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# A NEW SPECIES AND TWO KNOWN SPECIES OF FREE-LIVING MARINE NEMATODES (NEMATODA: MONOPOSTHIIDAE) FROM NORTHWEST FLORIDA, U.S.A.

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**ABSTRACT** Two known free-living marine nematodes, *Monoposthioides mayri* Wieser and Hopper, 1967 and *Monoposthia hexalata* Chitwood, 1936 are re-described from sediments in St. Andrew Bay and Lake Powell, Bay County, Florida, U.S.A. One new species of free-living marine nematode, *Monoposthia baxteri* n. sp., is described from nonvegetated sediments in St. Andrew Bay, Bay County, Florida. *M. baxteri* n. sp. differs from the other members of the genus in the shape of the gubernaculum which is more similar to that of the species of *Monoposthioides* than that of *Monoposthia*.

## INTRODUCTION

According to Lorenzen (1981), the family Monoposthiidae Filipjev, 1934 contains the genera *Monoposthia* de Man, 1889; *Monoposthioides* Hopper, 1963; *Nudora* Cobb, 1920; and *Rhinema* Cobb, 1920. The Monoposthiidae are characterized by the presence of a cuticle with strong transverse striations forming annuli, and a number of longitudinal cuticular ridges that appear as V-shaped markings. Vanreusel and Vincx (1989) referred to these structures as costae. The amphids are circular and are situated on the second annulus. The buccal cavity has a well-developed dorsal tooth and may have one or more ventral teeth or denticles.

Specimens of two of the four genera of the Monoposthiidae were collected from estuarine waters in northwest Florida. The two known and one new species of free-living marine nematodes in the genera *Monoposthioides* Hopper, 1963 and *Monoposthia* de Man, 1889 re-described and described, respectively, herein were collected from subtidal sediments in St. Andrew Bay and Lake Powell, Bay County, Florida. The sediments from the collection sites in St. Andrew Bay and Lake Powell were nonvegetated fine sand and silt.

## MATERIALS AND METHODS

Sediment samples were obtained with a cylindrical core sampler to a depth of 4-10 cm, depending on the site. Nematodes were extracted from the sediment by repeated decantation. The suspended material from four washings was allowed to settle for 15-20 minutes, and the supernatant water was decanted. Nematodes were removed alive from

the settled material and fixed in hot alcohol-formalin-acetic acid or hot 4% formalin in seawater for 24 hours. Specimens were dehydrated in glycerine by gradually bringing them to 70% ethyl alcohol and glycerine (9:1) and allowing the alcohol to evaporate. Specimens were mounted in anhydrous glycerine on Cobb slides. Specimens were deposited in the Florida Nematode Collection, University of Florida, Gainesville, Florida (UFNC).

All measurements are given in  $\mu\text{m}$  unless otherwise stated, and the mean is followed by the range in parentheses. Abbreviations: l = length of body in mm. w = width at midbody. hd = head diameter at level of first annulus. cs = length of cephalic sensilla. ad = width of amphid. aa = anterior end to anterior margin of amphid. bc = length of buccal cavity. nr = anterior end to nerve ring. es = length of esophagus. t = length of tail. cw = width at cloaca. aw = width at anus. av = anterior to vulva. a, b, c, V = demanian ratios.

## TAXONOMIC ACCOUNT

(After Lorenzen, 1981)

Chromadorida Filipjev, 1929

Monoposthiidae Filipjev, 1934

*Monoposthioides* Hopper, 1963

*Monoposthioides mayri* Wieser and Hopper, 1967

Figures 1-12

**Description:** Body relatively short, broad. Cuticle coarsely annulated; annuli originate immediately posterior to cephalic sensilla; first and second annuli larger than succeeding annuli. Annuli are complete lateral to cloaca.

Costae in 12 longitudinal rows; fully developed V-shaped costae originate between annuli 10 and 20 from anterior end [(38.5(30-56) in males; 60(50-77) in females]. Apex of costae directed posteriorly then reverse to anterior direction 234.7(218-256) from anterior end in males, 319.7(301-346) in females. In males, lateral, subventral, and ventral rows of costae terminate at level of cloacal opening; remaining rows terminate immediately posterior to cloacal opening. In females, subventral and ventral rows of costae terminate at level of vulva; remaining rows terminate posterior to anal opening. Head with circle of six, small, inner labial sensilla immediately adjacent to oral opening. Circle of six papilliform outer labial sensilla and four long, setiform cephalic sensilla present. Long cervical, somatic, and caudal sensilla present as subdorsal and subventral rows on each lateral surface. Amphid circular, situated on second annulus. Buccal cavity with cyathiform anterior chamber with circle of 12 small, flap-like structures. Anterior chamber of buccal cavity elongate with cuticularized, parallel walls. Esophagus with asymmetrical peribuccal expansion; dorsal side larger. Large, muscular, bipartite, posterior, esophageal bulb present with moderately cuticularized lumen. Excretory pore not observed. Tail conical, terminal one third without annuli; spinneret and caudal glands present.

**Males (n = 6):** l = 1.15(1.01-1.28). w = 40.1(38-43). hd = 16(14-17). cs = 22(21-24). ad = 2.8(2.5-3.0). aa = 13.8(13-16). bc = 23.7(19-27). nr = 68(61-75). es = 144.2(125-155). t = 99.8(93-106). cw = 31(29-34). a = 28.6(26.6-31.6). b = 7.98(7.23-8.53). c = 12.1(10.6-15.3). Male reproductive system diorchic. Large, non-striated, precloacal process present. Spicules absent. Single, heavily cuticularized gubernaculum present, 46.6(45-48) arc, 51(48-56) chord long, arcuate with proximal flange, dorsally directed process of flange longer than ventrally directed process.

**Females (n = 3):** l = 1.15(1.11-1.20). w = 50(48-51). hd = 16.7(16-18). cs = 19.7(19-21). ad = 4.0(3.0-5.0). aa = 13.3(13-14). bc = 25.3(22-27). nr = 78(72-82). es = 157(144-173). t = 94(90-101). aw = 25.7(24-27). av = 979(949-1020). a = 22.9(21.8-23.5). b = 7.33(6.94-7.85). c = 12.2(11.9-12.6). V = 85.3%(85-86). Female reproductive system monodelphic, prodelphic, ovary reflexed. Vulva with cuticular flap.

**Specimens:** Males, UFNC A157, A158, A159; females, UFNC A160.

**Locality:** St. Andrew Bay, Bay County, Florida (30°08'33"N, 85°42'43"W). Nonvegetated fine sand and silt.

**Remarks:** The specimens described above are considered to be *Monoposthioides mayri* based on the shape and size of the gubernaculum of the male, the enlarged second annulus, and the shape and size of the amphid. In the original description of *M. mayri*, the buccal cavity was

described as having a single, large, dorsal tooth and small subventral projections. These projections are part of three circles of small denticles that are not easily observed. The presence of inner labial sensilla was not mentioned in the original description or figured on the drawings. The male specimens described above differ from the original description of the male in that the costae reverse at a greater distance from the anterior end [234.7(218-256) vs. 140] and the cephalic sensilla are longer [22(21-24) vs. 17]. The female specimens described above differ from the original description of the females of *M. mayri* in that the "V" value is less than that of *M. mayri* (85-86% vs. 90-92%) and the costae reverse somewhat more posteriorly than in *M. mayri* (301-346 vs. 240-250 from the anterior end).

***Monoposthia* de Man, 1889**

***Monoposthia baxteri* n. sp.**

**Figures 13-21**

**Description:** Body relatively short, broad. Cuticle coarsely annulated; second annulus with anterior bulge at location of amphid. Annuli incomplete subventrally and ventrally in cloacal region of male. Costae in eight longitudinal rows; dorsal, subdorsal, subventral, and ventral rows originate on third annulus, lateral rows originate on annulus 13-15. Apex of costae directed posteriorly, reverse direction on annulus 83-88 from anterior end (posterior to esophageal bulb) in males; costae did not reverse in single female examined. In males, laterals, subventrals, and ventral rows of costae terminate at about level of cloacal opening; subdorsals and dorsal rows of costae terminate posterior to cloacal opening. In female, laterals, subventrals, and ventral rows of costae terminate at vulva; subdorsals and dorsal rows terminate immediately posterior to anal opening. Head with circle of six, setiform, inner labial sensilla immediately adjacent to oral opening. Circle of six, setiform, outer labial sensilla and circle of four, long, setiform cephalic sensilla present. Amphid circular; situated on second annulus. Long cervical, somatic, and caudal setiform sensilla present as subventral and subdorsal rows on each lateral surface. Buccal cavity with anterior cyathiform chamber with 12 flap-like structures. Large, heavily cuticularized, dorsal tooth and three circles of denticles present. Circles of denticles broken subdorsally and dorsally. Posterior chamber of buccal cavity elongate with cuticularized, parallel walls. Peribuccal region of esophagus expanded, asymmetrical; dorsal side larger. Large, muscular, bipartite, esophageal bulb with weakly cuticularized lumen present posteriorly. Excretory pore not observed. Tail conical, terminal one third without annuli; spinneret and caudal glands present.

**Males (n = 2):** l = 1.05(1.04-1.06). w = 56(54-58). hd = 22(22-22). cs = 26.5(26-27). ad = 3.0(3.0-3.0). aa =

10(10-10).  $bc = 30.5(29-32)$ .  $nr = 81(80-82)$ .  $es = 157.5(155-160)$ .  $cw = 36(35-37)$ .  $t = 55(54-56)$ .  $a = 18.8(18.3-19.3)$ .  $b = 6.67(6.50-6.84)$ .  $c = 11.6(11.4-11.8)$ . Reproductive system diorchic. Non-striated, preloocal process present. Spicules absent. Gubernaculum large, 55(54-56) arc, 60(59-61) chord long, arcuate, thorn-shaped with inner cuticularization. Distal end expanded with ventral process longer than dorsal process. Small teeth present on ventral surface of proximal tip of gubernaculum in paratype male, not observed in holotype male. Cuticle inflated in one place on midventral surface anterior to cloaca.

**Female (n = 1):**  $l = 1.02$ .  $w = 51$ .  $hd = 18$ .  $cs = 21$ .  $ad = 4$ .  $aa = 11$ .  $bc = 29$ .  $nr = 77$ .  $es = 144$ .  $aw = 27$ .  $t = 83$ .  $av = 914$ .  $a = 20.0$ .  $b = 7.08$ .  $c = 12.3$ .  $V = 90\%$ . Reproductive system monodelphic, prodelpic, ovary reflexed. Vulva with cuticular flap.

**Specimens:** Male, holotype, UFNC A166; male, paratype, UFNC A168; female, allotype, UFNC A167.

**Locality:** St. Andrew Bay, Bay County, Florida (30°08'33"N, 85°42'43"W). Nonvegetated fine sand and silt.

**Remarks:** Hopper (1963) erected the genus *Monoposthioides* to accommodate the species *Monoposthioides anonoposthia* Hopper, 1963 that was collected from the northern coast of the Gulf of Mexico. The genus *Monoposthioides* can be differentiated from the genera *Nudora*, *Rhinema* and *Monoposthia* in that the costae originate about midlevel of esophagus in *Monoposthioides* rather than on the second or third annulus as in the other three genera. In addition, *Monoposthioides* differs from *Nudora* and *Rhinema* in the absence of spicules.

*Monoposthioides* is most similar to the genus *Monoposthia* in that the spicules are absent and a single well-developed gubernaculum is present. Hopper (1963) differentiated *Monoposthioides* from *Monoposthia* on the basis that the costae originate much more posteriorly in *Monoposthioides*, the gubernaculum of the male in *Monoposthioides* is relatively larger and more arcuate with a large, ventrally directed process proximally and long spine distally, and the reproductive system of the male in *Monoposthioides* is diorchic. Wieser and Hopper (1967) emended the diagnosis of *Monoposthioides* to include the species *Monoposthioides mayri* Wieser and Hopper, 1967. In *M. mayri*, the long, distal spine of the gubernaculum is absent and the dorsal process of the proximal end of the gubernaculum is longer than the ventral process.

The diorchic male reproductive system cannot be used as a differentiating character of *Monoposthioides*, because diorchic males of known species of *Monoposthia* have been described by Kito (1981) and Vanreusel and Vincx (1989). Platt and Warwick (1988) use the diorchic condition of the male reproductive system as a character of the family

Monoposthiidae. Therefore, the genus *Monoposthioides* currently differs from *Monoposthia* in that the costae originate more posteriorly, and the gubernaculum is relatively larger and more arcuate in *Monoposthioides*.

*Monoposthia baxteri* n. sp. has characters of both *Monoposthia* and *Monoposthioides*. It is similar to *Monoposthia* in that the costae begin on the third annulus and to *Monoposthioides* in that the gubernaculum is relatively large, arcuate, and the proximal end has a large ventral process. *Monoposthia baxteri* n. sp. is placed in the genus *Monoposthia* based on the origin of the costae on the third annulus.

*Monoposthia baxteri* n. sp. is differentiated from all other members of the genus *Monoposthia* on the basis of the shape of the gubernaculum. It is the only species with a large, arcuate gubernaculum with an expanded proximal end with the ventral process longer than the dorsal process.

**Etymology:** *Monoposthia baxteri* n. sp. is named for Dr. George Baxter, Professor Emeritus, University of Wyoming, in recognition of his work and teaching in aquatic biology.

#### *Monoposthia hexalata* Chitwood, 1936 Figures 22-29

**Description:** Body relatively short, broad. Cuticle coarsely annulated. Second annulus not significantly larger than succeeding annuli but with an anterior bulge where the amphid is located. Annuli complete laterally and ventrally in cloacal region of male, but these annuli are not as distinct as the surrounding annuli. Costae in six longitudinal rows; originate on third annulus. Apex of costae directed posteriorly, reverse direction immediately posterior to esophageal bulb in males, immediately anterior to vulva in females. In males, subventral and ventral rows of costae terminate immediately anterior to cloaca; remaining rows terminate posterior to cloaca. In females, subventral and ventral rows of costae terminate immediately anterior to vulva; remaining rows terminate at or near last annulus on tail. Head with circle of six setiform inner labial sensilla immediately adjacent to oral opening. Circle of six setiform outer labial sensilla and four long, setiform, cephalic sensilla present. Amphid circular, situated on second annulus. Cervical, somatic, and caudal setiform sensilla present as subdorsal and subventral rows on each lateral surface. Buccal cavity with anterior cyathiform chamber with 12 flap-like structures. Anterior chamber of buccal cavity with single, large, heavily cuticularized dorsal tooth and pair of small, subventral, denticles; circles of denticles not observed. Posterior chamber of buccal cavity elongate with cuticularized, parallel walls. Peribuccal region of esophagus expanded, asymmetrical; dorsal side larger. Large, muscular, bipartite, esophageal bulb with weakly

cuticularized lumen present posteriorly. Excretory pore not observed. Tail conical; terminal one third without annuli; spinneret and caudal glands present.

**Males (n = 5):** l = 0.963(0.831-1.06). w = 48.4(43-53). hd = 18.6(17-19). cs = 24.8(22-26). ad = 3.1(3.0-3.2). aa = 7.4(7-10). bc = 25.6(22-29). nr = 77.6(67-86). es = 148.8(133-165). cw = 36.6(24-43). t = 92.2(80-99). a = 20.0(15.7-22.1). b = 6.47(6.11-6.82). c = 10.6(8.4-13.0). Reproductive system diorchic. Spicules absent. Gubernaculum claw-shaped 39.2(34-43) arc, 42.4(36-47) chord long, with proximal expansion with dorsally directed process, internal cuticularization, and arcuate distal part. Single large, subventral, papilliform, precloacal sensillum present on each lateral surface. Cuticle inflated midventrally in two places anterior to cloaca, particularly evident when tail is bent ventrally.

**Female (n = 1):** l = 0.945. w = 67. hd = 22. cs = 19. ad = 5. aa = 11. bc = 29. nr = 80. es = 174. aw = 26. t = 82. av = 788. a = 14.1. b = 5.43. c = 11.5. V = 83%. Reproductive system monodelphic, prodelphic, ovary reflexed. Vulva with cuticularized flap.

**Specimens:** Males, UFNC A161, A162, A163, A164; one female, UFNC A165.

**Locality:** St. Andrew Bay, Bay County, Florida (30°08'33"N, 85°42'43"W) and Lake Powell, Bay County, Florida (30°16'45"N, 85° 58'50"W). Nonvegetated fine sand and silt.

**Remarks:** The specimens described above agree closely with the description and drawings of *M. hexalata* provided in the original description given by Chitwood (1936). They differ from the original description in that there is a pair of precloacal papillae in the males that were not mentioned or figured in the original description. Chitwood (1936) describes and figures (Figure 2E) a circle of inner labial sensilla immediately adjacent to the oral opening but did not describe the circle of flap-like structures.

#### Key to the Species of the Genus *Monoposthia* De Man, 1889 Based on Males

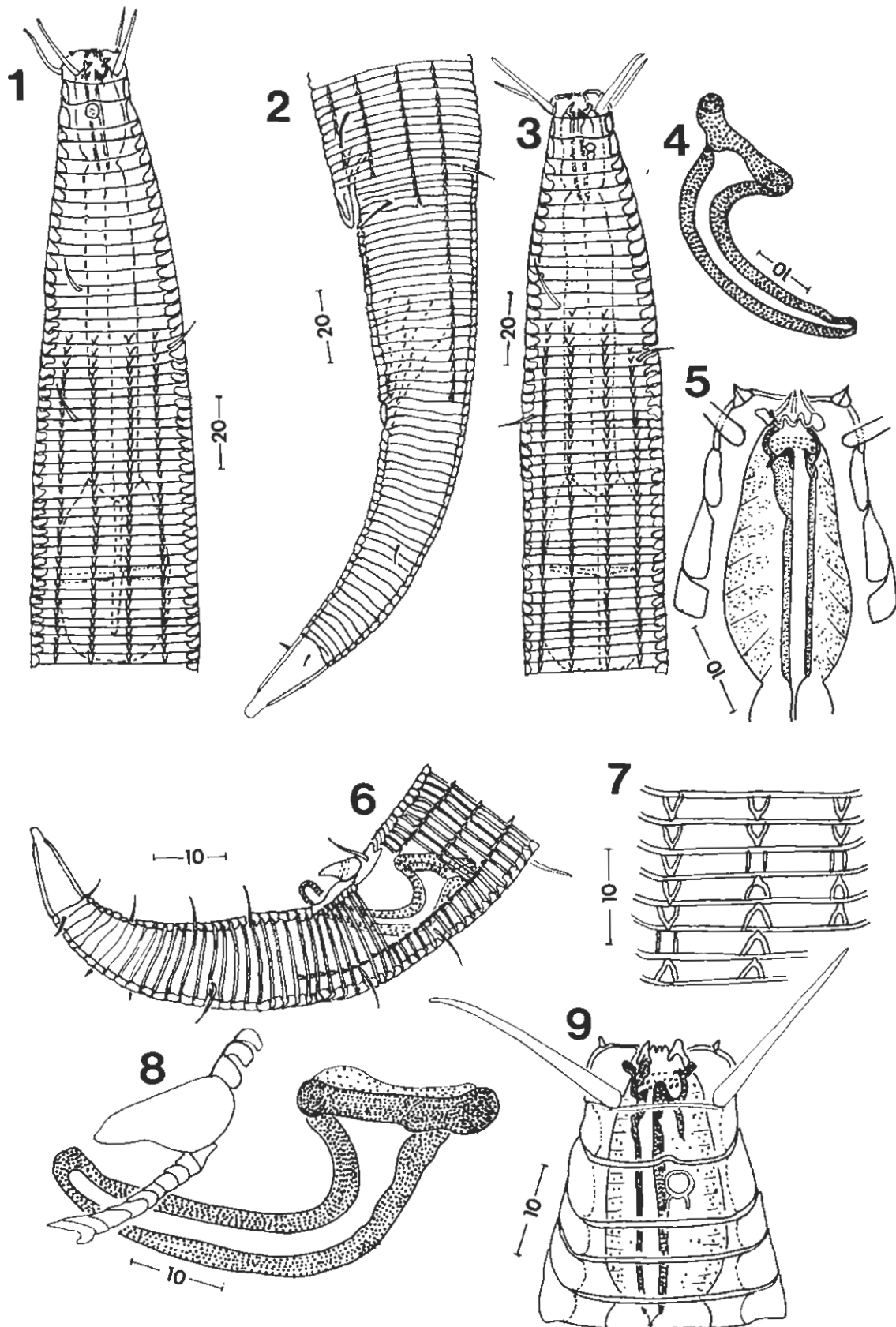
Wieser and Hopper (1967) presented a key to the species of the genus *Monoposthia* in which the second annulus was distinctly larger than succeeding annuli. The key included *Monoposthia thorakista* Schulz, 1935.

Gerlach and Riemann (1974) listed the species of *Monoposthia*, transferred *M. thorakista* to the genus *Nudora* Cobb, 1920, and listed the following species of the genus *Monoposthia* as valid: *M. arctica* Allgen, 1954; *M. costata* (Bastian, 1865) De Man, 1889; *M. desmodoroides* Allgen, 1959; *M. duodecimalata* Chitwood, 1936; *M. falklandiae* Allgen, 1959; *M. grahami* Allgen, 1959; *M. hexalata* Chitwood, 1936; *M. latiannulata* Platonova, 1971; *M. mielcki* Steiner, 1916; *M. mirabilis* Schulz, 1932; and *M. mielcki* Steiner, 1916; *M. mirabilis* Schulz, 1932; and *M. paramediterranea* Allgen, 1959. The genus also includes *Monoposthia octalata* Gal'tsova, 1976 from the White Sea.

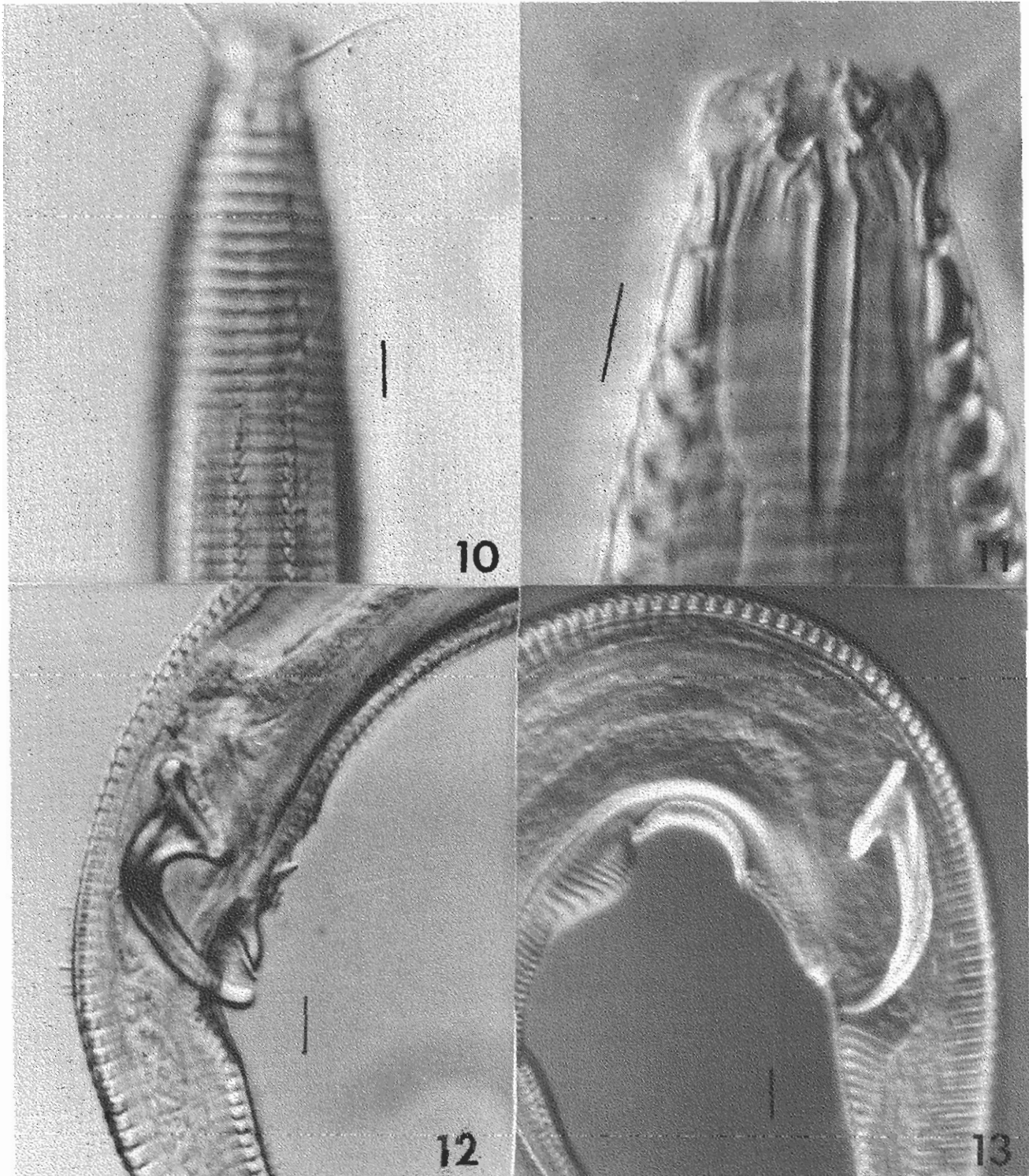
Examination of the original descriptions of the above listed species revealed that the following species of *Monoposthia* should be considered *species inquirenda* because only the female is known for some of the species or, if males are known, probably belong in the genus *Nudora* because of the presence of spicules and a gubernaculum: *M. arctica* Allgen, 1954; *M. desmodoroides* Allgen, 1959; *M. falklandiae* Allgen, 1959; *M. grahami* Allgen, 1959; *M. paramediterranea* Allgen, 1959.

In the following key to the species of the genus *Monoposthia*, the part of the key involving those species with an enlarged second annulus is modified from that given by Wieser and Hopper (1967) to exclude *M. thorakista*.

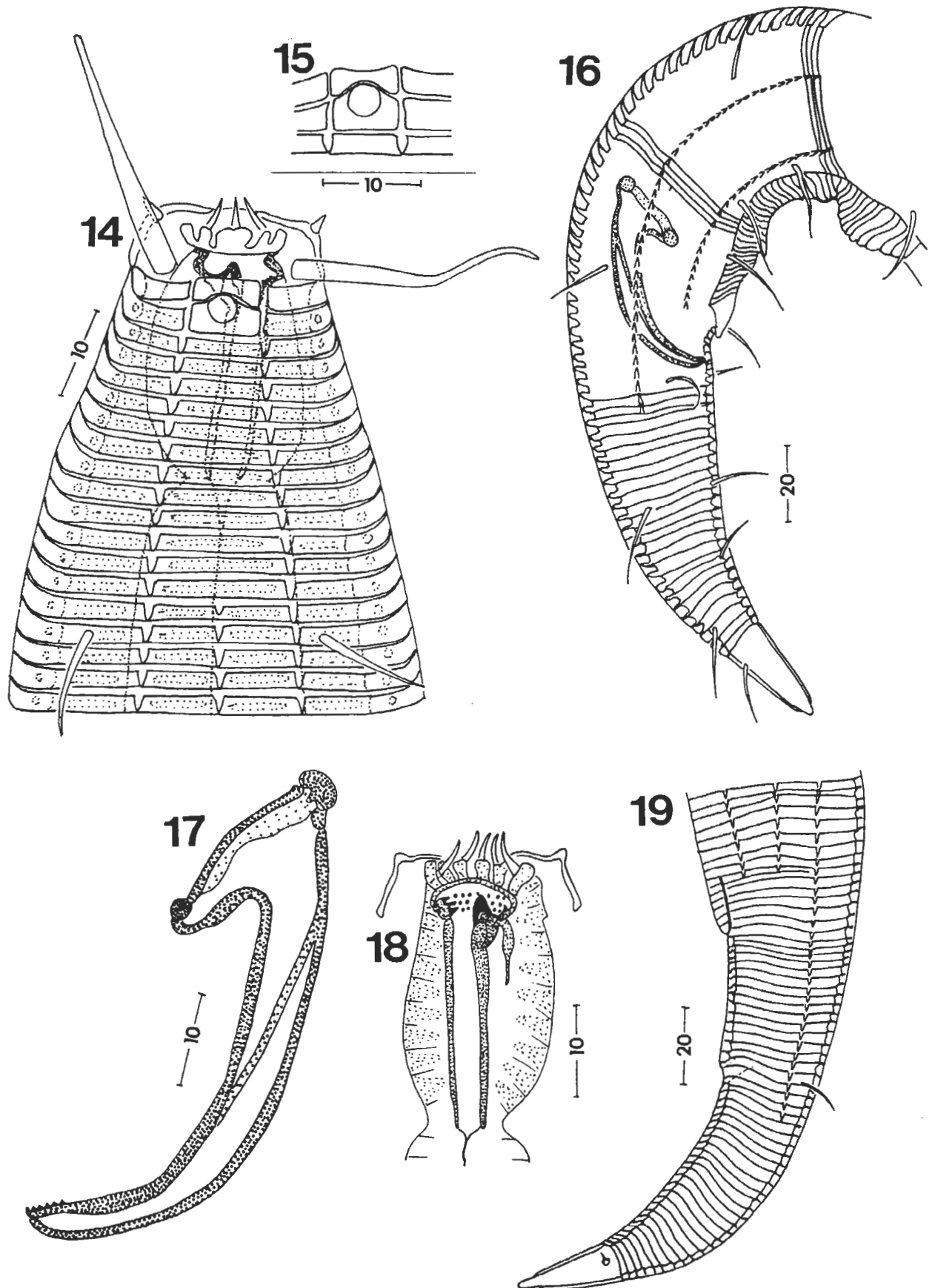
1. Second annulus distinctly larger than succeeding annuli ..... 2  
Second annulus not distinctly larger than succeeding annuli ..... 4
- 2(1). Cuticle with 12 longitudinal rows of costae ..... *Monoposthia duodecimalata* Chitwood, 1936  
Cuticle with 6 longitudinal rows of costae ..... 3
- 3(2). Cephalic sensilla less than 0.5 head diameter long; amphids about 0.33 of corresponding body diameter wide .....  
..... *Monoposthia mielcki* Steiner, 1916  
Cephalic sensilla about 1.0 head diameter long; amphids about 0.17 of corresponding body diameter wide  
..... *Monoposthia mirabilis* Schulz, 1932
- 4(1). Cephalic sensilla absent ..... *Monoposthia latiannulata* Platonova, 1971  
Cephalic sensilla present ..... 5
- 5(4). Cuticle with 10-20 longitudinal rows of costae ..... *Monoposthia costata* (Bastian, 1865)  
Cuticle with 6 or 8 longitudinal rows of costae ..... 6
- 6(5). Cuticle with 6 longitudinal rows of costae ..... *Monoposthia hexalata* Chitwood, 1936  
Cuticle with 8 longitudinal rows of costae ..... 7
- 7(6). Cephalic sensilla less than 1.0 head diameter long; gubernaculum 35.1  $\mu$ m long, broad, almost straight with curved distal part and dorsally directed proximal part ..... *Monoposthia octalata* Gal'tsova, 1976  
Cephalic sensilla more than 1.0 head diameter long; gubernaculum 54-56  $\mu$ m long, narrow, arcuate distal part and broad proximal part with ventrally directed process longer than dorsally directed process .....  
..... *Monoposthia baxteri* n. sp.



Figures 1-9. *Monoposthoides mayri* Wieser & Hopper, 1967. Fig. 1. Female, anterior end. Fig. 2. Female, posterior end. Fig. 3. Male, anterior end. Fig. 4. Male, gubernaculum. Fig. 5. Male, buccal cavity. Fig. 6. Male, posterior end. Fig. 7. Male, cuticle in region of reversal of costae. Fig. 8. Male, gubernaculum. Fig. 9. Male head. All scale bar values are given in  $\mu\text{m}$ .

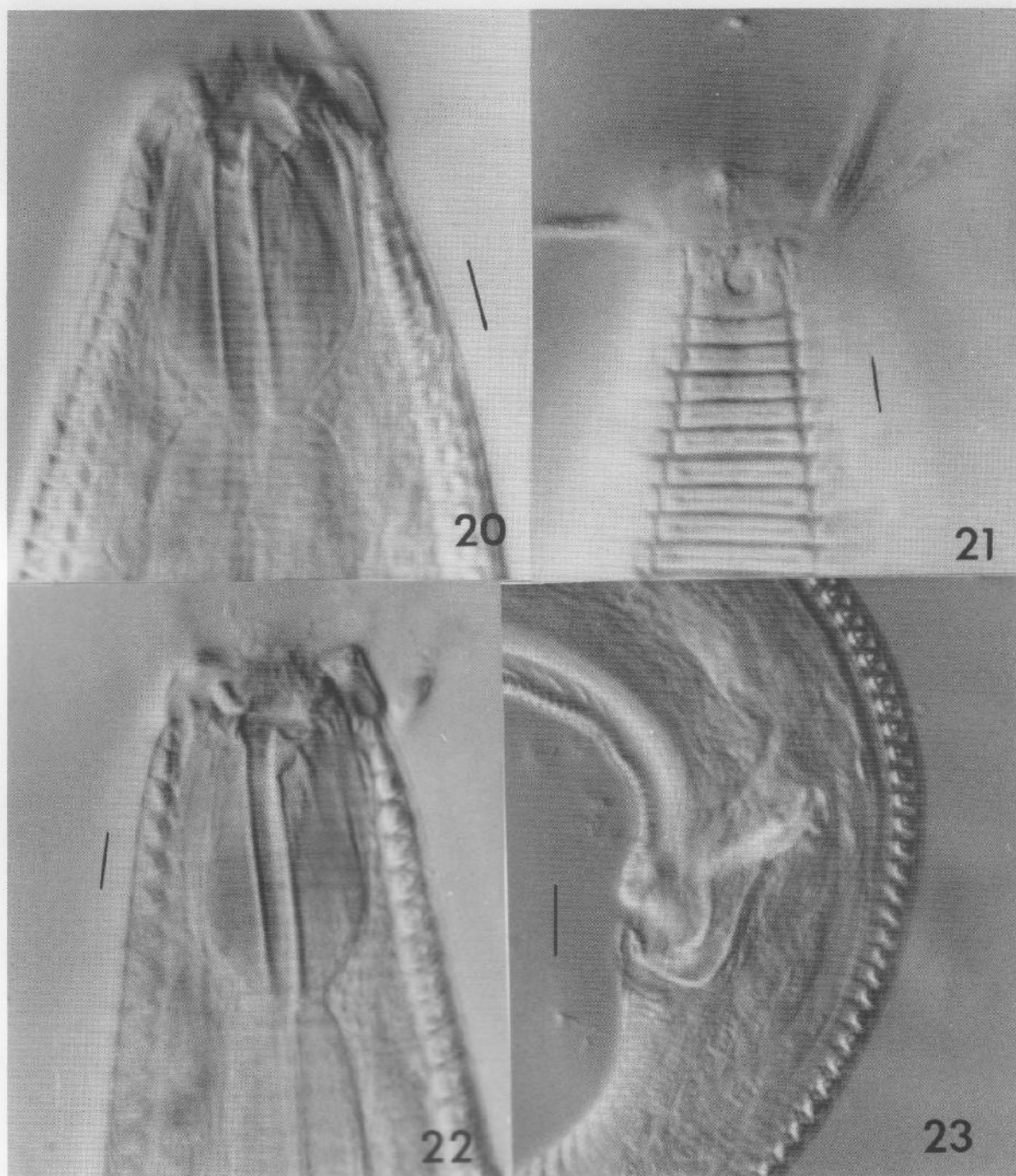


Figures 10-13. *Monoposthioides mayri*. Fig. 10. Male, anterior end with origin of costae, scale bar = 10 m. Fig. 11. Male, buccal cavity, scale bar = 5 m. Fig. 12. Male, gubernaculum, scale bar = 10 m. Fig. 13. *Monoposthia baxteri* n. sp. Fig. 13. Male, gubernaculum, scale bar = 10  $\mu$ m.

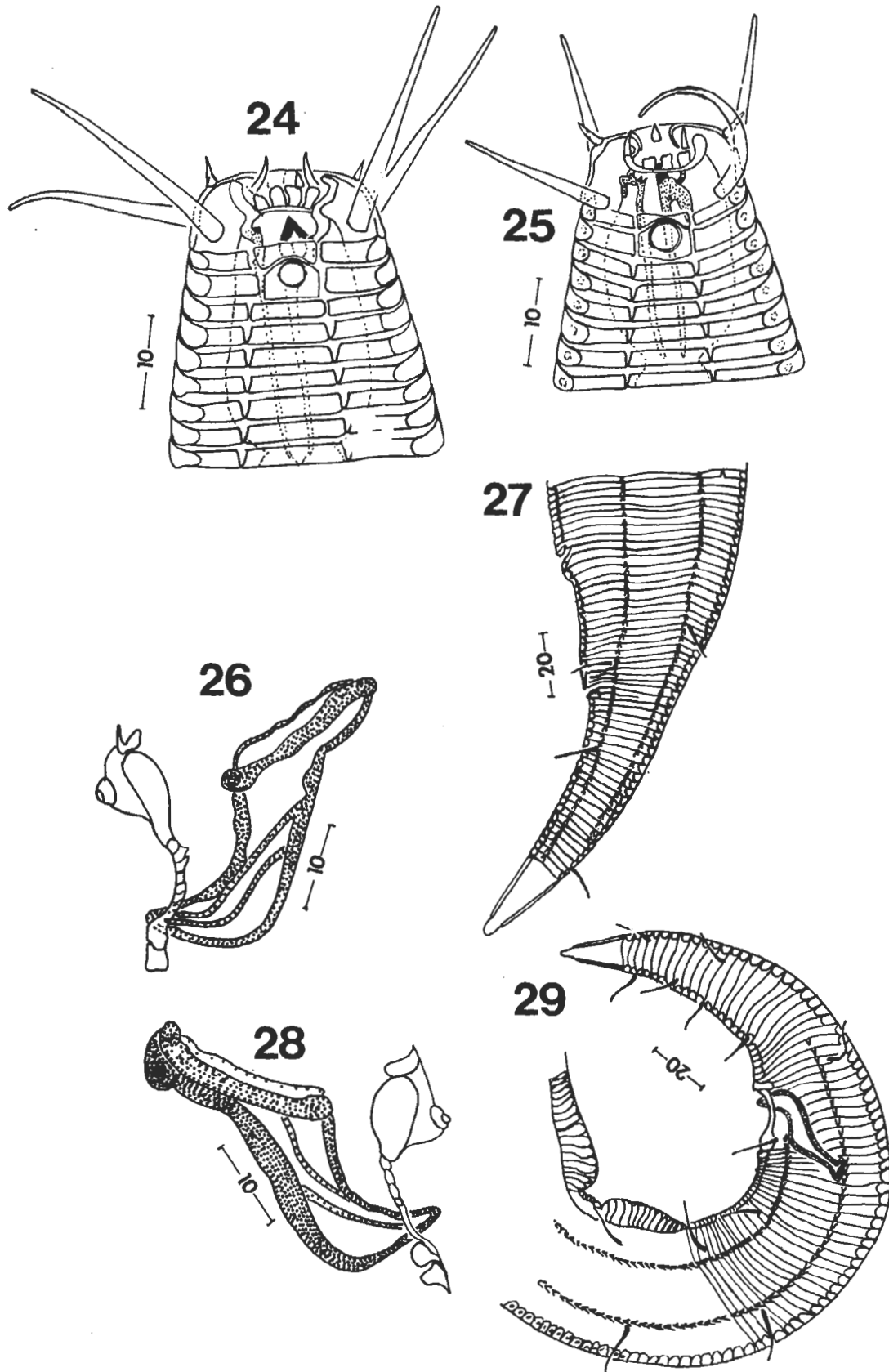


Figures 14-19. *Monoposthia baxteri* n. sp. Fig. 14. Male, head. Fig. 15. Male, first three annuli. Fig. 16. Male, posterior end. Fig. 17. Male, gubernaculum. Fig. 18. Male buccal cavity. Fig. 19. Female, posterior end. All scale bar values are given in µm.





Figures 20-21. *Monoposthia baxteri* n. sp. Fig. 20. Male, buccal cavity, scale bar = 5  $\mu$ m. Fig. 21. Male, amphid, scale bar = 5  $\mu$ m. Figures 22-23. *Monoposthia hexalata* Chitwood, 1936. Fig. 22. Male, buccal cavity, scale bar = 5  $\mu$ m. Fig. 23. Male, gubernaculum, scale bar = 10  $\mu$ m.



Figures 24-29. *Monoposthia hexalata* Chitwood, 1936. Fig. 24. Male, head. Fig. 25. Female, head. Fig. 26. Male, gubernaculum and cloacal region. Fig. 27. Female, posterior end left. Fig. 28. Male gubernaculum and cloacal region. Fig. 29. Male, posterior end. All scale bar values in  $\mu\text{m}$ .

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