Ann. Naturhist. Mus. Wien	102 B	279 - 290	Wien, Dezember 2000

Heteromysis arianii sp.n., a new benthic mysid (Crustacea, Mysidacea) from coralloid habitats in the Gulf of Naples (Mediterranean Sea)

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Abstract

Using a diver-operated suction pipe, *Heteromysis (Heteromysis) arianii* sp.n. was sampled from coralloid habitats in the biological protection zone Banco di Santa Croce (southern Gulf of Naples). Among known European species of *Heteromysis*, the new species is especially remarkable by a strong sexual dimorphism of the third thoracic endopod. Only the males show a peculiar subcuticular ornamentation in the precervical region of the carapace. A key to the six species of *Heteromysis* known from the Mediterranean Sea is given.

Key words: Mysidae, Heteromysini, taxonomy, new species, marine benthos

Zusammenfassung

Eine neue Myside, *Heteromysis (Heteromysis) arianii* sp.n., wurde mit Hilfe eines von Tauchern eingesetzten Saughebers im Korallinogen im biologischen Schutzgebiet Banco di Santa Croce im Süden des Golfes von Neapel entdeckt. Die neue Art zeichnet sich unter den europäischen Vertretern der Gattung *Heteromysis* durch einen besonders starken Geschlechtsdimorphismus am dritten Thorakal-Endopoditen aus. Nur bei Männchen findet man in der Präzervikal-Region des Carapax eine eigentümliche unter der kutikulären Decke gelegene Ornamentierung. Im Anhang wird ein Bestimmungsschlüssel für die sechs aus dem Mittelmeer bekannten *Heteromysis*–Arten gegeben.

Introduction

Most species of the genus *Heteromysis* S.I. SMITH, 1873, show a strictly benthic mode of life, preferring cryptic habitats during daytime, or live in permanent symbiosis with benthic invertebrates. Several species are nocturnally emergent and can be sampled with epibenthic nets only during the night. Therefore, mainly methodological reasons explain why relatively few (five) species were known from the Mediterranean and why only one or a few records of Mediterranean populations exist in all these species. As was generally predicted by WITTMANN (1999) for benthic mysids, a great number of additional species is also to be expected for the genus *Heteromysis* s.l. through intensified use of specifically designed benthic sampling methods such as SCUBA-examination of microhabitats, especially cryptic habitats, during the day and night, use of microtraps (MODLIN 1984) and examination of potential symbionts. The discovery of the new species described below is the result of such a specific benthic method, i.e. the use of a diver-operated suction pipe. Although no detailed information is available on the microdistribution of this species, it seems likely that the animals belong to the macro-meso-

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lithion and were sucked out from small recesses between biogenic gravel or stones constituting the uppermost stratum of the coralloid sediments.

Methods

Samples were taken on the sea floor with a diver-operated suction pipe ('sorbona') and subsequently fixed in a neutralized solution of 4 % formalin in ambient water. After sorting, the mysids were transferred into ethanol 70 % and after about one year into an aqueous solution of 60 % ethanol with 10 % diethylene glycol. Dissected materials were mounted in Swan-medium on slides. For the study of pores, one carapace per sex was detached from the animals, mounted on slides and studied after several weeks of bleaching in Swan. The mineral composition of statoliths was determined according to WITTMANN & al. (1993). Statolith diameters were calculated as the geometric mean of apparent length and width in ventral view. Body size was measured from tip of rostrum to the posterior margin of the telson, excluding the spines. For *Heteromysis* species, this type of measurement was applied by NOUVEL (1940) and TATTERSALL & TATTERSALL (1951), whereas SARS (1877) and BĂCESCU (1941, 1976) measured from tip of antennal scale to the end of the exopods of uropods. With certain modifications stated below, appendage terminology is according to TATTERSALL & TATTERSALL (1951), for non-sensory cuticle structures according to KLEPAL & KASTNER (1980).

Heteromysis (*Heteromysis*) *arianii* sp.n.
(Figs 1-17)

Type material: Holotype, ♂ ad. 2.9 mm, paratypes: ♂ ad. 2.8 mm, 3 ♀♀ subad. 3.2-4.0 mm, 1 juv., from a total of five samples; Tyrrhenian Sea, southern Gulf of Naples, near Castellamare di Stabia, Banco di Santa Croce, 40°40'58" N, 14°25'58" E, banks ca. 300 m off the coastline, depth 11-22 m, coralloid habitats with rocks, coarse sediments, bryozoans and gorgonians, 30 Mar. and 10-20 May 1999, leg. Valerio Zupo. Detailed information on the sampling stations [nos A1(1), A1(2), A2(1), B1(1)] and their fauna and ecology are available in ZUPO & BUIA (1999). The types, in part dissected and mounted on slides, are deposited at the Natural History Museum of Vienna, reg. nos 19340 (holotype), 19341-19344 (paratypes).

Definition: Carapace produced into a broad subtriangular rostrum with rounded apex, whereby the rostrum extends to about the terminal third of the basal segment of the antennular peduncle. Eyes well developed, eyestalks without processes, with smooth cuticle all around. Three large, smooth setae on the inner terminal corner of the terminal segment of the antennular peduncle. Antennal scale relatively stout and short, reaching to the middle of the terminal segment of the antennular peduncle; outer margin straight to slightly concave, giving the scale a slightly reniform appearance. Carpopropodus of third to eighth thoracic endopods with 2, 3-4, 4-5, 4, 4, and 4 segments. Third thoracic endopods dimorphic, forming a stronger subchela in males; inner face of the ischium well cuticularized and with rugged margins only in males; carpus with four strong spines in males or five spines in females. Mature males with well-developed processes on first to seventh thoracic sternites, advanced subadult females with reduced processes (small humps) on first to fifth sternites. Penis long and moderately slender, bent forwards; slightly longer than the merus but shorter than the ischium of the eighth thoracic endopod. Pleopods non-dimorphic, all of them reduced to small setose plates; first pleopod

Figs. 1-7: *Heteromysis arianii* sp.n. (1: holotype ♂ 2.9 mm; 2, 5, 7: paratype ♂ 2.8 mm; 3, 4, 6: paratype, subadult ♀ 4.0 mm): (1) anterior body region of male, (2) pores in front of posterior margin of carapace, (3) right antennula of female, dorsal, (4) labrum, oblique ventral view, (5) mandibles with left palpus, caudal aspect, (6) labium, (7) maxillula, caudal aspect.

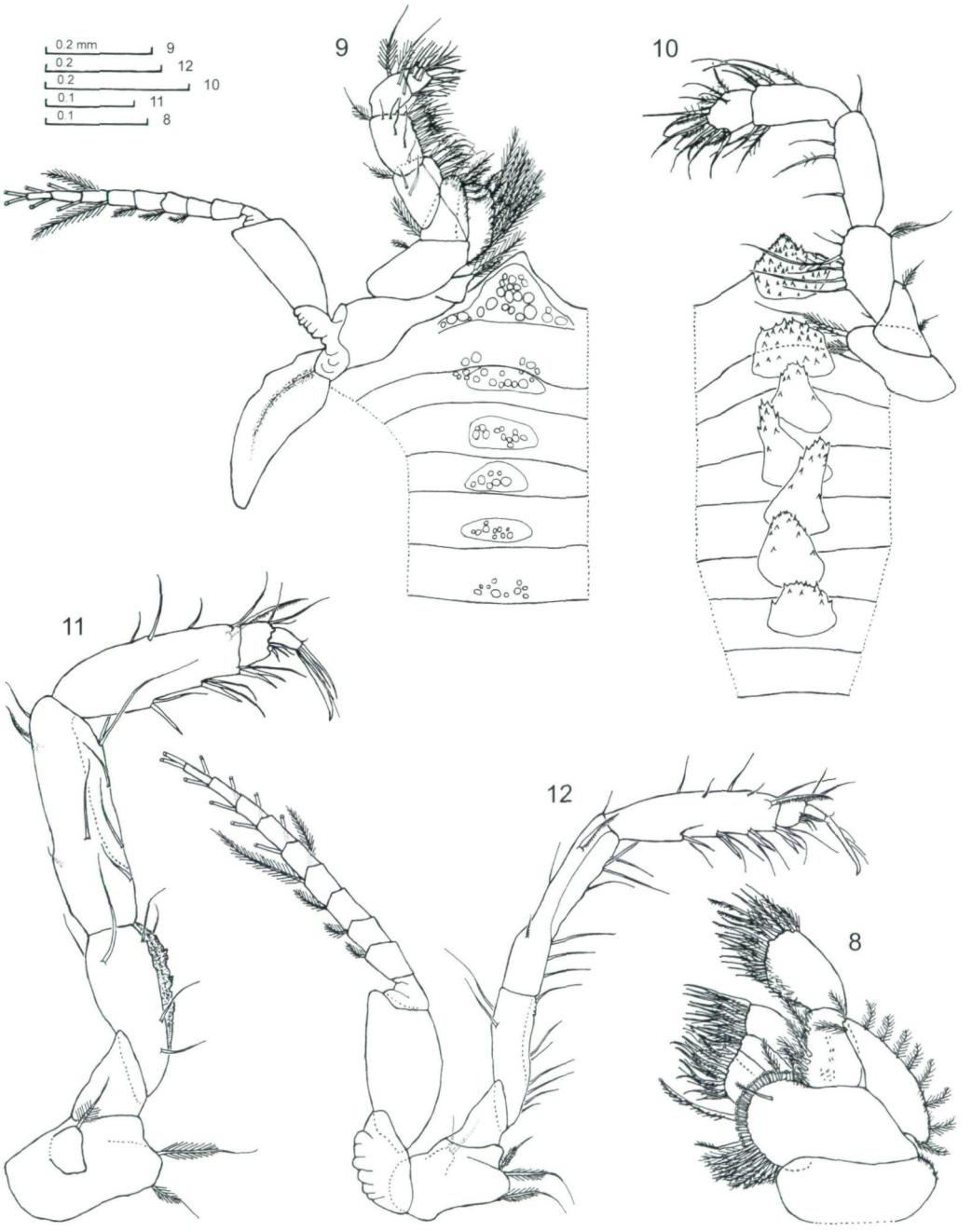
the smallest, but essentially similar to the remaining ones. Exopods of uropods extending slightly beyond endopods. Endopods with 11-14 spines along inner margin. Lateral margins of the telson with 12-13 spines distributed along entire extension, not counting the large apical spines. Apical spines are 1.7-2.0 times the length of the neighbouring latero-subapical spines. Telson with small apical cleft. Cleft armed with 7-11 laminae (= laminar processes) along basal 55-65 % of its margins, whereby most laminae are about as long as the lateral spines.

Description: General appearance (Fig. 1): Small robust mysids with the morphological habit being characteristic for a benthic rather than a pelagic mode of life. Body proportions as figured by NOUVEL (1940: Fig. 7) for both sexes of *Heteromysis armoricana*. Compared with that species, the sex-specific differences in body size are stronger in the present material (mature males 2.8-2.9 mm, almost mature subadult females 3.2-4.0 mm). Except for the dark brown colour of the cornea, no pigment was noted in this material. The absence of pigment may in part be due to about one year of preservation in an ethanol solution prior to first inspection.

Carapace (Figs 1, 2): The rostrum forms a flat, prominent, horizontal plate covering about 30-40% of the eyestalks. Carapace with a peculiar, butterfly-shaped group of pores in front of the posterior margin; this consists of ten small pores in a $2 \times (2 + 3)$ arrangement (Fig. 2), surrounding a large pore with less distinctly defined margins according phase contrast or differential contrast microscopy. Except for these pores, the carapace cuticle is smooth in both sexes. Nevertheless, only the males showed a peculiar subcuticular ornamentation (Fig. 1; see discussion), visible at low-power magnification. These 'ornaments' were only found in the cephalic region, especially around the contours of the prestomach, and were also visible on the frontal surface of the head, between the rostrum and the ocular symphysis.

Eyes and antennae (Figs 1, 3): Eyes globoid in dorsal view. Due to dorsoventral compression of the entire eye, the cornea appears ovoidal in lateral view. Cornea occupies about one third of the eye surface. Basal segment of the antennular peduncle with two setose apophyses, whereby only the outer one is long and slender. Inner terminal corner of the terminal segment with smooth setae only, whereas two additional, plumose setae (large in females, small in males), visible in Fig. 3, are positioned below this corner; there is no modified, leaf-like seta as would be typical of the subgenus *Olivemysis* BĂCESCU, 1968. Antennulae with weaker sexual dimorphism than usually found in mysids. Appendix masculina small and rounded, in median position on the ventral surface of the terminal segment of the antennular peduncle. Therefore, not the appendix itself, but only its dense brush of obliquely inward-directed, long bristles, is visible in dorsal view (Fig. 1). Inner antennular flagellum with some of the basal segments showing superficial annulations (Fig. 3) which could be mistaken for segmental borders. More such annulations were found in females (Fig. 3) versus males (Fig. 1). Antennal scale without spines, setose all around, except for a smooth zone occupying the basal 15-18 % of the outer margin. A small apical segment with five setae is separated from the basal part by a transverse suture.

Mouth parts (Figs 4-8): Labrum with flat and lozenged ventral face; with distinct anterior edge, but not produced into a spine-like process; posterior face with setae forming a dense brush in the contact zone with the mandibles. Mandibular palp normal, 3-segmented.



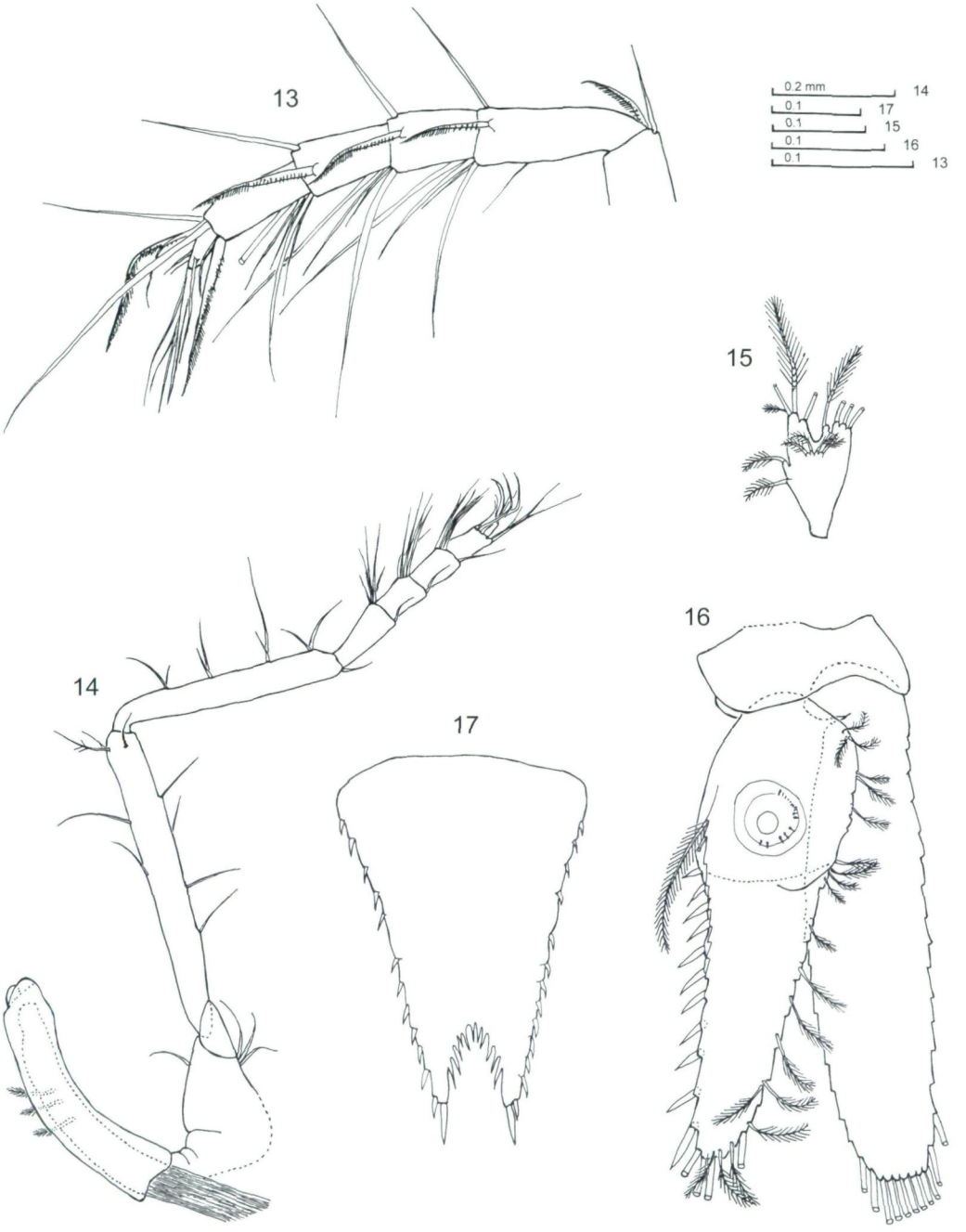
Figs. 8-12: *Heteromysis arianii* sp.n., paratypes (8, 10, 11: ♂ 2.8 mm; 9, 12: subadult ♀ 4.0 mm): (8) maxilla, frontal aspect, (9) first thoracic appendages (caudal aspect) with first to sixth thoracic sternites (ventral aspect) in female, (10) second thoracic appendages (caudal aspect) with first to eighth thoracic sternites (ventral aspect) in male, (11) right third thoracic endopod of male, caudal aspect, (12) left third thoracic appendages of female, rostral aspect.

Median segment with peculiar, large and basally thick setae along caudal margin; the largest seta, however, is in terminal position on the apparently (Fig. 5) outer corner. This is actually the frontal corner because the median segment is distorted in itself by about 60° so that the terminal segment faces obliquely caudal towards the mouth area. The masticatory portions of left versus right mandibles show a combination of bilateral with antero-posterior symmetry (Fig. 5). This orients the grinding surface of the pars molaris obliquely backwards in the right mandible, but obliquely forwards in the left one. The left grinding laminae is thus poorly visibly upon caudal inspection (Fig. 5), even though both partes molares are of about equal strength. Pars incisivus with 3-4 large teeth, and digitus mobilis with three teeth in each of both mandibles. Pars centralis ('spine row' in the terminology of TATTERSALL & TATTERSALL 1951) with 5-6 and with 3 spiny teeth in right and left mandibles, respectively. Labrum and maxilla as normal in this genus. Distal segment of maxillula terminally with weakly serrated spines, subterminally with a transverse row of four plumose setae. In front of these setae there is a transverse row of four pores, each with a diameter of about 1 µm (Fig. 7; pores in similar position were found in *Leptomysis* species by WITTMANN 1986). Endite of the maxillula with three large, distally spinose setae, and 8-9 smaller setae with diverse small modifications.

Thoracopods (Figs 9-14): Flagellum 8-segmented in the first thoracic exopod, and 9-segmented in the remaining exopods. Distinct dactylus present in all thoracic endopods; dactylus small in third to eighth endopod. First endopod with a strong claw, weakly serrated near the tip. Second endopod without claw; instead, 6-7 spine-like modified setae of different size are present, each bearing a series of minute teeth in basal to median portions. Third endopod with a powerful, smooth claw with terminally increasing curvature. Fourth endopod with a straight, very thin and seta-like claw (Fig. 13). Fifth to eighth endopods with long and strongly curved claws which are relatively thin but always distinctly stronger than that of fourth endopod. Fourth endopod with a pair of peculiar paradactylary setae which are distally pectinate and basally armed with a series of minute denticles (Fig. 13). Fifth to eighth endopods with three large, almost smooth, and strongly curved paradactylary setae. Terminally pectinate setae were also found along or near the outer margin of the merus and of the carpus in third and fourth endopods. The subadult females with eggs in the ovaries showed well-formed but still immature marsupial plates on the seventh and eighth thoracopods, plus rudimentary oostegites on the sixth thoracopods.

Gnathopods (Figs 11, 12): A strong subchela is formed by the third thoracic endopod in both sexes. This appendage is shorter, but stouter and more powerful in males. This dimorphism is stronger than previously described for any Mediterranean species, but weaker than in certain Australian species (MURANO 1988) of *Heteromysis*. Upon closure of the subchela, the powerful claw inserts into a longitudinal groove along most of the inner margin of the ischium. This groove is well cuticularized and shows rugged margins in males (Fig. 11). By contrast, the ischium is almost normal, showing only allusive modifications in females (Fig. 12). Inner face of the carpus with strong spines in a 2 + 1 + 1 arrangement in males and 2 + 1 + 1 + 1 in females.

Sternal processes and penis (Figs 9, 10, 14): As defined by BĂCESCU (1968) for the subgenus *Heteromysis*, the males are characterized by sternal processes emerging from most of the thoracic sternites (cf. NOUVEL 1940: Figs 3, 5; BĂCESCU 1968: Fig. 6D). In



Figs. 13-17: *Heteromysis arianii* sp.n. (13: paratype, subadult ♀ 4.0 mm; 14, 16, 17: paratype ♂ 2.8 mm; 15: holotype ♂ 2.9 mm): (13) carpopropodus of fourth thoracic endopod, (14) right eighth thoracic endopod with penis, rostral aspect, (15) fourth pleopod of male, (16) uropods, dorsal, (17) telson, dorsal.

males of the new species, processes were found on first to seventh sternites. Details of shape and orientation of the processes in Fig. 10 were reconstructed from objects deformed by the pressure exerted by a cover glass. Nonetheless, the intermediate processes are the longest and all of them are armed with numerous small teeth. Clearly homologous structures were found on the first to fifth sternites of females (Fig. 9) in the form of weakly elevated humps. In contrast to males, these humps showed no teeth, but contained numerous oil globules (i.e. lipid cells). Penis stiff, with three plumose setae in central position on the exterior face.

Abdomen (Figs 15-17): Pleopods with plumose setae, but no spines. Uropods normal. Endopod with series of spines between statocyst and tip, whereby the length of the spines as well as the spaces between the spines continuously increase towards the tip. Statoliths discoidal with indistinct fundus and prominent tegmen (similar to those described by SCHLACHER & al. 1992, for *H. formosa* S.I. SMITH, 1873), composed of fluorite (as in four *Heteromysis* species examined by ARIANI & al. 1993); diameter is 67-82 µm (n = 5), statolith formula is 2 + 3 + (4-6) + (5-7) = 14-17. Telson length is 1.1-1.3 times the ultimate abdominal somite or 0.7-0.9 times the exopod of uropods. Apical cleft is 23-29 % telson length.

Etymology: Dedicated to Prof. Dr. Antonio P. Ariani (Univ. Naples, Italy) on the occasion of his 60th birthday and in recognition of his important contributions to mysidology and zoology.

Discussion

Due to their usually cryptic mode of live, *Heteromysis* species are generally rarely found and most species descriptions are based on only one or two individuals. From this perspective, the new species described here is well founded on material. Although adult females are missing, three advanced subadult females with many and large eggs in the ovaries are present, indicating that these individuals were shortly before their first oviposition. It also appears to be significant in this context that all subadult females in this material were distinctly larger than the two adult males.

Concerning size and position, the subcuticular 'ornaments' of the male carapace in *H. arianii* sp.n. are somewhat reminescent of the 'turbercles' described by BĂCESCU & BRUCE (1980) on the carapace of *H. stellata* males from coral reefs in Australia. However, tubercles are external structures and the authors did not mention whether they detached the carapace from the animals for detailed microscopical examination. A further analogy is with the fat bodies distributed around the prestomach of both sexes in many species belonging to *Mysidetes* HOLT & TATTERSALL, 1906, and related genera (cf. WITTMANN 1996). The ornaments in *H. arianii* males, however, are less evenly rounded and show thicker walls than are typical of fat bodies; moreover, these contained no fat or oil that could be pressed out upon examination. The nature of these ornaments therefore remains unknown.

Heteromysis arianii shows a typical European morphological habit by presenting nondimorphic pleopods, a normal first pleopod, a strong but not excessively enlarged gnathopod, and by the absence of a leaf-like modified seta on the distal inner corner of the terminal segment of the female antennula. All these features are characteristic of

the subgenus *Heteromysis* S.I. SMITH, 1873. Among all European species so far described, the new species is exceptional by showing the most dimorphic gnathopods and the strongest modifications of male gnathopods. This alone would suffice to establish the new taxon at species level, but there are many further differences from previously described taxa.

By exhibiting eyestalks without processes and by having spines all along the lateral margins of the telson, the new species belongs to the group of European species comprising *H. armoricana* NOUVEL, 1940, *H. eideri* BĂCESCU, 1941, and *H. lybiana* BĂCESCU, 1976. Among many points of distinction, the new species differs from *H. armoricana* by a smaller number of spines (12-13 versus 18-20) on the lateral margins of the telson and by the carpus of the gnathopods showing spines along more than half its length, i.e. not only on the distal half (NOUVEL 1940: Fig. 2) as in *H. armoricana*. The new species differs from *H. eideri* by a larger rostrum with more rounded tip, by a longer antennal scale, by a smaller number of spines on the endopods of uropods, and fewer spines and laminae on the telson. The slightly reniform (Fig. 1) antennal scale in the new species somewhat resembles that of *H. lybiana*. However, the latter species shows a much longer and more distinctly reniform scale, whereby the reniform appearance is generally rare among the remaining *Heteromysis* species on a world-wide range. Further differences from *H. lybiana* are fewer spines (11-14 versus 17-18) on the endopods of uropods and a larger number of laminae (7-11 versus only 4) in the cleft of the telson.

Acknowledgements

Sincere thanks to Dr. Valerio Zupo, Dr. M.C. Buia and the staff of the Laboratorio di Ecologia del Benthos (Ischia, Gulf of Naples, Italy) for providing the mysid material. Sampling was supported by Iole Di Capua and V. Rando. Sampling activities were conducted in the frame of the research project "Ecologia della pesca e gestione sperimentale dell'area a tutela biologica del Banco di Santa Croce (Golfo di Napoli)" funded by the Italian "Ministero per le Politiche Agricole".

Key to the Mediterranean species of *Heteromysis*

Genus *Heteromysis* S.I. SMITH, 1873

Mysidae, Heteromysini with eyes normal. Appendix masculina representing a very small setose lobe or reduced to a setose ridge. Antennal scale usually short, setose all around, without or with a small apical segment. Mouthparts normal; labrum not produced into a spiniform process. First thoracic endopod with a large endite on the basis, and smaller endites on ischium and merus (an additional small, conical endite may be present on the coxa, as shown in Fig. 9, but was rarely noted by previous authors). Third thoracic endopod subchela-like, with enlarged carpus and strong nail. Carpopropodus of fourth to eighth thoracic endopods with 3-7 segments. Penis long and more or less cylindrical. Pleopods entire, reduced to small plates in both sexes; non-dimorphic (subgen. *Heteromysis* S.I. SMITH, 1873) or dimorphic (subgen. *Neoheteromysis* BĂCESCU, 1976, and, as far as known, *Olivemysis* BĂCESCU, 1968, and *Gnathomysis* BONNIER & PÉRÈZ, 1902). Uropods normal, entire; exopod with setae all around; endopod without or in most species with spines along inner margin. Telson with spines on lateral margins; distinct apical cleft present, margins of cleft with a number of laminae 1

1a. Third and fourth pleopods with two extremely long smooth setae, longer in males than in females. Distal inner corner of the terminal segment of the antennula with two pairs of smooth setae (plus plumose setae) in females. Libyan coast ..... *Heteromysis (Neoheteromysis) muelleri* BĂCESCU, 1976

1b. All pleopods non-dimorphic, normal; with smaller, mainly plumose setae. Distal inner corner of the terminal segment of the antennula with 0-4 smooth setae (plus plumose setae) in females 2

2a. Telson with spines all along the lateral margins 4

2b. Telson with spines mainly on distal half; without spines or at most one spine on basal third of each lateral margin 3

3a. Telson without spines on basal third of lateral margins; medio-apical spines longer or at least subequal compared to latero-apical spines. Endopod of uropods with 17-30 spines along inner margin between statocyst and tip. NE-Atlantic and W-Mediterranean ..... *Heteromysis (Heteromysis) norvegica* G.O. SARS, 1882

3b. Telson with one spine on basal third of each lateral margin; medio-apical spines distinctly shorter than latero-apical spines. Endopod of uropods with only one spine near the statocyst. NE-Atlantic and W-Mediterranean ..... *Heteromysis* (*Heteromysis*) *microps* (G.O. SARS, 1877)

4a. Antennal scale short, not extending beyond second segment of the antennular peduncle. Lateral margins of telson with 18-20 spines; medio-apical spines shorter than latero-apical spines; cleft with 11-20 laminae. Gnathopods with slender carpus; subterminally to terminally armed with 2 + 1 spines. Mediterranean coasts of Monaco, Tunisia and Turkey ..... *Heteromysis (Heteromysis) eideri* BĂCESCU, 1941

4b. Antennal scale extending beyond second segment of the antennular peduncle. Lateral margins of telson with 11-13 spines; medio-apical spines longer than latero-(sub)apical spines; cleft with less than 12 laminae 5

5a. Antennal scale extending beyond antennular peduncle; scale slender with concave outer margin. Cleft of telson armed with only four laminae. Libyan coast ..... *Heteromysis* (*Heteromysis*) *lybiana* BĂCESCU, 1976

5b. Antennal scale shorter, extending to distal third of the terminal segment of the antennular peduncle; scale comparatively stout, with straight or slightly concave outer margin. Cleft of telson armed with 7-11 laminae. Gnathopods with stout (females; Fig. 12) to very stout (males; Fig. 11) carpus; over more than half its length armed with 2 + 1 + 1 +1 spines (females) or 2 + 1 + 1 (males). Gulf of Naples ..... *Heteromysis* (*Heteromysis*) *arianii* sp.n.

References

ARIANI A. P., WITTMANN K. J. & FRANCO E. 1993: A comparative study of static bodies in mysid crustaceans: evolutionary implications of crystallographic characteristics. – Biological Bulletin 185: 393-404.

BĂCESCU M. 1941: Les Mysidacés des eaux méditerranéenes de la France (spécialment de Banyuls) et des eaux de Monaco. – Bulletin de l'Institut Océanographique (Monaco) 795 : 1-46.

BĂCESCU M. 1968: Heteromysini nouveaux des eaux Cubaines: trois espèces nouvelles de *Heteromysis* et *Heteromysoides spongicola* n.g. n.sp. – Revue Roumaine de Biologie – Zoologie 4 : 221-237.

BĂCESCU M. 1976: Contribution à la connaissance des Mysidacés (Crustacés) de la côte Lybienne, avec la description de deux nouvelles espèces, *Neoheteromysis mülleri* n. sg. n. sp. et *Heteromysis lybiana* n. sp. – Revue Roumaine de Biologie – Biologie animale 21: 85-91.

BĂCESCU M. & BRUCE A. J. 1980: New contributions to the knowledge of the representatives of the genus *Heteromysis* s.l. from the Australian coral reefs. – Travaux du Muséum d'Histoire naturelle «Grigore Antipa» 21: 63-72.

BONNIER J. & PÉRÈZ C. 1902: Sur un Crustace commensal des Pagures, *Gnathomysis gerlachei*, nov. sp., type d'une famille nouvelle des Schizopodes. – Comptes Rendus des Séances de l'Académie des Sciences (Paris) 134: 117-119.

HOLT E.W.L. & TATTERSALL W.M. 1906: Preliminary notice of the Schizopoda collected by H.M.S. "Discovery" in the Antarctic region. – The Annals and Magazine of natural History, ser. 7, 17: 1-11.

KLEPAL W. & KASTNER R.T. 1980: Morphology and differentiation of non-sensory cuticular structures in Mysidacea, Cumacea and Tanaidacea (Crustacea, Peracarida). – Zoologica Scripta 9: 271-281.

MODLIN R.F. 1984: Mysidacea from the Florida Middle Ground, northeast Gulf of Mexico, with descriptions of three new species of *Heteromysis* and a key to the Heteromysini of the western Atlantic. Journal of Crustacean Biology 4: 278-297.

MURANO M. 1988: Heteromysids (Crustacea ; Mysidacea) from northern Australia with description of six new species. – The Beagle (Records of the Northern Territory Museum of Arts and Sciences) 5: 27-50.

NOUVEL H. 1940: Observations sur la sexualité d'un Mysidacé, *Heteromysis armoricana* n. sp. – Bulletin de l'Institut Océanographique (Monaco) 789 : 1-11.

SARS G.O. 1877: Nye Bidrag til Kundskaben om Middelhavets Invertebratfauna. I. Middelhavets Mysider. – Archiv for Mathematik og Naturvidenskab (Kristiana) 2: 10-119, Tab. 1-36.

SARS G.O. 1882: Oversigt af Norges Crustaceer med foreløbige Bemærkninger over de nye eller mindre bekjendte Arter. I. (Podophthalmata – Cumacea – Isopoda – Amphipoda). – Forhandlinger i Videnskabs-Selskabet i Christiania 18: 1-55, Tab. 1-6.

SCHLACHER T. A., WITTMANN K. J. & ARIANI A.P. 1992: Comparative morphology and actuopalaeontology of mysid statoliths (Crustacea: Mysidacea). – Zoomorphology 112: 67-79.

SMITH S.I. 1873: Crustacea. Mysidea. – In: VERRILL, A.E. (Ed.): Report upon the invertebrate animals of Vineyard Sound and adjacent waters. – Report of the U.S. Commissioner of Fish and Fisheries, 1871 and 1872, Part 1, 18: 551-554, Plate III.

TATTERSALL W. M. & TATTERSALL O. S. 1951: The British Mysidacea. Ray Society, Publ. no. 136, London, p. 1-460.

WITTMANN K. J. 1986: Saisonale und morphogeographische Differenzierung bei *Leptomysis lingvura* und zwei verwandten Spezies (Crustacea, Mysidacea). – Annalen des Naturhistorischen Museums in Wien 87B: 265-294.

WITTMANN K .J. 1996: Morphological and reproductive adaptations in Antarctic meso- to bathypelagic Mysidacea, with description of *Mysifaun erigens* n.g. n.sp. – Biosystematics and Ecology Series 11: 221-231.

WITTMANN K. J. 1999: Global biodiversity in Mysidacea, with notes on the effects of human impact.- In: SCHRAM, F.R. & VAUPEL KLEIN, J.C. (Eds): Crustaceans and the biodiversity crisis. Vol. 1. Brill, Leiden, p. 511-525.

WITTMANN K. J., SCHLACHER T. A. & ARIANI A. P. 1993: Structure of Recent and fossil mysid statoliths. – Journal of Morphology 215: 31-49.

ZUPO V. & BUIA M.C. 1999: Ecologia della pesca e gestione sperimentale dell'area a tutela biologica del Banco di Santa Croce (Golfo di Napoli). – Multimedial CD-ROM, distributed by the Laboratorio di Ecologia del Benthos, Stazione Zoologica "A. Dohrn", Naples.