

THE GENERIC STATUS AND DISTRIBUTION OF *MONODELLA TEXANA* MAGUIRE, THE ONLY KNOWN NORTH AMERICAN THERMOSBAENACEAN

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Abstract.—Although the original description of *Monodella texana* Maguire, 1965, attributes several peculiar features, notably in the maxillipeds, to the sole North American representative of the Thermosbaenacea, a re-examination of material from the San Marcos area (Texas) revealed a close morphological similarity to European and West Indian taxa of *Monodella*, with which it clearly is congeneric.

Maguire's (1964, 1965) discovery of the first thermosbaenacean outside the Mediterranean area awoke considerable interest by biogeographers and stygobiologists. Maguire attributed his material without comments to the genus *Monodella*, at that time only known from groundwaters in Italy, Yugoslavia, and Israel. Presently, the genus is known also from Spain, the Balearic Islands, France, and Greece, and outside the Mediterranean area from the British and U.S. Virgin Islands, Culebra (E. of Puerto Rico), Haiti, Cuba (references in Stock, 1976, and Stock, in press), Puerto Rico (unpublished personal observations) and Somalia (Messana, 1979).

In the years following the description of the Texan thermosbaenacean, but preceding the discovery of extra-Mediterranean taxa, several carcinologists wondered whether Maguire had been right in considering the New World taxon congeneric with the Old World species. When Stock (1976) described a second New World species, found in St. Croix (U.S. Virgin Islands), it became clear that true *Monodellas* existed outside the Mediterranean, but at the same time doubt was cast on the correctness of Maguire's morphological observations. According to the original description, the Texan *Monodella* had a 2-segmented mandibular palp (versus 3-segmented in the other species), was devoid of endo- and exopodites on the 2nd maxilla (versus present), and fused coxo- and basipodal endites in the maxilliped (versus separate), and lacked maxillipedal epipodites (versus present). The most conspicuous difference between Maguire's description of *M. texana* and the other members of *Monodella* was the alleged presence, in the female, of a 2-segmented maxillipedal endopodite, whereas the normal female condition is characterized by the absence (or reduction to a vestigial setule) of an endopodite. The male maxillipedal exopodite of *M. texana* was described as 4-segmented, whereas 2-segmented is the normal situation.

None of these differences materialized in a new study based on 15 specimens from an artesian well in San Marcos, Hays County, Texas, not far from the type-locality. Since the original description obviously is wanting, and since the accompanying illustrations are on much too small a scale to make recognition of details possible, *Monodella texana* is completely re-described in the sequel.

The artesian well from which the present specimens came is at an old Federal Fish Hatchery, deeded to the Southwest Texas State University as an Aquatic Station in 1964. It derives its water and very interesting hypogean fauna from the underlying Edwards Aquifer. More details and an illustration of the artesian well can be found in the recent paper on the Amphipoda of the well (Holsinger and Longley, 1980).

The specimens have been collected by the junior author and his team at the Edwards Aquifer Research and Data Center, Southwest Texas State University, San Marcos, Texas. The senior author is indebted to Dr. John R. Holsinger, Old Dominion University, Norfolk, Virginia, for bringing the existence of freshly collected material to his notice.

Monodella texana Maguire, 1965

Monodella: Maguire, 1964:931–932, fig. 1.

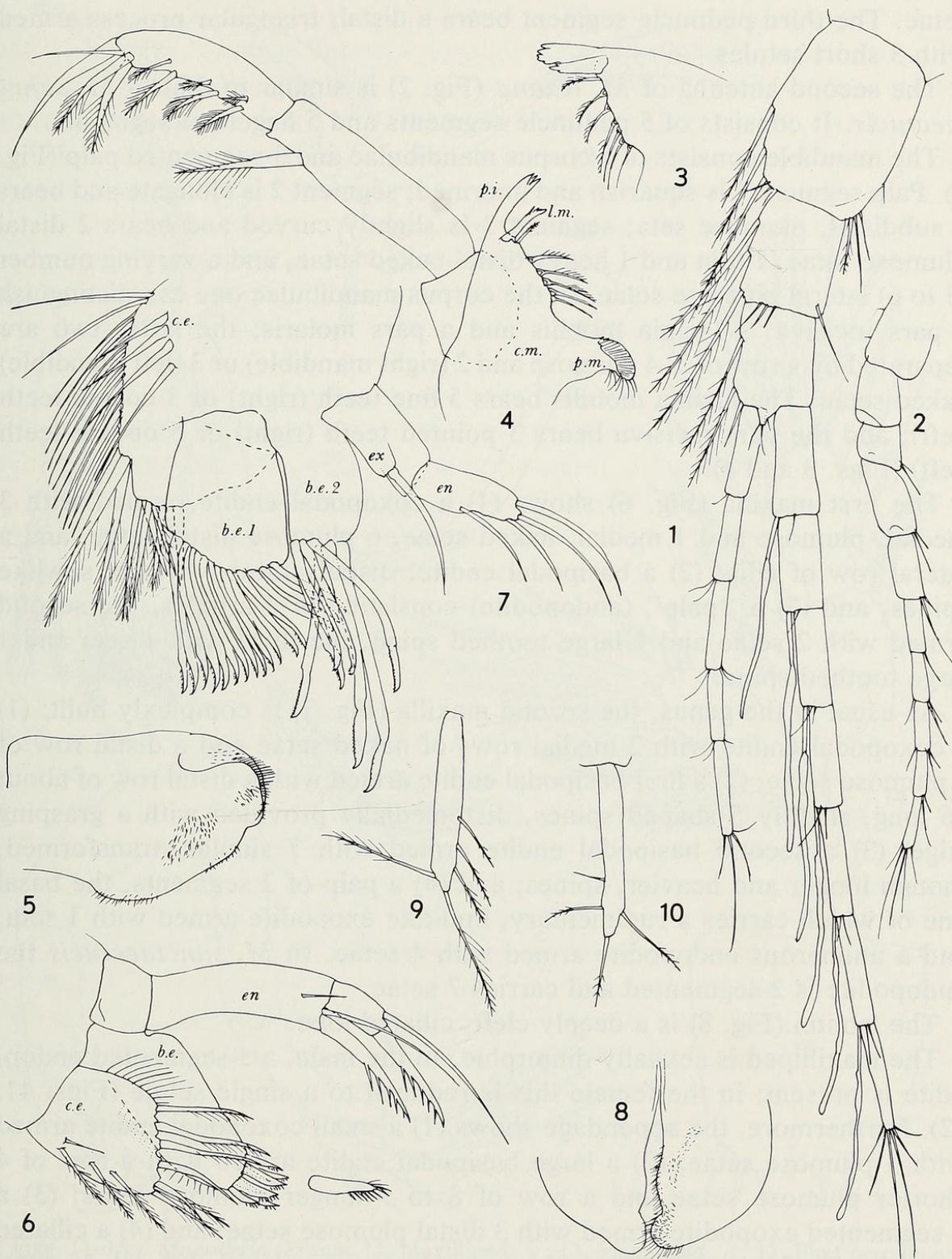
Monodella texana Maguire, 1965:149–154, figs. 1–3, pl. III; Karnei, 1978:38, fig. 15.

Monadella (lapsus calami) texana: Longley, 1978:23.

Body length 1.6–2.0 mm (♂) or 1.7–2.2 (♀). Females differ in external morphology from males in only a few characters: (1) the maxilliped is devoid of an endopod; (2) a penis on pereopod 7 is absent; (3) the proximal flagellum segments of the first antenna are devoid of aesthetes; (4) in certain phases of life, a dorsal brood pouch is present.

The animal is similar in body shape to other members of the genus *Monodella* and its appendages are remarkably similar to those of the only other Eastern Hemisphere species named so far, *M. sanctaecrucis* Stock, 1976. In the following description, *M. texana* will be compared with *M. sanctaecrucis*.

The first antenna (Fig. 1) has a 3-segmented peduncle (protopodite) and 2 flagellae; the main flagellum (exopodite) is 7- to 8-segmented, the accessory flagellum (endopodite) is about $\frac{2}{3}$ the length of the main flagellum and consists of 5 segments. All segments of the main flagellum in ♂ bear very long, stalked, aesthetes; in ♀ the proximal flagellum segments are devoid of aesthetes. The peduncle segments in *M. texana* are only slightly longer than wide (versus at least twice as long as wide in *M. sanctaecrucis*). The peduncle is armed with several long, plumose setae and some short, naked



Figs. 1-10. *Monodella texana*: 1, First antenna, ♂ (scale AB); 2, Second antenna, ♂ (AB); 3, Left corpus manibulae, ♀ (AC); 4, Right mandible, ♀ (AC); 5, Paragnath, ♀ (AC); 6, First maxilla, ♂ (AD); 7, Second maxilla, ♂ (AD); 8, Labium, ♀ (AC); 9, First pleopod, ♂ (AB); 10, Second pleopod, ♀ (AB). (For scales see Figs. 11-15.) *b.e.* = basipodal endite, *b.e.1*, *b.e.2* = first and second basipodal endite; *c.e.* = coxopodal endite; *c.m.* = corpus mandibulae; *en* = endopodite; *ex* = exopodite; *l.m.* = lacinia mobilis; *p.i.* = pars incisiva; *p.m.* = pars molaris.

setae. The third peduncle segment bears a distal, triangular process armed with 3 short setules.

The second antenna of *M. texana* (Fig. 2) is similar to that of *M. sanctaecrucis*. It consists of 5 peduncle segments and 5 flagellum segments.

The mandible consists of a corpus mandibulae and 3-segmented palp (Fig. 4). Palp segment 1 is squarish and unarmed; segment 2 is elongate and bears 1 subdistal, plumose seta; segment 3 is slightly curved and bears 2 distal plumose setae, 1 thin and 1 heavy distal naked setae, and a varying number (3 to 6) lateral plumose setae. In the corpus mandibulae one can distinguish a pars incisiva, a lacinia mobilis and a pars molaris; the latter two are separated by a row of 3-4 plumose and 2 (right mandible) or 3 (left mandible) naked setae. The lacinia mobilis bears 5 fine teeth (right) or 3 coarse teeth (left), and the pars incisiva bears 3 pointed teeth (right) or 5 obtuse teeth (left) (Figs. 3 and 4).

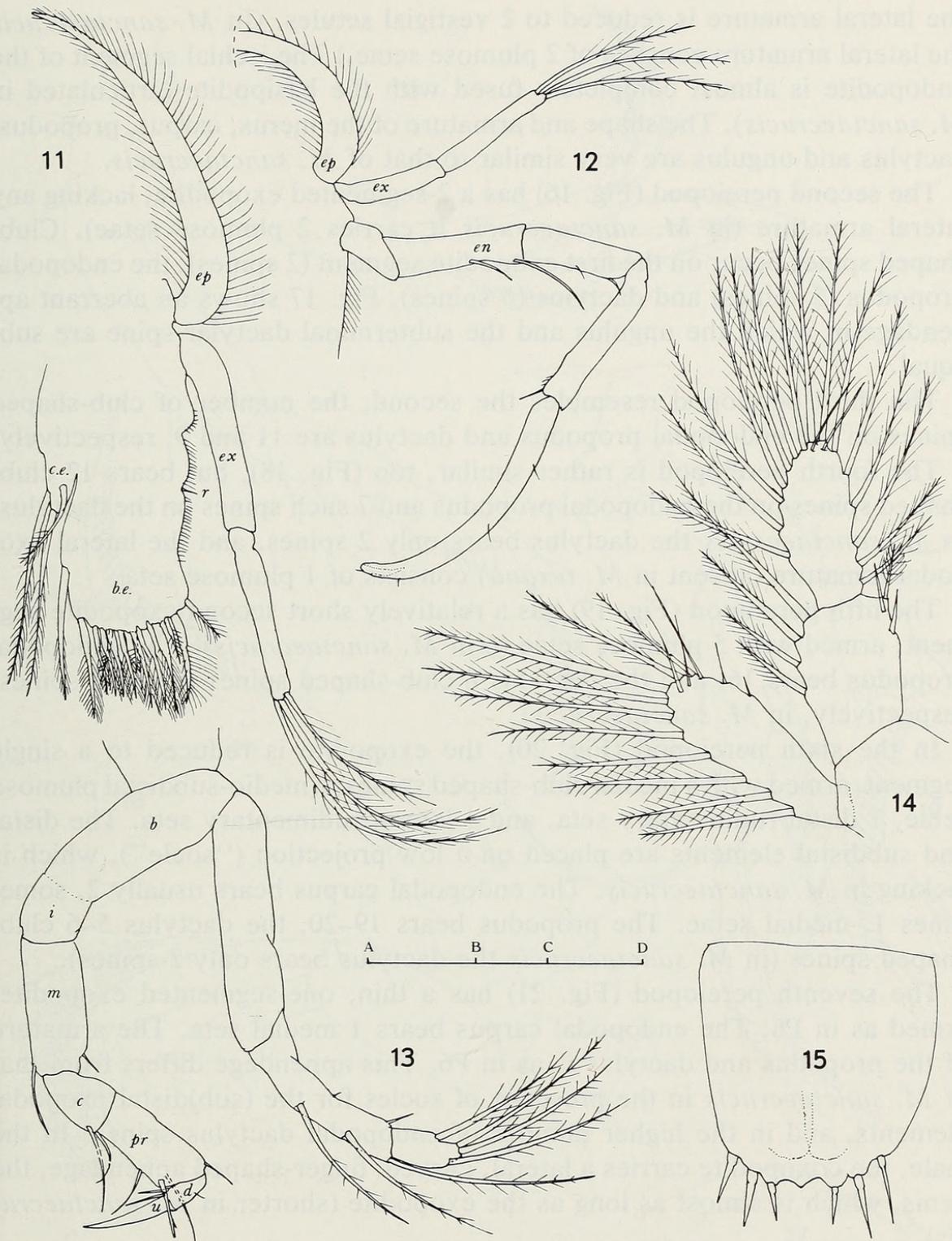
The first maxilla (Fig. 6) shows (1) a coxopodal endite, armed with 3 medial, plumose and 1 medial, naked setae, 6 plumose distal setae, and a lateral row of cilia; (2) a basipodal endite, distally armed with 6, sawlike spines, and (3) a "palp" (endopodite) consisting of 3 articles, the second armed with 2 setae and 1 large toothed spine, the third with 1 seta and 1 large toothed spine.

As usual in the genus, the second maxilla (Fig. 7) is complexly built: (1) a coxopodal endite with 2 medial rows of naked setae and a distal row of 8 plumose setae; (2) a first basipodal endite armed with a distal row of about 16 long, slightly S-shaped spines, distomedially provided with a grasping edge; (3) a second basipodal endite armed with 7 similar, transformed, though longer and heavier, spines; and (4) a palp of 2 segments, the basal one of which carries a rudimentary, bud-like exopodite armed with 1 seta, and a unimerous endopodite armed with 4 setae. In *M. sanctaecrucis* the endopodite is 2-segmented and carries 7 setae.

The labium (Fig. 8) is a deeply cleft, ciliated lobe.

The maxilliped is sexually dimorphic. In the male, a 5-segmented endopodite is present; in the female this is reduced to a single setule (Figs. 11, 12). Furthermore, the appendage shows (1) a small coxopodal endite armed with 3 plumose setae; (2) a large basipodal endite armed with a row of 4 shorter plumose setae and a row of 8 to 9 longer plumose setae; (3) a 2-segmented exopodite armed with 3 distal plumose setae; and (4) a ciliated epipodite. In *M. sanctaecrucis* the exopodite is armed with 3 distal, 1 lateral and 1 medial setae.

The first pereopod (Fig. 13) has a 3-segmented exopodite; in some specimens, the segmentation line between the second and third segments tends to become indistinct. The second exopodal segment bears 3 medial, plumose setae; the third segment bears 2 terminal and 2 subterminal plumose setae;



Figs. 11-15. *Monodella texana*: 11, Maxilliped, ♀; 12, Maxilliped, ♂; 13, First pereiopod, ♀; 14, Uropod, ♂; 15, Telson, ♂ (all to scale AB). *b* = basis; *b.e.* = basipodal endite; *c* = carpus; *c.e.* = coxopodal endite; *d* = dactylus; *en* = endopodite; *ep* = epipodite; *ex* = exopodite, *i* = ischium; *m* = merus; *pr* = propodus; *r* = rudiment of endopodite; *u* = ungulus.

the lateral armature is reduced to 2 vestigial setules. (In *M. sanctaegrucis* the lateral armature consists of 2 plumose setae.) The ischial segment of the endopodite is almost completely fused with the basipodite (articulated in *M. sanctaegrucis*). The shape and armature of the merus, carpus, propodus, dactylus and unguis are very similar to that of *M. sanctaegrucis*.

The second pereopod (Fig. 16) has a 2-segmented exopodite, lacking any lateral armature (in *M. sanctaegrucis* it carries 2 plumose setae). Club-shaped spines occur on the first exopodite segment (2 spines), the endopodal propodus (5 spines) and dactylus (5 spines). Fig. 17 shows an aberrant appendage in which the unguis and the subterminal dactylar spine are subequal.

The third pereopod resembles the second; the number of club-shaped spines on the endopodal propodus and dactylus are 11 and 9, respectively.

The fourth pereopod is rather similar, too (Fig. 18), but bears 12 club-shaped spines on the endopodal propodus and 7 such spines on the dactylus. In *M. sanctaegrucis* the dactylus bears only 2 spines, and the lateral exopodal armature (absent in *M. texana*) consists of 1 plumose seta.

The fifth pereopod (Fig. 19) has a relatively short second exopodite segment, armed with 5 plumose setae (6 in *M. sanctaegrucis*). The endopodal propodus bears 16, and the dactylus 8 club-shaped spines (6 and 2 spines, respectively, in *M. sanctaegrucis*).

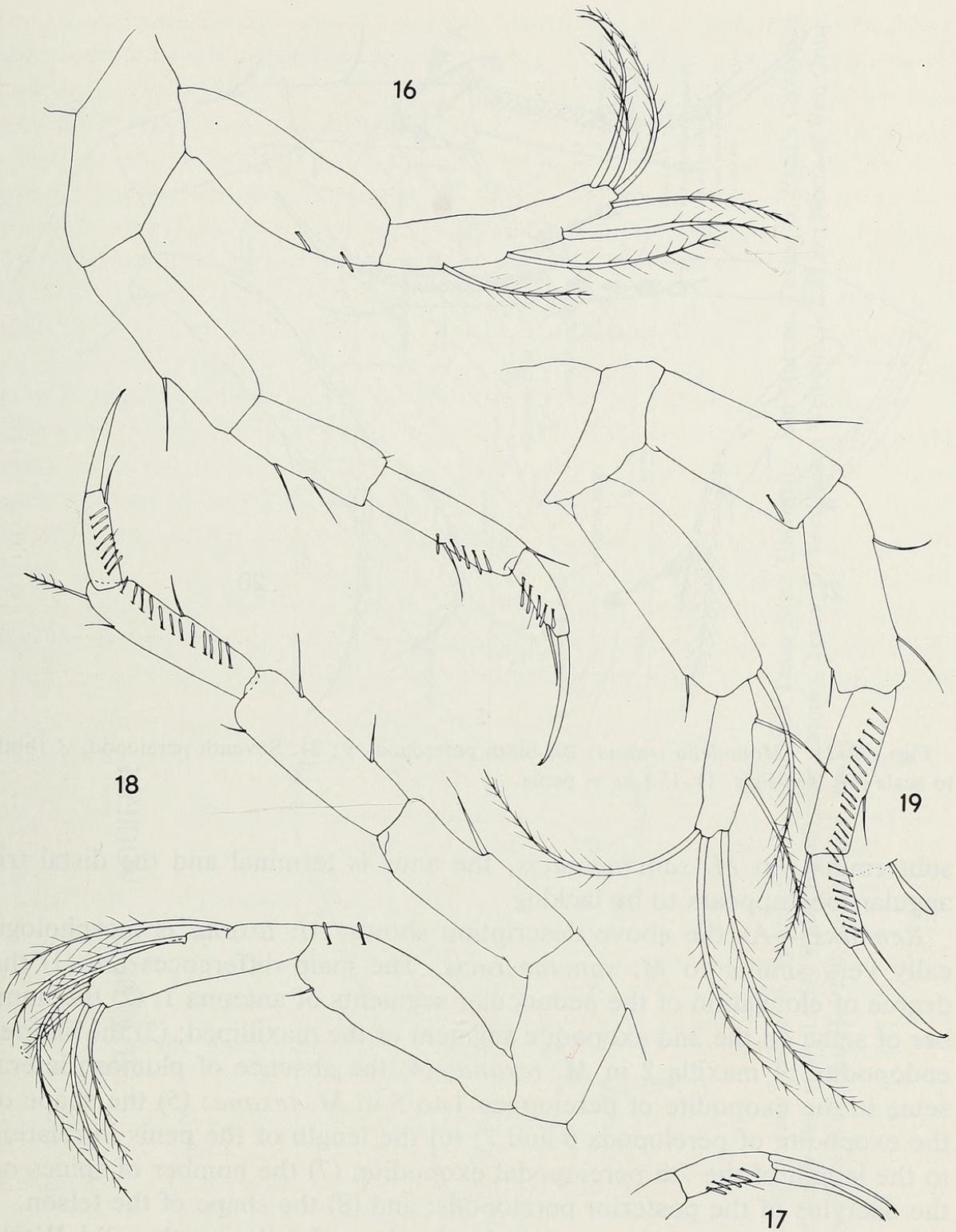
In the sixth pereopod (Fig. 20), the exopodite is reduced to a single segment, armed with 4 medial club-shaped spines, 2 medio-subdistal plumose setae, 1 distal rudimentary seta, and 1 lateral rudimentary seta. The distal and subdistal elements are placed on a low projection ("socle"), which is lacking in *M. sanctaegrucis*. The endopodal carpus bears usually 2, sometimes 1, medial setae. The propodus bears 19–20, the dactylus 5–6 club-shaped spines (in *M. sanctaegrucis* the dactylus bears only 2 spines).

The seventh pereopod (Fig. 21) has a thin, one-segmented exopodite, armed as in P6. The endopodal carpus bears 1 medial seta. The armature of the propodus and dactylus is as in P6. This appendage differs from that of *M. sanctaegrucis* in the presence of socles for the (sub)distal exopodal elements, and in the higher number of endopodal dactylus spines. In the male, the coxopodite carries a lateral, curved, finger-shaped appendage, the penis, which is almost as long as the exopodite (shorter in *M. sanctaegrucis*).

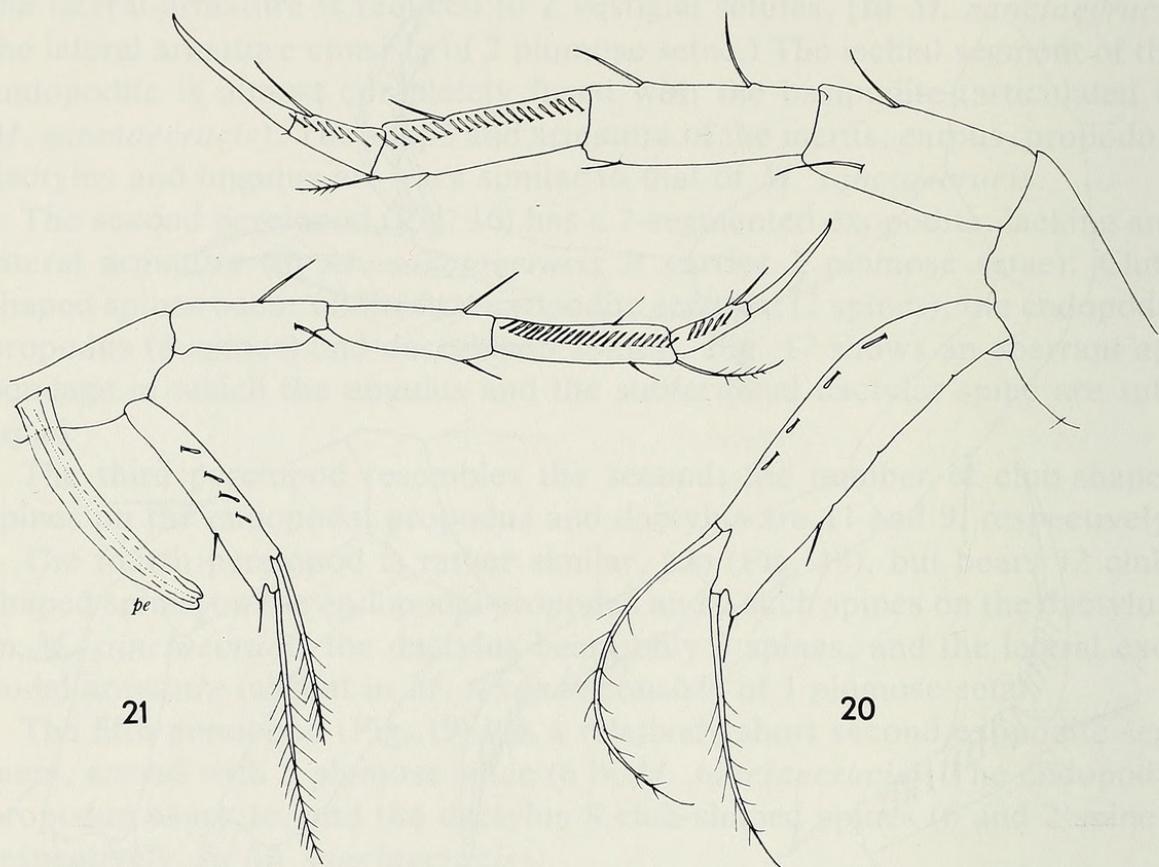
The first and second pleopods (Figs. 9, 10) are small, finger-shaped, one-segmented appendages, armed with 5 setae.

The uropod (Fig. 14) has a 2-segmented exopodite and a 1-segmented endopodite and is very similar in morphology to that of *M. sanctaegrucis*.

The telson (Fig. 15) bears 2 longer and 1 shorter spine on either side, and a triangular mid-distal lobe in between the two groups of spines. The anus is



Figs. 16–19. *Monodella texana*: 16, Second pereiopod, ♀; 17, Endopodal dactylus of aberrant second pereiopod, ♀; 18, Fourth pereiopod, ♀; 19, Fifth pereiopod, ♀. (All to scale AB, see Figs. 11–15.)



Figs. 20–21. *Monodella texana*: 20, Sixth pereopod, ♀; 21, Seventh pereopod, ♂ (both to scale AB, see Figs. 11–15.) *pe* = penis.

subterminal. In *M. sanctaerucis*, the anus is terminal and the distal triangular lobe appears to be lacking.

Remarks.—As the above description shows, *M. texana* is morphologically very similar to *M. sanctaerucis*. The main differences are (1) the degree of elongation of the peduncular segments of antenna 1; (2) the number of setae on the 2nd exopodite segment of the maxilliped; (3) the shorter endopodite of maxilla 2 in *M. texana*; (4) the absence of plumose lateral setae in the exopodite of pereopods 1 to 5 in *M. texana*; (5) the shape of the exopodite of pereopods 6 and 7; (6) the length of the penis in relation to the length of the 7th pereopodal exopodite; (7) the number of spines on the dactylus of the posterior pereopods; and (8) the shape of the telson.

The overall resemblance, even in the finer details, to the Old World species (see, for instance, Rouch, 1965, for good illustrations of *Monodella argentarii* Stella, 1951) is likewise striking.

In conclusion, it can be said that the members of the genus *Monodella*, notwithstanding their occurrence in several isolated areas of the world, have retained a remarkable morphological uniformity. So far, no marine representatives referable to *Monodella* are known, although marine Thermosbaenacea belonging to other genera have recently been found in the West

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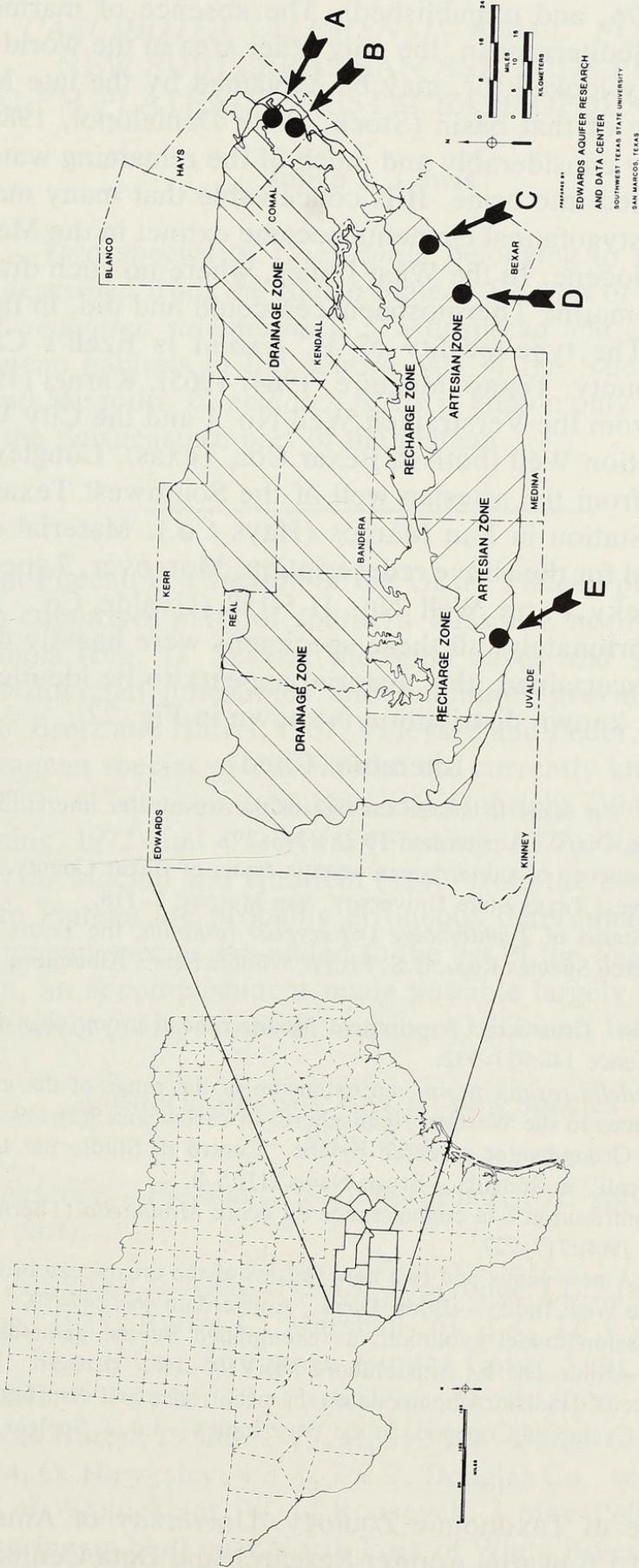


Fig. 22. Distribution of *Monodella texana*: A, Artesian Well, Southwest Texas State University, San Marcos, Texas; B, Ezell's Cave, San Marcos, Texas; C, Artesia Pump Station Well (City Water Board), San Antonio, Texas; D, Verstraeten Well No. 1, 2.85 km North of Von Ormy, Texas; E, George Ligocky Farm Well, No. H-5-158, near Uvalde, Texas.

Indies (Stock, 1976, and unpublished). The absence of marine Thermosbaenacea in the Mediterranean, the only other area in the world where they have been actively looked for, may be explained by the late Miocene hydrographic history of that basin (Stock, 1980; Danielopol, 1980). The sea level dropped very considerably and much of the remaining water was temporarily transformed into brine. It is conceivable that many marine ancestors of the actual stygofaunal elements became extinct in the Mediterranean during the late Miocene. In the West Indies, where no such drastic salinity crisis took place, marine Thermosbaenacea could and did, in fact, survive.

Distribution.—The type-locality of *M. texana* is Ezell's Cave, in San Marcos, Hays County, Texas (Maguire, 1964, 1965). Karnei (1978) records the species also from the Verstraeten Well No. 1 and the City Water Board Artesia Pump Station Well (both in Bexar Co., Texas). Longley (1978) records the species from the artesian well of the Southwest Texas State University Aquatic Station in San Marcos (Hays Co.). Material of the latter well has been used for the above redescription. Moreover, 7 specimens from the George Ligocky Farm Well No. H-5-158 (Uvalde Co., Texas) were studied, but, unfortunately, all these specimens were heavily damaged. As far as could be ascertained, this material appears to be identical to that of San Marcos. The known distribution is shown in Fig. 22.

Literature Cited

- Danielopol, D. 1980. An essay to assess the age of the freshwater interstitial Ostracoda of Europe.—*Bijdr. Dierk.*, Amsterdam 50(2):V243–291.
- Karnei, H. 1978. A survey of subterranean aquatic fauna of Bexar County, Texas.—M.Sc. Thesis, Southwest Texas State University, San Marcos: 1–118.
- Longley, G. 1978. Status of *Typhlomolge* (= *Eurycea*) *rathbuni*, the Texas Blind Salamander.—*Endangered Species Rep.*, U.S. Fish & Wildlife Serv., Albuquerque, New Mexico 2:i–vi, 1–45.
- Maguire, B., Jr. 1964. Crustacea: A primitive Mediterranean group also occurs in North America.—*Science* 146:931–932.
- . 1965. *Monodella texana* n. sp., an extension of the range of the crustacean order Thermosbaenacea to the Western Hemisphere.—*Crustaceana* 9(2):149–154, pl. III.
- Messana, G. 1979. Groundwater research by the "Centro di Studio per la Faunistica ed Ecologia tropicali" in Somalia.—*Stygo News* 2(2):5–8.
- Rouch, R. 1965. Contribution à la connaissance du genre *Monodella* (Thermosbaenacés).—*Ann. Spéléol.* 19(4):717–727.
- Stock, H. H. 1976. A new genus and two new species of the crustacean order Thermosbaenacea from the West Indies.—*Bijdr. Dierk.*, Amsterdam 46(1):47–70.
- . 1980. Regression model evolution, as exemplified by the genus *Pseudoniphargus* (Amphipoda).—*Bijdr. Dierk.*, Amsterdam 50(1):V105–144.
- . The influence of Hadziid Amphipoda on the occurrence and distribution of Thermosbaenacea and Cyclopoid Copepoda in the West Indies.—*Int. J. Speleol.* 10(4) [in press].

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Stock, J H and Longley, G. 1981. "Generic Status And Distribution Of Monodella-Texana The Only Known North American Thermosbaenacean." *Proceedings of the Biological Society of Washington* 94, 569–578.

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