

The Genus *Prochromadora* with a Redescription of *P. orleji* from a Marine Saltern in the People's Republic of China¹

A. C. TARJAN, J. S. DAVIS, AND K. B. NGUYEN²

Abstract: The genus *Prochromadora* Filipjev, 1922 comprising nine species is reviewed and a key is presented. Salient diagnostic characters of the genus are a single, large, solid dorsal tooth and a cuticle showing transverse rows of homogenous punctations that extend around the body without intervening lateral differentiation. A redescription and drawings of *P. orleji* from a solar saltworks in Qingdao, Shandong, the People's Republic of China, are presented.

Keywords: marine nematode, marine saltern, nematode, morphology, People's Republic of China, *Prochromadora*, *P. argentinensis*, *P. asupplementa*, *P. bulbosa*, *P. exigua*, *P. magna*, *P. megodonta*, *P. orleji*, *P. spitzbergensis*, *P. trisupplementa*.

Although knowledge of nematodes from marine and brackish waters is well documented from many locations (13), nematodes from hypersaline habitats have received little attention. The few hypersaline habitats studied include inland salt lakes (5,25), the salinity of which may reach 123 ppt (7,19,22), and the ponds of seaside salterns (solar saltworks) in which seawater is evaporated to produce sodium chloride. In the salterns, nematodes have been reported from saltworks on the coast of the Black Sea (3,11) and the Bahamas (4). In several ecological studies concerned with solar saltworks, only the occurrence of nematodes, not their identity, was acknowledged (1,2).

In this paper, in addition to reviewing the genus, we report on the morphology and taxonomy of *Prochromadora orleji* (de Man, 1880) Filipjev, 1922 collected from the uppermost 5–50-mm bottom sediments among the bases and roots of the seagrass *Ruppia* sp. in ponds of a solar saltworks whose salinity measured 70 ppt, a value representing twice that of the total dissolved solids of seawater.

SYSTEMATICS

Chromadoridae Filipjev, 1917

Chromadorinae Filipjev, 1917

Prochromadora Filipjev, 1922

The genus *Prochromadora* was established in 1922 by Filipjev (8) with the type species *P. megodonta* from the Black Sea. The genus was characterized by distinctive ornamentation of the annules, which were indistinguishable on the lateral sides, and by the massive, sclerotized, solid dorsal tooth. In 1930, Filipjev (9) revised the genus and transferred three species from the genus *Chromadora* to *Prochromadora*, namely *P. orleji* (de Man, 1880), *P. erythrophthalma* (Schneider, 1906), and *P. minor* (Cobb, 1894). The last two species later were placed in the genus *Chromadorina* by Wieser (24) who also included in the genus *Prochromadora* *P. exigua* (syn. *Chromadora exigua* Ditlevsen, 1928) and *P. magna* (syn. *Chromadorita magna* Schulz, 1935). Subsequently, *P. asupplementa* was described by Hopper (14), *P. trisupplementa* by Murphy (20), *P. spitzbergensis* by Gerlach (12), *P. bulbosa* by Galtsova (10), and *P. argentinensis* by Pastor de Ward (21). Currently, we recognize nine species in the genus.

Diagnosis

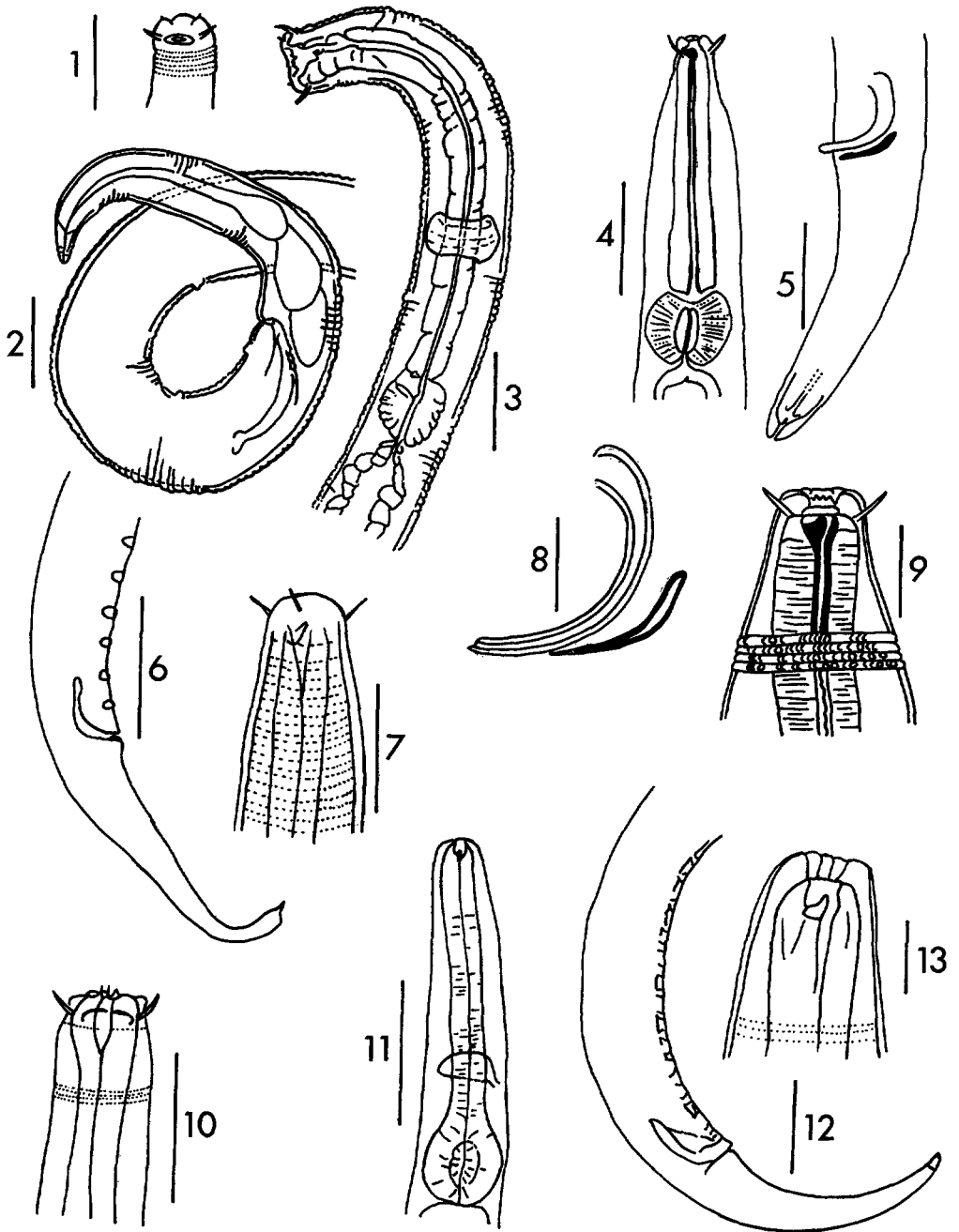
Body medium sized, attenuated at ends. Amphids usually indistinct, buccal cavity with one large solid dorsal tooth, cuticle with homogenous ornamentation that extends around the body, lateral longitudinal

Received for publication 6 August 1990.

¹ Florida Agricultural Experiment Station Journal Series No. R-00234.

² Department of Entomology and Nematology, and Department of Botany, University of Florida, Gainesville, FL 32611.

We appreciate the reviews of this manuscript by R. E. Esser, W. D. Hope, B. E. Hopper, E. J. Keppner, and Zhang Zhinan.



FIGS. 1-13. *Prochromadora argentinensis* (Figs. 1-3). 1) Male head. 2) Male tail, spicules, and supplements. 3) Anterior part of male, after Pastor de Ward (21). Bars 1-3 = 20 μ m. *Prochromadora asupplementa* (Figs. 4, 5, 8, 9). 4) Female esophageal region. 5) Male tail. 8) Male spicules and gubernaculum. 9) Female head, after Hopper (14). Bars 4, 5 = 30 μ m, bars 8, 9 = 10 μ m. *Prochromadora exigua* (Figs. 6, 7). 6) Male posterior region. 7) Male head, after Ditlevsen (8). Bar 6 = 50 μ m, bar 7 = 25 μ m. 10) *Prochromadora magna*. Female anterior end, after Schulz (23). Bar 10 = 100 μ m. *Prochromadora megadonta* (Figs. 11-13). 11) Male anterior end. 12) Male posterior end. 13) Male head, after Filipjev (8). Bar 11 = 50 μ m, bar 12 = 25 μ m, bar 13 = 10 μ m.

rows absent. Esophagus terminating in a conspicuous bulb.

Relationships

According to Hopper (15), *Prochromadora* has a single tooth and an homogenous cuticle and thus is most closely related to *Punctodora*. However, the punctations in the cuticle of *Punctodora* are larger, coarser, and spaced farther apart laterally than elsewhere on the body, whereas in *Prochromadora* the lateral punctations are similar to those elsewhere on the body. Wieser (24) lists *Prochromadora* as being similar to *Chromadorina* in general appearance, but the latter genus has three solid teeth as compared to the single tooth of *Prochromadora*. *Chromadora* Bastian, 1865 likewise appears close to *Prochromadora* but differs in having four longitudinal lateral rows of markings and three solid teeth.

Prochromadora argentinensis

Pastor de Ward, 1984

(Figs. 1–3)

Diagnosis

The male possesses five supplements which makes it unique among males of other species in this genus. The species is closest to *P. asupplementa* Hopper, 1961 but differs by the presence of supplements, in the shape of gubernaculum, and the absence of cervical papillae.

Male ($n = 3$): L = 750 (720–800) μm ; a = 28.3 (21.2–32.3); b = 6.6 (6.3–6.7); c = 8.4 (7.6–9.0); spicule length = 34 (34–35) μm .

Female ($n = 3$): L = 807 (700–920) μm ; a = 32.6 (28.6–35.0); b = 6.5 (6.1–6.9); c = 7.7 (6.7–8.4); V = 47.6 (46.7–48.6).

Prochromadora asupplementa Hopper, 1961
(Figs. 4, 5, 8, 9)

Diagnosis

The male, as the specific epithet implies, lacks supplementary organs. One other species, *P. bulbosa* Galtsova, 1976 also does not have precloacal male supplements. The gubernaculum in the male of *P. bulbosa* dif-

fers radically from that of *P. asupplementa* in having a ventrally directed projection which is absent in *P. asupplementa*. *Prochromadora asupplementa* has a blunter tail and shorter cephalic setae than *P. bulbosa*.

Male ($n = 1$): L = 642 μm ; a = 23.3; b = 6.9; c = 7.6; spicule length = 38 μm .

Female ($n = 1$): L = 657 μm ; a = 20.2; b = 7.5; c = 7.3; V = 45.

Prochromadora bulbosa Galtsova, 1976

(Figs. 14–16)

Diagnosis

Ocelli not observed. Supplements not present. Distinctive gubernaculum with a median, ventrally directed projection overlapping the spicule.

Holotype male: L = 413 μm ; a = 15.3; b = 4.6; c = 5.1.

Paratype male ($n = 3$): L = 470–524 μm ; a = 17.4–18.2; b = 5.4–8.3; c = 5.5–6.2; spicule length = 34 μm .

Prochromadora exigua (Ditlevsen, 1928)

Wieser, 1954

syn. *Chromadora exigua* Ditlevsen, 1928

(Figs. 6, 7)

Diagnosis

Male supplements number 12 (6). Row of supplements equal to 1.5 tail lengths, no pharyngeal bulb, tail slender (24).

Male ($n = 1$): L = 970 μm ; a = 31.7; b = 6.1; c = 9.4; spicule length = 31 μm ; measured from illustration in Ditlevsen (6).

Male ($n = 1$): L = 881 μm ; a = 20.8; b = 6.8; c = 8.7; spicule length = 31 μm ; gubernaculum length = 23 μm .

Female ($n = 1$): L = 849 μm ; a = 20.1; b = 7.2; c = 7.4; V = 47; measurements from Kreis (16).

Prochromadora magna (Schulz, 1935)

Wieser, 1954

syn. *Chromadorita magna* Schulz, 1935

(Fig. 10)

Diagnosis

Female ($n = 3$): L = 2,000–2,500 μm ; a = 19.1; b = 5.0; c = 8.8–9.6; V = 53.

Male: Unknown.

Remarks

Membership of this species in *Prochromadora* is questionable. The females are extraordinarily larger than those of other species. Nevertheless, the simple massive dorsal tooth and undifferentiated cuticular ornamentation seem to justify its present position.

Prochromadora megodontia Filipjev, 1922
(Figs. 11–13)

Description

Body medium sized, attenuated toward both ends. Cuticle with series of round punctations, appearing situated between annules and becoming elongated ovals posteriorly. Head truncated, cephalic setae not observed. Vestibule with sclerotized striae 3 μm long. Esophagus not enlarged anteriorly, terminal esophageal bulb 20% the length of the esophagus. Spicule 30 μm long, curved, with strong velum. Gubernaculum probably absent.

Male ($n = 1?$): $L = 640 \mu\text{m}$; $a = 23$; $b = 6.5$; $c = 6$.

Female: Unknown.

Prochromadora orleji (De Man, 1880)
Filipjev, 1922

Description

From de Man (17,18); Figs. 17–23 after de Man (18): Body relatively robust, narrowing toward both ends. Cuticle finely annulated without lateral ornamentation, bearing transverse lines of punctations. Setae few on the anterior part of the body. Head not set off, blunt, with four short setae. Stoma with dorsal tooth. Esophagus with two pink-red ocelli at anterior end and terminating in a large round bulb. Tail terminates with a conical spinneret. Vulva at middle of body. Ovaries paired, symmetrical. Male with 13–15 supplements. Spicules slender, slightly curved, gubernaculum present.

Male and female ($n = ?$): $L = 740 \mu\text{m}$; $a = 22$ – 25 ; $b = 6.0$ – 6.5 ; $c = 8.5$ – 9 for males, 7.5 – 8.5 for females.

From Filipjev (9); Figs. 39–42 after Filipjev (9): Body fusiform. Tail with pro-

nounced spinneret. Cuticle with rows of oval punctations, undifferentiated on the lateral sides. Cephalic setae situated posteriorly at about $\frac{3}{4}$ the width of the head. Amphid stretched transversely. Buccal cavity thin walled. Dorsal tooth large and massive, appearing to be followed by one or two smaller, equal sized subventral teeth. Cervical pore (excretory pore?) at level of nerve ring. Spicules 35 μm long, with membrane. Gubernaculum 15 μm long. Preanal supplements 15, occupying a distance 2.1 times as long as the tail.

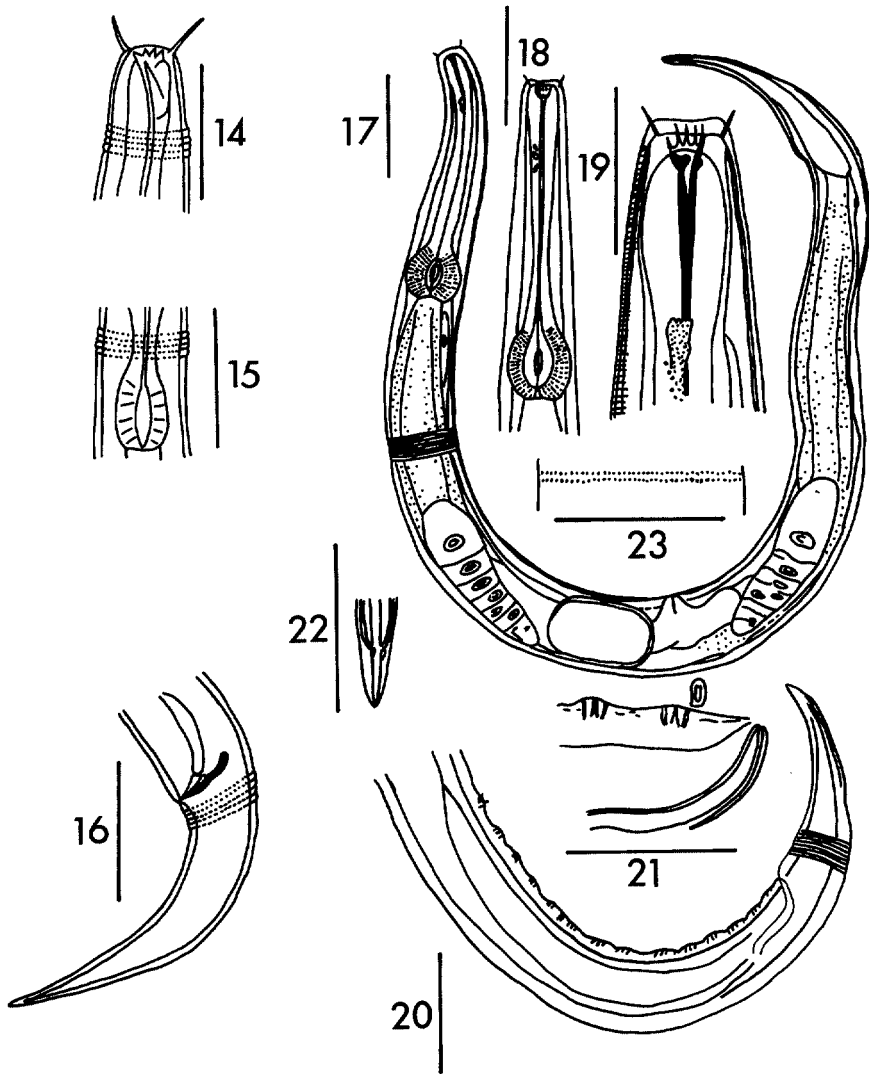
Male ($n = 1$): $L = 1,040 \mu\text{m}$; $a = 26$; $b = 7.7$; $c = 11.6$.

From Gerlach (11); Figs. 34–38 after Gerlach (11): Body plump. Cuticle finely annulated, with rows of round punctations on the annules. Large sublateral setae present. Four head setae, 6 μm long. Amphid appearing to be a spiral. Red-brown ocelli are situated 1.5 head widths from the anterior end. Buccal cavity with massive dorsal tooth. Posterior esophagus with a large spherical bulb. Spicules 31–37 μm long; gubernaculum weakly developed. Preanal supplements numbering 16 (16–18). Male tail three anal-body widths long; female tail four anal-body widths long.

Male ($n = ?$): $L = 580 \mu\text{m}$; $a = 18$; $b = 6.9$; $c = 9.7$.

Female ($n = ?$): $L = 567 \mu\text{m}$; $a = 16$; $b = 6.4$; $c = 7$; $V = 44$.

Emended, based on specimens from Qingdao, China; Figs. 24–33: Body plump (Fig. 28). Cuticle finely annulated and showing characteristic ornamentation, particularly prominent in cervical area (Fig. 29). Head truncated with four sublateral cephalic setae (Figs. 24, 30). Amphid not observed. Excretory pore indistinct, in posterior cervical region when observed. Ocelli appear as clumped granules of chromatin about 2.5 head widths below oral opening, close to esophageal lumen. The granules usually continue as a string posteriorly from the main grouping (Figs. 24, 27). Esophago-intestinal valve (cardia) thin, flattened, almost imperceptibly discoid. Female amphidelphic, gonads reflexed; vulva protruding on mature females (Fig. 25).



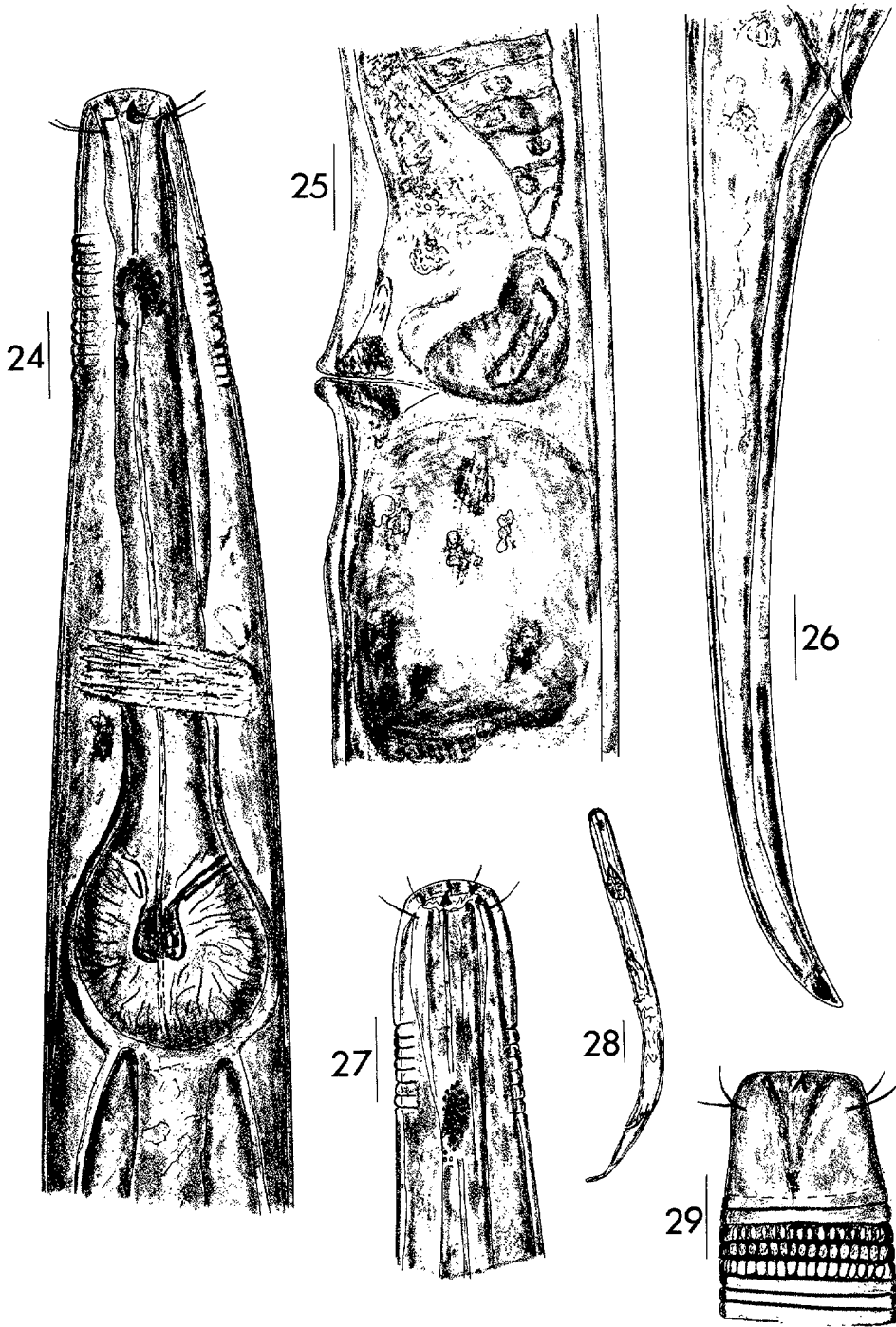
FIGS. 14-23. *Prochromadora bulbosa* (Figs. 14-16). 14) Male head. 15) Posterior part of male esophagus. 16) Male posterior region, after Galtsova (10). Bars 14-16 = 20 μ m. *Chromadora orleji*, after De Man (18) (Figs. 17-23). 17) Female. 18) Anterior end. 19) Head end in lateral view. 20) Male posterior end. 21) Spicules with two preanal papillae; above, ventral view of a papilla. 22) Tail terminus. 23) Two annular rings greatly enlarged. Bars 17, 18, 20 = 50 μ m; bars 19, 21-23 = 25 μ m.

Testis single. Supplements in ventral view shaped like rectangular ring (Fig. 32). Spicule ends showing oval openings, appearing to be divided into two chambers (Fig. 33). Spicular velum prominent, situated immediately anterior to, and in the curve of, the spicules (Fig. 31). Gubernaculum simple, slightly bent, rod-like in structure, showing two horn-like projections in ventral view (Fig. 32). Caudal glands present,

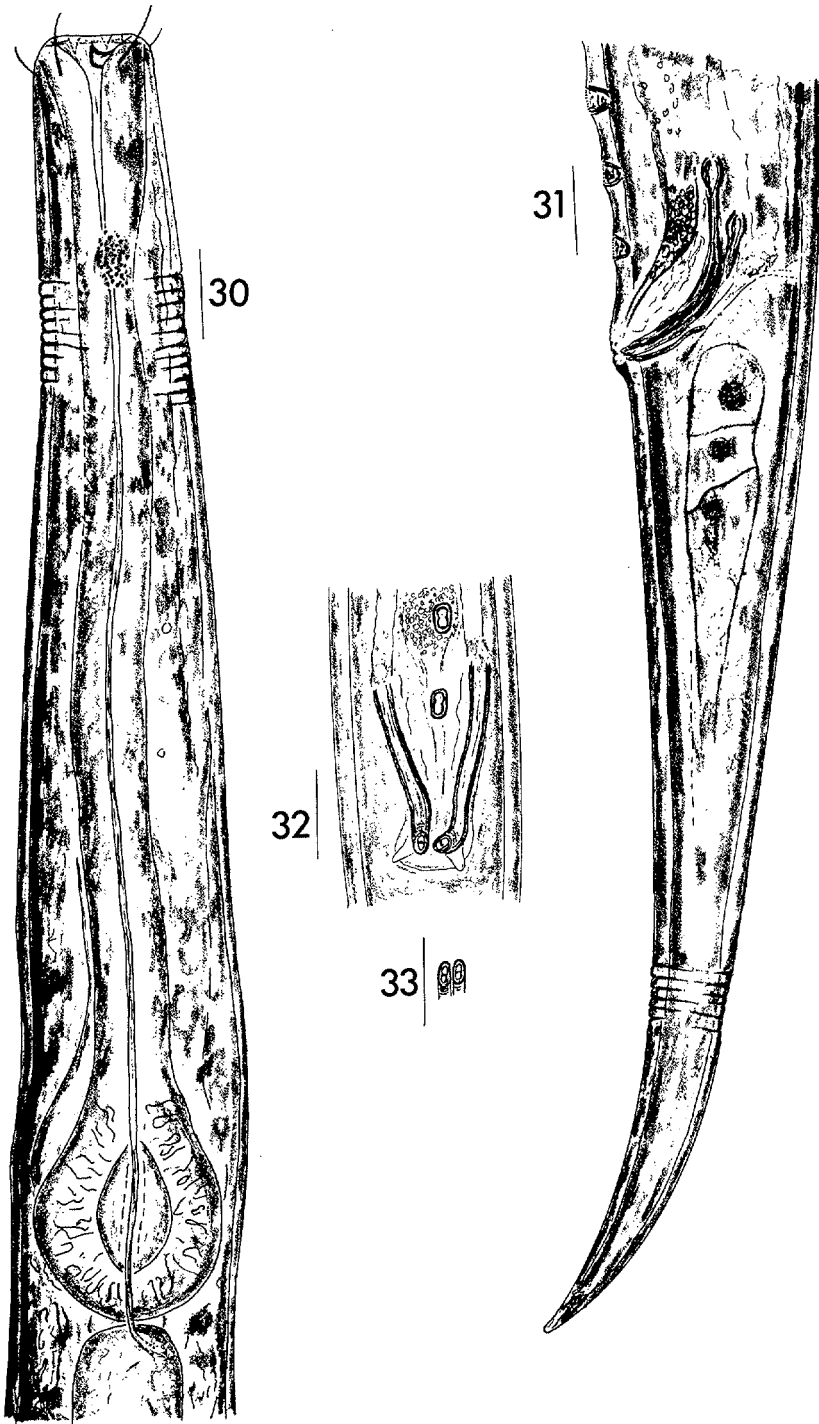
indistinct (Fig. 31). Sensillae not observed on tail.

Male ($n = 7$): L = 680 (570-817) μ m; a = 20.2 (13.7-26.7); b = 6.0 (5.4-7.0); c = 8.0 (7.0-10.1); arc of spicules = 25 μ m (23-28); gubernaculum length = 15 (13-16) μ m; supplements ($n = 24$) = 14 (10-17).

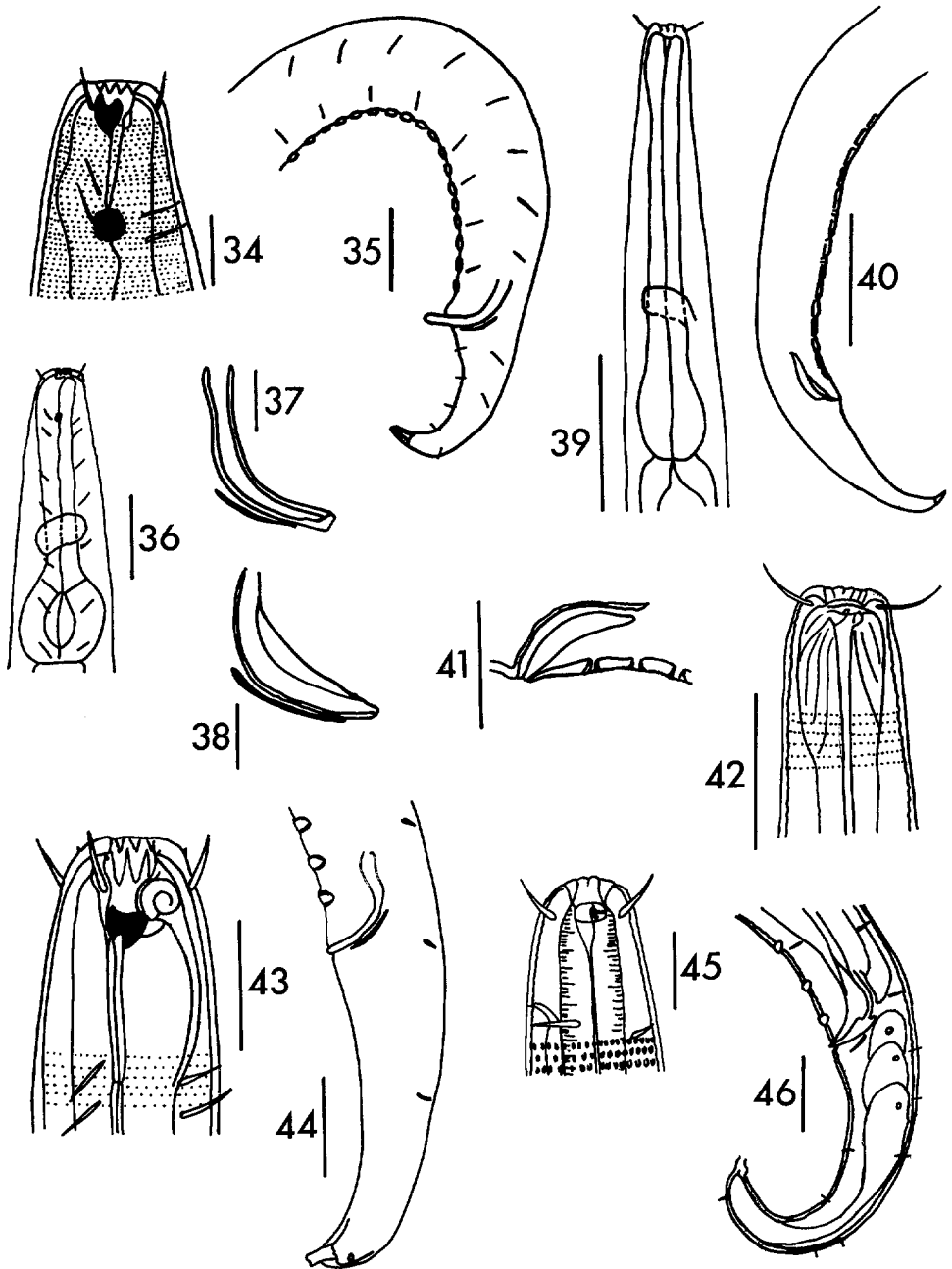
Female ($n = 7$): L = 724 (648-839) μ m; a = 20.0 (15.5-31.3); b = 6.0 (5.1-7.2); c = 7.1 (6.0-10.0); V = 48 (47-50).



FIGS. 24–29. *Prochromadora orleji*, specimens from China. 24) Female esophageal region. 25) Vulval region. 26) Female tail (extended). 27) Anterior region of young female. 28) Mature female. 29) Cuticular pattern on adult female from cervical area directly above chromatin granules. Three interpretations of cuticular ornamentation are shown, depending on the focus. Bars 24–27, 29 = 10 μm , bar 28 = 50 μm .



FIGS. 30-33. *Prochromadora orleji*, specimens from China. 30) Male esophageal region. 31) Male tail (extended). 32) Ventral view of spicules showing the underlying gubernaculum with two horn-like projections and two anteriorly situated oval supplements. 33) Ventral view of the ends of the spicules showing oval openings that appear divided into two equal chambers. Bars 30-33 = 10 μ m.



FIGS. 34-46. *Prochromadora orleji*, after Gerlach (11) (Figs. 34-38). 34) Male head. 35) Male tail, spicules and supplements. 36) Male anterior end. 37, 38) Spicules and gubernaculum. Bars 34, 37, 38 = 10 μm , bars 35, 36 = 30 μm . *Prochromadora orleji*, after Filipjev (9) (Figs. 39-42). 39) Male anterior end. 40) Male tail, spicules, and supplements. 41) Spicular area. 42) Male head. *Prochromadora spitzbergensis* (Figs. 43, 44). 43) Head. 44) Male posterior end, after Gerlach (12). Bar 43 = 10 μm , bar 44 = 20 μm . *Prochromadora trisupplementa* (Figs. 45, 46). 45) Female head, 46) Male tail with three typical supplements, from Murphy (20).

Prochromadora spitzbergensis
Gerlach, 1965
(Figs. 43, 44)

Diagnosis

Amphids appearing as subcircular spirals with two windings. Spicules 27 μm long with 20 conspicuous preanal supplements on male tail.

Male ($n = 1$): L = 995 μm ; a = 32; b = 6.6; c = 10; spicule length = 27 μm ; gubernaculum length = 18 μm .

Female ($n = 1$): L = 1,170 μm ; a = 29; b = 8.1; c = 9.3; V = 48.

Prochromadora trisupplementa
Murphy, 1963
(Figs. 45, 46)

Diagnosis

Amphids oval, positioned opposite dorsal tooth. Males with three large, cup-shaped preanal supplements. Spicules narrow, sharply bent. Two apices may be present on the dorsal tooth.

Male ($n = 1$): L = 570 μm ; a = 23; b = 5; c = 6; spicule length = 23 μm .

Female ($n = 2$): L = 790–820 μm ; a = 23–24; b = 6–7; c = 7–8; V = 46–48.

DISCUSSION

Filipjev (8) presented a key that characterized *Prochromadora orleji* as having the esophagus anteriorly swollen, and with 14 preanal supplements that extend twice the length of the tail. He identified *P. megodonta* and other species included in the new genus as not having an anteriorly swollen esophagus. Figures 17, 18, and 19 redrawn after de Man (18) indicate the anteriorly swollen esophagus resembling a pharyngeal bulb to which Filipjev apparently referred. In our opinion, such a character, especially when used as a major distinction between species, lacks sufficient importance, especially because the number of specimens upon which de Man's description was based is unknown, and because Filipjev's description dealt with only a single male.

Variation in marine nematodes has not

been studied adequately. Various environmental factors such as food source, competition, and even salinity of the water, might influence morphology. In addition, although de Man's 1884 illustrations do show an anteriorly swollen esophagus for *P. orleji* (cf. Figs. 17–19), the anterior ends of the esophagi also are depicted as being markedly swollen for two of the other three species illustrated on that page in de Man (18) and even slightly swollen for the third species. Hence, we disregard this character as being diagnostically important for *P. orleji*. *Prochromadora megodonta*, similar to *P. orleji*, also was described as having 14 supplements.

One of two points of possible distinction between the two species is the "c" ratio of 6 as compared to 8.5–9.0 for *P. orleji*. We use the given value of 30 μm for spicule length and, using Filipjev's drawings 17c and 17d, calculated the tail to measure 66 or 77 μm . The "c" value then would be either 8.3 or 9.7, but not 6.0 as given. Another point of variance presented in his key was that the length of the row of male supplements was twice as long as the tail for *P. orleji* but equal to the tail length for *P. megodonta*. We have found that the number of supplements counted on 24 specimens from Qingdao, China, may be 10–17, a variation of 70%. We conclude that the value of this diagnostic character for *P. megodonta* lacks credibility. The only credible diagnostic feature separating the two species appears to be the presence of ocelli in *P. orleji*. The apparent absence of these eyespots in *P. megodonta* mandate that it be regarded as a valid species and the type species for the genus.

Filipjev (9) found a single male specimen of *Prochromadora*, which he identified as "*P. oerleyi* (de Man, 1881)." He described the ocelli as violet-red, the buccal cavity with a cuticular bulge on the ventral side, setae *questionably* absent between the posterior papillae and the anus, and the distal part of the gubernaculum as being very strong. The only component of the above description given by de Man, 1881 for *P. orleji* was the color of the ocelli. The de-

manian formula given by Filipjev (9); i.e., $L = 1040 \mu\text{m}$, $a = 26$, $b = 7.7$, $c = 11.6$; differs from that presented by de Man, 1881; namely, length $740 \mu\text{m}$, $a = 22-25$, $b = 6-6.5$, $c = 8.5-9$. Along with these discrepancies, another important point of variance is Filipjev's observation that the massive dorsal tooth seemed to have below it one or two smaller subventral teeth which were equal in size. Gerlach (11) concluded that *Prochromadora oerleyi* (sic) of Filipjev (9) was a synonym of *Chromadora erythrophthalma* G. Schneider, 1906. Wieser (24) recognized the synonymy but redesignated the senior synonym as *Chromadorina erythrophthalma* (G. Schneider, 1906) Wieser, 1954.

W. D. Hope (pers. comm.) has proposed the possibility that *P. orleji* may not be a valid *Prochromadora* because it does possess ocelli, whereas none of the other species in the genus have these eyespots. The proposal of a new genus to accomodate single species is not warranted at this time.

KEY TO SPECIES OF THE GENUS
PROCHROMADORA

- 1. Female body length 2,000–2,500 μm *P. magna* (Schulz, 1935) Wieser, 1954
 Female body length less than 1,200 μm 2
- 2. Supplements absent 3
 Supplements present 4
- 3. Male tail terminus bluntly rounded, gubernaculum without a ventrally directed process
 *P. asupplementa* Hopper, 1961
 Male tail terminus acute to subacute, gubernaculum with a ventrally directed process
 *P. bulbosa* Galtsova, 1976
- 4. Supplements 5 or fewer 5
 Supplements 12 or more 6
- 5. Supplements 3, male body length about 570 μm
 *P. trisupplementa* Murphy, 1963
 Supplements 5, male body length about 780 μm
 *P. argentinensis* Pastor de Ward, 1984

- 6. Male body length 740 μm or less 7
 Male body length 880 μm or more 8
- 7. Ocelli present
 *P. orleji* (De Man, 1880) Filipjev, 1922
 Ocelli absent
 *P. megodonta* Filipjev, 1922
- 8. Preanal supplements 20
 *P. spitzbergensis* Gerlach, 1965
 Preanal supplements 12
 *P. exigua* (Ditlevsen, 1928) Wieser, 1954

LITERATURE CITED

- 1. Britton, R. H., and A. R. Johnson. 1987. An ecological account of a Mediterranean salina: The Salin de Giraud, Camarque (S. France). *Biological Conservation* 42:185–230.
- 2. Carpelan, L. H. 1957. Hydrobiology of the Alviso salt ponds. *Ecology* 38:375–390.
- 3. Caspers, H. 1952. Untersuchungen über die Tierwelt von Meeressalinen an der bulgarischen Küste des Schwarzen Meeres. *Zoologischer Anzeiger* 148: 243–249.
- 4. Davis, J. S. 1978. Biological communities of a nutrient enriched salina. *Aquatic Botany* 4:23–42.
- 5. De Deckker, P., and M. C. Geddes. 1980. Seasonal fauna of ephemeral saline lakes near the Coorong Lagoon, South Australia. *Australian Journal of Marine and Freshwater Research* 31:677–699.
- 6. Ditlevsen, H. J. 1928. Free-living marine nematodes from Greenland waters. *Medeleiser Groenland (Suppl.)* 23:199–250.
- 7. Entz, G. 1904. Die Fauna der Kontinentalen Kochsalzwässer. *Mathematische und naturwissenschaftliche Berichte aus Ungarn*. 19:89–124.
- 8. Filipjev, I. N. 1922. *Encore sur les nématodes libres de la Mer Noire*. *Trudy Stavropol'Skogo Sel'Skokhozyaistvennogo Instituta* 1:83–184.
- 9. Filipjev, I. N. 1930. Les nématodes libres de la baie de la Néva et de l'extrémité orientale du Golfe de Finlande. *Deuxième partie*. *Archiv für Hydrobiologie* 21:1–64.
- 10. Galtsova, V. V. 1976. List of species of nematodes of the White Sea. In T. A. Platonova and V. V. Galtsova, eds. *Nematodes and their role in the Meiobenthos*. *Issledoniya Fauny Morei (Nematody i ikh rol' v meiobentose)* 15:255–366. (Translated from Russian for the Smithsonian Libraries.)
- 11. Gerlach, S. A. 1951. Nematoden aus der Familie der Chromadoridae von den deutschen Küsten. *Kieler Meeresforschungen* 8:106–132.
- 12. Gerlach, S. A. 1965. Freilebenden Meeresnematoden aus der Gezeitenzone von Spitzbergen. *Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven* 9:109–172.
- 13. Gerlach, S. A., and F. Riemann. 1973. The Bremerhaven checklist of aquatic nematode. *Veröf-*

fentlichungen des Instituts für Meeresforschung in Bremerhaven (Suppl.) 4:1-734.

14. Hopper, B. E. 1961. Marine nematodes from the coast line of the Gulf of Mexico. *Canadian Journal of Zoology* 39:183-199.

15. Hopper, B. E. 1963. *Punctodora exochopora* n. sp. (Chromadoridae: Nematoda) from the Canadian shore of Lake Ontario. *Canadian Journal of Zoology* 41:1121-1126.

16. Kreis, H. A. 1963. Marine nematoda. *Zoology of Iceland* 2(14):1-68.

17. de Man, J. G. 1880. Ueber einige neue oder noch unvollständig bekannte Arten von frei in der reinen Erde lebenden Nematoden. (1. Supplement zu der Aufsatz S. 1 dieses Bandes.) *Tijdschrift voor Nederlands Dierk Vereen* 5:138-143.

18. de Man, J. G. 1884. Die frei in der reinen Erde und in süßen Wasser lebenden Nematoden der niederländischen Fauna. Eine systematishch-faunistische Monographie. Leiden, Holland: E. J. Brill.

19. Meyl, A. H. 1955. Freilebenden Nematoden aus binnenlandischen Salzbiotopen zwischen Braunschweig und Magdeburg. *Archiv für Hydrobiologie* 50:568-614.

20. Murphy, D. G. 1963. A new genus and two new species of nematodes from Newport, Oregon. *Proceedings of the Helminthological Society of Washington* 30:73-78.

21. Pastor de Ward, C. 1984. Tres especies nuevas de nematodes marinos de vida libre (Chromadoridae y Comesomatidae) para la Ria Deseado, Santa Cruz, Argentina. *Physis. Seccion A, B y C/ Asociación Argentina de Ciencias Naturales* 42(102):39-48.

22. Schneider, W. 1924. Zur Nematodenfauna der Salzquellen des norddeutschen Flachlandes. 1. Nematoden der Salzquellen von Oldesloe (Holstein). *Archiv für Hydrobiologie* 15:209-224.

23. Schulz, E. 1935. Marine nematoden von Sizilien und Gran Canaria. *Zoologischer Anzeiger* 109:299-304.

24. Wieser, W. 1954. Free-living marine nematodes. 11. Chromadoroidea. *Acta Universitatis Lundensis, Sweden (N. F. 2)* 50(16):1-148.

25. Williams, W. D. 1981. The limnology of saline lakes in western Victoria. *Hydrobiologia. Netherlands* 82:233-259.