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On a New *Microcerberus* from the Red Sea and the Relationship of the Microcerberidea to the Anthuridea (Crustacea, Isopoda)

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Microcerberus tabai sp.n. from the Gulf of Elat is described in detail. The relationship of the Microcerberida to the Anthuridea is discussed: the Microcerberidea have none of the synapomorphies of the Anthuridea.

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Introduction

The Microcerberidea are minute hypogean Isopoda living nearly exclusively in the coastal groundwater of sandy beaches. Only in some regions of marked marine regressions (Mediterranean, Caribbean) have some limnic Microcerberidea been found. With few exceptions (e.g. *Mexicerberus troglodytes* Schultz, 1974) the species have a uniform morphology and are distinguished by the structure of the appendix masculina. In the present study the morphology of *Microcerberus tabai* sp.n. is described and the relationship of the Microcerberidea to the Anthuridea is discussed.

Material

Several specimens of *M. tabai* sp.n., including mature males, were repeatedly collected at the following locality: sandy shore of Taba Beach (Sinai south of Elat, Red Sea), 0.3–2.0 m from wave line, in groundwater at a depth of 0.1–0.6 m. At many places along the Sinai coast the formation of a hypogean habitat suitable for *M. tabai* is prevented by a thick layer of beachrock underlying the sandy beaches.

The holotype is deposited in the ZMK (Zoologisches Museum, Kiel).

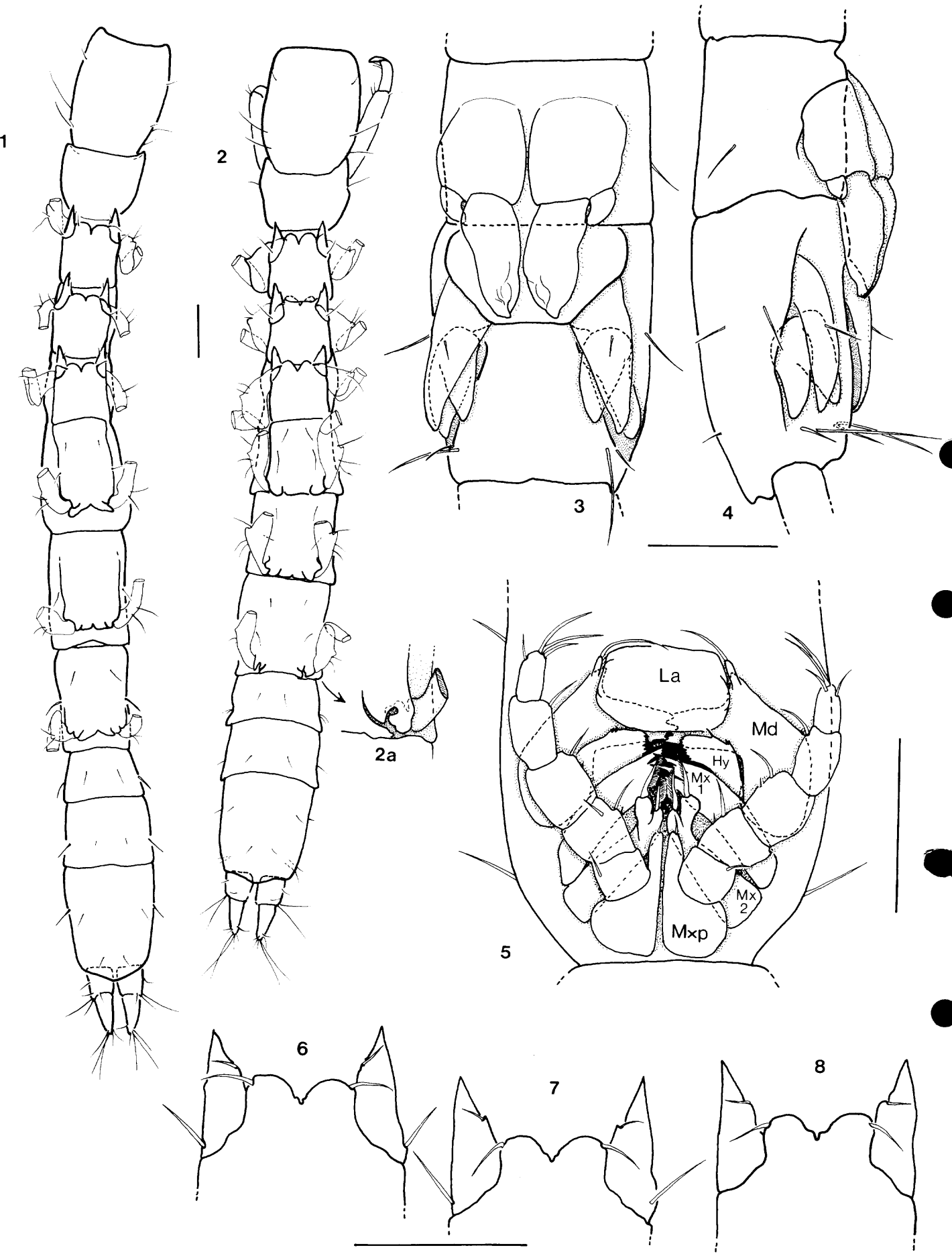
List of abbreviations

A 1	antenna 1	Mxp	maxilliped
A 2	antenna 2	P 1–7	pereopod 1–7
Hy	hypopharynx	Plp 1–5	pleopod 1–5
Md	mandible	Urp	uropod
Mx 1,2	maxilla 1,2	Tel	telson

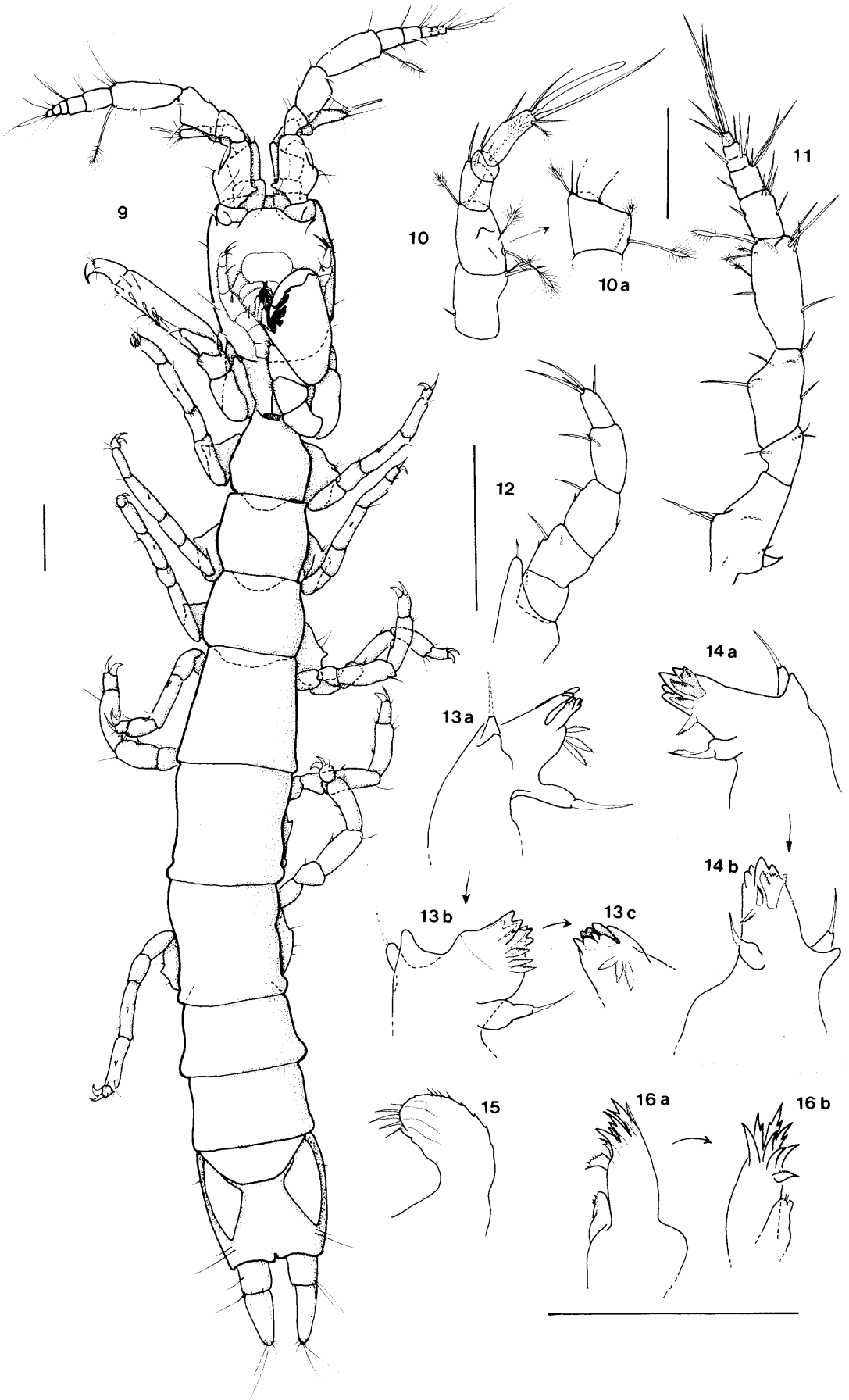
Microcerberus tabai sp.n.

Holotype. Immature male (length 1 mm), ZMK Cr. 2291.
Allotype. Mature male (length 1 mm), ZMK Cr. Nr. 2318.
Type locality. Sinai, Taba Beach, coastal groundwater, 2 m from wave line, depth 0.6 m.

Description of the holotype. Colourless animal, about 11 times longer than wide. Cephalothorax without eyes, longer than wide, relative length of pereonites: 1 = 2 = 3 > 4 < 5 = 6 > 7. Pleonite 1 smaller than pleonite 2, pleotelson nearly as long as pleonites 1 + 2 together (Fig. 1). Pereopods inserting dorsally, P 2–4 inserting on "lateral lobes of tergites" (coxae?) which form anteriorly directed acute points (Figs. 6–8). Tergites of pereonites 5–7 with complicated foldings at insertion of pereopods (Fig. 2*a*). Peduncle of A 1 of 3 articles, second article broadened (Fig. 10*a*) and bearing 3 plumose setae; flagellum with 2 articles: first article short, bearing 1 feather-like bristle and 1 tiny seta, second article bearing 4 setae, 1 aesthetasc and 1 small plumose seta (Fig. 10). Peduncle of A 2 with 5 articles, flagellum with 5 articles, last article bearing 4 setae. Mouthparts restricted to posterior two thirds of ventral cephalothorax (Figs. 5, 9), maxillipeds not covering the endites of other mouthparts. Mandibles (Figs. 13, 14) with single-jointed palp bearing 1 apical seta, and with long, pointed pars molaris. Palp inserting ventrally of knob of anteriolateral articulation of Md. Pars incisiva of right Md (Fig. 14) with 2 two-pointed teeth; lacinia mobilis broadening distally, with 2 dentated lobes, and just below lacinia two, finely serrated setae. Pars incisiva of left Md (Fig. 13) with 2 rows of 2 two-pointed teeth, the proximal 2 teeth possibly being immovable lacinia, and below only 3 ciliated setae. Hy (Fig. 15) with curved lateral lobes bearing some short apical setae and lateral hairs. Mx 1 (Fig. 16) with strongly developed lateral endite, armed with 8 teeth; proximal tooth finely serrated, 3 apical teeth with 2 points; medial endite short. Mx 2 (Fig. 17) with 2 serrated apical lobes. P 1 subchelate (Fig. 18), basis with dentiform projection on anterior margin; posterior part of carpus produced into acute lobe bearing 5 setae; stout propodus with 3 finely serrated spines and 2 longer proximal spines on posterior margin (Fig. 18); dactylus bearing long claw and 2 serrated spines. P 2–4 (Figs. 19, 20) similar; basis bearing simple and plumose setae; ischium with 2 setae; short merus with 3 setae; carpus long, cylindrical, posterior margin with 1 spine and 1 associated short seta, anterior



Figs. 1–8. Microcerberus tabai sp.n.—*1*. Dorsum of holotype (immature male).—*2*. Dorsum of immature adult (*2a*: Insertion of pereopod 7).—*3,4*. Ventral and lateral view of pleonites 1 + 2 of holotype.—*5*. Ventral view of mouthparts (immature adult).—*6–8*. Lateral lobes of tergites 2, 3 and 4. Scale = 0.05 mm.



Figs. 9–16. Microcerberus tabai sp.n. (*10–16*: holotype).—*9*. Ventral view of immature adult.—*10*. Dorsolateral view of A 1 (*10a*: Ventral view of second article).—*11*. A 2.—*12*. Mxp.—*13a, b, c*. Different views of left Md.—*14a, b*. Two views of right Md.—*15*. Lateral lobe of Hy.—*16*. Two views of Mx 1.

Scale = 0.05 mm.

margin with 1 spine and 1 plumose seta; propodus nearly as long as carpus; dactylus almost rectangular, with 2 setae and 2 terminal claws. P 5–7 (Figs. 21, 22) similar, carpus and propodus each with 1 spine on anterior margin, dactylus only with 1 seta and 2 claws. Plp 2 (Figs. 3, 4, 26) of immature male inserting on pleonite 2, with rectangular protopodite; exopodite very small, without setae; endopodite as long as protopodite, without characteristic structures. Plp 3 and 4 (Figs. 3, 4, 24, 25) without protopodite, inserting on pleotelson; Plp 3 with 1 branch covering Plp 4, Plp 4 with 2 similar branches. Protopodite of Urp (Fig. 23) with serrated scales on medial surface and with a total number of 6 setae, 2 of them inserting on reduced exopodite. Endopodite long, apex with 4 plumose and 5 simple setae.

Variations. Females could not be distinguished from immature adults, oostegites could not be found. Structure and setation of antennae, mouthparts and pereopods are similar in all specimens, including mature males. The latter differ from immature adults in having a more slender body (compare Figs. 1 and 2) and in the development of the Plp 2, which is completely absent in other adults. The appendix masculina of the mature male is characteristic for the species and differs from that of the immature male in its fully developed structure (Figs. 27, 28: allotype). It has 3 apical lobes: a medial, ear-shaped lobe (A); a central, long lobe (B) with hyaline, finely serrated lateral margin; and a short lateral lobe (C). The lobes are reinforced by chitinized sclerites.

Remarks. The most important distinctive feature of the Microcerberidea is the structure of the appendix masculina of the mature male, though it is not known in some species (*M. littoralis*, *M. simplex*, *M. stygius*) and often details are not known with sufficient precision. The endopod of Plp 2 very often consists of a broad basal trunk with 3 apical lobes, two of them rounded and one long and acute (*M. abotti*, *M. andamanensis*, *M. fukudai*, *M. kiiensis*, *M. machadoi*, *M. mirabilis*, *M. nunezi*, *M.singhalensis*). In some species the three lobes are short and none is remarkably long or acute (*M. anfindicus*, *M. boninensis*, *M. delamarei*, *M. mexicanus*, *M. phreaticus*, *M. ramosae*, *M. simplex*). *M. tabai* sp.n. belongs to this latter group, though it is clearly discernible that the medial lobe (B) corresponds to the long, acute or rod-like lobe of other Microcerberidea. At present it is not possible to say how the three-lobed appendix masculina is related to the two-lobed (e.g. *M. adriaticus*, *M. arenicola*, *M. brasiliensis* etc.) or one-lobed appendix masculina (*M. plesai*, *M. remyi*, *Yvesia striata*). The shape of this structure is very similar in the new species and in *M. minutus* Coineau & Botosaneanu, 1973 from Cuba, but in the latter species the central lobe is shorter than A or C and it has an apical concavity.

The comparison of several other features is nearly impossible, as many species are only known superficially. Details of the interesting mouthparts are not known in 21 out of 35 species!

Discussion

The general morphology, and especially the structure of the pleon and of the mouthparts, of the Microcerberidea has been clarified by Lang (1960), but still some questions are left open, above all the relationship to the Anthuridea.

To compare the Microcerberidea with the Anthuridea the morphology of the latter group has to be summarized:

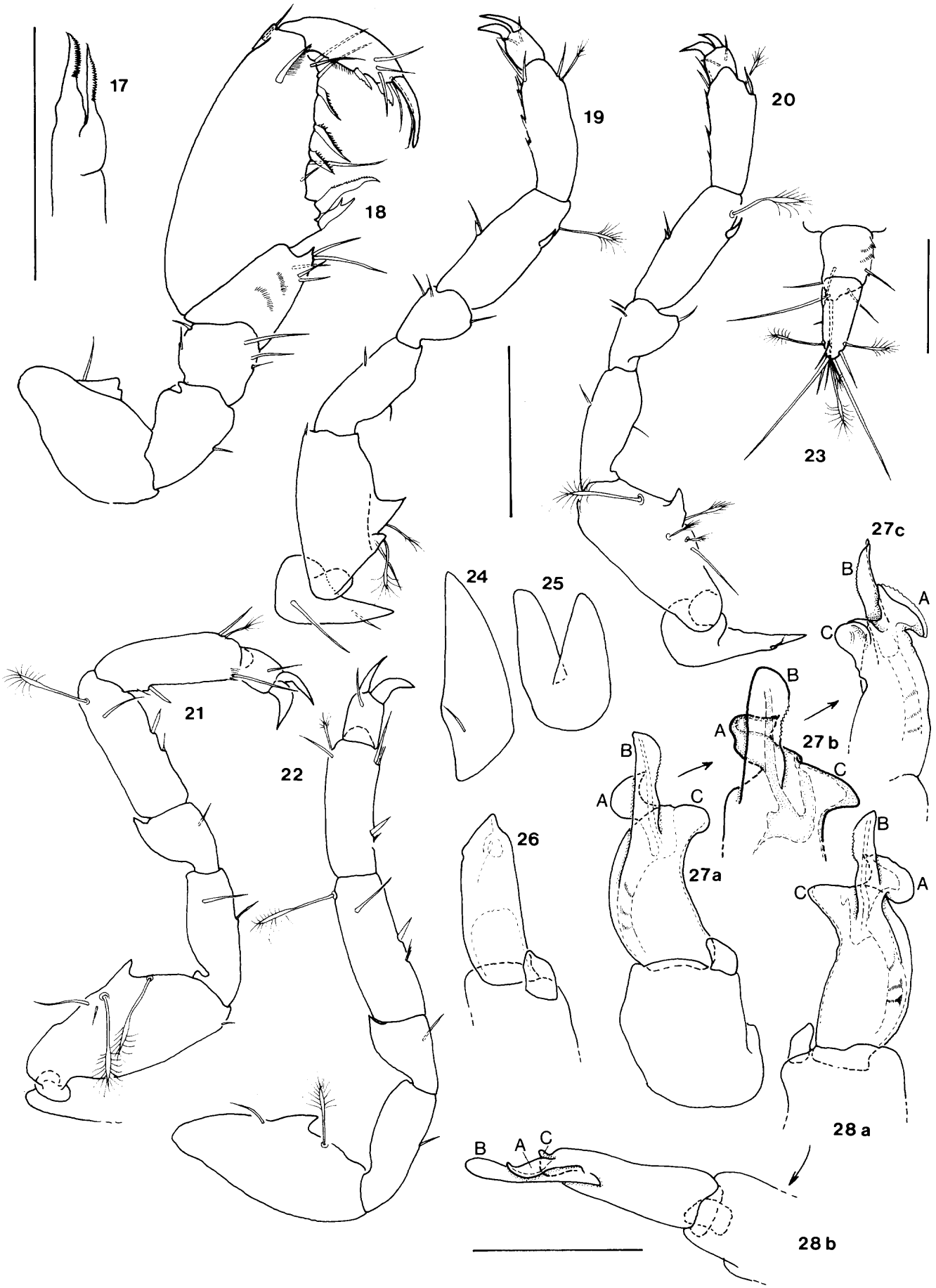
The Anthuridea can be divided into three families (Hyssuridae, Anthuridea, Paranthuridae: Wägele 1981), which represent 3 different phylogenetic branches emerging from an extinct common root. Some of the reconstructed features of the hypothetical common ancestor are (Wägele 1981): body long and slender, 5 pleonites unfused, 6th pleonite fused with telson, Md without lacinia mobilis, Hy with 2 pairs of lateral lobes, lateral endite of Mx 1 stiletto-like, Mx 2 reduced, P 1–3 possibly not subchelate, fan-like uropods, exopod inserting on dorsolateral margin of sympod.

Karaman (1933) justified the relationship of the Microcerberidea to the Anthuridea with the similarities in the general morphology: the Microcerberidea are long and slender Isopoda with a subchelate P 1, resembling many species of the family Anthuridea. However, this superficial resemblance can not be considered as relevant: all hypogean isopods are long and slender; a subchelate P 1 may be found in most suborders of Isopoda (Asellota, Valvifera, Flabellifera . . .). In 1940, Karaman added another argument: the appendix masculina of the Microcerberidea resembles that of the Anthuridea. At that time (1940) only two-lobed appendices masculinae were known, today it is impossible to hold this argument. The male Plp 2 of the Anthuridea is not very specialized, as in many other Isopoda, and has nothing in common with the Plp 2 of the Microcerberidea. In most Isopoda, the appendix masculina is a medial rod inserting on the endopodite of Plp 2. In the Microcerberidea the entire endopod forms the copulating organ.

Chappuis & Delamare-Deboutteville (1954) declared that the difference in the structure of the uropods in both groups is obvious, but the Microcerberidea could have been evolved from the Anthuridea by reduction in size and secondary degeneration of uropods and telson. This opinion can be refuted: the tailfan of the Anthuridea is characteristic by its leaf-like uropods and the dorsally displaced exopod. The tiny exopod of the Microcerberidea does not insert on the dorsolateral margin of the sympod, but it is placed in plesiomorphic fashion at the side of the endopod, as in the Oniscoidea and Asellota.

Further apomorphies of the Anthuridea are not present in the Microcerberidea: the Anthuridea have no lacinia mobilis, the row of setae of the Md is replaced by the lamina dentata, the Mx 2 is reduced. Lang (1960) remarked that the pereopods of the Anthuridea only bear 1 claw, while the Microcerberidea have 2 claws, as do many Asellota.

Lang (1960) separated the Microcerberidea from the Anthuridea and proposed to keep them as a new suborder, a view also supported in this study. But Lang continued his discussion with the remark: "This suborder, however, is no doubt most closely related to the Anthuridea", an opinion that survived until today (Coineau 1966, 1970; Schultz 1969; Kussakin 1973). It was necessary to study the phylogeny and the hypothetic common ancestor of the Anthuridea (Wägele 1981)



Figs. 17–28. Microcerberus tabai sp.n. (*17–26*: holotype).—*17*. Mx 2.—*18–22*. P 1, P 2, P 4, P 5, P 6.—*23*. Urp.—*24, 25*. Plp 3, 4.—*26*. Plp 2.—*27, 28*. Different views of Plp 2 of mature male (allotype).
Scale = 0.05 mm.

before a relationship between Anthuridea and Microcerberidea could be definitely dismissed: none of the synapomorphies of the Anthuridea is present in the Microcerberidea.

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