

***Corethrellonema grandispiculosum* n. gen., n. sp. and *Aproctonema chapmani* n. sp. (Nematoda: Tetradonematidae), Parasites of the Dipterous Insect Genera, *Corethrella* and *Culicoides* in Louisiana**

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**Abstract:** Two new nematodes of the family Tetradonematidae, parasitic in aquatic dipterous insects in Louisiana, are presented. *Corethrellonema grandispiculosum* n. gen., n. sp., from the chaoborid fly, *Corethrella brakeleyi* Coquillett, and *Aproctonema chapmani* n. sp., from the sand fly, *Culicoides arboricola* Root and Hoffman, are described and illustrated. The biology and life histories of these nematodes show that the adults occur in the last larval instar of the insect host. The adult nematodes mate in the body cavity of the insect, and later the female nematode, replete with eggs, exits from the larval fly causing the death of the insect. Male nematodes usually remain in the insect cadaver.

The family Tetradonematidae includes those mermithids which have adult stages in the body cavity of the host insect. Only three monotypic genera have been described, and all have terrestrial dipteran hosts. Because the three known species are widely separated morphologically, their recognition is not difficult. *Aproctonema entomophagum* Keilin, 1917, was described (6) from the fungus gnat *Bradysia pullula* (Winn.) (= *Sciara pullula*) from Cambridge, England. Cobb (2) described *Tetradonema plicans* Cobb, 1919 from another fungus gnat *Bradysia coprophila* (Lintner) (= *Sciara coprophila*) from Kansas, U.S.A. The third species, *Mermithonema entomophilum* T. Goodey, 1941, was described (4) from a scavenger fly, *Sepsis cynipsea* L., from St. Albans, England. Three additional works (7, 5, 3) advanced our knowledge of *Aproctonema entomophagum* and *Tetradonema plicans* respectively. Recent work in the USSR, describing larval nematodes from black flies as tetradonematids, is difficult to evaluate at this time. If one maintains that one of the main characters of the family Tetradonematidae is that adult nematodes must be present in the insects, then Rubtsov's species (9); *Aproctonema simuliophaga*,

*Mermithonema brevis*, *M. acicularis*, and the eight species of his new genus *Tetradomer-mis*, probably belong somewhere else.

Recently, I examined two new aquatic tetradonematids; one from the chaoborid fly, *Corethrella brakeleyi* Coquillett, and the other from the sand fly, *Culicoides arboricola* Root and Hoffman. Drs. H. C. Chapman and J. J. Petersen, Entomology Research Division, Agricultural Research Division, Agricultural Research Service, United States Department of Agriculture, Lake Charles, Louisiana, sent me material collected in Louisiana. These scientists are currently working on the biology and pathogenicity of these two new tetradonematids. The author wishes to express his appreciation to Miss Patricia A. McIntosh for technical assistance in this study.

Genus *Corethrellonema* n. gen.

**DIAGNOSIS:** *Tetradonematidae*.—Males die in tight coil. Spicule single, large, horn-like, twice curved. Pre- and postanal papillae numerous, crateriform. Females not encapsulated. Both sexes with faint cephalic framework. Stoma armed with a minute dorsal tooth. Esophagus in three parts: procorpus cylindrical; middle part of esophagus, posterior to nerve ring with three large conspicuously nucleated gland-like cells; the third part consists simply of an esophageal lumen with adhering degenerate tissue.

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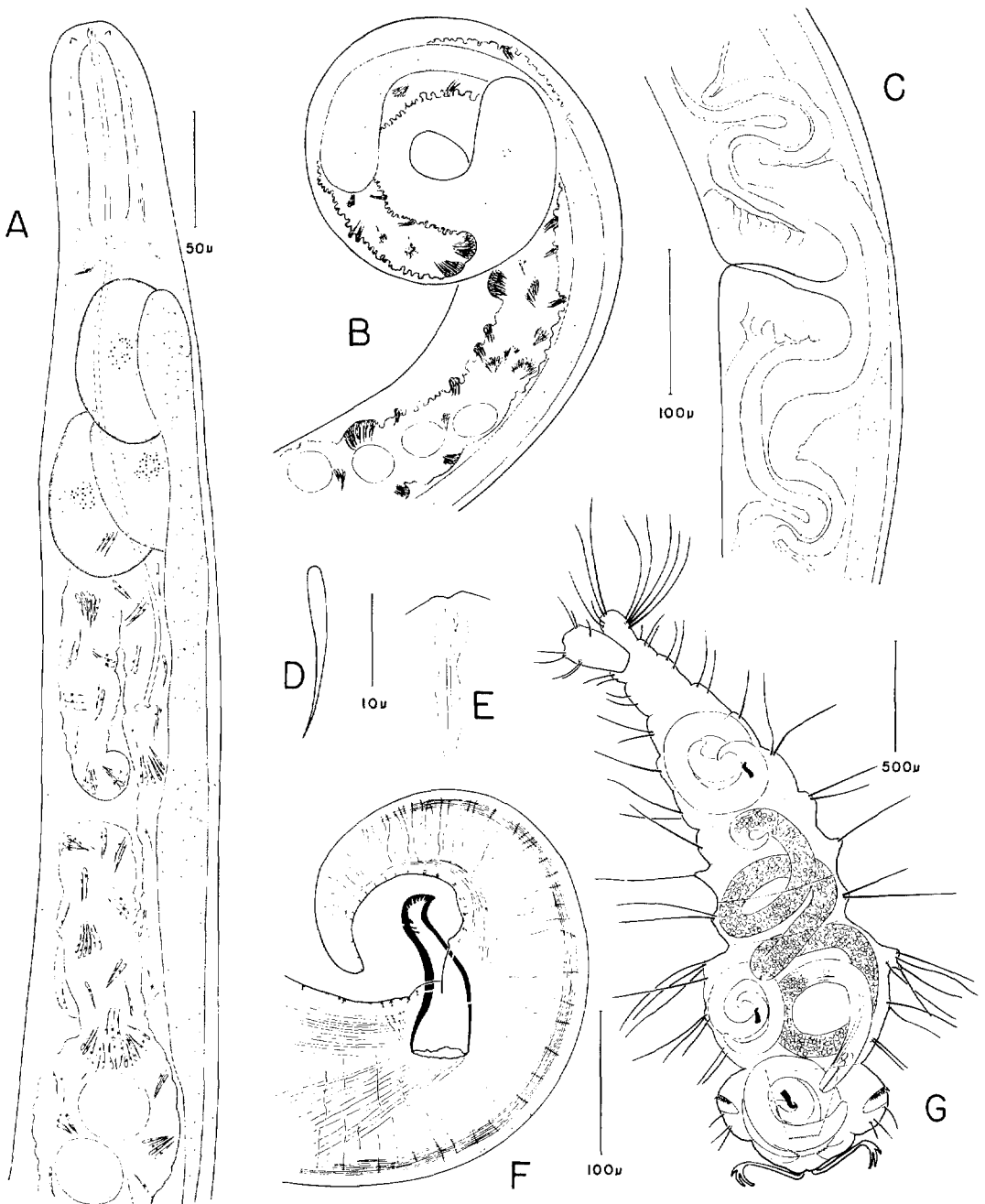


FIG. 1 A-G. *Corethrellonema grandispiculosum* n. gen., n. sp. from *Corethrella brakeleyi* in Louisiana. A. Female, anterior end, lateral view. B. Female, posterior end, lateral view. C. Vulval area, lateral view. D. Sperm. E. Stoma with minute dorsal tooth, female. F. Male, tail with diagnostic spicule. G. Parasitized *Corethrella* larva containing nematodes.

Trophosome prominent, not connected to esophageal lumen.

TYPE SPECIES: *Corethrellonema grandispiculosum* n. sp.

*Corethrellonema grandispiculosum*

n. gen., n. sp.

(Fig. 1, A-G)

*Males* (6): L = 1.48 mm (1.15-1.91); W at midbody = 96.6  $\mu$  (71.0-119.0); a = 15.7 (14.5-17.0); b = 8.6 (6.8-12.0); c = 8.1 (6.5-11.0); spicule L = 98.5  $\mu$  (68.6-117.6); spicule W = 24.3  $\mu$  (15.5-41.2).

*Holotype*  $\delta$ : L = 1.44 mm; W at midbody = 96.0  $\mu$ ; a = 15.0; b = 9.1; c = 7.8; spicule L = 114.2  $\mu$ ; spicule W = 20.6  $\mu$ .

*Females* (6): L = 7.34 mm (4.47-13.70); W at vulva = 104.0  $\mu$  (81.3-130.0); a = 70.4 (47.0-110.0); b = 14.8 (3.3-23.1); c = No anus; V% = 51.0 (48.5-54.5); egg = 32.5-37.4  $\mu$ .

*Allotype*  $\varphi$ : L = 7.85 mm; W at vulva = 81.3  $\mu$ ; a = 96.6; b = 23.1; c = No anus; V% = 52.9.

DESCRIPTION: All stages occur in the larval insect. Usually a large oviparous female nematode and two or three male nematodes are found in the body cavity of the last instar insect larva (Fig. 1G). One dissection revealed 13 males and no females.

*Male*.—Body tends to form a fairly tight coil when killed and relaxed by gentle heat. Cuticle with transverse striae, but not deeply constricted. Cephalic framework faint. Stoma armed with a minute dorsal tooth. Esophagus difficult to see, but appears similar to that of female. Trophosome not seen. Testes well developed, double, opposed, outstretched; vas deferens joins the testes in the posterior half of the nematode. Sperm club-shaped, (Fig. 1D) about 17  $\mu$  long. Spicule single, horn-like, twice curved, much wider proximally than distally (Fig. 1F); spicules sometimes degenerate, with abnormal shape.

Cuticular invagination present, appearing like a rudimentary gubernaculum. Numerous (35-40) pre- and postnatal papillae in two subventral rows. Caudal alae absent. Tail bluntly rounded, typically curved ventrad.

*Female*.—Body tends to form a loose coil when killed and relaxed by gentle heat. Cuticle with faint transverse striae. Cephalic framework faint. Stoma armed with a minute dorsal tooth (Fig. 1E). Esophagus apparently in three parts (Fig. 1A): the first part, the procorpus, is cylindrical; the second part, just posterior to the nerve ring, usually has three large conspicuously nucleated, gland-like cells, which empty into the lumen of the esophagus; the third part, posterior to these cells, is composed simply of an esophageal lumen with a forked blind end and some degenerate esophageal tissue. The trophosome is not connected to the esophageal lumen and is quite prominent in young females. It often extends anteriorly as far as the nerve ring and posteriorly just short of the tail (Fig. 1A, B). Vulva not protruding and not constricted (Fig. 1C). Vagina barrel shaped. Ovaries two, opposed, often fill 90% of body, may have irregular flexures at extremities. Sperm often in fan-shaped clusters in pockets of ovaries in older females (Figs. 1A, B). Tail bluntly rounded (Fig. 1B). Eggs smooth, thin shelled.

*Holotype*.—Male collected by J. J. Petersen, February 17, 1967. Slide T-109t, USDA Nematode Collection, Beltsville, Maryland.

*Allotype*.—Female same data as holotype. Slide T-110t, USDA Nematode Collection, Beltsville, Maryland.

*Paratypes*.—5  $\varphi$  and 4  $\delta$  mounted specimens, USDA Nematode Collection, Beltsville, Maryland; 2  $\varphi$  and 2  $\delta$  mounted specimens, University of California Survey Collection, Davis, California; and 2  $\varphi$  and 2  $\delta$  mounted specimens, Canadian National Collection, Ottawa, Canada.

*Type Host.*—*Corethrella brakeleyi* Coquillett.

*Type Locality.*—Chloe, Louisiana, U.S.A.

*Biology and Life History.*—Dissection of an infected late instar larva of *Corethrella brakeleyi* usually reveals one female and two or three male nematodes, although a total of six or more nematodes may be found (Fig. 1G). Unlike the members of the *Mermithidae*, this nematode mates shortly before the chaoborid larva is ready to pupate and the female nematode, replete with eggs, exits from the insect larva thereby killing the insect (1). The male nematode almost always remains within the cadaver. In the laboratory the time required from the onset of parasitism to escape of the mature female nematode is about nine days (8). Egg hatching begins about eight days after the exit of the female nematode. The infective stage larva then enters a healthy insect larva, and the cycle begins again. Percentage of parasitism is usually less than 30, but was found on one occasion to be as high as 72.

*Aproctonema chapmani* n. sp.

(Fig. 2, A-G)

*Males* (6): L = 0.296 mm (0.215–0.367); W at midbody = 55.8  $\mu$  (41.2–75.2); a = 5.5 (3.8–7.7); b = 5.6 (4.0–8.4); c = 21.1 (10.5–35.6); spicule L = 50.6  $\mu$  (39.1–64.9); spicule W = 6.3  $\mu$  (4.1–9.3).

*Holotype*  $\delta$ : L = 0.268 mm; W at midbody = 47.4  $\mu$ ; a = 5.5; b = 4.6; c = 18.5; spicule L = 39.1  $\mu$ ; spicule W = 4.1  $\mu$ .

*Females* (6): L = 2.34 mm (1.34–3.00); W at widest point = 175.4  $\mu$  (130.0–228.0); a = 13.7 (7.2–20.0); V% = 50.8 (46.3–54.5); egg = 45.5  $\mu$  (43.8–46.9).

*Allotype*  $\varphi$ : L = 1.92 mm; W at widest point = 157.6  $\mu$ ; a = 12.2; V% = 46.3.

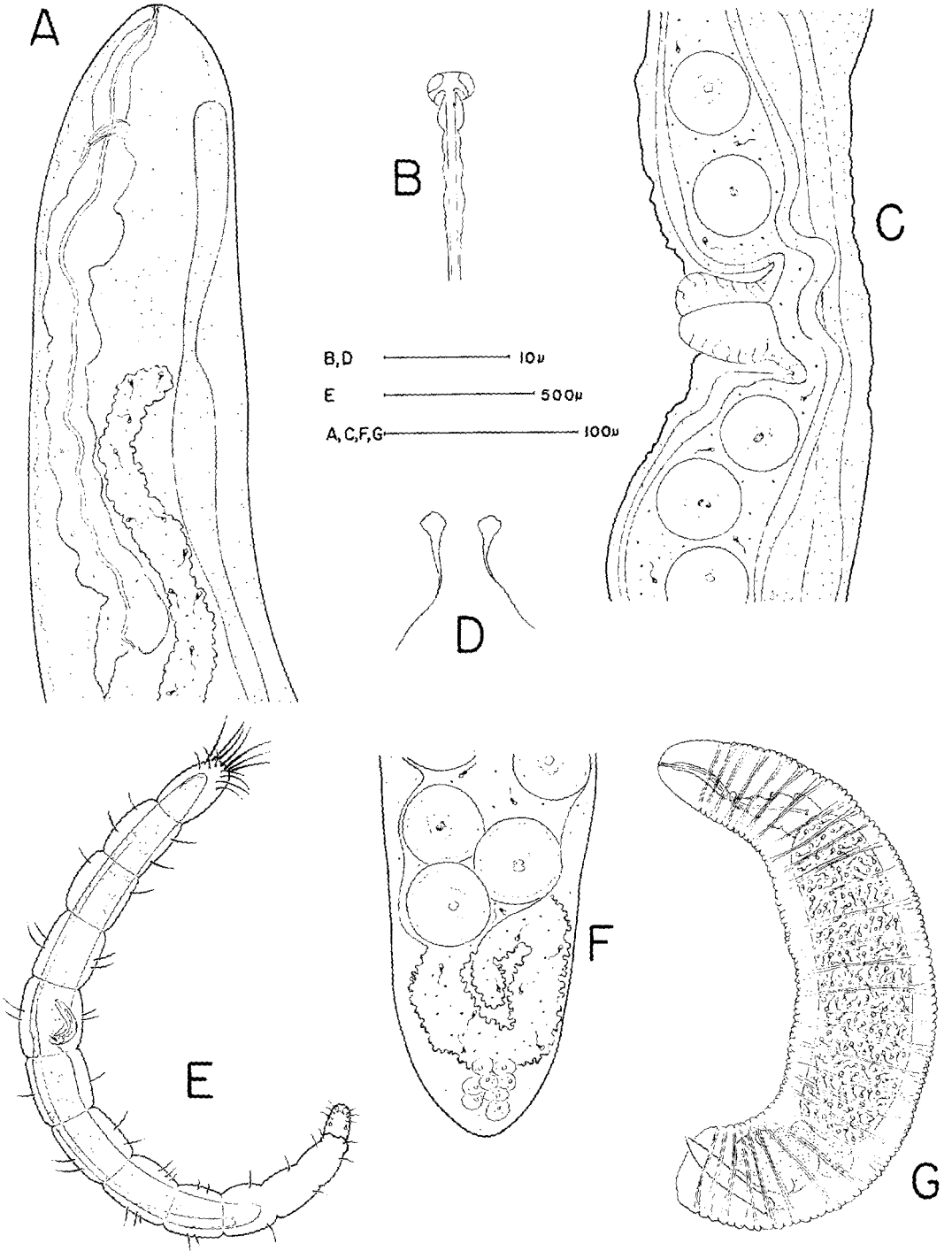
**DESCRIPTION:** All stages occur in the larval insect. Usually one to three large oviparous female nematodes and one to three small male nematodes occur in the body cavity of the last instar insect larva (Fig. 2E).

*Male.*—Found tightly wrapped around vulval area of female. Cuticle wrinkled with deeply constricted transverse striae in regular pattern (Fig. 2G). Cephalic framework well developed. Stoma armed with a minute dorsal tooth. Esophagus degenerate, glandular cells absent, lumen visible. Testes well developed, double, opposed, nonreflexed; vas deferens joins the testes about midbody. Sperm tadpole shaped, with cobra-like head, sperm length 10–13  $\mu$  (Fig. 2D). Spicule single, curved, sides parallel for most of length (Fig. 2G). Gubernaculum absent. Pre- and postanal papillae not seen. Caudal alae absent. Tail bluntly rounded.

*Female.*—Body tends to lie straight or with a bow shape when killed by gentle heat. Cuticle smooth when young, but with advancing age cuticle may occasionally be deeply constricted with transverse striae as found in male. Cephalic framework well developed. Stoma armed with a minute dorsal tooth (Fig. 2B). Esophagus and stichosome degenerate (Fig. 2A); lumen usually seen, often pushed to side by gonad. Trophosome well developed in young female, later reduced to group of cells (Fig. 2F). Vulval area deeply constricted by presence of male (Fig. 2C); vagina barrel shaped; ovaries two, opposed, often fill 95% of body, may have irregular flexures at extremities.

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FIG. 2 A-G. *Aproctonema chapmani* n. sp. from *Culicoides arboricola* in Louisiana. A. Female, anterior end, lateral view. B. Stoma with minute dorsal tooth, female. C. Vulval area, lateral view. D. Sperm. E. Parasitized *Culicoides* larva containing nematodes. F. Female, posterior end, lateral view. G. Male, full body.



Tail bluntly rounded (Fig. 2F). Eggs smooth, thin shelled.

*Holotype*.—Male collected by J. J. Petersen, October 17, 1967. Slide T-111t, USDA Nematode Collection, Beltsville, Maryland.

*Allotype*.—Female same data as holotype. Slide T-112t, USDA Nematode Collection, Beltsville, Maryland.

*Paratypes*.—2 ♀ and 3 ♂ mounted specimens, USDA Nematode Collection, Beltsville, Maryland; 2 ♀ and 2 ♂ mounted specimens, University of California Survey Collection, Davis, California; and 2 ♀ and 2 ♂ mounted specimens, Canadian National Collection, Ottawa, Canada.

*Type Host*.—*Culicoides arboricola* Root and Hoffman.

*Type Locality*.—West Bay, Louisiana, U.S.A.

*Differential Diagnosis*.—The spicule of *Aproctonema chapmani* is 39–65 microns long. The females are 1.3–3.0 mm long and the presence of the male deeply constricts the vulval area. Both males and older females have deeply constricted transverse striae in a regular pattern. In contrast, the spicule of *A. entomophagum* is 90 microns long. The females are 4.4–6.0 mm long and the vulva is not constricted. The cuticle is not known to have deep, patterned, transverse striae. Also, the type host and locality are different.

*Biology and Life History*.—Dissection of an infected late instar larva of *Culicoides arboricola* reveals one or more large female nematodes, almost filling the body of the insect and usually one or more male nematodes (Fig. 2E). Little is known of the biology of this nematode, but it is assumed that the nematodes mate, as in other tetradonematids, in the body cavity of the insect

just before pupation. After mating the male becomes wrinkled and is reduced in size. The female, replete with eggs, exits from the tree-hole dwelling larva of the sand fly, and, thereby, causes the death of the insect. The female nematode then lays its eggs in the tree-hole where, after hatching, the infective stage nematodes parasitize other sand fly larvae. Percentage of parasitism was not determined.

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