 mm. A1 peduncle 0.36–0.46 CL. A2 scale 0.38–0.40 CL. The present series includes the largest known specimen of the species.

Remarks. *Acanthosquilla derijardi* differs from other species of the genus in having more than 5 spines dorsally above the posterior margin of the telson. The Australian specimens fall into two broad forms. The two specimens from Little Trunk Reef closely agree with the holotype of *A. derijardi* in the shape of the rostral plate, the dorsal armature of the telson and the size of the large distal lobe on the outer proximal margin of the dactylus of the raptorial claw (in the single specimen with raptorial claws intact), but differ in having 5 teeth on the claw as in material reported by Moosa (1991) from New Caledonia. The two specimens from Shelburne Bay have a more elongate rostral spine, fewer dorsal spines on the telson and in the single specimen with intact raptorial claws, the dactylus bears 6 teeth and a relatively smaller outer triangular lobe than in the Trunk Reef specimen. Whereas the variation in the present series may suggest that *A. derijardi* is composite, two specimens from Sandakan, Borneo (male TL 46 mm, AM P16285; female TL 70 mm, ZRC 1970.10.22.9) are intermediate between the Trunk Reef and Shelburne Bay specimens. Moreover, Manning (1970a) noted somewhat similar variation in the type series of *A. derijardi*.

Acanthosquilla sirindhorn Naiyanetr agrees in most respects with the holotype of *A. derijardi*, and the characters by which it differs (5 instead of 6 teeth on the dactylus of the raptorial claws) are encompassed in variation in the type series and present material; they are considered conspecific.

Habitat. Soft substrates to a depth of 33 m.

Distribution. Western Indian Ocean and the Red Sea to the Indo-Malayan region, Japan, New Caledonia and now from northeastern Australia.

Acanthosquilla multifasciata (Wood-Mason, 1895)

Fig. 71

Lysiosquilla multifasciata Wood-Mason, 1895: 1–2, figs. 22–24 (type locality: Bombay, India).–Kemp, 1913: 122–124; 1915: 175–176.–Holthuis, 1941: 274–275.–Serène, 1952: 11–12, figs. 22–24.–Stephenson & McNeill, 1955: 247.
Lysiosquilla Valdiviensis Jurich, 1904: 372, pl. 26: fig. 2 (type locality unknown).
Lysiosquilla biminiensis var. *pacificus* Borradaile, 1900: 395, 398, 403 (type locality: Blanche Bay, New Britain, 4°16'S 152°13'E).
Acanthosquilla multifasciata.–Holthuis, 1967a: 4.–Moosa, 1991: 183.–Manning, 1995: 143–147, pls. 25, 26, figs. 78b, 80b, 81a,b,e,f, 82a,b, 83–86.

Material. QUEENSLAND: AM P4843, 1♀ (TL 64 mm), Dunk I., 17°57'S 146°09'E, E.J. Banfield; AM P56919, 1♂ (TL 60 mm), E of Weipa, Gulf of Carpentaria, 12°37.2'S 140°39.7'E, 58 m, SS0193 57, 30 Jan 1993; AM P56953, 1♂ (TL 57 mm), NE Gulf of Carpentaria, 12°23.7'S 140°41.1'E, SS0591 42; AM P57040 1♀ (TL 67 mm), NE Gulf of Carpentaria, 10°39.0'S 140°38.7'E, 42 m, SS0390 58; QM W8913, 1♂ (TL 10 mm), 2♀♀ (TL 10–15 mm), Middle Banks, Moreton Bay, Mar & Jun 1973; QM W12519, 1♂ (broken, CL 4.1 mm), Middle Banks, Moreton Bay, P. Saenger

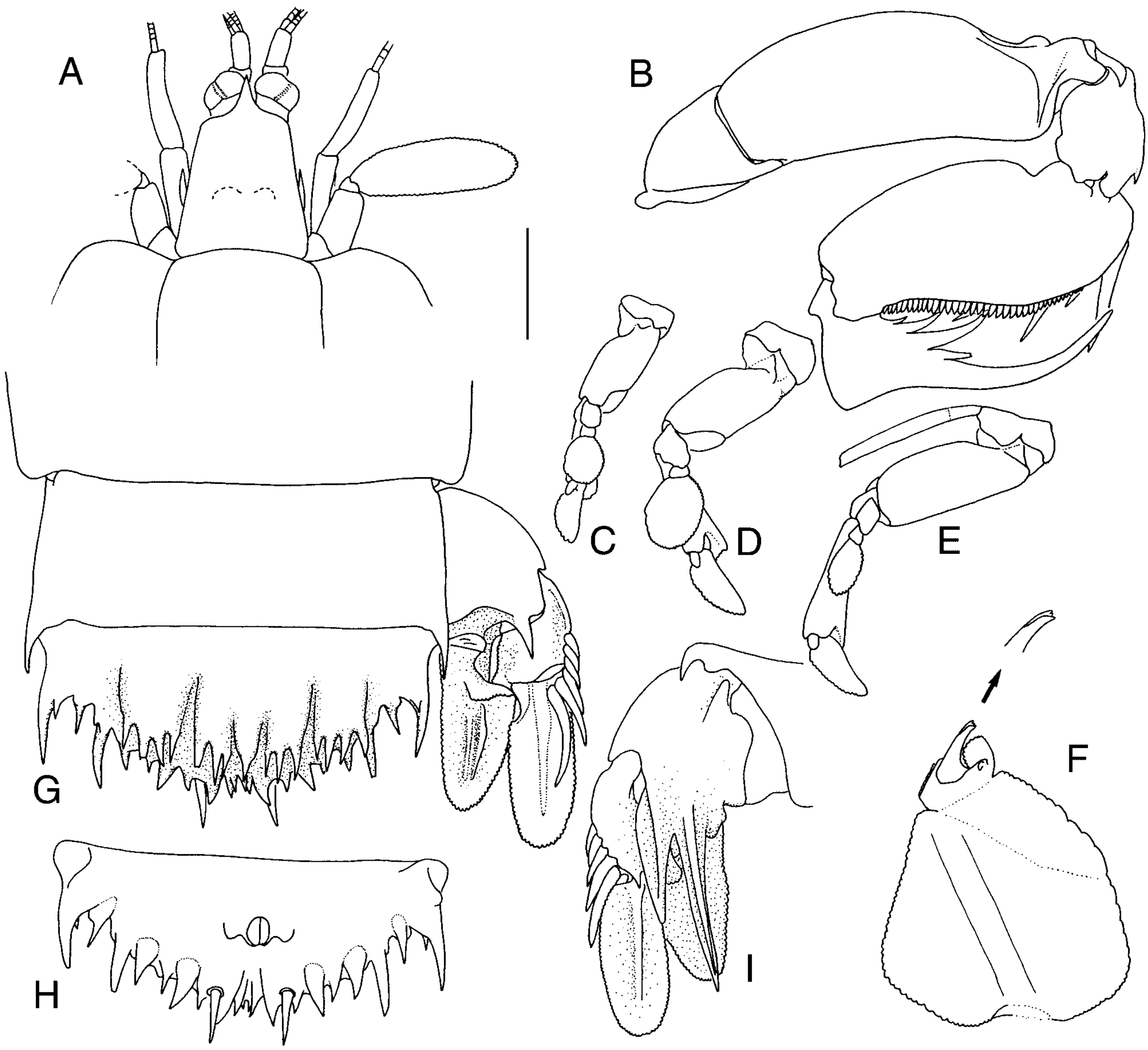

Figure 70. *Acanthosquilla derijardi* Manning, ♂ TL 47 mm (QM W17462). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C–E, pereiopods 1–3, posterior. F, PLP1 endopod, right anterior. G, AS5–6, telson & uropod, dorsal. H, telson, ventral. I, uropod, right ventral. Scale A–E, G–I = 2.5 mm; F = 1.7 mm.

& S. Cook, 6 Sep 1984. WESTERN AUSTRALIA: AM P56951, 1♀ (TL 16 mm), Northwest Shelf, 19°58.0–58.5'S 117°49.7–49.4'E, 43 m, 27 Jun 1983; NTM Cr012374, 1♂ (TL 36 mm), 19°58.9–58.7'S 117°51.3–51.5'E, 40 m, beam trawl, 22 Apr 1983.

Diagnosis. Ocular scales narrow, rounded, separate. Rostral plate longer than broad, trapezoid to subpentagonal with apical spine of varying length. Raptorial claw dactylus with 5 or 6 teeth; outer margin with basal notch, distal lobe triangular, distinctly larger than proximal lobe. AS6 without spinules on posterior margin adjacent to posterolateral spine. Telson with 2 pairs of fixed primary teeth; dorsal surface with 5 posteriorly directed spines in fan shaped row above marginal armature; with 3 or 4 SM denticles either side of midline; with 4 "intermediate" denticles in same plane. Uropodal protopod with smooth inner margin, without distal spines adjacent to endopod articulation; exopod proximal segment outer margin with 5 or 6 movable spines.

Colour in alcohol. Largely faded, but with traces of a dark transverse band on each thoracic and abdominal somite. Telson with dark, diffuse pigmentation, darkest either side of midline. Uropodal exopod distal segment dark on inner ½; endopod dark. carapace with posterolateral region dark.

Measurements. Male (n = 5) TL 10–60 mm, female (n = 5) TL 16–67 mm. A1 peduncle 0.38–0.45 CL. A2 scale 0.37–0.42 CL. The present series includes the largest known specimen of the species.

Remarks. The present specimens agree in most respects with published accounts (Wood-Mason, 1895; Kemp, 1913, 1915; Chopra, 1939; Manning, 1995) and with figures of

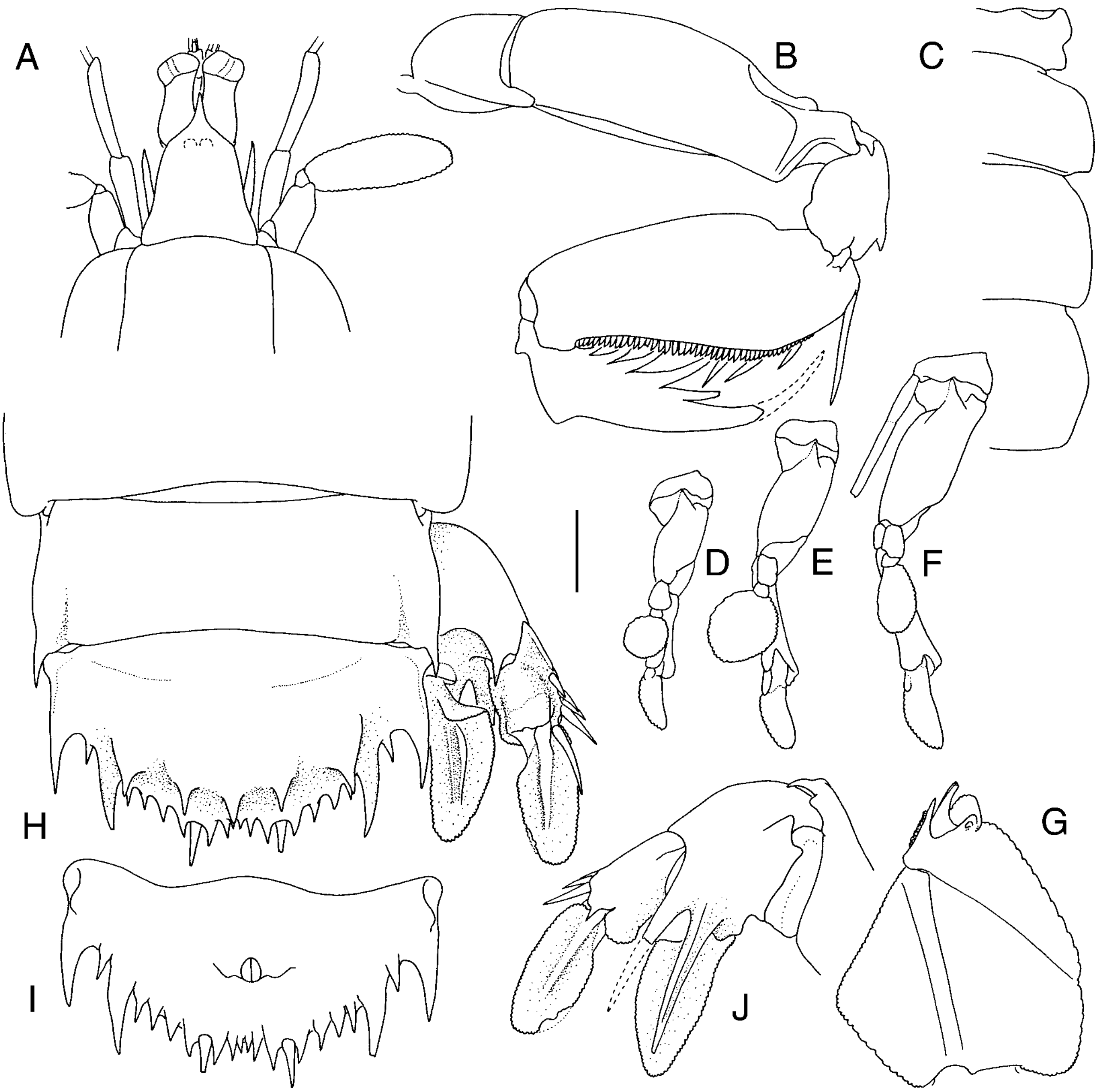

Figure 71. *Acanthosquilla multifasciata* (Wood-Mason), ♂ TL 57 mm (AM P56953). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS5–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, PLP1 endopod, right anterior. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. Scale A–F, H–J = 2 mm; G = 1.4 mm.

the holotype provided by the late R.B. Manning. Chopra (1939) reported variation in the position of the eyes relative to the rostral plate. Similar variation is present in Australian material and is an artefact of preservation; expansion or contraction of the articular membrane between the ophthalmic and antennular somites may occur during fixation.

Acanthosquilla multifasciata can be recognized by the presence of five spines above the posterior telson armature and the presence of two instead of three pairs of fixed primary teeth on the telson. The relative length of the rostral spine is variable in *A. multifasciata*, as is the number of teeth on the raptorial claw. An undescribed species of *Acanthosquilla* from the Marquesas Islands, closely resembling *A. multifasciata* is presently under study. This undescribed species differs from *A. multifasciata* chiefly in bearing a pair of fixed spines on the inner margin of the uropodal protopod adjacent to the endopodal articulation.

Habitat. Burrows are constructed in mud or sand substrates, from the shore down to 43 m. Chopra (1939) reported *A. multifasciata* from a depth of 73 m.

Distribution. Red Sea to Vietnam, Australia, Japan and Hawaii (Heard & Manning, 1990).

Alachosquilla Schotte & Manning, 1993

Alachosquilla Schotte & Manning, 1993: 572–573. Type species *Lysiosquilla digueti* Coutière, 1905, by original designation. Gender feminine.

Diagnosis. Rostral plate quadrate with 3 sharp anterior projections. Cornea subglobular. A2 protopod with mesial and ventral papillae. Mandibular palp present or absent. MXP1–5 with epipod. Ischium of raptorial claw unarmed. AS6 with posterolateral spines; posterior margin of sternum unarmed. Telson posterodorsal surface with fan-shaped row of 5 slender, posteriorly directed spines above marginal armature; with movable SM and 3 pairs of fixed primary teeth each with intervening denticle. Uropodal protopod terminating in 2 slender spines, ventrally carinate, inner longer.

Included species. Three: *A. digueti* (Coutière, 1905); *A. floridensis* (Manning, 1962a); and *A. vicina* (Nobili, 1904).

Remarks. *Alachosquilla* is represented in the Indo-West Pacific, eastern Pacific and western Atlantic each by a single species.

Key to species of *Alachosquilla*

1 Ocular scales separate. Uropodal protopod with ventral spine anterior to endopod articulation. SM denticles of telson in concave row on each side of midline, converging medially to form a posteriorly directed spine .... ***A. vicina***

—— Ocular scales fused. Uropodal protopod without ventral spine anterior to endopod articulation. SM denticles in straight or convex row on either side of midline, not forming a posteriorly directed spine medially 2

2 Telson with pair of dark posteromedian patches .... *A. floridensis*

—— Telson with single dark posteromedian patch .... *A. digueti*

Alachosquilla vicina (Nobili, 1904)

Fig. 72

Lysiosquilla vicina Nobili, 1904: 229 (type locality: Obock, Red Sea).–Kemp, 1915: 176–179, pl. 1: figs. 4–8.

Alachosquilla vicina.–Schotte & Manning, 1993: 572.

Material. QUEENSLAND: AM P54458, 1♂ (TL 27 mm), in front of research station, Lizard I., intertidal zone, dug from burrow, C. Harling, Aug 1997; AM P58555, 1♂ (TL 13 mm), Lizard I., taken at night light, R. Caldwell, Aug 1998; USNM 261282, 1♀ (TL 28 mm), Lizard I., intertidal zone, dug from burrow, C. Harling, Aug 1997. NORTHERN TERRITORY: NTM, 1♀ (TL 27 mm), Gove, NT Fisheries, 21 Apr 1972.

Diagnosis. Ocular scales rounded, separate. Raptorial claw dactylus with 9–11 teeth. Mandibular palp 3-segmented. Telson with 6–9 spiniform SM denticles either side of midline, forming inverted V in posterior view, converging medially to form a posteriorly directed spine. Uropodal protopod with spine anterior to endopod articulation; exopod proximal segment with 5 or 6 movable spines.

Colour in alcohol. Largely faded. Dorsum pale with dark transverse bands. Telson with subquadrate black spot at base of each upper dorsal spine either side of median spine.

Measurements. Male (n = 2) TL 13–27 mm, female (n = 2) TL 27–28 mm. A1 peduncle 0.43–0.52 CL, A2 scale 0.32–0.35 CL. Kemp (1915) reported specimens to 32 mm TL.

Remarks. The specimens agree well with each other except that on the right ½ of the telson in the 27 mm female from Gove, one of the primary teeth is poorly developed, and in the 13 mm TL male, the lateral spines of the rostral plate are not yet developed.

Habitat. *Alachosquilla vicina* constructs U-shaped burrows in intertidal or shallow sublittoral sand flats, and live in male female pairs. Collecting notes accompanying the 27 mm TL female specimen provided from Lizard Island indicate that they "were collected… when the water was about 0.3 m deep and then excavating the burrows into a sieve… burrows are about 1–1.5 cm in diameter and have walls up to 2 cm thick". Kemp (1915) suggested that *Alachosquilla vicina* lives in association with *Balanoglossus* sp. Whether or not this association is also holds for Australian populations of *A. vicina* remains to be determined.

Distribution. Red Sea and Gulf of Aden to the Philippines and now Australia.

Austrosquilla Manning, 1966

Austrosquilla Manning, 1966: 127. Type species *Lysiosquilla vercoi* Hale, 1924, by original designation. Gender feminine.

Diagnosis. Rostral plate with single median spine or point; without median carina or sulcus. A2 protopod with ventral and with or without mesial papillae. Mandibular palp absent. MXP1–4 or 5 (usually 1–5) with epipod. Ischium of raptorial claw with distal, ventral spine on outer margin. AS6 with posterolateral spine; posterior margin of sternum

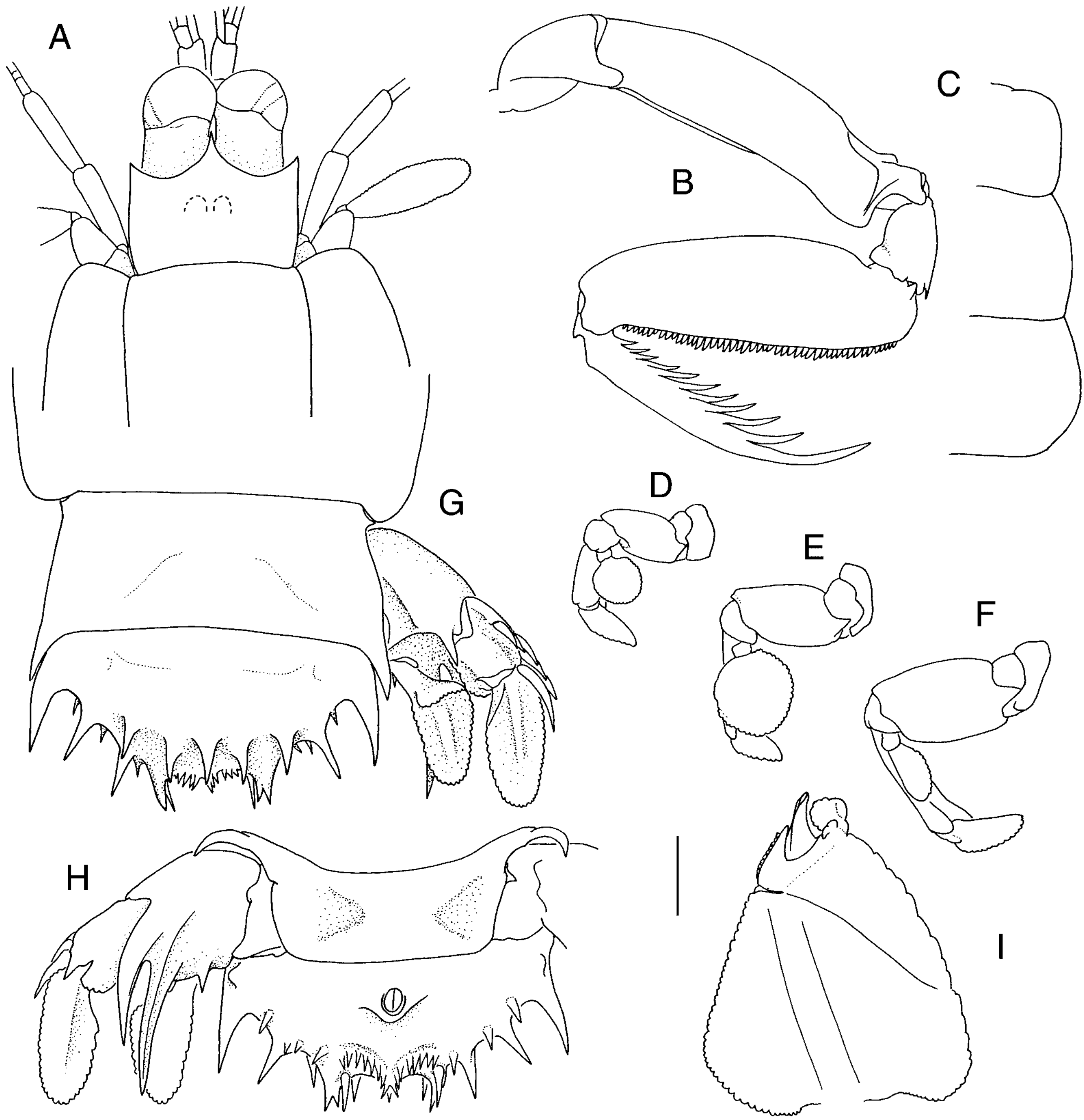

Figure 72. *Alachosquilla vicina* (Nobili). A–H, ♀ TL 27 mm (NTM). I, ♂ TL 27 mm (AM P54458). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, AS5–6, telson & uropod, dorsal. H, AS6, telson, & uropod, ventral. I, ♂ PLP1 endopod, right anterior. Scale A–H = 1 mm; I = 0.5 mm.

unarmed. Telson smooth, unarmed dorsally; with blunt posteromedian projection; with movable SM and fixed IM and LT teeth; with 4 "intermediate" denticles. Uropodal protopod terminating in 2 slender, flattened spines, inner longer; without ventral spine anterior to endopod articulation.

Included species. Six: *Austrosquilla melanocauda* (Kunze, 1981) n.comb.; *A. osculans* (Hale, 1924); *A. rachelae* n.sp.; *A. middletoni* n.sp.; *A. tsangi* n.sp.; and *A. vercoi* (Hale, 1924).

Remarks. *Austrosquilla* was erected by Manning (1966) for two Australian species *Lysiosquilla osculans* Hale, 1924 and *L. vercoi* Hale, 1924. Although only two species of *Austrosquilla* have been reported from Australia, specimens of both species reported in the literature are composite. Additionally, *Hadrosquilla melanocauda* Kunze, 1981, is referable to *Austrosquilla* and is herein transferred. Therefore *Austrosquilla* is recognized for six species, of which three are newly described below.

Austrosquilla most closely resemble species of *Pullosquilla*, especially *P. pardus* and *P. malayensis*, both in morphology and behaviour. Species of both genera share similar habitus, the armed distal margin of the ischium of the raptorial claw and four "intermediate" denticles on the telson. Species of *Austrosquilla* however, attain a much larger size and otherwise differ from *Pullosquilla* in bearing posterolateral spines on AS6. Like species of *Pullosquilla*, species of *Austrosquilla* (where known) live in monogamous, heterosexual, size-matched pairs. Species of both genera usually burrow in the intertidal or shallow sublittoral zones and are restricted to the Indo-West Pacific. *Pullosquilla*, however, is a tropical genus whereas *Austrosquilla* is endemic to temperate Australia. *A priori*, *Austrosquilla* and *Pullosquilla* appear closely related, but determination of relationships awaits further analysis.

The distribution of several species of *Austrosquilla* corresponds to Australian biogeographic provinces recognized by Knox (1963) and Womersley (1990) based largely on intertidal invertebrates and algae. *Austrosquilla osculans* and *A. rachelae* n.sp. ranges from Victoria to southern Western Australia corresponding to the Flindersian Province. The range of *Austrosquilla vercoi*, from South Australia to Tasmania and Victoria, corresponds to the Maugean Subprovince. *Austrosquilla tsangi* n.sp. ranges from southern Queensland to southern New South Wales corresponding to the Peronian Province.

Key to species of *Austrosquilla*

1 A2 protopod with 2 mesial papillae. MXP5 without epipod. Telson with posteromedian prominence terminating in distinct spine .... ***A. osculans***

—— A2 protopod without mesial papillae. MXP5 with epipod. Telson with posteromedian prominence with blunt apex 2

2 AS6 with 1 ventrolateral spine or angular projection anterior to uropodal articulation 3

—— AS6 with a ventrolateral spine and a larger triangular projection anterior to uropodal articulation 4

3 Telson anterolateral margin with distinct rounded projection (Fig. 77I). Rostral plate trianguloid, with lateral margins convergent proximally. Raptorial claw with 18–27 teeth on dactylus .... ***A. tsangi***

—— Telson anterolateral margin without distinct rounded projection. Rostral plate with lateral margins subparallel proximally. Raptorial claw with 8–12 teeth on dactylus .... ***A. vercoi***

4 Basal segment of pereiopods 1–3 each with inner and outer ventrally directed spines 5

—— Basal segment of pereiopods 1–3 each without ventrally directed spines .... ***A. middletoni***

5 Cornea broadened. Ocular scale slender, higher than broad. Telson "intermediate denticles" of similar size and aligned in approximately the same plane .... ***A. rachelae***

—— Cornea subglobular. Ocular scale as high as broad. Telson "intermediate denticles" with first and third larger and arising slightly above second and fourth .... ***A. melanocauda***

Austrosquilla melanocauda (Kunze, 1981) n.comb.

Fig. 73

Hadrosquilla melanocauda Kunze, 1981: 1–4, fig. 1 (type locality: Botany Bay, New South Wales, Australia).

Type material. HOLOTYPE: AM P28297, ♀ (TL 46 mm), Botany Bay, New South Wales, from gut of flounder (*Pseudorhombus arsius*), NSW Fisheries, 6 Oct 1978.

Diagnosis. Eye with cornea subglobular; lateral margin with prominent rounded projection. Ocular scale as high as broad. A2 protopod with 1 ventral papilla. Rostral plate longer than broad; trianguloid; with long apical spine; lateral margins sinuous. Raptorial claw ischium with triangular outer inferodistal spine, directed anteroventrally. MXP1–5 with epipod. Pereiopod 1–3 basal segment with inner and outer, ventrally directed spine. TS6–7 lateral process broadly rounded. AS6 lateral spine long, slender; with ventrolateral spine and triangular projection anterior to uropodal articulation. Telson inflated; posteromedian projection tapering, apex rounded, blunt; intermediate denticles short, broad, conical, first and third longer than and distinctly higher than second and fourth; with 6 or 7 SM denticles either side of midline. Uropodal exopod proximal segment outer margin with 6 movable spines.

Colour in alcohol. Dorsum with dark brown transverse bands. Telson with pair of black spots posteromedially. Uropodal exopod with proximal segment and inner portion

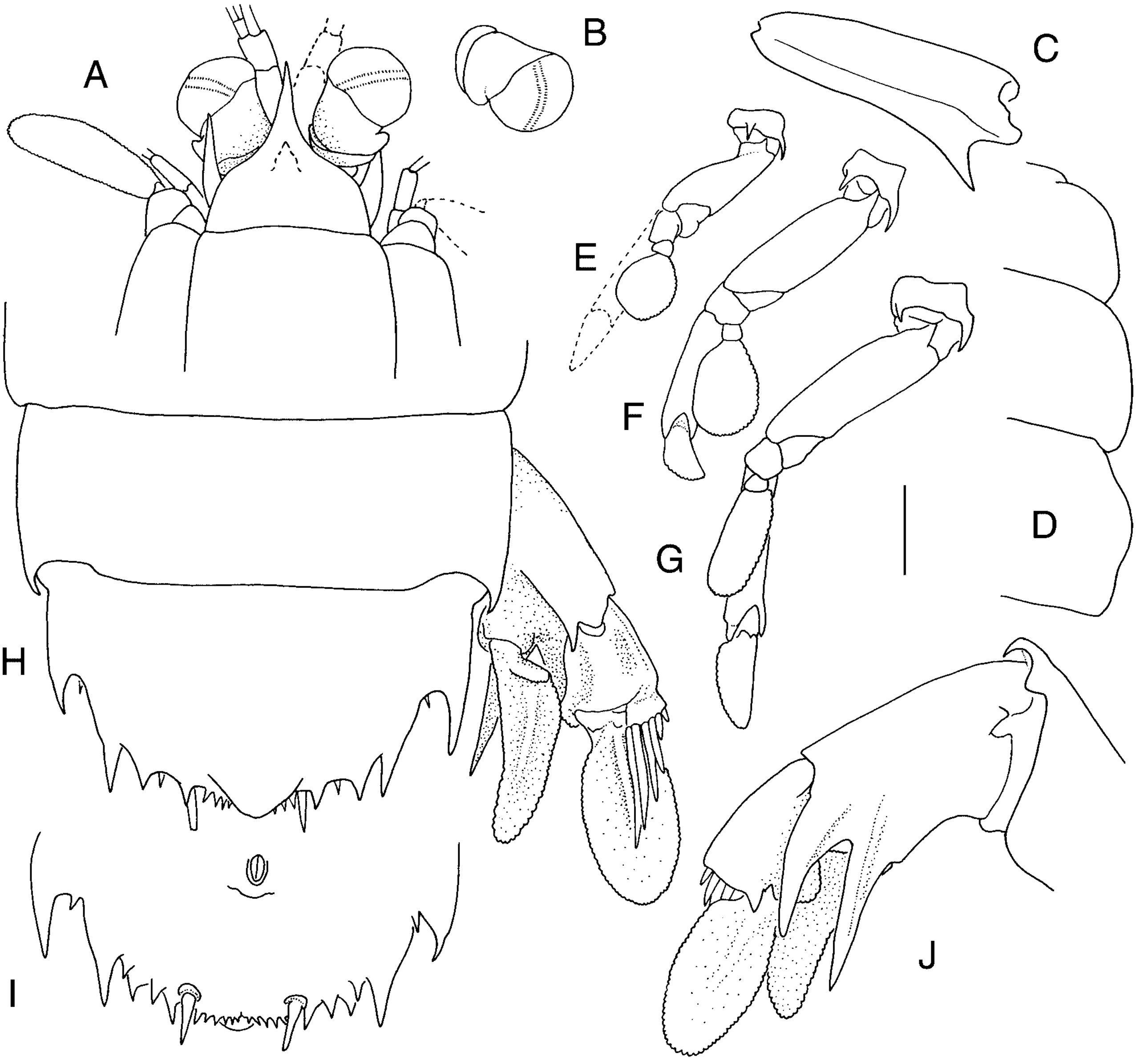

Figure 73. *Austrosquilla melanocauda* (Kunze, 1981) n.comb., holotype ♂ TL 46 mm. A, anterior cephalon, dorsal. B, eye, right lateral. C, raptorial claw ischium, right lateral. D, TS6–8 lateral processes, right dorsal. E–G, pereiopods 1–3, posterior. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. Scale = 1.5 mm.

of distal segment dark; endopod outer ½ dark. A2 protopod with black anterior margin.

Measurements. Female holotype TL 46 mm, A1 peduncle 0.49 CL, A2 scale 0.38 CL.

Remarks. *Austrosquilla melanocauda,* together with *A. rachelae* n.sp. differ from all others in the genus in bearing inner and outer ventrally directed spines on the basal segment of pereiopods 1–3. The differences between the two species are discussed under the account of *A. rachelae* n.sp., below. Unfortunately, *A. melanocauda* is known only from the holotype, and because it was taken from the gut of a fish, nothing is known of its biology. *Austrosquilla melanocauda* probably burrows in intertidal or shallow subtidal sandflats.

Habitat. Unknown.

Distribution. Known only from the type locality, Botany Bay.

Austrosquilla middletoni n.sp.

Fig. 74

Type material. (All South Australia) HOLOTYPE: AM P57123, ♂ (TL 46 mm), N end Foreshore Beach, Whyalla, intertidal sand flats, mid tide level, dug from burrows in anoxic sand, M. Middleton, S. & R. Ahyong, 12 Jan 1999. PARATYPES: AM P57124, 6♂♂ (TL 38–50 mm), 6♀♀ (TL 40–58 mm), N end Foreshore Beach, Whyalla, intertidal sand flats, mid tide level, dug from burrows in anoxic sand, M. Middleton, S. & R. Ahyong, 12 Jan 1999; AM P57125, 3♂♂ (TL 31–40 mm), 2♀♀ (TL 34–38 mm) Eight Mile Creek, Whyalla, intertidal sand flats in front of mangroves, mid tide level, dug from

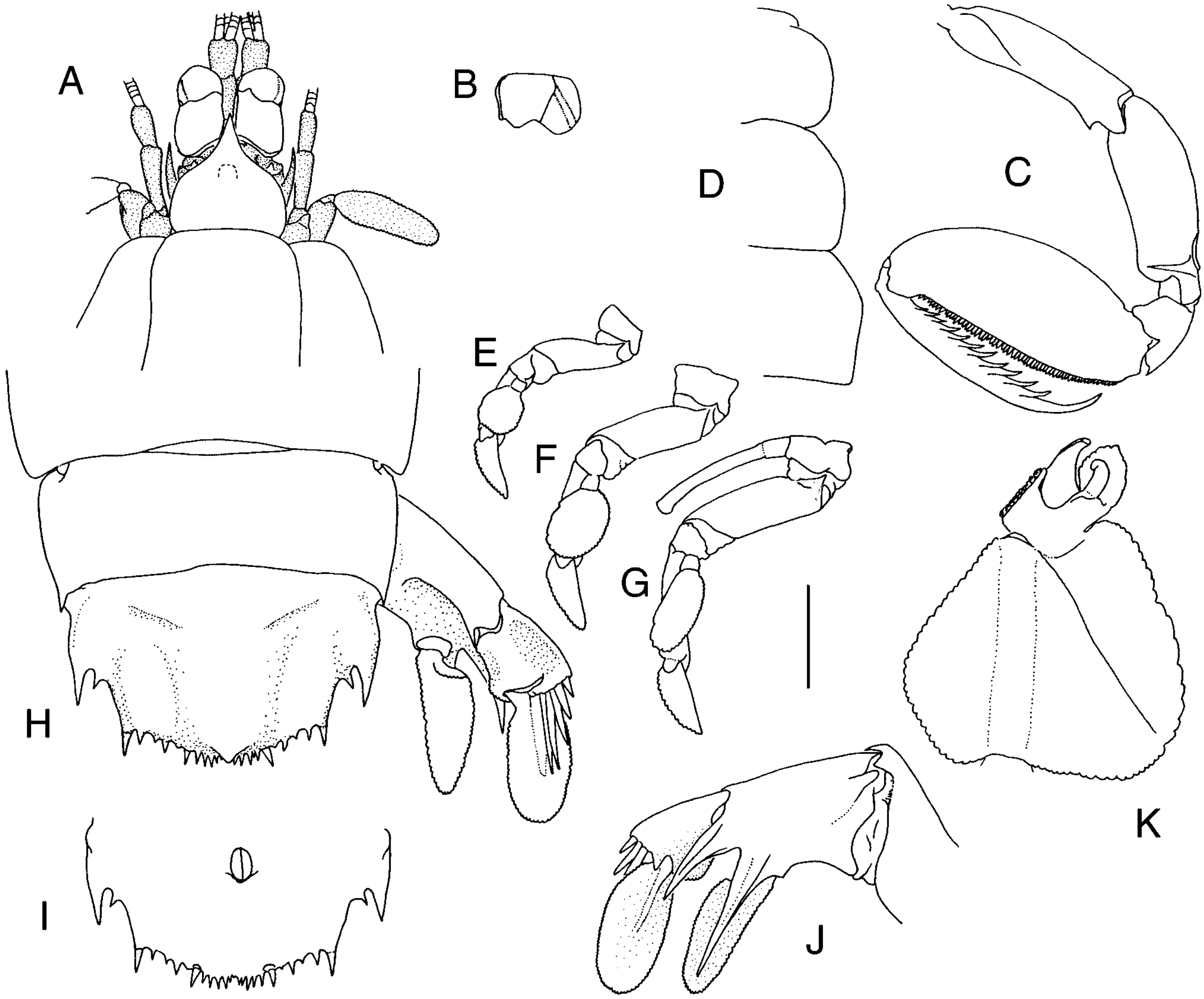

Figure 74. *Austrosquilla middletoni* n.sp., holotype ♂ TL 47 mm. A, anterior cephalon, dorsal. B, eye, right lateral. C, raptorial claw, right lateral. D, TS6–8 lateral processes, right dorsal. E–G, pereiopods 1–3, posterior. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A–J = 2 mm; K = 1 mm.

burrows in anoxic sand, M. Middleton, S. & R. Ahyong, 10 Jan 1999; AM P57126, 1♂ (TL 45 mm), 1♀ (TL 52 mm), N end Foreshore Beach, Whyalla, intertidal sand flats, mid tide level, dug from burrows in anoxic sand, M. Middleton, S. & R. Ahyong, 10 Jan 1999; AM P57127, 1♂ (TL 47 mm), 1♀ (TL 50 mm), N end Foreshore Beach, Whyalla, intertidal sand flats, mid tide level, dug from burrows in anoxic sand, M. Middleton, S. & R. Ahyong, 11 Jan 1999; SAM C5745, 2♂♂ (TL 34–38 mm), 1♀ (TL 37 mm), Corney Pt, Yorke Peninsula, I. Thomas, Jan 1957; SAM C5748, 1♂ (TL 38 mm), 2♀♀ (TL 32–38 mm), S end of Home Bay, Reevesby I., Sir Joseph Banks Group, dug from grey, shelly anoxic intertidal sand flat, S. Parker, 19 Jan 1986; SAM C5784, 4♂♂ (TL 27–37 mm), 6♀♀ (TL 19–35 mm), Moreton Bay, Reevesby I., Sir Joseph Banks Group, dug from intertidal sand flat, S. Parker & E. Spane, 21 Jan 1986; SAM C5789, 1♂ (TL 27 mm), 1♀ (32 mm), Nicholas Bay, Reevesby I., Sir Joseph Banks Group, dug from fine, grey-cream, muddy intertidal sand flat, S. Parker & C. Watts, 26 Jan 1986; SAM C5790, 1♀ (TL 34 mm), N end of Home Bay, Reevesby I., Sir Joseph Banks Group, dug from intertidal sand flat, S. Parker, 23 Jan 1986; SAM C5791, 2♂♂ (TL 32–37 mm), 2♀♀ (39–43 mm), Home Bay, Reevesby I., Sir Joseph Banks Group, in pairs in burrows in intertidal sand flat, S. Parker, 23 Jan 1986; SAM C5793, 2♂♂ (TL 28–29 mm), 3♀♀ (TL 21–34 mm), N end of Home Bay, Reevesby I., Sir Joseph Banks Group, dug from intertidal sand flat, S. Parker, 24 Jan 1986; SAM C5794, 1♂ (TL 42 mm), Sandy Beach, N of Kingston Southeast, with *Arenicola*, I. Thomas, 10 Nov 1977; SAM C5804, 5♂♂ (TL 32–36 mm), 5♀♀ (TL 19–39 mm), Moreton Bay, Reevesby I., Sir Joseph Banks Group, in vertical burrows in intertidal sand flat, S. Parker, 31 Jan 1985; SAM C5795, 1♂ (TL 34 mm), 1♀ (TL 40 mm), S end of Home Bay, Reevesby I., Sir Joseph Banks Group, dug from grey, shelly anoxic intertidal sand flat, S. Parker, 22 Jan 1986; SAM C5796, 2♂♂ (TL 33–37 mm), 2♀♀ (1 broken, other TL 38 mm), Moreton Bay, Reevesby I., Sir Joseph Banks Group, 30–38 cm down in wet intertidal sand at bottom of burrow, S. Parker, 22 Jan 1985.

Diagnosis. Cornea subglobular. A2 protopod with 1 ventral papilla. Rostral plate slightly longer than broad, triangular; lateral margins sinuous; with long apical spine extending anteriorly to or beyond level of cornea; without dorsal carina. Raptorial claw dactylus with 12–14 teeth; ischium with triangular outer inferodistal spine, directed antero-ventrally. MXP1–5 with epipod. Pereiopod 1 basal segment outer margin unarmed; with inner, ventrally directed, triangular projection. Pereiopods 2–3 basal segment unarmed. AS6 lateral spine short, triangular; with 1 slender and 1 larger blunt ventrolateral spine anterior to uropodal articulation. Telson inflated; posteromedian projection blunt; lateral proximal margin of telson sinuous.

Description. Eye not extending beyond A1 peduncle segment 2; cornea subglobular, inclined laterally on stalk; lateral margin with low, rounded projection. Ophthalmic somite anterior margin broadly rounded. Ocular scales fused, erect. A1 peduncle 0.38–0.45 CL. A2 protopod with 1 ventral papilla. A2 scale slender, 0.27–0.33 CL; entire margin setose. Rostral plate slightly longer than broad, triangular; lateral margins sinuous; with long apical spine extending anteriorly to or beyond level of cornea. Raptorial claw dactylus with 12–14 teeth; outer margin broadly curved, proximal margin angular, uninflated; carpus dorsal margin terminating in short, acute tooth directed ventrally; propodus distal margin unarmed; ischium with triangular outer inferodistal spine, directed anteroventrally. MXP1–5 with epipod. MXP5 basal segment without ventrally directed spine; merus inner margin with broad, evenly convex flange. Pereiopod 1 basal segment outer margin unarmed; with inner, ventrally directed, triangular projection. Pereiopods 2–3 basal segment unarmed. TS5 lateral process obsolete. TS6–7 lateral process broadly rounded. TS8 lateral process rounded; sternal keel obsolete. AS6 smooth, lateral spine short, triangular; with 1 slender and 1 larger blunt ventrolateral spine anterior to uropodal articulation; sternum posterior margin unarmed. Telson inflated; posteromedian projection tapering, apex obtuse, blunt; intermediate teeth short, apices extending posteriorly just beyond bases of submedian teeth; lateral teeth slender, apex not extending posteriorly to inner base of intermediate tooth; lateral proximal margin of telson unarmed; with 4–7 SM denticles either side of midline, short, spiniform, inner smallest and highest; intermediate denticles short, spiniform, first and third shorter than second and fourth; lateral denticle short, spiniform. Uropodal exopod proximal segment inner distal margin with broad, round lobe; outer margin with 4–6 movable spines, distalmost exceeding midlength of distal segment; distal margin stout ventral. Exopod distal segment longer than proximal segment.

Colour in life. Cornea silver-metallic grey. Base colour translucent cream. Carapace rostral plate anterior appendages speckled and raptorial claws with large white chromatophores and sparsely speckled with light brown and a few dark chromatophores; with dark spot anteriorly along gastric grooves. Thoracic somites and abdomen with diffuse transverse white bands; without dark transverse bands, at most with about 20 dark sparsely scattered chromatophores between white bands. Telson with anterior and posterior median white cluster of white chromatophores; posterior cluster occasionally bordered by diffuse cluster of dark chromatophores. Uropods usually colourless, at most with few sparsely scattered dark chromatophores. Females with orange-red gonads visible through cuticle.

Measurements. Male (n = 33) TL 19–42 mm, ♀ (n = 34) TL 21–43 mm. Other measurements of holotype: CL 8.0 mm, A1 peduncle 3.0 mm, A2 scale 2.2 mm.

Etymology. Named for Matthew Middleton who assisted in collecting the type material.

Remarks. *Austrosquilla middletoni* n.sp. may be distinguished from all others in the genus in lacking outer spines on the basal segment of the pereiopods and unlike other species of the genus, lacks distinctive dark, transverse bands on the body and the black pair of "eye-spots" on the telson. Several specimens show darkening at the articulations of the uropodal exopod segments, but these are artefacts of preservation.

Habitat. *Austrosquilla middletoni* occurs on intertidal anoxic sand-flats. Burrows are simple and U-shaped, with entrances are usually about 10 mm in diameter and 30–40 cm apart and usually high up in the intertidal zone. Whether or not *A. middletoni* has greater tolerance to low oxygen levels than *A. rachelae* and *A. tsangi* remains to be tested. The specimen from Kingston Southeast was collected with the polychaete worm, *Arenicola* sp., but it is unlikely that the two species occupied the same burrow. On the intertidal sand flats at Whyalla, *Austrosquilla middletoni*, *Arenicola* sp. and the callianassid decapod, *Biffarius ceramica* are sympatric, and burrow entrances were often found in close proximity such that the three species were occasionally sampled simultaneously.

Distribution. South Australia, from Spencer Gulf and Kingston Southeast.

Austrosquilla osculans (Hale, 1924)

Fig. 75

Lysiosquilla vercoi var. *osculans* Hale, 1924: 497, 501–502, pl. 33: fig. 3, fig. 384 (type locality: South Australia).
Lysiosquilla osculans.–Hale, 1927a: 33, 34, fig. 25.–Stephenson, 1955: 3, 4.–Stephenson & McNeill, 1955: 247.
Heterosquilla osculans.–Manning, 1963b: 321.
Heterosquilla (Austrosquilla) osculans.–Manning, 1966: 127–130, fig. 9.
Austrosquilla osculans.–Holthuis, 1967a: 6.–Michel & Manning, 1971: 239.

Type material. HOLOTYPE: SAM C186, ♀ (TL 34 mm), South Australia, A. Zeitz.

Australian material. VICTORIA: AM P3011, 1♀ (TL 31 mm), Western Port, J. Gabriel; AM P8606, 1♂ (TL 43 mm), Beaumaris, Port Phillip Bay, under stones on sand between tide marks, M. Ward, Jan 1926; AM P52769, 1♂ (TL 40 mm), Port Phillip Bay, Area 59, 10 Dec 1957; NMV J13880, 1♀ (TL 28 mm), Long I. Point, 30 Aug 1974; NMV J13874, 3♂♂ (TL 30–32 mm), Western Port, 38°22'S 145°32'E, J. Searle, 10 Aug 1915; NMV J37769, 1♀ (TL 30 mm) Port Phillip Bay, western sandy region, 38°09.9'S 144°44.7'E, 12 m, grab, R. Wilson & G. Walker-Smith, 17 Oct 1994; NMV J37771, 1♂ (TL 20 mm), Hobson's Bay, Port Phillip Bay, 37°54'S 144°59'E, 4 m, coarse sand, Poore & Rainer, 9 Mar 1971; NMV J37776, 1♂ (TL 31 mm), 1♀ (TL 34 mm), between Hogan's Gap & East Moncoeur I., 39°8.5'S 146°49'E, 57 m, polyzoa, sand & shell, B. Smith & party, 25 Nov 1973; NMV J37823, 1♀ (TL 21 mm), southern Port Phillip Bay, 38°21.0'S 144°48.1'E, 5 m, sand, grab, G. Poore & party, 17 Feb

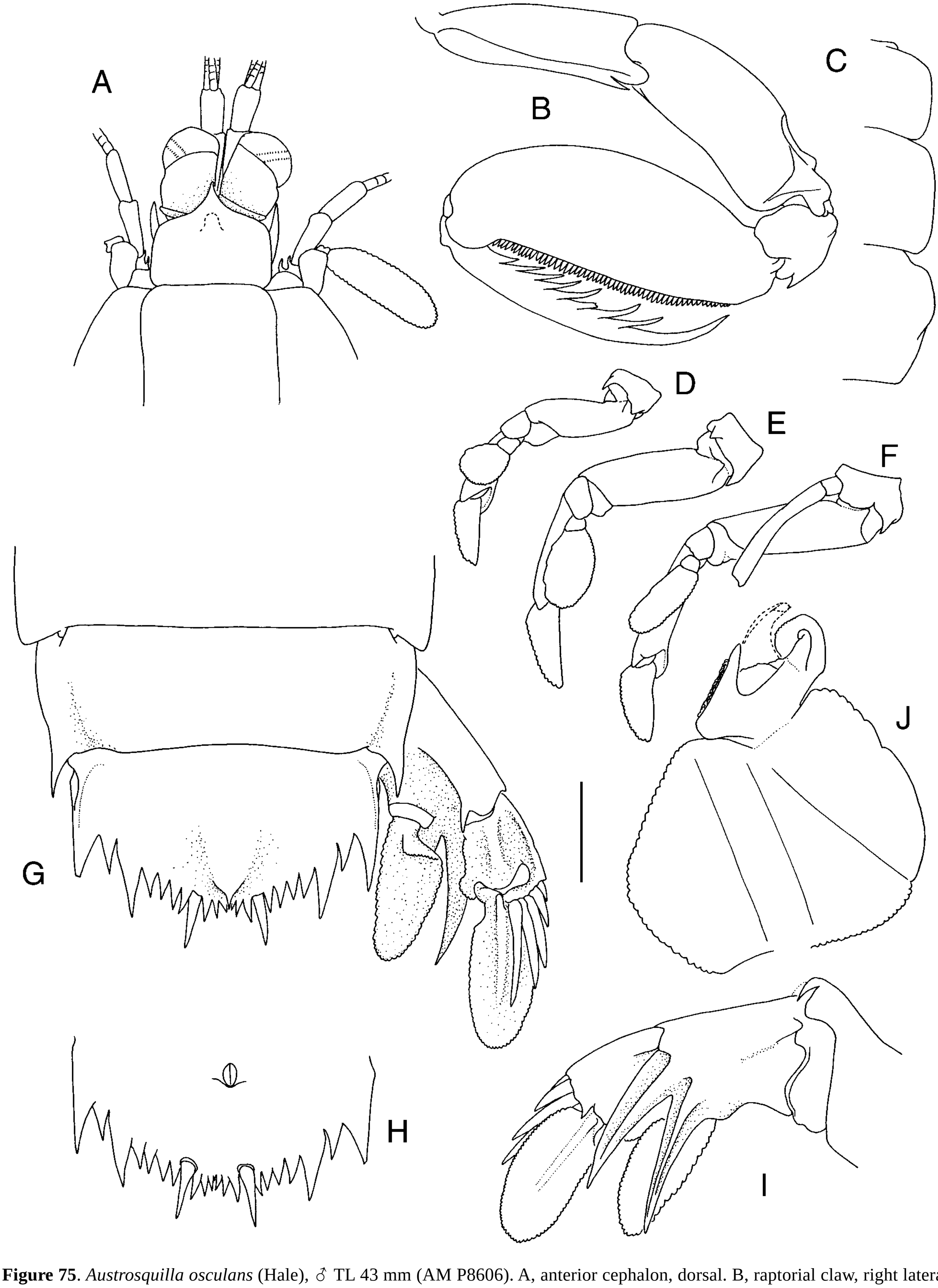

Figure 75. *Austrosquilla osculans* (Hale), ♂ TL 43 mm (AM P8606). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, AS5–6, telson & uropod, dorsal. H, telson, ventral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2 mm; J = 1 mm.

1971; USNM 140576, 1♂ (TL 25 mm), 1♀ (TL 24 mm), Western Port, T. Mortensen, 5 Sep 1914. TASMANIA: NMV J13883, 1♂ (TL 33 mm), 35 km N of Cape Wickham, King I., Bass Strait, 39°13.6'S 143°55.6'E, 85 m, fine shelly sand, epibenthic sled, R. Wilson, 23 Nov 1981. SOUTH AUSTRALIA: AM P52770, 1♂ (TL 25 mm), 1♀ (TL 15 mm), Spencer Gulf, T. Ward, 1979; SAM C5749, 1♀ (TL 37 mm), South Australia, W.H. Baker, 7 Jun 1924. WESTERN AUSTRALIA: AM P16287, 1♀ (TL 35 mm), off Albany, 34°55'S 119°00'E, 73 m, 7 Aug 1962; WAM C17605, 1♀ (TL 27 mm), W of Rottnest I., 32°02'S 115°22'E, 110 m, with sand, shell & sponge, *Honolulu* dredge, 2 Dec 1970.

Diagnosis. Cornea subglobular. A2 protopod with 2 mesial and 1 ventral papilla. Rostral plate subquadrate with rounded anterolateral angles and short median spine. Raptorial claw dactylus with 8–11 (usually 8 or 9) teeth; ischium with slender outer inferodistal spine, directed anteriorly. MXP1–4 with epipod. Pereiopods 1–2 basal segment with inner and outer, ventrally directed spine. Pereiopod 3 basal segment with outer, ventrally directed spine only. AS6 with 1 slender, ventrolateral spine and broad lobe anterior to uropodal articulation. Telson flattened; posteromedian projection terminating in slender spine; "intermediate" and LT denticles elongate, triangular; lateral proximal margin of telson without rounded, projecting lobe; with 3–5 SM denticles. Uropodal exopod proximal segment outer margin with 5 or 6 movable spines.

Colour in alcohol. Dorsum mottled with dark brown patches. Telson margin black and with pair of black patches posteromedially.

Measurements. Male (*n* = 10) TL 20–43 mm, female (*n* = 11) TL 15–37 mm. A1 peduncle 0.43–0.53 CL. A2 scale 0.30–0.37 CL. The present series includes the largest known specimen of the species.

Remarks. *Austrosquilla osculans* differs from all other species of the genus in the subquadrate rostral plate; in bearing mesial papillae on the antennal protopod; the distal spine on the ischium of the raptorial claw is small, slender and directed forwards rather than triangular and directed anteroventrally; the telson is flattened, not inflated; the posteromedian projection of the telson is produced to a slender spine; and the intermediate and lateral denticles of the telson are elongate and triangular. Unlike other species of the genus that burrow in fine, well sorted sand, *A. osculans* apparently prefers coarser grained habitats often in association with shell fragments. Further, *A. osculans* differs in colour pattern and may occur at greater depths (to 110 m) than other species of the genus which occupy the intertidal or shallow sublittoral zones.

Material of *A. osculans* reported from Western Australia by Stephenson (1962) are referable to *A. rachelae* n.sp. described below. Therefore, the present record from Albany is the first reliable record of *A. osculans* from Western Australia.

Habitat. Soft sandy substrates from the intertidal zone to a depth of 110 m.

Distribution. Known from Victoria and Bass Strait, South Australia to Albany, Western Australia.

Austrosquilla rachelae n.sp.

Fig. 76

Lysiosquilla osculans.–Stephenson, 1962: 34 (not *L. osculans* Hale, 1924).

Austrosquilla vercoi.–Manning, 1991: 7–8, fig. 7 [not *A. vercoi* (Hale, 1924)].

Type material. (All South Australia) HOLOTYPE: AM P57109, ♂, (TL 47 mm), Brighton Beach, Adelaide, intertidal sandflat near low water mark, yabby pump, S. Ahyong *et al*., 4 Jan 1998. PARATYPES: AM P57110, 3♀♀ (TL 56–58 mm), Brighton Beach, intertidal sandflat near low water mark, yabby pump, S. Ahyong *et al*., 4 Jan 1998; AM P57111, 1♂ (TL 49 mm), 4♀♀ (TL 33–52 mm), Brighton Beach, 150 m south of jetty, intertidal sandflat near low water mark, yabby pump, S. & R. Ahyong, Jan 1996; AM P57027, 1♂ (TL 50 mm), 5♀♀ (TL 52–57 mm), Brighton Beach, 150–200 m N of jetty, 0.4–0.5 m, rising tide, from burrows in fine sand, yabby pump, S. & R. Ahyong, 15 Jan 1999.

Australian material. SOUTH AUSTRALIA: ZMUC CRU 3673, 1♀ (TL 22 mm), Great Australian Bight, 37°31'S 138°44'E, sand, a little clay, 6 Dec 1951. VICTORIA: NMV J13881, 1♀ (TL 57 mm), Barwon Heads, sand beach near bluff, P. Chaplin, Apr 1983; NMV J37773, 1♂ (TL 50 mm), Black Rock, Breamlea, deep burrow in very fine sand, J. Dorsey, 24 Jan 1979. WESTERN AUSTRALIA: WAM C5751–5752, 2♂♂ (TL 52–54 mm), Cottlesloe, from gut of flounder, D. Diamond, 1940.

Diagnosis. Cornea slightly broadened. Ocular scales fused, slender, higher than wide. A2 protopod with 1 ventral papilla. Rostral plate longer than broad, triangular; with long apical spine extending to level of corneae of eyes; lateral margins sinuous. Raptorial claw dactylus with 14–18 teeth; ischium with triangular outer inferodistal spine, directed anteroventrally. MXP1–5 with epipod. Pereiopods 1–3 basal segment each with inner and outer, ventrally directed spines. AS6 with lateral spine long, slender; with 1 slender ventrolateral spine and triangular lobe anterior to uropodal articulation. Telson with posteromedian projection blunt; lateral proximal margin of telson without rounded, projecting lobe.

Description. Eye not extending beyond A1 peduncle segment 1; cornea faintly bilobed, set obliquely on stalk; lateral margin with low rounded projection. Ophthalmic somite anterior margin rounded. Ocular scales fused, slender, higher than wide. A1 peduncle 0.41–0.47 CL. A2 protopod with 1 ventral papilla. A2 scale 0.33–0.43 CL; entire margin setose. Rostral plate longer than broad, triangular; with long apical spine extending to level of corneae of eyes; lateral margins sinuous. Raptorial claw dactylus with 14–18 teeth; outer margin broadly curved, proximal margin angular, uninflated; carpus dorsal margin terminating in acute tooth directed ventrally; propodus distal margin with stout tooth; ischium with triangular outer inferodistal spine, directed anteroventrally. MXP1–5 with epipod. MXP5 basal segment without ventrally directed spine; merus inner margin with broad, evenly convex flange. Pereiopods 1–3 basal segment each with inner and outer, ventrally directed spines. TS5 lateral process obsolete. TS6–7 lateral process flattened. TS8 lateral process rounded; sternal keel obsolete. AS6 smooth, lateral spine long, slender; with 1 slender ventrolateral spine and triangular

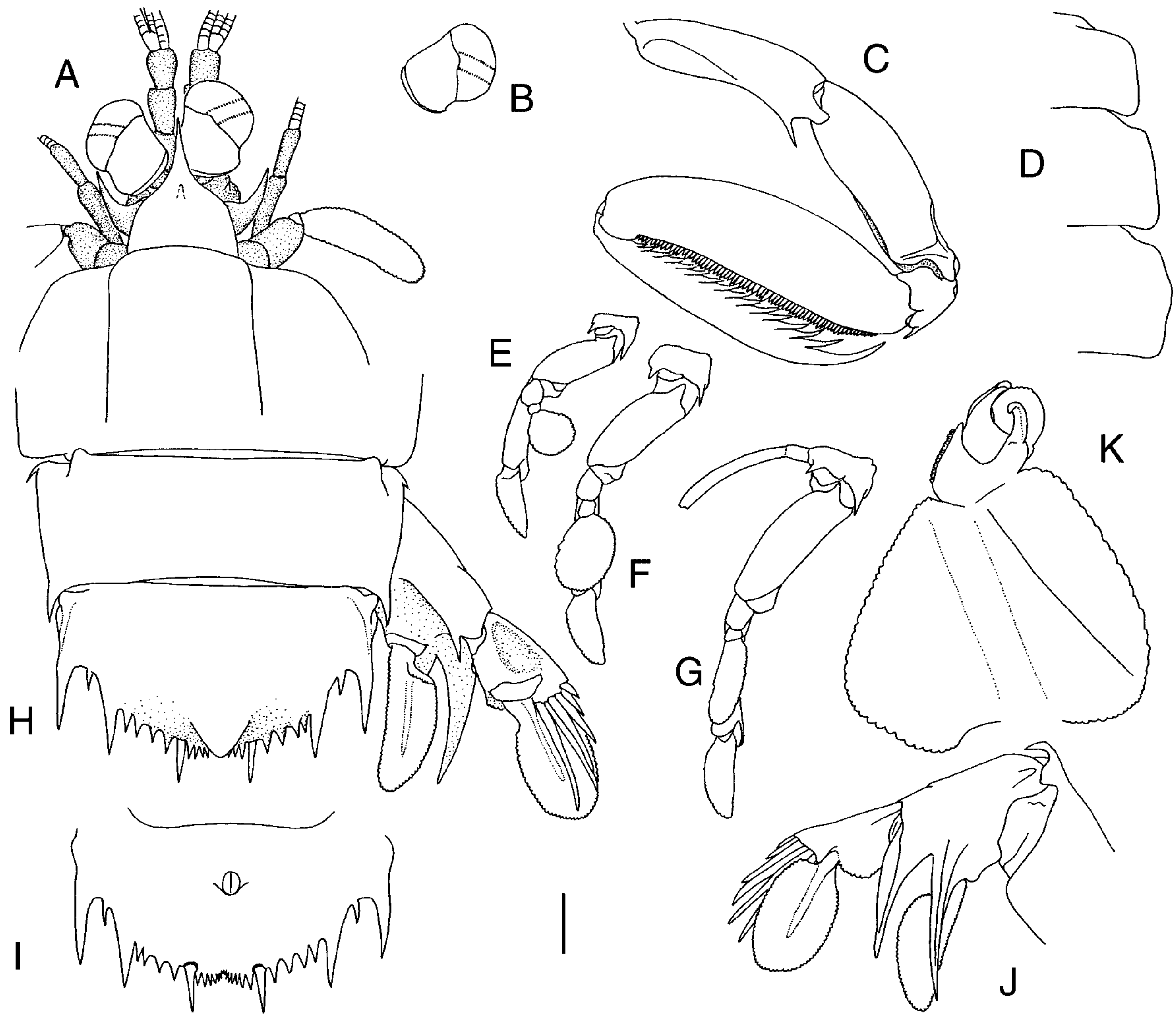

Figure 76. *Austrosquilla rachelae* n.sp., holotype ♂ TL 47 mm. A, anterior cephalon, dorsal. B, eye, right lateral. C, raptorial claw, right lateral. D, TS6–8 lateral processes, right dorsal. E–G, pereiopods 1–3, posterior. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A–J = 1.25 mm; K = 0.6 mm.

lobe anterior to uropodal articulation; sternum posterior margin unarmed. Telson inflated; posteromedian projection tapering, apex rounded, blunt; intermediate teeth elongate, apices extending posteriorly beyond midlength of submedian teeth; lateral teeth slender, apex extending posteriorly beyond inner base of intermediate tooth; lateral proximal margin of telson sinuous; with 6–9 SM denticles either side of midline, short, spiniform, inner smallest and highest; lateral denticle short, slender, triangular; intermediate denticles short, slender, triangular, subequal. Uropodal exopod proximal segment inner distal margin with broad, round lobe; outer margin with 5–7 movable spines, distalmost exceeding midlength of distal segment; distal margin with short ventral spine. Exopod distal segment longer than proximal segment.

Colour in life. Dorsum with dark brown transverse bands. Telson with pair of black spots posteromedially. Uropodal exopod with proximal segment and inner portion of distal segment dark; endopod dark. A2 protopod with black anterior margin. Females usually often orange gonads visible through cuticle. Cornea silver-metallic grey.

Etymology. Named for my wife Rachel, who assisted in collecting the type material and has assisted in numerous other ways during this study.

Measurements. Male (n = 6) TL 47–54, ♀ (n = 14) TL 22–58 mm. Other measurements of holotype: CL 7.8 mm, A1 peduncle 3.7 mm, A2 scale 3.1 mm.

Remarks. *Austrosquilla rachelae* n.sp. most closely resembles *A. melanocauda* but differs in having a broader cornea, the intermediate and lateral teeth of the telson are considerably longer, the intermediate denticles of the telson are equal in size and coloration of the uropodal endopod is different. In *A. rachelae*, the uropodal endopod is black on the distal ½, whereas the endopod is black on the inner ½ in *A. melanocauda*. Unlike *A. tsangi*, *A. middletoni*, and *A. osculans*, pairing behaviour is not yet known for *A. rachelae* n.sp.

The 22 mm specimen reported and figured by Manning (1991: fig. 7) as *A. vercoi* is *A. rachelae* and differs from larger specimens only in having a relatively smaller inner spine on the basal segment of pereiopod 3. Both specimens reported by Stephenson (1962) from Cottlesloe, Western Australia, as *A. osculans* are referable to *A. rachelae*.

Habitat. Clean, fine, well oxygenated intertidal sand flats at the lowest tide line. *Austrosquilla rachelae* constructs U-shaped burrows to a depth of about 35 cm.

Distribution. Known from Victoria to southwestern Australia.

Austrosquilla tsangi n.sp.

Fig. 77

Lysiosquilla vercoi.–Stephenson, 1953a: 46.–Stephenson & McNeill, 1955: 247 (part, New South Wales specimens; not *Lysiosquilla vercoi* Hale, 1924).

Heterosquilla (Austrosquilla) vercoi.–Manning, 1966: 130–132, fig. 10 (not *Lysiosquilla vercoi* Hale, 1924).

Type material. (All New South Wales) HOLOTYPE: AM P56777, ♂ (TL 51 mm), N end Seven Mile Beach, Gerroa, S of creek runout, 34°47'S 150°47'E, S. Ahyong & G. Tsang, 19 Mar 1997; PARATYPES: AM P56776, 2♂♂ (TL 49–50 mm), 4♀♀ (TL 29–53 mm), type locality, 31 Oct 1997; AM P56774–56775, 6♂♂ (TL 42–51 mm), 6♀♀ (TL 50–55 mm), type locality, S. Ahyong & G. Tsang, 19 Mar 1997; AM P56778, 1♂ (TL 49 mm), 4♀♀ (TL 50–57 mm), type locality, S. Ahyong & G. Tsang, 19 Mar 1997.

Australian material. QUEENSLAND: QM W1799, 1♀ (TL 52 mm), Southport, R. Pohlman, 8 May 1920. NEW SOUTH WALES: AM P8759, 1♂ (TL 47 mm), Gerringong Beach; AM P12371, 1♀ (TL 51 mm), Kingscliff, S of Tweed Heads, dug from sand on ocean beach, J. Kirchner, 1953; AM P41833, 1♀ (TL 49 mm), Sawtell Beach, between tide levels, N. Masen, 1 Jun 1971; AM P56773, 1♂ (TL 47 mm), 1♀ (TL 60 mm), Cudgen Beach, 28°19'S 153°34'E, dug from sand on ocean beach, N. Hacking, 1994; NMV J37791, 2♀♀ (TL 50–51 mm), Broulee (?), 35°51'S 150°11'E, M. Key, May 1979; USNM 252366, 1♀ (TL 54 mm), "Australia", 16 May 1950.

Diagnosis. Cornea subglobular. A2 protopod with 1 ventral papilla. Rostral plate slightly broader than long, triangular; lateral margins sinuous; apex acute but not produced to long spine. Raptorial claw dactylus with 18–27 teeth; ischium with triangular outer inferodistal spine, directed anteroventrally. MXP1–5 with epipod. Pereiopods 1–2 basal segment with inner and outer, ventrally directed spine. Pereiopod 3 basal segment with outer, ventrally directed spine only. AS6 lateral spine long, slender; with 1 slender, ventrolateral spine anterior to uropodal articulation. Telson inflated; posteromedian projection blunt; lateral proximal margin of telson with distinct, semicircular, laterally projecting lobe.

Description. Eye not extending beyond A1 peduncle segment 3; cornea subglobular, inclined laterally on stalk; lateral margin with prominent rounded projection. Ophthalmic somite anterior margin broadly rounded. Ocular scales fused, erect. A1 peduncle 0.39–0.54 CL. A2 protopod with 1 ventral papilla. A2 scale slender, length 0.35–0.43 CL; entire margin setose. Rostral plate slightly broader than long, triangular; lateral margins sinuous; apex acute but not produced to long spine. Raptorial claw dactylus with 18–27 teeth; outer margin broadly curved, proximal margin angular, uninflated; carpus dorsal margin terminating in short, acute tooth directed ventrally; propodus distal margin unarmed; ischium with triangular outer inferodistal spine, directed anteroventrally. MXP1–5 with epipod. MXP5 basal segment without ventrally directed spine; merus inner margin with broad, evenly convex flange. Pereiopods 1–2 basal segment with inner and outer, ventrally directed spine. Pereiopod 3 basal segment with outer, ventrally directed spine only. TS5 lateral process obsolete. TS6–7 lateral process flattened. TS8 lateral process rounded; sternal keel obsolete. AS6 smooth, lateral spine long, slender; with 1 slender, ventrolateral spine anterior to uropodal articulation; sternum posterior margin unarmed. Telson inflated; posteromedian projection tapering, apex obtuse, blunt; intermediate teeth short, apices extending posteriorly just beyond bases of SM teeth; lateral teeth slender, apex not extending posteriorly to inner base of IM tooth; lateral proximal margin of telson with distinct, semicircular, laterally projecting lobe; with 5–7 SM denticles either side of midline, short, spiniform, inner smallest and highest; "intermediate" denticles short, first and third triangular, shorter than second and fourth; LT denticle short, spiniform. Uropodal exopod proximal segment inner distal margin with broad, round lobe; outer margin with 5–7 movable spines, distalmost exceeding midlength of distal segment; distal margin with stout ventral spine. Exopod distal segment longer than proximal segment.

Colour in life. Dorsum with dark brown transverse bands. Telson with pair of black spots posteromedially. Uropodal exopod with proximal segment and inner portion of distal segment dark; endopod dark. A2 protopod with black anterior margin. Females often with orange gonads visible through cuticle. Cornea silver-metallic grey.

Measurements. Male (n = 12) TL 42–51 mm, female (n = 21) TL 29–57 mm. Other measurements of holotype: CL 8.0 mm, A1 peduncle 3.5 mm, A2 scale 3.1 mm.

Etymology. Named for Gordon Tsang who assisted in collecting the type material.

Remarks. *Austrosquilla tsangi* n.sp. most closely resembles *A. vercoi* (Hale, 1924) in basic facies, but differs in the narrower, more triangular rostral plate, and in having more teeth on the raptorial claw (18–27 instead of 11–14). *Austrosquilla tsangi* differs from all others in the genus in the high number of teeth on the raptorial claw and the prominent rounded lobe on the proximal lateral margin of the telson (Fig. 77I).

All records of *A. vercoi* from New South Wales and southern Queensland are referable to *A. tsangi*. Like *A. osculans* and *A. middletoni*, *A. tsangi* lives monogamously in heterosexual, size matched pairs. In the single ovigerous female collected, the egg mass consisted of only 32 eggs, 1.4–1.5 mm in diameter.

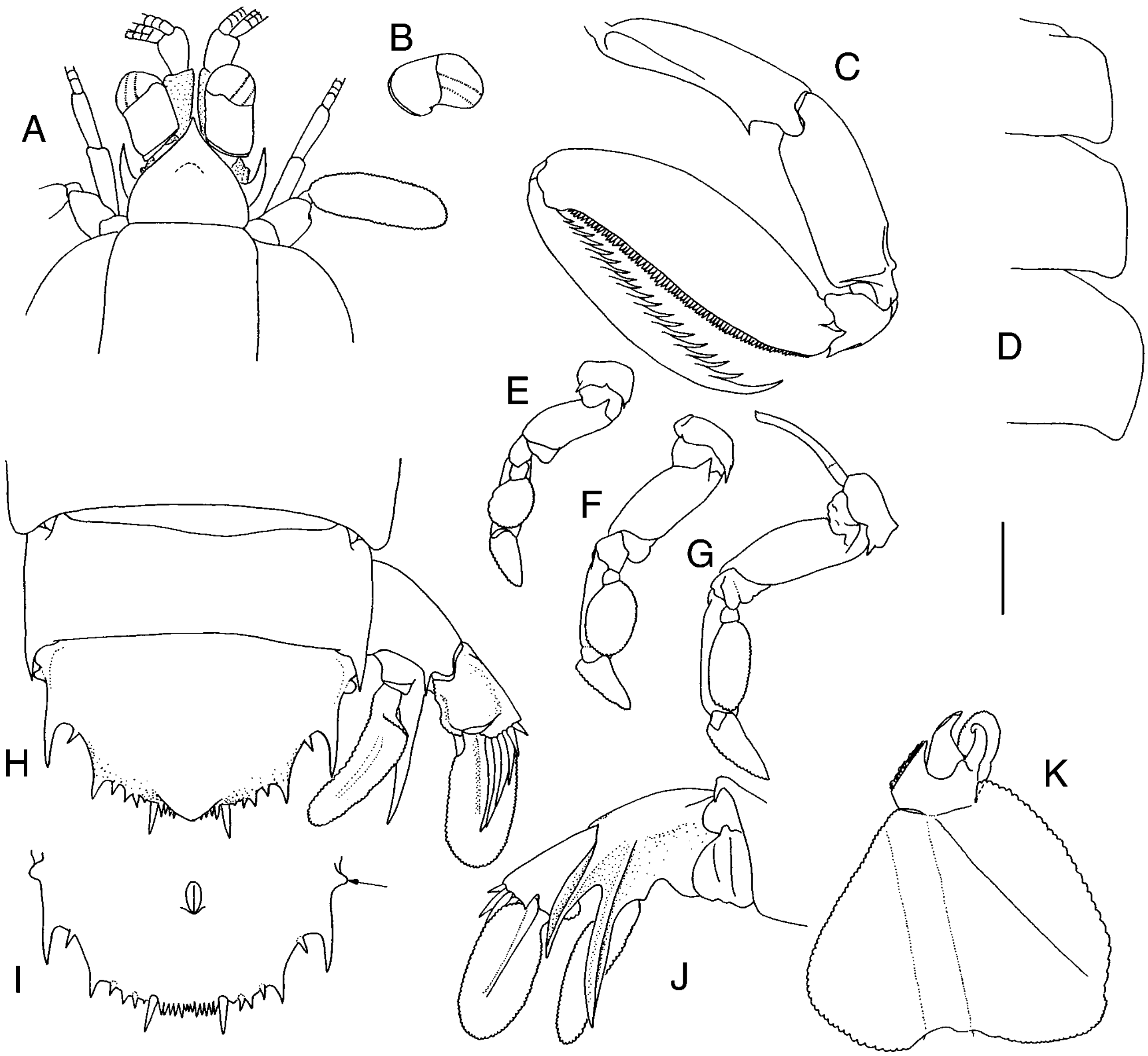

Figure 77. *Austrosquilla tsangi* n.sp., holotype ♂ TL 51 mm. A, anterior cephalon, dorsal. B, eye, right lateral. C, raptorial claw, right lateral. D, TS6–8 lateral processes, right dorsal. E–G, pereiopods 1–3, posterior. H, AS5–6, telson & uropod, dorsal. I, telson, ventral (arrow indicating proximal laterally projecting lobe). Uropod, right ventral. K, PLP1 endopod, right anterior. Scale A–J = 2 mm; K = 1 mm.

Habitat. *Austrosquilla tsangi* burrows in fine sand in the low intertidal zone on exposed and semi-exposed, longshore-drift beaches. Burrows are simple and U-shaped, with entrances of adults typically 10–12 mm in diameter and approximately 30 cm apart.

Distribution. Known from Southport, southern Queensland, south to southern New South Wales.

Austrosquilla vercoi (Hale, 1924)

Fig. 78

Lysiosquilla vercoi Hale, 1924: 497, 499–501, pl. 33: fig. 2, fig. 383 (type locality: Robe, South Australia); 1927a: 33, 34, fig. 25.–Stephenson, 1955: 3, 4.–Stephenson & McNeill, 1955: 247 (part, Victorian specimen only).–Guiler, 1956: 3.
Heterosquilla vercoi.–Manning, 1963b: 321.
Austrosquilla vercoi.–Michel & Manning, 1971: 239.

Type material. HOLOTYPE: SAM C185, ♀ (TL 40 mm), Robe, South Australia, dredged, J.C. Verco.

Australian material. VICTORIA: AM P850, 1♂ (TL c. 55 mm; broken), Port Phillip Bay, C. Gabriel; NMV J13869, 1♂ (TL 50 mm), Point Lonsdale, 38°17'S 144°37'E, J.A. Kershaw, Jan 1902. TASMANIA: TM 14403/G-147, 1♀ (TL 54 mm), Coles Bay, 42°08'S 148°18'E.

Diagnosis. Cornea subglobular. A2 protopod with 1 ventral papilla. Rostral plate subcordiform; with short apical spine;

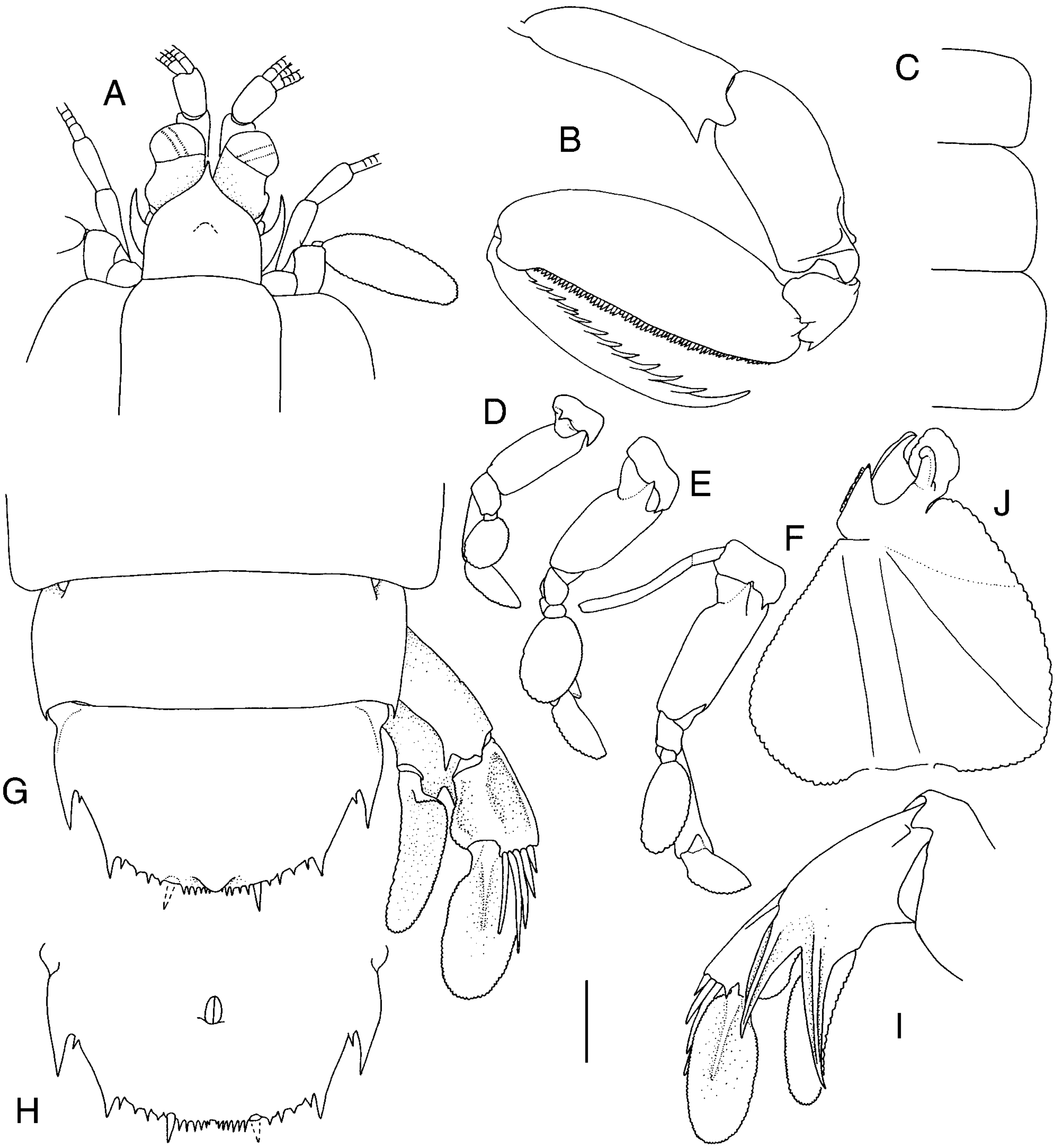

Figure 78. *Austrosquilla vercoi* (Hale), ♂ TL 55 mm (AM P850). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, AS5–6, telson & uropod, dorsal. H, telson, ventral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2 mm; J = 1 mm.

lateral margins subparallel or slightly convergent for proximal ½. Raptorial claw dactylus with 8–12 (usually 10–12) teeth; ischium with triangular outer inferodistal spine, directed anteroventrally. MXP1–5 each with epipod. Pereiopod 1 basal segment with inner and outer ventrally directed spine. Pereiopods 2–3 basal segment with outer ventrally directed spine only. AS6 with 1 broad, triangular ventrolateral projection anterior to uropodal articulation. Telson inflated; posteromedian projection tapering, apex rounded, blunt; lateral proximal margin of telson sinuous; with 5–8 SM denticles either side of midline. Uropodal exopod distal segment with 5 movable spines.

Colour in alcohol. Completely faded.

Measurements. Male (n = 2) TL 50–55 mm, female (n = 2) TL 40–54 mm. A1 peduncle 0.38–0.45 CL. A2 scale 0.35–0.38 CL. The present series includes the largest known specimens of the species.

Remarks. Records of *A. vercoi* from New South Wales are referable to *A. tsangi* n.sp. reported above.

Habitat. Unknown.

Distribution. Victoria, Tasmania and South Australia.

Bigelowina Schotte & Manning, 1993

Bigelowina Schotte & Manning, 1993: 574. Type species *Lysiosquilla biminiensis* Bigelow, 1893b, by original designation. Gender feminine.

Diagnosis. Rostral plate quadrate with median spine. Cornea subglobular. A2 protopod with mesial and ventral papillae. Mandibular palp three-segmented. MXP1–5 with epipod. Ischium of raptorial claw unarmed. AS6 with posterolateral spines; posterior margin of sternum unarmed. Telson posterodorsal surface with fan-shaped row of 5 slender, posteriorly directed spines above marginal armature; with movable SM and 2 pairs of fixed primary teeth (IM, LT); with 4 "intermediate" denticles; SM denticles of telson forming transverse row in posterior view. Uropodal protopod terminating in 2 slender spines, ventrally carinate, inner longer, without ventral spine anterior to endopod articulation.

Included species. Three: *B. biminiensis* (Bigelow, 1893b); *B. phalangium* (Fabricius, 1798) n.comb.; and *B. septemspinosa* (Miers, 1881).

Remarks. *Bigelowina* is most similar to *Acanthosquilla* and *Alachosquilla*, each of which share the fan shaped row of spines above the posterior armature of the telson. Characters distinguishing the three genera are outlined under the account of *Acanthosquilla*. As discussed under the account of *Acanthosquilla, A. phalangium* (Fabricius, 1798), belongs in *Bigelowina*. Thus *B. phalangium* is the single Indo-West Pacific representative of the genus.

Key to species of *Bigelowina*

1 Rostral plate with lateral proximal margins straight or concave. Posterolateral margin of carapace not lined with dark pigment .... ***B. phalangium***

—— Rostral plate with lateral proximal margins convex. Posterolateral margin of carapace darkly pigmented 2

2 Ocular scales fused .... *B. biminiensis*

—— Ocular scales separate .... *B. septemspinosa*

Bigelowina phalangium (Fabricius, 1798) n.comb.

Fig. 79

Squilla phalangium Fabricius, 1798: 416 (type locality: Bombay, India).–Kemp, 1913: 205.–Holthuis, 2000: 14–16, figs. 1, 2.
Coronis acanthocarpus White, 1847: 85 (*nomen nudum*; type locality: Port Essington, Northern Territory, Australia, 11°10'S 132°08'E).
Coronis acanthocarpus Claus, 1871: 129 (type locality: Port Essington, Northern Territory, Australia, 11°10'S 132°08'E).
Lysiosquilla acanthocarpus Miers, 1880: 3, 11, pl. 1: figs. 7–9 (type locality: Port Essington, Northern Territory, Australia, 11°10'S 132°08'E).–Haswell, 1882: 206.–Kemp, 1913: 4, 11, 111, 120, 196; 1915: 174.–Serène, 1952: 12–14, figs. 25–27.–Stephenson & McNeill, 1955: 247.
Acanthosquilla acanthocarpus.–Holthuis, 1967a: 3.–Manning, 1995: 140–141, figs. 79, 81c,d,g,h, 82c.
Acanthosquilla sarasinorum Müller, 1886: 471, 478, pl. 4: fig. 3 (type locality: Trincomali, Ceylon, 8°34'N 81°14'E).
Acanthosquilla humesi Manning, 1968b: 33–36, fig. 11 (type locality: Ambatozavary, Nosy Bé, Madagascar).–Ghosh, 1984: 261, 262, figs. 1–3; new synonymy.
Acanthosquilla phalangium.–Holthuis, 2000: 16, fig. 1.

Type material. NEOTYPE: NNM S 1163, ♂ (TL 78 mm), Bombay, India, S.R. Sane, 1964.

Australian material. QUEENSLAND: AM P14184, 1♂ (TL 69 mm), Albatross Bay, Gulf of Carpentaria, 12°40'S 141°42'E, Jun 1962–Mar 1963; AM P16284, 1♂ (TL 69 mm), Townsville Harbour, 19°16'S 146°49'E, dug from intertidal sand flat, 2 Nov 1964; AM P17729, 1♂ (TL 80 mm), Magnetic I., 19°08'S 146°50'E, 4.5–9.0 m, dredged from mud, K. Bryson, 6 Apr 1963; AM P56816, 1♂ (TL 58 mm), 1♀ (broken, CL 7.35 mm), Half Moon Bay, Yorkey's Knob, from burrows in intertidal sand flat, yabby pump, S. Ahyong, Jul 1988. WESTERN AUSTRALIA: NMV J13875, 1♂ (TL 58 mm), 2♀♀ (TL 62–64 mm), Kurrimine, 17°47'S 146°7'E, low tide, pumped from sand, NQ-3, G. Poore & H. Lew Ton, 1 Dec 1982; QM W21249, 1♀ (TL 21 mm), Mackenzie Anchorage, Napier, Broome Bay, 14°02.6'S 126°30.0'E, littoral muddy sand backed by *Rhizophora*, J. Short, 24 Nov 1995; WAM C7847, 2♀♀ (TL 50–52 mm), Barred Creek, 64 km N of Broome, mangrove flats, low tide, A. Kalnins, 5–10 Jan 1960. NORTHERN TERRITORY: AM P6788, 1♀ (TL 85 mm), Paradice Bay, North I., Sir Edward Pellow Group, 15°33'S 136°37'E, on sand flat, W. Paradice; NTM, 1♀ (TL 56 mm), Hope inlet, Shoal Bay, intertidal, D67/4, NT Fisheries, 12 Dec 1973; NTM, 1♂ (TL 56 mm), False Creek Point, Shoal Bay, intertidal, NT Fisheries, 24 Jan 1977; NTM, 1♀ (TL 46 mm), Fannie Bay, 12°24'S 130°49'E, yabby pump, D. White, 11 Jan 1988.

Other material. USNM 124095, 1♀ (TL 63 mm), Ambatozavary, Nosy Bé, Madagascar, E. Cutler, 16 Jul 1964 (holotype of *Acanthosquilla humesi* Manning).

Diagnosis. Ocular scales narrow, separate. Rostral plate trapezoid with slender apical spine, not extending beyond cornea; anterolateral angles almost acutely angled; lateral margins convergent anteriorly. Raptorial claw dactylus with 6–8 teeth. AS6 with slender ventrolateral spine. Telson with 5–7 SM denticles either side of midline; first and third "intermediate denticle" on higher plane and slightly larger and than second and fourth. Uropodal exopod proximal segment outer margin with 6 or 7 movable spines.

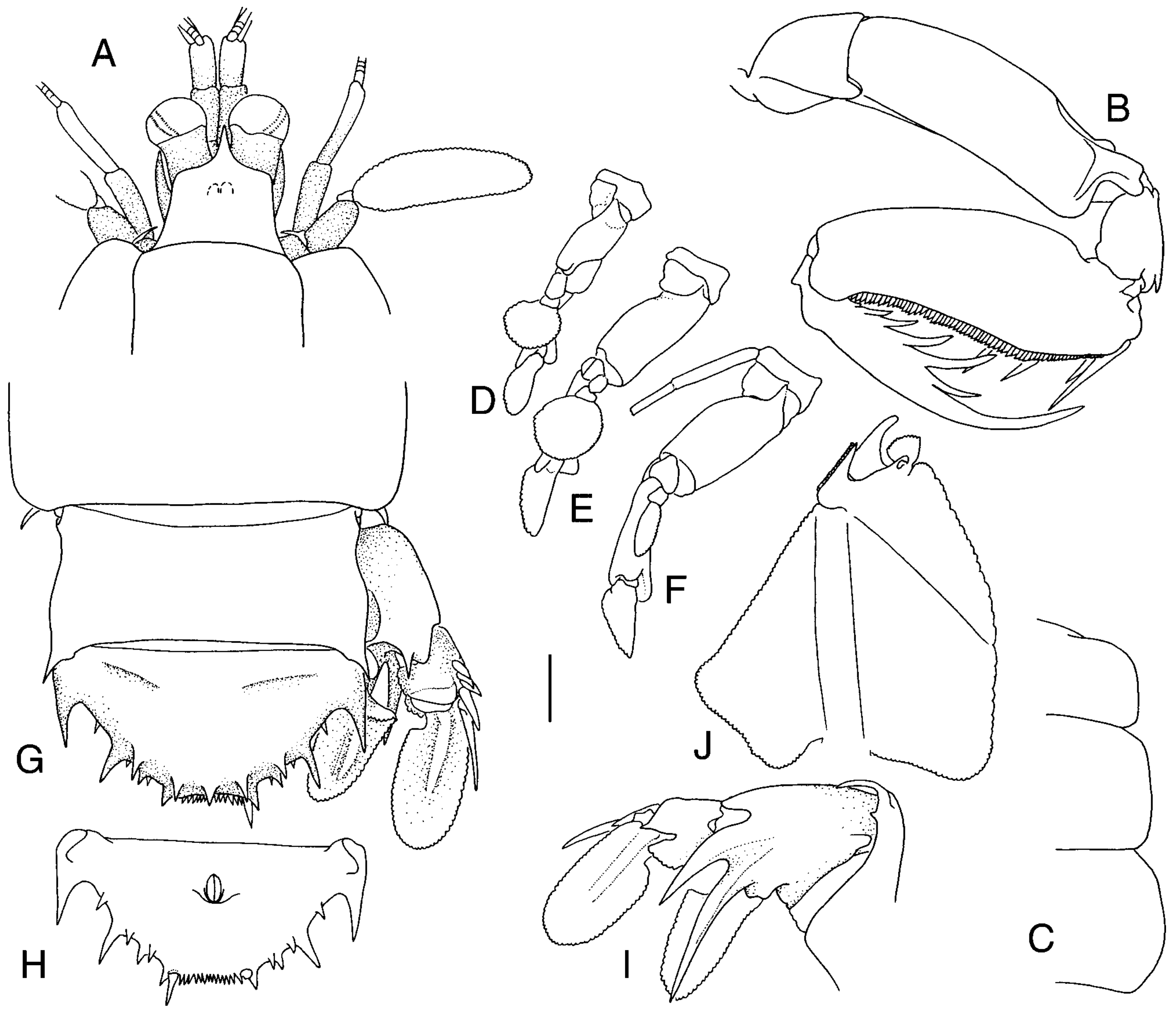

Figure 79. *Bigelowina phalangium* (Fabricius, 1798), ♂ TL 69 mm (AM P14184). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, AS5–6, telson & uropod, dorsal. H, telson, ventral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2 mm; J = 1 mm.

Colour in life. Base colour translucent yellow-white with overall dark brown transverse banding. Carapace with three black-brown transverse bands, tending forwards laterally; posterolateral angles black-brown. Thoracic and abdominal somites each with broad black-brown transverse band medially. Telson with four broad black brown patches corresponding to dorsolateral teeth. Uropodal protopod with black-brown patch basally; exopod with black-brown patch on distal ½ of proximal segment extending across articulation onto inner ⅓ of distal segment; endopod black brown.

Measurements. Male (n = 7) TL 56–80 mm, female (n = 10) TL 21–85 mm. A1 peduncle 0.40–0.48 CL. A2 scale 0.41–0.48 CL. Shanbogue (1986) reported specimens to 94 mm TL (as *A. acanthocarpus*).

Remarks. The identity of *Acanthosquilla phalangium* was subject to uncertainty until recently with designation of a neotype (Holthuis, 2000). Comparison of the neotype of *A. phalangium* with photographs of the dried holotype of *A. acanthocarpus* (NHM 957, dry collection) shows that the two species are synonymous. *Acanthosquilla phalangium* is herein transferred to *Bigelowina* based on the presence of a mesial papilla on the antennal protopod, subglobular corneae, the trapezoid to subquadrate rostral plate and the arrangement of submedian denticles into a transverse row, all characters shared by other species of *Bigelowina*, but not the type species of *Acanthosquilla, A. multifasciata*.

The present specimens agree well with neotype of *B. phalangium* and published accounts (e.g., Miers, 1880; Kemp, 1913; Manning, 1995), but show variation in the number of teeth on the dactylus of the raptorial claw (6–8 instead of 6 only). *Bigelowina phalangium* is most similar to the eastern Atlantic *B. septemspinosa*, but differs in rostral plate shape and colour pattern.

Acanthosquilla humesi was distinguished from *B. phalangium* (as *A. acanthocarpus*) by having four pairs of fixed primary teeth, each with an intervening denticle instead of two pairs of fixed primary teeth with four "intermediate" denticles (Manning, 1968b). Restudy of the type material of both species shows that the first and second "primary tooth" in *A. humesi* is indistinguishable from the first and third "intermediate denticle" in *B. phalangium*. The two species are identical in every respect, including colour pattern. Therefore *A. humesi* must be considered a synonym of *B. phalangium*.

Habitat. U-shaped burrows are constructed in intertidal sand or sandy-mud flats to less than 10 m depth.

Distribution. Western Indian Ocean to the western Pacific including northern Australia.

Hadrosquilla Manning, 1966

Hadrosquilla Manning, 1966: 115. Type species *Lysiosquilla perpasta* Hale, 1924, by original designation and monotypy. Gender feminine.

Diagnosis. Eye with cornea subglobular, peduncle partially concealed by rostral plate. Rostral plate quadrate. A2 protopod with 2 mesial and 1 ventral papillae. Dactylus of raptorial claw with 4–6 teeth; ischium without outer distal spine. Mandibular palp absent. MXP1–4 with epipod. AS6 with posterolateral spines; posterior margin of sternum unarmed. Telson thick, with 3 pairs of primary teeth (movable SM, fixed IM and LT teeth); with 2 IM denticles; dorsal surface with blunt, posteromedian projection, blunt lobes or teeth forming false eave above marginal armature. Uropodal protopod terminating in 2 slender flattened spines, ventrally carinate, inner longer, without ventral spine anterior to endopod articulation.

Included species. Two: *H. perpasta* (Hale, 1924) and *H. edgari* n.sp.

Remarks. *Hadrosquilla melanocauda* Kunze, 1981, is transferred to *Austrosquilla* above, and *H. edgari* is newly described from Tasmania. Both species of *Hadrosquilla* are endemic to southeastern Australia.

Key to species of *Hadrosquilla*

1 Rostral plate with rounded anterolateral angles; anterior margins transverse or sloping posteriorly. Telson with posteromedian projection rounded posteriorly. Dorsal posterior armature of the telson unsculptured, armed with 2 short spines either side of midline .... ***H. edgari***

—— Rostral plate with angular anterolateral angles; anterior margins concave. Telson with posteromedian projection rounded flattened, often medially emarginate. Upper, posterior armature of the telson sculptured, armed with 4–5 short spines either side of midline .... ***H. perpasta***

Hadrosquilla edgari n.sp.

Fig. 80

Lysiosquilla perpasta.–Stephenson, 1955: 2–4.–Edgar, 1997: 180 (not *Lysiosquilla perpasta* Hale, 1924).

Type material. (All Tasmania). HOLOTYPE: AM P52768, 1♂ (TL 40 mm), Cloudy Bay Lagoon, 43°26'S 147°13'E, 3 m, on sand, from burrow under rock, G. Edgar, ?Nov 1994. PARATYPES: AM P52767, 1♀ (TL 25 mm), Naracoopa, eastern King I., Bass Strait, 39°56'S 144°08'E, poison stn in tidal pool near jetty, C. Short, 20 Dec 1977; SAM C5798, 1♀ (TL 36 mm), ocean side of Eaglehawk Neck, 43°01'S 147°55'E, I.M. Thomas, 22 Nov 1976; TM No.14401/G-145, 2♂♂ (TL 31–32 mm), 1♀ (TL 33 mm), Tasman Peninsula, 43°06'S 147°58'E, Dr Evans, 9 Dec 1940.

Australian material. TASMANIA: TM G3832, 1♂ (broken, CL 3.5 mm), 1♀ (broken, CL 6.4 mm), Fortescue Bay, Tasman Peninsula, 10 m, sandy bottom, grab, FRV *Penghana*, A. Dartnall, 7 Jun 1977.

Diagnosis. Ocular scales fused, narrow, higher than wide. Rostral plate with short, triangular apical projection; lateral margins subparallel; anterior margins transverse or sloping posteriorly; anterolateral angles rounded; dorsal surface smooth. Raptorial claw dactylus with 6 or 7 teeth. AS6 with posterolateral spine long, slender. Telson posteromedian projection triangular, apex rounded, blunt; without mid-dorsal pits; with 1–2 (usually 2) evenly spaced, posteriorly directed teeth above movable SM tooth and IM denticles.

Description. Eye extending beyond A1 peduncle segment 2; partially concealed by rostral plate. Ophthalmic somite anterior margin broadly rounded. Ocular scales narrow, higher than wide; rounded, fused (emarginate in 1 specimen). A1 peduncle 0.39–0.51 CL. A2 scale 0.25–0.30 CL. Rostral plate broader than long; with short, triangular apical projection; lateral margins subparallel; anterior margins transverse or sloping posteriorly; anterolateral angles rounded. Raptorial claw dactylus with 6 or 7 teeth (7 on one side in 2 specimens); outer margin broadly curved, with basal notch; carpus dorsal margin terminating in slender acute spine, directed ventrally. TS5 lateral process obsolete. TS6–8 lateral process broadly rounded. TS8 sternal keel rounded, low. AS6 smooth, with long, slender posterolateral spine; with slender ventrolateral spine and broad triangular lobe anterior to uropodal articulation; sternum posterior margin unarmed. Telson posteromedian projection triangular, apex rounded, blunt; without mid-dorsal pits; with 1–2 (usually 2) evenly spaced, posteriorly directed teeth above movable submedian tooth and intermediate denticles; intermediate and lateral teeth broad, stout; lateral margins unarmed; 3 or 4 SM denticles either side of midline, spiniform, forming inverted V in posterior

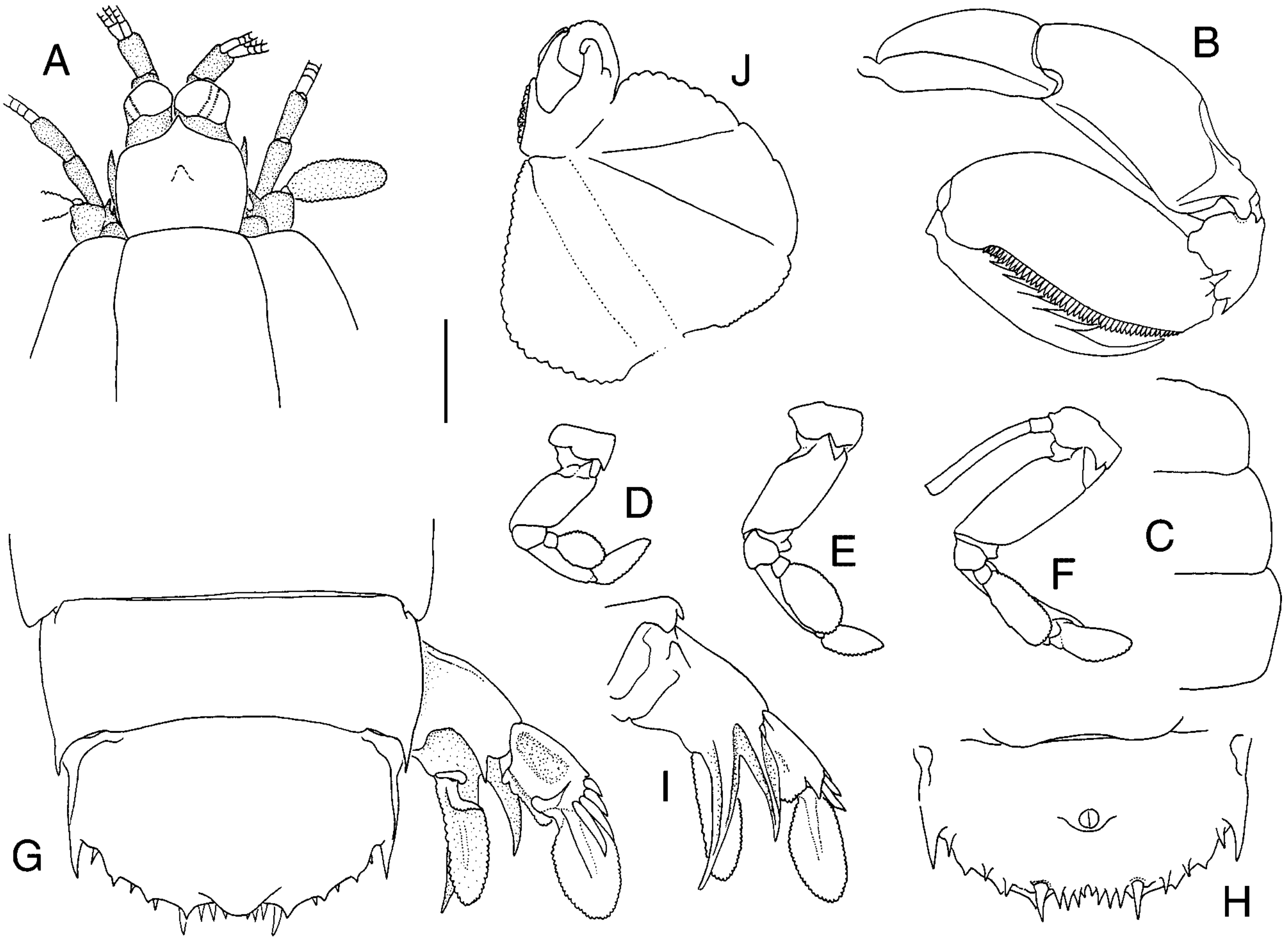

Figure 80. *Hadrosquilla edgari* n.sp., holotype ♂ TL 38 mm. A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, AS5–6, telson & uropod, dorsal. H, telson, ventral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2 mm; J = 1 mm.

view, inner smallest; IM and LT denticles short, slender. Uropodal exopod proximal segment inner margin with broad, round, distal lobe; outer margin with 4 (5 on one side of 1 specimen) movable spines, distalmost reaching or exceeding midlength of distal segment; distal segment longer than proximal segment.

Colour in life. Translucent creamy white with scattered dark chromatophores over entire surface in variable density. Specimens may appear relatively pale, or dark depending on chromatophore density.

Measurements. Male (n = 4) TL 31–40 mm, female (n = 4) TL 25–36 mm. Other measurements of holotype: CL 8.0 mm, A1 peduncle 3.1 mm, A2 scale 2.0 mm.

Etymology. Named for Graham Edgar, University of Tasmania, who collected the holotype.

Remarks. *Hadrosquilla edgari* n.sp. closely resembles *H. perpasta* but differs in the following characters: the ocular scales are narrower than in *H. perpasta*; the rostral plate anterolateral angles are rounded instead of distinctly angled and the anterior margins are transverse or sloping posteriorly instead of concave; the AS6 lateral spines are long and slender rather than short and triangular; the posteromedian projection of the telson is rounded or blunt rather than flattened and medially emarginate; the upper, posterior armature of the telson is unsculptured and is armed with two short spines instead of four to five; and there are no pits on the dorsal midline of the telson. The number of teeth on the dactylus of the raptorial claw and number of movable spines on the outer margin of the uropodal exopod differ in range, but overlap. In *H. edgari* n.sp. there are six or seven teeth on the dactylus of the raptorial claw and four (five on one side of the holotype) outer uropod spines whereas in *H. perpasta*, there are four to six teeth on the raptorial claw and five to six (rarely four) outer uropod spines. All specimens of *H. perpasta* reported from Tasmania by Stephenson (1955) are referable to *H. edgari*.

Habitat. Burrows in sand or under rocks on sand; intertidal to shallow sublittoral.

Distribution. Known only from Tasmania.

Hadrosquilla perpasta (Hale, 1924)

Fig. 81

Lysiosquilla perpasta Hale, 1924: 497–499, pl. 33: fig. 1, fig. 382 (type locality: Beare's Point, Queenscliff, Kangaroo I., South Australia); Hale, 1927a: 33, 34, fig. 23; 1927b: 307.–Stephenson, 1952: 9, 10; 1953a: 45, 46.–Stephenson & McNeill, 1955: 245–246.–Guiler, 1956: 3.

Heterosquilla perpasta.–Manning, 1963b: 321.–Holthuis, 1967b: 10.

Hadrosquilla perpasta.–Manning, 1966: 115–118, fig. 7.–Kunze, 1981: 3.

Type material. HOLOTYPE: SAM C184, ♀ (TL 57 mm), Beare's Point, Queenscliff, Kangaroo I., South Australia, 1876.

Australian material. QUEENSLAND: AM P12100, 1♂ (TL 25 mm), 2♀♀ (TL 15–25 mm), Moreton Bay; AM P12291, 3♂♂ (TL 28–32 mm), 2♀♀ (TL 33–34 mm), Myora; AM P12292, 1♂ (TL 38 mm), N of Dunwich lab, Moreton Bay, dug from burrow in *Zostera* flat, with egg mass, 27°31'S 153°24'E, W. Stephenson, 2 Aug 1952; AM P12293, 2♂♂ (TL 28–30 mm), 7♀♀ (TL 28–33 mm), Dunwich, Stradbroke I., Moreton Bay, fairly common under coral stones on flat, R. Domrow, 19 Aug 1952; AM P12294, 3♂♂ (TL 29–30 mm), 1♀ (TL 32 mm), Myora, Moreton Bay,

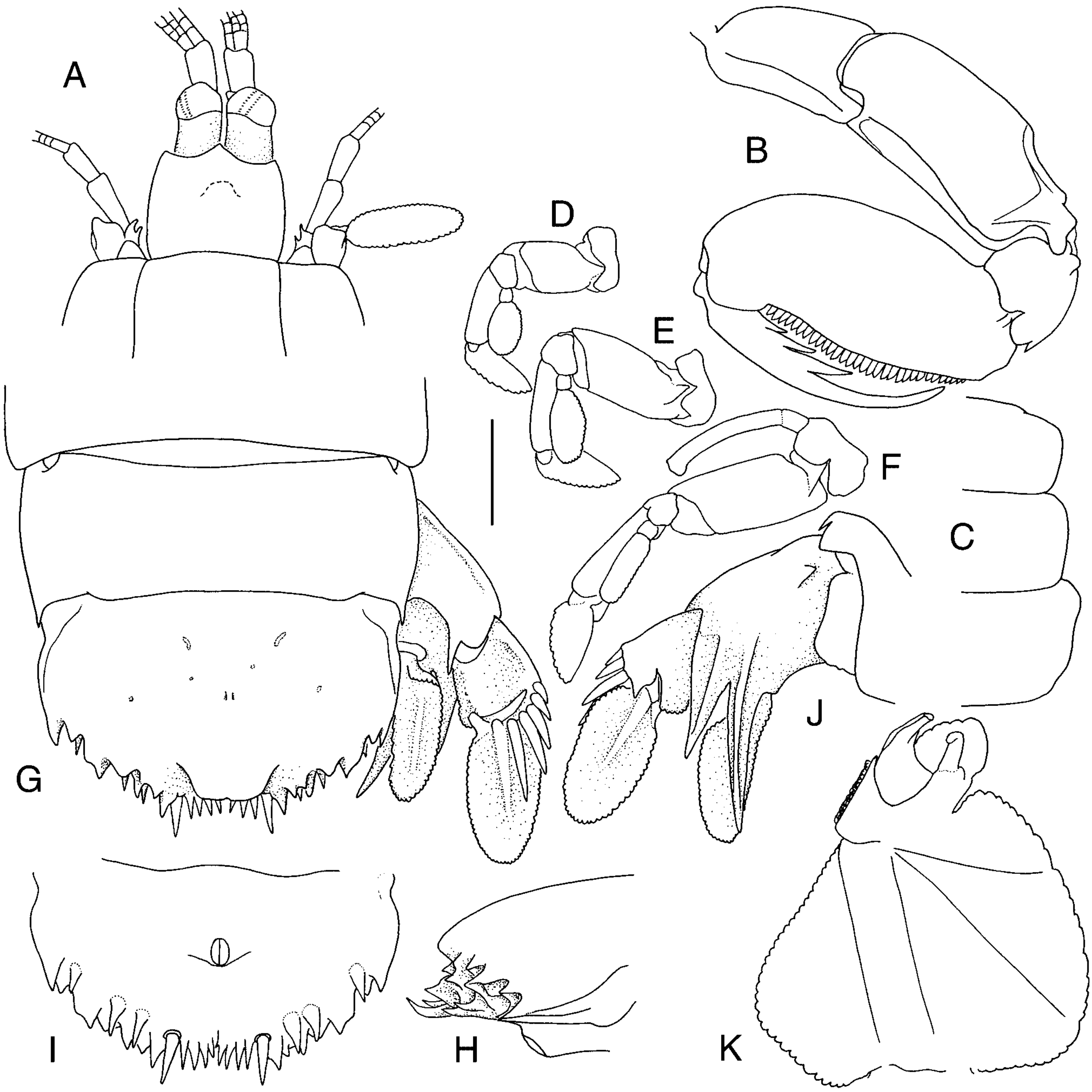

Figure 81. *Hadrosquilla perpasta* (Hale, 1924), ♂ TL 38 mm (SAM C5799). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8 lateral processes, right dorsal. D–F, pereiopods 1–3, posterior. G, AS5–6, telson & uropod, dorsal. H, telson, right lateral. I, telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A–J = 2 mm; K = 1 mm.

27°29'S 153°25'E, under dead coral clump, L. Lavis, 19 Jun 1952; AM P12368, 1♂ (TL 27 mm), 3♀♀ (TL 30–37 mm), Polka Point, Dunwich, Stradbroke I., Moreton Bay; AM P56973, 3♂♂ (TL 28–32 mm), 4♀♀ (TL 28–37 mm), Dunwich, Stradbroke I., Moreton Bay, 27°30'S 153°24'E, low tide, from burrows in *Zostera* flat, yabby pump, S. Ahyong *et al*., Sep 1998; QM W833, 1♀ (TL 28 mm), Bird I., Moreton Bay, sandy mud flat near high water mark, 18 May 1938; QM W1208, 1♂ (TL 19 mm), Myora, Moreton Bay; QM W1772, 1♂ (TL 27 mm), Bird I., Moreton Bay, 18 May 1938; QM W12222, 1♀ (TL 33 mm), N of Dunwich lab, Stradbroke I., Moreton Bay, dug from burrow, low water spring tide, W. Stephenson, 1 Jul 1950; QM, 3♂♂ (TL 32–34 mm), 3♀♀ (TL 34–36 mm), Dunwich, Stradbroke I., Moreton Bay, 27°30'S 153°24'E, low tide, from burrows in *Zostera* flat, yabby pump, S. Ahyong *et al*., Sep 1998. NEW SOUTH WALES: AM P8059, 1♀ (TL 57 mm), Georges River; AM P8942, 2♂♂ (TL 35–39 mm), 2♀♀ (TL 41–47 mm), Kurnell, Botany Bay; AM P9056, 4♂♂ (TL 33–38 mm), 3♀♀ (TL 32–42 mm), Kurnell, Botany Bay; AM P9408, 4♂♂ (TL 38–45 mm), 3♀♀ (TL 39–45 mm), off Sow & Pigs Shoal, Port Jackson; AM P9336, 1♂, Shellharbour; AM P9431, 1♂ (TL 34 mm), Long Reef; AM P11356, 1♂ (TL 48 mm), Gunnamatta Bay, Port Hacking, 34°04'S 151°08.5'E, F. McNeill; AM P16283, 1♂ (TL 45 mm), Long Reef. VICTORIA: AM P8698, 1♂ (TL 23 mm), Seal Point, Port Phillip Bay; AM P52771, 2♂♂ (TL 24–34 mm), 1♀ (TL 29 mm), Bell's Beach, S of Geelong, 0.6 m, low tide, surge channel with sand, rock & algae, rotenone & handnets, D. Hoese & W. Congleton, 18 Mar 1972; AM P52772, 3♀♀ (TL 16–42 mm), Port Campbell, near wharf, from sediment & rubble under dead abalone shell, R. Springthorpe & P. Berents, 28 Apr 1988; AM P52773, 1♀ (TL 30 mm), SW of Anglesea, 0.3 m, surge channel at low tide, rotenone & hand nets, D. Hoese & W. Congleton, 19 Mar 1972; NMV J13873, 1♀ (TL 22 mm), Merricks, Western Port Bay, 38°24'S 145°7'E, 23 Feb 1969; NMV J13884, 1♀ (TL 45 mm), Cinema Point, 38°25'S 144°02'E, 29 Aug 1982; NMV J24170, 1♂ (TL 36 mm), Horseshoe Reef, Fisherman's Cove, western end Bridgewater Bay, 38°23.5'S 141°24.5'E, 5 m, reef, B. Cohen & R. Wilson, 1 Mar 1992; NMV J31519, 1♀ (TL 17.5 mm), Point Leo, Western Port Bay, 38°25'S 145°04'E, under rocks on reef platform, G. Poore *et al*., 25 Feb 1993; NMV J37777, 1♂ (TL 40 mm) Grossard Point, McHaffies Bay, Phillip I., 38°28'S 145°14'E, 8 Mar 1976; NMV J37838, 1♂ (TL 19 mm), Point Addis, subtidal rock platform, 24 Nov 1982. SOUTH AUSTRALIA: SAM C5799, 4♂♂ (TL 23–37 mm), 8♀♀ (TL16–45 mm), Robe, W. Zeidler *et al*., 10 Feb 1977.

Diagnosis. Ocular scales fused broader than high, rounded. Rostral plate biconcave anteriorly, with angular median projection and distinctly angular anterolateral corners; lateral margins convex. Raptorial claw dactylus with 4–6 teeth. AS6 with posterolateral spine short, triangular. Telson posteromedian projection subquadrate, apex flattened, medially emarginate, occasionally with tubercle in emargination, and with pair of mid-dorsal pits occasionally coalesced as a larger, single pit; posterior margin highly sculptured with 4 or 5 irregularly spaced posteriorly directed lobes or teeth above movable SM teeth and IM denticles, and 1 blunt lobe above lateral denticle; intermediate and lateral teeth broad, stout; lateral margins unarmed; with 4 or 5 SM denticles either side of midline. Uropodal exopod proximal segment outer margin with 5 or 6 (rarely 4) movable spines.

Colour in life. Translucent creamy white with scattered dark chromatophores over entire surface in variable density. Specimens may appear relatively pale, or dark depending on chromatophore density.

Measurements. Male (n = 42) TL 19–47 mm, female (n = 50) TL 15–57 mm. A1 peduncle 0.35–0.44 CL. A2 scale 0.22–0.31 CL. The present series includes the largest known specimen of the species.

Remarks. Characters distinguishing *H. perpasta* from *H. edgari* are discussed above under the account of the latter. In the present material, number of teeth on the raptorial claw varies with locality. Specimens from South Australia bear 4 or 5 (usually 4) teeth on the dactylus of the raptorial claw, 4–6 (usually 4 or 5) dactylar teeth for material from Victoria, and 5 or 6 teeth for material from New South Wales and Queensland. The significance of these differences must be determined by further sampling and it is conceivable that *H. perpasta* as currently understood may prove composite. Presently, however, no characters are available to consistently distinguish material from different localities. Records of *H. perpasta* from Tasmania are referable to *H. edgari* described above.

Habitat. Burrows in sand or sandy-mud flats under rocks, debris or amongst *Zostera*; intertidal to 5 m.

Distribution. Known from scattered localities between Moreton Bay, southeast Queensland, to Robe, South Australia.

Pullosquilla Manning, 1978c

Pullosquilla Manning, 1978c: 18–19. Type species *Austrosquilla litoralis* Michel & Manning, 1971, by original designation.

Diagnosis. Rostral plate triangular or cordiform. A2 protopod with or without papillae. Mandibular palp absent. MXP1–5 with epipod. Ischium of raptorial claw with distal, ventral spine on outer margin. AS6 without posterolateral spines. Telson smooth, unarmed dorsally; posterior and margin armature variable. Uropodal protopod terminating in 2 slender, flattened spines, inner longer; without ventral spine anterior to endopod articulation.

Included species. Four: *P. litoralis* (Michel & Manning, 1971); *P. malayensis* (Manning, 1968a); *P. pardus* Moosa, 1991; and *P. thomassini* Manning, 1978c.

Remarks. *Pullosquilla* most closely resembles *Austrosquilla* in general habitus and in sharing the outer, distal spine on the ischium of the raptorial claw. *Pullosquilla*, however, lacks the posterolateral spines on AS6 that are present in *Austrosquilla*. The type description of *P. malayensis* attributed four epipods to the species. Re-examination of the type material of *P. malayensis* shows that the fifth and often the third or fourth epipods have been broken off. The specimens are in poor condition and were apparently once dried accounting for the damage to those epipods that are in the most exposed positions. Therefore, as in all other species of the genus, *P. malayensis* bears five epipods. All species of *Pullosquilla* occur in the Indo-West Pacific region and three are known from Australia.

Key to species of *Pullosquilla*

1 Telson with ventral surface covered with spinules. AS6 posterior margin with 2 large posteriorly directed spines. Uropodal protopod with 2 spines above articulation with exopod .... ***P. thomassini***

—— Telson with ventral surface without spinules. AS6 posterior margin unarmed. Uropodal protopod with 1 spine above articulation with exopod 2

2 Basal segments of pereiopods 1–2 each with outer, ventrally directed spine .... ***P. litoralis***

—— Basal segments of pereiopods 1–2 each with inner and outer, ventrally directed spine (inner spine shorter than outer) 3

3 Telson with “intermediate” denticles of about equal size and distinctly smaller than intermediate tooth; posterior marginal armature partially obscured in dorsal view by “false eave”. Proximal segment of uropodal exopod with 3 stiff setae on inner distal margin .... *P. malayensis*

—— Telson with first and third “intermediate” denticles larger than second and fourth; first and third “intermediate” denticles of similar size to intermediate tooth; posterior marginal armature fully visible in dorsal view. Proximal segment of uropodal exopod with 1 stiff seta on inner distal margin .... ***P. pardus***

Pullosquilla litoralis (Michel & Manning, 1971)

Fig. 82

Pullosquilla litoralis Michel & Manning, 1971: 237, fig. 1 (type locality: Atiheu Bay, Nuku Hiva I., Marquesas Is).–Manning, 1978c: 19–20.

Type material. HOLOTYPE: USNM 127453, ♀ (TL 19 mm), Atiheu Bay, Nuku Hiva I., Marquesas, A. Michel, 14 Mar 1963.

Australian material. QUEENSLAND: AM P58554, 1♂ (TL 12 mm), 1♀ (TL 13 mm), Lizard I., Queensland, from plankton, R.L. Caldwell, Dec 1999.

Diagnosis. A2 protopod dorsally unarmed; without papillae. Rostral plate triangular; broader than long. Raptorial claw dactylus with 9–12 teeth; outer, inferodistal spine on ischium slender. Pereiopods 1–3 basal segment each with outer ventrally directed spine. AS6 without ventrolateral spine anterior to uropodal articulation; sternum posterior margin unarmed. Telson with blunt posteromedian projection, forming false eave; with 1 pair of movable SM teeth and 2 pairs of fixed primary teeth; with 1 lateral and 4 “intermediate” denticles; with 7–9 SM denticles either side of midline in slightly convex row. Uropodal protopod with one dorsal spine above proximal exopod articulation. Uropodal exopod proximal outer margin with 3 curved, movable spines; proximal segment inner distal margin with 2–5 stiff setae; exopod distal segment ovate, elongate, length less than 3 times breadth; endopod unarmed dorsally, length about 3 times breadth.

Colour in alcohol. Largely faded. Carapace and body with chromatophores, black in the male, red in the female.

Measurements. Male (n = 1) TL 13 mm, female (n = 2) TL 13–19 mm. A1 peduncle 0.50–0.55 CL. A2 scale 0.31–0.36 CL. Manning (1978c) reported specimens to 19 mm TL.

Remarks. The specimens generally agree well with published accounts (Michel & Manning, 1971; Manning, 1978c) but differ in having a slightly different range in the number of teeth on the dactylus of the raptorial claw reported by the latter author (9–12 instead of 10–13). The Australian specimens (TL 13 mm) differ from the figure of the holotype of *P. litoralis* (TL 19 mm) in having a less well-developed false eave on the telson, such that the marginal armature is partially visible dorsally. Such differences relate in part to the orientation of the holotype when illustrated but also resemble allometric variation as reported by Manning (1978c) for a large series of *P. litoralis*. Both specimens were reared from larvae collected from plankton by R.L. Caldwell (University of California, Berkeley) at Lizard Island, Queensland.

Habitat. Manning (1978c) reported that *P. litoralis* burrows in sand beaches, sea grass beds and reef flats in shallow water.

Distribution. French Polynesia to the western Indian Ocean and now from Australia.

Pullosquilla pardus Moosa, 1991

Fig. 83

Pullosquilla pardus Moosa, 1991: 184–185, fig. 8 (type locality: New Caledonia).–Manning, 1995: 23 (list).

Type material. HOLOTYPE: MNHN St 1626, ♂ (TL 45 mm), New Caledonia, DW 238, 50 m.

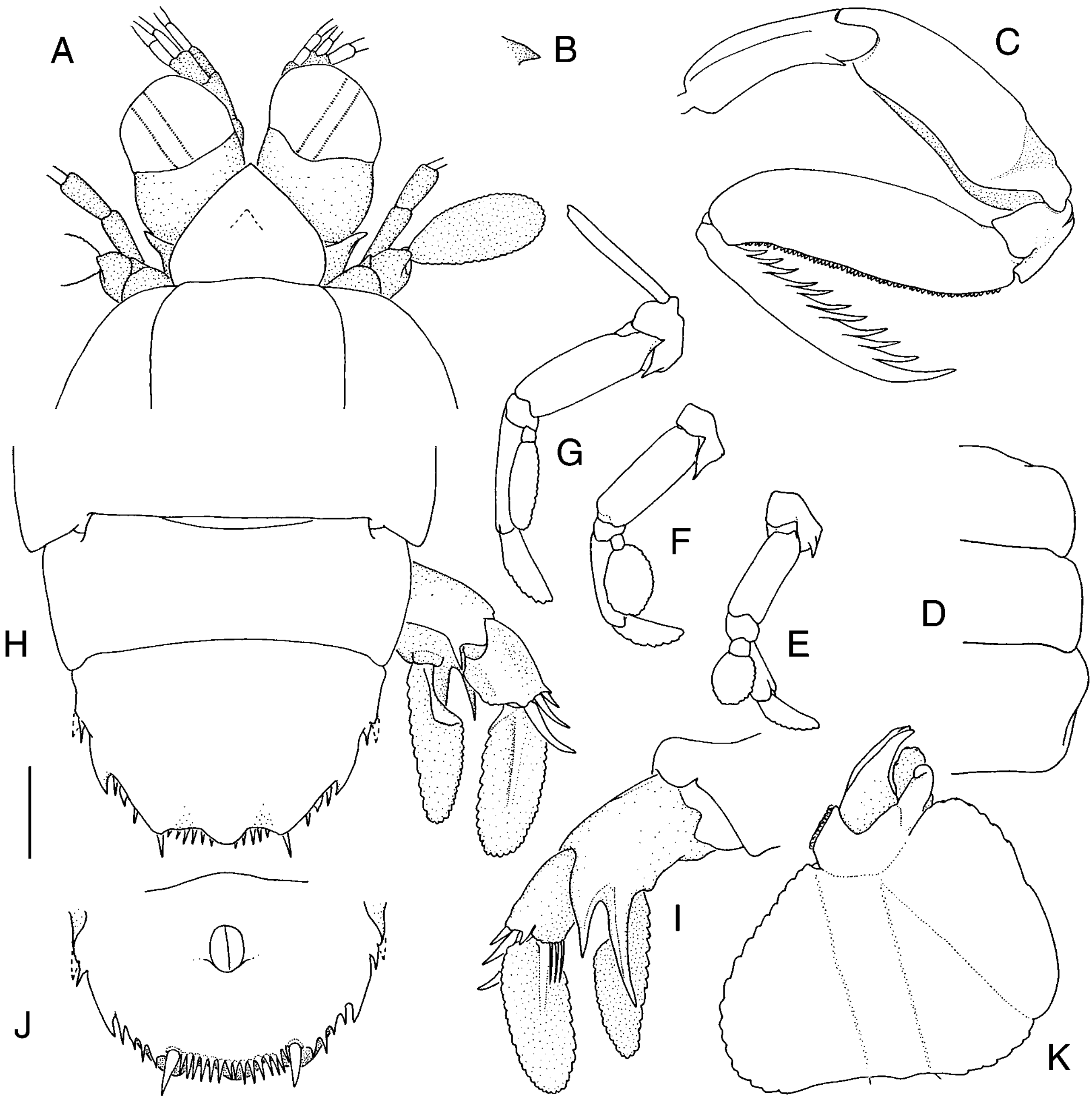

Figure 82. *Pullosquilla litoralis* Michel & Manning, 1971, ♂ TL 13 mm (AM P58554). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS6–8 lateral processes, right dorsal. E–G, pereiopods 1–3, posterior. H, PLP1 endopod, right anterior. I, AS5–6, telson & uropod, dorsal. J, telson, ventral. K, uropod, right ventral. Scale A–G, I–K = 0.5 mm; H = 0.25 mm.

Australian material. WESTERN AUSTRALIA: AM P56964, 1♂ (TL 11 mm), Northwest Shelf, 19°58.7'S 117°49.0'E, 41 m, benthic sled, S0383 D8, 26 Jun 1983; QM W17830–17831, 1♂ (broken, CL 3.9 mm), 1♀ (TL 21 mm), Hibernia Reef, Timor Sea, 11°58.7'S 123°22.9'E, reef lagoon, in sand, 6 m, second tarpaulin site, J. Short, 12 May 1992.

Diagnosis. A2 protopod dorsally unarmed; with 1 mesial and 1 ventral papilla. Rostral plate cordiform; broader than long; broadest in advance of base; lateral margins convex; apex acute. Raptorial claw dactylus with 11–15 teeth; outer, inferodistal spine on ischium slender. Pereiopods 1–2 basal segment each with inner and outer ventrally directed spine. Pereiopod 3 basal segment with outer spine only. AS6 with sharp ventrolateral spine and broad blunt lobe anterior to uropodal articulation; sternum posterior margin unarmed. Telson with blunt posteromedian projection, without false eave; with 1 pair of movable SM teeth and 4 pairs of fixed primary teeth, each with 1 intervening spiniform denticle;

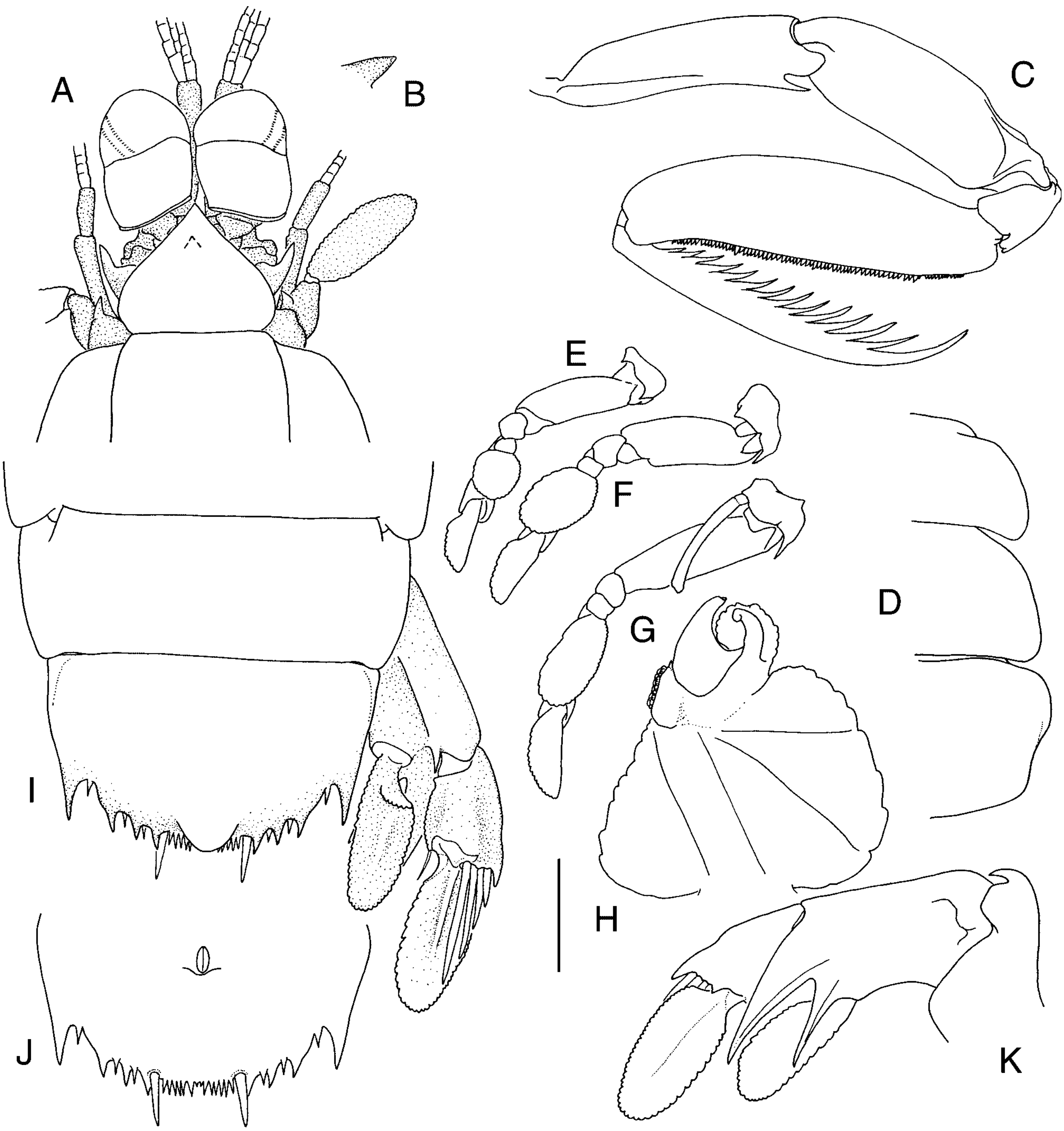

Figure 83. *Pullosquilla pardus* Moosa, ♂ TL 21 mm (QM W17830). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS6–8 lateral processes, right dorsal. E–G, pereiopods 1–3, posterior. H, PLP1 endopod, right anterior. I, AS5–6, telson & uropod, dorsal. J, telson, ventral. K, uropod, right ventral. Scale A–G, I–K = 1 mm; H = 0.5 mm.

with 4–7 SM denticles either side of midline in convex row; lateral margins unarmed. Uropodal protopod with one dorsal spine above proximal exopod articulation. Uropodal exopod proximal outer margin with 4 straight, movable spines; proximal segment inner distal margin with 1 stiff seta; exopod distal segment ovate, elongate, length less than 3 times breadth; endopod unarmed dorsally, length about 3 times breadth.

Colour in alcohol. Largely faded. Carapace with sparse black chromatophores, with diffuse maroon banding on TS5–8, and submedian patches of maroon pigment on AS1–5; with maroon pigment ventrally on TS7–8 and AS1.

Measurements. Male (*n* = 3) TL 11–45 mm, females (*n* = 1) TL 21 mm. A1 peduncle 0.44–0.47 CL. A2 scale 0.27–

0.32 CL. The holotype of *P. pardus* is the largest known specimen of the species.

Remarks. The Timor Sea specimens differ from the holotype in bearing more teeth on the raptorial claws (14 or 15 instead of 12), and more submedian denticles on the telson (6 instead of 4 or 5), but otherwise agree well with the type description. The smallest specimen, a juvenile male (TL 11 mm), closely resembles the holotype (TL 45 mm) in all respects including telson morphology, but differs in bearing 11 instead of 12 teeth on the raptorial claw, and in having an undeveloped petasma.

The male and female from the Timor Sea were collected in the same lot and were likely a mated pair. Pairing behaviour has not been reported for *P. pardus*, but several other lysiosquilloids, including other species of *Pullosquilla* are known to form monogamous pairs (Caldwell, pers. comm.).

Pullosquilla pardus closely resembles *P. malayensis* (Manning, 1968a) but appears to reach a considerably larger size. *Pullosquilla malayensis* is not known to exceed 20 mm TL. The main differences between *P. pardus* and *P. malayensis* are outlined by Moosa (1991) and in the key to species given above.

Habitat. Level sandy substrates in 6–50 m depth.

Distribution. New Caledonia and now the Timor Sea and the Northwest Shelf, Australia.

Pullosquilla thomassini **Manning, 1978c**

Fig. 84

Lysiosquilla n. sp.–Odhner, 1923: 7.
Pullosquilla thomassini Manning, 1978c: 20–21, fig. 9 (type locality: Grand Recif, Tuléar, Madagascar); 1980a: 269–270.

Type material. PARATYPES: USNM 156254, 1♀ (TL 17 mm), Tuléar, Madagascar, sand flats; USNM 156276, 1♂ (TL 10 mm), Tiahura reef complex, Moorea, Society Is, B. Thomassin, 1973.

Material. QUEENSLAND: AM P57194, 1♂ (TL 19 mm), 1♀ (TL 20 mm), Lizard I., Great Barrier Reef, in front of research station, mid low water line, dug from burrows, fine slightly muddy sand, R. Caldwell, Aug 1998.

Diagnosis. A2 protopod with blunt mesial projection; without ventral papillae. Rostral plate cordiform; slightly longer than broad; broadest in advance of base. Raptorial claw dactylus with 12–16 teeth; ischium with slender outer inferodistal spine. Pereiopod 1–3 basal segment each with posterior ventrally directed spine. AS6 with sharp ventrolateral spine and broad rounded lobe anterior to uropodal articulation; sternum posterior margin with narrow median concavity and slender spine laterally. Telson smooth dorsally; posterior margin produced to a false eave with 12–22 short posteriorly directed spines in sinuous row above marginal armature; SM teeth spiniform with movable apices; with 11–18 SM denticles either side of midline in broadly convex row; lateral margins with short 4 broad, curved short spines, decreasing in size posteriorly, each with flanked ventromesially by slender spine; midventral surface entirely covered with short, posteriorly directed spines. Uropodal protopod with 2 dorsal spines above proximal exopod articulation. Uropodal exopod proximal segment outer margin with 3 movable spines; proximal segment inner distal margin with 2–4 stiff setae; distal segment elongate, length approximately 4 times breadth; endopod length approximately 7 times breadth.

Colour in alcohol. Dorsum covered with white and black stellate chromatophores, most dense laterally. Telson with white and black chromatophores densest posterolaterally. Uropodal exopod distal segment and inner spine of protopod dark.

Measurements. Male (*n* = 2) TL 10–19 mm, female (*n* = 2) TL 17–20 mm. A1 peduncle 0.52–0.54 CL. A2 scale 0.28–0.36 CL. The present series includes the largest known specimen of the species.

Remarks. *Pullosquilla thomassini* is unique in the genus for the elaborate telson spination on the lateral and ventral surfaces. The two specimens examined agree well with the paratypes and type description (Manning, 1978c). As observed by Manning (1978c), the number of spines on the posterior margin of the false eave of the telson increases with increasing size. Like its congeners, *P. thomassini* lives in monogamous pairs. At Lizard Island, Queensland, *P. thomassini* burrows in coarse to fine, *Halimeda*-sand and may occur in densities of up to 20 individuals per square metre, from the shore to a depth of 40 m (R.L. Caldwell, pers. comm.).

Odhner (1923) reported a stomatopod from the Bonin (= Ogasawara) Islands as *Lysiosquilla* n.sp. Odhner's specimen, a 17.5 mm male, is described as having 15 teeth on the dactylus of the raptorial claw, four hook shaped teeth on the telson margins that decrease in size distally, 25 submedian denticles (in total) and a dorsal distal row 13 or 14 spines on the telson. Odhner's *Lysiosquilla* n.sp. is almost certainly referable to *P. thomassini* for it agrees well in all respects with the species.

Habitat. Burrows in sand from the shore to 40 m.

Distribution. Widely distributed in the Indo-West Pacific from Madagascar, the Red Sea, the Ogasawara Islands, French Polynesia, and now Australia.

TETRASQUILLIDAE Manning & Camp, 1993

Tetrasquillidae Manning & Camp, 1993: 88–89 (type genus *Tetrasquilla* Manning & Chace, 1990).
Heterosquillidae Manning, 1995: 123 (type genus *Heterosquilla* Manning, 1963b).

Diagnosis. Cornea bilobed. Raptorial claw dactylus uninflated basally; propodus with 3 or 4 proximal movable spines. Pereiopod 1–2 with subcircular or ovate endopods. Pereiopod 3 endopod slender or oval elongate. Abdominal articulation compact. Telson with primary teeth and denticles distinct, slender, not fused into margin. Proximal margin of uropodal endopod with weak dorsal fold.

Included genera. Eight: *Acaenosquilla* Manning, 1991;

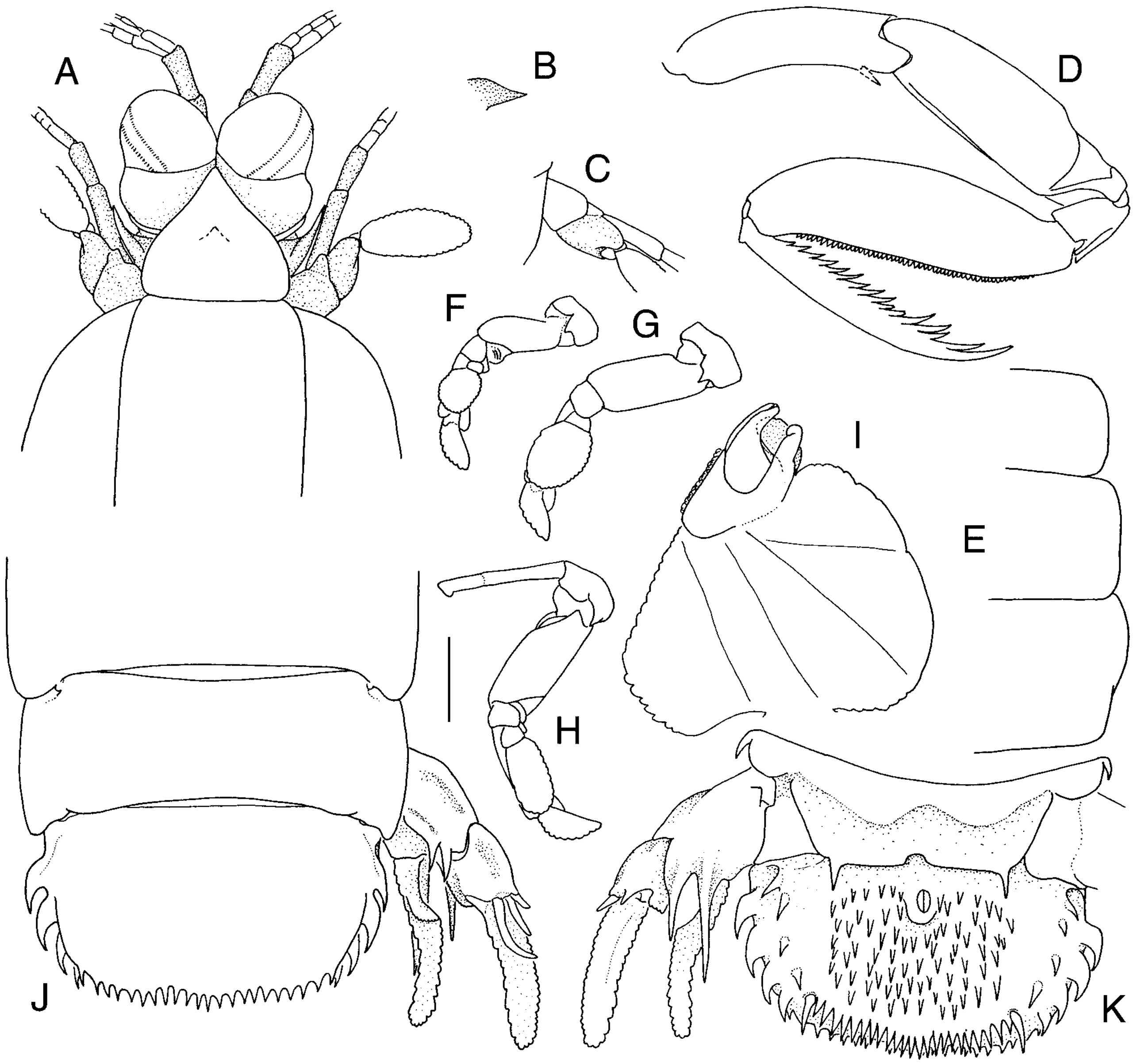

Figure 84. *Pullosquilla thomassini* Manning, ♂ TL 19 mm (AM P57194). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F–H, pereiopods 1–3, posterior. I, PLP1 endopod, right anterior. J, AS5–6, telson & uropod, dorsal. K, telson, AS6 & uropod, ventral. Scale A–H, J–K = 2 mm; I = 1 mm.

Allosquilla Manning, 1977a; *Heterosquilla* Manning, 1963b; *Heterosquilloides* Manning, 1966; *Heterosquillopsis* Moosa, 1991; *Kasim* Manning, 1995; *Tectasquilla* Adkison & Hopkins, 1984; and *Tetrasquilla* Manning & Chace, 1990.

Remarks. Ahyong (1997a) showed that *Paracoridon* Moosa, placed in Heterosquillidae by Manning (1995) belongs in the Coronididae. Survey of morphological variation in genera referred to the Tetrasquillidae and Heterosquillidae sensu Manning (1995) and Ahyong (1997a) shows that the two families should be synonymized. The presence of four teeth on the dactylus of the raptorial claw, used by Manning & Camp (1993) and Manning (1995) to distinguish tetrasquillids is not diagnostic for the family because *Heterosquilla tridentata* also bears four dactylar teeth. Thus, characters of Tetrasquillidae overlap those of Heterosquillidae such that the two families are indistinguishable. Moreover, the results of recent cladistic analyses (Ahyong & Harling, 2000) show that the tetrasquillid and heterosquillid genera are nested together, supporting synonymy of the two families. As also shown by Ahyong & Harling (2000), *Allosquilla* Manning, was incorrectly placed in the Nannosquillidae by Manning (1977a, 1995) and is instead a tetrasquillid.

The systematic position of *Lysiosquilla varicosa* Komai & Tung, 1930, has been subject to some uncertainty because the types are no longer extant and no further specimens are known (see Camp & Manning, 1986). Camp & Manning

(1986) and Manning (1995) tentatively placed it in the Nannosquillidae. The figures of the type of *L. varicosa*, however, suggest that it is referable to *Allosquilla* in bearing a distinctly bilobed cornea, 2 mesial (?) papillae on the antennal protopod, a weak dorsal fold on the uropodal endopod, 4 "intermediate" denticles on the telson, and absence of a postanal spine or spine anterior to the endopod articulation on the uropodal protopod. *Lysiosquilla varicosa* is herein transferred to *Allosquilla*. Two species of *Allosquilla* are now recognized: *A. africana* Manning, 1970d, from the Eastern Atlantic, and *A. varicosa* (Komai & Tung, 1930) n.comb., from Japan.

Only *Heterosquilla tricarinata* (Claus, 1871) and *Tetrasquilla mccullochae* (Schmitt, 1940) are known from the littoral zone (Manning, 1966; Manning & Chace, 1990). *Acaenosquilla* is known from depths as shallow as 36 m, but most tetrasquillids have been taken in depths exceeding 50 m, and as deep as 510–590 m for *Heterosquillopsis danielae* Moosa, 1991. Thus, the relatively deep habitats occupied by tetrasquillids in combination with their probably cryptic habits accounts for the few specimens available for study. Tetrasquillids are probably more common than is suggested by the number of specimens available for study.

Key to genera of Tetrasquillidae

1 Telson ventral surface with post-anal spine 2

—— Telson ventral surface without post-anal spine 5

2 Eyes largely concealed by rostral plate. Rostral plate elongate, pentagonal. Dactylus of raptorial claw with 4 teeth. Uropodal protopod without ventral spine anterior to endopod articulation .... *Tectasquilla*

—— Eyes not concealed by rostral plate. Rostral broad basally with apical spine. Dactylus of raptorial claw with more than 4 teeth. Uropodal protopod with ventral spine anterior to endopod articulation 3

3 Rostral plate distinctly longer than broad .... ***Kasim***

—— Rostral plate broader than long 4

4 Dactylus of raptorial claw with 6 or 7 teeth. Telson posterior margin with movable SM teeth and 2 pairs of fixed primary teeth; 4 "intermediate" denticles present .... ***Acaenosquilla***

—— Dactylus of raptorial claw with 8 teeth. Telson posterior margin with movable SM teeth and 4 pairs of fixed primary teeth, each with intervening denticle .... *Heterosquillopsis*

5 Uropodal protopod with outer spine distinctly longer than inner. Cornea subglobular or broadened, not bilobed .... ***Heterosquilla***

—— Uropodal protopod with inner spine as long as or longer than inner. Cornea distinctly bilobed 6

6 A2 protopod without mesial papilla. Uropodal protopod with ventral spine anterior to endopod articulation .... ***Heterosquilloides***

—— A2 protopod with one or two mesial papillae. Uropodal protopod without ventral spine anterior to endopod articulation 7

7 Dactylus of raptorial claw with 4 teeth. A2 protopod with 2 mesial papillae. Mandibular palp present. Upper posterior surface of telson with rows of posteriorly directed spines .... *Tetrasquilla*

—— Dactylus of raptorial claw with 6 or more teeth. A2 protopod with 1 mesial papilla. Mandibular palp absent. Upper posterior surface of telson without rows of posteriorly directed spines .... *Allosquilla*

Acaenosquilla Manning, 1991

Acaenosquilla Manning, 1991: 6. Type species *Lysiosquilla latifrons* de Haan, 1844, by original designation. Gender feminine.

Diagnosis. Eye with cornea strongly bilobed, set transversely on stalk. A2 protopod with 1 ventral papilla. Rostral plate broader than long; with short, broad basal portion and short apical spine; with ventral carina or spine. Raptorial claw dactylus with 6 or 7 teeth; propodus with 4 proximal movable spines. Mandibular palp 3-segmented. MXP1–5 with epipod. Pereiopod 1 endopod distal segment subcircular. Pereiopod 2 endopod distal segment ovate. Pereiopod 3 endopod distal segment slender. AS6 with posterolateral spine. Telson SM teeth with movable apices; with 4 "intermediate" and 1 lateral denticle; dorsal surface with broad, flat, median elevation terminating in a 3 acute spines, laterally with distinct marginal and several posteriorly armed carinae. Telson ventral surface with long postanal spine. Uropodal protopod with ventral spine anterior to endopod articulation.

Included species. Two: *A. brazieri* (Miers, 1880); and *A. latifrons* (de Haan, 1844).

Remarks. *Acaenosquilla* resembles two other tetrasquillid genera, *Heterosquillopsis* and *Kasim* in having both a postanal spine and subcircular or ovate endopods on pereiopod 1 & 2. Both *Acaenosquilla* and *Heterosquillopsis* differ from *Kasim* in having a broad rostral plate; in *Kasim*, the rostral plate is distinctly longer than broad. *Acaenosquilla* most closely resembles *Heterosquillopsis* but can be distinguished by having six to seven instead of eight teeth on the dactylus of the raptorial claw, and two instead of four pairs of fixed primary teeth on the telson. One species of *Acaenosquilla* is known from Australia.

Key to species of *Acaenosquilla*

1 Mesial lobe of cornea with apical tubercle or conical in shape. Telson with 1–3 sharp carinae in depression lateral to median prominence .... ***A. brazieri***

—— Mesial lobe of cornea rounded. Telson without carinae in depression lateral to median prominence .... *A. latifrons*

Acaenosquilla brazieri (Miers, 1880)

Fig. 85

Lysiosquilla Brazieri Miers, 1880: 11, 125, pl. I: figs. 3–6 (type locality: Port Jackson, New South Wales, Australia).–Haswell, 1882: 206.–Whitelegge, 1889: 222.–Bigelow, 1894: 503.–Chilton, 1911: 139.
Lysiosquilla latifrons.–Kemp, 1913: 128 (part).–Stephenson & McNeill, 1955: 248 (not *Lysiosquilla latifrons* de Haan, 1844).
Lysiosquilla latifrons brazieri.–Stephenson, 1962: 38–39, figs. 1e, f, pl. 1: figs. A–D.
Heterosquilla (Heterosquilloides) brazieri.–Manning, 1966: 125–127.
Acaenosquilla brazieri.–Manning, 1991: 6; 1995: 123.

Type material. HOLOTYPE: NHM 79.8, ♀ (TL 99 mm), Port Jackson, J. Brazier.

Australian material. QUEENSLAND: ZMUC CRU 3672, 1♀ (TL 23 mm), Coral Sea, 26°33'S 153°31'E, 55 m, gravel, 5 Nov 1951. NEW SOUTH WALES: AM G5487, 1♀ (TL 79 mm), Port Jackson, dredged, Mr Tiley; AM P13767, 1♀ (TL 56 mm), Kingscliff, 50 m, trawled, L. Wale, Jun 1961; AM P20731, 1♂ (TL 21 mm), off Malabar, Sydney, 54–59 m, dredged; QM W2045, 1♀ (TL 79 mm), off Tweed Heads, 36 m, W. Stephenson, 2 Mar 1961.

Diagnosis. Cornea with mesial lobe conical, with apical tubercle. Rostral plate ventral surface with carina and anteriorly directed spine. Raptorial claw dactylus with 6 or 7 teeth; outer margin faintly sinuous. AS6 posterolateral spine long, slender; with 1 slender spine and 1 broad, blunt triangular lobe anterior to uropodal articulation. Telson with 8–10 (12–15 in juvenile) SM denticles in slightly convex row; IM denticles acute, first and third shorter than second and fourth; lateral denticle slender, elongate; dorsal median elevation broad, flat, sharply defined, terminating in 3 acute spines; laterally with 2 broad, smooth, longitudinal carinae, terminating in a slender spine, inner carina anteriorly continuous with median elevation and separated posteriorly by deep depression, with 1–3 armed, intervening carinae; posterior surface between dorsal and marginal armature in adults with 2 to11 spines or tubercles. Uropodal exopod proximal segment with 6 or 7 movable spines on outer margin.

Colour in alcohol. Largely faded. Carapace with dark, transverse, median and posterior band. AS5 dark posterolaterally. Uropodal endopod dark; exopod distal segment dark excepting outer, distal ⅓.

Measurements. Male (n = 1) TL 21 mm, ♀ (n = 5) TL 23–99 mm. CI 356–553. A1 peduncle 0.47–0.58 CL. A2 scale length 2.80–3.30 width and 0.36–0.44 CL. The present series includes the largest known specimen of the species.

Remarks. *Acaenosquilla brazieri* closely resembles *A. latifrons* from Japan; the two species are distinguished in the key above. The smallest specimen of *A. brazieri* examined is sexually immature and bears more submedian denticles on the telson than adults (12–15 instead of 8–10), typical of postlarvae and juveniles. Unfortunately, no mature males could be studied, so the morphology of the petasma remains unknown.

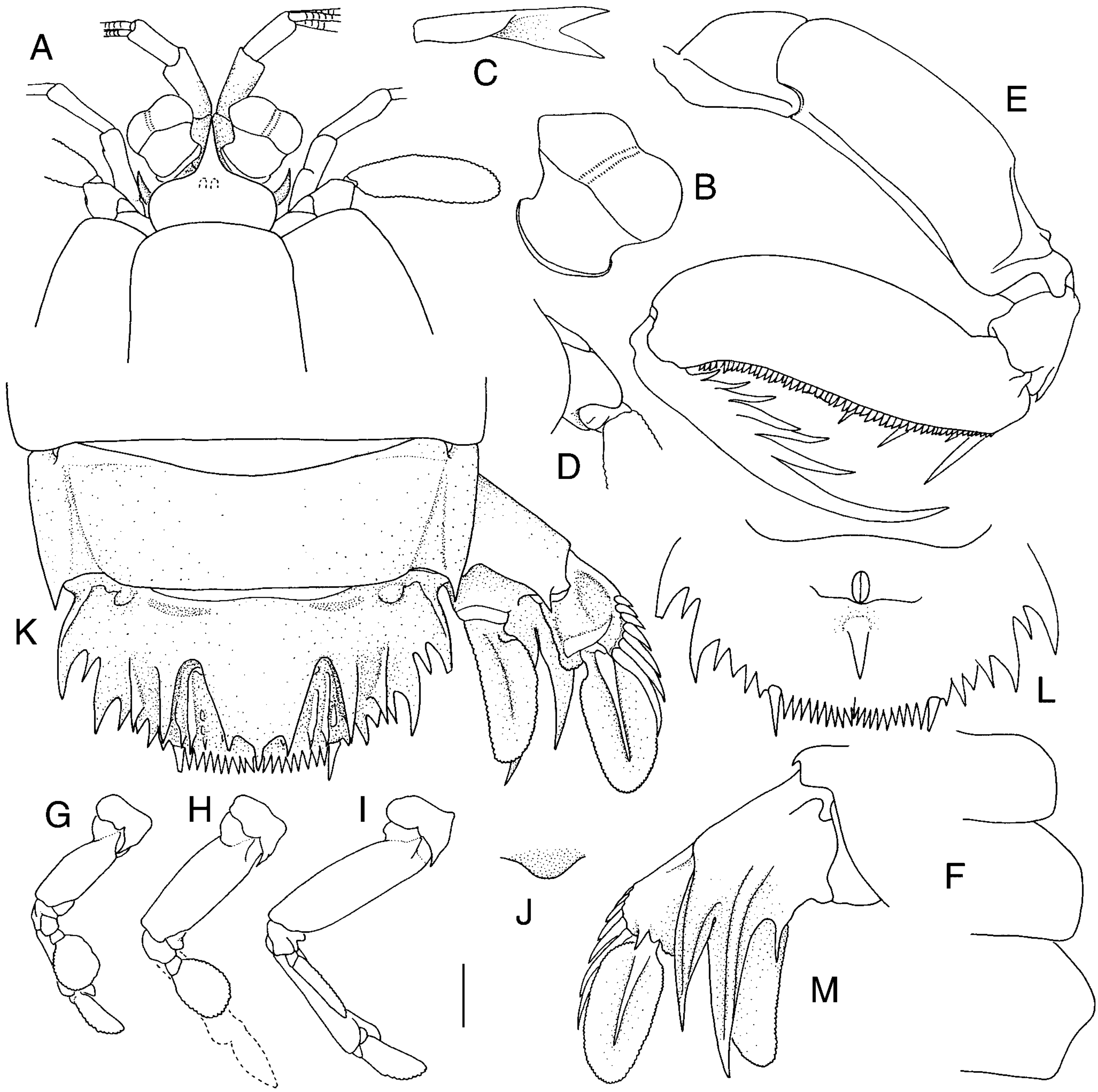

Figure 85. *Acaenosquilla brazieri* (Miers), ♀ TL 79 mm (QM W2045). A, anterior cephalon, dorsal. B, eye, right dorsal. C, rostral plate, right lateral. D, Av2 protopod. E, raptorial claw, right lateral. F, TS6–8 lateral processes, right dorsal. G–I, pereiopods 1–3, posterior. J, TS8 sternal keel, right lateral. K, AS5–6, telson & uropod, dorsal. L, telson, ventral. M, uropod, right ventral. Scale A, E–M = 2 mm; B–D = 1 mm.

Habitat. Taken in depths between 36 m and 54–59 m.

Distribution. New Zealand and the vicinity of Sydney to the New South Wales-Queensland border and the Coral Sea (Manning, 1991). Records from New Zealand require confirmation.

Heterosquilla Manning, 1963b

Heterosquilla Manning, 1963b: 320. Type species *Lysiosquilla platensis* Berg, 1900, by original designation. Gender feminine.

Diagnosis. Cornea subglobular or broadened, not distinctly bilobed, eyes not concealed by rostral plate. A2 protopod with one or two ventral papillae. Raptorial claw propodus with 3 or 4 proximal movable spines. Pereiopods 1–2 with oval elongate endopods. Telson posterior margin with movable, SM teeth and 2 pairs of fixed primary teeth; with 2–4 "intermediate" denticles; ventral surface without post-anal spine. Uropodal protopod with outer spine distinctly longer than inner; with ventral spine anterior to endopod articulation.

Included species. Five: *H. tricarinata* (Claus, 1871); *H. tridentata* (Thomson, 1882) n.comb.; *H. platensis* (Berg, 1900); *H. polydactyla* (von Martens, 1881); and *H. pentadactyla* n.sp.

Remarks. *Heterosquilla* is usually distinguished from *Heterosquilloides* by having two instead of four intermediate denticles on the telson. As discussed under "Terminology", lysiosquilloid genera have two "true" intermediate denticles, and the additional denticles in *Heterosquilloides* are derived from the base of the "true" denticles. Restudy of the species of *Heterosquilla* show that, as in *Heterosquilloides*, each species also has an additional "denticle" of varying size adjacent to each "true" intermediate denticle. Hence, the number of "intermediate" denticles is unreliable in separating *Heterosquilla* from *Heterosquilloides*. *Heterosquilla* differs from *Heterosquilloides* in having six instead of two rows of midband ommatidia on the cornea, and the outer spine of the uropodal protopod is distinctly longer, instead of shorter than or as long as the inner spine. Additionally species of *Heterosquilla* have a subglobular or broadened, but not strongly bilobed cornea. In *Heterosquilloides*, the cornea is strongly bilobed except in *Heterosquilloides armata* in which it is broadened.

Although Chilton (1891) synonymized *Squilla tridentata* Thomson, 1882, with *Lysiosquilla spinosa* (Wood-Mason, 1875) [= *Heterosquilla tricarinata* (Claus, 1871)], *Squilla tridentata* is a distinct species of *Heterosquilla* (see Manning, 1966). The new species of *Heterosquilla* discovered in the present study also represents the first record of the genus from Australia.

Key to species of *Heterosquilla*

1 Rostral plate distinctly longer than broad. Dactylus of raptorial claw with 17–20 teeth .... *H. polydactyla*

—— Rostral plate as broad as or broader than long. Dactylus of raptorial claw with fewer than 16 teeth 2

2 Dactylus of raptorial claw with 4 or 5 teeth 3

—— Dactylus of raptorial claw with 9 or more teeth 4

3 Dactylus of raptorial claw with 4 teeth. Rostral plate with lateral margins convex. Basal segment of pereiopod 3 in ♂♂ with inner and outer spine .... *H. tridentata*

—— Dactylus of raptorial claw with 5 teeth. Rostral plate with lateral margins concave. Basal segment of pereiopod 3 in ♂♂ with outer spine only .... ***H. pentadactyla***

4 Cornea broadened laterally. Rostral plate with sinuous lateral margins. Raptorial claw with 13–15 teeth on dactylus; propodus with 4 proximal movable spines. AS6 with distinct LT carinae .... *H. platensis*

—— Cornea subglobular. Rostral plate with convex lateral margins. Raptorial claw with 9–15 teeth on dactylus; propodus with 3 proximal movable spines. AS6 without distinct LT carinae, at most indicated by shallow groove .... *H. tricarinata*

Heterosquilla pentadactyla n.sp.

Fig. 86

Type material. HOLOTYPE: NMV J13877, ♂ (TL 43 mm), western Bass Strait, 55 km SW of Cape Otway, 39°16.7'S 143°06.7'E, 95 m, shelly sand, rock dredge, R. Wilson, 21 Nov 1981.

Diagnosis. Cornea subglobular. Rostral plate length and breadth subequal, trianguloid; lateral margins sinuous; apex slightly deflexed, blunt; with short, broad, median sulcus anteriorly. Raptorial claw dactylus with 5 teeth. Pereiopods 1–2 basal segment with inner and outer, ventrally directed spine; pereiopod 3 with outer spine only (at least in males). AS6 without submedian or intermediate carinae; lateral spine short, triangular; with blunt, triangular projection anterior to uropodal articulation. Telson SM teeth separated by V-shaped fissure; SM denticles, forming inverted V in posterior view; with 4 "intermediate" denticles; dorsal surface with broad, flat, median elevation and submedian carina each with blunt apex. Uropodal protopod inner spine slender, ½ length of inner margin of outer spine.

Description. Eye not extending beyond A1 peduncle segment 2; cornea subglobular, inclined laterally on stalk, partially concealed by rostral plate. Ophthalmic somite anterior margin flattened. Ocular scales quadrate, fused. A1 peduncle 0.50 CL. A1 somite dorsal processes with acute apices acute; spiniform directed anterolaterally. A2 protopod dorsally unarmed; ventrally with small anteriorly directed spine. A2 scale 0.35 CL. Rostral plate as long as broad, lateral margins sinuous; apex slightly deflexed, blunt; with short, broad, median sulcus anteriorly. Carapace anterolateral angles broadly rounded. Raptorial claw dactylus with 5 teeth, outer margin sinuous, proximal margin with indistinct basal notch; carpus dorsal margin terminating in short blunt tooth, directed ventrally; propodus distal margin

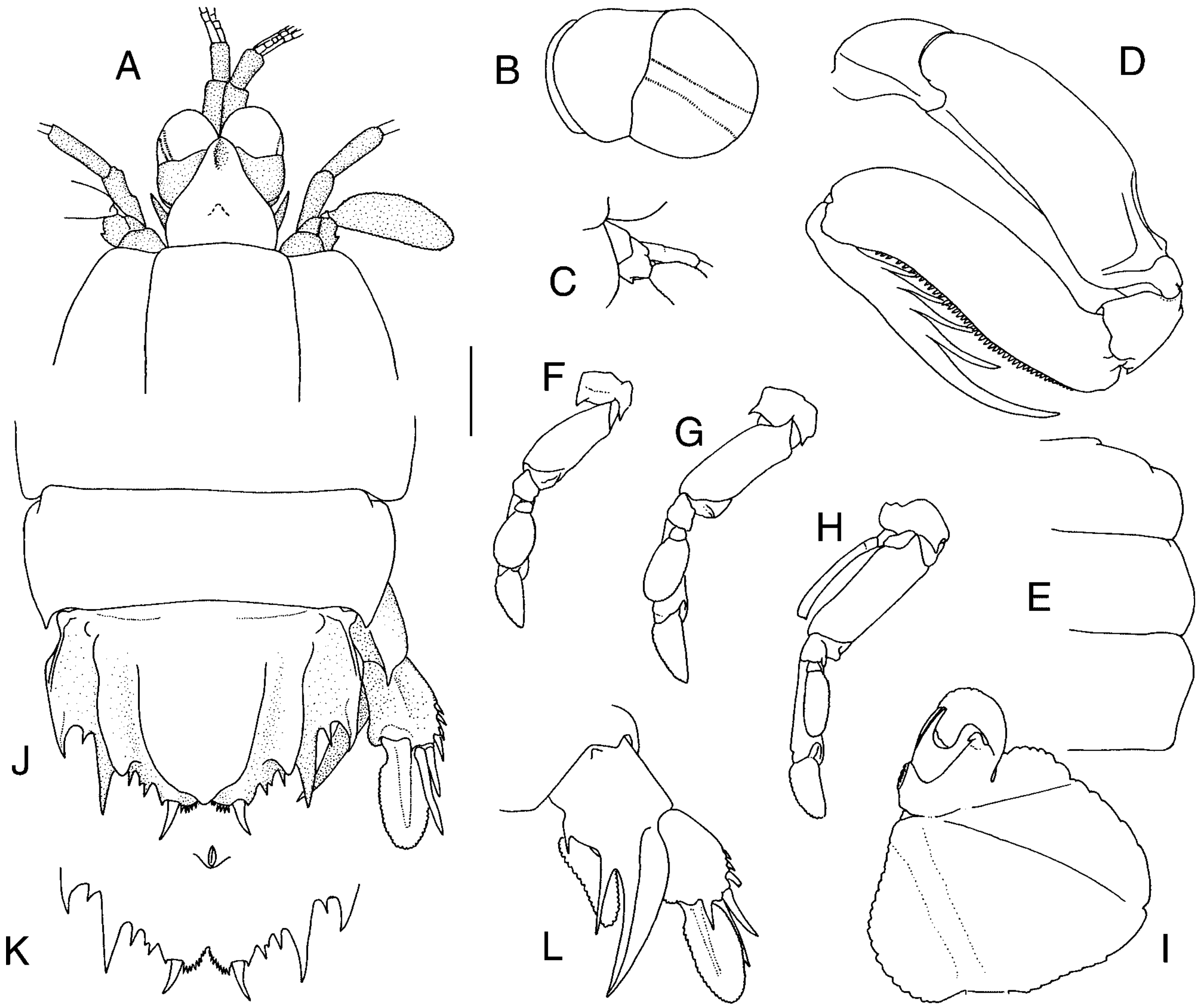

Figure 86. *Heterosquilla pentadactyla* n.sp., holotype ♂ TL 43 mm. A, anterior cephalon, dorsal. B, eye, right lateral. C, A2 protopod, right lateral. D, raptorial claw, right lateral. E, TS6–8 lateral processes, right dorsal. F–H, pereiopods 1–3, posterior. I, PLP1 endopod, right anterior. J, AS4–6, telson & uropod, dorsal. K, telson, ventral. L, uropod, right ventral. Scale A–H, J–L = 2 mm; I = 1 mm.

unarmed; PI 113; ischium less than ½ merus length. MXP 5 basal segment without ventrally directed spine. Pereiopods 1–2 basal segment with inner and outer, ventrally directed spine; pereiopod 3 basal segment with outer, ventrally directed spine only (at least in males); endopod distal segments ovate, slenderest on pereiopod 3. TS5 lateral process obsolete, without ventrally directed spine. TS6–8 lateral process broadly rounded. TS8 sternal keel rounded. AS4–5 smooth; posterior margin unarmed. AS6 smooth, without carinae; posterolateral spine short, triangular; with blunt, triangular projection anterior to uropodal articulation; sternum posterior margin unarmed. Telson thick; SM teeth slender, curved, separated by V-shaped fissure; with 8 or 9 minute SM denticles, forming inverted V in posterior view; with 4 acute "intermediate" denticles, first and third shorter than second and fourth; lateral denticle spiniform. Dorsal surface with broad, flat, median elevation and submedian carina terminating in a blunt lobe. Ventral surface without postanal carina or spine. Uropodal protopod inner spine slender, ½ length of inner margin of outer spine; with slender ventral spine anterior to endopod articulation. Uropodal exopod proximal segment inner margin with broad, round, distal lobe; outer margin with 5 or 6 movable spines, distalmost exceeding midlength of distal segment; distal margin with stout ventral spine. Exopod distal segment longer than proximal segment.

Colour in alcohol. Faded.

Measurements. Male holotype TL 43 mm. Other measurements of holotype: CL 8.5 mm, A1 peduncle 4.3 mm, A2 scale 2.9 mm.

Etymology. The specific epithet alludes to the armature of the raptorial claw and is derived from the Greek, *pente* and *dactylos*.

Remarks. *Heterosquilla pentadactyla* n.sp. closely resembles *H. tridentata* from New Zealand but differs in bearing five instead of four teeth on the dactylus of the raptorial claw, in lacking an inner spine on the basal segment of the third pereiopod (at least in males), and the margins of the rostral plate are sinuous instead of convex.

Habitat. Shelly sand at a depth of 95 m.

Distribution. Known only from Bass Strait, Victoria.

Heterosquilloides Manning, 1966

Heterosquilloides Manning, 1966: 124. Type species *Lysiosquilla insolita* Manning, 1963a, by original designation. Gender masculine.

Diagnosis. Cornea bilobed, with two rows of ommatidia in the midband; eyes not concealed by rostral plate. A2 protopod without mesial papillae. Raptorial claw propodus with 4 proximal movable spines. Pereiopods 1–2 with oval, elongate endopods. Telson with low, irregular dorsal carinae or spinules; posterior margin with movable submedian teeth and 2 pairs of fixed primary teeth; 4 "intermediate" denticles present; telson ventral surface without post-anal spine. Uropodal protopod with inner spine as long as or longer than inner; with ventral spine anterior to endopod articulation.

Included species. Three: *H. armata* (Smith, 1881); *H. insignis* (Kemp, 1911); and *H. insolitus* (Manning, 1963a).

Remarks. One species of *Heterosquilloides*, *H. insignis*, occurs in the Indo-Pacific and is known from Australia.

Key to species of *Heterosquilloides*

1 AS4–6 with numerous spinules along posterior margin .... *H. armata*

—— AS4–6 without numerous spinules along posterior margin, at most with a pair of submedian spines on posterior margin of AS6 2

2 AS6 with pair of submedian spines on posterior margin. A2 protopod with 1 ventral papilla .... *H. insolita*

—— AS6 without submedian spines on posterior margin. A2 protopod with 2 ventral papillae .... ***H. insignis***

Heterosquilloides insignis (Kemp, 1911)

Fig. 87

Lysiosquilla insignis Kemp, 1911: 94–95 (type locality: off North Andaman Is, 14°27'N 93°50'E); 1913: 4, 11, 111, 126–128, pl. 9: figs. 99–102.
Heterosquilla (Heterosquilloides) insignis.–Holthuis, 1967a: 13.
Heterosquilla (Heterosquilloides) insolita.–Manning, 1969c: 58, 60 (Galapagos Is specimen only; not *H. insolita* Manning, 1963a).
Heterosquilla (Heterosquilloides) zarenkovi Makarov, 1978: 179, fig. 2 (type locality: Tonkin Bay, Vietnam, 14°57'N 109°42.8'E).
Heterosquilloides insignis.–Moosa, 1986: 386, pl. 1: fig. c.–Manning, 1991: 6; 1995: 22, 124.

Material. WESTERN AUSTRALIA: NTM Cr00568, 1♂ (TL 65 mm), North West Shelf, 19°0.9'S 116°08.8'E, NWS-40 T/14, 384 m, A. Bruce 30 Jan 1984; NTM Cr000569, 1♀ (TL 55 mm), North West Shelf, 16°56.0'S 119°52.8'E, NWS-69 T/47, 432–434 m, A. Bruce, 5 Feb 1984.

Diagnosis. Eye with cornea strongly bilobed. Ocular scales fused. A2 protopod with 2 ventral papillae. Rostral plate longer than broad; broadest at base. Raptorial claw dactylus with 7 or 8 teeth. Pereiopods 1–2 basal segment with inner and outer, ventrally directed spine. Pereiopod 3 basal segment with outer spine only. TS6 lateral process quadrate. AS1–5 without posterior spinules; AS(3)4–5 each with short posterolateral spine. AS6 with low IM and LT carinae, armed posteriorly; posterior margin unarmed. Telson with 5 or 6 SM denticles either side of midline forming inverted V in posterior view. Dorsal surface median elevation laterally with 3 or 4 rows of irregular carinae or tubercles; upper posterior margin laterally with 1 acute, triangular spine and 1 short, triangular or rounded lobe. Uropodal exopod proximal segment outer margin with 6 movable spines.

Colour in alcohol. Faded.

Measurements. Male (n = 1) TL 65 mm, ♀ (n = 1) TL 55 mm. A1 peduncle 0.47–0.50 CL, A2 scale 0.29–0.31 CL. Moosa (1986) reported a specimens to 91 mm TL.

Remarks. The Australian specimens agree well in most respects with published accounts (Kemp, 1911, 1913; Manning, 1991; Moosa, 1986). The rostral plate in Australian specimens, like that of a specimen from South Africa reported by Manning (1991) bears convex instead of relatively straight margins as figured by Kemp (1913: pl. 9, fig. 99). *Heterosquilloides insignis* most closely resembles *H. insolitus* from the Western Atlantic, and differs chiefly in lacking submedian spines on AS6. The damaged specimen from the Galapagos Islands reported by Manning (1969c) as *H. insolitus* is referable to *H. insignis*.

Habitat. The Australian specimens of *H. insignis* were collected between depths of 384 and 432–434 m, presumably on soft substrates. Manning (1991) reported a bathymetric range of 275–510 m for this species.

Distribution. Widely distributed, from South Africa and the Andaman Islands, the Philippines, to Vietnam, Galapagos Islands and now from northwestern Australia.

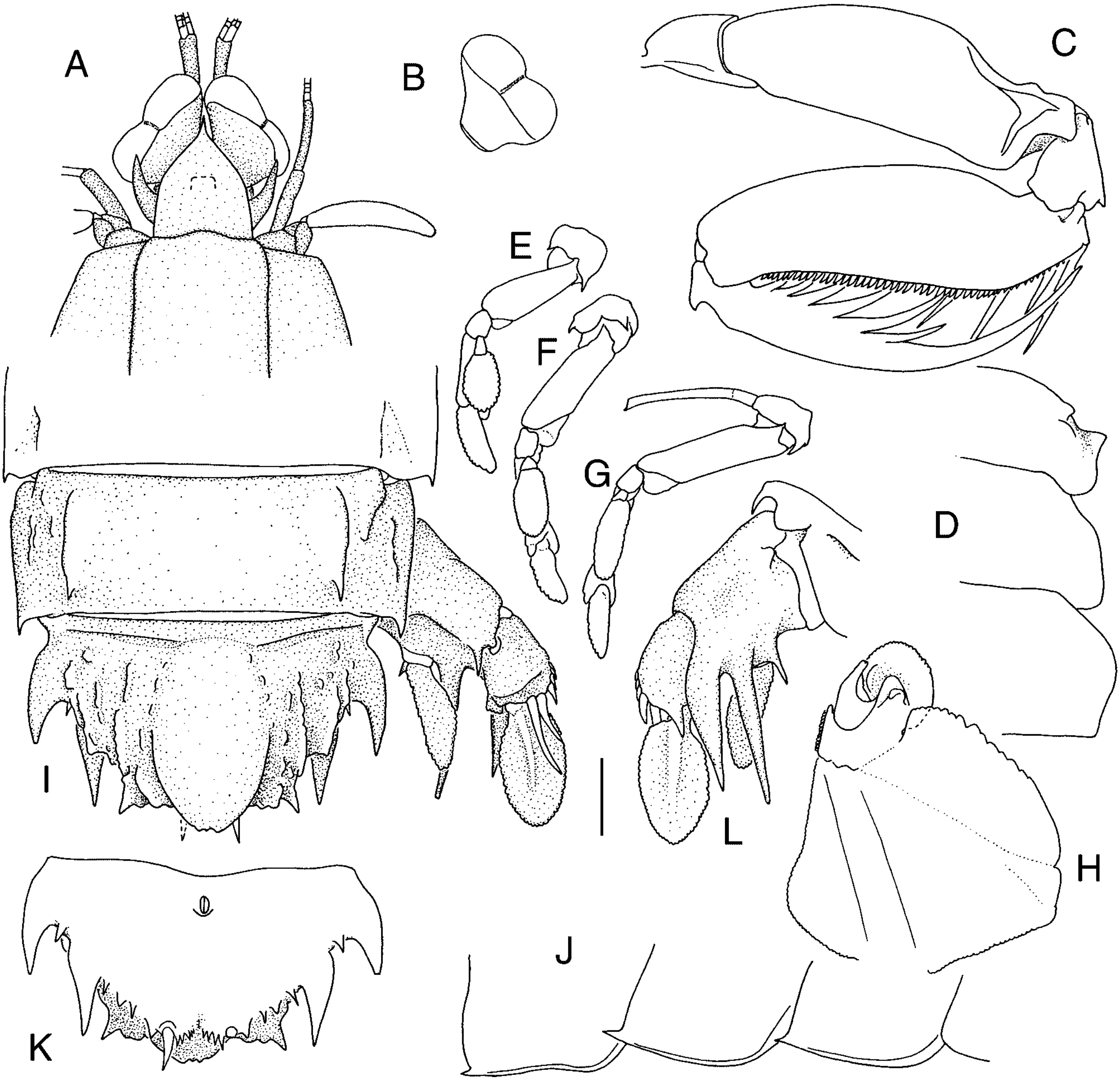

Figure 87. *Heterosquilloides insignis* (Kemp), ♂ TL 65 mm (NTM Cr00568). A, anterior cephalon, dorsal. B, eye, right dorsal. C, raptorial claw, right lateral. D, TS6–8 lateral processes, right dorsal. E–G, pereiopods 1–3, posterior. H, PLP1 endopod. I, AS5–6, telson & uropod, dorsal. J, AS3–5, right lower lateral. K, telson, ventral. L, uropod, right ventral. Scale A–G, I–L = 2.5 mm; H = 1.2 mm.

Kasim Manning, 1995

Kasim Manning, 1995: 124–125. Type species *Heterosquilloides philippinensis* Moosa, 1986, by original designation. Gender feminine.

Diagnosis. Eyes with cornea bilobed, not concealed by rostral plate. Rostral plate longer than broad, with long median spine. Dactylus of raptorial claw with more than 4 teeth; propodus with 4 proximal movable spines. Mandibular palp 3-segmented. MXP1–5 with epipod. Pereiopodal endopod 1–2 distal segment subcircular; endopod 3 distal segment slender. AS6 with posterolateral spine. Telson posterior margin with movable submedian teeth and 2 pairs of fixed primary teeth; 4 or more "intermediate" denticles present; ventral surface with post-anal spine. Uropodal protopod with inner spine longer than outer; with ventral spine anterior to endopod articulation.

Included species. Two: *K. insuetus* (Manning, 1970c); and *K. philippinensis* (Moosa, 1986).

Remarks. *Kasim* includes two described species. One species is known from Australia.

Key to species of *Kasim*

1 Inner margin of cornea conical. Dactylus of raptorial claw with 6 teeth. AS6 with submedian posterior spines and armed intermediate carina. Dorsal surface of telson with 4 or 5 pairs of longitudinal carinae .... ***K. insuetus***

—— Inner margin of cornea rounded. Dactylus of raptorial claw with 7 teeth. AS6 without submedian posterior spines or intermediate carina. Dorsal surface of telson without longitudinal carinae .... *K. philippinensis*

Kasim insuetus (Manning, 1970c)

Fig. 88

Heterosquilla (Heterosquilloides) insueta Manning, 1970c: 81–84, fig. 2 (type locality: Great Australian Bight, Western Australia, 33°43'S 125°04'E, 77 m).
Heterosquillopsis insueta.–Moosa, 1991: 179.
Kasim insuetus.–Manning, 1995: 22, 125.

Type material. HOLOTYPE: AM P16286, ♂ (TL 23 mm), Great Australian Bight, 33°43'S 125°04'E, 77 m, CSIRO Fisheries, 7 Jul 1962.

Australian material. WESTERN AUSTRALIA: SAM C5800, 1♀ (TL 20 mm), Great Australian Bight between Eyre & Eucla, 33°10'S 127°30'E, GAB 036, 100 m, epibenthic sled, S. Hageman *et al*., 17 Jul 1995; WAM C22579, 1♀ (broken, CL 10.5 mm), SW of Rottnest I., 146–151 m, C. Disley, 17 Sep 1965.

Diagnosis. Eye with cornea set transversely on stalk, mesial lobe conical. A2 protopod with small ventral papilla. Rostral plate with short, broad basal portion and long apical spine extending anteriorly beyond eyes; apical spine deflected dorsally, with dorsal and ventral carina. Raptorial claw dactylus with 6 teeth. TS6–7 rounded posterolaterally, not produced posteriorly. AS6 smooth medially; with SM spines on posterior margin and armed IM carinae; posterolateral spines slender. Telson with 14–23 SM denticles either side of midline; with 7–10 "intermediate" denticles. Dorsal surface with flat, low median elevation with 3 longitudinal carinae, each posteriorly armed; laterally with 3 or 4 longitudinal carinae, inner 2 longest and posteriorly armed. Telson ventral surface with short, irregular carinae lateral to postanal spine. Uropodal exopod outer margin with 7 movable spines.

Colour in alcohol. Complete faded excepting a band of sparsely distributed chromatophores across the anterior cephalon.

Measurements. Male (n = 1) TL 23 mm, ♀ (n = 2) TL 20 mm. A1 peduncle 0.52–0.54 CL, A2 scale 0.31–0.32 CL. The present series includes the largest known specimen of the species.

Remarks. *Kasim insuetus* is distinctive in the genus in bearing longitudinal carinae on the dorsal surface of the telson and a conical inner lobe of the cornea. Although *K. insuetus* was originally characterized as lacking papillae on the antennal protopod, the holotype and other specimens reported here all bear a small ventral papilla. The present specimens additional to the holotype are the first records of *K. insuetus* since its description and all agree well except that in the largest specimen (WAM C22579), the median spine of the rostral plate is more strongly developed (Fig. 88F). Unfortunately, the largest specimen lacks the posterior abdominal somites and telson; the TL is estimated at around 50 mm.

The presence of three mid-dorsal carinae on the telson of *K. insuetus* resembles *Erythrosquilla hamano*, newly described above. The median carina on the telson of *K. insuetus*, however, is distinctly lower than that of *E. hamano*. The similarity between the telson ornamentation of the two species is probably convergent because in all other respects, *K. insuetus* resembles most other lysiosquilloids including the presence of a six-row ommatidial midband on the cornea, spiniform dorsal processes on the antennular somite and articulated "flaps" on the outer margin of the pleopodal exopods (Ahyong & Harling, 2000). Additionally, species of *Kasim* bear a postanal spine on the telson, a character restricted to several genera of the Tetrasquillidae.

Habitat. Taken from depths of 77 m to 146–151 m, presumably on soft substrates.

Distribution. Known only from southwestern Australia from the vicinity of Eucla westwards to the vicinity of Rottnest Island.

PARASQUILLOIDEA Manning, 1995

Diagnosis. Cornea bilobed, with 2 or 3 bands of hexagonal ommatidia in the midband. MXP3–4 with propodi ovate, not ribbed or beaded ventrally. Body articulation compact, subcylindrical. Raptorial claw with ischiomeral articulation terminal; dactylus with 3 teeth, not inflated basally; propodus with 3 proximal movable spines. Endopod of PLP1 without lateral lobe. Telson with distinct MD carina; SM teeth with movable apices; with 2 IM denticles. Uropodal protopod with three primary spines; articulation of exopod segments terminal.

Included families. One, Parasquillidae Manning, 1995.

Remarks. As already discussed under the accounts of Eurysquilloidea and Gonodactyloidea, Parasquillidae was referred to a distinct superfamily by Ahyong & Harling (2000). Parasquilloids differ from gonodactyloids, with which they were originally aligned, by having two or three rows of hexagonal ommatidia in the midband of the cornea instead of six rows of rectangular ommatidia, lacking a dorsal spine or articulated plate on the antennal protopod, and in having three instead of two primary terminal spines on the uropodal protopod.

Species of *Parasquilla* and *Faughnia* both occupy relatively deep waters (c. 45–200 m) (Manning, 1969c; Manning & Chan, 1997). Conversely, species of *Pseudosquillopsis* may occur in littoral and shallow sublittoral habitats (Komai, 1938; Manning, pers. comm.).

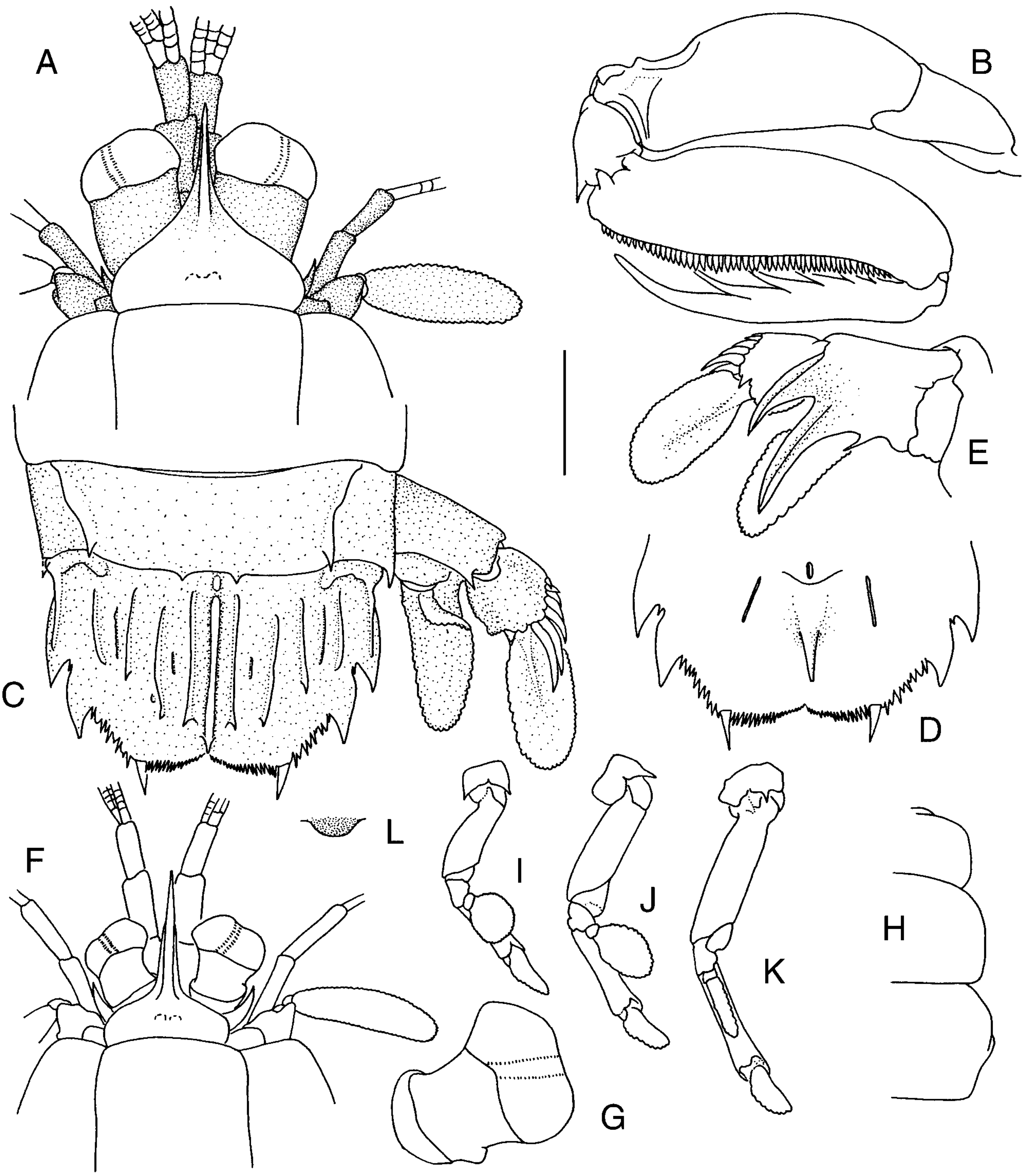

Figure 88. *Kasim insuetus* (Manning). A–E, ♀ TL 20 mm (SAM C5800). F–L, ♀ CL 10.5 mm (WAM 22579). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, AS5–6, telson & uropod, dorsal. D, telson, ventral. E, uropod, right ventral. F, anterior cephalon, dorsal. G, eye, right dorsal. H, TS6–8 lateral processes, right dorsal. I–J, pereiopods 1–3, posterior. L, TS8 sternal keel, right lateral. Scale A–E, = 2.5 mm; F, H–L = 7.5 mm; G = 3.75 mm.

PARASQUILLIDAE Manning, 1995

Parasquillidae Manning, 1995: 91 (type genus *Parasquilla* Manning, 1961b).

Diagnosis. As for superfamily.

Included genera. Three, *Faughnia* Serène, 1962; *Parasquilla* Manning, 1961b; and *Pseudosquillopsis* Serène, 1962.

Remarks. Two parasquillid genera are known from Australian waters and both represent new records.

Key to genera of Parasquillidae

1 Rostral plate longer than broad, with long apical spine .... *Pseudosquillopsis*

—— Rostral plate broader than long 2

2 Carapace with distinct reflected MG carinae. AS1–5 with SM carinae .... *Parasquilla*

—— Carapace with indistinct reflected MG carinae. AS1–5 without SM carinae .... ***Faughnia***

Faughnia Serène, 1962

Faughnia Serène, 1962: 12. Type species *Pseudosquilla haani* Holthuis, 1959, replacement name for preoccupied *Squilla empusa* de Haan, 1844, by original designation and monotypy. Gender feminine.

Diagnosis. Rostral plate without long anterior spine. Carapace with indistinct reflected MG carinae and distinct cervical groove. Raptorial claw carpus dorsal margin with 2 blunt teeth directed ventrally. Body subcylindrical; articulation compact. AS1–5 with indistinct IM, LT and MG carinae; without SM carinae. Telson with minute SM denticles

Included species. Four: *F. formosae* Manning & Chan, 1997; *F. haani* (Holthuis, 1959); *F. profunda* Manning & Makarov, 1978; and *F. serenei* Moosa, 1982.

Remarks. *Faughnia* most closely resembles the Atlanto-Eastern Pacific genus *Parasquilla*, but differs in having indistinct instead of distinct reflected marginal carinae on the carapace and lacks submedian carinae on AS1–5. Two species of *Faughnia* are known from Australian waters; both are new Australian records.

Key to species of *Faughnia* (based on Manning & Chan, 1997)

1 Dorsal surface of telson with MD and 5 pairs of carinae lateral to MD carina. Carinae of SM, IM, and LT teeth extending onto surface of telson; those of SM and LT teeth sometimes interrupted. Uropodal protopod with well-developed spinules on inner proximal margin .... *F. formosae*

—— Dorsal surface of telson with MD and at most 3 pairs of carinae lateral to MD carina. Uropodal protopod with smooth or crenulate inner margin 2

2 Carapace with anterolateral angles produced anteriorly, forming an acute angle. (AS5 with posteriorly armed IM carinae) .... *F. profunda*

—— Carapace with anterolateral angles not produced anteriorly, forming an obtuse angle 3

3 Telson without accessory MD carina, occasionally with low pits or shallow, irregular groove; with anterior IM and MG carinae only. AS5 with IM carina usually armed posteriorly .... ***F. serenei***

—— Telson with distinct, entire, accessory MD carina in addition to anterior IM and MG carinae. AS5 with IM carina unarmed posteriorly .... ***F. haani***

Faughnia haani (Holthuis, 1959)

Fig. 89

Squilla Empusa de Haan, 1844: pl. 51, fig. 6 (preoccupied by *Squilla empusa* Say, 1818; type locality: Japan).
Pseudosquilla empusa.–Miers, 1880: 4, 1884: 567.–Kemp, 1913: 3, 95–96, 104.
Pseudosquilla haani Holthuis, 1959: 179 (replacement name for *Squilla Empusa* de Haan, 1844, preoccupied) (type locality: Japan).
Parasquilla haani.–Lee & Wu, 1966: 44, fig. 2A–D.
Faughnia haani.–Manning & Makarov, 1978: 521.–Yamaguchi & Baba, 1993: 178–179, fig. 10.–Manning & Chan, 1997: 551–552, figs. 2, 4.

Australian material. WESTERN AUSTRALIA: AM P52741, 1♂ (TL 31 mm), Northwest Shelf, 19°28.9–29.0'S 116°29.0–29.4'E, 110–111 m, sand & mud, 26 Oct 1983. NORTHERN TERRITORY: AM P52740, 1♀ (broken, CL 21.0 mm), Arafura Sea, 8°54'S 135°14'E, 78–88 m, E. Blake & J. Paxton, 20 Nov 1980.

Other material. AM P60102, 1♀ (TL 134 mm), off Mugi Town, Tokushima Prefecture, Japan, 33°40'N 134°25'E, 130 m, trawl, Y. Ueta, 6 Apr 1987.

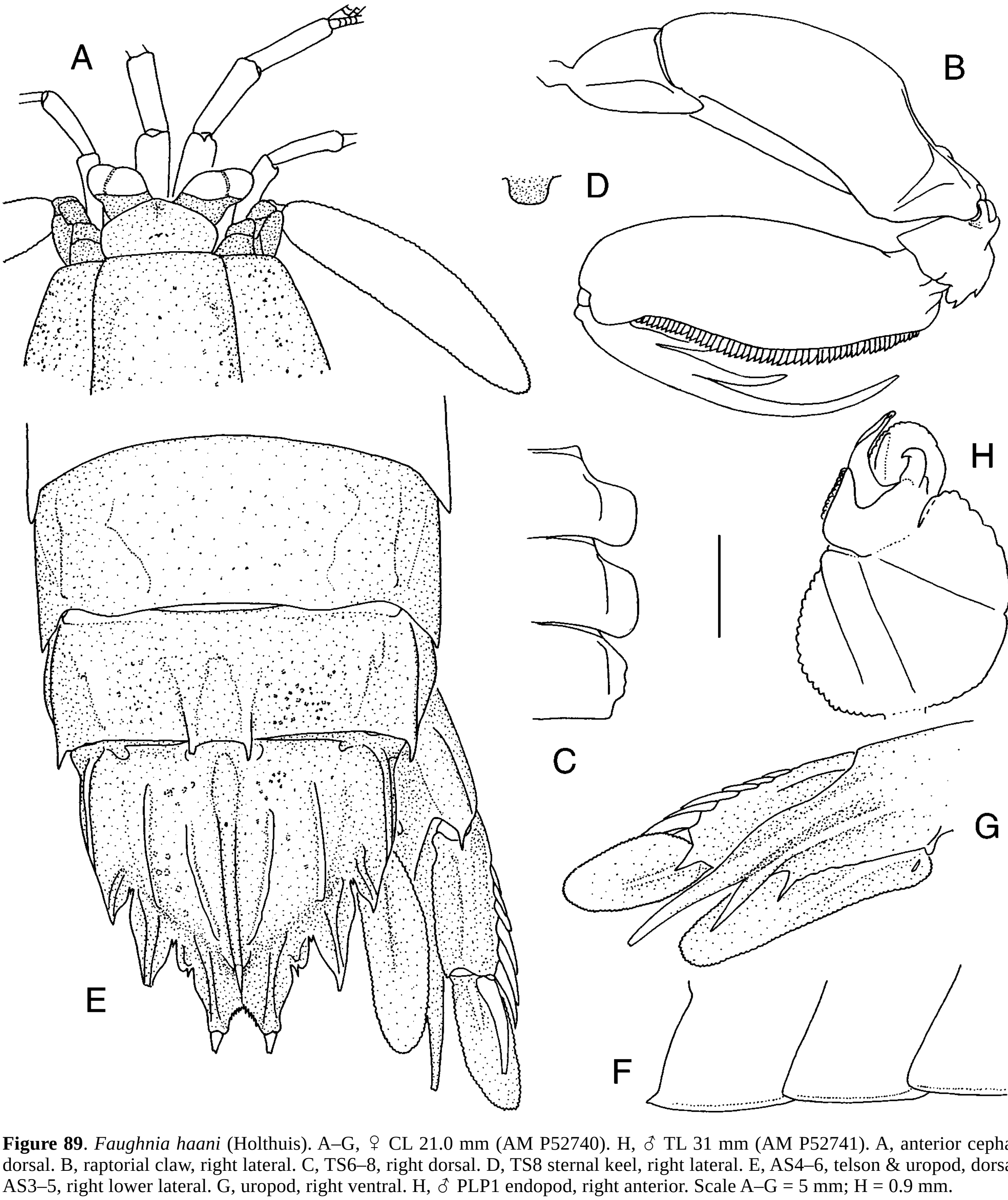

Figure 89. *Faughnia haani* (Holthuis). A–G, ♀ CL 21.0 mm (AM P52740). H, ♂ TL 31 mm (AM P52741). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8, right dorsal. D, TS8 sternal keel, right lateral. E, AS4–6, telson & uropod, dorsal. F, AS3–5, right lower lateral. G, uropod, right ventral. H, ♂ PLP1 endopod, right anterior. Scale A–G = 5 mm; H = 0.9 mm.

Diagnosis. Dorsal surface distinctly pitted. Carapace anterolateral angles rounded, not produced anteriorly. Abdominal carinae spined as follows: SM 6, LT 6, MG (4)5. Telson dorsal surface with 3 longitudinal carinae either side of midline (accessory MD, anterior IM, MG) in addition to carinae of primary teeth; accessory MD, anterior IM and MG carinae uninterrupted; carina of SM tooth extending slightly onto surface of telson; carina of IM and LT teeth short, not extending onto surface of telson. Uropodal protopod inner proximal margin crenulate; exopod proximal segment outer margin with 7 or 8 movable spines.

Colour in alcohol. Faded to dull grey.

Measurements. Male ($n = 1$) TL 31 mm, ♀ ($n = 2$) TL 134 mm, broken specimen CL 21 mm. A1 peduncle 0.61–0.69

CL. A2 scale length 0.57–0.72 CL. Manning & Chan (1997) reported specimens to 147 mm TL.

Remarks. The Australian specimens agree well with published accounts of *Faughnia haani* (see Yamaguchi & Baba, 1993; Manning & Chan, 1997) and a topotypic specimen, differing only in that the anterior margin of the rostral plate is more obtusely angled than figured in the former account.

Habitat. Sand and mud substrates at depths between 78–88 m and 110–111 m. Manning & Chan (1997) reported a bathymetric range of 73 m to 100–200 m.

Distribution. Japan, Taiwan, Hong Kong and now from the Northwest Shelf and Arafura Sea, Australia.

Faughnia serenei Moosa, 1982

Fig. 90

Faughnia serenei Moosa, 1982: 600, figs. 1–5 (type locality: Gulf of Thailand, South China Sea, 15°40'N 109°22.9–28.4'E); 1986: 385.–Manning & Chan, 1997: 552–553, figs. 3, 4.

Type material. HOLOTYPE: LIPI S1729, ♀ (TL 90 mm), Gulf of Thailand, South China Sea, 15°40'N 109°22.9–28.4'E, 110–198 m, shell, detritus & sand, beam trawl, R. Serène, 27 Feb 1960.

Australian material. QUEENSLAND: AM P56914, 1♂ (TL 127 mm), E of Swains Reef, 21°50.36'S 153°00.73'E, 201 m, trawled, QLD 1272, G. McIllwain, 15–16 Sep 1995; AM P56915, 1♀ (TL 143 mm), E of Swains Reef, 21°50.36'S 153°00.73'E, 201 m, trawled, sand & mud, QLD 1268, J. Lowry & K. Dempsey, 15–16 Sep 1995; QM

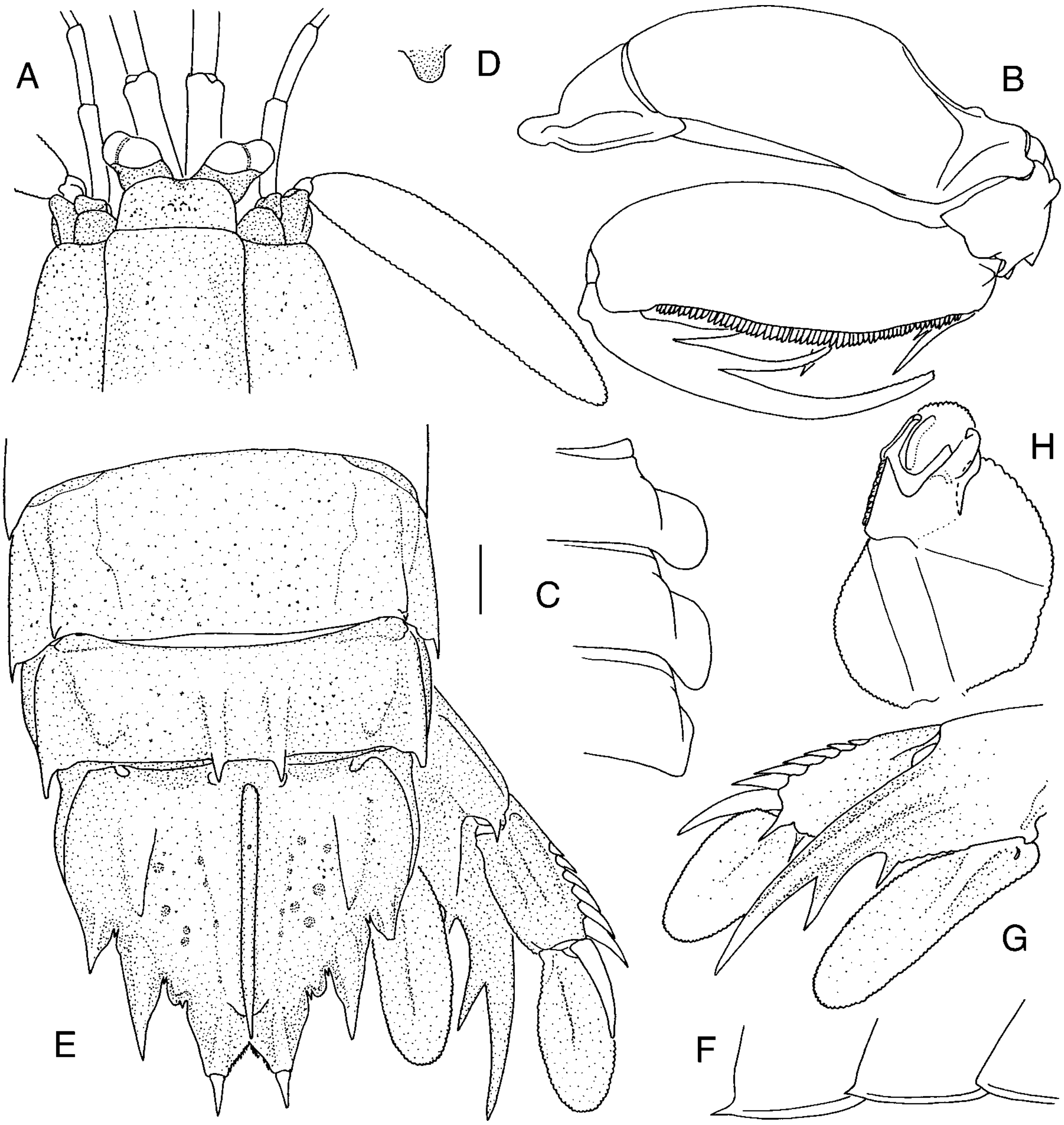

Figure 90. *Faughnia serenei* Moosa, ♂ TL 100 mm (QM W24217). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS6–8, right dorsal. D, TS8 sternal keel, right lateral. E, AS4–6, telson & uropod, dorsal. F, AS3–5, right lower lateral. G, uropod, right ventral. H, ♂ PLP1 endopod, right anterior. Scale A–G = 2.5 mm; H = 1.25 mm.

W11399, 1♂ (TL 122 mm), 22°40'S 153°35'E, 310 m, trawled, M. Dredge, 6 Sep 1983; QM W24217, 1♂ (TL 100 mm), Coral Sea, 18°05.9'S 147°10.8'E, 240–248 m, trawled, continental slope, 8 Dec 1985; QM W24218, 2♂♂ (TL 133–142 mm), Coral Sea, 18°07.7'S 147°11.1'E, 200 m, trawled, continental slope, RV *Soela*, 9 Dec 1985; QM W24199, 1♂ (TL 82 mm), Coral Sea, 17°56.6'S 147°03.4'E, 300–304 m, trawled, continental slope, P. Davie, 29 Nov 1985. WESTERN AUSTRALIA: NTM Cr002016, 2♂♂ (TL 107–132 mm), Northwest Shelf, S0184 086, trawled, T. Ward, 1984.

Diagnosis. Dorsal surface finely pitted, appearing smooth. Carapace anterolateral angles broadly rounded, not produced anteriorly. Abdominal carinae spined as follows: SM 6, IM (5), LT 6, MG (4)5. Telson dorsal surface with 2 longitudinal carinae either side of midline (anterior IM and MG) in addition to carinae of primary teeth; anterior IM and MG carina uninterrupted; carina of SM, IM and LT teeth short, not extending onto surface of telson. Uropodal protopod inner proximal margin crenulate or dentate; exopod proximal segment outer margin with 7–9 movable spines.

Colour in life. Pale yellowish. Pereiopods white with red dactylar setae. Uropodal exopod distal segment dark brown.

Measurements. Male (n = 8) TL 82–142 mm; female (n = 2) TL 90–143 mm. A1 peduncle 0.70–0.77 CL. A2 scale length 0.64–0.83 CL. Manning & Chan (1997) reported specimens as large as 159 mm TL.

Remarks. The Australian specimens agree well with the holotype and published accounts (Moosa, 1982; Manning & Chan, 1997), but differ in coloration from Taiwanese specimens reported by the latter authors. The overall colour of the Australian specimens is pale yellowish grey, whereas those figured by Manning & Chan (1997) are pinkish to orange. The significance of the colour differences is presently unclear; they may represent little more than normal variation since Manning & Chan (1997) reported that some specimens were also relatively pale.

Habitat. Sand and mud substrates at depths of 200–310 m. Manning & Chan (1997) reported a bathymetric range between 73–92 m and 170–230 m.

Distribution. Japan, Taiwan, the Philippines, the Gulf of Thailand (Manning & Chan, 1997), and for the first time from Australia.

Pseudosquillopsis Serène, 1962

Pseudosquillopsis Serène, 1962: 12. Type species *Squilla cerisii* Roux, 1828, by original designation. Gender feminine.

Diagnosis. Rostral plate with long median spine. Ophthalmic somite with triangular anterior margin. Ocular scales fused. Carapace with MG carina only; cervical groove indistinct medially. Raptorial claw carpus dorsally with blunt distal tooth. AS1–5 with MG carina only. Telson without SM denticles in adults.

Included species. Four: *P. cerisii* (Roux, 1828); *P. dofleini* (Balss, 1910); *P. lessoni* (Guérin-Méneville, 1830); and *P. marmorata* (Lockington, 1877).

Remarks. *Pseudosquillopsis* differs from both *Faughnia* and *Parasquilla* in having an elongate, spiniform rostral plate. One species, *P. dofleini*, is known from the Indo-West Pacific and Australia.

Key to species of *Pseudosquillopsis* (based on Manning, 1969e)

1 Inner proximal margin of uropodal protopod with spinules 2

—— Inner proximal margin of uropodal protopod smooth or with low, rounded tubercles 3

2 Spinules on inner margin of uropodal protopod increasing in size distally, with inner primary spine of uropodal protopod not markedly larger than distalmost spinule .... ***P. dofleini***

—— Spinules on inner margin of uropodal protopod small, not increasing in size distally, with distal spinule distinctly smaller than inner most primary spine of uropodal protopod .... *P. cerisii*

3 A1 peduncle as long as or longer than carapace. TS6–7 with lateral processes rounded posterolaterally .... *P. lessoni*

—— A1 peduncle shorter than carapace. TS6–7 lateral processes with posterolateral spine .... *P. marmorata*

Pseudosquillopsis dofleini (Balss, 1910)

Fig. 91

Pseudosquilla dofleini Balss, 1910: 7, fig. 1 (type locality: Misaki, Japan).
Pseudosquillopsis dofleini.–Manning, 1969e: 525, 535, 536.

Australian material. WESTERN AUSTRALIA: WAM C7860, 1♀ postlarva (TL 24 mm), 1.6 km N of West End, net at 18.3 m, P. Cawthorn, 14 Jun 1961; WAM 208–96, 1 late pelagic larva (TL 36 mm), 34 km W of Rottnest I., 36.6 m, larval net, P. Cawthorn, 12 Apr 1962.

Other material. ZMUC CRU2562, 1♂ postlarva (TL 32 mm), Misaki, Japan, Th. Mortensen Expn, 30 Apr 1914.

Diagnosis of adult. A1 peduncle shorter than carapace.

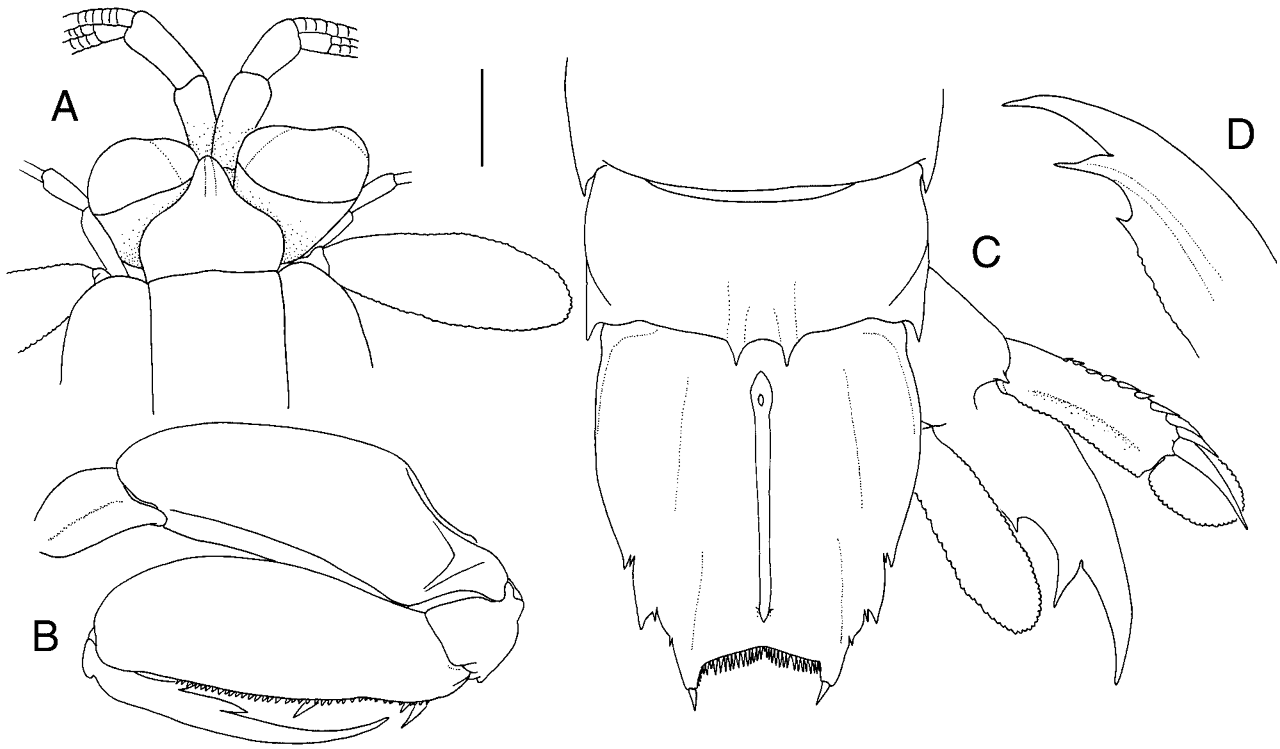

Figure 91. *Pseudosquillopsis dofleini* (Balss), ♀ postlarva TL 24 mm (WAM C7860). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, AS5–6, telson & uropod, dorsal. D, uropodal protopod, right ventral. Scale = 1 mm.

Rostral plate rounded laterally. TS6–7 with lateral processes rounded posterolaterally. Inner proximal margin of uropodal protopod with spinules on inner margin, increasing in size distally, with inner primary spine of uropodal protopod not markedly larger than distalmost spinule.

Description of postlarva. Dorsal integument smooth. Cornea broadened, trilobed (postlarval facies), extending beyond A1 peduncle segment 1; ophthalmic somite anterior margin unarmed; ocular scales low, separate. Carapace without carinae; rostral plate cordiform, broader than long, margins sinuous, apex blunt, anteriorly with low median carina. Raptorial claw dactylus with 3 teeth, outer margin with proximal notch; carpus with blunt distal dorsal tubercle; propodus opposable margin fully pectinate, with 3 movable spines proximally. Mandibular palp 1-segmented. MXP1–5 with epipod. TS6–8 lateral processes rounded. TS8 without sternal keel. Pereiopods 1–3 with 2-segmented endopod, distal segment slender, setose on posterior margin only. AS1–5 without dorsal carinae. AS5 with posterolateral spine. AS6 with SM and posterolateral spines. Telson longer than broad with a low, unarmed MD carina and faint indications of SM and IM carina; MG carina indistinct; SM teeth widely separate, with movable apices; with 15–17 spiniform SM denticles either side of midline. Uropodal protopod with 3 primary spines, inner shortest; unarmed dorsally excepting spine above exopodal articulation; outer margin smooth; inner margin crenulate proximally; exopod proximal segment outer margin with 10 movable spines, distalmost exceeding apex of distal segment.

Colour in alcohol. Faded.

Measurements. Male postlarva ($n = 1$) TL 32 mm, female postlarva ($n = 1$) TL 24 mm, late pelagic larva ($n = 1$) TL 36 mm. Other measurements of postlarvae: A1 peduncle 0.57–0.58 CL, A2 scale 0.46–0.48 CL. The holotype of *P. dofleini* is 85 mm TL (Balss, 1910).

Remarks. The present specimen is identified with *P. dofleini* on the basis of its close agreement with the 32 mm male postlarva from the type locality. Komai (1938) reported a postlarval size range of 23–33 mm TL, so the Australian specimen is within the size range of Japanese material. In both specimens, the inner proximal margin of the uropodal protopod is crenulate, but the Australian specimen differs in having a more distinctly trilobed cornea.

Habitat. Komai (1938: 269) remarked that *P. dofleini* was “rather common in the rocky shores around the Seto Marine Biological Laboratory”.

Distribution. Japan and now from southwestern Australia.

SQUILLOIDEA Latreille, 1802

Diagnosis. Cornea with 2 rows of hexagonal ommatidia in the midband. MXP3–4 with propodi ovate, not ribbed distally. Body depressed, articulation compact. Raptorial claw with ischiomeral articulation terminal, dactylus bearing four or more teeth; propodus with 3 proximal movable spines. Telson with MD carina; SM teeth movable or fixed; with 4 or more IM denticles. Uropodal protopod usually with two primary spines (rarely with one); articulation of exopod segments terminal.

Included families. One, Squillidae Latreille, 1802.

Remarks. Until recently, two families were recognized in Squilloidea: Squillidae Latreille, 1802 (with more than 40 genera), and Harpiosquillidae Manning, 1980b (with a single genus). Diagnostic characters of Harpiosquillidae, namely the excavate posterolateral margin of the carapace and spined margin of the propodus of the raptorial claw, are autapomorphies. Conversely, characters distinguishing Squillidae from Harpiosquillidae, namely the non-excavate posterolateral margin of the carapace and pectinate margin of the propodus of the raptorial claw, are plesiomorphies. Moreover, results of cladistic analyses (Ahyong & Harling, 2000; Ahyong, in prep.) show that Harpiosquillidae is deeply nested within the genera of the Squillidae. Therefore, Harpiosquillidae is synonymized with Squillidae, the single family recognized herein for Squilloidea. Squilloidea differs from other superfamilies in the following combination of characters: the propodi of maxillipeds 3–4 are ovate and lack distal ribbing; the telson bears a distinct median carina and four or more intermediate denticles. Squilloids have two rows of hexagonal ommatidia in the midband of the cornea and most bear longitudinal carinae on the dorsum of the thorax and abdomen. Unfortunately, the number of midband ommatidia or dorsal carinae must be used in combination with other characters when diagnosing squilloids. Two midband ommatidial rows on the cornea are also present in some lysiosquilloids, eurysquilloids and parasquilloids; dorsal carinae are also present in some members of the latter two superfamilies.

SQUILLIDAE Latreille, 1802

Squillares Latreille, 1802: 36 (type genus *Squilla* Fabricius, 1787).
Squillinae.–Giesbrecht, 1910: 148
Squillidae.–Manning, 1968c: 109, 113.
Harpiosquillidae Manning, 1980b: 367, 369 (type genus *Harpiosquilla* Holthuis, 1964); 1995: 148.

Diagnosis. As for superfamily.

Included genera. Forty-four, *Alima* Leach, 1817; *Alimopsoides* Moosa, 1991; *Alimopsis* Manning, 1977b; *Anchisquilla* Manning, 1968c; *Anchisquilloides* Manning, 1977b; *Anchisquillopsis* Moosa, 1986; *Areosquilla* Manning, 1976b; *Belosquilla* n.gen.; *Busquilla* Manning, 1978c; *Carinosquilla* Manning, 1968c; *Clorida* Eydoux & Souleyet, 1842; *Cloridina* Manning, 1995; *Cloridopsis* Manning, 1968c; *Crenatosquilla* Manning, 1984b; *Dictyosquilla* Manning, 1968c; *Distosquilla* Manning, 1977b; *Erugosquilla* Manning, 1995; *Fallosquilla* Manning, 1995; *Fennerosquilla* Manning & Camp, 1983; *Gibbesia* Manning & Heard, 1997; *Harpiosquilla* Holthuis, 1964; *Humesosquilla* Manning & Camp, 2001; *Kempina* Manning, 1978d; *Leptosquilla* Miers, 1880; *Lenisquilla* Manning, 1977b; *Levisquilla* Manning, 1977b; *Lophosquilla* Manning, 1968c; *Meiosquilla* Manning, 1968c; *Miyakea* Manning, 1995; *Natosquilla* Manning, 1978d; *Neclorida* Manning, 1995; *Neoanchisquilla* Moosa, 1991; *Oratosquilla* Manning, 1968c; *Oratosquillina* Manning, 1995; *Paralimopsis* Moosa, 1991; *Parvisquilla* Manning, 1973; *Pontiosquilla* Manning, 1995; *Pterygosquilla* Hilgendorf, 1890; *Quollastria* n.gen.; *Rissoides* Manning & Lewinsohn, 1982; *Schmittius* Manning, 1972b; *Squilla* Fabricius, 1787; *Squilloides* Manning, 1968c; and *Tuleariosquilla* Manning, 1978c.

Remarks. Squillidae contains more genera than any other stomatopod family and several changes to the generic classification are made below. *Keijia* Manning and *Toshimitsu* Manning are synonymized with *Carinosquilla* Manning and *Lophosquilla* Manning respectively. Two genera are newly recognized: *Belosquilla* for a species previously placed in *Alima*, and *Quollastria* for species of the *Oratosquillina gonypetes* group. The results of cladistic analysis of the squilloid genera (Ahyong, in prep.) also show *Squilla* is heterogeneous, supporting recognition of several new genera; they will be treated in future studies. Manning & Heard (1997) recognized *Gibbesia* for *Squilla neglecta* Gibbes, 1850, one of two species of *Squilla* bearing five teeth on the dactylus of the raptorial claw. *Squilla prasinolineata* Dana, 1852, also with five teeth on the dactylus of the raptorial claw, is provisionally transferred to *Gibbesia*.

Aside from the synonymy of Harpiosquillidae with Squillidae, the most significant change to the squilloid classification presented here is the inclusion of *Parvisquilla* in the Squillidae. *Parvisquilla* was transferred from Squillidae to Coronididae by Manning (1978c), but recent examination of specimens of this rare genus has shown them to be squilloid (see remarks under account of Coronididae). The key below distinguishes all squilloid genera recognized herein. Of the 44 genera in the Squillidae, 37 occur in the Indo-West Pacific and 25 are known from Australia. Two genera, *Distosquilla* and *Belosquilla* are endemic to Australia.

Key to genera of the Squillidae

1 Raptorial claw with opposable margin of propodus lined with slender, erect spines. Carapace with posterolateral margins deeply excavate .... ***Harpiosquilla***

—— Raptorial claw with opposable margin of propodus pectinate. Carapace with posterolateral margins rounded or angled, not deeply excavate 2

2 TS5 with lateral process single or obsolete 3

—— TS5 with lateral process bilobed 29

3 Carapace with MD carina 4

—— Carapace without MD carina 5

4 AS1–5 with MD carinae 22

—— AS1–5 without MD carinae 23

5 A1 somite greatly elongate, extending anteriorly well beyond apex of rostral plate 6

—— A1 somite not greatly elongate, not extending beyond apex of rostral plate 8

6 Raptorial claw with 4 or 5 teeth on dactylus. MXP1–3 with epipod 7

—— Raptorial claw with 6 or more teeth on dactylus. MXP1–4 with epipod .... *Leptosquilla*

7 Telson dorsal surface with upright tubercles or numerous carinae; MD carina low, singular or bicarinate. Lateral processes of TS6–7 without posterolateral spine .... *Parvisquilla*

—— Telson dorsal surface smooth, with single, distinct MD carina. Lateral processes of TS6–7 with posterolateral spine .... *Tuleariosquilla*

8 Cornea broader than stalk; stalk less than 3 times length of cornea 10

—— Cornea narrower than or as broad as widest part of stalk; stalk 4 or more times length of cornea 9

9 Eye stout, short; inner margins straight, flattened on proximal ½ to ⅔; cornea narrower than widest part of stalk. (Rostral plate always broader than long. First segment of A2 peduncle always extending anteriorly beyond eyes) .... ***Clorida***

—— Eye elongate; inner margins convex, not flattened on proximal ½; cornea narrower than or as wide as widest part of stalk. (Rostral plate as long as or longer than broad except in *C. chlorida* and *C. stephensoni*. First segment of A2 peduncle not extending anteriorly beyond eyes except in *C. chlorida*) .... ***Cloridina***

10 Ocular scales produced to anteriorly directed spines .... *Pterygosquilla*

—— Ocular scales blunt or rounded, not produced as spines 11

11 SM teeth of telson with fixed apices 12

—— SM teeth of telson with movable apices 13

12 Telson with numerous longitudinal carinae on dorsolateral surface .... ***Anchisquilla***

—— Telson without longitudinal carinae on dorsolateral surface .... ***Lenisquilla***

13 Carapace with anterolateral spines 14

—— Carapace without anterolateral spines 18

14 Mandibular palp absent 15

—— Mandibular palp present 17

15 Inner margin of uropodal protopod lined with spines 16

—— Inner margin of uropodal protopod smooth or crenulate .... *Schmittius*

16 Raptorial claw dactylus with 4 or 5 teeth. Telson with numerous longitudinal carinae lateral to postanal carina .... ***Fallosquilla***

—— Raptorial claw dactylus with 6 teeth. Telson ventral surface at most with postanal carina, without supplementary longitudinal carinae .... ***Levisquilla***

17 Rostral plate with length and breadth subequal. Raptorial claw dactylus with 7 or 8 teeth .... ***Neoanchisquilla***

—— Rostral plate distinctly longer than broad. Raptorial claw dactylus with 5 teeth .... *Neclorida*

18 Raptorial claw dactylus with 4 teeth 20

—— Raptorial claw dactylus with 5 or 6 teeth 19

19 Uropodal protopod with inner margin smooth or crenulate. Telson dorsolateral surface smooth, at most with shallow pits, without carinae or rows of tubercles .... *Rissoides*

—— Uropodal protopod with inner margin lined with spines. Telson dorsolateral surface with rows of tubercles or carinae .... *Pontiosquilla*

20 AS1–5 with distinct SM carinae .... ***Distosquilla***

—— AS1–5 without SM carinae 21

21 Cornea with anterior margin scalloped. A1 peduncle with spines and tubercles laterally .... *Crenatosquilla*

—— Cornea with anterior straight or concave, not scalloped. A1 peduncle without spines or tubercles laterally .... *Meiosquilla*

22 Raptorial claw dactylus with 5 or 6 teeth. MXP1–4 with epipod .... ***Anchisquilloides***

—— Raptorial claw dactylus with 8 teeth. MXP1–2 with epipod .... *Anchisquillopsis*

23 TS6–7 lateral processes posterolaterally rounded. Telson SM teeth with minute movable apices (adults frequently with insertion visible only). MXP4–5 without epipod .... ***Cloridopsis***

—— TS6–7 lateral processes sharp or angular posterolaterally. Telson SM teeth with fixed apices. MXP4 with epipod. MXP5 epipod present or absent 24

24 Raptorial claw dactylus with 4 teeth .... ***Squilloides***

—— Raptorial claw dactylus with more than 4 teeth 25

25 TS6 lateral process strongly bilobed, with anterior and posterior lobes of similar size 26

—— TS6–7 lateral processes single or not strongly bilobed, with posterior lobe distinctly larger than anterior lobe 27

26 TS5 lateral process a broad lobe with sharp apex. TS7 lateral process with small angular anterior lobe. Raptorial claw dactylus with 7 teeth .... *Fennerosquilla*

—— TS5 lateral process a slender spine. TS7 lateral process strongly bilobed, with large anterior lobe. Raptorial claw dactylus usually with 6 teeth .... ***Kempina***

27 Raptorial claw dactylus with 10 or 11 teeth .... *Humesosquilla*

—— Raptorial claw dactylus with 5 or 6 teeth 28

28 Raptorial claw dactylus with 5 teeth .... *Gibbesia*

—— Raptorial claw dactylus with 6 teeth .... *Squilla*

29 MXP1–5 with epipod. Raptorial claw propodus with sharp distal tooth .... ***Belosquilla***

—— MXP5 without epipod. Raptorial claw propodus without sharp distal tooth 30

30 Dorsum with numerous carinae, tubercles or mesh like ornamentation over dorsal surface in addition to normal complement of carinae 31

—— Dorsum without numerous carinae or tubercles over entire dorsal surface in addition to normal complement of carinae; at most with a few tubercles or one additional carina between carinae of normal complement 33

31 Carapace and mid-dorsal surface of thorax and abdomen covered by reticulated carinae forming fine, mesh-like pattern. Male PLP1 without posterior endite .... ***Dictyosquilla***

—— Carapace and body with numerous tubercles or longitudinal carinae, but not covered by reticulated carinae. Male PLP1 with posterior endite 32

32 Carapace with MD carina not interrupted at base of anterior bifurcation. Entire surface of carapace, thorax, abdomen and telson covered with numerous, closely spaced longitudinal carinae .... ***Carinosquilla***

—— Carapace with MD carina interrupted at base of anterior bifurcation. Carapace not covered by close set longitudinal carinae, but with some coarse tubercles. Thorax and abdomen with supplementary longitudinal carinae mid-dorsally above level of IM carinae. AS1–5 without numerous closely set carinae below IM carinae, but usually with coarse tubercles .... ***Lophosquilla***

33 Telson without prelateral lobe .... ***Alima*** (part)

—— Telson with prelateral lobe 34

34 TS6 lateral process indistinctly bilobed, with anterior margins concave or sinuous 35

—— TS6 lateral process distinctly bilobed 37

35 Raptorial claw dactylus with 6 teeth. MXP1–4 with epipod. Uropodal protopod with 2 lobes between terminal spines .... ***Alimopsoides***

—— Raptorial claw dactylus with 5 teeth. Uropodal protopod with 1 lobe between terminal spines 36

36 Mandibular palp present. MXP1–2 with epipod .... *Alimopsis*

—— Mandibular palp absent. MXP1–4 with epipod .... *Paralimopsis*

37 Carapace with MD carina not interrupted at base of anterior bifurcation 38

—— Carapace with MD carina interrupted at base of anterior bifurcation (branches of bifurcation present or absent) 39

38 Anterior bifurcation of MD carina of carapace opening anterior to dorsal pit. PLP1 endopod in ♂♂ with posterior endite .... ***Oratosquilla***

—— Anterior bifurcation of MD carina of carapace opening posterior to dorsal pit. PLP1 endopod in ♂♂ without posterior endite .... ***Miyakea***

39 Carapace anterior width about 0.6 carapace length. Anterior margin of ophthalmic somite with median spinule or tubercle (Dorsal surface smooth, polished) 40

—— Carapace anterior width about 0.5 carapace length or less. Anterior margin of ophthalmic somite rounded or medially emarginate 42

40 Eye with cornea less than ⅓ carapace length in adults. Raptorial claw dactylus with 6 or 7 teeth .... ***Erugosquilla***

—— Eye large, cornea ⅓ or more carapace length in adults. Raptorial claw dactylus with 5 or 10–18 teeth 41

41 Raptorial claw dactylus with 10–18 teeth; carpus with strongly tuberculate dorsal margin. Anterior margin of ophthalmic somite trapezoid .... *Natosquilla*

—— Raptorial claw dactylus with 5 teeth; carpus with irregular or undivided dorsal carina, at most with distal tubercles. Anterior margin of ophthalmic somite triangular .... ***Busquilla***

42 TS6 lateral process distinctly bilobed 43

—— TS6 lateral process single or indistinctly bilobed, with sinuous anterior margin .... ***Alima*** (part)

43 Raptorial claw merus with inferodistal spine .... ***Oratosquillina***

—— Raptorial claw dactylus without inferodistal spine 44

44 Mandibular palp absent .... *Areosquilla*

—— Mandibular palp present .... ***Quollastria***

Alima Leach, 1817

Alima Leach, in Tuckey, 1817, unnumbered plate in Appendix IV to Tuckey. Type species *Alima hyalina* Leach, 1817 [a junior subjective synonym of *Alima neptuni* (Linnaeus, 1768)], by monotypy. Gender feminine.

Diagnosis. Eye with cornea bilobed, width less than 0.3 CL. Ocular scales separate. Carapace with anterolateral spines; with normal complement of carinae; MD carina with or without branches of anterior bifurcation; posterolateral angles broadly rounded. Raptorial claw dactylus with 5 or 6 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp absent. MXP1–4 each with epipod. PLP1 endopod in adult males with posterior endite; hook process blunt distally. TS5 lateral process bilobed; anterior lobe a slender spine directed antero-laterally; posterior lobe flattened, directed laterally. TS6–7 lateral process faintly bilobed or with anterior margin sinuous. AS1–6 with normal complement of carinae. Telson SM teeth with fixed apices; prelateral lobe present or absent; dorsolateral surface without supplementary longitudinal carinae. Uropodal protopod inner margin crenulate.

Included species. Five: *A. hieroglyphica* (Kemp, 1911); *A. hildebrandi* (Schmitt, 1940); *A. neptuni* (Linnaeus, 1768); *A. orientalis* Manning, 1978c; *A. pacifica* n.sp.

Remarks. *Alima hieroglyphica*, originally described from the northern Indian Ocean by Kemp (1911), was regarded by Manning (1969c) as a senior synonym of the western Atlantic *A. hildebrandi* (Schmitt, 1940) and eastern Atlantic *A. labadiensis* (Ingle, 1960). Re-evaluation of *A. hieroglyphica* and its synonyms suggests that at least two species should be recognized, one without a prelateral lobe on the telson (Indo-West Pacific), and the other with the prelateral lobe on the telson (Atlantic). *Alima hieroglyphica* sensu stricto is restricted to the Indo-West Pacific population. *Alima hildebrandi* is removed from the synonymy of *A. hieroglyphica* and recognized for the Atlantic population. Following Manning (1969c), *Alima labadiensis* is presently regarded as a junior synonym of *A. hildebrandi*.

Squilla laevis Hess from Australia, placed in *Alima* by Manning (1968c), is referred to new genus, *Belosquilla*, described below. *Alima guinotae* Moosa, from New Caledonia, is conspecific with *Busquilla quadraticauda* and is synonymized under the account of the latter.

Confusion over the identity of *Alima neptuni* (Linnaeus, 1768) in relation to *Alima alba* (Bigelow, 1893b) (see Schotte & Manning, 1993) was recently stabilized by selection of a neotype of the former (Holthuis, 2000). The neotype of *A. neptuni* is the lectotype of *A. alba*, and therefore the former name has unquestionable priority. The type species of *Alima*, *A. hyalina* Leach, was based on a late pelagic larva. Through studying larval development, Manning (1962b) showed that *A. hyalina*, is conspecific with, and has priority over *A. alba*. Subsequently, Schotte & Manning (1993) questioned the synonymy of *A. alba* with *A. hyalina* on the basis that they could not be certain of whether Manning (1962b) was dealing with the larvae of *A. alba* or *A. hieroglyphica*. Alikunhi (1944, 1952, 1967), however, gave an account of *A. hieroglyphica* from late pelagic larva through to postlarva. Alikunhi's observations and figures show that the reservations expressed by Schotte & Manning (1993) over the identity of Manning's

(1962b) material are unwarranted. Neither *A. hieroglyphica* nor *A. hildebrandi* bear two lobes between the terminal spines of the uropodal protopod. Therefore, *A. hyalina* must be considered a junior synonym of *A. neptuni*.

Alima, as restricted here, comprises two groups. The first includes *A. neptuni* and *A. pacifica* n.sp. The second group includes *A. hieroglyphica*, *A. hildebrandi* and *A. orientalis*. The species of the second group differ from the first chiefly in bearing five instead of six teeth on the dactylus of the raptorial claw, a postanal carina, rounded instead of sharp telson denticles in adults and the uropodal protopod bears one instead of two lobes between the terminal spines. Two species of *Alima*, *A. pacifica* and *A. orientalis*, are presently known from Australia.

Key to species of *Alima*

1	Raptorial claw with 6 teeth on the dactylus. Telson without postanal carina. Uropodal protopod with 2 rounded lobes between terminal spines	2
——	Raptorial claw with 5 teeth on the dactylus. Telson with postanal carina. Uropodal protopod with 1 rounded lobe on outer margin of inner spine	3
2	Propodus of raptorial claw, when folded, reaching posteriorly beyond posterior extent of cervical groove of carapace and beyond proximal margin of merus. PI 109–115. Telson with dorsal posterior margin and carinae of primary teeth uninflated in adult ♂♂	*A. neptuni*
——	Propodus of raptorial claw, when folded, not reaching posteriorly beyond posterior extent of cervical groove of carapace or beyond proximal margin of merus. PI 124. Telson with dorsal posterior margin and carinae of primary teeth strongly inflated in adult ♂♂	***A. pacifica***
3	TS6 lateral process with small but distinct anterior lobe. Telson with dark ovate anterior patch on MD carina	***A. orientalis***
——	TS6 lateral process with anterior margin sinuous, not bilobed. Telson with dark elongate triangular patch on either side of MD carina	4
4	Telson with prelateral lobe	*A. hildebrandi*
——	Telson without prelateral lobe	*A. hieroglyphica*

Alima orientalis Manning, 1978c

Fig. 92

Alima orientalis Manning, 1978c: 21–23, fig. 10 (type locality: Taiwan); 1995: 23.

Material. QUEENSLAND: AM P58556, 1♂ postlarva (TL 15 mm), Lizard I., taken at night light, R.L. Caldwell, 1 Dec 1999. WESTERN AUSTRALIA: AM P56949, 1♂ (TL 25 mm), Northwest Shelf, 19°58.3–58.8'S 117°49.4–48.7'E, 43 m, S0383 D1, 25 Jun 1983; AM P56950, 1♀ (TL 34 mm), Northwest Shelf, 19°58.2–58.5'S 117°49.2–49.0'E, 41–42 m, sand, mud, S0383 D3, 26 Jun 1983; NTM Cr012360, 1♀ (TL 45 mm), Northwest Shelf, 19°58.3–58.5'S 117°49.0–49.2'E, 42 m, beam trawl, S0383 BT D02, 26 Jun 1983.

Diagnosis. A1 somite dorsal processes with blunt, rounded apices. Raptorial claw dactylus with 5 teeth, proximal margin with basal notch. TS6 lateral process bilobed; anterior lobe rounded, much smaller than posterior lobe. TS7 lateral process with anterior margin sinuous. Abdominal carinae spined as follows: SM (5)6, IM (4)5–6, LT (4)5–6, MG (1–2)3–5. Telson MD carina with rounded to quadrate patch proximally, more diffuse medially; with rounded denticles SM 3–6, IM 7–9, LT 1; ventral surface with smooth postanal carina. Uropodal protopod with lobe on outer margin of inner spine rounded, broader than adjacent spine, proximal margin concave; exopod proximal segment outer margin with 7 or 8 movable spines.

Colour in alcohol. Almost completely faded. Median carina of telson with small dark patch posteriorly and dark subquadrate patch anteriorly.

Measurements. Male (n = 1) TL 25 mm, female (n = 2) TL 34–45 mm, male postlarva (n = 1) TL 15 mm. CI 374–525. A1 peduncle 0.96–1.06 CL. A2 scale 0.37–0.46 CL. Anterior carapace width 0.45–0.49 CL. Naiyanetr *et al*. (2000) recorded *A. orientalis* to 62 mm TL.

Remarks. The present adult specimens agree well with the type description but some differ in having a greater range of armed abdominal carinae than reported for the types (SM 6, IM 5–6, LT (4)5–6, MG (1–3)4–5). In the present specimens, as in those reported by Naiyanetr *et al*. (2000) from the Gulf of Thailand, the median carina of the telson

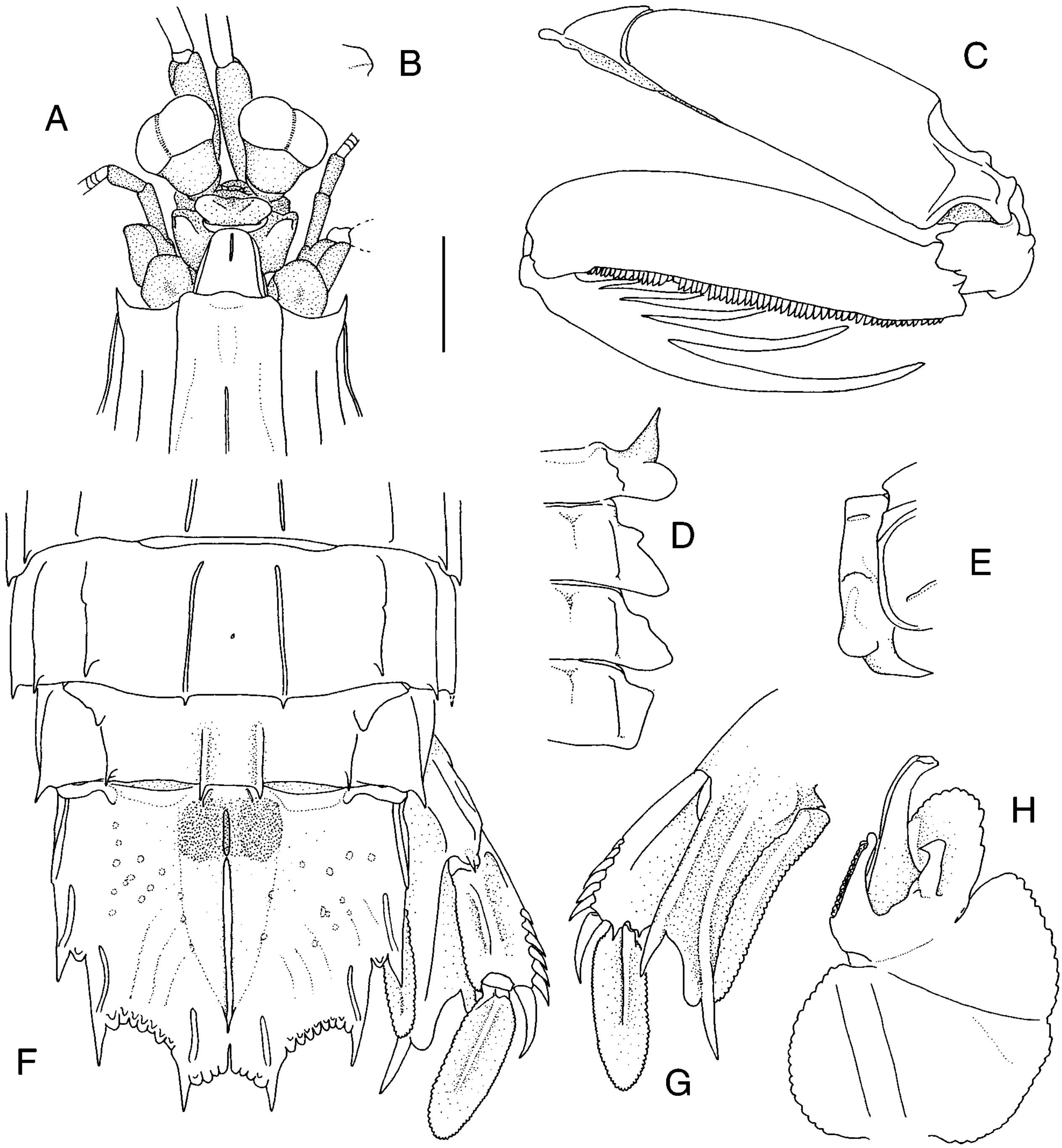

Figure 92. *Alima orientalis* Manning. A–G, ♀ TL 45 mm (NTM Cr12360). H, ♂ TL 25 mm (AM P56949). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, posterior carapace & TS5, right lateral. F, AS4–6, telson & uropod, dorsal. G, uropod, right ventral. H, PLP1 endopod, right anterior. Scale A–G = 2.5 mm; H = 0.6 mm.

bears a single large anterior patch instead of two as reported for the types, but in the largest Australian specimen, the pigmented subcuticular tissue directly beneath the median carina is collapsed, giving the initial impression of two spots. Therefore, as in the largest specimen of *A. orientalis* reported here, the appearance of two spots on the median carina of the telson reported in the types is likely an artefact of preservation.

The juvenile specimen agrees well with adults but differs in several size related features. The eye is relatively larger, the lateral processes of TS6–7 are rounded posteriorly instead of angular, fewer abdominal carinae are posteriorly armed, the petasma is undeveloped, the telson is relatively broader, the prelateral lobes of the telson are indistinct, the postanal carina is undeveloped, and the telson denticles bear spinular apices.

Alima orientalis most closely resembles *A. hieroglyphica* but differs in having a broader, more rounded rostral plate, a broader posterior lobe on the lateral process of TS5, a more distinct anterior lobe on the lateral process of TS6, and a single, ovate patch on the proximal portion of the median carina of the telson rather than an elongate, triangular patch either side of the median carina.

Habitat. Sandy mud substrates, at depths of 41–43 m. The postlarva was collected at a night light at Lizard Island, Queensland.

Distribution. Indo-West Pacific, from Taiwan, the Seychelles, the Gulf of Thailand, and now from Queensland and the Australian Northwest Shelf.

Alima pacifica n.sp.

Fig. 93

Type material. HOLOTYPE: USNM 169142, ♂ (TL 30 mm), Lizard I., Queensland, Australia, 14°40'S 145°27'E, 0–0.5 m, shallow pools amongst rubble on patch reef in front of research station, 3 Dec 1975. PARATYPE: AM P60105, 1♂ (TL 36 mm), Bunaken, N Sulawesi, 1°38.92'N 124°43.80'E, M. Erdmann, 22 Apr 2000.

Comparative material of *Alima neptuni*. AM P60116, 1♀ (TL

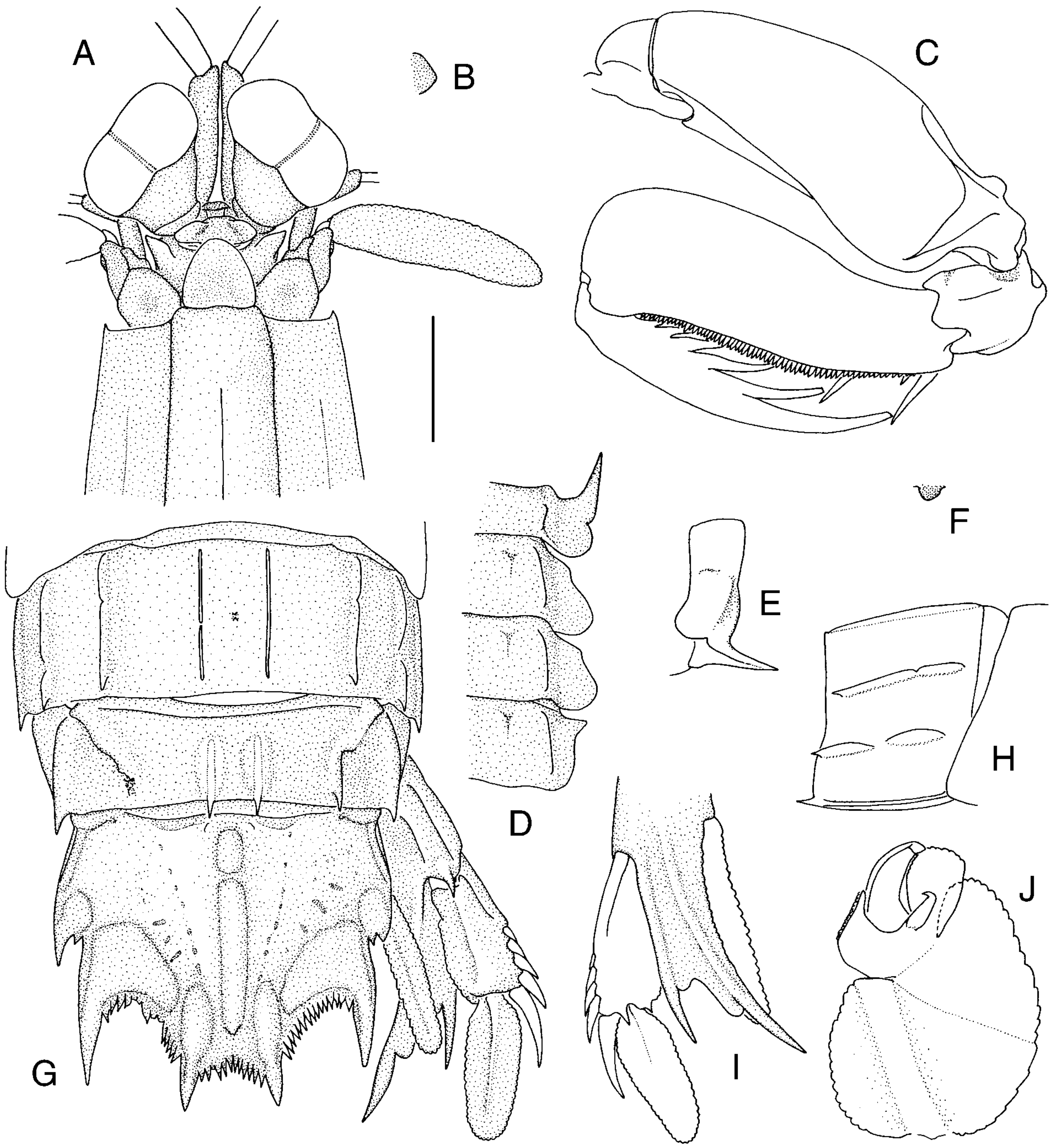

Figure 93. *Alima pacifica* n.sp., holotype ♂ TL 30 mm. A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, AS5, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2 mm; J = 1 mm.

47 mm), Lembeh Strait, N Sulawesi, Indonesia, M. Erdmann; USNM 18495, 1♀ (TL 41 mm), Bimini, Bahama Is, R.P. Bigelow [lectotype of *Alima alba* Bigelow and neotype of *Alima neptuni* (Linnaeus)]; USNM 111092, 1♀ (TL 36 mm), type locality (paralectotype of *Alima alba* Bigelow); USNM 264756, 1♀ (TL 42 mm), Worth Inlet, Florida, 26°46.42'N 80°02.42'W; USNM 264757, 1♂ (TL 46 mm), Tobago, R. Heard.

Diagnosis. Raptorial claw dactylus with 6 teeth; propodus when folded not reaching posteriorly beyond posterior extent of cervical groove of carapace or beyond proximal margin of merus; PI 124. TS5 lateral process with both lobes on same plane. TS6&7 with lateral process trianguloid; sinuous anteriorly; apex rounded. Telson without prelateral lobe; denticles sharp; dorsal posterior margin and carinae of primary telson teeth strongly inflated in adult males. Uropodal protopod with two rounded lobes between terminal spines, one on outer margin of inner, other proximally at base of outer spine.

Description. Dorsal integument smooth. Eye with CI 340–383. Ophthalmic somite anterior margin rounded. Ocular scales subtruncate. A1 peduncle 0.83–0.89 CL. A1 somite dorsal processes with blunt, rounded apices. A2 scale 0.44–0.45 CL. Rostral plate slightly broader than long; apex rounded; without MD carina. Carapace anterior width 0.45–0.49 CL; anterolateral spines small, not extending to base of rostral plate; IM carinae low, faintly indicated anteriorly; posterior median projection low. Raptorial claw dactylus with 6 teeth outer margin faintly broadly curved, with basal notch; propodus when folded not reaching posteriorly beyond posterior extent of cervical groove of carapace or beyond proximal margin of merus; PI 124. TS5 lateral process with both lobes on same plane; anterior lobe a stout spine directed anteriorly; posterior lobe spatulate with rounded apex. TS6–7 with trianguloid lateral process; sinuous anteriorly; apex rounded. TS8 anterolateral margin pointed; sternal keel rounded. AS1–5 SM carinae parallel. AS6 with small ventrolateral spine anterior to uropodal articulation; sternum posterior margin unarmed, without numerous transverse carinae. Abdominal carinae spined as follows: SM 6, IM 5–6, LT 5–6, MG 5. Telson broader than long; prelateral lobe absent; denticles sharp, SM 5–7, IM 12–15, LT 1; dorsal posterior margin and carinae of primary telson teeth strongly inflated in adult males. Uropodal protopod without tubercle or spinule anterior to endopod articulation; with two rounded lobes between terminal spines, one on outer margin of inner, other proximally at base of outer spine. Uropodal exopod proximal segment outer margin with 6 movable spines, distalmost reaching about to midlength of distal segment; distal segment longer than proximal segment.

Colour in alcohol. Completely faded in holotype. Paratype with scattered chromatophores over dorsum; AS 1–5 with dark IM carinae; AS2 with dark median transverse patch; telson with dark IM and LT carinae, MD carina with dark chromatophores distally and proximally; uropodal exopod distal segment dark on inner proximal ⅓; merus of raptorial claw with dark distal dorsal patch.

Etymology. Named *pacifica* alluding to the known distribution of the species.

Measurements. Male (n = 2) TL 30–36 mm. Other measurements of holotype: CL 7.3 mm, A1 peduncle 6.5 mm, A2 scale 3.3 mm.

Remarks. *Alima pacifica* n.sp. closely resembles *A. neptuni* in most respects including colour pattern, the smooth dorsum, presence of six teeth on the dactylus of the raptorial claw, two lobes between the terminal spines of the uropodal protopod, sharp telson denticles and the absence of a prelateral lobe or postanal carina on the telson. *Alima pacifica* differs from *A. neptuni* in bearing a shorter propodus on the raptorial claw, strongly inflated margins and carinae of the primary teeth of the telson and unarmed marginal carinae on AS3 & 4. The former two differences are the most significant because the last named is known to vary in many other squillids. In *A. pacifica*, the propodus of the raptorial claw when folded does not reach posteriorly beyond the posterior extent of the cervical groove on the carapace and is approximately in line with the proximal margin of the merus. In *A. neptuni*, the propodus of the raptorial claw reaches posteriorly beyond the cervical groove and beyond the proximal margin of the merus. These differences in the propodus length of the raptorial claw are reflected in the propodal indices of both species: PI 124 for *A. pacifica* vs. PI 109–115 for *A. neptuni*. The margins and carinae of the primary teeth of the telson are strongly inflated in *A. pacifica* (at least in adult males) in contrast to the uninflated condition in *A. neptuni*. That the telson margins are strongly inflated in *A. pacifica* as small as 30 mm TL suggests that the species matures at a smaller size than *A. neptuni*.

Variation in the type series is slight, with most significant difference being the condition of the lateral carina on AS5: divided in the holotype (Fig. 93H) and undivided in the paratype. The importance of this variation can only be assessed when additional specimens of *A. pacifica* become available.

The discovery of *A. pacifica* suggests that all records of *A. neptuni* from the Indo-West Pacific require verification. Published records of *A. neptuni* (also as *A. hyalina* Leach or *A. alba* Bigelow) from the Indo-West Pacific include Madagascar (Manning, 1970a), Indonesia (Moosa, 1975), the Red Sea (Manning & Lewinsohn, 1986), Hawaii (Townsley, 1953) and French Polynesia (Poupin, 1998).

Habitat. The holotype was collected from shallow pools amongst rubble on a coral reef flat.

Distribution. Presently known only from Australia and Indonesia.

Alimopsoides Moosa, 1991

Alimopsoides Moosa, 1991: 191. Type species *Alimopsoides tuberculata* Moosa, 1991, by monotypy. Gender masculine.

Diagnosis. Eye with cornea strongly bilobed. Carapace with MD carina interrupted at base of anterior bifurcation, branches of anterior bifurcation distinct, opening anterior to dorsal pit; posterolateral margin rounded. Raptorial claw dactylus with 6 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process blunt distally.

TS6–8 with distinct SM and IM carinae. TS5 lateral process bilobed. TS6–7 lateral process faintly bilobed. AS1–5 with SM, IM, LT and MG carina; AS2–6 with short MD carina. Telson SM teeth with fixed apices; dorsolateral surface with accessory MD and numerous supplementary carinae. Uropodal protopod inner margin crenulate, with 2 rounded lobes between terminal spines.

Included species. One: *A. tuberculatus* Moosa, 1991.

Remarks. *Alimopsoides* most closely resembles *Paralimopsis* and *Alimopsis* in the single or indistinctly bilobed lateral processes of TS6–7 and numerous dorsal carinae of the telson. *Alimopsoides* can be distinguished from *Alimopsis* and *Paralimopsis* by the presence of six instead of five teeth on the dactylus of the raptorial claw and two instead of one rounded lobes between the terminal spines of the uropodal protopod. The single species of *Alimopsoides* is known from Australia.

Alimopsoides tuberculatus Moosa, 1991

Fig. 94

Alimopsoides tuberculatus Moosa, 1991: 191–193, fig. 11 (type locality: Chesterfield plate, Loop I., New Caledonia).–Manning, 1995: 23.
Alima laevis.–Moosa, 1991: 188 [not *Alima laevis* (Hess, 1865)].

Type material. HOLOTYPE: MNHN St 1878, ♂ (TL 62 mm), Loop I., Chesterfield plate, New Caledonia, CORAIL 1, 20 Aug 1988.

Australian material. WESTERN AUSTRALIA: NTM Cr012404, 1♂ (TL 54 mm), 19°07–08'S 119°05–06'E, SO682 128, 78 m, beam trawl; NTM Cr012359, 1♀ (TL 43 mm), 19°05.0–05.2'S 118°57.2–57.8'E, 82 m, beam trawl.

Supplementary diagnosis. Eye with cornea strongly bilobed. A1 dorsal processes trianguloid, apices acute. Carapace with anterolateral spines; with MD, IM, LT, MG and reflected MG carinae; MD carina interrupted at base of anterior bifurcation, branches of anterior bifurcation distinct, opening anterior to dorsal pit. Raptorial claw dactylus with 6 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod. TS6–8 with distinct SM and IM carinae. TS5 lateral process bilobed; anterior lobe a slender spine directed anterolaterally; posterior lobe on higher plane, spatulate, directed laterally. TS6–7 lateral process faintly bilobed. AS1–5 with SM, IM, LT and MG carina; AS2–6 with short median carina and 2–3 coarse tubercles proximally between IM and LT carinae. AS6 with SM, IM and LT carinae; coarsely tuberculate between SM and IM carinae. Abdominal carinae spined as follows: SM 5–6, IM 4–6, LT 3–6, MG 1–5. Telson SM teeth with fixed apices; dorsolateral surface with accessory MD and numerous supplementary carinae and tubercles proximally; denticles SM 6, IM 11–13, LT 1; ventral surface with postanal carina and short, low carina on each SM tooth. Uropodal protopod inner margin crenulate; with 2 rounded lobes between terminal spines; exopod proximal segment outer margin with 6 or 7 movable spines.

Colour in alcohol. Largely faded. With dark pigment lining grooves and carinae of carapace, carina and posterior margins of body somites. AS2 with barrow transverse bar medially. Uropodal endopod distal segment with inner ½ dark; endopod dark on distal margins.

Measurements. Male (n = 2) TL 54–62 mm, ♀ (n = 1) TL 43 mm. CI 357–400. A1 peduncle 1.12–1.18 CL. A2 scale length 0.51–0.52 CL. Anterior carapace width 0.47–0.49 CL. The holotype is the largest known specimen of the species.

Remarks. The present specimens agree with the holotype (TL 62 mm) in most respects including colour pattern, but differ in bearing fewer abdominal tubercles and less well-developed ornamentation lateral to the postanal carina. All of the aforementioned differences are referable to size and these same differences are present in a smaller specimen (female TL 33 mm) from New Caledonia (MNHN St 1655) reported by Moosa (1991) as *Alima laevis*.

Habitat. Taken from depths of 78–82 m, presumably on soft substrates.

Distribution. New Caledonia and now the Australian Northwest Shelf.

Anchisquilla Manning, 1968c

Anchisquilla Manning, 1968c: 120, 127–128. Type species *Squilla fasciata* de Haan, 1844, by original designation. Gender feminine.

Diagnosis. Eye with cornea bilobed, distinctly broader than stalk, width less than 0.3 CL. Ophthalmic somite anterior margin triangular. Carapace with anterolateral spines; carinae reduced, at most with LT carinae indicated anteriorly and posteriorly only, and reflected MG carina; posterolateral margin rounded. Raptorial claw dactylus with 6 teeth. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS6–8 without SM carinae. TS5–7 lateral processes single. AS1–5 without SM carinae. Telson flattened, with 3 pairs of primary teeth (SM, IM, LT); SM teeth with fixed apices; prelateral lobe present; dorsolateral surface with curved supplementary longitudinal carinae; ventral surface with long postanal carina and with or without supplementary carinae. Uropodal protopod inner margin lined with slender spines.

Included species. Three: *A. chani* n.sp.; *A. fasciata* (de Haan, 1844); and *A. fasciaticauda* Liu & Wang, 1998.

Remarks. *Anchisquilla* most closely resembles *Neoanchisquilla* and the differences between the genera are outlined under the account of the latter. As already shown by Manning (1995), *Anchisquilla punctata* Blumstein based on a juvenile of *Busquilla quadraticauda* Fukuda. Two species of *Anchisquilla* are known from Australia; one is newly described.

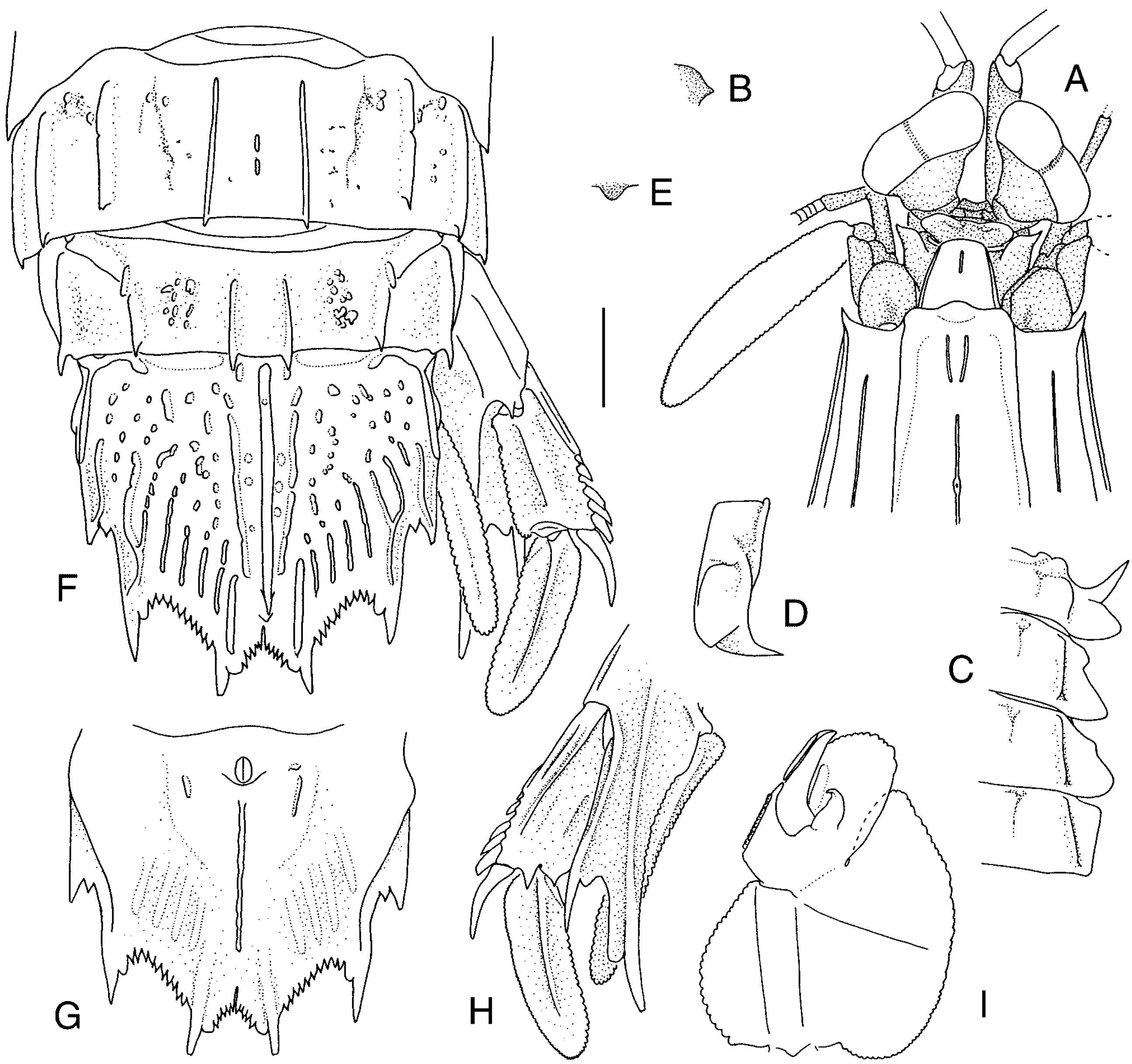

Figure 94. *Alimopsoides tuberculatus* Moosa, ♂ TL 54 mm (NTM Cr12404). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, TS5–8 lateral processes, right dorsal. D, TS5, right lateral. E, TS8 sternal keel, right lateral. F, AS4–6, telson & uropod, dorsal. G, telson, ventral. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 2.5 mm; I = 1.2 mm.

Key to species of *Anchisquilla*

1 Telson without accessory MD carina; dorsolateral carinae distinct posteriorly only .... *A. fasciaticauda*

—— Telson with accessory MD carina and distinct dorsolateral carinae 2

2 Telson prelateral lobe terminating in a distinct spine; with accessory MD carina subdivided into elongate tubercles; ventral surface at most with 2 or 3 low, short carinae lateral to postanal carina .... ***A. chani***

—— Telson prelateral lobe with blunt apex; with accessory MD carina entire or occasionally subdivided; ventral surface with distinct, longitudinal carinae lateral to postanal carina .... ***A. fasciata***

Anchisquilla chani n.sp.

Fig. 95

Type material. (All Queensland, Australia) HOLOTYPE: AM P55598, ♂ (TL 52 mm), Gulf of Carpentaria, 12°06.9'S 139°59'E, T. Wassenberg, Nov–Dec 1991. PARATYPES: AM P55593, 1♀ (TL 63 mm), Arafura Sea, 10°14.4'S 136°52.4'E, sand and mud, T. Wassenberg, Nov 1991; AM P55595, 1♀ (TL 61 mm), E of Cape Arnhem, Gulf of Carpentaria, 12°31.4'S 137°12'E, 49 m, sand and mud, T. Wassenberg, Nov 1990; AM P55596 (to QM), 1♂ (TL 71 mm), Nhulunbuy, 12°04.3'S 136°45.0'E, 49 m, T. Wassenberg, Nov 1991.

Diagnosis. Carapace with longitudinal groove in position of IM carina. Outer margin of dactylus of raptorial claw with shallow proximal notch. TS6–7 lateral process broadly rounded. AS1–5 with blunt tubercle proximally between IM and LT carinae. Telson dorsolateral surface with accessory MD carina comprising a broken line of elongate tubercles, and numerous curved supplementary longitudinal carinae, often short, broken anteriorly; prelateral lobe terminating in distinct spine; postanal carina long, at most with low tubercles or up to 3 short carinae laterally. Uropodal exopod distal segment entirely dark.

Description. Eye extending beyond midlength but not to end of A1 peduncle segment 1; cornea set obliquely on stalk; CI 444–527. A1 peduncle 1.01–1.11 CL. A2 scale 0.59–0.61 CL. Rostral plate longer than broad; lateral margins convergent; apex rounded; without median carina. Carapace anterior width 0.46–0.52 CL; LT carinae indicated anteriorly and posteriorly only; with longitudinal groove in position of IM carina. Outer margin of dactylus of raptorial claw

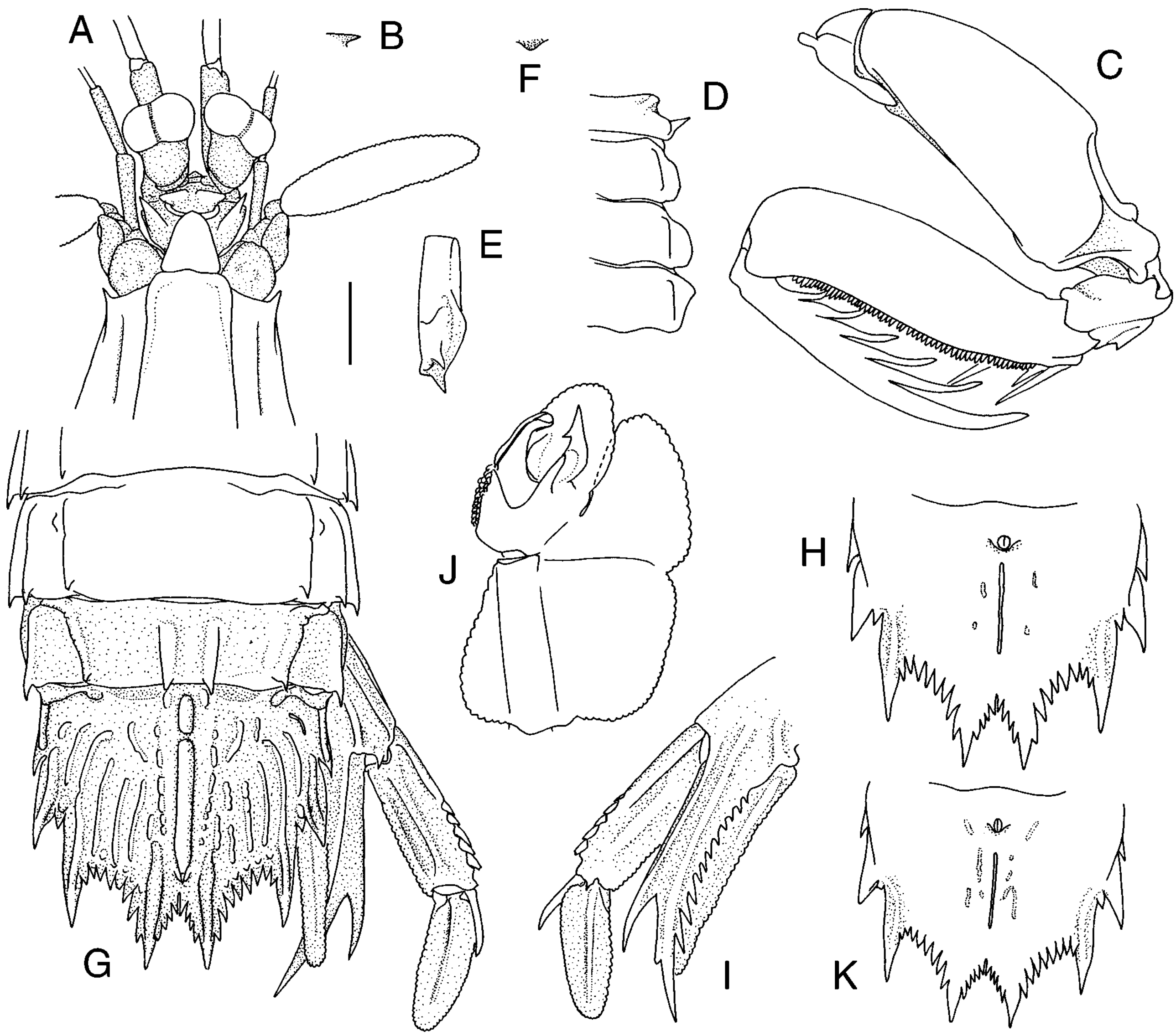

Figure 95. *Anchisquilla chani* n.sp. A–J, holotype ♂ TL 52 mm. K, paratype ♀ TL 61 mm (AM P55595). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, telson, ventral. I, uropod, right ventral. J, PLP1 endopod, right anterior. K, telson, ventral. Scale A–I, K = 2.5 mm; J = 1 mm.

with shallow notch proximally. TS5 lateral process a slender spine, directed anterolaterally, inclined ventrally; ventral spine slender, directed ventrally. TS6–7 lateral process broadly rounded. TS8 anterolateral margin rounded; sternal keel angular, directed posteriorly. AS1–5 with blunt tubercle proximally between IM and LT carinae. AS6 with surface between SM and IM carinae smooth or irregularly sculptured; with ventrolateral spine anterior to uropodal articulation; sternum posterior margin unarmed. Abdominal carinae spined as follows: SM 6, IM (4)5–6, LT 1–6, MG (1)2–5. Telson broader than long; prelateral lobe as long as margin of LT tooth, terminating in distinct spine; dorsolateral surface with accessory MD carina comprising a broken line of elongate tubercles, and numerous distinct supplementary longitudinal carinae, often short, broken anteriorly; denticles SM 4–5, IM 8–9, LT 1; postanal carina long, at most with low tubercles or up to 3 short carinae laterally; ventrolateral carina extending to base of LT tooth. Uropodal protopod with flattened ventral lobe anterior to endopod articulation; inner margin armed with 9–12 slender spines. Terminal spines of uropodal protopod with lobe on outer margin of inner spine rounded, narrower than adjacent spine; proximal margin straight to concave. Uropodal exopod proximal segment outer margin with 7 movable spines, distalmost flattened with acute apex, not exceeding midlength of distal segment; distal margin with slender ventral spine. Exopod distal segment entirely dark.

Colour in life. Dull olive green. Raptorial claw with yellowish meral depression. Distal segment of uropodal exopod black brown.

Etymology. Named for Tin-Yam Chan, National Taiwan Ocean University, for assisting my stomatopod studies in numerous ways.

Measurements. Male (n = 2) TL 52–71 mm, female (n = 2) TL 61–63 mm. Other measurements of holotype: CL 11.0 mm, A1 peduncle 12.3 mm, A2 scale 6.5 mm.

Remarks. *Anchisquilla chani* n.sp. closely resembles *A. fasciata* and differs from *A. fasciaticauda* in bearing an accessory median carina and distinct longitudinal carinae on the dorsolateral surface of the telson. *Anchisquilla chani* differs from *A. fasciata* in the following features: the outer, proximal margin of the dactylus of the raptorial claw is notched instead of entire; the accessory median carina of the telson is broken into a line of tubercles instead of being entire or only disrupted proximally; the distal apex of the prelateral lobe is distinctly spiniform instead of a blunt; and the ventral surface of the telson lateral to the postanal carina bears at most several short, low carinae or tubercles instead of distinct longitudinal carinae (Fig. 95H,K).

A specimen figured by Blumstein (1974: fig. 2) from Vietnam as *A. fasciata* is probably referable to *A. chani*; the accessory median carina is divided into tubercles and the prelateral lobe terminates in a distinct spine. Specimens referred to *A. fasciata* by Ghosh (1973) from the Gulf of Oman having interrupted carinae on the telson lateral to the median and without ventral carinae lateral to the postanal carina could also be referable to *A. chani*. Ahyong (1998) suggested that Ghosh (1973) could have been dealing with *Neoanchisquilla tuberculata*; it is now more plausible that the specimens are referable to *A. chani* in view of its closer resemblance to *A. fasciata*.

Habitat. Sand and mud substrates to 49 m depth.

Distribution. Known from the Gulf of Carpentaria, Australia, and possibly from the Gulf of Tonkin, Vietnam, and the Gulf of Oman.

Anchisquilla fasciata (de Haan, 1844)

Fig. 96

Squilla fasciata de Haan, 1844 (atlas): pl. 51, fig. 4 (type locality: Japan); 1849 (text): 224.–Kemp, 1913: 3, 10, 20, 34–36, pl. 1, figs. 21–23.–Hale, 1924: 496; 1927: 32, fig. 30, 21.–Stephenson, 1952: 5.–Stephenson & McNeill, 1955: 240–241, 258, 261.

Squilla subfasciata Tate, 1883: 52, pl. 2, figs. 1 a–d.

Anchisquilla fasciata.–Manning, 1968c: 120, 127.–Blumstein, 1974: 114–115.–Moosa, 1975: 9.–Manning, 1977b: 420.–Moosa, 1986: 390–391; 1991: 193–194.–Manning, 1991: 8.–Yamaguchi & Baba, 1993: 181–182, fig. 12.–Manning, 1995: 166–169, pl. 29, figs. 98–100.

Material. QUEENSLAND: AM P12079, 1♀ (TL 48 mm), NE of Woody Point Pier, Moreton Bay, 27°16'S 153°06'E, 6 m, W. Stephenson, 10 Nov 1951; AM P12281, 1♂ (TL 77 mm), 5 km NE of Woody Point, Moreton Bay, 27°25'S 153°20'E, 9 m, sandy mud, E. Grant, 9 Aug 1952; AM P12282–12283, 2♀♀ (TL 73–74 mm), 5 km NE of Woody Point, Moreton Bay, 27°25'S 153°20'E, 9 m, sandy mud, E. Grant, 9 Aug 1952; AM P12284, 1♀ (TL 70 mm), 3 km E of Redcliffe Jetty, Moreton Bay, 27°25'S 153°20'E, 9 m, T.C. Marshall, 19 Jun 1952; AM P12285, 1♀ (TL 66 mm), 6 km NE of Woody Point Pier, Moreton Bay, 27°25'S 153°20'E, 9 m, sandy mud, E. Grant, 8 Aug 1952; AM P12286, 1♀ (TL 68 mm), SE edge of Pearl Channel, Moreton Bay, 27°25'S 153°20'E, 12 m, muddy sand, E. Grant, 20 Nov 1952; AM P12287–12288, 2♀♀ (TL 70–77 mm), 5.6 km S of Woody Point Pier, Moreton Bay, 27°25'S 153°20'E, 8 m, E. Grant, 19 Oct 1952; AM P12289, 1♀ (TL 62 mm), ESE of Redcliffe Jetty, Moreton Bay, 27°25'S 153°20'E, 12 m, gritty mud, E. Grant, 28 Mar 1953; AM P12290, 1♂ (TL 39 mm), off Townsville, 19°16'S 146°49'E, 37 m, R. Bryson, Aug 1953; AM P12369, 1♂ (TL 64 mm), Trinity Inlet, Cairns, 16°58'S 145°47'E, G. Rowell, Nov 1953; AM P21655, 1♂ (TL 67 mm), 1♀ (TL 61 mm), SE Gulf of Carpentaria, 17°12'S 140°49'E, 8 m, J. Yaldwyn & D. McMichael, 23 Dec 1963; AM P55594, 1♂ (TL 37 mm), Shelburne Bay, 11°30'S 143°00'E, 21 m, dredge, T. Wassenberg, 15 Jan 1993; AM P55603, 1♀ (TL 30 mm), Gulf of Carpentaria, 12°26.7'S 139°11.7'E, 55 m, T. Wassenberg, Nov–Dec 1990; AM P55605, 1♂ (TL 25 mm), Gulf of Carpentaria, 13°30.2'S 140°42.5'E, 55 m, T. Wassenberg, Nov–Dec 1990; AM P55507, 3♂♂ (TL 75–81 mm), 1♀ (TL 61 mm), near Nassau River, Gulf of Carpentaria, 10–30 m, T. Wassenberg, 8–21 Dec 1976; AM P55601 (to QM), 1♀ (TL 30 mm), SE Gulf of Carpentaria, 15°32.1'S 139°41.8'E, 45 m, T. Wassenberg, Dec 1990; AM P55606 (to QM), 1♀ (TL 32 mm), Arafura Sea, 11°32.7'S 138°41.8'E, 53 m, T. Wassenberg, Nov–Dec 1990; AM P55599 (to QM), 1♂ (TL 32 mm), N of Duyfken Point, Gulf of Carpentaria, 12°22'S 141°35.2'E, T. Wassenberg, Nov–Dec 1991; AM P55597 (to QM), 1♀ (TL 58 mm), off Duyfken Point, Gulf of Carpentaria, 12°29.9'S 141°14.7'E, 49 m, T. Wassenberg, Nov–Dec 1991; QM W1788, 1♀ (TL 58 mm), 6.4 km NNE of Woody Point, Moreton Bay, 27°16'S 153°06'E, 7 m, E Grant, 30 Apr 1951; QM W2768, 1♂ (TL 50 mm), Moreton Bay; QM W2769, 1♀

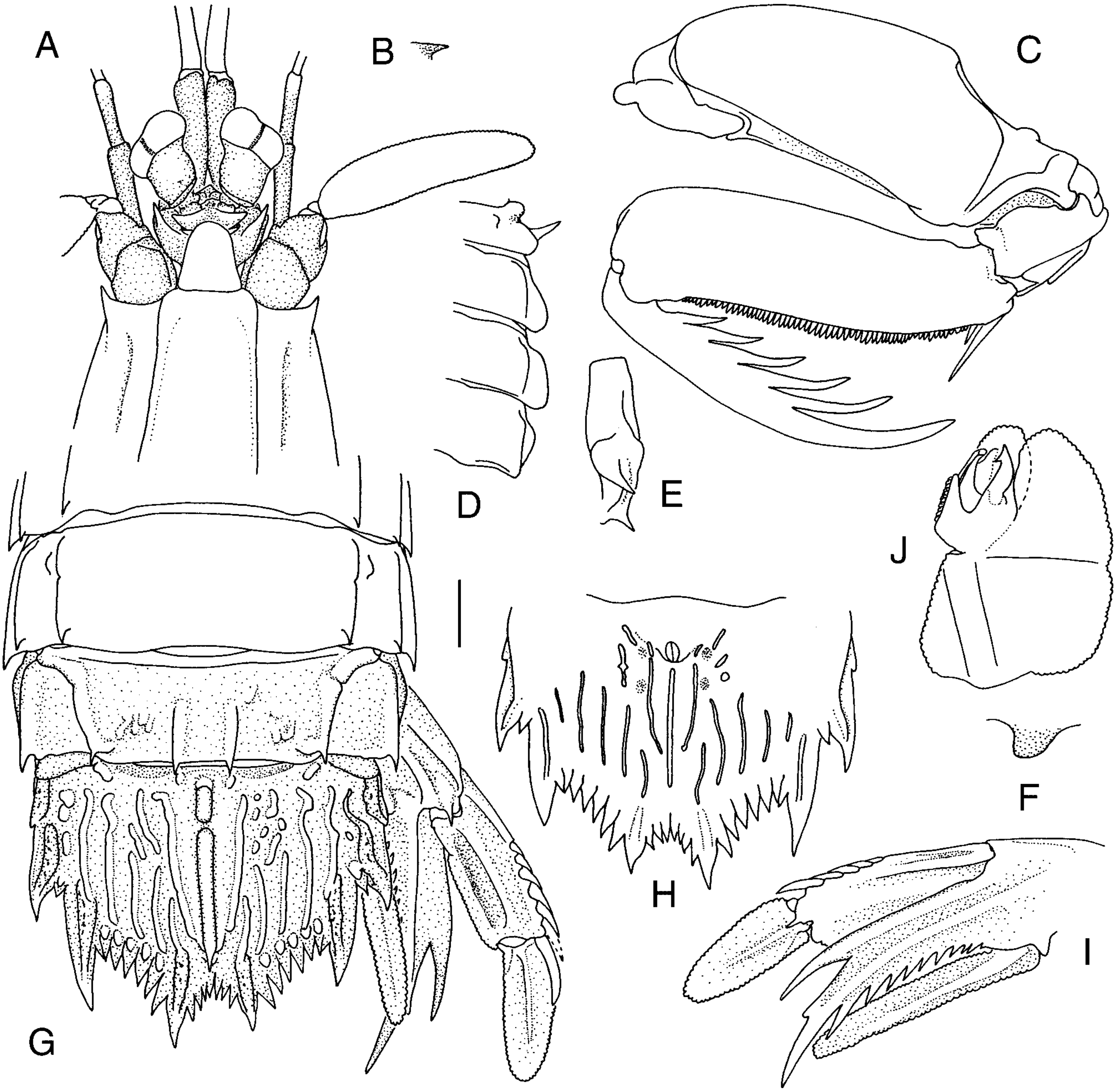

Figure 96. *Anchisquilla fasciata* (de Haan), ♂ TL 67 mm (AM P21655). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–E, G–H = 2.5 mm; F, I = 1.2 mm.

(TL 74 mm), 7.2 km E of Reef Point, Scarborough, Moreton Bay, 27°12'S 153°11'E, 11 m, mud, 15 Dec 1964; QM W2772, 2♂♂ (TL 45–54 mm), SW of M3 red beacon, Moreton Bay, 27°10'S 153°19'E, 29 Apr 1964; QM W2773, 2♂♂ (TL 73–77 mm), 5♀♀ (TL 60–71 mm), 7.2 km E of Reef Point Scarborough, Moreton Bay, 27°12'S 153°11'E, 11 m, mud, 15 Dec 1964; QM W3143, 3♂♂ (TL 58–75 mm), 11 km E of Scarborough, Moreton Bay, 27°12'S 153°14'E, 13.7 m, sand & mud, W. Stephenson, 10 Nov 1966; QM W3662, 1♂ (TL 77 mm), E of St Helena I. Moreton Bay, 27°24'S 153°15'E, 9–18 m, silty mud, museum party, 25 May 1970; QM W3959, 1♀ (TL 64 mm), 1.6 km E of Otter Rock, Moreton Bay, 27°16'S 153°08'E, 6.3 m, A. Jones, 9 Oct 1967; QM W6451, 3♂♂ (TL 64–70 mm), near Mitchell River, Gulf of Carpentaria, trawl, 22 m, T. Wassenberg, 8–21 Aug 1976; QM W12859, 1♂ (TL 74 mm), SE end of Hinchinbrook I., 18°27.5'S 146°22.7'E, trawl, C. Jones, 6 Feb 1986; QM W22283, 1♂ (TL 66 mm), near Brisbane, 1961. SOUTH AUSTRALIA: SAM C182, 1♂ (TL 56 mm), Gulf of St Vincent (holotype of *Squilla subfasciata* Tate). NORTHERN TERRITORY: AM P55600, 1♂ (TL 38 mm), NE of Wessell Is, Arafura Sea, 10°30.12'S 137°12.03'E, 50 m, T. Wassenberg, Nov 1990; AM P55602, 1♂ (TL 40 mm), E of Cape Arnhem, Gulf of Carpentaria, 12°31.4'S 137°12'E, 49 m, T. Wassenberg, Nov 1990; AM P55612, 1♂ (TL 33 mm), Arafura Sea, 10°29.7'S 137°14.5'E, 54 m, mixed shell & gravel, E. Ball & J. Paxton, 17 Mar 1975; AM P55604 (to QM), 1♂ (TL 43 mm), NE of Cape Arnhem, Gulf of Carpentaria, 11°27.7'S 137°41.7'E, 47 m, T. Wassenberg, Dec 1990.

Diagnosis. Carapace with longitudinal groove in position of IM carina. Outer margin of dactylus of raptorial claw without proximal notch. TS6–7 lateral process broadly rounded. TS8 anterolateral margin rounded. AS1–5 with blunt tubercle proximally between IM and LT carinae. Abdominal carinae spined as follows: SM 6, IM (3)4–6, LT (1)2–6, MG (1)2–5. Telson dorsolateral surface with entire accessory MD and numerous curved supplementary longitudinal carinae, often short, broken anteriorly; prelateral lobe with blunt apex; denticles SM 3–5, IM 6–10, LT 1; postanal carina long, usually with low tubercles proximally and longitudinal carinae laterally. Uropodal protopod inner margin armed with 7–14 slender spines; exopod proximal segment outer margin with 7–10 movable spines; exopod distal segment entirely dark.

Colour in life. Overall colour grey-brown to olive green with somewhat irregular mottled appearance. Telson with apices of primary teeth dark red. Uropodal exopod with distal segment black brown.

Measurements. Male (n = 29) TL 25–81 mm, female (n = 23) TL 30–77 mm. CI 509–698. A1 peduncle 0.95–1.06 CL. A2 scale 0.48–0.61 CL. Anterior carapace width 0.48–0.56 CL. Shanbogue (1986) reported specimens to 100 mm TL.

Remarks. The Australian specimens agree well with published accounts (Kemp, 1913; Holthuis, 1967b; Manning, 1995), and specimens from Thailand, Taiwan and Japan (AM, ZRC), but differ in having more numerous ventral telson carinae. The Australian population may represent a distinct species, but study of specimens from intermediate localities is first required.

Anchisquilla fasciata principally differs from *A. fasciaticauda* in bearing an accessory median carina on the telson, and differs from *A. chani* in bearing a blunt instead of spiniform prelateral lobe on the telson.

Habitat. Sandy, shelly or gritty mud and gravel substrates, in depths of 7–55 m.

Distribution. Western Indian Ocean to the Philippines, Vietnam, Taiwan, Japan, New Caledonia and Australia.

Anchisquilloides Manning, 1977b

Anchisquilloides Manning, 1977b: 421. Type species *Squilla mcneilli* Stephenson, 1953b, by original designation and monotypy. Gender masculine.

Diagnosis. Eye with cornea strongly bilobed, width less than 0.3 CL. A1 somite dorsal processes with short slender apices, directed anterolaterally. Carapace with anterolateral spines; with MD, reflected MG, and reduced LT carinae, distinct posteriorly only; MD carina distinct, uninterrupted anteriorly, anterior bifurcation absent; posterolateral margin rounded. Raptorial claw dactylus with 5 or 6 teeth; carpus with short undivided dorsal carina and distal tooth; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process blunt distally. TS6–8 with distinct SM and IM carinae. TS5–7 lateral process single. AS1–5 with MD and normal complement of carinae. AS6 with normal complement of carinae. Telson SM teeth with movable apices; prelateral lobe present; dorsolateral surface with curved rows of shallow pits and low SM swelling. Uropodal protopod inner margin crenulate.

Included species. Two: *A. mcneilli* (Stephenson, 1953b); and *A. michelae* Moosa, 1986.

Remarks. Cladistic analyses of the squilloid genera (Ahyong, in prep.) shows that *Anchisquilloides* is most closely related to *Anchisquillopsis*. *Anchisquilloides* differs from *Anchisquillopsis* in bearing five or six instead of eight teeth on the dactylus of the raptorial claw and four instead of two epipods. Species of *Anchisquilloides* and *Anchisquillopsis* generally occupy outer shelf or upper slope waters, but *A. mcneilli* is known from as shallow as 14 m.

Key to species of *Anchisquilloides*

1 TS5 with lateral process directed anteriorly or slightly inclined ventrally. Lobe on the outer margin of the inner spine of the uropodal protopod distinctly broader adjacent spine .... ***A. mcneilli***

—— TS5 with lateral apex of lateral process directed almost ventrally. Lobe on the outer margin of the inner spine of the uropodal protopod narrower than or subequal to width of adjacent spine .... *A. michelae*

Anchisquilloides mcneilli (Stephenson, 1953b)

Fig. 97

Squilla armata.–Whitelegge, 1900: 199 (not *S. armata* H. Milne Edwards, 1837).

Squilla mcneilli Stephenson, 1953b: 213–218, fig. 4 (type locality: off coast between Merimbula & Tathra, New South Wales, Australia).–Stephenson & McNeill, 1955: 242.–Stephenson, 1962: 34.–Manning, 1966: 99; 1977b: 421.

Anchisquilla mcneilli.–Manning, 1968c: 127; 1970c: 84, 85.

Anchisquilloides mcneilli.–Manning, 1977b: 421.–Moosa, 1986: 393.–Graham *et al*., 1993a: 24, 64; 1993b: 73.–Manning, 1995: 23.

Type material. (All New South Wales, Australia) HOLOTYPE: AM P8808, ♀ (TL 90 mm), off coast between Merimbula & Tathra, 36°49'S 150°05'E, 73 m, M. Ward, Mar 1927. ALLOTYPE: AM P4442, ♂ (TL 76 mm), off Wata Moli (= Wattamolla), near Botany Bay, 124 m, trawl, 7 Feb 1919. PARATYPES: AM P9677, 1♂ (TL 75 mm), 11 km NE of Twofold Bay, 37°02'S 150°02'E, 73–82 m,

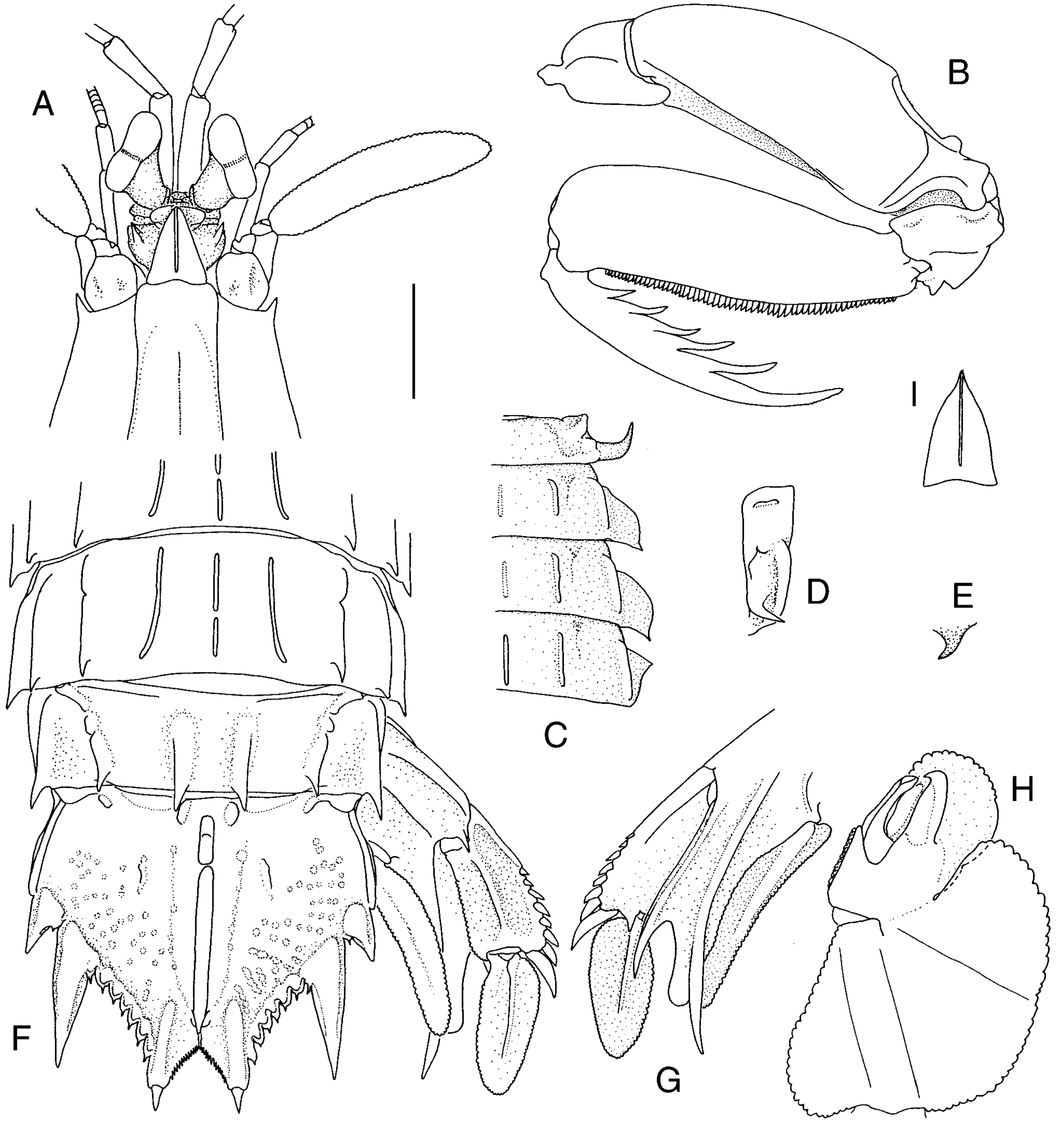

Figure 97. *Anchisquilloides mcneilli* (Stephenson). A–H, ♂ TL 82 mm (AM P54082). I, ♂ TL 100 mm (AM P41790). A, anterior cephalon, dorsal. B, raptorial claw, right lateral. C, TS5–8 lateral processes, right dorsal. D, TS5, right lateral. E, TS8 sternal keel, right lateral. F, AS4–6, telson & uropod, dorsal. G, uropod, right ventral. H, PLP1 endopod, right anterior. I, rostral plate, dorsal. Scale A–E, G–H = 5 mm; F, I = 1.7 mm.

trawl, H. Fletcher, May 1929; AM P5796, 1♀ (TL 83 mm), 4.8–6.4 km off Eden, 37°05'S 150°00'E, 46–55 m, from stomach of flathead (Platycephalidae), A. Livingstone & H. Fletcher, May 1922; AM G2205, 1♀ (TL 79 mm), 7–7.5 km off Barrenjoey, 33°34.5'S 151°26.5'E, 46–51 m, sand & gravel, Thetis stn 8, E. Waite, 22 Feb 1898.

Australian material. QUEENSLAND: AM P16848, 1♀ (TL 88 mm), 19.2 km NE of Bowen, 34–36 m; AM P43204, 1♀ (TL 103 mm), E of Mooloolaba, 26°52.74'S 153°35.34'E, 160 m, otter trawl, QLD-1119, J. McIllwain, 3 Aug 1994; QM W24203, 1♂ (TL 45 mm), Coral Sea, 17°59.0'S 147°05.7'E, 302–308 m, trawl, continental slope, 11 Jan 1986; QM W24196, 1♀ (TL 51 mm), Coral Sea, 17°58.7'S 147°08.7'E, 325–328 m, trawl, continental slope, P. Davie, 9 Dec 1985; QM W24210, 1♀ (TL 48 mm), Coral Sea, 17°59.3'S 147°06.0'E, 300 m, trawl, continental slope, 11 Jan 1986; QM W24215, 1♀ (TL 46 mm), Coral Sea, 18°01.3'S 147°07.5'E, 300 m, trawl, continental slope, 19 Jan 1986. NEW SOUTH WALES: AM P16281, 1♂ (TL 76 mm), off Port Stephens, 32°42'S 152°41'E, 228 m, A. Racek, 3 Jul 1959; AM P20980, 2♂♂ (TL 72–80 mm), 1♀ (TL 84 mm), E of Port Stephens, 101–106 m, trawl, 18 Aug 1975; AM P41790, 1♂ (TL 100 mm), 2♀♀ (TL 91–100 mm), E of Port Hunter, Newcastle, 32°55'S 151°56'E, 77 m, K90–19–11, K. Graham, 11 Dec 1990; AM P41791, 2♂♂ (TL 84–85 mm), 2♀♀ (TL 73–74 mm), NE of Tuncurry, 31°56'S 152°51'E, 94 m, K91–06–06, K. Graham, 16 Apr 1991; AM P41792, 2♀♀ (TL 89–90 mm), E of Port Hunter, Newcastle, 32°55'S 151°57'E, 72 m, K92–03–01, K. Graham, 13 Apr 1992; AM P41793, 1♀ (TL 81 mm), E of Port Hunter, Newcastle, 32°55'S 151°57'E, 77 m, K91–15–01, K. Graham, 2 Sep 1991; AM P49047, 1♂ (TL 62 mm), E of Merimbula, 36°56.0'S 150°12.2'E, 117 m, P. Berents, 4 Sep 1994; AM P49048, 2♀♀ (TL 40–72 mm), E of Disaster Bay, 37°18.6'S 150°03.9'E, 82 m, P. Berents, 2 Sep 1994; AM P53603, 1♂ (TL 82 mm), E of Tuncurry, 31°58'S 152°50'E, 95 m, K90–14–09, K. Graham, 25 May 1990; AM P53610, 1♀ (TL 70 mm), Hunter River, Newcastle, 32°56'S 151°46'E, 14 m, K. Graham, 30 Apr 1987; AM P53598, 1♂ (TL 70 mm), 2♀♀ (TL 83 mm; 1 broken, CL 17.9 mm) SE of Cape Hawke, 32°18'S 152°43'E, 92 m, K78–19–06, K. Graham, 12 Sep 1978; AM P53600, 1♂ (TL 81 mm), 1♀ (TL 70 mm), NE of Tuncurry, 31°56'S 152°51'E, 94 m, K91–06–06, K. Graham, 16 Apr 1991; AM P53608, 1♀ (TL 85 mm), E of Sydney, 33°50'S 151°20'E, K90–16–02, K. Graham, 1990; AM P53613, 1♂ (TL 66 mm), 2♀♀ (TL 69–82 mm), E of Botany Bay, 34°00'S 151°11'E, 19 Jan 1974; AM P54081, 1♀ (TL 81 mm), E of Newcastle, 33°04'S 152°09'E, 136 m, K93–06–05, K. Graham, 25 Mar 1993; AM P54082, 6♂♂ (TL 72–89 mm), 3♀♀ (TL 81–93 mm), SE of Brush I., 35°36'S 150°27'E, 119 m, K93–01–01, K. Graham, 10 Feb 1993; AM P56884, 1♂ (TL 88 mm), 1♀ (TL 90 mm), SE of Yamba, 29°23'S 153°35'E, 70–71 m, K95–06–28, K. Graham, 17 Apr 1996; AM P60080, 12♂♂ (TL 78–110 mm), 8♀♀ (TL 73–106 mm), off Sydney, K. Graham, 1995; AM P60081, 4♂♂ (TL 64–88 mm), 11♀♀ (TL 65–98 mm), NE of Broken Bay, 135 m, K86–01–03, K. Graham, 10 Feb 1986; WAM 217–96, 1♀ (TL 50 mm), off Cronulla, 60–100 m, grab dredge, CSIRO, 5 Dec 1963. TASMANIA: TM G834, 1♀ (TL 102 mm), Pirate's Bay, 80.5 m, 12 Feb 1945. WESTERN AUSTRALIA: SAM C5766, 2♀♀ (TL 46–48 mm), Great Australian Bight, approximately 195 km SW of Eucla, 33°20'S 127°45'E, 260 m, trawl, W. Zeidler & K. Gowlett-Holmes, 12 Jan 1989; SAM C5767, 1♂ (TL 54 mm), Great Australian Bight, approximately 170 km SW of Eucla, 33°16'S 128°01'E, 165 m, trawl, W. Zeidler & K. Gowlett-Holmes, 17 Jan 1989; SAM C5768, 1♂ (TL 55 mm), Great Australian Bight, approximately 170 km SSW of Eucla, 33°21'S 128°12'E, 355 m, trawl, W. Zeidler & K. Gowlett-Holmes, 18 Jan 1989; WAM 219–96, 1♀ (TL 38 mm), W of West End, Rottnest I., 177–183 m, 16 Sep 1965; WAM 1347–87, 2♂♂ (TL 64–48 mm), 5♀♀ (53–61 mm), Great Australian Bight, 162 m, from gut of Australian Tusk (fish), M. Walker 27 Mar 1978; WAM C8171, 1♂ (TL 32 mm), NW Rottnest I., 165–167 m, dredged, R. George, 15 Aug 1962; WAM C17585, 2♀♀ (TL 23–46 mm), W of Rottnest I., 31°59'S 115°14'E, 182 m, 23 Mar 1972.

Diagnosis. Dactylus of raptorial claw with 5 or 6 teeth. TS5 lateral process with apex directed anteriorly or slightly inclined ventrally. TS6–8 with MD carinae, those on TS6–7 indistinct in juveniles. Abdominal carinae spined as follows: SM 6, IM (1–2)3–6, LT 1–6, MG 1–5. Telson often with or without long, indistinct postanal carinae in largest specimens; denticles SM 9–14, IM 7–10, LT 1. Lobe on the outer margin of the inner spine of the uropodal protopod distinctly broader adjacent spine. Uropodal exopod proximal segment outer margin with 7–9 movable spines.

Colour in life. Overall dorsal colour light brown, with carinae and grooves yellow and dark brown. Telson with median carina yellow with dark brown patch below posterior spine, extending laterally along posterior margins. Uropodal protopod dark brown basally; exopod distal segment dark brown.

Measurements. Male (n = 41) TL 32–110 mm, female (n = 61) TL 23–106 mm. CI 374–524. A1 peduncle 0.86–1.02 CL. A2 scale length 0.48–0.65 CL. Anterior carapace width 0.40–0.52 CL. The present series includes the largest known specimen of the species.

Remarks. The present non-type specimens agree well the type series, but vary in the shape of the rostral plate margins (straight to convex) (Fig. 97A,I), the number of teeth on the dactylus of the raptorial claw (5 or 6, usually 5) and in the number of armed abdominal carinae. As in the types series of *A. mcneilli*, most specimens lack a postanal carina, but a low, indistinct carina is present in many of the largest specimens. The petasma is well developed in males 32 mm TL or greater.

Anchisquilloides mcneilli closely resembles *A. michelae* from the Philippines and most characters used by Moosa (1986) to distinguish the two species are within the range of variation of *A. mcneilli*. *Anchisquilloides mcneilli* differs from *A. michelae* in having the lateral process of TS5 inclined anteriorly or slightly inclined ventrally instead of almost directed ventrally, and the lobe on the outer margin of the inner spine of the uropodal protopod is distinctly broader than instead of subequal to the width of the adjacent spine. Additionally, TS6 usually bears a MD carina and the IM carinae are usually armed on AS1–2 in *A. mcneilli*, whereas TS6 always lacks a MD carina and the IM carinae of AS1–2 are always unarmed in *A. michelae*. *Anchisquilloides mcneilli* is primarily a temperate water species, for it is most in common at higher latitudes. The few specimens of *A. mcneilli* known from the Coral Sea were taken from the continental slope. The 79 mm TL ♀ paratype of *A. mcneilli* (AM G2205) is the basis of Whitelegge's (1900) erroneous record of *Squilla armata* from New South Wales.

Habitat. Sandy inshore waters to outer continental shelf or upper slope in depths between 14 m and 302–308 m, but usually greater than 90 m; often trawled with *Kempina mikado*.

Distribution. Known from the Coral Sea, Queensland, south to the Perth area, Western Australia.

Belosquilla n.gen.

Diagnosis. Eye with cornea bilobed, width less than 0.3 CL. A1 somite not greatly elongate. Carapace MD carina not interrupted at base of anterior bifurcation, branches of anterior bifurcation opening anterior to dorsal pit; posterolateral margin obtusely angled and produced ventrally. Raptorial claw dactylus with 6 teeth; propodus distal margin with stout tooth. Mandibular palp absent. MXP1–5 with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS5 lateral process bilobed; posterior lobe spatulate with rounded apex, directed laterally. TS6–7 lateral processes single. AS1–5 with SM, IM, LT and MG carinae. Telson SM teeth with fixed apices; dorsolateral surface with curved rows of shallow pits, without supplementary longitudinal carinae; ventral surface without postanal carina. Uropodal protopod terminating in 2 slender spines with one lobe between spines.

Type species. *Squilla laevis* Hess, 1865, by present designation and monotypy.

Included species. One: *B. laevis* (Hess, 1865).

Etymology. Derived from the combination of *Belo*, meaning sharp, and the generic name *Squilla*, alluding to propodal spine on the raptorial claw and sharp apex of the hook process of the petasma. Gender: feminine.

Remarks. *Belosquilla* n.gen. superficially resembles *Alima* Leach, 1817 in having a bilobed lateral process of TS5. It differs from *Alima* in showing no trace of bilobation on TS6–7 (indistinctly bilobed in *Alima*), the anterior bifurcation of the median carina of the carapace is uninterrupted basally, the posterolateral margin of the carapace is distinctly angled, not rounded, there are five instead of four epipods, and the hook process of the petasma is apically pointed instead of blunt, thus resembling species of *Squilla* and most other genera having a single lateral process of TS5. Thus, *Belosquilla* is intermediate between the genera with a singular and those with a bilobed lateral process on TS5 as shown by cladistic analysis of the squilloids (in prep.). The stout, sharp tooth on the distal margin of the propodus of the raptorial claw will distinguish *Belosquilla* from all other squilloids.

Belosquilla laevis (Hess, 1865) n.comb.

Fig. 98

Squilla laevis Hess, 1865: 170, fig. 22 (type locality: Sydney, Australia).–de Man, 1888b: 296.–Whitelegge, 1889: 60.–Kemp, 1913: 10, 18, 21, 49–50, pl. 3: figs. 35–37.–Hale, 1924: 492, 496, pl. 32: fig. 2; 1927a: 30, 32, fig. 20; 1929b: 67.–Stephenson, 1952: 6, 7; 1953a: 40; 1955: 4; Stephenson & McNeill, 1955: 242–243.–Stephenson, 1962: 33, 34.–Manning, 1966: 98–99; 1968c: 136, 137.–Edgar, 1997: 180.

Squilla interrupta.–Stephenson & McNeill, 1955: 240 (part, New South Wales specimen, not *Squilla interrupta* Kemp, 1911).

Alima laevis.–Manning, 1970a: 1433; 1995: 23.–Graham *et al*., 1993a: 24, 64; 1993b: 73.–Ahyong & Norrington, 1997.–Debelius, 1999: 292.

Squilla sp.–Jones & Morgan, 1994: 42.

Type material. HOLOTYPE: ZMG 961, ♂ (TL 105 mm), Sydney, New South Wales, Schütte, 1864.

Australian material. QUEENSLAND: AM P43224, 1♀ (TL 79 mm), Shoalwater Bay, trawl, QLD-1030, Oct 1993; QM W3935, 1♀ (TL 102 mm), 1.6 km E of Otter Rock, Moreton Bay, 27°16'S 153°08'E, 6.4 m, W. Stephenson, 23 Feb 1967; QM W3992, 1♂ (TL 109 mm), 11 km NE of Mackay, 21°04'S 149°17'E, 24 m, muddy sand, J. Davie, 11 Aug 1970; QM W6517, 1♂ (TL 86 mm), 1♀ (TL 103 mm), Noosa, 26°25'S 153°07'E, E. Grant, Jan 1977; QM W8628, 2♀♀ (TL 17–36 mm), Middle Banks, Moreton Bay, 27°11'S 153°21'E, Sep 1972. NEW SOUTH WALES: AM P12259, 39♂♂ (TL 60–110 mm), 36♀♀ (TL 47–108 mm), Evans Head, trawl, H. Lane, May–Jun 1963; AM P19319, 1♂ (TL 116 mm), George's River, washed up on oyster beds, P. Griffiths, 23 Jul 1973; AM P19321, 1♂ (TL 107 mm), SE of Cockatoo I., Sydney Harbour, 8 m, trawl, H. Recher & J. Paxton, 16 Mar 1972; AM P26895, 1♂ (TL 116 mm), near Gladesville Bridge, Parramatta River, caught at midnight on hook & line with prawn bait, H. Baker, 4 Mar 1978; AM P43219, 2♂♂ (TL 95–101 mm), 1♀ (TL 88 mm), Botany Bay, 10 m, trawl, N. Coleman, Sep 1979; AM P43238, 2♀♀ (TL 100–102 mm), Botany Bay, 15 m, N. Coleman, 17 Oct 1979; AM P49768, 19♂♂ (TL 56–96 mm), 18♀♀ (TL 62–87 mm), Port Jackson, 20 m, muddy sand, trawl, M. Beatson, 7 Feb 1994; AM P52611, 1♀ (TL 81 mm), Salamander Bay, Port Stephens, 32°43'S 152°05'E, scoop net under light, N. Carrick, 8 Mar 1978; AM P53601, 1♂ (TL 81 mm), NE of Clarence River mouth, 29°24'S 153°23'E, 24 m, trawl, K91–01–04, K. Graham, 13 Feb 1981; AM P53602, 2♀♀ (TL 96–97 mm), Clarence River, 29°22'S 153°23'E, 26 m, K90–08–41, K. Graham, 7 May 1990; AM P53604, 2♀♀ (TL 91–99 mm), E of Brunswick Heads, 28°26'S 153°39'E, 51 m, K91–12–21/24, K. Graham, 11 Aug 1991; AM P53605, 1♂ (TL 89 mm), 3♀♀ (TL 96–104 mm), Clarence River, 29°24'S 153°23'E, 26 m, K92–02–45, K. Graham, 1 Apr 1992; AM P54079, 5♀♀ (TL 84–99 mm), E of Woody Head, 29°20'S 153°21'E, 20 m, trawl, K96–06–52, K. Graham, AM P56978, 2♂♂ (TL 102–111 mm), Botany Bay, prawn trawl, S. Ahyong, Nov 1992; AM P56979, 2♂♂ (TL 59–85 mm), 1♀ (TL 68 mm), Botany Bay, prawn trawl, S. Ahyong, Nov 1989; NMV J37781, 1♀ (TL 93 mm), off Camp Cove, Sydney Harbour, 33°50'S 151°17'E, 15 m, mud, R. Kuiter, 16 Jan 1985; SAM C177, 1♂ (TL 103 mm), Port Jackson. SOUTH AUSTRALIA: NMV J13866, 2♂♂ (TL 89–91 mm), Great Australian Bight, 32°24'S 133°24'E, 40 m, P. Symond, 26 Oct 1972; NMV J37820, 1♂ (TL 83 mm), Spencer Gulf, 34°S 137°10'E, 30 m, 8 Apr 1981; SAM TC15361, 1♀ (TL 98 mm), St Vincent's Gulf, 40 km W of Port Willunga, 35°22'S 138°5'E, M. Corigliano, Apr 1981; SAM TC15370, 3♀♀ (TL 86–102 mm), Backstairs Pass, approx. 7 km NE of Kingscote, King I., 35°38'S 137°46'E, 33 m, P. March, Aug 1981; SAM C17, 1♂ (TL 98 mm), 1♀ (TL 57 mm), Encounter Bay, H. Pulleine, 1890; SAM C176, 1♀ (TL 61 mm), St Vincent Gulf, W. Baker; SAM C178, 1♂ (TL 87 mm; dry), 1♀ (TL 56 mm; dry), Encounter Bay, R. Pulleine, 1896; SAM C1921, 1♀ (CL 24.4 mm), Port Pirie, Spencer Gulf, SA Fisheries Dept, 1935; SAM C1925, 1♀ (TL 54 mm), Port Willunga, 26 May 1934; SAM C2156, 1♀ (CL 24.4 mm), Port Adelaide, 11 Apr 1938; SAM C5762, 1♂ (TL 94 mm), 1♀ (109 mm), Goat I., off Ceduna, 33°46'S 133°30'E, 36.6 m, T. Holder, early 1982; SAM C5763, 1♀ (TL 98 mm), northern Great Australian Bight, 32°24'S 133°30'E, 42 m, trawl, 5 May 1973; SAM C5764, 1♀ (TL 105 mm), 9.6 km off North Cape, King I., 30 m, R. Smith & S. Doyle, 15 Jan 1982; SAM C5765, 1♂ (TL 92 mm), W side of Eyre Peninsula, T. Asen, late 1982; SAM C5769, 3♂♂ (TL 94–100 mm), 8♀♀ (TL 87–105 mm), Douglas Bank, 6–7 Dec 1972; SAM C5773, 1♀ (TL 71 mm), Wallaroo; SAM C5778, 1♀ (TL 98 mm), Yarraville Shoal, KB, 4 Apr 1972; SAM C5779, 1♀ (TL 92 mm), Port Clinton, E. Lodge; SAM C5785, 1♀ (TL 104 mm), St Vincent's Gulf, approx. 18 km SE of Long Spit Beacon, 34°44'S 138°10'E, 20 m, trawl, L. Hobbs, 31 Oct 1989; SAM C5786, 2♂♂ (TL 92–104 mm), 1♀ (TL 101 mm), 25 km NNE of Kingscote, King I., 35°38.6'S 137°46'E, 28

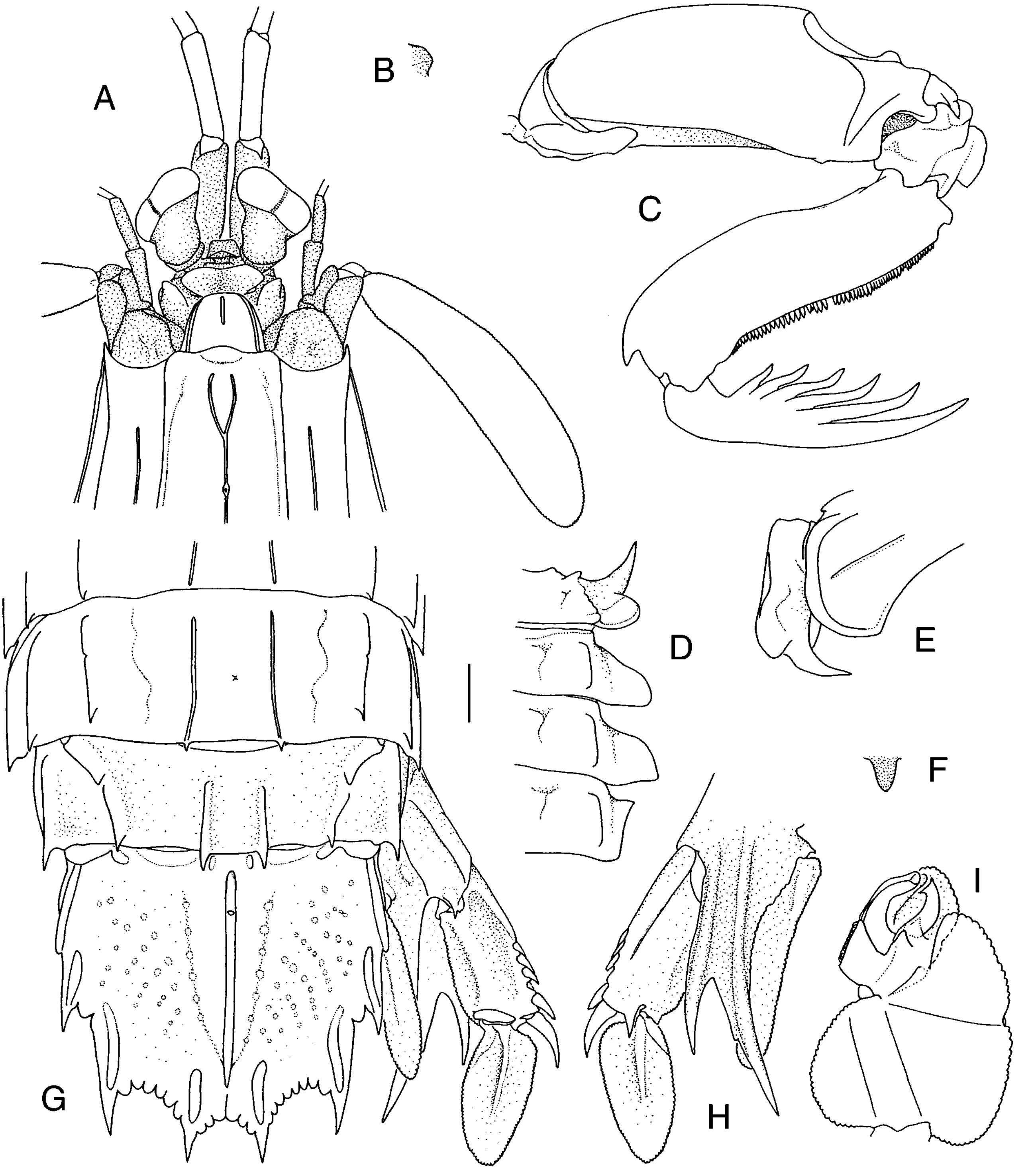

Figure 98. *Belosquilla laevis* (Hess) n.comb., ♂ TL 86 mm (AM P49738). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, posterior carapace & TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 2.5 mm; I = 1.25 mm.

Apr 1981; SAM C5787, 1♂ (broken, CL 19.4 mm), 1♀ (TL 102 mm), off Cowell, 37 m, trawl, B. Mills, Feb 1982; SAM C5788, 1♂ (TL 87 mm), 2♀♀ (TL 95–96 mm), St Vincent Gulf, 32 km W of Port Noarlunga, 35°11'S 138°06'E, 40 m, prawn trawl, M. Corigliano, 25 Mar 1981; SAM C5792, 2♂♂ (TL 107 mm; 1 broken, CL 28.3 mm), 3♀♀ (TL 101–105 mm), 15 km S of Cowell, 34°3.0'S 136°58.1'E, 29 m, mud & sand, N. Carrick, 28 Sep 1981; SAM C5797, 1♂ (TL 112 mm), off Emu Bay, 31 m, B. March *et al*., 15 Jan 1982. WESTERN AUSTRALIA: WAM C22575, 1♂ (TL 110 mm), Mandurah, Mrs Turner, 25 Jun 1966; WAM C22576, 8♂♂ (TL 116–124 mm), 3♀♀ (TL 120–123 mm), Cockburn Sound off Rockingham, Kwinana, S. Slack-Smith & A. Paterson, 25–26 Feb 1970; WAM C22578, 1♀

(TL 73 mm), Mandurah estuary, R. Cooper, Apr 1968; WAM 204–96, 2♀♀ (86–91 mm), Mandurah estuary, B. Schillow, Apr 1968; WAM 212–96, 1♀ (TL 48 mm), Cockburn Sound, 32°14'2"S 115°41'45"E, D. Heald, 15 Sep 1972; AM P17984, 1♂ (TL 116 mm), 5♀♀ (TL 94–107 mm), Cockburn Sound, Fremantle, N. Coleman, 19 Mar 1971; AM P19320, 1♂ (TL 84 mm), 1♀ (TL 93 mm), 48 km S of Carnarvon, 15–18 m, sandy mud with *Posidonia* & *Cymodocea* banks, N. Coleman, 3 Jun 1972.

Description. Dorsal integument pitted, rugose. Eye not extending beyond A1 peduncle segment 1; cornea bilobed, distinctly broader than and set obliquely on stalk; CI 365–591. Ophthalmic somite anterior margin subquadrate, medially emarginate. Ocular scales rounded, separate. A1 somite not greatly elongate; dorsal processes trianguloid, apices rounded, directed anterolaterally; A1 peduncle 0.77–1.04 CL. A2 scale 0.58–0.99 CL; entire margin setose. Rostral plate broader than long; subtrapezoid; lateral margins upturned, convergent; apex rounded to truncate; dorsal surface with short MD carina anteriorly. Carapace anterior width 0.55–0.62 CL; anterolateral spines not extending to base of rostral plate; with median, IM, LT MG and reflected MG carinae; MD carina not interrupted at base of anterior bifurcation, branches of anterior bifurcation opening anterior to dorsal pit; posterolateral margin obtusely angled and produced ventrally; posterior median projection low. Raptorial claw dactylus with 6 teeth; outer margin sinuous or broadly curved; slightly inflated in adult males; proximal margin angular; carpus dorsal carina undivided; merus without outer inferodistal spine; propodus distal margin with stout tooth. Mandibular palp absent. MXP1–5 with epipod. MXP5 basal segment with small, ventrally directed spine. TS5 lateral process bilobed; anterior lobe a slender spine directed anterolaterally; posterior lobe on higher plane, spatulate with rounded apex, directed laterally. TS6–8 with distinct SM and IM carinae. TS6–7 lateral process triangular, anterior margin convex, apex blunt. TS8 anterolateral margin triangular, apex acute; sternal keel rounded, inclined posteriorly. PLP1 endopod in adult males with hook process of petasma distally pointed, as long as tube process. AS1–5 with SM, IM, LT and MG carinae. AS1–5 SM carinae distinct, parallel. AS6 with ventrolateral spine anterior to uropodal articulation; sternum posterior margin unarmed, without transverse carinae. Abdominal carinae spined as follows: SM 5–6, IM (4)5–6, LT (1–2)3–6, MG 1–5. Telson length and breadth subequal; with 3 pairs of primary teeth (SM, IM, LT), each with dorsal carina; SM teeth with fixed apices; IM teeth slender, apices extending posteriorly slightly beyond bases of SM teeth; prelateral lobe subequal to or longer than margin of LT tooth; denticles rounded, each without dorsal tubercle, SM 2–3, IM 6–9, LT 1; MD carina interrupted proximally, armed posteriorly with short apical spine overhanging blunt tubercle; dorsolateral surface with curved rows of shallow pits, without supplementary longitudinal carinae; ventral surface without postanal carina; ventrolateral carina extending posteriorly to base of LT tooth. Uropodal protopod inner margin crenulate; terminating in 2 slender spines, dorsally and ventrally carinate, inner longer; unarmed dorsally excepting dorsal spine above proximal exopod articulation; with short, flattened ventral spine anterior to endopod articulation. Terminal spines of uropodal protopod with lobe on outer margin of inner spine low, rounded, narrower than adjacent spine; proximal margin straight or faintly concave. Uropodal exopod proximal segment unarmed dorsally; outer margin with 7–9 movable spines, distalmost not exceeding midlength of distal segment; distal margin with slender ventral spine. Exopod distal segment slightly longer than proximal segment.

Colour in life. Dorsal colour grey brown to pale olive green. Carinae and grooves of carapace, thoracic and abdominal somites dark brown. Raptorial claw with outer surface of merus pinkish-brown; carpus, propodus and dactylus white. AS2 and 5 usually with dark brown rectangular patch. Uropodal exopod with proximal segment dark on inner ½; distal segment yellow with narrow, dark medial portion proximally.

Measurements. Male (n = 101) TL 56–127 mm, female (n = 119) TL 17–123 mm. The present series includes the largest known specimens of the species.

Remarks. The present series agrees in almost all respects with the holotype. In the holotype, the base of the anterior bifurcation of the median carina of the carapace is relatively low, thus appearing interrupted. In all other specimens, the base of anterior bifurcation of the median carina of the carapace is well formed. *Belosquilla laevis* is the most common shallow water squilloid in temperate Australian waters and is frequently taken by commercial prawn trawlers.

Stephenson's (1960) record of *B. laevis* from near Cairns is based on *Miyakea nepa*. Specimens reported as *B. laevis* from New Caledonia by Moosa (1991) are referable to *Alimopsoides tuberculatus* Moosa, 1991.

Habitat. Shallow embayments or other sheltered coastal waters; burrows are simple and U-shaped, constructed in sand-mud substrates, often in association with seagrass or rubble; intertidal to 40 m.

Distribution. Australia: Mackay, central Queensland, south around the continent to Shark Bay, Western Australia.

Busquilla Manning, 1978c

Busquilla Manning, 1978c: 23. Type species *Busquilla plantei* Manning, 1978c, by original designation. Gender feminine.

Diagnosis. Dorsal integument smooth, appearing polished. Eye very large, cornea strongly bilobed, width at least 0.3 CL in adults, distinctly broader than and set obliquely on stalk. Ophthalmic somite anterior margin triangular, usually with apical spine. Carapace anterior width exceeding ½ median length; anterolateral spines small, not extending to base of rostral plate; with normal complement of carinae; MD carina indistinct or absent anterior to dorsal pit; posterolateral margin rounded. Raptorial claw dactylus with 5 teeth; carpus dorsal carina undivided or tuberculate in adults; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process blunt distally. TS5 lateral process obscurely bilobed; anterior lobe a small slender spine directed anteroventrally; posterior lobe minute, directed laterally. TS6–7 lateral process bilobed; anterior lobe much smaller than posterior lobe. AS1–5 each with normal complement of carinae. Telson SM teeth with fixed apices; prelateral lobe shorter than margin of LT tooth; dorsolateral surface without supplementary longitudinal carinae.

Included species. Two: *B. plantei* Manning, 1978c; and *B. quadraticauda* (Fukuda, 1911a).

Remarks. *Busquilla* most closely resembles *Erugosquilla* and *Natosquilla* in the smooth dorsum and broad carapace, and differs from both in bearing five instead of six or more teeth on the dactylus of the raptorial claw. *Erugosquilla* and *Natosquilla* also differ from *Busquilla* in having a strongly tuberculate dorsal carina on the carpus of the raptorial claw; in *Busquilla*, the carpus is irregular or only distally tuberculate. Moreover, the carpal tubercles on the raptorial claw in *Busquilla* are well developed only in adults. Adults of *Busquilla* have retained postlarval or early juvenile characters such large eyes, small anterolateral spines on the carapace, less pronounced lateral processes of TS5 (see Alikunhi, 1967 for account of postlarval *B. quadraticauda* as *Squilla boops*) along with late development of the tubercles on the carina of the carpus of the raptorial claw. Species of *Oratosquillina* and *Erugosquilla* (see Alikunhi, 1967) share similar postlarval and early juvenile features with *Busquilla*, but in adults, the eyes are relatively smaller, the anterolateral spines of the carapace are well developed as are the bilobate lateral processes of TS5, and in those species with the tuberculate carina on the carpus of the raptorial claw, the tuberculation is well developed even in early juveniles. *Busquilla* appears to be neotenous relative to *Oratosquillina* and *Erugosquilla*. *Alima guinotae* Moosa, 1991, is conspecific with *Busquilla quadraticauda* and is synonymized below. Both species of *Busquilla* are reported for the first time from Australian waters.

Key to species of *Busquilla*

1 Rostral plate with MD carina. Carpus of raptorial claw distally tuberculate in adults. Uropodal exopod distal segment entirely dark .... ***B. quadraticauda***

—— Rostral plate without MD carina. Carpus of raptorial claw smooth or irregular in adults. Uropodal exopod distal segment dark on inner ½ only .... ***B. plantei***

Busquilla plantei Manning, 1978c

Fig. 99

Busquilla plantei Manning, 1978c: 23–24, fig. 11 (type locality: Passe Lokobe, Madagascar); 1995: 23, 170.

Type material. HOLOTYPE: MNHN St 761, ♂ (TL 53 mm), Passe Lokobe, Madagascar, 17 m, sand with *Cerithinopsis*, R. Plante, May 1969. PARATYPE: USNM 56192, 1♂ (TL 65 mm), Madagascar.

Australian material. QUEENSLAND: QM W12858, 1♂ (TL 67 mm), S of Slasher's Reefs, trawl, "Red Spot Bycatch" stn 8, Shot 3, C. Jones 17 Feb 1985. WESTERN AUSTRALIA. NTM Cr012357, 1♀ (TL 33 mm), Northwest Shelf, 19°58.8–58.5'S 117°51.2–51.8'E, 42–44 m, beam trawl, S0183, 18 Feb 1983.

Diagnosis. Rostral plate without MD carina. Carpus of raptorial claw smooth or irregular in juveniles and adults. Abdominal carinae spined as follows: SM (5)6, IM (3)4–6, LT (1–2)3–6, MG 1–5. Telson as broad as long; denticles SM 3–4, IM 7–9, LT 1, rounded, each with low dorsal tubercle. Uropodal exopod proximal segment outer margin with 7 or 8 movable spines.

Colour in alcohol. Largely faded. Dorsum sparsely covered with dark chromatophores. AS5 with posterolateral margin dark. AS6 and telson with dark spot at lateral articulation. Telson with dark patch covering posterior spine of median carina and submedian teeth. Uropodal exopod with dark distal patch on proximal segment extending onto inner ½ of distal segment.

Measurements. Male (n = 3) TL 53–67 mm, female (n = 1) TL 33 mm. CI 231–276. A1 peduncle 1.12–1.35 CL. A2 scale 0.65–0.71 CL. Anterior carapace width 0.60–0.63 CL. The present series includes the largest known specimen of the species.

Remarks. The specimen from Queensland is the largest known of the species and together with the Western Australian specimen, represents the first Australian record. Both Australian specimens lack the raptorial claws, but otherwise agree in most respects with the type material. The chief difference between the types and the Queensland specimen is the degree of development of the modified endopod of pleopod 1 (petasma). The petasma is undifferentiated in the holotype, partially developed in the 65 mm TL paratype, and fully developed by 67 mm TL. Thus, *Busquilla plantei* probably matures at a larger size than does its congener, because in specimens of *B. quadraticauda* reported below, the petasma is already partially developed by 45 mm TL.

Busquilla plantei differs from *B. quadraticauda* in having a narrower rostral plate, in having a smooth instead of distally tuberculate carina on the carpus of the raptorial claw in both juveniles and adults, in lacking a median carina on the rostral plate, in having a more distinct anterior lobe on the lateral process of TS6 and in having only the inner ½, instead of the entire distal segment of uropodal exopod darkly pigmented. The degree of divergence of the abdominal submedian carinae in *Busquilla* is not a reliable diagnostic species character as used by Manning (1995) because they increasingly diverge with increasing size.

Habitat. Soft, sandy substrates to at least 17 m depth.

Distribution. Madagascar, and now from western and eastern Australia.

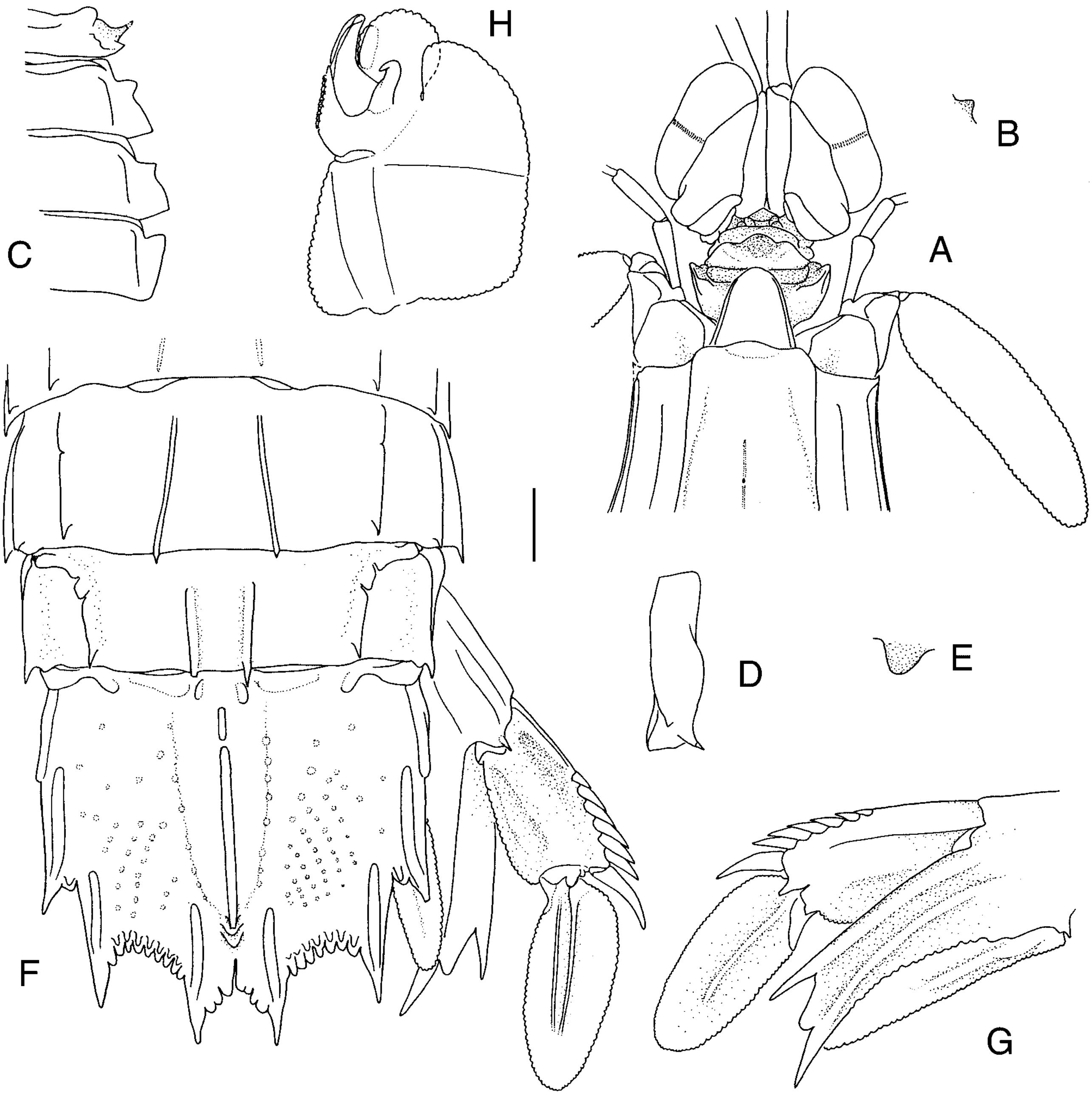

Figure 99. *Busquilla plantei* Manning, ♂ TL 67 mm (QM W12858). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, TS5–8 lateral processes, right dorsal. D, TS5, right lateral. E, TS8 sternal keel, right lateral. F, AS4–6, telson & uropod, dorsal. G, uropod, right ventral. H, PLP1 endopod, right anterior. Scale A–G = 2 mm; H = 1 mm.

Busquilla quadraticauda (Fukuda, 1911a)

Fig. 100

Squilla quadraticauda Fukuda, 1911a: 174, fig. 1; 1911b: 287–289, fig. 3–5 (published Apr 15) (type locality: Tungkang, Pingtung County, Taiwan, by present neotype designation).
Squilla boopis Kemp, 1911: 97 (published May) (type locality: Gulf of Martaban, Burma, 14°26'N 96°23'E).
Squilla boops.–Kemp, 1913: 3, 10, 22, 55, pl. 4, figs. 45–47.
Oratosquilla quadraticauda.–Manning, 1971b: 14.–Moosa, 1973: 24–25.
Anchisquilla punctata Blumstein, 1970: 218, fig. 1 (type locality: Gulf of Tonkin, 17°48'N 109°32'E, 102 m); 1974: 115.
Busquilla quadraticauda.–Manning, 1978c: 23; 1995: 23, 170.
Alima guinotae Moosa, 1991: 186–188, fig. 9 (type locality: St. Vincent Bay, New Caledonia, 21°51'S 165°45'E); new synonymy.

Type material. NEOTYPE: AM P60114, ♂ (TL 92 mm), Tungkang, Pingtung County, Taiwan, 5 Aug 1996.

Australian material. WESTERN AUSTRALIA: AM P43211, 1♂ (TL 46 mm), 155 km NNW of Port Hedland, Northwest Shelf, 19°00.4–00.3'S 118°01.0–01.1'E, 116–120 m, beam trawl, S0583, 29 Oct 1983.

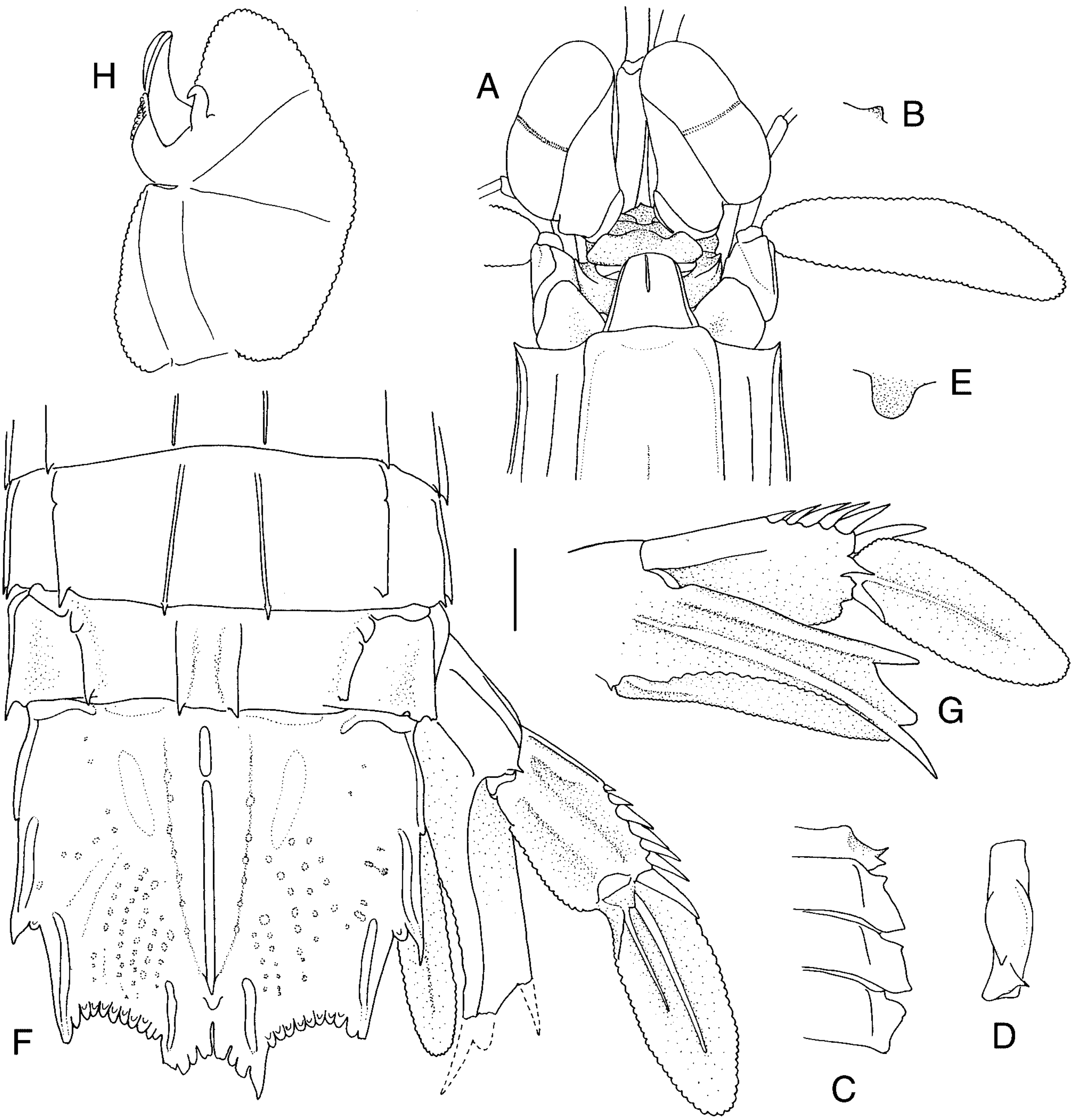

Figure 100. *Busquilla quadraticauda* (Fukuda) ♂ TL 46 mm (AM P43211). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, TS5–8 lateral processes, right dorsal. D, TS5, right lateral. E, TS8 sternal keel, right lateral. F, AS4–6, telson & uropod, dorsal. G, uropod, right ventral. H, PLP1 endopod, right anterior. Scale A–G = 2 mm; H = 1 mm.

Other material. MNHN St 1657, 1♂ (TL 45 mm), St Vincent Bay, New Caledonia, 21°51'S 165°45'E, 55–65 m, B. Richer de Forges, 21 Sep 1984 (holotype of *Alima guinotae* Moosa).

Diagnosis. Rostral plate with distinct MD carina. Carpus of raptorial claw undivided in juveniles, distally tuberculate in adults. AS5 SM carinae divergent posteriorly. Abdominal carinae spined as follows: SM 5–6, IM (2)3–6, LT 1–6, MG 1–5. Telson slightly broader than long; denticles SM 3–4, IM 8–10, LT 1, rounded, each with low dorsal tubercle. Uropodal exopod proximal segment outer margin with 6 or 7 movable spines.

Colour in alcohol. Almost completely faded. Dorsum with some sparsely scattered chromatophores. Exopod distal segment dark.

Measurements. Male (n = 3) TL 45–92 mm. CI 230–287. A1 peduncle 1.01–1.26 CL. A2 scale 0.67–0.75 CL. Anterior carapace width 0.63–0.66 CL. The neotype of *B. quadraticauda* is the largest known specimen of the species.

Remarks. The present series of specimens agree in most respects with each other, and as in *B. plantei*, the degree of divergence of the submedian carinae on AS5 increases with increasing size. Additionally, the carpus of the raptorial claw is smooth in the smaller specimens with two or three distal tubercles present in the largest specimens. *Busquilla quadraticauda* closely resembles *B. plantei* differing in having a broader rostral plate apex, in bearing a median carina on the rostral plate and in having the entire distal segment of the uropodal exopod darkly pigmented instead of the inner ½ only. The posterior endite of the endopod of the first pleopod is undeveloped in the two smaller males (TL 45–46 mm) and fully developed in the neotype (TL 92 mm). As remarked under the account of *B. plantei*, the endopod of the first pleopod in males of *B. quadraticauda* differentiates at a smaller size than in its congener.

The holotype of *B. quadraticauda* is no longer extant (T. Hamano, S. Kubota, pers. comm.). With three nominal species presently included in the synonymy of *B. quadraticauda*, along with its close similarity to *B. plantei*, a neotype designation is justified. A specimen from Japan is presently unavailable so an adult male specimen from Taiwan is herein selected as the neotype of *B. quadraticauda*. Although the original type locality of *B. quadraticauda* is Japan, Taiwan is in the same general area, namely the northwestern Pacific Ocean.

Alima guinotae Moosa, 1991, from New Caledonia, agrees in all respects with *B. quadraticauda* and is herein synonymized. Although *Alima guinotae* was characterized as lacking submedian carinae on the thoracic somites, re-examination of the holotype (MNHN St 1657) has shown them present. Poupin's (1998) record of *B. quadraticauda* from French Polynesia is based on juvenile *Oratosquilla fabricii* (see Ahyong, 2000b).

Habitat. Taken between 42–44 m and 116–120 m, presumably on soft substrates.

Distribution. Japan, Vietnam, Burma, Indonesia, New Caledonia, Hawaii and now from the Australian Northwest Shelf.

Carinosquilla Manning, 1968c

Carinosquilla Manning, 1968c: 121, 135. Type species *Squilla multicarinata* White, 1849, by original designation. Gender feminine.

Keijia Manning, 1995: 204–205. Type species *Squilla lirata* Kemp & Chopra, 1921, by original designation and monotypy. Gender feminine.

Diagnosis. Eye with cornea bilobed, width less than 0.3 CL. Carapace with anterolateral spines; with normal complement of carinae and numerous supplementary longitudinal carinae; MD carina distinct, uninterrupted at base of anterior bifurcation, branches of anterior bifurcation distinct, opening anterior to or posterior to dorsal pit; posterolateral margin rounded. Raptorial claw dactylus with 5–7 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp absent or 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process blunt distally. TS5–8 with distinct SM, IM and numerous supplementary longitudinal carinae. TS5–7 lateral process bilobed. AS1–6 with SM, IM, LT, MG, and numerous supplementary longitudinal carinae. AS6 sternum with transverse carinae. Telson SM teeth with fixed apices; prelateral lobe present; dorsolateral surface with numerous supplementary longitudinal carinae; ventral surface with long postanal carina and numerous supplementary carinae. Uropodal protopod inner margin crenulate to spinular.

Included species. Seven: *C. australiensis* n.sp.; *C. lirata* (Kemp & Chopra, 1921); *C. carinata* (Serène, 1950); *C. carita* n.sp.; *C. multicarinata* (White, 1849); *C. redacta* n.sp.; *C. thailandensis* Naiyanetr, 1983.

Remarks. Manning (1995) recognized only two species of *Carinosquilla*. The genus, however, is considerably more speciose than previously recognized. Whereas Manning (1995) followed Moosa (1991) in considering *C. thailandensis* to be a synonym of *C. carinata*, Naiyanetr *et al*. (2000) show that both species are distinct. Additionally, three new species of *Carinosquilla* are described from Australia. A fourth undescribed species of *Carinosquilla* from the Indian Ocean, previously identified with *C. carinata* (see Ingle, 1963; Manning, 1968b; Moosa & Cleva, 1984a), has been identified, but is being named elsewhere (Ahyong & Naiyanetr, in press).

Manning (1995) erected *Keijia* for *Squilla lirata* Kemp & Chopra, 1921, a species previously placed in *Carinosquilla* by Manning (1968c). The single character distinguishing *Carinosquilla* from *Keijia* was the absence of the mandibular palp in the latter. One of the new Australian species that otherwise closely resembles *C. multicarinata*, the type species of the genus, lacks the mandibular palp, invalidating the distinction between *Carinosquilla* and *Keijia*. *Keijia* is herein regarded as a junior synonym of *Carinosquilla*. Four species of *Carinosquilla* are known from Australia.

Key to species of *Carinosquilla*

1	Eyestalk with irregular carinae. TS5 with dorsal carinae either side of midline longitudinal or oblique, not transverse	4
——	Eyestalk without carinae	2
2	TS5 with dorsal carinae either side of midline transverse	3
——	TS5 with dorsal carinae on either side of midline longitudinal or oblique, not transverse. Inner margin of uropodal protopod crenulate	*C. lirata*

3 Mandibular palp present. Telson prelateral lobe with sharp apex .... *C. multicarinata*

—— Mandibular palp absent. Telson prelateral lobe with blunt apex .... ***C. carita***

4 Ocular scales with bifurcate apices 5

—— Ocular scales with apices entire, not bifurcate 7

5 Posterior margin of AS1–5 between SM carinae lined with short spines .... *Carinosquilla* sp.

—— Posterior margin of AS1–5 between SM carinae unarmed 6

6 AS1–2 with unarmed SM and IM carinae .... ***C. redacta***

—— AS1–2 with armed SM and IM carinae .... *C. carinata*

7 Merus of raptorial claw with longitudinal carina on outer margin. AS1–5 with posterior margin below IM carinae armed with 1–3 spines. AS6 with supplementary carina between SM and IM carinae terminating in a slender spine. Distal segment of uropodal exopod mostly or entirely black .... ***C. australiensis***

—— Merus of raptorial claw with vermiform sculpture on outer margin. AS1–5 with posterior margin below IM carinae unarmed. AS6 without armed supplementary carina between SM and IM, at most with short spinule on margin. Distal segment of uropodal exopod with proximal ⅓ black .... ***C. thailandensis***

Carinosquilla australiensis n.sp.

Fig. 101

Carinosquilla carinata.–?Moosa, 1991: 195 [part, not *C. carinata* (Serène, 1950)].

Type material. (All Queensland, Australia) HOLOTYPE: AM P54468, ♂ (TL 109 mm), Princess Charlotte Bay, 14°45'S 145°29'E, 30 m, T. Wassenberg, 21 Jun 1993. PARATYPES: AM P56893, 1♀ (TL 116 mm), Princess Charlotte Bay, 14°45'S 145°20'E, 20–30 m, Turtle stn 26, T. Wassenberg, 20 Jun 1993; AM P56894, 1♂ (TL 123 mm), Princess Charlotte Bay, 14°45'S 145°20'E, 20–30 m, Turtle stn 19, T. Wassenberg, 20 Jun 1993; AM P56895, 2♀♀ (TL 110; 1 broken, CL 28.8 mm), Princess Charlotte Bay, 14°45'S 145°20'E, 20–30 m, Turtle 72, 19 Jun 1993; AM P56896, 1♂ (TL 106 mm), Princess Charlotte Bay, 14°45'S 145°20'E, 20–30 m, Turtle stn 11, T. Wassenberg, 19 Jun 1993; AM P56898, 1♂ (TL 115 mm), Middle Banks, 11°46.01'S 143°36.43'E, GBR 494 121, T. Wassenberg, 17 Oct 1994; AM P56897 (to QM), 2♀♀ (TL 94–101 mm), Princess Charlotte Bay, 14°45'S 145°20'E, 20–30 m, Turtle stn 8, T. Wassenberg, 19 Jun 1993; QM W12864, 1♀ (TL 104 mm), near Keeper Reef, 18°46.2'S 147°12.6'E, trawl, C. Jones, 9 May 1985.

Diagnosis. Eyestalk with short, irregular carinae. Ocular scales entire, not bifurcate. Rostral plate longer than broad; with MD carina flanked by long supplementary carina. Carapace anterior bifurcation of MD carina opening anterior to dorsal pit. Raptorial claw dactylus with 5 teeth; merus outer face with low, longitudinal carina, occasionally slightly eroded. Mandibular palp 3-segmented. TS5 dorsal carinae longitudinal or oblique, not transverse. TS6–8 and AS1–5 with most or all supplementary dorsal carinae posteriorly armed above IM carinae. AS1–5 with 1–3 (usually 2) supplementary carinae armed below IM carinae. AS6 with SM carinae tricarinate; with a supplementary carina midway between SM and IM carinae terminating in a slender spine; terminal spine of IM carina occasionally with supplementary outer spine; sternum with anterior and posterior transverse carina, MD carina flanked by 4 or 5 sinuous transverse carinae, some uniting laterally. Abdominal somites with normal complement of carinae spined as follows: SM 1–6, IM 1–6, LT 1–6, MG 1–5. Telson with 1 LT denticle; dorsolateral carinae entire, not broken anteriorly. Uropodal protopod inner margin with slender spines; exopod distal segment dark.

Description. Eyestalk with short, irregular carinae; CI 413–469. Ocular scales entire, not bifurcate. A1 peduncle 1.06–1.18 CL. A1 somite dorsal processes with blunt, triangular apices; directed anterolaterally. A2 scale length 0.67–0.71 CL. Rostral plate longer than broad; lateral margins convergent, upturned, straight to sinuous; apex truncate to rounded; with long, distinct, MD carina flanked by long supplementary carina. Carapace anterior width 0.40–0.45 CL; anterior bifurcation of MD carina opening anterior to dorsal pit. Raptorial claw dactylus with 5 teeth; merus outer face with low, longitudinal carina, occasionally slightly eroded. Mandibular palp 3-segmented. TS5 lateral process with anterior lobe a slender spine directed anterolaterally; posterior lobe short, triangular with blunt to rounded apex directed laterally. TS6 lateral process anterior lobe broad, quadrate, apex truncate; posterior lobe broad, triangular, anterior margin straight to sinuous, apex blunt. TS7 lateral process anterior lobe triangular, blunt; posterior lobe larger than anterior lobe, broad, triangular, anterior margin convex, apex blunt. TS8 anterolateral margin triangular, apex sharp; sternal keel rounded. TS5 dorsal carinae longitudinal or oblique, not transverse. TS6–8 and AS1–5 with most or all supplementary dorsal carinae posteriorly armed above IM carinae. AS1–6 with 1–3 (usually 2) supplementary carinae unarmed below IM carinae. AS6 SM carina tricarinate,

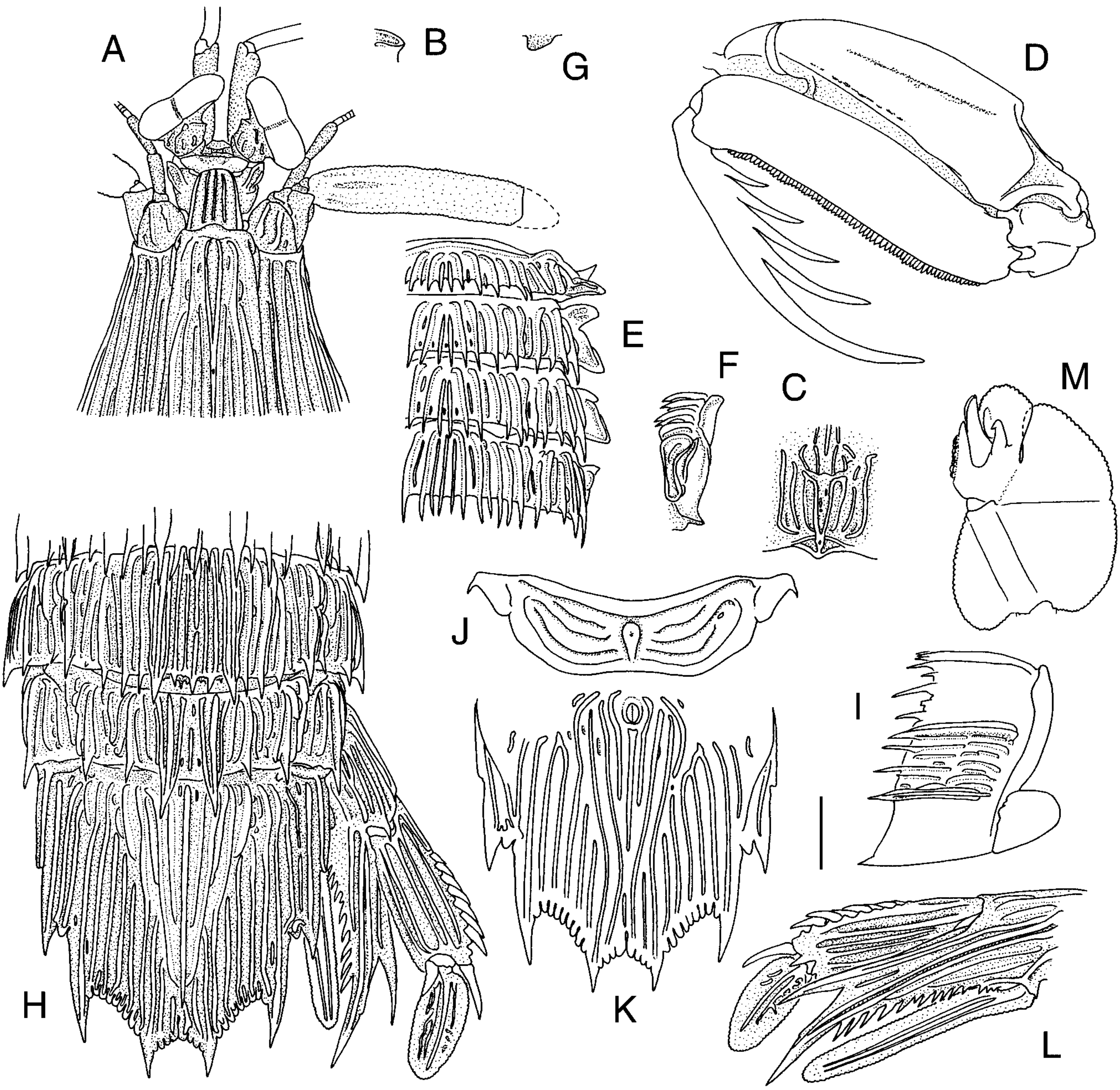

Figure 101. *Carinosquilla australiensis* n.sp., holotype ♂ TL 109 mm. A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, carapace, posteromedian. D, raptorial claw, right lateral. E, TS5–8, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, AS1, right lateral. J, AS6, ventral. K, telson, ventral. L, uropod, right ventral. M, PLP1 endopod, right anterior. Scale A–L = 5 mm; M = 2.5 mm.

occasionally with short median spinule or short spinule on posterior margin adjacent to SM spine; sternum with anterior and posterior transverse carina, MD carina flanked by 4–5 sinuous transverse carinae, some uniting laterally. Abdominal somites with normal complement of carinae spined as follows: SM 1–6, IM 1–6, LT 1–6, MG 1–5. Telson about as long as broad; prelateral lobe longer than margin of LT tooth; dorsolateral surface numerous supplementary longitudinal carinae, uninterrupted proximally; denticles 3–5, 7–10, 1. Uropodal protopod outer margin smooth; inner margin with 10–16 slender spines; with short ventral spine anterior to endopod articulation; protopod terminal spines with lobe on outer margin of inner spine rounded, narrower than adjacent spine, proximal margin straight or slightly concave. Exopod proximal segment outer margin with 9–12 movable spines, distalmost not exceeding midlength of distal segment; distal margin 2 ventral spines, outer longest. Exopod distal segment shorter than proximal segment; dorsally and ventrally carinate. Endopod dorsally and ventrally carinate.

Colour in alcohol. Overall pale grey with grooves on the carapace and posterior margins of thoracic and abdominal somites black brown. Telson with dark band across posterior ½; apices of primary teeth red. Terminal spines of uropodal protopod and outer spines of uropodal exopod red. Proximal segment of uropodal exopod black distally; distal segment entirely black or at most pale distal tip.

Etymology. Named *australiensis* alluding to the geographical distribution of the species.

Measurements. Male (n = 4) TL 106–123 mm, female (n = 6) TL 94–116 mm. Other measurements of holotype: CL 25.2 mm, A1 peduncle 27.3 mm, A2 scale 17.7 mm.

Remarks. *Carinosquilla australiensis* n.sp. most closely resembles *C. thailandensis* but differs in the following ways: the carina on the outer face of the merus of the raptorial claw is straight or slightly eroded instead of reticulated and irregular; the spines along the posterior margins of the thoracic and abdominal somites are relatively longer; the posterior margin of AS1–5 between intermediate and lateral carinae is armed with 1–3 (usually 2) slender spines instead of unarmed; one of the carinae between the submedian and intermediate carinae on AS6 is armed posteriorly; and the distal segment of the uropodal exopod is black over the entire or near entire surface instead of only the proximal ⅓ or ½.

Dorsal spination in most specimens of *C. australiensis* is uniform, but in about half of the specimens, the posterior intermediate spines of AS6 are flanked by a smaller spine, and in one specimen, the flanking spine is present on one side only. The 127 mm TL specimen from New Caledonia reported by Moosa (1991) as *C. carinata*, described as bearing five teeth on the dactylus and a crenulated outer carina on the merus of the raptorial claw, is likely referable to *C. australiensis*. Moosa's (1991) other specimens of *Carinosquilla* from New Caledonia, with 6 or 7 teeth on the dactylus of the raptorial claw are likely referable to *C. redacta*.

Habitat. Trawlable substrates at depths of 20–30 m.

Distribution. Northeast Queensland, from Princess Charlotte Bay to Keeper Reef.

Carinosquilla carita n.sp.

Fig. 102

Squilla multicarinata.–?Stephenson, 1962: 35, 38.

Type material. (All Western Australia) HOLOTYPE: AM P43212, ♂ (TL 42 mm), 43 km NNE of Dampier, 20°14.6–14.5'S 116°50.9–50.6'E, 40–41 m, on sand, beam trawl, 27 Oct 1983. PARATYPES: AM P56887, 1♀ (TL 38 mm), Northwest Shelf, 19°58.8'S 117°51.4'E, 42 m, dredge, S0383 D1, 25 Jun 1983; AM P56888, 1♀ (TL 25 mm), Northwest Shelf, 19°58.2–57.9'S 117°49.3–49.2'E, 42 m, sled, S0383S D2, 26 Jun 1983; AM P56889, 1♂ (TL 29 mm), Northwest Shelf, 19°59.2–58.7'S 117°48.6–49.0'E, 41 m, sled, S0383S D8, 26 Jun 1983; AM P57025, 1♂ (TL 44 mm), 43 km NNE of Dampier, 20°14.6–14.5'S 116°50.9–50.6'E, 40–41 m, on sand, beam trawl, 27 Oct 1983; NMV J37818, 2♀♀ (TL 21–33 mm), Northwest Shelf between Port Hedland & Dampier, 20°17'S 116°38'E, 42 m, very coarse sandy shell, with crinoids, epibenthic sled, G. Poore & H. Lew Ton, 10 Jun 1983; NTM Cr012376, 1♂ (TL 20 mm), Northwest Shelf, 19°29.4–29.7'S 118°52.3–52.4'E, 38 m, beam trawl, S0583 D09, 25 Oct 1983.

Australian material. QUEENSLAND: AM P56886, 1♂ (TL 37 mm), Gulf of Carpentaria, 12°00.0'S 138°12.0'E, 51 m, dredge, SS0193 25, T. Wassenberg, 15 Jan 1993. NORTHERN TERRITORY: NTM Cr011987, 2♀♀ (TL 20–23 m), Grose I., Beagle Gulf, 12°31.02'S 130°17.22'E, 17 m, R. Williams, 5 Oct 1993.

Diagnosis. Eye with peduncle without short, irregular carinae. Ocular scales entire, not bifurcate. Carapace with anterior bifurcation of MD carina opening anterior to dorsal pit. Raptorial claw dactylus with 5 teeth; merus outer face with longitudinal carina. Mandibular palp absent. TS5 dorsal carinae transverse, except medially. TS6–8 and AS1–6 with most or all dorsal carinae posteriorly armed above IM carinae. AS1–6 with supplementary carinae unarmed below IM carinae. Telson dorsolateral surface with numerous supplementary longitudinal carinae, uninterrupted proximally; prelateral lobe with blunt apex; with l LT denticle. Uropodal protopod inner margin with slender spines.

Description. Eye with peduncle without short, irregular carinae; CI 340–381. Ocular scales entire, not bifurcate. A1 peduncle 1.02–1.16 CL. A1 somite dorsal processes with acute apices; directed anterolaterally. A2 scale length 0.50–0.57 CL. Rostral plate as long as broad; lateral margins convergent, upturned, straight to sinuous; apex truncate to rounded; with long, distinct, MD carina flanked by long supplementary carina. Carapace anterior width 0.48–0.55 CL; anterior bifurcation of MD carina opening anterior to dorsal pit. Raptorial claw dactylus with 5 teeth; merus outer face with longitudinal carina. Mandibular palp absent. TS5 lateral process with anterior lobe a slender spine directed anterolaterally; posterior lobe short, broad with rounded apex directed laterally. TS6 lateral process anterior lobe quadrate, apex rounded to subtruncate; posterior lobe broad, rounded. TS7 lateral process anterior lobe short, rounded; posterior lobe broad, rounded, larger than anterior lobe. TS8 anterolateral margin triangular, apex acute; sternal keel triangular. TS5 dorsal carinae transverse, except medially. TS6–8 and AS1–6 dorsal carinae subparallel, most or all posteriorly armed above IM carinae. AS1–6 with supplementary carinae unarmed below IM carinae. AS6 SM carina unicarinate with supplementary longitudinal carinae laterally and medially; sternum with continuous transverse proximal carina and a slender MD carina flanked by transverse carina. Abdominal somites with normal complement of carinae spined as follows: SM 1–6, IM 1–6, LT (1)2–6, MG 1–5. Telson length and breadth subequal; prelateral lobe longer than margin of LT tooth, with blunt apex; dorsolateral surface numerous supplementary longitudinal carinae, uninterrupted proximally; denticles SM 3–4, IM 6–9, LT 1. Uropodal protopod inner margin with 7–10 slender spines; with ventral tubercle anterior to endopod articulation; protopod terminal spines with lobe on outer margin of inner spine rounded, as broad as or narrower than adjacent spine, proximal margin concave. Uropodal exopod proximal segment outer margin with 7–9 movable spines, distalmost not exceeding midlength of distal segment, distal margin with 2 slender ventral spines outer longest; exopod distal segment black, ventrally carinate, length subequal to proximal segment; endopod dorsally and ventrally carinate.

Colour in alcohol. Largely faded. Carapace with dark grooves. Thoracic and abdominal somites with dark posterior margins. Anterior margin of AS2 and posterior

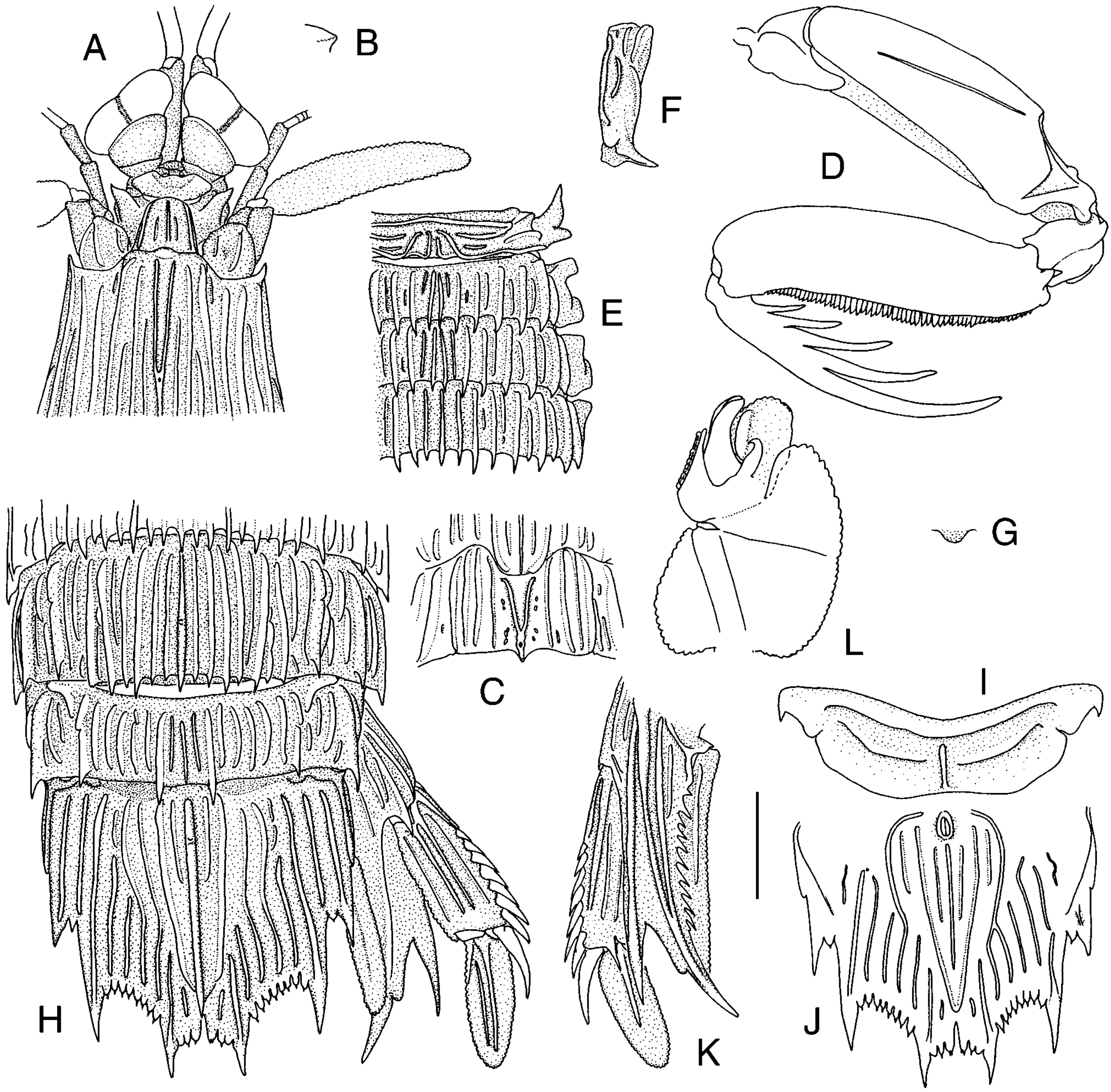

Figure 102. *Carinosquilla carita* n.sp., holotype ♂ TL 41 mm. A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, carapace, posteromedian. D, raptorial claw, right lateral. E, TS5–8, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, AS6, ventral. J, telson, ventral. K, uropod, right ventral. L, PLP1 endopod, right anterior. Scale A–K = 2.5 mm; L = 1.2 mm.

margin of AS5 with pair of dark, squarish patches lateral to submedian carinae. Telson with apex of median carina and carinae of primary teeth dark. Distal ½ of uropodal endopod and distal segment of exopod dark.

Etymology. From *Caritus* (Latin) meaning lacking, alluding to the absence of the mandibular palp.

Measurements. Male (*n* = 5) TL 20–44 mm, female (*n* = 6) TL 20–38 mm. Other measurements of holotype: CL 9.3 mm, A1 peduncle 10.5 mm, A2 scale 5.1 mm.

Remarks. *Carinosquilla carita* n.sp. agrees in almost all respects with *C. multicarinata*, but differs in lacking a mandibular palp, in having a relatively more slender anterior lobe on TS6, and in having a blunt instead of sharp or spiniform apex on the prelateral lobe. Stephenson's (1962) record of *C. multicarinata* is likely based on *C. carita* n.sp.

The smallest male examined (TL 20 mm) bears well-developed penes and petasmata, but has less distinct carinae on the rostral plate and a blunter apex on the dorsal processes of the antennular somite than in the larger specimens.

Habitat. Sand or coarse sandy shell substrates at 17–51 m depth.

Distribution. Northwest Shelf, Western Australia and the Gulf of Carpentaria.

Carinosquilla redacta n.sp.

Fig. 103

Carinosquilla carinata.–?Moosa, 1991: 194–196 [part, not *C. carinata* (Serène, 1950)].

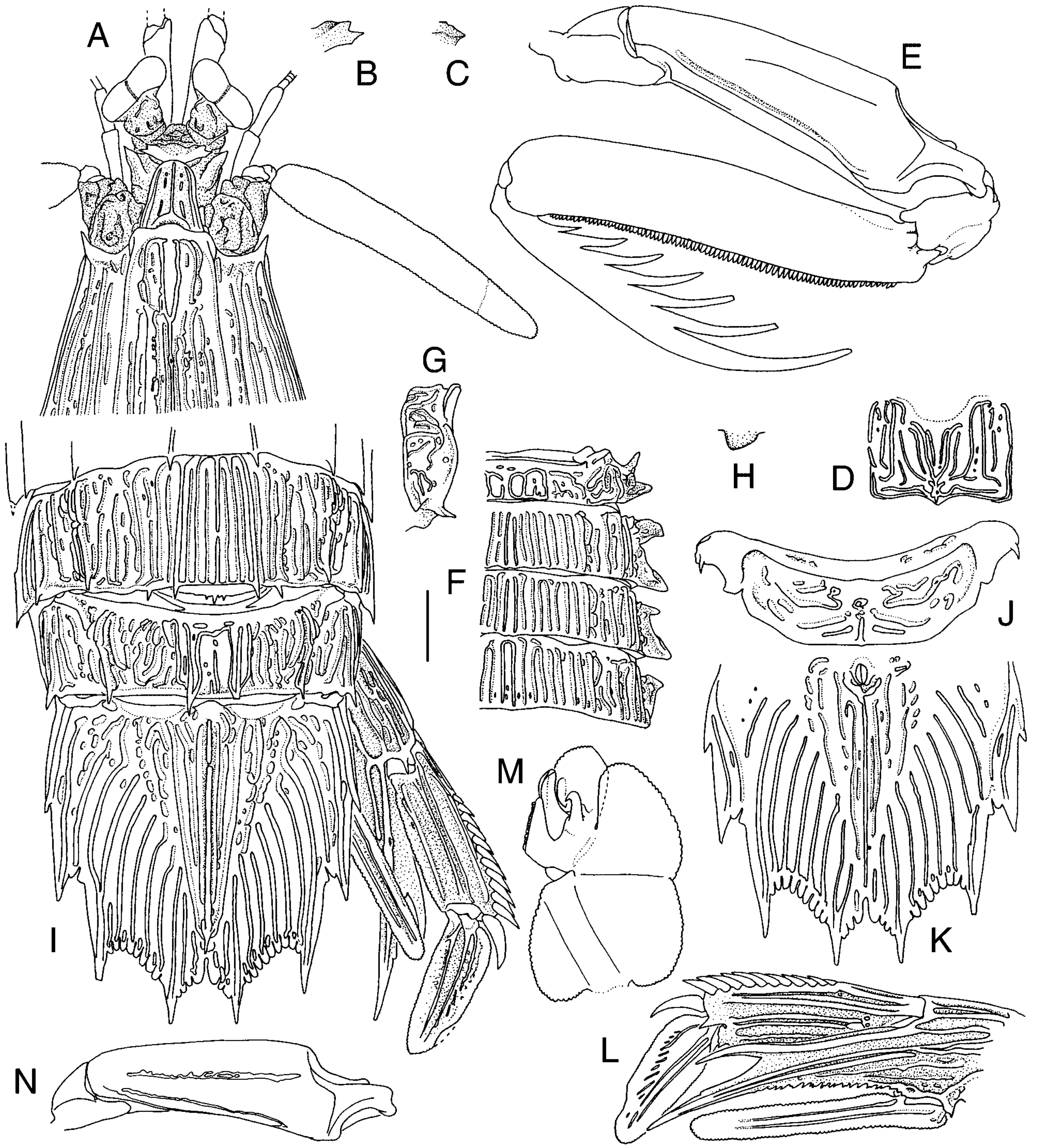

Figure 103. *Carinosquilla redacta* n.sp. A–M, holotype ♂ TL 125 mm. N, paratype ♀ TL 110 mm (AM P54471). A, anterior cephalon, dorsal. B, ocular scale, right dorsal. C, A1 somite dorsal process, right lateral. D, carapace, posteromedian. E, raptorial claw, right lateral. F, TS5–8, right dorsal. G, TS5, right lateral. H, TS8 sternal keel, right lateral. I, AS4–6, telson & uropod, dorsal. J, AS6, ventral. K, telson, ventral. L, uropod, right ventral. M, PLP1 endopod, right anterior. N, raptorial claw merus, right lateral. Scale A–L, N = 5 mm; M = 2.5 mm.

Type material. (All Queensland) HOLOTYPE: AM P54470, ♂ (TL 125 mm), Shelburne Bay, 11°52.8'S 143°09.8'E, 31 m, T. Wassenberg, 13 Jan 1993. PARATYPES: AM P54469, 1♀ (TL 108 mm), Princess Charlotte Bay, 14°45'S 145°29'E, 30 m, T. Wassenberg, 21 Jun 1993; AM P56945, 1♂ (TL 123 mm), Shelburne Bay, 11°47.6'S 143°14.7'E, 20–30 m, GBR0192 96/96, 25 May 1992; AM P56946, 1♂ (TL 130 mm), Shelburne Bay, 11°50'S 143°00'E, 20–30 m, dredge, SS0193 10, church dredge, 14 Jan 1993; AM P56947, 2♂♂ (TL 62–63 mm), Shelburne Bay, 11°35.08 142°58.8'E, stn II 033, T. Wassenberg, 21 May 1992; AM P56944 (to QM), 1♂ (TL 109 mm), Shelburne Bay, 11°45.00'S 143°12.95'E, 20–30 m, QDPI 95/95, T. Wassenberg, 29 May 1992; AM P56943, 3♀♀ (TL 57–150 mm), Shelburne Bay, 11°49.9'S 143°08.6'E, 31 m, dredge, SS0193 007, T. Wassenberg, 13 Jan 1993.

Australian material. QUEENSLAND: AM P54471, 1♀ (TL 110 mm), SE Gulf of Carpentaria, 15°32.1'S 139°41.8'E, 45 m, T. Wassenberg, Dec 1990; AM P55584, 1♀ (broken, CL 23.6 mm), SE Gulf of Carpentaria, 16°50'S 139°10'E, 11 m, trawl, J. Yaldwyn & D. McMichael, 13 Apr 1964; AM P56958, 1♂ (TL 54 mm), E of Duyfken Point, 12°29.9'S 141°14.7'E, SS0591 046, T. Wassenberg, 27 Nov 1991; AM P56959, 1♀ (TL 55 mm), N of Wellesley I., Gulf of Carpentaria, 14°31.3'S 139°12.3'E, 45 m, SS0390 038, T. Wassenberg, 29 Nov 1990.

Diagnosis. Eyestalk with short, irregular carinae. Ocular scales with bifurcate apices. Rostral plate with long MD carina and LT carinae, and several short intervening carinae or elongate tubercles. Carapace with anterior bifurcation of MD carina opening anterior to dorsal pit. Raptorial claw dactylus with 6 or 7 teeth; merus outer face with longitudinal carina or irregular, eroded carina. TS5 dorsal carinae longitudinal or reticulate. TS6–8 and AS1–6 each with posterior margin and supplementary carinae unarmed posteriorly, excepting additional spine lateral to SM spine on AS5; carinae of normal complement armed posteriorly as follows: SM (3)4–6, IM 3–6, LT 1–6, MG 1–5. Telson dorsolateral surface with numerous supplementary, longitudinal carinae, interrupted proximally; with 2 LT denticles. Uropodal protopod inner margin with serrations or short spines.

Description. Eyestalk with short, irregular carinae; CI 444–569. Ocular scales bifurcate. A1 peduncle 1.10–1.18 CL. A1 somite dorsal processes with acute apices, directed anterolaterally. A2 scale length 0.73–0.84 CL. Rostral plate with length and breadth, but appearing elongate; margins convergent; apex rounded to subtruncate; with long, distinct, MD carina and lateral carinae, and several short intervening carinae or elongate tubercles. Carapace anterior width 0.39–0.44 CL; anterior bifurcation of MD carina opening anterior to dorsal pit. Raptorial claw dactylus with 6–7 teeth; merus outer face with longitudinal carina or irregular, eroded carina. Mandibular palp 3-segmented. TS6 lateral process anterior lobe broad, quadrate, apex truncate; posterior lobe broad, triangular; anterior margin straight to sinuous; apex blunt. TS7 lateral process anterior lobe triangular, apex blunt; posterior lobe broad, triangular, anterior margin straight to sinuous; apex blunt. TS8 anterolateral margin triangular, apex blunt; sternal keel rounded. TS5 dorsal carinae longitudinal or reticulate. TS6–8 and AS1–6 each with posterior margin and supplementary carinae unarmed posteriorly, excepting additional spine lateral to SM spine on AS5; carinae of normal complement armed posteriorly as follows: SM (3)4–6, IM 3–6, LT 1–6, MG 1–5. AS6 SM carina tricarinate, laterally and medially with short, irregular carinae and tubercles; sternum with continuous transverse proximal carina, short median and numerous, irregular transverse carinae and tubercles lateral to MD carina; with ventrolateral spine anterior to uropodal articulation. Telson about as long as broad; prelateral lobe longer than margin of LT tooth; dorsolateral surface numerous supplementary longitudinal carinae, interrupted proximally; denticles SM 3–5, IM 8–10, LT 2. Uropodal protopod outer margin smooth; inner margin with 14–23 short spines; with minute ventral tubercle anterior to endopod articulation; protopod terminal spines with lobe on outer margin of inner spine rounded, narrower than adjacent spine, proximal margin concave. Exopod proximal segment outer margin with 10–12 movable spines, distalmost not exceeding midlength of distal segment; distal margin 2 ventral spines, outer longest. Exopod distal segment black on proximal ¾; length subequal to proximal segment; dorsally and ventrally carinate. Endopod dorsally and ventrally carinate.

Colour in life. Overall pale grey-brown with grooves on the carapace and posterior margin of thoracic and abdominal somites dark brown. Ventral surface including limbs translucent white. Telson with apices of primary teeth red. Terminal spines of uropodal protopod and outer spines of uropodal exopod red. Proximal segment of uropodal exopod black distally extending onto central proximal ⅓ of distal segment. Uropodal endopod with black apex.

Etymology. The specific epithet is based on the Latin, *redactus*, alluding to the reduced spination on the abdominal submedian and intermediate carinae relative to *C. carinata*.

Measurements. Male (n = 7) TL 62–130 mm, male (n = 7) TL 57–150 mm. Other measurements of holotype: CL 28.7 mm, A2 scale 22.2 mm.

Remarks. *Carinosquilla redacta* n.sp. closely resembles *C. carinata* (Serène, 1950) and an undescribed species from the Indian Ocean, previously known as *C. carinata* (see Ahyong & Naiyanetr, in press), in bearing bifurcate ocular scales and similar dorsal carination, but differs in having unarmed submedian carinae on AS1–2 or 3, and unarmed intermediate carinae on AS1–2. *Carinosquilla redacta* further agrees with *C. carinata* and differs from the undescribed Indian Ocean species in lacking spinules between the submedian carinae on AS1–5.

The present series of *C. redacta* agree closely morphologically but show variation in the number of teeth on the dactylus of the raptorial claw (six or seven, usually six), the longitudinal carinae on the outer margin of the merus of the raptorial claw is entire, except in one specimen in which it is eroded, and the submedian carinae on AS3 are occasionally armed. The petasma is fully developed in the smallest male examined (TL 62 mm).

As discussed under the account of *C. australiensis*, specimens of Moosa's (1991) *C. carinata* from New Caledonia are probably based on *C. australiensis* and *C.*

redacta. The distributions of the species of the *C. carinata* complex (*C. carinata*, *C. redacta*, and *Carinosquilla* sp.), appear to be discrete: *Carinosquilla* sp. occurs in the Indian Ocean, *C. carinata* occurs in the South China Sea to northern Indonesia; and *C. redacta* occurs off northeastern Australia.

Habitat. Sandy-mud substrates at depths between 20–30 m and 45 m.

Distribution. Northeast Queensland to the southeastern Gulf of Carpentaria.

Carinosquilla thailandensis Naiyanetr, 1983

Fig. 104

Carinosquilla thailandensis Naiyanetr, 1983: 394–399, figs. 2, 4 (type locality: Ko Phai, Chon Buri province, Thailand, 12°56'N 100°41'E).

Type material. HOLOTYPE: SMF 10747, ♂ (TL 136 mm), Ko Phai, Chon Buri Province, Gulf of Thailand P. Naiyanetr, 21 Dec 1980. PARATYPES: ZRC 1985.1-2, 1♂ (TL 121 mm), 1♀ (TL 132 mm), Chon Buri Province, Gulf of Thailand, P. Naiyanetr, 1979.

Australian material. QUEENSLAND: AM P56818, 1♀ (TL 113 mm), Shelburne Bay, 11°30'S 143°00'E, 21 m, sand, mud, T. Wassenberg, 15 Jan 1993; AM P21659, 1♂ (TL 98 mm), 1♀ (TL 130 mm), SE Gulf of Carpentaria, 16°50'S 139°10'E, 11 m, trawl, J. Yaldwyn & D. McMichael, 13 Apr 1964; AM P21660, 1♂ (TL 123 mm), SE Gulf of Carpentaria, 16°43'S 139°25'E, 11 m, trawl, CSIRO Prawn Survey, 11 Nov 1963; AM P54467, 1♀ (TL 73 mm), Shelburne Bay, 11°33.5'S 143°10.5'E, 30 m, T. Wassenberg, 10 May 1992; AM P56903, 1♂ (TL 48 mm), Gulf of Carpentaria, 12°00.0'S 138°12.0'E, 51 m, sand & shell, dredge, SS0193 25, T. Wassenberg, 15 Jan 1993; AM P56900 (to QM), 1♀ (TL 91 mm), North Queensland, 11°04.5'S 143°01.7'E, T. Wassenberg, 26 Apr 1993; AM P56906 (to QM), 1♀ (TL 118 mm), NE of Shelburne Bay, 11°17.03'S 143°16.46'E, QDPI 10 10, T. Wassenberg, 27 May 1992; AM P56901, 1♀ (TL 92 mm), Shelburne Bay, 11°04.1'S 142°52.4'E, SS0591 068, T. Wassenberg, 1991; AM P56902, 1♀ (TL 82 mm), Shelburne Bay, 11°28.00'S 142°01.56'E, 20–30 m, sand and mud, dredge, GBR0192 53/37, T. Wassenberg, 21 May 1992; AM P56907, 1♀ (TL 86 mm), NE of Orford Bay, 11°11.0'S 142°55.4'E, SS0591 070, T. Wassenberg, 1991; AM P56904, 1♀ (TL 152 mm), Shelburne Bay, 11°28.81'S 142°52.24'E, QDPI 187, T. Wassenberg, 26 Mar 1993; AM P56905, 1♂ (TL 126 mm), Shelburne Bay, 11°38.2'S 142°56.4'E, S0193 19, T. Wassenberg, 15 Jan 1993; P56907, 1♀ (TL 59 mm), NE of Orford Bay, 11°11.0'S 142°55.4'E, SS0591 70, T. Wassenberg, 30 Nov 1991; AM P56899, 1♀ (TL 122 mm), NE of Shelburne Bay, 11°00.8'S 143°02.6'E, T. Wassenberg, 12 Apr 1993; AM P56908, 1♀ (TL 97 mm), NE of Shelburne Bay, 11°30'S 143°30'E, QDPI 101, T. Wassenberg, 20 May 1992; AM P56909, 1♀ (TL 63 mm), Shelburne Bay, 11°24.07'S 143°0.08'E, GBR 0192 52/34, T. Wassenberg, 21 May 1992; AM P56910, 1♀ (TL 60 mm), NE of Shelburne Bay, 11°35.08'S 142°58.8'E, dredge, stn II 033, T. Wassenberg, 21 May 1992; QM, 1♀ (TL 112 mm), NE of Shelburne Bay, 11°52'S 143°10'E, *Tweed Seeker*, 18 Apr 1993.

Other material. AM P33797, 1♂ (TL 117 mm), Gulf of Thailand, Dec 1980; AM P33798, 1♀ (TL 124 mm), Gulf of Thailand, Dec 1980.

Diagnosis. Eyestalk with short, irregular carinae. Ocular scales entire, apices truncate, not bifurcate. Rostral plate with median carina flanked by long supplementary carina. Carapace with anterior bifurcation of MD carina opening anterior to dorsal pit. Raptorial claw dactylus with 5 teeth; merus outer face with irregular vermiform sculpture. Mandibular palp 3-segmented. TS5 dorsal carinae longitudinal or oblique, not transverse. TS6–8 and AS1–5 with most or all supplementary dorsal carinae posteriorly armed above IM carinae. AS1–6 with supplementary carinae below IM carinae unarmed posteriorly. AS6 SM carina tricarinate, occasionally with short median spinule or short spinule on posterior margin adjacent to SM spine. Abdominal somites with normal complement of carinae spined as follows: SM 1–6, IM 1–6, LT 1–6, MG 1–5. Telson dorsolateral surface with numerous supplementary longitudinal carinae, uninterrupted proximally; denticles SM 3–4, IM 7–12, LT 1. Uropodal protopod inner margin with 12–15 slender spines; exopod proximal segment outer margin with 9–11 movable spines.

Colour in life. Overall pale brown with grooves on the carapace and posterior margins of thoracic and abdominal somites black brown. AS2 and 5 with diffuse, dark brown rectangular patch medially, tending to form two blocks on AS5. Ventral surface including limbs translucent white. Telson with dark band across posterior ½; apices of primary teeth red. Terminal spines of uropodal protopod and outer spines of uropodal exopod red. Proximal segment of uropodal exopod black distally extending onto proximal ⅓ to ½ of distal segment.

Measurements. Male (n = 7) TL 48–136 mm, female (n = 18) TL 59–152 mm. CI 430–525. A1 peduncle 1.03–1.18 CL. A2 scale length 0.55–0.75 CL. Anterior carapace width 0.39–0.46 CL. The present series includes the largest known specimens of the species.

Remarks. The Australian specimens of *C. thailandensis* agree well with type material from the Gulf of Thailand. Although Moosa (1991) synonymized *C. thailandensis* with *C. carinata*, both species are distinct (Naiyanetr *et al*., 2000). As noted by Naiyanetr *et al*. (2000), the type description of *C. thailandensis* is erroneous in attributing bifurcate instead of undivided ocular scales to the species. *Carinosquilla thailandensis* most closely resembles *C. australiensis*, newly described above, and these two species differ from all others by the combination of the undivided ocular scales and presence of irregular carinae on the eyestalks. The differences between *C. thailandensis* and *C. australiensis* are outlined under the account of the latter.

Habitat. Sand, mud and shelly substrates at depths of 11–51 m.

Distribution. The Gulf of Thailand and now northeastern Australia.

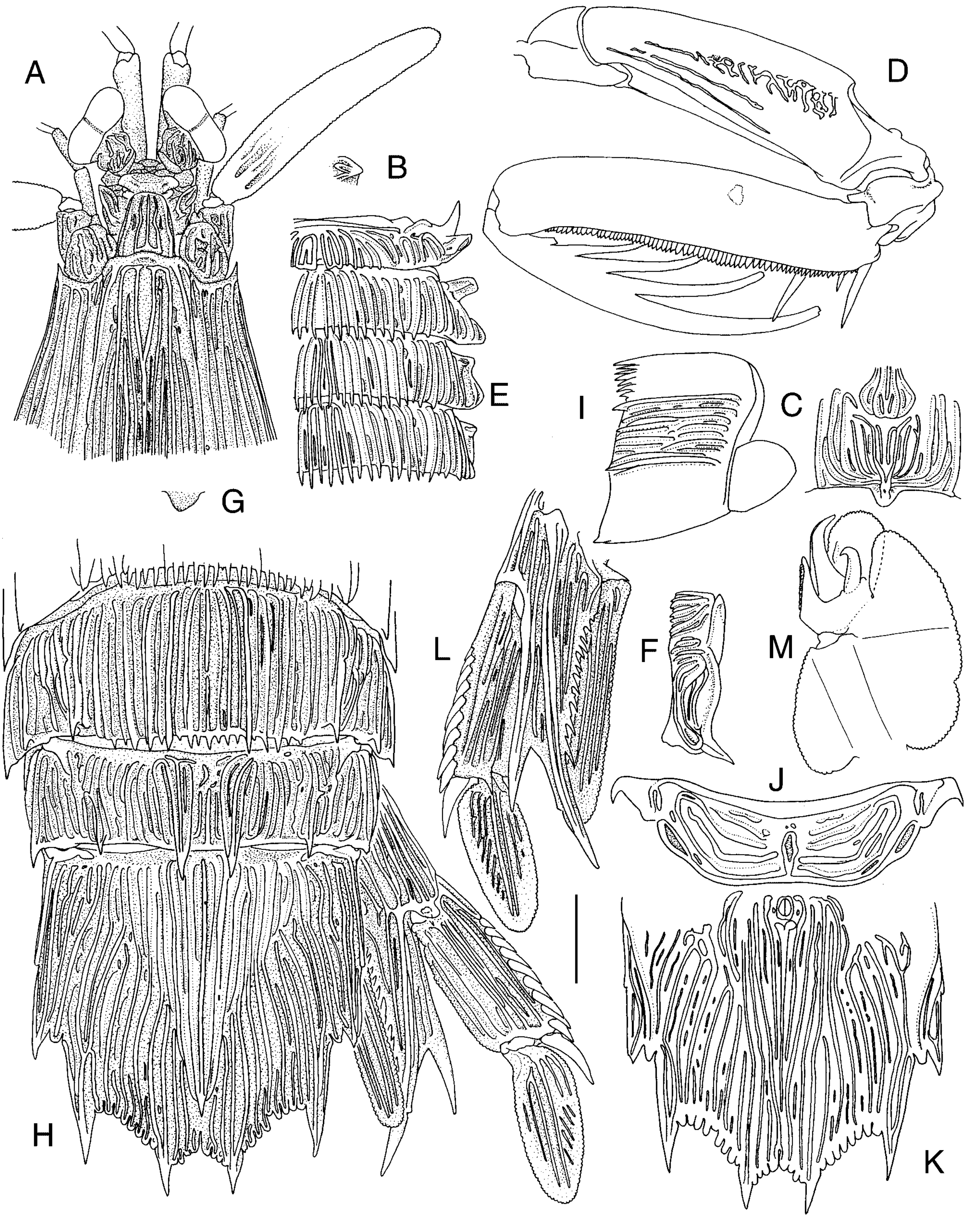

Figure 104. *Carinosquilla thailandensis* Naiyanetr, ♂ TL 98 mm (AM P21659). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, carapace, posteromedian. D, raptorial claw, right lateral. E, TS5–8, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, AS1, right lateral. J, AS6, ventral. K, telson, ventral. L, uropod, right ventral. M, PLP1 endopod, right anterior. Scale A–L = 5 mm. M = 2.5 mm.

Clorida Eydoux & Souleyet, 1842

Clorida Eydoux & Souleyet, 1842: 264. Type species *Clorida latreillei* Eydoux & Souleyet, 1842, by subsequent designation by Fowler (1912: 302). Gender feminine.

Diagnosis. Eye small, pyriform, cornea bilobed, narrower than stalk; stalk short, strongly inflated laterally, mesially flattened for at least proximal ½. Ocular scales fused. Rostral plate broader than long. Carapace with or without anterolateral spines; without MD and IM carinae; with reflected MG and reduced LT carinae, distinct posteriorly only; posterolateral margin rounded. Raptorial claw dactylus with 4 or 5 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp present or absent. MXP1–4 with epipod. PLP1 endopod in adult ♂♂ with posterior endite; hook process with distal point. TS5–7 lateral processes single. AS1–6 with or without SM carinae. Telson inflated, dorsolateral surface with rows of denticles or tubercles, without rows of shallow pits; prelateral lobe present; SM teeth usually with movable apices. Uropodal protopod inner margin armed with slender spines.

Included species. Fifteen: *C. albolitura* Ahyong & Naiyanetr, 2000; C. *bombayensis* (Chhapgar & Sane, 1967); *C. daviei* n.sp.; *C. decorata* (Wood-Mason, 1875); *C. depressa* (Miers, 1880); *C. denticauda* (Chhapgar & Sane, 1967); *C. gaillardi* Moosa, 1986; *C. granti* (Stephenson, 1953b); *C. japonica* Manning, 1978c; *C. javanica* Moosa, 1974; *C. latreillei* Eydoux & Souleyet, 1842; *C. obtusa* n.sp.; *C. rotundicauda* (Miers, 1880); *C. seversi* Moosa, 1973; and *C. wassenbergi* n.sp.

Remarks. *Clorida* resembles *Cloridina* in all respects except eye morphology. In *Clorida*, the inner, proximal, ½ to ⅔ of the eyestalk are relatively flat such that the eyes meet in the midline. In species presently assigned to *Cloridina*, the inner margin of the eye is convex or sinuous; the eyes do not “fit-together” in the midline. The two genera can presently be recognized, but see remarks under the account of *Cloridina*.

Most species of *Clorida* fall into one of two groups based on presence or absence of the mandibular palp (Ahyong & Naiyanetr, 2000). Species of the first group lack the mandibular palp, lack submedian carinae on AS1–5, bear at most a blunt tubercle instead of a spine under the lateral process of TS5, bear four teeth on the dactylus of the raptorial claw and lack a distinct basal notch on the outer proximal margin of the dactylus. In species of the second group, the mandibular palp is present, AS1–5 usually bear submedian carinae, a small but distinct spine is present under the lateral process of TS5, four or five (usually five) teeth are present on the dactylus of the raptorial claw and the outer proximal margin of the dactylus is notched.

Clorida depressa, with a mandibular palp shares traits of both groups. It resembles species of the first group in lacking any trace of submedian carinae on AS1–5 and in having at most an indistinct tubercle under the lateral process of TS5. *Clorida depressa* resembles those species of the second group in bearing a mandibular palp and four or five teeth on the dactylus of the raptorial claw, but the outer proximal margin of the dactylus is at most indistinctly notched.

Ahyong *et al*. (1999) suggested that *C. juxtadecorata* Makarov, 1979, was incorrectly synonymized with *C. decorata* by Manning (1995). Makarov’s (1979) figures are stylized but his account of *C. juxtadecorata* agrees well with *C. latreillei*, recently redescribed by Ahyong & Naiyanetr (2000), notably in the form of the lateral process of TS5, the shape of the telson denticles and the presence of a short postanal carina. *Clorida juxtadecorata* is presently regarded as a junior synonym of *C. latreillei*. The figures of the holotype of *C. juxtadecorata* given by Makarov (1979), although stylized, agree well with size-matched specimens of *C. latreillei*. The type material of *C. juxtadecorata*, if still extant, should be restudied to confirm the identity of the species. Although Manning (1991, 1995) synonymized *C. japonica* and *C. javanica* with *C. latreillei*, Ahyong & Naiyanetr (2000) showed each of these species to be distinct. Similarly, *C. seversi*, synonymized with *C. denticauda* by Manning (1995) is also distinct and removed from synonymy below.

Key to species of *Clorida*

1 AS5–6 with posteriorly armed SM carinae .... ***C. daviei***

—— AS5 with SM carinae unarmed posteriorly, or without SM carina 2

2 Mandibular palp present 6

—— Mandibular palp absent 3

3 Lateral process of TS5 a sharp, slender spine directed laterally 4

—— Lateral process of TS5 a short, triangular lobe 5

4 Dorsal processes of A1 somite sharp. Uropodal exopod proximal segment without dark patch distally .... ***C. granti***

—— Dorsal processes of A1 somite low, blunt. Uropodal exopod proximal segment with dark patch distally .... ***C. obtusa***

5 Raptorial claw with 4 well formed teeth on dactylus. Postanal carina present .... ***C. seversi***

—— Raptorial claw with 4 teeth on dactylus, with proximal minute, others large, well formed. Postanal carina absent or indistinct .... *C. denticauda*

6 Telson with numerous, distinct tubercles and carinae on ventral surface of telson, lateral to postanal carina ... 7

—— Telson ventral surface without distinct tubercles or carinae lateral to postanal carina (if even present) ... 8

7 Telson with MD carina and lateral margins strongly tuberculate ... ***C. wassenbergi***

—— Telson with MD carina and lateral margins not tuberculate ... *C. decorata*

8 Telson with postanal carina. TS5 lateral process with sharp or angular apex, directed laterally or anterolaterally. A1 somite dorsal processes with sharp apices, triangular or spiniform ... 9

—— Telson without postanal carina. TS5 lateral process a blunt lobe. A1 somite dorsal processes low, blunt ... 13

9 Lateral processes of TS6–7 with posterolateral acute angle or spinular ... ***C. bombayensis***

—— Lateral processes of TS6–7 rounded posterolaterally ... 10

10 Lateral process of TS5 a large anterolaterally recurved spine, broad basally ... *C. gaillardi*

—— Lateral process of TS5 a short spine or angular projection with straight anterior margin ... 11

11 Lateral process of TS5 a short spine with straight anterior margin. AS1–4 with distinct SM carinae ... 12

—— Lateral process of TS5 a short angular lobe with straight anterior margin. AS1–3 without SM carinae. AS4 with faint trace of SM carinae ... *C. japonica*

12 Telson with short postanal carina, not exceeding ½ distance between anal pore and posterior margin. TS5 lateral process produced to an acute triangular spine. Telson MD carina without large white median patch in life ... *C. latreillei*

—— Telson with long postanal carina, extending beyond ½ distance between anal pore and posterior margin. TS5 lateral process produced to a slender spine. Telson median carina with large white median patch in life ... ***C. albolitura***

13 Telson IM and LT teeth with blunt, obtuse apices (anterolateral spines often absent; uropodal exopod proximal segment with 5 or fewer, but usually 4 movable spines on outer margin) ... *C. rotundicauda*

—— Uropodal exopod proximal segment with 5 or more movable spines on outer margin. Telson IM and LT teeth with distinct, acute apices ... 14

14 AS1–5 without any trace of SM carinae ... ***C. depressa***

—— AS1–5 with SM carinae ... *C. javanica*

Clorida albolitura Ahyong & Naiyanetr, 2000

Fig. 105

Squilla latreillei.–Ingle, 1963: 14, figs. 2, 33 (not *C. latreillei* Eydoux & Souleyet, 1842).
Clorida latreillei.–Blumstein, 1974: 116, fig. 3.–Makarov, 1979: 47–48.–Manning, 1995: 189–191, fig. 119 (not *C. latreillei* Eydoux & Souleyet, 1842).
Clorida albolitura Ahyong & Naiyanetr, 2000: 317–320, fig. 2 (type locality: Ang Sila, Gulf of Thailand, Thailand).

Type material. (All Gulf of Thailand, Thailand) HOLOTYPE: AM P59110, 1♂ (TL 54 mm), Ang Sila, Chon Buri Province, trawled, fishing port, P. Ng, 29 Sep 1998. PARATYPES: ZRC 1999.2179–2180, 2♀♀ (TL 50–57 mm), Ang Sila, Chon Buri Province, trawled, S. Ahyong *et al*., 11 Nov 1999; ZRC 1999.2302, 1♂ (TL 57 mm), 1♀ (TL 58 mm), Pattani, trawled.

Australian material. QUEENSLAND: AM P57185, 2♂♂ (TL 40–51 mm), E Gulf of Carpentaria, 13°30.2'S 140°42.5'E, 55 m, dredged, SS0390 065, T. Wassenberg; AM P57188 (to QM), 1♀ (TL 43 mm), Arafura Sea, 11°10.2'S 139°03.2'E, SS0591 55, T. Wassenberg, Nov–

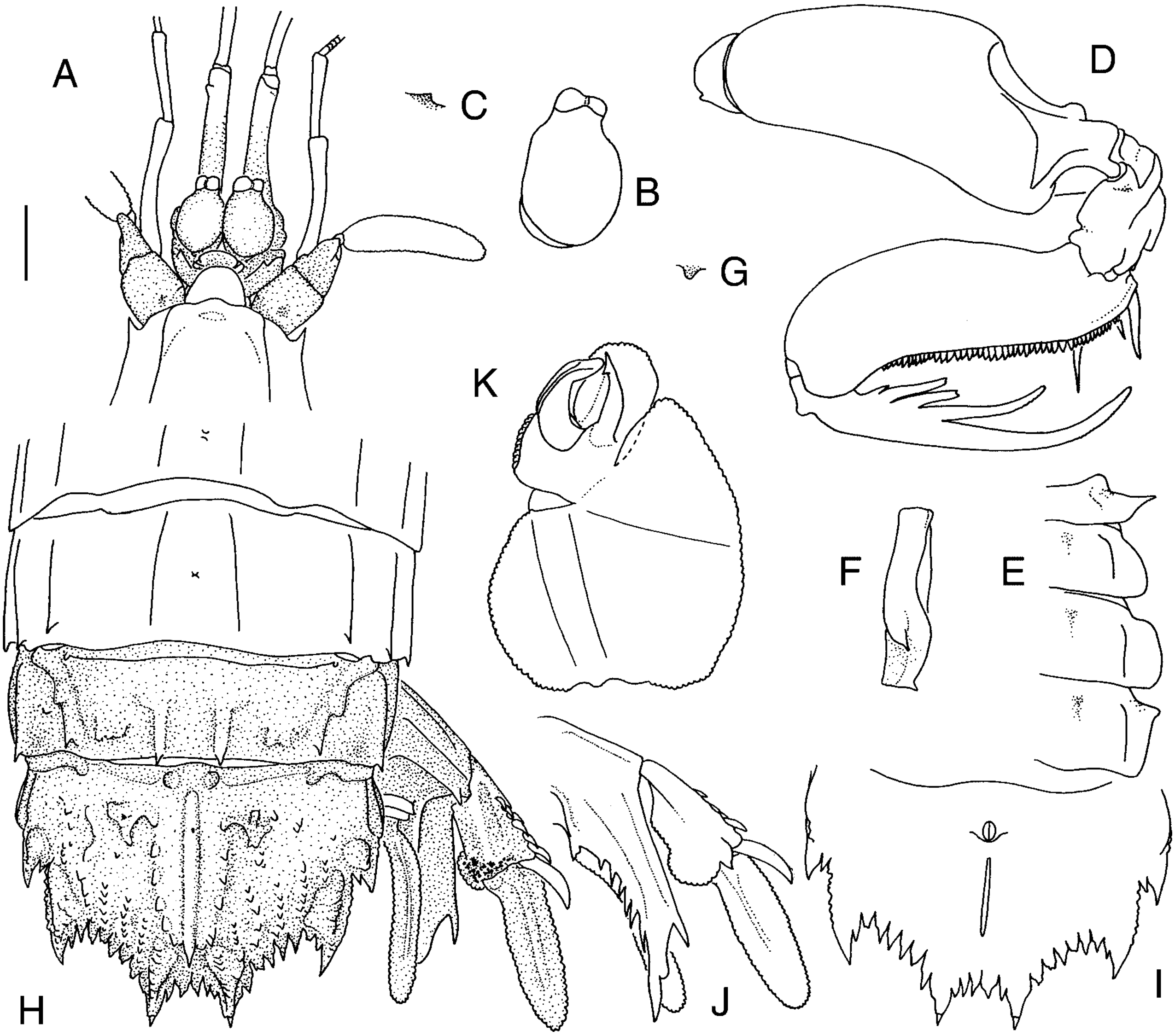

Figure 105. *Clorida albolitura* Ahyong & Naiyanetr, ♂ TL 42 mm (AM P57189). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A, C–J = 2 mm; B, K = 1 mm.

Dec 1991; AM P57189, 1♂ (TL 42 mm), Shelburne Bay, 11°35.08'S 142°58.8'E, dredge, stn II 033, T. Wassenberg, 21 May 1992; AM P57186, 1♂ (TL 55 mm), Shelburne Bay, 11°48.7'S 143°12.7'E, 31 m, SS0193 004, T. Wassenberg, 13 Jan 1993; AM P57187, 1♀ (TL 44 mm), Gulf of Carpentaria, 10°58.5'S 140°21.0'E, SS0591 58, T. Wassenberg, Nov–Dec 1991; AM P57192 (to QM), 1♂ (TL 39 mm), NE Gulf of Carpentaria, 14°30.5'S 140°42.46'E, 46 m, SS0390 067, T. Wassenberg; AM P57191, 2♂♂ (TL 41–42 mm), NE Gulf of Carpentaria, 10°58.3'S 140°13.4'E, 55 m, SS0390 059, T. Wassenberg 1990; AM P57190, 1♂ (TL 40 mm), NE Gulf of Carpentaria, 11°29.2'S 140°41.5'E, dredge, SS0390 061, T. Wassenberg, Dec 1990; AM P57193, 1♂ (TL 48 mm), NE Gulf of Carpentaria, 10°39.0'S 140°38.7'E, 42 m, stn 058, dredged T. Wassenberg, 1990. WESTERN AUSTRALIA: AM P41830, 1♀ (TL 48 mm), 125 km NNW of Dampier, 19°28.0–28.9'S 116°29.0–29.4'E, 110 m, silty bottom, beam trawl, *Soela* 26–18, B. Jenkins, 26 Oct 1983.

Other material. ZRC 1970.10.23.12, 1♀ (TL 48 mm), Nhatrang Bay, Vietnam, R. Serène, Nov 1948; ZRC 1999.2194, 1♀ (TL 45 mm), Andaman Sea, Phuket, Thai-Danish Expedition; AM P59109, 3♂♂ (TL 60–75 mm), Tungkang, Pingtung County, 5 Aug 1996.

Diagnosis. A1 somite dorsal processes with short, triangular apices. A2 peduncle segment 1 extending anteriorly beyond eyes. Carapace with anterolateral spines. Raptorial claw dactylus with 5 teeth; outer proximal margin with basal notch. Mandibular palp 2– or 3–, usually 3-segmented. TS5 lateral process a short slender lobe, apex usually spiniform, with small ventral spine. TS6 lateral process broadly rounded. TS7 lateral process subtruncate; anterolateral and posterolateral angles obtusely rounded. AS1–5 with low SM carinae. AS6 with distinct SM carinae. Abdominal carinae spined as follows: SM 6, IM 5–6, LT 5–6, MG (3–4)5. Telson dorsolateral surface with widely spaced rows of tubercles; margin of IM and LT teeth faintly crenulate (juveniles) to strongly tuberculate (adults); denticles SM 1–3, IM 5–8, LT 1; ventral surface with long postanal carina, extending beyond ½ distance between anal pore and posterior margin. Uropodal protopod outer margin smooth; inner margin with 4–8 slender spines. Uropodal exopod proximal segment outer margin with 6–8 movable spines; distal segment longer than proximal segment; with black patch at articulation of exopod segments.

Colour in alcohol. Largely faded. Grooves of carapace with diffuse brown pigment. Posterior margins of thoracic and abdominal somites black. Uropodal exopod with black patch at articulation of proximal and distal segments, extending to inner ½ of distal segment.

Measurements. Male (*n* = 14) TL 39–75 mm, female (*n* = 8) TL 43–58 mm. A1 peduncle 1.10–1.30 CL. A2 scale length 0.41–0.48 CL. Anterior carapace width 0.51–0.57 CL. The present series includes the largest known specimen of the species.

Remarks. A full account of this species is given by Ahyong & Naiyanetr (2000). *Clorida albolitura* closely resembles *C. latreillei* but differs chiefly in bearing a more slender lateral spine on TS5, tuberculate instead of relatively regular lateral margins of the telson, a postanal carina that extends beyond ½ the distance between anal pore and posterior telson margin, and the presence of a large white patch on the median carina of the telson in life. The Australian specimens are generally uniform morphologically and agree well with the type material and type account. Whereas two of 21 specimens reported by Ahyong & Naiyanetr (2000) (ZRC 1970.10.23.12 from Vietnam, ZRC 1999.2194 from Phuket) bear a two-segmented mandibular palp, all Australian specimens bear a three-segmented palp. In Australian specimens, abdominal submedian carinae are low and present on all somites, but in some specimens may be difficult to discern on AS1–2 unless the surface is dried.

An unusual variation in the present series is the presence of fixed apices of the submedian teeth in almost half of the specimens examined. Fixed submedian teeth are also present in some specimens of *C. bombayensis* studied by Manning (1995: fig. 112).

Habitat. Sand and mud substrates; 31–110 m.

Distribution. Western Indian Ocean to Vietnam, Japan, Taiwan and northern Australia.

Clorida bombayensis (Chhapgar & Sane, 1967)

Fig. 106

Squilla bombayensis Chhapgar & Sane, 1967: 1, fig. 1 (type locality: Bombay, India [18°58'N 72°50'E]).–Manning, 1995: 182–185, figs. 112, 113, 114a,b, 115a, pls. 32, 33.
Clorida latispina Manning, 1968a: 247–249, fig. 3 (type locality: Khota Bharu, Kelantan, Malaysia).
Clorida bombayensis.–Manning, 1968b: 5; 1995: 23, 182–185, pl. 32, 33, figs. 112, 113, 114a,b, 115a.

Australian material. QUEENSLAND: AM P54473, 1♀ (TL 69 mm), Gulf of Carpentaria, 13°24.1'S 138°35.8'E, T. Wassenberg, Nov 1991; AM P55587, 2♀♀ (TL 68–100 mm), E of Cape Arnhem, Gulf of Carpentaria, 12°15.2'S 138°17.2'E, T. Wassenberg, Nov–Dec 1991. NORTHERN TERRITORY: AM P54472, 1♂ (TL 68 mm), 1♀ (TL 94 mm), E of Wessell Is, Arafura Sea, 11°00.7'S 137°13.8'E, 47 m, muddy sand, T. Wassenberg, Nov 1990.

Other material. MZC 30.11.1899, 1♂ (TL 77 mm), Khota Bharu, Kelantan, Malaysia, Skeat Expedition (paratype of *Clorida latispina* Manning); USNM 77929, 1♀ (TL 62 mm), China Sea, off Hong Kong, 21°44'N 114°48'E, 62 m, 9 Aug 1908 (holotype of *Clorida latispina* Manning).

Diagnosis. A1 somite dorsal processes with short, spiniform apices. A2 peduncle segment 1 extending anteriorly beyond eyes. Carapace with anterolateral spines. Raptorial claw dactylus with 5 teeth, proximal margin with basal notch. Mandibular palp 3-segmented. TS5 lateral process broad basally with spiniform apex, directed anterolaterally and inclined ventrally; with short ventral spine, directed ventrally. TS6–7 lateral processes rounded anterolaterally, with posterolateral spine. AS1–5 with distinct, divergent, SM carinae. Abdominal carinae spined as follows: SM 6, IM 5–6, LT 5–6, MG (3–4)5. Telson dorsolateral surface with rows of low, irregularly spaced tubercles; denticles SM 3–4, IM 7–9, LT 1; ventral surface with postanal carina only. Uropodal protopod outer margin smooth; inner margin with 6–12 slender spines. Uropodal exopod proximal outer margin with 7 movable spines; distal segment longer than proximal segment; without black spot at articulation of exopod segments.

Colour in life. Female: overall dorsal colour light brown; pereiopods white. Male: not recorded, faded in alcohol.

Measurements. Male (*n* = 2) TL 68–77 mm, female (*n* = 5) TL 62–100 mm. A1 peduncle 1.13–1.24 CL. A2 scale length 0.46–0.53 CL. Anterior carapace width 0.49–0.53 CL. The present series includes the largest known specimens of the species.

Remarks. *Clorida bombayensis* differs from other species of the genus in bearing posterolateral spines on the lateral processes of TS6–7. The Australian specimens agree well with published accounts (Chhapgar & Sane, 1967; Manning, 1968a, 1995) and figures of the holotype provided by R.B. Manning. In *C. bombayensis*, the submedian carinae on AS1–5 are always distinct.

Habitat. Muddy sand substrates to a depth of at least 47 m.

Distribution. Bombay, India, to Vietnam, Hong Kong, and now northern Australia.

Clorida daviei n.sp.

Fig. 107

Type material. (All Northern Territory) HOLOTYPE: AM P56965, ♂ (TL 44 mm), NE of Groote Eylandt, Gulf of Carpentaria, 12°58.7'S 137°11.8'E, 45 m, SS0390 007, T. Wassenberg, Nov–Dec 1990. PARATYPES: AM P56966, 1♂ (TL 53 mm), 1♀ (TL 58 mm), N of Wessell I., Arafura Sea, 9°39.2'S 136°47.0'E, SS0591 15, T. Wassenberg, 21 Nov 1991; AM P56991 (to QM), 1♀ (TL 50 mm), N of Groote Eylandt, Gulf of Carpentaria, 12°57.3'S 136°46.1'E, 32 m, SS0390 008, T. Wassenberg, 23 Nov 1990;

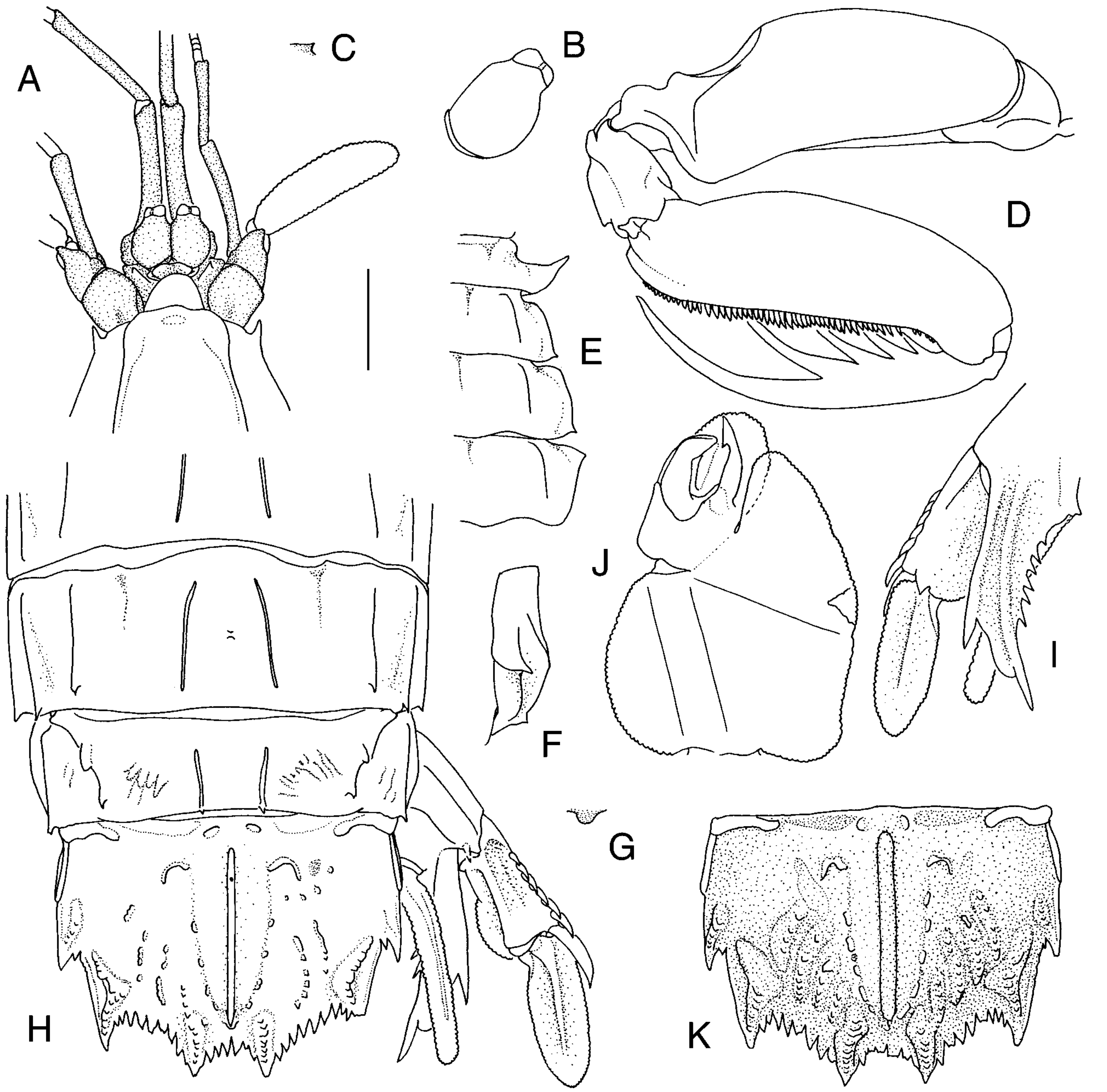

Figure 106. *Clorida bombayensis* (Chhapgar & Sane). A–I, ♀ TL 69 mm (AM P54473). J,K, ♂ TL 68 mm (AM P54472). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, uropod, right ventral. J, PLP1 endopod, right anterior. K, telson, dorsal. Scale A, C–I, K = 4 mm; B, J = 2 mm.

AM P56996, 1♀ (TL 37 mm), NE of Cape Arnhem, Gulf of Carpentaria, 11°27.7'S 137°41.7'E, 47 m, SS0390 103, T. Wassenberg, 13 Dec 1990; AM P56998, 1♂ (TL 42 mm), E of Cape Arnhem, Gulf of Carpentaria, 12°28.9'S 137°28.5'E, S0591 28, T. Wassenberg, Nov–Dec 1991; AM P56999, 2♂♂ (TL 26–32 mm), 4♀♀ (TL 45–55 mm), off Nhulunbuy, 12°04.3'S 136°45.0'E, SS0591 002, T. Wassenberg, Nov–Dec 1991; NTM Cr009570, 2♀♀ (TL 35–41 mm), Gulf of Carpentaria, 11°00.1'S 137°47.5'E, 48 m, dredge, A. Bruce & R. Williams, 22 Nov 1991.

Australian material. QUEENSLAND: AM P56967, 3♂♂ (TL 38–50 mm), Gulf of Carpentaria, 15°31.4'S 139°11.6'E, 45 m, dredge, SS0390 31, T. Wassenberg, Nov–Dec 1990; AM P56968, 2♂♂ (TL 46–47 mm), N of Wellesley Is, Gulf of Carpentaria, 14°31.3'S 139°12.3'E, 57 m, SS0390 36, T. Wassenberg, Nov–Dec 1990; AM P56990, 1♀ (TL 50 mm), Arafura Sea, 11°32.7'S 138°41.8'E, 53 m, SS0390 85, T. Wassenberg, Nov–Dec 1990; AM P56992, 1♀ (TL 52 mm), NE of Cape Arnhem, Arafura Sea, 10°41.8'S 138°31.1'E, SS0591 20, T. Wassenberg, Nov–Dec 1991; AM P56993 (to QM), 1♂ (TL 42 mm), 1♀ (TL 41 mm), Gulf of Carpentaria, 13°24.1'S 138°35.8'E, SS0591 34, T. Wassenberg, Nov–Dec 1991; AM P56994, 1♂ (TL 41 mm), Gulf of Carpentaria, 13°28.9'S 139°11.9'E, 57 m, SS0390 34, T. Wassenberg, Nov–Dec 1990; AM P56995, 1♂ (TL 47 mm), Gulf of Carpentaria, 11°03.5'S 139°54.8'E, SS0591 057, T. Wassenberg, Nov–Dec 1991; AM P56997, 1♀ (TL 40 mm), N of Wellesley Is, Gulf of

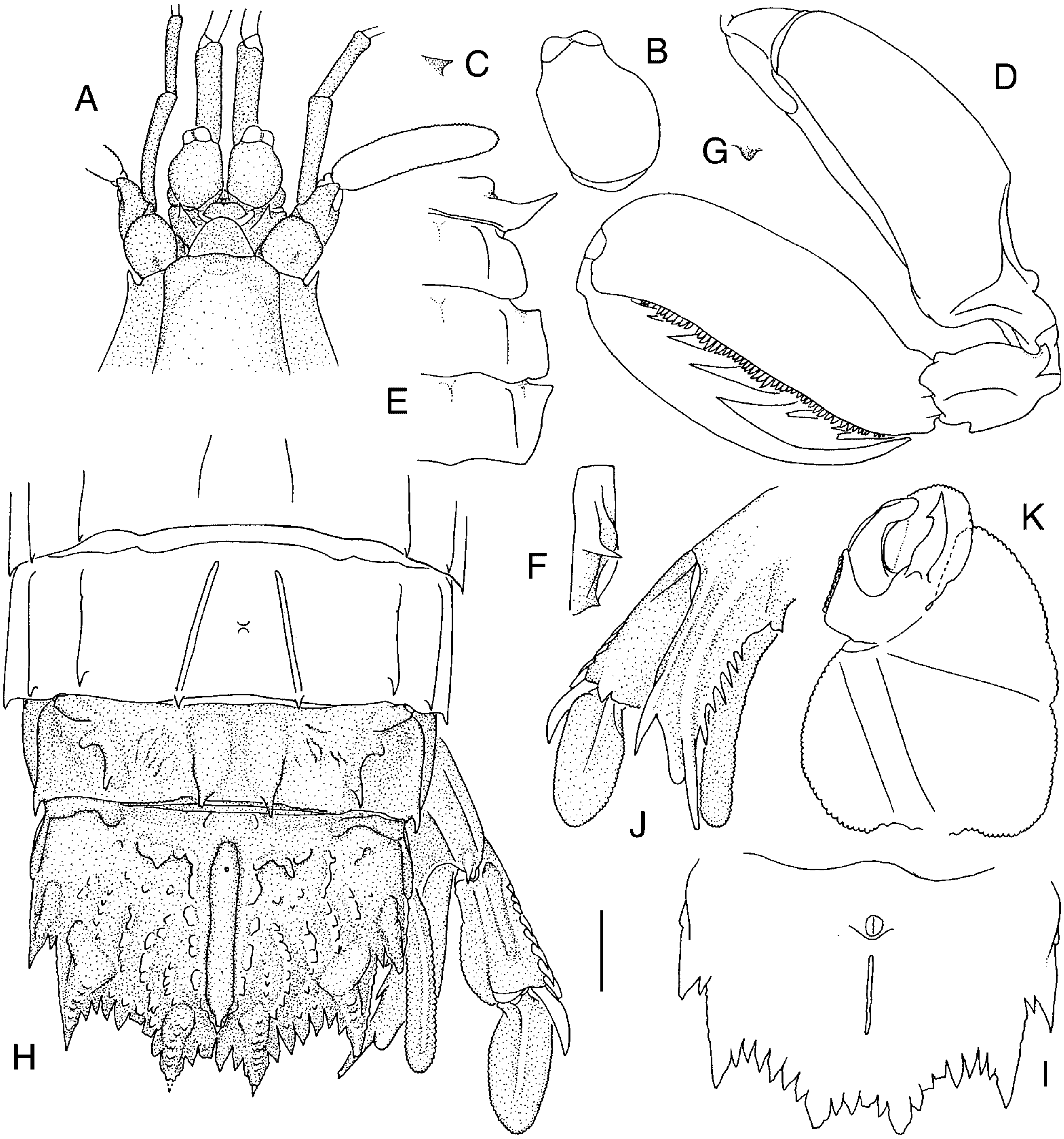

Figure 107. *Clorida daviei* n.sp., holotype ♂ TL 44 mm. A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A, C–J = 2 mm; B, K = 1 mm.

Carpentaria, 14°00.7'S 139°11.6'E, 59 m, SS0390 35, T. Wassenberg, 28 Nov 1990; QM W17430, 1♂ (TL 39 mm), Gulf of Carpentaria, 10°58.1'S 138°41.9'E, 52 m, dredged, 9 Dec 1991.

Diagnosis. A1 somite dorsal processes with short, spiniform apices. A2 peduncle segment 1 extending anteriorly beyond eyes. Carapace with anterolateral spines. Raptorial claw dactylus with 5 teeth. Mandibular palp 3-segmented. TS5 lateral process broad basally with spiniform apex, directed anterolaterally. TS6 lateral process broadly rounded. TS7 lateral process truncate, obtuse anterolaterally and posteriorly. AS1–5 SM carinae distinct. AS5 with posteriorly armed SM carinae. Telson ventral surface with postanal carina; ventral surface either side of midline smooth or with at most 4–5 tubercles or short low carinae towards posterior margin; Uropodal exopod with black spot at articulation of exopod segments.

Description. Eye small, not reaching midlength of A1 peduncle segment 1. Ophthalmic somite anterior margin triangular. Ocular scales fused, rounded laterally. A1 peduncle 1.12–1.32 CL. A1 somite dorsal processes with short, spiniform apices. A2 scale 0.51 CL. A2 peduncle segment 1 extending anteriorly beyond eyes. Rostral plate broader than long; apex rounded; without median carina. Carapace anterior width 0.46–0.53 CL; anterolateral spines not extending to base of rostral plate; without posterior median projection. Raptorial claw dactylus with 5 teeth; outer margin broadly curved, proximal margin with basal notch and small proximal lobe; propodus distal margin unarmed. Mandibular palp 3-segmented. TS6–8 SM carinae absent. TS5 lateral process broad basally with spiniform apex, directed anterolaterally and inclined ventrally; with small acute ventral spine, directed anterolaterally. TS6 lateral process broadly rounded. TS7 lateral process truncate, obtuse anterolaterally and posteriorly. TS8 anterolateral margin triangular; apex acute; sternal keel rounded. AS1–5 SM carinae distinct, straight or faintly sinuous, divergent. AS6 smooth medially, irregular laterally; with ventrolateral spine anterior to uropodal articulation; ventrally with low MD carina. Abdominal carinae spined as follows: SM 5–6, IM (3)4–6, LT (3)4–6, MG (2)3–5. Telson broader than long; prelateral lobe subequal to or longer than margin of LT tooth; denticles triangular, each with blunt dorsal tubercle, SM 1–3, IM 5–8, LT 1; margin of IM and LT teeth smooth to crenulate; dorsolateral surface with numerous widely spaced rows of closely spaced acute tubercles. Telson ventral surface with long, posteriorly tuberculate postanal carina; posterior surface either side of midline smooth or with at most 4–5 tubercles or short low carinae; ventrolateral carina extending posteriorly to base of LT tooth. Uropodal protopod outer margin smooth; inner margin with 6–10 slender spines; with short ventral spine anterior to endopod articulation. Protopod terminal spines with lobe on outer margin of inner spine rounded; broader than adjacent spine. Uropodal exopod proximal segment unarmed dorsally; inner distal ⅔ broadly convex, proximal ⅓ concave; outer margin with 8 movable spines, distalmost tapered with acute apex, reaching midlength of distal segment; distal margin with short, stout ventral spine. Exopod distal segment longer than proximal segment; with black spot at articulation of exopod segments.

Colour in life. Overall dorsal colour light tan brown. Grooves of carapace diffusely pigmented with brown. Posterior margins of thoracic and abdominal somites dark brown. Uropodal exopod with dark brown pigment over articulation of proximal and distal segments; distal segment with dark inner ½.

Etymology. Named for fellow carcinologist, Peter Davie, Queensland Museum, for his assistance and good cheer during several visits to the Queensland Museum.

Measurements. Male (n = 14) TL 26–53 mm, female (n = 13) TL 35–58 mm. Other measurements of holotype: CL 8.2 mm, A1 peduncle 10.0 mm, A2 scale 4.3 mm.

Remarks. *Clorida daviei* n.sp. is unique in the genus in bearing armed submedian carinae on AS5–6. This new species most closely resembles *C. decorata* in general facies and in having an angular anterolateral margin of the lateral process of TS7. *Clorida daviei* differs from *C. decorata* and resembles *C. latreillei* in having a more slender lateral process of TS5, and in lacking supplementary carinae and tubercles lateral to the postanal carina.

Habitat. Taken from trawlable substrates at depths of 45–59 m.

Distribution. Australia, from the Gulf of Carpentaria and Arafura Sea.

Clorida depressa (Miers, 1880)

Fig. 108

Chloridella depressa Miers, 1880: 14, 15, pl. 2: figs. 1–4 (type locality: Port Essington, Northern Territory, Australia) (name provided provisionally under account of *C. microphthalma*).–Haswell, 1882: 207 (not *Squilla microphthalma* H. Milne Edwards, 1837).

Squilla depressa.–Serène, 1952: 2–11, figs. 3, 4, 9, 18, 21, pl. 1: figs. 3, 6, pl. 2: figs. 3, 6–10.–Stephenson, 1952: 8; 1953a: 43.–Stephenson & McNeill, 1955: 240 (part).–Manning, 1966: 86, 87.

Clorida depressa.–Manning, 1968b: 5; 1995: 24, 180, 181.

Type material. HOLOTYPE: NHM 1957.12.12.1, ♂ (TL 38 mm), Port Essington, Northern Territory, Australia, R. Tilston.

Australian material. QUEENSLAND: AM P5614, 1♂ (TL 82 mm), Port Denison, 20°03'S 148°15'E, E. Rainford; AM P10934, 1♀ (TL 73 mm), Mackay, 21°09'S 149°11'E, C. Volskow; AM P17728, 1♂ (TL 47 mm), Magnetic I., 4.5–9 m, mud, K. Bryson, 6 Apr 1963; AM P21653, 1♂ (TL 71 mm), SE Gulf of Carpentaria, 17°31'25"S 140°36'20"E, 3.7 m, trawl, 18 Dec 1963; QM G11/12, 1♂ (TL 86 mm), Sandgate, Moreton Bay, Mr Grice; QM W1686, 1♀ (TL 76 mm), Russell I., Moreton Bay, E. Wood, 24 Oct 1946; QM W3140, 1♂ (TL 56 mm), The Esplanade, Cairns, N. Barnes, 28 Aug 1962; QM W4585, 1♂ (TL 72 mm), 1♀ (TL 25 mm), Trinity Inlet, Cairns, R. Timmins, 2 Dec 1974; QM W19303, 1♀ (TL 50 mm), small creek S of Bohle River mouth, Townsville, 19°11.5'S 146°32.7'E, littoral estuarine mud flat, P. Davie *et al*., 27 Oct 1993; QM W23391, 1♂ (TL 90 mm), Point Talburpin, Redland Bay, Moreton Bay, from intertidal burrow in sandy mud; 27°38'S 153°19'E, T. Knight, 7 Apr 1998. NORTHERN TERRITORY: AM P52723, 1♂ (broken, CL 13.0 mm), 3♀♀ (TL 65 mm; 2 broken, CL 9.1–11.1 mm), Charles Point, 12°23'S 130°37'E, mudflat, in gutter, M. Ward; AM P52725, 1♀ (TL 47 mm), Buffalo Creek, Beagle Gulf, 12°20'S 130°54'E, 0–1 m, sandy mud, estuarine, rotenone, D. Rennis & R. Williams, 10 Aug 1983; NTM Cr004666, 1♀ (TL 43 mm), 12°32.6'S 130°56.6'E, low water springs, mangroves, R. Willan, 11 Feb 1987; NTM, 1♀ (TL 48 mm), Channel I., Darwin, 24 May 1982; NTM, 1♀ (TL 32 mm), Drimmie Creek Security Pond, Gove, NT Fisheries, 25 Jun 1971; NTM, 1♂ (TL 27 mm), Drimmie Creek Security Pond, Gove, NT Fisheries, 5 Oct 1972; NTM, 1♂ (TL 26 mm), Gove, NT Fisheries, stn 3B, G3 B/1, Nov 1970; NTM, 1♂ (TL 30 mm), Gove, 21 Feb 1974; NTM, 1♀ (TL 13 mm), Gove, 6 Feb 1973; NTM, 1♀ (TL 20 mm), Gove, 22 Aug 1971.

Diagnosis. A1 somite dorsal processes with low, rounded or obtusely angled apices. Adults with A2 peduncle segment 1 extending anteriorly beyond eyes. Carapace with anterolateral spines. Raptorial claw dactylus with 4 or 5 teeth; outer proximal margin angular. Mandibular palp

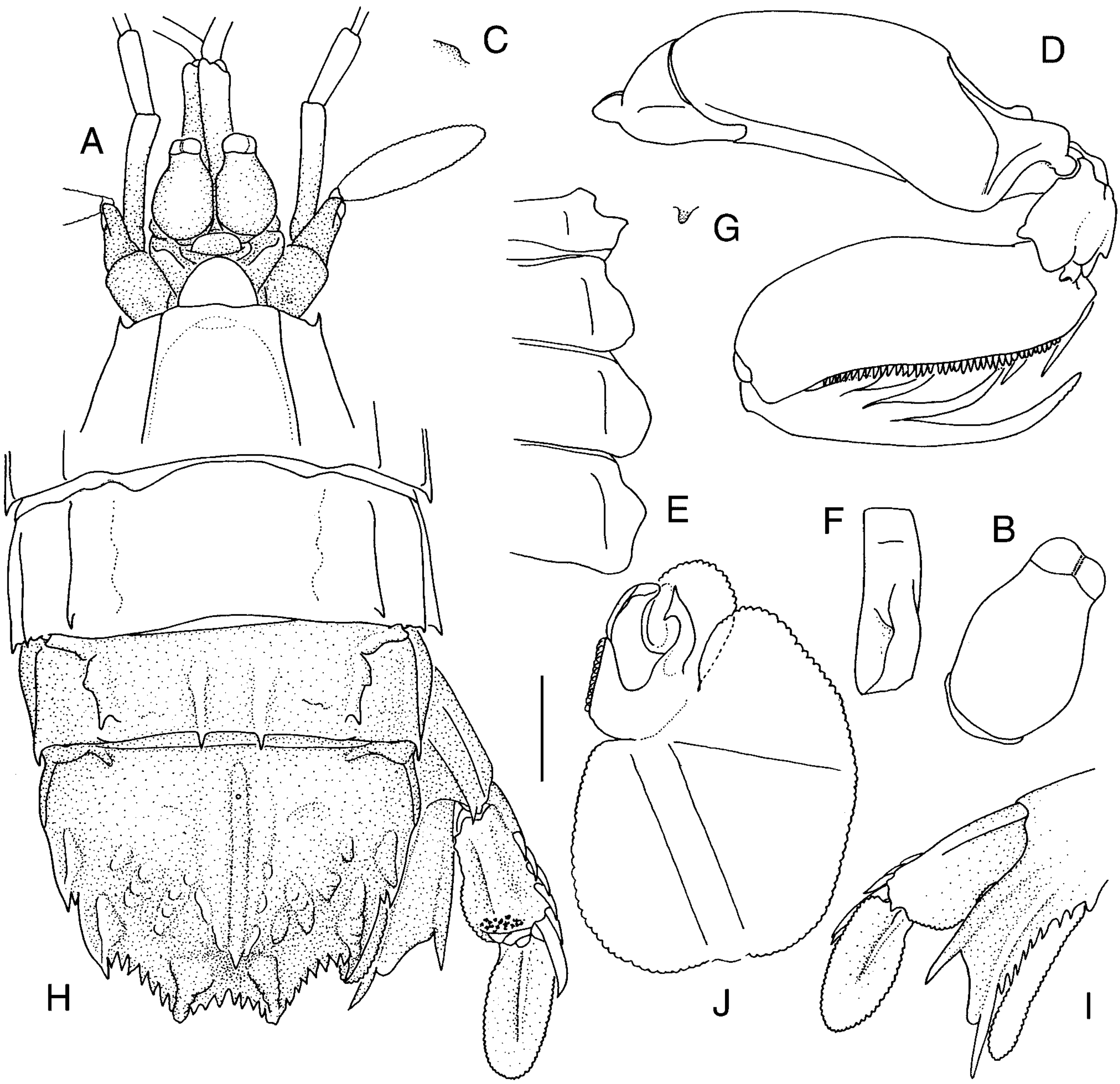

Figure 108. *Clorida depressa* (Miers), holotype ♂ TL 38 mm. A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A, C–I = 2 mm; B, J = 1 mm.

usually 3-segmented. TS5 lateral process a short blunt projection, directed laterally, with low ventral tubercle. TS6–7 lateral process broadly rounded. AS1–5 without SM carinae. Abdominal carinae spined as follows: SM 6, IM 5–6, LT 5–6, MG (1)2–5 (usually 1–5). Telson dorsolateral surface with widely and irregularly spaced tubercles concentrated posteriorly; margin of IM and LT teeth faintly crenulate; denticles SM 2–4, IM 6–8, LT 1; ventral surface without postanal carina or accessory carinae. Uropodal protopod outer margin smooth to crenulate; inner margin with 6–10 slender spines. Uropodal exopod proximal segment outer margin with 5–7 movable spines; with black patch distally.

Colour in life. Dorsal surface pale green. Carapace mottled with green and grey; posterior margin dark grey to black. TS6–8 and AS1–5 with posterior margins dark grey to black. AS2 with narrow, diffuse, dark grey transverse median line. AS3–5 with small median and submedian dark grey spots. AS6 and telson with carinae and tubercles deep green. Uropodal exopod proximal segment with dark grey to black patch distally. Ventral surface white. Pleopods with marginal setae brown.

Measurements. Male ($n = 12$) TL 26–90 mm, female ($n = 13$) TL 13–76 mm. A1 peduncle 1.00–1.13 CL. A2 scale 0.41–0.46 CL. Anterior carapace width 0.51–0.56 CL. The present series includes the largest known specimens of the species.

Remarks. *Clorida depressa* differs from other species of the genus in the blunt dorsal processes of the antennular somite, the presence of a mandibular palp, blunt lateral processes of TS5, absence of submedian carinae on AS1–5, and the absence of a postanal carina.

Unlike other species of the genus such as *C. latreillei* in which the abdominal spination is variable (Manning, 1991), abdominal spination is generally constant in *C. depressa*. The marginal carinae of AS1–5 are armed in most specimens except for a specimen (TL 48 mm) and several juvenile specimens less than 30 mm TL in which the marginal carinae of AS1–3 may be unarmed. In his treatment of *C. depressa*, Serène (1952), reported a specimen with unarmed marginal carinae on AS1; that specimen is referable to a new species of *Cloridina* described below.

The mandibular palp is three-segmented and present on both sides in most specimens. In several specimens, however, the mandibular palp is two-segmented, the palp is undeveloped in the 13 mm TL female, and in a 47 mm TL male, the palp is three-segmented on one side, and a bud is present on the other. Thus, the presence of the mandibular palp appears to be a reliable diagnostic character in *C. depressa*, except in minute specimens.

Habitat. Burrows in sandy-mud flats, usually intertidally, but also to about 10 m depth. *Clorida depressa* and *C. granti* may be sympatric, but the latter usually occurs subtidally below about 5 m depth.

Distribution. Southern Queensland, from Moreton Bay, north to the Gulf of Carpentaria and the vicinity of Darwin.

Clorida granti (Stephenson, 1953b)

Fig. 109

Squilla granti Stephenson, 1953b: 201–208, fig. 1, figs. 2A,B,D,F (type locality: NNE of Woody Point Pier, Moreton Bay, Queensland, Australia, 7°16'S 153°06'E).–Stephenson & McNeill, 1955: 240.
Clorida granti.–Manning, 1968b: 5; 1995: 24, 180, 181.

Type material. (All Queensland, Australia) HOLOTYPE: QM W1789, ♂ (TL 61 mm), 9 km NNE of Woody Point Pier, Moreton Bay, 7°16'S 153°06'E, 12 m, muddy sand, trawl, E. Grant, 3 Jan 1951. ALLOTYPE: QM W1840, ♀ (TL 46 mm), 34.8 km S of Woody Point Pier, Moreton Bay, 5–6 m, sandy mud, trawl, E. Grant, 20 Dec 1951. PARATYPES: QM W2003, 1♂ (TL 61 mm), 9 km NNE of Woody Point pier, Moreton Bay, 12 m, muddy sand, trawl, 3 Jan 1951; QM W2004, 1♂ (TL 63 mm) 4.8 km NE of Woody Point Pier, Moreton Bay, 9 m, sandy mud, trawl, E. Grant, 9 Aug 1952; QM W2002, 1♂ (TL 59 mm), 4.8 km S of Woody Point pier, Moreton Bay, 6 m, sandy mud, trawl, E. Grant, 10 Nov 1951; QM W1790, 1♂ (TL 63 mm), 7.2 km E of Scarborough pier, Moreton Bay, 12 m, heavy mud, trawl, E. Grant, 5 Aug 1950; QM W2001, 1♂ (TL 64 mm), Redcliffe area, Moreton Bay, A. Keone, Dec 1951; AM P12078, 1♂ (TL 61 mm), 9 km NNE of Woody Point Pier, Moreton Bay, 27°16'S 153°06'E, 12 m, trawl, W. Stephenson, 19 Dec 1950; AM P12077, 1♂ (TL 64 mm), 9 km NNE of Woody Point Pier, 27°16'S 153°06'E, 12 m, trawl, W. Stephenson, 19 Dec 1950; AM P12277, 1♀ (TL 41 mm), Scarborough, Moreton Bay, 27°12'S 153°07'E, dredged, 26 May 1913.

Australian material. QUEENSLAND: QM W2969, 1♂ (TL 65 mm), 1♀ (TL 54 mm), 4.8 km NNE of Pile Light, Moreton Bay, 12.8 m, muddy sand, dredged, 6 Feb 1968; QM W2970, 1♂ (TL 63 mm), 2♀♀ (TL 53–54 mm), 6 km N of Pile Light, Moreton Bay, 13.7 m, muddy sand, dredged, 6 Feb 1968; QM W2975, 1♀ (TL 49 mm), 4.8 km NNE of Pile Light, Moreton Bay, 12.8 m, muddy sand, dredged, 6 Feb 1968; QM W3667, 1♂ (TL 56 mm), 7.2 km E of Pine River entrance, 8.2 m, mud, 14 Aug 1967; AM P12367, 1♀ (TL 50 mm), Moreton Bay, Dept of Harbours & Marine, late 1952; AM P12278, 1♀ (TL 52 mm), ocean waters off Point Lookout, trawl, M. Drinan, Dec 1952; AM P13543, 1♂ (TL 43 mm), 1♀ (36 mm), 6.4–8 km from Urquhart Point, Embley Hey River, Weipa, 5.5–6.4 m, dredged, G. Webster, 1 Jul 1961; USNM 120324, 1♂ (TL < 55 mm, cephalon absent), off Redcliffe, 7–8 km E of Queen Beach, Moreton Bay, 9.2–11.0 m, W. Stephenson, 29 Mar 1966; USNM 120323, 1♂ (TL 60 mm), 1♀ (TL 51 mm), 3.2 km E of Woody Point Pier, 9.2–11.0 m, L. Wale *et al*., Dec 1966; QM W2862, 3♀♀ (TL 50–54 mm), 1.2 km NNW of Pile Light, Moreton Bay, 27°19'S 153°13'E; QM W2775, 2♂♂ (TL 54–58 mm), 1♀ (TL 51 mm), 3.2 km E of Woody Point Light, Moreton Bay, 27°16'S 153°08'E, 7.3 m, mud, 15 Dec 1964; QM W2776, 6♀♀ (TL 43–50 mm), 7.2 km E of Reef Point, Scarborough, Moreton Bay, 27°12'S 153°11'E, 15 Dec 1964; QM 2767, 1♂ (TL 68 mm), 3.2 km ESE of Woody Point, Moreton Bay, 27°16'S 153°08'E, 6.4 m, mud, 15 Dec 1964; QM W2863, 2♀♀ (TL 45–54 mm), 0.8 km ENE Pile Light, Moreton Bay, 27°19'S 153°13'E; QM W2766, 1♂ (TL 58 mm), 3.2 km E of Scarborough, Moreton Bay, 27°12'S 153°09'E; QM W2777, 1♂ (TL 53 mm), 4 km E of Reef Point, Scarborough, Moreton Bay, 27°12'S 153°11'E, 15 Dec 1964; QM W2778, 1♀ (TL 48 mm), 4 km E of Drury Point, Moreton Bay, 8.2 m, mud, 15 Dec 1964; QM W2822, 1♀ (TL 55 mm), 1.6 km W of Red Buoy, SW Bribie I., 27°07'S 153°07'E, 6 Jun 1967; QM W8743, 1♀ (TL 13 mm), mouth of Brisbane River, W of Bishop I., 27°24'S 153°10'E, 1–2 m, on sand, 20 Jul 1976; AM P57096, 1♂ (TL 35 mm), between Weipa & Karumba, Gulf of Carpentaria, 10–30 m, T. Wassenberg, 1977; AM P57097, 1♂ (TL 29 mm), 2♀♀ (TL 24–27 mm), N of Duyfken Point, 12°22.0'S 141°35.2'E, SS0591 047, T. Wassenberg, Nov–Dec 1991. NORTHERN TERRITORY: AM P57098, 1♂ (TL 54 mm), 1♀ (TL 47 mm), off Nhulunbuy, 12°04.3'S 136°45.0'E, T. Wassenberg, Nov 1991.

Diagnosis. A1 somite dorsal processes with short, triangular to spiniform apices. A2 peduncle segment 1 extending anteriorly beyond eyes. Carapace with anterolateral spines. Raptorial claw dactylus with 4 teeth; proximal margin without basal notch. Mandibular palp absent. TS5 lateral process a short, slender spine, directed laterally, without ventral spine. TS6–7 lateral process broadly rounded. AS1–5 without SM carinae. Abdominal carinae spined as follows: SM 6, IM 5–6, LT (4)5–6, MG (1–3)4–5. Telson dorsolateral surface with irregularly spaced tubercles, sharper in females; margin of IM and LT teeth crenulate; denticles SM 2–4, IM 5–8, LT 1; ventral surface with at most an indistinct postanal carina, often indicated by 1 or 2 very low tubercles. Uropodal protopod outer margin smooth or occasionally crenulate; inner margin with 6–9 slender spines. Uropodal exopod proximal outer margin with 5–7 movable spines; distal segment longer than proximal segment; without black spot at articulation of exopod segments.

Colour in alcohol. Largely faded. Grooves of carapace diffusely pigmented with brown. Posterior margin of thoracic and abdominal somites black. Uropod without distinctive pigmentation, at most with diffuse, scattered chromatophores. Stephenson (1953b) described the colour of freshly preserved specimens.

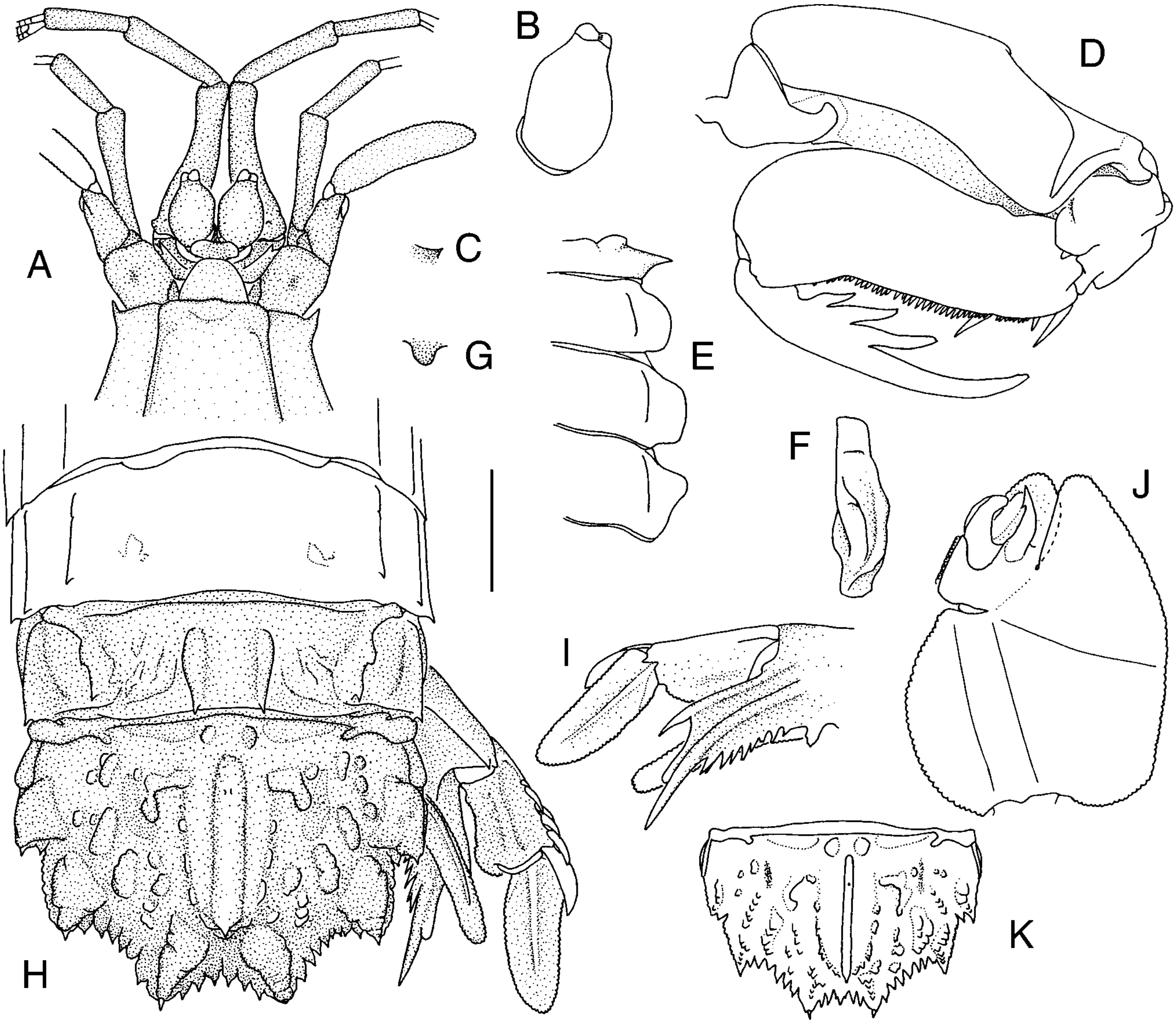

Figure 109. *Clorida granti* (Stephenson). A–J, ♂ TL 65 mm (QM W2969). K, ♀ TL 53 mm (QM W2970). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, uropod, right ventral. J, PLP1 endopod, right anterior. K, telson of ♀, dorsal. Scale A, C–F,H,I,K = 5 mm; B,G,J = 2.5 mm.

Measurements. Male (n = 22) TL 29–68 mm, female (n = 26) TL 13–54 mm. A1 peduncle 0.89–1.16 CL. A2 scale 0.41–0.49 CL. Anterior carapace width 0.52–0.59 CL. The present series includes the largest known specimen of the species.

Remarks. The present non-type specimens agree well with the type series of *C. granti*. *Clorida granti* is the only species of the genus that shows considerable variation in the condition of the postanal carina; it is usually absent, but may be present as a low prominence or as a series of blunt tubercles in smaller specimens (TL 24–29 mm) and occasionally in adults.

Clorida granti belongs to the group of species in the genus that lacks a mandibular palp, and differs from *C. denticauda* and *C. seversi* in having a spiniform instead of a short, angular lateral process of TS5. *Clorida granti* most closely resembles *C. obtusa*, newly described below, and differs in bearing sharp instead of blunt apices on the dorsal processes of the antennular somite, the postanal carina is usually absent (always present in *C. obtusa*) and the articulation of the of exopod segments is not marked by a black patch (present in *C. obtusa*). Stephenson's (1962) record of *C. granti* from Western Australia is based on *C. obtusa*.

Habitat. Sand or mud substrates in embayments and sheltered waters from the shallow sublittoral to 18 m depth; usually below 5 m.

Distribution. Moreton Bay, southern Queensland, north to the Gulf of Carpentaria.

Clorida obtusa n.sp.

Fig. 110

Squilla granti.–Stephenson, 1962: 33 (not *Squilla granti* Stephenson, 1953b).

Type material. (All Queensland, Australia) HOLOTYPE: AM P21654, 1♂ (TL 48 mm), SE Gulf of Carpentaria, 17°20'00"S 139°40'50"E, 8.2–9.2 m, trawl, *Rama*, CSIRO, 1 May 1964. PARATYPES: AM P57164, 1♂ (TL 39 mm), 1♀ (TL 37 mm), NE Gulf of Carpentaria, 11°17.8'S 140°59.8'E, SS0591 52, T. Wassenberg, Nov–Dec 1991; AM P57165 (to QM), 1♀ (TL 38 mm), NE Gulf of Carpentaria, 10°39'S 140°38.7'E, 42 m, T. Wassenberg, Nov–Dec 1990; AM P57161, 1♂ (TL 43 mm), 1♀ (TL 37 mm), NE Gulf of Carpentaria, 11°00.4'S 140°42.0'E, 47 m, SS0390 060, T. Wassenberg, Nov–Dec 1990; AM P57163, 1♂ (TL 30 mm), E Gulf of Carpentaria, 14°30.5'S 140°42.0'E, 46 m, stn 67, T. Wassenberg, Nov–Dec 1990; AM P57166, 1♂ (TL 22 mm), E Gulf of Carpentaria, 13°01.3'S 140°12.0'E, 63 m, T. Wassenberg, Nov–Dec 1990.

Australian material. QUEENSLAND: QM W6749, 1♂ (TL 16 mm), Hay Point, Mackay, 15–21 m, fine sand & mud, Milligan, 9–10 Aug 1975; AM P57167, 1♀ (TL 42 mm), Coral Sea, 11°32.6'S 143°28.31'E, stn 17, T. Wassenberg, 19 Nov 1993; AM P57159, 1♂ (TL 37 mm), 2♀♀ (TL 33–39 mm), Shelburne Bay, 11°30'S 143°00'E, 21 m, dredge, SS0193 27/20, T. Wassenberg, 15 Jan 1993; AM P57162 (to QM), 1♂ (TL 45 mm), 1♀ (TL 37 mm), NE of Orford Bay, 11°11'S 142°55.4'E, SS0591 070, T. Wassenberg, Nov–Dec 1991; AM P57160, 1♂ (TL 35 mm), 4♀♀ (TL 36–44 mm), E of Orford Bay, 11°08.2'S 142°58.8'E, SS0591 71, T. Wassenberg, Nov–Dec 1991. WESTERN AUSTRALIA: NTM Cr012361, 1♀ (TL 26 mm), Northwest Shelf, 19°29.4–29.6'S 118°52.6'E, 39–40 m, beam trawl, S0383 B08, 28 Jun 1983.

Diagnosis. A1 somite dorsal processes low, rounded. A2 peduncle segment 1 extending anteriorly beyond eyes. Carapace with anterolateral spines. Raptorial claw dactylus with 4 teeth. Mandibular palp absent. TS5 lateral process a short, slender spine, directed laterally; ventral spine absent. TS6–7 lateral process broadly rounded. AS1–5 without SM carinae. Telson margin of IM and LT teeth crenulate to denticulate; ventral surface with postanal carina. Uropodal exopod with black patch at articulation of exopod segments.

Description. Eye small, not reaching midlength of A1 peduncle segment 1. Ophthalmic somite anterior margin with median point. Ocular scales fused, emarginate medially, rounded laterally. A1 peduncle 0.82–1.07 CL. A1 somite dorsal processes low, rounded. A2 scale 0.38–0.47 CL. A2 peduncle segment 1 extending anteriorly beyond eyes. Rostral plate broader than long; apex rounded or slightly truncate; without dorsal carina. Carapace anterior width 0.41–0.50 CL; anterolateral spines not extending beyond base of rostral plate; without posterior median projection. Raptorial claw dactylus with 4 teeth; outer margin faintly sinuous or broadly curved, proximal margin without basal notch; propodus distal margin unarmed. Mandibular palp absent. TS6–8 without SM carinae. TS5 lateral process a short, slender spine, directed laterally, without ventral spine. TS6–7 lateral process broadly rounded. TS8 anterolateral margin produced to a small rounded lobe; sternal keel blunt. AS1–5 without SM carinae. AS6 surface irregular between SM and IM carinae; with ventrolateral spine anterior to uropodal articulation. Abdominal carinae spined as follows: SM 6, IM 5–6, LT 5–6, MG (3–4)5. Telson broader than long; prelateral lobe subequal to or longer than margin of LT tooth; denticles triangular, SM 2–4, IM 5–7, LT 1; margin of IM and LT teeth crenulate to denticulate; dorsolateral surface with rows of irregularly spaced tubercles. Telson ventral surface with distinct, postanal carina, tuberculate posteriorly; ventrolateral carina not extending posteriorly to LT denticle. Uropodal protopod outer margin smooth; inner margin with 5–8 slender spines; with blunt ventral lobe anterior to endopod articulation; protopod terminal spines with lobe on outer margin of inner spine rounded, as broad as adjacent spine, proximal margin concave. Uropodal exopod proximal segment unarmed dorsally; inner distal ½ broadly convex, proximal ½ concave; outer margin with 5–7 movable spines, distalmost spatulate with acute apex, not exceeding midlength of distal segment; distal margin with stout ventral spine. Exopod distal segment longer than proximal segment; with black spot at articulation of exopod segments.

Colour in life. Overall dorsal colour light tan brown. Carapace with margins and grooves distinctly outlined in black-brown. Posterior margin of thoracic and abdominal somites black-brown. Uropodal exopod with black patch at articulation of proximal and distal segments.

Measurements. Male (n = 9) TL 16–48 mm, female (n = 12) TL 26–44 mm. Other measurements of holotype: CL 4.4 mm, A1 peduncle 9.2 mm, A2 scale 4.1 mm.

Etymology. The specific epithet alludes to the blunt apices of the dorsal processes of the antennular somite.

Remarks. *Clorida obtusa* n.sp. most closely resembles *C. granti* in lacking a mandibular palp and in bearing a spiniform lateral process of TS5, but differs in bearing blunt instead of sharp apices on the dorsal processes of the antennular somite, the postanal carina is always well developed (usually absent or poorly developed in *C. granti*) and the articulation of the exopod segments is marked by a black patch (absent in *C. granti*). In *C. obtusa*, the grooves and margins of the carapace are distinctly outlined in black, whereas in *C. granti*, the gastric grooves are diffusely pigmented. A specimen reported by Stephenson (1962) as *C. granti*, having black carapace grooves and black uropod markings is referable to *C. obtusa*.

Habitat. Level, sandy-mud substrates at depths of 8–63 m.

Distribution. Mackay, Queensland, the Gulf of Carpentaria and the Northwest Shelf, Western Australia.

Clorida seversi Moosa, 1973

Fig. 111

Clorida seversi Moosa, 1973: 22–24, fig. 4 (type locality: N of Du Rowa I., N of Nuhu Rowa, Kai, Indonesia, 5°32'S 132°41'E).–Makarov, 1979: 54–55.

Type material. HOLOTYPE: LIPI S850, ♂ (TL 32 mm), N of Du Rowa I., N of Nuhu Rowa, Kai, Indonesia, 5°32'S 132°41'E, 27–

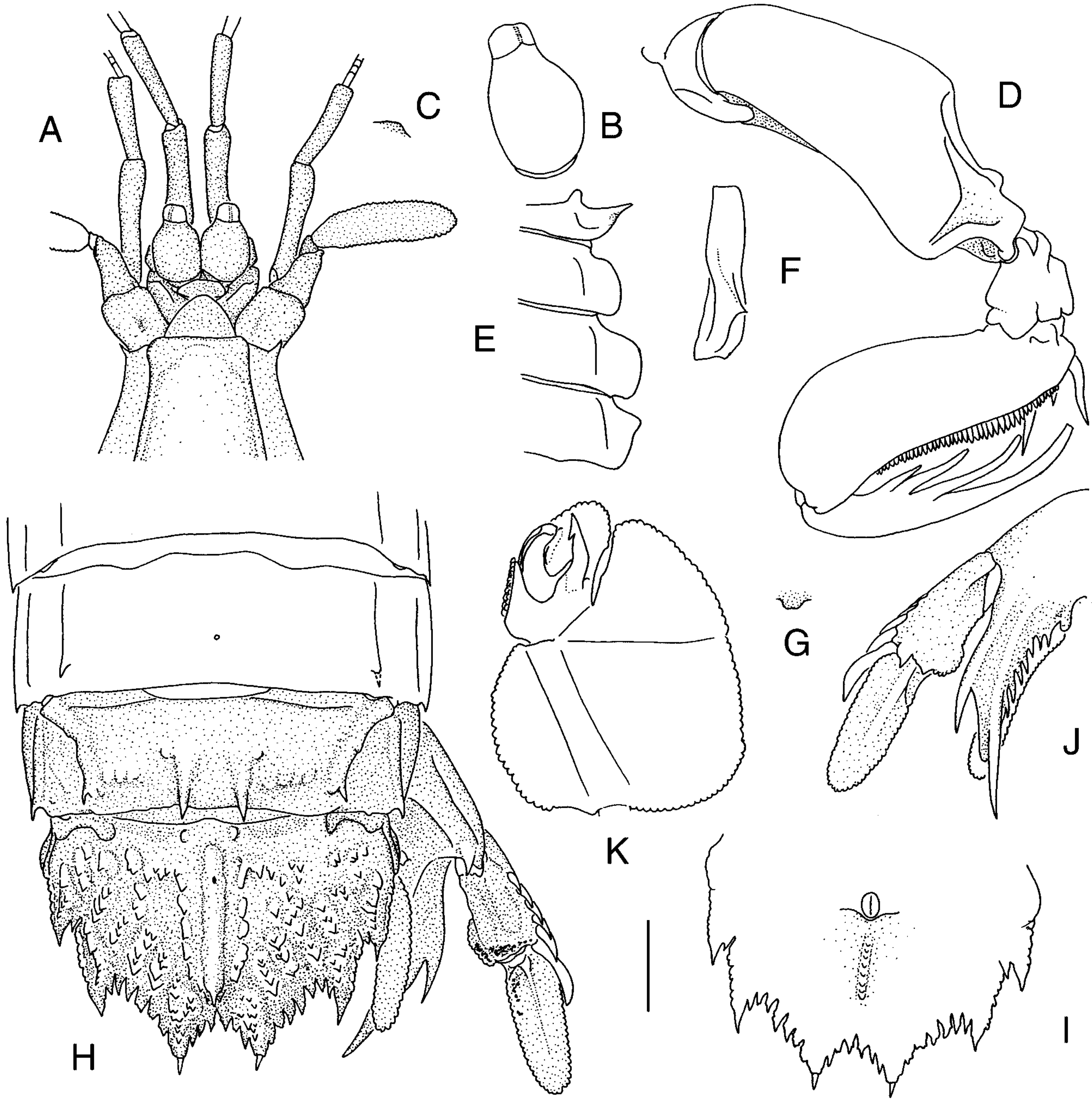

Figure 110. *Clorida obtusa* n.sp., holotype ♂ TL 48 mm. A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A, C–J = 2.5 mm; B, K = 1.2 mm.

37 m, dredged, sand & rubble, 11 Jun 1970. PARATYPES: LIPI S845, 1♂ (TL 27 mm), 8 miles SW of Tg. Ratoe, Waikoor, Aru, 6°07'S 135°57'E, 46 m, dredged, sand & rubble, RV Pele, 18 Jun 1970; LIPI S847–849, 1♂ (TL 20 mm), 2♀♀ (TL 30–31 mm), N of Du Rowa I., N of Nuhu Rowa, Kai, Indonesia, 5°32'S 132°41'E, 27–37 m, dredged, sand & rubble, 11 Jun 1970.

Australian material. QUEENSLAND: NMV J14455, 1♀ (TL 34 mm), Britomart Reef, 18°17'S 146°38'E, 15 m, reef front, with crinoids, G. Poore & H. Lew Ton, 27 Nov 1982; NMV J14456, 1♂ (TL 32 mm), Britomart Reef, 18°17'S 146°38'E, 9 m, lagoon floor from burrows, G. Poore & H. Lew Ton, 27 Nov 1982.

Diagnosis. A1 somite dorsal processes with short, triangular apices. A2 peduncle segment 1 extending anteriorly beyond eyes. Carapace with anterolateral spines. Raptorial claw dactylus with 4 well formed teeth, outer margin without basal notch. Mandibular palp absent. TS5 lateral process a short triangular lobe; with low ventral tubercle. TS6–7 lateral process broadly rounded. AS1–5 without SM carinae. Abdominal carinae spined as follows: SM 6, IM (5)6, LT 6, MG –. Telson dorsolateral surface with 6–7 evenly spaced rows of angular tubercles; margin of IM tooth crenulate or strongly tuberculate; denticles SM 3–5, IM 5–7, LT 1;

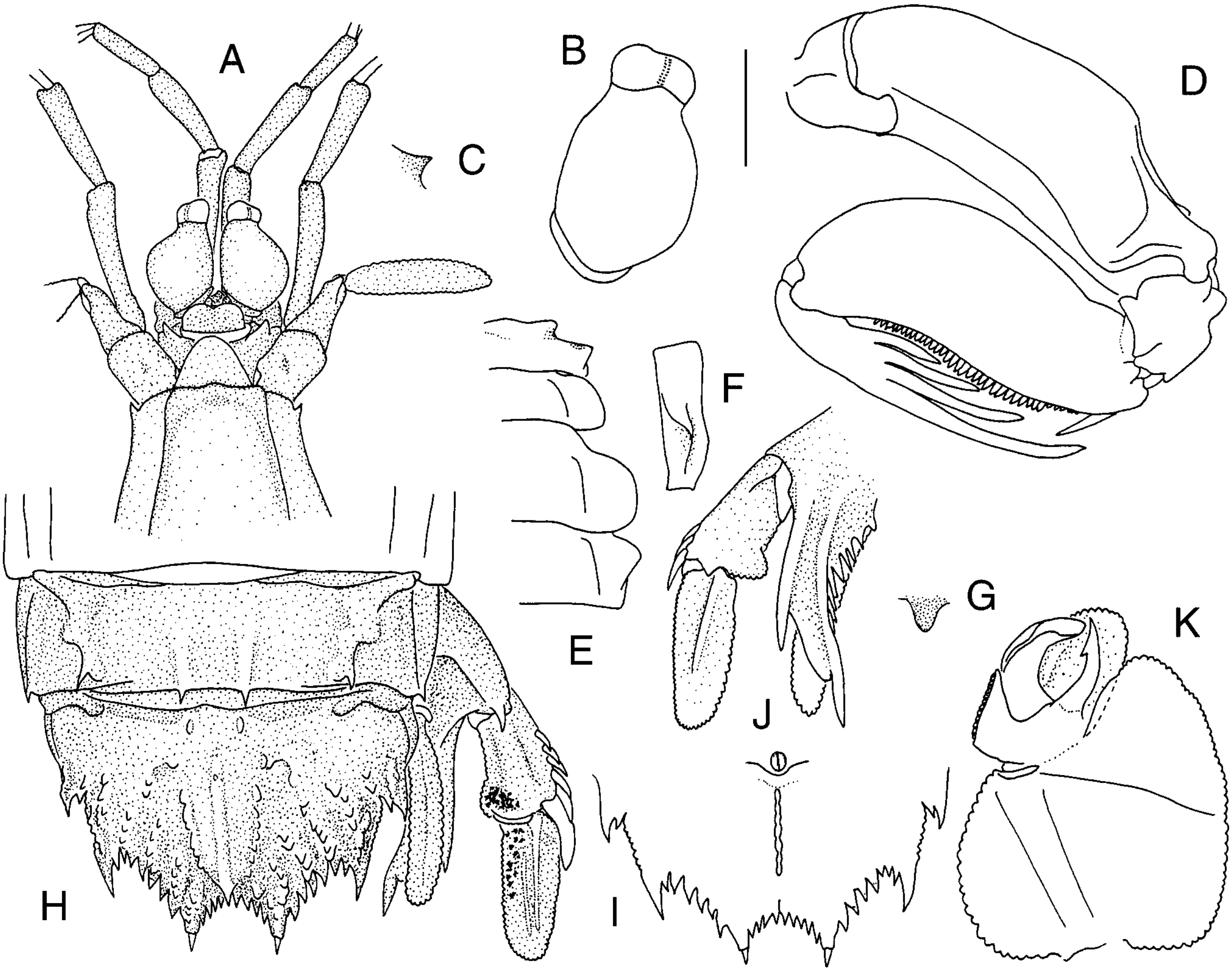

Figure 111. *Clorida seversi* Moosa, ♂ TL 32 mm (NMV J14456). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A, C–F, H–J = 2 mm; B,G,K = 1 mm.

ventrally with tuberculate postanal carina, without supplementary carinae laterally. Uropodal protopod outer margin smooth; inner margin with 5–9 slender spines; exopod proximal segment outer margin with 6–7 movable spines, distal segment longer than proximal segment; with black patch at articulation of exopod segments.

Colour in alcohol. Almost completely faded. Rostral plate and gastric grooves of carapace with some dark pigmentation; posterior and posterolateral margin of carapace dark. Posterior margin of TS5–8 and AS1–5 dark. Telson MD carina with dark distal patch including apical spine. Uropodal exopod proximal segment with dark distal patch; distal segment with dark diffuse patch on inner proximal ⅔. Uropodal endopod with diffuse dark patch on outer distal ½.

Measurements. Male (*n* = 4) TL 20–32 mm, female (*n* = 3) TL 30–34 mm. A1 peduncle 0.85–0.98 CL. A2 scale length 0.37–0.43 CL. Anterior carapace width 0.45–0.53 CL. The present series includes the largest known specimens of the species.

Remarks. Manning (1995) synonymized *C. seversi* and *C. nazasaensis* Garcia & Manning, 1982 with *C. denticauda*. Although *C. nazasaensis* is certainly a synonym of *C. denticauda*, *C. seversi* is distinct. The Australian specimens agree well with the types of *C. seversi* and differ only in having slightly blunter lateral processes of TS5. I have examined two specimens of *C. denticauda* from Taiwan (Ahyong *et al*., in prep.), a specimen from New Caledonia (reported by Moosa (1991) as *C. nazasaensis*) and data and figures of the holotype *of C. denticauda* provided by R.B. Manning. *Clorida seversi* differs from *C. denticauda* in the having four instead of three well formed dactylar teeth on the raptorial claw, the postanal carina is distinct instead of indistinct or absent, and six or seven instead of four or five movable spines are present on the outer margin of the uropodal exopod. Whereas each of the aforementioned differences may vary in some species of *Clorida*, they are consistent in the material examined here.

Habitat. Soft coral reef lagoon substrates; 9–15 m.

Distribution. Indonesia, Vietnam, and now northeastern Australia.

Clorida wassenbergi n.sp.

Fig. 112

Type material. (All Queensland, Australia) HOLOTYPE: AM P54462, ♂ (TL 85 mm), near Weipa, Gulf of Carpentaria, 12°39'S 141°50'E, 30 m, T. Wassenberg, 27 Jul 1976. PARATYPES: QM W6442, 7♀♀ (TL 62–105 mm), near Weipa, Gulf of Carpentaria, 12°39'S 141°53'E, 22 m, trawl, T. Wassenberg, 8–21 Dec 1976; AM P55589, 1♂ (TL 77 mm), 5♀♀ (TL 64–94 mm), near Nassau River, Gulf of Carpentaria, 15°53'S 141°32'E, 22 m, T. Wassenberg, 9–22 Dec 1976.

Australian material. NORTHERN TERRITORY: AM P55590, 1♀ (TL 71 mm), off Nhulunbuy, 12°4.3'S 136°45'E, T. Wassenberg, Nov 1991, AM P55591, 1♂ (TL 61 mm), off Marchinbar I., Wessell Is, 11°24.8'S 136°36.4'E, T. Wassenberg, Nov 1991; QM W24226, 1♂ (TL 88 mm), 3♀♀ (TL 78–79 mm), SW of Groote

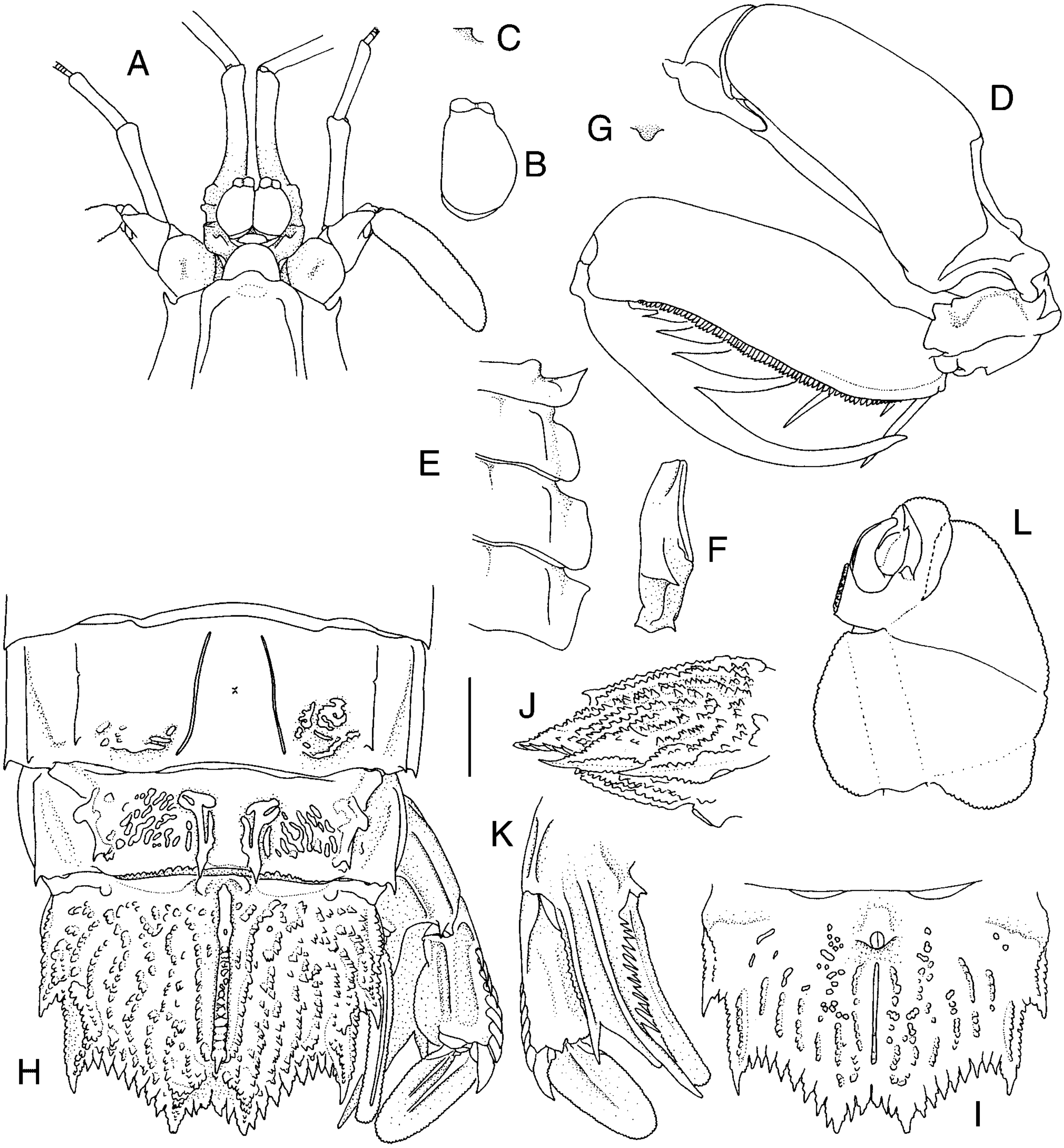

Figure 112. *Clorida wassenbergi* n.sp., holotype ♂ TL 85 mm. A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, telson, right lateral. K, uropod, right ventral. L, PLP1 endopod, right anterior. Scale A, C–K = 5 mm; B, L = 2.5 mm.

Eylandt, Gulf of Carpentaria, 14°00.4'S 136°00.3'E, 21.2 m, trawl, S. Cook, 12 Oct 1997.

Diagnosis. A1 somite dorsal processes with short, triangular apices. A2 peduncle segment 1 extending anteriorly beyond eyes. Carapace with anterolateral spines. Raptorial claw dactylus with 5 teeth. Mandibular palp 3-segmented. TS5 lateral process broad basally with sharp apex, directed anterolaterally and inclined ventrally, with acute ventral spine. TS6–7 lateral process rounded to truncate; anterolateral and posterolateral angles obtusely rounded. AS1–5 SM carinae distinct, straight, divergent. Telson with entire dorsolateral surface with numerous rows of closely spaced, acute tubercles; MD carina and margins of IM and LT teeth strongly tuberculate; ventral surface with long tuberculate postanal carina and numerous curved rows of coarse, closely spaced tubercles.

Description. Eye small, not reaching midlength of A1 peduncle segment 1. Ophthalmic somite anterior margin triangular. Ocular scales fused, rounded laterally. A1 peduncle 1.04–1.17 CL. A1 somite dorsal processes with short, triangular apices. A2 scale 0.44–0.52 CL. Rostral plate broader than long; apex rounded; without median carina. Carapace anterior width 0.49–0.54 CL; anterolateral spines not extending to base of rostral plate; without posterior median projection. Raptorial claw dactylus with 5 teeth; outer margin broadly curved, proximally with basal notch; propodus distal margin unarmed. Mandibular palp 3-segmented. TS6–8 SM carinae distinct, straight, divergent. TS5 lateral process broad basally with spiniform apex, directed anterolaterally and inclined ventrally, with acute ventral spine. TS6–7 lateral process rounded to truncate; anterolateral and posterolateral angles obtusely rounded. TS8 lateral process triangular, apex blunt; sternal keel rounded. AS1–5 SM carinae distinct, straight, strongly divergent. AS5 wrinkled and eroded between SM and IM carinae. AS6 tuberculate medially and laterally, posterior margin crenulate; with ventrolateral spine anterior to uropodal articulation; ventrally with low MD carina. Abdominal carinae spined as follows: SM 6, IM 5–6, LT 5–6, MG (3)4–5. Telson broader than long; prelateral lobe subequal to or longer than margin of LT tooth; MD carina and margin of IM and LT teeth strongly tuberculate; dorsolateral surface with numerous rows of longitudinal rows closely spaced acute tubercles; denticles triangular, each with acute dorsal tubercle, SM 2–3, IM 6–10, LT 1. Telson ventral surface with long tuberculate postanal carina and numerous curved rows of coarse, closely spaced tubercles; ventrolateral carina serrate. Uropodal protopod outer margin crenulate to serrate; inner margin with 10–15 slender spines; with short ventral spine anterior to endopod articulation. Protopod terminal spines with lobe on outer margin of inner spine rounded; as broad as or broader than adjacent spine. Uropodal exopod proximal segment unarmed dorsally; inner distal ¾ broadly convex, proximal ¼ straight or slightly concave; outer margin with 8–11 movable spines, distalmost spatulate with acute apex, not exceeding midlength of distal segment; distal margin with short, stout ventral spine. Exopod distal segment as long as or longer than proximal segment, without black patch at articulation of exopod segments.

Colour in life. Overall colour reddish brown with reddish submedian carinae on thoracic and abdominal somites. Uropods pale.

Etymology. Named for Ted Wassenberg, CSIRO Cleveland, Queensland, who collected many of the specimens used in this study.

Measurements. Male (*n* = 4) TL 61–88, female (*n* = 16) TL 62–105 mm. Other measurements of holotype: CL 16.1 mm, A1 peduncle 17.6 mm, A2 scale 8.1 mm.

Remarks. *Clorida wassenbergi* closely resembles *C. decorata*, but differs in bearing shorter dorsal processes on the antennular somite, and the entire dorsal and ventral surface, median carina and lateral margins of the telson are strongly tuberculate. The outer margin of the uropodal exopod is also crenulate or tuberculate in larger specimens.

Habitat. Soft sandy-mud substrates; 21–30 m.

Distribution. Known only from the Gulf of Carpentaria and Arafura Sea, Australia.

Cloridina Manning, 1995

Cloridina Manning, 1995: 191. Type species *Squilla microphthalma* H. Milne Edwards, 1837 [a junior subjective synonym of *Cloridina ichneumon* (Fabricius, 1798)], by original designation. Gender feminine.

Diagnosis. Eye small, elongate, cornea bilobed, narrower than or as broad as stalk; stalk elongate, inflated laterally, mesially convex. Ocular scales usually fused. Carapace with anterolateral spines; without MD and IM carinae; with reflected MG and reduced LT carinae, distinct posteriorly only; posterolateral margin rounded. Raptorial claw dactylus with 4 or 5 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp present or absent. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS5–7 lateral processes single. AS3–5 with or without SM carinae. Telson inflated, dorsolateral surface with rows of denticles or tubercles, without rows of shallow pits; prelateral lobe present; SM teeth with movable apices. Uropodal protopod inner margin lined with slender spines.

Included species. Eight: *C. chlorida* (Brooks, 1886); *C. ichneumon* (Fabricius, 1798); *C. inflata* (Moosa, 1991); *C. malaccensis* (Manning, 1968a); *C. moluccensis* (Moosa, 1973); *C. pelamidae* (Blumstein, 1970); *C. stephensoni* n.sp.; and *C. verrucosa* (Hansen, 1926).

Remarks. Of the genera recognized by Manning (1995) for species previously placed in *Clorida*, *Cloridina* closely resembles *Clorida* and *Neclorida*, differing only in eye morphology. *Cloridina* differs from *Clorida* in having a more elongate, slender eye in which the inner margin is evenly convex or sinuous, not having a flattened inner surface in the proximal ½ or ⅔ such that the eyes meet medially. Species of *Cloridina* and the monotypic *Neclorida* are closely related. In both genera, the eye is elongate, but in *Neclorida*, the cornea is distinctly broader than the widest part of the stalk. Thus, the eye morphology in *Cloridina* is intermediate between that of *Clorida* and *Neclorida*. The width of the cornea varies in species of *Cloridina*, from being narrower than the greatest width, to equal to the width of the stalk. Similarly, a gradation is present among species of *Clorida* in the width of the cornea. The eye form in *Clorida*, *Cloridina* and *Neclorida* appear to represent part of a continuum of variation supporting recognition of perhaps only the single genus *Clorida*. The distinctions between these three genera are arbitrary and artificial, but each is retained as distinct until study of additional collections and undescribed species from several Indo-West Pacific localities can be completed.

The identity of *C. ichneumon* was recently fixed by neotype selection (Holthuis, 2000). As suggested by Holthuis (2000), the type species of *Cloridina*, *C. microphthalma* is a junior synonym of *C. ichneumon* (Fabricius, 1798). Examination of the type material of both *C. ichneumon* and *C. microphthalma* corroborates the synonymy. A female syntype of *C. microphthalma* from Bombay (MNHN St 482) is herein designated the lectotype. Six of eight species of *Cloridina* are known from Australian waters, one of which is newly described.

Key to species of *Cloridina*

1 Uropodal protopod with two rounded lobes between terminal spines .... ***C. inflata***

—— Uropodal protopod with one rounded lobe on outer margin of inner spine 2

2 Ocular scales fused in adults, at most with shallow and narrow median emargination. Lateral processes of TS6–7 always without posterolateral spine 3

—— Ocular scales separate in adults, separated by broad emargination. Lateral processes of TS6–7 each usually with posterolateral spine .... ***C. pelamidae***

3 Rostral plate broader than or about as broad as long 4

—— Rostral plate distinctly longer than broad 6

4 TS5 lateral process blunt, angular. Dorsal processes of A1 somite low, rounded .... ***C. stephensoni***

—— TS5 lateral process produced to a laterally or anterolaterally directed spine. Dorsal processes of A1 somite with sharp, acute apices 5

5 TS5 lateral process a slender, laterally directed spine. Rostral plate broader than long. A2 peduncle segment 1 extending anteriorly beyond eyes .... ***C. chlorida***

—— TS5 lateral process a blunt trianguloid process, broad basally, directed laterally or slightly anterolaterally. Rostral plate as long as broad. A2 peduncle segment 1 not extending anteriorly beyond eyes .... *C. ichneumon*

6 Dactylus of raptorial claw without enlarged, triangular lobe on outer proximal margin .... ***C. verrucosa***

—— Dactylus of raptorial claw with enlarged, triangular lobe on outer proximal margin 7

7 Ventral surface of telson with rows of tubercles flanking postanal carina. Ocular scales fused into pentagonal shaped plate .... ***C. moluccensis***

—— Ventral surface of telson with postanal carina only, without tubercles flanking postanal carina. Ocular scales fused, but with shallow median emargination .... *C. malaccensis*

Cloridina chlorida (Brooks, 1886)

Fig. 113

Squilla chlorida Brooks, 1886: 21, 40, pl. 2, figs. 1–5 (type locality: Amboina, Indonesia, 3°43'S 128°12'E, 27 m).–Kemp, 1913: 3, 10, 20, 33.
Clorida chlorida.–Makarov, 1979: 41.–Manning, 1968b: 5–8, fig. 1.
Clorida granti.–Cannon *et al*., 1987: 63 [not *C. granti* (Stephenson, 1953b)].
Cloridina chlorida.–Manning, 1995: 24, 192.

Type material. HOLOTYPE: NHM 1894.10.16.11, ♂ (broken, CL 7.3 mm), Amboina, Indonesia, 3°43'S 128°12'E, 27 m, *Challenger*.

Australian material. QUEENSLAND: QM W15196, 1♂ (TL 53 mm), off Green I., 16°42.8'S 145°56.3'E, 39 m, trawl, C. Jones, 9 Oct 1980; QM W15197, 1♂ (TL 49 mm), off Green I., 16°42'S 145°56'E, C. Jones, 9 Oct 1980. WESTERN AUSTRALIA: NTM Cr012378, 1♂ (TL 22 mm), Northwest Shelf, trawl, AS0283 100.

Diagnosis. Eyestalk with slight constriction behind cornea. Ocular scales fused. A1 somite dorsal processes short, with acute, triangular apices, directed anterolaterally. A2 peduncle segment 1 extending anteriorly beyond eyes. Rostral plate broader than long. Raptorial claw dactylus with 4 or 5 teeth; proximal margin without basal notch. Mandibular palp 3-segmented. TS5 lateral process a slender

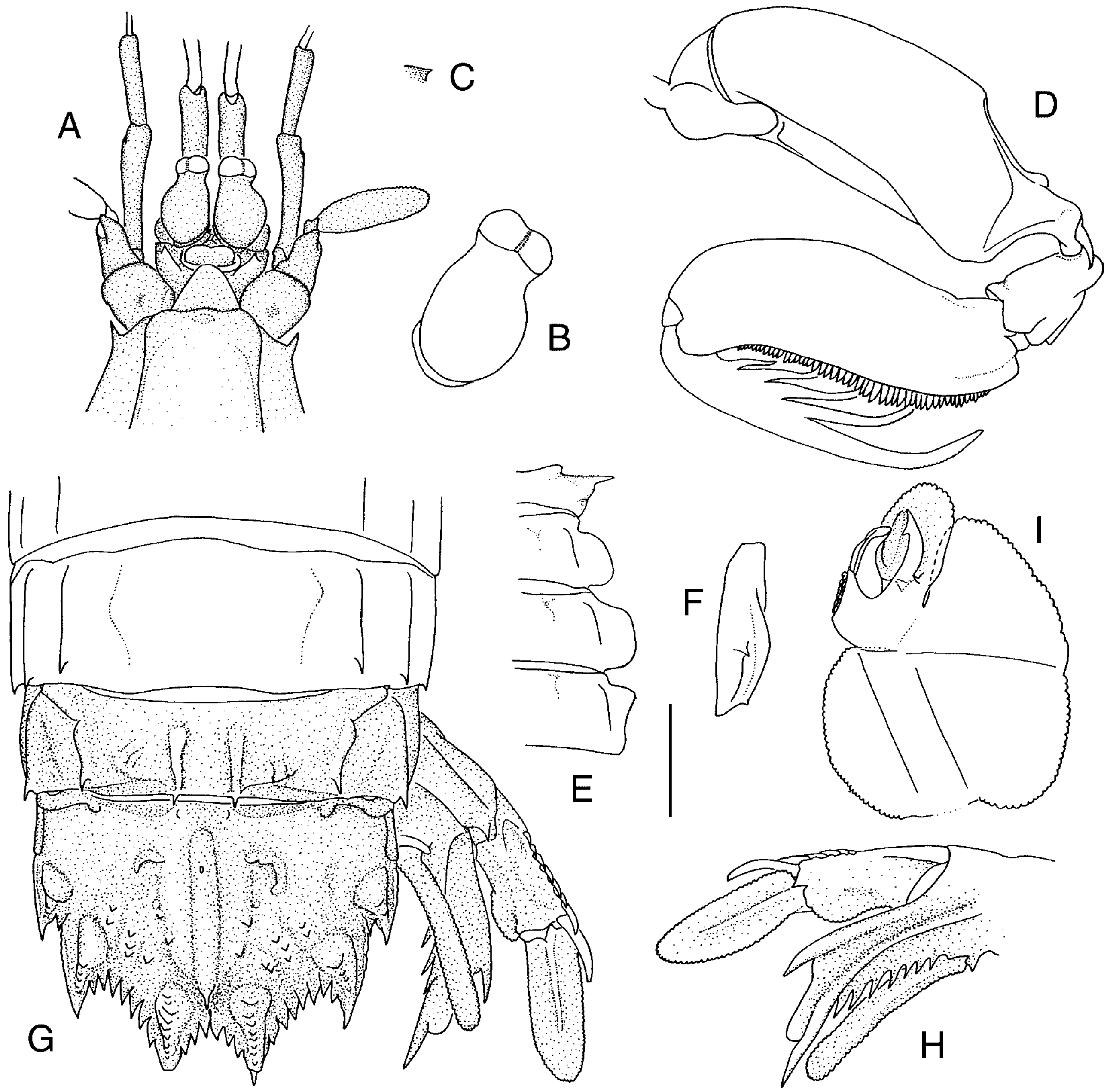

Figure 113. *Cloridina chlorida* (Brooks), ♂ TL 53 mm (QM W15196). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, AS5–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod. Scale A,C,D–F,H = 5 mm; B,I = 2.5 mm.

spine, directed laterally; with small ventral spine. TS6–7 lateral process broadly rounded. Abdominal carinae spined as follows: SM 6, IM (4)5–6, LT (4)5–6, MG (4)5. Telson dorsolateral surface with 3–4 blunt tubercles flanking MD carina and 3–4 rows of 2–3 tubercles above posterior margin; denticles SM 2–4, IM 7–8, LT 1; ventral surface at most with short, low postanal carina. Uropodal protopod inner margin with 8–10 slender spines, with one rounded lobe between terminal spines. Uropodal exopod proximal segment unarmed dorsally, outer margin with 7 or 8 movable spines.

Colour in alcohol. Overall dorsal colour with diffuse mottling, but with rectangular patch on TS6–8 and AS1–5. Uropodal exopod with black patch over articulation of segments extending onto inner ½ of distal segment.

Measurements. Male (*n* = 4) TL 22–53 mm. A1 peduncle 0.87–1.07 CL. A2 scale length 0.47–0.48 CL. Anterior carapace width 0.50–0.52 CL. The present series includes the largest known specimen of the species.

Remarks. The present specimens agree well with the holotype and published accounts (Brooks, 1886; Manning, 1968b, 1995). *Cloridina chlorida* differs from other species in the genus by the combination of a short rostral plate, sharp dorsal processes on the antennular somite and the spiniform lateral processes of TS5. Submedian carinae are absent from AS1–4, and are indistinct on AS5. The postanal carina is absent in the 53 mm TL specimen, and present as a short, low, protuberance in the others including the holotype. The petasma is well developed in all specimens.

Habitat. Manning (1968b) reported *C. chlorida* from Madagascar from muddy substrates at depths of 30–64 m.

Distribution. Vietnam, Indonesia and now northern Australia.

Cloridina inflata (Moosa, 1991)

Fig. 114

Clorida inflata Moosa, 1991: 199–202, fig. 13 (type locality: New Caledonia).
Cloridina inflata.–Manning, 1995: 24, 191–192.

Type material. HOLOTYPE: MNHN St 1279, ♀ (TL 41 mm), New Caledonia, lagoon, DW 757, 44 m. PARATYPE: USNM 243957, ♀ (TL 24 mm), Noumea, New Caledonia, 22°21'S 166°15'E, 70 m, B. Richer de Forges, 24 Oct 1984.

Australian material. NORTHERN TERRITORY: AM P52730, 1♀ (TL 51 mm), off Wessell Is, Arafura Sea, 11°0.7'S 137°41.9'E, 50 m, sandy mud, demersal trawl, T. Wassenberg, Dec 1990.

Diagnosis. Eyestalk with distinct constriction behind cornea. Ocular scales fused. A1 somite dorsal processes with spiniform apices, directed anteriorly. A2 peduncle segment 1 not extending anteriorly beyond eyes. Rostral plate longer than broad. Raptorial claw dactylus with 4 teeth; outer proximal margin with small, low proximal lobe and larger, rounded distal lobe. Mandibular palp 2- or 3-segmented. TS5 lateral process a short slender spine, broad basally, directed anterolaterally, inclined ventrally; with short, triangular ventral spine. TS6–7 lateral process broadly rounded. AS1–5 without SM carinae. Abdominal carinae spined as follows: SM 6, IM 5–6, LT 5–6, MG (4)5. Telson dorsolateral surface with tuberculate accessory MD carina and numerous rows of coarse, closely spaced tubercles; denticles SM 2–4, IM 6–8, LT 1. Telson ventral surface with long postanal carina and numerous rows of coarse tubercles. Uropodal protopod inner margin with 6–10 slender spines; protopod with 2 lobes between terminal spines, distal lobe on outer margin of inner spine, proximal lobe rounded, smaller than distal. Uropodal exopod proximal segment with row of angular dorsal tubercles in adults; outer margin with 6–8 movable spines.

Colour in life. Dorsal surface pale olive-green evenly speckled with dark chromatophores. Raptorial claw merus pale olive-green; carpus, propodus and dactylus white. Pereiopods white. Uropodal protopod and endopod pale olive-green; exopod proximal segment whitish, distal margin dark; exopod distal segment dark.

Measurements. Female (*n* = 3) TL 24–51 mm. A1 peduncle 0.70–0.80 CL. A2 scale 0.35–0.39 CL. Anterior carapace width 0.39–0.43 CL. The present series includes the largest known specimen of the species.

Remarks. The Australian specimen is the largest known of the species and shows well-developed tubercles on the dorsal surface of the proximal segment of the uropodal exopod as in the holotype; these tubercles are undeveloped in the 24 mm TL paratype. The Australian specimen agrees well with the holotype in bearing a more distinct lateral process of TS5 than figured by Moosa (1991: fig. 13).

Cloridina inflata differs from its congeners in having a distinct, semicircular lobe on the outer proximal margin of the dactylus of the raptorial claw, and in having two lobes between the terminal spines of the uropodal protopod.

Habitat. Sandy mud substrates at depths of 44–50 m.

Distribution. New Caledonia and now the Gulf of Carpentaria, Australia.

Cloridina moluccensis (Moosa, 1973) n.comb.

Fig. 115

Clorida malaccensis var. *moluccensis* Moosa, 1973: 19–22, fig. 3 (type locality: W of Udjir I., Wokam, Aru, Indonesia, 5°37'S 134°10'E).
Clorida moluccensis.–Moosa, 1991: 204.

Type material. HOLOTYPE: LIPI S846, ♂ (TL 69 mm), W of Udjir I., Wokam, Aru, Indonesia, 5°37'S 134°10'E, 55–66 m, dredged, mud & fine shelly grit, RV Pele, 16 Jun 1970. PARATYPE: LIPI S022, ♀ (TL 71 mm), Arafura Sea, 4°52'00"S 135°25'E, 90 m, trawl, mud & sand, M.K. Moosa, 28 Jun 1964.

Australian material. QUEENSLAND: AM P52728, 1♀ (TL 80 mm), near Yorke I., Torres Strait, 9°44'S 143°25'E, trawl, T. Wassenberg, 10 Mar 1988; AM P52729, 1♀ (TL 55 mm), E of Weipa, Gulf of Carpentaria, 12°37.2'S 140°39.7'E, 58 m, T. Wassenberg, 30 Jan 1993; QM W17477, 1♀ (TL 50 mm), Gulf of Carpentaria, 12°24.8'S 140°42.4'E, 58 m, dredged, 26 Nov 1991.

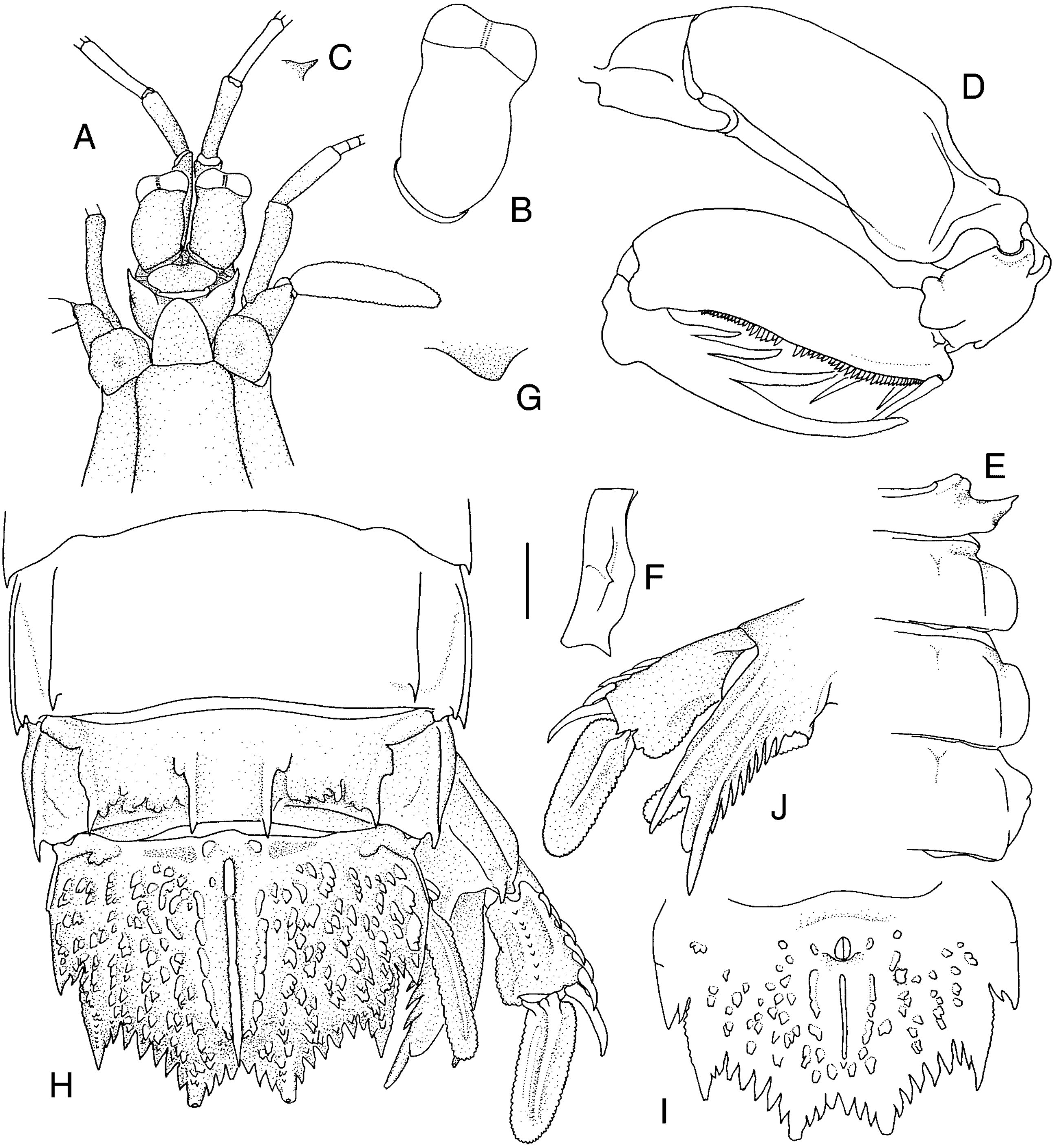

Figure 114. *Cloridina inflata* (Moosa), ♀ TL 51 mm (AM P52730). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, eye, right dorsal. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. Scale A, C–J = 2 mm; B = 1 mm.

Diagnosis. Eyestalk with distinct constriction behind cornea. Ocular scales fused. A1 somite dorsal processes with spiniform apices, directed anteriorly. A2 peduncle segment 1 not extending anteriorly beyond eyes. Rostral plate longer than broad. Raptorial claw dactylus with 4 or 5 teeth, proximal tooth often minute; outer margin proximal margin with small, blunt proximal lobe and larger, blunt triangular lobe. Mandibular palp 3-segmented. TS5 lateral process a short slender spine, directed anterolaterally, with short ventral spine. TS6–7 lateral processes broadly rounded. Abdominal carinae spined as follows: SM 6, IM 5–6, LT 6, MG 4–5. Telson dorsolateral surface with accessory MD carina composed of 6–7 elongate tubercles and 6–7 curved rows of closely spaced coarse tubercles; denticles SM 3–4, IM 7–9, LT 1. Telson ventral surface with postanal carina, tuberculate distally, flanked by row of 3–5 tubercles

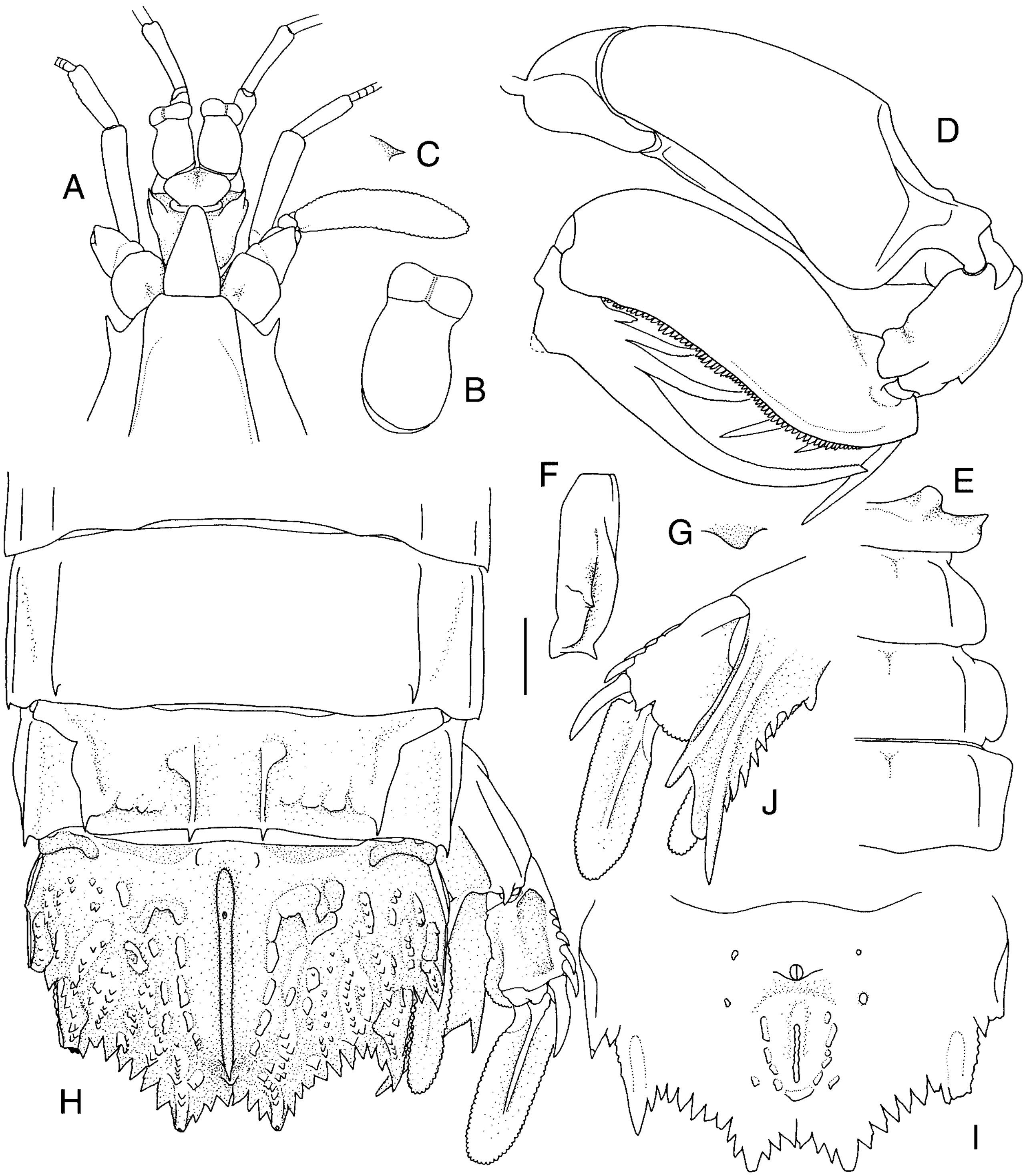

Figure 115. *Cloridina moluccensis* (Moosa), ♀ TL 80 mm (AM P52728). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, eye, right dorsal. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. Scale A, C–J = 3 mm; B = 1.5 mm.

converging distally and outer row of 3–4 irregularly spaced tubercles. Uropodal protopod inner margin with 5–8 slender spines; with one rounded lobe between terminal spines. Uropodal exopod proximal segment unarmed dorsally; outer margin with 6 movable spines.

Colour in life. Base colour cream-white with irregular dorsal transverse banding. A1 somite dorsal processes dark. A2 scale with scattered dark chromatophores proximally. Carapace with irregular dark brown patches anterolaterally, gastric grooves dark; with dark irregular transverse median band; with dark narrow irregular brown patch posterior to cervical groove; reflected marginal carina dark. Uropodal exopod proximal segment black on distal ⅓; distal segment black on inner ½ only; endopod black on distal ⅔.

Measurements. Male (n = 1) TL 69 mm, female (n = 4) TL 50–80 mm. A1 peduncle 0.65–0.67 CL. A2 scale length 0.36–0.42 CL. Anterior carapace anterior 0.38–0.41 CL. Moosa (1991) reported specimens up to 108 mm TL.

Remarks. Although Manning (1978c) synonymized *Cloridina moluccensis* with *C. malaccensis*, the two species differ in the ventral ornamentation of the telson and possibly in colour pattern. Both species are distinct as concluded by Moosa (1991). The prelateral lobe in the present series of *C. moluccensis* is distinct in all except the smallest specimen.

Habitat. Trawlable substrates to at least 58 m depth. Moosa (1973, 1991) reported *C. moluccensis* from Indonesia and New Caledonia respectively from mud, sand and shelly grit substrates at depths of 55–90 m and 26–29 m.

Distribution. Indonesia, New Caledonia (Moosa, 1991) and now from the Gulf of Carpentaria, Australia.

Cloridina pelamidae (Blumstein, 1970)

Fig. 116

Clorida pelamidae Blumstein, 1970: 220, figs. 2, 3 (type locality: Gulf of Tonkin, Vietnam, 20°20'N 106°47'E).
Clorida thailandica Naiyanetr, 1980: 38, pl. 35 (type locality, Ko Sichang, Chonburi Province, Thailand).
Cloridina pelamidae.–Manning, 1995: 191, 193, pl. 34, figs. 114c,d, 115b–d, 118a,b.

Australian material. NORTHERN TERRITORY: AM P56883, 1♀ (TL 70 mm), NE of Nicol I., Gulf of Carpentaria, 13°23.2'S 136°22.5'E, T. Wassenberg, 24 Nov 1991.

Other material. AM P57960, 1♂ (TL 60 mm), 3♀♀ (TL 64–81 mm), Pattani, southern Gulf of Thailand, Thailand, P. Naiyanetr; SMF 10749, 1♂ (TL 73 mm), Ko Sichang, Chonburi Province, Gulf of Thailand, P. Naiyanetr, 23 Dec 1979 (holotype of *Clorida thailandica* Naiyanetr); USNM 266771, 1♀ (TL 38 mm), Nhatrang Bay, Vietnam, 25 Nov 1951.

Diagnosis. Eye elongate, stalk with distinct constriction behind cornea. Ocular scales broad; subtruncate anteriorly, separate. A1 somite dorsal processes with spiniform apices, directed anteriorly. A2 peduncle segment 1 not extending anteriorly beyond eyes. Rostral plate triangular, longer than broad. Carapace with anterolateral spines. Raptorial claw dactylus with 4 or 5 teeth; outer margin faintly sinuous, proximal margin angular. Mandibular palp 3-segmented. TS6–8 without SM carinae. TS5 lateral process short, blunt or with acute apex directed laterally; ventral spine short. TS6–7 lateral processes with or without posterolateral spine. AS1–4 without SM carinae. AS5 at most with faintly indicated SM carinae. Abdominal carinae spined as follows: SM 6, IM 5–6, LT 5–6, MG (3–4)5. Telson dorsolateral surface with tuberculate accessory MD carina and curved rows of closely spaced acute tubercles; prelateral lobe shorter than margin of LT tooth; denticles SM 1–3, IM 7–8, LT 1; ventral surface usually with long postanal carina, without supplementary carinae or tubercles laterally. Uropodal protopod inner margin with 6–8 slender spines; protopod terminal spines with lobe on outer margin of inner spine rounded, deflected dorsally, broader than adjacent spine, proximal margin sinuous. Uropodal exopod proximal segment unarmed dorsally; outer margin with 6 or 7 movable spines. Exopod distal segment with black patch at articulation of exopod segments extending onto inner ¼ of distal segment.

Colour in life. Overall dorsal colour uniform light olive green, including merus and carpus of raptorial claw; ventral surface including pereiopods uropodal exopod, propodus and dactylus of raptorial claw cream-white. Carapace and rostral plate with dark brown outline; reflected marginal carinae and anterior ⅕ of gastric grooves with diffuse dark pigment. Posterior margin of TS6–8 and AS1–5 dark. Distal ½ of uropodal endopod dark. Uropodal exopod proximal segment with black patch on inner distal ½ to ⅔ extending onto inner ¼ of distal segment.

Measurements. Male (n = 2) TL 60–73 mm, females (n = 5) TL 38–81 mm. Other measurements: A1 peduncle 0.81–0.97 CL. A2 scale 0.39–0.41 CL. Anterior carapace width 0.40–0.44 CL. Manning (1995) reported *C. pelamidae* to 85 mm.

Remarks. The Australian specimen of *C. pelamidae* agrees in most respects with the Vietnamese and Thai specimens, but differs from most in bearing blunt instead of spinular posterolateral margins of the lateral processes of TS6–7, and there are five instead of four teeth on the raptorial claw. The postanal carina in most specimens, including the Australian specimen is usually long and distinct, but may be short and indistinct. In lacking posterolateral spines on the lateral processes of TS6–7, the Australian specimen is within the range of variation reported by Naiyanetr *et al*. (2000).

Specimens of *Cloridina pelamidae* that lack posterolateral spines on the lateral processes of TS6–7 superficially resemble *C. ichneumon* and will key out to the latter based on Manning (1968b, 1995). The cornea in *Cloridina ichneumon*, however, is relatively narrower than in *C. pelamidae*, the ocular scales are fused and slightly concave medially instead of distinctly separate, and the distal segment of the uropodal exopod lacks the dark pigment on the inner proximal ¼.

Habitat. Level soft substrates. Ahyong & Naiyanetr (in press) report the species from the Andaman Sea off Phuket, at a depth of 18.9 m.

Distribution. Vietnam, the Gulf of Thailand, Andaman Sea and now the Gulf of Carpentaria, Australia.

Cloridina stephensoni n.sp.

Fig. 117

Squilla depressa.–Serène, 1952: 2–11 (part, not *Squilla depressa* Miers, 1880).–Stephenson & McNeill, 1955: 240 (part, not *Squilla depressa* Miers, 1880).

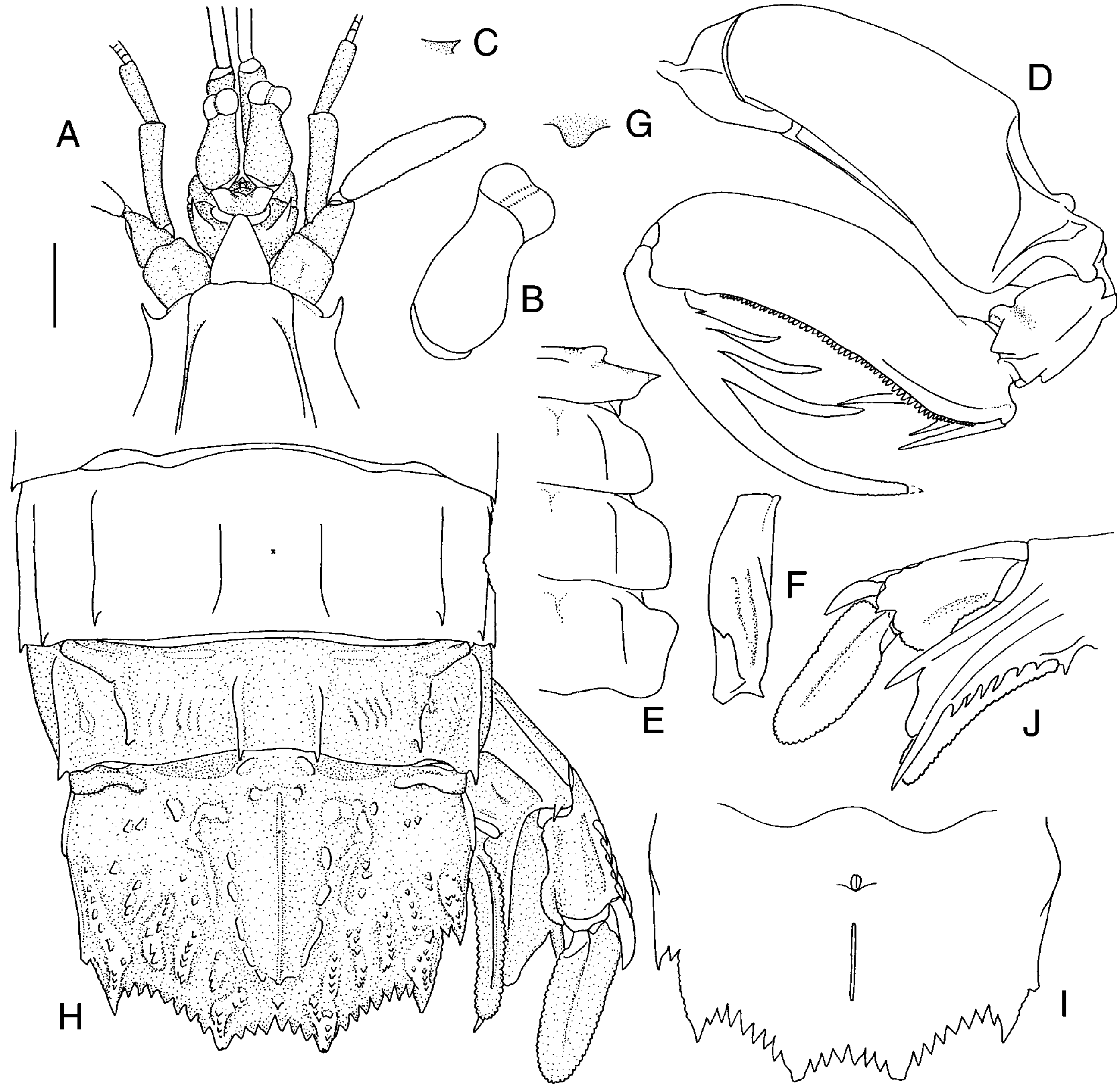

Figure 116. *Cloridina pelamidae* (Blumstein, 1970), ♀ TL 70 mm (AM P56883). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, eye, right dorsal. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, telson, ventral. J, uropod, right ventral. Scale A, C–J = 2.5 mm; B = 1.25 mm.

Squilla microphthalma.–Stephenson, 1962: 39–42, figs. 1a,d, pl. 1e–g.–Manning, 1966: 87 (not *S. microphthalma* H. Milne Edwards, 1837).

Clorida microphthalma.–Harling, 2000: 173, 175, fig. 2B, 176 [not *Clorida microphthalma* (H. Milne Edwards, 1837)].

Type material. (All Western Australia) HOLOTYPE: NHM 1932.11.30.191, ♂ (TL 43 mm), Roebuck Bay, B. Gray. PARATYPES: AM P13540, 1♂ (TL 19 mm), Roebuck Bay, tidal sand flat, A. Livingstone, 8 Aug 1929; AM P13541, 1♂ (TL 33 mm), 1♀ (TL 41 mm), Roebuck Bay, tidal sand flat, A. Livingstone, 8 Aug 1929.

Australian material. QUEENSLAND: AM P6785, 1♀ (TL 47 mm), Great Barrier Reef, 19°00'S 148°00'E, W. Paradice; AM P52727, 1♂ (TL 20 mm), Somerset Beach, Albany Pass, Cape York, 10°45'S 142°37'E, sand-mud in front of beach, in burrow under rock, I. Loch, 10 Jul 1976. NORTHERN TERRITORY: AM P13542, 1♂ (TL 30 mm), Fort Hill, Port Darwin, between tides, A. Livingstone, 1929; NTM Cr008721, 1♂ (TL 28 mm), Channel I., 12°34.9'S 130°55.4'E, rock pool, low water springs, K. Coombes, 16 Apr 1991; NTM Cr009846, 1♀ (TL 35 mm), near Gove Yacht Club, in front of mangroves, 12°12.0'S 136°43.0'E, mid low water, R. Hanley *et al*., 23 Nov 1991.

Diagnosis. Eyestalk at most with slight constriction behind cornea. Ocular scales fused. A1 somite dorsal processes with low, rounded or obtusely angled apices. A2 peduncle segment 1 extending anteriorly to level of anterior margin

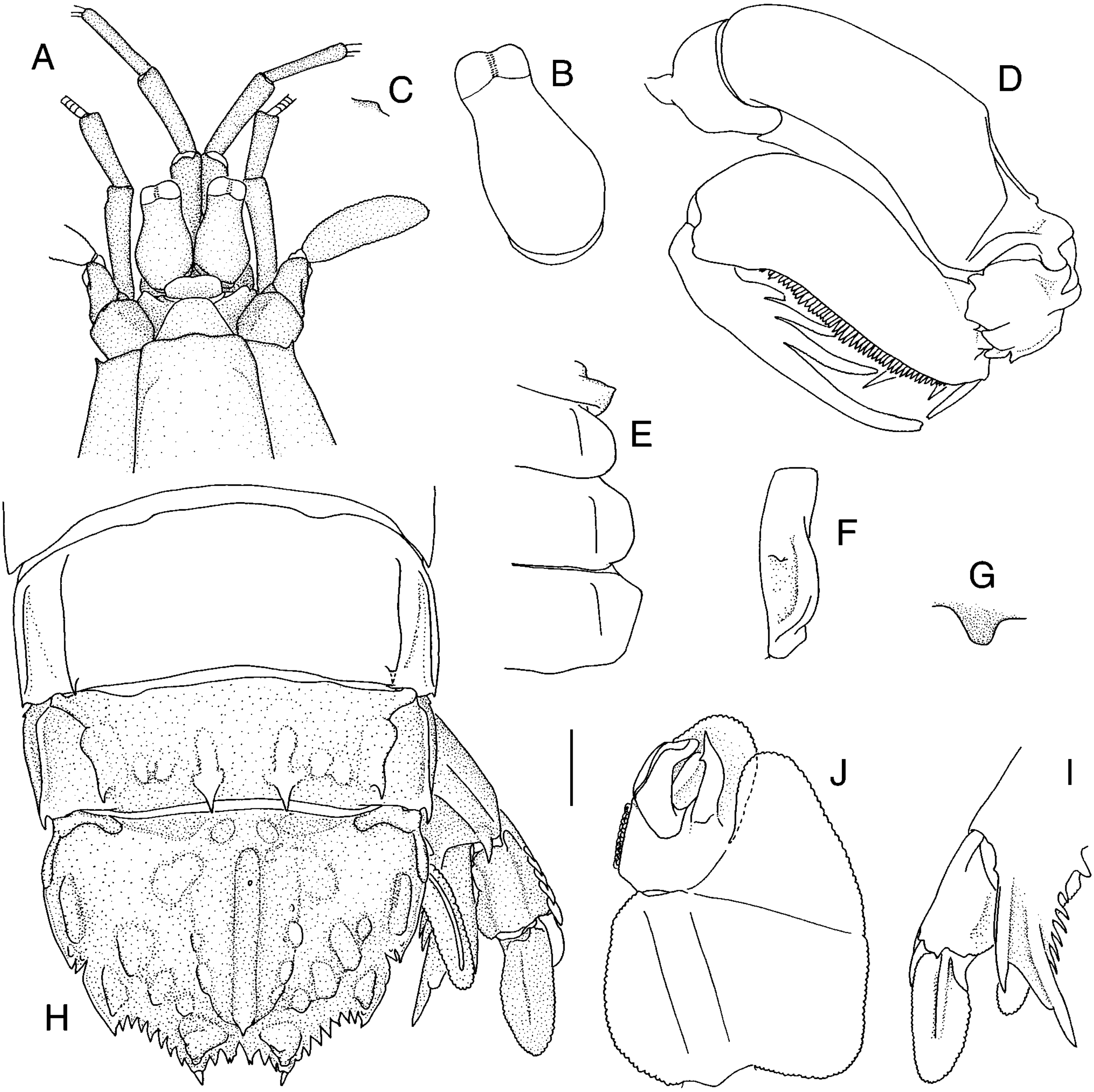

Figure 117. *Cloridina stephensoni* n.sp., holotype ♂ TL 43 mm. A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, uropod, right ventral. J, PLP1 endopod. Scale A,C,D–F,H,I = 5 mm; B,G,J = 2.4 mm.

of eyes. Rostral plate broader than long. Raptorial claw dactylus with 4 teeth; outer margin angular proximally. Mandibular palp present. TS5 lateral process a short laterally directed angular lobe, without ventral spine. TS6–7 lateral process broadly rounded. Telson dorsolateral surface irregular, with 3–4 irregular or inflated carinae posterolaterally. Telson ventral surface without postanal or supplementary carinae. Uropodal protopod with one rounded lobe between terminal spines.

Description. Eye small, elongate, extending beyond midlength, but not to end of A1 peduncle segment 1; stalk at most with slight constriction behind cornea. Ophthalmic somite anterior margin triangular. Ocular scales fused, rounded laterally; faintly emarginate medially. A1 peduncle 0.90–1.19 CL. A1 somite dorsal processes with low, rounded or obtusely angled apices. A2 scale length 0.37–0.42 CL. A2 peduncle segment 1 extending anteriorly to level of anterior margin of eyes. Rostral plate broader than long; lateral margins convergent, apex broadly rounded; without dorsal carina. Carapace anterior width 0.50–0.54 CL; anterolateral spines not extending to base of rostral plate;

without posterior median projection. Raptorial claw dactylus with 4 teeth; outer proximal margin angular; propodus distal margin unarmed. Mandibular palp 2– or 3-segmented. TS6–8 without SM carinae. TS5 lateral process a short laterally directed angular lobe, without ventral spine. TS6–7 lateral process broadly rounded. TS8 anterolateral margin rounded; sternal keel rounded. AS1–5 without SM carinae. AS6 with ventrolateral spine anterior to uropodal articulation. Abdominal carinae spined as follows: SM 6, IM 5–6 (6 in smallest specimen), LT 6, MG (2–4)5; MG spines of AS2–3 armed in largest specimen only and indicated by minute, acute projections. Telson broader than long; dorsolateral surface irregular, with 3–4 irregular or inflated carinae posterolaterally; prelateral lobe subequal to or shorter than margin of LT tooth; margin of IM tooth smooth or faintly crenulate; denticles triangular, each without dorsal tubercle, SM 2–4, IM 5–8, LT 1. Telson ventral surface without postanal or supplementary carinae; ventrolateral carina rudimentary, not extending posteriorly to base of LT tooth. Uropodal protopod outer margin smooth; inner margin with 5–7 slender spines; with blunt ventral spine anterior to endopod articulation; protopod terminal spines with lobe on outer margin of inner spine rounded, deflected dorsally, as broad as or broader than adjacent spine, proximal margin concave. Uropodal exopod proximal segment without dorsal spinules; inner margin with broad, round distal lobe; outer margin with 4–6 movable spines, distalmost spatulate with acute apex, not reaching beyond midlength of distal segment; distal margin with short ventral spine lateral to articulation with distal segment. Exopod distal segment longer than proximal segment; with black spot at articulation of exopod segments.

Colour in alcohol. Carapace with grooves and carinae lined with dark brown; with diffuse, dark-brown U-shaped pattern medially, opening anteriorly. Thoracic and abdominal somites each with dark-brown posterior margins and diffuse brown patches on medially, submedially and laterally. Telson covered with diffuse brown chromatophores except for submedian and lateral areas. Uropodal protopod with dark brown carinae; exopod proximal segment black-brown on distal ½; distal segment with a few scattered chromatophores; endopod with dark inner proximal margin and dark outer distal margin.

Measurements. Male (n = 6) TL 19–43 mm, female (n = 3) TL 41–47 mm. Other measurements of holotype: CL 8.8 mm, A1 peduncle 8.0 mm, A2 scale 3.5 mm.

Etymology. Named for the late W. Stephenson, who first reported this species from Australia as *C. microphthalma*.

Remarks. *Cloridina stephensoni* n.sp. differs from *C. ichneumon*, with which it was identified by Stephenson (1962) and Manning (1966) (both as *C. microphthalma*), in bearing a shorter rostral plate, unarmed apices of the dorsal processes of the antennular somite. In *C. ichneumon*, the rostral plate is as long as or longer than broad and the apices of the dorsal processes of the antennular somite are produced to acute spines. The differences between the uropodal protopod of *C. ichneumon* and *C. stephensoni* noted by Stephenson (1962) are referable to the orientation of the uropod during illustration. In the short rostral plate, *C. stephensoni* resembles *C. chlorida*, but in *C. chlorida*, the cornea is broader, the apices of dorsal processes of the antennular somite are produced to acute spines and the lateral process of TS5 is spiniform.

As noted under the remarks of the genus, the distinctions between *Clorida*, *Cloridina* and *Neclorida* are artificial. Hence, *C. stephensoni* also closely resembles *Clorida depressa*. *Cloridina stephensoni* differs from *Clorida depressa* in having a more convex inner margin of the eyestalk, and in having a longer eye such that eye extends beyond the midlength of the first segment of the antennular peduncle, and extends anteriorly to the distal apex of the first antennal segment. The petasma is developed in all males of *C. stephensoni* exceeding 28 mm TL.

Habitat. Intertidal sand flats and tide pools.

Distribution. Northern Australia, from localities between Roebuck Bay, Western Australia to the Great Barrier Reef, Queensland.

Cloridina verrucosa (Hansen, 1926)

Fig. 118

Squilla microphthalma.–Kemp & Chopra, 1921: 299 (part, not *S. microphthalma* H. Milne Edwards).
Squilla verrucosa Hansen, 1926: 3, pl. 1: figs. 1a–d (type locality: Lesser Sunda Is, Indonesia, 8°27'S 122°54.5'E, by lectotype selection [Manning, 1976b]).
Squilla merguiensis Tiwari & Biswas, 1952: 350, fig. 1a (type locality: 6.4 km N of Kabusa I., Mergui Archipelago, Andaman Sea).
Clorida merguiensis.–Manning, 1968b: 5; 1976b: 8–10, fig. 4.–Makarov, 1979: 44–47, fig. 3.
Clorida verrucosa.–Manning, 1968b; 1976b: 10–13, fig. 5.–Makarov, 1979: 42–44, fig. 2.–Manning, 1991: 10, fig. 10, 11.
Cloridina verrucosa.–Manning, 1995: 195, fig. 24, 120.

Type material. LECTOTYPE: ZMA, ♂ (TL 45 mm), Lesser Sunda Is, Indonesia, 8°27'S 122°54.5'E, 247 m, sandy mud, Siboga Expedition St. 306, 8 Feb 1900.

Australian material. QUEENSLAND: AM P52726, 1♂ (TL 29 mm), 1♀ (TL 27 mm), off Cairns, 16°51.6'S 146°01.2'E, 35 m, sandy mud & dead shell, W. Ponder *et al*., 14 Oct 1981; ex NMV J37801, 1♀ (TL 19 mm), NE of Townsville, 19°3'S 146°52'E, 23 m, muddy sand dredge, G. Poore & H. Lew Ton, 24 Nov 1982; NTM Cr008823, 1♂ (TL 27 mm), Gulf of Carpentaria, 12°16.9'S 139°54.4'E, 59 m, dredge, A. Bruce, 25 Nov 1991; NTM Cr010822, 4♂♂ (TL 22–28 mm), Gulf of Carpentaria, 15°39.9'S 139°36.2'E, 40 m, dredge, P. Alderslade, 2 Dec 1990; NTM Cr010828, 1♂ (TL 24 mm), 2♀♀ (TL 25–29 mm), Gulf of Carpentaria, 15°21.2'S 135°37.9'E, 55 m, dredge, P. Alderslade, 2 Dec 1990; NTM Cr009017, 2♂♂ (TL 24–29 mm), Gulf of Carpentaria, 10°57.6'S 140°23.0'E, 54 m, dredge, SS0591 58, A. Bruce, 29 Nov 1991; AM P57207, 3♂♂ (TL 31–32 mm), E Gulf of Carpentaria, 13°30.2'S 140°42.5'E, 55 m, dredge, SS0390 65, T. Wassenberg, Dec 1990; AM P57203, 1♀ (TL 37 mm), Princess Charlotte Bay, 14°45'S 145°20'E, 20–30 m, T. Wassenberg; AM P57206, 6♂♂ (TL 25–30 mm), 3♀♀ (TL 29–32 mm), N of Wellesley Is Gulf of Carpentaria, 15°31.4'S 139°11.6'E, 45 m, SS0390 38, T. Wassenberg, 29 Nov 1990; AM P57201, 1♀ (TL 27 mm), Gulf of Carpentaria, 11°24.00'S 140°29.9'E, SS0591 54, T. Wassenberg, 28 Nov 1991; AM P57202, 2♂♂ (TL 29–30 mm),

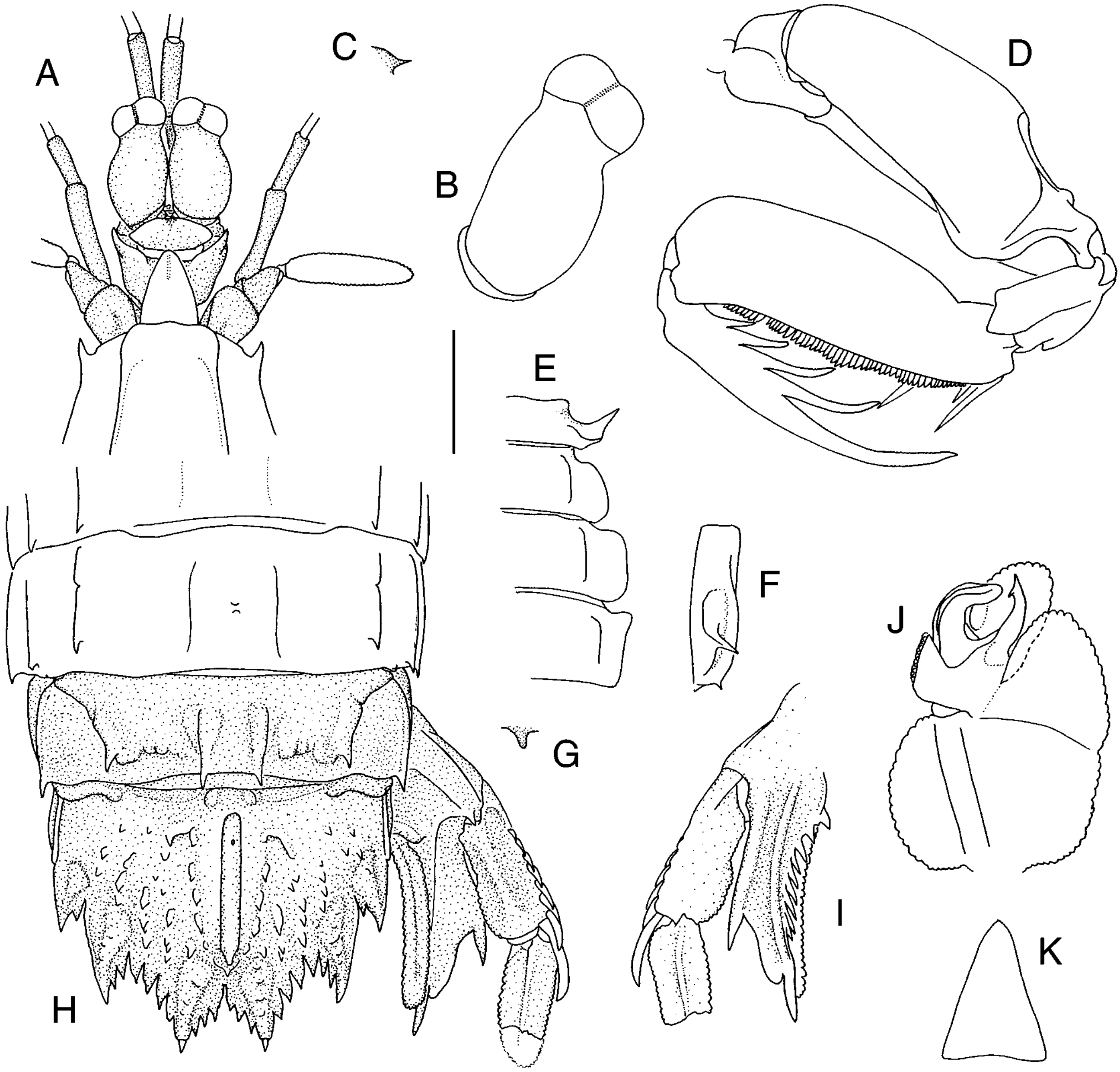

Figure 118. *Cloridina verrucosa* (Hansen). A–I, ♂ TL 29 mm (AM P57093). K, ♀ TL 27 mm (AM P57217). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS5–6, telson & uropod, dorsal. I, uropod, right ventral. J, PLP1 endopod. K, rostral plate, dorsal. Scale A, C–I = 2.5 mm; B,J,K = 1.2 mm.

Arafura Sea, 11°10.2'S 139°03.2'E, SS0591 55, T. Wassenberg, 28 Nov 1991; AM P57199, 1♂ (TL 29 mm), Gulf of Carpentaria, 12°26.4'S 139°25.8'E, 58 m, SS0390 79, T. Wassenberg, Dec 1990; AM P57209, 1♀ (TL 32 mm), NE Gulf of Carpentaria, 10°39.00'S 140°38.7'E, 42 m, SS0390 58, T. Wassenberg, 1990; AM P57208, 3♂♂ (TL 29–30 mm), NE Gulf of Carpentaria, 11°55.2'S 141°40.2'E, SS0591 49, T. Wassenberg, 25 Nov 1991; AM P57198, 2♂♂ (TL 25–26 mm), Gulf of Carpentaria, 12°17.4'S 139°55.9'E, SS0591 41, T. Wassenberg, 25 Nov 1991; AM P57200, 2♂♂ (TL 25–27 mm), 1♀ (TL 25 mm), NE Gulf of Carpentaria, 12°30.0'S 140°40.2'E, SS0591 43, T. Wassenberg, Nov 1991; AM P57197, 1♂ (TL 26 mm), Shelburne Bay, 11°25.6'S 143°01.8'E, SS0591 073, T. Wassenberg, 1 Dec 1991; AM P57092, 1♂ (TL 25 mm), off Cairns, 16°55'S 146°07'E, 37–40 m, sandy, shelly mud, benthic sled, W. Ponder & I. Loch, 8 Oct 1981; AM P57214, 1♂ (TL 29 mm), E Gulf of Carpentaria, 14°03.0'S 140°12.0'E, 62 m, dredge, SS0390 45, T. Wassenberg, Dec 1990; AM P57215, 2♂♂ (TL 26–29 mm), Arafura Sea, 11°10.5'S 139°23.8'E, SS0591 56, T. Wassenberg, 28 Nov 1991; AM P57212, 3♂♂ (TL 28–34 mm), SE Gulf of Carpentaria, SS0390 73, 15°32.1'S 139°41.8'E, 45 m, T. Wassenberg, Dec 1990; AM P57213, 1♂ (TL 29 mm), 2♀♀ (TL 26–32 mm), NE of Cape Arnhem, Arafura Sea, 10°41.8'S 138°31.1'E, SS0591 20, T. Wassenberg, 21 Nov 1991; AM P57210, 2♂♂ (TL 22–26 mm), E of Duyfken Point, Gulf of Carpentaria, 12°29.9'S 141°14.7'E, SS0591 46, T. Wassenberg, 1991; AM P57211, 1♀ (TL 24 mm), E Gulf of Carpentaria, 12°26.6'S 140°12.0'E, 61 m, SS0390 048, T. Wassenberg, 1990; AM P57216, 1♀ (TL 27 mm), E of Wessell Is, 10°57.7'S 138°01.0'E, SS0591 21, dredge, T. Wassenberg, 1991; AM P57217, 1♀ (TL 27 mm), Gulf of Carpentaria, 13°57.7'S 138°42.2'E, 55 m, SS0390 90, T. Wassenberg, 1 Dec 1990; QM, 1♀ (TL 37 mm), Gulf of Carpentaria, 13°02.6'S

139°12.1'E, 56 m, SS0390 33, T. Wassenberg, Nov 1990. NORTHERN TERRITORY: AM P55613, 1♂ (TL 28 mm), Arafura Sea, 10°29.7'S 137°14.5'E, 54 m, mixed shell & gravel, E. Ball & J. Paxton, 17 Mar 1975; AM P55615, 1♂ (TL 27 mm), Arafura Sea, 10°26.0'S 136°25.8'E, 57 m, sand, E. Ball & J. Paxton, 17 Mar 1975; AM P57093, 4♂♂ (TL 20–29 mm), Arafura Sea, 9°33.1'S 135°01.2'E, 123 m, Alpha Helix stn 14, E. Ball & J. Paxton, 18 Mar 1975; AM P57204, 6♂♂ (TL 24–32 mm), 5♀♀ (TL 17–29 mm), NE of Nicol I., 13°23.2'S 136°22.5'E, SS0591 32, T. Wassenberg, 25 Nov 1991; AM P57205, 1♀ (TL 27 mm), E of Wessell Is, 11°32.7'S 137°13.8'E, 47 m, SS0390 004, T. Wassenberg, Nov 1990; AM P57196, 1♀ (TL 34 mm), off Nhulunbuy, 12°04.3'S 136°45.0'E, SS0591 002, T. Wassenberg, 19 Nov 1991.

Diagnosis. Eyestalk with distinct constriction behind cornea. Ocular scales fused. A1 somite dorsal processes with spiniform apices, directed anteriorly. A2 peduncle segment 1 not extending anteriorly beyond eyes. Rostral plate longer than broad. Raptorial claw dactylus with 5 teeth; outer margin with proximal notch. Mandibular palp present. TS5 lateral process a short anteriorly recurved spine; ventral spine short. TS6–7 lateral processes broadly rounded. AS1–2 without SM carinae. AS3–5 SM carinae indistinct or absent. Abdominal carinae spined as follows: SM 6, IM (2–3)4–6, LT (1–4)5–6, MG (2–3)4–5. Telson dorsolateral surface with accessory MD carina composed of curved rows of closely spaced acute tubercles; denticles SM 2–4, IM 5–7, LT 1; ventral surface with long postanal carina, without supplementary carinae or tubercles laterally. Uropodal protopod inner margin with 6–10 slender spines; with one rounded lobe between terminal spines. Uropodal exopod proximal segment unarmed dorsally; outer margin with 7–9 movable spines.

Colour in alcohol. Largely faded. Dorsal surface with scattered chromatophores. Uropodal exopod with dark patch across articulation of segments extending onto inner ½ of distal segment.

Measurements. Male (n = 50) TL 22–45 mm, ♀ (n = 24) TL 17–37 mm. A1 peduncle 0.72–0.86 CL. A2 scale 0.34–0.40 CL. Anterior carapace width 0.43–0.53 CL. The present series includes the largest known of the species.

Remarks. The Australian specimens of *C. verrucosa* generally agree well with the holotype and published accounts (Hansen, 1926; Manning, 1976b, 1991; Makarov, 1979). Manning (1991) and Makarov (1979) reported considerable morphological variation in *C. verrucosa*, and the Australian specimens show similar variability. The rostral plate may or may not have a low median carina (more like a slight elevation), the mandibular palp varies in segmentation or may be absent, the number of abdominal somites bearing submedian carinae is variable, as is the spination of the abdominal carinae. The presence or absence of the carina on the rostral plate and degree of abdominal spination generally correlate with size. The median carina on the rostral plate is generally present only in the smaller specimens becoming obsolete with age, as is the case in several other similar genera such as *Levisquilla* and *Lenisquilla*. The abdominal spination generally increases with size. The submedian carinae on the abdomen are indistinct or near absent in the *C. verrucosa*, often being visible only if the dorsal surface is dried. All but two specimens of *C. verrucosa* examined bear a two- or three-segmented mandibular palp on both sides. One specimen lacks the mandibular palp on one side (QM, TL 37 mm female) and the other lacks the palp on both sides (TL 31 mm male, AM P57207). The absence of the mandibular palp in both specimens is likely attributable to damage because the insertions for the palp on the mandible are visible.

As in many squillids, male *Cloridina verrucosa* exhibits sexual dimorphism in having inflated telson carinae and tubercles. In most females, the apex of the rostral plate is sharper than in males.

Habitat. Muddy or shelly sand at depths of 23–123 m.

Distribution. Indonesia, the Philippines, New Caledonia, the Mergui Archipelago, Vietnam and now Australia.

Cloridopsis Manning, 1968c

Cloridopsis Manning, 1968c: 120, 128. Type species *Squilla scorpio* Latreille, 1828, by original designation. Gender masculine.

Diagnosis. Eye small, elongate, cornea bilobed, usually broader than and set slightly obliquely on stalk. Ocular scales separate. A1 somite dorsal processes trianguloid, with slender, acute apices, directed anterolaterally. Carapace with anterolateral spines; with normal complement of carinae; MD carina interrupted, anterior bifurcation absent; without posterior median projection; posterolateral margin rounded. Raptorial claw dactylus with 5 or 6 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp present or absent. MXP1–2 or 3 with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS6–8 with distinct SM and IM carinae. TS5 lateral process a single broad spine recurved anteriorly or anterolaterally; ventral spine stout; directed ventrally. TS6–7 lateral process single, broadly rounded. AS1–6 with normal complement of carinae. Telson SM teeth with minute, movable apices; prelateral lobe present; dorsolateral surface without supplementary longitudinal carinae; ventral surface without postanal carina. Uropodal protopod inner margin crenulate.

Included species. Six: *C. bengalensis* (Tiwari & Biswas, 1952); *C. dubia* (H. Milne Edwards, 1837); *C. gibba* (Nobili, 1903); *C. immaculata* (Kemp, 1913); *C. scorpio* (Latreille, 1828); and *C. terrareginensis* (Stephenson, 1953b).

Remarks. Manning (1995) recognized six species of *Cloridopsis*, from the Indo-West Pacific, but *C. aquilonaris* was recently shown to be a synonym of *C. scorpio* (see Ahyong *et al*., 1999). Therefore, five Indo-West Pacific species are recognized in addition to *C. dubia* from the Eastern Pacific and Western Atlantic. Species of *Cloridopsis* usually occur in shallow inshore waters with substantial terrigenous influence. Kemp (1913), Tiwari & Ghosh (1973), Manning (1979) and Ahyong *et al*. (1999) each reported *Cloridopsis* from estuarine habitats. Of the six species of *Cloridopsis*, one is known from Australia.

Key to species of *Cloridopsis*

1	MXP1–3 with epipod (Eastern Pacific and Western Atlantic)	*C. dubia*
——	MXP1–2 with epipod (Indo-West Pacific)	2
2	Mandibular palp present	3
——	Mandibular palp absent	4
3	Raptorial claw with 5 teeth on dactylus. Lateral process of TS5 with black patch basally	***C. terrareginensis***
——	Raptorial claw with 6 teeth on dactylus. Lateral process of TS5 without black patch basally	*C. bengalensis*
4	Cornea small, narrower than stalk	*C. gibba*
——	Cornea broader than stalk	5
5	Lateral process of TS5 with black patch basally	*C. scorpio*
——	Lateral process of TS5 without black patch basally	*C. immaculata*

Cloridopsis terrareginensis (Stephenson, 1953b)

Fig. 119

Squilla terrareginensis Stephenson, 1953b: 208–213, fig. 3A, B (type locality: Barron River, Cairns, Queensland, Australia).–Stephenson & McNeill, 1955: 242.–Manning, 1968c: 128.

Squilla scorpio.–White, 1847: 84.–Miers, 1880: 18 (part, Australian specimens only).–Stephenson & McNeill, 1955: 242 (not *Squilla scorpio* Latreille, 1828).

Cloridopsis terrareginensis.–Manning, 1995: 24, 196.

Type material. (All Queensland, Australia) HOLOTYPE: AM P9070, ♂ (TL 96 mm), mouth of Barron River, Cairns, 16°55'S 145°46'E, G. Stanley, May 1928. PARATYPES: AM P3794, 1♂ (TL 79 mm), 1♀ (TL 55 mm), Cooktown, 15°28'S 145°15'E, A. McCulloch, Aug 1913; QM W1841 1♂ (TL 93 mm), small brackish tributary near mouth of Barron River, Cairns, 16°55'S 145°46'E, sweep net, D. Tranter, 25 Aug 1952.

Australian material. QUEENSLAND: NMV J13854, 1♂ (TL 90 mm), Cooktown, J. Lund, 4 Jan 1943; QM W16863, 1♀ (TL 31 mm), Red Beach, near Weipa, 12°35'S 141°52'E, P. Davie & J. Short, 3 Nov 1990; AM P12267, 1♀ (TL 95 mm), Cairns area, 16°55'S 145°46'E, H. Flecker, 25 Apr 1953; AM P21650, 2♂♂ (TL 65–70 mm), 2♀♀ (TL 63–64 mm), Norman River, SE Gulf of Carpentaria, J. Yaldwyn & D. McMichael, 1965; AM P21647, 1♀ (TL 85 mm), SE Gulf of Carpentaria, 17°36.25'S 140°11.17'E, 2.3 m, CSIRO Prawn Survey, 17 Dec 1963; AM P21648, 1♀ (TL 60 mm), Karumba, Gulf of Carpentaria, 17°36.25'S 140°11.17'E, from mudflat, CSIRO Prawn Survey, 1963–1965; AM P21649, 7♂♂ (TL 41–80 mm), 4♀♀ (TL 44–62 mm), SE Gulf of Carpentaria, 16°55'S 140°41'E, less than 25 m, J. Yaldwyn & D. McMichael, Dec 1963; AM P55580, 1♂ (TL 32 mm), Saibai I., Torres Strait, 9°23'S 142°40'E, D. Brown, 7 Jul 1976; AM P55578, 3♂♂ (TL 54–89 mm), 1♀ (TL 66 mm), Gulf of Carpentaria, between Weipa & Karumba, trawl, T. Wassenberg, Dec 1976. WESTERN AUSTRALIA: WAM C8035, 1♀ (TL 103 mm), Carnarvon, off reef, H. Paul, Feb 1962; NHM 1932.11.30.192, 1♂ (TL 88 mm), Roebuck Bay, B. Gray; AM P55579, 1♂ (TL 54 mm), Broome, 17°58'S 122°14'E, muddy beach at bird observatory, seine net, 20 Sep 1992. NORTHERN TERRITORY: NHM 58.97, 1♀ (TL 75 mm), "northern Australia", J. Elsey; AM P52724, 1♀ (TL 32 mm), Charles Point, 12°23'S 130°37'E, in gutter, mudflat, M. Ward; NTM Cr007373, 1♂ (TL 32 mm), Bathurst I., 11°49'S 130°39'E, muddy sand channel, H. Larsen, 18 Nov 1982; NTM Cr005009, 1♀ (TL 32 mm), Darwin Harbour, mudflat in creek, low water springs, 13 Mar 1986; NTM, 1♂ (TL 85 mm), Hope inlet, Howard River mouth, Shoal Bay, intertidal, D154/52, NT Fisheries, 5 Dec 1975; NTM, 1♂ (TL 80 mm), Shoal Bay, 22 Aug 1972; NTM, 1♂ (TL 88 mm), Gove, 18 Jan 1972; NTM, 1♂ (TL 69 mm), Shoal Bay, 21 Feb 1972; NTM, 1♀ (TL 62 mm), Fannie Bay, 12°24'S 130°49'E, yabby pump, D. White & S. Zehntner, 23 Jan 1989.

Diagnosis. Eye with cornea broader than stalk. Rostral plate with distinct MD carina. Raptorial claw dactylus with 5 teeth. Mandibular palp 2-segmented. MXP1–2 with epipod. TS5 lateral process broad, apex sharp, directed anteriorly or anterolaterally; with black patch basally; ventrally with blunt angular lobe. Abdominal carinae spined as follows: SM 6, IM 5–6, LT (4)5–6, MG (1)2–5. Telson prelateral lobe longer than margin of LT tooth; denticles SM 1–2, IM 4–6, LT 1. Uropodal protopod with 6–7 movable spines.

Colour in alcohol. Largely faded. Posterior margin of thoracic and abdominal somites dark. Uropodal exopod with dark patch over articulation of segments. TS5 with black patch at base of lateral process.

Measurements. Male (n = 24) TL 32–96 mm, female (n = 16) TL 31–103 mm. CI 514–773. A1 peduncle 0.69–0.81 CL. A2 scale length 0.38–0.47 CL. Anterior carapace width 0.47–0.54 CL. The present series includes the largest known specimen of the species.

Remarks. *Cloridopsis terrareginensis* resembles *C. scorpio* in almost every respect, but differs in bearing a mandibular palp. As in *C. scorpio* (see Ahyong *et al*., 1999), the relative length of the rostral plate is variable and the apex of the lateral process of TS5 varies between being anteriorly to anterolaterally directed. In the smallest specimens examined, the movable apices of the submedian teeth are distinct, and are minute and inconspicuous in the largest specimens.

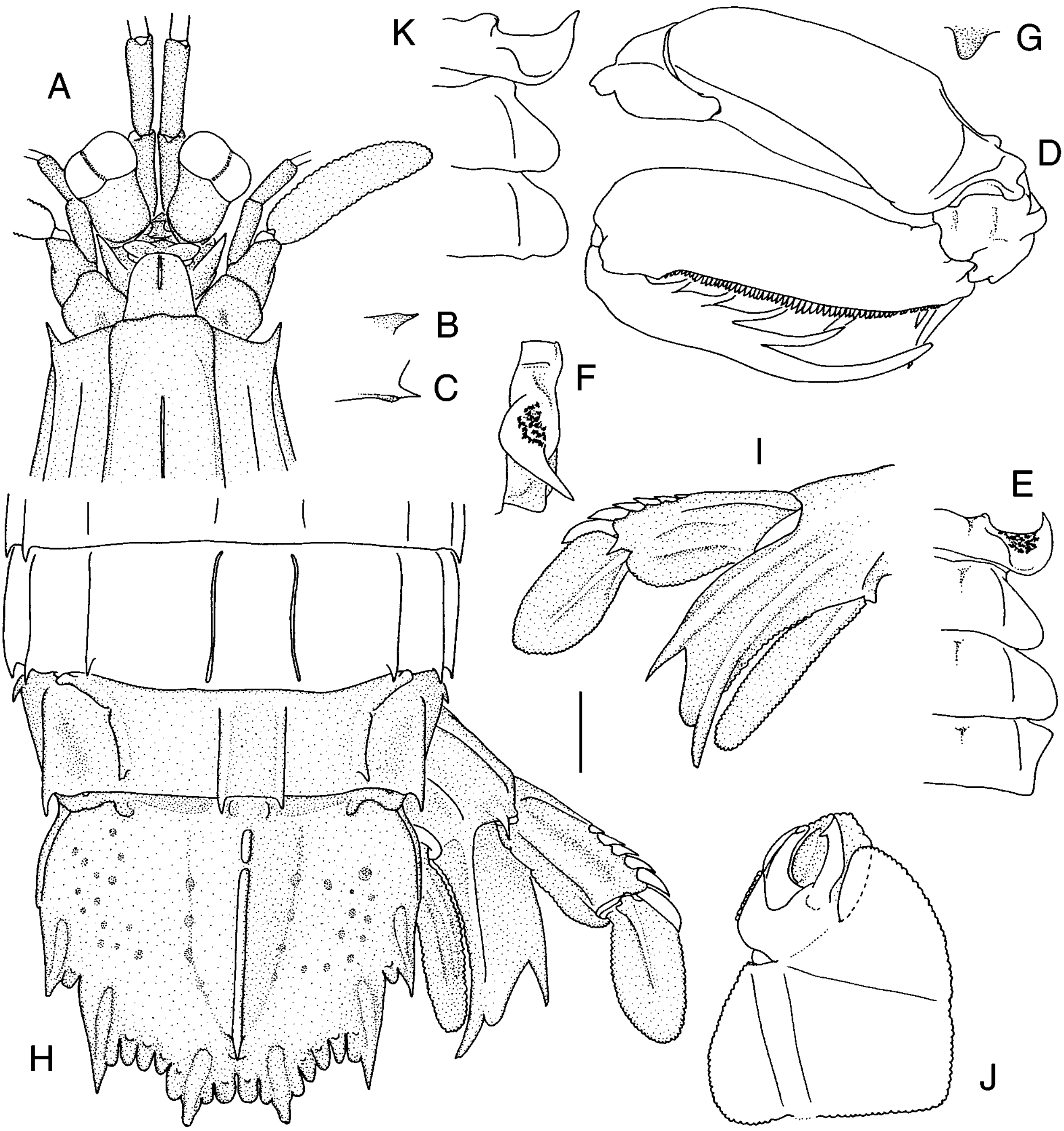

Figure 119. *Cloridopsis terrareginensis* (Stephenson). A–J, ♂ TL 54 mm (AM P55579). K, ♂ TL 88 mm (NHM 1932.11.30.192). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, carapace anterolateral spine, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, uropod, right ventral. J, PLP1 endopod, right anterior. K, TS5–7 lateral processes, right dorsal. Scale A–I, K = 5 mm; J = 2.5 mm.

As with its congeners, *C. terrareginensis* burrows in tidal or shallow subtidal mudflats. Many specimens reported here were collected from estuaries suggesting that *C. terrareginensis* tolerates or even favours relatively low salinity waters. The species appears to mature at a relatively small size; the penes and petasma in males are fully developed by 32 mm TL.

Previous reports of *Squilla scorpio* from Australia (White, 1847; Miers, 1880) are based on *C. terrareginensis*.

Habitat. Burrows in intertidal and subtidal mudflats to a depth of 25 m.

Distribution. Known only from northern Australia and Papua New Guinea.

Dictyosquilla Manning, 1968c

Dictyosquilla Manning, 1968c: 131–133. Type species *Squilla foveolata* Wood-Mason, 1895, by original designation and monotypy. Gender feminine.

Diagnosis. Mid-dorsal surface of carapace and thorax, and median surface of abdomen covered with irregular reticulated carinae. A1 somite not greatly elongate. Cornea bilobed. Carapace with normal complement of carinae and dorsal reticulations; MD carina and anterior bifurcation obscured by reticulations; posterolateral margin rounded. Raptorial claw dactylus with 6 teeth, proximal margin uninflated; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males without posterior endite; hook process blunt distally. TS5–7 lateral process bilobed. AS1–6 with normal complement of carinae. Telson dorsolateral surface with curved rows of supplementary carinae.

Included species. Two: *D. foveolata* (Wood-Mason, 1895); and *D. tuberculata* n.sp.

Remarks. *Dictyosquilla* is unique in the Squilloidea in bearing having the entire mid-dorsal surface covered with mesh-like reticulated carinae. As in *Miyakea* and *Natosquilla*, *Dictyosquilla* lacks the posterior endite on the endopod of the first pleopod in adult males. *Dictyosquilla* appears to exhibit an anti-tropical distribution pattern, being known only from Australia and from Borneo, northwestern Indonesia to Burma, Vietnam and Hong Kong, but not yet from intermediate localities.

Key to species of *Dictyosquilla*

1 AS1–5 with lateral margins below IM carinae distinctly tuberculate. Dorsolateral carinae of telson slender, approximately ½ the width of the intervening space between adjacent carinae .... ***D. tuberculata***

—— AS1–5 with lateral margins below IM rugose and pitted, not strongly tuberculate. Dorsolateral carinae of telson broad, almost as broad as the width of the intervening space between adjacent carinae .... *D. foveolata*

Dictyosquilla tuberculata n.sp.

Fig. 120A–K

Squilla foveolata.–Stephenson, 1953a: 41.–Stephenson & McNeill, 1955: 243.–Manning, 1966: 93 (not *Squilla foveolata* Wood-Mason, 1895).

Type material. (All Gulf of Carpentaria, Queensland, Australia) HOLOTYPE: AM P56763, ♂ (TL 96 mm), SE Gulf of Carpentaria, 25.6 m or less, CSIRO Prawn Survey, Dec 1963. PARATYPES: QM W6450, 1♀ (TL 104 mm), near Mitchell River, Gulf of Carpentaria, 22 m, trawl, T. Wassenberg, 8–21 Dec 1976; AM P21644, 2♂♂ (TL 87–88 mm), 1♀ (TL 97 mm), SE Gulf of Carpentaria, 16°53.8'S 139°22.5'E, 8.2 m, CSIRO Prawn Survey, 25 Oct 1963; AM P21646, 1♂ (TL 84 mm), 5♀♀ (TL 79–109 mm), SE Gulf of Carpentaria, 25.6 m or less, CSIRO Prawn Survey, 1962–1965; AM P21645, 2♂♂ (TL 96–98 mm), 4♀♀ (TL 92–107 mm), SE Gulf of Carpentaria, 25.6 m or less, CSIRO Prawn Survey, Dec 1963; AM P56764, 1♂ (TL 100 mm), 1♀ (TL 113 mm), Gulf of Carpentaria, between Weipa & Karumba, trawl, T. Wassenberg, Dec 1976.

Australian material. QUEENSLAND: QM W1809, 1♂ (TL 106 mm), between Magnetic I. & Townsville, prawn trawl, 5.5–9.1 m, R. Bryson, autumn 1952; QM W12865, 1♀ (TL 106 mm), SE end of Hinchinbrook I., 18°27.5'S 146°22.7'E, trawl, C. Jones, 7 Jan 1986; QM W12866, 1♀ (TL 124 mm), near Cape Bowling Green, 19°17.4'S 147°19.3'E, trawl, "Red Spot Bycatch", C. Jones, Jul 1985; AM P3530, 1♂ (TL 58 mm), 19 km NNE of Bowen, 35–46 m, FIS *Endeavour*. WESTERN AUSTRALIA: NTM Cr007677, 1♀ (TL 93 mm), Joseph Bonaparte Gulf, trawl, DW-35, D. White, 27–28 Jun 1990. NORTHERN TERRITORY: NTM, 1♀ (TL 75 mm), Chambers Bay, 12°06'S 131°32'E, 15 m, NT Fisheries, 5 May 1977; NTM Cr002902, 1♂ (TL 80 mm), N of Wessell Is, Arafura Sea, 56–57 m, W. Houston, 8 Mar 1985; AM P56765, 1♀ (TL 112 mm), Arafura Sea, 10°03.2'S 137°11.2'E, 42 m, SS0390 001, T. Wassenberg, Nov 1990.

Diagnosis. TS5 lateral process anterior lobe a short, narrow spine directed anteriorly; posterior lobe short, usually triangular and flattened, apex usually blunt, directed laterally. TS8 lateral process subquadrate, apex blunt. AS1–5 dorsal surface between IM and MG carinae coarsely tuberculate. AS6 dorsal surface coarsely tuberculate. Telson MD carina flanked by row of 3–5 blunt tubercles; dorsolateral surface with curved rows of slender supplementary longitudinal carinae; carinae tuberculate, distinctly more slender than intervening sulcus; proximal surface lateral to MD carina coarsely tuberculate. Telson ventral surface with irregular, usually tuberculate, postanal carina. Terminal spines of uropodal protopod with lobe on outer margin of inner spine rounded, apex projecting; proximal margin straight concave.

Description. Eye small, not extending anteriorly beyond A1 peduncle segment 1. A1 peduncle 1.02–1.23 CL. A1 somite dorsal processes low and blunt. A2 scale length 0.58–0.72 CL. Rostral plate with distinct median and short sinuous oblique carinae. Carapace anterior width 0.44–0.55 CL; anterolateral spines not extending beyond base of rostral plate; posterior margin with median posterior projection. TS5 lateral process bilobed; anterior lobe a short, slender spine directed anteriorly; posterior lobe short, triangular apex usually blunt, directed laterally. TS6 lateral process distinctly bilobed; anterior lobe subequal in size to posterior lobe, both subquadrate. TS7 lateral process distinctly bilobed; anterior lobe smaller than posterior lobe, triangular with apex acute; posterior lobe broad, triangular to subquadrate, anterior margin apex blunt. TS8 lateral process triangular, apex blunt; sternal keel rounded to subquadrate. AS1–5 with surface between IM and MG carinae coarsely tuberculate AS6 with dorsal surface coarsely tuberculate;

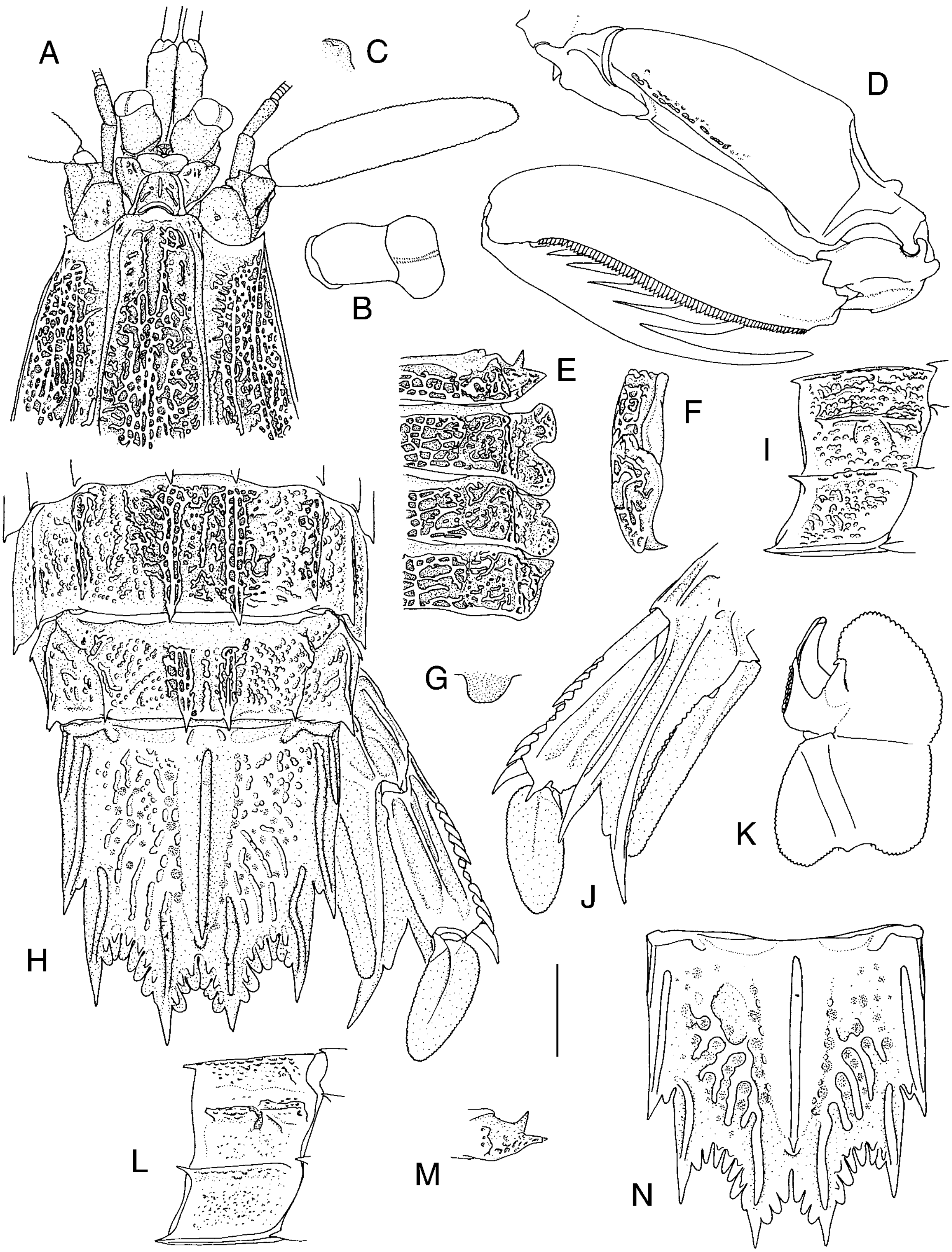

Figure 120. *Dictyosquilla tuberculata* n.sp., holotype ♂ TL 96 mm (A–K). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, AS5 right lateral. J, uropod, right ventral. K, PLP1 endopod, right anterior. *Dictyosquilla foveolata* (Wood-Mason), ♀ 100 mm (AM P51433), (L–N). L, AS5, right lateral. M, TS5 lateral process, right dorsal. N, telson, dorsal. Scale A–J, L–N = 5 mm; K = 2.5 mm.

with ventrolateral spine anterior to uropodal articulation; sternum posterior margin at most with blunt median tubercle. Abdominal carinae spined as follows: SM 4–6, IM (3)4–6, LT (2–3)4–6, MG 1–5. Telson MD carina flanked by row of 3–5 blunt tubercles; dorsolateral surface with curved rows of supplementary longitudinal carinae; carinae tuberculate, distinctly more slender than intervening sulcus; proximal surface lateral to MD carina coarsely tuberculate; carina of LT tooth extending anteriorly almost to proximal margin telson; denticles elongate, rounded, each with dorsal tubercle, SM 2–4, IM 5–7, LT 1. Telson ventral surface with irregular, usually tuberculate, postanal carina; and curved rows of low irregular tubercles between rows shallow circular pits; ventrolateral carina not extending to base of LT tooth. Uropodal protopod with minute ventral spine anterior to endopod articulation. Terminal spines of uropodal protopod with lobe on outer margin of inner spine rounded, as broad as or narrower than adjacent spine, apex projecting; proximal margin concave. Uropodal exopod proximal segment outer margin with 10–15 movable spines, distalmost not exceeding midlength of distal segment; distal margin with slender ventral spine. Uropodal exopod proximal segment unarmed dorsally; exopod distal segment shorter than proximal segment; entirely dark.

Colour in alcohol. Faded.

Measurements. Male (*n* = 10) TL 58–106 mm, female (*n* = 17) TL 75–124 mm. Other measurements of holotype: CL 22.2 mm, A1 peduncle 24.4 mm, A2 scale 13.8 mm.

Etymology. Named *tuberculata*, for the strongly tuberculate margins of the abdomen in adults.

Remarks. *Dictyosquilla tuberculata* n.sp. differs from the D. foveolata in usually bearing a broader posterior lobe on the lateral process of TS5, the lateral abdominal margins below the intermediate carinae are coarsely tuberculate instead of pitted and rugose, and the dorsolateral carinae of the telson are more slender (Fig. 120L-N). All previous records of *D. foveolata* from Australia (Stephenson, 1953a; Stephenson & McNeill, 1955; and Manning, 1966) are referable to *D. tuberculata*. Unfortunately, juveniles of *D. tuberculata* may be difficult to distinguish from *D. foveolata* because the abdominal tuberculation and telson carination will not have reached full development.

Habitat. Trawlable substrates between 5.5–9.1 m and 56–57 m depth.

Distribution. Northern Australia, from eastern Queensland to the Gulf of Carpentaria.

Distosquilla Manning, 1977b

Distosquilla Manning, 1977b: 421–422. Type species *Squilla miles* Hess, 1865, by original designation and monotypy. Gender feminine.

Diagnosis. Eye with cornea asymmetrically bilobed, distinctly broader than stalk, with outer margin of eye longer than inner margin. Carapace without anterolateral spines or MD carina; with reflected MG carina; posterolateral margin rounded. Raptorial claw dactylus with 4 teeth. Mandibular palp absent. MXP1–3 with epipod. PLP1 endopod in adult males with posterior endite; hook process blunt distally. TS5–7 lateral processes single. AS1–6 with normal complement of carinae and supplementary carina between IM and LT carinae. Telson SM teeth with movable apices; prelateral lobe absent. Uropodal protopod inner margin armed with slender spines.

Included species. One: *D. miles* (Hess, 1865).

Remarks. *Distosquilla* differs from other squilloids by the combination of an asymmetrically bilobed cornea, four teeth on the dactylus of the raptorial claw and absence of anterolateral spines and median carina of the carapace. The single species in the genus, *D. miles*, occurs in Australia.

Distosquilla miles (Hess, 1865)

Fig. 121

Squilla miles Hess, 1865: 165, pl. 7, fig. 21 (type locality: Sydney, New South Wales, Australia, but see remarks below).–Haswell, 1882: 207–208.–Whitelegge, 1889: 60.–Kemp, 1913: 36–37.–Alexander, 1916a.–Odhner, 1923: 3–5, figs. 1–3.–Hale, 1924: 492–495, pl. 32, fig. 1; 1927a: 30–31, figs. 15–17, 19.–Stephenson, 1955: 1, 2, 4.–Stephenson & McNeill, 1955: 241.–Guiler, 1956: 3.–Stephenson, 1962: 34.–Manning, 1968c: 127; 1977b: 421.
Squilla pectinata Tate, 1883: 49–50.
Anchisquilla miles.–Manning, 1968c: 127.
Distosquilla miles.–Manning, 1977b: 421–422; 1995: 24.–Debelius, 1999: 292.

Type material. HOLOTYPE: ZMG 962, ♀ (TL 140 mm), Sydney, New South Wales, Schütte, 1864.

Australian material. VICTORIA: AM P3010, 1♂ (TL 52 mm), dry, Port Phillip, J. Gabriel; NMV J37782, 1♂ (TL 145 mm), Sorrento; NMV J37844, 1♀ (TL 90 mm), Corinella, 38°25'S 145°26'E, Marine Study Group, 4 Apr 1971. TASMANIA: AM P12370, 1♀ (TL 65 mm), near mouth of Don River, 41°19'S 146°18'E, rock pool, about 1 m, mean tide level, K. Hiscock, May 1953; NMV J37779, 1♂ (TL 86 mm), Kettering, D'entrecasteaux Channel, 43°21'S 147°09'E, T. Sword, Jul 1973; NMV J37824, 1♀ (TL 91 mm), Crawfish I., *Zostera* bed on sand & weed, 18 Feb 1972; TM G962, 1♂ (TL 97 mm), Blackman's Bay, J. Cunningham, Jan 1956; TM G1712, 1♂ (TL 102 mm), Barnes Bay, Bruny I., R. Long, 23 Oct 1971; TM G46, 1♂ (TL 118 mm), Tasmania; TM G541, 1♂ (TL 109 mm), Snug Beach, from seaweed, R. Heddle, early Dec 1963; TM G961, 1♂ (TL 127 mm), Kelly Basin, Port Davey, R. Denne, 4 Nov 1964; TM G3483, 1♀ (TL 112 mm), Pittwater, from gut of 35 cm flathead (Platycephalidae), G. Prestedge, 29 Mar 1972; TM G3840, 1♀ (TL 47 mm), Great Taylor Bay, D. Penprase, 25 Jul 1968; TM G3841, 1♀ (TL 33 mm), Triabunna Wharf, from gut of flathead (Platycephalidae), 19 Apr 1951; TM G1711, 1♀ (TL 125 mm), Orford, washed ashore on seaweed, H. Montgomery, 6 Aug 1975; TM G150, 1♀ (TL 109 mm), Derwent River channel, dredged, 2 Aug 1954; TM G149, 2♂♂ (TL 42 mm, 1 broken), Eaglehawk Neck, Sep 1935; TM G148, 1♂ (TL 76 mm), 1♀ (TL 102 mm), Recherche Bay, Aug 1908; TM G2066, 1♀ (TL 118 mm), Norfolk Bay, Dunalley, J. Knight, Jul 1979; TM G2037, 1♀ (TL 122 mm), Great Taylor Bay, Bruny I., M. Smith, 1 Jan 1979; TM G1245, 1♀ (TL 34 mm), Woody I., dredged, A. Dartnall, 4 May 1967. SOUTH AUSTRALIA: SAM C172, (syntypes of *S. pectinata* Tate), 1♂ (TL 105 mm), 1♀ (TL 108 mm), Port Adelaide Creek, Adelaide; SAM C5803, 1♂ (TL 115 mm), 1♀ (TL 100 mm), Great Australian Bight, approx. 127 km SSW of Pearson I., Investigator Group, 35°08'S

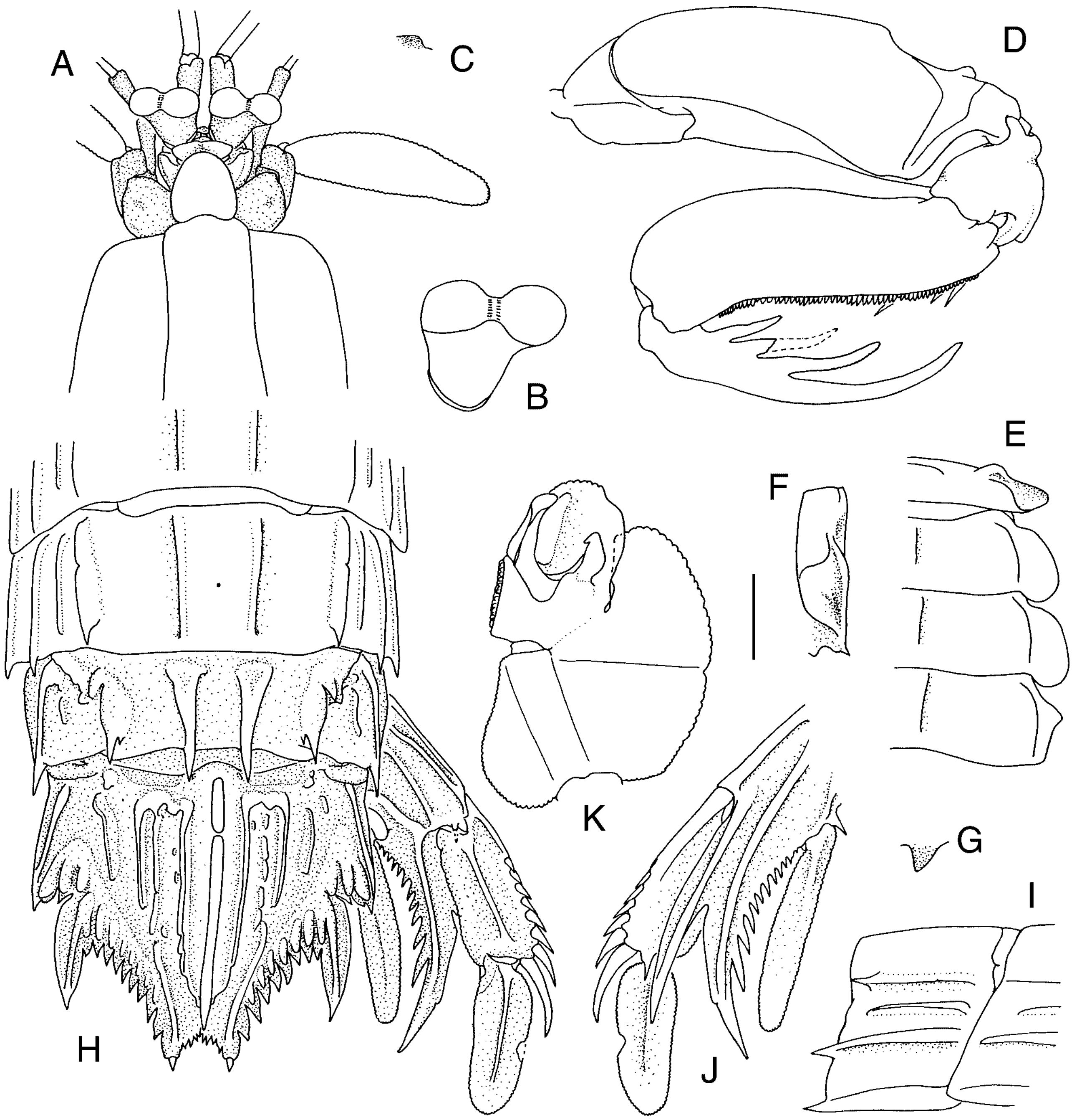

Figure 121. *Distosquilla miles* (Hess), ♂ TL 115 mm (SAM C5803). A, anterior cephalon, dorsal. B, eye, right dorsal. C, A1 somite dorsal process, right lateral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, AS4–5 right lateral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A–J = 5 mm; K = 2.5 mm.

133°47'E, 920–1040 m, trawl, K. Gowlett-Holmes, 12 Apr 1989; SAM C120, 1♀ (TL 128 mm), Adelaide, W. Colyer *et al*.; SAM C170, 1♀ (TL 98 mm), off St Kilda; SAM C3359, 1♂ (TL 133 mm), 1♀ (TL 132 mm), Tumby Bay, W. Betts, 26 Oct 1953; SAM C296, 2♀♀ (TL 117–130 mm), Semaphore, A. Humphries; SAM C1835, 3♀♀ (TL 117–133), Semaphore, 3 Oct 1928; SAM C1836, 1♀ (TL 151 mm), Semaphore, 3 Oct 1928; SAM C1837, 1♀ (TL 129 mm), Semaphore, 3 Oct 1928; SAM C175, 13♂♂ (TL 63–133), 12♀♀ (TL 77–145 mm), St. Vincent Gulf; SAM C3151, 1♂ (TL 116 mm), Brighton, M. Collyer, 17 Feb 1947; SAM C173, 1♂ (TL 121 mm), Brighton Beach, F. Yuill, 1888; SAM C174, 2♂♂ (TL 98–115 mm), 4♀♀ (TL 95–132 mm), Glenelg, after storm, H. Hale, Aug 1920; SAM 5750, 1♀ (TL 118 mm), Black Point, E. Wheare; SAM C5756, 1♂ (TL 71 mm), SE South Australia, Dr Holmes, 1972; SAM C5774, 1♂ (TL 158 mm), West Beach, S. Hancock; SAM C5775, 1♂ (TL 135 mm), Foul Bay, Yorke Peninsula, Monaghan, 25 Jan 1986; SAM C5776, 1♀ (TL 149 mm), near Whyalla, netted, R. Atkinson, 1970; SAM C5777, 1♀ (TL 142 mm), Wardang I., J. Kemp, 1941. WESTERN AUSTRALIA: AM P3682, 1♂ (TL 102 mm), Albany, 35°01'S 117°53'E; WAM 223–96, 1♂ (TL 121 mm), Middleton Beach, Albany, after storm, L. Grayson, 10 Aug 1984; WAM 221–96, 1♀

(TL 124 mm), Albany, 35°01'S 117°53'E, 1 Oct 1970; WAM C7850, 1♀ (TL 122 mm), Cape Riche near Albany, caught in herring net, A. Kaluins, Mar 1954; WAM C7858, 2♂♂ (TL 75–97 mm), Four Mile Reef off Busselton, from stomach of fiddle ray, 18 m, B. Wilson, 27 Jul 1958; WAM 224–96, 1♀ (TL 31 mm), Lancelin I., 1.8–3.7 m, beam trawl in bay, R. George, 12 Nov 1963.

Description. Dorsal integument smooth, polished. Eye small, not extending to end of A1 peduncle segment 1; cornea asymmetrically bilobed, distinctly broader than stalk; CI 389–728. Ophthalmic somite anterior margin rounded. Ocular scales broad; truncate; separate. A1 somite dorsal processes with low, blunt apices. A1 peduncle 0.64–0.92 CL. A2 scale slender, entire margin setose, length 0.46–0.53 CL. Rostral plate ovoid, about as long as broad, without median carina. Carapace anterolateral angles unarmed; without carinae excepting reflected MG and LT carinae, distinct posteriorly only; without posterior median projection. Raptorial claw dactylus with 4 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp absent. MXP1–3 with epipod. MXP5 basal segment without ventrally directed spine. Pereiopods 1–3 basal segment unarmed; endopod 2-segmented, distal segment slender. TS6–8 with distinct, flattened, SM and IM carinae. TS5 lateral process single, broadly rounded; ventral spine stout, acute. TS6–7 lateral process single, broadly rounded. TS8 lateral process angular, apex blunt; sternal keel triangular, inclined posteriorly, apex acute. AS1–6 with normal complement of carinae and supplementary carina between IM and LT carinae; carinae flattened. AS6 without ventrolateral spine anterior to uropodal articulation; sternum posterior margin with blunt median tubercle; with proximal transverse carina. Abdominal carinae spined as follows: SM 6 (often bispinous), IM 5–6, LT 5–6, MG (4)5. Telson trianguloid, with 3 pairs of primary teeth (SM, IM and LT), each with dorsal carina; IM teeth elongate, margin subequal to ½ median length of telson, apices extending posteriorly to bases of SM teeth; SM teeth with movable apices; prelateral lobe absent; MD carina interrupted proximally, posteriorly with short apical spine overhanging blunt tubercles; dorsolateral surface with accessory MD and supplementary longitudinal carinae and tubercles; denticles SM 3–8, IM 7–12, LT 1–2, triangular, each with dorsal tubercle. Telson ventral surface with long postanal carina; ventrolateral carina absent. Uropodal protopod terminating in 2 slender spines, dorsally and ventrally carinate, inner longer; unarmed dorsally excepting dorsal spine above proximal exopod articulation; with short spine anterior to endopod articulation; protopod inner margin armed with 7–12 slender spines. Protopod terminal spines with lobe on outer margin of inner spine rounded; as narrower than adjacent spine, proximal margin straight or faintly convex. Uropodal exopod proximal segment unarmed dorsally; outer margin with 8–13 movable spines, distalmost reaching midlength of distal segment, with distal, ventral spine. Exopod distal segment longer than proximal segment.

Colour in life. Overall dusky brown to dull yellow, with dark carapace grooves and margins of the thoracic and abdominal somites.

Measurements. Male (*n* = 38) TL 52–145 mm, female (*n* = 46) TL 31–151 mm. The present series includes the largest known specimens of the species.

Remarks. *Distosquilla miles* is endemic to southern Australia. Little is known of the biology of *D. miles*, but it generally occurs nearshore on soft level substrates. One specimen, however, was taken at 920–1040 m from the continental slope of South Australia and is significant as the deepest record for a squilloid. Hess's (1865) type locality for *D. miles*, Sydney, is almost certainly erroneous, for it has not been recorded from New South Wales since it was first described.

Distosquilla miles shows little morphological variation aside from typical allometric changes such as slight decrease in the relative size of the cornea and more robust telson carinae in mature males. The intermediate spines of AS6, however, frequently also bear a small basal spine, and the lateral denticle of the telson usually bears a blunt adjacent denticle.

Habitat. Usually from the shore or shallow subtidal zone, often in association with algae, seagrass and detritus, but as deep as 920–1040 m.

Distribution. Victoria, Tasmania, South Australia to the vicinity of Perth, Western Australia

Erugosquilla Manning, 1995

Erugosquilla Manning, 1995: 197. Type species *Squilla massavensis* Kossmann, 1880, by original designation. Gender feminine.

Diagnosis. Dorsal integument smooth, appearing polished. Eye large, T-shaped, cornea strongly bilobed, width less than 0.3 CL. Ophthalmic somite anterior margin usually spinulate. Carapace anterior width exceeding ½ median length; with anterolateral spines; with normal complement of carinae; MD carina low but distinct, interrupted at base of anterior bifurcation; branches of anterior bifurcation absent or faintly indicated, opening anterior to dorsal pit; posterolateral margin rounded. Raptorial claw dactylus with 6 or 7 teeth; carpus dorsal carina irregularly tuberculate. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process blunt distally. TS5–7 lateral process bilobed. AS1–5 with normal complement of carinae. Telson SM teeth with fixed apices; prelateral lobe present; MD carina lateral margins with or without rows of blunt tubercles; dorsolateral surface without supplementary longitudinal carinae. Uropodal protopod inner margin crenulate.

Included species. Six: *E. grahami* Ahyong & Manning, 1998; *E. hesperia* (Manning, 1968b); *E. massavensis* (Kossmann, 1880); *E. septemdentata* (Ahyong, 1994); *E. serenei* Ahyong & Manning, 1998; and *E. woodmasoni* (Kemp, 1911).

Remarks. The smooth dorsum, broad carapace and suppressed or indistinct anterior bifurcation of the median carina of the carapace in *Erugosquilla* are characters also shared by *Busquilla* and *Natosquilla*. *Busquilla* differs from *Erugosquilla* in bearing five instead of six or seven teeth on the dactylus of the raptorial claw and in the less distinct bilobation of the lateral processes of TS5–7. *Natosquilla* resembles *Erugosquilla* in the form of the lateral processes of TS5–7, but differs in bearing more than 10 teeth on the dactylus of the raptorial claw. Both *Busquilla* and *Natosquilla* differ from *Erugosquilla* in bearing unusually large eyes in which the cornea exceeds 0.3 CL in adults. Eye size, however, should be used cautiously in distinguishing *Busquilla*, *Natosquilla* and *Erugosquilla*, because the CI changes with size. The CI of juvenile *Erugosquilla* may overlap that of adult *Busquilla* and *Natosquilla*.

Species of *Erugosquilla* occur throughout the tropical Indo-West Pacific, usually nearshore in the shallow sublittoral zone (except for *E. septemdentata*, known from 460 m). So far as is known, species of *Erugosquilla* construct U-shaped burrows in soft level substrates. Two species *Erugosquilla* are known from Australia: *E. woodmasoni* and *E. grahami*.

Key to species of *Erugosquilla*

1 Raptorial claw dactylus with 7 teeth .... *E. septemdentata*

—— Raptorial claw dactylus with 6 teeth 2

2 Merus of raptorial claw with outer inferodistal angle acute or produced to a spine. Anterior margin of ophthalmic somite broadly rounded, usually with median spinule .... ***E. woodmasoni***

—— Merus of raptorial claw with outer inferodistal obtuse, never produced to a spine. Anterior margin of ophthalmic somite trapezoid usually with median spinule 3

3 Telson MD carina flanked by one or more rows of tubercles 4

—— Telson MD carina flanked by shallow groove, convergent posteriorly, with or without an irregular carina, without distinct rows of tubercles 5

4 Rostral plate with margins straight. Telson with 1 row of tubercles flanking MD carina .... *E. hesperia*

—— Rostral plate with margins sinuous. Telson with 2 row of tubercles flanking MD carina .... *E. massavensis*

5 Telson prelateral lobe subequal to or longer than margin of LT tooth in adults. AS1 with LT carina unarmed posteriorly. A1 peduncle banded with blue and yellow-orange in life .... ***E. grahami***

—— Telson prelateral lobe shorter than margin of LT tooth in adults. AS1 with LT carina armed posteriorly. A1 peduncle uniformly coloured in life .... *E. serenei*

Erugosquilla grahami Ahyong & Manning, 1998

Fig. 122

Squilla wood-masoni.–Stephenson & McNeill, 1955: 244 (Port Jackson specimen, not *Squilla woodmasoni* Kemp, 1911).
Squilla woodmasoni.–Holthuis, 1941: 255.
Squilla interrupta.–Stephenson & McNeill, 1955 (part, Port Jackson specimen, not *Squilla interrupta* Kemp, 1911).
Oratosquilla woodmasoni.–Graham *et al*., 1993a: 24, 64; 1993b: 73 [not *O. woodmasoni* (Kemp, 1911)].
Erugosquilla grahami Ahyong & Manning 1998: 653–658, 660–661, figs. 1, 2, 3A (type locality: off Patonga, New South Wales, Australia, 32°34'S 151°17'E).

Type material. HOLOTYPE: AM P42761, ♂ (TL 139 mm), off Patonga, New South Wales, Australia, 32°34'S 151°17'E, trawl, 7–10 m, S. Ahyong. PARATYPES: AM P42767 (to USNM), 1♂ (TL 133 mm), type locality, S. Ahyong, 29 Jan 1994; AM P42762–42766, 3♂♂ (TL 92–141 mm), 2♀♀ (TL 102–145 mm), type locality, S. Ahyong, 12 Feb 1994; AM P42768–42770, 3♂♂ (TL 136–151 mm), type locality, S. Ahyong, 12 Feb 1994.

Australian material. QUEENSLAND: AM P55586, 6♂♂ (TL 96–118 mm), 9♀♀ (TL 32–123 mm), NE of Wellesley Is, Gulf of Carpentaria, 16°01.8'S 140°11.9'E, 31 m, dredge, SS0390 41, T. Wassenberg, 30 Nov 1990; AM P55588, 1♀ (TL 110 mm), off Albatross Bay, Gulf of Carpentaria, 11°58.5'S 140°41.4'E, 54 m, T. Wassenberg, 4 Dec 1990; QM, 1♂ (TL 101 mm), 1♀ (TL 114 mm), NE of Wellesley Is, Gulf of Carpentaria, 16°01.8'S 140°11.9'E, 31 m, dredge, SS0390 41, T. Wassenberg, 30 Nov 1990. NEW SOUTH WALES: AM P9456, 1♂ (TL 150 mm), Folly Point, Middle Harbour, Port Jackson, 33°49.2'S 151°13.5'E, seine netted with prawns, C. Wheatley; AM P41798, 1♂ (TL 134 mm), E of Port Hunter, Newcastle, 32°55'S 157°56'E, 66 m, K. Graham, Jun 1990; AM P41799, 1♂ (TL 140 mm), SE of Brunswick Heads, 28°35'S 153°34'E, 12–15 m, K. Graham, 11 Aug 1991; AM P42955, 1♂ (TL 125 mm), off Newcastle, 32°55'S 151°56'E, 69–73 m, K. Graham, 3 Dec 1990; AM P42956–42958, 1♂ (TL 144 mm), 2♀♀ (TL 101–144 mm), off Clarence River, 30°48'S 153°02'E, 22–30 m, K. Graham, 5 Nov 1991; AM P42949–42954, 2♂♂ (TL 64–116 mm), 4♀♀ (TL 74–146 mm), Port Jackson, 33°55'S 151°15'E, M. Beatson, 7 Mar 1994; AM P56989, 1♀ (TL 160 mm), Port Jackson, 33°55'S 151°15'E, trawl, muddy sand,

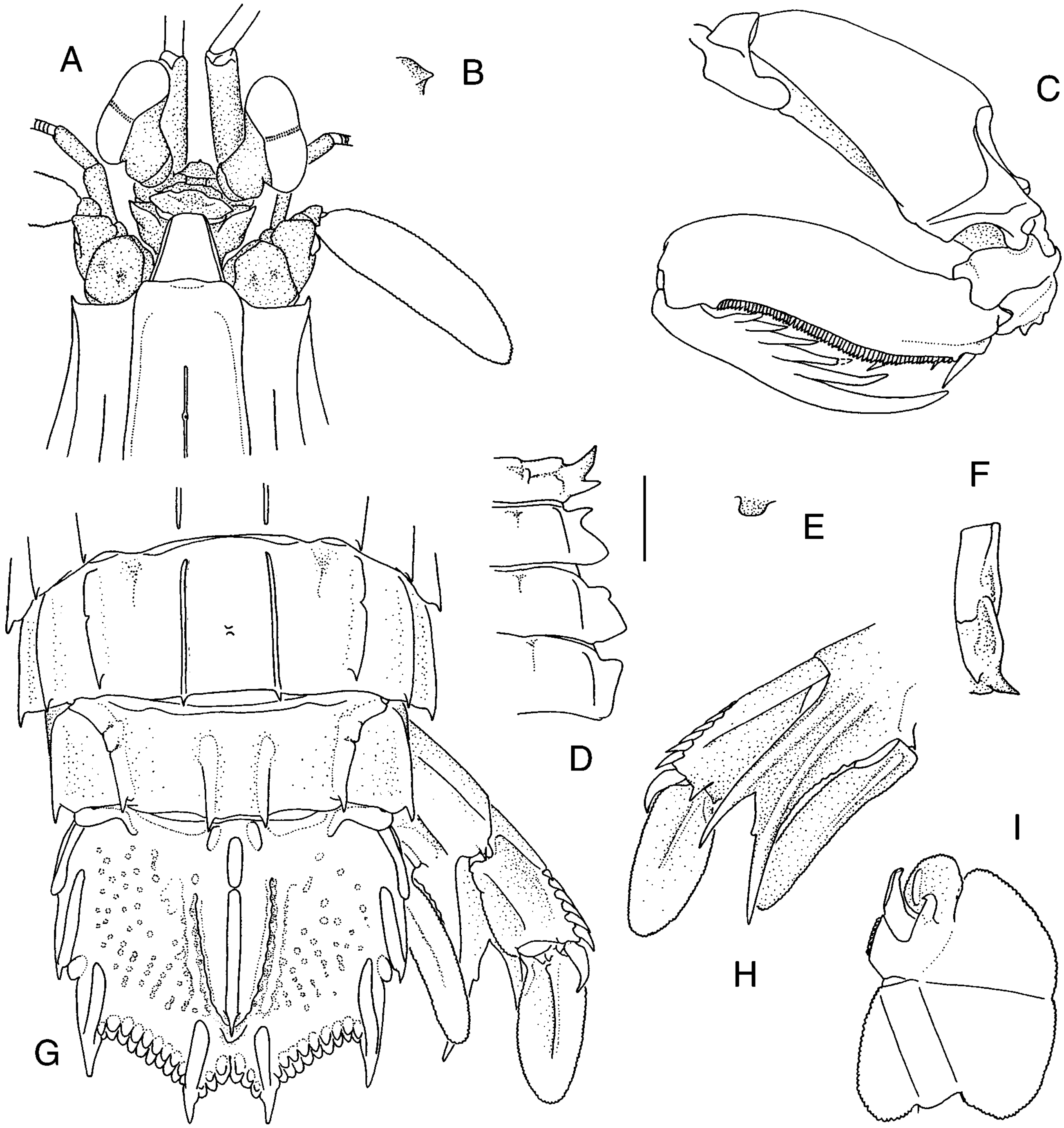

Figure 122. *Erugosquilla grahami* Ahyong & Manning, ♂ TL 96 mm (AM P55586). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 5 mm; I = 2.5 mm.

commercial fisherman, Nov 1989. WESTERN AUSTRALIA: AM P19332, 2♂♂ (TL 115–134 mm), 48 km S of Carnarvon, 24°52'S 113°38'E, 14–18 m, sandy-mud with *Posidonia* & *Cymodocea* banks, N. Coleman, 3 Jun 1972; AM P19333, 1♀ (TL 123 mm), off Carnarvon, 23 m, A. Nickol, May 1972; AM P52743, 1♀ postlarva (TL 20 mm), 1♀ (TL 25 mm), Northwest Shelf, 19°58.0–58.5'S 117°49.4–49.7'E, 43 m, 27 Jun 1983; WAM C23534, 1♂ (TL 126 mm), 24 km WSW of Carnarvon, 22–26 m, L. Marsh & M. Sinclair, 3–4 Jul 1975; WAM C23535, 2♀♀ (TL 111–120 mm), 24 km WSW of Carnarvon, 26 m, L. Marsh & M. Sinclair, 30 Jun 1975. WAM C23537, 1♀ (TL 147 mm), Shark Bay, trawl, W. & W. Poole, Sep 1963; WAM C23538, 1♂ (TL 177 mm), Melville Water, 10 Apr 1970; NORTHERN TERRITORY: NTM exCr010833, 1♂ (TL 36 mm), Gulf of Carpentaria, 14°06.9'S 137°33.0'E, 47 m, dredge, P. Alderslade, 1 Dec 1990.

Diagnosis. Ophthalmic somite anterior margin trapezoid with median spinule. A1 somite dorsal processes triangular, with acute apices, directed anterolaterally. Rostral plate broader than long; trapezoid. Raptorial claw dactylus with 6 teeth; merus outer inferodistal angle obtusely angled, blunt. Abdominal carinae spined as follows: SM 5–6, IM 3–6, LT (2)3–6, MG 1–5. Telson MD carina lateral margins flanked by pitted groove, with raised irregular margins; prelateral lobe subequal to (in smallest specimens) or longer than margin of LT tooth; denticles SM 3–4, IM 8–12, LT 1. Uropodal protopod terminal spines with lobe on outer margin of inner spine angular (in juveniles) to rounded (in adults), narrower than adjacent spine; exopod proximal segment outer margin with 7–9 movable spines.

Colour in life. Overall dorsal colour pale grey-green. Margin of rostral plate, dorsal carinae and gastric grooves of carapace, posterior margin of carapace and thoracic somites, SM carinae of body somites, red. AS2–5 with dark, rectangular median patch. Telson with carinae dark green, mid-dorsal surface maroon. Uropodal exopod with proximal segment dark blue; distal segment blue proximally, yellow distally. A1 peduncle with alternating blue and yellow-orange banding. A2 scale blue proximally, yellow-orange distally.

Measurements. Male (n = 27) TL 36–177 mm, female (n = 25) TL 32–160 mm, female postlarva (n = 1) TL 20 mm. CI 273–420. A1 peduncle 0.88–1.01 CL. A2 scale 0.51–0.69 CL. Anterior carapace width 0.56–0.62 CL. The present series includes the largest known specimen of the species.

Remarks. An account of *E. grahami* was recently given by Ahyong & Manning (1998).

Ahyong & Manning (1998) remarked on a Taiwanese specimen in which the anterior lobe of the lateral process of TS7 was more pointed than in most Australian specimens. Additional specimens of *E. grahami* from Taiwan examined since then show variation in the shape of the anterior lobe of TS7 as in Australian specimens. As noted by Ahyong & Manning (1998), *E. grahami* may be more widely distributed than presently known, and may have been misidentified in the literature. *Squilla interrupta* from Port Jackson reported by Stephenson & McNeill (1955) is referable to *E. grahami*. Ahyong & Manning (1998) noted that as well as colour in life, adult *E. grahami* could be distinguished from *E. serenei* by having a relatively longer prelateral lobe on the telson. *Erugosquilla grahami* also differs from *E. serenei* in having blunter dorsal processes of the antennular somite and unarmed lateral carinae on AS1.

Habitat. Sandy or sandy-mud substrates in shallow coastal embayments or protected waters to a depth of 66 m.

Distribution. Australia and Taiwan. The Australian range includes Botany Bay to northern New South Wales, and the Gulf of Carpentaria to Carnarvon, Western Australia.

Erugosquilla woodmasoni (Kemp, 1911)

Fig. 123

Squilla wood-masoni Kemp, 1911: 99; 1913: 74–76, pl. V: figs. 63–65 (type locality: Madras, India, by present lectotype designation).–Stephenson, 1952: 5–6.–Stephenson & McNeill, 1955: 243–244 (part).

Squilla woodmasoni.–Stephenson, 1953a: 42.–Manning, 1966: 100–101, fig. 5.

Oratosquilla woodmasoni.–Manning, 1971b: 11; 1978d: 36–39, figs. 21–22; 1991: 12–13.–Cannon *et al*., 1987: 63.

Oratosquilla tweediei Manning, 1971b: 11–14, fig. 4 (type locality: Singapore).

Oratosquilla jakartensis Moosa, 1975: 13–17, fig. 1 (type locality: Jakarta Bay, Indonesia).

Erugosquilla woodmasoni.–Manning, 1995: 200–204, pl. 36, figs. 123b, 124–126, 136k–m.–Ahyong & Manning, 1998: 661.

Type material. LECTOTYPE: USNM 143580, ♂ (TL 94 mm), Madras, India. PARALECTOTYPE: AM P3976, ♂ (TL 98 mm), Orissa coast, India, 13–15 m, R.M.S. Investigator.

Australian material. QUEENSLAND: AM E3158, 1♂ (CL 27.9 mm, broken), 19 km NE Bowen, 19°52'S 148°19'E, 35–46 m, FIS *Endeavour*, 1909–1914; AM P12266, 1♀ (TL 76 mm), Magnetic I., 19°08'S 146°50'E, 16 m, R. Bryson, 2 Mar 1953; AM P12977, 1♂ (TL 129 mm), between Hayman I. & Eshelby I., Cumberland Group, 20°03'S 148°53'E, 42 m, K. De Witte, 14 Sep 1957; AM P14182, 1♀ (TL 104 mm), Albatross Bay, Gulf of Carpentaria, 12°40'S 141°42'E, H. Foley, Jun 1962–Mar 1963; AM P14927, 1♂ (TL 119 mm), Weipa, Gulf of Carpentaria, 1961; AM P17735, 2♂♂ (TL 106–127 mm), 8 km N of Magnetic I., bottom trawl, G. Coates, Nov 1968; AM P17737, 2♀♀ (TL 112–135 mm), Townsville region, D. Fielder, pre 1965; AM P17740, 1♀ (TL 105 mm), Horseshoe Bay, Magnetic I., K. Bryson, 26 Apr 1966; AM P21635, 3♂♂ (TL 90–132 mm), 2♀♀ (TL 128–144 mm), SE Gulf of Carpentaria, 17°02'S 140°42'E, J. Yaldwyn & D. McMichael, Dec 1963; AM P21636, 1♂ (TL 124 mm), 2♀♀ (TL 92–125 mm), SE Gulf of Carpentaria, 17°02'S 140°42'E, CSIRO, 20 Nov 1963; AM P43208, 1♂ (TL 107 mm), 1♀ (TL 109 mm), S of Cooktown, 16°01'S 145°29'E, 20 m, on shell & mud, trawl, 6 Feb 1979; AM P43220, 1♂ (TL 122 mm), 3 km N of Split I., Shoalwater Bay, 22°23.25'S 150°43.89'E, 35 m, soft sandy substrate, trawl, S. Reader & D. Bray, 24 Oct 1993; AM P43239, 1♀ (TL 136 mm), Peel I., Moreton Bay, 7 m, sandy substrate with sponge (*Ircinia* sp.), weed & ascidians, otter trawl, A. Murray *et al*., 3 Jun 1993; AM P56911, 1♂ (TL 51 mm), NE of Shelburne Bay, 11°35.08'S 142°58.8'E, dredge, T. Wassenberg, 21 May 1992; AM P56874, 1♂ (TL 140 mm), Moreton Bay, 27°25'S 153°20'E, sand, mud, trawl, #129, Jul 1995; AM P56881–56882, 11♂♂ (TL 135–149 mm), 9♀♀ (TL 132–143 mm), Moreton Bay, 27°25'S 153°20'E, trawl, Jul 1997; AM P57094, 1♀ (TL 86 mm), Gulf of Carpentaria, between Karumba & Weipa, trawl, I. Loch, Dec 1976; NMV J37822, 1♀ (TL 133 mm), Deception Bay, 27°12'S 153°02'E, trawl, K. Simpson, 16–17 Mar 1987; NMV J37784, 1♂ (TL 102 mm), between Magnetic I. & Townsville, 6.4 m, trawl,

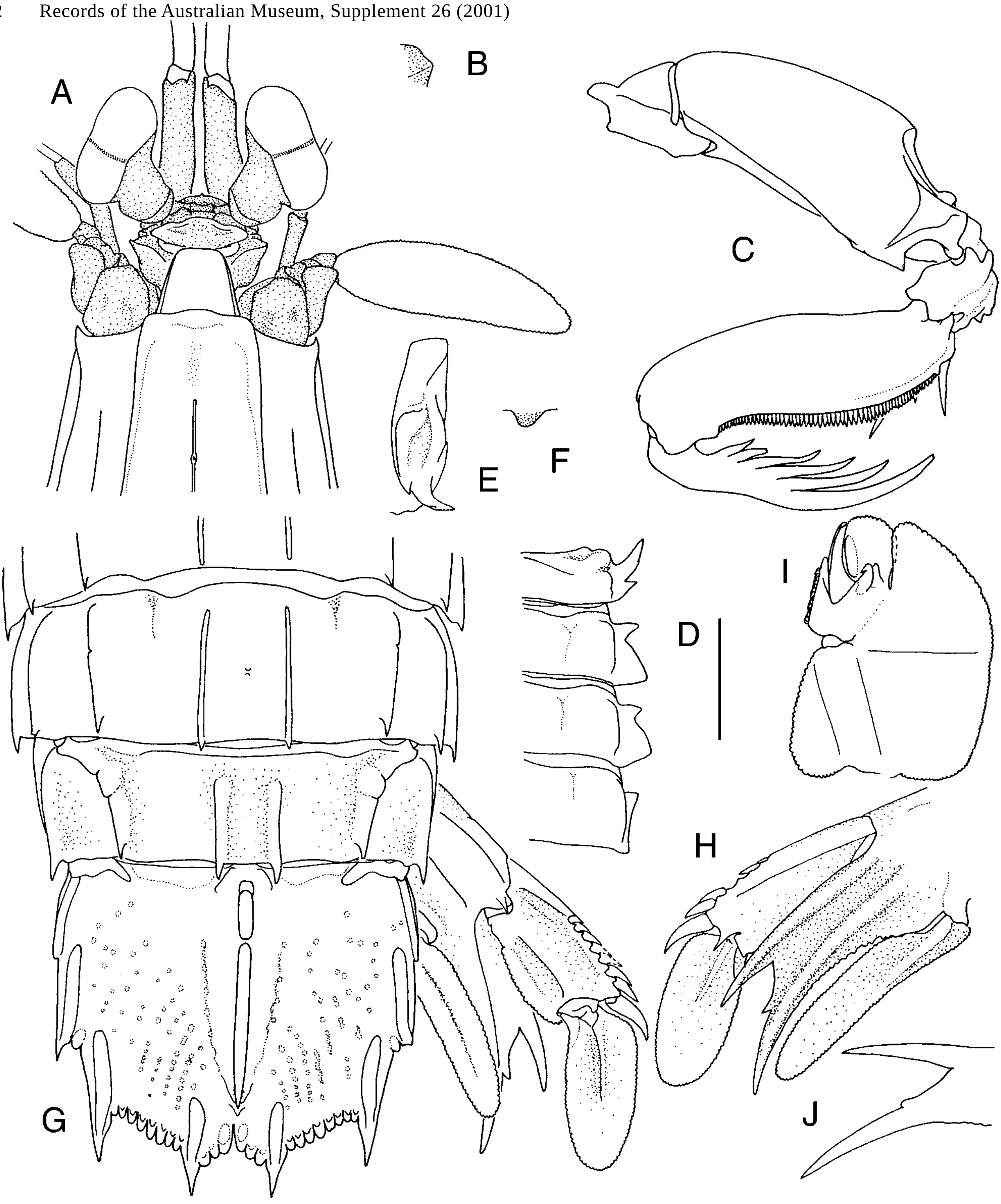

Figure 123. *Erugosquilla woodmasoni* (Kemp). A–H, ♂ TL 92 mm (AM P56876). I, ♂ TL 140 mm (AM P56882). J, ♀ TL 136 mm (AM P56881). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. J, uropodal protopod, right ventral. Scale A–I = 5 mm; J = 4 mm.

R. Bryson, autumn, 1952; QM W4703, 2♂♂ (TL 115–137 mm), W of Moreton I., trawl, 25 m, R. McKay, 26 Mar 1975; QM W24222, 1♂ (TL 139 mm), 1♀ (TL 145 mm), off Cairns, 17°00'S 145°57'E, 20 m, trawl, 25 Apr 1982; QM W24224, 1♂ (TL 135 mm), 2♀♀ (TL 142–145 mm), off Cairns, 17°00'S 145°57'E, 20 m, trawl, 25 Apr 1982; QM, 1♀ (TL 148 mm), Weipa, Gulf of Carpentaria, 12°48.70'S 141°31.08'E, AB11/94 stn 7, T. Wassenberg, Nov 1994; QM, 1♀ (TL 54 mm), N of Duyfken Point, Gulf of Carpentaria, 12°19.8'S 141°36.1'E, 13 m, trawl, SS0591 47, A. Bruce & R. Williams, 27 Nov 1991; QM, 1♂ (TL 126 mm), between Weipa and Karumba, E Gulf of Carpentaria, 10–30 m, 1976–1977; TM G41, 1♂ (TL 91 mm), between Magnetic I. &

Townsville, trawl, 6.4 m, R. Bryson, autumn 1952; USNM 125749 (part), 1♂ (TL 113 mm), Moreton Bay, 9.2 m, W. Stephenson, 29 Mar 1966; WAM C6852, 2♀♀ (TL 119–153 mm), 6.4 km ESE of Reef Point, Moreton Bay, 8 m, soft sandy mud, W. Stephenson, 12 Jun 1950; WAM C23539, 1♀ (TL 60 mm), Albatross Bay, 4.8 km off shore, Gulf of Carpentaria, 12°40'S 141°42'E, 7 m, dredge, mud with fine sand but no shells or weed, E. Gambung, 20 Jan 1962; WAM C23540, 1♀ (TL 84 mm), Albatross Bay, Gulf of Carpentaria, 12°40'S 141°42'E, 7.6 m, dredge, E. Gambung, 18 Jan 1962. NEW SOUTH WALES: AM P56876, 1♂ (TL 92 mm), 3♀♀ (TL 74–120 mm), Port Jackson, 33°55'S 151°15'E, 15–20 m, trawl, #127, M. Beatson, Feb 1994. WESTERN AUSTRALIA: AM P12372, 1♀ (TL 91 mm), ENE of White I., Shark Bay, 15°04'S 124°20'E, 7–11 m, otter trawl, K. Sheard; AM P12373–12374, 1♂ (CL 16.0, broken), 2♀♀ (CL 16.2–19.2, broken), mouth of Trubridge Creek, Exmouth Gulf, 21°53'S 114°22'E, 4 m, K. Sheard, 12 Sep 1952; AM P12375, 1♂ (TL 105 mm), 2♀♀ (broken, CL 22.3–25.8 mm), Learmouth, Exmouth Gulf, 21°53'S 114°22'E, 16 m, trawl, K. Sheard, 13 Sep 1953; AM P12376–12377, 2♂♂ (TL 110–122 mm), Exmouth Gulf, 21°53'S 114°22'E, 13 m, trawl, K. Sheard, 5 Sep 1953; NMV J37819, 1♀ (TL 137 mm), off Onslow, 20°20'S 114°40'E, 9 m, trawl, P. Gillies, 15 Jul 1980; WAM C7859, 1♀ (TL 136 mm), Exmouth Gulf, 21°05'S 114°15'E, trawl, R. McKay, Oct 1958; WAM C23533, 1♀ (broken, CL 24.3 mm), Exmouth Gulf, 21°05'S 114°15'E, R. Rowe, Aug 1973; WAM C23536, 1♀ (TL 110 mm), Exmouth Gulf area, trawl, J. Dobbyn, 1972. NORTHERN TERRITORY: AM P8450, 1♂ (TL 100 mm), Sir Edward Pellow Group, 15°33'S 135°47'E, seine net, K. Hudson; NMV J14450, 1♀ (TL 142 mm), 55 km NNW of Duyfken, Gulf of Carpentaria, 12°07'S 141°27'E, 36 m, L.C. Lu, 16 Sep 1982; NTM, 1♀ (TL 152 mm), Snake Bay, off Melville I., 60 m, trawl, Sep 1975; NTM, 1♀ (TL 115 mm), Shoal Bay area, 12 m, NT Fisheries, 17 Apr 1977; NTM, 1♂ (TL 90 mm), Shoal Bay, 12°17.55'S 130°53.5'E, 9–11 m, NT Fisheries, 27 Apr 1977.

Other material. LIPI CS160, 1♀ (TL 54 mm), Pasar Ikan fish market, Indonesia, M.K. Moosa, 22 May 1971 (holotype of *Oratosquilla jakartensis* Moosa). USNM 76026, 1♀ (TL 107 mm), Singapore, M.W.F. Tweedie, 1934 (holotype of *Oratosquilla tweediei* Manning).

Diagnosis. Ophthalmic somite anterior margin broadly rounded, usually with median spinule. A1 somite dorsal processes with obtuse apices, directed anterolaterally. Rostral plate short, broader than long, subtrapezoid. Raptorial claw dactylus with 6 teeth; merus outer inferodistal angle acutely angled or produced to a spine. SM (4)5–6, IM 3–6, LT 2–6, MG 1–5. Telson MD carina without rows of flanking tubercles; prelateral lobe length subequal to margin of LT tooth; denticles SM 2–4, IM 7–10, LT 1. Uropodal protopod terminal spines with lobe on outer margin of inner spine rounded to spiniform; exopod proximal segment outer margin with 7–10 movable spines.

Colour in life. Overall body colour is generally a uniform pale grey-green, but some specimens bear diffuse concentrations of chromatophores mid-dorsally on the abdominal somites giving a slightly mottled to somewhat banded appearance. Mid-dorsal surface of telson maroon. Uropodal exopod blue; distal segment dark blue mesially, pale blue or clear laterally. A2 protopod red-maroon.

Measurements. Male (n = 41) TL 51–149 mm, female TL (n = 47) 54–153 mm. CI 265–385. A1 peduncle 0.93–1.09 CL. A2 scale length 0.59–0.74 CL. Anterior carapace width 0.58–0.67 CL. The present series includes the largest known specimens of the species.

Remarks. The full range of morphological variation reported for *E. woodmasoni* and its synonyms (*O. jakartensis* and *O. tweediei*) is present in the Australian material. In material from Moreton Bay alone, the anterior bifurcation of the median carina of the carapace is faintly indicated in some specimens, completely suppressed in others; some specimens lack the usual median spinule on the anterior margin of the ophthalmic somite; the shape of the anterior lobe of the lateral processes of TS6–7 is variable; the lobe between the spines of the uropodal protopod is usually angular, but varies from low and rounded (Fig. 123J) to triangular (Fig. 123H); in most specimens the submedian carinae are posteriorly armed on AS5–6 only, but in some specimens, AS4 is also armed, either on both sides or one side only as in material reported from Malaysia (Manning, 1978d). Variability in spination of the submedian carinae of AS4 is also present in *E. hesperia* from the western Indian Ocean (see Tirmizi & Manning, 1968) and *E. serenei* from Vietnam (see Ahyong & Manning, 1998).

Erugosquilla woodmasoni can be distinguished from its congeners by the broadly rounded anterior margin of the ophthalmic somite and outer inferodistal margin of the merus of the raptorial claw that is usually produced to an acute point or spine. In other species of *Erugosquilla*, the anterior margin of the ophthalmic somite is trapezoid to broadly trianguloid, and the outer inferodistal margin of the merus of the raptorial claw is obtusely angled.

The specimens from Port Jackson represent the first records from New South Wales for *E. woodmasoni* since Kemp (1913). The records of Stephenson & McNeill (1955) and Graham *et al*. (1993a,b) of *E. woodmasoni* from New South Wales are based on *E. grahami*.

Kemp (1913) listed a series from Madras, India, as types but listed numerous specimens from Hong Kong to the Gulf of Aden as material examined. The original account of *E. woodmasoni*, however, does not specify a particular type series (Kemp, 1911). As shown by Ghosh & Manning (1988), the specimens listed by Kemp (1913) are all syntypes. Therefore, a male specimen from Madras, India (USNM 143580) is herein designated the lectotype. The remainder of Kemp's syntype series of *E. woodmasoni* in the Zoological Survey of India, other syntypes listed by Manning (1978d) and a specimen in the AM are paralectotypes.

Habitat. Level sandy-mud substrates in shallow embayments or other sheltered coastal waters; intertidal to around 50 m.

Distribution. Western Indian Ocean to Indonesia, Vietnam, the Philippines, Taiwan, Japan and Australia, from Port Jackson, New South Wales, north to Exmouth Gulf, Western Australia.

Fallosquilla Manning, 1995

Fallosquilla Manning, 1995: 204. Type species *Squilla fallax* Bouvier, 1914, by original designation and monotypy. Gender feminine.

Diagnosis. Eye elongate, with cornea bilobed, broader than and set transversely on stalk. Ocular scales partially fused. Carapace with anterolateral spines; without MD, IM, and LT carinae; posterolateral margin rounded. Raptorial claw dactylus with 4 or 5 teeth. Mandibular palp absent. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS5–7 lateral processes single. AS1–5 without SM carinae. Telson SM teeth with movable apices; dorsolateral and ventral surfaces with numerous supplementary longitudinal carinae and tubercles; prelateral lobe absent. Uropodal protopod inner margin armed with slender spines; protopod with 2 lobes between terminal spines.

Included species. One: *F. fallax* (Bouvier, 1914).

Remarks. Of the squilloids having single lateral processes of TS5–7 and having movable submedian teeth on the telson, *Fallosquilla* most closely resembles *Levisquilla*. Both genera bear a broad cornea, four epipods and lack the mandibular palp, but *Fallosquilla* differs in bearing four to five instead of six teeth on the dactylus of the raptorial claw, and numerous ventral carinae on the telson. Like *Levisquilla*, *Fallosquilla* is restricted to the Indo-West Pacific.

Fallosquilla fallax (Bouvier, 1914)

Fig. 124

Squilla fallax Bouvier, 1914: 699 (type locality: Port Louis, Mauritius); 1915: 308–311, figs. 39–42.
Squilla ambigua Hansen, 1926: 6, pl. 1: figs. 2a–e (type locality: E of Dangar Besar, Saleh-Bay, Indonesia, 8°26'S 117°40'E).
Clorida fallax.–Manning, 1968b: 8–11.–Makarov, 1979: 39.–Moosa, 1991: 198–199.
Fallosquilla fallax.–Manning, 1995: 24, 204.

Type material. LECTOTYPE: MNHN St 441, ♀ (TL 43 mm), Port Louis, Mauritius, P. Carié, 1913.

Australian material. QUEENSLAND: AM P54066, 1♂ (TL 55 mm), Gulf of Carpentaria, 10°58.5'S 141°12'E, 31 m, sandy mud, SS0390 056, T. Wassenberg, 1990. WESTERN AUSTRALIA: NTM Cr000806, 1♀ (TL 41 mm), Northwest Shelf, 19°58.9'S 117°51.3'E, 40 m, A. Bruce, 22 Apr 1983.

Other material. USNM 120322, 1♂ (TL 59 mm), New Georgia Island, Solomon Islands, L.A. Conwell, 25 Apr 1945; ZMA, 1♂ (TL 28 mm), anchorage E of Dangar Besar, Saleh-Bay, 36 m, Siboga Expedition St. 313, 14–16 Feb (holotype of *Squilla ambigua* Hansen).

Supplementary diagnosis. Eye small, elongate, cornea bilobed, broader than and set transversely on stalk. Ocular scales fused, but medially emarginate. A1 somite not greatly elongate; dorsal processes with slender, spiniform apices, directed anteriorly. Carapace with anterolateral spines; without carinae except for with reflected MG carina. Raptorial claw dactylus with 4 or 5 teeth, outer proximal margin with basal notch and low rounded lobe; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp absent. MXP1–4 with epipod. TS5 lateral process a single, short spine, directed anterolaterally; ventral spine slender, inclined anteriorly. TS6–7 lateral process single. AS1–5 without SM carinae. Abdominal somites armed on the as follows: SM 6, IM 6, LT 6, MG (5). Telson SM teeth with movable apices; dorsolateral and ventral surfaces with numerous supplementary longitudinal carinae and tubercles; dorsal carinae irregular or serrated; postanal carina with posterior spine; prelateral lobe absent; denticles SM 4–5, IM 5–9, LT 1. Uropodal protopod inner margin armed with 4–7 slender spines; protopod terminal spines with 2 lobes between spines, distal lobe on outer margin of inner spine rounded, broader than adjacent spine and deflected dorsally, proximal lobe rounded, smaller than distal. Uropodal exopod proximal segment with 5 movable spines.

Colour in alcohol. Carapace with diffuse transverse patch of chromatophores anteriorly and medially; posterolateral angles with dark diffuse patch enclosed by reflected marginal carinae. Abdomen with scattered chromatophores dorsally, chromatophores more concentrated laterally. Uropodal exopod with dark patch extending from distal ½ of proximal segment onto inner ½ of distal segment. Uropodal endopod with distal ½ dark.

Measurements. Male (n = 3) TL 28–59 mm, female (n = 2) TL 41–43 mm. CI 450–600. A1 peduncle 0.56–0.65 CL. A2 scale 0.31–0.35 CL. Anterior carapace width 0.37–0.48 CL. The present series includes the largest known of the species.

Remarks. Of the two specimens in the syntype series of *F. fallax*, the 43 mm TL female (MNHN St 441) is herein designated as the lectotype to fix the identity of the species. The Australian specimens agree well with the lectotype and published accounts (Bouvier, 1914, 1915; Hansen, 1926; Holthuis, 1967b; Manning, 1968b, 1995). The lectotype differs from the Australian specimens in having some of the ventral telson carinae more tuberculate and having some of the dorsal telson carinae slightly more serrated as in a specimen reported by Manning (1968b) from the Solomon Islands (USNM 120322), re-examined here. Although Bouvier's (1915) figure of the male paralectotype indicates that most telson carinae are broken, the illustration is stylized; these carinae are dorsally serrate as in the lectotype. Similarly, the telson carinae in the holotype of *Squilla ambigua* bears dorsally serrated telson carinae as in each of the specimens examined here.

Stephenson & McNeill's (1955) record of *Squilla fallax* from Port Jackson, New South Wales is based on *Levisquilla jurichi* (Makarov, 1979).

Habitat. Sandy mud substrates from 31–40 m. Moosa (1991) reported a bathymetric range for *F. fallax* of 27–78 m in New Caledonia.

Distribution. Indo-West Pacific from Mauritius and the Comoro Islands (Manning, 1968b), the Red Sea (Holthuis, 1967b), Indonesia (Hansen, 1926), Vietnam (Manning, 1995), the Solomon Islands (Manning, 1968b), New Caledonia (Moosa, 1991) and now from Australia.

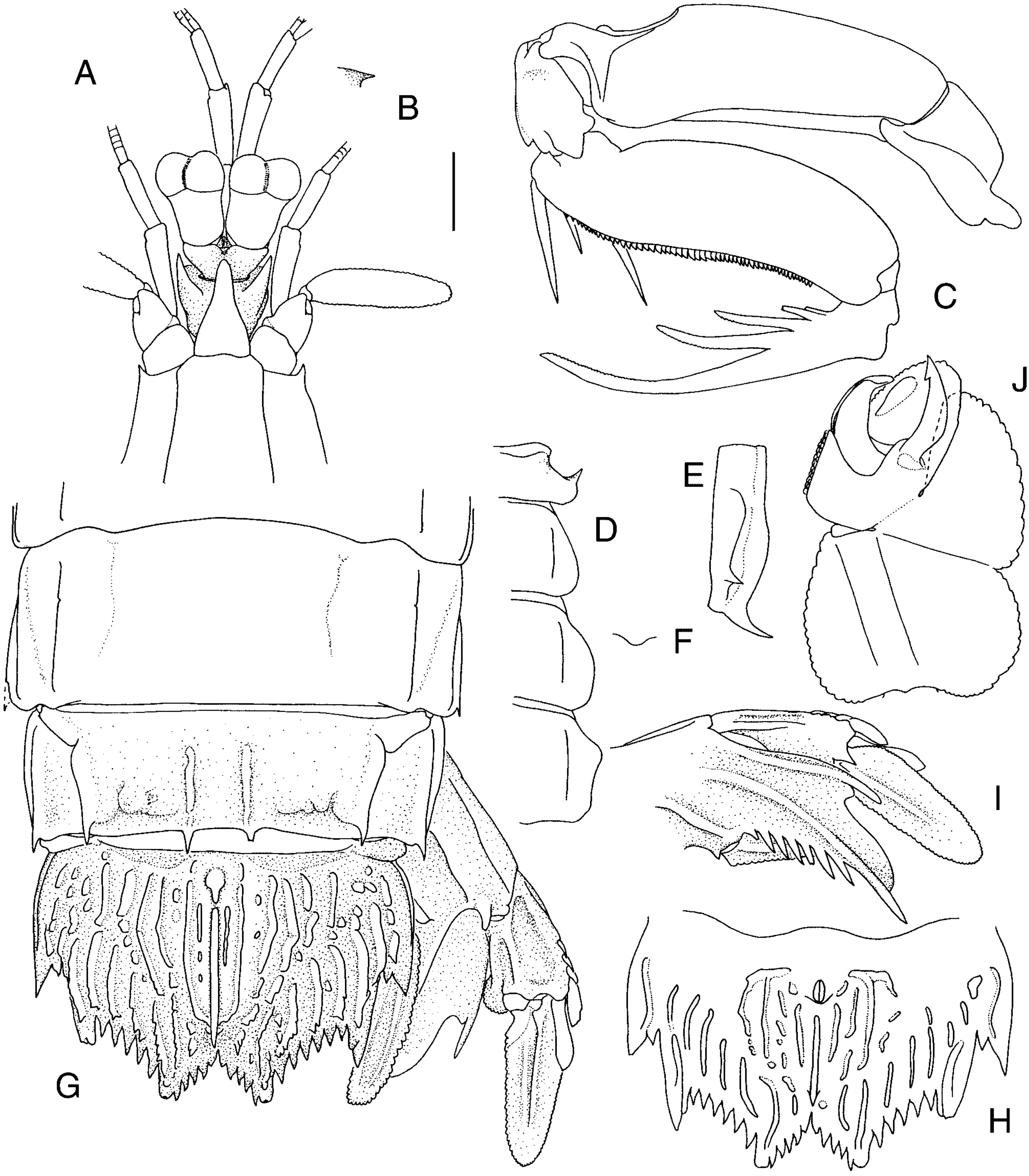

Figure 124. *Fallosquilla fallax* (Bouvier), ♂ TL 55 mm (AM P54066). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, left lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS5–6, telson & uropod, dorsal. H, telson, ventral. I, uropod, right ventral. J, PLP1 endopod. Scale A–I = 2 mm; J = 1 mm.

Harpiosquilla Holthuis, 1964

Harpiosquilla Holthuis, 1964: 140. Type species *Squilla harpax* de Haan, 1844, by original designation. Gender feminine.

Diagnosis. Eye large, T-shaped, cornea width less than 0.3 CL, strongly bilobed, distinctly broader than and set transversely on stalk. Ocular scales broad, rounded or truncate; separate. A1 somite not greatly elongate; dorsal processes slender, with acute apices, directed anterolaterally. Carapace with anterolateral spines; with normal complement of carinae, or without MD carina; MD carina interrupted, anterior bifurcation absent; posterolateral margin deeply excavate. Raptorial claw dactylus with 7–9 teeth; carpus dorsal carina absent; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–5 each with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS6–8 with IM and usually with SM carinae. TS5 lateral process single; ventral process directed ventrally. TS6–7 lateral processes single or bilobed. AS1–5 usually with normal complement of carinae, or without SM carinae. Telson SM teeth with fixed apices in adults; prelateral lobe present; dorsolateral surface without supplementary longitudinal carinae. Uropodal protopod inner margin crenulate.

Included species. Eight: *H. annandalei* (Kemp, 1911); *H. harpax* (de Haan, 1844); *H. indica* Manning, 1969b; *H. melanoura* Manning, 1968b; *H. philippina* Garcia, 1978; *H. raphidea* (Fabricius, 1798); *H. sinensis* Liu & Wang, 1998; and *H. stephensoni* Manning, 1969b.

Remarks. A significant finding of the present study of *Harpiosquilla* is the presence of variability in characters previously regarded as diagnostic for species of *Harpiosquilla*. Several species have been described based on narrow distinctions in these characters that are now known to be variable. Thus, the presence of the apical projection of the rostral plate is variable in *H. harpax* and *H. melanoura*; the apical projection is usually distinct, may be lacking entirely or show an intermediate form. The relative lengths of the lateral and marginal carinae of the telson are also variable in all of the species examined—they can still be useful distinguishing characters, but the range of variation must be considered when identifying species. In *H. stephensoni*, the lateral carina may be half or greater than the length of the marginal carina and in *H. annandalei* and *H. sinensis*, the lateral carina is approximately half the marginal carina length but may be slightly longer or shorter. In *H. harpax* and *H. melanoura*, the lateral carina varies from approximately one third to half the length of the marginal carina. Thus, the relative length of the lateral carina in *H. harpax* and *H. melanoura* overlaps that of *H. japonica* and *H. intermedia* in which the lateral carina is usually half or greater than half the length of the marginal carina. I can find no character to distinguish *H. harpax* from *H. japonica* and *H. intermedia*, and the three species are synonymized. Similarly, *H. paradipa* and *H. malagasiensis* are also synonymized with *H. harpax* below. The variation in the relative lengths of the lateral and marginal carinae of the telson suggests that the validity of *H. philippina* as distinct from *H. indica* require re-evaluation. *Harpiosquilla philippina* and *H. indica*, however, are not known from Australian waters and will be treated in a forthcoming study.

Of the eight nominal species of *Harpiosquilla*, five are known from Australia. *Harpiosquilla sinensis* Liu & Wang, 1998, has recently been reported from Australia (as *H. ocellata* Ahyong, Chan & Liao, 1998) and *H. annandalei* is reported for the first time from Australia.

Key to species of *Harpiosquilla*

1 Carapace without MD carina. Distal segment of uropodal exopod black .... ***H. melanoura***

—— Carapace with MD carina. Distal segment of uropodal exopod at black on inner ½ or with pale midband 2

2 TS7–8, usually 6–8, with IM carinae armed posteriorly 3

—— TS6–8, with IM carinae unarmed posteriorly 5

3 Rostral plate with long apical projection; margins concave .... *H. raphidea*

—— Rostral plate without apical projection; margins convex 4

4 SM carinae of AS5 armed posteriorly. Distal segment of uropodal exopod black with yellowish midline .... ***H. annandalei***

—— SM carinae of AS5 unarmed posteriorly. Distal segment of uropodal exopod black on inner ½ .... ***H. sinensis***

5 Raptorial claw with 7 teeth .... ***H. stephensoni***

—— Raptorial claw with 8 or 9 teeth 6

6 Dactylus of raptorial claw with 8 teeth. TS6–8 with SM carinae. AS1–5 usually with SM carinae (occasionally absent on some somites). MG carina of telson usually more than twice as long as LT carina .... ***H. harpax***

—— Dactylus of raptorial claw with 9 teeth. TS6–8 and AS1–5 without SM carinae. MG carina of telson less than or about twice as long as LT carina 7

7 AS2 with IM carina unarmed posteriorly. MG carina of telson less than twice as long as LT carina .... *H. indica*

—— AS2 with IM carina armed posteriorly. MG carina of telson about twice as long as LT carina .... *H. philippina*

Harpiosquilla annandalei (Kemp, 1911)

Fig. 125

Squilla annandalei Kemp, 1911: 99 (type locality: Gulf of Martaban, Burma, 14°48'N 95°52'E); 1913: 3, 10, 24, 92, pl. 7, figs. 78–80.

Harpiosquilla annandalei.–Manning, 1965: 250, pl. 11: fig. a.–Lee & Wu, 1966: 51, fig. 6a,b.–Manning, 1969b: 5–9, pl. 27, figs. 1–3; 1995: 148–153, figs. 87a,c, 88d, 89a, 90b–e, 91d, 92f, 94d.

Material. QUEENSLAND: AM P57037, 1♀ (TL 136 mm), N of Wellesley Is, Gulf of Carpentaria, 14°00.7'S 139°11.6'E, 59 m, SS0390 35, T. Wassenberg, 28 Nov 1990; AM P56892, 1♀ (TL 137 mm), Arafura Sea, 10°58.1'S 138°41.8'E, 52 m, SS0390 084, T. Wassenberg, 9 Dec 1990. WESTERN AUSTRALIA: NMV J13888, 1♀ (TL 111 mm), Northwest Shelf, between Port Hedland & Dampier, 19°27'S 117°5'E, 94.0 m, silty sand trawl, G. Poore & H. Lew Ton, 7 Jun 1983; WAM C9551, 1♂ (TL 82 mm), 3♀♀ (TL 58–103 mm), off Northwest Cape, 21°48'S 113°56'E, 123–128 m, beam trawl, 1 Feb 1964. NORTHERN TERRITORY: AM P49678, 1♀ (TL 103 mm), Arafura Sea, 10°26.0'S 136°25.8'E, 58 m, otter trawl on sand, Alpha Helix stn 12, E. Ball & J. Paxton, 17 Mar 1975; AM P54461, 1♂ (TL 99 mm), Arafura Sea, 10°S 137°E, 60–80 m, T. Wassenberg, 13 Oct 1992; NTM Cr010833, 1♀ (TL 123 mm), Gulf of Carpentaria, 14°06.9'S 137°33.0'E, 47 m, dredge, P. Alderslade, 01 Dec 1990; AM P56982, 2♀♀ (TL 48–100 mm), NE of Wessell Is, 10°30.12'S 137°12.03'E, 50 m, SS0390 002, T. Wassenberg, 22 Nov 1990; AM P56983, 1♀ (TL 100 mm), Arafura Sea, 10°S 137°E, 60–80 m, NT Fisheries, 18 Oct 1992; AM P57036, 1♂ (TL 77 mm), 1♀ (TL 57 mm), Arafura Sea, 10°03.2'S 137°11.2'E, 42 m, SS0390 001, T. Wassenberg, Nov 1990.

Diagnosis. Rostral plate without slender median projection; margins convex, apex rounded. Carapace with MD carina. Raptorial claw dactylus with 8 teeth, without angular projection in adult males. TS6–8 with distinct SM carinae; IM carinae armed posteriorly. TS5 IM carina produced to a short spine, directed laterally; ventral process triangular, apex acute. TS8 sternal keel produced posteriorly, apex usually sharp. AS1–5 with distinct SM carinae. Abdominal carinae spined as follows: SM 5–6, IM 1–6, LT 1–6, MG 1–5. Telson MD carina proximally with distinct dark oval “eye-spot” on either side, pale in outline; MG carina less than twice LT carina length; denticles SM 4–8, IM 9–14, LT 1; postanal carina not extending midway between anal pore and posterior margin. Uropodal exopod proximal segment outer margin with 8–10 movable spines; distal segment black with pale midline.

Colour in life. Overall dorsal colour pale grey, with scattered chromatophores over dorsal surface. Carapace grooves and carinae dark brown. Thoracic and abdominal somites with submedian carinae and posterior margin dark brown. AS2 with medial, black transverse bar. AS1 and 3–5 with traces of broken transverse bar. Telson with pair of dark brown eye-spots surrounded by white margin. Uropodal exopod with proximal segment black on inner ½; distal segment black with yellow midline. Second and third segment of A1 peduncle with one proximal and one distal black spot. Raptorial claw merus with inner black spot and yellow meral depression.

Measurements. Male (n = 3) TL 58–103 mm, female TL (n = 12) 48–137 mm. CI 258–339. A1 peduncle length 1.09–1.23 CL. A2 scale length 0.55–0.69 CL. Anterior carapace width 0.39–0.48 CL. The present series includes the largest known specimen of the species.

Remarks. The Australian specimens agree well with Manning (1965, 1969b) differing chiefly in the relative length of the antennular peduncle. The antennular peduncle in the Australian material is longer than the carapace length but shorter than the carapace length and rostral plate combined, thus approaching Vietnamese material (Manning, 1995) in which the antennular peduncle was as long as the carapace length and rostral plate combined. In Australian material, however, the pigmentation of the distal segment of the uropodal exopod resembles that displayed by a specimen from the Gulf of Oman (AM P16824) and a Japanese specimen figured by Manning (1965). The sternal keel of TS8 in the Australian specimens varies from being slender and acute to laterally compressed and blunt as in *H. sinensis*.

Habitat. Silty sand at depths between 47 m and 123–128 m. Manning (1969b) reported a bathymetric range of 15–206 m.

Distribution. Western Indian Ocean to the Philippines, Japan, Taiwan, Vietnam (Manning, 1995) and for the first time from Australia.

Harpiosquilla harpax (de Haan, 1844)

Fig. 126

Squilla harpax de Haan, 1844 (atlas): pl. 51, fig. 1 (type locality: Japan); 1849: 222 (text).–Tiwari & Biswas, 1952: 358, figs. 3b, d, f.

Squilla raphidea.–Stephenson, 1952: 4, 5; 1953a: 43.–Stephenson & McNeill, 1955: 239–240 (part, not *Squilla raphidea* Fabricius, 1787).

Harpiosquilla harpax.–Manning, 1968b: 15–18, fig. 4; 1969b: 6, 25–33, figs. 28–38; 1991: 8; 1995: 148, 153–158, pl. 28, figs. 90a, 92b, 93, 95, 96.–Yamaguchi & Baba, 1993: 179–180, fig. 11.–Ahyong & Norrington, 1997: 106.–Ahyong *et al*., 1999:

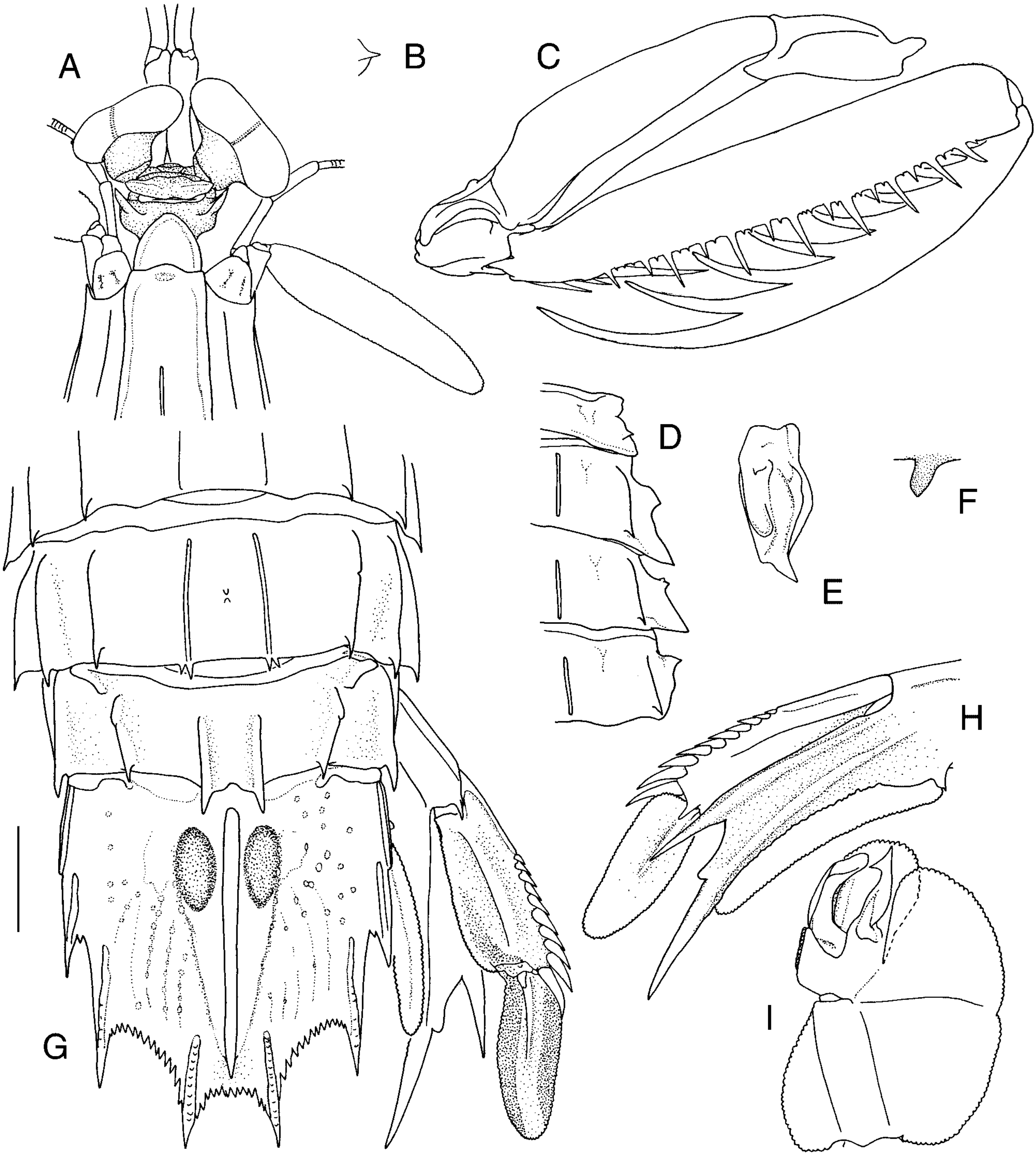

Figure 125. *Harpiosquilla annandalei* (Kemp), ♂ TL 99 mm (AM P54461). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, left lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 5 mm; I = 2.5 mm.

38, 41, fig. 2a–d.–Ahyong & Ebach, 1999: 227–228.

Harpiosquilla japonica Manning, 1969b: 15–17, figs. 10–11 (type locality: Wakanoura, Kii, Japan).–Garcia, 1978: 236; 1981: 14–16.–Manning, 1995: 158–160, figs. 87b,d, 88b, 91b, 92a,e, 94b; new synonymy.

Harpiosquilla intermedia Manning & Michel, 1973: 113–116, figs. 1, 2b (type locality: Baie de Ducos, New Caledonia).–Garcia, 1978: 236; 1981: 13–14; new synonymy.

Harpiosquilla malagasiensis Manning, 1978c: 30, fig. 15 (type locality: Tamatave, Madagascar); new synonymy.

Harpiosquilla paradipa Ghosh, 1987: 306–308, fig. 1 (type locality: Paradip, India); new synonymy.

Australian material. QUEENSLAND: AM G1792, 1♂ (broken, CL 36.2 mm), Cape Flattery, 14°58'S 145°21'E, P. Dawson, 1898; AM P12256, 1♀ (TL 248 mm), Tin Can Bay, 25°54'S 153°01'E, from

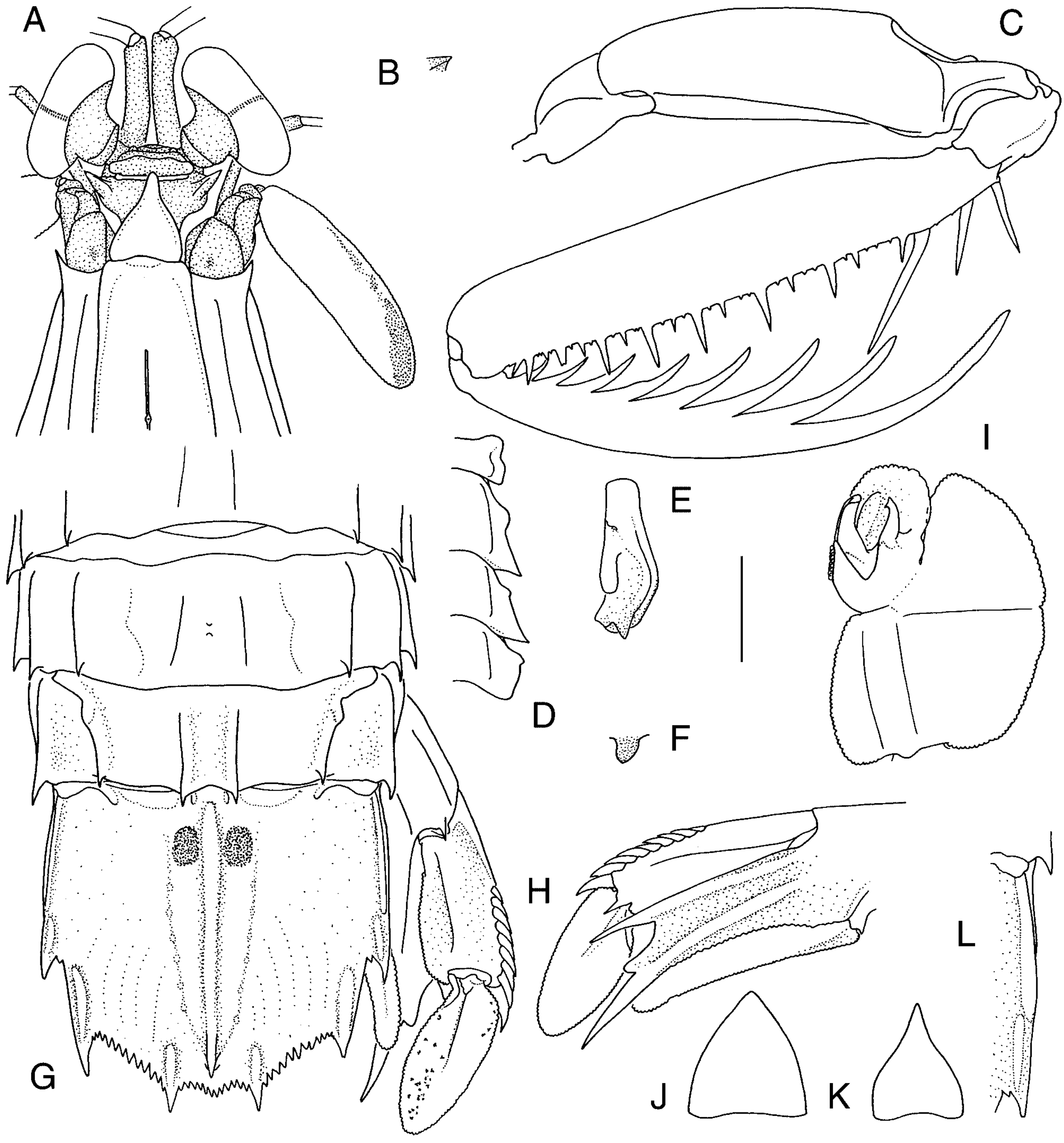

Figure 126. *Harpiosquilla harpax* (de Haan). A–I, ♂ TL 98 mm (AM P43223). J, ♀ TL 257 mm (QM W12234). K,L, ♀ TL 195 mm (QM W16649). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. J,K, rostral plate, dorsal. L, telson lateral & marginal carina, right dorsal. Scale A–H = 5 mm; I = 2.5 mm; J–L = 3 mm.

net, C. Lea, 7 Jul 1952; AM P15508, 1♀ (broken, CL 39.5 mm), off North East I., near Groote Eylandt, western Gulf of Carpentaria, 21°40'S 150°20'E, 45 m, CSIRO Prawn Survey, 4 Sep 1963; AM P17744, 1♀ (TL 140 mm), 2♂♂ (TL 134 mm), Magnetic I., K. Bryson, 6 Apr 1963; AM P17747, 1♀ (TL 220 mm), 8 km N of Magnetic I., trawl, G. Coates, Nov 1968; AM P43223, 1♂ (TL 98 mm), 5.5 km E of Cliff Point, Shoalwater Bay, 22°38.8'S 150°51.0'E, 36.6 m, on sand, trawl, S. Reader & D. Bray, 23 Oct 1993; QM W1248, 1♀ (TL 235 mm), Peel I., Moreton Bay, L. Klinger, 13 May 1941; QM W1726, 1♀ (TL 175 mm), off Cooktown, Jul 1992; QM W1727, 1♂ (broken, CL 32.2 mm), near Southport, 27°58'S 153°25'E, M. Hage; QM W3155, 1♀ (TL 262 mm), Moreton Bay, 27°00'S 153°00'E; QM W3940, 1♀ (TL 215 mm), 6.4 km N of Scarborough, Moreton Bay, caught in crab pot, R. Temme, 26 Oct 1973; QM W7456, 1♀ (TL 175 mm), off Sandgate, Moreton Bay, W. Croft, 30 May 1977; QM W9753, 1♂ (TL 216 mm), Moreton Bay, C. Freeleague, 22 Aug 1950; QM W12861, 1♂ (TL 147 mm), SE end of Hinchinbrook I., 18°27.5'S 146°22.7'E, trawl, C. Jones, 17 Mar 1985;

QM W12232, 1♂ (TL 165 mm), Princess Charlotte Bay, 19.8–27 m, mud & hard rubble, N. Haysom, 20 Mar 1958; QM W12233, 1♂ (TL 182 mm), off White Cliffs, N of Cairns, 16°35'S 145°31'E, 7.3 m, otter trawl on mud & sand, N. Haysom, 12 Mar 1958; QM W12234, 1♀ (TL 257 mm), Deception Bay, Moreton Bay, 27°12'S 153°02'E, tidal flats, G. Livingstone; QM W12235, 1♀ (TL 202 mm), Cumberland Group, N. Haysom, Aug 1957; QM W12863, 1♂ (TL 188 mm), near Cape Bowling Green, 19°17.4'S 147°19.3'E, trawl, C. Jones, 9 May 1985; QM W14225, 1♀ (TL 224 mm), off Cairns, inshore trawl, D. Tuma, Aug 1987; QM W15201, 1♀ (TL 200 mm), Queensland; QM W16649, 1♀ (TL 195 mm), Flinders I., 14°10'S 144°10'E, trawl, D. Tuma, May 1990; QM, 1♀ (TL 195 mm), Brighton, Moreton Bay, H. Snow, 9 Apr 1952; AM P57038 (to QM), 1♂ (TL 187 mm), Gulf of Carpentaria, 13°30.2'S 138°42.1'E, 55 m, SS0390 89, T. Wassenberg, 10 Dec 1990;WAM C6851, 1♂ (TL 178 mm), Queensland, T. Marshall, 5 Sep 1951. NEW SOUTH WALES: AM P12229, 1♂ (broken, CL 27.5 mm), Bobbin Head, west Jerusalem Bay, Hawkesbury River, from stomach of flathead (Platycephalidae), S. Wagg, May 1952; AM P12230, 1♂ (TL 152 mm), Hawkesbury River, 9 m, entangled in fisherman's line, E. Mullins, Mar 1952; AM P12334, 1♂ (TL 165 mm), Cowan Creek, Hawkesbury River, 33°36'S 151°10'E, from stomach of flathead (Platycephalidae), W. Mayo, Mar 1950; AM P12512, 1♀ (TL 225 mm), Newcastle Harbour, 32°56'S 151°46'E, trawl, A. Racek, 27 May 1954; AM P15399, 1♀ (TL 143 mm), Jerusalem Bay, Hawkesbury River, R. Woodger; AM P15400, 1♀ (TL 190 mm), Cowan Creek, Hawkesbury River, 33°36'S 151°10'E, handline & baited hook, L. Kelly, 23 Apr 1960; AM P15401, 1♀ (TL 185 mm), Cowan Creek, Hawkesbury River, 33°36'S 151°10'E, handline & baited hook, A. Leslie, 18 Mar 1961; AM P15402, 1♀ (TL 180 mm), Jerusalem Bay, Hawkesbury River, 9 m, handline baited with small fish, A. Iverach, 24 Jan 1965; AM P15403, 1♀ (TL 195 mm), Cowan Creek, Hawkesbury River, 33°36'S 151°10'E, 4 m, handline baited with prawn, A. Distin Morgan, 26 Apr 1965; AM P24992, 1♀ (TL 195 mm), near Jerusalem Bay, Hawkesbury River, hand line, K. Dean, 26 Oct 1976; AM P43217, 1♀ (TL 171 mm), Botany Bay, 15 m, soft bottom trawl, N. Coleman, 17 Oct 1979; AM P49687, 1♂ (TL 210 mm), Bald Rock Point, Cowan Waters, Hawkesbury River, caught on prawn bait, J. Ray, 21 Feb 1975; AM P56980, 1♀ (TL 197 mm), Botany Bay, prawn trawl, S. Ahyong, Nov 1990; QM W24223, 1♂ (TL 124 mm), off Cairns, 17°00.0'S 145°57.0'E, 20 m, trawl, 25 Apr 1982; SAM 5757, 1♂ (TL 167 mm), Cowan Creek, Hawkesbury River, J. Baker, 16 Jan 1978. NORTHERN TERRITORY: AM P56962, 1♂ (TL 55 mm), N of Groote Eylandt, 12°57.3'S 136°46.1'E, 32 m, SS0390 008, T. Wassenberg, 23 Nov 1990; AM P57039, 1♀ (TL 155 mm), off Nhulunbuy, 12°04.3'S 136°45.0'E, SS0591 002, T. Wassenberg, 19 Nov 1991; NTM Cr012181, 1♀ (TL 225 mm), Arafura Sea, 12°58.0'S 132°10.0'E, 27 m, H. Larson, 19 Oct 1981; NTM, 1♀ (TL 195 mm), NW of Cape Wessell, Arafura Sea, 10°24'S 136°32'E, 57 m, silty sand, pair trawl, R. Williams, 2 Feb 1985; NTM, 1♂ (TL 165 mm), N of Melville I., Arafura Sea, 10°51'S 130°43'E, 14 Oct 1975. WESTERN AUSTRALIA: NTM Cr007680, 1♀ (TL 183 mm), Joseph Bonaparte Gulf, 13°39.00'S 128°08.50'E, 70 m, DW-29, D. White, 27 Jun 1990.

Other material. USNM 26340, 1♀ (TL 172 mm), Wakanoura, Kii, Japan, Jordan & Snyder, 1900 (holotype of *Harpiosquilla japonica* Manning); USNM 125718, 1♂ (TL 165 mm), 1♀ (TL 135 mm), Wakanoura, Kii, Japan, Jordan & Snyder, 1900 (paratype of *Harpiosquilla japonica* Manning); USNM 141791, 1♀ (TL 209 mm), Baie de Ducos, New Caledonia, 6 m, mud, A. Michel, Dec 1970; USNM 141792, 1♂ (TL 200 mm), Baie de Ducos, New Caledonia, 6 m, mud, A. Michel, Dec 1970; ZMH K7364, 1♀ (TL 196 mm), Tamatave, Madagascar, Von Rosenberg, 11 Nov 1907 (holotype of *Harpiosquilla malagasiensis* Manning).

Diagnosis. Rostral plate longer than broad; triangular to cordiform; usually with slender median projection; margins usually sinuous, apex blunt. Carapace with MD carina. Raptorial claw dactylus with 8 teeth, outer margin strongly angular in adult ♂♂. TS5 IM carina low, irregular; ventral process triangular, apex acute, posterior margin slightly convex. TS6–8 with SM and IM carinae, unarmed posteriorly. TS8 sternal keel rounded, inclined posteriorly. AS1–5 with low or near absent SM carinae. Abdominal carinae spined as follows: SM 6, IM (1–2)3–6 (usually 2–6), LT 1–6, MG 1–5. Telson MD carina proximally with diffuse dark patch on either side of midline; with MG carina less than to greater than twice LT carina length, usually exceeding twice LT carina length; denticles SM 4–6, IM 10–14, LT 1; postanal carina extending midway between anal pore and posterior margin. Uropodal exopod proximal segment outer margin with 8–10 movable spines; exopod distal segment dark on inner ½ only.

Colour in life. Overall dorsal colour light grey-brown with slightly mottled appearance. Carinae and grooves of carapace, and posterior margins of body somites black-brown. AS6 with dark-green carinae. Telson with median carina and carinae of primary teeth green; median carina with proximal pair of dark spots. Uropodal endopod black-brown distally. Uropodal exopod with inner ½ black-brown, but with demarcation between inner and outer halves diffuse. A2 scale with outer distal margin black. Raptorial claw with meral depression yellow flanked proximally by diffuse black crescent.

Measurements. Male (n = 22) TL 55–216 mm, female (n = 32) TL 140–262 mm. CI 278–360. A1 peduncle 0.85–1.35 CL. A2 scale 0.55–0.69 CL. Carapace anterior width 0.41–0.49 CL. The 262 mm TL female reported here is the largest known of the species.

Remarks. *Harpiosquilla harpax* is the most widely distributed species of the genus and is the most common *Harpiosquilla* in Australian waters. Some characters, previously regarded as diagnostic for *H. harpax* are variable in the specimens examined. Thus, the rostral plate margins are usually sinuous with a slender apical projection. As noted by Holthuis (1967b) and Manning (1969b), however, the length and distinctness of the apical projection is variable and many specimens studied show intermediate rostral plate morphologies. The rostral plate of the lectotype of *H. harpax* bears a slender apical projection. In several Australian specimens and a paralectotype of *H. harpax* figured by Yamaguchi & Baba (1993: fig. 11), however, the rostral plate lacks the apical projection entirely, having convex margins, resembling that of the types of *H. japonica* (Fig. 126J). Similarly, the length of the lateral carinae of the telson with respect to the marginal carina is also variable. In *H. harpax* the lateral carina is usually distinctly less than one half the length of marginal carina (Manning, 1969c, 1995), but may exceed half the marginal carina length (Fig. 126L) overlapping other nominal species such as *H. japonica* in which the length of the lateral carina is usually half or greater than half that of the marginal carina. Two specimens show variation in the number of teeth on the dactyli of the raptorial claws, one specimen with seven and eight teeth, and another with eight and nine teeth; in both, the aberrant claw appears to be regenerating.

Harpiosquilla japonica and *H. intermedia* were characterized by lacking the distinct apical projection on the rostral plate and distinguished by differences in the relative length of the rostral plate and marginal carinae of the telson. The variation now known to be present in the rostral plate morphology and relative lengths of the telson carinae in *H. harpax* shows that it is a senior synonym of *H. japonica* and *H. intermedia*.

Harpiosquilla malagasiensis from Madagascar, known only from the holotype, agrees closely with *H. harpax*, including the short lateral carinae of the telson, and differs in having an apically rounded rostral plate. The condition of the rostral plate in the holotype of *H. malagasiensis*, re-examined for this study, appears to be the result of damage. The submedian carinae on AS1–4 in *H. malagasiensis* are slightly more distinct than is usual in *H. harpax*, but are within the range of variation of the latter. Therefore, I consider *Harpiosquilla malagasiensis* to be based on a specimen of *H. harpax* with a damaged rostral plate. Manning (1968b) has already reported *H. harpax* from Madagascar.

Ghosh (1987) described *H. paradipa* from Paradip, India, distinguished by the absence of a distinct apical projection on the rostral plate, the absence of submedian carinae on AS1–5, and the intermediate carina of the telson being half the length of the marginal carina. As already noted, the length of the intermediate carina is variable in *H. harpax*. The rostral plate of *H. paradipa*, figured by Ghosh, has sinuous margins and is within the normal range of variation already reported by Manning (1969b). The reported absence of submedian carinae on AS1–5 in *H. paradipa* are likely a misinterpretation since the distinctness of the submedian carinae is variable and may be near absent and difficult to detect in *H. harpax* unless the surface of the cuticle is dried. Moreover, Ghosh reported that submedian carinae were present on the thoracic somites. Thus, *H. paradipa* must be considered a synonym of *H. harpax* because the characters apparently distinguishing the former are in fact typical of the latter.

The lectotype of *H. harpax* (male, TL 152.5 mm, NNM 28H) was selected by Manning (1968b) instead of Yamaguchi & Baba (1993) as indicated by Fransen & Holthuis (2000).

Habitat. Sandy-mud substrates in shallow coastal waters including estuaries and embayments, from the intertidal zone to 70 m. Manning (1969b) reported *H. harpax* from as deep 93 m.

Distribution. Widely distributed in the Indo-West Pacific from the Red Sea and western Indian Ocean to Taiwan, the Philippines, Vietnam, Japan, New Caledonia and Australia. In Australia, *Harpiosquilla harpax* is known from Joseph Bonaparte Gulf, Western Australia, eastwards to Botany Bay, New South Wales.

Harpiosquilla melanoura Manning, 1968b

Fig. 127

Squilla raphidea.–Stephenson & McNeill, 1955: 239–240 (part, not *S. raphidea* Fabricius, 1787).

Harpiosquilla melanoura Manning, 1968b: 14, 18–21, fig. 5 (type locality: Banc de Pracel, W coast of Madagascar 17°00'S 43°30'E); 1969b: 6, 21–25, figs. 18–27.–Moosa, 1989: 228.–Manning, 1995: 148, 160–161, figs. 88a, c, 89 b, 91a, 92d, 94c.–Graham *et al*., 1993a: 24, 64; 1993b: 73.

Type material. HOLOTYPE: USNM 124092, ♂ (TL 129 mm), Banc de Pracel, W coast of Madagascar, 55 m, sand, A. Crosnier, Jul 1959.

Australian material. QUEENSLAND: AM P49679, 1♂ (TL 131 mm) off Mooloolaba, 26°41'S 153°08'E, 47 m, N. Coleman, Apr 1969; AM P56974, 1♀ (TL 168 mm), Shelburne Bay, 11°14.02'S 143°25.98'E, T. Wassenberg, 29 Mar 1993; AM P56976, 1♀ (TL 130 mm), NE of Shelburne Bay, 11°30'S 143°30'E, T. Wassenberg, 25 Nov 1992; QM W3985, 1♀ (TL 140 mm), E of Coloured Sands, half way between Noosa & Double I. Point, 26°10'S 153°07'E, Oct 1969; QM W12862, 1♂ (TL 152 mm), NE Qld, trawl, C. Jones, 19 Dec 1985. NEW SOUTH WALES: AM P7929, 1♂ (TL 161 mm), Rose Bay, Port Jackson, 33°52'S 151°15'E, in prawn net, A. Golding, 10 Mar 1925; AM P41829, 1♀ (TL 161 mm), Trial Bay, 30°48'S 153°02'E, 22–30 m, K. Graham, 5 Nov 1991; AM P41794, 1♀ (TL 136 mm), E of Clarence River mouth, 29°21'S 153°36'E, 71–73 m, K. Graham, 1 May 1990; AM P41795, 2♀♀ (TL 150 mm), Trial Bay, 30°53'S 153°04'E, 54 m, K. Graham, 7 Nov 1991; AM P49680, 1♂ (TL 152 mm), Coffs Harbour, K. Graham; AM P56977, 3♀♀ (TL 146–160 mm), Botany Bay, 10–15 m, muddy sand, trawl, S. Ahyong, Nov 1992; AM P57886 1♀ (TL 138 mm), SE of Yamba, 29°40–43'S 153°27–26'E, 55–60 m, trawl, K. Graham, 19 Jul 1999; AM P57887, 2♂♂ (TL 142–157 mm), Sydney Harbour, between, Bradley's Head and Kiribilli, 17–18 m, trawl, J. Starck, 24 Feb 2000. NORTHERN TERRITORY: AM P56975, 1♀ (TL 152 mm), Arafura Sea, 10°S 137°E, 60–80 m, 18 Oct 1992.

Diagnosis. Rostral plate longer than broad; triangular to cordiform; usually with slender median projection; margins sinuous, apex blunt. Carapace without MD carina. Raptorial claw dactylus with 8 teeth; outer margin broadly curved, angular in adult males. TS6–8 without SM carinae; IM carinae unarmed posteriorly. TS5 IM carina low, rounded; ventral process triangular, apex acute, posterior margin slightly convex. TS8 sternal keel rounded, inclined posteriorly. AS1–4 without SM carinae. AS5 at most with faint indication of SM carinae. Abdominal carinae spined as follows: SM 6, IM (2)3–6, LT 1–6, MG 1–5. Telson MD carina proximally with oval maroon patch on either side; MG carina equal to or exceeding twice LT carina length; denticles SM 3–7, IM 9–14, LT 1; postanal carina not extending midway between anal pore and posterior margin. Uropodal exopod proximal segment outer margin with 7–10 movable spines; exopod distal segment black, at most with narrow pale outline.

Colour in life. Overall dorsal colour dull tan brown. Carapace grooves and carinae dark, with diffuse, dark brown patch mid-dorsally. Thoracic and abdominal somites with black- brown posterior margins. AS2 with narrow, diffuse transverse dark bar. Telson with primary teeth yellow; median carinae with pair of ovate red-maroon spots proximally. Uropodal protopod with terminal spines yellow; exopod proximal segment with yellow outer margin; exopod distal segment black; endopod black on distal ½.

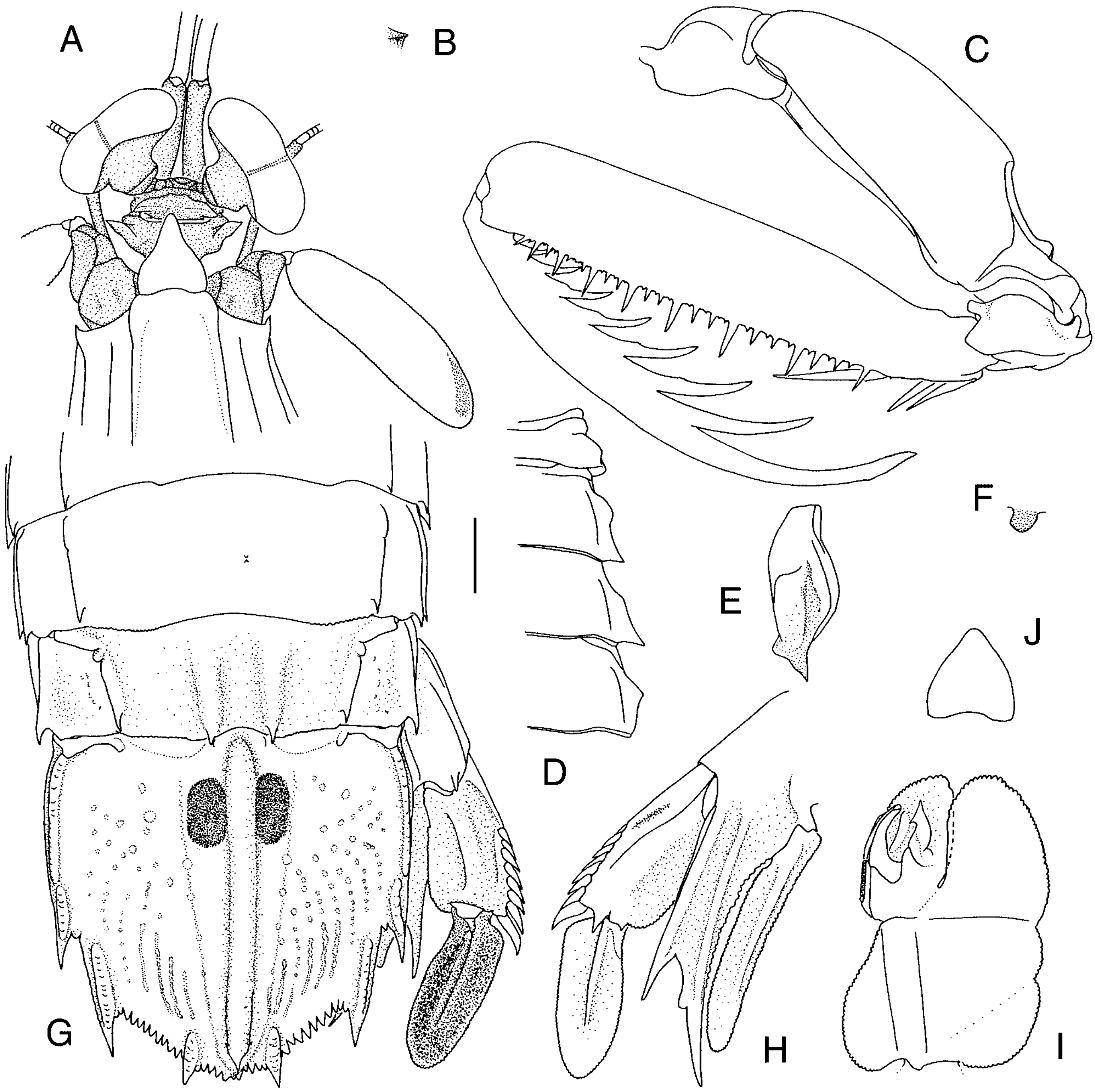

Figure 127. *Harpiosquilla melanoura* Manning. A–I, ♂ TL 131 mm (AM P49679). J, ♀ TL 168 mm (AM P56974) A, anterior cephalon, dorsal. B, A1 somite dorsal processes, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral process, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. J, rostral plate, dorsal. Scale A–H, J = 5 mm; I = 2.5 mm.

Measurements. Male (n = 7) TL 129–161 mm, ♀ (n = 12) TL 130–168 mm. CI 235–299. A1 peduncle 0.96–1.07 CL. A2 scale 0.63–0.68 CL. Anterior carapace width 0.43–0.51 CL. The present series includes the largest known specimen of the species.

Remarks. The present material agrees well with the holotype and accounts of Manning (1968b, 1969b, 1995), but show variation in the relative length of the lateral carina of the telson. Thus, the lateral carina varies from about one third to almost one half the length of the marginal carina. One specimen lacks the apical projection on rostral plate (Fig. 127J).

Sexual dimorphism described by Manning (1969b) for *H. melanoura* is evident in the present specimens: in males (TL >130 mm), the outer margin of the dactylus of the raptorial claw is obtusely produced, the dactylar teeth are basally inflated and the median carina of the telson is inflated.

Habitat. Muddy sand substrates down to 60–80 m.

Distribution. Western Indian Ocean to the Philippines, Japan, Vietnam and New South Wales, and Australia (Manning, 1969b, 1995). The known Australian range now includes the Arafura Sea, Northern Territory to Queensland, south to Botany Bay, New South Wales.

Harpiosquilla sinensis Liu & Wang, 1998

Fig. 128

Harpiosquilla annandalei.–Graham *et al*., 1993b: 73 (not *Squilla annandalei* Kemp).

Harpiosquilla ocellata Ahyong, Chan & Liao, 1998 (type locality: Taiwan) (published Dec 1998; new synonymy).

Harpiosquilla sinensis Liu & Wang, 1998: 590–592, 594–596, fig. 2. (type locality: Nansha Is, South China Sea, 5°13.32'N 108°53.06'E) (published Nov 1998).

Type material. PARATYPE: CAS 93NS53–4 ♂ (TL 201 mm), Nansha Is, South China Sea, 4°53.84'N 110°21.61'E, 116 m, 16 May 1993.

Australian material. QUEENSLAND: AM P49682–49685, 4♀♀ (TL 171–206 mm), E of Swains Reef, 22°28.34'S 152°59.45'E to 22°26.75'S 153°09.17'E, 137 m, trawl, J. Lowry & K. Dempsey, 8–9 Sep 1995; QM 24197, 2♀♀ (TL 52–154 mm), Coral Sea,

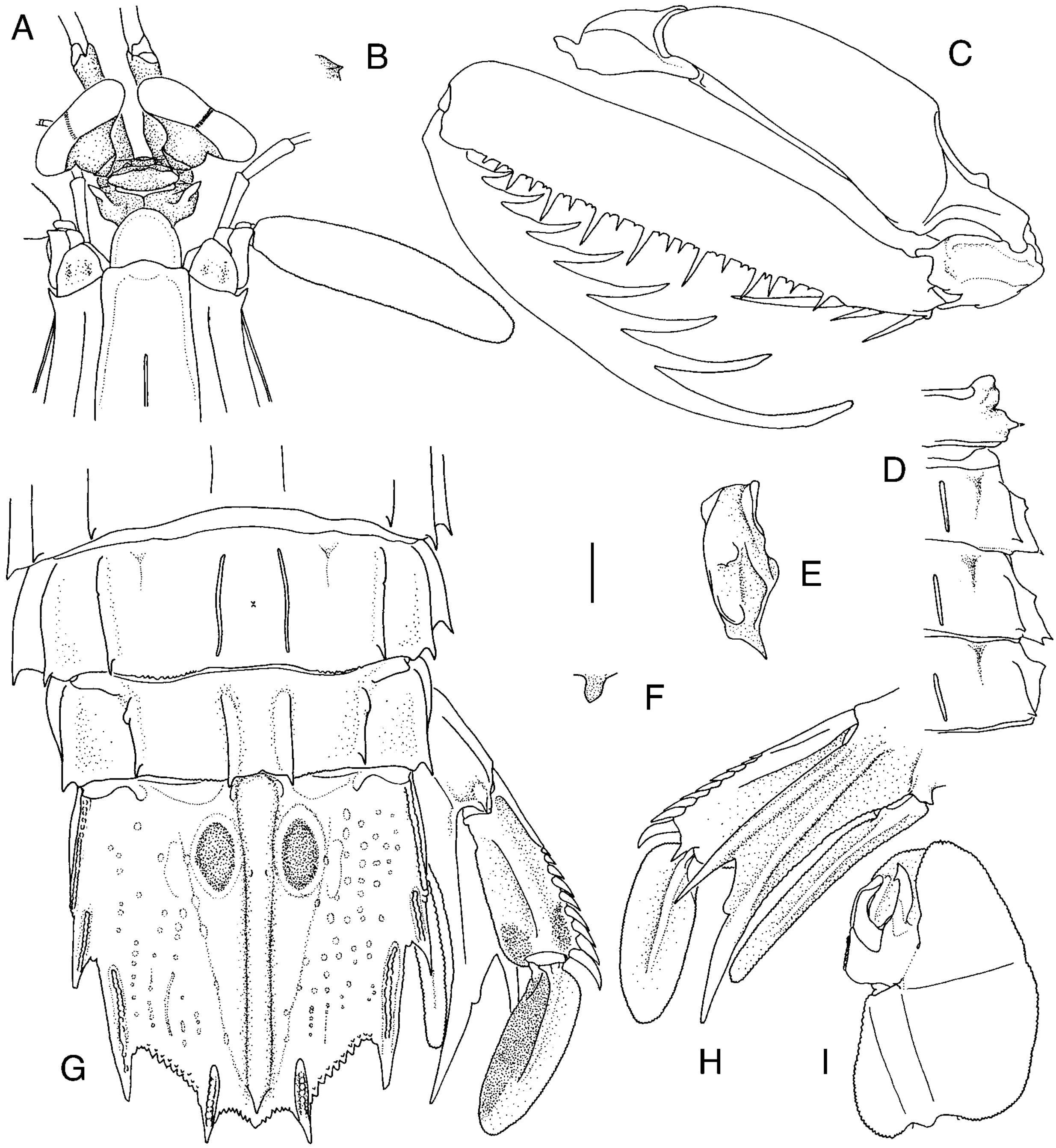

Figure 128. *Harpiosquilla sinensis* Liu & Wang, ♂ TL 159 mm (AM P41823). A, anterior cephalon, dorsal. B, A1 somite dorsal processes, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral process, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 5 mm; I = 2.5 mm.

18°00.7'S 147°01.4'E, 208–212 m, continental slope, P. Davie, 29 Nov 1985. NEW SOUTH WALES: AM P41823, 1♂ (TL 159 mm), E of Port Hunter, Newcastle, 32°54'S 151°59'E, 73 m, K. Graham, 5 Sep 1991; AM P41785, 1♂ (TL 145 mm), E of Port Hunter, Newcastle, 32°55'S 151°57'E, 72 m, K. Graham, 13 Apr 1992; AM P49681, 1♂ (TL 148 mm), off Newcastle, 32°55'S 151°57'E, 63–68 m, K. Graham, 2 Nov 1995.

Other material. NTOU H-1995–12–2, 1♂ (TL 157 mm), Tong-Kong, Ping-Tong County, SW Taiwan, sandy-mud, about 200 m, trawl, 2 Dec 1995 (holotype of *Harpiosquilla ocellata* Ahyong, Chan & Liao). Paratypes of *Harpiosquilla ocellata* Ahyong, Chan & Liao: AM P51184, 1♂ (TL 155 mm), Su-Aou, I-Lan County, NE Taiwan, about 200 m, sandy-mud, trawl, 9 Nov 1995; AM P51185, 1♂ (TL 200 mm), Tong-Kong, Ping-Tong County, SW Taiwan, 5 Aug 1996; NTOU P-1994–1–26, 1♀ (TL 232 mm), Tong-Kong, Ping-Tong County, SW Taiwan, 26 Jan 1994; NTOU P-1995–11–9, 1♂ (TL 154 mm), 1♀ (TL 195 mm), Su-Aou, I-Lan County, NE Taiwan, about 200 m, sandy-mud, trawl, 9 Nov 1995; NTOU P-1995–12–2, 2♂♂ (TL 157–180 mm), Tong-Kong, Ping-Tong County, SW Taiwan, 2 Dec 1994; NTOU 1996–8–5, 1♂ (TL 197 mm), Tong-Kong, Ping-Tong County, SW Taiwan, 5 Aug 1996.

Diagnosis. Rostral plate broader than long; without slender median projection; margins convex, apex rounded. Carapace with MD carina. Raptorial claw dactylus with 8 teeth; outer margin slightly angular in adult males. TS6–8 with distinct SM carinae; IM carinae armed posteriorly (occasionally unarmed on TS6). TS5 with IM carina produced to a short spine, directed laterally; ventral process triangular, apex acute. TS8 sternal keel quadrate, apex triangular, inclined posteriorly. AS1–5 with distinct SM carinae. Abdominal carinae spined as follows: SM 6, IM 1–6, LT 1–6, MG 1–5. Telson MD carina proximally with distinct dark oval patch either side, pale in outline; MG carina about twice LT carina length; denticles SM 5–11, IM 9–16, LT 1; postanal carina usually extending midway between anal pore and posterior margin. Uropodal exopod proximal segment outer margin with 8 or 9 movable spines; exopod distal segment black on inner ½ only.

Colour in life. Overall dorsal colour light brown. Carapace grooves and carinae dark brown. Thoracic and abdominal somites with submedian carinae and posterior margin dark brown. AS2 with medial, black transverse bar. AS1 and 3–5 with traces of broken transverse bar. Telson maroon to purple median carina and with proximal pair of black eye-spots surrounded by white margin. Uropodal exopod with proximal segment dark on inner distal ½; distal segment black on inner ½, yellowish on outer ½. Second and third segments of A1 peduncle with one proximal and one distal black spot. Raptorial claw merus with inner black spot and yellow meral depression.

Measurements. Australian material: males (n = 11) TL 145–201 mm; females (n = 8) TL 52–206 mm. CI 278–336. A1 peduncle 0.99–1.28 A2 scale 0.57–0.80 CL. Carapace anterior width 0.41–0.46 CL. The present series includes the largest known specimens of the species.

Remarks. *Harpiosquilla sinensis* Liu & Wang and *H. ocellata* Ahyong, Chan & Liao are indistinguishable and were published in November and December 1998, respectively. Therefore, *H. ocellata* must be considered a synonym of *H. sinensis*. Colour figures of the species are given by Ahyong *et al*. (1998). Although *H. sinensis* was described under Wang & Liu in a paper authored by Liu & Wang (1998), I attribute *H. sinensis* to Liu & Wang following the discussion of peculiar methods of species name attributions commonly used by taxonomists in China (Ng, 1994).

Harpiosquilla sinensis shares armed intermediate carinae on TS7–8 (and usually TS6) with *H. raphidea* and *H. annandalei* but most closely resembles the latter in lacking an elongate apical projection on the rostral plate and in bearing a pair of large "eye-spots" on the median carina of the telson. *Harpiosquilla sinensis* differs from *H. anandalei* chiefly in lacking armed submedian carinae on AS5 and in attaining a larger size (TL 206 mm vs 137 mm).

The submedian teeth of the telson bear movable apices in the juvenile female (TL 52 mm) suggesting that *H. sinensis* matures at a larger size than its congeners.

Habitat. Sandy-mud substrates from near shore to the continental slope at depths between 63 m and 212 m.

Distribution. Taiwan to the southern South China Sea, and eastern Australia from central Queensland south to the Newcastle Bight, New South Wales.

Harpiosquilla stephensoni Manning, 1969b

Fig. 129

Squilla raphidea.–Tate, 1883: 48.–Stephenson & McNeill, 1955: 239–240 (part).–Stephenson, 1962: 34 (not *S. raphidea* Fabricius).
Harpiosquilla harpax.–Manning, 1966: 87–89, fig. 1 (not *S. harpax* de Haan).
Harpiosquilla sp.–Manning, 1968c: fig. 4a.
Harpiosquilla stephensoni Manning, 1969b: 6, 17–21, figs. 12–17 (type locality: Port Curtis, Queensland, Australia, 23°55'S 151°23'E).–Manning & Michel, 1973: 115, fig. 2c.–Manning, 1995: 23, 149.

Type material. HOLOTYPE: AM P9664, ♀ (TL 315 mm), Port Curtis, Queensland, 23°55'S 151°23'E, seine net over flat, C. Bedsor. PARATYPES: AM P9685 1♀ (broken, CL 51.6 mm), Cairns Inlet, Queensland, 16°55'S 145°46'E, P. Clarke; AM P12382, 1♀ (TL 220 mm), near Emery Point, Darwin Harbour, Northern Territory, 12°27'S 130°50'E, seine net off beach, F. Wells, early 1954; AM P12770, 1♀ (TL 168 mm), Darwin Harbour, Northern Territory, 12°27'S 130°50'E, F. Wells; AM P14924, 1♀ (TL 240 mm), Darwin Harbour, Northern Territory, 18.3 m, C. Holman, 2 Jul 1962; AM P14925–14926, 2♀♀ (TL 245–277 mm), Port Curtis area, Queensland, M. Ward & W. Boardman, Jul 1929; AM P15503–15507, 4♂♂ (TL 136–202 mm), 1♀ (TL 135 mm), SE Gulf of Carpentaria, Queensland, 25 m or less, Dec 1963; AM P15509, 1♂ (TL 208 mm), SE Gulf of Carpentaria, Queensland, 25 m or less, Dec 1963; USNM 111354, 1♀ (TL 170 mm), near Emery Point, Darwin Harbour, Northern Territory, 12°27'S 130°50'E, seine net off beach, F. Wells, early 1954; USNM 125720, 1♂ (TL 272 mm), Port Curtis area, Queensland, M. Ward & W. Boardman, Jul 1929.

Australian material. QUEENSLAND: AM P10680, 1♂ (broken, CL 40 mm), Tampian Beach, Emu Park, Keppel Bay, 23°25'S 150°55'E, washed up after cyclone, dry specimen, fragmented, H. Bernhard, 14 Jul 1935; AM P21624, 1♂ (TL 202 mm), SE Gulf of Carpentaria, 17°24.0'S 140°43.0'E, 2.7–4.5 m, trawl, 7 Nov

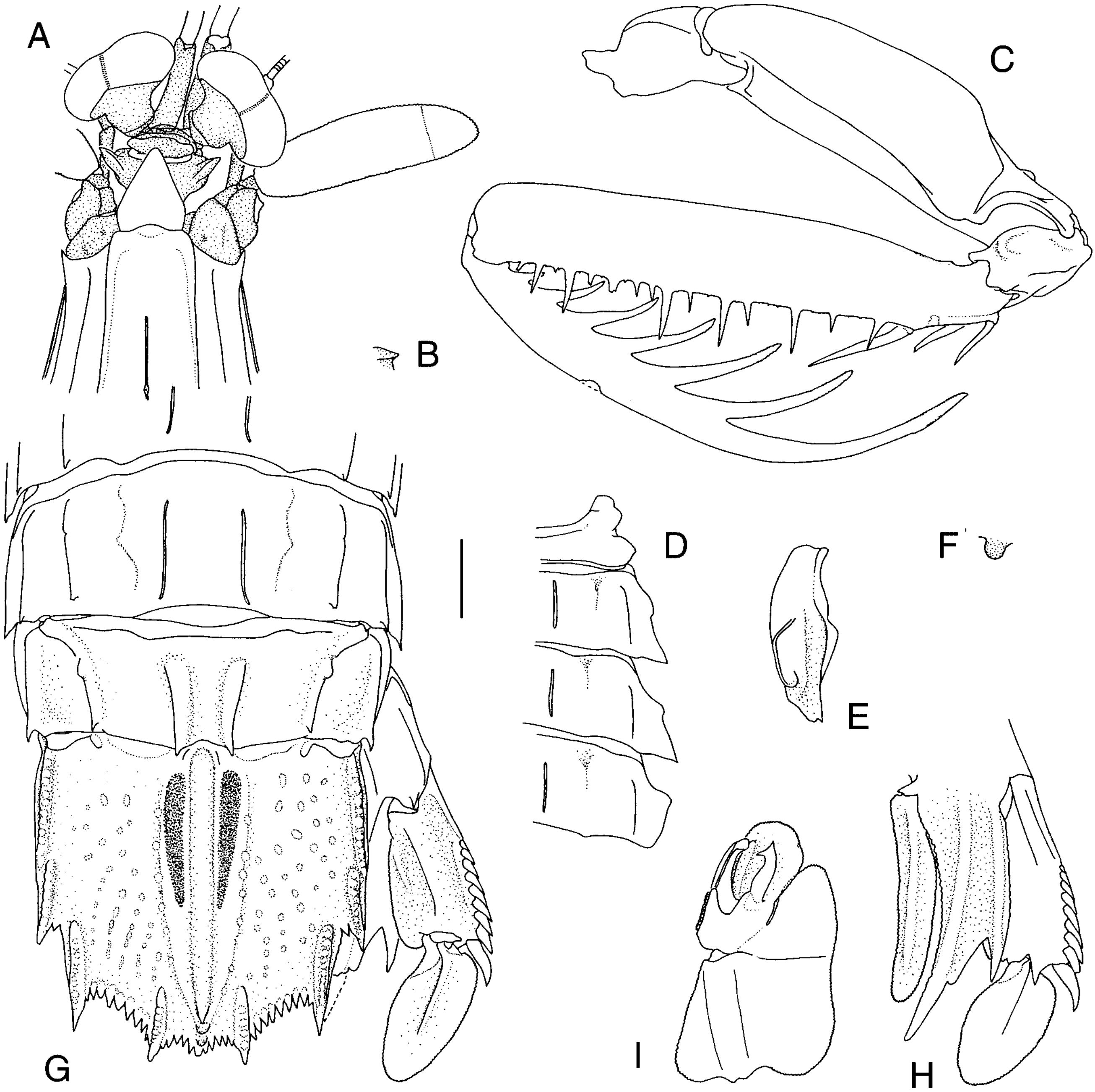

Figure 129. *Harpiosquilla stephensoni* Manning, ♂ TL 136 mm (AM P15504). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 5 mm; I = 2.5 mm.

1963; AM P21625–21626, 1♂ (TL 185 mm), 1♀ (TL 225 mm), SE Gulf of Carpentaria, 16°51.0'S 140°40.0'E, 16 m, trawl, 23 May 1965; AM P49686, 1♀ (TL 226 mm), Princess Charlotte Bay, west of Flinders I., 14°13'S 144°07'E, 15–18 m, 24 Feb 1979; AM P56809, 1♂ (TL 60 mm), 1♀ (broken, CL 38.0 mm), Gulf of Carpentaria between Weipa & Karumba, trawl, KL0476, T. Wassenberg, 1976; QM W1808, 1♂ (TL 182 mm), between Magnetic I. & Townsville, prawn trawl, 5.5–9.1 m, R. Bryson, autumn 1952; QM W16652, 1♀ (TL 233 mm), Flinders I., 14°10'S 149°10'E, D. Tuma, May 1990. WESTERN AUSTRALIA: NTM Cr007676, 1♀ (TL 232 mm), Joseph Bonaparte Gulf, 14°10.00'S 128°15.90'E, 46 m, DW-42, D. White, 28 Jun 1990; WAM C7245, 1♀ (TL 135 mm), Wyndham, 15°29'S 128°06'E, R. Patterson, Jan 1956. NORTHERN TERRITORY: NTM, 2♀♀ (TL 178–197 mm), Van Dieman Gulf, 12°06'S 131°32'E, 12–15 m, trawl, NT Fisheries, 5 May 1977; SAM C187, 2♀♀ (TL 130–185 mm), Northern Territory; WAM C9553, 4♂♂ (TL 140–185 mm), Beagle Gulf, off Port Darwin, 12°14'S 130°34'E, E. Barker, 4 Sep 1965.

Diagnosis. Rostral plate as long as or longer than broad; without slender median projection; margins convex; apex, blunt. Carapace with MD carina, but often indistinct.

Raptorial claw dactylus with 7 teeth, outer margin strongly angular in adult males. TS5 with IM carina produced to an acute or blunt, laterally directed lobe; ventral process broad, posterior margin rounded, with short distal spine. TS6–8 with distinct SM carinae; IM carinae unarmed posteriorly. TS8 sternal keel rounded, inclined posteriorly. AS1–5 with distinct SM carinae. Abdominal carinae spined as follows: SM 6, IM 2–6, LT 1–6, MG 1–5. Telson MD carina proximally with distinct dark oval patch on either side; with MG carina greater than to less than twice LT carina length; denticles SM 4–7, IM 6–11, LT 1; postanal carina usually extending beyond midway between anal pore and posterior margin. Uropodal exopod proximal segment outer margin with 7–10 movable spines; exopod distal segment yellow in life.

Colour in life. Overall dorsal colour pale tan-brown with translucent white lateral margins. Carapace grooves and carinae and posterior margins of body somites black-brown. Telson with posterior ⅓ pale yellow. Telson with elongate, red-brown, triangular patch on either side of median carina. A2 scale clear. Raptorial claw with merus and carpus diffusely pigmented with brown chromatophores; propodus and dactylus translucent white with yellow patch at articulation. Pereiopods and uropods pale yellow.

Measurements. Males (n = 16) TL 60–272 mm, females (n = 15) TL 130–315 mm. CI 289–434. A1 peduncle 0.76–0.92 CL. A2 scale 0.57–0.73 CL. Anterior carapace width 0.44–0.49 CL. The present series includes the largest known specimens of the species.

Habitat. Taken from sandy-mud substrates in bays or sheltered areas. Shore to 46 m.

Remarks. The non-type specimens agree well with the type series, but the marginal carinae of the telson varies from less than, to twice the length of the lateral carina.

Harpiosquilla stephensoni is unique in the genus in bearing seven teeth on the dactylus of the raptorial claw. In its large size, general habitus and pale yellow uropods, *H. stephensoni* most closely resembles and is perhaps most closely related to *H. raphidea*. Both species bear well-developed submedian carinae on the abdomen and display marked sexual-dimorphism in the inflation of the telson carinae and denticles. The distributions of the species are discrete, but adjacent. *Harpiosquilla stephensoni* is known only from the northern coastline of Australia and *H. raphidea* is known from Indonesia to the South China Sea and westwards to Pakistan.

Manning (1969b) listed several possible but unconfirmed records of *H. stephensoni* from Queensland and the Northern Territory, each published as *S. raphidea*: Tate (1883), Stephenson (1952, 1953a) and Stephenson & McNeill (1955). The records of Tate (1883) from Darwin, and a specimen from Keppel Bay (Stephenson & McNeill, 1955) are based on *H. stephensoni*; those of Stephenson (1952, 1953a) are based on *H. harpax*.

Habitat. Sandy mudflats from the shore to a depth of 46 m.

Distribution. Australia: from Wyndham, Western Australia to Tampian Beach, Keppel Bay, Queensland.

Kempina Manning, 1978d

Kempina Manning, 1978d: 39. Type species *Squilla mikado* Kemp & Chopra, 1921, by original designation. Gender feminine.

Diagnosis. Dorsal integument pitted, rugose. Eye small, cornea strongly bilobed, width less than 0.3 CL. Carapace with anterolateral spines; with normal complement of carinae; MD carina distinct, uninterrupted at base of anterior bifurcation, branches of anterior bifurcation distinct, opening anterior to dorsal pit; posterolateral margin angular. Raptorial claw dactylus usually with 6 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS5 lateral process a single slender spine directed laterally; ventral spine slender, directed ventro-laterally. TS6–7 lateral processes distinctly bilobed. AS1–6 with normal complement of carinae. AS1–5 with LT carinae bicarinate. Telson SM teeth with fixed apices; prelateral lobe present; dorsolateral surface without supplementary longitudinal carinae. Uropodal protopod inner margin crenulate.

Included species. Two: *K. mikado* (Kemp & Chopra, 1921); and *K. stridulans* (Wood-Mason, in Alcock, 1894).

Remarks. Cladistic analysis of the Squilloidea (Ahyong, in prep.) suggests that *Kempina* is most closely allied to the western Atlantic genus *Fennerosquilla*. The single, spiniform lateral process of TS5 in combination with strongly bilobed lateral processes of TS6–7 will distinguish *Kempina* from other squilloids. Both species of *Kempina* occur in the Indo-West Pacific and one is known from Australia.

Key to species of *Kempina*

1 Rostral plate with median carina. AS5 with pair of large dark dorsal patches .... ***K. mikado***

—— Rostral plate without median carina. AS5 without pair of large dark dorsal patches .... *K. stridulans*

Kempina mikado (Kemp & Chopra, 1921)

Fig. 130

Squilla stridulans.–Kemp, 1913: 78 (part, Japanese specimens only, not *S. stridulans* Wood-Mason, 1895).
Squilla mikado Kemp & Chopra, 1921: 301, fig. 2 (type locality: Misaki, Japan).–Komai, 1927: 320.–Manning, 1965: 257–259, 262, pl. 12: fig. a.
Squilla zanzibarica Chopra, 1939: 143–148, figs. 2, 4 (type locality: off Zanzibar, 5°38'54"S 39°15'42"E to 5°40'18"S 39°17'36"E).
Oratosquilla mikado.–Manning, 1971b: 3.
Kempina zanzibarica.–Manning, 1981b: 298–300, fig. 1.
Kempina mikado.–Manning, 1978d: 40, fig. 23a–c.–Moosa, 1986: 400–402, fig. 10.–Manning, 1991: 14; 1995: 24, 208.–Graham *et al*., 1993a: 24, 64; 1993b: 73.
Kempina cf *mikado*.–Cannon *et al*., 1987: 63.

Australian material. QUEENSLAND: AM P43205, 4♂♂ (TL 118–163 mm), 2♀♀ (TL 152–176 mm), E of Mooloolaba, 26°52.74'S 153°35.34'E, 160 m, trawl, QLD-1119, J. McIllwain *et al*., 3 Aug 1994; AM P43206, 1♀ (TL 130 mm), E of Mooloolaba, 26°36.35'S 153°38.36'E, 150 m, trawl, QLD-1120, J. McIllwain *et al*., 3 Aug 1994; NMV J13860, 1♂ (TL 132 mm), off Cardwell, 17°59–56'S 147°00–146°57'E, 218–220 m, FRV Soela, S01/86/03, M. Gomon, 9

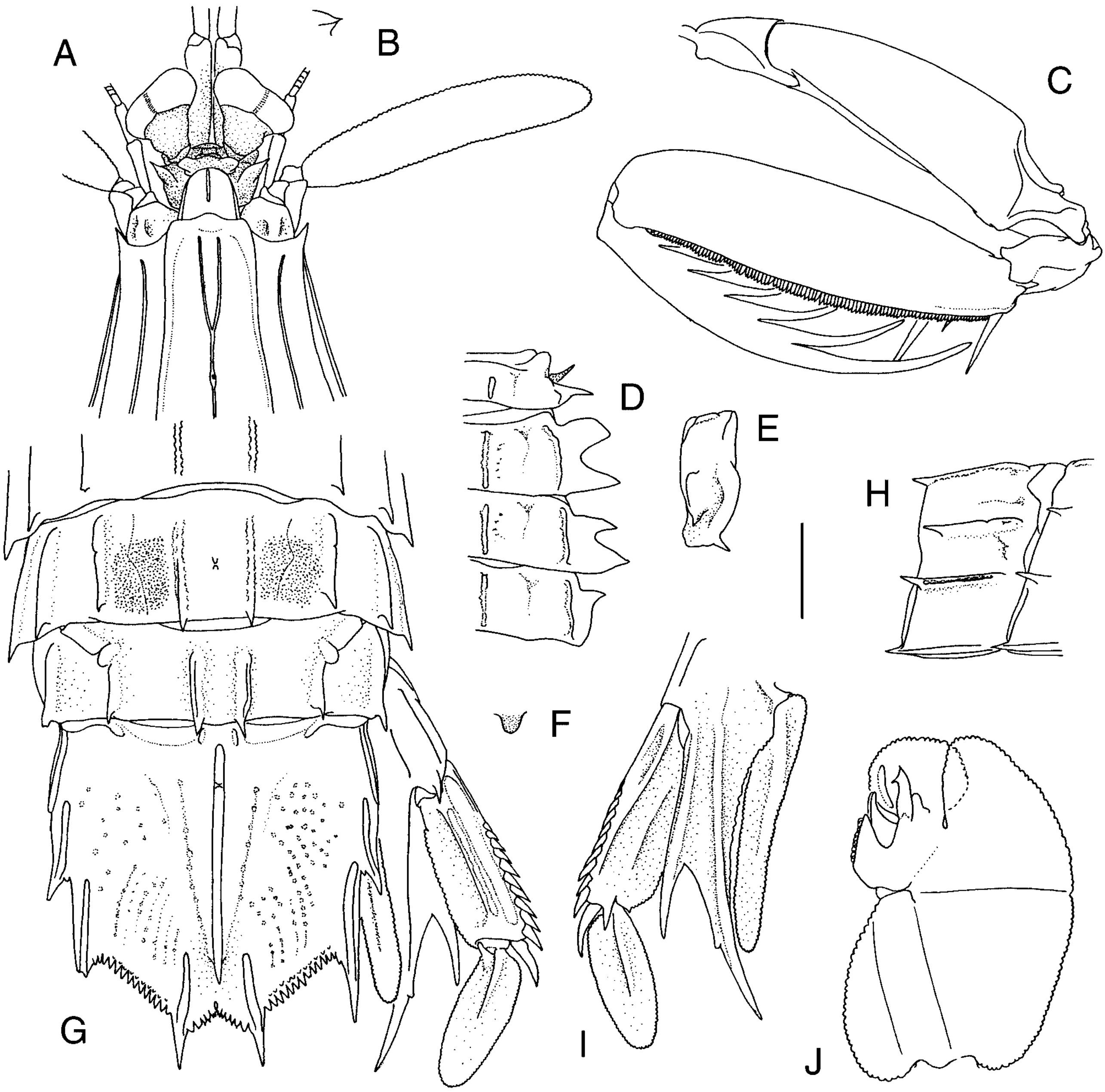

Figure 130. *Kempina mikado* (Kemp & Chopra). A–H, ♀ TL 81 mm (AM P53607). J, ♂ TL 145 mm (AM P53626). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, AS5, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 5 mm; J = 4.3 mm.

Jan 1986; NMV J37839, 1♀ (TL 144 mm), 95 km E of Dunk I., 18°0'S 147°2'E, 220 m, S01/86 1, sand with some gorgonians, engels trawl, M. Gomon, H. Larson & M. McGrouther, 8 Jan 1986; QM W3142, 1♂ (TL 145 mm), off Cape Moreton, 27°02'S 153°28'E, 183 m, trawl, L. Wale, Jun 1964; QM W4422, 1♀ (TL 145 mm), 29 km N of Cape Moreton, 26°44'S 153°28'E, 112–117 m, trawl, sand & dead shell, F. Wallace, 19–20 Mar 1970; QM W10156, 1♀ (TL 150 mm), 26°20'S 153°53'E, 300 m, Craigmin stn 2, 13 Sep 1980; QM W10157, 1♀ (TL 168 mm), 22°10'S 154°10'E, 570 m, Craigmin stn 9, 21 Sep 1980; QM W10158, 1♂ (broken, CL 31.0 mm), 2♀♀ (broken, CL 34.2–34.4 mm), 21°30'S 152°56'E, 240 m, Craigmin stn 11, 22 Sep 1980; QM W24202, 1 juvenile ♀ (TL 53 mm), Coral Sea, 17°59.7'S 147°03.5'E, 256–260 m, trawl, continental slope, 16 Jan 1986; QM W24209, 1 juvenile ♀ (TL 53 mm), Coral Sea, 17°59.8'S 147°06.5'E, 300 m, trawl, continental slope, 17 Jan 1986; QM W24219, 3♂♂ (TL 74–118), 5♀♀ (TL 102–159 mm), 1 juvenile ♀ (TL 55 mm), Coral Sea, 18°00.7'S 147°01.4'E, 208–212 m, trawl, continental slope, P. Davie, 29 Nov 1985. NEW SOUTH WALES: AM P28700, 3♂♂ (TL 141–171 mm), E of Cape Byron, 28°35'S 153°50'E, 137 m, prawn trawl, K. Graham, 18 Aug 1978; AM P41797, 1♂ (TL 144 mm), 1♀ (TL 182 mm), E of Port Hunter, Newcastle, 32°53'S 152°00'E, 70 m, K92–13–11, K. Graham, 14 Apr 1992; AM P41796, 3♂♂ (TL 158–175 mm), 2♀♀ (TL 165–174 mm), E of Port Hunter, Newcastle, 32°55'S 151°57'E, 77 m, K90–13–01, K. Graham, 18 Sep 1990; AM P53597, 1♀ (TL 166 mm), E of Long Reef, 33°46'S 151°28'E, K90–15–07, 121 m, K. Graham, 18 Oct 1990; AM P53606, 2♂♂ (TL 77–160 mm), 1♀ (TL 176 mm), SE of Newcastle, 33°07'S 151°56'E, K93–04–01/04, 121 m, K. Graham, 2 Mar 1993; AM P53607, 1♀ (TL 81 mm), SE of Coff's Harbour, 30°48'S 153°02'E, 30 m, K91–16–02, K. Graham, 6 Nov 1991; AM P53626, 1♂ (TL 145 mm), 1♀ (TL 135 mm), E of Newcastle, 32°53'S 152°00'E, 119 m, K90–11–05, K. Graham, 13 Jun 1990; AM P55585, 1♂ (140 mm), off Newcastle, 32°54'S 151°59'E, 70–75 m, K95–14–16, #127, K. Graham, 19 Oct 1995. WESTERN AUSTRALIA: NMV J14438, 1♂ (TL 101 mm), 1♀ (TL 153 mm), Northwest Shelf, between Port Hedland & Dampier, 19°33'S 118°28'E, NWA 11, 38 m, on sand, trawl, G. Poore & H. Lew Ton, 3 Jun 1983; NTM Cr000719, 1♂ (TL 123 mm), Northwest Shelf, 18°41.4'S 118°22.7'E, 145 m, S0283, P. Blyth, 15 Apr 1983; WAM C9550, 1♂ (TL 101 mm), 2♀♀ (TL 51–80 mm), W of Northwest Cape, 21°48'S 113°56'E, 122–128 m, CSIRO, 1 Feb 1964. NORTHERN TERRITORY: NTM Cr009747, 1♀ (TL 119 mm), Arafura Sea, 9°40.1'S 133°06.4'E, 123 m, trawl, R. Williams, 3 Oct 1992.

Other material. AM P60103, 1♂ (TL 76mm), 1♀ (TL 107mm); off Ogata, Tosa Bay, Shikoku, 33°01'N 133°01'E, 30–60 m, trawler, Hiromitsu Endo (Kochi University), 20 Mar 1997; SMF, 1♂ (TL 68 mm), Japan, no specific locality, coll. T. Sakai; SMF, 1♂ (TL 150 mm), Sagami Bay, Japan, 150 m, Tiefe.

Diagnosis. Rostral plate with MD carina. Carapace with undivided portion of MD carina anterior to dorsal pit about ⅓–⅕ distance between dorsal pit and anterior margin. TS6 lateral process anterior lobe broad, trapezoid, apex acute; posterior lobe broad, triangular, anterior margin straight to slightly convex, apex acute. TS7 lateral process anterior lobe slender, trapezoid to spiniform, apex acute; posterior lobe broad, triangular, anterior margin straight to slightly convex, apex acute. Abdominal carinae spined as follows: SM 5–6, IM (2)3–6, LT 1–6, MG 1–5. Telson denticles SM 5–8, IM 11–17, LT 1. Uropodal exopod proximal segment with 10–13 movable spines on outer margin.

Colour in life. Overall dorsal colour light brown. Carapace grooves and posterior margin on thoracic and abdominal somites dark brown. Carapace with orange posteromedian margin. AS2 with dark brown mid-dorsal patch. AS5 with pair of dark brown patches. Telson with carinae infused with pale orange. Uropodal protopod and exopod with orangish margins; exopod with dark brown proximal segment extending onto distal segment proximally.

Measurements. Male (n = 27) TL 68–175 mm, ♀ (n = 26) TL 51–182 mm, juvenile ♀ (n = 3) TL 53–55 mm. CI 434–594. A1 peduncle 0.91–1.11 CL. A2 scale 0.67–0.88 CL. Anterior carapace width 0.41–0.46 CL. The present series includes the largest known specimen of the species.

Remarks. *Kempina mikado* differs from its only congener, *K. stridulans* in bearing a median carina on the rostral plate and in bearing large, dark submedian patches on AS5. The relative length of the anterior bifurcation in relation to the remainder of the median carina of the carapace is variable in *K. mikado* and thus unreliable as a diagnostic character as used by Chopra (1939) and Manning (1995).

The present series agrees well with the topotypic specimens and published accounts (Kemp & Chopra, 1921; Manning, 1965, 1978d; Moosa, 1986). Variation in spination of the intermediate and lateral carinae of the abdomen is within the reported range for *K. mikado*. The dactylus of the raptorial claw usually bears six teeth, but one specimen (male, TL 123 mm) bears seven and eight teeth and another (male, TL 118 mm) bears eight teeth on both dactyli. In adults, the prelateral lobe of the telson is as long as or longer than margin of lateral tooth, but shorter than the margin of the lateral tooth in juveniles.

Apparently, *Kempina mikado* matures at a relatively large size—the anterolateral spines of the carapace are undeveloped and the mandibular palp is minute and two-segmented in specimens up to 55 mm TL. Above this size, the anterolateral spines of the carapace are developed and the third segment of the mandibular palp is differentiated, but the petasma does not reach adult form until approximately 65–80 mm TL.

Habitat. Level, sandy or sandy-mud substrates from nearshore to the outer continental shelf and slope in depths of 30–570 m. Australian specimens have often been taken with *Anchisquilloides mcneilli*. Manning (1991) reported a bathymetric range of 58 m to 753–804 m for *K. mikado*.

Distribution. Western Indian Ocean to Vietnam, Japan, the Philippines, New Caledonia and now from northern and eastern Australia south to the vicinity of Sydney, New South Wales.

Lenisquilla Manning, 1977b

Lenisquilla Manning, 1977b: 422. Type species *Squilla lata* Brooks, 1886, by original designation. Gender feminine.

Diagnosis. Eye elongate; cornea bilobed, broader than stalk, width less than 0.3 CL. Carapace with anterolateral spines; MD carina absent; with IM, reflected MG and reduced LT carinae, distinct anteriorly and posteriorly only; postero-lateral margin rounded. Raptorial claw dactylus with 5 or 6 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS5–7 lateral process a single slender spine directed anterolaterally, slightly inclined ventrally. AS1–5 SM carinae variably present. Telson SM teeth with fixed apices; prelateral lobe indistinct; dorsolateral surface without supplementary longitudinal carinae. Telson ventral surface with short postanal carina. Uropodal protopod inner margin with slender spines.

Included species. Two: *L. gilesi* (Kemp, 1911); and *L. lata* (Brooks, 1886).

Remarks. Of the two species of *Lenisquilla* recognized here, one is known from Australia. *Lenisquilla pentadactyla* Moosa, 1991, from New Caledonia is synonymized with *L. lata*, below.

Key to species of *Lenisquilla*

1 AS1–5 each with distinct SM carinae .... *L. gilesi*

—— AS1–4 each without SM carinae; SM carina on AS5 indistinct or absent .... ***L. lata***

Lenisquilla lata (Brooks, 1886)

Fig. 131

Squilla lata Brooks, 1886: 21, 34–37, pl. 1: figs. 1–3 (type locality: Arafura Sea, 8°56'S 136°05'E).–Kemp, 1913: 3, 10, 21, 37, pl. 2: fig. 24.–Manning, 1965: 262.–Manning, 1977b: 422.

Squilloides latus spinosus Blumstein, 1970: 223, figs. 4, 5 (type locality: Gulf of Tonkin, 17°48'N 109°32'E).

Squilloides espinosus Blumstein, 1974: 121, fig. 7 (type locality: Gulf of Tonkin, 18°00'N 109°32'E).

Squilloides latus.–Blumstein, 1974: 123

Lenisquilla lata.–Manning, 1969a: 13, fig. 4; 1991: 10–11, fig. 12; 1995: 24, 209.–Graham *et al*., 1993a: 24, 64.

Lenisquilla spinosa.–Moosa, 1986: 403–404.

Lenisquilla pentadactyla Moosa, 1991: 205–207, fig. 14 (type locality: New Caledonia, 20°46.8'S 165°17.3'E); new synonymy.

Type material. LECTOTYPE: NHM 94.10.16.8, 1♂ (TL 74 mm), Arafura Sea, 8°56'S 136°05'E, 90 m. PARALECTOTYPE: NHM 94.10.16.9, 1♀ (TL 75 mm), type locality.

Australian material. QUEENSLAND: QM W24204, 1♀ (TL 75 mm), Coral Sea, 18°00.7'S 147°01.4'E, 220 m, trawl, continental slope, RV *Soela*, 18 Jan 1986; QM W24205, 1♀ (TL 72 mm), Coral Sea, 18°01.2'S 147°03.6'E, 220 m, trawl, continental slope, RV *Soela*, 11 Jan 1986; QM W24207, 1♀ (TL 62 mm), Coral Sea, 18°00.0'S 147°01.0'E, 220 m, trawl, continental slope, RV *Soela*, 9 Jan 1986; QM W24200, 3♂♂ (TL 49–64 mm), 1♀ (TL 66 mm), Coral Sea, 18°00.7'S 147°01.4'E, 208–212 m, trawl, continental slope, RV *Soela*, P. Davie, 29 Nov 1985; QM W24214, 1♀ (TL 59 mm), Coral Sea, 17°59.9'S 147°00.8'E, 218–219 m, trawl, continental slope, RV *Soela*, 12 Jan 1986; AM P55609, 1♂ (TL 40 mm), N of Wellesley Is, Gulf of Carpentaria, 15°31.4'S 139°11.6'E, 45 m, Nov–Dec 1990. NEW SOUTH WALES: AM P41828, 1♂ (TL 75 mm), K90–16–02, K. Graham, 1990; AM P41834, 3♀♀ (TL 74–76), E of Port Hunter, 32°55'S 151°56'E, K90–19–11, 77 m, K. Graham, 11 Dec 1990. WESTERN AUSTRALIA: NTM Cr012395, 1♂ (TL 62 mm), Northwest Shelf, T37/70, trawl. NORTHERN TERRITORY: AM P55607, 1♀ (TL 85 mm), NE of Groote Eylandt, Gulf of Carpentaria, 13°3.7'S 137°41.4'E, Nov–Dec 1991; AM P55608, 1♀ (TL 81 mm), NE of Wessell Is, Arafura Sea, 10°30.12'S 137°12.03'E, 50 m, Nov 1990; AM P55610, 1♂ (TL 56 mm), off Nhulunbuy, 12°9.2'S 136°42.1'E, T. Wassenberg, 20 Nov 1991; AM P55611, 1♀ (TL 53 mm), Arafura Sea, 10°14.4'S 136°52.4'E, 1991; AM P55617, 1♀ (TL 42 mm), NE of Wessell Is, Arafura Sea, 10°19.8'S 137°23.6'E, Nov–Dec 1991; AM P56880, 1♂ (TL 88 mm), N of Wessell Is, Arafura Sea, 10°28.5'S 137°11.9'E, 50 m, Dec 1990.

Other material. MNHN St 1202, ♂ (TL 37 mm), New Caledonia, 20°46.8'S 165°17.3'E, 135–150 m, grey mud, dredged, stn 835, Jan 1987 (holotype of *Lenisquilla pentadactyla* Brooks).

Diagnosis. Rostral plate with or without indistinct dorsal MD carina. Raptorial claw dactylus with 5 or 6 teeth. AS1–4 without SM carinae. AS5 at most with faintly indicated SM carinae. Abdominal carinae spined as follows: SM 6, IM (3)4–6, LT (1–3)4–6, MG (1–3)4–5. Telson denticles SM 1–2, IM 6–9, LT 1. Uropodal protopod inner margin with 5–14 spines; exopod proximal segment outer margin with 9 or 10 movable spines.

Colour in life. Dorsal colour light yellow brown.

Measurements. Male (n = 10) TL 40–88 mm, female (n = 13) TL 42–85 mm. CI 607–924. A1 peduncle 0.53–0.90 CL. A2 scale length 0.47–0.53 CL. Anterior carapace width 0.41–0.53 CL. The present series includes the largest known specimens of the species.

Remarks. In the series of *Lenisquilla lata* studied here, the most significant variation is in the armature of the raptorial claw. Most specimens have six teeth on both claws, some have five and six teeth, whereas others have five teeth on both claws. Thus, I can find no character to separate *L. pentadactyla* from *L. lata* and they are herein synonymized. The indistinct rostral carina in the holotype of *L. pentadactyla* is present in some of the smaller specimens examined here; it becomes obsolete with increasing size. The male syntype (TL 74 mm) is herein selected as the lectotype to fix the identity of species. Both lectotype and paralectotype are deposited in the NHM.

Habitat. Sandy-mud substrates from 45–220 m depth.

Distribution. Western Indian Ocean to Japan, New Caledonia and Australia.

Levisquilla Manning, 1977b

Levisquilla Manning, 1977b: 422. Type species *Squilla inermis* Manning, 1965, by original designation and monotypy. Gender feminine.

Diagnosis. Eye small, elongate, cornea bilobed, broader than stalk. Ocular scales broad; truncate; partially fused. A1 somite not greatly elongate; dorsal processes trianguloid with spiniform apices. Carapace with anterolateral spines;

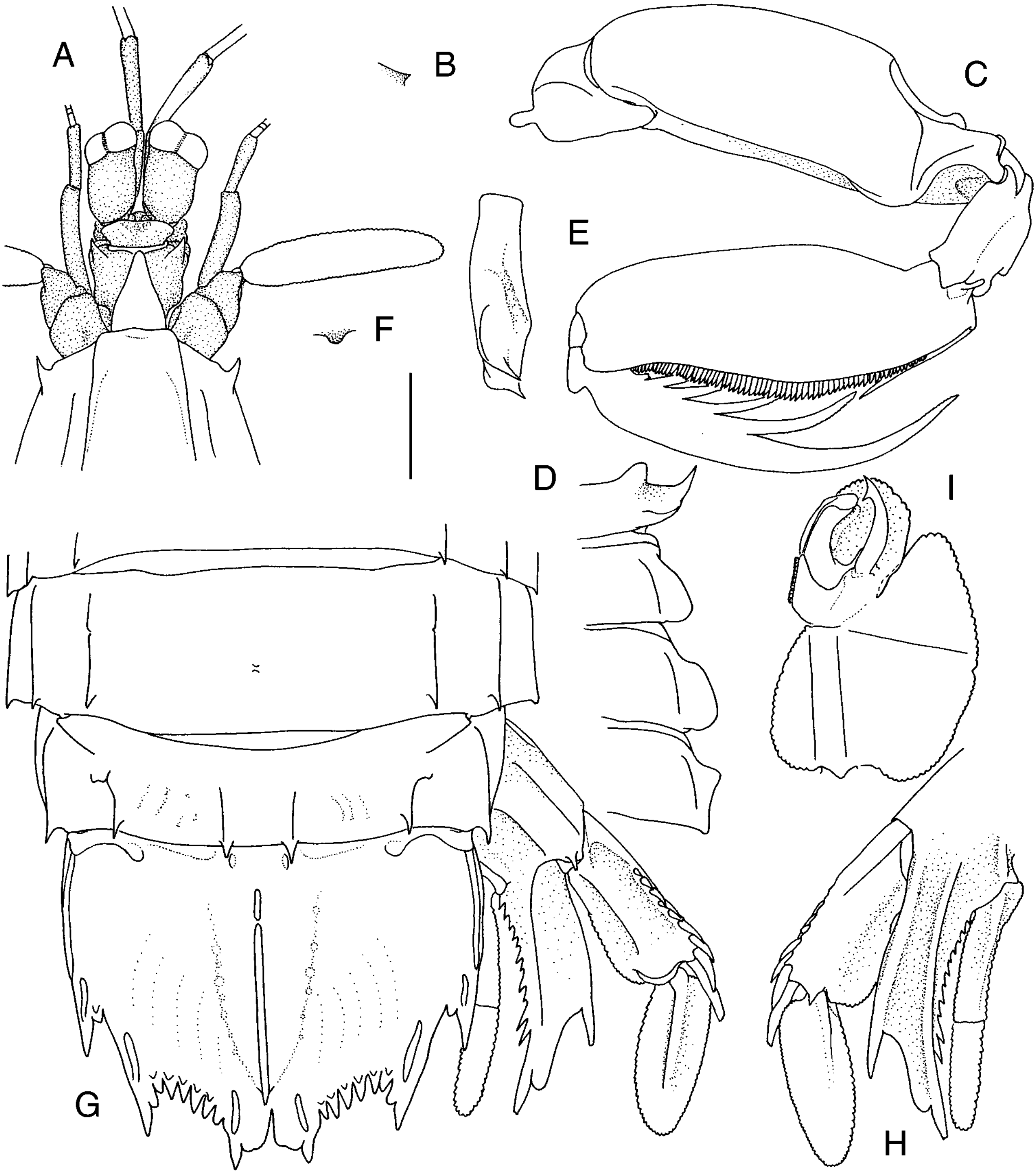

Figure 131. *Lenisquilla lata* (Brooks), ♂ TL 49 mm (QM W24200). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS5–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 2.5 mm; I = 1.8 mm.

MD carina absent; with indistinct reflected MG, reduced or absent LT carinae, evident posteriorly only; posterolateral margin rounded. Raptorial claw dactylus with 6 teeth; carpus dorsal undivided; merus without outer inferodistal spine. Mandibular palp absent. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS5 lateral process a short, anteriorly recurved spine basally. TS6–7 lateral process single. AS1–5 without SM carinae. Telson SM teeth with movable apices; prelateral lobe present, but indistinct in juveniles. Uropodal protopod inner margin lined with slender spines; distalmost movable spines on outer margin of exopod proximal segment spatulate.

Included species. Three: *L. inermis* (Manning, 1965); *L. jurichi* (Makarov, 1979); and *L. minor* (Jurich, 1904).

Remarks. *Levisquilla* most closely resembles *Fallosquilla* sharing the broad cornea, presence of four epipods, and absence of the mandibular palp. Species of *Levisquilla* differ from *Fallosquilla* in bearing six instead of four or five teeth on the dactylus of the raptorial claw and in lacking the numerous ventral carinae on the telson. *Squilla incerta* Hansen, 1926, assigned to *Levisquilla* by Manning (1995), is transferred to *Pontiosquilla* Manning, 1995. *Squilla incerta* agrees with species of *Pontiosquilla* and differs from *Levisquilla* in lacking anterolateral spines on the carapace, in having a blunt lateral process of TS5, spiniform distal movable spines on the outer margin of the uropodal exopod, and unarmed dorsal processes of the antennular somite [also present in *P. caledonica* (Moosa)].

Key to species of *Levisquilla*

1 Telson without mid-dorsal carinae. Postanal carina absent .... ***L. inermis***

—— Telson with mid-dorsal carinae. Postanal carina present in adults 2

2 Telson with accessory MD carina .... ***L. jurichi***

—— Telson without accessory MD carina, at most with a row of widely spaced tubercles .... *L. minor*

Levisquilla inermis (Manning, 1965)

Fig. 132

Squilla inermis Manning, 1965: 255–257, fig. 2 (type locality: Enoshima, Sagami Bay, Japan, 70 m, 14 Jul 1941).–Manning, 1977b: 422.
Squilla lata.–Komai, 1927: 310, pl. 14: figs. 1, 1b (not *S. lata* Brooks, 1886).
Anchisquilla inermis.–Blumstein, 1974: 115.
Levisquilla inermis.–Manning, 1995: 24, 209–210.

Australian material. QUEENSLAND: AM P54062, 1♀ (TL 26 mm), Torres Strait, 10°25.5'S 141°20.6'E, SS0591 059, Nov–Dec 1991; AM P54064, 1♀ (TL 29 mm), Arafura Sea, 11°10.5'S 139°23.8'E, SS0591 056, Nov–Dec 1991; AM P54065, 1♂ (TL 26 mm), Arafura Sea, 10°33.4'S 138°42.6'E, 53 m, trawl, SS0390 083, Nov–Dec 1990; AM P54063 (to QM), 1♂ (TL 26 mm), E Gulf of Carpentaria, off Duyfken Point, 12°29.9'S 141°14.7'E, SS0591 046, Nov–Dec 1991. WESTERN AUSTRALIA: NMV J37799, 2♂♂ (TL 16 mm), Northwest Shelf, between Port Hedland & Dampier, 19°24'S 116°51'E, 108 m, silty sand trawl, NWA 32, G. Poore & H. Lew Ton, 7 Jun 1983. NORTHERN TERRITORY: AM P54061, 1♂ (TL 29 mm), 1♀ (TL 24 mm), Arafura Sea, 10°26.0'S 136°25.8'E, 58 m, sand, otter trawl, Alpha Helix stn 12, E. Ball & J. Paxton, 17 Mar 1975.

Other material. AM P60118, 1♂ (TL 46 mm), 1♀ (TL 42 mm), Seto Inland Sea, off Takeshima I., Aio Town, Yamaguchi Prefecture, trawl, T. Hamano, 27 Oct 1989; AM P60119, 1♀ (TL 40 mm), Seto Inland Sea, off Yashima I., Yanai City, Yamaguchi Prefecture, Japan, 50 m, trawl, T. Hamano, 23 May 1987.

Diagnosis. Anterior margin of ophthalmic somite rounded. TS6–7 lateral process trianguloid, rounded posterolaterally. TS8 anterolateral margin angular with blunt apex. Abdominal carinae spined as follows: SM 6, IM 5–6, LT (4–5)6 (usually 5–6), MG (4)5. Telson prelateral lobe faintly indicated, slightly shorter than or longer than margin of LT tooth; denticles SM 3–6, IM 6–9, LT 1; dorsolateral surface without supplementary carinae; postanal carina absent. Uropodal protopod inner margin with 6–10 slender spines; protopod terminal spines with rounded lobe on outer margin of inner spine only, without rounded proximal lobe; exopod proximal segment outer margin with 7–9 movable spines.

Colour pattern in alcohol. Completely faded.

Measurements. Male (n = 6) TL 16–46 mm, female (n = 5) TL 24–42 mm. CI 463–575. A1 peduncle 0.85–0.95 CL. A2 scale length 0.41–0.47 CL. Anterior carapace width 0.53–0.56 CL. The 46 mm TL male from Japan is the largest known of the species.

Remarks. *Levisquilla inermis* differs from all other species of the genus in lacking supplementary carinae on the dorsolateral surface of the telson and in lacking a postanal carina. The specimens reported here agree well with the type description (Manning, 1965) and specimens from Japan, but show size related variation in abdominal spination and shape of the outer uropodal exopod spines. The distal movable spine on the outer margin of the proximal uropodal exopod segment is spinular in the smallest specimens, and becomes increasingly spatulate with increasing size. The largest specimen from Japan bears an asymmetrical telson deformity of the telson in the form of an additional lateral primary tooth.

The shape of the hook process in *L. inermis* (Fig. 132J) is a useful specific character, differing from that of *L. jurichi* (Fig. 133K) and *L. minor* in being distinctly longer and more slender.

Habitat. Silty sand substrates in depths of 53–108 m.

Distribution. Japan to Vietnam (Manning, 1995), and now northern Australia.

Levisquilla jurichi (Makarov, 1979)

Fig. 133

Clorida jurichi Makarov, 1979: 40, fig. 1 (type locality: Tonkin Bay, Vietnam, 21°13.5'N 109°45.8'E).–Moosa, 1991: 202
Squilla fallax.–Stephenson & McNeill, 1955: 241, 258, 261 (not *Squilla fallax* Bouvier, 1915).
Levisquilla jurichi.–Manning, 1995: 25, 209–210.

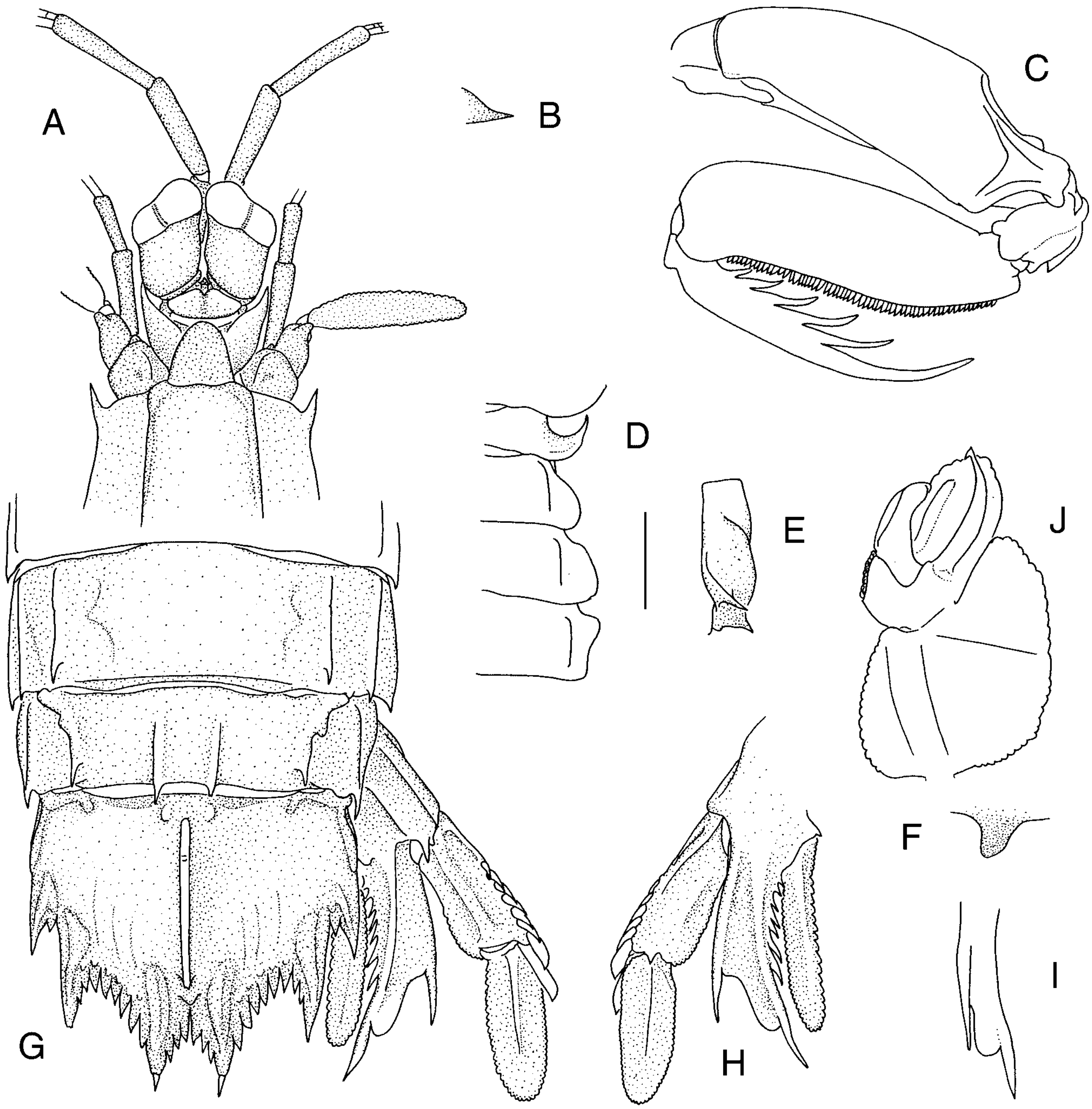

Figure 132. *Levisquilla inermis* (Manning), ♂ TL 29 mm (AM P54061). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, uropodal protopod, right lateral. J, PLP1 endopod, right anterior. Scale A–I = 1.5 mm; I = 0.7 mm.

Material. QUEENSLAND: AM P55574, 1♀ (broken, CL 4.9 mm), Albany Pass region, 10°47'S 142°39'E, M. Ward, Sep 1928; QM W3964–3965, 3♂♂ (TL 16–21 mm), 1.6 km S of Southwest Rocks, Moreton Bay, grab, sand & mud, Mar 1971; QM W6750, 1♀ (TL 17 mm), Hay Point, Mackay, 15–21 m, fine sand & mud, Milligan, 7–10 Aug 1975; NMV J37801, 2♂♂ (TL 12 mm; 1 broken, CL 4.1 mm), 4♀♀ (TL 11–15 mm), 1♀ postlarva (TL 10.7 mm), NE of Townsville, 19°3'S 146°52'E, 23 m, muddy sand dredge, G. Poore & H. Lew Ton, 24 Nov 1982; NMV J37804, 1♂ (TL 13 mm), NE of Townsville, 18°50'S 146°47'E, 26 m, muddy sand dredge, G. Poore & H. Lew Ton, 24 Nov 1982. NEW SOUTH WALES: AM P10289, 1♂ (TL 51 mm), off Dawes Point, Port Jackson, 33°51.4'S 151°12.4'E, 9 m, dredged, W. Hale, Mar 1933. WESTERN AUSTRALIA: AM P54059, 1♂ (TL 20 mm), 3♀♀ (TL 16–18 mm) Northwest Shelf, 19°58.3–58.8'S 117°49.4–48.7'E, 43 m, benthic sled. S0383 D1S, 25 Jun 1983; AM P54060, 1♂ (TL 14 mm), Northwest Shelf, 19°58.0–58.5'S 117°49.4–49.7'E, 43 m, benthic sled. S0383 D9S, 27 Jun 1983; NTM Cr000807, 1♂ (TL 19 mm), Northwest Shelf, 19°58.9'S 117°51.3'E, 40 m, NWS-5 S0283, A. Bruce, 22 Apr 1983; NTM Cr006264, 1♀ (TL 22 mm), Northwest Shelf, 35 m, R.

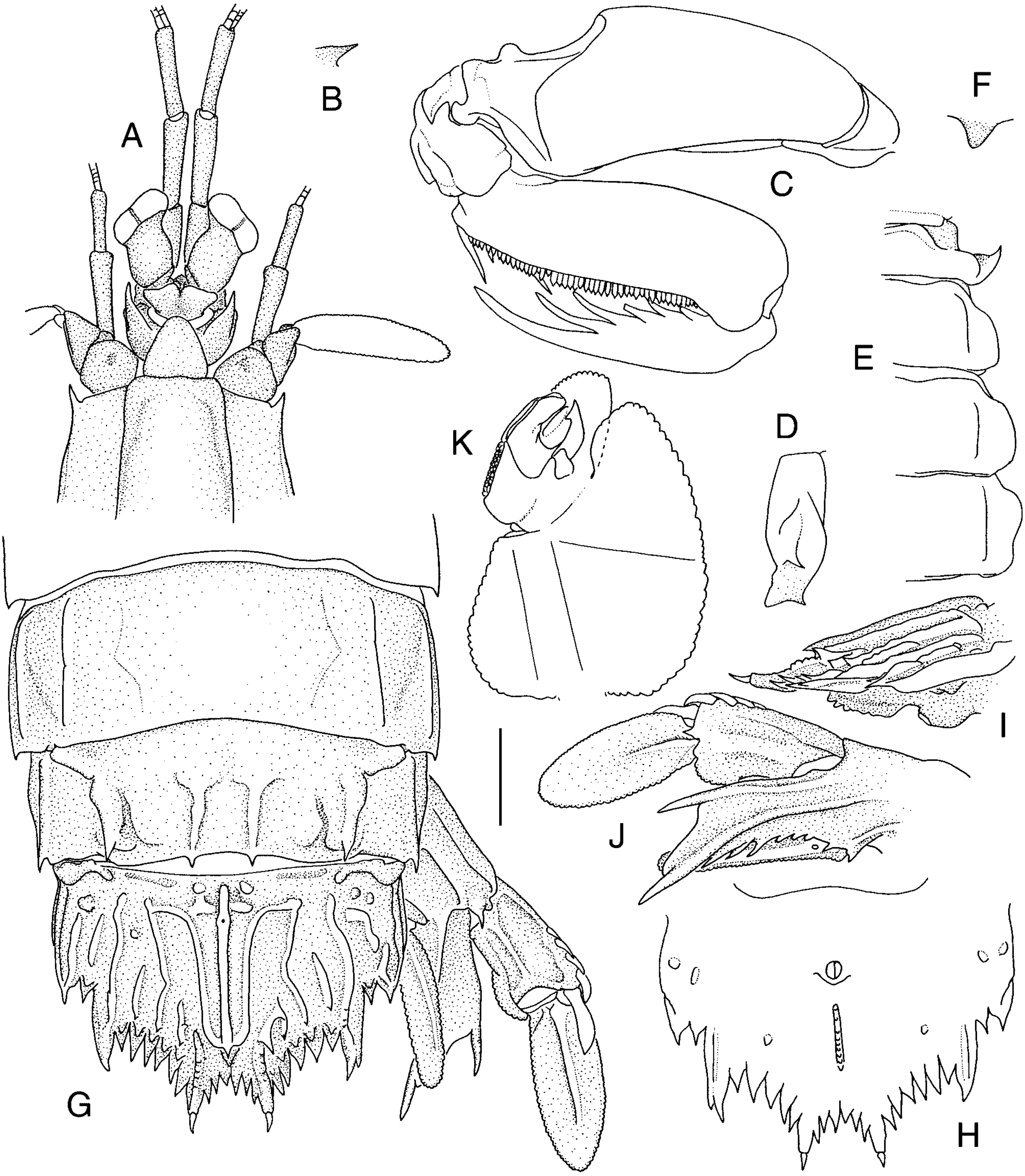

Figure 133. *Levisquilla jurichi* (Makarov), ♂ TL 51 mm (AM P10289). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, telson, ventral. I, telson, right lateral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A–J = 2.5 mm; K = 1.2 mm.

Edwards, 28 Apr 1982; NTM Cr012358, 1♂ (TL 21 mm), Northwest Shelf, 19°30.8'S 118°49.3–48.8'E, 38–39 m, S0483 B7, 30 Aug 1983; NTM Cr012369, 2♂♂ (TL 18–19 mm), 1♀ (TL 24 mm), Northwest Shelf, 19°56.7–56.9'S 117°53.6–53.4'E, 40 m, S0583 B2, 26 Oct 1983.

Diagnosis. Anterior margin of ophthalmic somite triangular. TS6–7 lateral process subtruncate, broadly rounded anterolaterally, and posterolaterally. TS8 anterolateral margin rounded. Abdominal carinae spined as follows: SM 6, IM 6, LT 6, MG (4)5. Telson denticles SM 3–5, IM 5–10, LT 1; dorsolateral surface with accessory MD and numerous supplementary longitudinal carinae, those between carinae of SM and IM teeth terminating in small spine. Telson ventral surface with short, posteriorly denticulate postanal carina; with short carina under IM tooth; with blunt midlateral and 2 anterolateral tubercles. Uropodal protopod inner margin with 6–11 slender spines; protopod terminal spines with rounded lobe on outer margin of inner spine only, without proximal rounded lobe; exopod proximal segment outer margin with 5–7 movable spines.

Colour in alcohol. Faded.

Measurements. Male (*n* = 13) TL 12–51 mm, ♀ (*n* = 11) TL 11–24 mm, ♀ postlarva TL 11 mm. CI 373–661. A1 peduncle 0.68–0.89 CL. A2 scale length 0.31–0.37 CL. Anterior carapace width 0.48–0.58 CL. The present series includes the largest known specimen of the species.

Remarks. *Levisquilla jurichi* differs from others in the genus by the combination of the carinate dorsal surface of the telson (including the accessory median carina), and presence of one instead of two rounded lobes between the terminal spines of the uropodal protopod. *Levisquilla inermis* lacks the postanal and mid-dorsal carinae on the telson; and *L. minor* lacks the accessory median carina on the telson, and bears two lobes between the spines of the uropodal protopod instead of one.

In the smallest specimens of *L. jurichi* examined, the anterolateral spines of the carapace are present as small tubercles and the accessory median carinae on the telson are visible, although the other mid-dorsal carinae on the telson are fewer in number. Thus, the large series of *L. jurichi* reported here shows that diagnostic characters for the species are well developed by 11–12 mm TL. The postanal carina is indistinct in specimens below 12 mm TL, and is tuberculate distally in the largest specimen. As in *L. inermis* and *L. minor*, the distal movable spine on the outer margin of the proximal uropodal exopod segment is spinular in the smallest specimens, becoming increasingly spatulate with increasing size. One specimen with a regenerating raptorial claw bears five teeth on the dactylus.

Habitat. Sand and mud substrates; 9–43 m in Australia. Ahyong & Naiyanetr (in press) the species from mud or sand with shell fragments at depths of 20–42.5 m.

Distribution. The Andaman Sea, Vietnam, New Caledonia and now from Australia.

Lophosquilla Manning, 1968c

Lophosquilla Manning, 1968c: 121, 133. Type species *Squilla costata* de Haan, 1844, by original designation. Gender feminine.

Toshimitsu Manning, 1995: 234–235. Type species *Lophosquilla tiwarii* Blumstein, 1974, by original designation and monotypy. Gender masculine.

Diagnosis. Eye with cornea bilobed, width less than 0.3 CL. Carapace with anterolateral spines; with MD, IM, LT, MG and reflected MG carinae, and at most with short carinae and tubercles adjacent to MD carina; MD carina distinct, interrupted at base of anterior bifurcation; branches of anterior bifurcation distinct; opening anterior to dorsal pit; posterolateral margin rounded. Raptorial claw dactylus with 6 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp absent. MXP1–4 each with epipod. PLP1 endopod in adult males with posterior endite; hook process blunt distally. TS5–7 lateral process bilobed. TS6–8 with distinct SM and IM carinae; with or without short supplementary carinae or irregular coarse tubercles and short irregular reticulated carinae. AS1–5 with normal complement of carinae, MD and supplementary carinae concentrated around SM and IM carinae; with or without numerous tubercles and short carinae laterally. Telson SM teeth with fixed apices; prelateral lobe present or absent; dorsolateral surface with curved rows of shallow pits, tubercles and supplementary longitudinal carinae.

Included species. Three: *L. costata* (de Haan, 1844); *L. makarovi* Manning, 1995; and *L. tiwarii* Blumstein, 1974.

Remarks. Manning (1995) erected *Toshimitsu* for *Lophosquilla tiwarii*, a species that differed from other species of *Lophosquilla* chiefly in bearing prelateral lobes on the telson. Other characters used by Manning (1995) to distinguish *Toshimitsu* from *Lophosquilla* sensu stricto, such as the spination of AS4 and the relative width of the lateral lobes of TS6 are variable between species in other genera. Moreover, recent cladistic analysis of the squilloid genera show that *Toshimitsu* and *Lophosquilla* are together monophyletic. Therefore, little justification exists for retaining the monotypic *Toshimitsu* and it is herein synonymized with *Lophosquilla*.

Lophosquilla is restricted here to the type species, *L. costata*, *L. makarovi* and *L. tiwarii*. *Lophosquilla paulocarinata* Blumstein, 1972, bears all diagnostic characters of *Paralimopsis* Moosa, 1991, and is herein transferred. Two of three species of *Lophosquilla* are known from Australia.

Key to species of *Lophosquilla*

1 Telson without prelateral lobe. AS4 with armed SM carinae. Lobe on outer margin of inner spine of uropodal protopod produced to a short, slender spine .... ***L. tiwarii***

—— Telson with prelateral lobe. AS4 with unarmed SM carinae. Lobe on outer margin of inner spine of uropodal protopod rounded 2

2 Carapace with line of tubercles adjacent to MD carina anterior to cervical groove. TS6–8 with MD carina. Abdominal somites with one or more undivided carinae as well as tubercles between MD and SM carinae. Telson with carinae lateral to postanal carina .... ***L. costata***

—— Carapace smooth adjacent to MD carina anterior to cervical groove, without line of tubercles. TS6–7 without MD carina. Abdominal somites with at most one carina between MD and SM carinae. Telson without carinae lateral to postanal carina .... *L. makarovi*

Lophosquilla costata (de Haan, 1844)

Fig. 134

Squilla costata de Haan, 1844 (atlas): pl. 51, fig. 5 (type locality: Japan); 1849: 223 (text).–Holthuis, 1941: 256.

Lophosquilla costata.–Yamaguchi & Baba, 1993: 182–183, fig. 13.–Graham *et al*., 1993a: 24, 64.–Manning, 1995: 25, 211.

Lophosquilla makarovi.–Manning, 1995: 211 (paratype only, not *L. makarovi* Manning, 1995).

Australian material. QUEENSLAND: AM P21651, 2♂♂ (TL 63–69 mm), 2♀♀ (TL 64–66 mm), SE Gulf of Carpentaria, 16°41.42'S 140°30.5'E, 18 m, 10 Jul 1964; AM P21652, 1♂ (TL 55 mm), SE Gulf of Carpentaria, 16°43.5'S 139°25.2'E, 11 m, 11 Nov 1963; AM P54460, 1♂ (TL 46 mm), 5♀♀ (TL 47–75 mm), eastern Gulf of Carpentaria between Karumba & Weipa near Nassau River, 15°53'S 141°32'E, 22 m, trawl, T. Wassenberg, 8–21 Dec 1976; QM W3989, 1♀ (TL 89 mm), 11 km NE of Mackay, 21°04'S 149°17'E, muddy sand, J. Davie, 11 Aug 1970; QM W6441, 4♂♂ (TL 57–65 mm), 9♀♀ (TL 49–79 mm), Gulf of Carpentaria, near Weipa, 12°39'S 141°53'E, trawl, 22 m, RP01/76, T. Wassenberg, 8–21 Dec 1976. NEW SOUTH WALES: AM P41824, 1♀ (TL 77 mm), NE of mouth of Clarence River, 29°24'S 153°23'E, 24 m, trawl, K91–01–04, K. Graham, 13 Feb 1991. NORTHERN TERRITORY: NTM, 1♂ (TL 64 mm), 1♀ (TL 49 mm), Hope Inlet, Mickett Creek area, Shoal Bay, intertidal, NT Fisheries, 25 Jul 1973; NTM, 1♀ (TL 52 mm), Shoal Bay, NT Fisheries, 22 Aug 1972.

Other material. USNM 136307, 1♀ (TL 71 mm), South Cheung Chau I., Hong Kong, B. Morton, 26 Nov 1970 (paratype of *Lophosquilla makarovi* Manning); AM G5486, 1♀ (TL 50 mm), Japan.

Diagnosis. Carapace with line of tubercles adjacent to MD carina anterior to cervical groove (but represented by irregular carina in smallest specimens). TS6–8 with MD carina and 3 or 4 carinae between SM carinae. AS1–5 with 1 or 2 long carinae and shorter tubercles and broken carinae between MD and SM carinae. Abdominal carinae spined as follows: SM 5–6, IM (3)4–6, LT 2–6, MG 1–5. Telson with prelateral lobe; with long postanal carina, flanked by tubercles, 2 irregular, discontinuous carinae and shorter curved carinae distally; denticles SM 3–4, IM 7–8, LT 1. Uropodal protopod with round lobe on outer margin of inner spine; exopod with 7 or 8 movable spines.

Colour in alcohol. Almost completely faded, but with dark proximal median patch on median carina of telson.

Measurements. Male (n = 9) TL 46–69 mm, female (n = 22) TL 47–89 mm. CI 423–512. A1 peduncle 0.92–1.03 CL. A2 scale 0.51–0.58 CL. Anterior carapace width 0.43–0.48 CL. The present series includes the largest known specimen of the species.

Remarks. *Lophosquilla costata* differs from *L. tiwarii* and resembles *L. makarovi* by the presence of prelateral lobe on the telson and a rounded lobe instead of a spine on the outer margin of the inner spine of the uropodal protopod. *Lophosquilla costata* differs from *L. makarovi* by the presence of a row of tubercles on the carapace lateral to the median carina, carinae between the submedians on TS5–7, and longitudinal carinae on the ventral surface of the telson lateral to the postanal carina. The paratype of *L. makarovi* agrees in all respects with, and is referable to *L. costata*.

Yamaguchi & Baba (1993) designated a female syntype (NNM S 452) as the lectotype.

Habitat. Muddy sand from the shore to 24 m depth.

Distribution. Japan, Taiwan, Hong Kong, the Philippines and Australia, from the Northern Territory to northern New South Wales.

Lophosquilla tiwarii Blumstein, 1974

Fig. 135

Squilla costata.–Kemp, 1913: 84, pl. 6: figs. 70–72 (part, Burmese specimen).–Kemp & Chopra, 1921: 303 (not *Squilla costata* de Haan, 1844).

Squilla sp. prox. *costata*.–Tiwari & Biswas, 1952: 354–355, figs. 2b,e,g,j.

Lophosquilla tiwarii Blumstein, 1974: 123–124, fig. 8 (type locality: Gulf of Tonkin, Vietnam, 20°20'N 108°25'E).–Moosa, 1986: 404–405.–Manning, 1991: 11, 12.

Lophosquilla costata.–Garcia, 1981: 19–21 (not *L. costata* de Haan, 1844).

Toshimitsu tiwarii.–Manning, 1995: 235–236, fig. 142.

Material. QUEENSLAND: AM P57177, 1♀ (TL 38 mm), E of Wessell Is, Arafura Sea, SS0591 21, 1991; AM P57178, 2♀♀ (TL 32–44 mm), Gulf of Carpentaria, 11°26.8'S 138°12.4'E, 50 m, SS0390 26, Nov 1990; AM P57179, 3♀♀ (TL 35–46 mm), Gulf of Carpentaria, 12°00.0'S 139°14.3'E, 53 m, SS0390 31, Nov 1990; AM P57180, 1♀ (TL 31 mm), Arafura Sea, 11°32.7'S 138°41.8'E, 53 m, SS0390 85, 9 Dec 1990; AM P57181, 1♀ (TL 33 mm), Gulf of Carpentaria, 12°06.9'S 139°59.0'E, SS0591 40, 25 Nov 1991; AM P57184, 1♂ (TL 23 mm), NE of Cape Arnhem, Arafura Sea, 10°41.8'S 138°31.1'E, SS0591 20, 21 Nov 1991. NORTHERN TERRITORY: AM P43228, 1♂ (TL 21 mm), 2♀♀ (TL 37–39 mm), Arafura Sea, 10°29.7'S 137°14.5'E, 53 m, mixed shell & gravel, otter trawl, 17 Mar 1975; AM P43234, 1♀ (TL 33 mm), Arafura Sea, otter trawl; AM P57174, 2♀♀ (TL 35–41 mm), N of Groote Eylandt, 13°29.7'S 136°42.00'E, SS0390 009, Nov 1990; AM P57175, 1♀ (TL 42 mm), NE of Wessell Is, Arafura Sea, 10°30.12'S 137°12.03'E, 50 m, SS0390 002, Nov 1990; AM P57176, 1♂ (TL 26 mm), 4♀♀ (TL 32–42 mm), Arafura Sea, 10°03.2'S 137°11.2'E, 42 m, SS0390 001, Nov 1990; AM P57182,

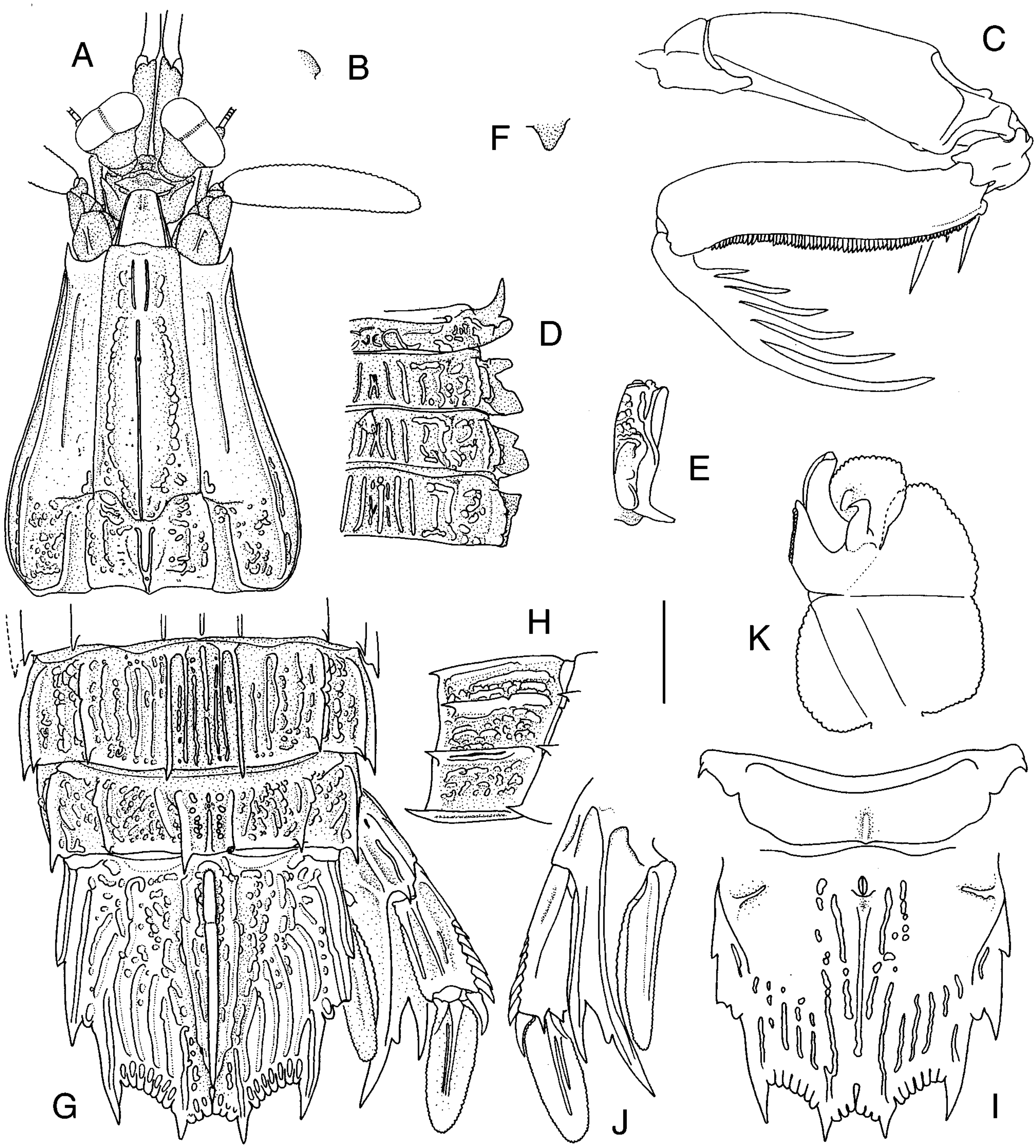

Figure 134. *Lophosquilla costata* (de Haan). A–J, ♀ TL 77 mm (AM P41824). K, ♂ TL 46 mm (AM P54460). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS5–6, telson & uropod, dorsal. H, AS5, right lateral. I, AS6 & telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A–J = 5 mm; K = 1.2 mm.

1♂ (TL 35 mm), Arafura Sea, 10°14.4'S 136°52.4'E, SS0591 16, Nov–Dec 1991; AM P57183, 3♂♂ (TL 30–33 mm), N of Groote Eylandt, Gulf of Carpentaria, 12°57.3'S 136°46.1'E, 32 m, SS0390 008, 23 Nov 1990.

Diagnosis. Carapace with numerous tubercles or short carinae posterolaterally and lateral to MD carina. TS5–8 dorsal surface with irregular coarse tubercles and short irregular reticulated carinae; with rugose MD, SM, and IM carinae; MD carina of TS5 and TS8 unicarinate, that of TS6–7 bicarinate. AS1–5 with MD and several longitudinal carinae between SM carinae. AS6 with MD and tricarinate SM carinae. Abdominal carinae spined as follows: SM (3)4–

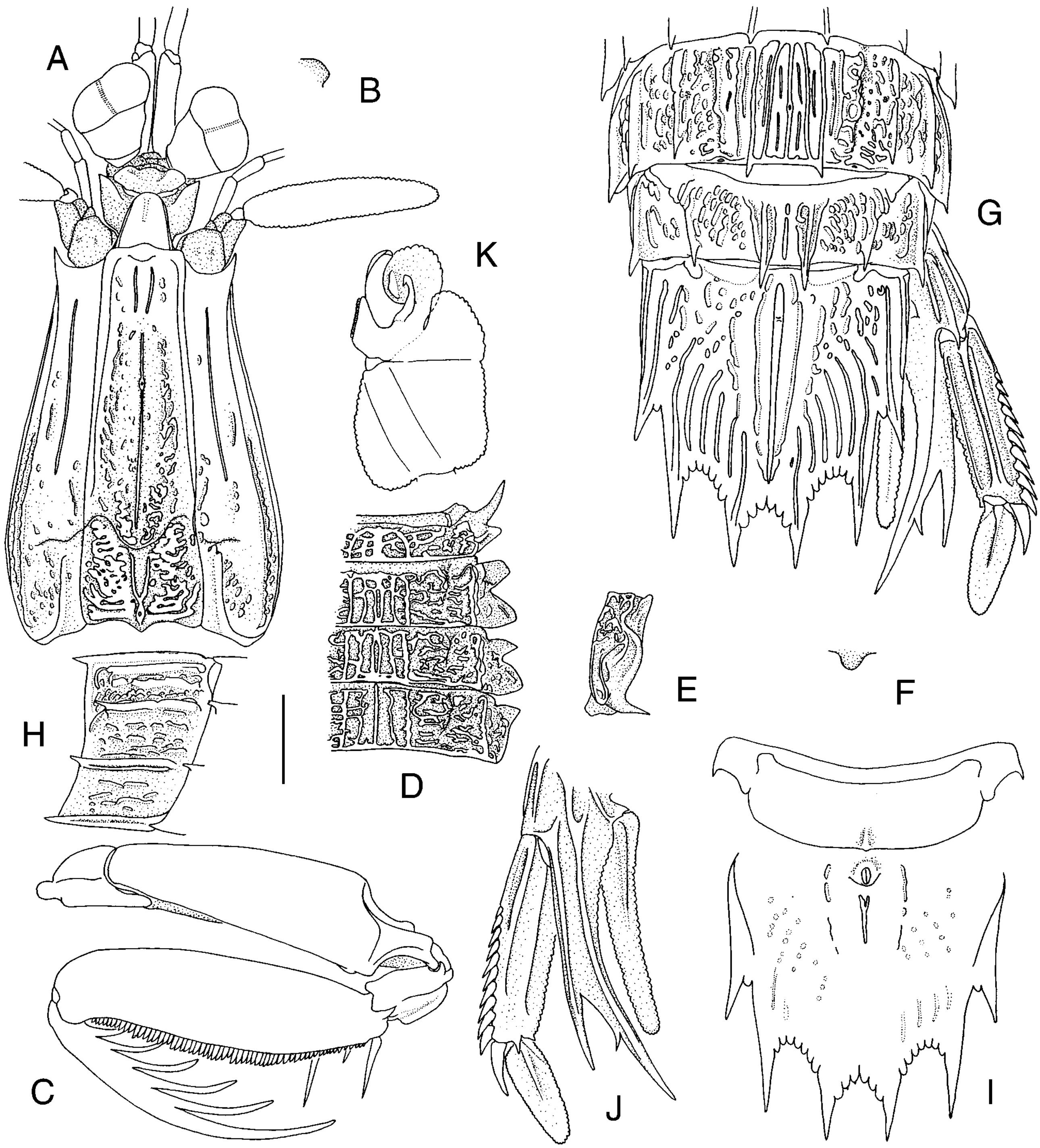

Figure 135. *Lophosquilla tiwarii* Blumstein. A–J, ♀ TL 37 mm (AM P43228). K, ♂ TL 33 mm (AM P57183). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS5–6, telson & uropod, dorsal. H, AS5, right lateral. I, AS6 & telson, ventral. J, uropod, right ventral. K, PLP1 endopod, right anterior. Scale A–J = 2 mm; K = 1 mm.

6, IM (1–2)3–6, LT (1)2–6, MG 1–5. Telson without prelateral lobe. Uropodal protopod with spine on outer margin of inner spine.

Description. Dorsal integument rugose, pitted, tuberculate and carinate. Eye not extending beyond A1 peduncle segment 1; cornea bilobed, distinctly broader than and set obliquely on stalk; CI 416–497. Ophthalmic somite anterior margin with rounded to flattened apex. Ocular scales truncate. A1 somite dorsal processes trianguloid, with blunt, rounded apices, directed anterolaterally; A1 peduncle 0.92–1.05 CL. A2 scale 0.46–0.54 CL. Rostral plate slightly broader than or as broad as long; lateral margins convergent, apex rounded; dorsally with marginal carina and indistinct median carina. Carapace anterior width 0.42–0.48 CL; anterolateral spines extending to but not beyond base of rostral plate; with normal complement of carinae; MD carina distinct, interrupted at base of anterior bifurcation; branches of anterior bifurcation distinct, opening anterior to dorsal pit; with numerous tubercles or short carinae posterolaterally and lateral to MD carina; posterior median projection distinct, obtuse. Raptorial claw dactylus with 6 teeth; outer margin broadly curved, proximal margin with faint basal indentation; carpus dorsal carina undivided; propodus distal margin unarmed; merus outer inferodistal angle unarmed, at most a blunt angle. Mandibular palp absent. MXP1–4 with epipod. MXP5 basal segment with ventrally directed spine. TS5–8 dorsal surface with irregular coarse tubercles and short irregular reticulated carinae; with rugose MD, SM, and IM carinae; MD carina of TS5 and TS8 unicarinate, that of TS6–7 bicarinate. TS5 lateral process bilobed; anterior lobe a slender spine directed anterolaterally; posterior lobe short, apex blunt, directed laterally. TS6–7 lateral process distinctly bilobed. TS6 lateral process with anterior lobe subequal to posterior lobe, subquadrate, apex rounded to truncate; posterior lobe broad, trianguloid, apex blunt. TS7 lateral process with anterior lobe smaller than posterior lobe, triangular, apex sharp; posterior lobe broad, triangular, anterior margin slightly convex, apex blunt. TS8 anterolateral margin triangular, apex sharp; sternal keel rounded. Pereiopods 1–3 with basal segment unarmed; endopod segments fused, distal segment slender. AS1–5 with MD and several longitudinal carinae between SM carinae; with unicarinate IM, bicarinate LT and M6 carinae; SM carinae subparallel; with numerous tubercles and short carinae laterally. AS6 with MD and tricarinate SM carinae; with short carinae and tubercles between SM, IM and LT carinae; with sharp ventrolateral spine anterior to uropodal articulation. Abdominal carinae spined as follows: SM (3)4–6, IM (1–2)3–6, LT (1)2–6, MG 1–5. Sternum posterior margin with blunt median tubercle. Telson flattened, slightly longer than broad; with 3 pairs of primary teeth (SM, IM, LT), each with dorsal carina; SM teeth with fixed apices; prelateral lobe absent; MD carina interrupted proximally, armed posteriorly with long apical spine overhanging blunt tubercle; dorsolateral surface with accessory MD carina, with irregular tubercles proximally and curved rows of supplementary longitudinal carinae; denticles SM 2–3, IM 6–8, LT 1, rounded, each without dorsal tubercle; ventral surface with short postanal carina and short irregular carina flanking anal pore; ventrolateral carina extending to base of IM tooth. Uropodal protopod terminating in 2 slender spines, dorsally and ventrally carinate, inner longer; unarmed dorsally excepting dorsal spine above proximal exopod articulation; protopod multicarinate proximally; with ventral tubercle anterior to endopod articulation; terminal spines with spine on outer margin of inner spine. Uropodal exopod proximal segment unarmed dorsally; inner margin straight, with short proximal concavity; outer margin with 9–12 movable spines, distalmost not exceeding midlength of distal segment; distal margin with 2 ventral spines, outer longest. Exopod distal segment shorter than proximal segment; endopod unarmed dorsally, entire margin setose.

Colour pattern in alcohol. Completely faded.

Measurements. Male (*n* = 7) TL 21–35 mm, ♀ (*n* = 18) TL 32–46 mm. Moosa (1986) reported specimens to 66 mm TL from the Philippines.

Remarks. *Lophosquilla tiwarii* is redescribed above to supplement the brief type description (Blumstein, 1974). The present specimens agree in most respects with the accounts of Kemp (1913), Tiwari & Biswas (1952), Blumstein (1974) and Manning (1995). The Australian specimens differ, however, in the following features: the posterior lobe of the lateral process of TS5 is triangular instead of broadly rounded, and the carina of the submedian teeth of the telson is single instead of bifurcate proximally. In these characters, the Australian specimens resemble a specimen reported by Garcia (1981) from the Philippines. The Australian specimens of *L. tiwarii* and the specimen reported by Garcia (1981) may represent a distinct species, but more material must be examined from intermediate localities before this issue can be settled.

The complexity of the supplementary dorsal carination increases with size in *L. tiwarii*. At 21 mm TL, supplementary abdominal and telson carinae, except the median carina, are undeveloped. By 33 mm TL, dorsal tubercles and supplementary carina on the abdomen and telson are well developed. The petasma is well developed in the smallest males examined.

Habitat. Sandy-mud or shelly substrates at depths of 42–53 m. Moosa (1986) reported *L. tiwarii* to a depth of 182–187 m in the Philippines. Ahyong & Naiyanetr (in press) report the species from the Andaman Sea off Phuket at a depth of 38.2 m

Distribution. Burma to the Gulf of Tonkin, Vietnam, Philippines, and now northern Australia.

Miyakea Manning, 1995

Miyakea Manning, 1995: 213. Type species *Squilla nepa* Latreille, 1828, by original designation. Gender feminine.

Diagnosis. Dorsal integument pitted, rugose. Eye with cornea bilobed, width less than 0.3 CL. Ocular scales separate. Carapace with anterolateral spines; with normal complement of carinae; MD carina distinct, uninterrupted at base of anterior bifurcation; branches of anterior bifurcation distinct, opening posterior to dorsal pit; posterolateral margin rounded. Raptorial claw dactylus with 6 teeth; carpus dorsal carina sinuous or with low irregular tubercles; merus outer surface with inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult ♂♂ without posterior endite; hook process blunt distally. TS6–8 with distinct SM and IM carinae. TS5–7 lateral processes bilobed. AS1–6 with normal complement of carinae. Telson SM teeth with fixed apices; prelateral lobe present; dorsolateral surface without supplementary longitudinal carinae.

Included species. Two: *M. holoschista* (Kemp, 1911); and *M. nepa* (Latreille, 1828).

Remarks. Species of *Miyakea* resemble species of *Oratosquillina* and most species of *Oratosquilla* in bearing a normal complement of carinae on the carapace and body, bilobed lateral processes on TS5–7, an outer inferodistal spine and six teeth on the dactylus of the raptorial claw. *Miyakea* differs from *Oratosquilla* and *Oratosquillina* in having the dorsal pit enclosed by the branches of the anterior bifurcation of the median carina of the carapace and in lacking the posterior endite of the endopod on the first pleopod in males. In *Oratosquilla* and *Oratosquillina*, the anterior bifurcation of the median carina of the carapace opens anterior to the dorsal pit and the posterior endite of the endopod of the first pleopod is present in males. *Dictyosquilla* and *Natosquilla* are the only other squillid genera without the posterior endite on the endopod of the first pleopod in males. Both species of *Miyakea* occur in the Indo-West Pacific but only *M. nepa* is known from Australia.

Key to species of *Miyakea*

1 Carapace with portion of MD carina between cervical groove and anterior bifurcation simple, not bicarinate. AS4 with SM carinae usually armed posteriorly .... ***M. nepa***

—— Carapace with portion of MD carina between cervical groove finely bicarinate. AS4 with SM carinae unarmed posteriorly .... *M. holoschista*

Miyakea nepa (Latreille, 1828)

Fig. 136

Squilla nepa Latreille, 1828: 471 (type localities: Xiamen, China, by present neotype designation).–Haswell, 1882: 208–209.–Kemp, 1913: 3, 10, 22, 30, 195, pl. 4: fig. 49.–Holthuis, 1941: 245–246.–Stephenson, 1953a: 41.–Stephenson & McNeill, 1955: 243.–Manning, 1968b: 31–32, fig. 10.

Squilla Edwardsi Giebel, 1861: 320 (type locality: Insel Banka, Indonesia, 2°15'S 106°00'E).

Squilla laevis.–Stephenson, 1960: 61 (not *Squilla laevis* Hess, 1865).

Squilla wood-masoni.–Stephenson & McNeill, 1955: 244 (part, not *Squilla woodmasoni* Kemp, 1911).

Oratosquilla nepa.–Manning, 1968b: 31–32, fig. 10; 1971b: 3.–Moosa, 1986: 410; 1991: 212.–Manning, 1991: 12.

Miyakea nepa.–Manning, 1995.–Ahyong *et al*., 1999: 47, 52, fig. 6a–d.

Type material. NEOTYPE: ZRC 1999.2082, 1♀ (TL 106 mm), Xiamen, China, Cai & Ng, 18 Nov 1998.

Australian material. QUEENSLAND: QM W12226, 1♀ (TL 132 mm), off White Cliffs, N of Cairns, 16°35'S 145°31'E, 7.3 m, otter trawl on mud & sand, N. Haysom, 12 Mar 1958; QM W12868, 3♂♂ (TL 141–144 mm), SE end Hinchinbrook I., 18°27.5'S 146°22.7'E, trawl, C. Jones, 6 Feb 1986; AM P14183, 1♂ (TL 117 mm), Albatross Bay, Gulf of Carpentaria, 12°40'S 141°42'E, H. Foley, Jun 1962; AM P21639, 2♀♀ (TL 114–125 mm), SE Gulf of Carpentaria, 17°24.7'S 140°42.0'E, 3.7 m, trawl 1, 27 Jul 1963; AM P21640, 3♂♂ (TL 117–132 mm), 4♀♀ (TL 124–140 mm), SE Gulf of Carpentaria, 16°55'S 140°41'E, less than 25 m, J. Yaldwyn & D. McMichael, Dec 1963; AM P21641, 1♀ (TL 136 mm), SE Gulf of Carpentaria, 17°30.1'S 140°27.6'E, 5.5 m, 31 Jul 1963; AM P21643, 4♂♂ (TL 80–122 mm), 7♀♀ (TL 78–136 mm), SE Gulf of Carpentaria, less than 25 m; AM P55575, 1♂ (TL 126 mm), 1♀ (TL 127 mm), near Nassau River, Gulf of Carpentaria, 15°53'S 141°32'E, 22 m, trawl, Dec 1976; AM P55576, 1♀ (TL 109 mm), Gulf of Carpentaria, between Karumba & Weipa, trawl, I. Loch, Dec 1976; AM P21642, 6♂♂ (TL 79–113 mm), SE Gulf of Carpentaria, 17°37'S 140°08'E, 5 m, 9 Sep 1963; QM, 1♂ (TL 122 mm), 1♀ (TL 129 mm), Albatross Bay, Gulf of Carpentaria, 12°50'S 140°30'E, 20 m, T. Wassenberg, Jan 1991. NORTHERN TERRITORY: AM P12380, 1♀ (TL 128 mm), near Emery Point, Darwin, 12°27'S 130°50'E, F. Wells, 1954; NTM, 1♂ (TL 130 mm), 6.4 km N of Jones Shoal, off Cobourg Peninsula, 10°53'S 132°17.1'E; NTM, 1♂ (TL 69 mm), Shoal Bay, NT Fisheries, 22 Aug 1972; NTM, 1♀ (TL 150 mm), Arafura Sea, 12°58'S 132°10'E, A. Bruce, 18 Oct 1981.

Other material. ZRC 1999.2094, 2♀♀ (TL 72–82 mm), Qianjiang, Y. Cai & N.K. Ng, 12 Nov 1998; ZRC 1999.2113, 1♀ (TL 96 mm), Houzhai, Nan'ao County, Guangdong, China, Y. Cai & N.K. Ng, 12 Nov 1998; ZRC 1999.2115, 3♀♀ (TL 68–72 mm), Qianjiang, Nan'ao County (island), China, 14 Nov 1998. ZRC 1970.10.19.8–9, 2♀♀ (TL 145–150 mm), Singapore, fishmarket, M. Tweedie, Oct 1933; ZRC 1970.10.19.5, 1♂ (TL 115 mm), Siglap, Singapore, M. Tweedie, Jun 1933.

Diagnosis. Carapace with portion of MD carina between cervical groove and anterior bifurcation simple, not finely bicarinate. AS4 SM carinae usually posteriorly spined. Abdominal carinae spined as follows: SM (3–4)6 (usually 4–6), IM 3–6, LT (1–2)3–6, MG 1–5. AS2 & 5 with dark transverse mid-dorsal patch. Telson denticles SM 2–3, IM 7–10, LT 1. Uropodal exopod outer margin with 8–10 movable spines.

Colour in life. Overall dorsal colour olive grey-green. Carinae and grooves of carapace, carinae and posterior margins of body somites dark green. Telson with MD carina and carinae of primary teeth dark green; with dark transverse band medially. Uropodal protopod with terminal spines pink; exopod distal segment dark blue-green distally; exopod proximal segment yellow with dark inner proximal infusion.

Measurements. Male (n = 22) TL 69–144 mm, female (n = 29) TL 68–150 mm. CI 523–724. A1 peduncle 0.84–0.92 CL. A2 scale length 0.60–71 CL. Anterior carapace width 0.51–0.57 CL. Kemp (1913) reported specimens up to 166 mm TL.

Remarks. The specific name, *nepa*, has been consistently applied to the present species since the study of Bigelow (1894). Unfortunately, however, Bigelow (1894) did not examine type material and Latreille's (1828) limited account of *M. nepa* (as *Squilla nepa*) could apply to almost any Indo-West Pacific squillid with bilobed lateral processes of TS5–7. Therefore, the species commonly referred to as *M.*

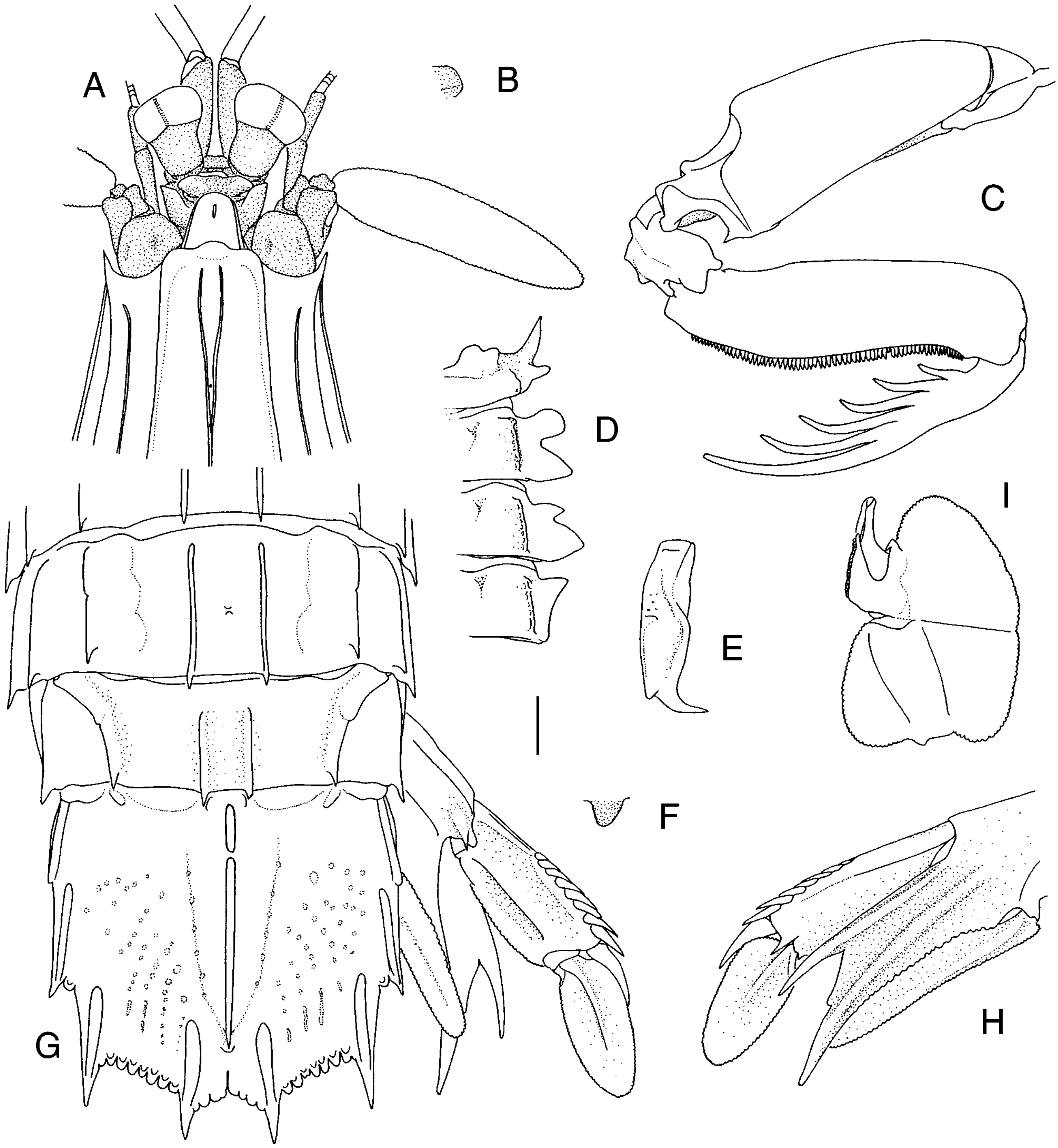

Figure 136. *Miyakea nepa* (Latreille), ♂ TL 85 mm (AM P21643). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, left lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 2.5 mm; I = 1.25 mm.

nepa may or may not be conspecific with Latreille's type material. Moreover, a second species closely allied to and sympatric with *M. nepa*, *M. holoschista*, was subsequently described by Kemp (1911). The type material of *M. nepa* is untraceable and considered lost based on examination by myself (in 1998) and A. Anker (in 2000) of the collections and records of the Muséum national d'Histoire naturelle, Paris, where Latreille's types ought to be deposited. Therefore, in view of the potential ambiguity of the identity of *M. nepa* and its status as the type species of the genus, a neotype is herein selected to fix the identity of the species. The neotype is a 106 mm TL female specimen from Xiamen, China and is deposited in the Zoological Reference Collection of the Raffles Museum, Singapore.

The present specimens of *M. nepa* from Australia agree well with topotypic material and published accounts (Kemp, 1913; Manning, 1968b, 1995; Ahyong *et al*., 1999). No Australian or Chinese specimens, however, bear armed submedian carinae on AS3 as in some specimens from Madagascar reported by Manning (1968b) and some specimens from Singapore studied here. Spined submedian carinae on AS4 are diagnostic for *M. nepa*, but two otherwise normal specimens show reduced spination. In one specimen, the submedian carinae on AS4 are both unarmed and in the other, the submedian carinae are armed only on one side.

Habitat. Level sand and mud substrates; shallow sublittoral to less than 25 m.

Distribution. Western Indian Ocean to Vietnam, Taiwan, the Philippines, New Caledonia, French Polynesia and Australia.

Neoanchisquilla Moosa, 1991

Neoanchisquilla Moosa, 1991: 208. Type species *Neoanchisquilla semblatae* Moosa, 1991, by monotypy. Gender feminine.

Diagnosis. Eye with cornea bilobed; cornea broader than and set obliquely on stalk, width less than 0.3 CL. Ophthalmic somite with rounded anterior margin. Carapace anterolateral angles armed; MD and IM carinae absent; LT carina indistinct, indicated posteriorly only; with indistinct reflected MG carina; posterolateral margin rounded. Raptorial claw dactylus with more than 6 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite (unknown in *N. australiensis*). TS5–7 lateral process single. TS5–8 and AS1–5 without SM carinae. Telson SM teeth with movable apices; prelateral lobe present; dorsolateral surface with numerous supplementary longitudinal carinae or rows of tubercles. Uropodal protopod inner margin armed with slender spines.

Included species. Three: *N. australiensis* Ahyong, 1998; *N. semblatae* Moosa, 1991; and *N. tuberculata* Ahyong, 1998.

Remarks. The genus was fully reviewed by Ahyong (1998). *Neoanchisquilla* closely resembles *Anchisquilla*, but the anterior margin of the ophthalmic somite is rounded instead of triangular, there are seven or eight instead of six teeth on the dactylus of the raptorial claw and the apices of the submedian teeth of the telson are articulated instead of fixed. *Neoanchisquilla* is known only from the Indo-West Pacific with one Australian species.

Key to species of *Neoanchisquilla* (based on Ahyong, 1998)

1 Rostral plate ovoid; apex broadly rounded. Carapace anterolateral spines extending to base of rostral plate. Dactylus of raptorial claw with 8 teeth. Telson dorsal surface without accessory MD carina .... *N. semblatae*

—— Rostral plate triangular; apex narrow, blunt. Carapace anterolateral spines small, not extending to base of rostral plate. Dactylus of raptorial claw with 7 teeth 2

2 Telson dorsolateral surface with numerous curved rows of tubercles. TS6–7 lateral processes flattened, margin slightly sinuous. Ventral surface of telson with rows of tubercles adjacent to postanal carina .... *N. tuberculata*

—— Telson dorsolateral surface with numerous undivided carinae. TS6–7 lateral processes broadly rounded. Ventral surface of telson without rows of tubercles adjacent to postanal carina .... ***N. australiensis***

Neoanchisquilla australiensis Ahyong, 1998

Fig. 137

Neoanchisquilla australiensis Ahyong, 1998: 219–222: fig. 2.

Type material. HOLOTYPE: NTM Cr012355, ♀ (TL 25 mm), Northwest Shelf, Western Australia, 19°58.6–59.1'S 117°49.0–49.4'E, 43 m, beam trawl, FRV *Soela*, 25 Jun 1983.

Diagnosis. Rostral plate slightly longer than broad; triangular; apex narrow, blunt. Raptorial claw dactylus with 7 teeth. TS6–7 lateral process broadly rounded. Abdominal carinae spined as follows: SM 6, IM 6, LT 6, MG 2–5. Telson dorsal surface with MD carina and numerous undivided carinae; ventral surface without rows of tubercles either side of postanal carina; denticles SM 7, IM 12–14, LT 1. Uropodal protopod inner margin lined with 11 spines; exopod proximal segment outer margin with 6 movable spines.

Measurements. Female (n = 1) TL 25 mm. CI 421. A1 peduncle 0.85 CL. A2 scale length 0.48 CL. Anterior carapace width 0.50 CL.

Remarks. A full account of the species is given by Ahyong (1998).

Habitat. Taken from trawlable substrates at 43 m.

Distribution. Known only from the type locality, the Northwest Shelf, Western Australia.

Oratosquilla Manning, 1968c

Oratosquilla Manning, 1968c: 120, 133. Type species *Squilla oratoria* de Haan, 1844, by original designation. Gender feminine.

Diagnosis. Dorsal integument variously pitted. Eye large,

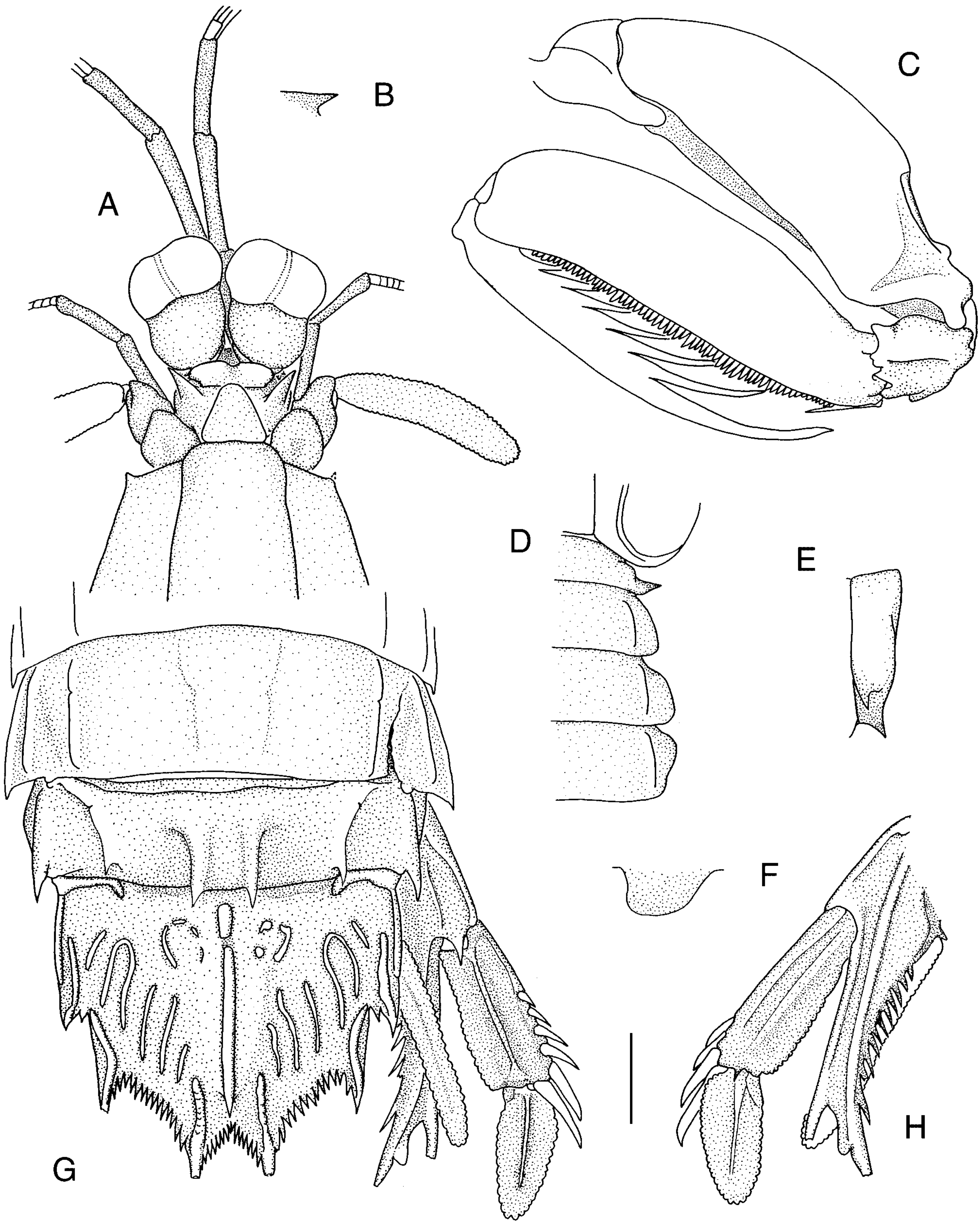

Figure 137. *Neoanchisquilla australiensis* Ahyong, holotype TL 25 mm. A, anterior cephalon, dorsal; B, A1 somite dorsal process, right lateral; C, raptorial claw, right lateral; D, TS5, right lateral; E, posterior carapace and TS5–8 lateral processes, right dorsal; F, TS8 sternal keel, right lateral; G, AS5–6, telson and uropod, dorsal; H, uropod, right ventral. Scale A–E, G = 1.25 mm; F = 0.6 mm. (Modified after Ahyong [1998]).

T-shaped, strongly bilobed, distinctly broader than and set obliquely on stalk, cornea width less than 0.3 CL. Ocular scales separate. Carapace with anterolateral spines; with normal complement of carinae; MD carina distinct, not interrupted at base of anterior bifurcation; branches of anterior bifurcation distinct, opening anterior to dorsal pit; posterolateral margin rounded. Raptorial claw dactylus with 6 teeth, outer margin without basal notch; carpus dorsal carina bi- or tri-tuberculate; merus outer inferodistal angle with or without spine. Mandibular palp 3-segmented. MXP1–4 with epipod. PLP1 endopod in adult males with posterior endite; hook process blunt distally. TS6–8 with distinct SM and IM carinae. TS5–6 lateral processes bilobed. AS1–6 with normal complement of carinae; carinae distinct. Telson SM teeth with fixed apices; prelateral lobe present; dorsolateral surface with curved rows of shallow pits; without supplementary longitudinal carinae; ventral surface with short postanal carina. Uropodal protopod inner margin crenulate.

Included species. Four: *O. kempi* (Schmitt, 1931); *O. fabricii* (Holthuis, 1941); *O. mauritiana* (Kemp, 1913); and *O. oratoria* (de Haan, 1844).

Remarks. *Oratosquilla* differs from other squillid genera having bilobed lateral processes of TS5–6 and in having the anterior bifurcation of the median carina of the carapace uninterrupted basally and opening anterior to the dorsal pit. Although Manning (1995) placed *Squilla fabricii* Holthuis, 1941, in *Oratosquillina*, Ahyong (2000b) showed that it belongs to *Oratosquilla* and is a senior synonym of *O. calumnia* (Townsley, 1953).

Oratosquilla kempi differs from its congeners by lacking the inferodistal meral spine, having the lateral process of TS7 at most indistinctly bilobed and in bearing a pair of large dark patches on AS5. Of the four species of *Oratosquilla*, one is known from Australia.

Key to species of *Oratosquilla*

1 Raptorial claw merus without outer inferodistal spine .... *O. kempi*

—— Raptorial claw merus with outer inferodistal spine 2

2 SM carinae of AS4–6 each with posterior spine 3

—— SM carinae of AS4 unarmed .... ***O. oratoria***

3 Dorsum smooth, not punctate. Anterior lobe of lateral process of TS7 blunt .... *O. mauritiana*

—— Dorsum distinctly punctate. Anterior lobe of lateral process of TS7 pointed to blunt .... *O. fabricii*

Oratosquilla oratoria (de Haan, 1844)

Fig. 138

Squilla oratoria de Haan, 1844 (atlas): pl. 51, fig. 2 (type locality: Japan); 1849 (text): 223.–Kemp, 1913: 3, 10, 23, 66, pl. 5, figs. 54–56 (part).–Manning, 1965: 259–260.
Squilla affinis Berthold, 1845: 46 (type locality: China).
Oratosquilla oratoria.–Manning, 1971b: 4, 6–8, fig. 2.–Yamaguchi & Baba, 1993: 183–186, figs. 14, pl. 3a,b.–Manning, 1995: 25, 224, figs. 136a, b, 137.–Ahyong *et al*., 1999: 49, 52, fig. 6f–i.

Australian material. NEW SOUTH WALES: AM P49735, 3♀♀ (TL 95–168 mm), off Patonga Beach, Hawkesbury River, 32°34'S 151°17'E, 10 m, trawl, muddy sand, S. Ahyong, 12 Feb 1994; AM P49736, 4♂♂ (TL 136–172 mm), 2♀♀ (TL 161–171 mm), off Patonga Beach, Hawkesbury River, 32°34'S 151°17'E, 10 m, trawl, muddy sand, S. Ahyong, 29 Jan 1994; AM P49739, 13♂♂ (TL 93–143 mm), 8♀♀ (TL 98–182 mm), Port Jackson, 33°55'S 151°15'E, 20 m, trawl, muddy sand, M. Beatson, 7 Mar 1994; AM P49767, 7♂♂ (TL 94–139 mm), 8♀♀ (TL 101–178 mm), Port Jackson, 33°55'S 151°15'E, 20 m, trawl, muddy sand, M. Beatson, 7 Feb 1994; AM P56988, 2♂♂ (TL 161–180 mm), 1♀ (TL 130 mm), Port Jackson, 33°55'S 151°15'E, trawl, muddy sand, commercial fisherman, Nov 1989; AM P60079, 1♀ (TL 168 mm), Drummoyne Bay, Parramatta River, caught on fishing line with fish bait, J. Grayson, 20 Dec 1985; QM W18008, 1♂ (broken, CL 31.4 mm), 1♀ (broken, CL 27.1 mm), Sydney Fish Markets, (probably trawled in Sydney Harbour), purchased, 30 Oct 1991. VICTORIA: NMV J23753, 1♀ (TL 185 mm), Gippsland Lakes, 38°06'S 147°32'E, 4 Jul 1991.

Other material. AM G444, 1♂ (TL 111 mm), Yokohama, Japan; AM P60101, 2♂♂ (TL 81–122 mm), 8♀♀ (TL 95–155 mm), East China Sea, Japan, trawl, 18 Aug 1989.

Diagnosis. Dorsal integument pitted, rugose. A1 somite dorsal processes with blunt apices. Rostral plate broader than long; apex truncate to rounded. TS6 lateral process distinctly bilobed. Anterior lobe slender; apex rounded, blunt. Posterior lobe broad, triangular; anterior margin straight or faintly convex; apex sharp. TS7 lateral process with anterior lobe triangular, apex sharp to blunt. Abdominal carinae spined as follows: SM 5–6, IM (3)4–6, LT (2)3–6, MG 1–5. Telson with prelateral lobe as long as or longer than margin of lateral tooth; denticles SM 2–5, IM 5–10, LT 1. Uropodal exopod proximal segment outer margin with 7–9 movable spines.

Colour in life. Overall dorsal colour light grey or brown in large males. Carinae and grooves of carapace, SM and IM carina of body dark red. Posterior margin of body somites dark green. Telson with MD carina, tubercles and carinae of primary teeth dark brown-green; apices of primary teeth red. Uropodal protopod with red terminal spines. Uropodal exopod with proximal segment dark blue distally; distal segment yellow with dark inner margin.

Measurements. Male (n = 30) TL 81–180 mm, female (n = 33) TL 95–185 mm. CI 385–526. A1 peduncle 0.79–0.98 CL. A2 scale length 0.58–0.73 CL. Carapace anterior width

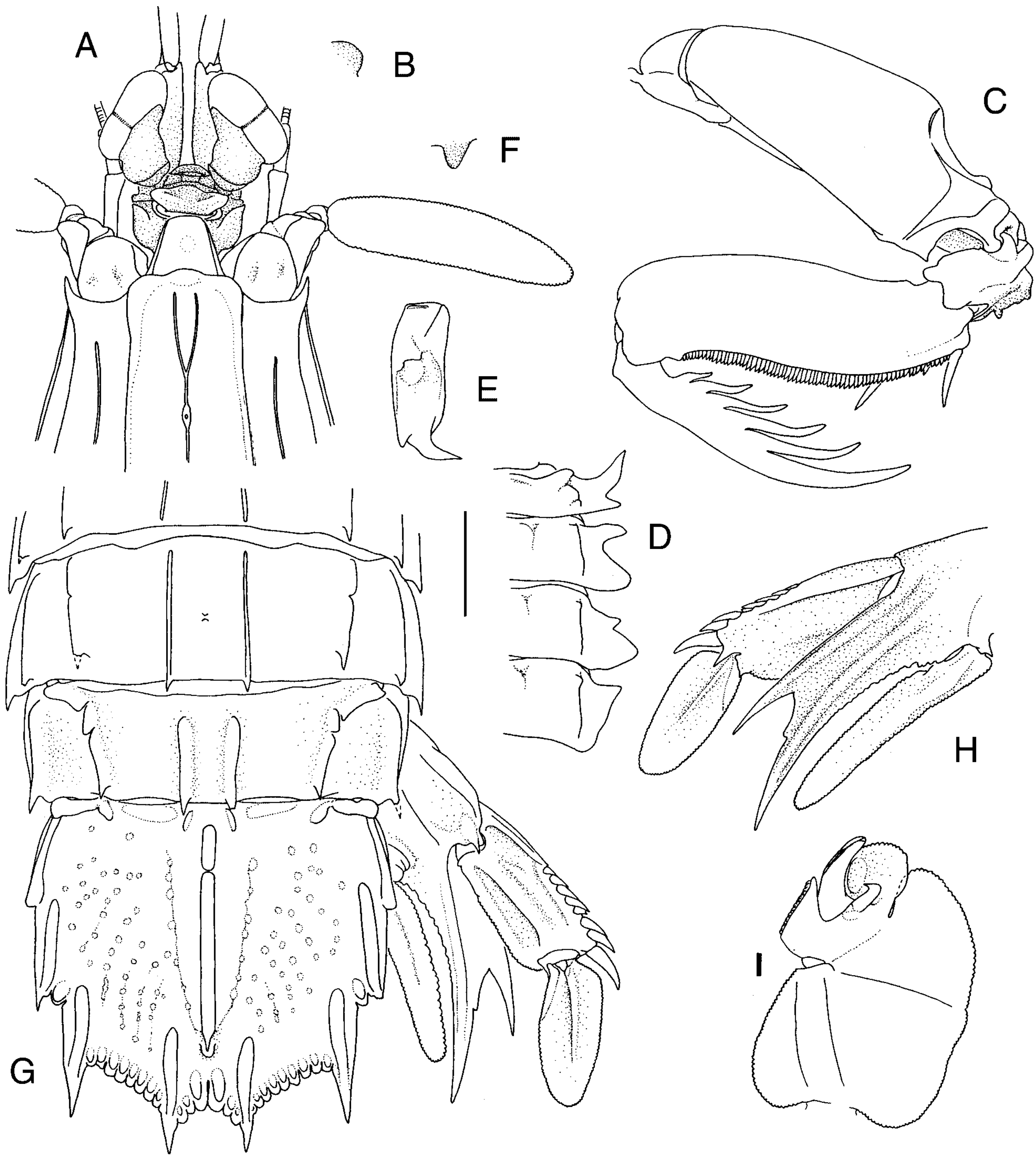

Figure 138. *Oratosquilla oratoria* (de Haan), ♂ TL 95 mm (AM P49767). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 5 mm; I = 2.5 mm.

0.50–0.56 CL. The present series includes the largest reported specimens of the species.

Remarks. *Oratosquilla oratoria* differs from other species in the genus by the combination of the armed outer inferodistal margin of the merus of the raptorial claw and unarmed submedian carinae on AS4. *Oratosquilla oratoria* supports an important fishery in Japan where it is locally known as "shako". The biology of *O. oratoria* in Japan has been extensively studied (e.g., Hamano & Matsuura, 1987; Hamano *et al*., 1987).

The present specimens agree well with published accounts (Kemp, 1913; Manning, 1971b, 1995; Ahyong *et al*., 1999), figures of the type material given by Yamaguchi

& Baba (1993) and specimens from Japan reported above. Yamaguchi & Baba (1993) designated a male syntype (NNM S 451) as the lectotype. In the present series, the apex of the rostral plate is usually truncate but is occasionally rounded, and the anterior lobe of TS7 varies from blunt to sharp.

Chilton (1911) listed *Squilla affinis* Berthold, 1845 [= *Oratosquilla oratoria* (de Haan)] from New Zealand despite the fact that his specimen lacked locality data. Moreover, his description and figure could apply to almost any species of *Oratosquilla* or *Oratosquillina*. Thus, the present report of *O. oratoria* from Australia represents the first reliable record of the species from the southern hemisphere.

Oratosquilla oratoria has a limited distribution in Australia, being known only from the estuaries in the Sydney region, New South Wales, and the Gippsland Lakes, Victoria. In the northern hemisphere, *O. oratoria* ranges from Russia, Japan and Korea south to Vietnam (Manning, 1995). The strongly disjunct distribution of *O. oratoria* suggests that the Australian population may be a distinct species. Australian specimens, however, are indistinguishable in morphology and colour pattern from specimens of *O. oratoria* from Macau, Taiwan and Japan in Australian Museum collections. Moreover, although *O. oratoria* is now commercially trawled in the Sydney area, no Australian specimens of *O. oratoria* are known prior to the mid-1980s. *Oratosquilla oratoria* could be a relatively recent introduction from the northern hemisphere, perhaps via international shipping. If so, *O. oratoria* would represent the first known introduction of a stomatopod in Australian waters.

Habitat. Sheltered embayments or estuaries; muddy sand in depths of 10–20 m.

Distribution. Southern Russia, Japan, China, southward to Hong Kong and Vietnam (Manning, 1995); now from southeastern Australia.

Oratosquillina Manning, 1995

Oratosquillina Manning, 1995: 224. Type species *Squilla interrupta* Kemp, 1911, by original designation. Gender feminine.

Diagnosis. Dorsal integument smooth or variously pitted. Cornea width less than 0.3 CL, strongly bilobed. A1 somite not greatly elongate; dorsal processes trianguloid, directed anterolaterally. Carapace anterior width less than or slightly exceeding half median length; with anterolateral spines; with normal complement of carinae; MD carina distinct, interrupted at base of anterior bifurcation; branches of anterior bifurcation distinct or absent, opening anterior to dorsal pit; posterolateral margin rounded. Raptorial claw dactylus with 5 or 6 teeth; carpus dorsal carina undivided or irregularly tuberculate; merus outer inferodistal angle armed. Mandibular palp 3-segmented or absent. MXP1–4 each with epipod. PLP1 endopod in adult males with posterior endite (unknown in *O. berentsae*). TS5–7 lateral process bilobed. AS1–6 with normal complement of carinae.

Included species. Thirteen: *O. anomala* (Tweedie, 1935); *O. asiatica* (Manning, 1978d); *O. berentsae* n.sp.; *O. gravieri* (Manning, 1978d); *O. inornata* (Tate, 1883); *O. interrupta* (Kemp, 1911); *O. manningi* Ahyong, Chan, & Liao, 2000; *O. megalops* (Manning, 1980c); *O. microps* (Garcia & Manning, 1982); *O. pentadactyla* (Manning, 1978d); *O. perpensa* (Kemp, 1911); *O. quinquedentata* (Brooks, 1886); and *O. stephensoni* (Manning, 1978d).

Remarks. *Oratosquillina* Manning, 1995, was recognized for those species previously placed in the *gonypetes* and *perpensa* groups of *Oratosquilla*. *Oratosquillina* is here restricted to species of the *perpensa* group; species of the *gonypetes* group are referred to a new genus *Quollastria*, below. *Oratosquillina*, as restricted here, is principally distinguished from *Quollastria* by the possession of an inferodistal spine on the outer margin of the merus of the raptorial claw. Further differences between *Oratosquillina* and *Quollastria* are outlined under the account of the latter.

Some characters formerly considered diagnostic for species are variable. The relative length of the rostral plate, width and shape of the lobe between the terminal spines of the uropodal protopod varies, often allometrically, and must be used with caution. Other characters, such as the shape of the apex of the dorsal processes of the antennular somite (in lateral view) and the ventral surface of the antennular somite bear useful specific characters. Except for *O. manningi* and *O. berentsae*, all species of *Oratosquillina* bear a mandibular palp.

Re-evaluation of the composition of *Oratosquillina* based on type material and large series of many species of the genus, some of which occur in Australian waters, has revealed several synonyms and several new species. *Oratosquillina inornata* is a senior synonym of *O. solicitans* and *O. hindustanica*. *Oratosquillina megalops* is also likely a synonym of *O. inornata*, but both species are recognized pending further study. Variation in rostral plate length in two nominal species, *O. perpensa* and *O. gravieri* calls into question the validity of the latter, but both species presently recognized pending further study. Difficulty in distinguishing *O. perpensa* from *O. gravieri* is reflected in the last couplet of the key below. Ahyong (2000b) showed that *Squilla fabricii* Holthuis, 1941, belongs in *Oratosquilla* instead of *Oratosquillina* as posited by Manning (1995). Of the 13 species of *Oratosquillina* recognized here, seven occur in Australia.

Key to species of *Oratosquillina*

1 Telson with numerous carinae on dorsolateral surface of telson 2

—— Telson without carinae on dorsolateral surface of telson 4

2 Telson with bicarinate accessory MD carina. Dorsum of body rugose 3

—— Telson without accessory MD carina. Dorsum of body smooth, polished .... ***O. berentsae***

3 Mandibular palp present. Dactylus of raptorial claw with 6 teeth .... *O. microps*

—— Mandibular palp absent. Dactylus of raptorial claw with 5 teeth .... ***O. manningi***

4 Dactylus of raptorial claw with 5 teeth 5

—— Dactylus of raptorial claw with 6 teeth 6

5 TS5 with posterior lobe of lateral process with pointed apex. TS6 with anterior lobe of lateral process trapezoid or triangular, with blunt apex. AS1–2 with LT carinae unarmed posteriorly .... ***O. quinquedentata***

—— TS5 with posterior lobe of lateral process with blunt apex. TS6 with anterior lobe of lateral process slender, with sharp apex. AS2 or 1–2 with LT carinae armed posteriorly .... *O. pentadactyla*

6 Raptorial claw with dorsal carina of carpus tuberculate or divided into two triangular lobes 7

—— Raptorial claw with dorsal carina of carpus entire 8

7 Dorsal carina of carpus of raptorial claw divided into two triangular lobes. SM carinae of AS4 without posterior spine. Lobe on outer margin of inner spine of uropodal protopod straight or convex. Rostral plate without median carina .... ***O. interrupta***

—— Dorsal carina of carpus of raptorial claw tuberculate. SM carinae of AS4 with posterior spine. Lobe on outer margin of inner spine of uropodal protopod with concave margin. Rostral plate usually with short MD carina .... *O. asiatica*

8 Carapace without branches of anterior bifurcation of MD. Lobe on outer margin of inner spine of uropodal protopod usually with straight or slightly concave margin, occasionally distinctly concave. (Ventral surface of A1 somite with narrow median groove anteriorly, flanked on each side by anteriorly directed triangular projection) .... ***O. stephensoni***

—— Carapace with branches of anterior bifurcation of MD carina. Ventral surface of A1 somite with or without narrow median groove 9

9 Dorsal processes of A1 somite with blunt, rounded apices (in lateral view). Dorsum finely rugose, not distinctly pitted. TS6 lateral process with anterior lobe quadriform or slender, not triangular 10

—— Dorsal processes of A1 somite usually with sharp or angular apices (in lateral view). Dorsum distinctly rugose and pitted, often with eroded appearance on abdomen. TS6 lateral process with anterior lobe trianguloid 12

10 Rostral plate appearing short. Raptorial claw propodus with blunt, distal projection on extensor margin .... *O. anomala*

—— Rostral plate elongate. Raptorial claw propodus without blunt, distal projection on extensor margin 11

11 CI less than or about 290–313 in specimens up to TL 70 mm .... *O. megalops*

—— CI 313–377 in specimens up to TL 70 mm .... ***O. inornata***

12 Rostral plate appearing short .... *O. perpensa*

—— Rostral plate appearing elongate .... ***O. gravieri***

Oratosquillina berentsae n.sp.

Fig. 139

Type material. HOLOTYPE: AM P56782, ♀ (TL 93 mm), SE of Evans Head, 29°24–25'S 153°29–28'E, 49–51 m, trawl, K95–06–56, K. Graham, 8 Jun 1995. PARATYPES: AM P56783, 1♀ (TL 100 mm), SE of Evans Head, 29°24–25'S 153°29–28'E, 49–51 m, trawl, K95–06–56, K. Graham, 8 Jun 1995; AM P56784, 1♀ (TL 75 mm), Port Jackson, between Bradley's Head and Bennelong Point, 15–20 m, muddy sand, trawl, M. Beatson, 7 Mar 1994.

Diagnosis. Dorsal integument smooth, polished, without fine pitting. A1 somite dorsal processes apices spiniform. Rostral plate with short median carina. Carapace without branches of anterior bifurcation of MD carina. Raptorial claw dactylus with 6 teeth. Mandibular palp absent. Telson dorsolateral surface with rows of shallow pits and numerous short carinae posteriorly; without accessory MD carina; ventral surface with long, smooth, postanal carina and 4–5 supplementary carinae posteriorly.

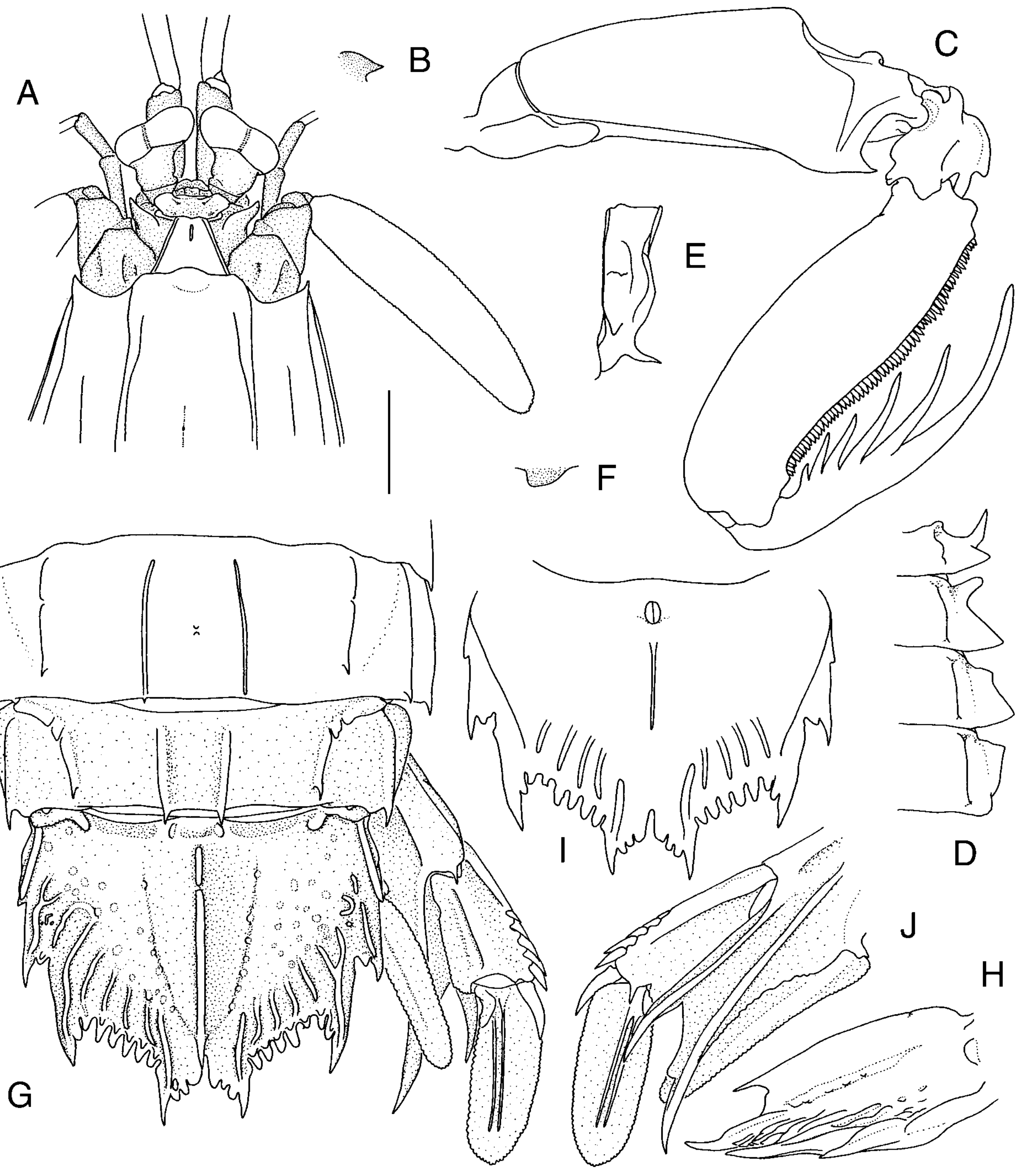

Figure 139. *Oratosquillina berentsae* n.sp., holotype ♀ TL 93 mm. A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS5–6, telson & uropod, dorsal. H, telson, right lateral. I, telson, ventral. J, uropod, right ventral. Scale = 5 mm.

Description. Dorsal integument smooth, polished, without fine pitting. Eye small, cornea set transversely on stalk; CI 482–561. Ophthalmic somite anterior margin medially emarginate. A1 peduncle 0.85–1.01 CL. A1 somite dorsal processes with spiniform apices, directed anterolaterally. A2 scale length 0.59–0.65 CL. Rostral plate broader than long; trapezoid; with marginal and short median carina; convergent; apex truncate or emarginate. Carapace anterior width 0.49–0.53 CL; anterolateral spines not extending to base of rostral plate; branches of anterior bifurcation of median carina absent; posterior median projection obtuse. Raptorial claw dactylus with 6 teeth (5 on one side of smallest specimen, regenerating); outer margin sinuous, proximal margin angular; carpus dorsal carina undivided; propodus distal margin unarmed; merus outer inferodistal angle produced into acute spine. Mandibular palp absent. MXP1–4 each with epipod. TS5 lateral process anterior lobe a slender spine directed anterolaterally; posterior lobe short, triangular, directed laterally. TS6 lateral process anterior lobe slender with blunt apex; posterior lobe broad, triangular with straight anterior margin. TS7 lateral process with anterior lobe low, blunt, much smaller than posterior lobe; posterior lobe broad, triangular, with straight anterior margin. TS8 anterolateral margin triangular; sternal keel angular, blunt. AS1–5 SM carinae distinct, subparallel. AS6 with ventrolateral spine anterior to uropodal articulation. Abdominal carinae spined as follows: SM (5)6, IM 4–6, LT (3)4–6, MG 1–5. Telson broader than long; prelateral lobe usually longer than margin of LT tooth; MD carina interrupted proximally, with slender posterior spine; dorsolateral surface with rows of shallow pits and numerous short carinae posteriorly; denticles rounded, each with dorsal tubercle, SM 3–4, IM 7–8, LT 1; ventral surface with long, smooth, postanal carina and 4 or 5 supplementary carinae posteriorly. Uropodal protopod with minute ventral tubercle anterior to endopod articulation; terminal spines with lobe on outer margin of inner spine rounded, subequal to or narrower than adjacent spine, proximal margin straight concave. Uropodal exopod proximal segment inner margin broadly convex; outer margin with 6 or 7 movable spines, distalmost not reaching midlength of distal segment; distal margin with 2 ventral spines, outer longest. Exopod distal segment longer than proximal segment; pale with inner proximal ⅓ dark.

Colour in life. Light grey brown dorsally, darker mid-dorsally with transverse "block" on each thoracic and abdominal somite, darkest on AS2. Carinae and grooves of carapace, posterior margins of body somites dark brown. Submedian carinae of thoracic and abdominal somites dark red. Telson with median carina and carinae of primary teeth dark red; median carina with short, diffuse bar proximally, distal ½ with large, black quadrate patch. Uropodal protopod with red terminal spines; endopod black on distal ½; exopod with pink movable spines; exopod distal segment pale with inner proximal ⅓ dark.

Measurements. Female (*n* = 3) TL 75–100 mm. Other measurements of holotype: CL 22.5 mm, A1 peduncle 20.8 mm, A2 scale 14.6 mm.

Etymology. Named for Penny Berents, Australian Museum, for her support and encouragement in my stomatopod studies.

Remarks. *Oratosquillina berentsae* n.sp. differs from congeners in having a smooth instead of pitted dorsum, the anterior and posterior lobes of the lateral processes of TS5 are more distinctly separated and the anterior lobe of the lateral process of TS7 is less distinct. *Oratosquillina berentsae* superficially resembles *O. microps* and *O. manningi* in having dorsal carinae on the telson, and further resembles *O. manningi* in lacking the mandibular palp. The dorsal carination of the telson in *O. berentsae*, however, does not resemble that of *O. microps* and *O. manningi*. *Oratosquillina microps* and *O. manningi* both bear a bicarinate accessory median carina on the telson and the mid-dorsal carinae cover the entire telson surface. In contrast, *O. berentsae* lacks an accessory median carina on the telson, and the mid-dorsal carinae are absent proximomedially.

The three specimens in the type series agree well in colour pattern and morphology. The variation present in the abdominal spination appears to be size related, with fewest abdominal carinae armed in the smaller paratype. The smaller paratype bears five teeth on the dactylus of a raptorial claw that is regenerating; all others bear six teeth.

Habitat. Level muddy sand substrates in depths between 15–20 m and 49–51 m.

Distribution. Australia, from northern New South Wales, south to Port Jackson.

Oratosquillina gravieri (Manning, 1978d)

Fig. 140

Squilla inornata.–Stephenson, 1953a: 41; 1955: 2, 4.–Manning, 1966: 95–97, fig. 3. (not *Squilla inornata* Tate, 1883).
Oratosquilla inornata.–Manning, 1978d: 18, fig. 9 (part, Queensland specimen only).–Moosa, 1991: 211–212 [not *Oratosquilla inornata* (Tate, 1883)].
Oratosquilla gravieri Manning, 1978d: 7, 14–15, fig. 6 (type locality: Hongay, Baie d'Along, Tonkin, Vietnam).–Moosa, 1986: 409.
Oratosquillina gravieri.–Manning, 1995: 228–231, pl. 38, figs. 136c, d, 138, 139.

Type material. HOLOTYPE: MNHN St 716, ♂ (TL 92 mm), Hongay, Baie d'Along, Gulf of Tonkin, Dawydoff, Oct 1931.

Australian material. QUEENSLAND: AM P12219, 1♂ (TL 100 mm), 6.4 km E of Scarborough Pier, 12 m, sandy mud, trawl, E. Grant, 3 Nov 1951; AM P12511, 1♂ (TL 98 mm), Repulse Bay, near Mackay; AM P16841, 1♂ (TL 73 mm), 1♀ (TL 90 mm), 19.2 km NNE of Bowen, 20°01'S 148°14'E, 35–46 m, FIS *Endeavour* 1909–1914; AM P17734, 3♀♀ (TL 81–118 mm), Magnetic I., 5–9 m, mud bottom, dredged, K. Bryson, 6 Apr 1963; AM P17742, 1♀ (TL 63 mm), Townsville area, D. Fielder, pre 1965; AM P43222, 1♂ (TL 88 mm), 2♀♀ (TL 71–87 mm), Shoalwater Bay, trawl, QLD-1017, Oct 1993; AM P56891, 1♂ (TL 77 mm), Arafura Sea, 10°58.1'S 138°41.8'E, 52 m, SS0390 084, T. Wassenberg, 9 Dec 1990; AM P56963, 1♂ (TL 104 mm), 1♀ (TL 95 mm), Shelburne Bay, 11°52.8'S 143°09.8'E, T. Wassenberg, 13 Jan 1993; NMV J13865, 1♂ (TL 79 mm), between Magnetic I. & Townsville, prawn trawl, 5.5–9.1 m, R. Bryson, autumn 1952; NMV J37800, 1♀ (TL 33 mm) off N Queensland, 12°23.07'S

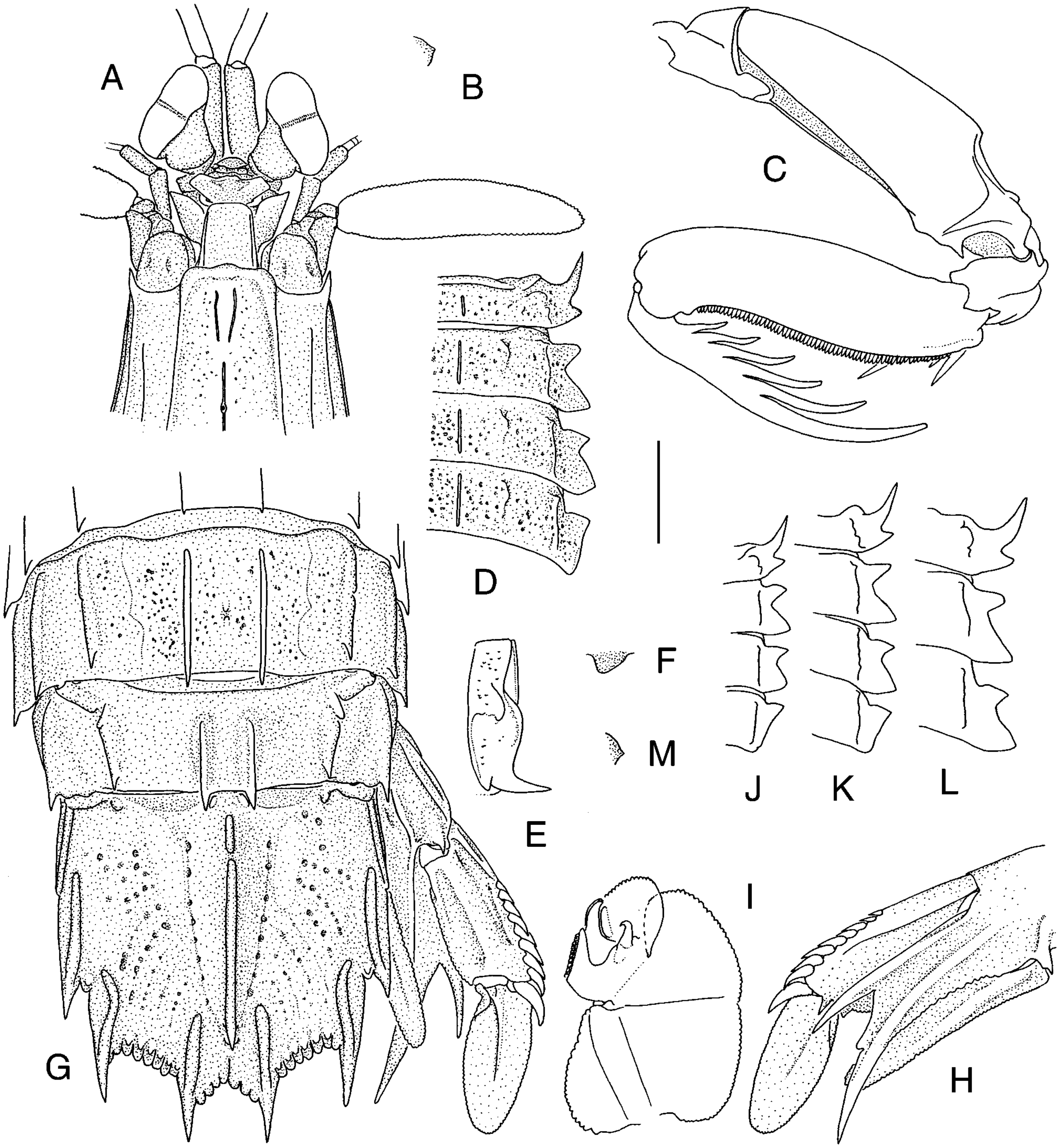

Figure 140. *Oratosquillina gravieri* (Manning). A–I ♂ TL 90 mm (QM W1816). J, ♀ TL 33 mm (NMV J37800). K, ♂ TL 79 mm (NMV J13865). L, ♂ TL 100 mm (AM P12219). M, ♀ TL 96 mm (QM W3147). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, left ventral. I, PLP1 endopod, right anterior. J,K, TS5–8 lateral processes, right dorsal. L, TS5–7 lateral processes, right dorsal. M, A1 somite dorsal process, right lateral. Scale A–H, K–M = 5 mm; I, J = 2.5 mm.

140°57.58'E, 59 m, dredge, C. Lu, 25 Mar 1983; QM G268, 1♀ (TL 65 mm), 19 km NNE of Bowen, 17 Oct 1913; QM W1810–1820, 6♂♂ (TL 63–102 mm), 5♀♀ (TL 100–116 mm), between Magnetic I. & Townsville, 30 May 1952; QM W3147, 1♂ (TL 98 mm), 2♀♀ (TL 96–105 mm), 3.2 km E of Woody Point, Moreton Bay, 9–11 m, trawl, L. Wale & T. Hailstone, 5–6 Dec 1966; QM W12228, 1♀ (TL 106 mm), Cumberland Group, 20°00'S 149°00'E, N. Haysom, Aug 1957; QM W12229, 1♀ (TL 97 mm), off White Cliffs, N of Cairns, 16°35'S 145°31'E, 7.3 m, otter trawl on mud & sand, N. Haysom, 12 Mar 1958; QM W12850, 3♂♂ (TL 70–104 mm), near Trunk Reef, 18°20.7'S 146°41.8'E, trawl, C. Jones, 15 Feb 1985; QM W12856, 1♂ (TL 84 mm), Torres Strait, trawl, C. Jones, Feb 1986; QM, 4♂♂

(TL 91–100 mm), NE of Wellesley Is, SE Gulf of Carpentaria, 15°56.7'S 139°42.7'E, 35 m, SS0390 072, T. Wassenberg, 1990; QM, 1♀ (TL 95 mm), E Gulf of Carpentaria, 13°01.3'S 140°12.0'E, 63 m, SS0390 47, T. Wassenberg, 1 Dec 1990; QM, 1♀ (TL 75 mm), Gulf of Carpentaria, 12°56.4'S 139°41.7'E, SS0390 078, T. Wassenberg, 8 Dec 1990; QM, 1♀ (TL 80 mm), near Yorke Is, Torres Strait, trawl, T. Wassenberg, 10 Mar 1988; QM, 1♂ (TL 73 mm), 2♀♀ (TL 57–93 mm), NE of Orford Bay, 11°11.0'S 142°55.4'E, SS0591 070, T. Wassenberg; QM, 2♂♂ (TL 52–97 mm), 2♀♀ (TL 60–72 mm), Gulf of Carpentaria, 12°00.0'S 139°14.3'E, 53 m, SS0390 31, T. Wassenberg; QM, 2♂♂ (TL 86–97 mm), Gulf of Carpentaria, 12°26.7'S 139°11.7'E, 55 m, SS0390 32, T. Wassenberg; QM, 1♀ (TL 86 mm), Gulf of Carpentaria, 10°58.5'S 140°21.9'E, SS0591 058, T. Wassenberg, 29 Nov 1991; QM, 1♂ (TL 90 mm), 3♀♀ (TL 115–118 mm), NE of Shelburne Bay, 11°52'S 143°10'E, *Tweed Seeker*, 18 Apr 1993; QM, 1♂ (TL 102 mm), N of Shelburne Bay, 11°35.08'S 143°58.8'E, GBR 0192 54/33, T. Wassenberg, 21 May 1992; USNM 111379, 1♂ (TL 91 mm), 19.2 km NNE of Bowen, 20°01'S 148°14'E, 35–46 m, FIS *Endeavour* 1909–1914. NORTHERN TERRITORY: AM P42207, 1♀ (TL 96 mm), Arafura Sea, 10°35'S 133°45'E, S07/80/43P, E. Blake & J. Paxton, 16 Nov 1980; AM P43213, 1♀ (TL 116 mm), Arafura Sea, 11°47'S 136°16'E, 24 m, S07/80/66P, E. Blake & J. Paxton. 22 Nov 1980; AM P43231, 1♀ (TL 54 mm), Arafura Sea, Alpha Helix stn 13, gravel & shell over fine grey mud, E. Ball & J. Paxton; AM P56985, 2♀♀ (TL 98–105 mm), off Nhulunbuy, 12°04.3'S 136°45.0'E, SS0591 002, T. Wassenberg, 19 Nov 1991; AM P57168, 1♂ (TL 77 mm), NE of Wessell Is, Arafura Sea, 10°30.12'S 137°12.03'E, 50 m, SS0390 002, T. Wassenberg, 22 Nov 1991; AM P57169, 1♀ (TL 39 mm), off Bald Point, Gove Peninsula, 13°08.5'S 136°35.7'E, SS0591 31, T. Wassenberg, 23 Nov 1991; AM P57170, 1♂ (TL 55 mm), E of Wessell Is, 11°24.8'S 136°36.4'E, SS0591 006, dredge, T. Wassenberg, 19 Nov 1991; AM P57171, 1♀ (TL 46 mm), NE of Gove Peninsula, 11°39.0'S 136°54.6'E, SS0591 025, T. Wassenberg, 22 Nov 1991; AM, 1♀ (TL 35 mm), Arafura Sea, 10°29.7'S 137°14.5'E, 54 m, mixed shell & gravel, E. Ball & J. Paxton, 17 Mar 1975; NTM exCr010833, 1♂ (TL 36 mm), 2♀♀ (TL 47–86 mm), Gulf of Carpentaria, 14°06.9'S 137°33.0'E, 47 m, dredge, P. Alderslade, 1 Dec 1990; NTM Cr009543, 1♂ (TL 52 mm), N of Junction Bay, Arafura Sea, 10°40'S 133°50'E, 60 m, T. McGuigan, 17 Apr 1986; NTM Cr010793, 1♀ (TL 39 mm), Gulf of Carpentaria, 14°07.3'S 137°27.0'E, 48 m, dredge, P. Alderslade, 1 Dec 1990; NTM, 2♀♀ (TL 105 mm; 1 broken, CL 20.9 mm), 6.4 km N of Jones Shoal, off Cobourg Peninsula, 10°53'S 132°17.1'E; NTM, 1♂ (TL 98 mm), North Point I., Groote Eylandt, 18–33 m, Aug 1970; QM, 3♀♀ (TL 70–95 mm), N of Wessell I., Arafura Sea, 9°39.2'S 136°47.0'E, SS0591 15, T. Wassenberg, 21 Nov 1991; QM, 2♂♂ (TL 96–98 mm), E of Wessell Is, 10°59.2'S 137°48.2'E, SS0591 022, dredge, T. Wassenberg, 22 Nov 1991; QM, 2♂♂ (TL 76–85 mm), NE of Nicol I., Gulf of Carpentaria, 13°03.7'S 137°41.4'E, SS0591 033, T. Wassenberg, 24 Nov 1991; QM, 1♂ (TL 71 mm), 2♀♀ (TL 94–95 mm), N of Wessell I., 9°39.2'S 136°47.0'E, SS0591 015, T. Wassenberg, 21 Nov 1991; QM, 1♂ (TL 78 mm), 1♀ (TL 105 mm), SW Gulf of Carpentaria, 14°29.8'S 136°19.0'E, 17 m, SS0390 14, T. Wassenberg.

Other material. AM P12152–12153, 1♂ (TL 113 mm), 1♀ (TL 102 mm), Vietnam, R. Serène; MNHN St 1327, 1♂ (TL 107 mm), St. Vincent Bay, New Caledonia, M. Kulbicki, 22 Aug 1985; USNM 266697, 2♀♀ (TL 94–110 mm), Annam, Station Cauda, Vietnam, R. Serène, 19 Nov 1946; USNM 266701, 1♂ (TL 99 mm), Annam, Station Cauda, Vietnam, R. Serène, 19 Nov 1946.

Diagnosis. Dorsal integument coarsely and irregularly pitted, rugose. A1 somite dorsal processes apices angular to sharp. Rostral plate broader than to as long as broad, usually appearing elongate; without dorsal carina. Carapace with branches of anterior bifurcation of MD carina distinct. Raptorial claw dactylus with 6 teeth; carpus dorsal carina undivided. Mandibular palp 3-segmented. TS6 lateral process anterior lobe broad, trianguloid, apex rounded to angular, blunt; posterior lobe broad, triangular, anterior margin straight or sinuous, apex blunt. TS7 lateral process with triangular anterior and posterior lobes, with obtuse emargination between lobes. Abdominal carinae spined as follows: SM 5–6, IM 4–6, LT (2)3–6, MG 1–5. Telson prelateral lobe slightly longer than to shorter than margin of lateral tooth; dorsolateral surface without supplementary longitudinal carinae; denticles SM 3–5, IM 7–9, LT 1; ventral surface with short postanal carina; without supplementary ventral carinae. Uropodal protopod with lobe on outer margin of inner terminal spine rounded, proximal margin concave. Uropodal exopod proximal segment outer margin with 8–10 movable spines; distal segment dark on proximal ⅔ of inner ½.

Colour in life. Light grey brown dorsally. Carinae and grooves of carapace, submedian carinae and posterior margins of body somites dark red. Telson with median carina and carinae of primary teeth red; median carina dark red-maroon spot proximally and narrow dark patch on posterior ⅓. Uropodal protopod with red terminal spines; endopod black on distal ½; exopod with pink movable spines; exopod distal segment yellowish with inner proximal ⅓ to ½ dark, diffuse distally.

Measurements. Male (n = 45) TL 36–113 mm, female (n = 50) TL 33–118 mm. CI 356–495. A1 peduncle 0.87–1.05 CL. A2 scale length 0.53–0.62 CL. Anterior carapace width 0.43–0.50 CL. Moosa (1991) reported *O. gravieri* (as *O. inornata*) from New Caledonia to 123 mm TL.

Remarks. *Oratosquillina gravieri* is one of the most common species of the genus in northern Australian waters. As discussed under the account of *O. inornata*, most records of *O. gravieri* from Australia are based on the present species. The large series of *O. gravieri* examined here exhibits variation in several characters previously regarded as diagnostic for the species. Thus, the shape of the apices of the dorsal processes of the antennular somite varies from blunt or angular to sharp, being generally sharpest in largest specimens, and as with most other squillids, the relative width of the lobe between the terminal spines of the uropodal protopod is inversely related to body size. The anterior lobe of the lateral process of TS6 in Australian *O. gravieri* is usually trianguloid with a blunt to rounded apex but may be somewhat trapezoid as figured by Manning (1966, fig. 3b) (Fig. 140J–L). Topotypic specimens of *O. gravieri* differ from most Australian specimens in having a more strongly triangular anterior lobe of the lateral process of TS6, resembling the 79 mm TL specimen from Townsville (Fig. 140K). The differences in the shape of the anterior lobe of the lateral process in Australian and Vietnamese *O. gravieri* may prove significant but more material from the South China Sea and intermediate localities is required to evaluate the range of variation. The most significant variation, however, is in the length of the rostral plate. The rostral plate is usually elongate or "squarish", occasionally ranging to short as in *O. perpensa*, confounding species separation.

Thus, no consistent character is available to distinguish *O. perpensa* from *O. gravieri* for variation in the two species overlaps. Moreover, the ranges of *O. perpensa* and *O. gravieri* in the northern hemisphere, primarily the South China Sea area, are coincident adding further support to the possibility that the two species are synonyms. *Oratosquillina perpensa* and *O. gravieri* likely represent extremes of variation of a single species that perhaps shows regional or clinal variation. Both *O. perpensa* and *O. gravieri* are presently recognized pending completion of a study of Taiwanese material. In Australian waters, *O. gravieri* could be confused with *O. stephensoni*, with which it is often sympatric, and the differences between the species are outlined under the account of the latter.

Oratosquillina inornata reported by Moosa (1991) from New Caledonia are referable to *O. gravieri*: the dorsum is distinctly punctate and rugose, the rostral plate is elongate, the apices of the dorsal processes of the antennular somite are pointed and the anterior lobe of the lateral process of TS6 is trianguloid.

Habitat. Soft sand and mud substrates; shallow subtidal to at least 59 m depth.

Distribution. Vietnam to the Philippines, New Caledonia and Australia. In Australia, *O. gravieri* ranges from southern Queensland to the Gulf of Carpentaria and Arafura Sea.

Oratosquillina inornata (Tate, 1883)

Fig. 141

Squilla inornata Tate, 1883: 51, pl. 2 (type locality: Gulf of St. Vincent, South Australia).–Stephenson & McNeill, 1955: 245.–Stephenson, 1962: 33.
Squilla oratoria var. *perpensa* Kemp, 1911: 98 (part); 1913: 70 (part, not pl. 5: figs. 57–59) (not *S. perpensa* Kemp, 1911).
Squilla oratoria var. *inornata*.–Hale, 1924: 492, 495–496; 1927a: 30, 32, fig. 22.–Holthuis, 1941: 248–249 (part).
Oratosquilla inornata.–Manning, 1971b: 8; 1978d: 17–19, fig. 8.
Oratosquilla hindustanica Manning, 1978d: 15–17, figs. 7, 15 (type locality: Tuticorin, Madras, Gulf of Manaar, India, 8°47'N 78°08'E); new synonymy.
Oratosquilla solicitans Manning, 1978d: 25–28, figs. 13, 14, 15 (type locality: Sandakan, Sabah, Malaysia, 5°50'N 118°07'E); new synonymy.
Oratosquillina inornata.–Manning, 1995: 225, 228.
Oratosquillina hindustanica.–Manning, 1995: 225, 228.
Oratosquillina solicitans.–Manning, 1995: 225, 228.
Oratosquillina gravieri.–Manning, 1995: 229 [part, not *O. gravieri* (Manning, 1978d)].

Type material. LECTOTYPE: SAM C180, ♀ (broken, CL 14.3 mm), Gulf of St. Vincent, South Australia. PARALECTOTYPE: SAM C4163, ♀ paralectotype (TL 39 mm), Gulf of St. Vincent, South Australia.

Australian material. QUEENSLAND: AM G4223, 1♂ (TL 59 mm), Gulf of Carpentaria, C. Hedley; SAM C181, 1♂ (TL 80 mm; dry), Cairns, E. Allen; AM P5613, 1♀ (TL 89 mm), Port Denison, E. Rainford, 1921; QM W1740, 1♀ (TL 112 mm), Bowen, E. Rainford. WESTERN AUSTRALIA: AM P13545, 2♂♂ (TL 68–76 mm), Entrance Point, Broome, rocky reef shore between tides, A. Livingstone, Aug 1929; QM W20427, 1♂ (TL 48 mm; broken, CL 10.9 mm), Macleay I., Kimberley coast, 15°57.5'S 123°42.1'E, littoral mud flat, lower tidal zone, J. Short, 21 Nov 1994. NORTHERN TERRITORY: NTM, 3♂♂ (TL 48–69 mm), 5♀♀ (TL 49–68 mm), Shoal Bay, NT Fisheries, 22 Aug 1972; NTM, 1♀ (TL 69 mm), W Hope Inlet, Shoal Bay, intertidal, NT Fisheries, 9 Mar 1976; NTM, 1♀ (TL 59 mm), Drimmie Creek, Gove, NT Fisheries, 11 Jan 1971.

Other material. USNM 125069, 2♀♀ (TL 89–95 mm), Tuticorin, Madras, Gulf of Manaar, India, J. Hornell (paratypes of *Oratosquilla hindustanica* Manning); USNM 125743, 1♀ (TL 85 mm) Sandakan, Sabah, Malaysia, A. Herre, 30 Jun 1929 (holotype of *Oratosquilla solicitans* Manning); USNM 143576, 1♂ (TL 67 mm), 1♀ (TL 69 mm), Tuticorin, Madras, Gulf of Manaar, India, J. Hornell (paratypes of *Oratosquilla hindustanica* Manning); USNM 266700, 1♀ (TL 94 mm), Station Cauda, Vietnam, 19 Nov 1946.

Diagnosis. Dorsal integument finely rugose. A1 somite dorsal processes with blunt apices. Rostral plate usually broader than long, but appearing elongate; apex truncate to rounded; without median carina. Carapace with branches of anterior bifurcation of MD carina distinct. Raptorial claw dactylus with 6 teeth; carpus dorsal carina undivided. Mandibular palp 3-segmented. MXP1–4 with epipod. TS6 lateral process anterior lobe large, broad, quadrate to trapezoid, apex truncate or slightly rounded. TS7 lateral process with emargination between lobes acute. Abdominal carinae spined as follows: SM 5–6, IM 4–6, LT (1–2)3–6, MG 1–5. Telson denticles dorsolateral surface without supplementary longitudinal carinae; SM 3–5, IM 7–9, LT 1; ventral surface with short, postanal carina; without supplementary carinae ventral carinae. Uropodal protopod terminal spines with lobe on outer margin of inner terminal spine rounded, narrower than or as broad as adjacent spine, proximal margin concave. Uropodal exopod proximal segment outer margin with 7–9 movable spines; distal segment dark on inner ½ only.

Colour in alcohol. Largely faded. Grooves and carinae of carapace, posterior margin of thoracic and first five abdominal somites black. AS2 with dark, narrow transverse bar. Telson with diffuse, elongate bar either side of MD carina. Distal segment of uropodal exopod black on inner ½.

Measurements. Male (n = 7) TL 48–80 mm, female (n = 18) TL 39–112 mm. CI 318–416. A1 peduncle 0.93–1.01 CL. A2 scale 0.48–0.58 CL. Anterior carapace width 0.43–0.51 CL. The present series includes the largest known specimens of the species.

Remarks. Manning's (1978d) redescription of *O. inornata* included specimens of two species: *O. inornata*, and *O. gravieri*. Specimens reported by Manning (1966) and Stephenson (1953a, 1955) as *Squilla inornata* are also referable to *O. gravieri*. Whereas *O. gravieri* has a strongly rugose, distinctly pitted dorsum, that of *O. inornata* is finely and evenly pitted, a feature probably overlooked in the types of *O. inornata* because of their poor condition. Also, the anterior lobe of the lateral process of TS6 is generally quadrate in *O. inornata*, trianguloid in *O. gravieri*.

Restudy of the type material of *O. inornata*, *O. solicitans* and *O. hindustanica*, shows that the latter two must be considered synonyms of the former. The elongate rostral plate, evenly pitted dorsum and quadrate anterior lobe on the lateral process of TS6 are distinctive of *O. inornata*. Moreover, the anterior margin of the rostral plate varies

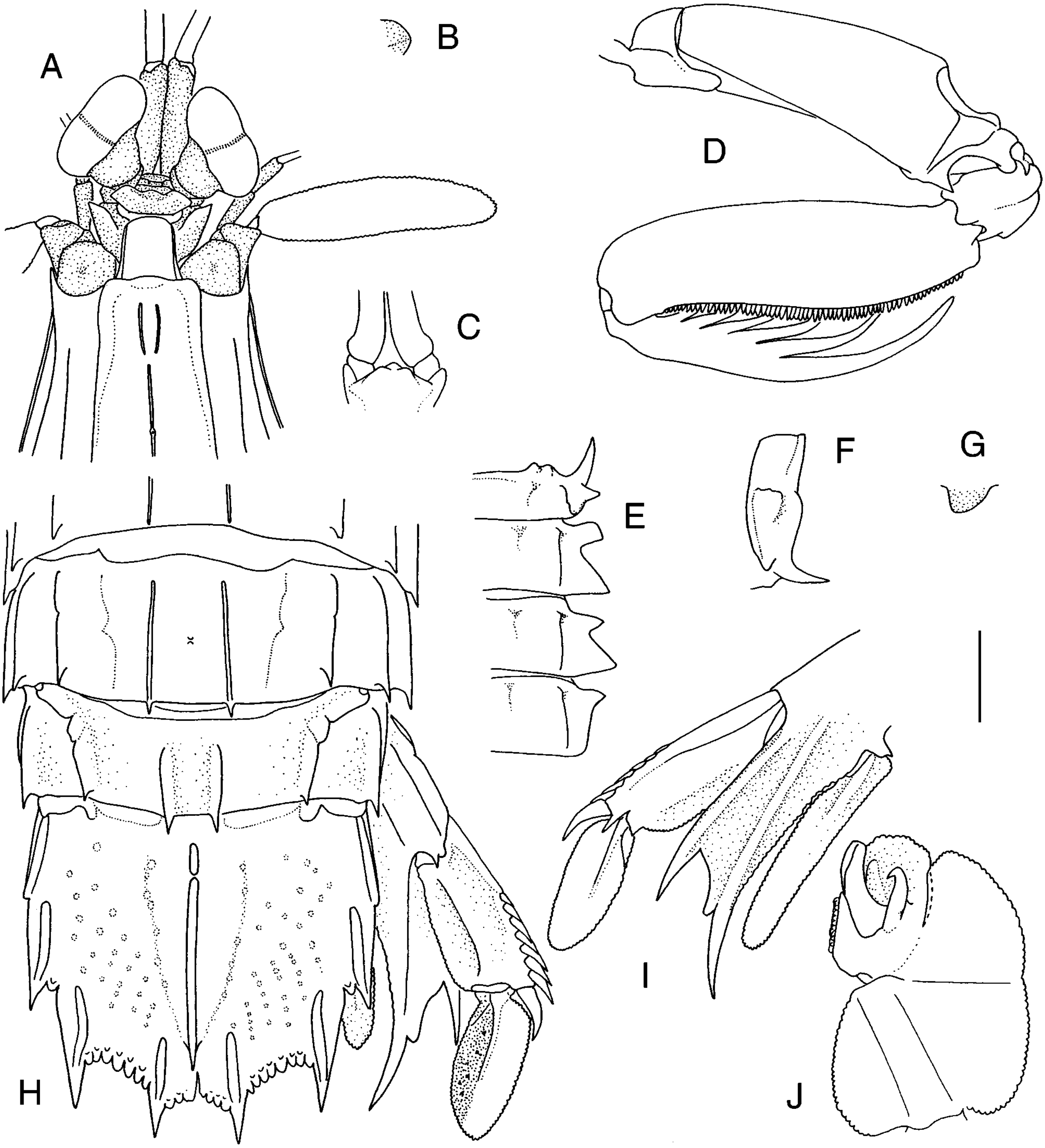

Figure 141. *Oratosquillina inornata* (Tate), ♂ TL 76 mm (AM P13545). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, A1 somite, ventral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 2.5 mm; J = 1.25 mm.

from rounded to truncate and the size of the lobe between the terminal spines of the uropod is also variable in Australian specimens, encompassing the full range of variation reported for *O. solicitans* and *O. hindustanica* (Manning, 1978d). The length of the prelateral lobe of the telson also varies, from slightly shorter than to longer than the margin of the lateral tooth.

Oratosquilla megalops, characterized by having relatively larger eyes than *O. solicitans* (see Manning, 1980c), is a likely synonym of *O. inornata*. The reported corneal indices (CI) of the three known specimens of *O. megalops* (CI 290–313 for TL 63–69 mm) approach or overlap those of some similarly sized *O. inornata* (CI 313–353 for TL 57–69 mm) from Australia. Both *O. megalops* and *O. inornata* are recognized here pending study of large series of *O. inornata* from several localities.

Oratosquillina inornata is a tropical species and has not been recorded from the type locality, Gulf of St. Vincent, South Australia, since its description (Tate, 1883). The presence of tropical species in temperate southern and southwestern Australia is likely the result of the influence of the Leeuwin Current, an eastern boundary current of the Indian Ocean that flows from northwestern Australia southwards to South Australia (Garrey *et al*., 1981).

Habitat. Intertidal and shallow subtidal mud or sandy-mud flats.

Distribution. Widely distributed throughout the Australian-Indo-Malaysian region from India, Vietnam, Thailand to Taiwan, Malaysia, Indonesia and Australia. The Australian range includes St Vincent's Gulf, South Australia, and northwestern Australia to the Gulf of Carpentaria and Cairns, Queensland.

Oratosquillina interrupta (Kemp, 1911)

Fig. 142

Squilla interrupta Kemp, 1911: 98 (type locality: Hong Kong, by present lectotype designation); 1913: 3, 10, 23, 72, pl. 5, figs. 60–62.–Holthuis, 1941: 253–254.–Stephenson, 1952: 7; 1953a: 42; 1960: 61.–Stephenson & McNeill, 1955: 241 (part).–Manning, 1966: 97, 98, fig. 4; 1967a: 105.
Squilla wood-masoni.–Stephenson & McNeill, 1955: 244 (part, not *Squilla woodmasoni* Kemp, 1911).
Oratosquilla arabica Ahmed, 1971: 251, fig. 1 (type locality: Arabian Gulf).
Oratosquilla interrupta.–Manning, 1971b: 8; 1978d: 6, 7.
Oratosquillina interrupta.–Manning, 1995: 225, 227, 231–233, figs. 136e–g, 140, 141.–Ahyong *et al*., 1998: 49–50, fig. 6j–m.

Type material. LECTOTYPE: AM P3982, ♂ (TL 102 mm), Hong Kong, G. Dennys. PARALECTOTYPE: AM P3981, 1♀ (TL 91 mm), Hong Kong, G. Dennys.

Australian material. QUEENSLAND: AM P12076, 1♂ (TL 155 mm), NE of Woody Point Pier, Moreton Bay, 27°16'S 153°06'E, 12 m, W. Stephenson, 19 Dec 1950; AM P12257, 1♀ (TL 160 mm), Deception Bay, Moreton Bay, A. Keong, Oct 1952; AM P12261–12262, 1♂ (TL 103 mm), 1♀ (TL 97 mm), Cleveland Bay, Townsville, 19°13'S 146°55'E, G. Coates, Sep 1952; AM P12264, 1♂ (TL 62 mm), Cleveland Bay, Townsville, 19°13'S 146°55'E, G. Coates, Sep 1952; AM P12265, 2♀♀ (TL 85–90 mm), mouth of Norman River, Gulf of Carpentaria, 18°38'S 141°19'E, 4 m, T. Marshall; AM P12365, 1♀ (TL 145 mm), Brisbane River, trawl, N. Haysom, 19 Nov 1953; AM P12509–12510, 2♀♀ (TL 137–160 mm), Repulse Bay, Mackay, 20°35'S 149°45'E, 15 m, A. Racek, Oct 1954; AM P17741, 1♀ (TL 122 mm), Mission Beach, Tully, from burrow in sand, W. Hall, 6 Dec 1963; AM P21631–21632, 1♂ (TL 113 mm), 5♀♀ (TL 95–122 mm), SE Gulf of Carpentaria; AM P21633, 1♂ (TL 119 mm), SE Gulf of Carpentaria, 17°30.12'S 140°23.03'E, 5.5 m, 26 Nov 1963; AM P21634, 3♂♂ (TL 97–115 mm), 4♀♀ (TL 107–130 mm), SE Gulf of Carpentaria, less than 25 m, Dec 1963; AM P54466, 1♂ (TL 99 mm), near mouth of Ross River, 19°16'S 146°50'E, 10 m, trawl, D. Paul, 6 Mar 1997; AM P55577, 1♂ (TL 118 mm), S of Urangan boat anchorage, Hervey Bay, 25°17'S 152°54'E, among seagrass in pool on mudflats, I. Loch, 24 Nov 1976; AM P55582, 1♂ (TL 117 mm), 1♀ (TL 136 mm), Princess Charlotte Bay, T. Wassenberg; AM P55583 (to QM), 3♀♀ (TL 126–132 mm), Gulf of Carpentaria, between Weipa & Karumba, T. Wassenberg, Dec 1976; NMV J37775, 1♂ (TL 139 mm), 1♀ (TL 150 mm), Burnett Heads, 6–17 m on muddy bottom, J. Watson, 8 Oct 1974; NMV J37829, 1♀ (TL 134 mm), Deception Bay, 27°12'S 153°02'E, prawn trawl, K. Simpson, 16–17 Mar 1987; QM W561, 1♀ (TL 94 mm), New Farm Park, Brisbane River, 28°28'S 153°03'E, J. White; QM W868, 1♀ (TL 102 mm), Rockhampton, R. Vallin; QM W1050, 1♀ (TL 101 mm), Hamilton, Brisbane River, 27°26'S 153°04'E, G. Steadman; QM W1165, 1♀ (TL 116 mm), Brisbane River, 27°14'S 152°30'E, Mr Venn, 13 Nov 1940; QM W1260, 1♀ (TL 113 mm), Mud I., Moreton Bay, E. Carroll; QM W1736, 1♂ (broken, CL 29.1 mm), Burleigh Heads, W. Bligh; QM W1794, 1♀ (TL 143 mm), Mermaid Beach near Burleigh, 28°02'S 153°26'E, T. Ross, Jan 1952; QM W2024, 1♂ (TL 87 mm), Wellington Point, Moreton Bay, F. Roff, 19 Aug 1960; QM W2416, 2♂♂ (TL 91–95 mm), mouth of Burdekin River, 19°40'S 147°36'E, R. Budge, 6 Jan 1966; QM W12227, 1♀ (TL 105 mm), Bowling Green Bay, 19°21'S 147°15'E, J. Fletcher, 19 Oct 1958; QM, 1♂ (TL 115 mm), Torres Strait, 10°25.0'S 141°46.2'E, SS0591 63, T. Wassenberg. NEW SOUTH WALES: AM G5480, 1♂ (TL 143 mm), Port Jackson, 33°51'S 151°16'E, G. Bennett; AM P9665, 1♀ (TL 83 mm), 20–35 km NE of Green Cape, 37°00'S 150°08'E, 71–84 m, A. Livingstone & H. Fletcher, Jun 1924; AM P12258, 1♀ (TL 136 mm), Evans Head, 29°08'S 153°28'E, H. Lane, 5 Jun 1953; AM P49734, 1♂ (TL 129 mm), off Patonga Beach, Hawkesbury River, 32°34'S 151°17'E, 7–10 m, trawl, sandy mud, S. Ahyong, 12 Feb 1994. WESTERN AUSTRALIA: NMV J37832, 1♀ (TL 140 mm), off Onslow, 20°20'S 114°40'E, 9 m, prawn trawl, P. Gillies, 15 Jul 1980. NORTHERN TERRITORY: AM P55581, 1♀ (TL 144 mm), near mouth of Liverpool River, 12°00'S 134°13'E, 9–10 m, near bottom trawl, D. Griffin, 28 Jul 1975; NTM, 1♂ (TL 128 mm), 1♀ (TL 49 mm), Hope Inlet, Mickett Creek area, Shoal Bay, intertidal, NT Fisheries, 25 Jul 1973; NTM, 1♂ (TL 110 mm), Shoal Bay, 12°18.5'S 130°56'E, 3.7–5.5 m, NT Fisheries. 4 Apr 1977; NTM, 2♂♂ (TL 38–53 mm), 2♀♀ (TL 66–90 mm), Shoal Bay, NT Fisheries, 22 Aug 1972.

Diagnosis. Dorsal integument lightly pitted. A1 somite dorsal processes with blunt, angular, apices, acute in largest specimens. Rostral plate broader than or as long as broad. Carapace with branches of anterior bifurcation of MD carina distinct. Raptorial claw dactylus with 6 teeth; carpus with dorsal carina divided into two triangular lobes. Mandibular palp 3-segmented. MXP1–4 with epipod. Abdominal carinae spined as follows: SM 5–6, IM 4–6, LT 3–6, MG 1–5. Telson prelateral lobe slightly shorter to slightly longer than margin of lateral tooth; denticles SM 2–4, IM 6–9, LT 1; dorsolateral surface without supplementary longitudinal carinae; ventral surface with short, smooth postanal carina; without supplementary ventral carinae. Uropodal protopod terminal spines with lobe on outer margin of inner terminal spine rounded, proximal margin straight or convex; exopod proximal segment outer margin with 7–9 movable spines, exopod distal segment dark on inner ¾ of inner ½.

Colour in life. Overall dorsal colour pale olive green. Carapace grooves and posterior margin of body somites dark green. Carapace with median carina and submedian carinae of body somites dark red to green. AS2 with narrow, red-brown transverse bar. Telson with carinae of primary teeth dark green; apices of primary teeth red; median carina with single proximal dark maroon spot. Uropodal protopod with red terminal spines; exopod distal segment yellowish with dark infusion on proximal ⅓.

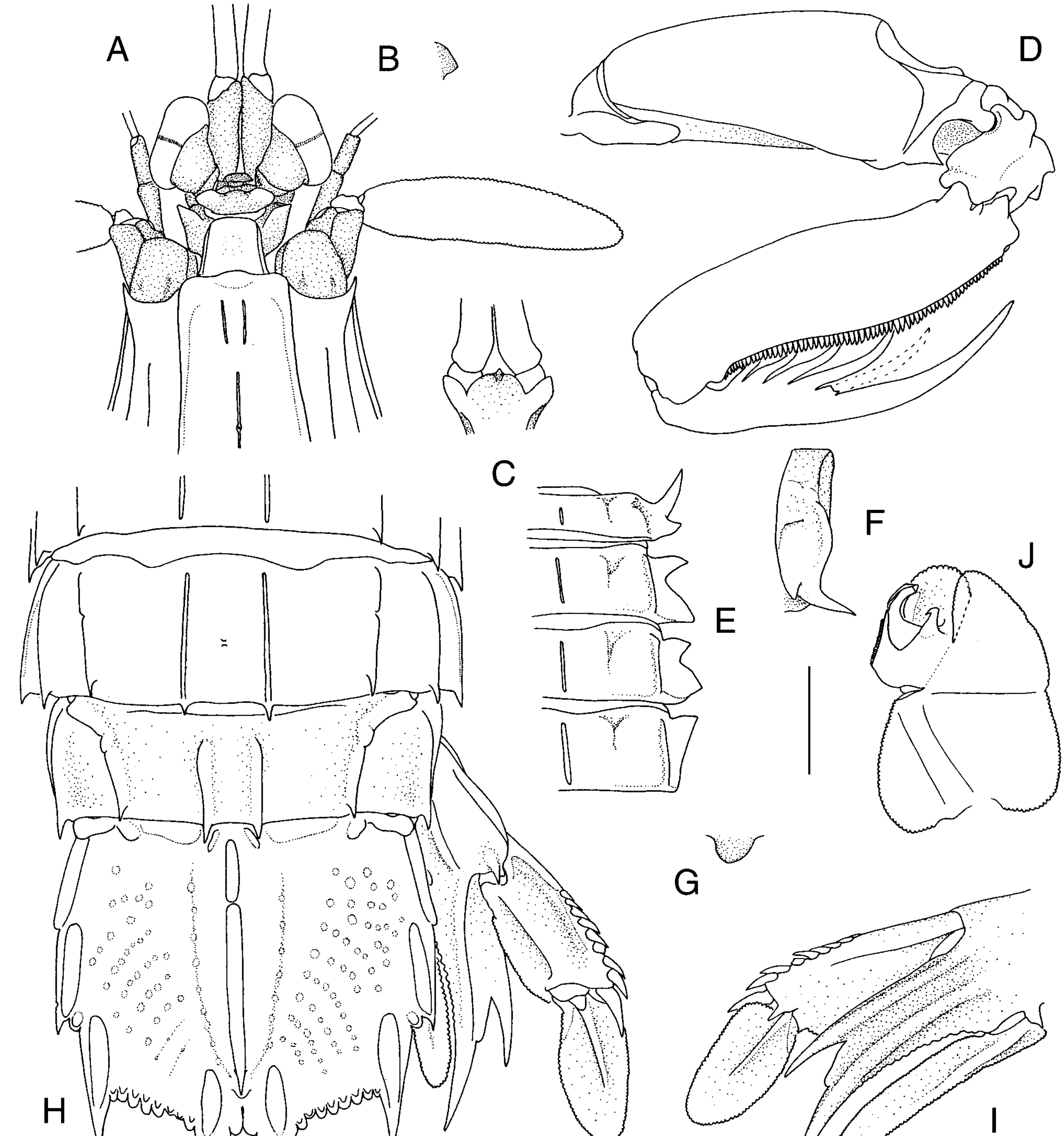

Figure 142. *Oratosquillina interrupta* (Kemp), ♂ TL 99 mm (AM P54466). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, A1 somite, ventral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, uropod, right ventral. J, PLP1 endopod, right anterior. Scale A–I = 5 mm; J = 2.5 mm.

Measurements. Male (n = 22) TL 38–155 mm, female (n = 38) TL 66–160 mm. CI 449–636. A1 peduncle 0.81–1.03 CL. A2 scale length 0.54–0.65 CL. Carapace anterior width 0.46–0.54 CL. The present series includes the largest known specimens of the species.

Remarks. *Oratosquillina interrupta* is unique in the genus for having the dorsal carina of the carpus of the raptorial claw divided into two equal lobes.

The present series agrees well with the type material and published accounts (Kemp, 1911, 1913; Holthuis, 1941;

Manning, 1966, 1995; Ahyong *et al*., 1999). Unlike other species of *Oratosquillina*, shape of the apices of the dorsal processes of the antennular somite is variable. In most specimens, the apices of the dorsal processes of the antennular somite are blunt to angled and sharp in the largest specimens. The prelateral lobe varies from slightly shorter to slightly longer than the margin of the lateral tooth. The petasma is fully developed by 62 mm TL.

Kemp (1913) listed a series from the Hughli Delta as types, but listed numerous specimens from various Indian localities, the Andaman Sea, Hong Kong, and Singapore. The original account of *O. interrupta*, however, did not restrict the type series to the Hughli Delta specimens (Kemp, 1911). As shown by Ghosh & Manning (1988), all of the specimens of *O. interrupta* listed by Kemp (1913) are syntypes. Two syntypes of *O. interrupta* (AM P3981–3982) sent on exchange from the Zoological Survey of India are present in the collections of the Australian Museum. Therefore, the male specimen from Hong Kong (AM P3982) is herein designated lectotype. The female from Hong Kong (AM P3981) is a paralectotype, as are the remainder of Kemp's syntype series in the Zoological Survey of India.

Habitat. Level sand and mud substrates in sheltered coastal waters and bays; intertidal to around 25 m.

Distribution. Persian Gulf eastwards to Taiwan, Hong Kong, Vietnam and Australia (Manning, 1995). The Australian range includes Port Jackson, New South Wales, north to Onslow, Western Australia.

Oratosquillina manningi Ahyong, Chan, & Liao, 2000

Fig. 143

Oratosquillina manningi Ahyong, Chan, & Liao, 2000: 42–47, figs. 1, 2 (type locality: Tai-Shi, NE Taiwan).

Type material. HOLOTYPE: NTOU H 1996–8–4, ♂ (TL 87 mm), Tai-Shi, I-Lan County, NE Taiwan, trawl, 4 Aug 1996. PARATYPES: NTOU P 1997–12–1, 1♀ (TL 79 mm), Tai-Shi, I-Lan County, NE Taiwan, sand-mud, commercial trawl, Y.J. Liao, 1 Dec 1997. AM P53856, 1♀ (TL 90 mm), Tai-Shi, I-Lan County, NE Taiwan, sand-mud, trawl, Y.J. Liao, 1 Dec 1997.

Australian material. WESTERN AUSTRALIA: NTM Cr012381, 1♂ (TL 39 mm), Northwest Shelf, 19°41–42'S 117°56–57'E, 53 m, trawl, S0283 126, 21 Feb 1983; NTM Cr012402, 1♂ (TL 59 mm), Northwest Shelf, 19°07–08'S 119°05–06'E, 78 m, trawl, SO682 128, 9 Dec 1982.

Diagnosis. Rostral plate trapezoid with indistinct median carina. Carapace without branches of anterior bifurcation of MD carina. Raptorial claw dactylus with 5 teeth; carpus dorsal carina undivided. Mandibular palp absent. AS6 with short, low, median carina (often indistinct). Abdominal carinae spined as follows: SM (5)6, IM 4–6, LT 2–6, MG 1–5. Telson dorsolateral surface with bicarinate accessory MD and numerous supplementary longitudinal carinae; denticles SM 2–4, IM 9–11, LT 1; ventral surface with long, smooth postanal carina flanked by sinuous carina and numerous curved carinae. Uropodal exopod proximal segment outer margin with 7–9 movable spines.

Colour in alcohol. Faded, but with traces of dark pigment on primary telson teeth.

Measurements. Male (*n* = 3) TL 39–87 mm, female (*n* = 2) TL 79–90 mm. CI 503–605; A1 peduncle 0.91–0.99 CL. A2 scale 0.69–0.74 CL. Anterior carapace anterior width 0.54–0.56 CL.

Remarks. A full account of this species is given by Ahyong, Chan & Liao (2000). *Oratosquillina manningi* is unique in the genus for lacking a mandibular palp and bearing supplementary carinae on the ventral surface of the telson. *Oratosquillina manningi* is identical to *O. microps* from the Philippines in the dorsal carination of the telson but differs in bearing a median carina on the rostral plate, lacking the mandibular palp, bearing five instead of six teeth on the dactylus of the raptorial claw and numerous ventral carinae on the telson.

Habitat. Sand and mud substrates in depths of 53–78 m in Australia. The species was recorded at a depth of 32 m from the Andaman Sea, Thailand (Ahyong & Naiyanetr, in press).

Distribution. Known only from northwestern Australia, Taiwan and the Andaman Sea.

Oratosquillina quinquedentata (Brooks, 1886)

Fig. 144

Squilla quinquedentata Brooks, 1886: 21, 26, pl. 1: fig. 3, pl. 2: fig. 6 (type locality: Arafura Sea, 9°59'S 139°42'E).–Kemp, 1913: 52.–Stephenson & McNeill, 1955: 243.
Oratosquilla quinquedentata.–Manning, 1971b: 14; 1978d: 23–25, fig. 12.
Oratosquillina quinquedentata.–Manning, 1995: 25, 225.

Type material. HOLOTYPE: NHM 94.10.16.6, ♂ (TL 140 mm), Arafura Sea, 9°59'S 139°42'E, 51 m, Challenger stn 188, 10 Sep 1874.

Australian material. QUEENSLAND: AM P11886, 1♂ (TL 50 mm), Brampton I., 20°49'S 149°17'E, from tidal mudflat, B. Dew; AM P21637, 1♂ (TL 147 mm), SE Gulf of Carpentaria, 17°21'50"S 139°39'30"E, 7 m, 10 Jan 1964; AM P21638, 2♂♂ (TL 117–122 mm), 1♀ (TL 151 mm), SE Gulf of Carpentaria, less than 25 m; AM P56920, 1♀ (TL 155 mm), NE of Shelburne Bay, 11°30'S 143°30'E, QDPI 102, 25 Nov 1992; AM P56960, 1♂ (TL 54 mm), E of Orford Bay, 11°18.2'S 142°58.8'E, SS0591 71, 1 Dec 1991; AM P56961, 1♀ (TL 55 mm), East I., 11°23.4'S 142°55.8'E, SS0591 72, Dec 1991; AM P56984, 1♂ (TL 94 mm), NE Gulf of Carpentaria, 10°39.0'S 140°38.7'E, 42 m, SS0390 58, T. Wassenberg, 1990; AM P57095, 1♂ (TL 142 mm), Shelburne Bay, 11°13'00"S 143°05'15"E, *Friulana*, T. Wassenberg, 4 Apr 1993; NTM Cr008814, 1♂ (TL 125 mm), N of Duyfken Point, Gulf of Carpentaria, 12°19.8'S 141°36.1'E, 13 m, trawl, SS0591 47, A. Bruce & R. Williams, 27 Nov 1991; QM W3990, 1♂ (TL 109 mm), 11 km NE of Mackay, 21°04'S 149°17'E, muddy sand, J. Davie, 11 Aug 1970; QM, 1♀ (TL 142 mm), NE Gulf of Carpentaria, 12°30.0'S 140°40.2'E, SS0591 43; QM, 1♂ (TL 137 mm), Shelburne Bay, 11°12.0'S 143°59.8'E, PEG II, T. Wassenberg, 27 Apr 1993; QM, 1♀ (TL 92 mm), Arafura Sea, 11°10.5'S 139°23.8'E, SS0591 56, T. Wassenberg, 28 Nov 1991; QM, 1♀ (TL 134 mm), Torres Strait, 10°25.0'S 141°46.2'E, SS0591 63, T. Wassenberg; QM, 1♀ (TL 145 mm), NE Shelburne Bay, 11°30'S 143°30'E, QDPI 101, T. Wassenberg, 25 Nov 1992; QM, 1♂ (TL 148 mm), NE of Shelburne Bay, 11°52'S 143°10'E, *Tweed Seeker*, 18 Apr 1993. WESTERN AUSTRALIA: AM P56952, 1♂ (TL 33 mm),

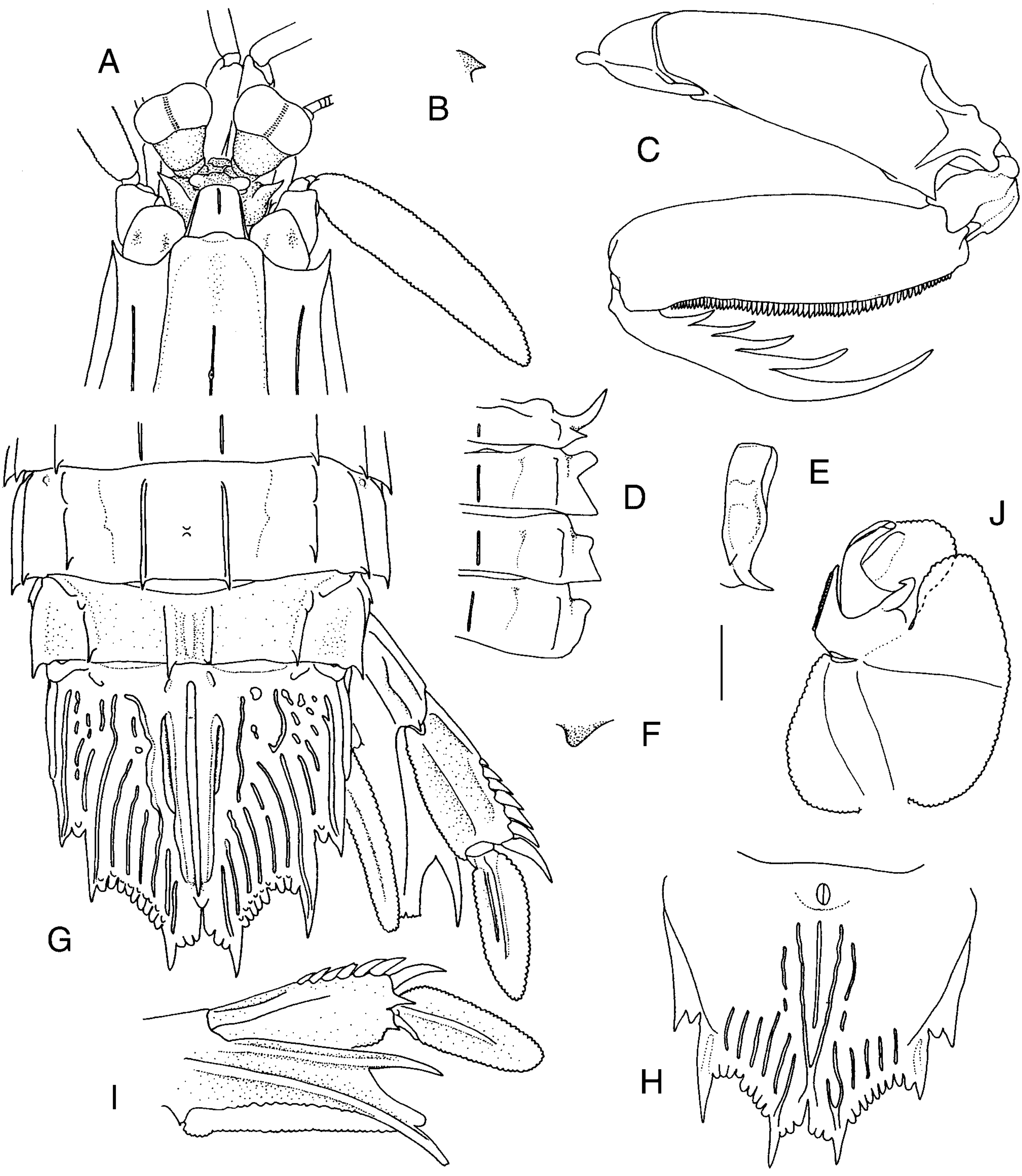

Figure 143. *Oratosquillina manningi* Ahyong, Chan, & Liao, ♂ TL 59 mm (NTM Cr012402). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, telson, ventral. I, uropod, left ventral. J, PLP1 endopod, right anterior. Scale A–I = 2.5 mm; J = 1 mm.

Northwest Shelf, 19°58.8'S 117°51.4'E, 42 m, dredge, S0383 D1, 25 Jun 1983; NTM Cr000761, 2♀♀ (TL 91–96 mm), Northwest Shelf, 19°30.8'S 118°46.3'E, 35 m, A. Bruce, 26 Apr 1983; NTM Cr012398, 1♂ (TL 85 mm), Northwest Shelf, 1982; NTM Cr012403, 1♂ (TL 109 mm), Northwest Shelf, 19°07–08'S 119°05–06'E, 78 m, beam trawl, S0682 128; NTM Cr012372, 1♂ (TL 30 mm), 19°58.9–58.7'S 117°51.3–51.5'E, 40 m, S0283 B1BT. NORTHERN TERRITORY: AM P6588, 1♀ (TL 146 mm), Paradice Bay, North I., Sir Edward Pellow Group, 15°33'S 136°47'E, 6 m, in fish trap on clean sand, W. Paradice; NTM Cr010855, 1♀ (TL 149 mm), Northwest Bay,

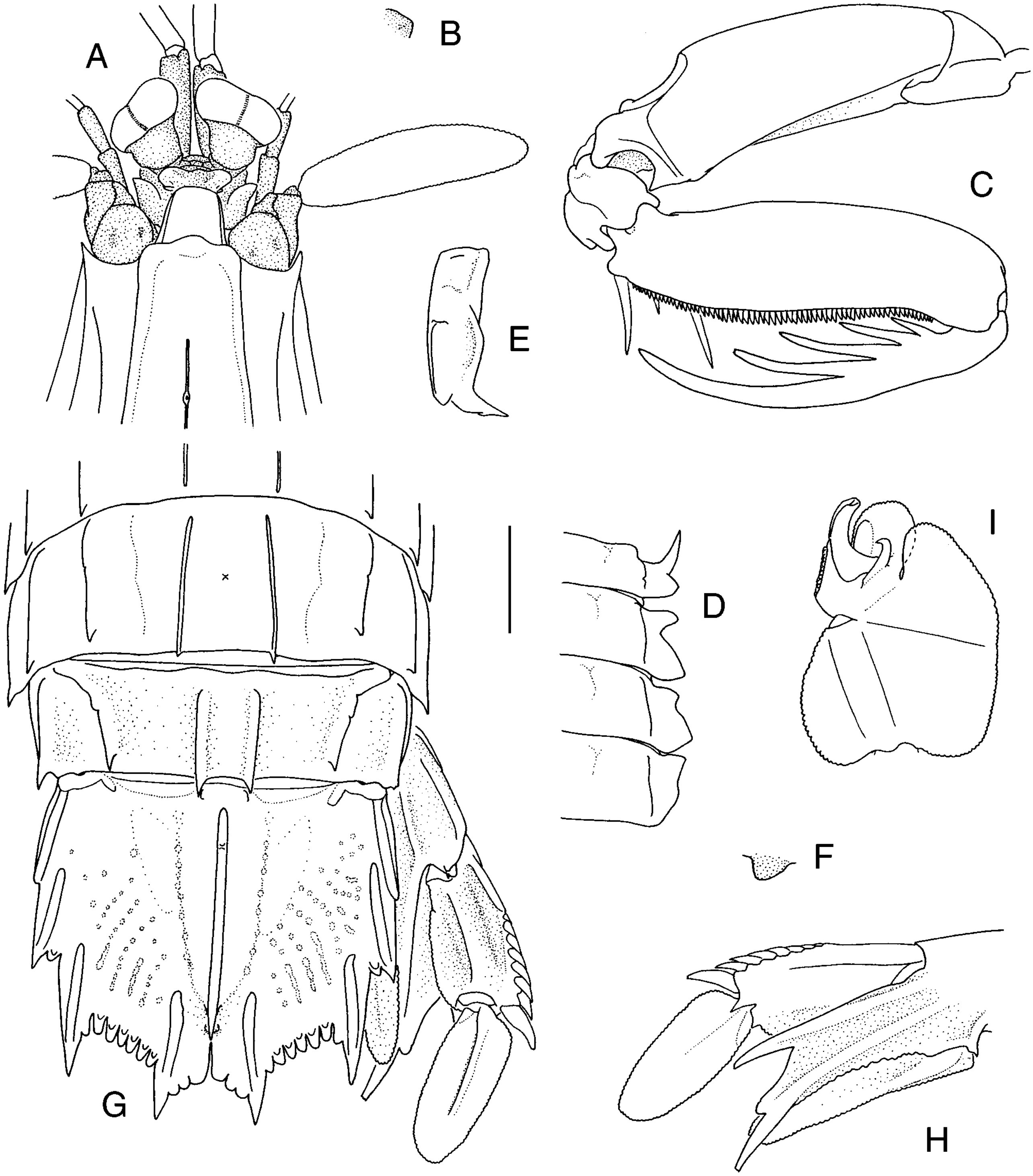

Figure 144. *Oratosquillina quinquedentata* (Brooks), ♂ TL 85 mm (NTM Cr012398). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, left lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 5 mm; I = 2.5 mm.

13°44.0'S 136°33.7'E, R. Buckworth, 14–15 Mar 1993; QM, 1♂ (TL 148 mm), E of Wessell Is, 11°24.8'S 136°36.4'E, dredged, SS0591 006, T. Wassenberg, 19 Nov 1991.

Diagnosis. Dorsal integument lightly pitted. A1 somite dorsal processes with blunt apices. Rostral plate as long as or broader than long; without median carina. Carapace with branches of anterior bifurcation of MD carina indistinct or absent. Raptorial claw dactylus with 5 teeth; carpus dorsal carina undivided. Mandibular palp 3-segmented. TS5 lateral process with posterior lobe short with blunt apex blunt. TS6 lateral process anterior lobe smaller than posterior lobe, triangular or trapezoid with blunt apex. TS7 lateral process with anterior lobe much smaller than posterior lobe, low, rounded or angular. Abdominal carinae spined as follows: SM 5–6, IM (4)5–6, LT (3)4–6, MG 1–5. Telson prelateral lobe longer than margin of lateral tooth; dorsolateral surface without supplementary longitudinal carinae; denticles SM 2–3, IM 6–9, LT 1; ventral surface with long postanal carina; without supplementary ventral carinae. Uropodal protopod with lobe on outer margin of inner terminal spine rounded, narrower than adjacent spine, proximal margin concave. Uropodal exopod proximal segment outer margin with 7–10 movable spines; distal segment; dark on proximal ⅔ of inner ½.

Colour in life. Light grey brown dorsally, darker mid-dorsally. Carinae and grooves of carapace, submedian carinae and posterior margins of body somites red. Telson with median carina and carinae of primary teeth red; median carina with narrow dark band across anterior and posterior ⅓. Uropodal protopod with red terminal spines; endopod black on distal ½; exopod with pink movable spines; exopod distal segment yellow with small black patch on inner proximal ⅓.

Measurements. Male (*n* = 17) TL 30–148 mm, female (*n* = 11) TL 55–155 mm. CI 412–603. A1 peduncle 0.81–0.99 CL. A2 scale length 0.50–0.61 CL. Anterior carapace width 0.42–0.51 CL. The present series includes the largest known specimens of the species.

Remarks. The Australian material exhibits variation in some characters used by Manning (1978d) to distinguish *O. quinquedentata* from *O. pentadactyla*. Thus, in *O. quinquedentata*, the cornea is usually of similar size to rather than smaller than that of size matched *O. pentadactyla*, the rostral plate is usually shorter than broad, but may be as long as broad, and the lateral carina of AS3 may be armed posteriorly. *Oratosquillina quinquedentata* differs from *O. pentadactyla* in having a blunt instead of sharp posterior lobe on the lateral process of TS5, the anterior lobe of the lateral process of TS6 is broader and blunt instead of slender and sharp, the lateral carinae of AS1–2 are unarmed, and the median carina of the telson bears large dark pigment patch at either end.

Habitat. Sandy-mud or muddy substrates including mudflats; shore to 51 m depth.

Distribution. Bombay, Indian, the Andaman Sea and Gulf of Thailand to northern Australia, from Queensland to Western Australia.

Oratosquillina stephensoni (Manning, 1978d)

Fig. 145

Squilla perpensa.–Manning, 1966: 99–100 (Australian specimen only; not *Squilla perpensa* Kemp, 1911).

Squilla anomala.–Stephenson, 1952: 7, 8; 1953a: 43.–Stephenson & McNeill, 1955: 245 (not *Squilla anomala* Tweedie, 1935).

Oratosquilla stephensoni Manning, 1978d: 29–30, fig. 16 (type locality: 1.6–2.4 km E of St. Helena I., Moreton Bay, Queensland, Australia, 27°15'S 153°15'E).

Oratosquillina stephensoni.–Manning, 1995: 225, 227.

Type material. HOLOTYPE: USNM 125754, ♂ (TL 134 mm), 1.6–2.4 km E of St. Helena I., Moreton Bay, Queensland, Australia, 27°15'S 153°15'E, 8.2 m, L. Wale, 15 Feb 1966. PARATYPES: AM P24776, 1♂ (TL 134 mm), 1♀ (TL 120 mm), 1.6–2.4 km E of St. Helena I., Moreton Bay, 27°15'S 153°15'E, 8.2 m, L. Wale, 15 Feb 1966; QM W5767, 1♂ (TL 116 mm), 1♀ (TL 122 mm), 1.6–2.4 km E of St Helena I., Moreton Bay, 27°15'S 153°15'E, 8.2 m, L. Wale, 15 Feb 1966.

Australian material. QUEENSLAND: AM P12227–12228, 1♂ (TL 117 mm), 1♀ (TL 140 mm), 6.4 km E of Scarborough Pier, 12 m, sandy-mud, trawl, E. Grant, 3 Nov 1951; AM P12260, 1♂ (TL 133 mm), Moreton Bay, 27°25'S 153°20'E, W. Stephenson, 1 Oct 1953; AM P21627, 1♂ (TL 104 mm), 2♀♀ (TL 105–107 mm), SE Gulf of Carpentaria, 16°37'03"S 140°50'01"E, 13 m, trawl, 23 Aug 1963; AM P21628, 3♂♂ (TL 96–116 mm), 3♀♀ (TL 118–130 mm), SE Gulf of Carpentaria, 16°S 140°E, less than 26 m, Dec 1963; AM P21629, 1♀ (TL 111 mm), SE Gulf of Carpentaria, 16°55'06"S 140°41'04"E, 17 m, trawl, 23 May 1965; AM P21630, 5♂♂ (TL 75–107 mm), 8♀♀ (TL 79–117 mm), SE Gulf of Carpentaria, 16°S 140°E, less than 26 m, Dec 1963; AM P43221, 2♂♂ (TL 89–90 mm), 1♀ (TL 79 mm), 6 km NE of Port Clinton, Shoalwater Bay, 22°28.17'S 150°44.44'E, 43 m, sand, D. Bray & S. Reader, 23 Oct 1993; AM P55592, 1♂ (TL 85 mm), 3♀♀ (TL 63–115 mm), between Weipa & Karumba, Gulf of Carpentaria, 10–30 m, trawl, T. Wassenberg, Dec 1976; AM P56875, 1♂ (TL 136 mm), Moreton Bay, sand, mud, trawl, Jul 1995; AM P56948, 2♂♂ (TL 121–150 mm), Moreton Bay, 27°25'S 153°20'E, offshore prawn trawlers; QM W1796, 1♂ (TL 116 mm), N end of Moreton Bay, 9 m, otter trawl; QM W1797, 1♀ (TL 138 mm), NE Moreton Bay, 27°25'S 153°20'E, 9 m, otter trawl, early Jun 1950; QM W3150, 1♂ (TL 58 mm), E. of Victoria Point, Moreton Bay, 13 Oct 1967; QM W3937, 1♂ (TL 145 mm), 1♀ (TL 157 mm), 2.4 km NE of Mud I., Moreton Bay, 27°19'S 153°16'E, 10 m, on mud, A. Jones, 9–10 Aug 1967; QM W3962, 1♂ (TL 43 mm), 1.6 km S of Southwest Rocks, Moreton Bay, sand & mud, Sep 1971; QM exW12228, 1♀ (TL 92 mm), Cumberland Group, 20°00'S 149°00'E, N. Haysom, Aug 1957; QM W16583, 2♂♂ (TL 135 mm), Moreton Bay, 27°00'S 153°00'E, trawl; QM W22266, 1♀ (TL 64 mm), 6.4 ESE of Reef Point, Moreton Bay, 8 m, trawl, soft sandy mud, E. Grant, 12 Jun 1950; TM G40, 1♀ (TL 103 mm), between Magnetic I. & Townsville, prawn trawl, 6.4 m, R. Bryson, autumn 1952; WAM C9539, 3♂♂ (TL 83–101 mm), 6♀♀ (TL 93–119 mm), Gulf of Carpentaria, stn 1544, R. George, 15 Nov 1964; WAM C9540, 5♂♂ (TL 85–105 mm), 6♀♀ (TL 96–107 mm), Gulf of Carpentaria, stn 1529, R. George, Nov 1964; WAM 9545, 2♀♀ (TL 86–103 mm), Gulf of Carpentaria, stn 1546, R. George, 15 Nov 1964. WESTERN AUSTRALIA: AM P60077, 1♀ (TL 110 mm), Carnarvon, 22 m, sandy-mud & algae beds, N. Coleman, 3 Jun 1972; WAM C11754, 3♂♂ (TL 91–109 mm), 2♀♀ (TL 111–121), Exmouth Gulf, 13 m, trawl, R. Mitchell, 19 May 1974; NTM Cr007678, 1♂ (TL 87 mm), Joseph Bonaparte Gulf, 14°02.40'S 128°03.00'E, 52–55 m, trawl, D. White, 28 Jun 1990. NORTHERN TERRITORY: WAM C9541, 1♀ (TL 107 mm), Darwin, E. Barker, 4 Sep 1965; WAM C9542, 2♂♂ (TL 82–86 mm), 3♀♀ (TL 92–104 mm), Beagle Gulf, off Port Darwin, 12°14'S 130°34'E, E. Barker, 4 Sep 1965; WAM C9543, 2♂♂ (TL 88–91 mm), 4♀♀ (TL 86–105 mm), Beagle Gulf, off Port Darwin, 12°14'S 130°34'E, E. Barker, 4 Sep 1965; WAM C9544, 2♂♂ (TL 78–92 mm), Beagle Gulf, off Port Darwin, 12°14'S 130°34'E, E. Barker, 4 Sep 1965; NHM 82.7, 1♂ (TL 62 mm), Port Darwin, 13–32 m, HMS Alert; AM P14928, 1♂ (TL 85 mm), Chambers Bay, near Darwin, 12°13'S 131°35'E, prawn trawl, V. Wells, 7 Nov 1959.

Diagnosis. Dorsal integument distinctly pitted, rugose. A1 somite dorsal processes with blunt apices. Rostral plate broader than long; without median carina. Carapace without branches of anterior bifurcation of MD carina. Raptorial

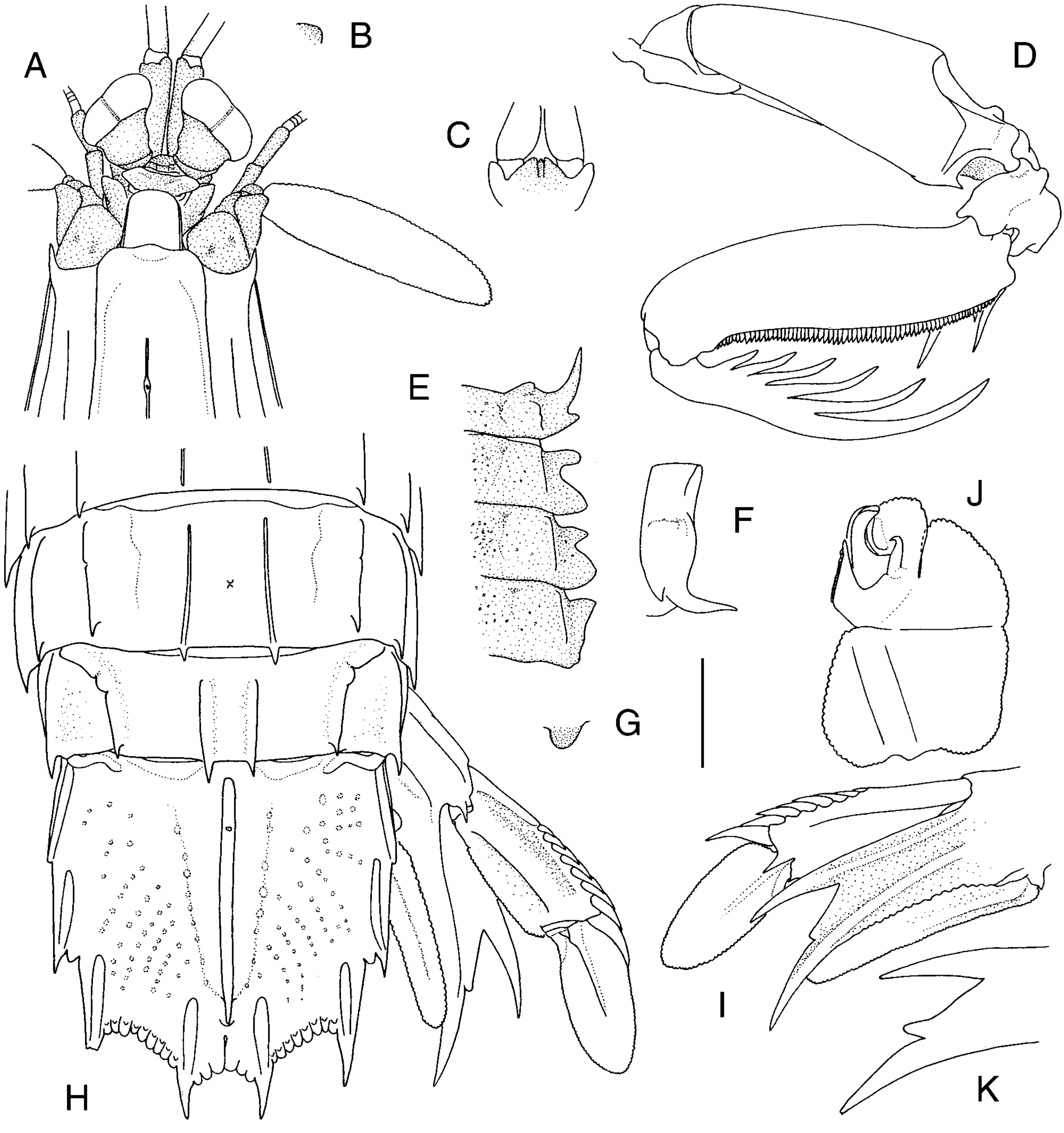

Figure 145. *Oratosquillina stephensoni* (Manning). A–J, ♂ TL 85 mm (AM P55592). K, ♂ TL 62 mm (NHM 82.7). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, A1 somite, ventral. D, raptorial claw, right lateral. E, TS5–8 lateral processes, right dorsal. F, TS5, right lateral. G, TS8 sternal keel, right lateral. H, AS4–6, telson & uropod, dorsal. I, uropod, right ventral. J, PLP1 endopod, right anterior. K, uropodal protopod, right ventral. Scale A–I = 5 mm; J, K = 2.5 mm.

claw dactylus with 6 teeth; carpus dorsal carina undivided. Mandibular palp 3-segmented. TS6 lateral process anterior lobe slender, apex rounded. TS7 lateral process anterior lobe triangular, with emargination between anterior and posterior lobes acute. Abdominal carinae spined as follows: SM 5–6, IM 4–6, LT (2)3–6, MG 1–5. Telson prelateral lobe subequal to or shorter (occasionally longer) than margin of lateral tooth; denticles SM 2–4, IM 6–11, LT 1; dorsolateral surface without supplementary longitudinal carinae; ventral surface with short, postanal carina; without supplementary ventral carinae. Uropodal protopod with lobe on outer margin of inner terminal spine rounded, narrower than adjacent spine, proximal margin slightly convex to concave. Uropodal exopod proximal segment outer margin with 7–9 movable spines.

Colour in life. Light grey brown dorsally, darker mid-dorsally with transverse “block” on each thoracic and abdominal somite. Carinae and grooves of carapace, submedian carinae and posterior margins of body somites red. Telson with median carina and carinae of primary teeth red; median carina with narrow dark band across anterior and posterior ⅓. Uropodal protopod with red terminal spines; endopod black on distal ½; exopod with pink movable spines; exopod distal segment yellow with small black patch on inner proximal ⅓.

Measurements. Male (n = 46) TL 43–150 mm, female (n = 51) TL 63–157 mm. CI 430–602. A1 peduncle 0.83–0.94 CL. A2 scale length 0.55–0.67 CL. Anterior carapace width 0.46–0.53 CL. The present series includes the largest known specimens of the species.

Remarks. *Oratosquillina stephensoni* most closely resembles *O. gravieri* and *O. perpensa* in the deeply pitted, rugose dorsum. *Oratosquillina stephensoni* differs from both *O. perpensa* and *O. gravieri*, as well as all other congeners that lack supplementary carinae on the telson, in lacking the branches of the anterior bifurcation of the carapace.

A previously unrecognized diagnostic character in *Oratosquillina* is the shape of the ventral surface of the antennular somite. In *O. anomala*, *O. interrupta* and *O. stephensoni*, the ventral surface of the antennular somite bears a narrow, median, anterior groove (Figs. 142C, 145C); this groove is absent from all others in the genus and will therefore distinguish *O. anomala*, *O. stephensoni* and *O. interrupta*. In *O. stephensoni*, the median ventral groove on the antennular somite is flanked on either side by an anteriorly directed triangular projection, whereas in *O. anomala* and *O. interrupta*, these projections are absent.

Two characters previously considered diagnostic for *O. stephensoni* are variable. The length of the rostral plate is usually "short", but the relative length may overlap that of *O. gravieri*, for instance, that usually has an "elongate" rostral plate. The lobe on the outer margin of the inner spine of the uropodal protopod was characterized as convex or straight (Manning, 1978d), but in the present series, varies from distinctly concave to convex. Two specimens of *Oratosquillina stephensoni* each with a regenerating claw, bear five and seven teeth respectively on the regenerating dactyli instead of the usual six.

As shown by Manning (1978d), previous records of *Squilla anomala* from Australia by Stephenson (1952, 1953a) and Stephenson & McNeill (1955) are referable to *O. stephensoni*. Similarly, Manning's (1966) record of *Squilla perpensa* from Port Darwin is based on a specimen of *O. stephensoni* with a concave lobe between the terminal spines of the uropod (Fig. 146K).

Habitat. Sheltered coastal waters and embayments on level sandy-mud or mud substrates; 6.4–43 m.

Distribution. Northern Australia from Carnarvon, Western Australia to Moreton Bay, Queensland.

Quollastria n.gen.

Diagnosis. Dorsal integument rugose, pitted. Cornea width less than 0.3 CL, strongly bilobed. A1 somite not greatly elongate; dorsal processes trianguloid, directed antero-laterally. Carapace anterior width less than or slightly exceeding ½ median length; with anterolateral spines; with normal complement of carinae; MD carina distinct, interrupted at base of anterior bifurcation; branches of anterior bifurcation opening anterior to dorsal pit; posterolateral margin rounded. Raptorial claw dactylus with 5 or 6 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp 3-segmented. MXP1–4 with epipod (2–3 in *Q. imperialis*). PLP1 endopod in adult males with posterior endite; hook process blunt distally. TS5–7 lateral processes distinctly bilobed. Telson SM teeth with fixed apices; prelateral lobe present; dorsolateral surface with or without supplementary longitudinal carinae. Uropodal protopod inner margin crenulate.

Type species. *Quollastria capricornae* n.sp. by present designation.

Etymology. The name is an anagram of *Oratosquilla*, a similar genus. Gender: neuter.

Included species. Nine: *Q. capricornae* n.sp.; *Q. fossulata* (Moosa, 1986) n.comb.; *Q. gonypetes* (Kemp, 1911) n.comb.; *Q. kapala* n.sp.; *Q. imperialis* (Manning, 1965) n.comb.; *Q. ornata* (Manning, 1971b) n.comb.; *Q. simulans* (Holthuis, 1967b) n.comb.; *Q. striata* (Manning, 1978d) n.comb.; and *Q. subtilis* (Manning, 1978d) n.comb.

Remarks. *Quollastria* is newly erected for the species of the *gonypetes* group in *Oratosquillina* (see Manning, 1995). *Oratosquillina* is restricted to the species of the *perpensa* group. *Quollastria* differs from *Oratosquillina*, as restricted here, in lacking the outer inferodistal spine on the merus of the raptorial claw. Species of *Quollastria* also differ from *Oratosquillina* in generally being smaller, not exceeding about 100 mm TL in contrast to about 150 mm TL, and in bearing large dark patches of pigment or a dark, or at least a dark concentration of pigment around the posterior margin and submedian carinae of AS5. Species of *Quollastria* also tend to occur in deeper waters, usually greater than about 50 m, in contrast to species of *Oratosquillina* that are common in the shallow subtidal zone.

Several known, but generally under-utilized characters have proven particularly useful in distinguishing species. In particular, the length of the lateral carina and prelateral lobe of the telson in adults, pigmentation of the distal segment of the uropodal exopod and the shape of the apex of the dorsal processes of the antennular somite (in lateral view), whether rounded to angular or produced to a spine, are usually important specific characters. As in *Oratosquillina*, however, some characters formerly considered diagnostic for species in *Quollastria* have proven variable. Hence, the relative length of the rostral plate and width of the lobe between the terminal spines of the uropodal protopod often vary allometrically and must be used with caution. In some species the number of dactylar teeth on the raptorial claw was found to be variable and this has been instrumental in clarifying species concepts among species similar to *Q. gonypetes* that usually have five teeth on the dactylus. Maxillipeds 1–4 each have an epipod in all species of *Quollastria* except for *Q. imperialis* in which only maxillipeds 1–2 or 3 bear an epipod.

Although Manning (1978d, 1995) regarded *Q. simulans* from the Red Sea as conspecific with *Q. imperialis* from the South China Sea and Japan, both species are distinct (but see remarks under account of *Q. gonypetes*). *Quollastria simulans* differs from *Q. imperialis* in bearing a pair of dark square patches of AS5 and in bearing four instead of two or three epipods. However, I consider *Q. birsteini*, also from the Red Sea, to be conspecific with *Q. simulans*. Characters used by Makarov (1971) to distinguish *Q. birsteini* from *Q. simulans* are variable or based on misinterpretation of Holthuis (1967b). Hence, the spination of the intermediate abdominal carinae is variable in *Quollastria*, and Makarov's (1971) attribution of a double instead of single spine on the dorsum of the uropodal protopod to *Q. simulans* is a misinterpretation of Holthuis' (1967b) figure of the holotype. Manning (1978d) has already remarked that the paratype of *Q. simulans* is probably conspecific with *Q. striata*. Four of nine species of *Quollastria* are known from Australia.

Key to species of *Quollastria*

1 Raptorial claw dactylus with 5 teeth 2

—— Raptorial claw dactylus with 6 teeth 3

2 A1 somite dorsal processes with apices produced to a sharp spine. Uropodal exopod with proximal segment as long as or shorter than distal segment. AS5 with pair of large, dark, submedian squares .... ***Q. gonypetes***

—— A1 somite dorsal processes with blunt apices, rounded or at most obtusely angled. Uropodal exopod with proximal segment longer than distal segment. AS5 with pair of large, dark, submedian triangles .... ***Q. subtilis***

3 Telson dorsolateral surface with accessory MD carinae and numerous slender carinae over entire surface. AS5 with single, dark, rectangular dorsomedian patch .... *Q. striata*

—— Telson dorsolateral surface without accessory MD carina, at most with short carinae on posterior ½, but usually with shallow grooves formed by coalescence of dorsal pits 4

4 Uropodal protopod with lobe outer margin of inner spine produced to a slender spine .... *Q. ornata*

—— Uropodal protopod with lobe on outer margin of inner spine rounded or blunt 5

5 MXP4 without epipod .... *Q. imperialis*

—— MXP4 with epipod 6

6 AS5 with pair of large, dark, submedian squares. TS8 with sternal keel near obsolete, at most a low swelling .... *Q. simulans*

—— AS5 without pair of large, dark, submedian squares, instead with narrow transverse bar along posterior margin of AS5. TS8 with sternal keel distinct, rounded 7

7 Telson IM denticles closely spaced, with denticles appressed or with intervening gap distinctly less than ½ width of denticles. Uropodal exopod distal segment dark on inner ½ only (at most with scattered chromatophores on outer ½) 8

—— Telson IM denticles distinctly spaced, with intervening gap about ½ width of denticles. Uropodal exopod distal segment black on inner proximal ⅔ and outer proximal margin .... ***Q. kapala***

8 Dorsal processes of A1 somite blunt to angular, not produced to a distinct spine in adults. Telson dorsolateral surface without distinct carinae in adults .... ***Q. capricornae***

—— Dorsal processes of A1 somite produced to a distinct spine in adults. Dorsolateral surface of telson in specimens exceeding about TL 85 mm with numerous short distinct, carinae on posterior ½ .... *Q. fossulata*

Quollastria capricornae n.sp.

Fig. 146

Oratosquilla imperialis.–Graham *et al*., 1993a: 24, 64; 1993b: 73 [not *O. imperialis* (Manning, 1965)].

Type material. (All Queensland, Australia) HOLOTYPE: AM P56912, 1♂ (TL 90 mm), E of Mooloolaba, 26°52.74'S 153°35.34'E, 160 m, otter trawl, QLD-1119, J. McIllwain, 3 Aug 1994. PARATYPES: AM P56873, 4♂♂ (TL 81–85 mm), 3♀♀ (TL 77–96 mm), E of Swains Reef, 22°25.00–11.97'S 153°20.39–12.58'E, QLD-1255, 181 m, trawl, FV *Seadar Bay*, J. Lowry & K. Dempsey, 9–10 Sep 1995; AM P56879, 1♀ (TL 91 mm), E of Swains Reef, 22°23.49'S 153°04.48'E, 139 m, trawl, FV *Seadar Bay*, QLD-1251, J. Lowry & K. Dempsey, 8–9 Sep 1995; AM P56916, 4♀♀ (TL 79–99 mm), E of Swains Reef, 22°26.75'S 153°09.17'E, 139 m, trawl, QLD-1250, J. Lowry & K. Dempsey, 8–9 Sep 1995; AM P56917, 2♀♀ (TL 68–96 mm), E of Swains Reef, 22°25.00'S 153°20.39'E, trawl, 181 m, QLD-1254, J. Lowry & K. Dempsey, 9–10 Sep 1995; AM P57101, 1♀ (TL 75 mm), E of Swains Reef, QLD-1258, J. Lowry & K. Dempsey.

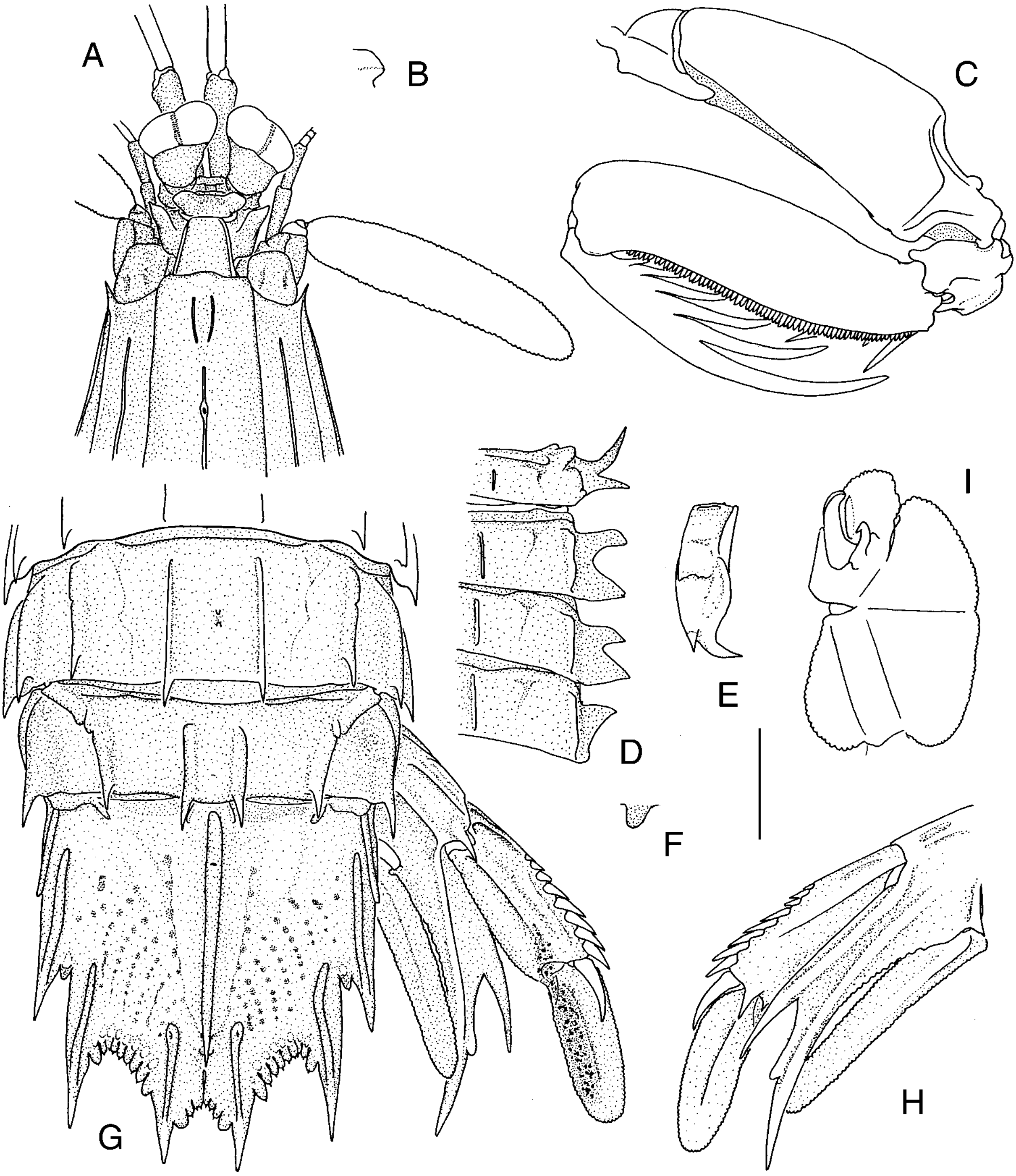

Figure 146. *Quollastria capricornae* n.sp., holotype ♂ TL 90 mm. A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 5 mm; I = 2.5 mm.

Australian material. QUEENSLAND: QM W3153, 1♂ (TL 85 mm), 7♀♀ (TL 95–110), 48–64 km E of Caloundra (Cape Moreton Wide Ground), 128–146 m, mid Sep 1967; QM W24201, 4♂♂ (TL 39–50 mm), 1♀ (TL 45 mm), Coral Sea, 18°00.7'S 147°01.4'E, 208–212 m, trawl, continental slope, P. Davie, 29 Nov 1985; QM W24208, 2♂♂ (TL 47–60 mm), Coral Sea, 17°58.9'S 147°01.1'E, 218–220 m, trawl, continental slope, RV *Soela*, 15 Jan 1986. NEW SOUTH WALES: AM P29443, 1♀ (broken, CL 20.8 mm), E of Tweed Heads, 28°15'S 153°50'E, K78–23–11, 131 m, prawn trawl, K. Graham, 6 Nov 1978; AM P29445, 1♀ (TL 84 mm), E of Byron Bay, 28°42'S 153°51'E, K78–17–21, 153 m, prawn trawl, K. Graham, 18 Aug 1978; AM P41788, 1♂ (TL 82 mm), NE of Tuncurry, 31°56'S 152°51'E, K91–06–06, 94 m, prawn trawl, K. Graham, 16 Apr 1991; AM P41789, 1♀ (TL 99 mm), E of Clarence R, 29°27'S 153°34'E, K90–12–20, 71 m, prawn trawl, K. Graham, 31 Aug 1990; AM P56871, 1♀ (TL 100 mm), off Coffs Harbour, #131, K. Graham, 1995; AM P56872, 1♂ (TL 96 mm), SE of Evans Head, 29°25'S 153°36'E, 69–74 m, K95–11–27, #130, K. Graham, 29 Aug 1995; AM P56877, 1♂ (TL 99 mm), off Clarence R, 63–72 m, prawn trawl, K90–08–04, K. Graham; AM P56878, 1♂ (TL 83 mm), off Crowdy Head, 28°35'S 153°35'E, 90 m, K90–14–09, K. Graham, 13 Nov 1990. WESTERN AUSTRALIA: NMV J13861, 1♀ (TL 63 mm), Northwest Shelf between Port Hedland & Dampier, 18°48'S 118°21'E, NWA 19, 118 m, on sand, trawl, G. Poore & H. Lew Ton, 4 Jun 1983; NMV J37815, 1 juvenile ♂ (TL 23 mm), Northwest Shelf, between Port Hedland & Dampier, 18°45'S 118°24'E, NWA 23, 142 m, trawl, G. Poore & H. Lew Ton, 5 Jun 1983.

Diagnosis. Dorsal integument lightly pitted. A1 somite dorsal processes with blunt or angular apices. Raptorial claw dactylus with 6 teeth. MXP1–4 with epipod. TS8 sternal keel distinct, rounded to angular. Telson prelateral lobe shorter than margin of lateral tooth; LT carina long, usually extending anteriorly to or beyond midlength of prelateral lobe; dorsolateral surface without supplementary longitudinal carinae. Uropodal protopod with lobe on outer margin of inner terminal spine with rounded apex. Uropodal exopod distal segment as long as or slightly longer than proximal segment; dark on inner ½ only.

Description. Dorsal integument lightly pitted. Eye small; CI 464–587. Ophthalmic somite anterior margin quadrate, medially emarginate to flattened. Ocular scales truncate. A1 peduncle 0.91–1.12 CL. A1 somite dorsal processes with blunt or angular apices, directed anterolaterally. A2 scale length 0.59–0.78 CL. Rostral plate length and breadth subequal; trapezoid; lateral margins upturned, straight; apex truncate; without median carina. Carapace anterior width 0.46–0.52 CL; anterolateral spines not extending to base of rostral plate; branches of anterior bifurcation of MD carina distinct; posterior median projection distinct, obtuse. Raptorial claw dactylus with 6 teeth; outer margin broadly curved, proximal margin angular lobe; carpus dorsal carina undivided; propodus distal margin unarmed; merus outer inferodistal angle unarmed, rounded. Mandibular palp 3-segmented. MXP1–4 with epipod. TS5 lateral process anterior lobe a slender spine directed anterolaterally; posterior lobe short, slender, apex acute, directed laterally. TS6 lateral process anterior lobe slender, trapezoid, apex truncate; posterior lobe broad, triangular straight, apex acute. TS7 lateral process anterior lobe smaller than posterior lobe, slender, triangular; apex acute; posterior lobe broad, triangular, anterior margin straight, apex acute. TS8 anterolateral margin triangular, apex acute; sternal keel rounded to angular. AS1–5 SM carinae distinct, slightly divergent posteriorly. AS6 at most with small ventrolateral tubercle anterior to uropodal articulation. Abdominal carinae spined as follows: SM 5–6, IM (2)3–6, LT (1)2–6, MG 1–5. Telson as long as or slightly longer than broad; prelateral lobe shorter than margin of lateral tooth; denticles closely spaced, SM 3–5, IM 7–9, LT 1, rounded, occasionally with spiniform apices, each with dorsal tubercle; MD carina interrupted proximally, posteriorly with slender spine; LT carina long, usually extending anteriorly to or beyond midlength of prelateral lobe; dorsolateral surface without supplementary longitudinal carinae; ventral surface with short, smooth, postanal carina; without supplementary ventral carinae. Uropodal protopod with minute ventral tubercle anterior to endopod articulation; terminal spines with lobe on outer margin of inner spine rounded, narrower than adjacent spine, proximal margin concave. Uropodal exopod proximal segment inner margin straight or broadly convex; outer margin with 8–10 movable spines, distalmost not exceeding midlength of distal segment; distal margin with 2 ventral spines, outer longest. Exopod distal segment length subequal to or slightly longer than proximal segment; dark on inner ½ only.

Colour in life. Overall dorsal colour light brown with scattered dark chromatophores over entire surface. Rostral plate margins orange red margins. Carapace with dark carinae and grooves dark; MD carina red; median posterior margin orange. TS5–8 and AS1–5 with median tubercles and SM carinae brown. AS2 with narrow dark-brown transverse bar. anteriorly. AS5 with narrow dark-brown bar on posterior margin. Telson with carinae of primary teeth yellow-orange and red apices. Telson with carinae of primary teeth red. Telson median carina with anterior dark square and dark posterior ½. Uropodal protopod with terminal spines and carinae red; endopod pale blue distal ½ black; exopod proximal segment dark-brown distally, outer spines pink; exopod distal segment black on inner ½, outer ½ light blue. A2 protopod dark brown laterally. A2 scale with scattered brown chromatophores anteriorly and posteriorly; distal margin yellow.

Measurements. Male (n = 17) TL 23–99 mm, female (n = 24) TL 45–110 mm. Other measurements of holotype: CL 18.5 mm, A1 peduncle 18.5 mm, A2 scale 13.5 mm.

Etymology. Named for the fishing vessel, *Capricorn 1*, used to collect the holotype.

Remarks. *Quollastria capricornae* n.sp. most closely resembles *Q. fossulata*, *Q. imperialis* and *Q. kapala*. *Quollastria imperialis* differs from each of these species in bearing 2 or 3 instead of 4 epipods. *Quollastria capricornae* differs from *Q. kapala* in being less rugose, with less distinct submedian carinae on the dorsum; the apices of the dorsal processes of antennular somite are blunt or angular instead of an acute spine; the prelateral lobe on the telson is shorter than the margin of the lateral tooth; the lateral carina of the telson is longer, extending anteriorly to or beyond the midlength of the marginal carina; the pigmentation of the distal segment of the uropodal exopod is restricted to the inner ⅘, instead of the inner ⅔ and outer proximal margin; and the intermediate denticles of the telson are appressed instead of distinctly spaced. *Quollastria capricornae* differs from *Q. fossulata* in bearing blunt or angular instead of sharp dorsal processes of the antennular somite in adults, a less rugose dorsum with less well-developed submedian carinae, and in lacking numerous dorsal carinae on telson in adults.

The 63 mm TL female from the Northwest Shelf (NMV J13861) bears four epipods on one side, three on the other; close examination of that specimen shows that the fourth epipod has been broken off. On the east coast of Australia, *Quollastria capricornae* may occur sympatrically with *Q. kapala* and *Q. gonypetes*.

Habitat. Level sandy substrates in depths of 71–212 m.

Distribution. Australia, from central New South Wales, to the Northwest Shelf, Western Australia.

Quollastria gonypetes (Kemp, 1911) n.comb.

Fig. 147

Squilla gonypetes Kemp, 1911: 96 (type locality: restricted to vicinity of Cheduba I., Burma, 18°48'N 93°38'E, 13 m, by lectotype selection [Manning, 1978d]); 1913: 3, 10, 22, 54, pl. 4, figs. 42–44 (part).–Stephenson, 1962: 35.–Manning, 1965: 250–253, pl. 11: fig. b.

Oratosquilla gonypetes.–Manning, 1971b: 14; 1978d: 7, 12–14, fig. 5.–Graham *et al*., 1993a: 24, 64.

Oratosquillina gonypetes.–Manning, 1995: 25, 228.

Material. QUEENSLAND: AM P56824, 2♂♂ (TL 54–64 mm), 1♀ (TL 63 mm), Coral Sea, 15°09'S 150°49'E, stn 14. NEW SOUTH WALES: AM P41826, 1♂ (TL 97 mm), 1♀ (TL 102 mm), E of Clarence River mouth, 29°24'S 153°35'E, 73 m, K90–08–04, K. Graham, 02 May 1990; AM P41787, 1♂ (TL 94 mm), 2♀♀ (TL 87–95 mm), E of Clarence River mouth, 29°27'S 153°34'E, 71 m, K90–12–20, K. Graham, 31 Aug 1990; AM P56820, 1♂ (TL 95 mm), Yamba, 29°26'S 153°22'E, trawl, Mar 1995; AM P56821, 4♂♂ (TL 44–97 mm), 3♀♀ (TL 90–97 mm), SE of Yamba, 29°22'S 153°29'E, 52 m, K95–11–40, K. Graham, 2 Sep 1995; AM P56822, 1♀ (TL 98 mm), SE of Yamba, 29°29'S 153°27'E, 53 m, K95–18–05, K. Graham, 14 Nov 1995; AM P56823, 1♂ (TL 97 mm), Coffs Harbour, K. Graham, 1995; AM P56825–56826, 1♂ (TL 95 mm), 2♀♀ (TL 90–100 mm), SE of Yamba, 29°31'S 153°26'E, 53 m, K95–06–24, K. Graham, 30 May 1995; AM P56827, 2♂♂ (TL 80–100 mm), 1♀ (TL 97 mm), SE of Yamba, 29°25'S 153°28'E, 51 m, K95–06–56, K. Graham, 8 Jun 1995; AM P57885, 2♀♀ (TL 102–103 mm), SE of Yamba, 29°40–43'S 153°27–26'E, 55–60 m, demersal prawn trawl, K. Graham, 19 Jul 1999; AM P60078, 1♂ (TL 91 mm), 1♀ (TL 104 mm), off Sandon Bluffs, 55–64 m, FV *Trader Horn*, K. Graham, 7 Jul 1999. WESTERN AUSTRALIA: AM P41825, 3♀♀ (TL 41–61 mm), 135 km NNW of Dampier, 19°28.9–29.0'S 116°29.4–29.0'E, 110 m, silty substrate, beam trawl, B. Jenkins, Oct 1983; AM P43235, 3♀♀ (TL 34–41 mm), 133 km NNW of Port Hedland, 19°00'S 118°01'E, SO583 29–26, 29 Oct 1983; NTM Cr012365, 1♂ (TL 32 mm), Northwest Shelf, 19°55.2–55.6'S 117°55.6–56.0'E, 40 m, beam trawl, S0583 B3, 26 Oct 1983; WAM C8169, 1♂ (TL 42 mm), about 100 km ENE of Troughton I., 82 m, sand & mud, R. George, 23 Oct 1962; WAM C7841, 1♀ (TL 37 mm), off Onslow, about 16 km N of Long I., B. Wilson, 7 Jun 1960. NORTHERN TERRITORY: AM P43230, 3♂♂ (TL 40–45 mm), Arafura Sea, Alpha Helix stn 12, E. Ball & J. Paxton, 17 Mar 1975; AM P43233, 1♂ (TL 55 mm), Arafura Sea, Alpha Helix stn 14, E. Ball & J. Paxton, 18 Mar 1975.

Diagnosis. Dorsal integument evenly pitted, rugose. A1 somite dorsal processes with spiniform apices, directed anterolaterally. Carapace with branches of anterior bifurcation of MD carina distinct in adults. Raptorial claw dactylus usually with 5 teeth (occasionally with 6 or 7). MXP1–4 each with epipod. TS8 sternal keel rounded, distinct to near obsolete. AS5 with mid-dorsal pair of large dark squares. Abdominal carinae spined as follows: SM 5–6, IM (2)3–6, LT (1)2–6, MG 1–5. Telson prelateral lobe as long as (in juveniles) or shorter than or margin of LT tooth (in adults); LT carina long, extending to or slightly beyond midlength of prelateral lobe in adults; dorsolateral surface without accessory MD carina but with curved rows of pits, pits coalesced in adults to form longitudinal grooves with low intervening carinae; denticles SM 3–4, IM 5–9, LT 1. Uropodal protopod with rounded lobe on outer margin of inner terminal spine. Uropodal exopod proximal segment outer margin with 7–10 movable spines; distal segment slightly longer than proximal segment; dark on inner ½ only.

Colour in life. Overall dorsal colour light brown with scattered dark chromatophores over entire surface. Rostral plate with orange red margins. Carapace with dark carinae and grooves; median carina, gastric grooves and median posterior margin red. TS5–8 and AS1–5 with red median tubercles and submedian carinae. AS1–5 with IM carinae red medially. AS2 with diffuse black, transverse rectangular bar overlain by red. AS5 with black square lateral to each SM carina. Telson with carinae of primary teeth red, that of LT tooth red to level of apex of prelateral lobe; MD carina with red posterior spine. Uropodal protopod with terminal spines and carinae red; endopod white-yellow with distal ½ black; exopod proximal segment black distally, outer spines red; exopod distal segment black on inner ¾, remainder yellow. A1 peduncle segment 1 dark brown laterally, segments 2 and 3 with narrow dark brown band distally. A2 protopod dark brown laterally. A2 scale with scattered brown chromatophores anteriorly and posteriorly; distal margin yellow. Raptorial claw merus with dark brown dorsolateral margin.

Measurements. Male (n = 20) TL 32–100 mm, female (n = 21) TL 34–104 mm. CI 380–529. A1 peduncle 0.93–1.06 CL. A2 scale 0.52–0.68 CL. Anterior carapace width 0.43–0.51 CL. The present series includes the largest known specimens of the species.

Remarks. The present series of *Q. gonypetes* includes not only a large size range but the largest known specimens of the species permitting assessment of morphological variation in the species. The branches of the anterior bifurcation of the median carina of the carapace become increasingly distinct with size, and may be indistinct in smaller specimens as reported by Manning (1978d) for

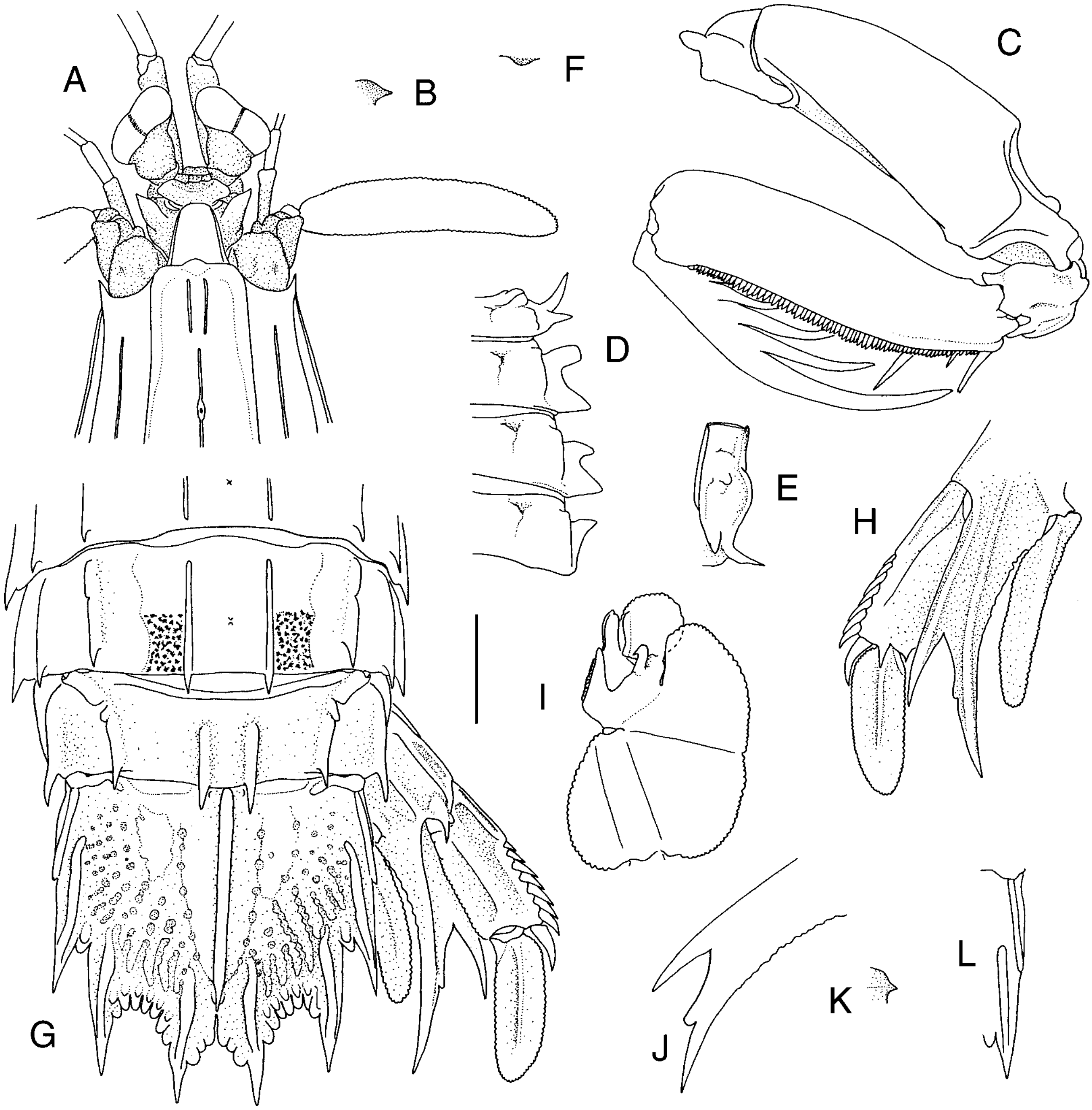

Figure 147. *Quollastria gonypetes* (Kemp). A–I, ♂ TL 80 mm (AM P56827). J–L, ♂ TL 44 mm (AM P56821). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. J, uropodal protopod, right ventral. K, A2 protopod, right lateral. L, telson, lateral dorsal. Scale A–H = 5 mm; J–L = 2.5 mm.

specimens 55 mm TL or smaller, including the lectotype. The lateral processes of TS6 varies in width and the distinctness of the telson carinae, and the size of the lobe between the spines of the uropodal protopod also varies with size. Thus, the low mid-dorsal carina on the telson are absent or indistinct until the TL exceeds 50–60 mm; the shape of the lobe between the spines of the uropodal protopod is variable and decreases in relative width with increasing size (Fig. 147H,J); and the lateral carina of the telson increases in relative length with increasing size (Fig. 147G,L), extending anteriorly to or slightly beyond the midlength of the marginal carina by 80–90 mm TL, approaching that of *Q. striata* (Manning, 1978d). The shape of the sternal keel on TS8 is rounded, varying from near obsolete to distinct. Only in *Q. subtilis* and *Q. simulans* is the TS8 keel also near obsolete.

Most specimens bear five teeth on the dactylus of the raptorial claw, but several bear five and six teeth on the dactyli, and one specimen bears seven teeth on both claws. Similar variation in the spination of the raptorial claw, is also present in a series of *Q. gonypetes* from Taiwan, including material with six teeth on both claws (Ahyong *et al*., in prep.). All specimens otherwise agree in all respects including colour pattern. In each of the Australian specimens with more than five teeth on the dactylus of the raptorial claw, the aberrant dactyli appear to be regenerating from damage.

Oratosquillina simulans from the Red Sea was distinguished from *Q. gonypetes* based on the number of teeth on the raptorial claw (Holthuis, 1967b). Re-examination of the holotype of *Q. simulans* shows that it agrees in all other respects with typical *Q. gonypetes* of similar size, including colour pattern, the sharp dorsal processes on the antennular somite and near obsolete sternal keel. The colour pattern described by Holthuis (1967b) for the holotype of *Q. simulans* has largely faded, but the distinctive pair of square patches on AS5 remains. Thus, *Q. simulans* is identical to *Q. gonypetes*, differing only in bearing six instead of five teeth on the dactylus of the raptorial claw. Should the number of teeth on the dactylus of the raptorial claw in *Q. gonypetes* prove variable apart from regeneration from damage, then it is a likely senior synonym of *Q. simulans*.

Habitat. Sandy-mud substrates at depths of 40–110 m. Manning (1978d) reported a bathymetric range of 13–73 m.

Distribution. Widely distributed throughout the Indo-West Pacific from the western Indian Ocean, India, Australia, Indonesia, Philippines, Vietnam to Japan.

Quollastria kapala n.sp.

Fig. 148

Type material. (All New South Wales, Australia) HOLOTYPE: AM P56781, ♂ (TL 95 mm), SE of Point Dangar, 28°13'S 153°50'E, 134 m, K78–23–11, K. Graham, 6 Nov 1978. PARATYPES: AM P29444, 2♂♂ (TL 80–83 mm), 1♀ (TL 93 mm), E of Tweed Heads, 28°14'S 153°50'E, 144 m, K78–09–08, prawn trawl, K. Graham, 2 Jun 1978; AM P56779, 1♂ (TL 90 mm), SE of Clarence River, 29°36'S 153°47'E, 411 m, K78–16–03, K. Graham, 2 Aug 1978; AM P56780, 1♀ (TL 87 mm), E of Tweed Heads, 28°15'S 153°50'E, K78–23–11, 131 m, prawn trawl, K. Graham, 6 Nov 1978.

Australian material. QUEENSLAND: AM P56913, 1♀ (TL 113 mm), E of Mooloolaba, 26°52.74'S 153°35.34'E, 160 m, otter trawl, QLD-1119, J. McIllwain, 3 Aug 1994; QM W14364, 1♂ (TL 88 mm), 1♀ (TL 76 mm), 27°35'S 153°50'E, 210 m, trawl, G. Smith, 15 Dec 1982.

Diagnosis. Dorsal integument coarsely pitted, rugose. A1 somite dorsal processes with acute apices, produced to a triangular spine, directed anterolaterally. Raptorial claw dactylus with 6 teeth. MXP1–4 each with epipod. TS8 sternal keel distinct, rounded to angular. Telson prelateral lobe usually longer than (rarely as long as) margin of LT tooth; LT carinae short, not extending anteriorly to midlength of prelateral lobe; dorsolateral surface without supplementary longitudinal carinae; denticles widely spaced, gap between denticles exceeding ½ denticle width. Uropodal protopod with lobe on outer margin of inner terminal spine rounded. Uropodal exopod distal segment length subequal to proximal segment; dark on inner ¾ of inner ½ and outer proximal margin.

Description. Dorsal integument coarsely pitted, rugose. Eye small; CI 530–629. Ophthalmic somite anterior margin medially emarginate to flattened, quadrate. Ocular scales rounded. A1 peduncle 0.93–1.03 CL. A1 somite dorsal processes with acute apices, produced to a triangular spine, directed anterolaterally. A2 scale length 0.76–0.85 CL. Rostral plate length and breadth subequal; trapezoid; lateral margins upturned, straight; apex truncate; without median carina. Carapace anterior width 0.44–0.50 CL; anterolateral spines not extending to base of rostral plate; branches of anterior bifurcation of MD carina distinct; posterior median projection distinct, often acute. Raptorial claw dactylus with 6 teeth; outer margin broadly curved, proximal margin angular; carpus dorsal carina undivided; propodus distal margin unarmed; merus outer inferodistal angle unarmed, rounded. Mandibular palp 3-segmented. MXP1–4 each with epipod. TS5 lateral process anterior lobe a slender spine directed anterolaterally; posterior lobe slender, apex acute, directed laterally. TS6 lateral process anterior lobe broad, quadrate to trapezoid, apex truncate; posterior lobe broad, triangular; anterior margin straight, apex acute. TS7 lateral process anterior lobe smaller than posterior lobe, slender, triangular, apex acute; posterior lobe broad, triangular, anterior margin straight, apex acute. TS8 anterolateral margin triangular; apex acute; sternal keel rounded to angular. AS1–5 SM carinae distinct, parallel. AS6 at most with 1 blunt ventrolateral spinule anterior to uropodal articulation. Abdominal carinae spined on the following somites: SM 5–6, IM (2)3–6, LT 1–6, MG 1–5. Telson length and breadth subequal; prelateral lobe usually longer than (rarely as long as) margin of LT tooth; LT carinae short, not extending anteriorly to midlength of prelateral lobe; MD carina interrupted proximally, posteriorly with slender spine; dorsolateral surface without supplementary longitudinal carinae; denticles SM 4–5, IM 6–10, LT 1, rounded, occasionally with spiniform apices, each with dorsal tubercle; denticles widely spaced, gap between denticles exceeding ½ denticle width; ventral surface with; short, smooth, postanal carina; without supplementary ventral carinae. Uropodal protopod with minute ventral tubercle anterior to endopod articulation; terminal spines with lobe on outer margin of inner spine rounded, narrower than adjacent spine, proximal margin concave. Uropodal exopod proximal segment inner margin straight or broadly convex; outer margin with 8–9 movable spines, distalmost not exceeding midlength of distal segment; distal margin with 2 ventral spines, outer longest. Exopod distal segment length subequal to proximal segment; dark on inner ¾ of inner ½ and outer proximal margin.

Colour in life. Dorsally light brown with scattered dark chromatophores over entire surface. Carapace carinae and grooves dark. Rostral plate margins, median carina and median posterior margin red-orange. TS5–8 and AS1–5 with median tubercles and submedian carinae dark red. AS2 with narrow dark-brown transverse bar anteriorly. AS5 with narrow diffuse dark-brown bar on posterior margin. Telson with carinae of primary teeth red. Telson median carina with anterior dark square and dark posterior ½. Uropodal protopod with terminal spines and carinae red; endopod pale blue distal ½ black; exopod proximal segment dark-brown

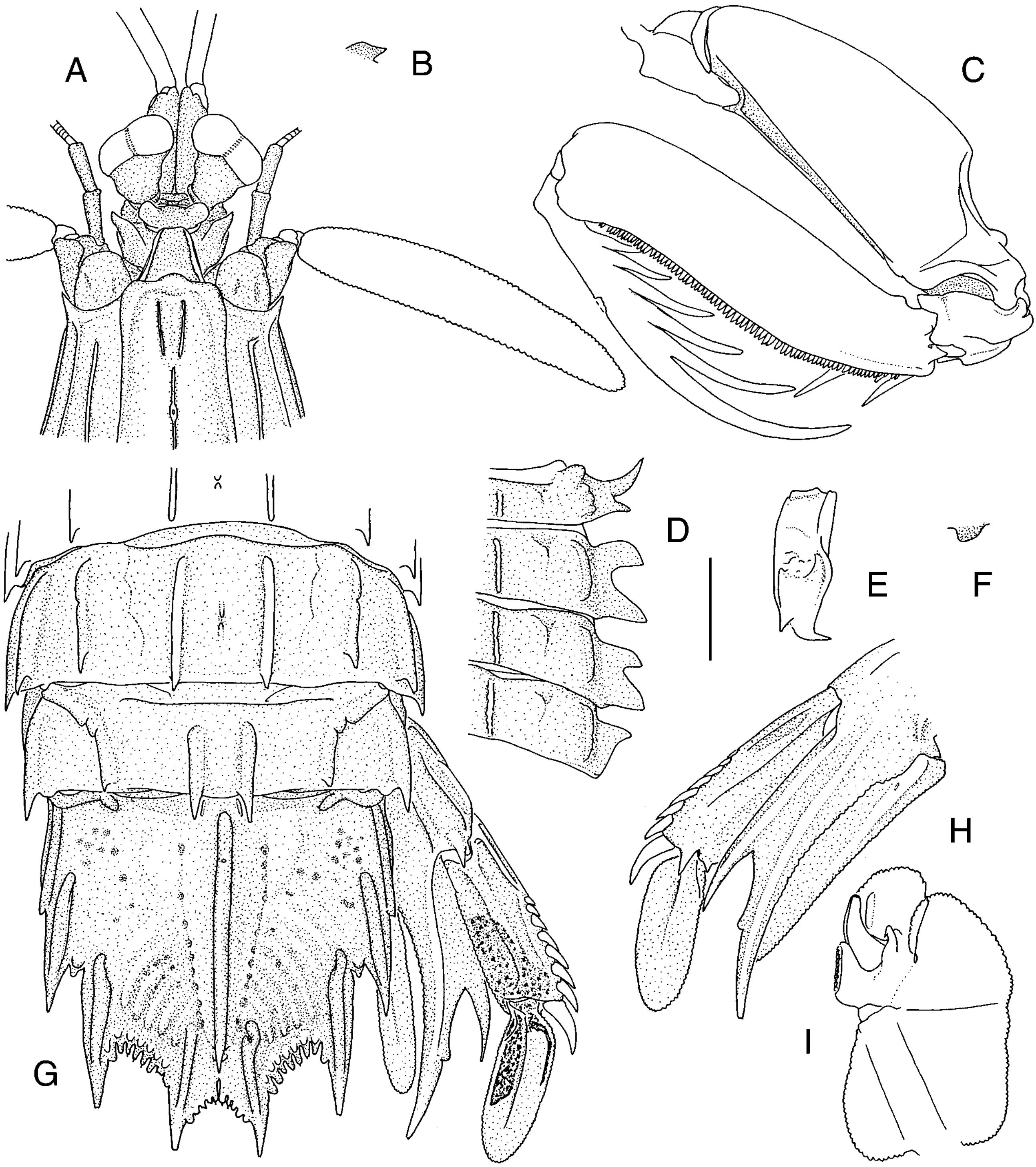

Figure 148. *Quollastria kapala* n.sp., holotype ♂ TL 95 mm. A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. Scale A–H = 5 mm; I = 2.5 mm.

on inner ½, outer spines pink; exopod distal segment black on inner proximal ⅔ and proximal outer margin, clearly demarcated from light blue remainder. A2 protopod dark brown laterally. A2 scale with scattered brown chromatophores anteriorly and posteriorly; distal margin yellow.

Etymology. Named for the FRV *Kapala*, used to collect the holotype and many other specimens used in this study. Used as a noun in apposition.

Measurements. Male (n = 5) TL 80–95 mm, ♀ (n = 4) TL 76–110 mm. Other measurements of holotype: CL 21.7 mm, A1 peduncle 21.8 mm, A2 scale 17.4 mm.

Remarks. *Quollastria kapala* n.sp. closely resembles *Q. capricornae*, *Q. imperialis* and *Q. fossulata* described from the Philippines. The differences between *Q. kapala*, *Q. imperialis* and *Q. capricornae* are outlined under the account of the latter. *Quollastria kapala* differs from *Q. fossulata* in dorsal telson ornamentation, the prelateral lobe of the telson is longer than (rarely equal to) the margin of the lateral tooth instead of being shorter, the intermediate denticles are more widely spaced, with the space between the denticles exceeding ½ the width of the adjacent denticles, and the pigmentation of the distal segment of the uropodal exopod differs. In *Q. kapala*, the distal segment of the uropodal exopod segment is black on inner proximal ⅔ and outer proximal margin instead of dark on the inner margin only. Specimens of *Q. fossulata* exceeding approximately 80 mm TL, have distinct and well formed dorsal carinae, whereas in *Q. kapala*, of similar size the shallow grooves are present. Smaller specimens of the two species are difficult to distinguish using telson carination, but they may usually be distinguished by other characters already discussed. Specimens of *Q. fossulata* reported by Moosa (1991) from New Caledonia should be re-examined; they may be referable to *Q. kapala*.

Habitat. Taken on trawlable substrates; 131–411 m.

Distribution. Eastern Australia, from southern Queensland south to northern New South Wales.

Quollastria subtilis (Manning, 1978d) n.comb.

Fig. 149

Squilla gonypetes.–Manning, 1968b: 23–25, fig. 7 (not *S. gonypetes* Kemp, 1911).
Oratosquilla gonypetes.–Manning, 1970a: 1430 [not *O. gonypetes* (Kemp, 1911)].
Oratosquilla subtilis Manning, 1978d: 33–34, fig. 19 (type locality: off Visakhapatnam coast, Madras, India).–Moosa, 1991: 213.
Oratosquilla turbata Manning, 1978d: 35–36, fig. 20 (type locality: Banc de Pracel, W coast of Madagascar, 17°00'S 43°30'E); 1991: 12; new synonymy.
Oratosquillina subtilis.–Manning, 1995: 225, 226.

Type material. PARATYPES: USNM 77989, 1♂ (TL 40 mm), Buton Strait, off Tikola Peninsula, S Celebes I., Indonesia, 4°31'40"S 122°49'42"E, 68 m, green mud, *Albatross* sta. 5642, 14 Dec 1909; USNM 77990, 1♂ (TL 52 mm), San Andreas I., Philippines, 13°38'N 121°58'E, 91.5 m, soft grey mud, *Albatross* sta. 5220, 24 Apr 1908.

Australian material. QUEENSLAND: AM P57099, 2♂♂ (TL 47 mm), 3♀♀ (TL 48–51 mm), Shelburne Bay, 11°52.8'S 143°09.8'E, 31 m, SS0193 006, T. Wassenberg, 13 Jan 1993; AM P57100 1♀ (TL 43 mm), Shelburne Bay, 11°48.7'S 143°12.7'E, 31 m, SS0193 004, T. Wassenberg, 13 Jan 1993; AM P57133, 1♀ (TL 49 mm), E of Orford Bay, 11°18.2'S 142°58.8'E, SS0591 071, T. Wassenberg, 1 Dec 1991; AM P57134, 1♀ (TL 36 mm), E of Duyfken Point, 12°29.9'S 141°14.7'E, SS0591 46, dredged, T. Wassenberg, 27 Nov 1991; AM P57135, 1♂ (TL 35 mm), 2♀♀ (TL 40–43 mm), off Albatross Bay, Gulf of Carpentaria, 11°58.5'S 140°41.4'E, 54 m, SS0390 63, T. Wassenberg, 4 Dec 1990; AM P57136, 1♀ (TL 47 mm), E Gulf of Carpentaria, 14°03.0'S 140°12.0'E, 62 m, SS0390 45, T. Wassenberg, 1990; AM P57144, 1♂ (TL 48 mm), E of Orford Bay, 11°18.2'S 142°58.8'E, SS0591 071, T. Wassenberg, 1 Dec 1991; AM P57154, 1♀ (TL 48 mm), near Jardine I., Shelburne Bay, 11°23.4'S 142°55.8'E, SS0591 072, T. Wassenberg, 1 Dec 1991; AM P57155, 1♂ (TL 45 mm), Shelburne Bay, 11°25.6'S 143°01.8'E, SS0591 073, T. Wassenberg, 1 Dec 1991; AM P57143, 1♀ (TL 47 mm), Gulf of Carpentaria, 14°58.9'S 139°12.1'E, SS0390 37, T. Wassenberg, Nov 1990; AM P57137, 1♂ (TL 32 mm), 2♀♀ (TL 44–49 mm), Gulf of Carpentaria, 12°00.0'S 139°14.3'E, 53 m, SS0390 31, T. Wassenberg, Nov 1990; AM P57148, 3♂♂ (TL 39–46 mm), 3♀♀ (TL 37–52 mm), E Gulf of Carpentaria, 13°01.3'S 140°12.0'E, 63 m, SS0390 47, T. Wassenberg, 1 Dec 1990; AM P57138, 2♂♂ (TL 34–35 mm), 3♀♀ (TL 30–35 mm), Gulf of Carpentaria, 15°26.8'S 138°12.0'E, 44 m, SS0390 018, grab, T. Wassenberg, 25 Nov 1990; AM P57140, 1♂ (TL 49 mm), Princess Charlotte Bay, 14°45'S 145°20'E, 20–30 m, Turtle stn 3, T. Wassenberg, 18 Jun 1993; AM P57141, 1♂ (TL 30 mm), 1♀ (TL 48 mm), Gulf of Carpentaria, 12°17.4'S 139°55.9'E, SS0591 41, T. Wassenberg; AM P57142, 3♀♀ (TL 38–45 mm), N of Wellesley Is, Gulf of Carpentaria, 15°31.4'S 139°11.6'E, 45 m, SS0390 38, T. Wassenberg, 29 Nov 1990; AM P57145, 1♀ (broken, CL 10.8 mm), NE Gulf of Carpentaria, 10°39'S 140°38.7'E, 42 m, T. Wassenberg, Dec 1990; AM P57146, 2♀♀ (TL 38–40 mm), Arafura Sea, 11°10.5'S 139°23.8'E, SS0591 056, T. Wassenberg, 28 Nov 1991; AM P57147, 1♀ (TL 41 mm), Coral Sea, 15°09'S 150°44'E, stn 014; AM P57149, 1♀ (TL 43 mm), Gulf of Carpentaria, 12°06.9'S 139°59.0'E, SS0591 40, T. Wassenberg, 25 Nov 1991; AM P57150, 3♂♂ (TL 31–37 mm), 1♀ (TL 46 mm), E of Weipa, Gulf of Carpentaria, 12°37.2'S 140°39.7'E, 58 m, SS0193 57, T. Wassenberg, 30 Jan 1993; AM P57151, 1♀ (TL 43 mm), N of Wellesley Is, Gulf of Carpentaria, 14°31.3'S 139°12.3'E, 57 m, SS0390 36, T. Wassenberg, Nov 1990; AM P57152, 1♂ (TL 30 mm), Gulf of Carpentaria, 11°24'S 140°29.9'E, SS0591 54, T. Wassenberg, 28 Nov 1991; AM P57156, 1♂ (TL 37 mm), 1♀ (TL 35 mm), E Gulf of Carpentaria, 12°26.6'S 140°12.0'E, SS0390 48, T. Wassenberg, 1 Dec 1996; AM P57157, 1♂ (TL 42 mm), Gulf of Carpentaria, 12°26.4'S 139°25.8'E, 58 m, SS0390 79, T. Wassenberg, 8 Dec 1990; AM P57158, 2♀♀ (TL 37–42 mm), NE Shelburne Bay, 11°35.08 142°58.8'E, dredge, 21 May 1992; NTM Cr010814, 2♂♂ (TL 40–46 mm), Gulf of Carpentaria, 15°28.9'S 135°36.7'E, 47 m, dredge, P. Alderslade, 2 Dec 1990; QM, 2♂♂ (TL 38–40 mm), 3♀♀ (TL 34–41 mm), NE Gulf of Carpentaria, 12°30.0'S 140°40.2'E, SS0591 43, T. Wassenberg; QM, 2♂♂ (TL 44–45 mm), 2♀♀ (TL 47–49 mm), NE of Orford Bay, 11°11.0'S 142°55.4'E, SS0591 70, T. Wassenberg, 30 Nov 1991. NORTHERN TERRITORY: AM P43229, 1♂ (TL 32 mm), Alpha Helix stn 17, 17 Mar 1975; AM P43230, 1♂ (TL 22 mm), Alpha Helix stn 12, E. Ball & J. Paxton, 17 Mar 1975; AM P43232, 3♂♂ (TL 26–35 mm), Arafura Sea, stn 14, E. Ball & J. Paxton, 18 Mar 1975; AM P57139, 1♂ (broken, CL 8.30 mm), E of Wessell Is, 11°24.8'S 136°36.4'E, dredged, SS0591 006, T. Wassenberg, 19 Nov 1991; AM P57153, 1♂ (TL 35 mm), N of Groote Eylandt, 13°29.7'S 136°42.0'E, SS0390 009, T. Wassenberg, 23 Nov 1990. WESTERN AUSTRALIA: AM P43236, 1♀ (TL 39 mm), 147 km NNW of Port Hedland, 19°00'S 118°01'E, SO583 29–26, 29 Oct 1983; AM P52742, 1♂ (TL 20 mm), Northwest Shelf, 19°28.9–29.0'S 116°29.0–29.4'E, 110–111 m, 26 Oct 1983; AM P56828, 1♂ (TL 32 mm), 1♀ (TL 38 mm), 125 km NNW of Dampier, 19°29.0'S 116°29.0'E, 110 m, silty substrate, beam trawl, B. Jenkins, Oct 1983.

Other material. USNM 124672, 1♂ (TL 53 mm), Banc de Pracel, W coast of Madagascar, 17°00'S 43°30'E, 55 m, muddy sand, A. Crosnier, Jun 1959 (holotype of *Oratosquilla turbata* Manning).

Diagnosis. Dorsal integument lightly pitted. A1 somite dorsal processes with blunt apices, rounded to obtusely angled. Carapace with branches of anterior bifurcation of MD carina distinct. Raptorial claw dactylus usually with 5 teeth (occasionally 6). MXP1–4 each with epipod. TS8 sternal keel low, rounded, near obsolete. AS5 with mid-dorsal pair of dark triangles. Abdominal carinae spined as

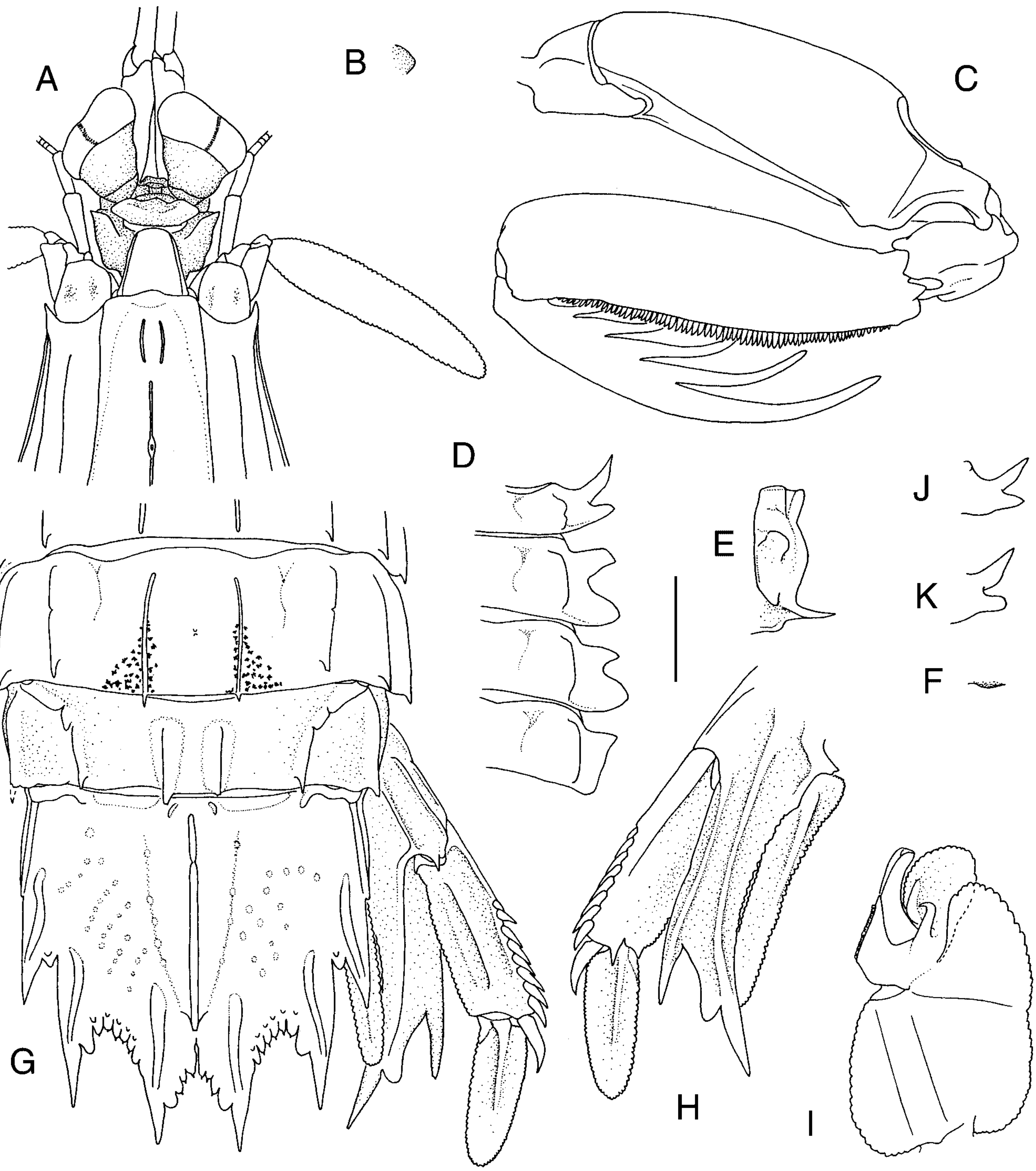

Figure 149. *Quollastria subtilis* (Manning) (all AM P57099). A–I, ♂ TL 47 mm. J, ♀ TL 48 mm. K, ♀ TL 51 mm. A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, uropod, right ventral. I, PLP1 endopod, right anterior. J,K, TS5 lateral process, right dorsal. Scale A–H,J,K = 2.5 mm; I = 1.25 mm.

follows: SM 5–6, IM 4–6, LT (3)4–6, MG (1–3)4–5 (usually 1–5). Telson prelateral lobe subequal to margin of LT tooth; LT carina short, not extending anteriorly beyond posterior ¼ of prelateral lobe; dorsolateral surface without supplementary longitudinal carinae; denticles SM 3–5, IM 6–9, LT 1. Uropodal protopod with lobe on outer margin of inner terminal spine with rounded apex. Uropodal exopod proximal segment inner outer margin with 8–10 movable spines; exopod distal segment shorter than proximal segment; dark on inner ½ only.

Colour in life. Dorsal surface pale grey-brown, with darker, diffuse patches between SM and LT carinae. Carinae and grooves of carapace dark red-brown. SM carinae and posterior margins of thoracic and abdominal somites dark red. TS6–7 with dark patch between IM carinae and lateral processes. AS2 with narrow dark red-brown band, medially diffuse. AS5 with dark red-brown triangular patch lateral to SM carinae. AS6 dark below LT carinae. Telson with dorsal pits dark; carinae of primary teeth red; MD carina with dark rectangle proximally and dark triangle distally, encompassing apical spine. Uropodal protopod pale brown with dark proximal patch, with dark articulation with exopod and with dark inner subdistal margin; endopod with dark distal margin; exopod proximal segment with dark distal margin, distal segment dark on inner ½; movable spines on outer margin of exopod proximal spines clear red.

Measurements. Male (*n* = 37) TL 20–53 mm, female (*n* = 40) TL 34–52 mm. CI 391–488. A1 peduncle 0.92–1.14 CL. A2 scale length 0.52–0.60 CL. Anterior carapace width 0.42–0.49 CL. The present series includes the largest known specimens of the species.

Remarks. *Quollastria subtilis* is readily recognized by the blunt apices of the dorsal processes of the antennular somite, the presence of five (occasionally six) teeth on the dactylus of the raptorial claw, triangular submedian patches on AS5, and in having the distal segment of the uropodal exopod longer than the proximal.

The large series of *Q. subtilis* examined here shows that the relative lengths of the uropodal exopod segments change with size: the distal segment is relatively longest in the smallest specimens and decreases in relative length with increasing size. Likewise, the lobe on the outer margin of the inner spine of the uropodal protopod is relatively broadest in smaller specimens, becoming narrower with increasing size. As in *Q. gonypetes*, the number of teeth on the dactylus of the raptorial claw is variable; usually five teeth are present, but some specimens bear six teeth on one or both claws. The most significant variation, however, is in the shape of the posterior lobe of the lateral process of the TS5. The lobe varies from conical to blunt and quadrangular (Fig. 149D,J,K), as in *O. turbata*. Thus, the range of morphological variation shown in *Q. subtilis* encompasses that of *O. turbata* and the two species must be considered synonyms. In the holotype of *O. turbata*, examined for this study, the proximal segment of the uropodal exopod is longer than the distal segment, as originally described for *Q. subtilis*.

Habitat. Sand or silty substrates between depths of 31 and 110–111 m.

Distribution. New Caledonia, the Philippines, Indonesia, Burma to India (Manning, 1995), Madagascar and now Australia.

Squilloides Manning, 1968c

Squilloides Manning, 1968c: 131. Type species *Squilla leptosquilla* Brooks, 1886, by original designation. Gender feminine.

Diagnosis. Eye with strongly bilobed cornea, set obliquely on stalk. Ocular scales separate. A1 somite dorsal processes trianguloid, slender, apices acute, directed anterolaterally. Carapace with anterolateral angles spines; with normal complement of carinae, or without IM carinae and anterior portion of LT carinae; MD carina without anterior bifurcation. Raptorial claw dactylus with 4 teeth; carpus dorsal carina undivided; merus without outer inferodistal spine. Mandibular palp absent. MXP1–4 each with epipod. PLP1 endopod in adult males with posterior endite; hook process with distal point. TS5 lateral process a single broad lobe, directed laterally or anterolaterally; ventral spine stout, directed anteroventrally. TS6–7 lateral process single, broadly rounded anteriorly, acute posteriorly. AS1–6 with normal complement of carinae. Telson trianguloid; SM teeth with fixed apices; prelateral lobe absent; dorsolateral surface without pits or supplementary carinae. Uropodal protopod with slender spine anterior to endopod articulation; inner margin of protopod crenulate.

Included species. Two: *S. leptosquilla* (Brooks, 1886); and *S. tenuispinis* (Wood-Mason, 1875).

Remarks. Of the two known species of *Squilloides*, one occurs in Australian waters. *Squilloides* may be recognized by the combination of four teeth on the dactylus of the raptorial claw, single lateral processes of TS5–7, and fixed apices of the submedian teeth of the telson. *Squilloides* is restricted to the Indo-West Pacific, but most closely related to *Schmittius* Manning, 1972b, from the eastern Pacific.

Key to species of *Squilloides*

1 Carapace with IM carina .... ***S. leptosquilla***

—— Carapace without IM carina .... *S. tenuispinis*

Squilloides leptosquilla (Brooks, 1886)

Fig. 150

Squilla leptosquilla Brooks, 1886: 30–34, pl. 1: figs. 1–2 (type locality: Celebes Sea, Philippines, 12°46'N 122°10'E).–Kemp, 1913: 46–48.–Jurich, 1904: 370–372, pl. 25(I): fig. 1.
Squilla leptosquilla var *dentata* Jurich, 1904: 372, pl. 25(I): fig. 2.
Squilloides leptosquilla.–Moosa & Cleva 1984b: 80.–Moosa, 1986: 410–411, pl. I: figs. D, E.–Manning, 1991: 15; 1995: 26.

Type material. HOLOTYPE: NHM 1894.10.16.7, ♂ (TL 66 mm), Philippine Islands, 12°46'N 122°10'E, *Challenger* stn 204B.

Australian material. WESTERN AUSTRALIA: NTM Cr000592, 1♀ (TL 80 mm), Northwest Shelf, NWS-32, 402–408 m, A. Bruce, 28 Jan 1984; NTM Cr000753, 1♀ (TL 93 mm), Northwest Shelf, 18°41.6'S 117°18.6'E, 320–360 m, NWS-6, A. Bruce, 25 Apr 1983; NTM Cr0123401, 1♀ (TL 103 mm), Northwest Shelf, CSIRO Cruise 0184 stn 19, 31 Jan 1984; NTM Cr002015, 1♂ (TL 76 mm), 2♀♀ (TL 69–82 mm), Northwest Shelf; NTM Cr008261, 3♀♀ (TL 86–104 mm), Timor Sea, 9°49'S 130°13'E, 260 m, trawl, D. Evans, 12 Dec 1990; NTM Cr0123400, 1♂ (TL 89 mm), 1♀ (TL 95 mm), Northwest Shelf, 18°06'S 118°06'E, 340 m, S0183–2.

Diagnosis. Carapace with IM carinae. Abdominal carinae spined as follows: SM 6, IM (1–2)3–6, LT 1–6, MG 1–5. Telson

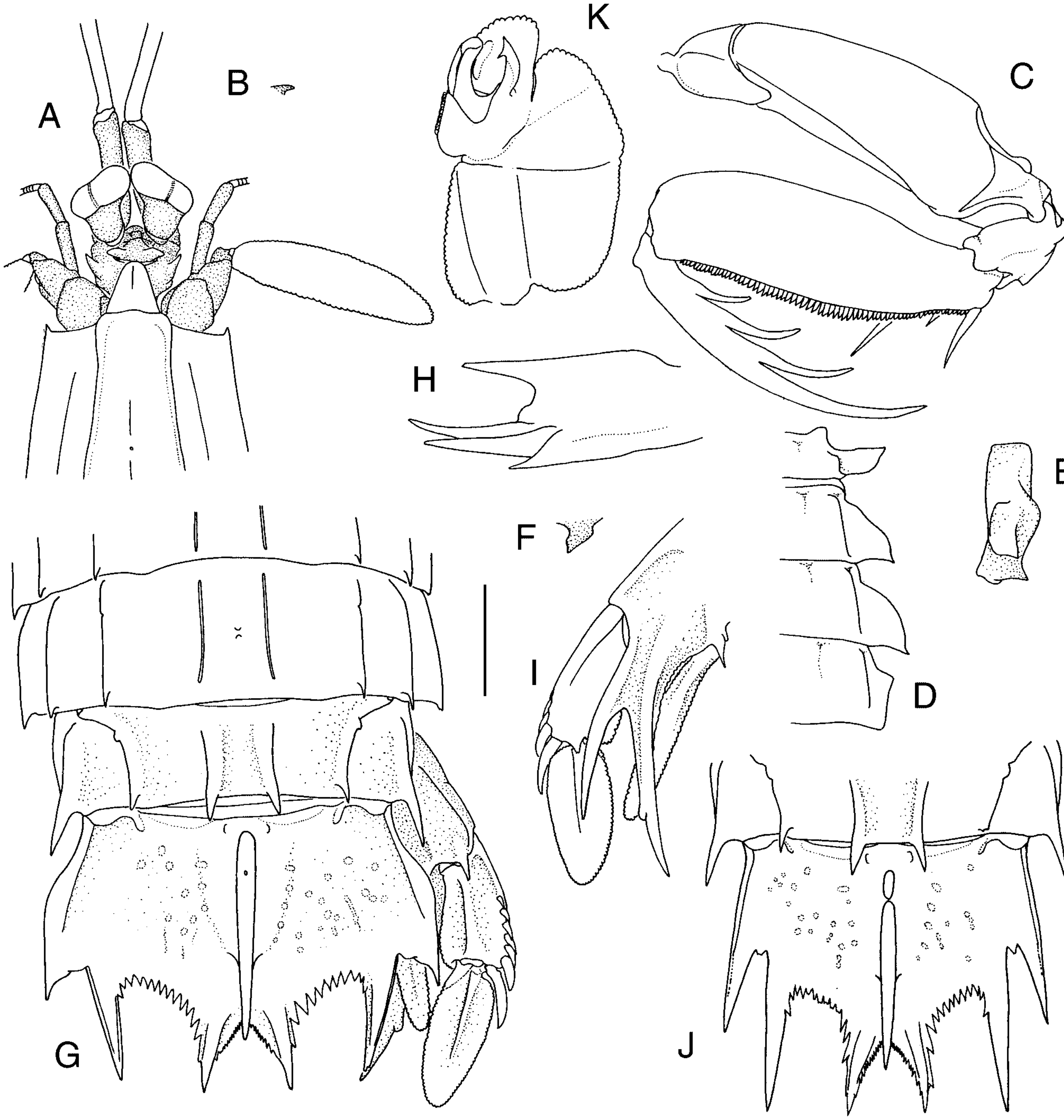

Figure 150. *Squilloides leptosquilla* (Brooks). A–J, ♂ TL 89 mm (NTM Cr0123400). K, ♀ TL 80 mm (NTM Cr000592). A, anterior cephalon, dorsal. B, A1 somite dorsal process, right lateral. C, raptorial claw, right lateral. D, TS5–8 lateral processes, right dorsal. E, TS5, right lateral. F, TS8 sternal keel, right lateral. G, AS4–6, telson & uropod, dorsal. H, telson, right lateral. I, uropod, right ventral. J, PLP1 endopod, right anterior. K, AS6 & telson of ♀, dorsal. Scale A–I, K = 5 mm; J = 2.5 mm.

denticles SM 12–19, IM 8–14, LT 1. Uropodal exopod proximal segment outer margin with 7–9 movable spines.

Colour in alcohol. Faded, but with brown pigmentation lateral to the median carina of the telson in one specimen (Cr000592).

Measurements. Male (n = 3) TL 66–89 mm, female (n = 9) TL 80–104 mm. CI 472–574. Anterior carapace width 0.42–0.49 CL. A1 peduncle 1.08–1.19 CL. A2 scale length 0.51–0.56 CL. Moosa (1986) reported specimens to 118 mm TL from the Philippines.

Remarks. The specimens generally agree well with the holotype and accounts of Brooks (1886) and Kemp (1913) but vary in most characters used by Kemp to distinguish *S. leptosquilla* from *S. tenuispinis*. Thus, in *S. leptosquilla*, the length of the rostral plate is variable with an evenly rounded to obtuse apex, the distinctness of the median carina of the carapace is variable, the lateral process of TS5 varies from being laterally to anterolaterally directed. Kemp (1913) also noted that in *S. tenuispinis*, the median carina of the telson is slightly lower and the eyestalks are more inflated than in *S. leptosquilla*; these differences may be referable to size since all specimens of *S. tenuispinis* reported by Kemp are below 62 mm TL. The presence of intermediate carinae on the carapace in *S. leptosquilla* is the single character available to distinguish it from *S. tenuispinis*; should that prove size related or variable, the two species will have to be synonymized. Brooks' (1886) figure of the holotype of *S. leptosquilla* is erroneous in showing a median carina on the rostral plate; at most a faint elevation is present on the rostral plate of the specimen.

Sexual dimorphism in the relative lengths of the primary teeth of the telson reported by Moosa (1986) for Philippine specimens is also evident in the Australian material.

Habitat. Unknown. Moosa (1986) summarized the bathymetric range as 170–754 m.

Distribution. Indo-Australian region from the Philippines (Brooks, 1886; Moosa, 1986), Indonesia (Hansen, 1926), the Andaman Islands (Kemp, 1913) and now from the Northwest Shelf, Australia.

Discussion

The results of the present study double the known stomatopod fauna of Australian waters. Bathysquilloidea is represented by 2 genera and 3 species; Erythrosquilloidea is represented by 1 genus and species; Eurysquilloidea is represented by 5 genera and 8 species; Gonodactyloidea is represented by 15 genera and 46 species; Lysiosquilloidea is represented by 13 genera and 26 species; Parasquilloidea is represented by 2 genera and 3 species; and Squilloidea is represented by 25 genera and 59 species. The known Australian Stomatopod fauna now totals 146 species and 63 genera, in 14 families and 7 superfamilies—about 50% of species and 74% of genera from the Indo-West Pacific. Of the 80 species newly reported from Australia, 26 are new to science. Forty-six species (32% of the Australian fauna) are presently known only from Australia or its immediate environs. Manning (1989) recorded 132 species from the Indian Ocean and Liu & Wang (1999) reported 101 species from the China Seas. About 200 stomatopod species are known from the central to western Pacific (unpubl.). In comparison, therefore, the size of the Australian fauna must be considered large.

The large size of the Australian fauna no doubt owes much to the extensive coastline and close proximity to the species rich Indo-Malay archipelago, as well as the diversity of habitat including extensive coral reefs and sheltered areas of soft substrate. Gonodactyloids dominate in coral and rocky reef habitats and not surprisingly, a large proportion of gonodactyloids reported here were collected from the Great Barrier Reef. Squilloids and lysiosquilloids dominate soft, level substrates and consequently are generally sampled by demersal trawls. Tropical squilloids and lysiosquilloids tend to exhibit a continuous east-west distribution pattern correlating with continuity of suitable habitat. Conversely some gonodactyloids show east-west biogeographic discontinuities. These include *Haptosquilla trispinosa/H. corrugata, Gonodactylellus molyneux/G. snidsvongi* and to a lesser extent *Chorisquilla hystrix/C. spinosissima*. Each of these species occur on coral reefs and the distributional discontinuities correlate with discontinuity of habitat. Coral reefs are present off eastern Queensland and off north-western Australia, but not in the Gulf of Carpentaria.

As remarked by Stephenson & McNeill (1955), the Australian stomatopod fauna comprises two main components: an endemic, temperate fauna, and a large, primarily tropical component that includes many, more widely distributed tropical species. Certainly, several tropical species also may occur off southern Australia and overlap the ranges of the temperate species, but these tropical species are temporary residents, transported south by southern flowing boundary currents in the east (the East Australian Current) and in the west (Leeuwin Current). Most of the 16 endemic temperate water species (11% of the total fauna) also belong to endemic genera. Only *Hemisquilla australiensis, Kasim insuetus, Oratosquillina berentsae* and *Anchisquilloides mcneilli* have cognates elsewhere. Conversely, no tropical genera are endemic, but 29 tropical species (20% of the total fauna) are presently known only from Australia. Further study of the stomatopod faunas of surrounding areas such as Papua New Guinea and Indonesia, will be required to more realistically assess the ranges of those species presently known only from Australia.

Despite the extensive coverage of the present work, much remains to be learned about the Australian and greater Indo-West Pacific stomatopod fauna. Most specimens studied here were collected incidentally via standard, non-specific methods such as trawling, dredging and "habitat sampling". The cryptic behaviour of most stomatopods, however, means that not only the abundance, but species richness is likely to be much greater than that implied by the size of existing collections. Many habitats remain to be specifically targeted for stomatopods, and future sampling will likely yield many more species from Australia. For example, many gonodactyloids live in deep rock and coral cavities, and often may be sampled only by smashing substrate. Similarly, most lysiosquilloids live in deep burrows, but in soft substrates, and rarely leave the burrow. As a result, lysiosquilloids may be taken by dredge or grab, but not usually by trawling. Moreover, many lysiosquilloids, especially tetrasquillids, occupy relatively deep habitats (50 m or greater) and are infrequently encountered, despite possible high abundance. Thus, any conclusions drawn about the Australian fauna in relation to faunas elsewhere in the Indo-West Pacific must be considered preliminary and highly generaleneralized. Not only is the Australian stomatopod fauna probably highly underestimated, but so are many areas in the Indo-West Pacific as well. Large, existing stomatopod collections from across the Indo-West Pacific including the Indo-Malayan region, southeast Asia and the central Pacific await study, let alone habitats that have never been specifically explored for stomatopods in Australia.

Checklist of the Australian Stomatopoda

An asterisk * indicates a species newly recorded from Australia and **bold** signifies a new species.

Bathysquilloidea Manning, 1967b
Bathysquillidae Manning, 1967b (2 genera, 3 species)
Altosquilla Bruce, 1985
Altosquilla soelae Bruce, 1985
Bathysquilla Manning, 1963b
Bathysquilla crassispinosa (Fukuda, 1909)
Bathysquilla microps (Manning, 1961a)
Erythrosquilloidea Manning & Bruce, 1984
Erythrosquillidae Manning & Bruce, 1984 (1 genus, 1 species)
Erythrosquilla Manning & Bruce, 1984
Erythrosquilla hamano* n.sp.
Eurysquilloidea Manning, 1977a
Eurysquillidae Manning, 1977a (5 genera, 8 species)
Coronidopsis Hansen, 1926
Coronidopsis serenei Moosa, 1973*
Eurysquilloides Manning, 1963b
Eurysquilloides sibogae (Hansen, 1926)*
Manningia Serène, 1962
Manningia australiensis Manning, 1970c
Manningia notialis Manning, 1966
Manningia raymondi Bruce, 1986
Manningia wilsoni* n.sp.
Raysquilla Ahyong, 2000a
Raysquilla manningi Ahyong, 2000a
Sinosquilla Liu & Wang, 1978
Sinosquilla sinica Liu & Wang, 1978*
Gonodactyloidea Giesbrecht, 1910
Gonodactylidae Giesbrecht, 1910 (4 genera, 20 species)
Gonodactylaceus Manning, 1995
Gonodactylaceus falcatus (Forskål, 1775)
Gonodactylaceus glabrous (Brooks, 1886)*
Gonodactylaceus graphurus (Miers, 1875)
Gonodactylaceus ternatensis (de Man, 1902)*
Gonodactylellus Manning, 1995
Gonodactylellus affinis (de Man, 1902)
Gonodactylellus annularis Erdmann & Manning, 1998*
Gonodactylellus caldwelli Erdmann & Manning, 1998
Gonodactylellus erdmanni* n.sp.
Gonodactylellus espinosus (Borradaile, 1898)*
Gonodactylellus incipiens (Lanchester, 1903)
Gonodactylellus micronesicus (Manning, 1971a)*
Gonodactylellus molyneux* n.sp.
Gonodactylellus rubriguttatus Erdmann & Manning, 1998*
Gonodactylellus snidsvongi (Naiyanetr, 1987)*
Gonodactylellus viridis (Serène, 1954) n.comb.*
Gonodactyloideus Manning, 1984a
Gonodactyloideus cracens Manning, 1984a
Gonodactylus Berthold, 1827
Gonodactylus childi Manning, 1971a*
Gonodactylus chiragra (Fabricius, 1781)
Gonodactylus platysoma Wood-Mason, 1895
Gonodactylus smithii Pocock, 1893
Hemisquillidae Manning, 1980b (1 genus, 1 species)
Hemisquilla Hansen, 1895
Hemisquilla australiensis Stephenson, 1967
Odontodactylidae Manning, 1980b (1 genus, 4 species)
Odontodactylus Bigelow, 1893a
Odontodactylus cultrifer (White, 1851) n.comb.
Odontodactylus latirostris (Borradaile, 1907)*
Odontodactylus japonicus (de Haan, 1844)
Odontodactylus scyllarus (Linnaeus, 1758)
Protosquillidae Manning, 1980b (4 genera, 13 species)
Chorisquilla Manning, 1969d
Chorisquilla brooksii (de Man, 1888a)*
Chorisquilla convoluta* n.sp.
Chorisquilla hystrix (Nobili, 1899)*
Chorisquilla quinquelobata (Gordon, 1935)
Chorisquilla spinosissima (Pfeffer, 1888)
Chorisquilla tweediei (Serène, 1950)
Echinosquilla Manning, 1969d
Echinosquilla guerinii (White, 1861)*
Haptosquilla Manning, 1969d
Haptosquilla corrugata* n.sp.
Haptosquilla glyptocercus (Wood-Mason, 1875)
Haptosquilla stoliura (Müller, 1886)
Haptosquilla trispinosa (Dana, 1852)
Haptosquilla tuberosa (Pocock, 1893)*
Siamosquilla Naiyanetr, 1989
Siamosquilla laevicaudata (Sun & Yang, 1998) n.comb.*
Pseudosquillidae Manning, 1977a (4 genera, 7 species)
Pseudosquilla Dana, 1852
Pseudosquilla ciliata (Fabricius, 1787)
Pseudosquillana Cappola & Manning, 1995
Pseudosquillana richeri (Moosa, 1991)
Pseudosquillisma Cappola & Manning, 1995
Pseudosquillisma oculata (Brullé, 1837)
Raoulserenea Manning, 1995
Raoulserenea hieroglyphica (Manning, 1972a)*
Raoulserenea komaii (Moosa, 1991)*
Raoulserenea ornata (Miers, 1880)
Raoulserenea oxyrhyncha (Borradaile, 1898)*
Takuidae Manning, 1995 (1 genus, 1 species)
Taku Manning, 1995
Taku spinosocarinatus (Fukuda, 1909)
Lysiosquilloidea Giesbrecht, 1910
Lysiosquillidae Giesbrecht, 1910 (3 genera, 7 species)
Lysiosquilla Dana, 1852
Lysiosquilla colemani* n.sp.
Lysiosquilla sulcirostris Kemp, 1913*
Lysiosquilla suthersi* n.sp.
Lysiosquilla tredecimdentata Holthuis, 1941
Lysiosquillina Manning, 1995
Lysiosquillina maculata (Fabricius, 1793)
Lysiosquillina sulcata (Manning, 1978b)*
Lysiosquilloides Manning, 1977a
Lysiosquilloides siamensis (Naiyanetr, 1980)*
Nannosquillidae Manning, 1980b (6 genera, 15 species)
Acanthosquilla Manning, 1963b
Acanthosquilla derijardi Manning, 1970a*
Acanthosquilla multifasciata (Wood-Mason, 1895)
Alachosquilla Schotte & Manning, 1993
Alachosquilla vicina Nobili, 1904*
Austrosquilla Manning, 1966
Austrosquilla osculans (Hale, 1924)
Austrosquilla melanocauda (Kunze, 1981) n.comb.
Austrosquilla middletoni* n.sp.
Austrosquilla rachelae* n.sp.
Austrosquilla tsangi* n.sp.
Austrosquilla vercoi (Hale, 1924)
Bigelowina Schotte & Manning, 1993
Bigelowina phalangium (Fabricius, 1798) n.comb.
Hadrosquilla Manning, 1966

Hadrosquilla edgari* n.sp.
Hadrosquilla perpasta (Hale, 1924)
Pullosquilla Manning, 1978c
Pullosquilla litoralis Michel & Manning, 1971*
Pullosquilla pardus Moosa, 1991*
Pullosquilla thomassini Manning, 1978c*
TETRASQUILLIDAE Manning & Camp, 1993 (4 genera, 4 species)
Acaenosquilla Manning, 1991
Acaenosquilla brazieri (Miers, 1880)
Heterosquilla Manning, 1963b
Heterosquilla pentadactyla* n.sp.
Heterosquilloides Manning, 1966
Heterosquilloides insignis (Kemp, 1911)*
Kasim Manning, 1995
Kasim insuetus (Manning, 1970c)
PARASQUILLOIDEA Manning, 1995
PARASQUILLIDAE Manning, 1995 (2 genera, 3 species)
Faughnia Serene, 1962
Faughnia haani (Holthuis, 1959)*
Faughnia serenei Moosa, 1982*
Pseudosquillopsis Serene, 1962
Pseudosquillopsis dofleini (Balss, 1910)*
SQUILLOIDEA Latreille, 1802
SQUILLIDAE Latreille, 1802 (25 genera, 59 species)
Alima Leach, 1817
Alima orientalis Manning, 1978c*
Alima pacifica* n.sp.
Alimopsoides Moosa, 1991
Alimopsoides tuberculatus Moosa, 1991*
Anchisquilla Manning, 1968c
Anchisquilla chani* n.sp.
Anchisquilla fasciata (de Haan, 1844)
Anchisquilloides Manning, 1977b
Anchisquilloides mcneilli (Stephenson, 1953b)
Belosquilla n.gen.
Belosquilla laevis (Hess, 1865) n.comb.
Busquilla Manning, 1978c
Busquilla plantei Manning, 1978c*
Busquilla quadraticauda (Fukuda, 1911a)*
Carinosquilla Manning, 1968c
Carinosquilla australiensis* n.sp.
Carinosquilla carita* n.sp.
Carinosquilla redacta* n.sp.
Carinosquilla thailandensis Naiyanetr, 1983*
Clorida Eydoux & Souleyet, 1842
Clorida albolitura Ahyong & Naiyanetr, 2000
Clorida bombayensis (Chhapgar & Sane, 1967)*
Clorida daviei* n.sp.
Clorida depressa (Miers, 1880)
Clorida granti (Stephenson, 1953b)
Clorida obtusa* n.sp.
Clorida seversi Moosa, 1973*
Clorida wassenbergi* n.sp.
Cloridina Manning, 1995
Cloridina chlorida (Brooks, 1886)*
Cloridina inflata (Moosa, 1991)*
Cloridina moluccensis (Moosa, 1973)*
Cloridina pelamidae (Blumstein, 1970)*
Cloridina stephensoni* n.sp.
Cloridina verrucosa (Hansen, 1926)*
Cloridopsis Manning, 1968c
Cloridopsis terrareginensis (Stephenson, 1953b)
Dictyosquilla Manning, 1968c
Dictyosquilla tuberculata* n.sp.
Distosquilla Manning, 1977b
Distosquilla miles (Hess, 1865)
Erugosquilla Manning, 1995
Erugosquilla woodmasoni (Kemp, 1911)
Erugosquilla grahami Ahyong & Manning, 1998
Fallosquilla Manning, 1995
Fallosquilla fallax (Bouvier, 1914)*
Harpiosquilla Holthuis, 1964
Harpiosquilla annandalei (Kemp, 1911)*
Harpiosquilla harpax (de Haan, 1844)
Harpiosquilla melanoura Manning, 1968b
Harpiosquilla sinensis Liu & Wang, 1998
Harpiosquilla stephensoni Manning, 1969b
Kempina Manning, 1978d
Kempina mikado (Kemp & Chopra, 1921)
Lenisquilla Manning, 1977b
Lenisquilla lata (Brooks, 1886)
Levisquilla Manning, 1977b
Levisquilla inermis (Manning, 1965)*
Levisquilla jurichi (Makarov, 1979)*
Lophosquilla Manning, 1968c
Lophosquilla costata (de Haan, 1844)
Lophosquilla tiwarii (Blumstein, 1974)*
Miyakea Manning, 1995
Miyakea nepa (Latreille, 1828)
Neoanchisquilla Moosa, 1991
Neoanchisquilla australiensis Ahyong, 1998
Oratosquilla Manning, 1968c
Oratosquilla oratoria (de Haan, 1844)*
Oratosquillina Manning, 1995
Oratosquillina berentsae* n.sp.
Oratosquillina interrupta (Kemp, 1911)
Oratosquillina gravieri (Manning, 1978d)*
Oratosquillina inornata (Tate, 1883)
Oratosquillina quinquedentata (Brooks, 1886)
Oratosquillina stephensoni (Manning, 1978d)
Oratosquillina manningi Ahyong, Chan & Liao, 2000
Quollastria n.gen.
Quollastria capricornae* n.sp.
Quollastria gonypetes (Kemp, 1911) n.comb.
Quollastria kapala* n.sp.
Quollastria subtilis (Manning, 1978d) n.comb.*
Squilloides Manning, 1968c
Squilloides leptosquilla (Brooks, 1886)*

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References

Adkison, D.L., R.W. Heard & T. Hopkins, 1983. Description of a new genus and species, *Acoridon manningi* (Stomatopoda: Coronididae), from the Gulf of Mexico. *Journal of Crustacean Biology* 3(3): 454–462.

Adkison, D.L., & T.S. Hopkins, 1984. *Tectasquilla lutzae*, new genus and species (Crustacea: Stomatopoda: Lysiosquillidae) from the Gulf of Mexico. *Proceedings of the Biological Society of Washington* 97(3): 532–537.

Ahmed, M.M., 1971. A new species of *Oratosquilla* (Crustacea: Stomatopoda) from the Arabian Gulf. *Pakistan Journal of Scientific and Industrial Research* 14(3): 251–253.

Ahyong, S.T., 1994. *Oratosquilla septemdentata* n.sp. (Crustacea: Stomatopoda: Squillidae), a new species of deep water stomatopod from Halmahera, Indonesia. *Records of the Australian Museum* 46(1): 1–4.

Ahyong, S.T., 1997a. A phylogenetic analysis of the Stomatopoda (Crustacea: Malacostraca). *Journal of Crustacean Biology* 17(4): 695–715.

Ahyong, S.T., 1997b. A new species of *Manningia* (Crustacea: Stomatopoda) from Irian Jaya, Indonesia, with remarks on the genus. *Raffles Bulletin of Zoology* 45(2): 327–333.

Ahyong, S.T., 1998. Review of *Neoanchisquilla* Moosa, 1991 and *Neclorida* Manning, 1995 (Crustacea: Stomatopoda: Squilloidea), with descriptions of two new species of *Neoanchisquilla* from the Indian Ocean. *Records of the Australian Museum* 50(2): 217–229.

Ahyong, S.T., 2000a. *Raysquilla manningi*, a new genus and species of stomatopod from the Australian Northwest Shelf. *Journal of Crustacean Biology* 20(special number 2): 37–41.

Ahyong, S.T., 2000b. Redescription of *Squilla fabricii* Holthuis, 1941 (Crustacea: Stomatopoda), and its transfer to *Oratosquilla* Manning, 1968. *Proceedings of the Biological Society of Washington* 113(4): 926–930.

Ahyong, S.T., T.Y. Chan & Y.J. Liao, 1998. A new stomatopod (Crustacea: Malacostraca) of the genus *Harpiosquilla* Holthuis, 1964, from Taiwan and Australia. *Proceedings of the Biological Society of Washington* 111(4): 929–935.

Ahyong, S.T., T.Y. Chan & Y.J. Liao, 2000. *Oratosquillina manningi*, a new species of stomatopod from Taiwan and Australia. *Journal of Crustacean Biology* 20(special number 2): 42–47.

Ahyong, S.T., K.H. Chu, T.Y. Chan & Q.C. Chen, 1999. Stomatopoda of the Zhujiang estuary between Hong Kong and Macau. *Crustaceana* 72(1): 37–54.

Ahyong, S.T., & M. Ebach, 1999. First occurrence of a subfossil stomatopod crustacean from Australia. *Alcheringa* 3/4: 227–228.

Ahyong, S.T., & C. Harling, 2000. The phylogeny of the Stomatopod Crustacea. *Australian Journal of Zoology* 48(6): 607–642.

Ahyong, S.T., & R.B. Manning, 1998. Two new species of *Erugosquilla* from the Indo-West Pacific (Crustacea: Stomatopoda: Squillidae). *Proceedings of the Biological Society of Washington* 111(3): 653–662.

Ahyong, S.T., R.B. Manning & K. Reed, 2000. Revision of *Pseudosquillana* Cappola & Manning, 1995 (Crustacea: Stomatopoda: Pseudosquillidae). *Raffles Bulletin of Zoology* 48(2): 301–311.

Ahyong, S.T., & P. Naiyanetr, 2000. Revision of the *Clorida latreillei* species complex with description of a new species (Squillidae: Stomatopoda). *Raffles Bulletin of Zoology* 48(2): 313–325.

Ahyong, S.T., & P. Naiyanetr, in press. Stomatopod Crustaceans from Phuket and the Andaman Sea. *Phuket Marine Biological Centre Research Publication*.

Ahyong, S.T., & S.F. Norrington, 1997. Stomatopod Crustacea in the Macleay Museum, University of Sydney. *Proceedings of the Linnean Society of New South Wales* 118: 97–110.

Ahyong, S.T., & J.E. Randall, 2001. *Lysiosquillina lisa*, a new species of mantis shrimp from the Indo-West Pacific (Stomatopoda: Lysiosquillidae). *Journal of South Asian Natural History* 5(2): 135–140.

Alcock, A., 1894. On the results of the deepsea dredging during the season 1890–91 (concluded). Natural history notes from H.M. Marine Survey Steamer "Investigator," Commander R.F. Hoskyn, R.N., late commanding, series 2, no. 1. *The Annals and Magazine of Natural History*, series 6, 13: 400–411.

Alexander, W.B., 1916a. On a stomatopod new to Australia, with a list of the Western Australian species of the order. *Journal and Proceedings of the Royal Society of Western Australia* 1: 8–9.

Alexander, W.B., 1916b. Further notes on W.A. stomatopods. *Journal and Proceedings of the Royal Society of Western Australia* 1: 9–10.

Alikunhi, K.H., 1944. Final pelagic larva of *Squilla hieroglyphica* Kemp. *Current Science, Bangalore* 13(9): 237–238.

Alikunhi, K.H., 1952. An account of the stomatopod larvae of the Madras Plankton. *Records of the Indian Museum* 49(3–4): 239–319, figs. 1–25.

Alikunhi, K.H., 1967. An account of the post-larval development, moulting and growth of the common stomatopods of the Madras coast. In *Proceedings of the Symposium on Crustacea*, pp. 824–939. Marine Biological Association of India, part II: iv+945 pp.

Balss, H., 1910. Ostasiatische Stomatopoden. Beiträge zur Naturgeschichte Ostasiens. Herausgegeben von Dr. F. Doflein. *Abhandlungen der Wissenschaften, Mathematisch-Naturwissenschaftliche Klasse, Munich*, supplement 2, 2: 1–11.

Balss, H., 1921. Results of Dr. E. Mjobergs Swedish Expeditions to Australia 1910–13, XXIX. Stomatopoda, Macrura, Paguridea und Galatheidea. Kungl. *Svenska Vetenskapsakademiens Hanflingar* 61(10): 1–24.

Barber, P.H., & M.V. Erdmann, 2000. Molecular systematics of the Gonodactylidae (Stomatopoda) using mitochondrial cytochrome oxidase C (subunit 1) DNA sequence data. *Journal of Crustacean Biology* 20(special number 2): 20–36.

Barber, P.H., S.R. Palumbi, M.V. Erdmann & M.K. Moosa, 2000. Biogeography: a marine Wallace's Line? *Nature* 406(6797): 692–693.

Barnard, K.H., 1950. Descriptive list of South African Stomatopod Crustacea (Mantis Shrimps). *Annals of the South African*

Museum 38: 838–864.

Berg, C., 1900. Datos sobre algunos crustáceos nuevos para la fauna Argentina. *Communicaciones del Museo Nacional de Buenos Aires* 1(7): 223–235.

Berthold, A.A., 1827. Latreille's Natürliche Familien des *Thierreichs, aus dem Französchen met Ammerkungen und Zusätzen*. Weimer. Pp. 606.

Berthold, A.A., 1845. Ueber verschiedene neue oder seltene Reptilien aus Neue-Granada und Crustaceen aus China. *Gesellschaft der Wissenschaften zu Göttingen, Nachrichten* 1845: 37–48.

Bigelow, R.P., 1893a. Preliminary notes on the Stomatopoda of the Albatross collections and on other specimens in the National Museum. *Johns Hopkins University Circulars* 12(106): 100–102.

Bigelow, R.P., 1893b. The Stomatopoda of Bimini. *Johns Hopkins University Circulars* 12(106): 102–103.

Bigelow, R.P., 1894. Report on the Crustacea of the Order Stomatopoda collected by the steamer Albatross between 1885 and 1891, and on other specimens in the U. S. National Museum. *Proceedings of the United States National Museum* 17: 489–550, figs. 1–10, pls. 1, 2.

Bigelow, R.P., 1901. The Stomatopoda of Porto Rico. *Bulletin of the United States Fish Commission* 20(2): 149–160 (dated 1900, published 1901).

Bigelow, R.P., 1931. Stomatopoda of the southern and eastern Pacific Ocean and the Hawaiian Islands. *Bulletin of the Museum of Comparative Zoölogy, Harvard University* 72(4): 105–191, pls. 1, 2.

Blumstein, R., 1970. New stomatopod crustaceans from the Gulf of Tonkin, South China Sea. *Crustaceana* 18(2): 218–224.

Blumstein, R., 1972. A new species of *Lophosquilla* from the Indian Ocean. *Crustaceana* 22(1): 64–66.

Blumstein, R., 1974. Stomatopod crustaceans from the Gulf of Tonkin with the description of new species. *Crustaceana* 26(2): 112–126.

Borradaile, L.A., 1898. On some Crustaceans from the South Pacific—Part I: Stomatopoda. *Proceedings of the Zoological Society of London* 1898: 32–38, pls. 5–6.

Borradaile, L.A., 1900. On the Stomatopoda and Macrura brought by Dr Willey from the South Seas. In *Zoological Results based on the material from New Britain, New Guinea, Loyalty Islands and elsewhere, collected during the years 1895, 1896, and 1897*, ed. A. Willey, vol. 4, pp. 395–428, pls. 36–39. Cambridge University Press.

Borradaile, L.A., 1907. Stomatopoda from the western Indian Ocean. The Percy Sladen Trust Expedition to the Indian Ocean in 1905, under the leadership of J. Stanley Gardiner. *Transactions of the Linnean Society of London*(2, Zoology) 12: 209–216, pl. 22.

Bouvier, E.-L., 1914. Sur la faune carcinologique de l'ile Maurice. *Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences*, Paris, 159: 698–704.

Bouvier, E.-L., 1915. Décapodes marcheurs (Reptantia) et stomatopodes recueillis à l'ile Maurice par M. Paul Carié. *Bulletin Scientifique des France et Belge, series 7* 48(3): 178–318.

Boyko, C.B., 2000. The rise and fall of *Lysiosquilla desaussurei* and description of *L. manningi* n. sp.: the tale of the type. *Journal of Crustacean Biology* 20(special number 2): 48–55.

Brooks, W.K., 1886. Report on the Stomatopoda collected by H.M.S. Challenger during the years 1873–76. *The Voyage of the H.M.S. Challenger, Zoology*, 16: 1–116, pls. 1–16.

Bruce, A.J., 1985. *Altosquilla soelae*, new genus, new species, a bathysquillid stomatopod from the Australian Northwest Shelf. *Journal of Crustacean Biology* 5(3): 468–475.

Bruce, A.J., 1986. *Manningia raymondi* sp. nov., a new eurysquillid stomatopod from the Northern Territory, Australia. *The Beagle* 2(1): 17–21 (dated 1985, published April, 1986).

Bruce, A.J., 1988. Two mantis shrimps new to the Australian fauna (Crustacea: Stomatopoda: Bathysquillidae). *The Beagle* 5(1): 87–96, frontispiece A.

Brullé, G.A., 1837–1839. Crustacés. In *Histoire naturelle des Iles Canaries, Zoologie*, eds. P. Barker-Webb & S. Berthelot, vol. 2 (2, Entomologie), pp. 13–18 (1839), atlas (1837).

Cadenat, J., 1957. *Lysiosquilla aulacorhynchus*, espèce nouvelle de Stomatopode de la cote occidental d'Afrique. Diagnose preliminaire. *Bulletin Institut Français Afrique Noire series A* 19(1): 126–133, figs. 1–8.

Caldwell, R.L., & H. Dingle, 1976. Stomatopods. *Scientific American* 234(1): 80–89.

Caldwell, R.L., & R.B. Manning, 2000. A new dwarf pseudosquillid of the genus *Raoulserenea* from French Polynesia (Crustacea, Stomatopoda). *Zoosystema* 22(1): 101–106.

Camp, D.K., & R.B. Manning, 1986. Observations on *Nannosquilla*, with descriptions of three new species from the northwestern Atlantic (Crustacea: Stomatopoda). *Smithsonian Contributions to Zoology* 444: 1–17.

Cannon, L.R.G., G.B. Gordon & P. Campbell, 1987. Community patterns revealed by trawling in the inter-reef regions of the Great Barrier Reef. *Memoirs of the Queensland Museum* 25(1): 45–70.

Cappola, V., & R.B. Manning, 1995. Research on the coast of Somalia. Crustacea Stomatopoda. *Tropical Zoology* 7: 271–291 (dated 1994, published 1995).

Cappola, V., & R.B. Manning, 1999. Relationships within the stomatopod genus *Eurysquilla*. *Proceedings of the Fourth International Crustacean Congress 1998* 1: 383–393.

Chhapgar, B.F., & S.R. Sane, 1967. Two new species of *Squilla* (Stomatopoda) from Bombay. *Crustaceana* 12(1): 1–8.

Chilton, C., 1891. Notes on the New Zealand Squillidae. *Transactions and Proceedings of the Royal Society of New Zealand Institute* 23: 58–68, pl. 10.

Chilton, C., 1911. Revision of the New Zealand Stomatopoda. *Transactions and Proceedings of the Royal Society of New Zealand Institute* 43: 134–139, figs. 1–4.

Chopra, B., 1939. Stomatopoda. *John Murray Expedition Scientific Reports* 6(3): 137–181, figs. 1–13.

Clark, P.F., K. Harrison & S. Goodman, 1990. Decapoda and Stomatopod by De Man: 1887 or 1888? *Archives of Natural History* 17(1): 79–80.

Claus, C., 1871. Die Metamorphose der Squilliden. *Abhandlungen der königlichen Gesellschaft der Wissenschaften zu Göttingen* 16: 111–163, pls. 1–8.

Coleman, N., 1987. *Australian Sea Life South of 30°S*. Lane Cove, NSW: Doubleday. Pp. 288.

Coutière, H., 1905. Note sur *Lysiosquilla digueti* n. sp. commensale d'un polynoïden et d'un balanoglosse de Basse Californie. *Bulletin de la Societie Philomathique de Paris* (9)7: 174–179.

Cronin, T.W., N.J. Marshall & R.L. Caldwell, 1997. Visual pigment diversity in two genera of mantis shrimps implies rapid evolution (Crustacea; Stomatopoda). *Journal of Comparative Physiology A* 179: 371–384.

Dana, J.D., 1852 (1852–1855). Crustacea, Part 1. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U.S.N., 13: 1–685 (1852). Atlas: 1–27, pls. 1–96 (1855). Philadelphia: C. Sherman.

Debelius, H., 1999. *Crustacea Guide of the World*. Frankfurt: IKAN.

Desmarest, A.G., 1823. Malacostracés, Malacostraca. *Dictionnaire des Sciences Naturelles* 28: 158–425. Paris and Strasbourg.

Dingle, H., R.L. Caldwell & R.B. Manning, 1977. Stomatopods of Phuket Island. *Phuket Marine Biological Centre, Research Bulletin* 20: 1–20.

Edgar, G., 1997. *Australian Marine Life: The Plants and Animals of Temperate Waters*. Kew, Victoria: Reed Books, pp. 544.

Edmondson, C.H., 1921. Stomatopoda in the Bernice P. Bishop Museum. *Occasional Papers of the Bernice Pauahi Bishop Museum of Polynesian Ethnology and Natural History* VII (13): 279–302, figs. 1, 2.

Edmondson, C.H., 1923. Crustacea from Palmyra and Fanning Islands, with descriptions of new species of crabs from Palmyra Island by Mary R. Rathbun. *Bulletin of the Bernice P. Bishop Museum* 5: 1–43, pls. 1–2.

Erdmann, M.V., & R.L. Caldwell, 1997. Stomatopod Crustaceans as bioindicators of marine pollution stress on coral reefs. *Proceedings of the 8th International Coral Reef Symposium* 2:

1521–1526.

Erdmann, M.V., & R.B. Manning, 1998. Preliminary descriptions of nine new stomatopod Crustaceans from coral reef habitats in Indonesia and Australia. *Raffles Bulletin of Zoology* 46(2): 615–626.

Erdmann, M.V., & R.B. Manning, 1999. A new species of *Siamosquilla* from Indonesia (Crustacea: Stomatopoda: Protosquillidae). *Proceedings of the Biological Society of Washington* 112(1): 94–96.

Erdmann, M.V., & O. Sisovann, 1998. Distribution and abundance of reef-flat stomatopods in Teluk Jakarta and Kepulauan Seribu. In *Proceedings of Coral Reef Evaluation Workshop, Pulau Seribu, Indonesia, Study 10*, ed. S. Soemodiharjo, UNESCO.

Eydoux, F., & L.F.A. Souleyet, 1842. Crustacés. Voyage autour du Monde exécuté pendant les années 1836 et 1837 sur la Corvette La Bonite Commandée par M. Vaillant, Capitaine de Vaiseau, Zoologie 1: 219–272, pl. 5. Paris: Arthus Bertrand.

Fabricius, J.C., 1775. *Systema entomologiae, sistens insectorum classes, ordines, genera, species, adiectis synonymis, locis, descriptionibus, observationibus*, pp. 1–832. Kort, Flensburg and Leipzig.

Fabricius, J.C., 1781. *Species Insectorum Exhibentes Eorum Differentias Specificas, Synonyma Auctorum, Loca Natalia, Metamorphosin Adiectis, Observationibus, Descriptionibus* 1, pp. vii+552. Hamburgii et Kilonii.

Fabricius, J.C., 1787. *Mantissa insectorum sistens eorum species nuper detectas: adjectis characteribus genericis, differentiis specificis, emendationibus, observationibus*. Proft Hafniae 1: 1–348.

Fabricius, J.C., 1793. *Entomologia Systematica Emendata et Aucta. Secundum Classes, Ordines, Genera, Species. Adjectis Synonimis, Locis, Observationibus, Descriptionibus*, 2, pp. vii+519. Hafniae.

Fabricius, J.C., 1798. *Supplementum Entomologiae Systematicae*, pp. ii+572. Hafniae.

Forskål, P., 1775. *Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, Vermium*, pp. 19+xxxii+164. Hauniae (Copenhagen).

Fowler, H.W., 1912. The Crustacea of New Jersey. *Annual Report of the New Jersey State Museum*, Part II, 1911: 29–650.

Fransen, C.H.J.M., & L.B. Holthuis, 2000. Type-catalogue of the stomatopod Crustacea in the collections of the Nationaal Natuurhistorisch Museum. *Zoologische Mededelingen* 73: 381–389.

Fukuda, T., 1909. Japanese Stomatopoda. *Dobutsugaku Zasshi*, 21: 54–62, 167–174, pl. 5 (In Japanese; published in English, 1910).

Fukuda, T., 1910. Report on the Japanese Stomatopoda with descriptions of two new species. *Annotationes Zoologicae Japonenses* 7(3): 139–152, pl. 4.

Fukuda, T., 1911a. Supplement to Japanese Stomatopoda. *Dobutsugaku Zasshi* 23: 173–175, pl. 1. (In Japanese; published in English, 1911b).

Fukuda, T., 1911b. Further report on Japanese Stomatopoda with descriptions of two new species. *Annotationes Zoologicae Japonenses* 7(5): 285–290, pl. 11.

Garcia, R.G., 1978. *Harpiosquilla philippina*, a new stomatopod crustacean from the Philippines. *Kalikasan, Philippine Journal Biology* 7(3): 231–237.

Garcia, R.G., 1981. Inventory of the littoral fauna of Tayabas Bay—Crustacea: Stomatopoda. *National Museum Manila, Philippines, Zoological Papers* 6: 1–33.

Garcia, R.G., & R.B. Manning, 1982. Four new species of stomatopod crustaceans from the Philippines. *Proceedings of the Biological Society of Washington* 95(3): 537–544.

Garrey, J., H. Maxwell & G.R. Cresswell, 1981. Dispersal of tropical marine fauna to the Great Australian Bight by the Leeuwin Current. *Australian Journal of Marine and Freshwater Research* 32: 493–500.

Ghosh, H.C., 1973. A note on two species of stomatopods from the Arabian Sea collected by the "John Murray" Expedition 1933–1934. *Crustaceana* 24(1): 143–144.

Ghosh, H.C., 1975. A new species of *Manningia* (Stomatopoda, Gonodactylidae) from the Andaman Islands. *Crustaceana* 28(1): 33–36.

Ghosh, H.C., 1984. On a small collection of Stomatopoda (Crustacea) from Goa. *Bulletin of the Zoological Survey of India* 6(1–3): 261–266.

Ghosh, H.C., 1987. Stomatopoda: Crustacea. Fauna of Orissa. *State Fauna Series* 1: 305–318.

Ghosh, H.C., 1990. Stomatopoda: Crustacea. Fauna of Lakshadweep. *State Fauna Series* 2: 199–212.

Ghosh, H.C., & R.B. Manning, 1988. Types of stomatopod crustaceans in the Zoological Survey of India. *Proceedings of the Biological Society of Washington* 101(3): 653–661.

Gibbes, L.R., 1850. On the carcinological collections of the cabinets of the Boston Society of natural history in the United States, with an enumeration of the species contained therein, and descriptions of new species. *Proceedings of the American Association for the Advancement of Science, 3rd meeting*: 167–201 (pp. 1–37 on separate).

Giebel, C., 1861. Neue *Squilla* von der Insel Banka. *Zeitschrift für Gesammten Naturwissenschaften* 18: 319–320.

Giesbrecht, W., 1910. Stomatopoden, Erster Theil. *Fauna und Flora des Golfes von Neapel Monographie* 33: i–vii, 1–239, pls. 1–11.

Gordon, I., 1935. On two new species of Crustacea from Christmas Island. *Annals and Magazine of Natural History*, series 10, 16: 629–637.

Gosliner, T.M., D.W. Behrens & G.C. Williams, 1996. *Coral Reef Animals of the Indo-Pacific*. Monterey, California: Sea Challengers, pp. vi+314.

Graham, K.J., G.W. Liggins, J. Wildfoster & S.J. Kennelly, 1993a. *Kapala Cruise Report* 110: 1–69. NSW Fisheries Research Institute.

Graham, K.J., G.W. Liggins, J. Wildfoster & S.J. Kennelly, 1993b. *Kapala Cruise Report* 112: 1–74. NSW Fisheries Research Institute.

Gravier, Ch., 1930. Sur une collection de Crustacés (Stomatopodes) reueillis par Mme. Pruvot sur les côtes de la Nouvelle Calédonie. *Bulletin du Muséum national d'Histoire naturelle, Paris*, series 2, 2(2): 214–216.

Guérin-Méneville, F.E., 1830. Crustacés, Arachnides, et Insectes. In *Voyage autour du monde, exécuté par Ordre du Roi, sur la Corvette de Sa Majeste, "La Coquille," pendant les années 1822, 1823, 1824, et 1825. Zoologie*, ed. L.I. Duperrey, vol. 2, pt. 2, sect. 1, pp. 1–319, pls. 1–24.

Guiler, E., 1956. Supplement to a list the Crustacea of Tasmania. *Records of the Queen Victoria Museum, Launceston, new series*, 5: 1–8.

Haan, W. de, 1844 (1833–1850). Crustacea. In *Fauna Japonica sive descriptio animalium, quae in itinere per Japoniam, jussu et auspiciis superiorum, qui summum in India Batavia Imperium tenent, suscepto, annis 1823–1830 collegit, notis observationibus et adumbrationibus*, ed. Ph.F. von Siebold, pp. 243, illustravit. Lugdunum Batavorum: A. Arnz.

Hale, H.M., 1924. Notes on Australian Crustacea. No. 1. *Records of the South Australian Museum* 2(4): 491–502, pls. 32–33, figs. 381–384.

Hale, H.M., 1927a. *The Crustaceans of South Australia. Part 1. Handbook of the Flora and Fauna of South Australia*, pp. 1–201, figs. 1–202. Adelaide.

Hale, H.M., 1927b. The Crustacea. The fauna of Kangaroo Island, South Australia 1. *Transactions of the Royal Society of South Australia* 52: 307–321, figs. 1–7.

Hale, H.M., 1929a. Crustacea from Princess Charlotte Bay, north Queensland. The Isopoda and Stomatopoda. *Transactions of the Royal Society of South Australia* LIII: 33–36.

Hale, H.M., 1929b. Notes on the fauna of Dirk Hartog Island, Western Australia. No. 4.—Crustacea. *Transactions of the Royal Society of South Australia* LIII: 67–70.

Hamano, T., N.M. Morrissy & S. Matsuura, 1987. Ecological information on *Oratosquilla oratoria* (Stomatopoda, Crustacea) with an attempt to estimate the annual settlement date from growth parameters. *Journal of the Shimonoseki University of Fisheries* 36: 9–27.

Hamano, T., & S. Matsuura, 1987. Egg size, duration of incubation, and larval development of the Japanese mantis shrimp in the laboratory. *Bulletin of the Japanese Society of Fisheries* 53(1): 23–39.

Hansen, H.J., 1895. Isopoden, Cumacean und Stomatopoden der Planktonexpedition. *Ergebnisse der Plankton-Expedition der Humboldt-Stiftung* 2(Gc): 1–105, pls. 1–8.

Hansen, H.J., 1926. The Stomatopoda of the Siboga Expedition. *Siboga-Expeditie, monographe* 35: 1–48, pls. 1–2.

Harling, C., 2000. Re-examination of eye design in the classification of stomatopod crustaceans. *Journal of Crustacean Biology* 20(1): 172–185.

Haswell, W., 1882. *Catalogue of the Australian Stalk- and Sessile-eyed Crustacea*. Sydney: The Australian Museum, Sydney, pp. xxiv+324.

Heard, R., & R.B. Manning, 1990. *Caecopilumnus crassipes* (Tesch, 1918) (Decapoda, Brachyura, Pilumnidae) and *Acanthosquilla multifasciata* (Wood-Mason, 1895) (Stomatopoda, Nannosquillidae), new to the Hawaiian Islands. *Crustaceana* 59(1): 105–107.

Henderson, J.R., 1893. A contribution to Indian Carcinology. *Transactions of the Linnean Society of London, series 2 (Zoology)* 5(10): 325–458, pls. 36–40.

Hendrickx, M.E., & J. Salgado-Barragán, 1991. Los estomatöopos (Crustacea: Hoplocarida) del Pacifico Mexicano. *Instituto Cienias del Mar Y Limnologia, Universidad Nacional Autöonoma de México Publicaciones Especiales* 10: 1–200.

Herklots, J.A., 1851. Addimenta ad Faunam Carcinologicum Africae Occidentalis, sive descriptiones specierum novarum e crustaceorum ordine, quas in Guinea collegit vir strenuus H. S. Pel, praefectus residentiis in littore guineae, pp. 28. Leiden: Lugduni-Batavorum.

Hess, W., 1865. Beiträge zur Kenntniss der Decapoden-Krebse Ost-Australiens. *Archiv fur Naturgeschichte* 31(1): 127–173, pls. 6–7.

Hilgendorf, F., 1890. Eine neue Stomatopoden-Gattung Pterygosquilla. *Sitzungsberichte der Gesellschaft naturforschender Freunde zu Berlin* 1890: 172–177, fig. 1–2

Hof, C.H.J., 1998. Fossil stomatopods (Crustacea: Malacostraca) and their phylogenetic impact. *Journal of Natural History* 32(10/11): 1567–1576.

Holthuis, L.B., 1941. The Stomatopoda of the Snellius Expedition. Biological Results of the Snellius Expedition XII. *Temminckia* 6: 241–294.

Holthuis, L.B., 1959. Stomatopod Crustacea of Suriname. *Studies on the Fauna of Suriname and other Guyanas* 10: 173–191.

Holthuis, L.B., 1964. Preliminary note on two new genera of Stomatopoda. *Crustaceana* 7(2): 140–141.

Holthuis, L.B., 1967a. Fam. Lysiosquillidae et Bathysquillidae. Stomatopoda I. In *Crustaceorum Catalogus*, eds. H.E. Gruner & L.B. Holthuis, vol. 1, pp. 1–28. Den Haag: W. Junk.

Holthuis, L.B., 1967b. The stomatopod Crustacea collected by the 1962 and 1965 Israel South Sea Expeditions. The second Israel South Red Sea Expedition, 1965, report no. 1. *Israel Journal of Zoology* 16: 1–45.

Holthuis, L.B., 2000. Nomenclatural notes on eighteenth century Stomatopoda (Hoplocarida). *Journal of Crustacean Biology* 20(special number 2): 12–19.

Holthuis, L.B., & R.B. Manning, 1969. Stomatopoda. In *Arthropoda, Treatise on Invertebrate Palaeontology*, ed. R.C. Moore, part R, vol. 4, pp. 535–552. Lawrence, Kansas: Geological Society of America and University of Kansas.

Ingle, R.W., 1960. *Squilla labadiensis* n. sp. and *Squilla intermedia* Bigelow, two stomatopod crustaceans new to the west African coast. *Annals and Magazine of Natural History series* 13, 2(2): 565–576.

Ingle, R.W., 1963. Crustacea Stomatopoda from the Red Sea and Gulf of Aden. Contributions to knowledge of the Red Sea, Number 26. *Bulletin, Sea Fisheries Research Station (Haifa)* 33: 1–69.

Ingle, R.W., 1971. On the nomenclature of *Gonodactylus graphurus* White, 1847 (nomen nudum), Miers, 1875 (Stomatopoda, Gonodactylidae). *Crustaceana* 21(2): 220–221.

Ingle, R.W., & N. Merrett, 1971. A stomatopod Crustacean from the Indian Ocean, *Indosquilla manihinei* gen. et sp. nov. (Family Bathysquillidae) with remarks on *Bathysquilla crassispinosa* (Fukuda, 1910). *Crustaceana* 20(2): 192–198.

Jones, D., & G. Morgan, 1994. *A Field Guide to Crustaceans of Australian Waters*. Australia: Reed.

Jurich, B., 1904. Die Stomatopoden der Deutsche Tiefsee-Expedition. *Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898–1899*, 7: 361–408, pls. 25–30.

Keenan, C.P., P.J.F. Davie & D.L. Mann, 1998. A revision of the genus *Scylla* de Haan (Crustacea: Decapoda: Brachyura: Portunidae). *Raffles Bulletin of Zoology* 46 (1): 217–245.

Kemp, S., 1911. Preliminary descriptions of new species and varieties of Crustacea Stomatopoda in the Indian Museum. *Records of the Indian Museum* 6(2): 93–100.

Kemp, S., 1913. An account of the Crustacea Stomatopoda of the Indo-Pacific region, based on the collection in the Indian Museum. *Memoirs of the Indian Museum* 4: 1–217, figs. 1–10, pls. 1–10.

Kemp, S., 1915. On a collection of stomatopod Crustacea from the Philippine Islands. *The Philippine Journal of Science* 10(3D): 169–186, pl. 1.

Kemp, S., & B. Chopra, 1921. Notes on Stomatopoda. *Records of the Indian Museum* 22: 297–311.

Kinzie, R.A. III, 1968. The ecology of the replacement of *Pseudosquilla ciliata* (Fabricius) by *Gonodactylus falcatus* (Forskål) (Crustacea: Stomatopoda) recently introduced into the Hawaiian Islands. *Pacific Science* 22(4): 465–475.

Knox, G.A., 1963. The biogeography and intertidal ecology of the Australasian coasts. *Oceanography and Marine Biology Annual Reviews* 1: 341–404.

Komai, T., 1927. Stomatopoda of Japan and adjacent localities. *Memoirs of the College of Science, Kyoto Imperial University* (B) 3(3): 307–354, figs. 1–2, pls. 13–14.

Komai, T., 1938. Stomatopoda occurring in the vicinity of Kii Peninsula. *Annotationes Zoologicae Japonenses* 17(3/4): 263–275.

Komai, T., & Y.M. Tung, 1930. Report on the Stomatopoda Collected by the surveying ships of the Imperial Fisheries Experimental Station on the continental shelf bordering Japan. *Annotationes Zoologicae Japonenses* 13(1): 13–19.

Kossmann, R., 1880. Malacostraca. *Zoologische Ergebnisse einer in Aufrage der königlichen Academie der Wissenschaften zu Berlin ausgefürten Reise in die Küstengebiete des Rothen Meeres* 2(1): 1–140, pls. 1–15.

Kunze, J.C., 1981. A new species of *Hadrosquilla* Manning, 1966 from eastern Australia (Stomatopoda, Lysiosquillidae). *Crustaceana* 40(1): 1–4.

Lamarck, J.B.P.A. de, 1818. *Histoire naturelle des animaux sans vertèbres présentant les caractères généraux et particuliers de ces animaux, leur distribution, leur classes, leurs familles, leurs genres, et la citation des principales espèces qui s'y rapportent; précédée d'une introduction offrant la détermination des caractères essentiels de l'animal, sa distinction du végétal et des autres corps naturelles, enfin, l'exposition des principes fondamentaux de la zoologie* 5: 1–612. Paris: Deterville.

Lanchester, W.F., 1903. Stomatopoda, with an account of the varieties of Gonodactylus chiragra. Marine Crustaceans VIII. In *The fauna and geography of the Maldive and Laccadive Archipelagoes: being the account of the work carried on and of the collections made by an expedition during the years 1899 and 1900*, ed. J.S. Gardiner, vol. 1, pp. 444–459.

Latreille, P.A., 1802. *Histoire naturelle, générale et particulière, des Crustacés et des Insectes* vol. 3, pp. 467. Paris: F. Dufart.

Latreille, P.A., 1828. Squille, *Squilla*. *Encyclopédie Méthodique. Entomologie ou Histoire naturelle des Crustacés, des Arachnides et des Insectes* 10: 467–475. Paris: Agasse.

Leach, W.E., 1817–1818. A general notice of the animals taken by Mr John Cranch, during the expedition to explore the source of the River Zaire. Appendix 4. Pp. 407–419 (1818), 1 unnumbered plate (1817). In *Narrative of an expeditio to explore the River Zaire, usually called the Congo, in South Africa, in 1816, under the direction of Captain J.K. Tuckey, R.N., to which is added the journal of Professor Smith, some general observations on the country and its inhabitants, and an appendix, containing the natural history of that part of the Kingdom of Congo through which the Zaire flows*, ed. J.K. Tuckey, pp. 498. London: John Murray

Lee, S.-C., & S.-K. Wu, 1966. The stomatopod Crustacea of Taiwan. *Bulletin of the Institute of Zoology, Academia Sinica* 5: 41–58.

Lenz, H., 1905. Ostafrikanische Dekapoden und Stomatopoden gesammelt von Herrn Prof. Dr. A. Voeltzkow. In *Wissenschaftliche Ergebnisse der Reisen in Madagaskar und Ostafrika in den Jahren 1889–95, volume 3*, ed. A. Voeltzkow, *Abhandlungen der Senckenbergischen naturforschenden Gesellschaft* 27(4): 341–392, pls. 47, 48.

Linnaeus, C., 1758. *Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis Locis*. Edition 10, vol. 1, pp. iii+824. Holmiae.

Linnaeus, C., 1768. *Systema Naturae per Regna Tria Naturae, Secundum Classes, Ordines, Genera, Species, cum Characteribus, Differentiis, Synonymis Locis.* Edition 12. Stockholm 3: 1–236.

Liu, J.-Y., & Y. Wang, 1978. Description of a new genus and two new species of Stomatopod Crustacea from the South China Sea. *Oceanologia et Limnologia Sinica* 9(1): 89–92 (Chinese text), 93–94 (English text), pl. 1.

Liu, J.-Y., & Y. Wang, 1998. On two new species of the Squillidae and Harpiosquillidae (Crustacea Stomatopoda) from the South China Sea. *Oceanologia et Limnologia Sinica* 29(6): 588–592 (Chinese text), 592–596 (English text), figs. 1, 2.

Liu, J.-Y., & Y. Wang, 1999. The stomatopod fauna of the China Seas. *Proceedings of the Fourth International Crustacean Congress* 1998 1: 569–582.

Lockington, W.N., 1877. Remarks on the Crustacea of the Pacific coast, with descriptions of some new species. *Proceedings of the California Academy of Sciences* 7: 28–36 (pp. 1–9 on separate).

Makarov, R.R., 1971. Fauna and distribution of Red Sea Stomatopoda. In *Benthos of the shelf of the Red Sea*, ed. A.O. Kovalevsky, pp. 141–155. Kiev, U.S.S.R.: Academia nauk SSSR. (In Russian).

Makarov, R.R., 1976. A new species of the rare genus of mantis shrimps *Coronidopsis andamanensis* sp.n. (Crustacea, Stomatopoda). *Zoologischeskij zhurnal* 55(12): 1908–1912.

Makarov, R.R., 1978. New data on crustaceans of the families Lysiosquillidae and Gonodactylidae (Crustacea, Stomatopoda) from Tonkin Bay (Vietnam). *Zoologischeskij zhurnal, Moscow* 57: 176–189. (In Russian).

Makarov, R.R., 1979. A collection of stomatopod crustaceans of the genus *Clorida* Eydoux & Souleyet, 1842, from Tonkin Bay, Vietnam. *Crustaceana* 37(1): 39–56.

Man, J.G. de, 1888a (1887–1888). Bericht über die von Herrn Dr. J. Brock im indischen Archipel gesammelten Decapoden und Stomatopoden. *Archiv für Naturgeschichte* 53(I, 2): 215–288, pls. 7–10 (issued 1887); 53(I, 3): 289–600, pls. 11–22a (issued 1888, fide Clark *et al*., 1990).

Man, J.G. de, 1888b. Report on the podophthalmous Crustacea of the Mergui Archipelago, collected for the trustees of the Indian Museum, Calcutta, by Dr. John Anderson, F.R.S., Superintendent of the Museum. *Journal of the Linnean Society, London, (Zoology)* 22: 1–312, pls. 1–19.

Man, J.G. de, 1898. Bericht über die von Herrn Schiffscapitän Storm zu Atjeh, an den westlichen Küsten von Malakka, Borneo and Celebes sowie in der Java-See gesammelten Decapoden und Stomatopoden, sechster (schluss-) Theil. *Zoologische Jahrbücher, Abtheilung fur Systematik, Geographie und Biologie der Thiere* 10: 677–708, pls. 28–38.

Man, J.G. de, 1902. Die von Herrn Professor Kükenthal im Indischen Archipel gesammelten Dekapoden und Stomatopoden (in) Kükenthal, W., Ergebnisse einer zoologischen Forschungsreise in den Molukken und Borneo. *Abhandlungen der Senckenbergischen naturforschenden Gesellschaft* 25: 467–929, pls. 19–27.

Manning, R.B., 1961a. A new deepwater species of *Lysiosquilla* (Crustacea: Stomatopoda) from the Gulf of Mexico. *Annals and Magazine of Natural History series* 13, 3: 693–697, pls. 10, 11.

Manning, R.B., 1961b. Stomatopod Crustacea from the Atlantic coast of northern South America. *Allan Hancock Atlantic Expedition, Report* 9: 1–46.

Manning, R.B., 1962a. Seven new species of stomatopod crustaceans from the northwestern Atlantic. *Proceedings of the Biological Society of Washington* 75: 215–222.

Manning, R.B., 1962b. *Alima hyalina* Leach, the pelagic larva of the stomatopod crustacean *Squilla alba* Bigelow. *Bulletin of Marine Science of the Gulf and Caribbean* 12(3): 496–507.

Manning, R.B., 1963a. A new species of *Lysiosquilla* (Crustacea, Stomatopoda) from the northern Straits of Florida. *Bulletin of Marine Science of the Gulf and Caribbean* 13(1): 54–57.

Manning, R.B., 1963b. Preliminary revision of the genera *Pseudosquilla* and *Lysiosquilla* with descriptions of six new genera. *Bulletin of Marine Science of the Gulf and Caribbean* 13(2): 308–328.

Manning, R.B., 1963c. *Hemisquilla ensigera* (Owen, 1832), an earlier name for *H. bigelowi* (Rathbun, 1910). *Crustaceana* 5(4): 315–317.

Manning, R.B., 1964. A new West American species of *Pseudosquilla* (Stomatopoda). *Crustaceana* 6(4): 303–308.

Manning, R.B., 1965. Stomatopoda from the collection of His Majesty The Emperor of Japan. *Crustaceana* 9(3): 249–262, pls. 11, 12.

Manning, R.B., 1966. Notes on some Australian and New Zealand stomatopod Crustacea, with an account of the species collected by the Fisheries Investigation Ship *Endeavour*. *Records of the Australian Museum* 27(4): 79–137, figs. 1–10.

Manning, R.B., 1967a. Stomatopoda in the Vanderbilt Marine Museum. *Crustaceana* 12(1): 101–106.

Manning, R.B., 1967b. Preliminary account of a new genus and a new family of Stomatopoda. *Crustaceana* 13(2): 238–239.

Manning, R.B., 1967c. Notes on the *demanii* section of the genus *Gonodactylus* Berthold with descriptions of three new species. *Proceedings of the United States National Museum* 123: 1–27.

Manning, R.B., 1967d. Review of the genus *Odontodactylus* (Crustacea: Stomatopoda). *Proceedings of the United States National Museum* 123: 1–35.

Manning, R.B., 1968a. Three new stomatopod crustaceans from the Indo-Malayan area. *Proceedings of the Biological Society of Washington* 81: 241–250.

Manning, R.B., 1968b. Stomatopod Crustacea from Madagascar. *Proceedings of the United States National Museum* 124: 1–61.

Manning, R.B., 1968c. A revision of the family Squillidae (Crustacea, Stomatopoda), with the description of eight new genera. *Bulletin of Marine Science* 18(1): 105–142.

Manning, R.B., 1969a. Notes on the stomatopod Crustacea from southern Africa. *Smithsonian Contributions to Zoology* 1: 1–17.

Manning, R.B., 1969b. A revision of the genus *Harpiosquilla* (Crustacea, Stomatopoda), with descriptions of three new species. *Smithsonian Contributions to Zoology* 36: 1–41.

Manning, R.B., 1969c. Stomatopod Crustacea of the western Atlantic. *Studies in Tropical Oceanography, Miami* vol. 8, pp. viii+380.

Manning, R.B., 1969d. Notes on the *Gonodactylus* section of the family Gonodactylidae (Crustacea, Stomatopoda), with descriptions of four new genera and a new species. *Proceedings of the Biological Society of Washington* 82: 143–166.

Manning, R.B., 1969e. The postlarvae and juvenile stages of two species of *Pseudosquillopsis* (Crustacea: Stomatopoda) from the Eastern Pacific region. *Proceedings of the Biological Society of Washington* 82: 525–538.

Manning, R.B., 1970a. Some stomatopod crustaceans from Tuléar, Madagascar. *Bulletin du Muséum national d'Histoire naturelle, Paris*, series 2, 41(6): 1429–1441 (dated 1969, published 1970).

Manning, R.B., 1970b. A new genus and species of stomatopod crustacean from Madagascar. *Bulletin du Muséum national d'Histoire naturelle, Paris*, series 2, 42(1): 206–209.

Manning, R.B., 1970c. Two new stomatopod crustaceans from Australia. *Records of the Australian Museum* 28(4): 77–85.

Manning, R.B., 1970d. The R/V Pillsbury deep-sea biological expedition to the Gulf of Guinea, 1964–65, 13: the stomatopod Crustacea. *Studies in Tropical Oceanography* 4(2): 256–275.

Manning, R.B., 1971a. Two new species of *Gonodactylus* (Crustacea, Stomatopoda) from Eniwetok Atoll, Pacific Ocean. *Proceedings of the Biological Society of Washington* 84: 73–80.

Manning, R.B., 1971b. Keys to the species of *Oratosquilla* (Crustacea: Stomatopoda), with descriptions of two new species. *Smithsonian Contributions to Zoology* 71: 1–16.

Manning, R.B., 1971c. *Lysiosquilla panamica*, a new species of stomatopod crustacean from the eastern Pacific region. *Proceedings of the Biological Society of Washington* 84: 225–230.

Manning, R.B., 1972a. Two new species of *Pseudosquilla* (Crustacea, Stomatopoda) from the Pacific Ocean. *American Museum Novitates* 2484: 1–11.

Manning, R.B., 1972b. Notes on some stomatopod Crustaceans from Peru. *Proceedings of the Biological Society of Washington* 85(24): 297–308.

Manning, R.B., 1972c. Stomatopod Crustacea. *Eastern Pacific Expeditions of the New York Zoological Society. Zoologica, New York* 56: 95–113 (dated 1971, published 1972).

Manning, R.B., 1973. Preliminary definition of a new genus of Stomatopoda. *Crustaceana* 23(3): 299–300.

Manning, R.B., 1974. A new stomatopod crustacean from Mauritius. *Revue Suisse de Zoologie* 81(1): 69–72.

Manning, R.B., 1975a. *Gonodactylus botti*, a new stomatopod crustacean from Indonesia. *Senckenbergiana Biologica* 56(4/6): 289–291.

Manning, R.B., 1975b. Two new species of the Indo-West Pacific genus *Chorisquilla* (Crustacea, Stomatopoda), with notes on *C. excavata* (Miers). *Proceedings of the Biological Society of Washington* 88: 253–261.

Manning, R.B., 1976a. Notes on some Eastern Pacific stomatopod Crustacea, with descriptions of a new genus and two new species of Lysiosquillidae. *Proceedings of the Biological Society of Washington* 89(16): 221–232.

Manning, R.B., 1976b. Redescriptions of *Oratosquilla indica* (Hansen), with accounts of a new genus and two new species (Crustacea, Stomatopoda). *Beaufortia* 25(318): 1–13.

Manning, R.B., 1977a. A monograph of the West African stomatopod Crustacea. *Atlantide Report* 12: 25–181.

Manning, R.B., 1977b. Preliminary accounts of five new genera of stomatopod crustaceans. *Proceedings of the Biological Society of Washington* 90(2): 420–423.

Manning, R.B., 1977c. Stomatopod Crustacea in the Muséum d'Histoire Naturelle, Geneva. *Revue Suisse de Zoologie* 84: 279–295.

Manning, R.B., 1978a. Notes on some species of the *Falcatus* group of *Gonodactylus* (Crustacea: Stomatopoda: Gonodactylidae). *Smithsonian Contributions to Zoogogy* 258: 1–15.

Manning, R.B., 1978b. Synopses of the Indo-West Pacific species of *Lysiosquilla* Dana, 1852 (Crustacea: Stomatopoda: Lysiosquillidae). *Smithsonian Contributions to Zoogogy* 259: 1–16.

Manning, R.B., 1978c. New and rare stomatopod Crustacea from the Indo-West Pacific region. *Smithsonian Contributions to Zoogogy* 264: 1–36.

Manning, R.B., 1978d. Further observations on *Oratosquilla*, with accounts of two new genera and nine new species (Crustacea: Stomatopoda: Squillidae). *Smithsonian Contributions to Zoogogy* 272: 1–44.

Manning, R.B., 1978e. A new genus of stomatopod crustacean from the Indo-West Pacific region. *Proceedings of the Biological Society of Washington* 91(1): 1–4.

Manning, R.B., 1979. Notes on two species of stomatopod Crustacea from Phuket Island, Thailand. *Proceedings of the Biological Society of Washington* 92(2): 394–398.

Manning, R.B., 1980a. *Pullosquilla thomassini* Manning, 1978, new to the Red Sea. Senckenbergiana Biologica 60(3/4): 269–270.

Manning, R.B., 1980b. The superfamilies, families, and genera of Recent Stomatopod Crustacea, with diagnoses of six new families. *Proceedings of the Biological Society of Washington* 93(2): 362–372.

Manning, R.B., 1980c. *Oratosquilla megalops*, a new stomatopod crustacean from Taiwan. *Proceedings of the Biological Society of Washington* 93(3): 523–524.

Manning, R.B., 1981a. Neotype selection for the stomatopod *Squilla chiragra* Fabricius, 1781. *Crustaceana* 40(2): 217–219.

Manning, R.B., 1981b. First record of *Kempina zanzibarica* (Chopra 1939) from the Red sea, with notes on *Lenisquilla gilesi* (Kemp 1911) (Crustacea: Stomatopoda). *Senckenbergiana Biologica* 61(3/4): 297–303.

Manning, R.B., 1984a. *Gonodactyloideus cracens* n. gen., n. sp., a new stomatopod crustacean from Western Australia. *The Beagle* 1(9): 83–86.

Manning, R.B., 1984b. *Crenatosquilla*, a new genus of stomatopod crustacean from the East Pacific. *Proceedings of the Biological Society of Washington* 97(1): 191–193.

Manning, R.B., 1989. Zoogeographical relationships of stomatopod Crustacea from the northern Arabian Sea. *Marine Science of the Arabian Sea Proceedings* 10: 113–119.

Manning, R.B., 1990a. Stomatopod Crustacea from the Persian Gulf, with the description of a new *Manningia*. *Steenstrupia* 16(6): 93–108.

Manning, R.B., 1990b. *Mortensenenus minus*, a new genus and species of coronidid stomatopod from Mauritius. *Journal of Crustacean Biology* 10(1): 162–164.

Manning, R.B., 1991. Stomatopod Crustacea collected by the *Galathea* Expedition, 1950–1952, with a list of Stomatopoda known from depths below 400 meters. *Smithsonian Contributions to Zoogogy* 521: 1–18.

Manning, R.B., 1995. Stomatopod Crustacea of Vietnam: the legacy of Raoul Serène. *Crustacean Research, Special No.* 4: 1–339. Kumamoto, Japan: The Carcinological Society of Japan, Shimoda Printing.

Manning, R.B., & A.J. Bruce, 1984. *Erythrosquilla megalops*, a remarkable new stomatopod from the western Indian Ocean. *Journal of Crustacean Biology* 4(2): 329–332.

Manning, R.B., & D.K. Camp, 1981. A review of the *Platysquilla* complex (Crustacea, Stomatopoda, Nannosquillidae), with the designation of two new genera. *Proceedings of the Biological Society of Washington* 94(2): 591–597.

Manning, R.B., & D.K. Camp, 1983. *Fennerosquilla*, a new genus of stomatopod crustacean from the northwestern Atlantic. *Proceedings of the Biological Society of Washington* 96(2): 317–322.

Manning, R.B., & D.K. Camp, 1993. Erythrosquilloidea, a new superfamily and Tetrasquillidae, a new family of stomatopod crustaceans. *Proceedings of the Biological Society of Washington* 106(1): 85–91.

Manning, R.B., & D.K. Camp, 2001. A new genus of stomatopod from the Caribbean Sea (Stomatopoda: Squillidae). *Journal of Crustacean Biology* 21(1): 202–204.

Manning, R.B., & F.A. Chace, 1990. Decapod and Stomatopod Crustacea from Ascension Island, South Atlantic Ocean. *Smithsonian Contributions to Zoogogy* 503: 1–91.

Manning, R.B., & T.-Y. Chan, 1997. The genus *Faughnia* from Taiwan, with the description of a new species (Stomatopoda: Parasquillidae). *Journal of Crustacean Biology* 17(3): 546–554.

Manning, R.B., & R.G. Garcia, 1982. Notes on species of *Coronidopsis* (Crustacea, Stomatopoda, Eurysquillidae). *Journal of Crustacean Biology* 2(4): 593–599.

Manning, R.B., & R. Heard, 1997. Stomatopod Crustaceans from the Carolinas and Georgia, Southeastern United States. *Gulf Research Reports* 9(4): 303–320.

Manning, R.B., R.K. Kropp & J. Dominguez, 1990. Biogeography of deep-sea Crustacea, family Bathysquillidae. *Progress in Oceanography* 24: 311–316.

Manning, R.B., & Ch. Lewinsohn, 1981. Selection of a Neotype for *Cancer falcatus* Forskål, 1775 (Stomatopoda). *Crustaceana* 41(3): 314–316.

Manning, R.B., & Ch. Lewinsohn, 1982. *Rissoides*, a new genus of stomatopod Crustacean from the East Atlantic and South Africa. *Proceedings of the Biological Society of Washington* 95(2): 352–353.

Manning, R.B., & Ch. Lewinsohn, 1986. Notes on some stomatopod Crustacea from the Sinai Peninsula, Red Sea. *Smithsonian Contributions to Zoogogy* 433: 1–19.

Manning, R.B., & R.R. Makarov, 1978. A new species of *Faughnia* from the western Indian Ocean (Crustacea, Stomatopoda). *Bulletin du Muséum national d'Histoire naturelle, Paris*, series 3, 520 (Zoologie 356): 517–523.

Manning, R.B., & A. Michel, 1973. *Harpiosquilla intermedia*, a new stomatopod Crustacean from New Caledonia. *Proceedings of the Biological Society of Washington* 86(9): 113–116.

Manning, R.B., & M.L. Reaka, 1981a. *Gonodactylus aloha*, a new stomatopod crustacean from the Hawaiian Islands. *Journal of Crustacean Biology* 1(2): 190–200.

Manning, R.B., & M.L. Reaka, 1981b. *Gonodactylus siamensis*, a new stomatopod crustacean from Thailand. *Proceedings of the Biological Society of Washington* 94(2): 479–482.

Manning, R.B., & M.L. Reaka, 1982. *Gonodactylus insularis*, a new stomatopod crustacean from Enewetak Atoll, Pacific Ocean. *Proceedings of the Biological Society of Washington* 95(2): 347–351.

Manning, R.B., & P. Struhsaker, 1976. Occurrence of the Caribbean stomatopod, *Bathysquilla microps*, off Hawaii, with additional records for *B. microps* and *B. crassispinosa*. *Proceedings of the Biological Society of Washington* 89(38): 439–450.

Martens, E. von, 1881. Squilliden aus dem Zoologische Museum in Berlin. *Sitzungs-Berichte des Gesellschaft Naturforschender zu Berlin* 1881: 91–94.

McNeill, F.A., 1926. The biology of North-West Islet, Capricorn Group, (J) Crustacea. *Australian Zoologist* 4(5): 299–318, figs. 1, 2, pl. XLI.

McNeill, F.A., 1968. Crustacea, Decapoda & Stomatopoda. *Scientific reports of the Great Barrier Reef Expedition 1928–29* 7(1): 1–98, pl. 1, 2. London: British Museum (Natural History).

Michel, A., 1970. Larves pélagiques et post-larves du genre *Odontodactylus* (Crustacés: Stomatopodes) dans le Pacifique tropical sud et équatorial. *Cahiers O.R.S.T.O.M., série Océanographie*, vol. VIII(2): 111–126, figs. 1–9.

Michel, A., & R.B. Manning, 1971. A new *Austrosquilla* (Stomatopoda) from the Marquesas Islands. *Crustaceana* 20(3): 237–240.

Miers, E.J., 1875. On some new or undescribed species of Crustacea from the Samoa Islands. *Annals and Magazine of Natural History*, series 4, 16: 341–344.

Miers, E.J., 1876. *Catalogue of the stalk- and sessile-eyed Crustacea of New Zealand*. London: E.W. Janson.

Miers, E.J., 1880. On the Squillidae. *Annals and Magazine of Natural History* 5: 1–30, 108–127.

Miers, E.J., 1881. On a collection of Crustacea made by Baron Hermann-Maltzam at Goree Island, Senegambia. *Annals and Magazine of Natural History* series 5, 8: 204–220, 259–281, 364–377.

Miers, E.J., 1884. Crustacea. In *Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert," 1881–2*, pp. 178–322, 513–575, pls. 18–35, 46–52.

Milne-Edwards, A., 1868. Observations sur la faune carcinologique des Iles du Cap Vert. *Nouvelles Archives du Muséum d'Histoire Naturelle, Paris*, 4: 49–69, pls. 16–18.

Milne-Edwards, A., 1878. Observations sur la faune carcinologique des Iles du Cap Vert. *Nouvelles Archives de Muséum d'Histoire Naturelle, Paris*, 4: 49–68, pls. 16–18.

Milne Edwards, H., 1837. *Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux* 2: 1–532. Atlas: 32pp, pls. 1–14, 14 bis, 15–25 bis, 26–42. Paris: Roret.

Moosa, M.K., 1973. The stomatopod Crustacea collected by the Mariel King memorial expedition in Malaku waters. *Marine Research in Indonesia* 13: 1–30.

Moosa, M.K., 1974. On a new and rare species of Stomatopoda (Crustacea) from Indonesian waters. *Treubia* 28(3): 73–82.

Moosa, M.K., 1975. Notes on stomatopod Crustacea from Seribu Islands and adjacent waters with a description of a new species. *Marine Research in Indonesia (Penelitian Laut di Indonesia)* 15: 1–20.

Moosa, M.K., 1982. *Faughnia serenei*, new species, a stomatopod from the South China Sea. *Journal of Crustacean Biology* 2(4): 600–604.

Moosa, M.K., 1986. Stomatopod Crustacea. Résultats du Campagnes MUSORSTOM I & II Philippines, 2. *Mémoires du Muséum national d'Histoire naturelle, Paris*, series A, Zoologie 133: 367–414 (dated 1985, printed 1986).

Moosa, M.K., 1989. Some stomatopods (Crustacea: Stomatopoda) from Japanese waters, with description of a new species. *Bulletin of the National Science Museum, Tokyo*, series A (Zoology) 15(4): 223–229.

Moosa, M.K., 1991. The Stomatopoda of New Caledonia and Chesterfield Islands. In *Le benthos des fonds meubles des lagons de Nouvelle-Calédonie*, ed. Richer de Forges, vol. 1, pp. 149–219. Paris: Editions de l'ORSTOM.

Moosa, M.K., & R. Cleva, 1984a. Sur une collection de Stomatopodes (Crustacea: Hoplocarida) provenant des iles Seychelles. *Bulletin du Muséum national d'Histoire naturelle, Paris*, series 4, 6(section A, no. 2): 421–429.

Moosa, M.K., & R. Cleva, 1984b. Stomatopod Crustacea collected by the mission Corindon II in the Makassar Strait, Indonesia. *Marine Research in Indonesia* 24: 73–82.

Moosa, M.K., & M.V. Erdmann, 1994. A survey of the distribution of Stomatopod Crustacea in the Spermonde Archipelago. *Proceedings of the International Symposium on Marine Research in the Spermonde Archipelago*, pp. 74–92.

Moreira, C., 1903. Campanhas de pesca de hiate Annie, dos Srs. Bandeira e Bravo. Estudos preliminaires. *Crustaceos Lavoura* 7(1–3): 1–14.

Müller, F., 1886. Zur Crustaceenfauna von Trincomali. *Verhandlungen der Naturforschenden Gesellschaft in Basel* 8(1): 470–479, pl. 4.

Naiyanetr, P., 1980. Stomatopoda of Thailand. *Chulalongkorn University, Bangkok*, pp. 1–95, 35 pls.

Naiyanetr, P., 1983. Two stomatopod crustaceans from the Gulf of Thailand with a key to the genus *Carinosquilla* Manning, 1968. *Senckenbergiana biologica* 63(5/6): 393–399 (dated 1982, printed 1983).

Naiyanetr, P., 1987. Two new stomatopod crustaceans from Thailand with a key to the genus *Manningia* Serène, 1962. *Crustaceana* 53(3): 237–242.

Naiyanetr, P., 1989. *Siamosquilla hyllebergi*, a new genus and new species of stomatopod crustacean from Thailand. In *Biology of Stomatopods. Selected symposia and monographs. U.Z.I.*, ed. E.A. Ferrero, vol. 3, pp. 281–284. Mucchi, Modena.

Naiyanetr, P., 1995. *Acanthosquilla sirindhorn* n.sp., a new mantis shrimp from Thailand (Stomatopoda, Nannosquillidae). *Crustaceana* 68(4): 409–417.

Naiyanetr, P., S.T. Ahyong & P.K.L. Ng, 2000. Reinstatement of *Carinosquilla thailandensis* Naiyanetr, 1983, with a first record of *Alima orientalis* Manning, 1978, from the Gulf of Thailand, and notes on *Cloridina pelamidae* (Blumstein, 1970) (Stomatopoda: Squillidae). *Crustaceana* 73(10): 1291–1295.

Ng, P.K.L., 1994. The citation of species names and the role of the author's name. *Raffles Bulletin of Zoology* 42(3): 509–513.

Nobili, G., 1899. Contribuzioni alla conoscenza della fauna carcinologica della Papuasia, della Molucche e dell'Australia. *Annali del Museo Civico di Storia Naturale Giacomo Doria, Genoa*, 40 (= series 2, 20): 230–282 (1–53 on separate).

Nobili, G., 1903. Contributo alla fauna carcinologica di Borneo. *Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino* 18(447): 27–32.

Nobili, G., 1904. Diagnoses préliminaires de vingthuit espèces nouvelles de Stomatopodes et Décapodes Macroures de la Mer Rouge. *Bulletin du Muséum d'Histoire Naturelle, Paris* 10: 228–237.

Nobili, G., 1906. Fauna Carcinologique de la Mer Rouge. Decapodes et Stomatopodes. *Annales des Sciences Naturelles, Zoologie et Paléontologie* (9)4: 1–347, pls. 1–11.

Odhner, T., 1923. Indopazifiche Stomatopoden. Göteborgs kungl. *Vetenskaps-och Vitterhets-Sämhalles Handlingar* 27(4): 1–16, pl.1.

Owen, R., 1832. Characters of some new species of stomatopus Crustacea collected by Mr Cuming. *Proceedings of the Zoological Society of London* 1832(2): 5–6.

Pfeffer, G., 1888. Übersicht der von Herrn Dr. Franz Stuhlmann in Ägypten, auf Sansibar und dem gegenüberliegenden Festlande gesammelten Reptilien, Amphibien, Fische, Mollusken und Krebse. *Mitteilungen aus dem Hamburgischen zoologische Museum und Institut* 6: 28–35.

Pocock, R.I., 1893. Report upon the stomatopod crustaceans obtained by P. W. Bassett-Smith, Esq., Surgeon R. N., during the cruise, in the Australian and China seas, of H.M.S. "Penguin," Commander W. U. Moore. *Annals and Magazine of Natural History*, series 6, 11: 473–479, pl. 20B.

Poupin, J., 1998. Crustacea Decapoda and Stomatopoda of French Polynesia. *Atoll Research Bulletin* 451: 1–62.

Rathbun, M.J., 1914. Stalk-eyed Crustaceans collected at the Monte Bello Islands. *Proceedings of the Zoological Society of London* 3: 653–664.

Reaka, M.L., & R.B. Manning, 1980. The distributional ecology and zoogeographical relationships of stomatopod Crustacea from Pacific Costa Rica. *Smithsonian Contributions to the Marine Sciences* 7: 1–29.

Reaka, M.L., & R.B. Manning, 1987. Stomatopod Crustacea of Enewetak Atoll. In *The Natural History of Enewetak Atoll, vol. 2: Biogeography and Systematics*, eds. D.M. Devaney *et al*., chapter 17, pp. 181–190. US Department of Energy.

Roux, P., 1828. *Crustacés de la Méditerranée et de son littoral. Paris and Marseille*. Pp. 176, pls. 1–45. (Pages not numbered but published in 9 parts: 1, 2 [pls. 1–10, 1828], 3 [pls. 11–15, 1829], 4–9 [pls. 10–45, 1830]).

Roxas, H.A., & E. Estampador, 1930. Stomatopoda of the Philippines. *Natural and Applied Science Bulletin, University of the Philippines* 1(1): 93–131.

Rumphius, G.E., 1705. *D'Amboinische Rariteitkamer*. Pp. 1–340, pls. 1–60. Amsterdam.

Say, T., 1817–1818. An account of the Crustacea of the United States. *Journal of the Academy of Natural Sciences of Philadelphia* 1(1–2): 57–63, 65–80 (plate 4), 97–101, 155–160, 161–169 (all for 1817), 235–253, 313–316, 374–380, 381–401, 423–441 (all for 1818).

Schmitt, W.L., 1931. Chinese Stomatopoda collected by S.F. Light. *Lingnan Science Journal* 8: 127–155 (dated 1929, printed 1931).

Schmitt, W.L., 1940. The stomatopods of the west coast of America, based on collections made by the Allan Hancock Expedition, 1933–38. *Allan Hancock Pacific Expeditions* 5(4): 129–225.

Schotte, M., & R.B. Manning, 1993. Stomatopod Crustacea from Tobago, West Indies. *Proceedings of the Biological Society of Washington* 106(3): 566–581.

Serène, R., 1950. Deux nouvelles espèces Indo Pacifiques de Stomatopodes. *Bulletin du Muséum national d'Histoire naturelle, Paris*, series 2, 22(5): 571–572.

Serène, R., 1951. Observations sur deux *Pseudosquilla* d'Indochine. *Treubia* 21(1): 11–25.

Serène, R., 1952. Étude d'une collection de Stomatopodes de l'Australian Museum du Sydney. *Records of the Australian Museum* 23(1): 1–24, pls. 1–3.

Serène, R., 1954. Observations biologiques sur les stomatopodes. *Mémoires de l'Institut Océanographique de Nhatrang* 8: 1–93, pls. 1–10.

Serène, R., 1962. Révision du genre *Pseudosquilla* (Stomatopoda) et définition de genres nouveaux. *Bulletin de l'Institut océanographique, Monaco* 1241: 1–27.

Shanbogue, S.L., 1986. Studies on stomatopod Crustacea from the seas around India. In *Recent Advances in Marine Biology (Dr. S. Jones 70th Birthday Commemoration Volume)*, ed. P.S.B.R. James, pp. 515–567. New Delhi: Today & Tomorrow's Printers & Publishers.

Smith, S.I., 1881. Preliminary notice of the Crustacea dredged, in 64 to 325 fathoms, off the south coast of New England, by the U.S. Fish Commission in 1880. *Proceedings of the United States National Museum* 3: 413–452.

Stephenson, W., 1952. Faunistic records from Queensland. Part I—General Introduction. Part II—Adult Stomatopoda (Crustacea). *Zoology Papers of the University of Queensland* I(1): 1–15.

Stephenson, W., 1953a. Notes on the Australian Stomatopoda (Crustacea) in the collections of the Queensland Museum. *Memoirs of the Queensland Museum* 13(1): 40–49.

Stephenson, W., 1953b. Three new Stomatopoda (Crustacea) from eastern Australia. *Australian Journal of Marine and Freshwater Research* 4(1): 201–218.

Stephenson, W., 1955. Notes on stomatopod Crustacea from Victoria and Tasmania. *Memoirs of the National Museum, Melbourne* 19: 1–4.

Stephenson, W., 1960. Notes on Queensland Stomatopoda (mantis prawns). *Queensland Naturalist* 16(3–4): 61.

Stephenson, W., 1962. Some interesting Stomatopoda—mostly from Western Australia. *Journal of the Royal Society of Western Australia* 45(2): 33–43.

Stephenson, W., 1967. A comparison of Australasian and American specimens of *Hemisquilla ensigera* (Owen, 1832) (Crustacea: Stomatopoda). *Proceedings of the United States National Museum* 120: 1–18.

Stephenson, W., & F. McNeill, 1955. The Australian Stomatopoda (Crustacea) in the collections of the Australian Museum, with a check list and key to the known Australian species. *Records of the Australian Museum* 23(5): 239–265.

Stimpson, W., 1857. On the Crustacea and Echinodermata of the Pacific shores of North America. *Boston Journal of Natural History* 6: 444–532, pls. 18–23.

Sun, X., & S. Yang, 1998. Studies on stomatopod Crustacea from Nansha Islands, China. Part 1, Protosquillidae and Pseudosquillidae, with descriptions of a new genus and two new species. Studies on marine fauna and flora and biogeography of the Nansha Islands and neighbouring waters. Vol. 3: 142–155.

Tate, R., 1883. Descriptions of some new species of *Squilla* from South Australia. *Transactions and Proceedings of the Royal Society of South Australia* 6: 48–53, pl. 2.

Tattersall, W.M., 1906. On the Leptostraca, Schizopoda and Stomatopoda collected by Professor Herdman, at Ceylon, in 1902. Supplementary Report XXXIII. In *Report to the Government of Ceylon on the Pearl Oyster Fisheries in the Gulf of Manaar*, ed. Herdman, 5: 157–188, pls. 1–3.

Thomson, G.M., 1882. Additions to the crustacean fauna of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 14: 230–238, pls. 17, 18.

Tirmizi, N.M., & Q.B. Kazmi, 1984. A handbook on the Pakistani mantis shrimp *Oratosquilla*. Centre of Excellence in Marine Biology Publication 4. University of Karachi, Pakistan. Pp, i–vi, 1–101.

Tirmizi, N.M., & R.B. Manning, 1968. Stomatopod Crustacea from West Pakistan. *Proceedings of the United States National Museum* 125: 1–48.

Tiwari, K.K., & S. Biswas, 1952. On two new species of the genus *Squilla* Fabr., with notes on other stomatopods in the collections of the Zoological Survey of India. *Records of the Indian Museum* 49(3–4): 349–363, figs. 1–5.

Tiwari, K.K., & H.C. Ghosh, 1973. Redescription of *Squilla bengalensis* Tiwari and Biswas (Crustacea: Stomatopoda). *Proceedings of the Zoological Society of Calcutta* 26(1): 33–37.

Townsley, S.J., 1953. Adult and larval stomatopod crustaceans occurring in Hawaiian waters. *Pacific Science* 7(4): 399–437.

Tuckey, J.K., 1817. See under Leach (1817–1818).

Tweedie, M.W.F., 1935. Two new species of *Squilla* from Malayan waters. *Bulletin of the Raffles Museum* 10: 45–52, pl. 1.

Tweedie, M.W.F., 1950. The fauna of the Cocos-Keeling Islands, Brachyura and Stomatopoda. *Bulletin of the Raffles Museum, Singapore* 22: 102–148.

Vis, C.W. de, 1883. Description of a species of a squill from Moreton Bay. *Proceedings of the Linnean Society of New South Wales* 7: 321–322.

Waterhouse, F.H., 1893. List of the Dates of Delivery of the Sheets of the "Proceedings" of the Zoological Society of London, from the commencement in 1830 to 1859 inclusive. In: May 2, 1893. Sir W.H. Flower, K.C.B., LL.D., F.R.S., President, in the Chair. *Proceedings of the Zoological Society of London* 1893, XXX: 436–440. (Cited in White [1849] below).

White, A., 1847. *List of the Species of Crustacea in the Collection of the British Museum, London*, pp. viii+143.

White, A., 1849. Description of two new species of Crustacea. *Proceedings of the Zoological Society of London* 15: 144, pl. 6 (also published in *The Annals and Magazine of Natural History*, series 2, 4: 381–382, 1849) (dates of publication fide Waterhouse [1893], dated 1848, printed 1849).

White, A., 1851. Descriptions of two species of Crustacea in the British Museum. *Proceedings of the Zoological Society of London* 18: 95–97, pls. 15, 16 (dated 1850, published 1851 [fide Waterhouse, 1893; Duncan, 1937]).

White, A., 1861. Descriptions of two species of Crustacea belonging to the families Callianassidae and Squillidae. *Proceedings of the Zoological Society of London* 1861: 42–44, pls. 6, 7.

Whitelegge, T., 1889. List of the marine and fresh-water invertebrate fauna of Port Jackson and the neighbourhood. *Journal of the Royal Society of New South Wales* 23: 163–323 (pp. 1–161 separate).

Whitelegge, T., 1900. Scientific results of the trawling expedition of H.M.C.S. Thetis, off the coast of New South Wales, in February and March, 1898, Part 1. *Memoirs of the Australian Museum* 4(2): 135–199.

Womersley, H.B.S., 1990. Biogeography of Australasian Marine Macroalgae. In *Biology of Marine Plants*, eds. M. Clayton & R. King, pp. 367–381. Melbourne: Longman Cheshire.

Wood-Mason, J., 1875. (On some new species of stomatopod Crustacea). *Proceedings of the Asiatic Society of Bengal* 1875: 231–232 (untitled).

Wood-Mason, J., 1895. Figures and descriptions of nine species of Squillidae from the collection in the Indian Museum. Calcutta, pp. 1–11.

Wood-Mason, J., & A. Alcock, 1891. Note on the result of the last season's deep-sea dredging, no. 21. Natural history notes from H.M. Indian Marine Survey steamer "Investigator," Commander R.F. Hoskyn, R.N., Commanding. *The Annals and Magazine of Natural History* 6, 7: 258–272.

Yamaguchi, T., & K. Baba, 1993. Crustacean specimens collected in Japan by Ph.F. von Siebold and H. Bürger and held by the Nationaal Natuurhistorisch Museum in Leiden and other museums. In *Ph.F. von Siebold and Natural History of Japan Crustacea*, ed. T. Yamaguchi. Kumamoto: The Carcinological Society of Japan. Shimoda Printing.

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Index to taxa

Pagination for the principal reference is bold, reference is also made to keys (italics), and to illustrations (*).