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The ascidian-associated mysid *Corellamysis eltanina* gen.nov., sp.nov. (Mysida, Mysidae, Heteromysinae): a new symbiotic relationship from the Southern Ocean

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Abstract

A new mysid species representing a new genus is described based on specimens collected in the 1968 cruise of the U.S. Navy Ship Eltanin from the Macquarie Island region (Southern Ocean). The new mysid, *Corellamysis eltanina*, is characterized by the globular eyes lacking definite eyestalks, the seven and eighth thoracic endopods specialized as gnathopods forming a strong subchela, and by the armature and shape of the uropod endopod and telson. *Corellamysis eltanina* lives only in the branchial sacs of the ascidian *Corella brewinae* suggesting an obligate endocommensal symbiotic association. Therefore, this is the first known report of a mysid living symbiotically with a benthic tunicate, as well as the first report of a mysid symbiosis from the Southern Ocean. The distribution and habitats of known symbiont mysids are reviewed. An update of identification key to world genera and subgenera of Heteromysinae is suggested.

Key words: new genus, Heteromysinae, Symbiosis, Ascidians, Macquarie Island

Introduction

The phenomenon of symbiosis has for a long time attracted the attention of biologists because such interspecific interactions are essential for the foundation of many species, in shaping the social behaviour of marine invertebrates and in affecting the organization, structure, and function of benthic communities (Roughgarden 1975; Vermeij 1983; Margulis & Sagan 1995; Hay *et al.* 2004; Baeza 2007; Thomsen *et al.* 2010).

Ascidians are well known as hosts of symbionts belonging to many taxa (Monniot 1990) from protozoans to fishes. Nemerteans (Monniot 1961; Dalby 1996) and crustaceans including shrimps, crabs, amphipods isopods and copepods are the most numerous symbionts in invertebrates. They have been described living symbiotically on, in or with other marine organisms all around the world (Thiel & Baeza 2001). The adoption of a symbiotic life style represents one of the most important environmental adaptations of these species (Ross 1983) and, depending on the type of host inhabited and the form of association between host and symbiont a great diversity of relationships can be expected. Copepods represent the largest part of the ascidian crustacean symbionts with varied families. Since their first record (Thorell 1859) the ascidian copepods, sometimes highly modified, have interested many authors (monographies by Illg 1958; Illg & Dudley 1980; Monniot 1990) and still give rise to studies with description of new genera and species (Marchenkov & Boxshall 2005; Boxshall & Marchenkov 2007; Ooishi 2009, 2012). Amphipods are also frequently encountered inside the pharyngeal and cloacal cavities of solitary or compound ascidians (Vader 1984; Thomas 1997; Thiel 1999, 2000; Darwin 1997) either as true symbionts or only occasionally sheltered by their host. Also, decapods, mainly shrimps, have been found to live in large solitary ascidians (Fransen 2006; Marin & Anker 2008; Baeza & Díaz-Valdés 2011; Kneer *et al.* 2013).

Although the great majority of mysids are strictly free-living, a small proportion of species exhibit diverse types of associations with other macro-invertebrates. Sponges, cnidarians, gastropod shells and echinoderms are described as the main hosts in the bibliography (e.g. Mauchline 1980; Fukuoka 2005). Among mysid relationships with other marine invertebrates, symbioses are in most cases assumed rather than clearly demonstrated (Mauchline

1980) and the degree of the associations are frequently diffusely facultative. However, mysid associations that appear to have an obligate symbiotic life style have been reported from tropical and temperate areas (Wittmann 2013).

During the 1968 cruise of the U.S. Navy Ship *Eltanin*, some Heteromysinae Norman, 1892 (Mysida, Mysidae) individuals were found associated with ascidians sampled in the Macquarie Island region (Southern Ocean). The mysids extracted from the ascidians were tentatively ascribed to a new genus and a new species. This paper deals with the morphological description of this new genus and new species and discusses their affiliation to the subfamily Heteromysinae. Furthermore, because this symbiont/host relationship has never been described, we attempt to define some aspects of the type of symbiosis observed. The distribution and habitats of known symbiotic mysids are also reviewed.

Material and methods

The specimens examined in the present study come from the branchial sac of some specimens of *Corella brewinae* Monniot, 2013 (Asciacea, Phlebobranchia, Corellidae). They were stored among the Muséum National d'Histoire Naturelle (Paris) collections with other ascidians from American surveys of the N.O "Eltanin". The ascidian results of the "Eltanin" cruises were firstly described in Monniot & Monniot (1983). In this publication, all *Corella* Hancock, 1870 studied were named *C. eumyota* Traustedt, 1882. Reexamination of all *Corella* specimens led to the description of 3 different closely allied species (Monniot 2013); one of which, *C. brewinae*, is the host of the new mysid described in this work.

Mysids were removed from the branchial sacs of *C. brewinae* fixed with formalin and stored separately in 70% ethanol for later examination. Specimens were ascribed to one of the six life history stages defined by Mauchline (1980) and measured under a dissecting microscope with an eyepiece micrometer. The total body length (TL) of individuals was measured from the apex of the rostrum to the posterior end of the telson, excluding setae. Specimens selected for the species description were dissected and temporarily mounted on slides. Dissected appendages were drawn with the aid of a camera lucida mounted on a Zeiss Axioscop 20 microscope. The terminology for cuticular projections follows Watling (1989) and Garm (2004) for spines and setae, respectively.

Nomenclature of higher Mysida taxa follows Meland & Willassen (2007) and Mees & Meland (2012). Type material is deposited at the Biological Reference Collections (CBR) of the Institut de Ciències del Mar (CSIC) in Barcelona, Spain. In accordance with Article 30.1.1 of the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature 1999), which states that if the genus name is a compound word formed from two or more components, the gender is given by the final component, and considering that *Mysis* should be treated as feminine (Holmquist, 1958), the new species is named to accord with that gender.

The use of the terms such as symbiosis and commensalism follows Ross (1983) and Brusca & Brusca (1990). The definition of ectosymbiosis and endosymbiosis follows Nardon & Charles (2002): in ectosymbiosis the smaller associate remains external; in endosymbiosis the smaller associate is inside the host, even in the digestive tract, or in inside special organs.

Results

Order Mysida Haworth, 1825

Family MYSIDAE Haworth, 1825

Subfamily HETEROMYSINAE Norman, 1892

Corellamysis San Vicente gen. nov.

Type species. *Corellamysis eltanina* San Vicente sp. nov. by present designation.

Included species. *Corellamysis eltanina*.

Gender. The name *Corellamysis* is defined as feminine.

Etymology. The new genus name is given after the symbiotic association with the ascidean genus *Corella* Hancock, 1870 combined with the generic name *Mysis* to give *Corellamysis*.

Diagnosis. Small Heteromysinae mysids (female maximum size: 9.3 mm TL; male: 5.6 mm TL) distinguished within the subfamily through the globular eyes lacking definite eyestalks; antennal scale without distal transverse suture, proximal one-third of the outer margin; third thoracopod not forming gnathopod; thoracopods third to sixth with carpopropodus divided into subsegments; merus of seven to eighth thoracic endopods armed along its inner margin with diverse strong cuspidate setae; eighth thoracic endopods more larger and longer than anterior ones; uropod endopod armed along its inner margin with 15–20 short cuspidate setae extending from near the statocyst to near the apex; telson without cleft, with the apex rounded, distal half of lateral margins armed with 11–17 cuspidate setae increasing in size towards apex.

***Corellamysis eltanina* San Vicente sp. nov.**

(Figs. 1–7)

Material examined. Holotype: One brooding female 9.3 mm TL (catalogue number: ICMM13102501). “Eltanin” survey USA. 54°31’S–159°00’ E, 110 m depth. 18/06/1968. Dissected, one vial.

Paratypes: One mature male 5.6 mm TL (catalogue number: ICMM13102502); dissected, one vial; from the same locality as holotype. One immature female 5.8 mm TL (catalogue number: ICMM13102503); not dissected; one vial; from the same locality as holotype. One juvenile 3.4 mm TL (catalogue number: ICMM13102504); not dissected; one vial; from the same locality as holotype. One juvenile 3.4 mm TL (catalogue number: ICMM13102505); not dissected; one vial; from the same locality as holotype.

The material comes from the Muséum National d’Histoire Naturelle, Paris. Individuals were found inside the branchial sacs of three specimens (among 56 examined) of *Corella brewinae* Monniot 2013 (Ascidiacea, Phlebobranchia, Corellidae) collected in the same trawl. The holotype and one juvenile paratype were removed from one *C. brewinae* specimen, the immature female paratype and one juvenile paratype from another ascidian specimen and the mature male paratype from a third ascidia.

Etymology. This species is named after the U.S. Navy Ship “Eltanin”, operated by the National Science Foundation from 1957 to 1972; specimens were collected in the 1968 cruise and sent to the Muséum National d’Histoire Naturelle for identification and study.

Description. The description below refers to both sexes, unless otherwise stated.

General body form moderately robust (Figs. 1A–B, 2A–B). Carapace with anterior margin evenly rounded, not forming definite rostral projection; posterior margin dorsally emarginated, leaving last thoracic somite partially uncovered; posterolateral lobe covering anterior abdominal somite. Abdomen robust, as wide as middle portion of carapace, not tapering posteriorly; all abdominal somites subequal in length.

Eyes without definite eyestalks (Figs. 2C–D), flattened and subquadrangular with rounded corners, visual elements imperfectly developed and without trace of pigment in preserved individuals, laterally not extending beyond carapace limits.

Antennular peduncle (Figs. 2A, E) extending slightly beyond antennal scale. First article longer than wide; second article shortest, half as long as broad; third article as long as broad; in male, small sub-spherical and hirsute appendix masculina present on ventral side of third article.

Antennal sympod (Figs. 2F–G) with outer distal dorsal angle rounded and ventral distal middle finger-like protuberance. Peduncle not extending beyond scale; first article short, as long as broad, inner margin rounded; second article twice as long as broad, inner distal margin armed with one simple seta; third article half shorter than second one, distal inner margin armed with one or two simple setae. Antennal scale two-three times longer than maximum width, not extending beyond antennular peduncle; margins convex, setose on its inner margin and on the distal one-third of its outer margin, proximal two-thirds of outer margin entire; without apical suture.

Labrum (Fig. 3F) more or less symmetrical, as long as wide; without frontal spiniform process; posterior margin with short irregularly distributed thin simple setae.

Mandibles (Figs. 3A–E) well developed. Three-segmented palp, first article shortest; second article slightly longer than wide, with simple setae on both margins; third article about twice as long as broad, armed on distal third of inner margin with 6 or 7 ventral serrated setae and 2 or 3 distal simple setae; one distal large conspicuous

seta. Mandibles with well developed incisor and reduced molar process; left mandible plus row of 2 simple spines and 3 serrated spines; counterpart on right mandible comprising 8 entire spines; right lacinia mobilis well developed (Figs. 3D–E).

Maxillule (Fig. 3G) apex of outer lobe armed with 7 strong cuspidate setae and single row of 4 simple setae on ventral surface; inner lobe with 12 simple setae.

Maxilla (Fig. 3H) apparently without exopod; distal article of endopod oval, longer than wide, margins armed with about 23 pappose setae on inner and outer distal two-thirds; inner margin of coxal endite armed with 2 rows of pappose setae; inner margin of bilobulate basal endites also armed with pappose setae.

Thoracopods grouped in three different shape groups. First and second thoracic appendages formed as maxillipeds, third to sixth endopods with carpopropodus 2-segmented, and seventh and eighth with endopods specialized as gnathopods.

First thoracopod (Figs. 4A–B) short, with unarmed epipodite. Endopod with merus longer than carpopropodus; dactylus sub-spherical densely setose, bearing a series of simple setae on both margins. Exopod longer than endopod, with 7-segmented flagellum.

Second thoracopod (Figs. 4C–D) slightly longer than first one, with small endite on the basis. Endopod with preischium and ischium subequal in length; merus subequal to carpopropodus; dactylus sub-spherical, densely setose with a series of simple setae on both margins. Exopod longer than endopod, with 8-segmented flagellum.

Third to sixth thoracopods (Figs. 4E–H, 5A–B) with endopod longer than exopod; ischium and merus subequal in length; carpopropodus 2-segmented, shorter than merus; inconspicuous segmentation between the carpopropodus and dactylus; strong distal nail present. Exopod with 9-segmented flagellum. Sixth thoracic appendages of female with rudimentary oostegites, armed with 3 simple setae on its distal margin, 1 on outer margin and 2 on inner margin (Fig. 5A)

Seventh and eighth thoracopod endopods quite different from the rest, with undivided carpopropodus and inconspicuous segmentation between carpopropodus and dactylus; merus armed along its inner margin with strong cuspidate setae forming powerful subchela (Figs. 5C–F, 6A). Eighth thoracopod with enlarged endopod, much longer and larger than anterior ones; endopod longer than exopod; merus large, armed along its inner margin with 9 (male) or 25 (female) cuspidate setae; undivided carpopropodus; dactylus with strong distal nail present. Exopod with rudimentary basal plate and 8-segmented flagellum.

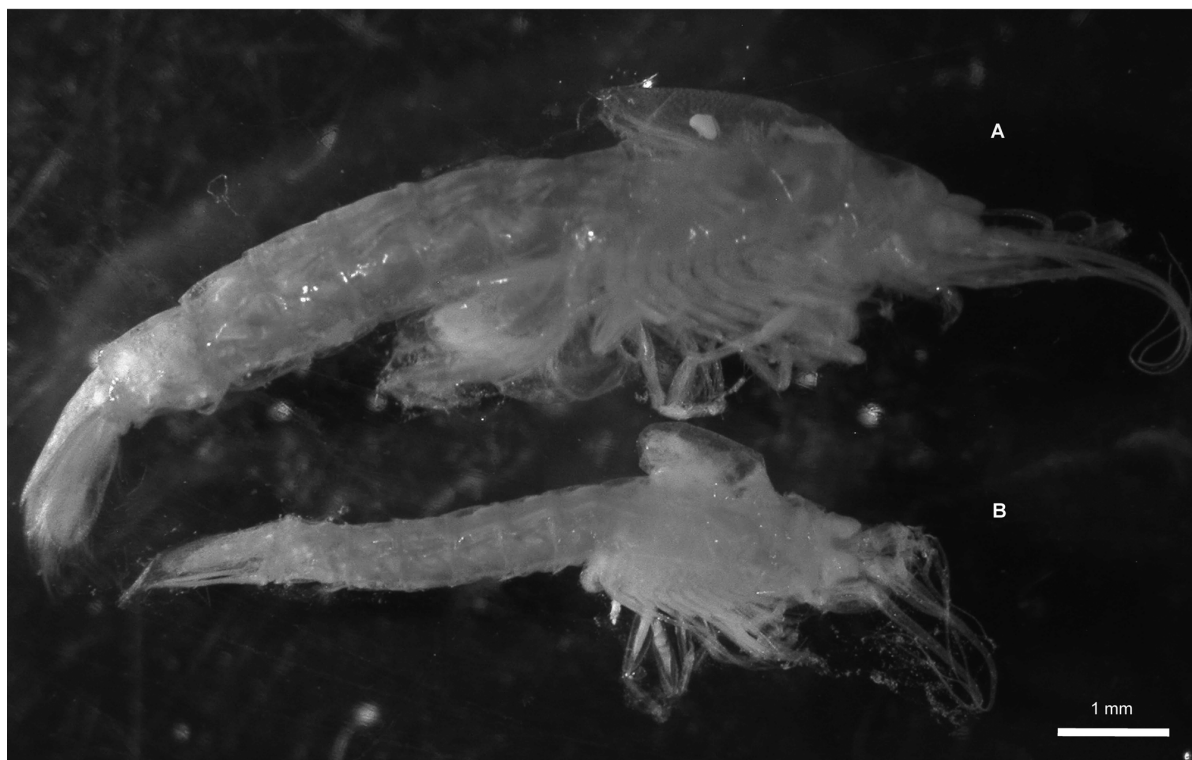


FIGURE 1. *Corellamysis eltanina* gen. et sp. nov. Photograph of ethanol preserved specimens. (A) holotype, brooding female in lateral view; (B) paratype, immature female in lateral view.

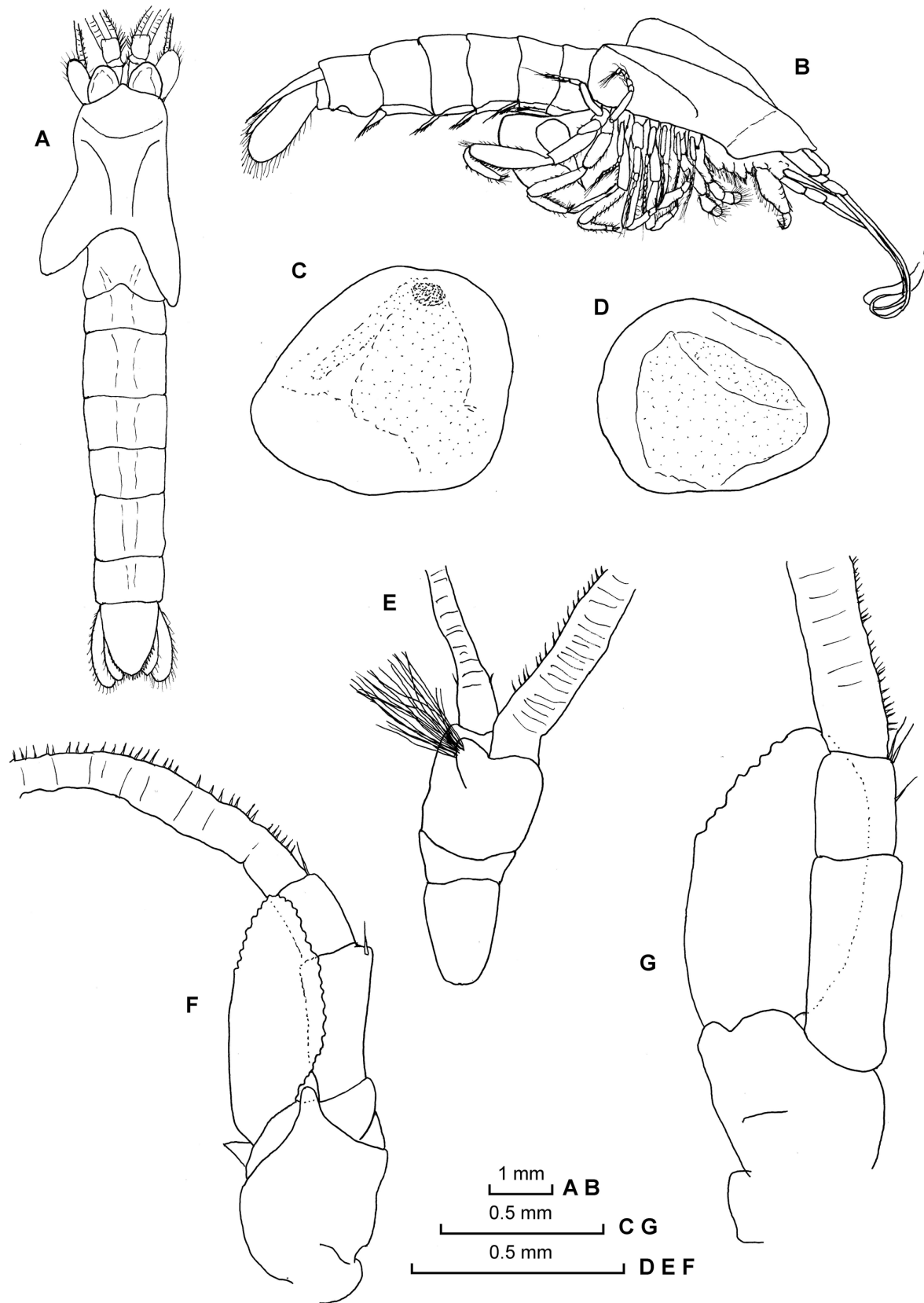


FIGURE 2. *Corellamysis eltanina* gen. et sp. nov. (A–C, G) holotype, brooding female; (D–F), paratype, immature male. (A) female habitus in dorsal view; (B) female habitus in lateral view; (C) female eye in dorsal view (D) male eye in dorsal view; (E) male antennule in ventral view; (F) male antenna in ventral view; (G) female antenna in dorsal view.

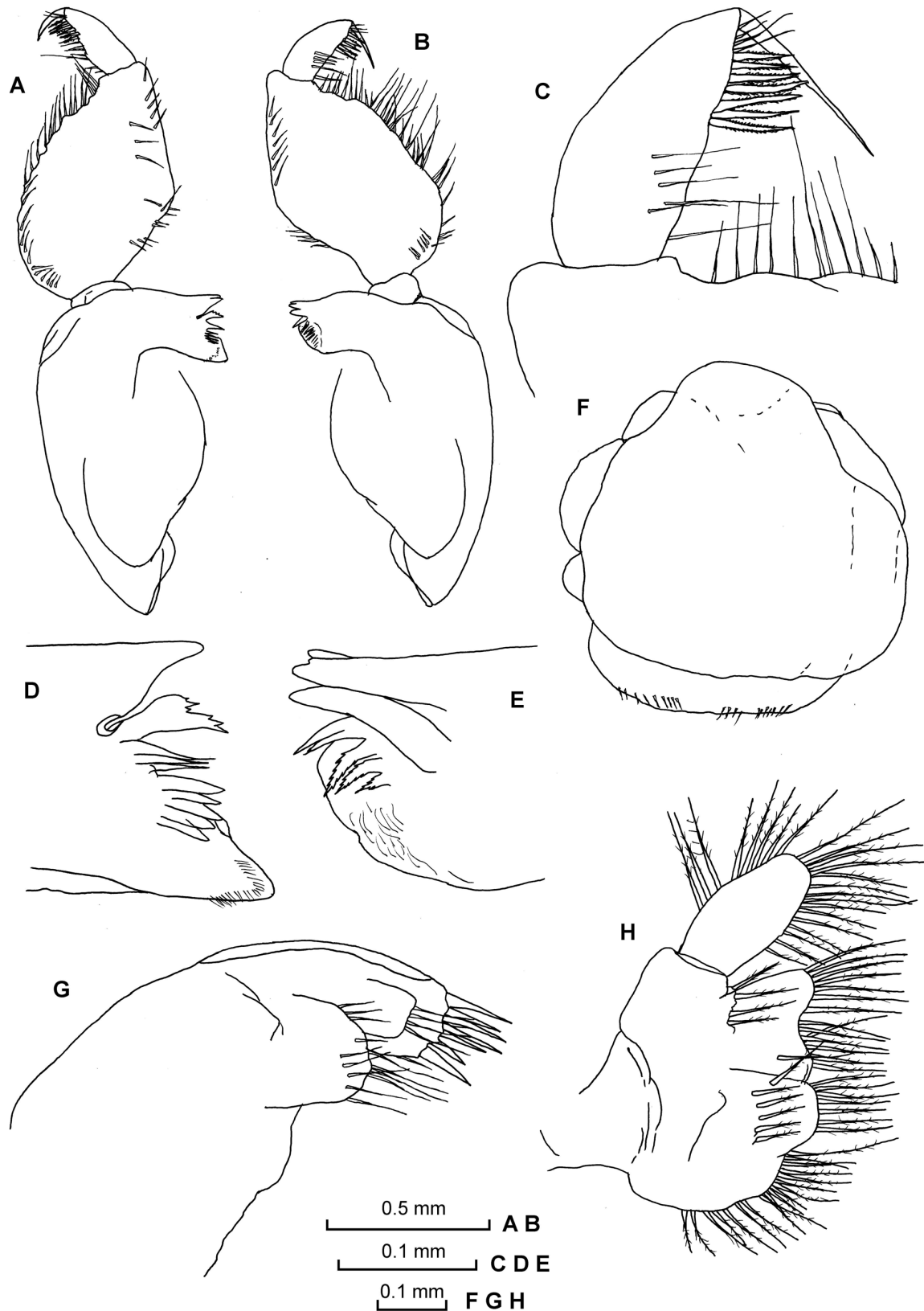


FIGURE 3. *Corellamysis eltanina* gen. et sp. nov. Holotype, brooding female. (A) right mandible; (B) left mandible; (C) distal article of left mandible ; (D-E) incisor to molar process of right and left mandible, respectively; (F) labrum; (G) maxillule; (H) maxilla.

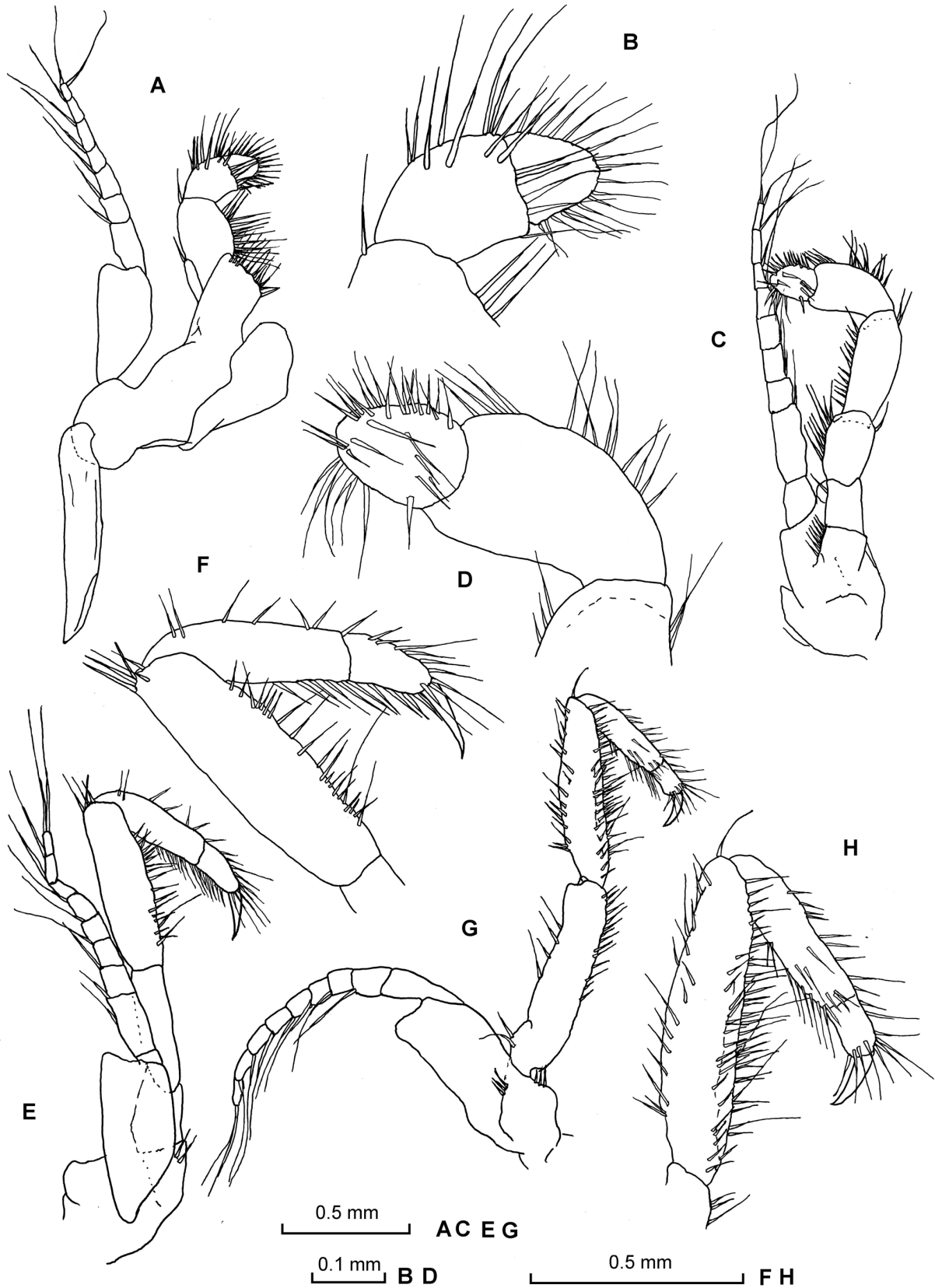


FIGURE 4. *Corellamysis eltanina* gen. et sp. nov. Holotype, brooding female. (A) 1st thoracopod; (B) distal articles of endopod of 1st thoracopod; (C) 2nd thoracopod; (D) distal articles of endopod of 2nd thoracopod; (E) 3rd thoracopod; (F) distal articles of endopod of 3rd thoracopod; (G) 5th thoracopod; (H) distal articles of endopod of 5th thoracopod.

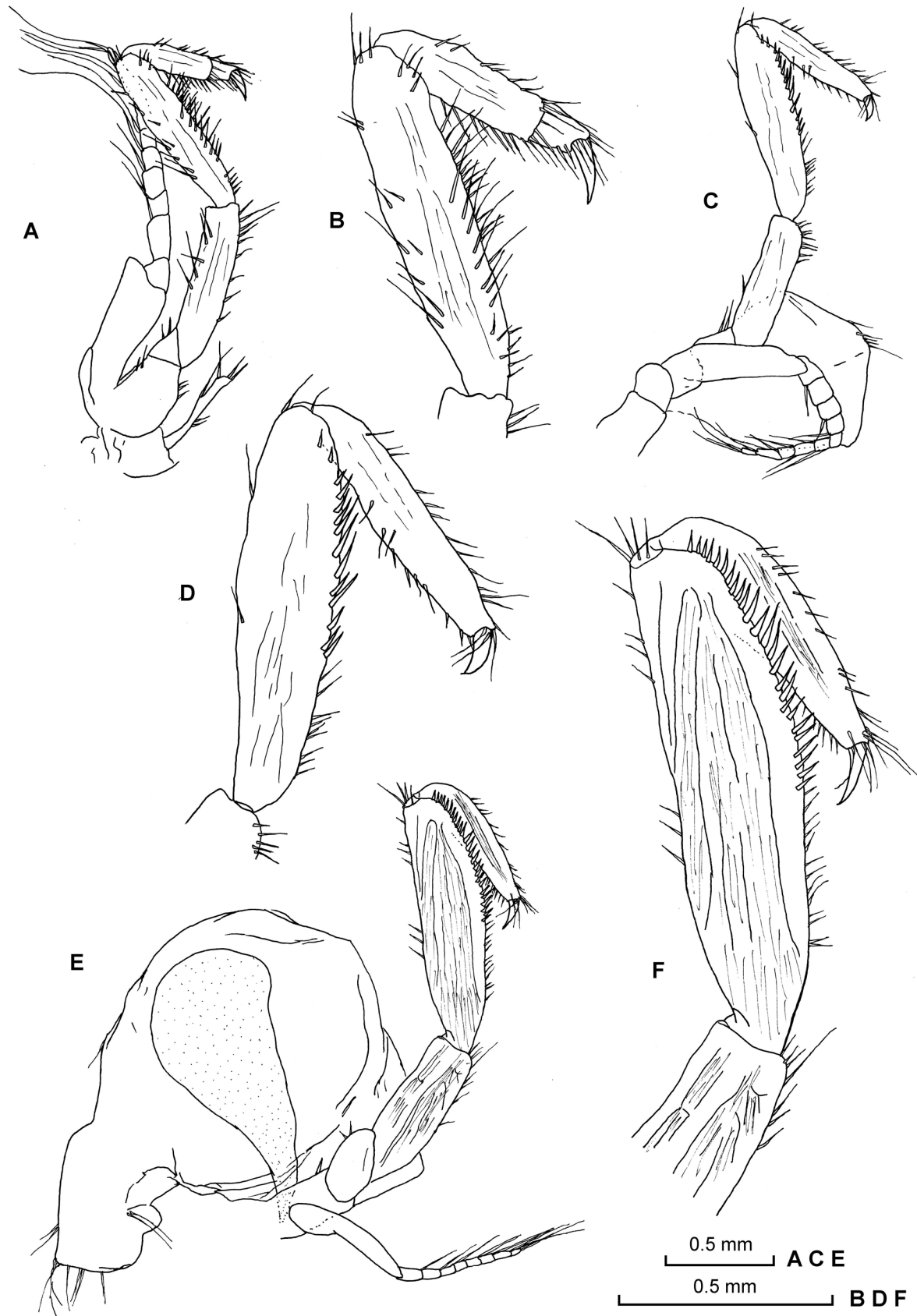


FIGURE 5. *Corellamysis eltanina* gen. et sp. nov. Holotype, brooding female. (A) 6th thoracopod; (B) distal articles of endopod of 6th thoracopod; (C) 7th thoracopod; (D) distal articles of endopod of 7th thoracopod; (E) 8th thoracopod; (F) distal articles of endopod of 8th thoracopod.

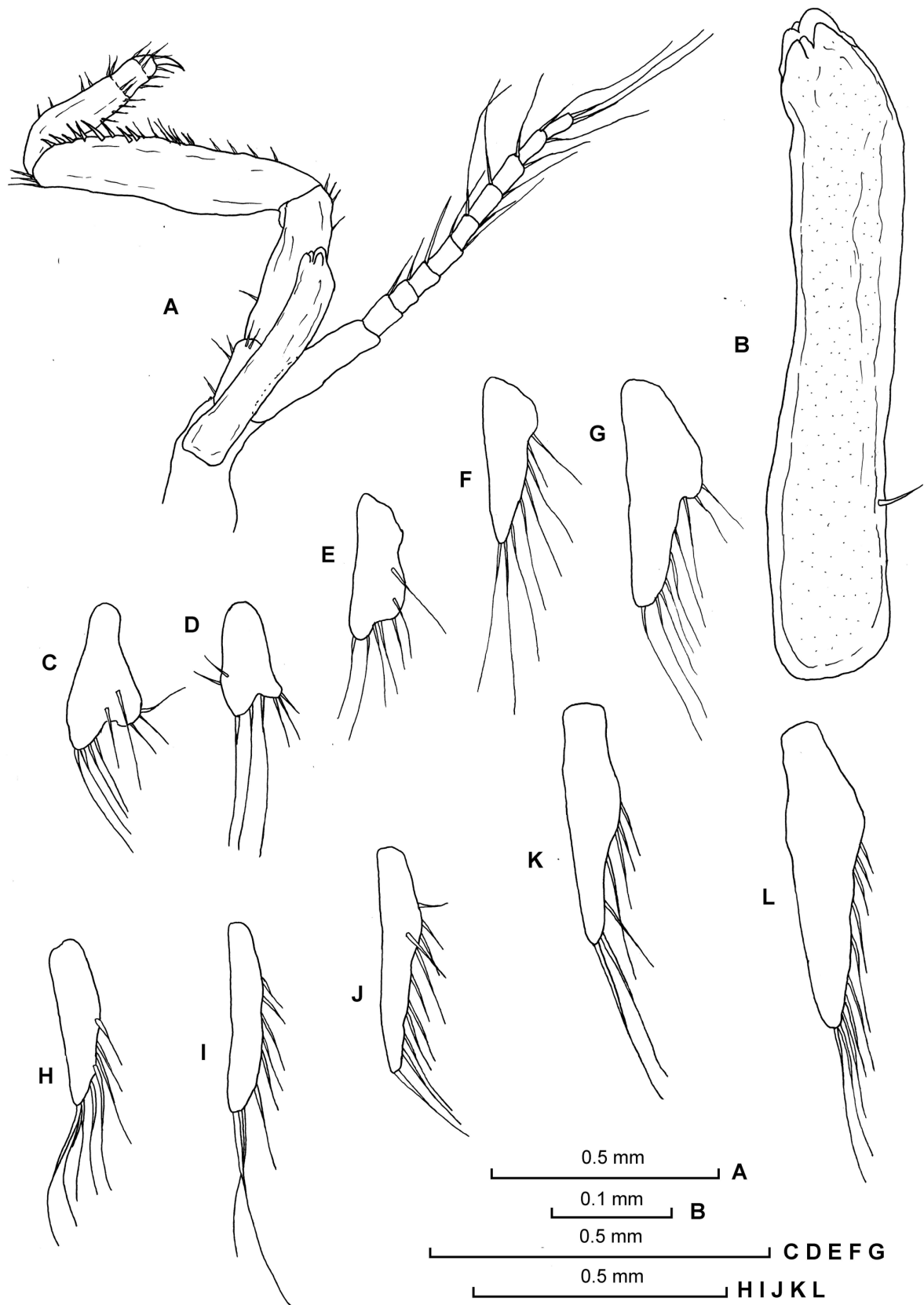


FIGURE 6. *Corellamysis eltanina* gen. et sp. nov. (A–G) paratype, mature male; (H–L) holotype, brooding female. (A) male 8th thoracopod; (B) male genital organ; (C) male 1st pleopod; (D) male 2nd pleopod; (E) male 3rd pleopod; (F) male 4th pleopod; (G) male 5th pleopod; (H) female 1st pleopod; (I) female 2nd pleopod; (J) female 3rd pleopod; (K) female 4th pleopod; (L) female 5th pleopod.

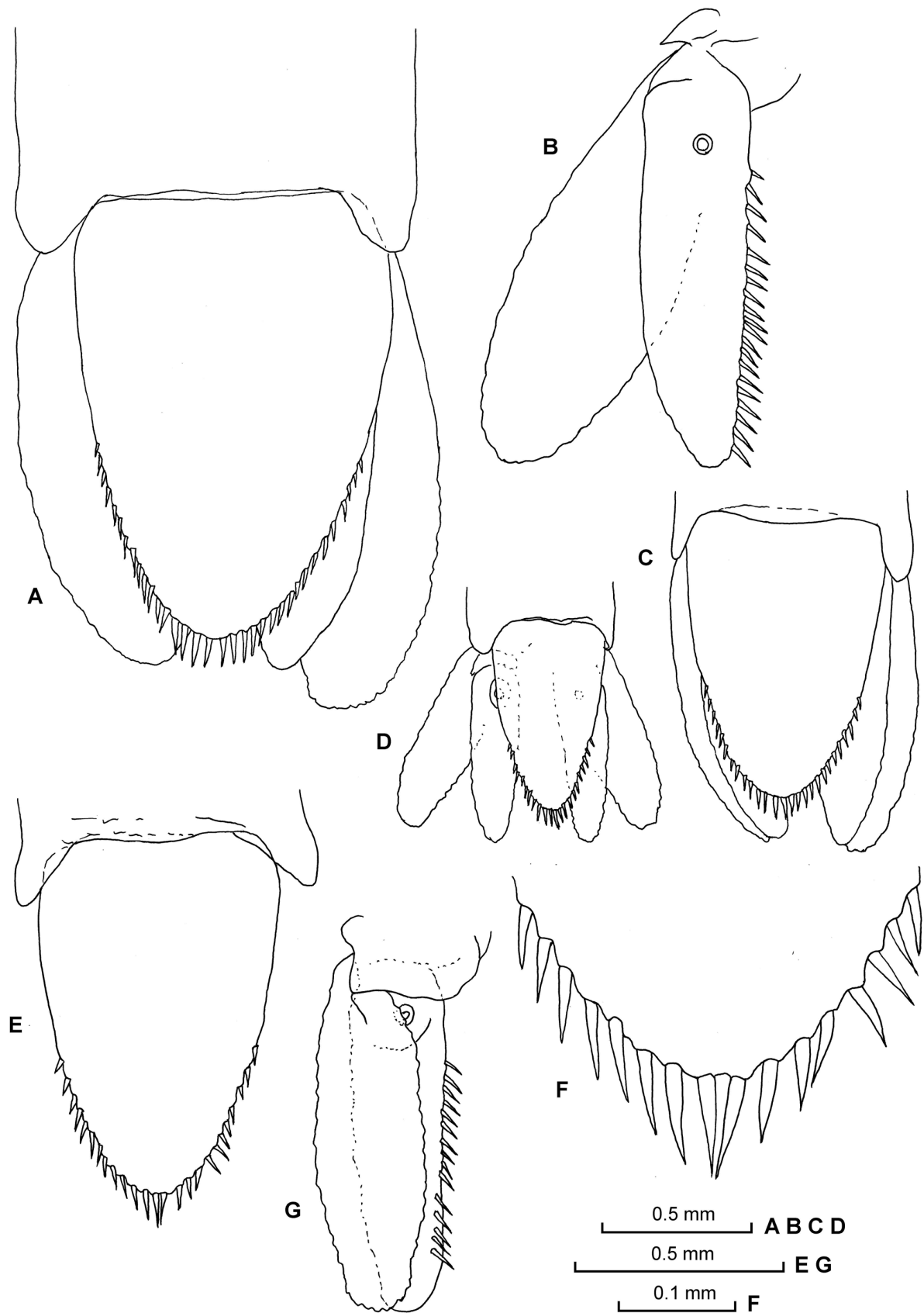


FIGURE 7. *Corellamysis eltanina* gen. et sp. nov. (A–B) holotype, brooding female; (C) paratype, immature female; (D) paratype, juvenile; (E–G) paratype, mature male. (A) brooding female telson and uropods in dorsal view; (B) brooding female uropod; (C–D) telson and uropods in dorsal view of immature female and juvenile, respectively; (E) male telson in dorsal view; (F) posterior end of male telson; (G) male uropod.

Oostegites of seventh thoracopods developed, smaller than those of eighth thoracopods (Figs. 5C, E). Penes roughly cylindrical, reaching two-thirds of ischium length. Each penis with simple seta located at proximal one-fourth of its length on outer margin; distal margin obscurely 6-lobate (Figs. 6A–B).

Pleopods uniramous, reduced to unsegmented lobes in both sexes (Figs. 6C–L), increasing in length from first to fifth pairs; fifth pleopod extending to posterior half of last abdominal somite (Fig. 2B).

Uropodal endopod (Figs. 7B, G) slender, extending slightly beyond apex of telson, inner margin armed with 15–20 short cuspidate setae extending from near statocyst to near apex. Female uropodal exopod slightly longer and broader than endopod (subequal in male and immature specimens), setose all round (Figs. 7A–D, G).

Telson entire, linguiform, about two times as long as broad at base; distal half of lateral margins armed with 11 (juvenile)–17 (brooding female) cuspidate setae, increasing in size towards apex (Figs. 7A, C–D, E–F). Colour (in long-time preserved specimens): almost transparent tegument with brown pigmentation distributed on the abdomen and some appendages.

Distribution and habitat. The known distributional area of the new *Corellamysis* species is at the moment limited to the Macquarie Island region (Southern Ocean), at 110 m depth. All individuals were collected in the branchial sacs of three ascidian individuals of *Corella brewinae*.

Discussion

The Heteromysinae at present contains 14 genera (Mees & Meland 2012) with two morphologically distinct lines. The traditional definition of the subfamily (tribe Heteromysini, at present an obsolete item according to Meland & Willassen 2007) has expanded in recent years due to the discovery of new genera and the relocation of other taxa previously included in the subfamily Leptomysinae.

Heteromysinae *sensu stricto* are characterized by a small or reduced appendix masculina, antennal scale setose all round, third thoracic endopod specialized as gnathopod, long to medium sized tubular penis, reduced pleopods in both sexes, uropodal endopod with setae on inner margin, and telson with apical cleft armed with spinules (Tattersall & Tattersall 1951). Five genera are included in this group: *Heteromysis* Smith, 1873, *Heteromysoides* Bacescu, 1968, *Ischiomysis* Wittmann, 2013, *Platymysis* Brattegard, 1980 and *Retromysis* Wittmann, 2004.

The concept of the tribe Heteromysini by Tattersall & Tattersall (1951) was amplified to accommodate the new taxa *Bermudamysis* Bacescu & Iliffe, 1986; *Burrimysis* Jaume & Garcia, 1993; *Kochimysis* Panampunnayil & Biju, 2007, *Harmelinella* Ledoyer, 1989 and *Deltamysis* Bowman & Orsi, 1992. Also, the Leptomysinae genera *Platyops* Bacescu & Iliffe, 1986, *Pseudomysidetes* W.M. Tattersall, 1936, *Mysidetes* Holt & Tattersall, 1905 and *Mysifaun* Wittmann, 1996, have been transferred to the Heteromysinae (Bowman & Orsi 1992; Bravo & Murano 1996; Mees & Meland 2012). All these genera differ in some morphological aspects from the traditional description of the subfamily, especially because they do not have a third thoracic endopod forming a gnathopod.

The emended and extended diagnosis of the subfamily Heteromysinae takes into account the following major morphological characters: antennal scale setose all round; endopod of third thoracopod sometimes enlarged and robust; pleopods rudimentary in both sexes (except long third pleopod of male *Harmelinella*); penis long, cylindrical; telson with or without apical cleft (Ledoyer 1989; Bowman & Orsi 1992; Bravo & Murano 1996). Analyses of 18S rRNA emphasizes the strength of uniramous male pleopods and male genital organs as uniquely derived morphological characters, and gives ample support for redefining the Heteromysinae (Meland & Willassen 2007).

In accordance with this modern definition of the subfamily, the placement of *Corellamysis* gen. nov. in the Heteromysinae seems beyond doubt. Nevertheless, due to the shape of the antennal scale and the configuration of the carpopropodus of the third to sixth thoracopods, it is necessary to slightly modify the subfamily diagnosis given by Bravo and Murano (1996) as follows: processus masculinus of antennule usually reduced, antennal scale setose, third thoracic endopod sometimes enlarged and robust, carpopropodus of fourth to sixth thoracic endopods divided into subsegments, pleopods of both sexes rudimentary, except the long third pleopod male of *Harmelinella*, penis long, cylindrical, and telson with or without apical cleft.

The new genus is placed within a phenotypic genus-group within the subfamily, characterized by the absence of enlarged endopod of the third thoracopod. The establishment of the new genus *Corellamysis* mainly relies on the combination of characters afforded by the eye, the peculiar shape of thoracopods seventh and eighth, the telson shape and the uropodal endopod armature for its distinction from the allied genera.

The new genus shows some morphological similarities to *Deltamysis*, *Kochimysis*, *Platyops* and *Pseudomysidetes* in the form of the eyes and the entire telson. However, the inner margin of uropodal endopod without setae (characteristic of *Deltamysis*, *Kochimysis* and *Platyops*), and the armature of the maxillar endopod, the shape of thoracopodal endopods showing gradual length reductions posteriorly, and the long and narrow telson of *Pseudomysidetes*, clearly distinguish these genera from *Corellamysis*. Also, *C. eltanina* is recognised by the peculiar prehensile endopods of the thoracopods seven and eight (not described in any of the four aforementioned genera nor in any other Heteromysinae genera).

All individuals of the new taxon described in this paper have been found only in the branchial sacs of several ascidian individuals, clearly suggesting an endo-symbiotic association. Depending on their lifestyles, mysids may be classified into two main groups: completely free-living individuals (the great majority of species) and individuals living as symbionts with more or less facultative or obligatory relationships. The exact nature of mysid associations with other species is in most cases unknown and the boundaries between free-living lifestyles and symbiosis appear, therefore, very diffuse.

Known records of mysid associations with their hosts are listed in Table 1. In this table, species that do not appear to select a specific animal for a relationship and/or have been collected also in free-living habitats are considered as facultative. Otherwise, those species that have been described only associated with a host are considered obligates (many of them only known from the type locality). To date no mutualistic or parasitic relationships has been reported, except, perhaps, that between *Heteromysis (Olivemysis) actiniae* Clarke, 1955 and the sea anemone *Bartholomea annulata* (Lesueur, 1817) in the Caribbean Sea. Clarke (1955) reported *H. actiniae* in small colonies numbering 5 to 20 individuals among tentacles of the anemone and feeding on particles ejected by *Bartholomea*. Clarke (1955) states that this mysid swims in small groups among the expanded tentacles of the anemone but does not appear to be attacked by nematocysts. It rests for periods on the basal portions of the tentacles of the anemone where there are fewer arrays of nematocysts.

Based on the review of the literature (with special reference to the large number of *Heteromysis* species listed by Fukuoka 2005), associations between mysids and other invertebrates may be classified as ectosymbiosis (ectocommensalism) or endosymbiosis (endocommensalism), both of them with facultative and/or obligatory habits. Ectosymbionts represents 60.6% and endosymbionts the 39.4% of such known relationships. Within the order Mysida (174 genera and 1128 species: Mees & Meland, 2012), only 11 genera containing 66 species (6.3% and 5.4%, respectively) are described as associated with other taxa. The genus *Heteromysis* Smith, 1873 with 47 known associated species contains by far the highest mysid symbiont biodiversity.

The majority of mysid interactions have been found in benthic systems. There are only two examples of pelagic facultative associations: *Indomysis tsumamali* Bacescu, 1973 associated with the sea anemone, *Megalactis hemprichii* Ehrenberg, 1834 and the medusa *Cassiopea andromeda* (Forsskål, 1775) in the Red Sea (Bacescu 1973) and *Mysidopsis cathengelae* Gleye, 1982 with the purple jellyfish, *Chrysaora* sp. from Southern California (Martin & Kuck 1991).

Thirty-one ectocommensal facultative associations of mysids with sponges, corals, sea anemones, medusae, echinoderms and gorgonians, representing more or less small inter-specific relationship, have been reported (Table 1). Randall *et al.* (1964) observed, *Mysidium gracile* (Dana, 1852), in the presence of danger, moving to shelter in the spaces between the spines of the echinoderm *Diadema antillarum* Philippi, 1845. Emery (1968) found that schools of *M. gracile*, when threatened by a predatory fish, crowded into the nesting caves of several species of pomacentrid fish that inhabit reefs. The nesting fish made no attempt to eat the mysids, but drove off potential predators. Three species of *Leptomysis* from the Mediterranean Sea are frequently associated with the sea anemone, *Anemonia viridis* (Forsskål, 1775), and less frequently associated with *Aiptasia mutabilis* (Gravenhorst, 1831) (see Wittmann 2008). Among these species, some individuals returned to their host after they were driven away by strong wave action (Patzner 2004) or related to nycthemeral migrations (Wittmann 1978). Greenwood & Hadley (1982) found *Idiomysis inermis* Tattersall, 1922 only above the green oral disc of the sea anemone *Stichodactyla haddoni* (Saville-Kent, 1893) in eastern Australia, but Tattersall (1922) observed this species among weeds. Some individuals of *Anchialina typical* Krøyer, 1861 are associated with corals, sponges, and artificial substrates (Modlin 1984). Diverse species of the genus *Heteromysis* with a facultative association with sponges, gorgonians, ophiuroid, sea anemones and gastropod shells are reported by Fukuoka (2005).

TABLE 1. Main known mysid associations with other marine invertebrate (*Heteromysis* spp. adapted from Fukuoka, 2005).

Species	Geographical zone	Depth	Type of symbiosis / Associated host
<i>Amalhimysis gibba</i> Brattegard, 1969 ⁽¹⁾	Gulf of Mexico	26 m	Ectocommensalism facultative On a scaly soft coral.
<i>A. polita</i> Brattegard, 1974 ⁽²⁾	Caribbean Sea	5-38 m	Around hard and soft corals, sponge <i>Calyxsporgia vaginalis</i> (Lamarck, 1814); other free-living habitats.
<i>Anchialina typica</i> Krøyer, 1861 ⁽¹⁾	Circumtropical	0-50 m	Associated with corals, sponges, artificial substrates; other free-living habitats.
<i>Dioptrromysis paucispinosa</i> Brattegard, 1969 ⁽²⁾	Caribbean Sea	1-10 m	Hard corals, surface of sponge <i>Porites porites</i> Pallas, 1766; other free-living habitats.
<i>Heteromysis brucei</i> Tattersall, 1967 ⁽³⁾	East Asian	0-1 m	In rocky pool with weeds and colonial zooanthid; washings of coral <i>Galaxea fascicularis</i> (Linnaeus, 1767).
<i>H. pacifica</i> Tattersall, 1967 ⁽³⁾	Australasia	littoral	Among coral on beaches.
<i>H. (Heteromysis) arianii</i> Wittmann, 2000 ⁽⁴⁾	Mediterranean Sea	11-22 m	Coralloid habitats with rock, coarse sediments, bryozoans and gorgonians.
<i>H. (Heteromysis) communis</i> Bacescu, 1986 ^(5,6)	Australia	0-10 m	Pool among corals, unidentified sponge..
<i>H. (Heteromysis) formosa</i> Smith, 1873 ^(7,8)	North Atlantic	0-225 m	Empty shell of <i>Maetra</i> sp.; other free-living habitats
<i>H. (Heteromysis) gymnura</i> Tattersall, 1922 ^(6,9,10)	Tanzania; India; Australia	1-40 m	Unidentified gorgonians and the arms of the ophiuroid <i>Astroba nigra</i> Doederlein, 1911; among seaweeds.
<i>H. (Heteromysis) norvegica</i> Sars, 1882 ⁽¹¹⁾	Mediterranean Sea; East Atlantic	0-400 m	Unidentified empty shells; other free-living habitats.
<i>H. (Heteromysis) spinosa</i> Bacescu, 1986 ^(5,6)	Australia	0-6 m	Coral rubble; other free-living habitats.
<i>H. (Heteromysis) spottet</i> Price & Heard, 2000 ⁽¹²⁾	Caribbean Sea	1-18 m	Unidentified sponge; other free-living habitats.
<i>H. (Olivemysis) coralina</i> Modlin, 1987 ^(2,13)	East American	6 m	From upper spur and groove, vertical buttress wall with hard and soft coral.
<i>H. (Olivemysis) kenslevi</i> Modlin, 1987 ^(2,13)	East American	6 m	Coral; rock.
<i>H. (Olivemysis) mayana</i> Brattegard, 1970 ^(2,14,15,16)	Caribbean Sea	0-27 m	Green sea anemones and <i>Bartholomea annulata</i> (Le Sueur, 1817); empty shells of <i>Strombus gigas</i> Linnaeus, 1758; corals <i>Eusmilta</i> and <i>Siderastrea</i> ; other free-living habitats.
<i>H. (Olivemysis) meenakshiae</i> Bamber, 2000 ⁽¹⁷⁾	East Asian	16 m	Sponge epifauna, tube of the annelid <i>Salmacina chysteri</i> (Huxley, 1855).
<i>H. (Olivemysis) quadrispinosa</i> Murano, 1988 ⁽⁶⁾	Australia	4-6 m	Coral, rubble.
<i>H. (Olivemysis) sexspinosa</i> Murano, 1988 ⁽⁶⁾	Australia	8 m	From unidentified gorgonian host.
<i>H. (Olivemysis) sicilisetia</i> Brattegard, 1970 ⁽¹⁴⁾	Caribbean Sea	0-2 m	Among sponge <i>Porites</i> sp. and other corals, and under coral fragments.
<i>H. (Olivemysis) tenuispina</i> Murano, 1988 ⁽⁶⁾	Australia	6-40 m	Coral, rubble.
<i>Idiomysis inermis</i> Tattersall, 1922 ^(18,19)	Australia	0-4m	Above the anemone oral disc <i>Stichodactyla haddoni</i> (Saville-Kent, 1893); also among weeds.
<i>I. isurnamali</i> Bacescu, 1973 ⁽¹⁵⁾	Red Sea	1-20 m	Anemone <i>Megalactis hemprichi</i> Ehrenberg, 1834, medusa <i>Cassiopea Andromeda</i> Forskål, 1775.

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TABLE 1. (Continued)

Species	Geographical zone	Depth	Type of symbiosis / Associated host
<i>Leptomysis lingvura</i> (Sars, 1866) ⁽²⁰⁾	Mediterranean Sea	0-50 m	Anemone <i>Anemonia viridis</i> (Forskål, 1775); other free-living habitats.
<i>L. lingvura adriatica</i> Wittmann, 1986 ⁽²¹⁾	Mediterranean Sea	0-50 m	Anemone <i>Anemonia viridis</i> (Forskål, 1775); other free-living habitats.
<i>L. truncata</i> (Heller, 1863) ⁽²²⁾	Mediterranean Sea	0-50 m	Anemone <i>Anemonia viridis</i> (Forskål, 1775); other free-living habitats.
<i>Mysidopsis cathengelae</i> Gleye, 1982 ^(19,23)	East America	0-8 m	Purple jellyfish, <i>Chrysaora</i> sp.; other free-living habitats.
<i>Mysidium columbiae</i> (Zimmer, 1915) ⁽²⁾	Caribbean Sea	0-10 m	Coral heads, <i>Gorgonia</i> sp., sea urchin <i>Diadema antillarum</i> (Philippi, 1845); other free-living habitats.
<i>Mysidium gracile</i> (Dana, 1852) ⁽²⁴⁾	Brazil; Caribbean Sea	3-4 m	Between the spines of <i>Diadema antillarum</i> (Philippi, 1845) other free-living habitats.
<i>Mysidium integrum</i> Tattersall, 1951 ^(1,2)	Caribbean Sea	0-30 m	Gorgonians, anemone (<i>Bartholomea</i>); sea urchin <i>Diadema</i> ; sponges (<i>Agelas</i> , <i>Calyspongia</i> , <i>Ircinia</i>), corals (<i>Madracis</i> , <i>Oculina</i> , and <i>Lophogorgia</i>); other free-living habitats.
<i>Mysidopsis velifera</i> Brattegard, 1973 ⁽²⁾	Caribbean Sea	0-45 m	Near the base of hard and soft corals; other free-living habitats.
Ectocommensalism obligatory			
<i>Heteromysis minuta</i> Tattersall, 1967 ⁽³⁾	East Asia	littoral	Among the coral <i>Galaxea fascicularis</i> (Linnaeus, 1767).
<i>H. singaporensis</i> Tattersall, 1967 ⁽³⁾	East Asia	littoral	Among the coral <i>Galaxia fascicularis</i> (Linnaeus, 1767).
<i>H. (Heteromysis) australica</i> Bacescu & Bruce, 1980 ^(6,25)	Australia	8 m	On the coral <i>Porites andrewsii</i> Dana, 1864.
<i>H. (Heteromysis) heronensis</i> Bacescu, 1979 ⁽²⁶⁾	Australia	--	With coral <i>Acropora</i> sp.
<i>H. (Olivemysis) actiniae</i> Clarke, 1955 ^(2,14,16,27,28)	Caribbean Sea	littoral	Anemone <i>Bartholomea annulata</i> (Le Sueur, 1817).
<i>H. (Olivemysis) essingtonensis</i> Murano, 1988 ⁽⁶⁾	Australia	4-8 m	From unidentified gorgonian host.
<i>H. (Olivemysis) wirtzi</i> Wittmann, 2008 ⁽²⁰⁾	Island of Madeira	28 m	Anemone <i>Telmatactis ericoides</i> (Duchassaing, 1850).
<i>Ischiomysis peterwirtzi</i> Wittmann, 2013 ⁽²⁹⁾	East Atlantic	8 m	Anemone <i>Telmatactis ericoides</i> (Duchassaing, 1850).
<i>I. telmatactiphila</i> Wittmann, 2013 ⁽²⁹⁾	East Atlantic	46 m	Anemone <i>Telmatactis ericoides</i> (Duchassaing, 1850).
Endocommensalism facultative			
<i>Anathimysis torleivi</i> Ortiz <i>et al.</i> , 2000 ^(30,31)	Caribbean Sea	4-11 m	Sponge <i>Calyspongia vaginalis</i> (Lammark, 1814); on <i>Pseudopterogorgia americana</i> and other gorgonians.
<i>Heteromysis filitelsona</i> Modlin, 1984 ⁽¹⁾	East Atlantic	30 m	Sponge <i>Agelas dispar</i> Duchassaing & Michelotti, 1864; corals <i>Madracis decactis</i> (Lyman, 1859), <i>Millepora alaicornis</i> Linnaeus, 1758 and <i>Eumicea calyculata</i> (Ellis & Solander, 1786).
<i>H. odontops</i> Walker, 1898 ^(10,32)	East Pacific	littoral	Gastropod shells of unidentified dardanian crabs; other free-living habitats
<i>H. (Olivemysis) abrucei</i> Bacescu, 1979 ^(1,25,26)	Australia	littoral	Unidentified sponges and corals.
<i>H. (Olivemysis) beetoni</i> Modlin, 1984 ⁽¹⁾	East Atlantic	30 m	Sponges (<i>Agelas</i> , <i>Ircinia</i> and <i>Halictona</i>); corals.
<i>H. (Olivemysis) bermudensis</i> Sars, 1885 ^(2,10,13,15,27,33,34,35,36,37)	Caribbean Sea	0-18 m	Empty shells of <i>Strombus gigas</i> Linnaeus, 1758; probably with anemone <i>Bartholomea</i> ; other habitats.

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TABLE 1. (Continued)

Species	Geographical zone	Depth	Type of symbiosis / Associated host
<i>H. (Olivemysis) guttarti</i> Bacescu, 1968 ^(2,21,3,5,37)	Caribbean Sea	5-31 m	Sponges (<i>Agelas</i> and <i>Ircinia</i>); muddy bottom.
<i>H. (Olivemysis) panamensis</i> Tattersall, 1967 ⁽³⁾	East Pacific	5-20 m	Innermost spiral of gastropod shells occupied by a hermit crab <i>Dardanus</i> sp.; sandy and shelly bottoms
<i>H. (Olivemysis) tuberculospina</i> Modlin, 1987 ⁽²⁾	Caribbean Sea	0-8 m	Empty shells of <i>Strombus gigas</i> Linnaeus, 1758, sponges <i>Callyspongia vaginalis</i> (Lamark, 1814) and <i>Ircinia</i> sp.; other free-living habitats.
<i>H. (Olivemysis) zeylanica</i> Tattersall, 1922 ^(3,6,9)	Tanzania; India; Australia	littoral	Cavity of the sponge <i>Siphonochalina siphonella</i> Levi, 1965; other free-living habitats.
Endocommensalism obligatory			
<i>Antronyxis anophelinae</i> Tattersall, 1951 ^(38,30,40)	East Pacific	0-1 m	In the holes of the crab <i>Cardisoma crassum</i> Smith, 1870.
<i>Corellamysis eltanina</i> gen. nov., sp. nov. ⁽⁵⁴⁾	Southern Ocean	110 m	Branchial sac of the ascidian <i>Corella brewinae</i> Monniot, 2013.
<i>Heteromysis komaii</i> Fukuoka, 2005 ^(41,42)	East Asia	20-30 m	Gastral cavity of <i>Callyspongia confoderata</i> (Ridley, 1884).
<i>H. mexicana</i> Escobar & Soto, 1990 ⁽⁴³⁾	Caribbean Sea	168 m	Empty shells of <i>Strombus gigas</i> Linnaeus, 1758.
<i>H. (Gnathomysis) gerlachei</i> (Bonnier & Pérez, 1902) ^(44,45)	Red Sea	--	Gastropod shells of unidentified Paguridea.
<i>H. (Gnathomysis) harpax</i> (Hilgendorf, 1879) ^(10,46,47)	Indian Ocean	intertidal	Gastropod shells of the diogenid hermit crab <i>Dardanus</i> spp.
<i>H. (Gnathomysis) harpaxoides</i> Bacescu & Bruce, 1980 ^(6,25)	Australia	--	Shells occupied by <i>Dardanus megistos</i> (Herbst, 1804) and <i>Dardanus</i> sp.
<i>H. (Neoheteromysis) muelleri</i> Bacescu, 1976 ⁽⁴⁸⁾	Mediterranean Sea	75 m	Sponges <i>Cacospongia scalaris</i> (Ridley, 1884) and <i>Hippospongia communis</i> (Lamarck, 1814).
<i>H. (Olivemysis) agelas</i> Modlin, 1987 ⁽²⁾	Caribbean Sea	15-17 m	Sponge <i>Agelas dispar</i> Duchassaing & Michelotti, 1864.
<i>H. (Olivemysis) dardani</i> Wittmann, 2008 ⁽²⁰⁾	Island of Madeira	10-20 m	Shells inhabited by the diogenid hermit crab <i>Dardanus calidus</i> (Risso, 1827).
<i>H. (Olivemysis) gomezi</i> Bacescu, 1970 ⁽⁴⁹⁾	Caribbean Sea	2 m	Cavity of an unidentified sponge.
<i>H. (Olivemysis) mellelandi</i> Price and Heard, 2011 ⁽⁵⁰⁾	Caribbean Sea	24-27 m	Cavity of an unidentified sponge.
<i>H. (Olivemysis) mariani</i> Bacescu, 1970 ^(49,51)	Caribbean Sea	3-15 m	Cavity of an unidentified sponge.
<i>H. (Olivemysis) maxima</i> Murano, 1998 ⁽⁵²⁾	Australia	shallow	Unidentified sponge.
<i>H. (Olivemysis) rubrocincta</i> Bacescu, 1968 ⁽³⁵⁾	Caribbean Sea	26 m	Sponge <i>Agelas</i> sp.
<i>H. (Olivemysis) xanthops</i> Li, 1964 ⁽⁵³⁾	East Asia	deep	Unidentified sponge.
<i>Heteromysoides spongicola</i> Bacescu, 1968 ⁽³⁵⁾	Caribbean Sea	26 m	From an unidentified sponge among corals.

⁽¹⁾ Modlin (1984); ⁽²⁾ Modlin (1987); ⁽³⁾ Tattersall (1967); ⁽⁴⁾ Wittmann (2000); ⁽⁵⁾ Bacescu (1986); ⁽⁶⁾ Murano (1988); ⁽⁷⁾ Smith (1879); ⁽⁸⁾ Tattersall & Tattersall (1951); ⁽⁹⁾ Tattersall (1922); ⁽¹⁰⁾ Tattersall (1962); ⁽¹¹⁾ Wittmann & Wirtz (1998); ⁽¹²⁾ Price & Heard (2000); ⁽¹³⁾ Price *et al.* (2002); ⁽¹⁴⁾ Brattegard (1970); ⁽¹⁵⁾ Brattegard (1973); ⁽¹⁶⁾ Brattegard (1974); ⁽¹⁷⁾ Bamber (2000); ⁽¹⁸⁾ Greenwood & Hadley (1982); ⁽¹⁹⁾ Mees & Meland (2012); ⁽²⁰⁾ Wittmann (2008); ⁽²¹⁾ Wittmann (1978); ⁽²²⁾ Patzner (2004); ⁽²³⁾ Martin & Kueck (1991); ⁽²⁴⁾ Randall *et al.* (1964); ⁽²⁵⁾ Bacescu & Bruce (1980); ⁽²⁶⁾ Bacescu (1979); ⁽²⁷⁾ Clarke (1955); ⁽²⁸⁾ Brattegard (1969); ⁽²⁹⁾ Wittmann (2013); ⁽³⁰⁾ Ortiz *et al.*, 2000; ⁽³¹⁾ Price & Heard (2004); ⁽³²⁾ Walker (1898); ⁽³³⁾ Sars (1885); ⁽³⁴⁾ Verrill (1923); ⁽³⁵⁾ Bacescu (1968); ⁽³⁶⁾ Bowman (1981); ⁽³⁷⁾ Bacescu & Ilife (1986); ⁽³⁸⁾ Tattersall (1951); ⁽³⁹⁾ Bowman (1973); ⁽⁴⁰⁾ Mauchline (1980); ⁽⁴¹⁾ Fukuoka (2005); ⁽⁴²⁾ Saito & Hosino (2011); ⁽⁴³⁾ Escobar-Briones & Soto (1990); ⁽⁴⁴⁾ Bonnier & Pérez (1902); ⁽⁴⁵⁾ Nouvel (1964); ⁽⁴⁶⁾ Hilgendorf (1879); ⁽⁴⁷⁾ Vannini *et al.* (1993); ⁽⁴⁸⁾ Bacescu (1976); ⁽⁴⁹⁾ Bacescu (1970); ⁽⁵⁰⁾ Price & Heard (2011); ⁽⁵¹⁾ Bacescu & Ortiz (1984); ⁽⁵²⁾ Murano (1998); ⁽⁵³⁾ Li (1964); ⁽⁵⁴⁾ Present study.

Other ectocommensal mysid associations with corals, gorgonians and anemones seem to be clearly obligate (9 known species). The nature of coral and gorgonian associations with mysids are virtually unknown; however, anemone relationships are relatively well described. Mysids associating with sea anemones may seek protection, food, a reproductive mate or all of these features (Clarke 1955; Wittmann 2008, 2013; Wittmann & Wirtz 1998). Probably, such mysid associations are similar to that observed in shrimp-actinian symbiosis deriving benefits to the shrimps (food scraps and protection) from their hosts, but having no obvious effect on them (Shick 1991).

With the exception of the holes of the red land crab *Cardisoma crassum* Smith, 1870 representing an obligate association for the Pacific mysid *Antromysis anophelinae* Tattersall, 1951, only two main types of association between mysids and other invertebrates can be considered as endocommensals: living in the innermost spiral of gastropod shells normally occupied by hermit crabs or in the cavities of sponges. Endocommensal mysids are represented by four genera and 26 species (including *A. anophelinae*).

Facultative gastropod associations are represented by four *Heteromysis* species from the East Pacific and Caribbean Sea, reported from shells with dardanid crabs and the queen conch (*Lobatus gigas* (Linnaeus, 1758)). Spongicolous facultative endocommensals belong to the genera *Heteromysis* (7 species) and *Amathimysis* (1 species) and are reported from the Caribbean Sea and from the East African-Australasian region.

Obligate gastropod associations include five *Heteromysis* species from the Indo-Pacific, the Atlantic and the Caribbean Sea living in gastropod shells with Paguridea or in empty shells of the queen conch. Mysids considered as spongicolous obligate endocommensals belongs to the genera *Heteromysis* (9 species) and *Heteromysoides* (1 species) living mainly in coastal waters from the Mediterranean Sea, the Australasian region, the East Asian region. Reported sponge hosts include diverse genera like *Cacospongia*, *Hippospongia*, *Callyspongia* or *Agelas*.

Although endocommensal mysids are often found inside of sponges and gastropod shells, their host specificity information is as yet very scanty. *Heteromysis* (*Gnathomysis*) *harpax* (Hilgendorf, 1879) lives in pairs inside the shells of various species of tropical *Dardanus* hermit crabs. Usually, this mysid occupies the hindmost portion of the shell, but they will sometimes crawl and swim as far as the shell mouth. The mysids do not appear to perform active cleaning behaviour nor are faecal feeders and can follow the hermit when it changes shell and also avoid expulsion when the hermit moults (Vannini *et al.* 1993, 1994). By contrast, Tattersall (1962) suggested that *H. (G.) harpax* may feed on hermit waste material. *Heteromysis* (*Olivemysis*) *dardani* Wittmann, 2008 was found only in shells inhabited by *Dardanus calidus*, and accompanied by a number of amphipods, errant polychaetes, or alpheid shrimps (Wittmann 2008).

Spongicolous mysids are found living on the surface or inside of their hosts (Ii 1964; Murano, 1998; Bamber 2000). *Heteromysis* (*Olivemysis*) *zeylanica* Tattersall, 1922 and *Heteromysis komaii* Fukuoka, 2005 have been found in the gastral cavity of sponges (Tattersall 1967; Fukuoka 2005; Saito & Hoshino 2011). Other species have been collected in washings of unidentified sponges (Brattegard 1973; Bowman 1981; Murano 1988; Price & Heard 2000).

Ultimately, the nature of the known, but still poorly understood associations between mysids and their hosts is in most cases not well documented. Some authors define these symbioses as a diverse array with different degrees of commensalism, including ecto- and endo-commensalism, protection or diffuse mutualisms. According to Hay *et al.* (2004), many aquatic biological interactions fall within the limits of mutualism as a dynamic reciprocal association shifting from positive to negative depending on the context. It is clear that our knowledge of the nature and dynamics of these mysid-host associations is still largely incomplete and should be investigated in more detail emphasizing their behavioural aspects (Gasca *et al.* 2007).

The discovery of a tunicate as a host of a mysid represents a new symbiotic association never described previously. Although the number of *Corellamysis eltanina* specimens studied is small, all individuals were found within the branchial sac of the ascidia *Corella brewinae*; this implies that, with the information available, the new species has a clearly obligate endocommensal symbiotic behaviour.

The cosmopolitan genus *Corella* is essentially characterized by the digestive tract and gonads located in the right body side, the branchial sac flat with longitudinal vessels and spiral stigmata. The body shape of *C. brewinae* varies but is more or less oval and specimens which are up to 5 cm in length are often found in aggregates of different sizes (Monniot 2013). Although *C. brewinae* has been collected from the Indian Ocean (Amsterdam Island), South Pacific Ocean (New Zealand and Stewart Island), and Southern Ocean (Macquarie Island region), only in the latter area do some specimens appear to associate with the new mysid genus and species.

The relationship *Corellamysis/Corella* expressed as “symbiont size/host size x 10” range is between 1.8

(female) and 1.2 (male). These values may be considered higher than in a species that only utilises its host for protection and indicate that few individuals may be able to cohabit in a single host (Yanagisawa & Hamaishi 1986). As has been really observed in the analyzed *C. eltanina* specimens, only one or two symbionts are present in a single host. As proposed by Thiel & Baeza (2001), the larger the symbiotic crustacean in relation to its host, the higher is its potential to monopolise its host, which can have a significant impact on predation pressure, intra-specific encounter probability and reproductive biology of the symbiont. Symbiotic crustaceans that inhabit their hosts as solitary individuals, in pairs, or in structured groups are characterised by highly powerful weapons, which allow them to exclude unrelated intraspecific or possibly even interspecific competitors (Thiel & Baeza 2001). Elongation of one or more pairs of thoracopods is not a common feature of mysids. The functional aspects of these modifications are, for the most part, unknown (Mauchline 1980), but a "symbiont weaponry" has been considered as a factor that directly affects the monopolisation potential and consequently also the social behaviour of a symbiotic crustacean (Thiel & Baeza 2001).

The large and peculiar prehensile endopod of the eighth thoracopod of *C. eltanina* is morphologically similar to those described of the third thoracopod endopod of *Heteromysis* species. The genus *Heteromysis* currently comprises 77 species, many of which are known to live in association with other benthic animals such sponges, corals, sea anemones, gorgonians, or hermit crabs (Fukuoka 2005). If these peculiar modifications in the enlargement of some thoracopod endopods may be defined as weapons, then it is suggested that, with the adoption of the symbiotic life, these weaponries probably have played an important role in determining the behaviour and morphological evolution of such mysids (Vannini *et al.* 1993). Otherwise, the unique shape of thoracopods seventh and eighth of *Corellamysis* indicates a great morphological distance from other Heteromysinae genera, supporting the conclusions of Wittmann (2008, 2013) that symbiotic associations arose from several independent lines within the subfamily Heteromysinae.

All previous reported mysid symbiotic interactions were from the tropical-temperate coastal areas, so the discovery of the new taxon in subantarctic waters from the Macquarie Island region (Southern Ocean) represents a significant expansion in south latitude symbiont distributions. This implies that, at least *C. eltanina* represents an exception to the general rule that such peracarid-like associations seem to be especially common and most elaborately developed in tropical waters (Levinton 1982; Wader 1983; Jonsson *et al.* 2001; Baeza 2007).

The mysid fauna of the subantarctic islands of the Kerguelen province (Kerguelen, Macquarie and McDonald Islands area, *sensu* Petryashov 2007) remains insufficiently studied with only 17 known species (San Vicente 2010). Among them, only four Heteromysinae species have been previously reported: *Mysidetes dimorpha* O. Tattersall, 1955, *M. kerguelensis* (Illig, 1906), *M. morbihanensis* Ledoyer, 1995 and *M. posthon* Holt & Tattersall, 1906. In the entire Southern Ocean, Heteromysinae includes only two genera, *Mysidetes* (with 10 known species) and *Mysifaun* (one species), both with a high degree of endemism. The known distributional area of the new *Corellamysis* species is at the moment limited to the Macquarie Island and can be considered, in consequence, a Southern Ocean endemism.

The distribution of different genera of the Southern Ocean suggests that the Mysida probably had various geographical origins (Brandt *et al.* 1998). It seems possible that some of the mysids with symbiotic lifestyles increased their potential to invade Antarctic shelf areas via the disappearing South America and the Antarctic Peninsula archipelago during the course of the Gondwana fragmentation. The resulting isolation has greatly affected the marine fauna, and different processes (recolonization, evolution and speciation) have led to its current composition (Clarke & Crame 1989; Gili *et al.* 2006; Corbera *et al.* 2008). In this sense, the symbiosis between *Corella* and *Corellamysis* would represent an independent radiation line in the origin and evolution of ascidians and mysids in the Southern Ocean shelf areas.

The accumulation curve for described symbiotic mysids (Fig. 8) shows that no asymptote has been reached, and there has been no slowing in the rate of discovery for new species. This curve shows a marked increase in the number of described species from the 1970s (probably due to the massive use of SCUBA from this decade and to the increased sampling efforts in the Caribbean) and the climbing curve indicates an incomplete documented fauna (Clarke & Johnston 2003; Boltovskoy *et al.* 2005). Thus, there is a high probability of discovering new symbiotic mysid species and additional collecting efforts, as well as identification of material of existing collections, will likely produce further undiscovered species.

Finally, an identification key to world genera and subgenera of the subfamily Heteromysinae is proposed to include the new genus herein described.

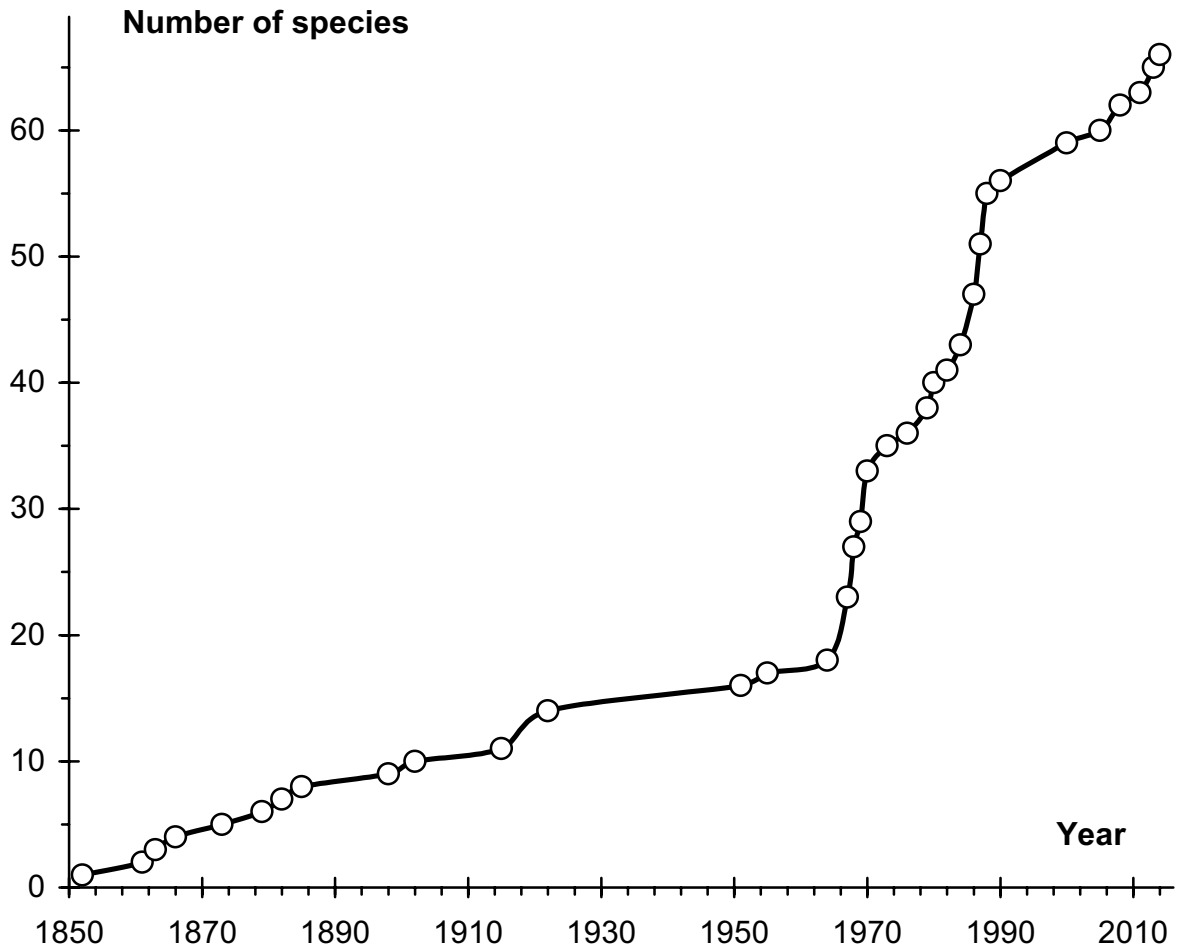


FIGURE 8. Cumulative numbers of symbiotic mysid species discovered over time.

Key to the genera and subgenera of Heteromysinae

(modified from Modlin 1984; Bowman & Orsi 1992; and Bravo & Murano 1996)

1. Third thoracopod endopod with some of the distal segments enlarged. Telson with apical cleft 2
- Third thoracopod endopod without some of the distal segments enlarged. Telson with or without apical cleft 9
2. Body isopod-like, dorsoventrally flattened. Pleonites with well developed pleura *Platymysis* Brattegard, 1980
- Body not dorsoventrally flattened. Pleonites without well developed pleura. 3
3. Eyes reduced, restricted to distolateral part of eyestalk *Heteromysoides* Bacescu, 1968
- Eyes well developed, occupying full width of distal part of eyestalk. 4
4. Fourth thoracopod endopod with several weakly modified setae on the carpus, with apically bifid claw. Eighth male thoracic endopod with modified flagellate setae on the outer margin of the ischium, with a strong spiniform extension of the preischium *Ischiomysis* Wittmann, 2013
- Fourth thoracopod endopod without modified setae on the carpus, without apically bifid claw. Eighth male thoracic endopod without modified setae on the outer margin of the ischium, without spiniform extension of the preischium 5
5. Females with large sternal plate in traverse orientation, emerging from the eighth sternite. Terminal segment of male antennula with modified setae with a roughly navicular portion armed on only one side with numerous tubercles and teeth on the upper mediiodistal corner. *Retromysis* Wittmann, 2004
- Females without sternal plate emerging from the eighth sternite. Terminal segment of male antennula without modified setae or with modified without a roughly navicular portion (genus *Heteromysis* S.I. Smith, 1873) 6
6. Third thoracic endopod very robust, greatly inflated; merus enlarged, dentate; exopod reduced. Endopod of uropod longer than exopod. *H. (Gnathomysis)* Bonnier & Perez, 1902
- Third thoracic endopod only moderately robust. Endopod of uropod shorter than exopod 7
7. Pleopods not sexually dimorphic. Pleon with medial sternal processes. *H. (Heteromysis)* Smith, 1873
- Fourth pleopods sexually dimorphic. Pleon without medial sternal processes. 8

8. Antennule with two modified setae on distomedial corner of third segment, medial seta linguiform with subterminal flagellum, lateral seta simple, very long, directed laterally *H. (Olivemysis)* Bacescu, 1968
- Antennule with two pairs of simple setae on distomedial corner of third segment, pairs diverging from each other. Fourth pleopod with the two apical setae longer than the fourth pleonite. *H. (Neoheteromysis)* Bacescu, 1976
9. Telson with clear apical cleft 10
- Telson without or with minute apical cleft 14
10. Male pleopod 3 very long, 2-segmented *Harmelinella* Ledoyer, 1989
- Male pleopod 3 rudimentary, unsegmented 11
11. Penes extremely thick, large to giant in length; provided with erectile capability due to a variously folded cuticle *Mysifaun* Wittmann, 1996
- Penes without variously folded cuticle 12
12. Eyes without cornea *Burrimysis* Jaume & Garcia, 1993
- Eyes with well-developed cornea 13
13. Inner margin of endopod uropod with row of cuspidate setae (except *M. hanseni* Zimmer, 1914) *Mysidetes* Holt & Tattersall, 1906
- Inner margin of endopod uropod without cuspidate setae *Bermudamysis* Bacescu & Iliffe, 1986
14. Inner margin of endopod uropod without cuspidate setae 15
- Inner margin of endopod uropod with row of cuspidate setae 17
15. Eye strongly dorso-ventrally flattened, with latero-external visual part. Telson armed with three lateral setae *Platyops* Bacescu & Iliffe, 1986
- Eyes normal. Telson armed with 4–6 lateral setae 16
16. Eye cornea narrower than the eyestalk. Antennal peduncle much longer than the antennal scale, with the distal two segments subequal in length; antennal scale without distal transverse suture. Male second thoracic endopod with notches on outer margin *Kochimysis* Panampunnayil & Biju, 2007
- Eye cornea as wide as the eyestalk. Antennal peduncle as long as the antennal scale, with the third segment longer than the second one; antennal scale with a distal transverse suture. Male second thoracic endopod without notches on outer margin *Deltamysis* Bowman & Orsi, 1992
17. Eyes with definite eyestalks. Distal segment of endopod of maxilla with five very powerful triangular spines strongly serrated. Endopod of thoracopods 5–8 slender and feeble. Telson long and narrow *Pseudomysidetes* Tattersall, 1936
- Eyes without eyestalks. Distal segment of endopod of maxilla without powerful spines. Endopod of thoracopods 7–8 forming a powerful subchela. Telson linguiform *Corellamysis* **gen. nov.**

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