

DESCRIPTION OF A NEW SOUTH AFRICAN ARMINACEAN
AND THE PROPOSED RE-INSTATEMENT OF THE GENUS
ATTHILA BERGH (MOLLUSCA, OPISTHOBRANCHIA)

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(With 4 figures and 2 tables)

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ABSTRACT

The morphology of a previously undescribed arminacean opisthobranch mollusc found off the Cape Peninsula coast, South Africa, is described. The new form cannot be accommodated in any of the existing arminacean families and the new family Lemindidae is proposed here. The anatomy of the new species, *Leminda millecra* sp. nov., is compared with representatives of the arminacean families Charcotiidae, Heterodorididae, and Doridomorphidae. Examination of the literature has shown the necessity of re-instatement of the genus *Atthila* Bergh, 1899, previously synonymized with *Heterodoris* Verrill & Emerton, 1882.

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INTRODUCTION

The South African arminaceans described to date belong to the families Arminidae and Janolidae, probably the most frequently encountered arminacean families in the literature. Members of the remaining families are not globally widely distributed and many are rarely found. However, a new species with morphological features allied to the Heterodorididae, Doridomorphidae and Charcotiidae has been found to be quite common below 30 m depth, and occasionally extending to 10 m depth, off the Cape Peninsula coast.

All specimens, except for one that was dredged, were collected by divers with the aid of SCUBA. Specimens were dissected under a light microscope. The new species is described here and its affinities within the Arminacea are

discussed. The latter requires examination of the various descriptions of *Heterodoris robusta* Verrill & Emerton, 1882.

Type specimens are deposited in the South African Museum collections and the other material in the Ecological Survey Collection, Zoology Department, University of Cape Town.

DESCRIPTION

Family **Lemindidae** fam. nov.

Diagnosis

Body elevated with a frontal veil and mantle margins expanded and undulating, held dorsally above the body. The digestive gland ramifies extensively within the mantle margin. The anus opens lateroposteriorly; the radula is multiseriate and there is a copulatory bursa.

Leminda gen. nov.

Diagnosis

Body robust and elevated; quadrangular in section. A velum is present. Mantle margin broadly expanded and undulating, held vertically above the body. Foot large and well developed. Rhinophores smooth and retractile into low-rimmed sheaths. Radula broad and multiseriate with simple hook-shaped teeth. Cladohepatic digestive gland ramifying extensively into the mantle margin. Eyes absent. Copulatory bursa opens between the male and female reproductive apertures.

Type species

Leminda millecra.

Etymology

The generic name is derived from my daughter's name, Melinda.

Leminda millecra sp. nov.

Figs 1–3

Material

Holotype. SAM-A35791: off Sandy Bay, west coast of Cape Peninsula (34°02'S 18°19'E); 36 m depth; 3 January 1981; collected by T. M. Gosliner.

Paratypes. SAM-A35792: 3 specimens; off Sandy Bay, west coast of Cape Peninsula (34°02'S 18°19'E); 36 m depth; 3 January 1981; collected by T. M. Gosliner.

Other material. 1 specimen; Whittle Rock, False Bay, Cape Province (34°15'S 18°33'E); 36 m depth; 27 December 1980; collected by W. R. Liltved.

4 specimens; Castle Rock, False Bay, Cape Province (34°18'S 18°29'E); 13 m depth; 23 February 1972 and 27 April 1973; collected by R. J. Griffiths. 1 specimen; off Mzimhlava River, Transkei (31°32.2'S 29°42.8'E); dredge; 15 August 1981; collected by R. N. Kilburn.

Etymology

The species name is derived from a combination of the names in my daughter's maternal ancestry (Imrie, Clark and Leman).

External morphology

The body is large (Fig. 1A), up to 60 mm or more in length, with a soft and smooth surface. The muscular foot is broad, square in front, tapering posteriorly

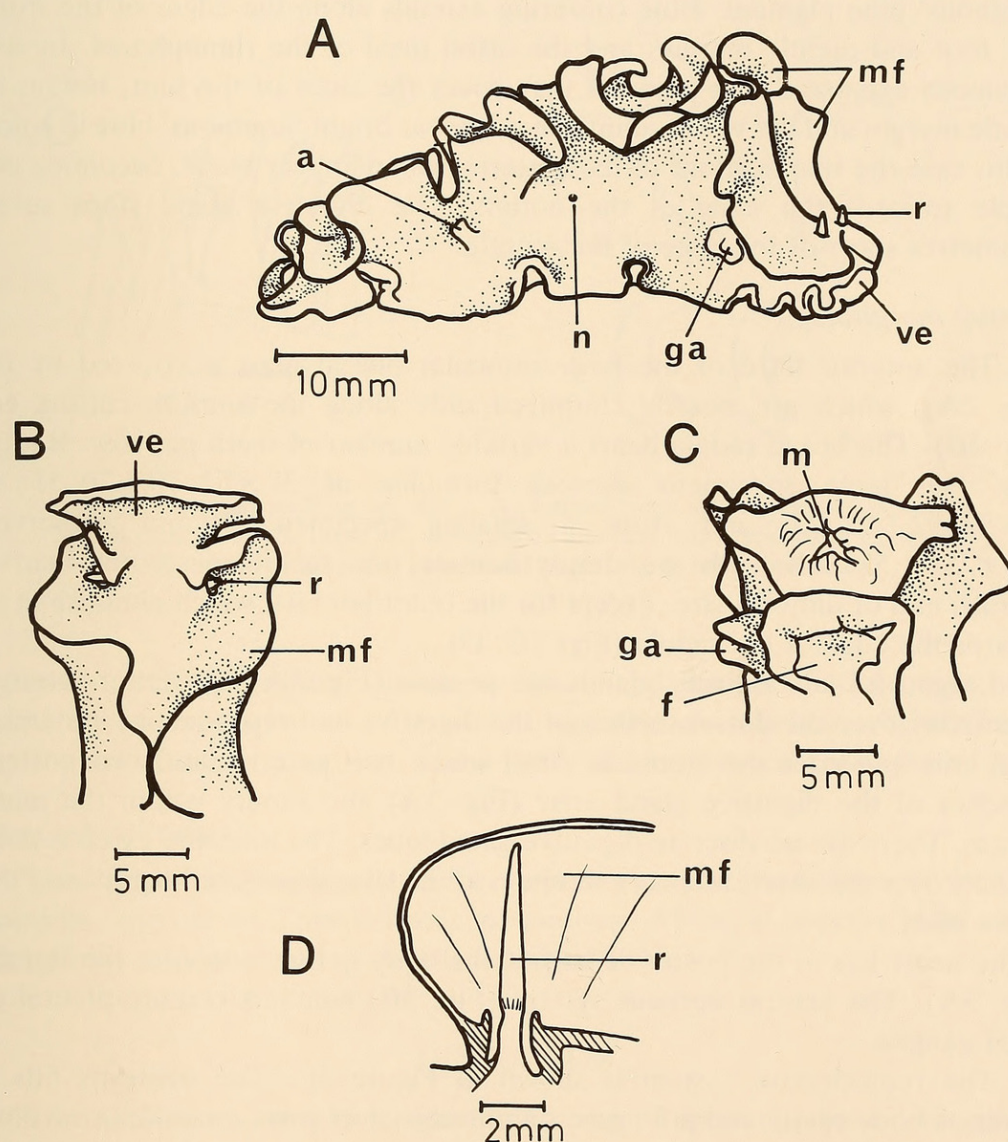


Fig. 1. External morphology of *Leminda millecra* sp. nov. A. Lateral view of whole animal. B. Dorsal view of head. C. Ventral view of head. D. Vertical section through rhinophore cavity.

to a short blunt tail. A large velum extends anterior to the mouth (Fig. 1B, C). The mantle edge is enlarged into a continuous broad undulating margin, originating between the rhinophores, wide in front and narrowing, but continuous, over the tail region (width 12 mm to 4 mm respectively in a preserved 60 mm animal). It is held vertically over the dorsum and contains extensively ramified digestive gland. The rhinophores are smooth and can be retracted into sheaths that bear a narrow collar (Fig. 1D). Eyes are absent. The positions of the genital apertures, nephroproct and anus are shown in Figure 1A.

Colour

The body is translucent white with dark brown to black digestive gland visible in the mantle margin. The epidermis is coloured to varying intensity with 'luminous' blue pigment. Blue colouring extends along the edges of the frontal veil, foot and mantle margin, and the distal third of the rhinophores. In some specimens extensive blue pigment may cover the sides of the foot, notum and mantle margin and the whole animal may appear bright 'luminous' blue in colour. In this case the ramifications of the digestive gland appear black, becoming deep purple towards the edge of the notum. The digestive gland stops several millimetres short of the edge of the mantle.

Internal morphology

The anterior third of the large muscular buccal mass is covered by jaws (Fig. 2A), which are heavily chitinized only along the smooth cutting edge (Fig. 2B). The broad radula bears a variable number of teeth per row. Radulae from two large specimens showed formulae of $37 \times 51-70.1.70-51$ and $39 \times 73-92.1.92-73$, and from a smaller specimen (50 mm preserved), $27 \times c. 52.1.52$. All teeth are simply hamate, the rachidian stouter than the laterals, and of uniform size, except for the outer laterals, which diminish in size towards the edge of the radula (Figs 2C, D).

Large oral and salivary glands are present (Fig. 3A), the latter ramifying extensively over the dorsal surface of the digestive and reproductive systems. A large crop precedes the stomach, from which two anterior and two posterior branches of the digestive gland arise (Fig. 3A) and ramify within the mantle margin. There are no discrete digestive gland lobes. The intestine extends dorso-laterally over the anterior aorta and opens at the lateral anus in the posterior third of the body.

The heart lies in the posterior half of the body cavity, dorsal to the intestine (Fig. 3A). The central nervous system (Fig. 3B) contains cerebro-pleural and pedal ganglia.

The reproductive system is shown in Figure 3C. The ovotestis fills the posterior body cavity and a long hermaphrodite duct joins a sac-like convoluted ampulla, which narrows and branches to the vas deferens. The oviduct is deeply embedded between the vagina and the female gland masses, and no branch can be seen before it enters the musculature of the vagina. The mucous gland is

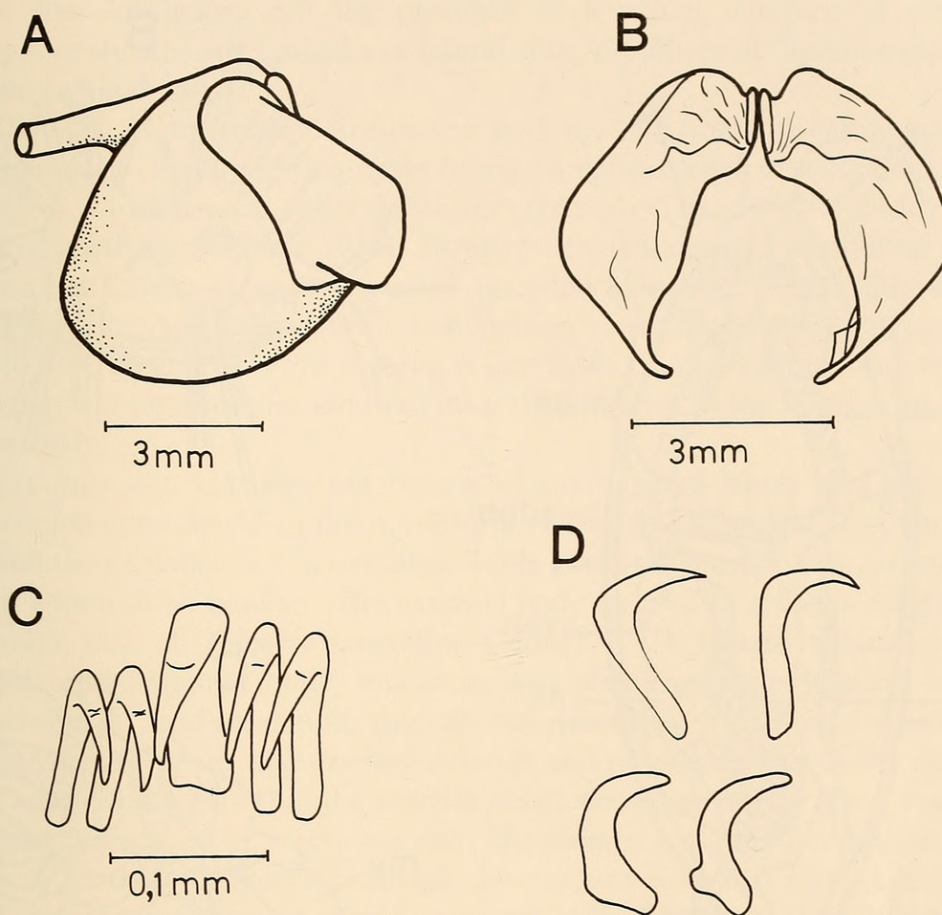


Fig. 2. *Leminda millicra* sp. nov. A. Lateral view of buccal mass showing position of jaws. B. Jaws. C. Rhachidian and first two lateral teeth of radula. D. Sharp unused and blunt used lateral teeth from the radula.

extensive. A receptaculum seminis is absent and the copulatory bursa opens beside the vaginal aperture. The coiled vas deferens thickens slightly before entering the muscular penis sac, which bears an elongate conical unarmed penis.

Geographical range

This species has been collected from both east and west coasts of the Cape Peninsula, and off the Transkei coast of southern Africa. It appears to be a cool-water form, seldom found at depths less than 30 m.

DISCUSSION

The Arminacea are a heterogeneous group of opisthobranchs distinguished primarily by the presence of a velum (Odhner 1934) and general absence of tentacles (except in the genus *Goniaeolis* and the family Janolidae). Placement of an individual species within this group is usually based upon the possession of a

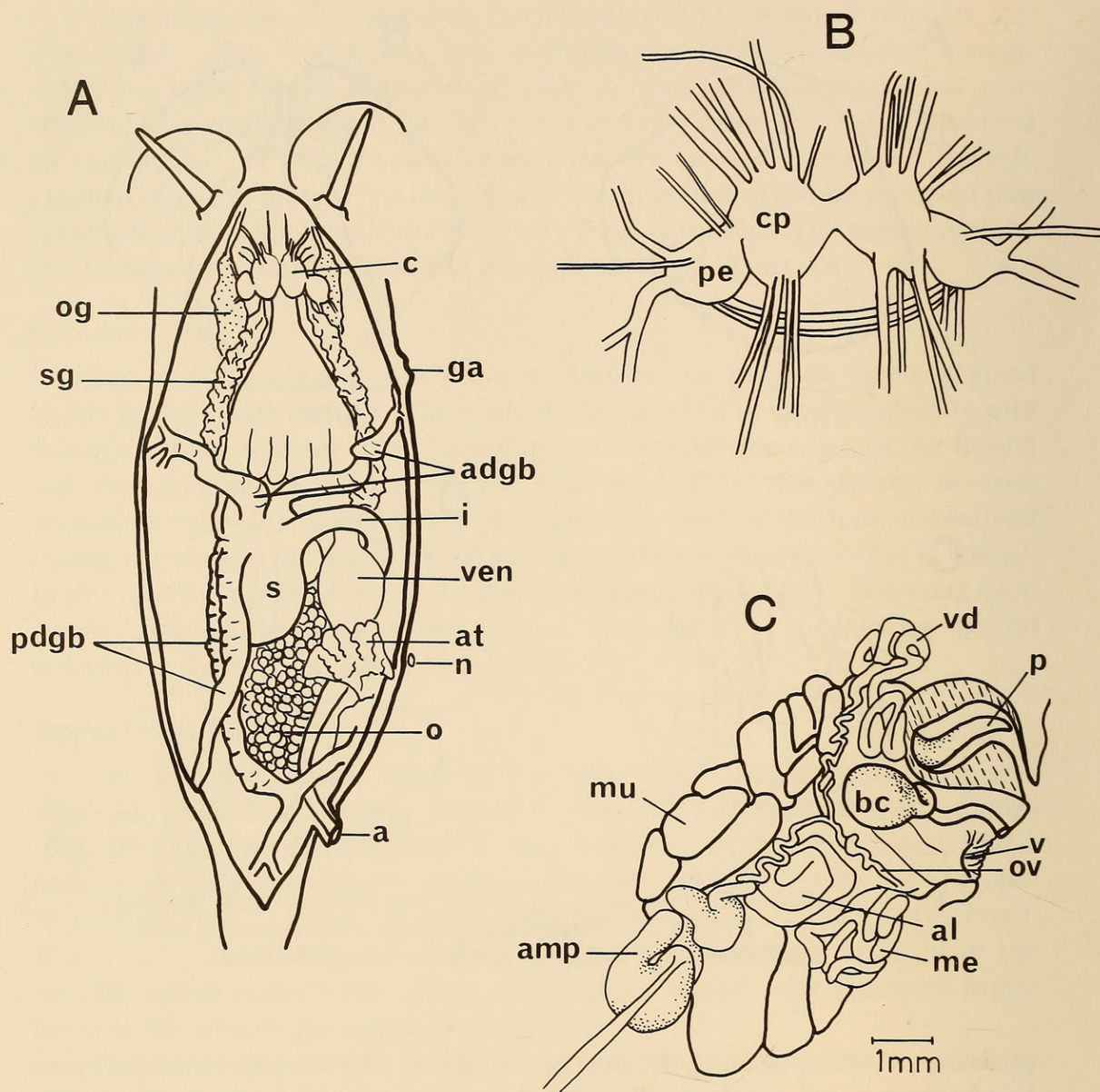


Fig. 3. *Leminda millecra* sp. nov. A. Internal morphology, dorsal view. B. Central nervous system. C. Reproductive system.

combination of characters rather than any one distinctive feature. In addition to the presence of a velum, the arminaceans usually possess only a single seminal vesicle (except in Janolidae), a lateral anus (except in Janolidae), and generally simple rhinophores without a sheath (Franc 1968). As in the other major nudibranch groups the Arminacea have representatives with doridiform to aeolidiform external appearance (Odhner 1934, 1939), a digestive system ranging from more or less holohepatic to cladohepatic with a tendency towards the latter, rhinophores retractile or non-retractile, and radulae ranging from broad multiseriate to reduced with 3 teeth per row. Characters placing *Leminda millecra*

within the Arminacea are the presence of a velum, absence of extended rhinophore sheaths and tentacles, a lateral anus, cladohepatic digestive gland and a single seminal vesicle.

Division of the order Arminacea into the sub-orders Euarminacea and Metarminacea (Franc 1968) is again based on the presence of a combination of characters, which present either doridiform (primitive) or aeolidiform (advanced) facies respectively (Odhner 1934). However, the characters constituting 'primitiveness' or 'advancement' remain in question (Gosliner 1981) and as many members of the Arminacea show a combination of aeolid and dorid characters (as defined by Odhner 1934) this division is untenable. Future reorganization within the group will no doubt be required once the affinities of the families are better understood.

Leminda millecra does not belong in any existing family and appears to possess characters found in the doridiform Heterodorididae and Doridomorphidae, and the aeolidiform Charcotiidae. Table 1 lists the morphological features of genera within these families. The external body form of *L. millecra* most closely resembles that of *Telarma antarctica* Odhner, 1934 (Charcotiidae), with its elevated, quadrangular body, much exposed mantle margins bearing ramified digestive gland, and its smooth rhinophores. However, the internal structure of *T. antarctica* differs in that discrete anterior and posterior lobes of the digestive gland are present (Fig. 4A), the seminal vesicle joins the female gland mass, and the radula is reduced to 5 teeth per row. The members of the Charcotiidae are all Antarctic forms with reduced radulae. *Heterodoris robusta* Verrill & Emerton, 1882 (Heterodorididae), described in Verrill (1882), has an external body form similar to *L. millecra* but the mantle margins are only slightly extended; it has an elevated body and a narrow and thin undulating mantle margin (Odhner 1926). Like *L. millecra* it does not possess eyes and has a broad radula with many simple hooked teeth. These similarities are contrasted by the following differences: the digestive gland in *H. robusta* consists of three large discrete lobes filling the body cavity (Fig. 4B); the gland has a ramified structure but does not enter the mantle (Odhner 1926); the rhinophores are perfoliate, the mantle has dispersed tubercles (Bouchet 1977) and the reproductive system differs in the presence of a prostate; the seminal vesicle opens into the vagina (Odhner 1926; Bouchet 1977); and a cylindrical rather than a conical penis is present. The members of the family Doridomorphidae bear little resemblance to *L. millecra*. *Doridomorpha gardineri* Eliot, 1906, has a flattened dorid shape but with a horizontally broadened mantle edge. The external and internal anatomy of *D. gardineri* differs from *L. millecra* in several respects: the animal appears to be small; the rhinophores are perfoliate; the jaws are denticulate; the radula is reduced; and the reproductive system is triaulic. However, the digestive systems in the two species are very similar (Fig. 4C, D). Thus, while some similarities exist, the considerable differences between *L. millecra* and the members of the above three families are considered sufficient to warrant separate familial status and the family Lemindidae is therefore proposed. The similarities between the above four families are not

TABLE 1
Comparison of the morphological features of *Leminda millecra* sp. nov. and members of three arminacean families.

	<i>Leminda</i> (Lemnidae)	<i>Telarma</i> (Charcotiidae)	<i>Pseudotritonia</i> (Charcotiidae)	<i>Charcotia</i> (Charcotiidae)	<i>Heterodoris</i> (Heterodoridae)	<i>Doridomorpha</i> (Doridomorphae)
Reference	present study	Odhner 1934	Thiele 1912	Vayssi�re 1906	Verill 1882; Odhner 1926; Bouchet 1977.	Eliot 1906; Eliot & Evans 1908.
Body shape	elevated with broadened raised mantle margins	elevated with broadened raised mantle margins	elevated quad- rangular with broadened mantle margin	'Tritonia-like'	elevated, broad notum with conti- nuous thin (nar- row) undulating margin	flat, mantle broadened laterally giving dorid appearance
Size	60 mm	55 mm	20 mm	14 mm	20-37 mm	10 mm
Rhinophores	smooth, retractile	smooth, non- retractile	smooth (possible longitudinal folds)	'cylindrical', non-retractile	perfoliate, retractile	perfoliate, retractile
Eyes	absent	present	unknown	unknown	absent	present
Masticatory border	smooth	smooth	unknown	denticulate	smooth	denticulate
Radula	about 70.1.70	2.1.2	2.1.2	1.1.1	82.1.82 to 130.1.130	4.1.4
Digestive gland	diffuse cladohepa- tic into mantle margin, no lobes present	ramified clado- hepatic but an- terior and pos- terior lobes present	ramifies towards warts in body wall	3 large lobes	3 large lobes	diffuse cladohepatic, no lobes present; ramifies into mantle margin
Seminal vesicle	opens separately beside the vagina	opens via a short duct into the fe- male gland mass	unknown	unknown	a long thin duct opens into the vagina	with one duct open- ing into the oviduct and another ex- teriorly beside the vagina

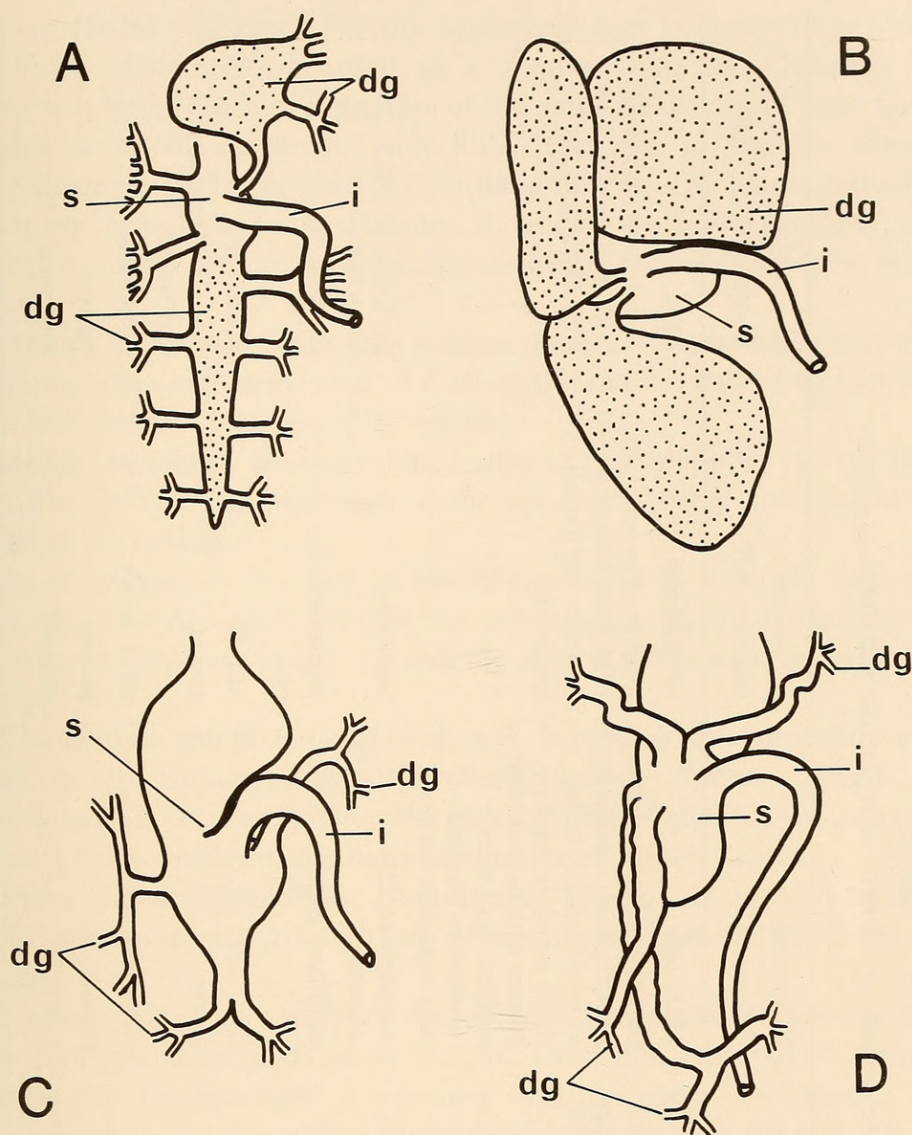


Fig. 4. Comparison of the digestive system of four species of Arminacea showing the stomach, intestine and digestive gland. Stippled area indicates the presence of discrete lobes of digestive gland. A. *Telarma antarctica* (after Odhner 1934). B. *Heterodoris robusta* (after Odhner 1926). C. *Doridomorpha gardineri* (after Eliot & Evans 1908). D. *Leminda millecra* sp. nov.

considered sufficient to support their fusion into a single family. The six species listed in Table 1 represent an assortment of dorid and aeolid characters; however, no single character is common to more than two or three species. There appears to be no consistent feature or combination of features to link the species together and serve in diagnosing a joint family.

In order to evaluate the family Heterodorididae for the above discussion the descriptions of *Heterodoris robusta* were reviewed. Examination of the descriptions by Verrill & Emerton, in Verrill (1882), Odhner (1926) and Bouchet (1977), and of *Atthila ingolfiana* (Bergh, 1899), which was synonymized with *H. robusta*

TABLE 2
Comparison of the morphology of *Heterodoris robusta* and *Athila ingolfiana*.

	<i>H. robusta</i> Verill 1882	<i>H. robusta</i> Odhner 1926	<i>H. robusta</i> Bouchet 1977	<i>A. ingolfiana</i> Bergh 1899
Reference				
Size	28 mm	35, 37 mm	up to 20 mm	32 mm
Shape	Mantle forming an undulating and crenulated edge around back; dorsum with sparsely scattered papillae conical, unequal in size, irregularly placed; longitudinal crest of papillae on head.	Mantle edge thin, minutely and irregularly undulating, without branchial tufts; velum minutely papillate, dorsum with rows of blunt papillae; body sides tuberculate; longitudinal crest of papillae on head.	Confirmed as per Odhner 1926; back with dispersed tubercles and a small anterior ridge.	Mantle formed into margin; back with 3 series of 4 to 5 conical papillae.
Rhinophores	stout, clavate, perfoliate, retractile	perfoliate (c. 25), retractile	annulated	perfoliate (c. 30), retractile
Rhinophore cavity	no distinct edge to cavity	no distinct edge to cavity	no distinct edge	two-lobed edge
Radula rows	unknown	28	28	33
Teeth	'about 168'	130.1.130	82.1.82	120.1.120
Tooth denticulations	absent	absent	absent	present on median and first lateral
Penis	cylindrical	cylindrical	short, heavy	cylindrical
Copulatory bursa	unknown	present	present	present
Eyes	unknown	absent	absent	unknown

by Odhner (1926), indicate that the synonymy was not warranted and that *A. ingolfiana* should be regarded as a separate species. Odhner's (1926) synonymy was based upon examination of the external surface of what remained of Bergh's dissected specimen, with little reference to Bergh's reasonably adequate description. There remain essential differences in anatomical structure that have not been taken into account. Reference to Table 2, which lists the salient features from the original descriptions of the species, shows the following differences:

1. *Atthila ingolfiana*, although a smaller specimen, bears more perfoliations on the rhinophores and more rows of teeth in the radula, indicating that it is not merely a less mature specimen of *H. robusta*.

2. *Atthila ingolfiana* bears a bilobed edge to the rhinopore cavity. This was confirmed in Odhner's examination of the specimen and is not present in any specimens of *H. robusta*.

3. In *A. ingolfiana* the size of the lateral teeth in a radula row initially increases and then decreases towards the radula edge. In *H. robusta* the lateral teeth continue to increase in size towards the edge of the radula, the largest being at the edge.

4. The median and first lateral teeth in *A. ingolfiana* are denticulate whereas the teeth of *H. robusta* showed no denticulations (Odhner 1926). If the denticulations had been worn from the older teeth in Odhner's specimens, they should have been visible on the newer unused teeth in the radula.

5. From the drawing of the reproductive system, *A. ingolfiana* does not appear to possess a prostatic portion of the vas deferens. This is present in *H. robusta*.

The above differences indicate that Bergh's and Odhner's specimens were probably representative of different species. Until new material of *Atthila* and *Heterodoris* can be examined, I consider that the genus and species *Atthila ingolfiana* should be maintained as separate from *Heterodoris robusta*. The genus *Atthila* Bergh, 1899, should thus be re-instated, bearing the following diagnosis (Bergh 1899): Body elevated as in *Tritonia*, rhinophores perfoliate with bilobed edge to the rhinophore cavity. Masticatory border smooth, radula multi-seriate with denticulated median and first lateral teeth. Digestive gland lobes extensive, but do not ramify into the body wall.

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ABBREVIATIONS

a	anus	n	nephridiopore
adgb	anterior digestive gland	o	ovotestis
	branches	oe	oesophagus
al	albumen gland	og	oral gland
amp	ampulla	ov	oviduct
at	atrium	p	penis
bc	bursa copulatrix	pdgb	posterior digestive gland
c	cerebral ganglion		branches
cp	cerebro-pleural ganglion	pe	pedal ganglion
dg	digestive gland	r	rhizophore
f	foot	s	stomach
ga	genital aperture	sg	salivary gland
i	intestine	v	vagina
me	membrane gland	ve	velum
mf	mantle folds	ven	ventricle
mu	mucous gland	vd	vas deferens



Griffiths, Roberta J. 1985. "Description of a new South African arminacean and the proposed re-instatement of the genus *Atthila* Bergh (Mollusca, Opisthobranchia)." *Annals of the South African Museum. Annale van die Suid-Afrikaanse Museum* 95, 269–280.

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