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ON SOME NEMATODES BELONGING TO THE ORDERS CHROMADORIDA AND ENOPLIDA FROM INDIA

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(With 5 Text-figures)

INTRODUCTION

The soil and freshwater nematodes in general, and the non-stylet bearing nematodes in particular, have received little attention in India. In the order Enoplida, one new species of the genus *Oncholaimus* Dujardin was described by Stewart (1914); Kreis (1936) reported a single specimen of *Tobrilus gracilis* (Bastian) from Madras and Sukul (1967, 1968, 1968*a*) described three new species belonging to this order. Khera (1970) described the male of *Tripyla* (*Tripyla*) *glomerans* Bastian from Srinagar and attempted a revision of the genus *Tripyla* Bastian; he also recorded the occurrence of *Ironus ignavus* Bastian and *Cryptonchus abnormis* Allgen from India and reviewed both the genera (in press). There is no record of any species belonging to the order Chromadorida from India. Following is an account of some nematodes from Rajasthan, Uttar Pradesh, Orissa and Kerala belonging to these two orders.

I am grateful to Dr. A. P. Kapur, Director, Zoological Survey of India for providing facilities and to Dr. M. Oostenbrink of Landbouwhogeschool, Wageningen, The Netherlands, for advice regarding the genus *Oncholaimium*.

SYSTEMATIC ACCOUNT

Order CHROMADORIDA

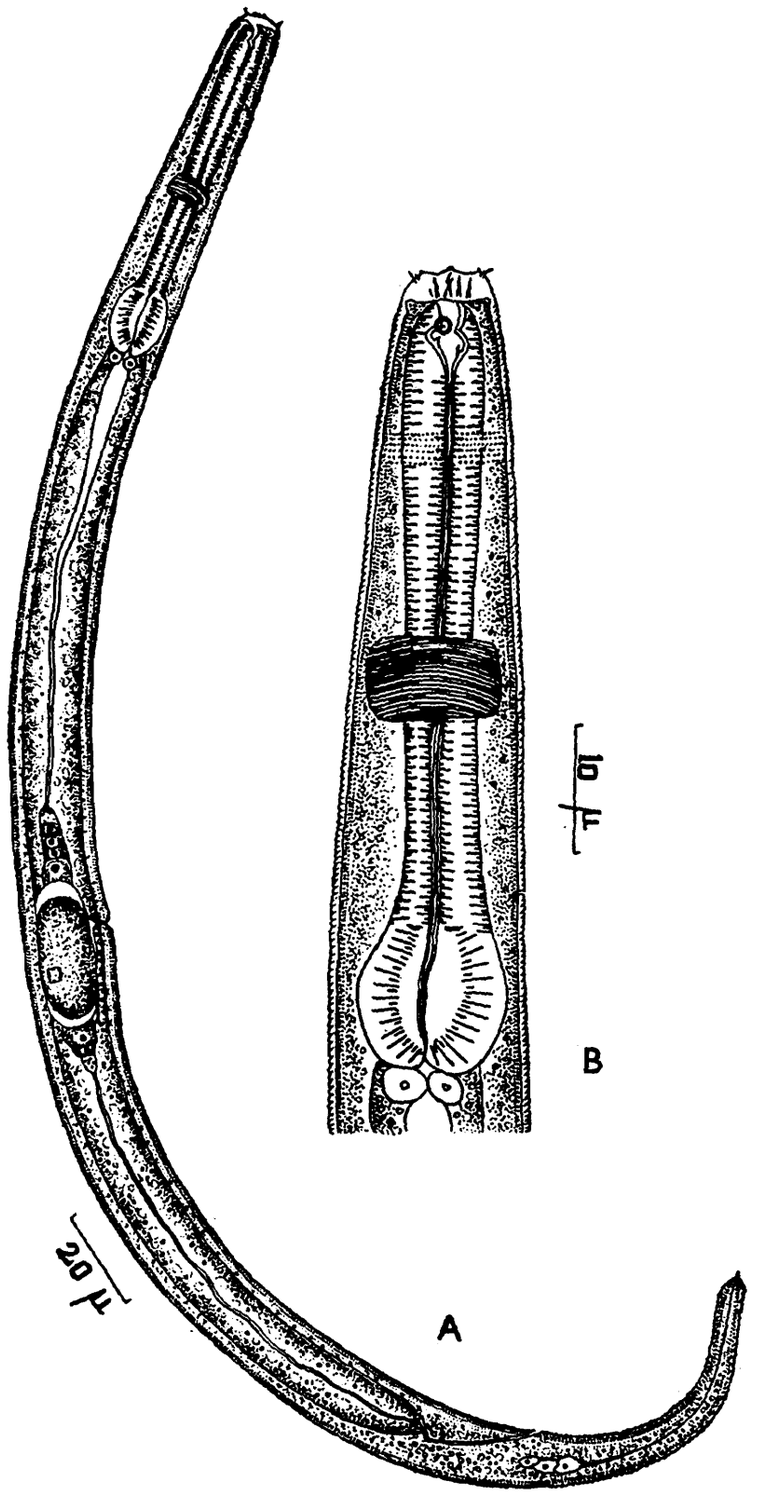
Family CYATHOLAIMIDAE

Genus **Achromadora** Cobb

1. **Achromadora ruricola** (de Man)

(Text-fig. 1)

1880. *Cyatholaimus ruricola* de Man, *Tijdschr. Nederl. Dierk. Vereen.*, **5**: 18.
1893. *Chromadora minima* Cobb, *Macleay Mem. Vol. Linn. Soc. N. South Wales*: 43.
1913. *Achromadora minima:* Cobb, *J. Wash. Acad. Sci.*, **3**: 441.
1922. *Cyatholaimus minimus:* Micoletzky, *Arch. Naturg.*, (1921), Abt. A, **87**: 378.
1922. *Cyatholaimus ruricola:* Micoletzky, *Arch. Naturg.*, (1921), Abt. A, **87**: 379.
1922. *Cyatholaimus ruricola* var. *acutus* Micoletzky, *Arch. Naturg.*, (1921), Abt. A, **87**: 379, 381.
1925. *Achromadora ruricola:* Micoletzky, *K. Danske Vidensk. Selsk. Skr. Naturv. of Math. Afd.*, **8**: R 10 (2): 187.
1963. *Achromadora ruricola:* Goodey, *Soil and freshwater nematodes*: 359.
1964. *Achromadora ruricola:* Loof, *Nematologica*, **10**: 242.



Text-fig. 1.—*Achromadora ruricola* (de Man), ♀, Achalgarh population. (A) Entire nematode. (B) Anterior portion up to the oesophageal region.

Material.—(i) 2♀, 3 Juveniles; Uttar Pradesh: Lucknow, ditches nr. R. Gomti; 13.iv.1967. (ii) 2♀; Rajasthan: Mt. Abu, Achalgarh Tank; 9.v.1965; all *S. Khera* Coll.

Measurements.—Lucknow population: 2♀ : Length = 0.40–0.44 mm; *a* = 22–26; *b* = 5.5–5.8; *c* = 5.7–6.0; V = 45–47.

3 Juveniles: Length = 0.28–0.34 mm; a = 24–27; b = 4.8–5.2; c = 5.4–5.8.

Achalgarh population : 2♀: Length = 0.40–0.42 mm; a = 18–23; b = 5.7–6.3; c = 6.0–6.4; V = 45–47; eggs = 25–28 × 11–12 µm.

Remarks.—The nematodes collected from Achalgarh have outstretched ovaries, and amphids near the proximal end of the stoma. Loof (1964), while describing *A. ruricola*, stated that the amphids had shifted forward during the mounting process. The outstretched condition of the ovary, though unique, is being treated as a variation. This would, however, entail emendation in the generic diagnosis as follows:

Achromadora Cobb

Emended diagnosis: Cyatholaiminae. Cuticle with transverse striae bearing rows of punctations. Amphids spiral. Head not offset, with six indistinct lips, each with a small apical papilla. At the base of lips a circlet of 10 cephalic setae, 2 lateral, 4 subdorsal and 4 subventral. Stoma rather funnel-shaped, with a prominent dorsal tooth medially placed and 1 or 2 smaller subventral teeth situated further back. Oesophagus cylindrical with a terminal pseudobulb. Caudal glands and terminal duct present. Vulva equatorial; gonads paired, opposed. Male with paired spicules and a large gubernaculum.

Type species: *Achromadora ruricola* (de Man).

Goodey (1951, 1963), while giving measurements and description of *A. ruricola*, has stated that male of the species is absent although a diagram of tail of male of this species, based after de Man (1884), has been given in his works. de Man (1880, 1884) described both the male and female of this species—measurements and de Manian formula are common to both the sexes and an account of the male has been given.

Distribution.—Rajasthan and U.P. The genus *Achromadora* is being recorded for the first time from India.

Ethmodora n.g.

Generic diagnosis: Cyatholaiminae. Similar to *Achromadora* Cobb but there are only four cephalic setae and a stomal capsule surrounds the stoma.

Type species: *Ethmodora stagnalis* n.sp.

2. **Ethmodora stagnalis** n.sp.

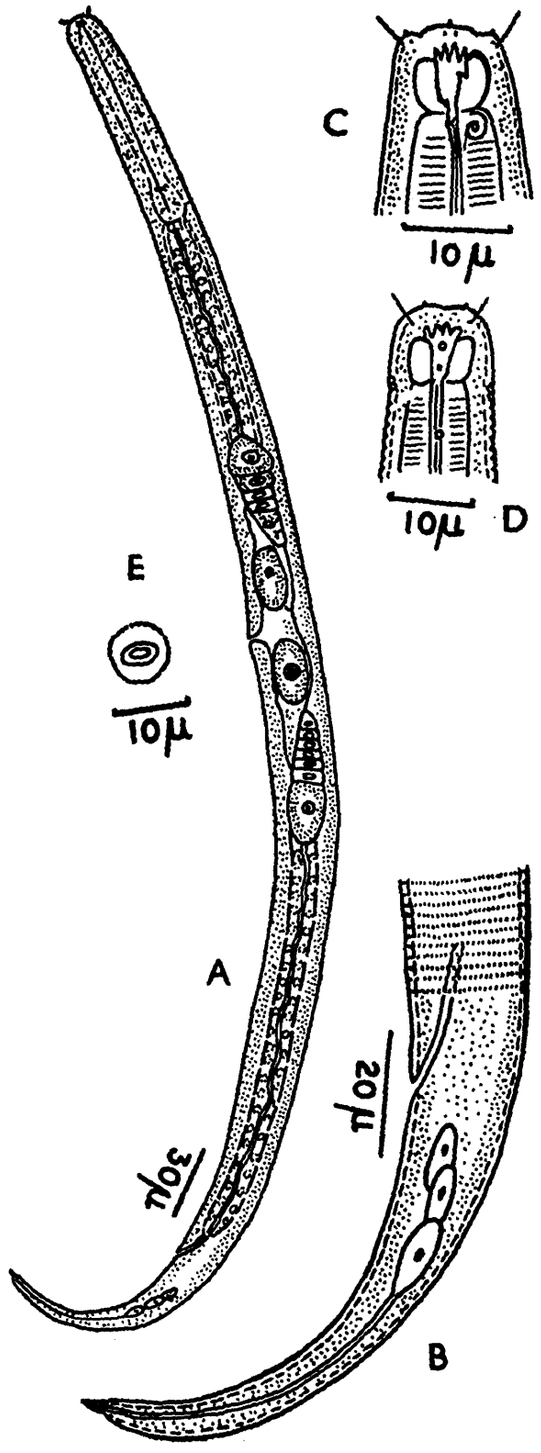
(Text-fig. 2)

Material.—5♀; Kerala: Dist. Trichur, Cranganore, Dalwa Kulam (stagnant freshwater pond); 21.x.1964; *C. Nandakumar* Coll.

Measurements.—5♀; Length = 0.58–0.65 mm; a = 22–26; b = 6.0–6.4; c = 7.0–7.6; V = 42–45; eggs = 22–26 × 12–15 µm.

Male unknown.

Holotype (♀): Length = 0.63 mm; $a = 25$; $b = 6.3$; $c = 7.2$; V = $^{13}43.^{14}$



Text-fig. 2.—*Ethmodora stagnalis* n.g., n.sp. ♀. (A) Entire nematode. (B) Posterior region and tail. (C) Head end, lateral view. (D) Head end, dorsal view. (E) Vulvar opening.

Body slender. Anterior region not markedly attenuated. Tapering tail 78 μm long, ending in a spinneret. Body cuticle bears prominent transverse striae composed of fine punctations. Amphids fine, spiral, just behind the level of the base of stoma. Head not offset, 10 μm wide, flattened-rounded in front, with six partially fused lips, each with a small apical papilla. A circlet of four submedian setae at the base of lips. Stoma 5×3 μm; funnel-shaped with a prominent medial dorsal tooth and one smaller ventral tooth situated further back. Stoma enclosed in a stomal capsule, latter clearly separated from the oesophagus. Oesophagus muscular, 90 μm long, cylindrical for the most part but swollen and ovate terminally forming a pseudobulb. Three oesophago-intestinal cells present. Intestine moderately broad with thick walls and narrow lumen. Rectum 16 μm long, smaller than anal body-diameter. Three caudal glands with a terminal duct ending in a spinneret. Nerve ring and excretory pore not visible.

Gondas paired, opposed and reflexed. Both the ovaries short. One egg in each uterus. Vulva slightly pre-equatorial, transversely elliptical, flush with body surface.

Diagnosis and Relationship.—Of the various genera belonging to the subfamily Cyatholaiminae Micoletzky, the new genus comes close to the genera *Achromadora* Cobb and *Ethmolaimus* de Man, occupying an intermediate position between the two genera. It resembles the genus *Achromadora* in the shape and structure of stoma but differs in possessing a stomal capsule and four cephalic setae. The new genus resembles *Ethmolaimus* in having a stomal capsule surrounding the stoma but differs in the shape and structure of stoma.

Holotype.—♀; Kerala: Dist. Trichur, Cranganore, Dalwa Kulam (stagnant freshwater pond); 21.x.1964; *C. Nandakumar* Coll; Z.S.I.

Paratypes.—4♀; other data as for holotype.

Family CHROMADORIDAE

Chromanema n.g.

Generic diagnosis: Chromadorinae. Cuticle unstriated, ornamented with irregularly arranged, coarse, rounded punctations differentiated all over the body except laterally; the tail, however, bears punctations all over. Two circlets of cephalic setae, anterior circlet with eight and posterior with six setae. Amphids large, crescentic, slit-like. Stoma funnel-shaped, in two portions: proximal portion cup-shaped, comprising cheilostom and protostom with longitudinal folds in cheilostom and with a large pointed tooth on dorsal protorhabdion; distal portion, comprising telostom, becoming narrow as it proceeds distally. A ring (whose homologies are not clear), comprising three plates, at the junction of protostom and telostom. Oesophagus club-shaped. Oesophago-intestinal valve cells prominent. Single testis. Gubernaculum and ventral supplements absent.

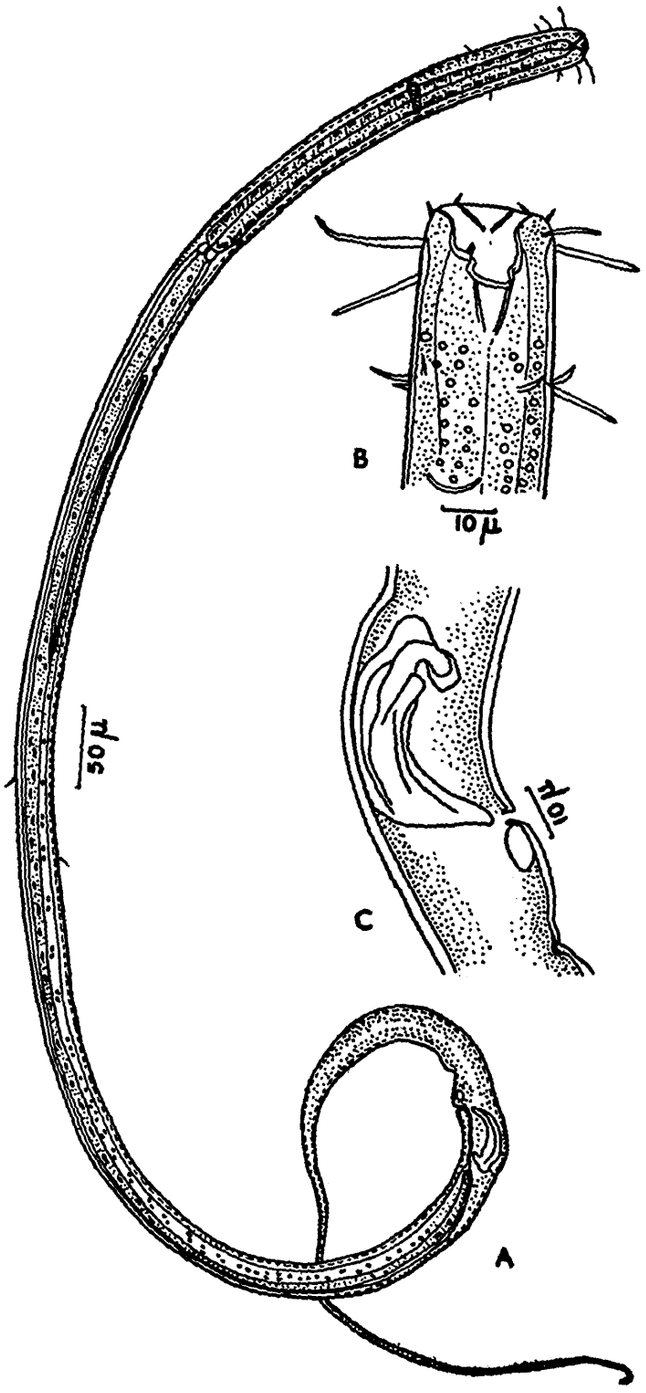
Type species: *Chromanema solitarium* n.sp.

3. **Chromanema solitarium** n.sp.

(Text-fig. 3)

Material.—1♂; Kerala: Dist. Trichur, cranganore (Vattakulam pond); 21.x.1964; *C. Nandakumar* Coll.

Measurements.—Holotype (♂): Length = 1.62 mm; $a = 46.3$; $b = 6.2$; $c = 3.25$; T = 40; spicula = 50 μm.



Text-fig. 3—*Chromanema solitarium* n.g., n.sp. ♂. (A) Entire nematode. (B) Head end. (C) Cloacal region with spicule.

Body elongate, slender, blunt at the anterior extremity, finely pointed posteriorly. Posterior portion of the nematode drawn out, coiled ventrally, attenuating gradually beyond the cloacal aperture. Tail 500 μm long, filiform. Body cuticle as in generic diagnosis. A few bristles here and there on the body. Head continuous, 22 μm wide, with six indistinct lips. Cephalic setae as in genus. Amphids at about two head-widths from the anterior end, immediately behind the posterior circlet of setae. Stoma as in genus, 25 × 18 μm; cheilostom with six longitudinal folds (= cheilorhabdions) in the walls, protostom with three protorhabdions; telostom surrounded by oesophageal collar. Oesophagus 250 μm long without a valvular apparatus. Intestinal wall moderately thick. Caudal glands not observed. Nerve ring surrounds oesophagus anterior to its middle at 105 μm from the anterior end. Excretory pore not seen.

Spicula stout, heavily sclerotized, rose-thorn shaped, ventrally arcuate, tapering towards bluntly pointed tip. Each spicule with a distinctly flanged capitulum bent at right angles to the body of the spicule; the latter also bears longitudinal ridges.

Diagnosis and Relationship.—Of the various freshwater genera included in the family Chromadoridae by Goodey (1963), the new genus comes closest to *Chromadorella* Filipjev in possessing an oesophagus without a distinct bulb—all other genera possess a distinct bulb. The new genus, however, differs from *Chromadorella* in possessing only a single dorsal tooth. The presence of a three-piece ring at the junction of protostom and telostom, absence of ventral supplements (latter absent in some species of the genus *Hypodontolaimus* de Man) and gubernaculum sets the new genus apart from all other genera of Chromadoridae obtained from the freshwater biotope.

Holotype.—♂; Kerala: Dist. Trichur, cranganore (Vattakulam pond); 21.x.1964; *C. Nandakumar* Coll; Z.S.I.

Biological Notes.—The nematode has been found in a freshwater pond near the sea-coast—obviously a vagrant form from marine habitat since the entire group (Chromadoridae) has not been found in ponds away from the sea-coast.

The nematode had a rapid jerky movement.

Order ENOPLIDA

Family ONCHOLAIMIDAE

Genus **Oncholaimium** Cobb

4. **Oncholaimium oxyure** (Ditlevsen)

1912. *Oncholaimus oxyuris* Ditlevsen *Vidensk. Medd.*, **63**: 233.
1926. *Oncholaimus oxyuris* var. *esknaesicus* G. Schneider, *Zool. Anz.*, **66**: 222.
1932. *Oncholaimus oxyuris:* de Coninck, *Bull. Mus. Royal d'Histoire Nat. de Belgigue*, **8**(8): 10.
1934. *Oncholaimium oxyure:* Kreis, *Capita Zool.*, **4**(5): 232.

Material.—1♂, 4 Juveniles; Orissa: Dist. Ganjam, Chilka Lake at Balugaon; 3.xi.1966; *H.S. Nama* Coll.

Measurements.—4 Juveniles: Length = 1.33–1.65 mm; a = 28–35; b = 5.7–6.7; c = 17–30.

1♂: Length = 2.8 mm; *a* = 85; *b* = 7.8; *c* = 40; T = 60; spicula = 37 μm.

The male bears eight pre-cloacal setae; no post-cloacal setae.

Distribution.—Orissa: Dist. Ganjam, Chilka Lake at Balugaon. The genus *Oncholaimium* is being recorded from India for the first time.

Family Tripylidae

Genus **Tobrilus** Andrássy

5. **Tobrilus sexsetiferous** n.sp.

(Text-fig. 4)

Material.—11♀, 8♂; Rajasthan: Jodhpur (Tank nr. Umaid Bhawan Palace), 4.v.1964; *S. Khera* Coll.

Measurements.—11♀: Length = 1.1–1.41 mm; *a* = 26–34; *b* = 6.0–6.8; *c* = 8.5–9.0; V = 39–44; eggs = 38–40 × 20–22 μm.

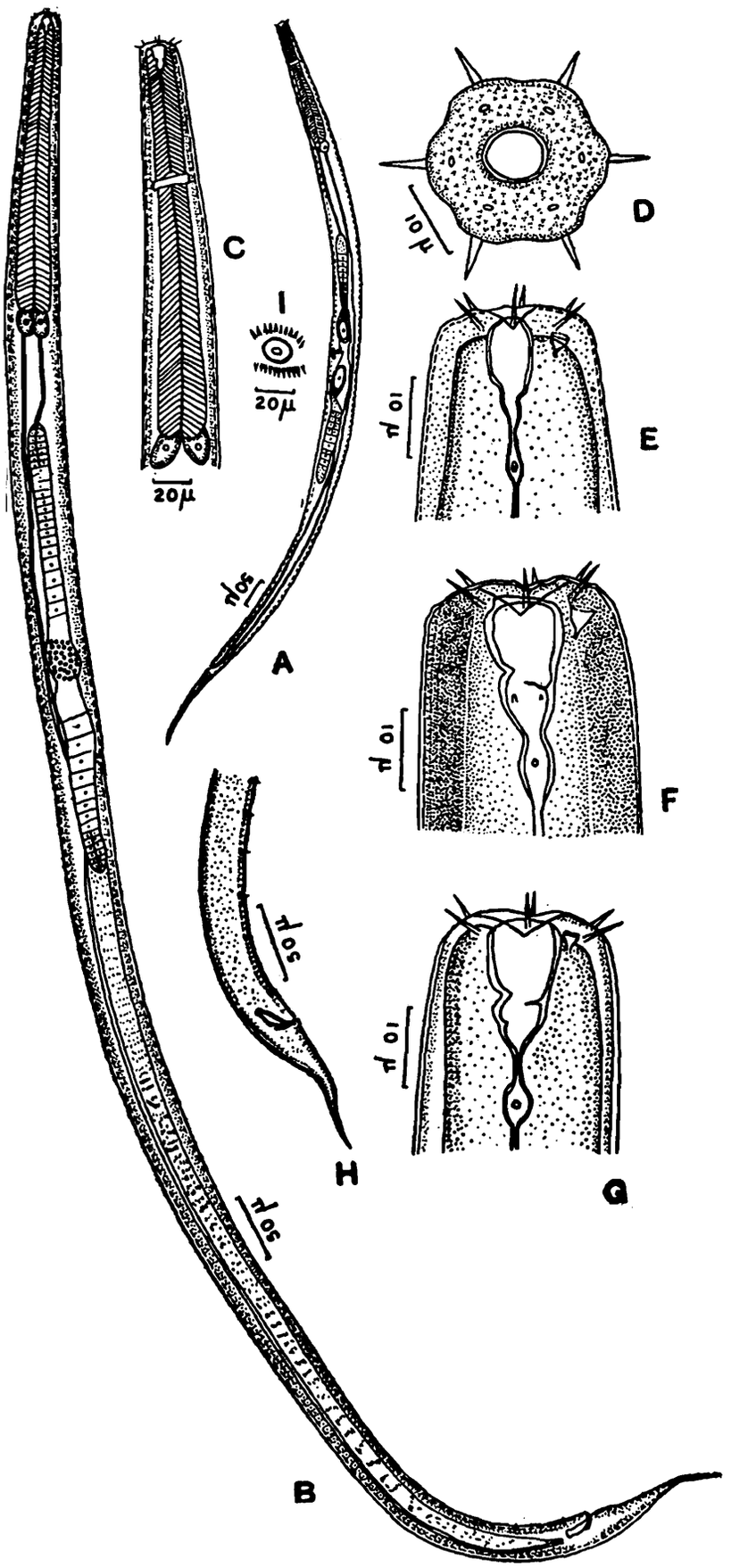
8♂: Length = 0.90–1.37 mm; *a* = 28–38; *b* = 5.6–6.8; *c* = 11.0–13.1; spicula = 20–22 μm; gubernaculum = 10–12 μm.

Holotype (♀): Length = 1.41 mm; *a* = 27.5; *b* = 6.3; *c* = 8.8; $V = 16_{44}16$.

Body transparent. Tail conical, ending in a fine point, 160 μm in length, about eight times the anal body-diameter long. Body cuticle smooth, without setae. Head 22 μm broad. A circlet of six stout cephalic setae at the base of lips, each cephalic seta about 1/4 head-width long. Amphids large, cup-shaped at the base of cephalic setae. Stoma longer than wide, 25 × 10 μm, in three sections, with continuous sclerotized walls: the anteriormost section being the largest, between triangular and subglobular in shape 10 × 10 μm; middle section funnel-shaped, 8 × 7 μm with three teeth, one dorsal and two subventral; the third section elliptical with finer walls and two prominent lateral teeth. At the junction of the first two sections the cuticular walls form a ledge towards the lumen of stoma. Stoma enveloped by an oesophageal collar. Oesophagus 224 μm long with no valvular apparatus. Three large ovoid oesophago-intestinal gland cells. Intestine and its lumen broad except near the female reproductive system where these are narrowed. Rectum 19 μm in length, about one anal body-diameter long. Nerve ring surrounds oesophagus at about 36% of its length from anterior end. Excretory pore absent.

A circular vulva more or less flush with body surface, surrounded by a rosette of cuticular warts. Eggs large and oval, from unicellular to two-celled stage.

Male.—General structure similar to that of female. Posterior end curved slightly ventrally on thermal death. Tail 104 μm long, four times the anal body-diameter in length. Stoma 20 × 5 μm, the anterior-most section most spacious, subglobular, 10 × 5 μm; middle section much reduced, more or less cylindrical, 5 × 2 μm, with three usual teeth; the



Text-fig. 4.—*Tobrilus sexsetiferous* n.sp. (A) Female, entire. (B) Male, entire. (C) Female, anterior portion up to oesophago-intestinal gland cells. (D) *En face* view. (E) Male, anterior end. (F) & (G) Female, anterior end. (H) Male tail. (I) Vulvar opening.

posterior-most section elliptical, $5 \times 1.5\ \mu m$, with two large lateral teeth. Cuticular ledge at the junction of the first two sections in the female not evident here.

Two poorly sclerotized spicules possessing a narrow capitulum and a broad body which narrows towards the tip. Gubernaculum strongly sclerotized. Six pre-cloacal, midventral supplements, nearly of the same size. No caudal alae.

Diagnosis and Relationship.—The new species comes close to *T gracilis* (Bastian), *T allophysis* (Steiner), *T aberrans* (W. Schneider), *T consimilis* (W. Schneider) and *T vibratus* Sukul in possessing cephalic setae which are about 1/4 the head width, a tail without a terminal seta and six supplements nearly of the same size in the males.

The new species differs from these and other species of the genus as enumerated by Andrâssy (1959, 1964) in possessing six cephalic setae at the base of lips, in having a ledge at the junction of the first two sections of stoma in the female and rosettiform cuticular warts surrounding the vulva. Further, there is sexual dimorphism in the structure of stoma, the middle section of the latter being much wider in female than in male.

Holotype.—♀: Rajasthan: Jodhpur (Tank nr. Umaid Bhawan Palace), 4.v.1964; *S. Khera* Coll; Z.S.I.

Paratypes.—10♀, 8♂; other data as for holotype.

Biological Notes.—A large number of female and male nematodes of this species were collected from time to time from the banks to about a depth of two feet from various tanks of Rajasthan and Kerala. Some nematodes were also collected from the banks of R. Yamuna near Wazirabad Pumping Station, Delhi where algal matter was found in abundance, while others were recovered from moist soil of pits, up to four feet deep, dug up in a dried pond during drought to get water for drinking purposes at Khandwai Talai, a village near Agolai about 32 km. west of Jodhpur.

These nematodes, as those of the next species, had rapid wriggling movements followed by uncoiling and coiling movement. All these movements were punctuated by periods of quiescence. The nematodes could anchor themselves to the substratum by means of the tip of their tail thus resting or even wriggling in a vertical position.

6. **Tobrilus confusus** n.sp.

(Text-fig. 5)

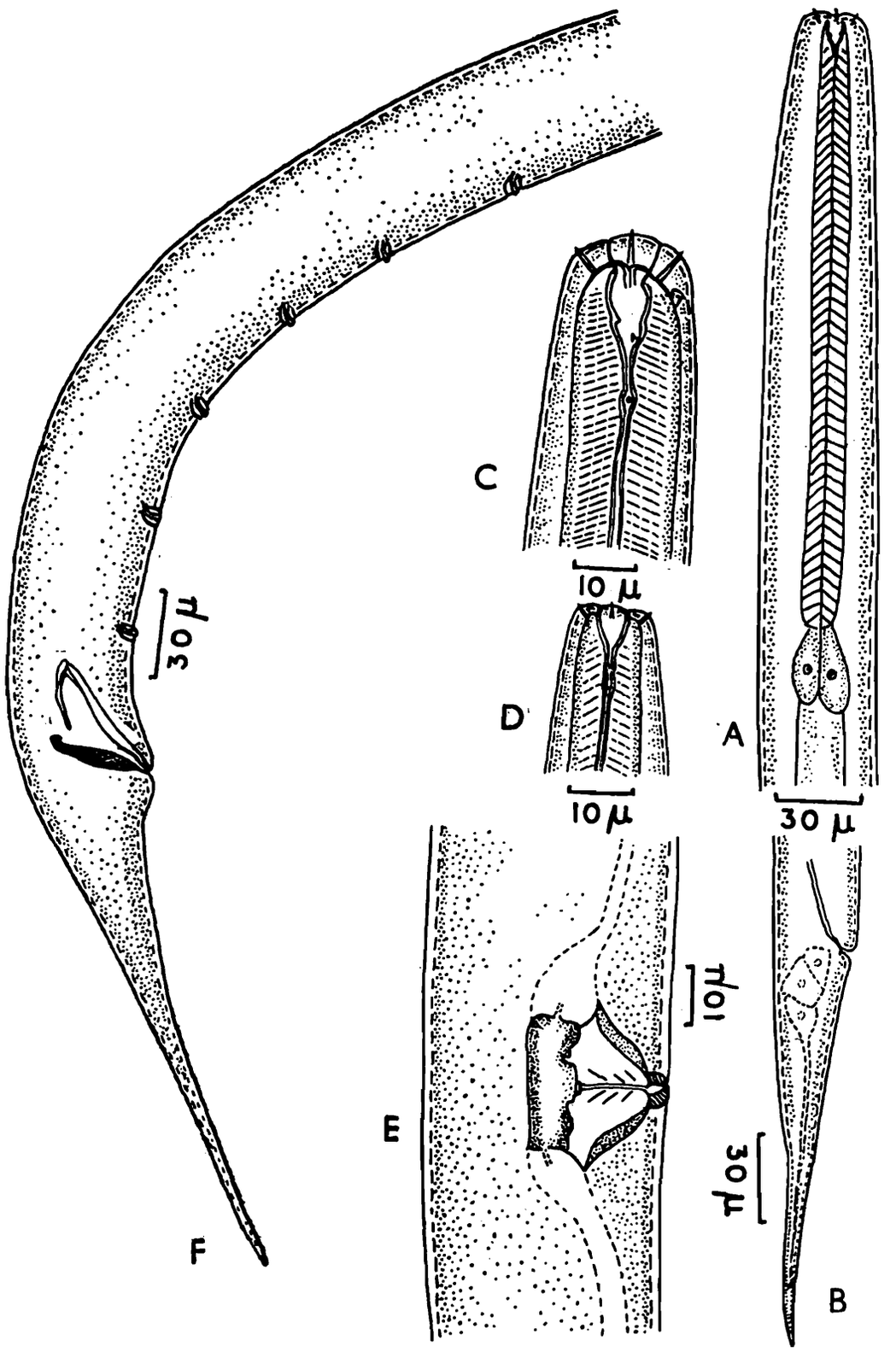
Material.—1♀, 1♂, 5 Juveniles; Rajasthan: Dist. Nagaur, Didwana (ponds); 3.x.1967; *S. C. Verma* Coll.

Measurements.—5 Juveniles: Length = 0.65–0.83 mm; $a = 45$–53; $b = 4.5$–5.0; $c = 9.0$–10.7.

1♂: Length = 1.07 mm; $a = 48$; $b = 7$; $c = 12.75$; $T = 62.6$; spicula = $22.5\ \mu m$; gubernaculum = $15\ \mu m$; accessory piece = $12.5\ \mu m$.

Holotype (♀): Length = 1.57 mm; $a = 38$; $b = 7.5$; $c = 11.6$; $V = 10_{45}8$.

Body transparent. Tail conical ending in a fine point, 135 μm in length, seven times anal body-diameter long. Body cuticle smooth without setae. Head broad, 18 μm wide. Ten small equal-sized setae in two circlets: first circlet of six setae arising from the base of lips; second circlet



Text-fig. 5.—*Tobrilus confusus* n.sp. (A) Anterior portion, male. (B) Female tail. (C) Head end, female. (D) Head end, male. (E) Vaginal region showing ovejector. (F) Male tail.

slightly posterior, of four setae. Each seta about 1/6 the head width long. Amphids large, cup-shaped with ellipsoid opening behind the posterior circlet of cephalic seate. Stoma longer than wide, 18×7 μm, in three sections with continuous well sclerotized, walls: the anterior most section being the largest, cup-shaped, 8×7 μm; middle section funnel-shaped, 5×4 μm, with three teeth, one dorsal and two subventral; the third section tubular, 5×1 μm, with finer walls and two prominent lateral teeth. Stoma enveloped by an oesophageal collar. Oesophagus 209 μm long with no valvular apparatus. Three large, ovoid, oesophago-intestinal gland cells. Intestine and its lumen broad except near the female reproductive system where these are narrowed. Rectum 10 μm in length, being about half the anal body-diameter long. Nerve ring surrounds oesophagus at about 33% of its length from anterior end. Excretory pore absent.

Circular vulva, more or less flush with body surface.

Male.—General structure similar to that in female. Posterior end curved slightly ventrally on thermal death. Tail 84 μm long, and 4½ times the anal body-diameter in length. Stoma 12×4.5 μm. The anterior-most section 6.0×4.5 μm, somewhat funnel-shaped; the middle section much reduced, cylindrical-elliptical, 3.5×1.5 μm, with three teeth; the posterior-most section cylindrical, 2.5×1 μm, with two teeth. Oesophagus 151 μm long.

Two somewhat arcuate, spindle-shaped, poorly sclerotized spicules. The capitulum of each of the two spicules connected to one of the upper (shorter) limbs of a Y-shaped accessory piece. Gubernaculum strongly sclerotized, of the shape of a bowling pin with its head recurved ventrally and with a strong diagonal ridge marking its posterior third from the anterior two-third. Six equal, pre-cloacal, mid-ventral supplements.

Diagnosis and Relationship.—The new species is unique in having an accessory piece in addition to the usual spicula and gubernaculum.

It comes closest to *T sexsetiferous* n.sp. in the stoma exhibiting sexual dimorphism, in the position of amphids, in the number of teeth in the stoma and in the number of pre-cloacal supplements but differs in having ten cephalic setae, in the absence of a ledge between the first two sections of stoma in the female and cuticular warts around the vulva, in the shape of spicules and gubernaculum, in addition, of course, to the presence of an accessory piece.

Holotype.—♀; Rajasthan: Dist. Nagaur, Didwana (ponds); 3.x.1967; *S. C. Verma* Coll; Z.S.I.

Paratypes.—1♂, 5 Juveniles; other data as for holotype.

Taxonomic note regarding the Genus *Tobrilus*

Owing to the absence of lateral fields, the anterior position of amphids, the division of stoma in three sections and the presence of six cephalic setae in *T. sexsetiferous*, the diagnosis of the genus *Tobrilus*, as given by Goodey (1963), is emended as follows :

Tobrilus Andrássy

Emended diagnosis: Tripylidae. Cuticle smooth, body tapering behind, but very little in front. Amphids cup- or funnel-shaped with a flattened

oval opening situated near the level of stoma. Head not offset, provided with six, more or less roundly conical, lips each provided with a very small apical papilla. Six, ten or more stout setae at the base of lips. Stoma in two or three sections, its walls distinctly sclerotized; the anterior section without teeth or denticles, the posterior section(s) denticulated. Oesophageal collar surrounds the stoma. Oesophagus club-shaped. Three distinct oesophago-intestinal gland cells. Vulva practically equatorial; female gonads didelphic, amphidelphic and reflexed. Testes paired; gubernaculum present. A series of pre-cloacal supplements in male. Tail of both sexes tapering, caudal glands and terminal duct present. A few fine setae irregularly scattered over the body and tail in most of the species. Males unknown in some species.

Type species: *Tobrilus gracilis* (Bastian).

SUMMARY

Ethmodora stagnalis n.g., n.sp. and *Chromanema solitarium* n.g., n.sp., both belonging to order Chromadorida are described. Two new species of *Tobrilus*, *T sexsetiferous* and *T confusus* (order Enoplida) are described, and the generic diagnosis of *Tobrilus* Andrássy and *Achromadora* Cobb emended. Genera *Achromadora* (order Chromadorida) and *Oncholaimium* Cobb (order Enoplida) are recorded from India for the first time.

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