

Shallow-Water Pycnogonida
from the
Izu Peninsula, Japan

KOICHIRO NAKAMURA

and

C. ALLAN CHILD

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 386

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ABSTRACT

Nakamura, Koichiro, and C. Allan Child. Shallow-Water Pycnogonida from the Izu Peninsula, Japan. *Smithsonian Contributions to Zoology*, number 386, 71 pages, 21 figures, 1983.—The combination of three pycnogonid collections from shallow waters (mostly 7 to 30 meters) around the Izu Peninsula contains 52 described (and 2 undescribed) species, including 18 previously undescribed species and one new genus, *Chonothea*. The new species described are: *Achelia orpax*, *A. spatula*, *Ammothea spicula*, *Ammothella cymosa*, *Ascorhynchus fusticulum*, *A. okai*, *A. prosum*, *Chonothea hians*, *Cilunculus haradai*, *C. sekiguchii*, *Tanystylum nabetensis*, *Anoplodactylus carnatus*, *A. excelsus*, *A. lagenus*, *A. stellatus*, *Nymphon akane*, *Callipallene sagamiensis*, and *Pycnogonum uedai*. Previous literature on this locality is reviewed and the zoogeography of the species is discussed.

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Shallow-Water Pycnogonida from the Izu Peninsula, Japan

Koichiro Nakamura and C. Allan Child

Introduction

The Izu Peninsula of Honshu Island is bounded by Sagami Bay on the east and Suruga Bay on the west (Figure 1). The majority of over 7000 specimens of 52 described species in 17 genera reported here were collected at littoral and infralittoral (7 to 15 meters) depths at Nabeta Bay (Ohura or Ōura Bay on charts, 34°39'30"N, 138°56'40"E), in the vicinity of Shimoda, Sagami Bay. Sagami Bay is the most intensely studied body of water in Japan for its marine fauna. Yet, almost all of the reported work on pycnogonids has been about specimens taken by trawl and dredge from deeper waters (below 30 meters). Half of Utinomi's (1971:340) reports on 46 species in 17 genera from Sagami Bay and adjacent waters are from deeper waters. Very little work has been done on the littoral and infralittoral species inhabiting Sagami Bay or, for that matter, any other shallow-water area off Japan. This report brings together the records of a shallow-water (mostly from 7 to 15 meters) collection of pycnogonids taken over several years by the first author, while he was at the Shimoda Marine Research Center (SMRC) of the University of Tsukuba.

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HISTORICAL BACKGROUND.—As far as we can determine, Böhm (1879b) described the first pycnogonids of Japan from Enoshima at the head of Sagami Bay. These were *Ammothea hilgendorfi*, *Ascorhynchus ramipes*, and *Proprallene longiceps*. The same year, Slater (1879) described *Ascorhynchus auchenicum* and *Pycnogonum tenue* from different Japanese localities. In 1890, Ortmann described three new species, *Ascorhynchus cryptopygium* and *Anoplo-dactylus gestiens* from Sagami Bay, and *Nymphon japonicum* from Kyushu. Ives (1891) described *Ascorhynchus japonicum* from Sagami Bay and other Japanese localities. Loman's (1908) *Siboga* monograph listed eight new and three known species from Indonesia and adjacent localities, which have been found since to inhabit Japanese waters. In his only paper on Japanese pycnogonids, Loman (1911) figured and described *Achelia superba*, *Hedgpethia dofleini* (as *Colossendeis dofleini*), *Pycnogonum ungelatum*, and a possibly new but unnamed *Pallenopsis* species, which was not figured.

The first pycnogonid records that we have found published by Japanese zoologists are those of Shishido (1899), who extended distributions for the eight previously known Japanese species of Böhm (1879), Slater (1879), and Ortmann (1890). The second published records are apparently those of Fukui (1919) who lists Japanese distributions for 14 known species. Ohshima and Utinomi published the majority of subsequent Japanese works on pycnogonids, but almost no

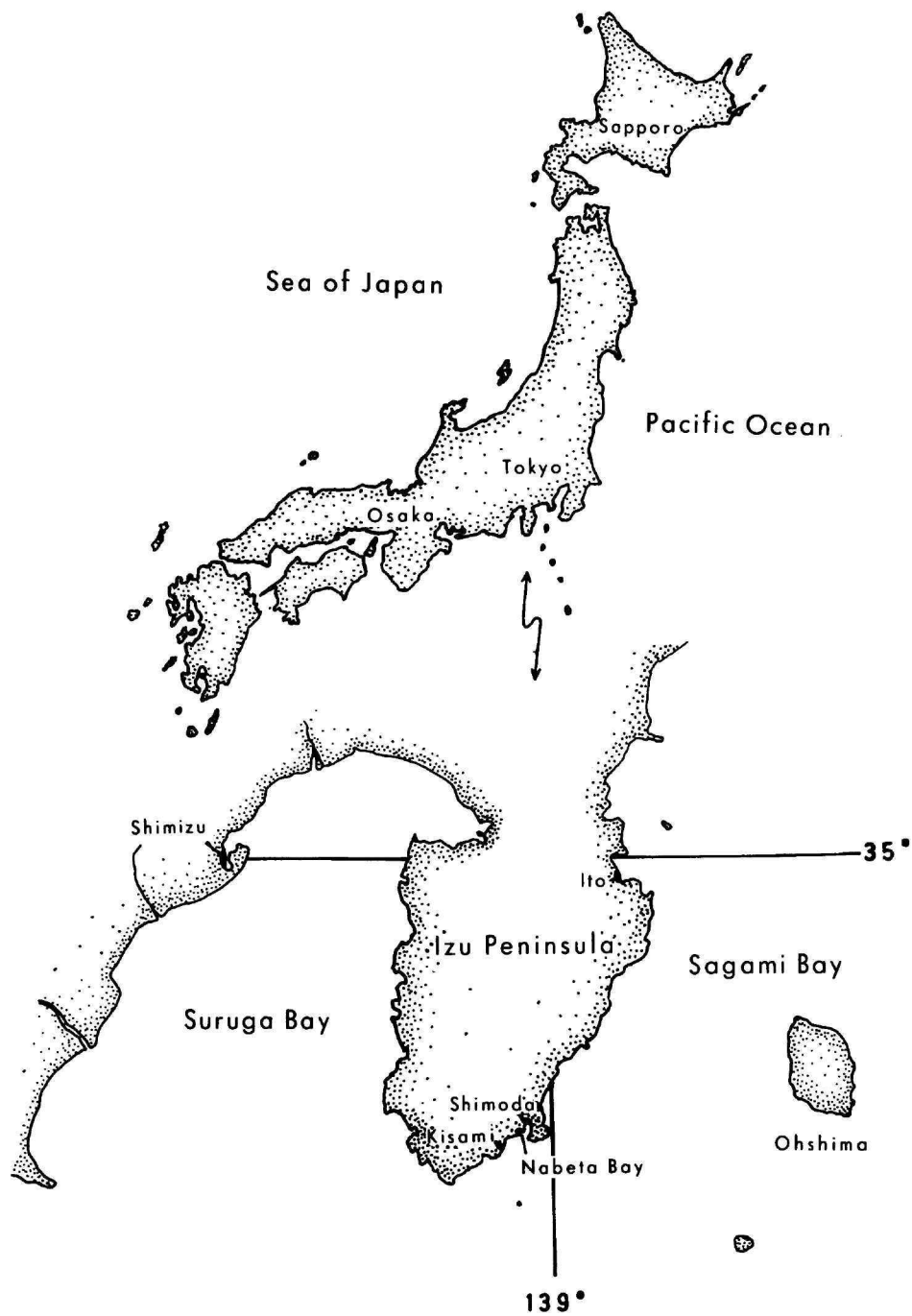


FIGURE 1.—The Japanese Islands with an enlargement of the Izu Peninsula showing the general collecting locality.

taxonomic work has been published since Utinomi's (1971) comprehensive resumé of Japanese shallow-water pycnogonida.

The more significant recent literature includes Hedgpeth's (1949) paper on mostly deeper water Japanese species collected by the American fisheries steamer *Albatross*, in which he described or listed three new and three known species from the vicinity of Izu Peninsula. Many later works by Stock (1953, and 1954 in particular) and Utinomi (1951, 1954, 1959, 1962, and especially 1971) enumerate the wealth of pycnogonids known from Sagami Bay and other Japanese waters.

CURRENT KNOWLEDGE AND ZOOGEOGRAPHY OF THE FAUNA.—Prior to this report and that of Nakamura and Child (1982), which is based on additional specimens of this same SMRC collection, 18 species in 11 genera of pycnogonids had been known from littoral and infralittoral (to 30 meters) localities of Sagami Bay. With the publication of these two papers, 29 species (with 1 unnamed and 8 new) in 13 genera are now known from the Sagami Bay shallows, an increase in species of 62 percent. In depths of 30 to 50 meters, there are now a total of 13 species known (1 unnamed and 7 new), and twelve species from below 50 meters are reported on here (with 6 of them being new). Many others known from the literature, however, were not found during this study. The new genus described herein is from the last depth category and was taken by the research vessel *Tansei Maru*. This vessel collected 10 of the new species found in the vicinity of the Izu Peninsula in depths from 37 to 336 meters.

With the majority of collecting efforts having been expended in Sagami Bay, it is not surprising that most of the 54 species in this report are recorded from there. Sagami Bay contains 39 of the species (including 2 unnamed) discussed in this report, and adjacent Suruga Bay has only an additional two. An additional 13 species are found in both bays. Perhaps more littoral and infralittoral collecting in Suruga Bay would raise the total number known from that bay, but it would be more likely to raise the total of the number shared by both bays. There are other

shallow-water species known from Japan, some of which can be expected to appear in future collections from Sagami and Suruga bays.

Utinomi (1971) lists only 5 species of the predominantly shallow-water genus *Anoplodactylus* from Japan, which is not surprising because of the paucity of reports on Japanese littoral and infralittoral pycnogonids. The present report adds 7 additional species to this list, 6 of which are new in the two reports (this report and Nakamura and Child, 1982) on the Shimoda collections. The one previously known species in the Shimoda collections, which is new to Japan, is *A. pulcher* Carpenter, which had a distribution pattern known only in the Indo-South Pacific (Madagascar to Western Australia and several localities inbetween). Only 3 of the 5 species recorded by Utinomi are reported here. A subspecies *Callipallene brevirostris novaezealandiae* (Thomson), shares this southern distribution and is recorded here from the North Pacific for the first time.

Three species previously known only from their type-localities are herein reported as new to Japan. These are *Anoropallene laysani* Child, known only from Laysan Island, Hawaii, *Callipallene panamensis* Child, from the Pacific coast of Panama, and *Propallene saengeri* Staples, from the Queensland coast of Australia. *Endeis mollis* (Carpenter), a pantropical species, has been recorded only as far north as the Ryukyu Islands, but is now known to inhabit the Shimoda area.

The most surprising extension of distribution is that of *Paranymphon spinosum* Caullery. This species was known only from the North Atlantic Ocean in depths of about 500 to 2000 meters (minimum recorded depth is 55 meters) and its capture in Sagami Bay at 113 meters presents another distributional anomaly, gaps which are often encountered in pycnogonid records.

There are 11 species reported here that are encountered only in Japan and can be considered endemic. This is not as great a percentage as it first appears when all of the deep-water species not reported here but known from Japan are considered along with those of the shallows. This number also does not include the 18 new species

treated here or the 3 reported in Nakamura and Child (1982). There are no known endemic genera except possibly *Chonothoa* described herein.

MATERIALS.—The materials used in this study originally comprised three groups, distinguished from each other by time and place of collection. The first group consisted of those specimens collected by one of us (KN) while gathering sufficient specimens for studies of *Propallene longiceps* in Nabeta Bay, near the Shimoda Marine Research Center of the University of Tsukuba, from 1969 to 1977. The second group was composed of those specimens collected by dredging by the senior author and H. Ueda near Shimoda. The third group was from Dr. Koichi Sekiguchi's collection taken off the Izu Peninsula by the research vessel *Tansei Maru* of the Ocean Research Institute of the University of Tokyo, in 1969 and 1971 (cruises KT69-12 and KT71-2). These three groups or collections are now considered together in this report and our earlier paper (Nakamura and Child, 1982).

All material in this report has been deposited in the National Museum of Natural History,

Smithsonian Institution, under catalog numbers of the former United States National Museum (USNM), except for certain suites of *Anoplodactylus perforatus*, *A. shimodaensis*, *Ascorhynchus utinomii*, *Propallene longiceps*, and a number of paratype specimens that have been retained by the senior author.

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PYCNOGONIDA

Key to the Japanese Families of Pycnogonida

(Adapted from Hedgpeth, 1948, and Child, 1979)

1. Chelifores and palps present; ovigers in both sexes 2
 Chelifores or palps, or both, lacking or greatly reduced; ovigers in both sexes or male only 4
- 2(1). Chelifores or chela, or both, vestigial (some achelate); palps of 1 segment or 5- to 10-segmented; ovigers from 7- to 10-segmented, with or without feeble strigilis and terminal claw, with simple or denticulate spines **AMMOTHEIDAE**
- Chelifores and chelae well developed, functional 3
- 3(2). Palps 5-segmented; oviger 10-segmented with strong strigilis, terminal claw and denticulate spines; propodus with auxiliary claws
 **NYMPHONIDAE**
- Palps lacking or 1-, 2-, or 4-segmented; oviger 10-segmented, with strong strigilis, simple or denticulate spines, without terminal claw; propodus with or without auxiliary claws **CALLIPALLENIDAE**
- 4(1). Palps 9-segmented: chelifores lacking; ovigers 10-segmented, in both sexes, with strong strigilis, terminal claw and spatulate spines; pro-

- podus without auxiliary claws **COLOSSENDEIDAE**
- Palps lacking; chelifores present or lacking; ovigers 6- to 9-segmented in male only; propodus with or without auxiliary claws 5
- 5(4). Chelifores present, functional; ovigers 6-segmented, lacking strigilis and terminal claw, with simple spines or setae; auxiliary claws lacking or tiny and weak **PHOXICHILIDIIDAE**
- Chelifores lacking 6
- 6(5). Body and legs slender (*Anoplodactylus*-like); ovigers 7-segmented, lacking strigilis and terminal claw, with simple spines or setae; strong auxiliary claws **ENDEIDAE**
- Body and legs stout, short, with or without reticulations; oviger 8- or 9-segmented, without strigilis, with terminal claw, simple or bifid spines; auxiliary claws present or lacking **PYCNOGONIDAE**

Family AMMOTHEIDAE Dohrn

Key to the Japanese Genera of Ammotheidae

(Adapted from Hedgpeth, 1948)

- 1. Body circular, discoidal or triangular, lateral processes touching or only narrowly separated distally; scape 1-segmented; palps 1- to 8-segmented 2
- Body more slender, lateral processes separated by half their width or widely separated; scape with 1 or 2 segments; palps 8- to 10-segmented 4
- 2(1). Palps 8-segmented; chela present but vestigial; proboscis long-oval or pyriform; first coxae usually with tall dorsodistal tubercles **Achelia**
- Palps with 5 to 7 segments or 1-segmented; chela lacking; proboscis conical or barrel-shaped; first coxae without dorsodistal tubercles 3
- 3(2). Body circular; palps with 5 to 7 segments; oviger with 10 segments; propodus with auxiliary claws **Tanystylum**
- Body triangular; palps 1-segmented; oviger 7-segmented; propodus lacking auxiliary claws **Chonothoa**, new genus
- 4(1). Chelifore scape 1-segmented, chela functional; palps 8- or 9-segmented (variable); lateral processes with very tall dorsodistal tubercles **Paranymphon**
- Chelifore scape 1- or 2-segmented, chela vestigial; palps 9- or 10-segmented; lateral processes with shorter dorsodistal tubercles or none 5
- 5(4). Chelifores implanted within anterior cephalic segment hood; oviger segment 2 longer than segment 4 **Cilunculus**
- Chelifores implanted in full view; oviger segment 2 equal to or shorter than segment 4 6
- 6(5). Palps 9-segmented; proboscis ovoid or a long cone; tall tubercles and long setae lacking; chelifores short, 2-segmented; abdomen short, blunt **Ammothea**

- Palps 9- or 10-segmented; proboscis pyriform; tall tubercles and long setae usually present; chelifores usually long, 2- or 3-segmented; abdomen long, usually pointed 7
- 7(6). Palps 10-segmented, first 2 segments tiny; chelifores 2-segmented, small, chelae vestigial; propodus without large heel spines and lacking auxiliary claws; trunk segments with large flaring posterior rims **Ascorhynchus**
- Palps 9-segmented; chelifores 3-segmented, long, chela vestigial; propodus with large heel spines and auxiliary claws; trunk segments without flaring posterior rims **Ammothella**

Genus *Achelia* Hodge, 1864

Key to the Japanese Species of *Achelia*

(For *A. segmentata*, see p. 12)

1. Trunk with tubercle on abdomen base, with or without median dorsal trunk tubercle; proboscis inflated, egg-shaped ***A. bituberculata***
Trunk without dorsal tubercles; proboscis variously shaped 2
- 2(1). Ocular tubercle tall; chelifores and palp second segment long, slender; lateral processes not touching ***A. superba***
Ocular tubercle low; chelifores and palps short; lateral processes touching 3
- 3(2). Lateral processes and appendages with long plumose or "feathered" spines ***A. orpax***, new species
Lateral processes and appendages with simple spines or setae 4
- 4(3). Ovipiger spines simple, spatulate, and blunt ***A. spatula***, new species
Ovipiger spines denticulate, with lateral serrations 5
- 5(4). Chelifore scape without distal tubercle; propodus heel with 2 strong spines ****A. kiiensis***
Chelifore scape with distal tubercle; propodus heel with 3 strong spines 6
- 6(5). Ocular tubercle taller than wide; chelifore scape longer than 3 times its width; 4 terminal palp segments conspicuously longer than wide; abdomen carried erect ***A. echinata sinensis***
Ocular tubercle wider than tall; chelifore scape shorter than 3 times its width; 4 terminal palp segments hardly longer than wide; abdomen carried horizontally ****A. alaskensis***

* Not discussed herein.

***Achelia bituberculata* Hedgpeth**

Achelia bituberculata Hedgpeth, 1949:287-289, fig. 41a-g.—
Stock, 1954:94-95, fig. 44.—Utinomi, 1962:97-99, fig. 4;
1971:329.

Achelia ohshimai Utinomi, 1951:163-166, fig. 2; 1954:18-20,
fig. 8; 1965:336, fig. 20; 1971:330 [new synonymy].

MATERIAL EXAMINED.—Sagami Bay: Nabeta
Bay, 22 Dec 1970 (1 juv); 19 Nov 1971 (1 juv); 8

Aug 1972 (1 juv); 15 Aug 1972 (1♀). Off Shimoda, 18 Aug 1973 (1♀).

REMARKS.—Examination of Hedgpeth's holotype (male) of *Achelia bituberculata* and comparison of it with our females and Utinomi's figures of *A. ohshimai* convinces us that all are of the same species. The literature has many good figures under both species designations with details of appendages and spines, but there is apparently enough variation in the median trunk tubercles and a few other lesser characters so that the two have received separate species designations until now. Hedgpeth's figures of the type are partly in error and do not include a lateral view. The holotype has a large tubercle forming the anterior base of the abdomen and a second large median tubercle directly anterior to the abdomen base. The chelifore scapes have two dorsal tubercles each, although they are not figured by Hedgpeth. The spines of all appendages are as figured by Stock (1954:95, fig. 44b), with rugosities over most of their length. These spines are also found on all appendages of *Achelia ohshimai*.

Utinomi (1962:98, fig. 4A) figured a male with a trifurcate median trunk tubercle for *A. bituberculata*, but figured specimens of both sexes of *A. ohshimai* without a median trunk tubercle except for one above the abdomen. This situation exists with the juveniles in hand. One has a small tubercle, but the others have none anterior to the one on the abdominal base. All have rugose spines on the appendages.

The characters that agree in both named species are numerous, particularly in the legs. The male third and fourth legs always have a long sexual pore tubercle on the second coxae ventrally, and both sexes have a long dorsodistal tubercle on the femur with a much smaller tubercle proximal to it; the tibiae have swollen areas bearing spines, and the terminal segments are very nearly alike in all specimens. Both have rugose spines, a tall anterior tubercle on the abdomen, small bispinose tubercles anterodistally on the lateral processes with single taller tubercles laterally to these, and a large very inflated proboscis. The ovigers all agree in the same sex, but the ovigers of most *Achelia* species are

strikingly similar except for size.

Hedgpeth's (1949:289) original description of the oviger and his figure 41b are in error in stating that the appendage has 9 segments instead of 10. He omitted the first segment and most of the second from the figure. They are subequal in length and shorter than the third segment.

The most variable character in all specimens is the median dorsal trunk tubercles which vary in size and shape, and may be present or absent. There is apparently always some form of tubercle at the base of the abdomen, but the tubercle just anterior to it may be missing or present, short or tall, multilobed, or simple. The leg tubercles also vary from specimen to specimen. There may be tall setose tubercles on the major leg segments or they may be low and rounded. Regardless of shape, they all have the rugose spine or spines.

The combined distribution and depths for the two previously designated species still confines *A. bituberculata* to an endemic Japanese range in shallow depths. It is now known from the Sea of Okhotsk off northern Hokkaido to central Honshu in depths from intertidal to 75 meters.

Achelia echinata sinensis Lou

Ammothea (Achelia) echinata var. *sinensis* Lou, 1936:19, figs. 7-9, pls. 2-4 [figures].

Achelia echinata sinensis.—Utinomi, 1971:328-329 [literature].

MATERIAL EXAMINED.—Sagami Bay: Off Shimoda, 18 Aug 1973 (1♂). Off Kisami, 26 Aug 1971 (1 juv). Nabeta Bay, 3 Oct 1969 (1 juv); 19 Dec 1969 (3 juv); 10 Jul 1970 (1♀); 22 Dec 1970 (4♂, 6♀, 12 juv); 11 Mar 1971 (1 juv); 20 May 1971 (1♂, 2♀, 1 juv); 30 Sep 1971 (1♂, 1 juv); 19 Nov 1971 (2♂, 2♀); 5 Feb 1972 (1♂, 1 juv); 3 Jun 1972 (1 juv); 8 Aug 1972 (2♂ with eggs, 2♂, 3♀); 15 Aug 1972 (1♂ with eggs, 1♂); 28 Aug 1972 (2 juv); 27 Jul 1973 (1♂, 1♀); 8 Aug 1973 (3♂, 3♀, 1 juv); 17 Aug 1973 (3♀); 26 Oct 1973 (2♂, 2♀); 3 Aug 1976 (1♀).

REMARKS.—It seems probable that there is only one subspecies of *Achelia echinata* inhabiting north-west Pacific seas. The wide variation shown by many species of this genus, including the subspe-

cies *sinensis*, has lead authors to propose at least three subspecific names for Far Eastern specimens of *A. echinata*. Perhaps enough variation could be found in a substantial series of each subspecies to call all of them the parent species without subspecific designations, thereby giving this species a cosmopolitan temperate distribution. This Far Eastern subspecies has a known distribution from northern China to Japan and the Russian Far Eastern shores. It has a rather wide depth range from the intertidal to 366 meters.

Stock (1965:14–15) suggested that *A. nana* may be synonymous with *A. echinata*. They are extremely close in most characters and may prove to be the same, showing as much variation as many other *Achelia* species. There appears to be almost nothing visible lying outside the scope of known variation with which to separate the two species. Our collections contain no recognizable *A. nana* from its known distributional range for use in comparison.

Achelia orpax, new species

FIGURE 2

Material Examined.—Sagami Bay: Off Shimoda, 8 Aug 1973 (1♀, holotype, USNM 183800).

DESCRIPTION.—Trunk compact, circular in outline, unsegmented. Lateral processes contiguous proximally, slightly separated distally, each armed with long dorsodistal tubercle bearing several barbed or feathered large spines laterally and distally. Cephalic segment with tubercles over chelifore insertion, armed with feathered spines. Ocular tubercle at extreme anterior of cephalic segment, more than twice as tall as its diameter, rounded distally, with tiny apical cone. Eyes darkly pigmented, placed at tip of ocular tubercle. Proboscis large, barrel-shaped, subequal in length to trunk. Abdomen long, extending to second coxae tips of fourth legs, armed with several pairs of large feathered spines and several small distal setae.

Chelifore scape long, slightly curved, armed with many dorsal and lateral long feathered spines and several short distal setae, spines more than twice as long as segment diameter. Chela

globular, without fingers, armed with single lateral feathered spine.

Palp 8-segmented, second and fourth segments subequal in length, armed with short feathered spines distally. Four terminal segments only slightly longer than wide, armed with many short feathered spines laterally and ventrally. Palp spines shorter than segment diameter.

Oviger 10-segmented, segments short, seventh and eighth armed with single dorsodistal seta. Strigilis weak, armed with denticulate spines in the formula 2: 2: 3: 2, each with 5 or 6 lateral serrations.

Legs moderately stout. Third leg, first coxa armed with dorsolateral feathered spines and tall dorsodistal tubercle armed with several feathered spines. Second coxa armed with several lateral and many ventrodistal feathered spines. Third coxa armed with several short ventral setae and fringe of long feathered spines distally. Femur equal to tibia 1 in length, inflated, armed with 6 dorsal and many ventral and distal feathered spines of various lengths. Both tibiae armed with many long dorsal and dorsolateral feathered spines and a few lateral and ventral setae. Tarsus short, quadrangular, armed with several ventral setae and a single dorsal seta. Propodus slender, well curved, armed with 3 large heel spines, 7 or 8 small sole spines, 3 dorsodistal feathered spines and several short dorsal and lateral setae. Claw half propodal length, well curved. Auxiliaries about two-thirds main claw length.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 1.04; trunk width, 1.09; proboscis length, 1.01; abdomen length, 0.92; third leg, coxa 1, 0.37; coxa 2, 0.46; coxa 3, 0.4; femur, 0.96; tibia 1, 0.97; tibia 2, 0.67; tarsus, 0.14; propodus, 0.6; claw, 0.3.

ETYMOLOGY.—The specific name *orpax* is from the Greek and means a sapling or young shoot, in reference to the many feathered spines covering much of this species.

DISTRIBUTION.—Known only from the type-locality off Shimoda, Izu Peninsula, in 30 meters.

REMARKS.—Among the many *Achelia* species inhabiting the rim of the north Pacific Ocean, *Achelia orpax* appears to be most closely related to

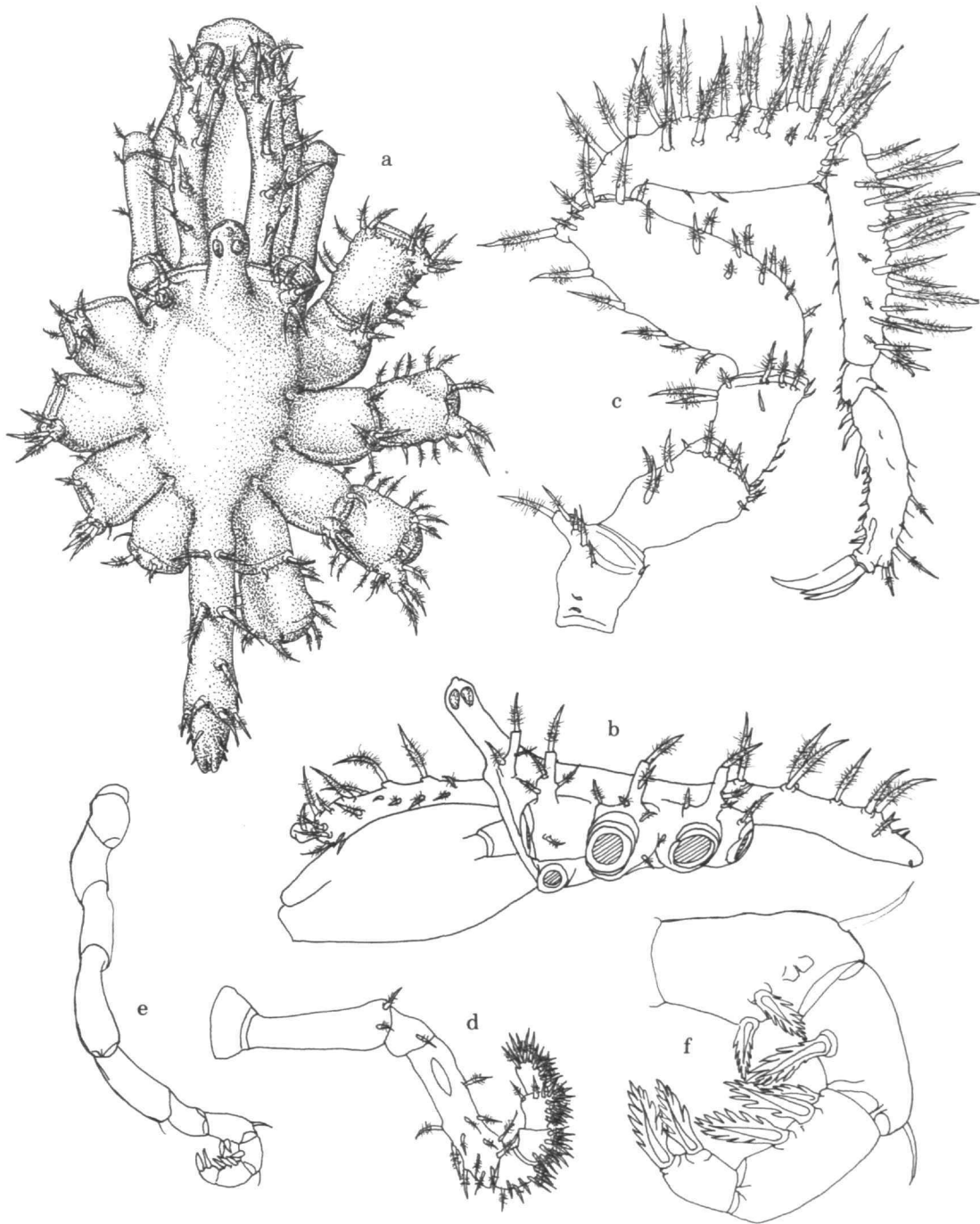


FIGURE 2.—*Achelia orpax*, new species, holotype, female: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, third leg; *d*, palp; *e*, oviger; *f*, oviger strigilis, enlarged.

Achelia kurilensis Losina-Losinsky, 1961. Many species of *Achelia* have a tall lateral process and coxa 1 tubercles, but *A. orpax* appears to be unique in the many feathered spines on these tubercles. With the new species, *A. kurilensis* shares the characters of many long spines on the lateral processes and appendages, legs with similar shape and segment lengths, a long curved propodus with both main claw and the auxiliaries of similar length, similar trunk and proboscis shape, and female ovigers of similar segment lengths. Unfortunately the male of *A. orpax* is unknown. The two species differ markedly in the palp which, in *A. orpax* is much shorter in all segments, and has a very dense growth of short feathered spines on its ventrodiscal surface. The abdomen and ocular tubercle are both fairly long in the two species, but those of *A. orpax* are longer and the abdomen and chelifores have many more feathered spines. No other northern Pacific species has so many long spines dorsally nor are they feathered as in *A. orpax*.

Achelia spatula, new species

FIGURE 3

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 23 Aug 1971 (1♂, holotype, USNM 183801).

DESCRIPTION.—Trunk compact, circular in outline, unsegmented. Lateral processes contiguous, each armed with low anterodistal and posterodistal tubercle bearing single short setae. Anterior rim of cephalic segment armed with similar lateral tubercles, without setae. Ocular tubercle cylindrical, almost twice as tall as maximum diameter, with conical apex. Eyes large, darkly pigmented. Proboscis stout, barrel-shaped, lips large, separated by laterodistal cleft. Abdomen arising from posterior trunk bulge, carried horizontally (length and setae arrangement, if any, unknown, posterior part missing).

Chelifore large, club-shaped. Scape 1-segmented, robust, swollen distally, armed with several distal setae. Chela small, carried anaxially, no longer than wide, finger represented by slight crease distally.

Palp 8-segmented, second segment longest, sub-

equal to fourth, terminal 4 segments no longer than twice their diameters. All segments except first armed with very few setae and short spatulate spines.

Oviger 10-segmented, third segment longest, slightly longer than subequal second and fourth. Terminal segments increasingly shorter distally, armed with 5 ectal spatulate spines on seventh segment, 2 short endal spatulate spines on terminal 3 segments and 2 ectal setae on eighth segment. Without denticulate spines. Spatulate spines flattened distally, with rounded tips.

Legs moderately stout. First coxae armed with 1 low anterodistal tubercle and 1 taller dorsodistal tubercle, each with setae, and from 2 to 5 lateral setae. Second coxa of posterior 4 legs with genital spur almost equal in length to segment diameter, armed distally with 2 or 3 setae, coxae armed with several lateral and distal setae. Third coxa armed with 3 proximoventral setae, 1 or 2 lateral setae and several distal setae. Femur armed with very few lateral and distal setae and short dorso-distal tubercle bearing short setae and extremely tiny cement gland tube. First tibia armed with few dorsal setae and dorsodistal tubercle longer than that of femur, armed with few distal setae. Second tibia with few dorsal setae, without distal tubercle. First tibia the longest segment, femur shorter, second tibia shortest of major segments. Tarsus short, quadrangular, armed with several ventral spatulate spines and one dorsal spatulate spine. Propodus robust, moderately curved, with dorsodistal tubercle bearing spatulate spines. Heel armed with 3 broad spines, sole with 12 to 14 short spines. Dorsal surface armed with 5 or 6 short spatulate spines. Claw robust, almost half propodal length. Auxiliary claws slender, slightly over half main claw length.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 1.86; trunk width, 1.8; proboscis length, 1.58; abdomen length, unknown, damaged; 4th leg, coxa 1, 0.66; coxa 2, 0.96; coxa 3, 0.68; femur, 1.76; tibia 1, 1.93; tibia 2, 1.7; tarsus, 0.2; propodus, 1.08; claw, 0.5.

ETYMOLOGY.—The specific name *spatula* is derived from the Latin diminutive of *spatha* (a broad flat tool or blade) and refers to the spatulate

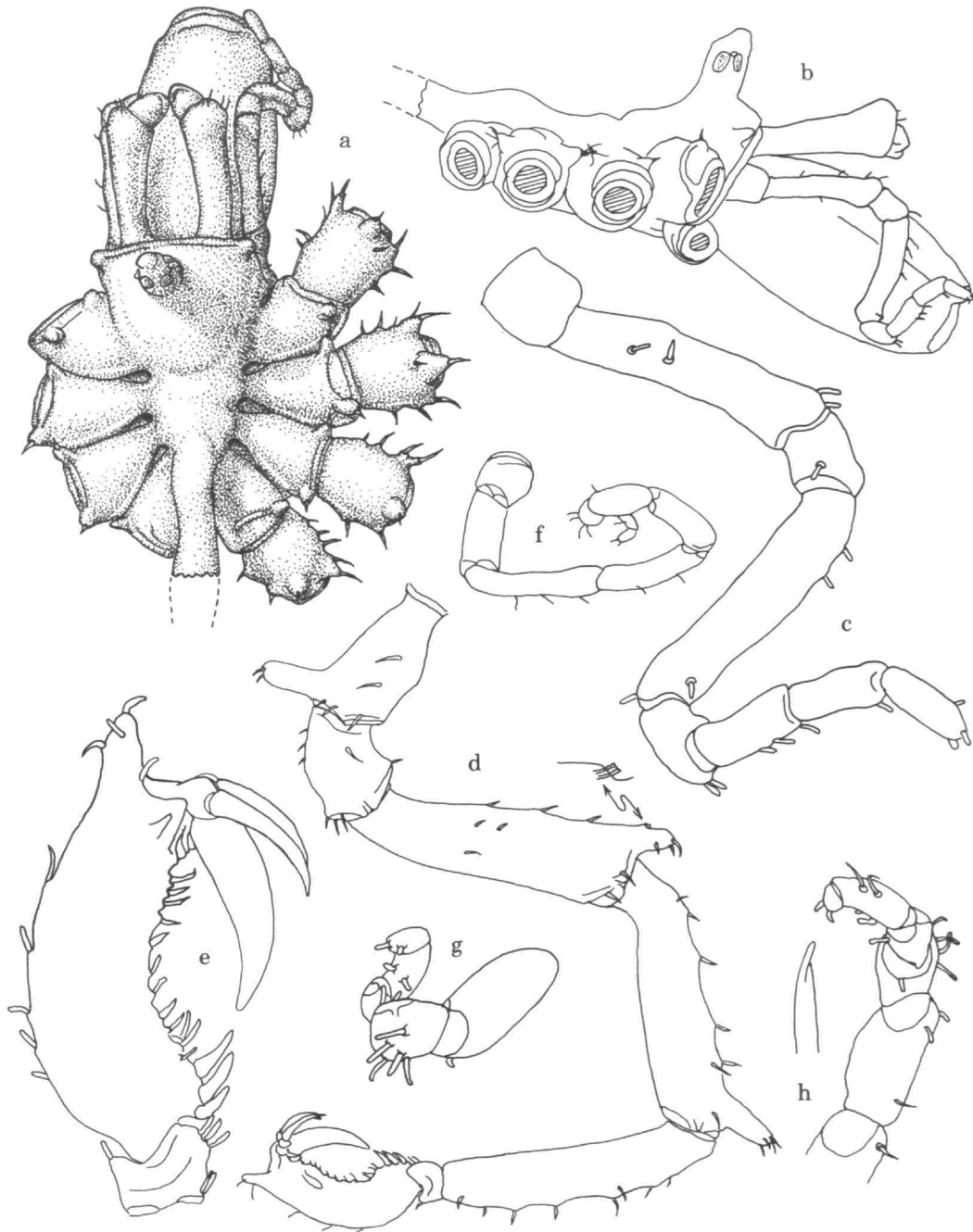


FIGURE 3.—*Achelia spatula*, new species, holotype, male: a, trunk, dorsal view; b, trunk, lateral view; c, palp; d, third leg, with enlargement of femoral cement gland; e, terminal segments of third leg, enlarged; f, oviger; g, oviger strigilis, enlarged; h, oviger strigilis in dorsal view, with enlargement of a spine.

spines on most appendages of this new species, particularly those of the palps and ovigers.

DISTRIBUTION.—Known only from the type-locality in Nabeta Bay, Izu Peninsula, in 7 to 15 meters.

REMARKS.—This species resembles *Achelia bituberculata* Hedgpeth, *A. harrietae* Marcus, 1940 (= *A. discoidea* Exline), and *A. spinoseta* (Hilton, 1939). It shares with these three species, the same trunk configuration, robust legs with large genital tubercles on the posterior four legs and a tiny cement gland situated on a dorsodistal femur tubercle, and similar lateral process tubercles. It differs from *A. bituberculata* in lacking a tubercle at the abdominal base and it has large tubercles on the first coxae, which are absent in *A. bituberculata*. The chelifores in this new species are also much larger than those of Hedgpeth's species.

Achelia harrietae has bulbous tubercles on the lateral processes and first coxae along with many more spines on these appendages. The legs are longer in each segment, the chelifores shorter and armed with a dorsodistal tubercle, and the ocular tubercle is placed at the anterior rim of the cephalic segment. These characters are all somewhat different in *A. spatula*. Hilton's species, *A. spinoseta*, differs from the new species in having much shorter chelifores, a much shorter ocular tubercle, a more bulbous proboscis, terminal palp segments with ventral lobes, and many more setae on the legs. All three of these species differ from *A. spatula*, as do all known Pacific species, in lacking the characteristic spatulate spines on appendages, particularly the ovigers where the other species have spines with various patterns of denticulation on their sides. All similarly placed spines of *A. spatula* are of a simple spatula shape.

Achelia superba (Loman)

Ammonothea superba Loman, 1911:11–12, figs. 14–24.

Achelia superba.—Utinomi, 1971:328 [literature].

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 5 (4♂, 4♀, 3 juv).

Sagami Bay: *Tansei Maru* cruise KT71-2, sta 29 (2♂, 3♀). Off Shimoda, 8 Aug 1973 (4♂, 5♀).

REMARKS.—The depths of 290 to 300 meters reported at station 29 are apparently the deepest at which this species has ever been taken. Utinomi (1971:328) summarized the known depth range as being from 40 to 180 meters. The species is endemic to Japan and the Russian Far Eastern island of Sakhalin.

At first glance, the species appears very much like an *Ammonothea* with its slender trunk and appendages, tall ocular tubercle and abdomen, well separated lateral processes, and slender proboscis; but its 2-segmented chelifores, oviger configuration, and lack of a tall tubular femoral cement gland on each male leg show that it is indeed a species of *Achelia*.

Achelia species indeterminate

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 28 Aug 1972 (1♀).

REMARKS.—This single female is probably *Achelia echinata sinensis*, but differs in the following respects from that subspecies: the chelifores are shorter and broader, the lateral process and coxae tubercles are much smaller and less conspicuous, the leg tubercles are fewer and less pronounced, the main claws are shorter, and the oviger sixth segment does not have a large proximally pointing spine. The specimen is otherwise very similar to *A. echinata sinensis*.

Genus *Ammonothea* Leach, 1814

Achelia segmentata Utinomi (1954:20–22, fig. 9) from Hokkaido appears to have more characters of the genus *Ammonothea* than those of *Achelia*, but since the seven recorded specimens of *A. segmentata* all lack ovigers, the species may have to be placed in another known or new genus when more is understood concerning the morphology of both sexes. Utinomi's specimens (recorded as females) may all be juveniles, but the chelae appear fully atrophied in his holotype. This is a characteristic of adults in *Achelia* and some species of *Ammonothea*. This species will be omitted from keys to both these genera until its taxonomic position is better established.

Key to the Japanese Species of *Ammothea*

1. Chelifore 1-segmented, without chela (proboscis ovoid, blunt to flat at tip; integument smooth) *A. hilgendorfi*
- Chelifore 2-segmented, with vestigial chela 2
- 2(1). Proboscis ovoid, rounded at tip; integument slightly granular; trunk long, lateral processes well separated **A. hedgpethi*
- Proboscis conical, slender, pointed at tip; integument with conical papillae; trunk short, compact; lateral processes almost touching ...
..... *A. spicula*, new species

* Not discussed herein.

Ammothea hilgendorfi (Böhm)

Corniger Hilgendorfi Böhm, 1879a:187, pl. 2: figs. 3-3d.
Lecythorhynchus Hilgendorfi Böhm, 1879c:140.—Utinomi, 1971: 336 [literature].
Ammothea hilgendorfi.—Stock, 1956:43, 45.—Child, 1979:8.

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 21 (1♀). Nabeta Bay, 3 Oct 1969 (1 juv); 19 Dec 1969 (3 juv); 10 Jul 1970 (1♀, 1 juv); 30 Oct 1970 (1 juv); 22 Dec 1970 (1♂ with eggs, 2♀, 16 juv); 26 Nov 1970 (1♂ with eggs, 1♀, 3 juv), 19 Jan 1971 (2♂, 2♀, 3 juv); 11 Mar 1971 (2 juv); 20 May 1971 (1♂, 3 juv); 8 Aug 1972 (1♀, 1 juv); 15 Aug 1972 (2 juv), 28 Aug 1972 (2 juv), 27 Jul 1973 (1♀), 17 Aug 1973 (1♀, 1 juv), 26 Oct 1973 (1♀, 1 juv).

REMARKS.—Adults of this species are easily recognized in having a slender chelifore scape but no chela in any form.

This is a common littoral and shallow-water pycnogonid of the North Pacific Ocean. In the Americas, it has been found as far south as Baja California, Mexico, and in the Far East, along the China coast. There are also records of its capture in the Society and Hawaiian islands. There are many collections from Sagami Bay.

Ammothea spicula, new species

FIGURE 4

Material Examined.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 17 (1 juv, paratype, USNM 183803). *Tansei Maru* cruise KT71-2, sta 23 (1♀, holotype, USNM 183802).

DESCRIPTION OF HOLOTYPE.—All protruding surfaces of integument armed with tiny sharply conical papillae. Trunk oval in outline, completely segmented, with three low median dorsal swellings. Lateral processes equal to or slightly longer than their diameters, separated by less than half their diameters. Ocular tubercle moderately short, subequal to its diameter in length, with a conical apex. Eyes small, darkly pigmented, placed distally. Proboscis a long tapering cone, almost as long as trunk, slightly curved ventrally, rounded at tip, mouth tiny. Abdomen erect, short, cylindrical, tapering toward tip, slightly longer than 1.5 times basal width.

Chelifore short, robust. Scape 1-segmented, swollen dorsodistally, armed with 1 or 2 dorsodistal setae. Chela globular, as long as wide, armed with single middorsal seta, fingers represented by distal cleft.

Palp 9-segmented, basal segment small, shorter than its diameter. Fourth segment longest, terminal 5 segments consecutively shorter, armed with ventral setae not as long as segment diameter.

Oviger 10-segmented, basal segment moderately large, over 1.5 times longer than its diameter. Second segment longest, slightly longer than fifth. Third and fourth subequal. Second to sixth segments armed with small ectal and lateral setae. Seventh segment armed with field of short distal setae, eighth with 3 ectal setae, ninth with 1 endal seta, and terminal segment with 1 bifurcate endal spine and 1 distal seta.

Legs slender, armed with very few, mostly dor-

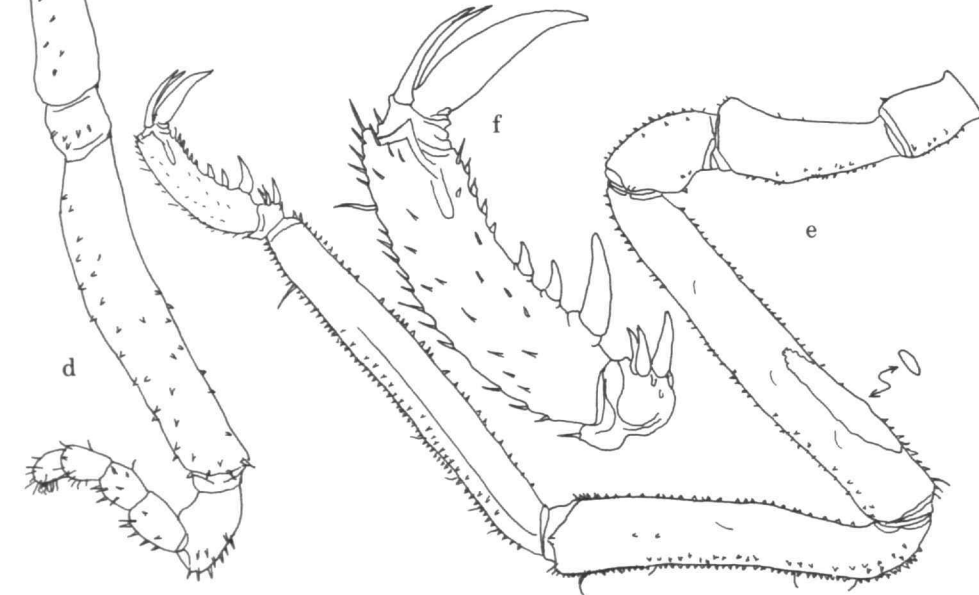
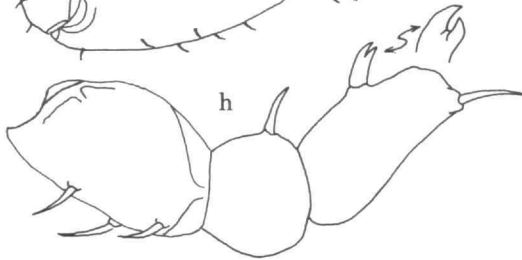
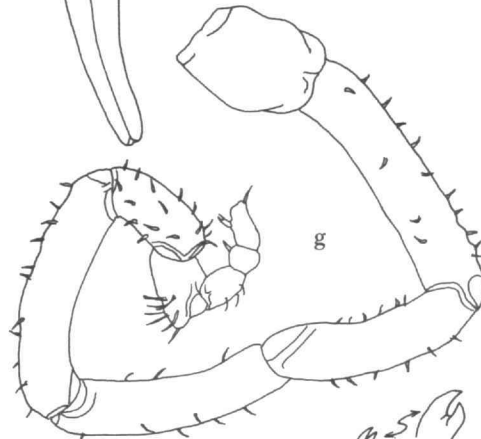
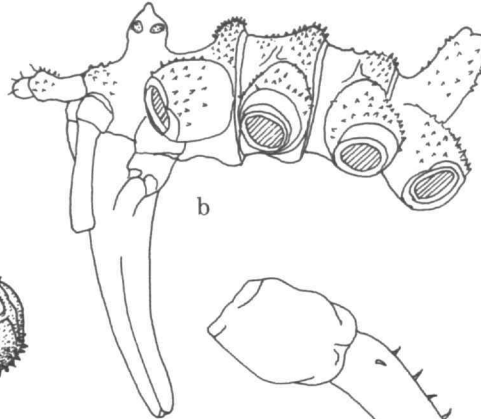
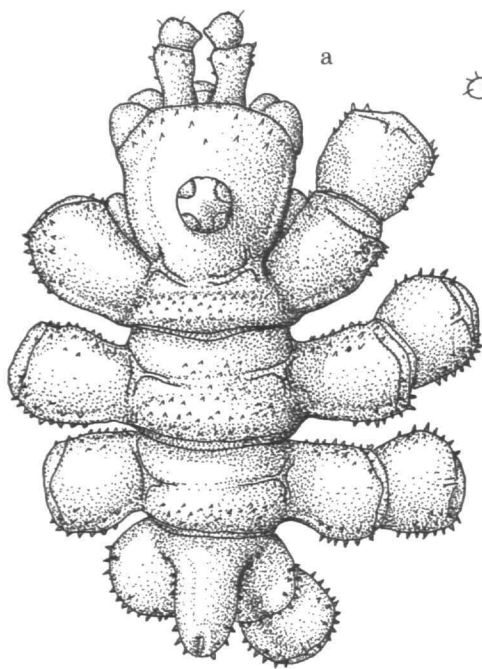


FIGURE 4.—*Ammothea spicula*, new species, holotype, female: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, chelifore, enlarged; *d*, palp; *e*, third leg, with enlargement of femoral cement gland pore; *f*, terminal segments of third leg, enlarged; *g*, oviger; *h*, terminal three segments of oviger, enlarged, with further enlargement of bifurcate spine.

sodistal, setae. Second coxa with slight ventrodistal genital spur. Femur longest, with cement gland placed at 0.75 dorsodistally of segment length, opening a pore on barely discernible swelling. Second tibia longer than first. Tarsus short, armed with 1 large spine and 2 distal shorter spines on ventral surface, 1 short seta on dorsal surface. Propodus slightly curved, armed with many dorsal and lateral short setae, 1 large heel spine proximally and 2 shorter heel spines in a row distally, and several very small sole spines. Claw robust, slightly over half propodal length. Auxiliary claws long, slender, about 0.6 length of main claw.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 2.04; trunk width, 1.63; proboscis length, 1.72; abdomen length, 0.5; third leg, coxa 1, 0.47; coxa 2, 1.06; coxa 3, 0.68; femur, 2.52; tibia 1, 2.09; tibia 2, 2.34; tarsus, 0.18; propodus, 0.8; claw, 0.43.

ETYMOLOGY.—The specific name *spicula* is the Latin diminutive of *spica* (little sharp point) and refers to the many little sharp points covering the

exposed surfaces on the integument.

DISTRIBUTION.—Known only from the type-locality in western Sagami Bay, in 50 to 170 meters.

REMARKS.—There are, as far as we can determine, three known species of *Ammothea* having narrow downturned or styliform proboscides. These are *A. stylirostris* Gordon, 1932, *A. longispina* Gordon, 1932, and *A. striata* (Möbius, 1902), all of which inhabit the Antarctic. All other known species have variously inflated, bulbous, or ovoid proboscides lacking any hint of styliform shape.

The new species is much smaller than any of the three Antarctic species and lacks the characteristic median dorsal trunk tubercles of the three, having only low inflated areas where these tubercles would be. The oviger terminal segments are quite different between the new species and the three Antarctic species, and none of the latter has the single bifurcated spine on the terminal oviger segment found in *A. spicula*. There are numerous other differences in segment lengths and spination, and apparently no other species of *Ammothea* has its integument covered nearly to this degree with the tiny spikes as those found on *A. spicula*.

Clark (1977:174–176), in his review of the genus as found in the southern hemisphere, gives a key to adults of the genus. This new species can be traced as far as couplet 11, where it would be placed between *A. longispina* and *A. stylirostris*.

Genus *Ammothella* Verrill, 1900

Key to the Japanese Species of *Ammothella*

(For *A. profunda*, see p. 32)

1. Propodus with vestigial or without primary claw, auxiliary claws short, very curved **A. biunguiculata**
Propodus with long gently curved primary and auxiliary claws 2
- 2(1). Trunk lateral processes glabrous; appendages with many long blunt tubular spines; cement gland an exposed long tube **A. indica**
Trunk lateral processes with many lateral rough-surfaced spines; appendages with many long pointed spines, without blunt spines; cement gland within a tall truncated cone ... **A. cymosa**, new species

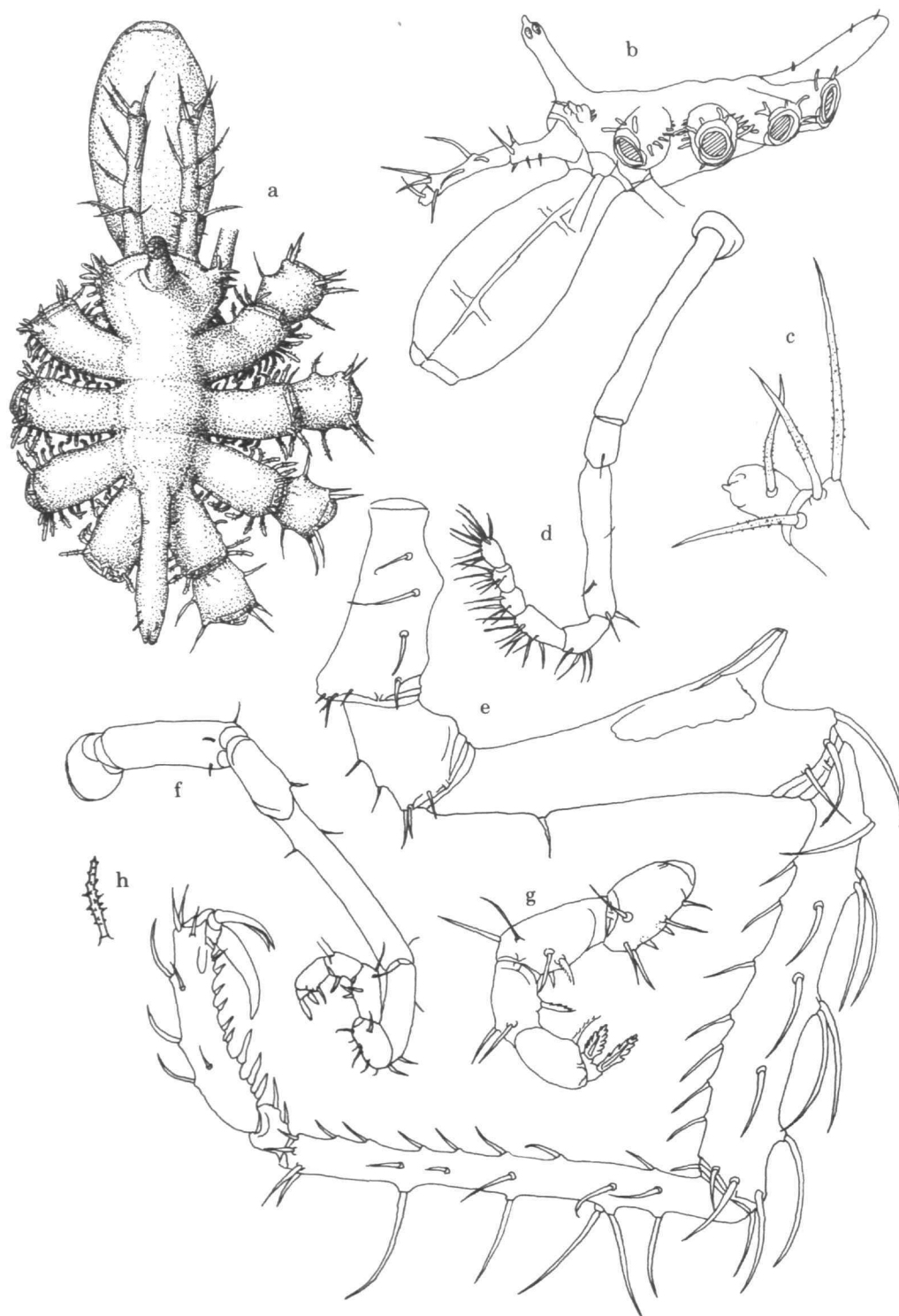


FIGURE 5.—*Ammothella cymosa*, new species, holotype, male: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, distal part of chelifore, enlarged; *d*, palp; *e*, third leg; *f*, oviger; *g*, oviger strigilis, enlarged; *h*, lateral process spine, enlarged.

Ammothella biunguiculata (Dohrn)

Ammothella biunguiculata Dohrn, 1881:158, pl. 8, figs. 1-3.

Ammothella biunguiculata.—Stock, 1974:12-13, fig. 1 [literature].—Munilla, 1978:8-9 [list], 44 [text].

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 26 Oct 1973 (1♀).

REMARKS.—This is a cosmopolitan warm shallow-water species. The scarcity of this species in the many collecting records from Nabeta Bay and from Sagami Bay itself, suggests that this area may mark the approximate northern limit of its Japanese distribution. This specimen represents the northernmost Japanese record. It is quite common in the shallows around Kyushu and the Japanese Inland Sea.

This species is easily recognized by its lack of a propodal main claw and the two very curved auxiliary claws.

Ammothella cymosa, new species

FIGURE 5

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 23 (1♂, holotype, USNM 183804).

DESCRIPTION.—Trunk robust, oval in outline, unsegmented. Lateral processes separated by less than their diameters, twice as long as their diameters, armed with several dorsodistal and many lateral complex spines bearing pointed papillae. Spines distally blunt. Anterolateral corner of ocular segment armed with multilobed tubercle armed with papillose spines. Ocular tubercle long, over 3 times longer than diameter, rounded at tip which bears a small papilla or knob. Eyes at tip of ocular tubercle, small, darkly pigmented. Proboscis inflated, without constrictions, almost as long as trunk. Oral surface and lips flat. Abdomen moderately short, reaching just beyond tips of first coxae of posterior pair of legs, armed with few middorsal spines and distal setae.

Chelifere slender, scape 2-segmented, basal segment about half length of distal segment, both segments armed with several long papillose spines and few setae. Longest spines measure over twice segment diameter. Chela small, vestigial, slightly

longer than wide, armed with single long dorso-lateral spine bearing papillae. Finger represented by tiny lateral tubercle.

Palp 9-segmented, second segment longest, third and fourth armed with few setae, terminal 5 segments with many ventral setae longer than segment diameters. Terminal segments cylindrical and ovoid, increasingly shorter in length distally.

Oviger 10-segmented, basal segment small, not longer than wide. Second segment armed with few distal setae. Fourth segment longest, slightly longer than second, armed with few lateral setae. Terminal segments increasingly shorter to tenth, which is wider than long. Sixth segment armed with 2 short endal spines, several endal setae, and 2 lateral setae. Seventh armed with 4 distal setae and 2 compound spines, eighth with 2 distal setae and 1 endal compound spine, ninth with 1 endal compound spine, and tenth with 2 compound spines. Spines with 5 or 6 serrations per side.

Legs moderately slender. First coxa armed with single lateral papillose spine and 4 or 5 dorsodistal papillose spines. Second coxa with low middorsal swelling and short genital spur armed with several small setae, and 3 or 4 long simple spines laterally. Third coxa slightly longer than first coxa, armed with 2 ventral and several ventrodorsal setae. Femur armed with single ventral and few long dorsodistal setae without rugosities. Cement gland a large distally pointing truncate cone slightly shorter than segment diameter, placed at 0.75 the dorsal segment length. Gland a large opaque area beneath the cone emptying through tube placed dorsally within cone. First tibia the longest major segment, slightly longer than tibia 2, which is a little longer than femur. Both tibiae armed with many long dorsal and lateral simple spines and a row of shorter ventral spines, some dorsal spines longer than twice segment diameter. Tarsus triangular, armed with 2 ventral spines. Propodus slightly curved, moderately long, without heel but with 3 large heel spines. Sole armed with 5 or 6 short spines and 2 distal setae. Dorsal surface with 3 spines equal in length to segment diameter and several lateral and distal setae. Claw robust, nearly half propodus length, auxi-

liaries slender, over half main claw length.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 1.44; trunk width, 1.34; proboscis length, 1.25; abdomen length, 0.64; third leg, coxa 1, 0.29; coxa 2, 0.51; coxa 3, 0.33; femur, 1.08; tibia 1, 1.2; tibia 2, 1.18; tarsus, 0.12; propodus, 0.58; claw, 0.25.

ETYMOLOGY.—The Latin specific name *cymosa* (full of shoots) refers to the many shoot-like lateral spines almost covering the sides of each lateral process.

DISTRIBUTION.—Known only from the type-locality in western Sagami Bay, in 256 meters.

REMARKS.—This new species has many similarities to, and may be a synonym of one of, the two Russian Far Eastern species, *Ammothella pilosa* and *A. rostrata*, of Losina-Losinsky (1961:101–105, figs. 22, 23), who gives diagrammatic rather than precise figures for her new species. The three species share the many lateral process spines, tall ocular tubercles, similar chelifore configuration and spination, a cement gland of similar size, shape and placement, and similar palps and terminal leg segments. We believe that the diagrammatic figures show sufficient differences from *A. cymosa* to warrant establishing it as a separate species, at least until it can be compared with specimens of *A. pilosa* and *A. rostrata*.

The new species differs from *A. pilosa* principally in having a shorter fifth oviger segment, fewer leg spines, and shorter spines on the ventral leg surface, a much shorter abdomen extending only as far as the distal end of coxa 1 on the posterior legs, shorter propodus with less spination, and shorter claws. The anterolateral corners of the cephalic segment on *A. pilosa* have a very long spine in the place where the multilobed tubercles are found in *A. cymosa*, and the proboscis of the latter is much less inflated.

The new species differs from *A. rostrata* in having much shorter dorsodistal lateral process spines in the male than are shown in Losina-Losinsky's (1961) figure 23A. The tubercles on the anterolateral corners of the cephalic segment of *A. rostrata* are very tall and the abdomen is very much longer, the legs are less spinose, having fewer of the long spines than *A. cymosa*. Losina-Losinsky

does not figure the male oviger of her new species and the oviger figured for the female is so diagrammatic as to be useless.

The cement gland habitus is unusual for all three of these species. The usual cement gland in *Ammothella* is a naked tube placed almost at the dorsodistal tip of the femur and is not enclosed within a cone or other form of tubercle. The cement glands of these species are placed more proximally than the tubular type and all appear to be housed in a conical tubercle. This is more in keeping with the cement glands of many species in the genus *Ascorhynchus*, some of which are figured in this report. This cement gland similarity in some of the species of *Ammothella*, is closer systematically to *Ascorhynchus*. This latter genus, on the other hand, is characterized by two distinct forms of cement gland: the single raised conical or tubercular gland on the femur dorsal surface, and the multiple cement glands of many species situated on the posterior surface as flat pores. It is possible that in the future this gross difference in cement gland configuration may serve as a good subgeneric distinction between the two groups of *Ascorhynchus*.

Ammothella indica Stock

Ammothella indica Stock, 1954:113, figs. 54–56c, 57a–c.—Uti-nomi, 1971:331 [literature].

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 13 Aug 1970 (1♀); 30 Oct 1970 (1♀); 22 Dec 1970 (1♂, 1♀, 1 juv); 20 May 1971 (1♂); 19 Jun 1971 (1♀); 14 Jul 1971 (2♂); 19 Nov 1971 (1♀); 5 Feb 1972 (1 juv), 27 Jul 1973 (1♀); 3 Aug 1976 (1♀). Off Shimoda, 8 Aug 1973 (1♂).

REMARKS.—This Indo-Pacific shallow-water species is similar to several *Ammothella* species: *A. appendiculata* and its possible junior synonym *A. rugulosa*, and *A. pacifica*, *A. setacea*, and possibly *A. spinifera* and *A. symbius*. In all of these species, the trunk and appendages are similar in gross appearance and all of these species have characteristic long blunt spines, sometimes called "clubbed" spines. Fortunately for taxonomists, the number and placement of these spines differs

markedly among most species, along with other characters which contribute to the validity of each.

This species has been reported previously from Enoshima, Sagami Bay, by Utinomi (1959:203, figs. 2-3), from an unknown depth.

Genus *Ascorhynchus* Sars, 1877

Key to the Japanese Species of *Ascorhynchus*

(Adapted from Stock, 1953:304-305)

1. Longitarsal group: tarsus of posterior six legs more than half as long as propodus 2
 Brachytarsal group: tarsus of posterior six legs shorter than half the propodus 7
- 2(1). Chelifore scape 2-segmented; animal size large, leg span 5 to 10 cm or more ***A. japonicum**
 Chelifore scape 1-segmented; animal size smaller, leg span 5 cm or less 3
- 3(2). Trunk without median row of tubercles 4
 Trunk with median row of tubercles 6
- 4(3). First pair of legs without trace of claws **A. ramipes**
 First pair of legs with claws, however small 5
- 5(4). First pair of legs with minute claws; ovigers implanted partly at base of ocular tubercle **A. utinomii**
 First pair of legs with claws longer than segment diameter; ovigers implanted behind ocular tubercle **A. glaberrimum**
- 6(3). Ocular tubercle at anterior of short first trunk segment; tarsus very short, *Ammothella*-like ***A. tuberosum**
 Ocular tubercle at midpoint of long first trunk segment; tarsus slightly longer than propodus, cylindrical **A. auchenicum**
- 7(1). Lateral processes with many small spinose lateral tubercles, without dorsodistal tubercles **A. fusticulum**, new species
 Lateral processes with few tiny spinose lateral tubercles or without, with dorsodistal tubercles 8
- 8(7). Ocular tubercle short; tarsus of posterior legs almost half length of propodus, both with short setae only; abdomen carried ventrally **A. cryptopygium**
 Ocular tubercle tall; tarsus of all legs about 0.33 propodal length, both with some setae longer than segment diameter; abdomen carried horizontally or slightly erect 9
- 9(8). Ocular tubercle bulbous at tip, anterior-pointing; femur length equal to second tibia **A. prosum**, new species
 Ocular tubercle pointed at tip, erect; femur shorter than second tibia **A. okai**, new species

* Not discussed herein.

***Ascorhynchus auchenicum* (Slater)**

Parazetes auchenicus Slater, 1879:281-283.

Ascorhynchus auchenicum.—Utinomi, 1971:332 [literature].

Ascorhynchus glabroides Ortmann, 1890:160-161, pl. 24: figs. 3a, b.—Utinomi, 1971:333 [literature].

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 5 (2♂ with eggs, 4♀, 5 juv).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 9 (1♂, 1♀); sta 14 (2 juv), sta 21 (5♂ with eggs, 2♂, 8♀). *Tansei Maru* cruise KT71-2, sta 29 (1♂, 1♀). Off Kisami, 22 May 1970 (5♀, 3 juv); 1 Nov 1970 (1♀, 5 juv).

REMARKS.—Comparison of several female specimens of *Ascorhynchus auchenicum* in this collection with a single female of *A. glabroides* in the USNM collections reported on by Hedgpeth (1949:293), convinces us that the two species are synonymous. The figures given by Ortmann are at best diagrammatic and any other adequate figures of *A. glabroides* have never been published. The two differences often cited in literature as distinguishing these two species are abdomen length and claw length on the fourth pair of legs. Hedgpeth (1949:293) stated that "the abdomen reaches to about the middle of the second coxae of the last pair of legs." In fact, the abdomen of his specimen only extends to about half the length of the first coxae of the last pair of legs, as does the abdomen of *A. auchenicum*. The claw on the fourth pair of legs is slightly shorter for *A. glabroides* than for *A. auchenicum*, the claw-propodus length ratio being about 1:4 for the former and 1:3 for the latter. There is some variability in this length ratio for the several specimens examined of *A. auchenicum*, but claw length differences have never been a valid single criterion for retention of a species. We could find no other significant differences in the two species except that the single *A. glabroides* is slightly larger than the specimens of *A. auchenicum*. We therefore unite the two species, both of which have been reported from Sagami Bay among other Indo-Pacific localities.

***Ascorhynchus cryptopygium* Ortmann**

Ascorhynchus cryptopygium Ortmann, 1890:159, pl. 24, fig. 2.—Utinomi, 1971:333 [literature].

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 5 (1♂, 1♀).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 9 (1♂ with eggs); sta 21 (27♂ with eggs, 11♂, 66♀, 21 juv). *Tansei Maru* cruise KT71-2, sta 29 (1♂ with eggs, 1♂-deformed, 9♀).

REMARKS.—The male without eggs from station 29 has a curious deformity. The right oviger is normal, but the left oviger is represented only by a tiny bud of several segments placed ventrally anterior to the cephalic tubercle. The other oviger is placed normally, behind the tubercle.

The two specimens from station 5 are apparently the first recorded from outside Sagami Bay. All previous records of this species have been confined to Sagami Bay, but further collecting along the coast of Honshu should produce more specimens of this fairly common pycnogonid. The specimens from Suruga Bay extend the known depths of 110 to 274 meters recorded for this species into slightly shallower waters of 75 meters.

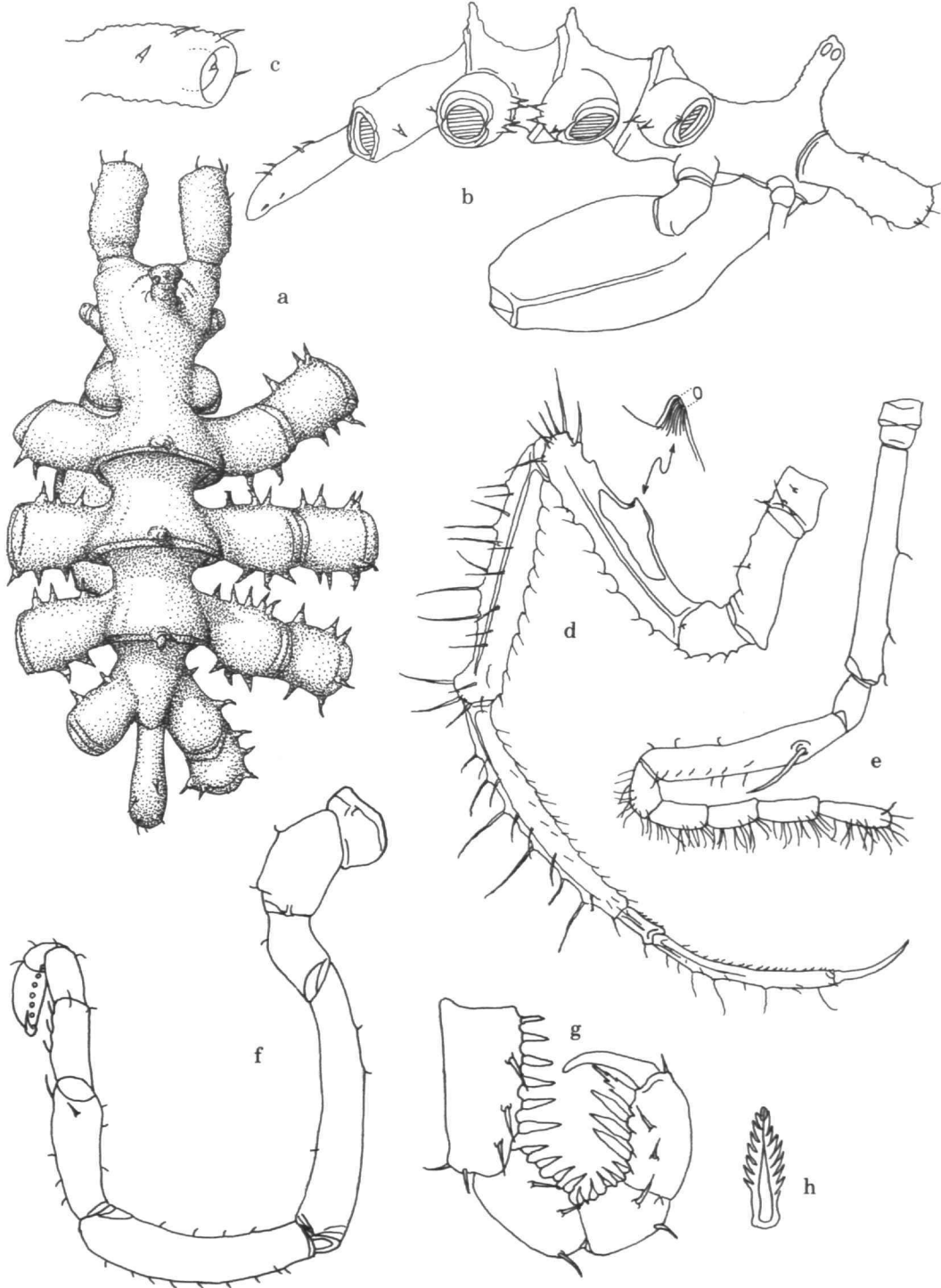
***Ascorhynchus fusticulum*, new species**

FIGURE 6

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 5 (1♂, holotype, USNM 183805).

DESCRIPTION.—Trunk robust, compact oval in outline, fully segmented, with 3 slender median dorsal tubercles. Lateral processes separated by less than their diameters, slightly longer than maximum diameters, without dorsodistal tubercles, but armed with 1 to 5 lateral tubercles each with short spine at tip, in the following order: first lateral processes with 3 posteriorly, second with 3 anterior and 3 posterior, third with 3 to 5 anterior and 2 or 3 posterior, fourth with 1 or 2 anterior and none posterior. Ocular tubercle at anterior of short neck, about 3 times taller than its diameter, rounded at tip, small lightly pigmented eyes placed distally. Proboscis stout, al-

FIGURE 6.—*Ascorhynchus fusticulum*, new species, holotype, male: a, trunk, dorsal view; b, trunk, lateral view; c, chelifore, enlarged; d, third leg, with enlargement of femoral cement gland; e, palp; f, oviger; g, strigilis of oviger, enlarged; h, oviger denticulate spine, enlarged.



most 0.66 of trunk length, with 1 proximal constriction, oral surface large, flat. Abdomen moderately long, reaching midlength of second coxae of posterior pair of legs, slightly inflated distally, armed with several short lateral and dorsoposterior setae.

Chelifore scape robust, club-shaped, with slightly papillose surface, armed with few lateral, ventral, and distal setae. Chela tiny, bulbous, inserted within concave scape tip. Fingers atrophied, represented by a slight distal cleft.

Palp 10-segmented, basal 2 segments very short, not as long as wide. Third segment longest, slightly longer than fifth. Fifth armed with several short distal setae and 1 long lateral spine, longer than twice segment diameter. Terminal 5 segments almost equal except tenth, which is slightly longer, each armed with many ventral setae slightly longer than segment diameter.

Oviger 10-segmented, basal segment wider than long, fourth segment longest, slightly longer than fifth, both armed with short endal and ectal setae. Sixth segment half length of fifth, armed with several short lateral and distal setae. Strigilis segments each armed with several lateral and distal setae and endal denticulate spines in the formula 6 : 4 : 4 : 5, spines having 8 or 9 denticulations per side. Terminal claw moderately curved, slender, without serrations, not as long as terminal segment.

Legs slender, moderately short, brachytarsal. Coxa 1 with 2 dorsodistal setae and 2 to 4 short lateral tubercles each with stout spine. Second coxa with very small unarmed genital spur. Third coxa with row of ventral short setae on tiny tubercles. Femur subequal in length to second tibia, both shorter than first tibia, all armed with row of short ventral setae on tiny tubercles. Femur with 2 long dorsodistal spines and several dorso-lateral shorter spines. Cement gland a large mid-dorsal sack beneath a raised rectangular tubercle housing the tiny gland pore dorsodistally on posterior 6 legs only. First and second tibiae armed with row of long lateral setae and several dorsal setae of different lengths, some on tubercles, longest setae twice segment diameter. Tarsus short,

rectangular, armed with several short ventral spines and 1 dorsodistal seta. Propodus long, slender, almost 4 times length of tarsus, armed with row of short sole spines, without heel or longer heel spines, and bearing several short and long dorsal setae. Claw slender, moderately curved, almost half length of propodus.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 1.92; trunk width, 1.18; proboscis length (laterally), 1.24; abdomen length, 0.69; third leg, coxa 1, 0.35; coxa 2, 0.66; coxa 3, 0.36; femur, 1.22; tibia 1, 1.38; tibia 2, 1.21; tarsus, 0.24; propodus, 0.91; claw, 0.44.

ETYMOLOGY.—The specific name *fusticulum* is the Latin diminutive of *fustis* (knotty club or bludgeon) and is in reference to the knotty club-shaped chelifores of this new species.

DISTRIBUTION.—Known only from the type-locality, eastern Suruga Bay, off Izu Peninsula, in 75 to 85 meters.

REMARKS.—This short-limbed robust new species is comparable to very few of the known North Pacific species of *Ascorhynchus*. Most species are graceful slender long-legged forms of the same or slightly larger size (excepting *A. japonicum*, which is huge in comparison). The anterior terminal leg segments differ in length from those of the remaining posterior six legs; the terminal leg segments are all alike in this new species. Of the brachytarsal species known in the North Pacific, *A. fusticulum* shows similarities to the other two new species described, *A. okai* and *A. prosum*. It is similar to *A. prosum* in leg size, shape and spination, the cement gland, oviger, palp, and long ocular tubercle. It differs from *A. prosum* in having from three to five lateral tubercles on the lateral processes instead of one, shorter and more slender median trunk tubercles, no dorsodistal lateral process tubercles, much heavier chelifore scapes, a shorter abdomen, and a much shorter and less curved propodus.

Ascorhynchus fusticulum differs from *A. okai* in lacking any form of dorsodistal lateral process tubercles and in having a longer ocular tubercle, lateral tubercles on the lateral processes, a larger raised femoral cement gland tubercle, and oviger

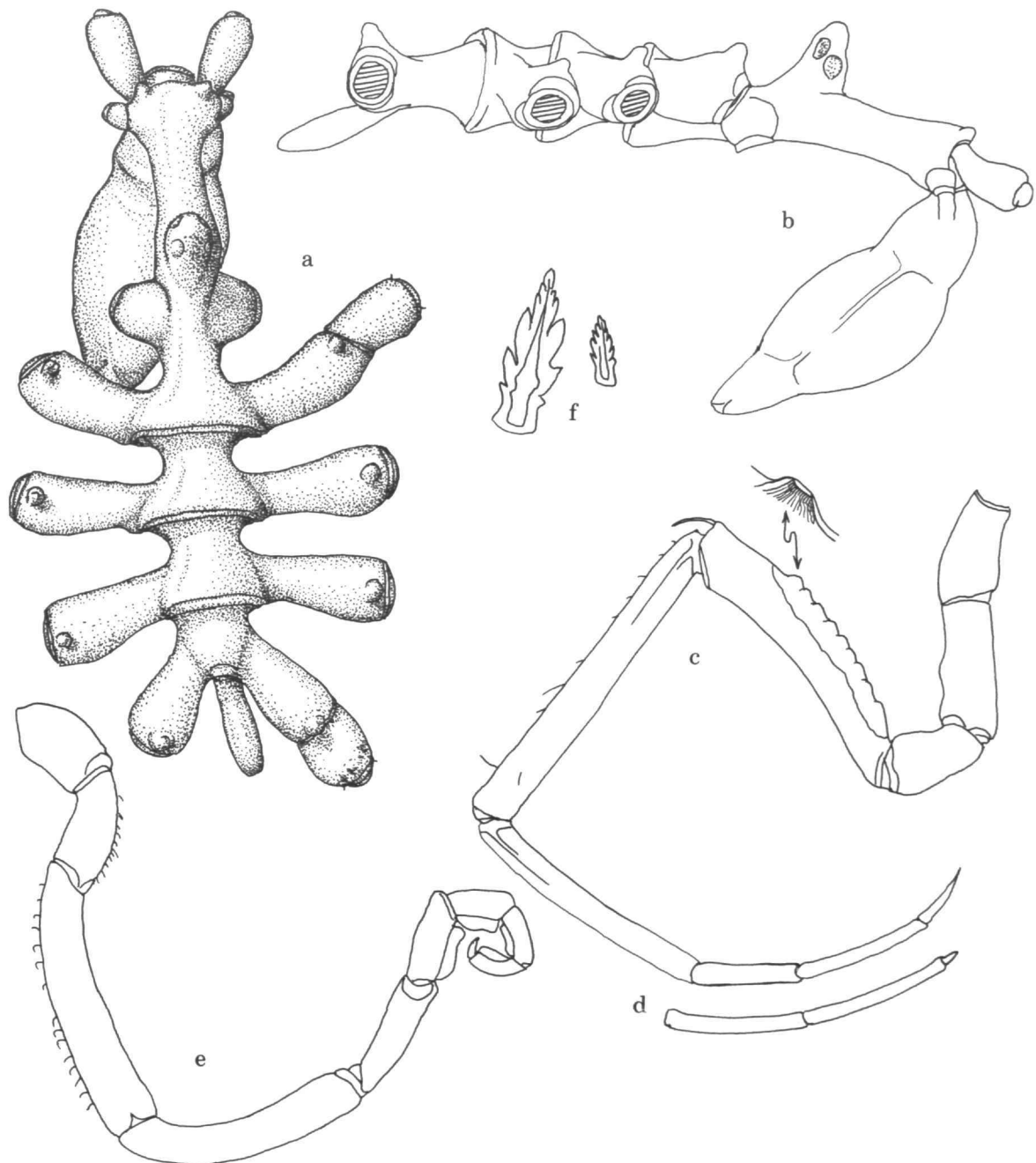


FIGURE 7.—*Ascorhynchus glaberrimum* Schimkewitsch, male: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, third leg, with enlargement of one femoral cement gland; *d*, terminal leg segments of first leg; *e*, oviger; *f*, enlargements of oviger denticulate spines.

terminal segments (strigilis) with different spine arrangements and number, and a much shorter terminal claw.

The leg span for *A. fusticulum*, measured across the second lateral processes, is about 15 mm, making it one of the smallest *Ascorhynchus* species of the North Pacific. The only smaller species in this report is *A. okai* with a leg span of 12.8 mm.

Ascorhynchus glaberrimus Schimkewitsch

FIGURE 7

Ascorhynchus glaberrimus Schimkewitsch, 1913:242, pl. 3a: figs. 8-14.

Ascorhynchus glaberrimus.—Utinomi, 1955:26, fig. 15; 1971:334 [literature].

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 3 (1 juv); sta 5 (6♂ with eggs, 7♂, 11♀, 1 juv).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 14 (1♂ with eggs, 1♂, 2♀); sta 21 (2♀); sta 24 (1 juv). *Tansei Maru* cruise KT71-2, sta 23 (1♂ with eggs); sta 29 (1♂ with eggs, 2♂, 2♀). Nabeta Bay, 21 May 1970 (1 juv); 13 Aug 1970 (1 juv); 23 Aug 1974 (1 juv); Off Kisami, 22 May 1970 (1♂ with eggs, 1♂, 1♀, 4 juv); 1 Nov 1970 (2♂ with eggs, 1♂, 2♀, 25 juv). Off Shimoda, 8 Aug 1973 (1♂, 1♀, 2 juv); 18 Aug 1973 (1♂ with eggs, 1♂, 1♀, 1 juv).

REMARKS.—This is a relatively small species with a leg span of about 30 mm, and has a "bald, unadorned appearance" as stated by Hedgpeth (1949:293). The species has never been adequately figured, and we include a set of new figures here. Schimkewitsch described this species from a single female and the cement glands of the male have never been described (Figure 7c). The cement glands are prominent on the femur dorsal surface and are multiple, having from 7 to 11 raised pores on each leg, the number varying from leg to leg on any specimen. On some specimens they are less prominent, being only slightly raised or hardly raised at all, but the pores are always multiple.

This species has been recorded previously from Nabeta Bay (Utinomi, 1971:334), but most collecting localities place it in the vicinity of Nagasaki and Amakusa Island in Kyushu, and as far

as is known, it is endemic to Japan. It has been collected from the shore to 93 meters.

Ascorhynchus okai, new species

FIGURE 8

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 5 (1♂, holotype, USNM 183806).

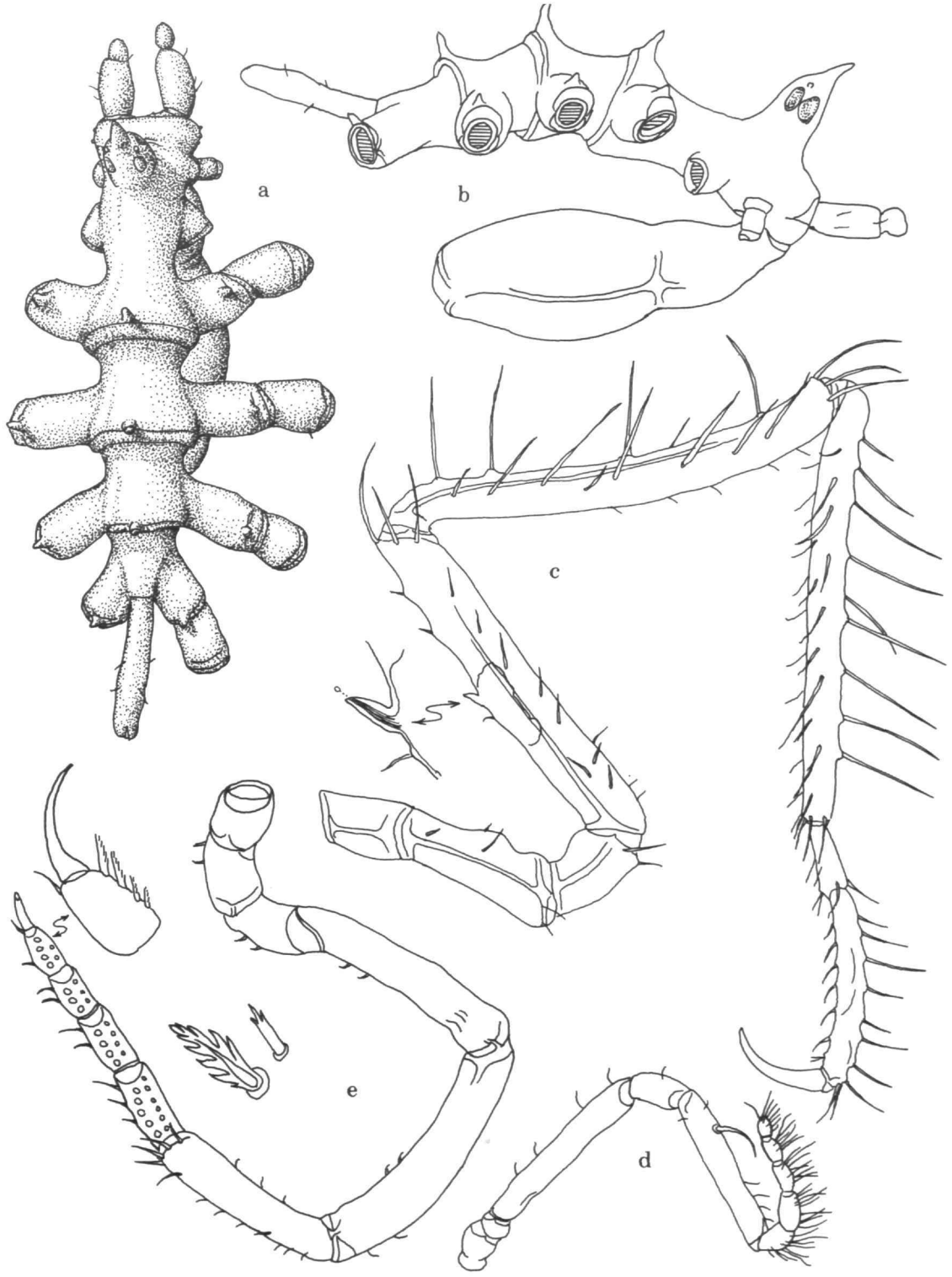
DESCRIPTION.—Holotype small, leg span about 13 mm. Trunk elongate, with small slender median dorsal tubercles. Lateral processes less than twice as long as their diameters, separated by distances slightly greater than their diameters, armed with tiny dorsodistal tubercles not taller than wide. Ocular tubercle large, situated toward anterior of cephalic segment, slightly taller than its diameter, capped with slender tubercle shorter than ocular tubercle diameter at eyes. Eyes large, darkly pigmented. Proboscis almost as long as trunk, with single proximal constriction, lips only slightly protruding from flat oral surface. Abdomen long, reaching almost to middle of second coxae of posterior pair of legs, armed with several dorsolateral setae.

Chelifore short, inflated. Scape 1-segmented, armed with several lateral setae. Chela small, rounded, without trace of fingers.

Palp 10-segmented, basal 2 segments short, first slightly longer than wide, second shorter than its diameter. Third segment longest, slightly longer than fifth. Third through fifth armed with several dorsal and lateral setae, fifth with single long dorsal seta. Terminal five segments consecutively shorter, each only slightly longer than its diameter, armed with many ventral setae longer than segment diameter.

Oviger 10-segmented. First segment short, second and third longer, subequal in length, fourth almost as long as fifth, the longest segment. Second through fifth segments armed with pair of short recurved spines, fifth with few distal setae.

FIGURE 8.—*Ascorhynchus okai*, new species, holotype, male: a, trunk, dorsal view; b, trunk, lateral view; c, third leg, with enlargement of femoral cement gland; d, palp; e, oviger, with enlargement of terminal segments and major and minor denticulate spines.



Sixth segment armed with few short lateral setae and several longer distal setae. Strigilis four segments armed with 2 or 3 dorsal setae and 2 rows of denticulate endal spines in the formula 5:4:3:4, for the row of larger spines, and 6:4:3:2, for the row of smaller spines. Larger spines with 4 or 5 pairs of serrations; smaller spines, less than half the size of the larger with single pair of laterodistal serrations. Terminal claw slender, well curved, slightly longer than terminal segment, unarmed.

Legs slender, moderately long, brachytarsal. Second coxa with few dorsolateral setae and 2 or 3 ventrodiscal setae. Femur with a row of lateral setae and few dorsal and ventral setae. Single cement gland on median dorsal surface, consisting of subcuticular gland capped by single distal-pointing small truncate cone. Tibiae armed with row of short and long setae, several long dorsal setae and several short ventral setae; long setae twice as long as segment diameter or slightly longer. Tibia 1 the longest segment, tibia 2 only slightly shorter. Tarsus slender, rectangular, slightly over 0.3 propodal length, armed with 4 or 5 ventral spines as long as segment diameter and 2 lateral setae and 1 dorsal seta. Propodus slightly curved, armed with 7 or 8 sole spines of equal length, few lateral setae and 10 or 11 dorsal and distal setae, some longer than twice segment diameter. Claw robust, well curved, slightly over half propodal length.

MEASUREMENT OF HOLOTYPE (mm).—Trunk length, 1.3; trunk width, 0.87; proboscis length, 1.18; abdomen length, 0.48; third leg, coxa 1, 0.27; coxa 2, 0.51; coxa 3, 0.32; femur, 1.14; tibia 1, 1.39; tibia 2, 1.26; tarsus, 0.21; propodus, 0.58; claw, 0.3.

ETYMOLOGY.—Named for Dr. Hidemiti Oka, professor emeritus of Tokyo Kyoiku University and former director of the Shimoda Marine Biological Station, Tokyo Kyoiku University.

DISTRIBUTION.—Known only from the type-locality, Suruga Bay, in 75 to 85 meters.

REMARKS.—This is a very small slender species, apparently closely related to *Ascorhynchus fusticulum*, new species. Both species share small slender median trunk tubercles, short lateral processes

and chelifores, tibiae with many long setae, a single median cement gland, and similar proboscides with a single proximal constriction. The differences are in the many spinose tubercles on the anterior and posterior surfaces of each lateral process of *A. fusticulum*, the different shaped ocular tubercles (cylindrical for *A. fusticulum*, conical with a slender apical cone for *A. okai*), the shorter terminal palp segments in *A. okai*, chelifores of a much larger diameter in *A. fusticulum*, a much more slender cement gland tube in *A. okai*, and a double row of spines on the strigilis of *A. okai*, but a single row of spines with more serrations per side in *A. fusticulum*. Although both specimens were taken at the same station in Suruga Bay, the many definite differences between the two specimens allow us, without hesitation, to assign them to different species.

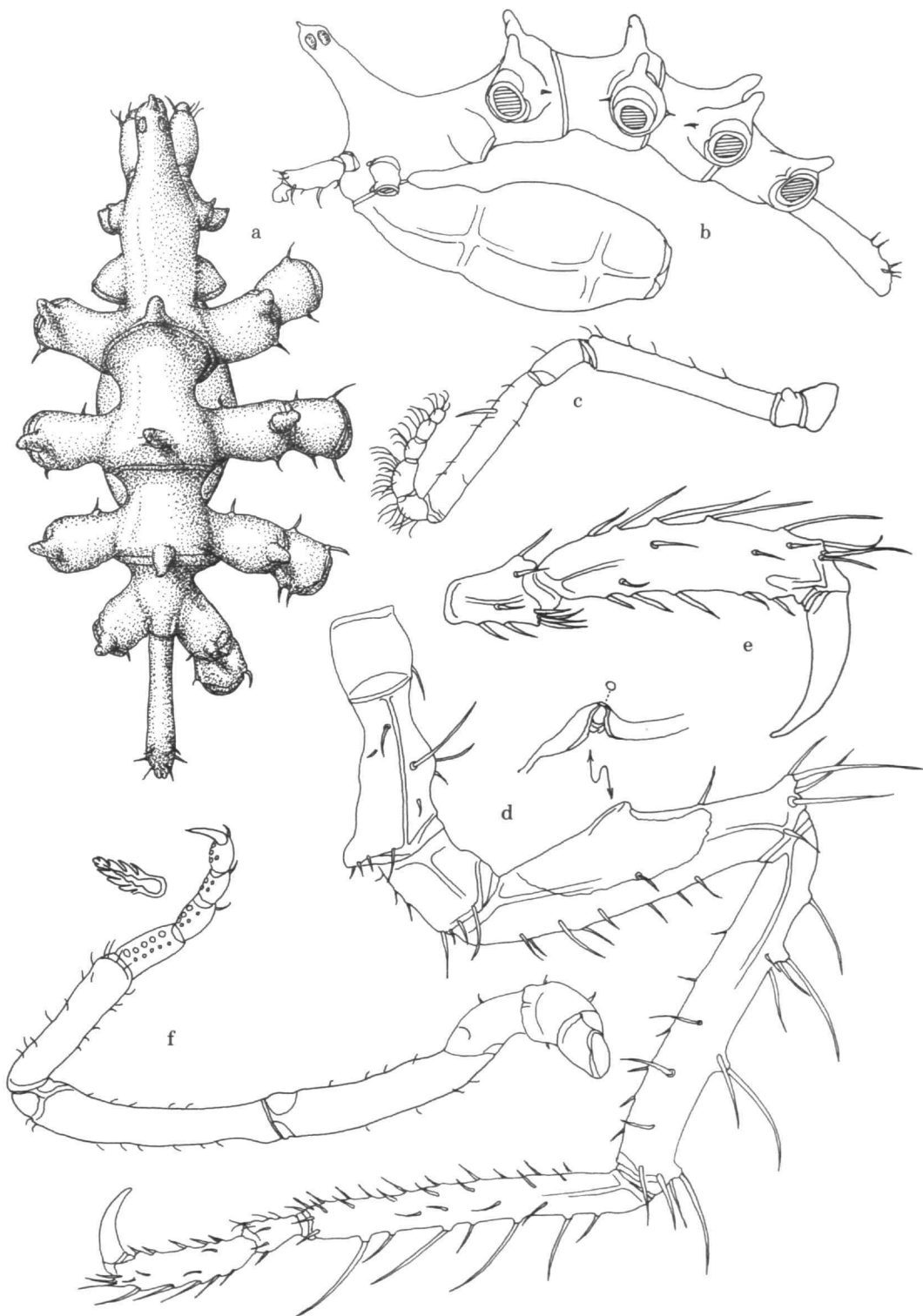
Ascorhynchus prosum, new species

FIGURE 9

MATERIAL EXAMINED.—Sagami Bay: Off Shimoda, 18 Aug 1973 (1♂, holotype, USNM 183807, 1♀, allotype, USNM 183808).

DESCRIPTION OF HOLOTYPE.—Moderately small, leg span about 24 mm. Trunk elongate, fully segmented, with median dorsal trunk tubercles, each slightly longer than its diameter. Anterior of cephalic segment without tubercles over chelifore insertion. Lateral processes separated by about their diameters, from 1 to 1.5 times longer than their diameters, armed with dorsodistal tubercles slightly shorter than median trunk tubercles. First, second, and fourth lateral processes armed with a posterolateral seta, second and third lateral processes with an anterolateral seta or spine near base of process. Ocular tubercle placed above palp bases, at extreme anterior of cephalic segment, more than twice as tall as its median diameter, projecting anteriorly. Eyes small,

FIGURE 9.—*Ascorhynchus prosum*, new species, holotype, male: a, trunk, dorsal view; b, trunk, lateral view; c, palp; d, third leg, with enlargement of femoral cement gland; e, terminal segments of third leg, enlarged; f, oviger, with single major denticulate spine, enlarged.



lightly pigmented, placed distally on ocular tubercle just below apical cone. Proboscis long, almost 0.6 of trunk length, with distal and proximal constrictions giving trilobed shape, oral surface flat, lips flat. Abdomen long, reaching almost to tips of second coxae on fourth legs, slightly swollen distally, armed with several dorsodistal setae.

Chelifore scape 1-segmented, short, swollen, armed with several ventral and distal setae. Chela tiny, globular, fingers represented by anterior cleft.

Palp 10-segmented, basal 2 segments small, not longer than wide, third segment longest, slightly longer than fifth. Fifth segment armed with several dorsal and lateral setae, 1 long endal seta. Terminal 5 segments increasingly shorter, each only slightly longer than its diameter, armed with many ventral setae, some longer than segment diameter.

Oviger 10-segmented, implanted just anterior to and not touching first lateral processes. Basal segment short, not longer than wide, second and third segments armed with few setae. Fourth segment subequal to fifth, both armed with ectal and endal rows of several setae. Sixth segment armed with several short setae and several longer distal setae. Strigilis segments increasingly shorter and smaller, armed with dorsodistal seta each, and two rows of denticulate spines, the larger row with the formula 5 : 3 : 2 : 3, and the smaller row of spines in the formula 5 : 3 : 2 : 1. The larger spines with 5 or 6 serrations per side, the smaller spines with 1 or 2 serrations per side. Terminal claw slightly longer than terminal segment, without serrations or teeth.

Legs moderately long and slender, brachytarsal. First coxa without tubercles, armed with 2 dorsodistal setae and few short lateral setae. Second coxa armed with 2 long dorsolateral setae, several short setae, and a short genital spur with short distal setae. Third coxa subequal to first, armed with few ventral and several distal setae. Femur equal in length to second tibia, first tibia slightly longer. Femur armed with several ventral setae and 6 distal setae, 3 of which are longer than segment diameter. Single cement gland a

very large sack filling almost half of femur, culminating in a low broad cone containing the gland tube exiting through a tiny pore. Distal gland is 1 short seta. First tibia armed with 4 dorsal setae originating from low tubercles, the setae longer than the segment diameter, with lateral and distal shorter setae and several short ventral setae. Second tibia with corresponding 4 dorsal setae on tubercles, 3 shorter dorsal setae, and several ventral short setae increasing in numbers distally. Tarsus and propodus alike on all legs. Tarsus rectangular, slightly longer than wide, armed with 1 dorsodistal seta, several lateral setae and 6 or 7 ventrodorsal setae. Propodus short, slightly curved dorsally, sole straight, armed with 5 or 6 short sole spines, several short lateral setae and 8 or 9 dorsal setae, some longer than segment diameter. Claw robust, well curved, slightly over half propodal length.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length (chelifore insertion to tip 4th lateral processes), 1.99; trunk width (across 2nd lateral processes), 1.13; proboscis length, 1.2; abdomen length, 0.56; third leg, coxa 1, 0.6; coxa 2, 1.09; coxa 3, 0.6; femur, 2.28; tibia 1, 2.62; tibia 2, 2.28; tarsus, 0.38; propodus, 1.02; claw, 0.52.

ETYMOLOGY.—The specific name is from the Latin *prosus* (turned forward or onward) and pertains to the large forward-leaning ocular tubercle.

DISTRIBUTION.—Known only from the type-locality in Sagami Bay, off Shimoda, in 30 meters.

REMARKS.—Known species of the genus *Ascorhynchus* can be divided, like most other pycnogonids, into artificial groups based on various sets of shared characters or on the absence of some or all of these characters. In this genus, there are 13 known species that share the characters of a tarsus $\leq \frac{1}{2}$ the propodal length (brachytarsal), a 1-segmented scape, and tubercles present on both median trunk and lateral processes. Since the femoral cement gland or glands are unknown for some species, this character cannot be compared with *A. prosum*. The species sharing the above characters are *A. abyssi*, *A. cactoides*, *A. compactum*, *A. colei*, *A. cryptopygium*, *A. endoparasiticus*, *A. fusticulum*, *A. inflatum*, *A. latipes*, *A. okai*, *A. ornatum*, *A. pudicum*, and *A. tenuirostre*. The two blind, deep-

water species, *A. abyssi* and *A. inflatum*, have few other characters in agreement with the new species. Two of these species are chelate as adults, *A. endoparasiticus* and *A. pudicum*, although in a genus that is normally achelate in adults, the presence of a functional chela merits further investigation. *Ascorhynchus compactum* and *A. latipes* have closely placed lateral processes separated by little or no spaces. The legs of both species lack the long setae and the ocular tubercles of both are short, among other differences. The terminal segments of the legs of *A. cryptopygium* differ in lengths between the first and 4th pairs of legs, and the lateral process tubercles are tiny, unlike those of *A. prosum*. The same short tubercles occur in *A. colei* and *A. tenuirostre*. In the former, the legs lack long setae and the scape is very long, while in the latter, the proboscis is very long and flask-shaped with one constriction. In *A. cactoides*, all trunk tubercles are very slender and pointed, and the femur and first tibia have long dorsodistal tubercles. *Ascorhynchus ornatum* has very long terminal claws on the legs and very long scapes, unlike *A. prosum*. The two new species, *A. fusticulum* and *A. okai*, differ from *A. prosum* in the many small spinose tubercles on the lateral processes of *A. fusticulum*, and the very low dorsodistal lateral process tubercles and broader ocular tubercle of *A. okai*. *Ascorhynchus prosum* is larger than either of these two species, and differs from both in the cement glands, terminal leg segments, chelae, and ovigers.

Ascorhynchus ramipes (Böhm)

Gnamptorhynchus ramipes Böhm, 1879b:56-59.

Ascorhynchus ramipes.—Ultinomi, 1971:332-333 [literature].

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 9 (1♀); sta 14 (1♀). Nabeta Bay, 28 Aug 1969 (1♂ with eggs); 12 Sep 1969 (1♀, 1 juv); 3 Oct 1969 (1♂ with eggs, 2♀, 5 juv), 14 Nov 1969 (1♂ with eggs, 2♂, 3♀, 97 juv), 19 Dec 1969 (12♂ with eggs, 11♂, 27♀, 41 juv), 21 May 1970 (8♂ with eggs, 3♂, 4♀, 4 juv); 13 Jun 1970 (8♂ with eggs, 11♀, 43 juv); 13 Aug 1970 (17♂ with eggs, 4♂, 17♀, 3 juv); 26 Nov 1970 (4♂ with eggs, 4♂, 9♀, 20 juv); 22 Dec 1970 (8♂, 5♀,

34 juv), 2 Apr 1971 (5♂, 4♀); 8 Aug 1972 (5♂ with eggs, 8♂, 9♀, 2 juv); 28 Aug 1972 (11♂ with eggs, 1♂, 11♀, 2 juv); 27 Jul 1973 (10♂ with eggs, 2♂, 7♀, 2 juv); 8 Aug 1973 (1♂ with eggs, 2♂, 1♀, 2 juv); 17 Aug 1973 (2♂ with eggs, 4♂, 13♀, 1 juv); 26 Oct 1973 (1♂ with eggs, 7♂, 1♀, 34 juv); 23 Aug 1974 (14♂ with eggs, 3♂, 25♀, 6 juv); 3 Aug 1976 (10♂ with eggs, 7♂, 15♀, 15 juv); 16 Aug 1977 (2♂ with eggs, 2♀).

REMARKS.—This species is one of those most commonly found in Sagami Bay, appearing in almost every paper dealing with the pycnogonids of that area. The 660 specimens listed above represent over 9% of the present collection.

It has a known distribution from eastern India (as *Ascorhynchus latum* Calman) to Japan, but has seldom been collected outside Japanese waters. It is a shallow-water species, the deepest collecting record being 94 meters, at *Tansei Maru* station 9.

The species is easily recognized, among several similar Japanese species in this genus, by the absence of any claw, however small, on the first pair of legs. The tarsus and propodus are noticeably longer on the first pair of legs than on the posterior three pairs. The other known Japanese species of this genus all have claws of various lengths on the first legs.

Ascorhynchus utinomii Nakamura and Child

Ascorhynchus utinomii Nakamura and Child, 1982:283-285, fig. 1.

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 28 Aug 1969 (1♂); 12 Sep 1969 (3♂ with eggs, 1♂, 1♀); 14 Nov 1969 (1♂ with eggs, 2♀); 19 Dec 1969 (5♂ with eggs, 5♂, 6♀); 7 Apr 1970 (3♂ with eggs, 1♂, 2♀); 21 May 1970 (1♂ with eggs, 2♂, 2♀); 10 Jul 1970 (1♂ with eggs); 26 Nov 1970 (8♂ with eggs, 15♂, 19♀); 22 Dec 1970 (2♂ with eggs, 3♂, 1♀); 19 Jan 1971 (1♂ with eggs, 3♂, 6♀); 8 Aug 1972 (1♂ with eggs, 2♂, 3♀); 28 Aug 1972 (4♂ with eggs, 1♂, 3♀); 27 Jul 1973 (5♂ with eggs, 2♂, 2♀); 17 Aug 1973 (2♂ with eggs, 1♂, 2♀); 26 Oct 1973 (9♂ with eggs, 5♂, 7♀); 23 Aug 1974 (1♂ with eggs, 1♂, 6♀); 3 Aug 1976 (5♂ with eggs, 2♂, 19♀).

REMARKS.—This shallow-water species is dif-

ferentiated from other known Japanese medium-sized *Ascorhynchus* species by the proboscis, which has a single proximal constriction instead of the two usually found in others. The first pair of legs also have minute propodal claws, and the ovigers are implanted beneath part of the ocular tubercle instead of entirely anterior to or posterior to the ocular tubercle as in other Japanese species.

In spite of the fairly large number of specimens (178) collected during different times of the year and over a period of six years, no specimen of this species has been collected outside the relatively small confines of Nabeta Bay (the type-locality), and no juveniles or larvae are known. The apparent confinement to Nabeta Bay is possibly an artifact of collecting, but the species seems to be endemic to Japan, if not to the middle eastern coast of Honshu. The absence of juveniles and larvae of this species was also noted by Nakamura and Sekiguchi (in press) in their survey of the seasonal occurrence of Nabeta Bay species. This lack of young suggests habitat relationships unlike those of most pycnogonids, where the male carries the young until nearly mature. In this instance, a commensal or parasitic relationship is indicated, possibly involving larger sessile invertebrates—such as a mollusk (Benson and Chivers, 1960:16–18)—that have been suggested in the literature on larval development. Examination of sponges, echinoderms, ascidians, and mollusks from Nabeta Bay might reveal young of this species within one of these associates.

As suspected in the original description of this species, the cement glands consist of about 15 tiny pores along the posterodorsal surface of almost the entire femur length.

Genus *Chonothea*, new genus

DIAGNOSIS.—Tanystylomorph with short, triangular unsegmented trunk carrying extremely large barrel-shaped proboscis. Ocular tubercle with eyes at posterior of cephalic segment. Chelifores very short, 1-segmented. Palp 1-segmented, oval. Oviger (female) tiny, slender, 7-segmented, without strigilis or terminal claw. Legs short, robust, propodus *Pycnogonum*-like, without auxiliary claws.

ETYMOLOGY.—From the Greek *chonos* (funnel-shaped hollow) and the suffix of the genus *Amotheo*. This pertains to the extremely large funnel-shaped proboscis. Gender masculine.

TYPE-SPECIES.—*Chonothea hians*, new species (monotypy).

REMARKS.—This new genus has the legs of a typical species in the genus *Pycnogonum*, the short chelifore stumps and closely spaced lateral processes of the genus *Tanystylum*, but the 1-segmented palps and tiny 7-segmented ovigers (in the female) of no other known pycnogonid. This combination again emphasizes the extreme diversity of character states or combinations that are present among some 900 species of pycnogonids.

***Chonothea hians*, new species**

FIGURE 10

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT71-2, sta 27 (1♀, holotype, USNM 183809).

DESCRIPTION.—Animal moderately small, leg span about 11.7 mm. Trunk compact, triangular, slightly wider than long, with 2 low median tubercles. Posterior trunk tubercle off center to left (damaged?), bifurcate. First and second lateral processes slightly separated, others contiguous. Ocular tubercle low, rounded, at posterior of cephalic segment, with 4 slightly pigmented eyes. Proboscis massive, almost as long as trunk, inflated, with 2 distal constrictions. Oral surface almost quadrangular, lips widely gaping. Abdomen moderately long, reaching to distal tips of second coxae of fourth lateral processes, inflated medially, tapering distally, armed with several short lateral and dorsal setae.

Chelifore 1-segmented, cylindrical, terminating distally in flat surface, without chela.

Palp 1-segmented, slightly longer than chelifore, inflated, terminating in 1 or 2 tiny papillae.

Oviger 7-segmented (female), tiny. Second and fourth segments subequal, fifth segment longest, sixth segment only 0.6 length of fifth, seventh segment wider than long. Proximal 4 segments glabrous, fifth with 3 distal short setae, sixth with 1 or 2 distal short setae, and seventh with 1 terminal seta.

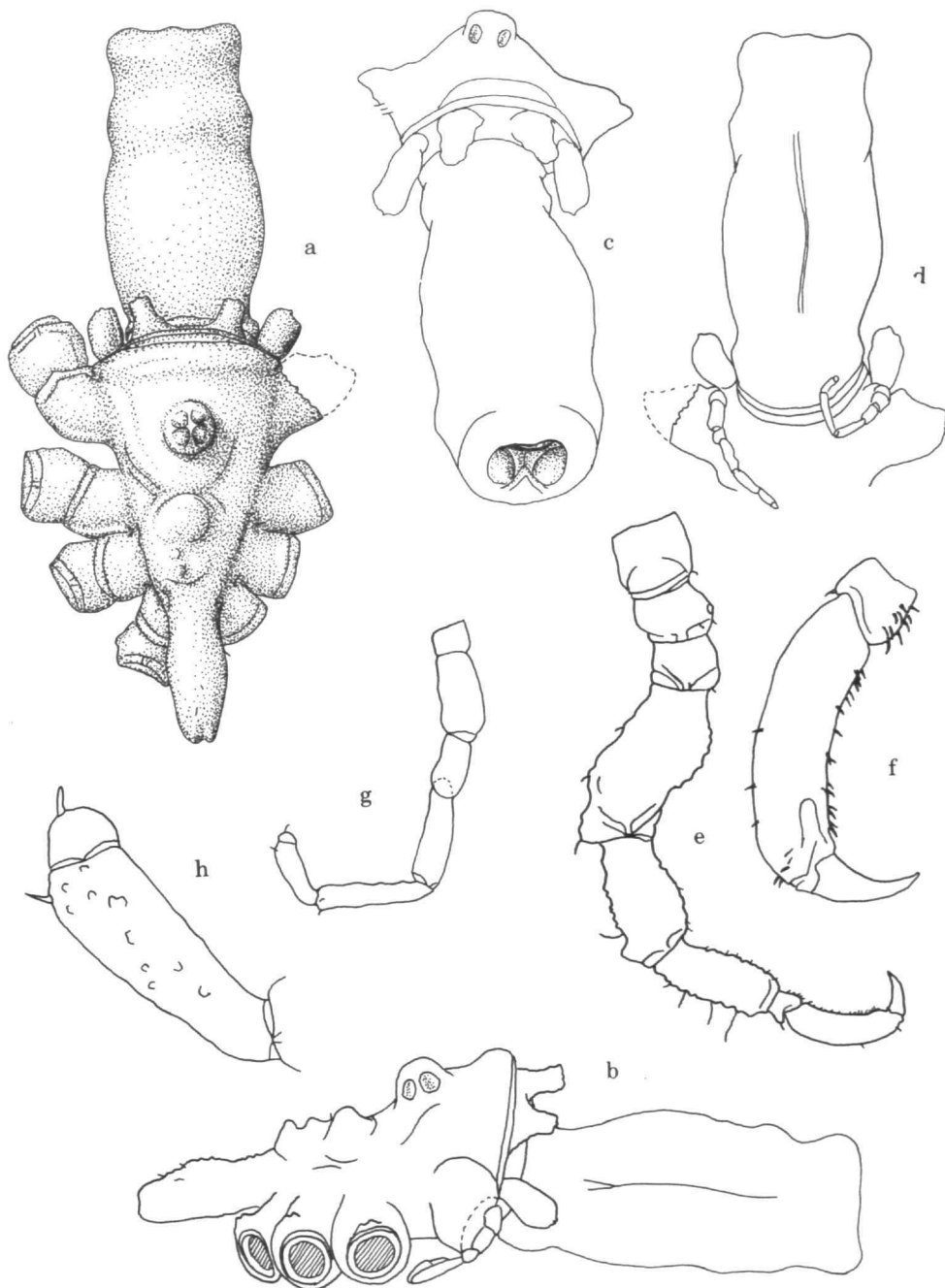


FIGURE 10.—*Chonothea hians*, new genus, new species, holotype, female: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, anterior oblique view of proboscis and trunk anterior; *d*, ventral view of proboscis and trunk anterior; *e*, third leg; *f*, terminal segments of third leg, enlarged; *g*, oviger; *h*, terminal segments of oviger, enlarged.

Leg short, robust. Coxae and lateral processes only as long as wide or even shorter. Sexual pore on midventral surface of all second coxae. First coxa longer than second or third. Femur the longest of major segments, inflated with ventral and dorsal bulges and large low dorsodistal tubercle armed with short seta. First tibia less than twice as long as its diameter, armed with several tiny ventral setae and a dorsodistal seta proximal to low tubercle. Second tibia twice as long as its diameter, armed with many tiny ventral setae and 4 dorsal setae not longer than segment diameter. Tarsus short, quadrangular, armed with many short ventral setae. Propodus moderately short, slightly curved, without heel, armed with 17 or 18 sole spines and several tiny dorsal and distal setae. Claw robust, well curved, less than half length of propodus. Auxiliaries lacking.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 1.87; trunk width (across 1st lateral process to center of ocular tubercle $\times 2$), 1.97; proboscis length, 1.74; abdomen length, 0.9; third leg, coxa 1, 0.41; coxa 2, 0.38; coxa 3, 0.34; femur, 1.1; tibia 1, 0.78; tibia 2, 0.72; tarsus, 0.18; propodus, 0.68; claw, 0.26.

ETYMOLOGY.—The specific name *hians* (to gape or open in the sense of spreading) is from the Latin and pertains to the huge open or gaping mouth.

DISTRIBUTION.—Known only from the type-locality, western Sagami Bay, in 160 to 174 meters.

REMARKS.—This unique specimen is damaged by the loss of part of the first right lateral process and its leg. It is possible but not probable that the palps are also damaged. The distal tip of each single-segmented palp is not frayed or torn, but instead has an apparently natural distal curve with 1 or 2 tiny papillae at the tip. If the palps were damaged and consisted of more than 1 segment, this specimen would be reminiscent in some ways of *Tanystylum brevipes*, in that both share an especially large proboscis, ocular tubercle of the same size and position, a large abdomen with tubercles arising from its base (these tubercles are not figured in any illustration of *T. brevipes*, to our knowledge), and contiguous lateral processes. The chelifore stumps are quite like

those of many *Tanystylum* species. The differences are in the female ovigers (male unknown), which are much smaller in relation to trunk size than those of a female *Tanystylum*, and have 7 segments in the new species, while those of all known *Tanystylum* species have 10 segments in both sexes.

The terminal leg segments of the new species are more like those of many species of the genus *Pycnogonum*, which are without a heel or heel spines and without auxiliary claws. The triangular trunk shape of *Chonothea hians* is quite different from that of most pycnogonid genera and species. Most are circular or ovoid with the second lateral processes the longest of the four pairs. Here, the first pair are the longest and each succeeding pair posterior to these is shorter than the next anterior pair.

The dorsal trunk tubercles appear damaged with the posterior bifurcate tubercle offset to the left of the midline. The specimen is obviously damaged, but the configuration of this tubercle may be only slightly different on specimens collected in the future.

Genus *Cilunculus* Loman, 1908

There is an *Ammothella* species from Japan that we propose to transfer to the genus *Cilunculus*. This is *Ammothella profunda* Hedgpeth (1949:289–291, fig. 42), the unique type-specimen that we reexamined for purposes of comparison with several *Cilunculus* species. There are no specimens of *profunda* in the collections being reported herein. The figures given by Hedgpeth are slightly in error in not illustrating the definite hood into which the chelifores insert. The genus *Ammothella* is known to inhabit shallow waters and the extreme depth (1141 meters) at which *A. profunda* was captured originally led us to question the validity of its generic designation. Besides depth differences, the *Cilunculus* hood is the principal character separating it from *Ammothella* and we feel that the discovery of this heretofore unrecognized hood is sufficient justification to assign this species to *Cilunculus*. The two genera are otherwise extremely close.

The trunk and proximal parts of each appendage of *Cilunculus profundus* are densely crowded

with tiny spines bearing rugosities and some with bifurcate tips, and the species also has 3-segmented chelifores and several other major differ-

ences from *C. haradai*. The remaining characters in Hedgpeth's figures are quite accurate for *C. profundus*.

Key to the Japanese Species of *Cilunculus*

1. Chelifores of 2 segments 2
Chelifores of 3 segments 3
- 2(1). Lateral processes separated by greater than their diameters, armed with long dorso- and laterodistal setae *C. sekiguchii*, new species
Lateral processes separated by less than their diameters, armed with only laterodistal setae *C. haradai*, new species
- 3(1). Trunk with median dorsal tubercles on each segment; legs with many short setae *C. armatus*
Trunk flat, without median dorsal tubercles; legs with fewer long setae **C. profundus*, new combination

* See text above.

Cilunculus armatus (Böhm)

Lecythorhynchus armatus Böhm, 1879c:141-142.

Cilunculus armatus.—Hedgpeth, 1949:294-295, fig. 43 [figures].—Utinomi, 1971:334-335 [literature].

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 5 (18♂ with eggs 12♂, 40♀, 5 juv).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 14 (1♀); sta 21 (80♂ with eggs, 169♂, 326♀, 74 juv); sta 24 (4♂ with eggs, 7♂, 4♀, 5 juv). *Tansei Maru* cruise KT71-2, sta 26 (1♂ with eggs, 1♂); sta 27 (1♀). Off Kisami, 30 Aug 1969 (1♂ with eggs, 1♂, 1♀, 2 juv); 22 May 1970 (25♂ with eggs, 71♂, 56♀, 114 juv), 1 Nov 1970 (31♂ with eggs, 78♂, 88♀, 80 juv); 16 May 1971 (9♂ with eggs, 3♂, 18♀, 6 juv). Off Shimoda, 8 Aug 1973 (2♂ with eggs, 3♂, 3♀, 2 juv).

REMARKS.—This species is easily recognized by the short bulbous proboscis, a general setose appearance with crowded lateral processes, and the tuberculate hood overreaching short chelifores.

Cilunculus armatus is one of the most numerous species in this collection, with 1342 specimens taken. It is very common in Sagami Bay at depths of about 15 to over 399 meters, and is found from the Sea of Okhotsk to southern Kyushu Island, Japan, to a depth of 618 meters.

Cilunculus haradai, new species

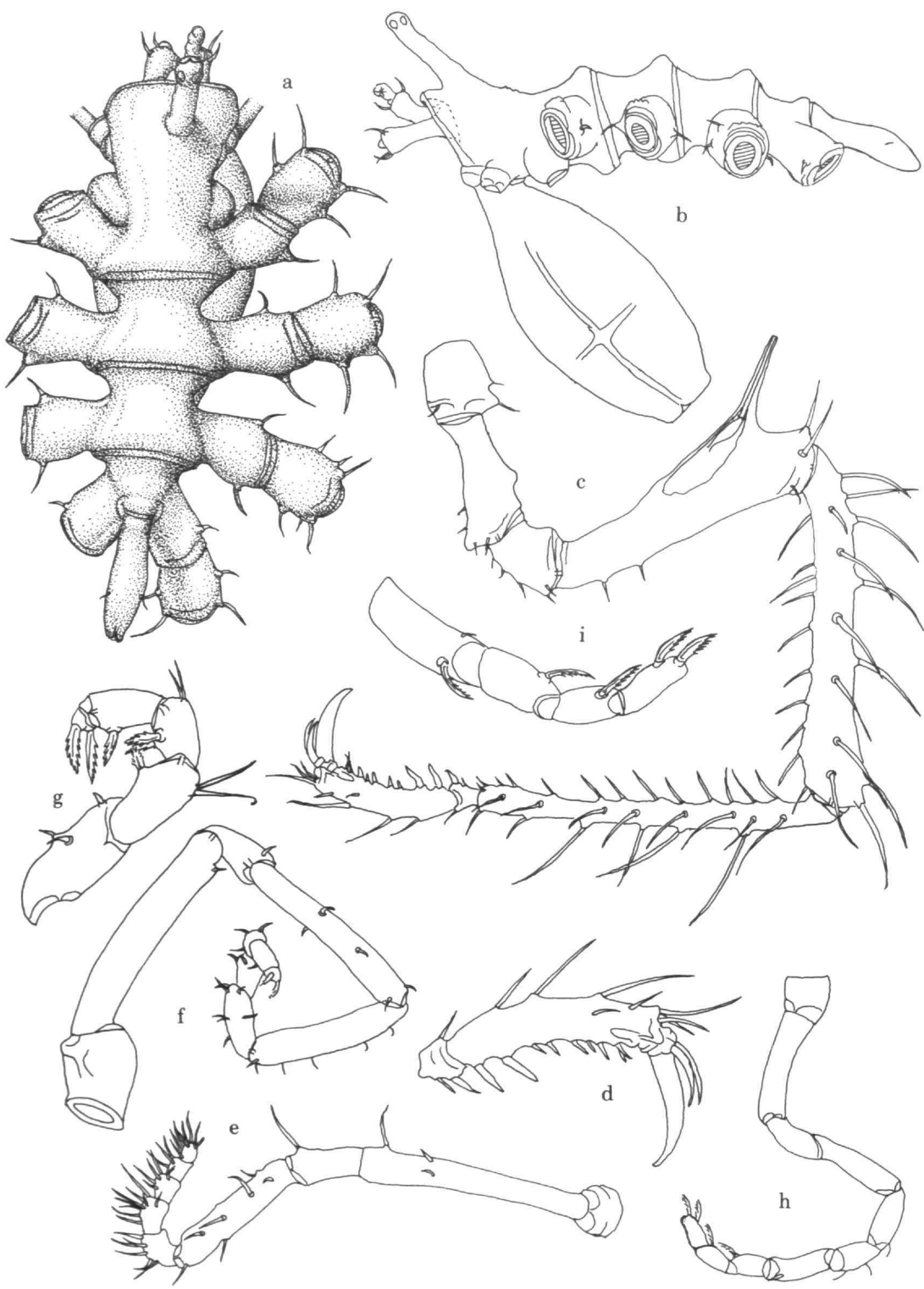
FIGURE 11

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 21 (1♂ with eggs, 2♂, 9♀, 3 juv paratypes). *Tansei Maru* cruise KT71-2, sta 27 (1♂, holotype, USNM 183810). Off Shimoda, 8 Aug 1973 (2♀, paratypes).

DESCRIPTION.—Animal small, leg span about 13.5 mm. Trunk robust, fully segmented, lateral processes separated by slightly less than their diameters, each armed with a large anterior and posterior seta except anterior of first and posterior of fourth lateral processes. Neck broad, expanding anteriorly into hood circling chelifores. Ocular tubercle cylindrical, pointing obliquely anterior, with conical apex. Eyes placed distally, slightly pigmented. Abdomen of moderate length, extending only past proximal rim of coxa 2 of posterior legs, swollen distally, armed with 2 lateral setae.

Proboscis a long oval shape, almost 0.66 trunk length, oral surface flattened, without constrictions.

Chelifores very small, scape 1-segmented, moderately short, length slightly over twice diameter, armed with 2 or 3 short distal setae. Chela only slightly longer than wide, rounded at tip, fingers tiny bumps separated by crease.



Palp 9-segmented, basal segment wider than long. Second segment longest, armed with long dorsodistal seta and 2 or 3 short setae proximal to this. Third segment armed with long dorsodistal seta, fourth with several lateral, dorsal, and ventral setae. Terminal 5 segments increasingly shorter, terminal segment not longer than wide, all armed with many ventral setae longer than segment diameters.

Oviger 10-segmented, basal segment large, slightly longer than wide, twice diameter of remaining segments. Second segment longest, armed with 1 or 2 distal setae. Fourth and fifth segments armed with few lateral and ectal setae. Strigilis weak, sixth segment armed with 3 or 4 short recurved spines. Terminal 4 segments armed with denticulate spines in the formula 1 : 2 : 1 : 2. Seventh and eighth segments armed ectally with 2 long spines each. Terminal segment not as long as wide.

Legs slender, setose. First coxa armed with 2 anterolateral and posterolateral setae slightly shorter than segment diameter. Second coxa with small ventrodorsal tubercle armed with 4 or 5 short setae. Third coxa with few ventral setae. Femur shorter than tibiae, armed with 2 dorsodistal setae and 2 proximoventral setae. Cement gland a swollen bulge just past middorsum, culminating in a long slender cone containing the tube, which is longer than the segment diameter. Tibia 1 slightly longer than tibia 2, both armed with many long setae on dorsal, lateral, and ventral surfaces, dorsal setae longer than segment diameter. Tarsus short, triangular, armed with dorsal seta and ventral seta and spine. Propodus moderately long, slightly curved, armed with 2 broad heel spines, 7 or 8 short sole spines, several dorsal setae longer than segment diameter and several short distal setae. Claw almost half propodal length, straight proximally, well curved distally. Auxillary claws half main claw length.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk

length, 1.93; trunk width, 1.2; proboscis length, 1.38; abdomen length, 0.6; third leg, coxa 1, 0.3; coxa 2, 0.48; coxa 3, 0.32; femur, 1.18; tibia 1, 1.46; tibia 2, 1.42; tarsus, 0.13; propodus, 0.59; claw, 0.3.

ETYMOLOGY.—This specific name honors the late Dr. Isokichi Harada, former director of the Shimoda Marine Biological Station of Tokyo Kyoiku University and professor at that university.

DISTRIBUTION.—This species is known from its type-locality, western Sagami Bay, in 30 to 174 meters, and from off Shimoda in 30 m.

REMARKS.—There are 16 known species of *Cilunculus*, (including *C. bifidus* = *Scipiolus bifidus* by Stock, 1968:14–15, fig. 3; see Child, 1982:11). They can be divided conveniently if artificially into two groups based on the chelifore scape having either one or two segments. In addition to *C. haradai*, seven other species have a scape with one segment: *C. alcornis*, *C. antillensis*, *C. bifidus*, *C. europaeus*, *C. frontosus*, *C. kravcovi*, and *C. tubicinis*. Of these seven, few have the relatively compact trunk and lateral processes without tubercles, as found in *C. haradai*, and six are blind or apparently blind with eyes not evident. *Cilunculus haradai* is closest to *C. antillensis*, the one remaining compact species.

Cilunculus antillensis is also blind and its tall ocular tubercle has a bifurcate tip as in several other species of this genus, but the dorsal trunk configuration, palps, ovigers, chelifores, and general leg habitus are similar to *C. haradai*. *Cilunculus haradai* has fewer lateral process setae, many long leg setae, a longer cement gland placed not as far distally on the femur, two instead of three heel spines, and slightly shorter auxiliary claws in relation to the main claw. The principal differences lie in the ocular tubercle of both species, and the great differences in depths at which captured: *C. haradai* at 30 to 174 meters; *C. antillensis* at about 914 meters.

Cilunculus sekiguchii, new species

FIGURE 12

MATERIAL EXAMINED.—Sagami Bay: Off Kishima, 22 May 1970 (1♂, holotype, USNM 183813).

FIGURE 11.—*Cilunculus haradai*, new species, holotype, male: a, trunk, dorsal view; b, trunk, lateral view; c, third leg; d, terminal segments of third leg, enlarged; e, palp; f, oviger; g, oviger strigilis, enlarged. Paratype, female: h, oviger; i, oviger strigilis, enlarged.

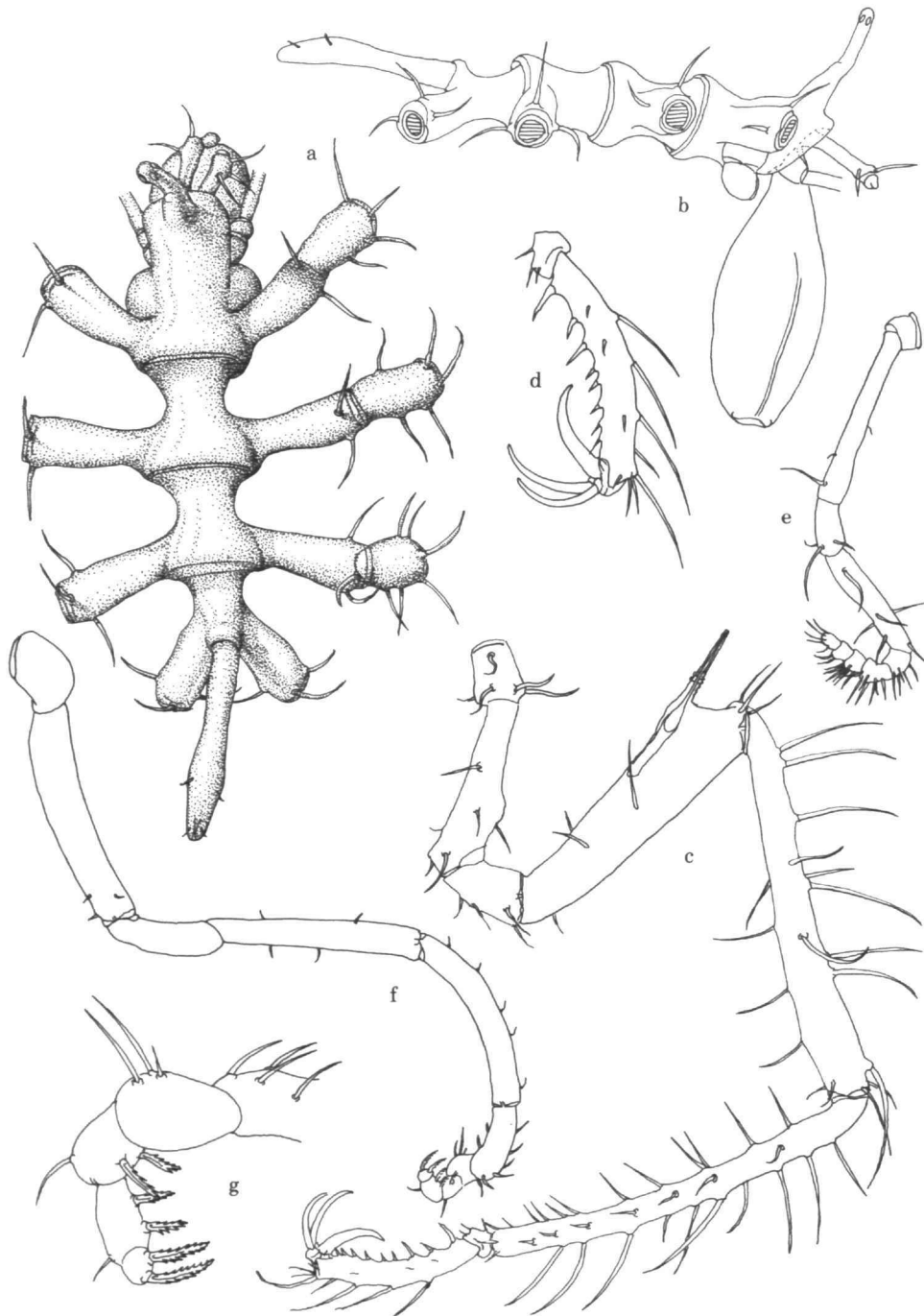


FIGURE 12.—*Cilunculus sekiguchii*, new species, holotype, male: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, third leg; *d*, terminal segments of third leg, enlarged; *e*, palp; *f*, oviger; *g*, oviger strigilis, enlarged.

Tansei Maru cruise KT69-12, sta 21 (2♂, 2♀, paratypes). *Tansei Maru* cruise KT71-2, sta 29 (1♀, paratype). Off Shimoda, 8 Aug 1973 (1♀, paratype); 18 Aug 1973 (1♀, paratype).

Suruga Bay: *Tansei Maru* cruise KT69-12, sta 5 (3♀, paratypes).

DESCRIPTION.—Animal small, leg span about 13.6 mm. Trunk slender, elongate, completely segmented. Lateral processes long, over twice as long as their diameters, well separated by twice their diameters or more, armed with 3 long distal setae except anterior of first and second lateral processes. Neck narrow, slightly wider than minimum trunk diameter. Anterior of cephalic segment only slightly wider than neck, extending anteriorly over chelifores to form hood. Ocular tubercle long, more than 3 times longer than basal diameter, a tapering cylinder with small very lightly pigmented eyes distally. Abdomen long, slender, extending for half the length of second coxae of fourth legs, with slight dorsodistal bulge, armed with 4 distal setae. Proboscis a long oval, slightly over half trunk length, flattened at oral surface, without constrictions.

Chelifore scape 1-segmented, small, slender, approximately 4 times longer than wide, armed with 2 or 3 distal setae over twice longer than segment diameter. Chela globular, slightly longer than wide, with distal crease but without fingers or setae.

Palp 9-segmented, basal segment small, not longer than wide, second segment longest, armed with long distal seta, third segment armed with 1 long and few short distal setae, fourth with several long setae. Terminal segments not longer than wide, armed with many ventral setae longer than each segment diameter.

Oviger 10-segmented, basal segment slightly longer than wide, second segment longest, slightly longer than fourth, which is subequal to fifth. Longer segments armed with several short setae. Strigilis sixth segment armed with 6 recurved setae equal to segment diameter, seventh with 3 ectal setae, 2 longer than segment diameter, eighth and ninth with 1 ectal seta and 2 endal denticulate spines. Terminal segment almost circular, armed with 2 denticulate spines.

Leg slender, tibia 1 the longest segment. First coxa armed with 1 or 2 lateral and 2 dorsodistal long setae, second coxa with 2 or 3 long lateral setae, third coxa with 1 or 2 lateral setae. Femur armed with 2 long lateral setae, 3 or 4 shorter dorsodistal setae, and cement gland, a distal tube in conical sheath equal to segment diameter in length. Tibiae armed with several long dorsal, lateral, and ventral setae, most from one to over twice segment diameter. Tarsus small, triangular, with 3 ventral setae. Propodus long, well curved, armed with 3 strong heel spines, 5 or 6 small sole spines, 4 long dorsal setae, and several shorter lateral and distal setae. Claw slender, almost straight proximally, well curved distally. Auxiliary claws very slender, as long as main claw.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 1.92; trunk width (across 2nd lateral processes), 1.25; proboscis length, 1.07; abdomen length, 0.74; third leg, coxa 1, 0.26; coxa 2, 0.64; coxa 3, 0.32; femur, 1.11; tibia 1, 1.43; tibia 2, 1.41; tarsus, 0.12; propodus, 0.62; claw, 0.25.

ETYMOLOGY.—This species is named for Professor Koichi Sekiguchi of the University of Tsukuba, chief scientist of the *Tansei Maru* cruises, for his fine collaboration in collecting material for this report (with K.N.).

DISTRIBUTION.—This species is known from the type-locality, off Kisami, and from western Sagami Bay and eastern Suruga Bay, in 30 to 300 meters.

REMARKS.—Of the 14 species of *Cilunculus* known prior to this report, 7 (p. 35, not including *C. haradai*) have scapes composed of a single segment. Unlike *C. sekiguchii*, one of these species, *C. alcornis*, has median trunk tubercles, and *C. europaeus* lacks an ocular tubercle and is blind. Three other species, *C. antillensis*, *C. bifidus*, and *C. tubicinis* share several characters with *C. sekiguchii*, but differ in their tall ocular tubercles, bifurcate at the tip and lacking eyes. *Cilunculus kravcovi* is more robust than this new species and has long dorsal setae placed near the base of each lateral process. The ocular tubercle is a long slender cone pointed at the tip and lacks eyes, and the oviger of *C. kravcovi* apparently has a terminal claw. The remaining species with 1-segmented

scapes, *C. frontosus*, lacks chelae and has many long setae on the anterior and posterior of each lateral process.

This new species shares some characters with *C. haradai* (p. 33). Both have a long ocular tubercle with eyes, lack median trunk tubercles, have very similar cement glands, many long setae on the tibiae, and have very similar ovigers and palps. The differences are in the trunk shape: compact with lateral processes more closely placed to each other for *C. haradai*; long and slender with lateral processes separated by at least twice their diameters for *C. sekiguchii*, and in the placement of setae on the lateral processes and coxae of the two species. The combination of a tall rounded ocular tubercle with eyes, the long lateral process setae on slender well-separated lateral processes, and the lack of dorsal tubercles on the median trunk and lateral processes, all serve to distinguish this new species from all others known in the genus.

Genus *Paranymphon* Caullery, 1896

Paranymphon spinosum Caullery

Paranymphon spinosum Caullery, 1896:361, pl. 12: figs. 1-6.—Hedgpeth, 1948:253, fig. 41 [figures].—Stock, 1978:204-205, fig. 5d-g [figures, literature].

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 21 (1♀).

REMARKS.—We can find nothing about this single female that differs from typical specimens found in the North Atlantic, although this is the first record of this species from the Pacific Ocean. The species is very distinctive and would be difficult to confuse with any other ammotheid, except perhaps for *Hemichela*. The very long lateral process tubercles, chelate chela having both fingers (*Hemichela* lacks one), extremely short proboscis, and lack of long setae on all appendages except the chelifores, set this species apart from almost all other pycnogonids.

Paranymphon spinosum has been taken in depths from as shallow as 55 meters, but it is more often found in depths from 500 to 2000 meters. The fact that this relatively small species is now known from the Pacific for the first time may be a collecting anomaly due to the larger mesh size of most trawl nets used for collecting specimens. The species may be a rare inhabitant of colder North Pacific waters, although the collecting depth of 113 meters where this specimen was found is neither very deep nor cold. There are a number of distributional puzzles among the pycnogonids and it is safe to say that this will not be the last.

Genus *Tanystylum* Miers, 1879

Key to the Japanese Species of *Tanystylum*

1. Entire animal covered with short setae; appendage segments bulbous; proboscis gradually tapering to rounded point **T. anthomasthi*
Animal not covered with setae; appendage segments more slender; proboscis ovoid or tubular 2
- 2(1). Lateral processes with low dorsodistal tubercles; chelifore stumps almost hidden in dorsal view; proboscis conical proximally, tubular distally *T. scrutator*
Lateral processes with single dorsodistal seta, without tubercles; chelifore stumps longer, clearly visible from dorsal view; proboscis ovoid, tapering distally *T. nabetensis*, new species

* Not discussed herein.

Tanystylum nabetensis, new species

FIGURE 13

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 21 May 1970 (1♂ with eggs, holotype, USNM 183819, 1♂ with eggs, 1♀, paratypes); 22 Dec 1970 (1♂, damaged, paratype).

DESCRIPTION.—Animal tiny, leg span 5.7 mm. Trunk circular in outline, unsegmented, with fold posterior to ocular segment. Lateral processes contiguous, armed with single small dorsodistal seta each. Ocular segment glabrous, extending slightly anterior to circle formed by lateral processes. Ocular tubercle low, rounded, only half as tall as its diameter, capped by tiny anterior-pointing tubercle. Eyes darkly pigmented, posterior pair twice as large as anterior two. Abdomen moderately short, not extending beyond first coxae of posterior legs, with anterior bulge and median constriction, armed with several dorsal setae. Proboscis almost cylindrical, moderately short, with constriction just proximal to lips.

Chelifere 1-segmented, short, less than 0.25 of proboscis length, armed with 3 distal setae.

Palp 5-segmented, longer than proboscis. Basal segment short, not longer than wide, second slightly longer, armed with 2 dorsal setae. Third segment longest, armed with several distal setae, fourth curved, only as long as wide, armed with several longer ventral setae, as long or longer than segment diameter. Terminal segment almost as long as third, armed with scattered setae ventrally and distally, some setae slightly longer than segment diameter.

Oviger 10-segmented, segments 2, 3, and 5 armed with several short spines. Sixth segment inflated, armed with endal recurved spine and 3 or 4 ectal setae. Terminal 4 segments increasingly shorter in length, proximal 2 armed with 3 ectal setae, without spines or lateral apophysis on seventh segment. Terminal 2 segments with 1 and 2 denticulate spines respectively, the single spine on ninth segment having a single lateral tiny serration, the two on tenth segment having forked or bifurcate tips and no serrations. Female oviger smaller, with shorter segments and fewer spines and setae.

Leg robust, short, coxae armed with dorsodistal and ventrodistal short setae. Femur the longest segment, with ventral bulge at midpoint and low dorsodistal tubercle bearing fringe of short setae. Cement gland a short tube just proximal to dorsodistal tubercle. Tibiae with low proximal, middle, and distal bulges dorsally, each bearing several short setae. Tarsus short, armed with several ventral setae. Propodus robust, well curved, armed with 3 broad heel spines, 7 or 8 short sole spines and several lateral and dorsal short setae. Claw short, broad, well curved, less than half propodal length. Auxiliary claws about 0.6 length of main claw.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 0.56; trunk width, 0.58; proboscis length, 0.31; abdomen length, 0.26; third leg, coxa 1, 0.2; coxa 2, 0.21; coxa 3, 0.21; femur, 0.45; tibia 1, 0.43; tibia 2, 0.41; tarsus, 0.09; propodus, 0.38; claw, 0.18.

ETYMOLOGY.—Named for the type-locality, Nabeta Bay.

DISTRIBUTION.—Known only from Nabeta Bay in western Sagami Bay, in 7 to 15 meters.

REMARKS.—The majority of *Tanystylum* species established on male specimens (6 species are based on females) have a seventh oviger segment lacking a lateral tubercle or swelling. Fourteen species have this tubercle or swelling while 22 do not. In *T. nabetensis*, the seventh segment is implanted anaxially on the sixth, a common situation with male *Tanystylum* ovigers, but it does not have the tubercle or swelling on the seventh segment. Another good diagnostic character in this genus is the shape of the proboscis, usually barrel-shaped, conical, styliform, or cylindrical. The proboscis of *T. nabetensis* is cylindrical with a distal constriction. The species apparently closest to *T. nabetensis* in sharing these and other characters is *T. bredini*, from the Society Islands and Tuamotu Archipelago. The two species have a very similar proboscis, the straight seventh oviger segment, a low ocular tubercle bearing a small blunt tubercle, a short abdomen with a bulge at its base, and legs with many similarities. The differences between the two species are that *T. nabetensis* has shorter chelifere stumps, a 5-seg-

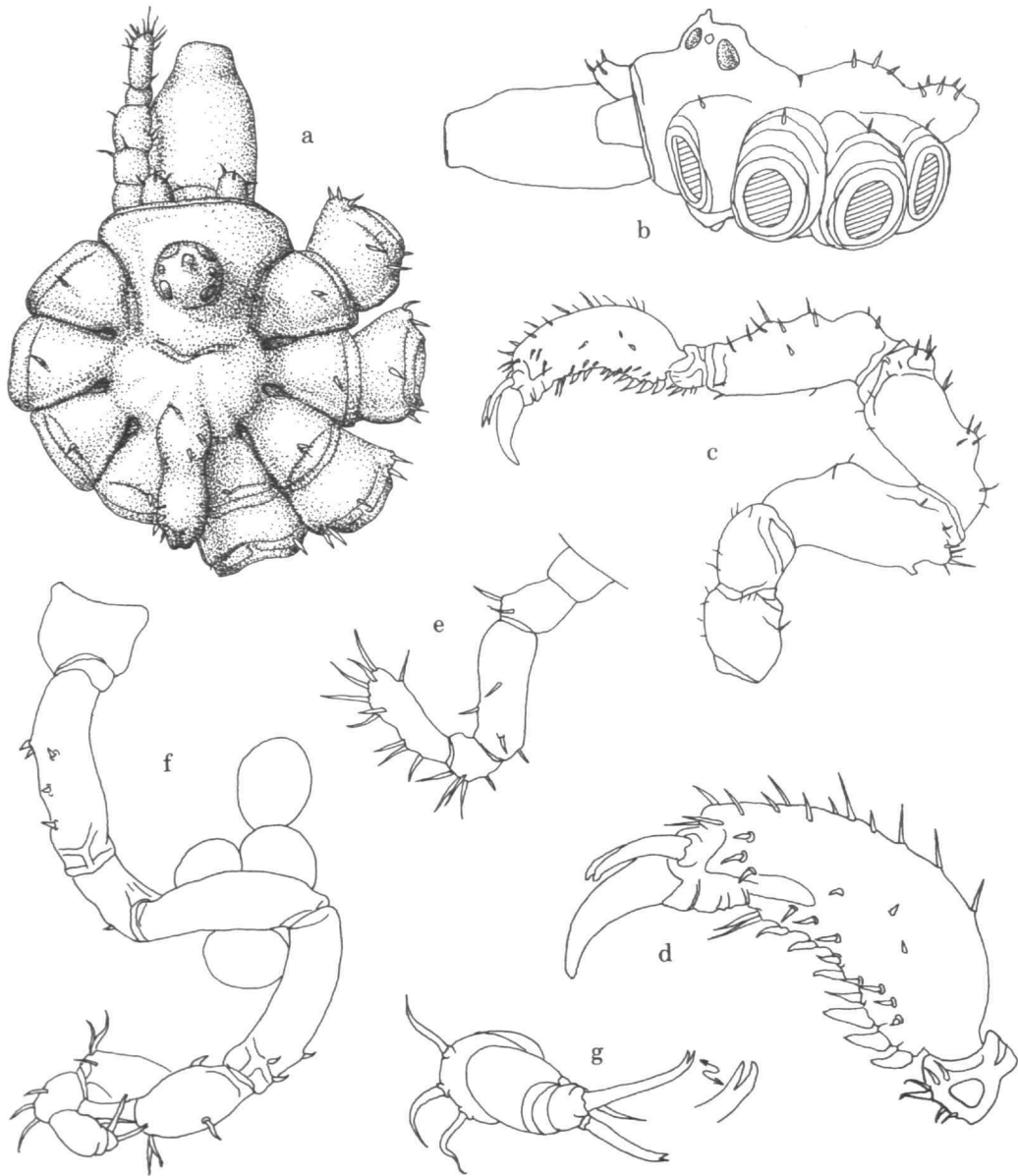


FIGURE 13.—*Tanystylum nabetensis*, new species, holotype, male: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, third leg; *d*, terminal segments of third leg, enlarged; *e*, palp; *f*, oviger, with eggs; *g*, oviger terminal segments, enlarged, with distal spine tip further enlarged.

mented palp rather than one with 4 segments, a cement gland placed more proximally rather than at the tip of the femur, a longer second oviger segment and an inflated and longer sixth oviger segment. The new species has many differences from the other known Sagami Bay species, *T. scrutator*, including a cylindrical proboscis instead of one shaped like a tapering cone with a long tube distally.

Tanystylum scrutator Stock

Tanystylum scrutator Stock, 1954:142-145, fig. 70.—Utinomi, 1971:337.

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 19 Dec 1969 (1♀).

REMARKS.—The male of this species remains unknown, but the characters of the species are sufficiently marked to distinguish the female easily. The main character of this species is the very tubular distal proboscis, which is longer and more slender distally than other species of this genus having tubular proboscides.

This species is known only from Sagami Bay, from this record, and from the type-locality at Misaki. The two recorded depths give it a shallow range from the shore to 15 meters.

Family ENDEIDAE Norman

Genus *Endeis* Philippi, 1843

Key to the Japanese Species of *Endeis*

(Based on adult males)

- Legs with only small isolated spines, femur straight, with less than 20 cement gland pores per femur ***E. mollis***
- Legs with large spine-bearing swellings; femur with more than 20 cement gland pores ****E. meridionalis***

* Not discussed herein.

***Endeis mollis* (Carpenter)**

Phoxichilus mollis Carpenter, 1904:182-183, figs. 1-7.
Endeis mollis.—Utinomi, 1971:327 [literature].—Stock, 1975a: 1083-1085; 1975b:76.—Child, 1979:66.

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 27 Jul 1973 (1 juv); 23 Aug 1974 (1 juv); 3 Aug 1976 (1♀). Off Shimoda, 8 Aug 1973 (1♀, 1 juv).

REMARKS.—This pantropical species has never been recorded from Japan proper, but only as far north as the Ryukyu Islands (Ohshima, 1935: 139). It has been recorded from littoral habitats to deeper waters in about 60 meters. The only other species of this genus known to Japan, *Endeis meridionalis*, has been taken only in Kyushu.

Family PHOXICHILIDIIDAE Sars

Genus *Anoplodactylus* Wilson, 1878

Key to the Japanese Species of *Anoplodactylus*

- 1. Femur with multiple cement glands 2
- Femur with single cement gland 5
- 2(1). Femur with 17 to 25 cement gland pores ***A. perforatus***
- Femur with less than 10 cement gland pores 3

- 3(2). Femur with 5 to 8 cement gland slits **A. pycnosoma**
 Femur with 3 cement gland pores 4
- 4(3). Trunk elongate; oviger 5-segmented; femur with large setose lateral
 and dorsodistal tubercles; proboscis with distal tubercles forming
 triangle at lips **A. stellatus**, new species
 Trunk compact; oviger 5-segmented; femur without tubercles; pro-
 boscis cylindrical; propodus sickle-shaped ***A. hokkaidoensis**
- 5(1). Cement gland a slender tube 6
 Cement gland a truncate or flask-shaped cone 7
- 6(5). Cement gland tube not as long as femur diameter **A. gestiens**
 Cement gland tube very long, twice femur diameter **A. pulcher**
- 7(5). Cement gland a narrow necked flask **A. lagenus**, new species
 Cement gland a truncate cone 8
- 8(7). Cement gland near dorsodistal end of femur 9
 Cement gland middorsal or more proximal on femur 10
- 9(8). Propodus with lamina over entire sole, with 2 heel spines
 **A. shimodaensis**
 Propodus with lamina less than one-third sole length, with 1 large
 heel spine **A. excelsus**, new species
- 10(8). Second coxae with long genital spur bearing sexual pore; cement
 gland a low broad cone **A. versluysi**
 Second coxae without long spur; cement gland a taller cone 11
- 11(10). Chelifore scape tuberculate; lateral processes with 2 laterodistal tu-
 bercles; proboscis with angular ventrodorsal tips .. ***A. mamillosus**
 Chelifore scape without tubercles; lateral processes with single slender
 dorsodistal tubercle; proboscis distally rounded
 **A. carnatus**, new species

* Not discussed herein.

Anoplodactylus carnatus, new species

FIGURE 14

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 22 Dec 1970 (1♂, holotype, USNM 183822); 11 Mar 1971 (1♀, allotype).

DESCRIPTION.—Animal tiny, leg span about 5.3 mm. Trunk compact, robust, first and second segmentation lines complete, third lacking. Lateral processes only slightly longer than their diameters, separated by about 0.3 of their diameters, armed with small slender dorsodistal tubercle with seta. Neck short, broader than long, flanked by large palp bulges. Ocular tubercle over twice as tall as its diameter, with small tubercle at apex, eyes toward apex, lightly pigmented. Proboscis short, robust, only about twice

as long as basal diameter, rounded distally. Abdomen erect, about as long as ocular tubercle, glabrous.

Chelifore scape moderately short, with slight ventral curve, armed with two dorsodistal setae. Chela palm curved, without setae, fingers as long as palm. Immobile finger straight with curved tip, without setae. Movable finger well curved, with 1 short dorsal seta. Fingers lacking teeth or denticulations.

Oviger 6-segmented, moderately short. Second segment armed with 1 short seta, third segment with proximal constriction. Strigilis segments slightly curved, unarmed except for terminal segment bearing 4 to 5 short setae.

Legs moderately short. First coxa armed with small laterodistal tubercles bearing short setae

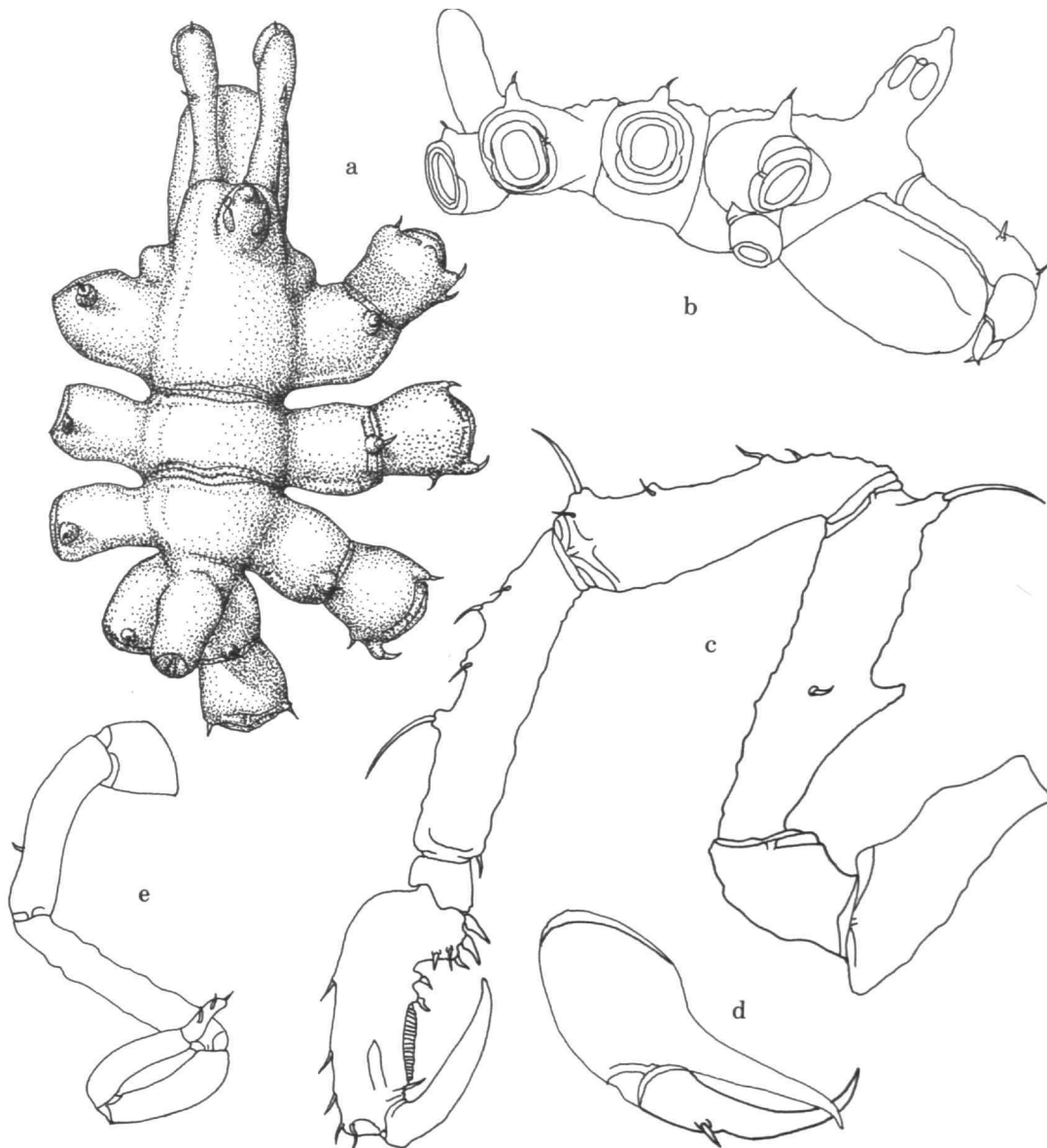


FIGURE 14.—*Anoplodactylus carnatus*, new species, holotype, male: a, trunk, dorsal view; b, trunk, lateral view; c, third leg; d, chela, enlarged; e, oviger.

and a small posterior seta on all but posterior first coxae. Second and third coxae glabrous. Femur with 2 midlateral setae and single long seta on dorsodistal small tubercle. Cement gland a slender truncate cone at middorsal of femur. Femur the longest segment with first tibia slightly shorter

than second. Both tibiae armed with few dorsal setae 2 originating from low tubercles and 1 longer seta from slightly larger dorsodistal tubercle. Long setose tubercle of tibia 2 at only 0.6 the length of this segment. Tarsus short, almost rectangular, unarmed. Propodus short, robust, with

marked heel perpendicular to sole. Heel armed with 2 stout spines and 3 or 4 short setae distal to spines. Sole armed with 2 proximal spines, a propodal lamina over half its length, and 1 or 2 distal setae. Dorsal propodal surface with 5 or 6 short setae. Claw robust, moderately curved, about 0.7 length of propodus. Auxiliary claws lacking.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 0.71; trunk width, 0.47; proboscis length, 0.32; abdomen length, 0.17; third leg, coxa 1, 0.17; coxa 2, 0.34; coxa 3, 0.18; femur, 0.44; tibia 1, 0.38; tibia 2, 0.37; tarsus, 0.07; propodus, 0.27; claw, 0.2.

ETYMOLOGY.—The specific name *carnatus* (fleshy or fat) is from the Latin and pertains to the short robust appearance of the entire animal.

DISTRIBUTION.—Known only from Nabeta Bay, western Sagami Bay, in 7 to 15 meters.

REMARKS.—This species has the characters of the old genus *Halosoma* and would carry this designation if the genus had not been reduced to a synonym of *Anoplodactylus*. *Anoplodactylus carnatus* is extremely close to Losina-Losinsky's "*Halosoma*" *derjugini* (1929:551–553, fig. 5) from off Vladivostok, but differs in having fewer appendage setae, a longer cement gland cone, fully segmented first and second trunk segments, and longer oviger strigilis segments with far fewer setae. Losina-Losinsky's figures are somewhat diagrammatic but the above differences are sufficient to separate the two species until more specimens can be compared.

Anoplodactylus excelsus, new species

FIGURE 15

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 5 (1♂ with eggs, holotype, USNM 183824, 2♂ with eggs, 6♂, 14♀, paratypes).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 21 (2♂, paratypes).

DESCRIPTION.—Animal moderately small, leg span slightly less than 18 mm. Trunk elongate, slender, first 2 segmentation lines present but incomplete, third lacking. Lateral processes slen-

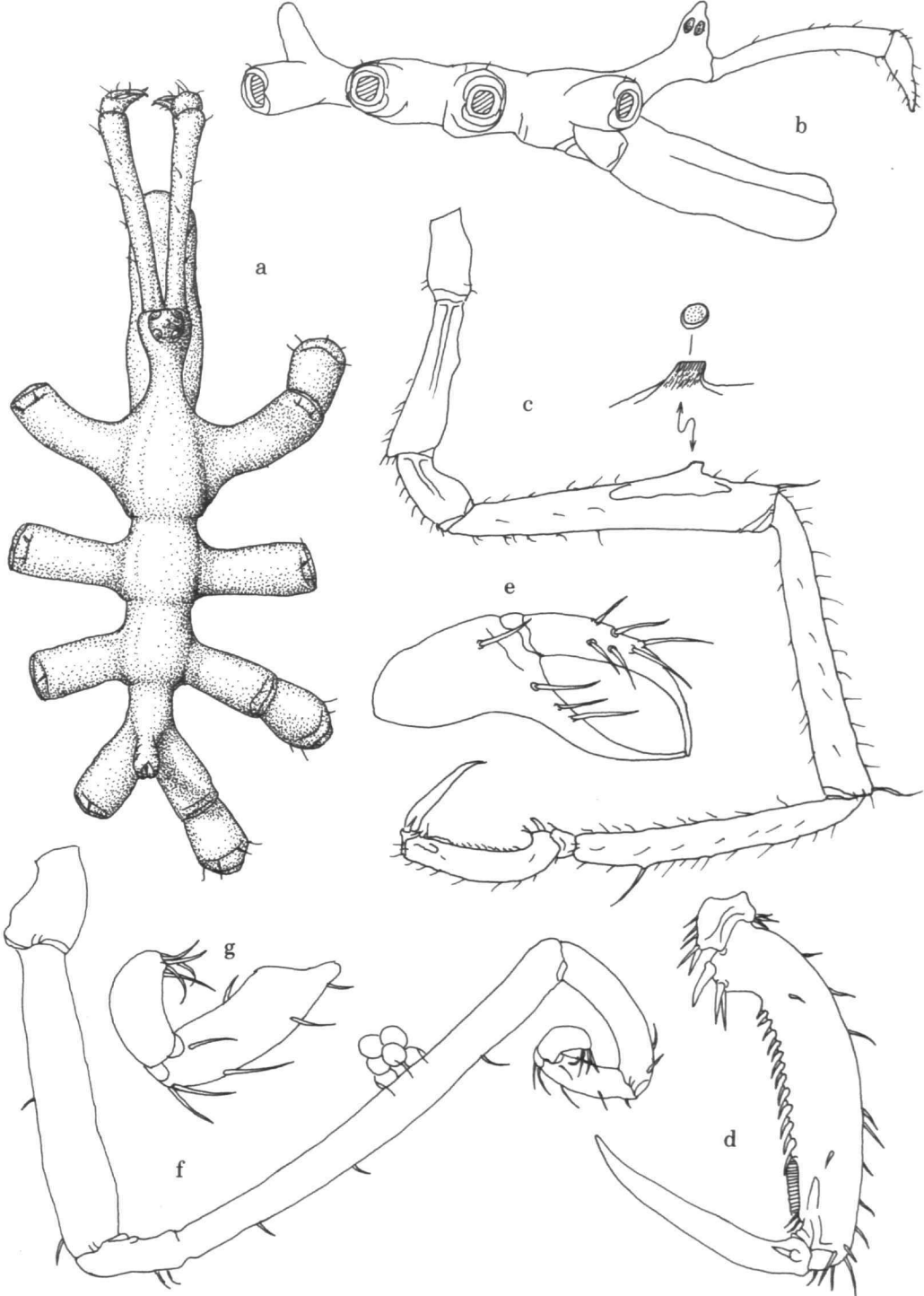
der, moderately long, over twice longer than their diameters at most, separated by almost twice their diameters anteriorly, armed with 1 or 2 dorsodistal setae, without tubercles. Neck very slender, obliquely erect. Ocular tubercle a truncate cone bulging at large darkly pigmented eyes, tubercle 1.5 times taller than its diameter, lateral papillae not evident. Proboscis long, slender, with slight basal and median constrictions, lips blunt. Abdomen obliquely erect, tapering to rounded tip, unarmed, only slightly taller than ocular tubercle.

Chelifore scape slender with slight ventral curve, armed with few dorsal, lateral, and ventral setae shorter than segment diameter. Chela palm ovoid, armed with 2 or 3 ectal and endal setae. Fingers moderately curved, overlapping at tips. Immobile finger armed with 3 setae, movable finger with 6 setae. Fingers without teeth.

Oviger 6-segmented, long, third segment almost twice length of second, both armed with few ectal setae shorter than segment diameter. Strigilis 3 segments slightly curved, fifth segment armed with lateral and ectal setae, sixth with tuft of distal setae longer than segment diameter.

Legs moderately slender, major segments armed with dorsal, lateral, and ventral setae shorter than segment diameter and single dorso-distal long seta. Coxae 1 and 3 subequal in length to coxa 2, each armed with ventral and ventro-distal setae. Femur subequal in length to tibia 1, tibia 2 slightly shorter. Femoral cement gland a single short stout tube with cribriform tip, placed at distal third of segment. Tarsus short, subtriangular, armed with 3 dorsal setae and 5 ventral setae. Propodus slender, long, sole straight. Heel armed with single long spine and 2 stout setae, sole with 12 or 13 small curved spines, few lateral and dorsal setae and short lamina 0.3 of sole length. Claw long, slender, slightly curved, two-thirds propodal length, auxiliaries tiny.

FIGURE 15.—*Anoplodactylus excelsus*, new species, holotype, male: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, third leg, with enlargement of femoral cement gland; *d*, terminal segments of third leg, enlarged; *e*, chela, enlarged; *f*, oviger; *g*, oviger two terminal segments, enlarged.



MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 2.24; trunk width, (across 2nd lateral processes), 1.36; proboscis length, 1.38; abdomen length, 0.32; third leg, coxa 1, 0.46; coxa 2, 0.9; coxa 3, 0.42; femur, 1.7; tibia 1, 1.67; tibia 2, 1.5; tarsus, 0.13; propodus, 0.84; claw, 0.58.

ETYMOLOGY.—The specific name *excelsus* (high, lofty or distinguished) is from Latin and pertains to the neck and ocular tubercle, elevated in this species, and its clean and distinguished appearance.

DISTRIBUTION.—Known from Suruga Bay in 75 to 85 meters and from Sagami Bay in 113 meters.

REMARKS.—There are a few small slender species of *Anoplodactylus*, with a single cement gland per leg, which share several other characters displayed by this new species. These are *A. pacificus* Hilton, *A. pectinus* Hedgpeth, *A. pelagicus* Flynn, *A. pharus* Stock, *A. arcuatus* Child, and *A. gestiens* (Ortmann). These species all have one large heel spine, sometimes preceded by a smaller second spine, a long slender oviger (unknown for *A. pharus*), moderately long slender legs, and chelae having long slender fingers bearing setae but without teeth. On the other hand, each of these species have some characters which differ from *A. excelsus*. The ocular tubercle of *A. pelagicus* is very short, broader than it is tall, and the cement gland is a longer tube placed more proximally on the femur. The major heel spine of *A. pectinus* is, as the specific name alludes, pectinate, and the cement gland is of the broad, concave, cribriform type. The ocular tubercle of *A. pharus* is capped with a very tall cone above the eyes and the only known specimen, a female, has a very long propodal lamina which in the male, probably would be equal or greater in length than that of the female. In *A. gestiens*, the strigilis segments are much longer and have a different arrangement of setae, the propodal lamina is longer, and the cement gland is a longer tube at the midpoint of the dorsal femur. The lateral processes are longer in *A. arcuatus*, and the unique cement gland of this species is a long curved tube almost at the dorsodistal end of the femur.

This new species appears superficially closest to *A. pacificus*, a species known from California, in

the proboscis, chelae, and legs. All are moderately long and slender. On closer examination, the heel of *A. pacificus* bears a second smaller spine proximal to the first, the oviger terminal segment is much shorter and has less setae, the ocular tubercle (although broken off the type) has a much taller cone above the eyes, and the cement gland, again a very useful diagnostic character, is a longer flaring tube placed almost medially on the femur.

The various characters discussed above, in combination, serve to separate *A. excelsus* from any previously described species in this genus and mark it as another new Japanese species of *Anoplodactylus*.

Anoplodactylus gestiens (Ortmann)

Phoxichilidum gestiens Ortmann, 1890:166, pl. 24: fig. 8a-d.
Anoplodactylus gestiens.—Utinomi, 1971:325-326 [literature].—Child and Nakamura, 1982:292-296, fig. 1.—Nakamura and Child, 1982:289-290 [text], fig. 4.

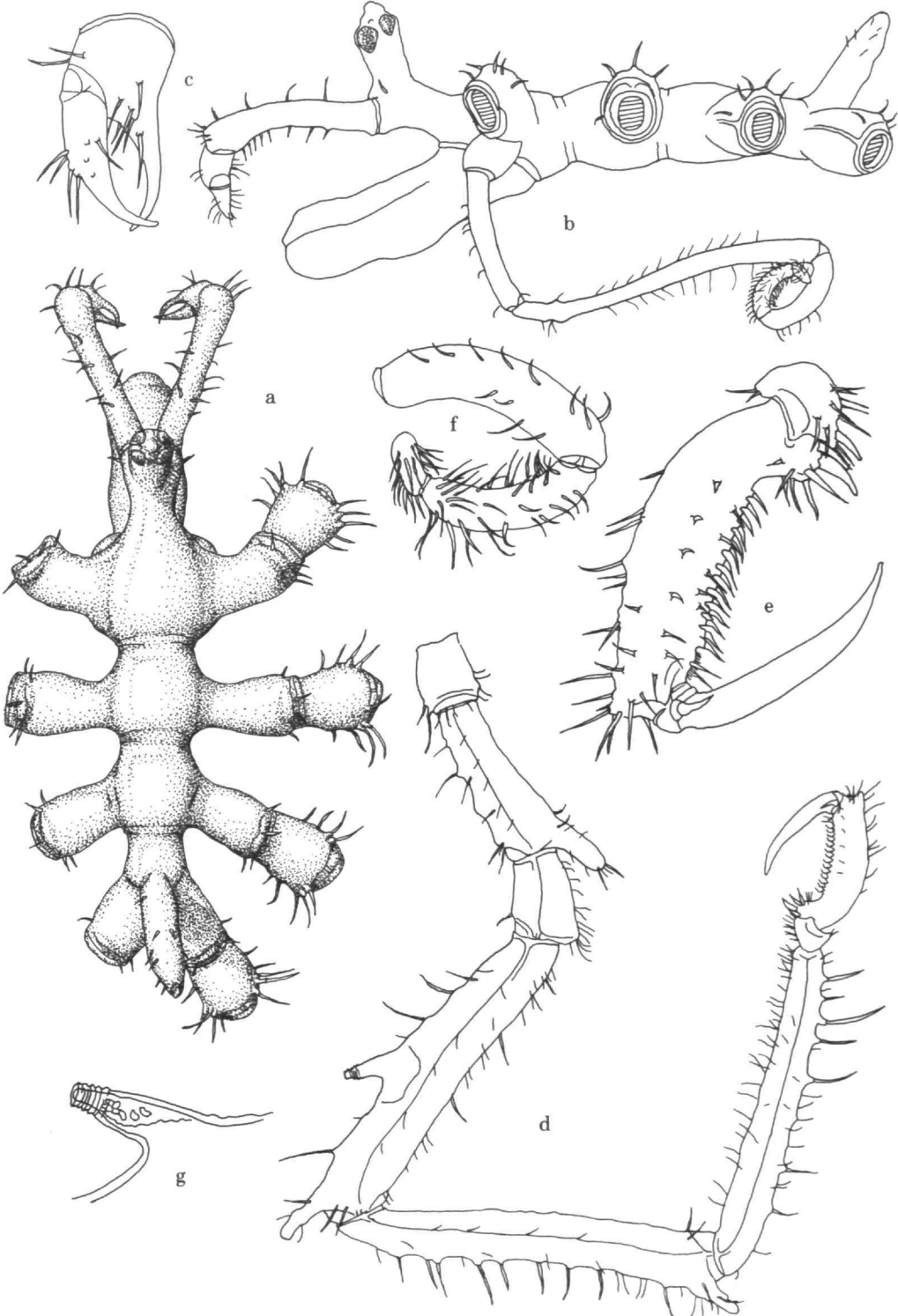
MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 4 (1♂, 1♀).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 9 (1♀ juv); sta 13 (1♂ juv); sta 21 (17♂ with eggs, 262♂, 288♀, 9♂ juv, 22♀ juv, including 1 gynandromorph); sta 23 (2♀). *Tansei Maru* cruise KT71-2, sta 26 (1♀); sta 27 (1♂ juv); sta 29 (2♂, 2♀, 1♀ juv). Off Kisami, 22 May 1970 (3 juv).

REMARKS.—This common species has been recently figured by Nakamura and Child (1982: 290, fig. 4) and is the only known long slender species in Japanese shallows, except *Anoplodactylus excelsus*. The differences between these two species are discussed under the latter species (above).

Although this species is recorded in almost every paper enumerating Japanese species, it has a remarkably limited known distribution: the coasts of Honshu Island, except for the single Nagasaki Prefecture record of Utinomi (1971: 326). It has a known depth range from the shore to 300 meters.

FIGURE 16.—*Anoplodactylus lagenus*, new species, holotype, male: a, trunk, dorsal view; b, trunk, lateral view, with oviger; c, chela, enlarged; d, third leg; e, terminal segments of third leg, enlarged; f, oviger strigilis, enlarged; g, femoral cement gland tube, enlarged.



***Anoplodactylus lagenus*, new species**

FIGURE 16

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 9 (1♀, allotype). Off Kisami, 1 Nov 1970 (1♂, holotype, USNM 183827).

DESCRIPTION.—Animal moderately small, leg span 25.4 mm. Trunk moderately slender, segments inflated, segmentation lines indistinct, incomplete. Lateral processes separated by little more than their diameter, bearing low dorsodistal bulges armed with 4 to 6 dorsal and lateral setae. Neck slender, armed with short lateral seta on each side. Ocular tubercle cylindrical with blunt conical apex, about twice as tall as basal width, with large darkly pigmented eyes. Proboscis moderately short, swollen at midlength, lips rounded. Abdomen almost erect, tapering, slightly longer than ocular tubercle, armed with 11 or 12 short distal setae.

Chelifere slender, overreaching proboscis by almost half scape length. Scape armed with many setae equal to or shorter than segment length. Chela palm rectangular, armed with several lateral and dorsal setae. Immobile finger slender, with few basal setae. Movable finger stout, armed with field of 8 or 9 ectal setae. Both fingers well curved, overlapping at tips, without endal teeth.

Oviger long, slender, third segment slightly more than twice length of second, both armed with rows of ectal and endal setae. Strigilis segments well curved, fifth and sixth segments with many setae as long or longer than segments. Terminal segment long, oval.

Legs moderately long, robust, rather heavily setose. Coxa 2 longer than coxae 1 and 3 combined, armed with long genital spur on third and fourth legs equal in length to coxa diameter. Femur and tibia 1 with dorsodistal tubercles shorter than segment diameter, armed with many setae, some dorsally longer than segment diameter. Tibia 2 armed with low dorsal tubercles bearing long setae, some longer than segment diameter. Femoral cement gland a large bottle-shaped tube pointing distally with distal wrinkles, placed just distal to median point of segment.

Femur and tibia 1 subequal in length, tibia 2 slightly shorter. Tarsus subtriangular, short, armed with 2 dorsal setae, one ventral spine and many setae. Propodus curved proximally, straight distally, with marked heel bearing single large spine and 5 setae. Sole with 14 or 15 short curved spines and very short distal propodal lamina. Propodus armed with many lateral, dorsal, and distal short setae. Claw long, slightly curved, more curved distally, auxiliaries prominent, as long as claw diameter.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 3.30; trunk width (across 2nd lateral processes), 1.94; proboscis length, 1.63; abdomen length, 0.77; third leg, coxa 1, 0.48; coxa 2, 1.32; coxa 3, 0.64; femur, 2.62; tibia 1, 2.64; tibia 2, 2.22; tarsus, 0.1; propodus, 0.96; claw, 0.74.

ETYMOLOGY.—The specific name *lagenus* is from the Greek *lagenos* or *lagynos* and refers to a flagon or flask. The cement gland of this species bears a striking resemblance to a flask.

DISTRIBUTION.—The new species is known from the type-locality, off Kisami, Izu Peninsula, in 30 meters, and from further off shore in 76 to 94 meters.

REMARKS.—The closest morphological relatives to this species are five western hemisphere species, all relatively large (trunk length about 3 mm or longer). These are *Anoplodactylus iuleus* Stock, *A. insigniformis* Stock, *A. lentus* Wilson, *A. massiliensis* Bouvier, and *A. massiliformis* Stock. Each of these shares with the new species a rather long tenuous trunk with lateral processes well separated with low inconspicuous dorsodistal tubercles or without these tubercles, and most but not all of these species have a dorsodistal tubercle on the major leg segments. The majority differ in the size and shape of the single cement gland carried by each. The cement gland of two of the very long legged species, *A. massiliensis* and *A. lentus*, is a slit without a tube or other raised structure for the aperture. The gland shape of *A. massiliformis* and *A. insigniformis* is that of a broad raised tube or chimney with a flaring distal rim. The species closest to this new species is *A. iuleus*. The propodus, chela, trunk configuration, proboscis and oviger are very similar for the two species, but *A. iuleus* has a very

short ocular tubercle no taller than its diameter and the tubular cement gland is a tiny cone at the top of a distinct femoral bulge. There are other small differences in leg armature, strigilis segment lengths, and the fact that *A. iuleus* lacks the distinctive dorsodistal tubercles on the major leg segments. There is no known Japanese species so closely related to *A. lagenus* as these western species.

Anoplodactylus perforatus Nakamura and Child

Anoplodactylus perforatus Nakamura and Child, 1982:289-291, fig. 3.

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 12 Sep 1969 (1♂ with eggs); 21 May 1970 (7♂, 10♀, 7♂ juv, 5♀ juv); 13 Jun 1970 (14♂ with eggs, 17♂, 25♀, 9♂ juv, 7♀ juv); 10 Jul 1970 (4♂ with eggs, 2♂, 7♀); 13 Aug 1970 (2♂ with eggs, 1♂, 3♀); 2 Oct 1970 (6♂ with eggs, 3♀); 30 Oct 1970 (1♂, 6♀, 1♂ juv); 26 Nov 1970 (2♂); 19 Jan 1971 (2♂, 7♀ juv); 2 Apr 1971 (1♂, 2♀, 1♂ juv), 20 May 1971 (1♂ with eggs, 3♂, 4♀, 2♂ juv, 4♀ juv); 19 Jun 1971 (123 specimens); 15 Aug 1972 (1♂ with eggs, 1♀); 28 Aug 1972 (2♂ with eggs, 5♀); 27 Jul 1973 (17♂ with eggs, 2♂, 21♀); 8 Aug 1973 (2♂ with eggs, 2♂, 3♀); 17 Aug 1973 (8♂ with eggs, 5♂, 20♀, 4 juv); 26 Oct 1973 (22♂ with eggs, 9♂, 15♀, 2 juv); 23 Aug 1974 (81♂ with eggs, 31♂, 89♀); 3 Aug 1976 (59♂ with eggs, 11♂, 81♀); 16 Aug 1977 (1♂ with eggs, 1♂, 2♀); and the type specimens.

REMARKS.—This is one of the four most common species taken in the Shimoda area with almost 800 specimens collected at most times of the year. Only a single male has been found further north in Sagami Bay (a paratype) outside the Shimoda area, and in deeper water. Further collecting within the type depth range of 7 to 15 meters around Sagami and Suruga bays should produce many more specimens of this species.

The above records indicate males carrying eggs from May through October, suggesting a single breeding season in the warm weather months in Sagami Bay. This seasonality was also suggested by Nakamura and Sekiguchi (in press), who

found egg carrying males of this species from June to October at Shimoda. They correlate this with temperature and suggest a migration elsewhere during the colder months. This might also suggest a dying off of adults during the winter, but whether or not some adults of one year class survive into the next year for breeding purposes is unknown for this species and, indeed, for most pycnogonids. Obviously, some of the eggs or young remain viable over the winter, but we have little or no knowledge of the life span of the more than 800 pycnogonid species.

This species is easily recognized, at least in the male, by the many (17 to 25) cement gland pores on each femur. The species has no other conspicuous characters and like most species of this genus, the specific designation of the female is difficult to impossible to determine without accompanying males.

Anoplodactylus pulcher Carpenter

Anoplodactylus pulcher Carpenter, 1908:97-98, pl. 12: figs. 13-19.—Stock, 1954:84; 1965:29, fig. 45; 1968:49; 1973:97.—Arnaud, 1973:957.

Anoplodactylus stylops Loman, 1908:71, pl. 2: figs. 20-24.

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 3 (1♀).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 14 (1♀ juv); sta 24 (1♀). Off Kisami, 22 May 1970 (1♂ with eggs, 2♂, 1♀, 3 juv); 1 Nov 1970 (3♂ with eggs, 4♂, 7♀). Off Shimoda, 8 Aug 1973 (6♂, 2♀, 2 juv); 18 Aug 1973 (4♂, 3♀).

REMARKS.—This species is easily recognized in both sexes by the 2 or 3 very long setae distally on each lateral process, and in the male by the extremely elongate cement gland tube at the midpoint of each femur. It also has a very elongate ocular tubercle and abdomen and a relatively short proboscis.

This species has been found from the Persian Gulf and Madagascar to Western Australia in the Indian Ocean, but never as far north as Japan until now. It has been collected subtidally down to 91 meters, and the above collecting records fall well within this range.

***Anoplodactylus pycnosoma* (Helfer)**

Peritrachia pycnosoma Helfer, 1938:176-177, fig. 7.

Anoplodactylus pycnosoma.—Stock, 1953:41, fig. 5; 1954:75-77, fig. 33 [figures].—Utinomi, 1971:326 [literature].—Child, 1975:20.—Stock, 1975b:132.

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 26 Oct 1973 1♀, 1 juv.

REMARKS.—This is the fourth record of *Anoplodactylus pycnosoma* since Helfer's original description. Helfer (1938) and Stock (1954) found it in Japan and the above specimens provide the third Japanese record. Child (1975) found it in Western Australia, and Stock (1975b) recorded it in Tanzania. All known collecting depths are shallow.

The best recognition character for this species, in males, is the series of from 5 to 8 cement gland slits on each femur. The species has affinities with *Anoplodactylus robustus* (Dohrn) and *A. monotrema* Stock, all of which are compact, have a barrel-shaped proboscis with ventrolateral extensions at the mouth area, and lack tubular cement glands. The male cement glands differ, among other characters, with *A. robustus* which has 2 or 3 per femur and with *A. monotrema* which has a single gland per femur.

***Anoplodactylus shimodaensis* Nakamura and Child**

Anoplodactylus shimodaensis Nakamura and Child, 1982: 285-287, fig. 2.

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 24 (1♀). Nabeta Bay, 12 Sep 1969 (1♀); 21 May 1970 (1♂ with eggs, 1♂, 4♀); 13 Jun 1970 (6♂ with eggs, 8♀); 10 Jul 1970 (1♂ with eggs, 4♀); 13 Aug 1970 (2♂ with eggs, 2♀); 2 Oct 1970 (1♀); 30 Oct 1970 (6♂ with eggs, 7♀); 26 Nov 1970 (1♂ with eggs, 3♀); 22 Dec 1970 (2♂ with eggs, 3♂, 7♀); 11 Mar 1971 (1♂, 4♀); 2 Apr 1971 (1♂); 19 Jun 1971 (4♂ with eggs, 9♀); 19 Nov 1971 (1♂ with eggs, 1♀); 28 Aug 1972 (1♀); 8 Aug 1973 (1♂ with eggs, 1♂, 1♀); 17 Aug 1973 (1♂); 26 Oct 1973 (5♂ with eggs, 3♀); 3 Aug 1976 (4♂ with eggs, 1♀).

REMARKS.—This small robust species is recognized by its fairly long lateral processes in relation

to trunk length, the tiny globular chelae with slender overlapping fingers lacking teeth, and the shape and placement of the dorsodistal cement gland, unique among Japanese species of this genus.

Anoplodactylus shimodaensis is known only from several places at the southern tip of the Izu Peninsula in Sagami Bay. It lives there in from 7 to 40 meters and has not been found in the littoral.

***Anoplodactylus stellatus*, new species**

FIGURE 17

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 17 Aug 1973 (1♂, holotype, USNM 183829).

DESCRIPTION.—Animal moderately small, leg span 13.4 mm. Trunk elongate, first and second segmentation lines complete, third lacking. Lateral processes increasingly long from posterior to anterior members, separated by distances greater than their diameters, armed dorsodistally with 1 to 3 short setae, without tubercles. Ocular tubercle about 1.5 times taller than basal width, with slender short tubercle above lightly pigmented eyes. Proboscis short, stout, tapering distally to flaring terminus bearing 3 radially placed triangular tubercles around mouth. Abdomen erect, cylindrical, rounded distally, armed with 4 short distal setae.

Chelifore short, slender, armed with robust dorsodistal tubercle, several dorsal setae. Chela long, slender, fingers equal in length to palm, armed with few setae. Fingers well curved, overlapping distally, both armed with 4 slender sharp teeth.

Oviger short, third segment slightly over twice length of second, armed with few short setae. Strigilis well curved, terminal segment triangular, short, glabrous.

Legs moderately short, second coxa shorter than combined length of first and third, armed with few distal setae. Third and fourth legs with very short, low genital spur on coxa 2. Femur the longest segment, tibia 1 slightly longer than tibia 2, all armed with few dorsal setae, a long dorsodistal seta, and femur with a long dorsodistal spur

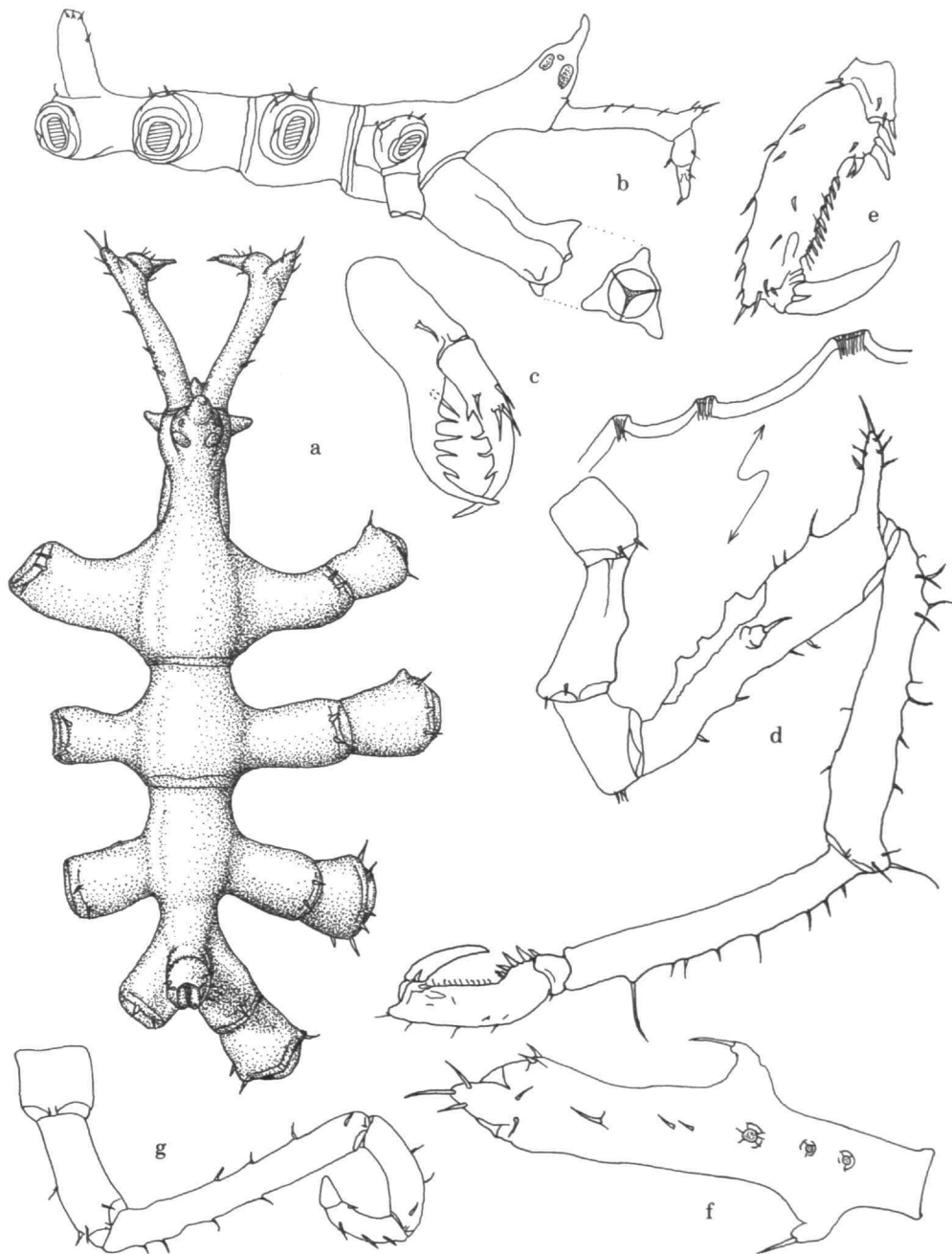


FIGURE 17.—*Anoplodactylus stellatus*, new species, holotype, male: *a*, trunk, dorsal view; *b*, trunk, lateral view, with anterior view of proboscis; *c*, chela, enlarged; *d*, third leg, with enlargement of femoral cement glands; *e*, terminal segments of third leg, enlarged; *f*, femur, dorsal view; *g*, oviger.

as long as segment diameter. Femur with large triangular anterolateral tubercle toward proximal end of segment and another large posterior tubercle placed midlaterally, both armed with single large seta. Cement gland erupting through 3 truncate cones with cribriform tips of unequal size, placed proximally to midlength of femur. Tarsus short, triangular, armed with 1 dorsal seta and several short ventral setae. Propodus slightly curved, with low heel bearing 2 stout spines, distal one larger, and 2 stout lateral setae. Sole straight, armed with 10 or 11 small straight spines, without lamina. Claw short, robust, well curved, slightly over half propodus length. Auxiliary claws tiny.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 2.08; trunk width, (across 1st lateral processes), 1.15; proboscis length, 0.67; abdomen length, 0.36; third leg, coxa 1, 0.35; coxa 2, 0.61; coxa 3, 0.42; femur (without tubercle), 1.28; tibia 1, 1.24; tibia 2, 1.14; tarsus, 0.17; propodus, 0.6; claw, 0.32.

ETYMOLOGY.—The specific name *stellatus* (starred) is from Latin and refers to the star-shaped proboscis when viewed anteriorly.

DISTRIBUTION.—Known only from the type-locality, Nabeta Bay, in 7 to 15 meters.

REMARKS.—Two characters found on this otherwise unremarkable species render it unique among the many known species of this genus. The first is the peculiar stellate shape of the distal proboscis. Several pycnogonids have proboscid shapes that are peculiar among members of their genus or family. For example, *Anoplodactylus batangensis* (Helfer) has a curved tapering cone-shaped proboscis, while the two known species of the genus *Hedgpethius* have 3 triangular tubercles arranged radially around midproboscis. These peculiar proboscis shapes are most likely associated with feeding habits. The physignomy of this new species may in fact be an adaptation to attaining an otherwise unavailable food source; the triangular opening of the food source may exclude other pycnogonids with the more usual cylindrical proboscis. A number of colonial ectoprocts have variously shaped opercula, some of which are triangular. The alcyonarian, madreporarian, and several other coelenterate groups offer a

wealth of rigid stomata, some triangular, through which a triangular proboscis could be inserted to remove soft parts. It must remain conjecture as to whether these pycnogonid characters are adaptations to the shape of the food source or even whether these or other pycnogonids may be predator-specific only to a certain kind or shape of food.

The second peculiar character of this new species is the presence of large conical tubercles laterally on the femur. In almost all instances, such tubercles are confined to the dorsal surface of major leg segments. These distally pointing tubercles are uncommon in pycnogonids and we can find no other species of *Anoplodactylus* with these large lateral tubercles.

Multiple cement glands per femur are uncommon in *Anoplodactylus*. Of almost 90 known species, there are 16, including *A. stellatus*, with 2 or more glands per femur. Among species of the very closely related genus *Phoxichilidium*, many glands with flat pore openings are the rule rather than the exception, but with *Anoplodactylus*, less than 20 percent of the known species have more than a single gland per femur. The 3 glands on each femur of *A. stellatus* are of unequal size, with the most distal cup being the largest. This character is again unusual because most cement glands in multiple sets are of equal size.

Because of these unusual characters, this pycnogonid cannot be confused with any other known species.

Anoplodactylus versluysi Loman

Anoplodactylus versluysi Loman, 1908:73–74, pl. 3: figs. 33–39.—Utinomi, 1971:326–327 [literature].

MATERIAL EXAMINED.—Sagami Bay: Off Shimoda, 8 Aug 1973 (3♀). Nabeta Bay, 27 Jul 1973 (1♀).

REMARKS.—This slender somewhat tenuous species fortunately has several characters that make it determinable in the female: the posterodistal tubercle on all first coxae, the tall slender tip of the ocular tubercle, and the ventral bulges on the proboscis. The male has a single rather short but robust femoral cement gland, not unlike

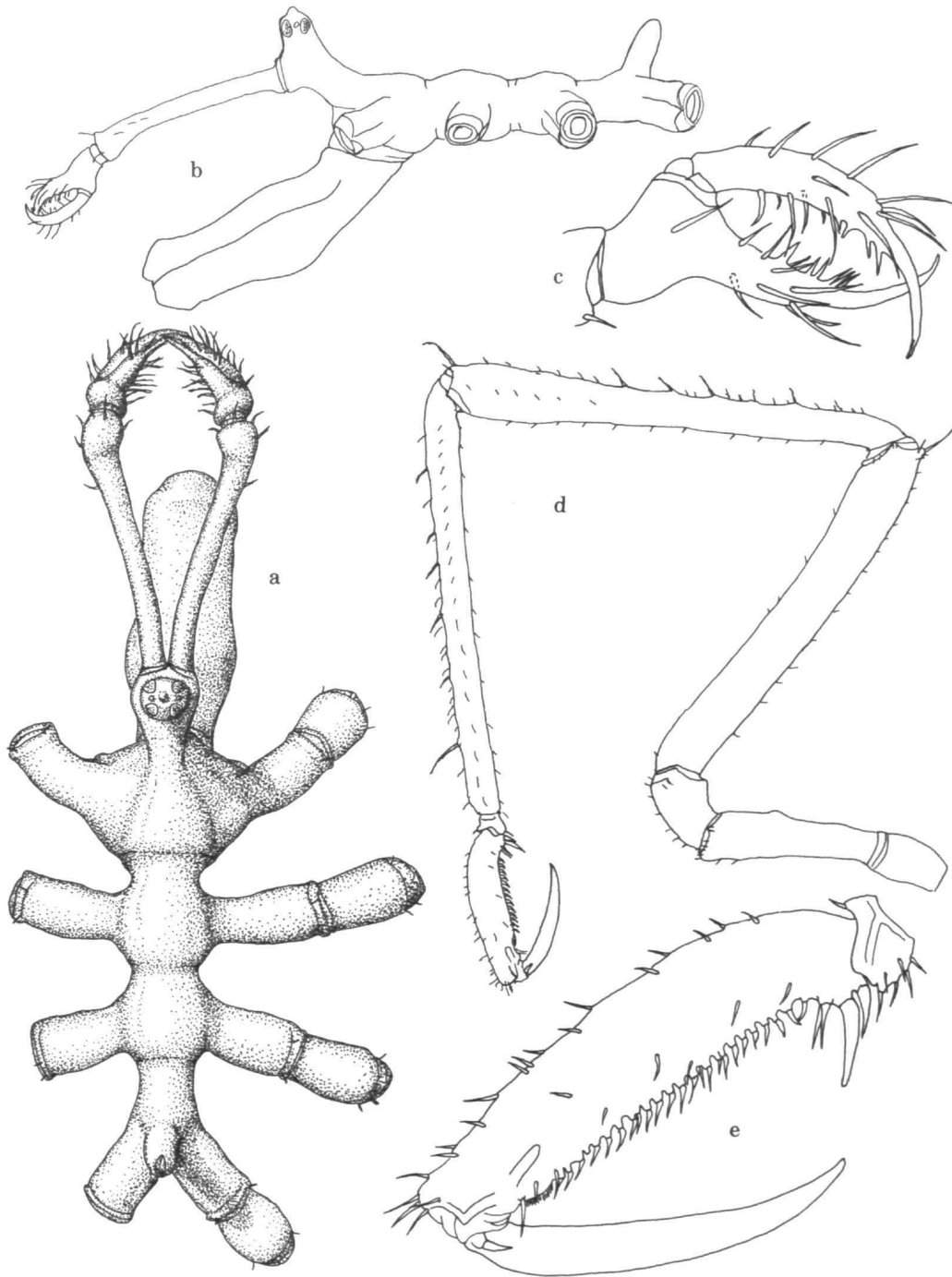


FIGURE 18.—*Anoplodactylus* species, female: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, chela, enlarged; *d*, third leg; *e*, terminal segments of third leg, enlarged.

that of many other species in this crowded genus. The slender trunk, along with the above characters, distinguish the species from any other known Japanese species of *Anoplodactylus*.

The species has been taken before in Sagami Bay (Utinomi, 1971:326), but it is seldom collected elsewhere throughout its Indo-Pacific distribution. Its recorded depth range is from sublittoral usually to less than 100 meters, the only exception being Loman's single record of 120–400 meters.

Anoplodactylus species

FIGURE 18

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 17 (1♀, 1 juv).

REMARKS.—This very large species (leg span about 33 mm), may prove to be new when a male is collected. In *Anoplodactylus*, only the male has the full range of diagnostic characters, and females unaccompanied by males in the same collection are difficult or impossible to identify with certainty.

This species is not unlike *Anoplodactylus iuleus* Stock, from the tropical Atlantic. Both are relatively large, have well-separated lateral processes without tubercles, have very similar propodi and chelifores, particularly in the chelae and their adornment, and have legs with about the same appearance. This species is not *A. iuleus* because of the very low ocular tubercle of the latter and its single heel spine and fewer teeth on each chela finger.

These two specimens were collected from just north of Shimoda in 50 meters.

Family NYMPHONIDAE Wilson

Genus *Nymphon* Fabricius, 1794

REMARKS.—There are a wealth of *Nymphon* species found in the North Pacific and at least 20 of these are found in Japanese and adjacent waters. For an excellent treatment, including a key, of these Pacific species, see Hedgpeth's (1949) continuingly valid report on the Japanese *Albatross* collections.

Nymphon akane, new species

FIGURE 19

MATERIAL EXAMINED.—Sagami Bay: Off Kisami, 16 May 1971 (1♀, holotype, USNM 183830).

DESCRIPTION.—Animal of moderate size, leg span about 21.3 mm. Trunk elongate, segments swollen, completely segmented. Lateral processes almost twice as long as and separated by almost twice their diameters, glabrous. Neck narrower than trunk diameter, moderately long. Ocular tubercle low, not taller than wide, rounded, with two lateral low bumps, placed directly above oviger implantation. Eyes large, lightly pigmented. Proboscis cylindrical, rounded distally to small mouth. Abdomen robust, slightly inflated, tapered at tip, slightly longer than fourth lateral processes, armed with several dorsolateral setae.

Chelifore large, slender, scape slightly curved, more than 4 times longer than its diameter, armed with few dorsal and distal setae. Chela palm short, bulbous, armed with several dorsal setae. Fingers slightly curved, well curved at tips, almost three times longer than palm. Immobile finger with low tubercle bearing 4 or 5 setae longer than finger diameter, armed with 12 long sharply pointed teeth. Movable finger without setae, armed with 14 long sharp teeth. Fingertips cross when fingers close.

Palp first segment no longer than wide, second segment longest, third and fifth subequal, fourth about two-thirds length of terminal segment. Third segment armed with few ventrodiscal short setae, fourth and fifth with many short lateral and ventral setae.

Oviger (female, male unknown) with very short basal segment. Fourth segment slightly shorter than fifth, which has ectal row of short setae. Strigilis with many short ectal setae, with endal denticulate spines in the formula 8:7:6:6. Spines with 3 denticulations per side. Terminal claw slender, moderately curved, with 5 sharp endal teeth.

Legs slender, armed with row of short setae ventrally, row of longer dorsal setae and a long dorsodistal seta on each major segment. Second coxa slightly longer than first and third com-

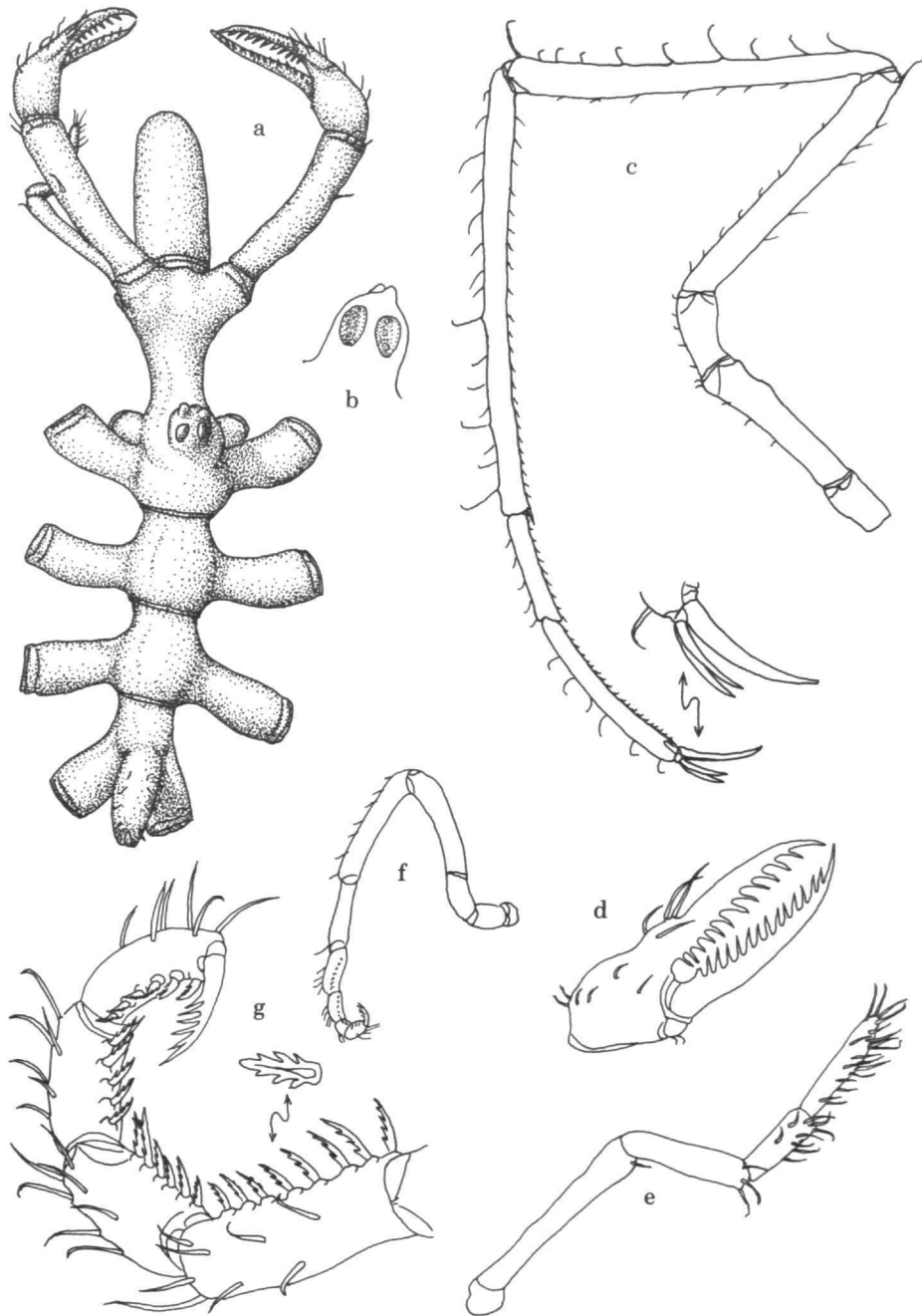


FIGURE 19.—*Nymphon akane*, new species, holotype, female: *a*, trunk, dorsal view; *b*, ocular tubercle, lateral view; *c*, third leg, with enlargement of terminal claws; *d*, chela, enlarged; *e*, palp; *f*, oviger; *g*, oviger strigilis, enlarged, with further enlargement of denticulate spine.

bined. Second tibia longest with tibia 1 and femur each slightly shorter than the last. Tarsus of the brevitarsal group, two-thirds as long as propodus. Propodus slightly curved, without heel or large heel spines, sole with row of short spines over entire length of propodus. Claw slightly curved, slender, less than one-fourth propodus length. Auxiliary claws slender, long, almost two-thirds main claw length.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 2.34; trunk width, 0.86; proboscis length, 0.76; abdomen length, 0.46; third leg, coxa 1, 0.38; coxa 2, 0.98; coxa 3, 0.48; femur, 1.74; tibia 1, 2.22; tibia 2, 2.5; tarsus, 0.68; propodus, 1.04; claw, 0.23.

ETYMOLOGY.—The species name is taken from the Research Vessel *Akane* of the Shimoda Marine Research Center.

DISTRIBUTION.—Known only from the type-locality off Kisami, Izu Peninsula, in 30 meters.

REMARKS.—This relatively shallow-water species shows some similarities to *Nymphon soyoi* Utinomi, *N. benthos* Hedgpeth, and to *N. micronyx* Sars. None has a palp with length ratios that correspond to those of *N. akane*, but all have similar trunk, neck, and proboscis shapes. The tarsus-propodus and claw ratios of *N. benthos*, *N. micronyx* and *N. arkane* are very similar (unknown for *N. soyoi*), but the auxiliary claws of the first two are shorter than those of *N. akane*. The palm of these three species is longer than those of *N. akane*, whose fingers have fewer teeth than those of the other three. No known northern Pacific species has the same combination of characters as *N. akane*: the brevitarsal terminal leg segments, long auxiliary claws, short chela palm, fingers with only 12 to 14 teeth, and palp segment length ratios. The only species of the above three found in the same depth range as the new species is *N. micronyx*, which is known from one collection from Kamchatka in 35 meters. The other two are from very much deeper water.

Nymphon japonicum Ortmann

Nymphon japonicum Ortmann, 1890:158–159, pl. 24: fig. 1.—Hedgpeth, 1949:249–250, fig. 20 [figures].—Utinomi, 1971:320 [literature].

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 23 (2♀, 1 juv), sta 24 (1♂). Off Kisami, 16 May 1971 (1 juv).

REMARKS.—Hedgpeth's (1949, fig. 20) figures illustrate the diagnostic characters of this species quite well. We also found some variation in the propodal claw in the three adults above, as did Hedgpeth in his specimens. This variation is not found, though, in the tarsus-propodus length ratio, which is always close to 1 : 1. The chelifore is distinctive with many teeth over the length of the long fingers, longer than the slender palm. This species is apparently endemic to Japan, and it occurs in depths of 30 to 432 meters.

Nymphon micropedes Hedgpeth

Nymphon micropedes Hedgpeth, 1949:254–256, fig. 24.—Utinomi, 1971:321 [literature].

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 23 (3♂, 5♀, 4 juv).

REMARKS.—This species is easily recognized by its very small terminal leg segments when compared with the proximal six segments, as its specific name states.

The distribution of this species, as presently known, is confined to the northern half of Honshu Island, from off Suruga Bay to the Tsugaru Straits, with a depth range of 85 to 923 meters. The specimens in hand fall within this distribution.

Nymphon ortmanni Helfer

Nymphon ortmanni Helfer, 1938:164, fig. 1.—Utinomi, 1971:320 [literature].

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 4 (1♂ with eggs, 1♀, 10 juv); sta 5 (2 juv).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 13 (2♂); sta 21 (37♂ with eggs, 150♂, 106♀, 212 juv); cruise KT71-2, sta 26 (1♂).

REMARKS.—This is a common and apparently endemic Japanese species. All records except one are from either Suruga or Sagami bays or the Tsugaru Straits in about 150 to 450 meters. The single questionable record is that of Mortensen

(in Stock, 1954:20-21), who lists a now-unknown "Station Unisapi." This record was made four days after Mortensen's last Sagami Bay record and before other Japanese records and, thus, is undoubtedly somewhere along the Honshu coast. The present collection reduces the minimum depth range to 75 meters, but adds nothing new

to its geographic distribution.

Stock (1954:20-21) has listed the variations and differences between this species and *N. japonicum*; in comparing the two, the most readily noticeable difference is that of size. This species is much smaller than *N. japonicum*, even to the unaided eye.

Family CALLIPALLENIDAE Hilton

Key to the Japanese Genera of Callipallenidae

- 1. Palp a low unsegmented knob or entirely lacking; oviger 10-segmented, with or without denticulate spines; propodus with auxiliary claws 2
- Palp in ♂ only, small, of 2 or 4 segments; oviger 9- or 10-segmented, with denticulate spines on strong strigilis; propodus without auxiliary claws 3
- 2(1). Palp a low unsegmented knob; chela fingers small, at right angles to palm; oviger with feeble strigilis having many simple spines **Pallenopsis**
- Palp entirely lacking; chela fingers and palm large, fingers not at right angles to palm; oviger with well-formed strigilis having denticulate spines **Callipallene**
- 3(1). Palp 4-segmented; oviger 9-segmented **Anoropallene**
- Palp 2-segmented; oviger 10-segmented **Propallene**

Genus Anoropallene Stock, 1956

Anoropallene laysani Child

Anoropallene laysani Child, 1972:147-150, fig. 1.

MATERIAL EXAMINED.—Sagami Bay: Off Shimoda, 18 Aug 1973 (1♂).

REMARKS.—Comparison of this specimen with the type, also a male, contributes nothing new to the species' morphology, but extends its known distribution. The type was taken off Laysan Island in the Hawaiian Islands. This second specimen greatly extends its distribution westward to Japan and extends the known depth range from 80 meters for the type to 30 meters for this specimen.

This species rests uneasily in the genus *Anoropallene*, which is diagnosed as lacking both auxi-

liaries and oviger claw; otherwise the genus is very similar to the genus *Oropallene*. The latter genus contains species with both auxiliaries and oviger claw. This species has auxiliaries but lacks an oviger claw, placing it technically in an intermediate position between the two genera. The presence or absence of auxiliary claws has been discarded in many cases as a diagnostic character because of their variability or loss in valid species of auxiliary clawed genera. The presence or absence of an oviger terminal claw appears to be a more valid character and is cited as part of the generic diagnosis in many of the genera in this "top-heavy" family of few species in most genera. It is possible that the family needs revision based on broader morphological diagnoses of the many genera it contains.

Genus Callipallene Flynn, 1929

Key to the Japanese Species of Callipallene

- 1. Proboscis narrowly conical; leg tibiae and propodus heavily setose; chela fingers without teeth ***C. conirostris**

- Proboscis broader, rounded or egg-shaped; leg tibiae and propodus sparsely setose; chela fingers with some teeth 2
- 2(1). Neck very long, longer than proboscis; legs, particularly coxa 2, very long, slender; ♂ oviger fifth segment more than 10 times longer than its diameter **C. amaxana*
- Neck shorter, not longer than proboscis; legs and coxae of much shorter proportions; ♂ oviger segments much shorter in length 3
- 3(2). Neck short, little or no separation between cephalic segment anterior bulge and oviger implantation; propodus very short, well curved **C. dubiosa*
- Neck longer, with some interval between bulge and oviger implantation; propodus longer, more than 4 times longer than wide 4
- 4(3). Propodal auxiliary claws pectinate; strigilis with denticulate dimorphic spines *C. panamensis*
- Propodal auxiliary claws smooth; strigilis with denticulate spines of one kind and shape 5
- 5(4). Chela fingers shorter than palm; propodal heel with 4 spines, tarsus without spine; ocular tubercle a low cone; strigilis segments less than 4 times longer than wide *C. brevirostris novaezealandiae*
- Chela fingers longer than palm; propodal heel with 3 spines, tarsus with spine; ocular tubercle a low cylinder with conical apex; strigilis segments more than 4 times longer than wide *C. sagamiensis*, new species

* Not discussed herein.

Callipallene brevirostris novaezealandiae
(Thomson)

Pallene novae-zealandiae Thomson, 1884:246-247, pl. 14: figs. 1-4.

Callipallene brevirostris novaezealandiae.—Child, 1975:10 [literature].—Stock, 1975b:132.

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT69-12, sta 21 (1♂, 1♀). Nabeta Bay, 23 Aug 1974 (1♂ with eggs, 2♂, 2♀).

REMARKS.—We compared these seven specimens with the two female types of Hedgpeth's (1949:275-277, fig. 35) *Callipallene dubiosa*. We found them to be very closely related but still two distinct species. There are definite, although slight, differences. The neck of Hedgpeth's species is notably shorter than the necks of the females here, and the proboscis of *C. dubiosa* is more egg-shaped in ventral aspect and has less pronounced ventrodistal bulges. The legs agree in length ratios for the two sets of females, but the propodus

differs in *C. dubiosa*, and agrees with that of *C. b. novaezealandiae*, by having more heel spines (7) and more sole spines (about 15) than the specimens in hand. The chelae of both sets of females are very similar, but those of the Japanese specimens have fewer and longer setae laterally and ventrally than has *C. dubiosa*. The greatest difference we can find between these Japanese specimens and Thomson's species is that none of the former (not Thomson's) specimens have the crenulate heel spines like those of *C. b. novaezealandiae*.

Hedgpeth noted under remarks in his discussion of *C. dubiosa* that the two species are quite similar, but he made an error in counting heel spines. There are seven in two rows of 4 and 3 each on *C. dubiosa*, with a single spine on the tarsus flanked by small setae. Until specimens of Thomson's species identified from New Zealand can be compared with *C. dubiosa*, we believe it is

prudent to maintain the two species as separate, but concur in calling the specimens in hand Thomson's species because of their almost complete agreement.

This species has never been found as far north as Japan, and these specimens extend its distribution to the western edge of Sagami Bay in 113 meters and 7 to 15 meters, respectively.

Callipallene panamensis Child

Callipallene panamensis Child, 1979:42-44, fig. 14.

MATERIAL EXAMINED.—Sagami Bay: Off Kisanami, 22 May 1970 (1♀); 1 Nov 1970 (1♀); 16 May 1971 (2♂ with eggs, 2♀). Off Shimoda, 8 Aug 1973 (1♀).

REMARKS.—We find very little difference between these specimens and the type of this species from Panama. The few differences are not sufficient to erect a new species. These differences are: proboscis less bulbous ventrodistally, neck slightly narrower, tibia with more and longer setae, propodus heel with four spines (sometimes five) and a small spine ventrodistally on the tarsus, and more setae on the chelifore palm. These specimens conform to the Panama species in all other characters, including the pectinate auxiliary claws, dimorphic denticulate spines on the ovigers, and the configuration and length ratios of the appendages.

This species was known only from the Pacific side of the Panama Canal. The Sagami Bay record extends its distribution to the western Pacific, and extends its depth range from intertidal to 30 meters.

Callipallene sagamiensis, new species

FIGURE 20

MATERIAL EXAMINED.—Sagami Bay. *Tansei Maru* cruise KT69-12, sta 21 (1♂, holotype, USNM 183832; 3♂, 2♀, 1 juv, paratypes). Off Shimoda, 18 Aug 1973 (1♀ ovig, paratype).

DESCRIPTION.—Animal moderately small, leg span 18.8 mm. Trunk completely segmented. Neck not longer than its diameter, anterior ex-

pansion no longer than wide, armed with pair of short dorsolateral setae over each chelifore insertion. Lateral processes little longer than their diameters and separated by slightly more than their diameters, glabrous. Ocular tubercle a short cylinder with apical cone slightly longer than its basal diameter. Eyes large, slightly pigmented. Abdomen a truncate cone slightly taller than ocular tubercle, armed with 4 dorsodistal setae. Proboscis moderately long, proximally a cylinder, distally tapering to rounded lips.

Chelifores robust, scape slightly curved, armed with several endal and distal setae. Chela length subequal to scape, fingers longer than palm. Palm armed with many dorsal setae, few ventrally. Immobile finger slightly curved, armed with few ectal setae, about 10 blunt triangular teeth. Movable finger straight, slightly curved at tip, armed with 8 or 9 blunt low teeth (apparently worn).

Oviger of typical shape, fifth segment longest, bearing large distal apophysis with terminal seta, sixth with one distal seta. Strigilis segments relatively long, slender, armed with distal setae and endal denticulate spines in the formula 9 : 8 : 7 : 8. Spines monomorphic, with a pair of marginal teeth near base and broad oval marginal fringe with tiny denticulations.

Legs long, slender, tibiae with many setae, some longer than segment diameter. Coxa 2 very long, 2.5 times longer than coxae 1 and 3 combined. Femur with few setae, with small midventral bulge bearing few setae. Second tibia longest, tibia 1 shorter with femur shortest of major segments. Cement glands not found. Tarsus short, quadrangular, armed with 2 dorsal setae, 3 or 4 ventral setae, without spine. Propodus moderately long, well curved, with several long dorsal setae and few short ventral setae. Without marked heel but with 3 large heel spines and a row of 15 or 16 short sole spines. Claw long, slightly curved, more than half length of propodus. Auxiliaries long, slender, two-thirds length of main claw.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 1.98; trunk width, 0.95; proboscis length, 0.61; abdomen length, 0.25; third leg, coxa 1, 0.31; coxa 2, 0.94; coxa 3, 0.4; femur, 1.82; tibia

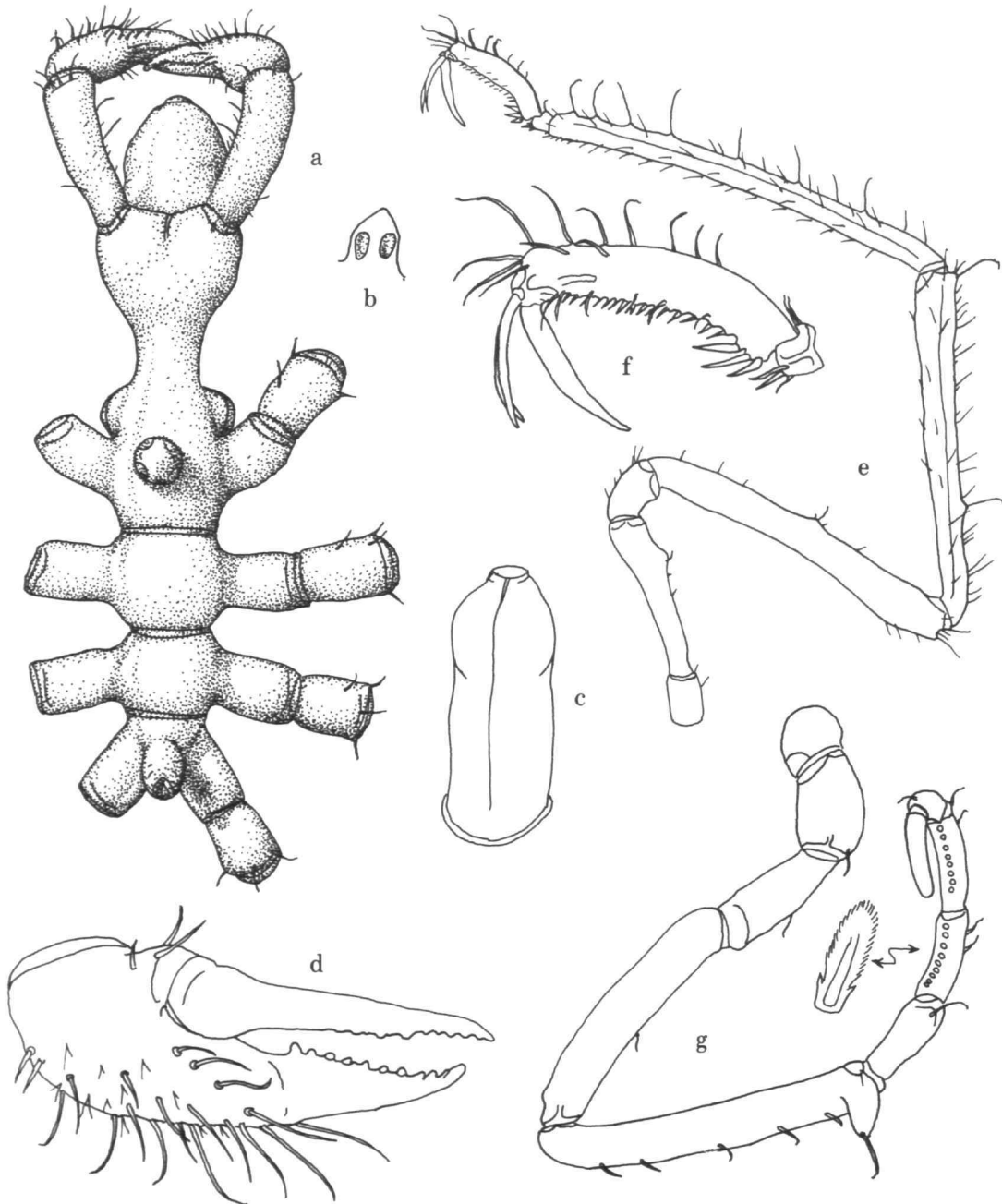


FIGURE 20.—*Callipallene sagamiensis*, new species, holotype, male: *a*, trunk, dorsal view; *b*, ocular tubercle, lateral view; *c*, proboscis, ventral view; *d*, chela, enlarged; *e*, third leg; *f*, terminal segments of third leg, enlarged; *g*, oviger, with enlargement of denticulate spine.

1, 1.93; tibia 2, 2.24; tarsus, 0.12; propodus, 0.61; claw, 0.37.

ETYMOLOGY.—Named for its type-locality, Sagami Bay.

DISTRIBUTION.—Known from the type-locality, just north of Shimoda in 113 meters and from off Shimoda in 30 meters.

REMARKS.—This species is closest in relation to another Japanese species, *Callipallene cuspidata* Stock, the type-locality of which is off Sagami Bay in 400 fathoms (732 meters). The latter has many characters that differ from *C. sagamiensis*. The general habitus of trunk, proboscis, chelifores, and legs make it very like *C. cuspidata*, but the specific differences are found in the ocular tubercle tip (a tall pointed cone for *C. cuspidata*, a low and inconspicuous cone for *C. sagamiensis*), the shorter palm of *C. sagamiensis* along with a longer tibia 1, different finger shape and teeth arrangement, fewer strigilis denticulate spines, and the lack of a midventral setose bump on the femur. The new species is also slightly larger in most measurements than the type of *C. cuspidata*.

This is a difficult genus to deal with, particularly since various growth stages of some of its species exhibit age-related morphological differences. We believe this to be a new species, but should further collections show sufficient variations in the above characters to bridge a gap between this species and *C. cuspidata* (or even

other species), then the taxonomic difficulties of this genus will only increase and, in some instances, result in tautology.

Genus *Pallenopsis* Wilson, 1881

Pallenopsis (*Pallenopsis*) *virgata* Loman

Pallenopsis virgatus Loman, 1908:69, pl. 9: fig. 134, pl. 10: figs. 135–136.

Pallenopsis virgata.—Utinomi, 1971:324 [literature].

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 4 (1♂).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 9 (1♂, 2 juv); sta 14 (2♀, 1 juv). *Tansei Maru* cruise KT71-2, sta 23 (1♀). Off Kisami, 16 May 1971 (1♂, 1♀).

REMARKS.—Males of this species have a typical tubular cement gland orifice on the midventral femur and have small chelae with a setose distal pad and fingers carried anaxially. The subgenus is based on the chelae morphology (Stock, 1975a:1017).

The species has been collected from many localities in southern and middle Japan, including Sagami Bay (Utinomi, 1959:200), and it occurs in relatively shallow waters compared to many members of the genus. The specimens recorded here are from depths of 30 to 210 meters. It has also been found (Loman, 1908) by the *Siboga* off the Malaysian Peninsula.

Genus *Propallene* Schimkewitsch, 1909

Key to the Japanese Species of *Propallene*

- Leg span (♂) about 13 mm; palps long, second segment about 8 times longer than its diameter; cement gland tubes confined to ventral femur and sometimes coxa 3 *P. longiceps*
 Leg span (♂) about 5.8 mm; palps shorter, second segment only 5 times longer than its diameter; over 20 cement glands ventrally on femur and both tibiae, none on coxa 3 *P. saengeri*

Propallene longiceps (Böhm)

Pallene longiceps Böhm, 1879b:59.

Propallene longiceps.—Utinomi, 1971:322 [literature].—Sekiguchi, Nakamura, and Konuma, 1971:137–139.—Stock, 1975c:90–91, 94 [key], figs. 1–20 [figures].—Nakamura

and Sekiguchi, 1980:163–168, figs. 1–5.—Nakamura, 1981:49–62, 17 figs., 2 tables.—Nakamura and Sekiguchi, in press.

MATERIAL EXAMINED.—Sagami Bay: Off Kisami, 16 May 1971 (41♂ with eggs, 16♂, 74♀, 5

juv). Nabeta Bay, 28 Aug 1969 (2♂ with eggs, 2♂, 3♀); 12 Sep 1969 (1♂); 21 May 1970 (11♂ with eggs, 14♂, 33♀, 12 juv); 13 June 1970 (1♂ with eggs); 26 Nov 1970 (16 juv); 22 Dec 1970 (3♂); 8 Aug 1972 (38♂ with eggs, 20♂, 43♀, 3 juv); 28 Aug 1972 (58♂ with eggs, 67♂, 94♀, 32 juv); 27 Jul 1973 (74♂ with eggs, 32♂, 77♀, 17 juv); 8 Aug 1973 (187♂ with eggs, 60♂, 197♀, 44 juv); 17 Aug 1973 (38♂ with eggs, 67♂, 181♀, 115 juv); 26 Oct 1973 (86♂ with eggs, 35♂, 98♀, 40 juv); 23 Aug 1974 (31♂ with eggs, 70♂, 102♀, 25 juv); 3 Aug 1976 (1♂ with eggs, 3♀); 16 Aug 1977 (1♂ with eggs, 2♂, 3♀).

REMARKS.—This is by far the most common pycnogonid collected during the study on which this report is based. Some 2170 specimens were taken at most times of the year and their seasonal occurrence is the subject of a separate report by Nakamura and Sekiguchi (in press). The species is quite common in the shallow waters of bays and in grass beds, and it has been taken repeatedly in plankton tows. It has been collected previously in Sagami Bay and in Nabeta Bay at Shimoda (Utinomi, 1971:322). It is endemic to Japan and has been collected as deep as 103 meters.

The species of this genus share many similar characters and are difficult to differentiate. There is also notable dimorphism between the sexes, particularly in neck length, lateral process length, and propodus shape. As with all species of *Propallene*, only the males bear palps, which have only two segments. The length and setation of the second palp segment serve as good characters partly to differentiate among the species. In *Propallene longiceps*, the second segment is about 8 times longer than its average diameter, and it has a slight constriction in its proximal half denoting a third segment in embryonic development. It has 8 or 9 distal long setae. The propodus of this species is rather bulbous in appearance, such that the sole is convex in its proximal half. The femur has from 7 to 9 slender ventral tubes venting the cement gland and there are also 2 to 3 tubes on coxa 3 in addition to the femoral tubes. The

species is rather large for this genus with the trunk measuring almost 3 mm in length for the male. Most species are somewhat less, including *P. saengeri*.

Propallene saengeri Staples

Propallene saengeri Staples, 1979:90–93, fig. 4.

MATERIAL EXAMINED.—Sagami Bay: Off Kisami, 22 May 1970 (3♂, 1♀); 1 Nov 1970 (11♂ with eggs, 2♂, 3♀, 1 juv).

REMARKS.—This species, previously known only from Australia, is recorded from Japan for the first time. It is half the size of the more common Japanese species, *Propallene longiceps* (trunk length 2.2 to 2.4 mm, *P. saengeri* trunk length 1.1 to 1.2 mm). Besides its smaller size, there are several other differences. *Propallene saengeri* has a shorter palp second segment, only 5 to 6 times longer than its average diameter, and has no proximal or other constriction. It has 4 or 5 terminal setae. The propodus is a curved cylinder, not inflated as in *P. longiceps*, and has a concave sole with much larger spines. The cement gland tubes are found on the femur and also both tibiae, and are more numerous in these specimens than in the type. On our specimens, the tubes number 9 or 10 per femur, 6 or 7 on tibia 1, and 4 or 5 on tibia 2, and none on coxa 3. The trunk shows less sexual dimorphism except in the slightly longer neck of the female. We find very little variation in other characters of these specimens as compared with Staples' figures of the type.

The Japanese specimens have 1 or 2 more chela teeth and more setae on the palm and immovable finger, have 1 or 2 less denticulate spines (in total) on the strigilis, and have slightly more setose leg segments. The propodus of the type appears to be slightly more inflated than those of our specimens, but the other characters are so close that we would find it difficult to assign the Japanese specimens to a new species.

The depth records for this species are extended from a maximum of 4.8 meters to 30 meters.

Family COLOSSENDEIDAE Hoek

Genus *Hedgpethia* Turpaeva, 1973Key to the Japanese Species of *Hedgpethia*

1. Tarsus shorter than propodus, claw less than half propodal length *H. brevitarsis*
 Tarsus as long as or longer than propodus, claw more than half propodal length 2
- 2(1). Distal spine of oviger terminal segment larger than others, modified, subchelate with terminal claw *H. chitinoso*
 Distal spine of oviger terminal segment not larger than others or modified, not subchelate **H. dofleini*

* Not discussed herein.

***Hedgpethia brevitarsis* (Losina-Losinsky and Turpaeva)**

Colossendeis brevitarsis Losina-Losinsky and Turpaeva, 1958: 26-27, fig. 2; 1961:109.

Rhopalorhynchus brevitarsis.—Stock, 1970:9 [key].

Hedgpethia brevitarsis.—Turpaeva, 1973:183 [text], 185 [key], table 2.

MATERIAL EXAMINED.—Sagami Bay: *Tansei Maru* cruise KT71-2, sta 29 (2 specimens).

REMARKS.—This species is easily separated from the other five known species in this genus (*Hedgpethia articulata*, *H. bicornis*, *H. californica*, *H. chitinoso*, and *H. dofleini*) by the reduced length of its tarsus and claw. These terminal leg segments are notably longer in the other species, either equal to or longer than the propodus.

This species is recorded for the first time in Japanese waters. It was previously known from the Sea of Okhotsk and the Gulf of Alaska in depths greater than the 290-300 meters at which our two Japanese specimens were found.

***Hedgpethia chitinoso* (Hilton)**

Colossendeis chitinoso Hilton, 1943:4.—Utinomi, 1971:337-338 [literature].

Rhopalorhynchus chitinosum.—Stock, 1970:9 [key].

Hedgpethia californica chitinoso.—Turpaeva, 1973:186-189, table 3.

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 4 (6 specimens); sta 5 (17 specimens).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 9 (2 specimens). *Tansei Maru* cruise KT71-2, sta 29 (1 specimen).

REMARKS.—Turpaeva (1973:186-189) reduced this species and *H. bicornis* to subspecies of *H. californica*, a situation not supported by such diagnostic characters as differences in the distal spine on terminal oviger segments, shape of the other oviger spines, and length ratios of some of the appendage segments. The ratio of the tarsus to propodus is the one most often cited, and there are length differences in the terminal leg segments of all three species. We believe the differences are sufficient to maintain these as three separate species.

The known range of this fairly common species is from the Aleutian Islands to southern Kyushu, Japan. In its more northerly habitats, it is found in deeper water (to about 800 m) than in Japan, where it has been collected in as shallow waters as 20 meters. The above records are from depths of 75 to 300 meters.

Family PYCNOGONIDAE Wilson

Genus *Pycnogonum* Brünnich, 1764Key to the Japanese Species of *Pycnogonum*

1. Oviger 8-segmented, exclusive of claw 2
 Oviger 9-segmented, exclusive of claw 3
- 2(1). Trunk compact, lateral processes touching, dorsal trunk tubercles low, broad; tibia 2 only two-thirds length of femur; auxiliary claws minute *P. uedai*, new species
 Trunk longer, lateral processes well separated, dorsal trunk tubercles narrower, taller; tibia 2 almost as long as femur; auxiliary claws half main claw length **P. benokianum*
- 3(1). Proboscis bottle-shaped, distally bulbous; trunk with low median tubercles on raised ridge; tibia 2 not longer than wide; auxiliary claws lacking **P. buticulosum*
 Proboscis a tapering truncated cone; trunk with slender median tubercles or tubercles lacking; tibia 2 longer than wide; auxiliary claws tiny or lacking 4
- 4(3). Proboscis long, tapering distally to slender tube; trunk with slender median tubercles; femur cylindrical; auxiliary claws lacking. *P. tenue*
 Proboscis a short broad truncated cone; median trunk tubercles lacking; femur with large ventral bulge; auxiliary claws tiny. *P. ungelatum*

* Not discussed herein.

Pycnogonum tenue Slater

Pycnogonum littorale var. *tenue* Slater, 1879:281-283.

Pycnogonum tenue.—Hedgpeth, 1949:303, figs. 48b, 50c [figures].—Utinomi, 1971:338 [literature].

MATERIAL EXAMINED.—Suruga Bay: *Tansei Maru* cruise KT69-12, sta 4 (1♀).

Sagami Bay: *Tansei Maru* cruise KT69-12, sta 18 (1♂, 1♀); sta 20 (1♂). Nabeta Bay, 27 July 1973 (1 juv).

REMARKS.—This fairly common Japanese species is easily recognized by its long slender proboscis lacking a small bulbous tip, its crowded lateral processes, tall slender median trunk tubercles, 9-segmented ovigers, and usually (but not always) lightly reticulated integument.

It has been found in many Japanese localities in depths from 27 to 300 meters. The above records reduce the minimum depth at which it has been found to 7 meters. It has been collected previously in both Suruga and Sagami bays.

Pycnogonum uedai, new species

FIGURE 21

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 5 Feb 1972 (1♂, holotype, USNM 183831).

DESCRIPTION.—Holotype tiny, maximum leg span about 6.5 mm. Trunk a long oval in outline, tapering toward posterior, completely segmented, with 3 low median tubercles oval in outline, and several tiny median tubercles just posterior to ocular tubercle. Lateral processes very short, not as long as wide, touching proximally, slightly separated distally, anterior 2 pairs armed with low broad posterolateral tubercle, all armed with low rounded dorsodistal tubercle, without setae. Dorsal and ventral sutures separating trunk and lateral processes conspicuous, but without reticulations. Ocular tubercle low, rounded, half as tall as its diameter, with lightly pigmented eyes. Abdomen moderately long, distally blunt, a swol-

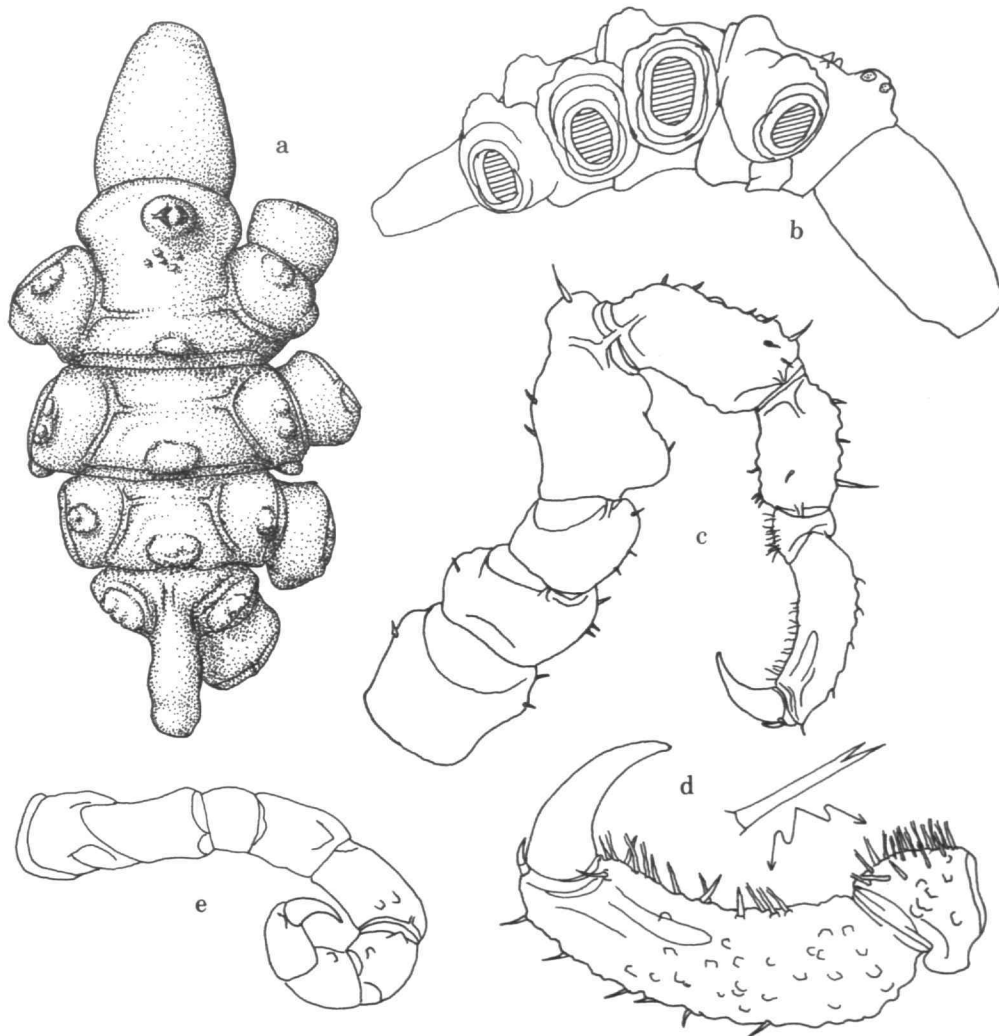


FIGURE 21.—*Pycnogonum uedai*, new species, holotype, male: *a*, trunk, dorsal view; *b*, trunk, lateral view; *c*, third leg; *d*, terminal segments of third leg, with enlargement of ventral spine; *e*, oviger.

len cylinder extending almost to distal end of coxa 2 of fourth legs, glabrous. Proboscis egg-shaped, almost half trunk length, mouth flat.

Oviger glabrous, 8-segmented, second and fifth segments subequal, third not longer than wide. Terminal 3 segments increasingly shorter and more slender. Terminal claw robust, well curved, shorter than terminal segment.

Legs moderately short, robust, armed with few setae. First and third coxae no longer than wide,

coxa 2 not as long as wide. Femur with broad low dorsodistal tubercle and broad taller proximoventral tubercle. Femur slightly longer than tibia 1, tibia 2 only 0.7 as long as tibia 1. Tarsus short, robust, quadrangular, armed with dense field of setae ventrally, each seta with bifurcate tip. Propodus moderately curved, armed with few dorsal short setae. Sole with few spines, many bifurcate setae increasing in numbers distally. Claw very broad at base, robust, well curved, slightly less

than half propodus length. Auxiliary claws tiny, only 0.12 main claw length.

MEASUREMENTS OF HOLOTYPE (mm).—Trunk length, 1.78; trunk width (across 1st lateral processes), 1.17; proboscis length, 0.84; abdomen length, 0.46; third leg, coxa 1, 0.25; coxa 2, 0.22; coxa 3, 0.23; femur, 0.44; tibia 1, 0.43; tibia 2, 0.29; tarsus, 0.14; propodus, 0.44; claw, 0.2.

ETYMOLOGY.—Named for Mr. Hajime Ueda, a member of the staff of the Shimoda Marine Research Center, University of Tsukuba, in appreciation of his valuable assistance in collecting the specimens reported on herein.

DISTRIBUTION.—Known only from its type-locality, Nabeta Bay, in from 7 to 15 meters.

REMARKS.—The combination of vestigial auxiliary claws, low tubercles on the middorsal trunk and dorsodistal lateral processes, a barrel- or egg-shaped proboscis without tubercles, a large ventral femur bulge, and a cylindrical flat-tipped abdomen, is not found in any other species of this genus. This tiny species is closest in morphology to another Japanese species, *Pycnogonum ungelatum*, except that the latter has one more segment in the oviger. The general habitus of the two is

similar, but the raised median ridges on the trunk of *P. ungelatum* are not tubercles nor does this species have the low lateral process tubercles of *P. uedai*. The new species is also very much smaller ($\frac{1}{4}$ as long) than *P. ungelatum*.

***Pycnogonum ungelatum* Loman**

Pycnogonum ungelatum Loman, 1911:7–8, pl. 2: figs. 25–27.—Hedgpeth, 1949:304, figs. 48c, 50e–g [figures].—Utinomi, 1971:339 [literature].

MATERIAL EXAMINED.—Sagami Bay: Nabeta Bay, 5 Feb 1972 (1 juv). Off Shimoda, 8 Aug 1973 (1♀).

REMARKS.—This relatively large species shares the characters of tiny auxiliary claws, a ventral femoral tubercle, and a short second tibia with *P. uedai*, described above. It lacks the bottle-shaped proboscis, trunk, and lateral process tubercles, and the relatively cylindrical abdomen of the latter species, and the trunk is 6 mm or more long.

The type-locality for this species is Sagami Bay, but it has never been found in as shallow water as the present records (7 to 30 meters).

Station List

SURUGA BAY

Tansei Maru Cruise KT69-12

- Station 3: 34°41'48"N, 138°43'48"E, 86-102 m, 13 Jul 1969
Ascorhynchus glaberrimum, *Anoplodactylus pulcher*
- Station 4: 34°40'36"N, 138°43'06"E, 210-165 m, 13 Jul 1969
Anoplodactylus gestiens, *Nymphon ortmanni*, *Pallenopsis virgata*,
Hedgpathia chitinoso, *Pycnogonum tenue*
- Station 5: 34°39'48"N, 138°45'36"E, 85-75m, 13 Jul 1969
Achelia superba, *Ascorhynchus auchenicum*, *A. cryptopygium*, *A. fusticulum*, *A. glaberrimum*, *A. okai*, *Cilunculus armatus*, *C. sekiguchii*, *Anoplodactylus excelsus*, *Nymphon ortmanni*, *Hedgpathia chitinoso*

SAGAMI BAY

Tansei Maru Cruise KT69-12

- Station 9: 34°34'12"N, 138°52'06"E, 94-76 m, 14-16 Jul 1969
Ascorhynchus auchenicum, *A. cryptopygium*, *A. ramipes*, *Anoplodactylus gestiens*, *A. lagenus*, *Pallenopsis virgata*, *Hedgpathia chitinoso*
- Station 13: 34°37'06"N, 138°58'48"E, 138-140 m, 14-16 Jul 1969
Anoplodactylus gestiens, *Nymphon ortmanni*
- Station 14: 34°37'30"N, 138°57'00"E, 72-54 m, 14-16 Jul 1969
Ascorhynchus auchenicum, *A. glaberrimum*, *A. ramipes*, *Cilunculus armatus*, *Anoplodactylus pulcher*, *Pallenopsis virgata*
- Station 17: 34°41'12"N, 139°00'12"E, 50 m, 14-16 Jul 1969
Ammothea spicula, *Anoplodactylus* sp.
- Station 18: 34°43'24"N, 139°01'54"E, 120 m, 14-16 Jul 1969
Pycnogonum tenue
- Station 20: 35°00'36"N, 139°08'48"E, 120 m, 16 Jul 1969
Pycnogonum tenue
- Station 21: 35°00'54"N, 139°08'36"E, 113 m, 17 Jul 1969
Ammothea hilgendorfi, *Ascorhynchus auchenicum*, *A. cryptopygium*, *A. glaberrimum*, *Cilunculus armatus*, *C. haradai*, *C. sekiguchii*, *Paranymphon spinosum*, *Anoplodactylus excelsus*, *A. gestiens*, *Nymphon ortmanni*, *Callipallene brevisrostris novaezealandiae*, *C. sagamiensis*
- Station 23: 34°35'42"N, 138°59'42"E, 256 m, 18 Jul 1969
Ammothea cymosa, *Anoplodactylus gestiens*, *Nymphon japonicum*, *N. micropedes*

- Station 24: 34°38'12"N, 138°56'24"E, 37-40 m, 18 Jul 1969
Ascorhynchus glaberrimum, *Cilunculus armatus*, *Anoplodactylus pulcher*, *A. shimodaensis*, *Nymphon japonicum*

Tansei Maru Cruise KT71-2

- Station 23: 34°46'12"N, 139°04'30"E, 160-170 m, 2 Feb 1971
Ammothea spicula, *Ascorhynchus glaberrimum*, *Pallenopsis virgata*
- Station 26: 34°51'30"N, 139°07'42"E, 336-315 m, 3 Feb 1971
Cilunculus armatus, *Anoplodactylus gestiens*, *Nymphon ortmanni*.
- Station 27: 34°53'24"N, 139°09'30"E, 160-174 m, 3 Feb 1971
Chonothea hians, *Cilunculus armatus*, *C. haradai*, *Anoplodactylus gestiens*
- Station 29: 34°58'36"N, 139°10'24"E, 290-300 m, 1 Feb 1971
Achelia superba, *Ascorhynchus auchenicum*, *A. cryptopygium*, *A. glaberrimum*, *Cilunculus sekiguchii*, *Anoplodactylus gestiens*, *Hedgpathia brevisrostris*, *H. chitinoso*

Off Kisami, Izu Peninsula

34°38'25"N, 138°56'07"E, 30 m

- 30 Aug 1969: *Cilunculus armatus*
- 22 May 1970: *Ascorhynchus auchenicum*, *A. glaberrimum*, *Cilunculus armatus*, *C. sekiguchii*, *Anoplodactylus gestiens*, *A. pulcher*, *Callipallene panamensis*, *Propallene saengeri*
- 1 Nov 1970: *Ascorhynchus auchenicum*, *A. glaberrimum*, *Cilunculus armatus*, *Anoplodactylus lagenus*, *A. pulcher*, *Callipallene panamensis*, *Propallene saengeri*
- 16 May 1971: *Cilunculus armatus*, *Nymphon akane*, *N. japonicum*, *Callipallene panamensis*, *Pallenopsis virgata*, *Propallene longiceps*
- 26 Aug 1971: *Achelia echinata sinensis*

Off Shimoda, Izu Peninsula

34°39'02"N, 138°56'42"E, 30 m

- 8 Aug 1973: *Achelia orpax*, *A. superba*, *Ammothea indica*, *Ascorhynchus glaberrimum*, *Cilunculus armatus*, *C. haradai*, *C. sekiguchii*, *Anoplodactylus pulcher*, *A. versluysi*, *Endeis mollis*, *Callipallene panamensis*, *Pycnogonum ungelatum*
- 18 Aug 1973: *Achelia echinata sinensis*, *A. bituberculata*, *Ascorhynchus glaberrimum*, *A. prosum*, *Cilunculus sekiguchii*, *Anoplodactylus pulcher*, *Anoropallene laysani*, *Callipallene sagamiensis*

Nabeta Bay, Izu Peninsula

34°39'40"N, 138°56'40"E, 7–15 m

- 28 Aug 1969: *Ascorhynchus ramipes*, *A. utinomii*, *Propallene longiceps*
 12 Sep 1969: *Ascorhynchus ramipes*, *A. utinomii*, *Anoplodactylus perforatus*, *A. shimodaensis*, *Propallene longiceps*
 3 Oct 1969: *Achelia echinata sinensis*, *Ammothea hilgendorfi*, *Ascorhynchus ramipes*
 14 Nov 1969: *Ascorhynchus ramipes*, *A. utinomii*
 19 Dec 1969: *Achelia echinata sinensis*, *Ammothea hilgendorfi*, *Ascorhynchus ramipes*, *A. utinomii*, *Tanystylum scrutator*
 7 Apr 1970: *Ascorhynchus utinomii*
 21 May 1970: *Aschorhynchus glaberrimum*, *A. ramipes*, *A. utinomii*, *Tanystylum nabetensis*, *Anoplodactylus perforatus*, *A. shimodaensis*, *Propallene longiceps*
 13 Jun 1970: *Ascorhynchus ramipes*, *Anoplodactylus perforatus*, *A. shimodaensis*, *Propallene longiceps*
 10 Jul 1970: *Achelia echinata sinensis*, *Ammothea hilgendorfi*, *Ascorhynchus utinomii*, *Anoplodactylus perforatus*, *A. shimodaensis*
 13 Aug 1970: *Ammothella indica*, *Ascorhynchus glaberrimum*, *A. ramipes*, *Anoplodactylus perforatus*, *A. shimodaensis*
 2 Oct 1970: *Anoplodactylus perforatus*, *A. shimodaensis*
 30 Oct 1970: *Ammothea hilgendorfi*, *Ammothella indica*, *Anoplodactylus perforatus*, *A. shimodaensis*
 26 Nov 1970: *Ammothea hilgendorfi*, *Ascorhynchus ramipes*, *A. utinomii*, *Anoplodactylus perforatus*, *A. shimodaensis*, *Propallene longiceps*
 22 Dec 1970: *Achelia echinata sinensis*, *A. bituberculata*, *Ammothea hilgendorfi*, *Ammothella indica*, *Ascorhynchus ramipes*, *A. utinomii*, *Tanystylum nabetensis*, *Anoplodactylus carnatus*, *A. shimodaensis*, *Propallene longiceps*
 19 Jan 1971: *Ammothea hilgendorfi*, *Ascorhynchus utinomii*, *Anoplodactylus perforatus*
 11 Mar 1971: *Achelia echinata sinensis*, *Ammothea hilgendorfi*, *Anoplodactylus carnatus*, *A. shimodaensis*
 2 Apr 1971: *Ascorhynchus ramipes*, *Anoplodactylus perforatus*, *A. shimodaensis*
 20 May 1971: *Achelia echinata sinensis*, *Ammothea hilgendorfi*, *Ammothella indica*, *Anoplodactylus perforatus*, *A. shimodaensis*
 14 Jul 1971: *Ammothella indica*
 23 Aug 1971: *Achelia spatula*
 30 Sep 1971: *Achelia echinata sinensis*
 19 Nov 1971: *Achelia echinata sinensis*, *A. bituberculata*, *Ammothella indica*, *Anoplodactylus shimodaensis*
 5 Feb 1972: *Achelia echinata sinensis*, *Ammothella indica*, *Pycnogonum ungelatum*, *P. uedai*
 3 Jun 1972: *Achelia echinata sinensis*
 8 Aug 1972: *Achelia echinata sinensis*, *A. bituberculata*, *Ammothea hilgendorfi*, *Ascorhynchus ramipes*, *A. utinomii*, *Propallene longiceps*
 15 Aug 1972: *Achelia echinata sinensis*, *A. bituberculata*, *Ammothea hilgendorfi*, *Anoplodactylus perforatus*
 28 Aug 1972: *Achelia echinata sinensis*, *Achelia* sp., *Ammothea hilgendorfi*, *Ascorhynchus ramipes*, *A. utinomii*, *Anoplodactylus perforatus*, *A. shimodaensis*, *Propallene longiceps*
 27 Jul 1973: *Achelia echinata sinensis*, *Ammothea hilgendorfi*, *Ammothella indica*, *Ascorhynchus ramipes*, *A. utinomii*, *Endeis mollis*, *Anoplodactylus perforatus*, *A. versluysi*, *Propallene longiceps*, *Pycnogonum tenue*
 8 Aug 1973: *Achelia echinata sinensis*, *Ascorhynchus ramipes*, *Anoplodactylus perforatus*, *A. shimodaensis*, *Propallene longiceps*
 17 Aug 1973: *Achelia echinata sinensis*, *Ammothea hilgendorfi*, *Ascorhynchus ramipes*, *A. utinomii*, *Anoplodactylus perforatus*, *A. shimodaensis*, *A. stellatus*, *Propallene longiceps*
 26 Oct 1973: *Achelia echinata sinensis*, *Ammothea hilgendorfi*, *Ammothella biunguiculata*, *Ascorhynchus ramipes*, *A. utinomii*, *Anoplodactylus perforatus*, *A. pycnosoma*, *A. shimodaensis*, *Propallene longiceps*
 23 Aug 1974: *Ascorhynchus glaberrimum*, *A. ramipes*, *A. utinomii*, *Endeis mollis*, *Anoplodactylus perforatus*, *Callipallene brevirostris novaezealandiae*, *Propallene longiceps*
 3 Aug 1976: *Achelia echinata sinensis*, *Ammothella indica*, *Ascorhynchus ramipes*, *A. utinomii*, *Anoplodactylus perforatus*, *A. shimodaensis*, *Endeis mollis*, *Propallene longiceps*
 16 Aug 1977: *Ascorhynchus ramipes*, *Anoplodactylus perforatus*, *Propallene longiceps*

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