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Heteromysis (*Heteromysis*) *abednavandii* sp.n.: a new species from coral reef aquaria in the Aqua Terra Zoo, Vienna, Austria (Mysida, Mysidae)

K. J. Wittmann*

Abstract

After the detection of *Heteromysis* (*Olivemysis*) *domusmaris* Wittmann & Abed-Navandi, 2019, an additional species of the genus *Heteromysis* has been encountered in coral reef exhibition tanks and connected filtration tanks of the public aquarium center Haus des Meeres (Aqua Terra Zoo), Vienna, Austria. This material is first described here as *Heteromysis* (*Heteromysis*) *abednavandii* sp.n. based on its most striking characteristics: a large dorsal apophysis on the basal segment of the antennular trunk, labrum anteriorly produced into a short, rounded process, and a toothed longitudinal ridge terminally on the caudal face of the merus of the third thoracic endopod in both sexes. Besides features typical of the subgenus *Heteromysis*, the new species is also characterized by important features of the antennae, eyes, rostrum, carpopropodus of third thoracic endopod, penes, and by spine patterns on the endopods of uropods and telson. The most similar species are known from (sub)tropical waters of the mid Indian Ocean to the West-Pacific, to a lesser extent also Caribbean and Mediterranean. Short notes are given on color, foregut, and larval morphology.

Key words: First description; taxonomy; anthropogenic dispersal; public aquarium center.

Introduction

Among the ninety species (plus one non-nominotypical subspecies) so far acknowledged by Mees & Meland (2019) in the genus *Heteromysis* S.I. Smith, 1873, a total of three species have previously been first described from public aquarium centers, up to now without any records from natural populations. Two species were contributed by Murano & Fukuoka (2003) from exhibition tanks in the Aquarium of Kushimoto Marine Park Center, Wakayama, Japan; a third one was described by Wittmann & Abed-Navandi (2019) from the coral reef system in the public aquarium center Haus des Meeres (Aqua Terra Zoo), Vienna, Austria. An additional, fourth one is here first described from the latter system. The high frequency of previously unknown species in large, long-term maintained seawater aquaria points to the important role of the international trade with aquarium organisms for passive dissemination of small non-decorative organisms. It also points to the comparatively scant knowledge of this mysid genus (largely because most species show a cryptic mode of life) and to the need for intensified research efforts.

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Material and Methods

Specimens of *Heteromysis* (*Heteromysis*) *abednavandii* sp.n. were sampled in February to April 2019 with a small suction pipe from recesses in the service tanks of the public aquarium center Haus des Meeres, Vienna; no additional specimens were encountered upon intensive inspections in September and October 2019. This species was found in a few coral reef aquaria and associated service tanks of only a single floor of the center where it was ten times rarer than the co-occurring *Heteromysis* (*Olivemysis*) *domusmaris* Wittmann & Abed-Navandi, 2019. The latter species was already widely distributed in the building upon first detection in December 2018 and was still present in great numbers upon all subsequent inspections. Both species probably had hitch-hiked in crevices of foundation rocks of live corals imported from the Central Indo-Pacific Ecoregion (Philippines, Indonesia and NE-Australia) via a Dutch wholesaler (DeJongMarinelife Inc., NL). The surface structures populated by both mysid species in the service tanks were mostly open-celled polyurethane foam which served as a filter of the aquarium system. For additional aquarium characteristics see Wittmann & Abed-Navandi (2019).

Freshly captured animals were placed in small Petri dishes for microphotography (specimens in Figs. 1, 5). Their otherwise rapid movements were slowed down by gradual addition of CO_2-enriched water. Drawings of sex-specific features are labeled by symbols for females or males, respectively, in Figs. 1–7. The absence of such labels implies absent or unapparent sex-specific differences. Additional methods, taxonomy and terminology as in Wittmann & Abed-Navandi (2019) and in the literature cited there. Types deposited at the Natural History Museum of Vienna (NHMW).

Systematic account

Order Mysida Boas, 1883

Family Mysidae Haworth, 1825

Subfamily Heteromysinae Norman, 1892

Tribe Heteromysini Norman, 1892

Genus *Heteromysis* S.I. Smith, 1873

Subgenus *Heteromysis* S.I. Smith, 1873

***Heteromysis* (*Heteromysis*) *abednavandii* sp.n.** (Figs. 1–7)

Material. Holotype adult male with 3.5 mm body length, NHMW 26552, in vial, filtration tank of the "coral reef system" in the Haus des Meeres, Vienna, coll. 06.04.2019, leg. D. Abed-Navandi; — **Paratypes**, all from filtration tanks of the "coral reef system" in the Haus des Meeres, Vienna, leg. D. Abed-Navandi: 4 adult females (3.7–4.5 mm), 4 adult males (2.8–4.3 mm), 1 subadult female (3.6 mm), NHMW 26553, in vial, 02.03.2019 to 06.04.2019; 1 adult female (4.5 mm), NHMW 26554, on slides, 22.02.2019; 1 adult female (4.4 mm), NHMW 26555, on slides, 22.03.2019; 1 adult male (3.4 mm), NHMW 26556, on slides, 02.03.2019; 1 adult male (again 3.4 mm), NHMW 26557, on slides, 02.03.2019.

Etymology. The species name is a noun with male ending in genitive singular, dedicated to Daniel Abed-Navandi (Vienna), who detected the new species and provided the materials for the present contribution.

Type locality. Not defined because the locality of origin ought to be indicated according to Art. 76.1.1. of the nomenclatorial code (ICZN, 1999). The species is so far known only from coral reef aquaria and service tanks in the public exhibition center Haus des Meeres (Aqua Terra Zoo), Vienna, Austria.

Diagnosis. The differential diagnosis below attaches main weight to differences from the nine most similar species listed in the discussion. The subsequent general diagnosis covers the entire genus *Heteromysis.*

Differential diagnosis: eyes large, well-developed cornea extends over 20% eye surface. Eyestalks smooth all around, anteriorly not projecting beyond cornea, without spiniform extension. Carapace normal, anteriorly ending in a large, triangular rostrum. Tip of rostrum terminally acute or less frequently narrowly blunt. Antennula (antenna 1) with setae only, without (flagellate) spines. Mesio-terminal edge of antennular trunk without modified setae, except for two (weakly modified) flagelliform, smooth setae as in Fig. 2C, D; median segment with one seta of that kind plus an additional, short one on dorsal apophysis; basal segment with large dorsal apophysis bearing two long, flagelliform setae (besides barbed setae). Antennal sympod (antenna 2) with spiniform extension on outer face (Fig. 2F). Antennal scale with apical segment 7–9% total scale length. Mouthparts normal, labrum anteriorly produced into a short, rounded process; median segment of mandibular palp setose all or nearly all along both margins. Carpopropodus of thoracic endopods 1–8 with 2, 2, 2, 4–5, 5, 4–5, 4–5, and 3–5 segments, respectively. Third thoracic endopods specialized as gnathopods by forming a powerful subchela. Merus terminally with toothed longitudinal ridge on caudal face (Fig. 4C, F, J, M). Carpopropodus swollen with maximum width 26–31% length in females, 29–37% in males. Inner margin of carpus with series of 2–6 smooth spines, continuously increasing in length apically; mesio-terminal edge with 0–2 toothed or serrated spines (Fig. 4B, E, H, L, Q; numbers of any spines increase with increasing size of carpus). Propodus with one large, sparsely toothed seta projecting above the claw (Fig. 4Q). Carpopropodus of endopod 4 near outer margin with modified setae (spinulose at basal 10–40%; Fig. 4O, P), no such setae in endopods 5–8. Penes subapically with 2–4 smooth setae, no apical setae (Fig. 6J). Endopod of uropods (Figs. 5A, 6A) armed with linear series of 11–15 spines along inner margin from statocyst to shortly below apex; distal 6–11 spines subequal. Each lateral margin of telson proximally smooth, whereas armed with continuous series of 8–11 spines along distal 36–46%, not counting the pair of apical spines (Figs. 5A, 6B). Lateral spines continuously increasing in size towards the tip. Proximally rounded, U-shaped terminal cleft occupies 15–20% length of telson. Cleft armed with 6–10 acute laminae along basal 36–65% of its margins, distal portions smooth. Disto-lateral lobes each with two spines on narrowly truncate apex. The inner apical spines are 9–13% telson length; outer apical spines are 0.7–0.9 times length of the inner ones.

General diagnosis: all items of the differential diagnosis plus the following: appendix masculina small, with dense tuft of long setae. Antennal scale extends slightly before to slightly beyond end of trunk of antennal flagellum; scale subequal to antennular trunk, due to its more proximal insertion reaching only to half the length of the terminal segment of the antennular trunk in both sexes. Antennal scale stout, with slightly convex to straight outer margin; scale setose all around, length 3.1–3.8 times maximum width. Left gnathopods (Fig. 4A, G) weaker than right gnathopods (Figs. 4D, K; 5B) in both sexes. Claw of thoracic endopod 1 subapically serrated, claws 2–8 smooth. Claw 3 large,

Fig. 1: In-vitro microphotographs of *Heteromysis abednavandii* sp.n., paratypes (NHMW 26553), CO_2-treated living specimens. A, adult female with body length 4.1 mm, dorsal; B, C, male 4.3 mm in dorsal (B) and (C) lateral view. Laboratory photos by Helmuth Goldammer. Three photos mounted together on same panel, background cleaned using electronic tools by the present author.

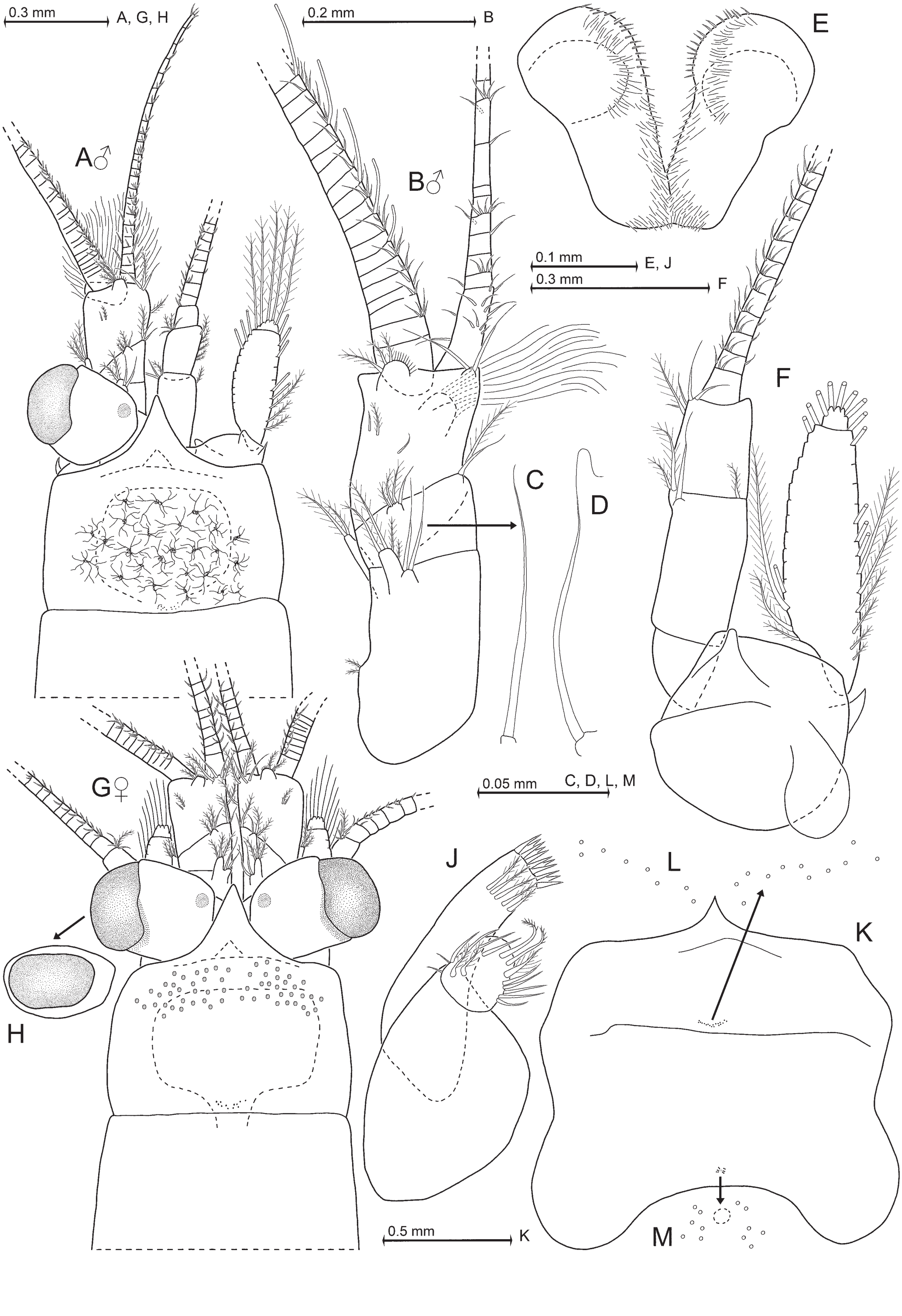
the strongest (Fig. 4Q); claw 4 shorter, weakly curved, slender (Fig. 4R); claws 5–8 again shorter, more strongly curved, slender as well (Fig. 4S–V). Penes 1.2–1.5 times length of merus 8; each with two rounded apical lobes (Fig. 6J). Only the males with median processes from thoracic sternites 2–8 (Fig. 3B), not counting the usual, large lobe (Fig. 3A, B) on the first sternite, ensuring the caudal closure of the mouth area in both sexes. Pleopods reduced to small, setose, obscurely bilobate plates, without spines in both sexes. Uropods (Figs. 5A, 6A) normal, entire; exopods reach with 11–24 % of their length beyond endopods and 15–26 % beyond telson; endopods 0–14 % beyond telson. Telson (Figs. 5A, 6B) subtriangular, length 1.0–1.4 times maximum width, 0.7–1.0 times endopod of uropod, and 0.6–0.9 times exopod of uropod.

Description. All features of the diagnosis. General appearance small, robust. Size of adult females 3.7–4.5 mm (n = 6), males 2.8–4.3 mm (n = 7). Cephalothorax comprises 34–40 % body length, pleon 46–53 %, carapace 29–40 %, and rostrum 4–5 %. Abdominal somites 1–5 measure 0.8–1.1, 0.8–1.1, 0.8–1.1, 0.7–0.9, and 0.7–0.9 times the length of somite 6, respectively.

Carapace (Fig. 2A, G, K–M). Normal, without apparent sexual dimorphism. Carapace covers 78–93 % of cephalothorax dorsally. Rostrum represents a distinct horizontal, triangular plate, covering basal portions of normal-oriented eyestalks. Rostrum reaches to the middle of artificially straight forward-oriented eyestalks. A triangular, terminally blunt, subrostral process (dashed triangles behind the rostrum in Fig. 2A, G) forms a small anterior extension of the head (without appendages). Antero-lateral edges of carapace not produced (Fig. 2K). Cervical sulcus well developed; no cardial sulcus visible. Posterior margin evenly rounded, posteriorly weakly emarginated, leaving 0.5–2.5 ultimate thoracic somites mid-dorsally exposed. As in many species of Mysidae, two characteristic groups of pores present medially on carapace. The anterior group is closely in front of the cervical sulcus and consists of 11–19 pores with about 1 µm diameter in a roughly V-shaped arrangement (Fig. 2L). The posterior group of pores (Fig. 2M) less closely in front of the posterior margin of the carapace; it consists of 8–12 such pores, surrounding a larger but indistinct, rounded structure. Except for the here stated structures, outer surface of carapace smooth in both sexes.

Eyes (Figs. 1; 2A, G, H). Eyes well developed, thick. Cornea diameter 1.2–1.7 times the length of apical segment of antennular trunk (measured along dorsal median line). Eyestalks and cornea dorsoventrally compressed. In dorsal view the cornea appears calotte-shaped, measuring 0.6–0.7 times the length of eyestalk (cornea not included). In lateral view (Fig. 2H) the cornea appears oviform to oval with upper and lower margins flattened.

Antennulae (Fig. 2A–D, G). Three-segmented trunk not stouter in males (Fig. 2A, B) than in females (Fig. 2G). Measured along dorsal midline, the basal segment is 40–51 % trunk length, median 16–21 %, and terminal 33–41 %. Median segment anteriorly obliquely truncate. Basal segment on basal half of its outer face with 2–4 small, barbed setae. This segment terminally with a dorsal and a lateral apophysis (Fig. 2B). Dorsal apophysis anteriorly with 3–4 barbed plus two long, smooth, flagelliform setae. Median segment with one plumose and 1–2 shorter barbed setae on outer apophysis. Dorsally it bears a small apophysis with 3–4 barbed plus a smooth, flagelliform seta. Mid-dorsal apophysis of terminal segment with 3–4 barbed setae; its mesio-terminal margin lined


0.3 mm A, G, H
0.2 mm B
E
A♂
B♂
0.1 mm E, J
0.3 mm F
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0.05 mm C, D, L, M
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H
J
L
K
0.5 mm K
M

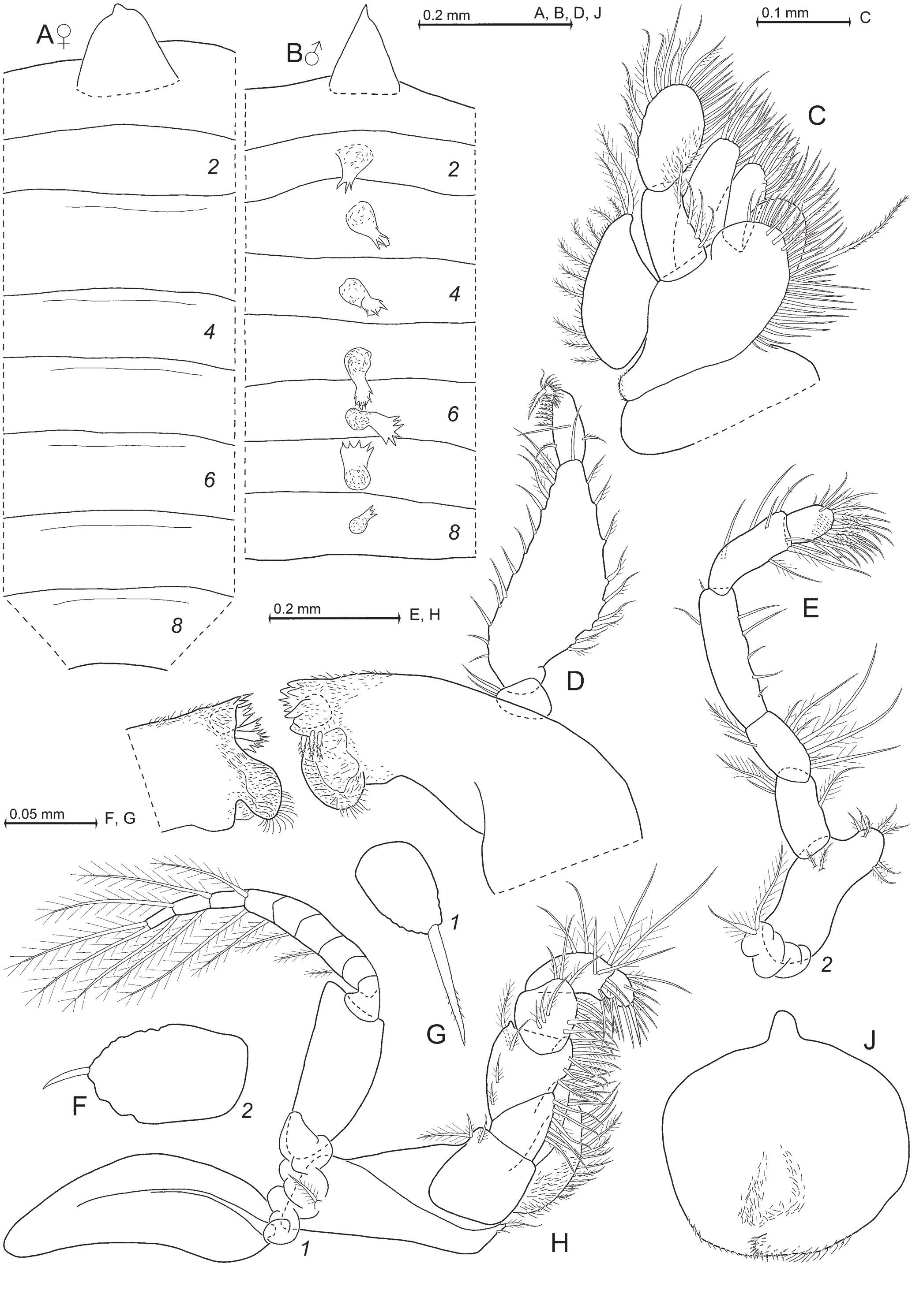
by small cilia. Mesio-terminal edge of the trunk with two large, smooth, flagelliform setae mostly facing opposite directions plus 0–1 plumose seta in males (Fig. 2A, B), or 2–4 plumose setae in females (Fig. 2G). In both sexes the outer antennular flagellum is thicker than the inner one by a factor of 1.1–1.7 when measured near the basis of the flagella.

Antennae (Fig. 2A, F). A short, broad apical segment with five plumose setae is separated from the basal part of the antennal scale by a transverse suture. Antennal sympod with anteriorly directed, apically rounded subtriangular process on dorsal face. Sympod caudally with bulbous lobe containing the end sac of the antennal gland. The three-segmented antennal peduncle with basal segment 19–23 % peduncle length, second 44–48 %, and third 29–36 %.

Mouthparts (Figs. 2E, J; 3C, D, J). Labrum (Fig. 3J) caudally serrate by a series of small, stiff bristles. Dense fields of setae on caudal and ventral faces of labrum. Mandibular palp three-segmented (Fig. 3D). Its proximal segment 9–12 % length of palp, inner margin with 2–1 setae. Remaining segments strongly setose. Length of median segment 2.3–2.7 times its maximum width and 69–74 % palp length. Terminal segment 17–22 % palp length. Pars molaris with strong grinding surface in both mandibles. Pars incisiva with 4–6 teeth, digitus mobilis with 3–4 teeth, and pars centralis with 3–4 spiny teeth. Labium normal, comprising two hairy lobes with dense set of stiff bristles on distal half of inner face (Fig. 2E). Distal segment of maxillula terminally with 11–13 smooth spines; no pores visible (Fig. 2J); subterminally with 5–6 setae barbed on distal half. Endite of maxillula terminally with two distally spiny setae accompanied by a proximally thick barbed seta; inner and outer margins with numerous smooth setae. Maxilla (Fig. 3C) normal, densely setose, with various types of setae, but no spines or teeth. Its leaf-like exopod not extending beyond basal segment of endopod; outer margin of exopod all along with plumose setae, the two apical setae larger than the remaining ones. Basal segment of endopod with four basally barbed setae. Terminal segment with maximum width 58–67 % length. This segment plus the sympod, and all three large endites of the sympod, with densely setose distal margins. Inner margin of sympod with a striking, long seta bearing minute denticles along distal 50–70 %.

Thoracopods (general; Figs. 3E–H; 4; 6J, K). A plumose seta plus a shorter barbed seta present at the intersegmental joint (Fig. 3E) connecting the sympod of thoracopod 2 with the corresponding thoracic sternite; 0–1 barbed seta in similar position on thoracopod 1 (Fig. 3H), no such setae in remaining thoracopods. Length of flagella as well as of basal plates increase from exopod 1 to 4, and decrease from exopod 4 to 8. Basal plates (Figs. 3H, 6J) weakly expanded, length 1.8–2.5 times width in both sexes. Outer margin of the plates ends in a well-rounded (Figs. 3H, 6J) to angular edge. Flagellum

◀ Fig. 2: *Heteromysis abednavandii* sp.n., holotype male with body length 3.5 mm (A; NHMW 26552), paratypes females 4.5 mm (E, G, H; NHMW 26554), 4.4 mm (D, F, K–M; NHMW 26555), and male 3.4 mm (B, C, J; NHMW 26557). A, anterior body region of male, dorsal aspect, right antennula and left antenna omitted; B, male antennula, dorsal, details showing flagellate setae in this (C) and another specimen (D); E, labium; F, antenna, ventral; G, anterior body region of female, detail (H) shows left eye in lateral view; J, maxillula, caudal; K, carapace expanded on slide, details (L, M) showing pore groups (pore diameters not to scale).


A♀
B♂
0.2 mm A, B, D, J
0.1 mm C
C
2
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6
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0.2 mm E, H
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0.05 mm F, G
1
G
F
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2
1
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J

8-segmented (Fig. 3H) in exopod 1, versus 9-segmented (Fig. 6J) in exopods 2–8, not counting the large intersegmental joint between basis and flagellum. The first thoracopods with large, leaf-like, smooth epipod (Fig. 3H). Length of endopods increases from thoracopods 1 to 5 and remains subequal among nos. 5–8. Endopod 5, when stretched, extends to basal or up to terminal segment of antennular trunk, endopod 8 to mandibles or at most to end of antennal scale. Basis of endopods 5–8 with a short, broad, lappet-like apophysis below endopod (Figs. 4N, 6J); no such apophysis in endopods 1–4 (Figs. 3E, 4O). Ischium becomes more slender and length of ischium increases from endopods 1 to 5; both these measurements remain (sub)equal among nos. 5–8. Ischium shorter than merus in endopods 1–4 (Figs. 3E, H; 4A, O), subequal among nos. 5, 6, but longer than merus in nos. 7, 8 (Fig. 6J). Thoracic endopods 1–3 each with dactylus (Figs. 3F, G; 4Q) larger than that of endopods 4–8 (Fig. 4R–V).

Maxillipeds (thoracic endopods 1, 2; Fig. 3E–H). Coxa of first maxilliped (Fig. 3H) with small endite bearing one barbed seta at its tip. Basis with large, prominent endite that is densely setose on inner margin. Ischium and merus each with one smaller but distinct, medially setose endite. Large dactylus with strong, subterminally serrated claw (Fig. 3G). Basis of second maxilliped with large, distinctly medially projecting endite (Fig. 3E). In both sexes, combined praeischium plus ischium are 0.8–1.0 times merus length, carpopropodus plus dactylus 1.0–1.1 times merus. Dactylus very large, nonetheless bearing an only short, smooth claw (Fig. 3F). This claw not discernible in Fig. 3E because hidden among the dense brush of setae on dactylus. This brush formed by large numbers of normal setae and 9–12 modified setae, the latter apically bent, bearing two symmetrical series of denticles (stiff barbs) on either side in subbasal to median portions.

Gnathopods (thoracic endopods 3; Figs. 4A–M, Q; 5B). Size of gnathopods in relation to body size not clearly different between sexes. Basis with distinct but much shorter endite compared to that (Fig. 3E) of endopod 2. Ischium and merus strong, as normal in gnathopods. Carpus 0.8–1.0 times merus length, 1.2–1.4 times ischium. Claw 27–45% carpopropodus length in left gnathopods, 38–48% in right ones. Compared with left gnathopods, the right ones show more teeth on the mesio-terminal, modified spines of the carpus (Fig. 4E, L versus Fig. 4B, H), and on the terminal longitudinal ridge of the merus (Fig. 4F, M versus Fig. 4C, J).

Marsupium (Fig. 4N). Oostegites 1, 2 (derivates of thoracopods 7, 8) without setae on upper (dorsal) margins. Lower margins from subbasal region up to the rounded tip bearing series of setae, most of which are barbed by fine cilia along their subbasal to median portions. Each oostegite near basis with 4–6 setae which are microserrated along distal half. Ventral and rostral portions of the outer face of only the second oostegite with 12–14 flagelliform setae as in Fig. 2C, but shorter than the barbed setae; length of these setae increasing towards the tip of this oostegite. Thoracopod 6 with terminally

◀ Fig. 3: *Heteromysis abednavandii* sp.n., paratypes females with body length 4.5 mm (A, J; NHMW 26554), 4.4 mm (H; NHMW 26555), and males 3.4 mm (B, F, G; NHMW 26556), 3.4 mm (C–E; NHMW 26557). A, B, thoracic sternites 1–8 expanded on slide, in female (A) and male (B); C, maxilla, rostral; D, mandibles with right palpus, rostral aspect; E, second thoracic endopod, rostral; F, dactylus with claw in second thoracic endopod; G, dactylus with claw in first thoracic endopod; H, first thoracopods, caudal; J, labrum.


0.3 mm A, D, G, K
0.2 mm O
0.05 mm P
0.05 mm B, C, E, F
H, J, L, M
A♂
B
C
D♂
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F
G♀
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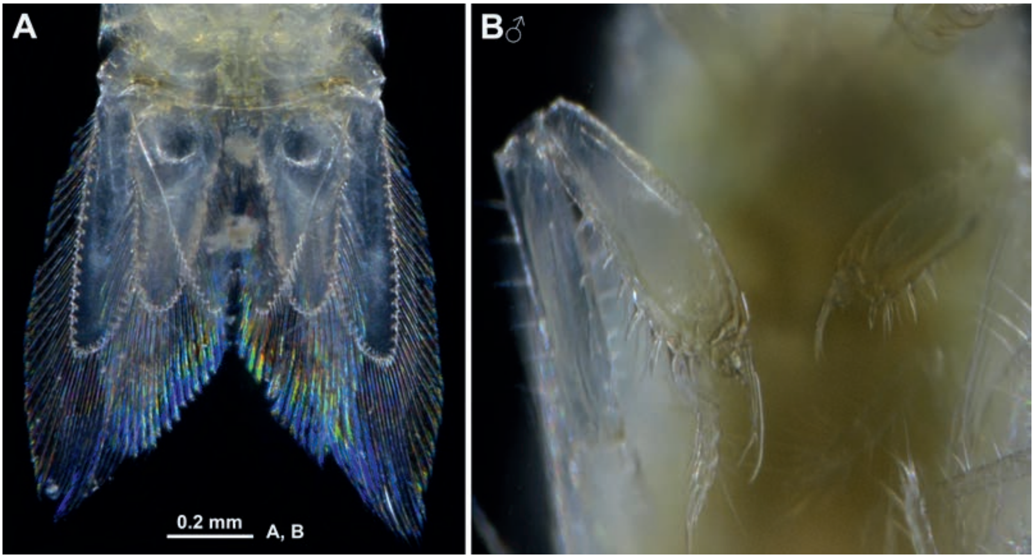


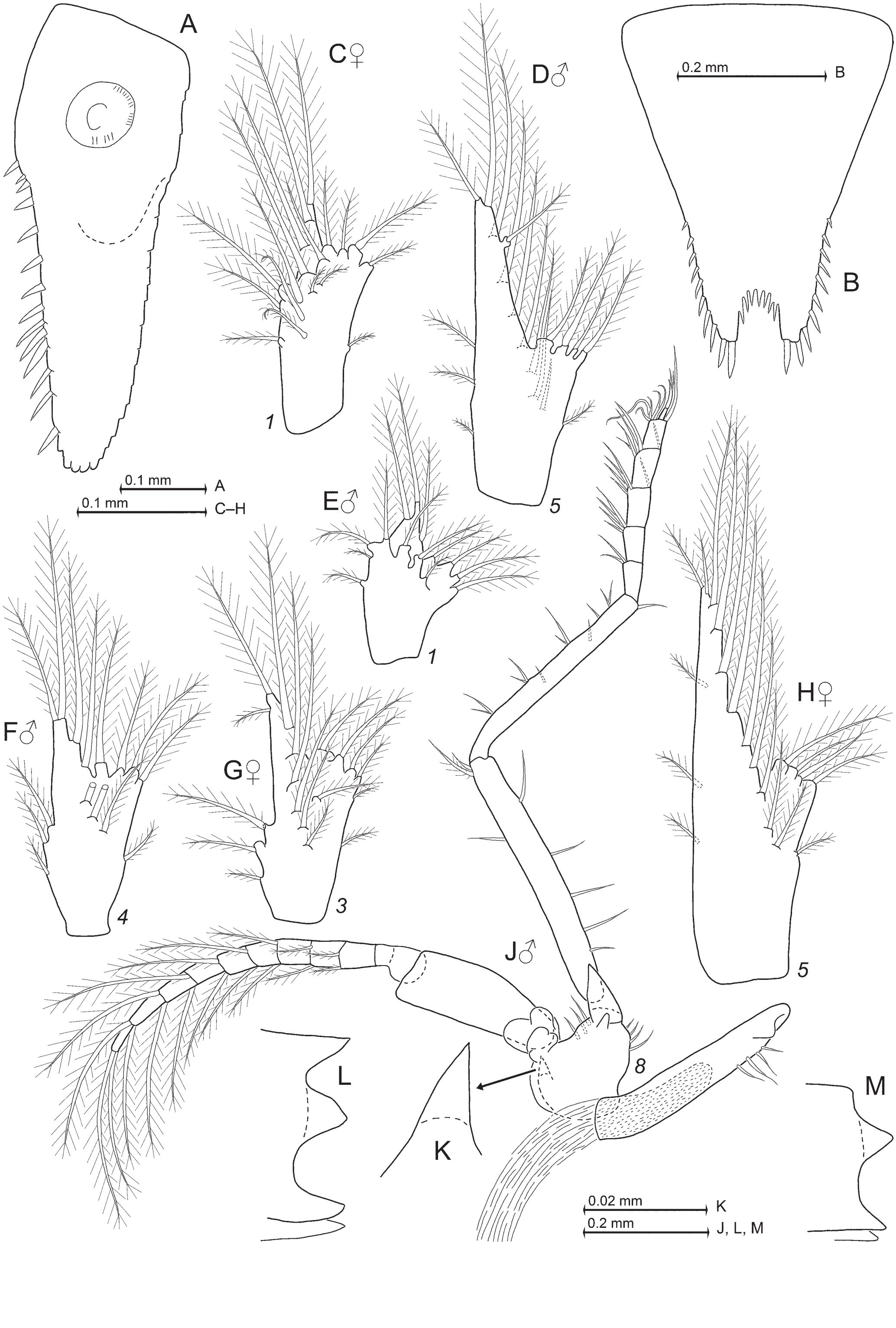
Fig. 5: In-vitro microphotographs of *Heteromysis abednavandii* sp.n., paratype, CO_2-treated living adult male with body length 4.3 mm (NHMW 26553); A, tail fan, dorsal aspect; B, gnathopods, ventral. Laboratory photos by Helmuth Goldammer. Two photos mounted together on same plate, background of panel (A) cleaned using electronic tools by the present author.

well-rounded rudimentary oostegite represented by a small, rounded lobe with three microserrated setae at tip (Fig. 4N).

Penes (Fig. 6J) **and pleopods** (Fig. 6C–H). Both penes stiff, slender, shape roughly tube-like, pointing downwards-backwards. Each penis with smooth cuticle (not considering setae) all around. The two lobes close to the ejaculatory opening are smooth and have no setae. Pleopods without sex-specific differences when related to same body size. Length without setae increases from first to fifth pleopods. All setae are plumose or barbed.

Uropods (Figs. 5A, 6A) **and telson** (Figs. 5A, 6B). Uropodal exopods stout, inner margin strongly convex; outer margin slightly convex, almost straight. Endopods basally with large statocyst. Statoliths discoidal with shallow fundus and distinct tegmen. Mineral composition is fluorite (as also in 18 *Heteromysis* species examined by WITTMANN & ARIANI, 2019, and WITTMANN & ABED-NAVANDI, 2019). Statolith diameter 53–107 µm (n = 8), statolith formula 2 + 3 + (5–6) + (6–9) = 18–20 (n = 4). Telson length 1.1–1.3

◀ Fig. 4: *Heteromysis abednavandii* sp.n., paratypes adult males with body length 3.4 mm (A–F; NHMW 26557), 3.4 mm (O, P, R, U, V; NHMW 26556), and females 4.4 mm (G–M; NHMW 26555), 4.5 mm (N, Q, S, T; NHMW 26554). A–M, modified spine on carpus (B, E, H, L) and ridge on inner-terminal edge of merus (C, F, J, M) in left male gnathopod, caudal aspect (A), right male gnathopod, rostral (D), left female gnathopod, rostral (G), and right female gnathopod, caudal (K); N, sympod of thoracic endopod 6 with rudimentary oostegite, rostral; O, thoracic endopod 4, rostral, detail (P) showing modified seta from median segment of 'tarsus'; Q, apical portion of right female gnathopod, caudal; R–V, dactylus with claw in thoracic endopods 4–8.


A
C♀
D♂
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A
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E♂
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F♂
G♀
H♀
4
3
J♂
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K
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J, L, M

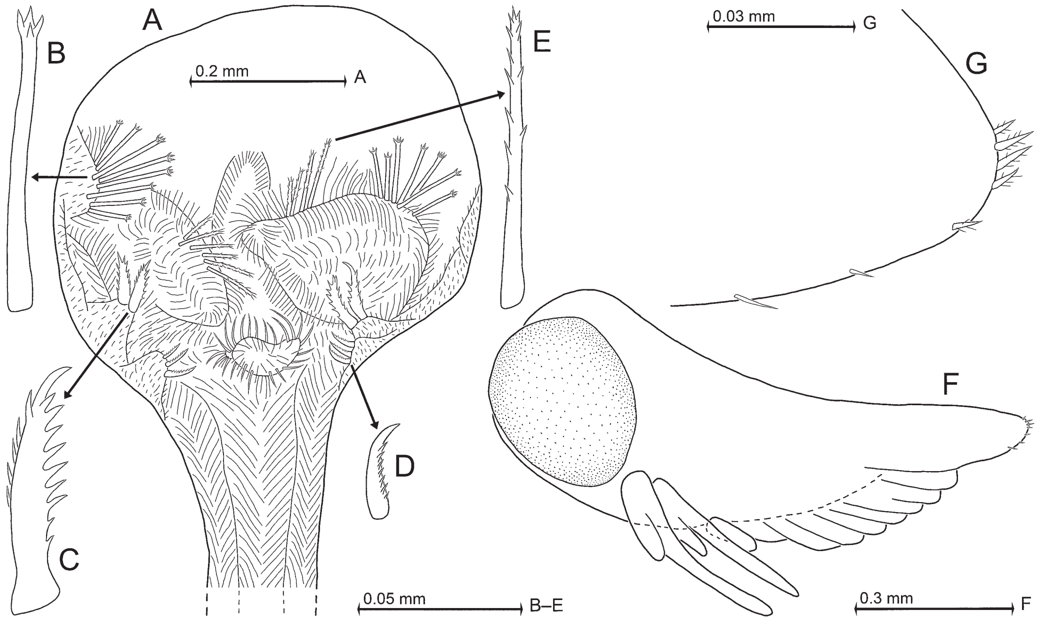

Fig. 7: *Heteromysis abednavandii* sp.n., female paratype with body length 4.4 mm (A–E; NHMW 26555) and nauplioid larvae from female 4.5 mm (F, G; NHMW 26554). A, cardiac portion of foregut, dorsal aspect, dorsal wall omitted, details (B–E) showing modified spines; F, nauplioid larva at late substage N3; G, tip of nauplioid abdomen in another specimen.

times that of sixth pleonite. Apical cleft slightly deeper than wide. Proximal portions of cleft lined by acute laminae which are shorter than average-sized spines along distal third of lateral margins of telson. For further details of the telson, see 'Diagnosis' above.

Foregut (Fig. 7A–E). Setae, but no spines, close to inlet from esophagus. Primary cardiac filter formed ventrally by dense combs of stiff setae behind inlet. Lateralia, infoldings, and superomedianum of the cardiac chamber densely covered by smooth, slender setae and spines. Superomedianum in addition with a number of stronger, smooth spines. Lateralia anteriorly with dense series of slender, apically coronate spines of different length (Fig. 6B), more caudally and medially with separate group of apically pronged spines (Fig. 6E). The latter spines with small teeth along their distal 2/3. Posterior part of lateralia with three unilaterally, centrally serrated spines (Fig. 7D). Dorsolateral infolding with two stronger, centro-apically serrated spines (Fig. 7C).

◀ Fig. 6: *Heteromysis abednavandii* sp.n., holotype male with body length 3.5 mm (M; NHMW 26552), paratypes females 4.5 mm (A, G, H, L; NHMW 26554), 4.4 mm (C; NHMW 26555), and males 3.4 mm (B, D, F; NHMW 26556), 3.4 mm (E, J, K; NHMW 26557). A, endopod of uropod, ventral, setae and ventral wall of statocyst omitted; B, telson; C, G, H, female pleopods 1, 3, 5, rostral; D–F, male pleopods 5, 1, 4, caudal (D) or rostral (E, F); J, male thoracopod 8 with penis, rostral aspect, detail (K) showing tooth-like projection from caudal face of sympod; L, M, variants of scutellum paracaudale, lateral.

Color (Fig. 1). General appearance transparent with yellow to orange-brown portions, rendering visible, if present, contents of foregut and alimentary canal. Small orange to brown chromatophore spots scattered over the thorax, with greatest density above the foregut. 'Color' pattern of the cephalic region differs between Fig. 2A and Fig. 2G due to different 'expansion' of chromatophores. Eyestalks with deep red, narrow stripe lining the posterior margin of the cornea (best visible in Fig. 1C). The iridescence of bodies and appendages (Figs. 1, 5A) varies with the direction of incident light.

Nauplioid larvae (Fig. 7F, G). The three available specimens with smooth cuticle all around except for the tip of the abdomen, which bears four barbed spine-setae at tip and 3–5 setae in subapical positions. Remaining features in Fig. 7F are typical of the state of development.

Discussion

Assignment and distinction of the new species

***Heteromysis* (*Heteromysis*) *abednavandii* sp.n.** clearly fits the diagnosis given in the key by Băcescu (1968) for the subgenus *Heteromysis* S.I. Smith, 1873, by showing non-dimorphic, rudimentary pleopods without spines or modified setae, by the absence of flagellate spines on the antennular trunk, and by the third thoracic endopod moderately robust, carpus enlarged.

For differentiation from the remaining species of the genus *Heteromysis*, the new species must be checked not only against the 20 species of the subgenus *Heteromysis* currently acknowledged by Mees & Meland (2019) plus *Heteromysis* (*Heteromysis*) *mureseanui* Băcescu, 1986, explicitely assigned to this subgenus by Băcescu (1986: Fig. 1), but also against the additional 27 species with questionable or unknown subgeneric assignment. In the past, published descriptions of *Heteromysis* species have been very heterogeneously structured: many data sets are fragmentary from today's point of view, limiting comparison between individual species. The structure of uropods and telson are among the few characters known from all 21 + 27 here considered species and are sufficiently differentiated, thus useful as valid tools for species distinction:

The new species is characterized by spine series along the inner margin of the endopod of uropods from the statocyst up to shortly below the tip of the endopod of uropods (Fig. 6A); telson with short, basally rounded terminal cleft furnished with laminae in basal portions, terminal portions of cleft smooth; lateral margins of telson with spines only on distal half; lateral spines of telson continuously increasing in length toward the narrowly truncate apex of the latero-terminal lobes (Fig. 6B). This set of characters is shared with only nine out of the total of 48 species considered: two of these species pertain to the subgenus *Heteromysis*, namely *H.* (*H.*) *spinosa* Băcescu, 1986, and *H.* (*H.*) *riedli* Wittmann, 2001; other seven species are not assigned to any subgenus, namely *H. macropsis* Pillai, 1961, *H. minuta* O.S. Tattersall, 1967, *H. elegans* Brattegard, 1974, *H. inflaticauda* Wang, 1998, *H. thailandica* Fukuoka & Murano, 2002, *H. japonica* Murano & Hanamura, 2002, and *H. nomurai* Murano & Fukuoka, 2003. The published data on these nine species is checked here in detail for potential differences from the new species:

***Heteromysis macropsis* PILLAI, 1961**, from the coast of Kerala, western India, N-Indian Ocean, was described based only on two immatures. It differs from the new species by smaller cornea in relation to the large eyestalk; basal segment of antennular trunk without or with inconspicuous medio-dorsal lobe; antennal sympod without spiniform projection on outer margin; antennal scale not subdivided; gnathopods with three large, barbed setae projecting above the claw; fewer (8) spines on the endopods of uropods.

***Heteromysis thailandica* FUKUOKA & MURANO, 2002**, from the Mergui Archipelago, Andaman Sea, is known based on only one damaged male, gnathopods unknown. It differs from the new species by a flagellate spine on the mesio-terminal edge of the antennular trunk; basal segment of antennular trunk without medio-dorsal lobe; antennal sympod without spiniform projection on outer margin; labrum without anterior process; median segment of mandibular palp with only one seta subapically on outer margin; carpopropodus of thoracic endopod 4 without spinulose setae; penes with apical setae.

***Heteromysis minuta* O.S. TATTERSALL, 1967**, from Singapore, Indo-Pacific, differs from the new species by wider rostrum; cornea with few functional ocelli and without pigment; eyestalks anteriorly projecting beyond cornea; basal segment of antennular trunk without medio-dorsal lobe; antennal scale not subdivided; gnathopods slender, with small, throughout unmodified spines; merus 3 without longitudinal carina; carpopropodus of thoracic endopods 4–8 each with more (6) segments.

***Heteromysis inflaticauda* WANG, 1998**, from the northern part of the South China Sea, W-Pacific, differs from the new species by wider, terminally more rounded rostrum; basal segment of antennular trunk without medio-dorsal lobe; labrum without anterior process; gnathopods only with normal, unmodified spines on carpus; more (28) spines on endopod of uropods; more (15–19) spines on lateral margins of telson; more (25) laminae occupying a greater portion (75–84 %) of margins of the deeper (1/3 length) telson cleft.

***Heteromysis* (*Heteromysis*) *spinosa* BĂCESCU, 1986**, from coastal waters of Northern Australia, Timor Sea, was described based on only one juvenile (subadult ?) female. It differs from the new species by small, posteriorly truncate cornea; rostrum very short, keeping the eyestalks fully exposed; merus 3 without longitudinal carina; gnathopods with more slender carpopropodus carrying smooth, unmodified spines; fewer (6) spines on endopod of uropods; telson (sub)terminally with three enormous spines on each latero-terminal lobe; bottom of telson cleft with fewer (4) laminae.

***Heteromysis japonica* MURANO & HANAMURA, 2002**, from the Uraga Channel, central Japan, NW-Pacific, differs from the new species by basal segment of antennular trunk without medio-dorsal lobe; antennal sympod without spiniform projection on outer margin; merus 3 without longitudinal carina; gnathopods with five paired spines on distal half of carpus and with three long setae projecting above claw; carpopropodus of thoracic endopods 4, 5 with more (6) segments; carpopropodus of thoracic endopod 4 without spinulose setae; penes with apical setae.

***Heteromysis nomurai* MURANO & FUKUOKA, 2003**, is known only from the Aquarium of the Kushimoto Marine Park Center, Japan. It differs from the new species by basal segment of antennular trunk without medio-dorsal lobe; antennal sympod without spiniform projection on outer margin; antennal scale not subdivided; labrum without anterior process; thorax without sternal processes in both sexes; carpopropodus of thoracic endopod 4 without subbasally spiny setae; endopods 4–8 with more (6–7) segments; penes with apical setae. Gnathopods highly similar, not considering differently modified, large setae projecting above the claw.

***Heteromysis elegans* Brattegard, 1974**, from the Caribbean coast of Colombia differs from the new species by wider, terminally more rounded rostrum; basal segment of antennular trunk with weakly developed medio-dorsal lobe; antennal sympod without spiniform projection on outer margin; labrum without anterior process; median segment of mandibular palp with fewer setae on outer margin; gnathopods with more slender carpopropodus bearing setae but no spines; on average more (15–25) spines on endopod of uropods.

***Heteromysis* (*Heteromysis*) *riedli* Wittmann, 2001**, from the Gulf of Naples, Tyrrhenian Sea, Mediterranean, differs from the new species by anterior margin of eyestalks furnished with field of scales; shorter, obtuse-angled rostrum; basal segment of antennular trunk with weakly developed medio-dorsal lobe; males with two curiously modified, backward-oriented setae on mesio-terminal edge of antennular trunk; antennal scale with much shorter terminal segment; labrum without anterior process; merus 3 without longitudinal carina; gnathopods with more slender carpopropodus bearing smooth, unmodified spines; on average more (14–19) spines on endopod of uropods.

Distribution

The unexpected appearance of two species belonging to different subgenera of the genus *Heteromysis*, namely *H.* (*Olivemysis*) *domusmaris* and *H.* (*Heteromysis*) *abednavandii* sp.n., in the coral reef system of the Haus des Meeres, Vienna, Austria, shows an uncanny parallelism with the appearance of two other, morphologically distant species, namely *H.* (*Olivemysis*) *kushimotensis* Murano & Fukuoka, 2003, and *Heteromysis nomurai*, in exhibition tanks of the Kushimoto Marine Park Center in Wakayama, Japan (Murano & Fukuoka, 2003). It is surprising that as many as four species out of a total of 91 known *Heteromysis* species (including the new one) were first described from aquarium systems. Wittmann & Abed-Navandi (2019) explained the detection of new *Heteromysis* species in aquaria by the great numbers of still undiscovered species, many of which have so far escaped detection due to their cryptic mode of life as indicated by their appearance in field samples from marine caves and by successful extraction from gravel, foraminate stones, corals, sponges, seaweeds, dead mollusc shells, discarded bottles, etc. (f.i. Wittmann & Wirtz 1998, Wittmann 2001, Fukuoka 2005, Wittmann & Chevaldonné 2017). So far, most organisms first described from aquaria are pathogens of fish (Martínez-Murcia et al. 2008; Vaughan et al. 2008, 2016; Chisholm & Whittington 2009). First records of new species in aquaria are rare for free-living crustaceans. Ng et al. (2015) identified two new species of decorative land crabs in material from the aquarium trade and successfully traced the origin back to Java, where they sampled material then used for first description.

Seven out of the nine *Heteromysis* species discussed above as sharing uropod and telson structure with *H. abednavandii* sp.n. are known from shallow tropical waters of the mid Indian Ocean to the West-Pacific. For both 'Viennese' *Heteromysis* species the distribution of the respective closely related species fits well with the fact that most coral reef materials in the Haus des Meeres are imports from the tropical Indo-Pacific. The detailed origin of these species could not be traced back because each was found already distributed among several aquaria with different coral species and different substrata upon first detection. Determining the natural range of these species remains a challenge for future research.

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