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ABSTRACT: Dunlins and western willets were collected on their winter feeding grounds at Bodega Bay and Bolinas Lagoon, California, during 1986. Six digeneans, 8 cestodes, 2 acanthocephalans, and a new nematode were found in dunlins. Seven digeneans, 2 cestodes, 1 acanthocephalan, and the new nematode were found in western willets; 4 helminths including the new roundworm were common to dunlins. *Thominx cecumitis* sp. n. differs from other capillarid nematodes with a spinous spicule-sheath in having a short, globular vulvar appendage, peanut-shaped eggs, a cuticular ball at the posterior tip of the body, narrow lateral alae, and a cuticular genital bursa.

KEY WORDS: helminths, *Calidris alpina, Catoptrophorus semipalmatus inornatus,* California, *Thominx cecumitis* sp. n. (Nematoda), new host records.

Dunlin, *Calidris alpina* (L.), and western willet, *Catoptrophorus semipalmatus inornatus* (Brewster), were sampled on their winter feeding grounds in California during 1986. The purpose of this study was to identify the helminth parasites that were mainly from the digestive system, to redescribe *Levinseniella gymnopocha,* and to report on a new species of nematode.

Materials and Methods

Nine dunlins were sampled in February and in March 1986 at Bodega Bay, California, and in March 1986 in Bolinas Lagoon, California for a total of 27 birds. Nine western willets were sampled in January 1986 at Bodega Bay. Dunlins collected at Bodega Bay represented distinct populations; those in February remained to feed in the area, whereas those sampled in March left the area each day (Ruiz, 1986, pers. comm.). Birds were collected by nets and killed in the field by Drs. Greg M. Ruiz and Wayne P. Sousa. Intestinal tracts were removed and immediately frozen using the technique described by Bush and Threlfall (1984). For necropsies, the samples were thawed. The portion posterior to the gizzard and anterior to the ceca was divided into 4 sections, and the remainder of the posterior intestine was separated into the ceca, large intestine, and cloaca. Mesenteric veins were also examined. Parasites were preserved in 5% buffered formalin and studied using standard permanent mounts. Scolices of some tapeworms were mounted in Berlese's fluid and lightly flattened to study the rostellar hooks. Drawings were made with the aid of a camera lucida. Lengths of nematodes were taken using a map measurer after magnified drawings were made with a camera lucida. Measurements are in micrometers unless stated otherwise with ranges presented first followed by the means in parentheses. Voucher specimens and types have been deposited in the Helminthological Collections of the U.S. National Museum and the accession numbers are listed in Tables 1 and 2.

Results and Discussion

Parasites of dunlin

Seventeen parasite taxa were found from the intestine and mesenteric veins from a total of 27 dunlins (Table 1). The taxa consisted of 6 digeneans, 8 cestodes, 2 acanthocephalans, and 1 nematode.

Digenea

Ascorhytis charadriformis (Microphallidae) was found in the large intestine of dunlins and was originally described from charadriiform birds in California (Young, 1949). Gulls are other avian hosts in the life cycle, which involves littorine snail and grapsid crab intermediate hosts (Ching, 1963a). Five specimens of *Austrobilharzia penneri* (Schistosomatidae) were found in the mesenteric veins. They were in the minimum size range but had similar anterior locations of the spiral ovary and spatial relationships of the suckers as described by Short and Holliman (1961). Martin (1972) suggested that the schistosomatid cercaria, which he found in *Cerithidea californica,* was *A. penneri* although experimental infections of chicks and pigeons were not successful. Dunlins are the first natural host reported for this blood fluke. *Cloacitrema michiganense* (Philophthalmidae) and *Parorchis acanthus* (Philophthalmidae) were found in the cloaca; of 4 coinfections, 2 involved immature worms. Both digeneans utilize *C. californica* as the first intermediate host (Martin, 1972; LeFlore et al., 1985) and infect their next hosts passively through ingested matter containing metacercarial cysts. *Hi-*

Table 1. Parasites of dunlin, *Calidris alpina*, from Bodega Bay and Bolinas Lagoon, California, 1986.

Parasite	Location, month*			USNM coll. no.
	Bodega Bay, February	Bodega Bay, March	Bolinas Lagoon	
Digenea				
Ascorhytis charadriformis (Young, 1949)	0	3, 13	0	80771
Austrobilharzia penneri Short and Holliman, 1961	0	0	3, 5	80772
Cloacitrema michiganense McIntosh, 1938	0	0	6, 13	80773
Himasthla leptosoma (Creplin, 1829)	5, 86	7, 31	7, 26	80774
Levinseniella gymnopocha Coil, 1956	0	7, 29	1, 1	80775
Parorchis acanthus (Nicoll, 1906)	0	0	6, 9	80776
Cestoda				
Aploparaksis brachyphallos (Krabbe, 1869)	6, 13	4, 30	0	80777
A. crassirostris (Krabbe, 1869)	7, 121	7, 104	7, 26	80778
A. retroversa Spasskii and Gubanov, 1961	6, 26	6, 40	4, 9	80779
Dicranotaenia amphitricha Lopez-Neyra, 1942	3, 19	5, 20	4, 13	80780
Echinocotyle nitida (Krabbe, 1869)	7, 21	5, 19	6, 12	80781
Nadejdolepis paranitidulans (Golikowa, 1959)	9, 1,928	9, 2,431	9, 2,760	80782
Retinometra deblocki (Schmidt and Neiland, 1968)	4, 8	3, 7	2, 5	80783
Trichocephaloides megalocephala (Krabbe, 1869)	6, 13	4, 16	1, 2	80784
Acanthocephala				
Arhythmorhynchus comptus Van Cleave and Rausch, 1950	0	0	2, 4	80788
A. eroliae (Yamaguti, 1939)	1, 1	0	5, 9	80789
Nematoda				
Thominx cecumitis sp. n.	1, 1	6, 9	2, 3	80785, 80786

* At all locations 9 birds were sampled. Measurements indicate: number of infected birds, number of parasites.

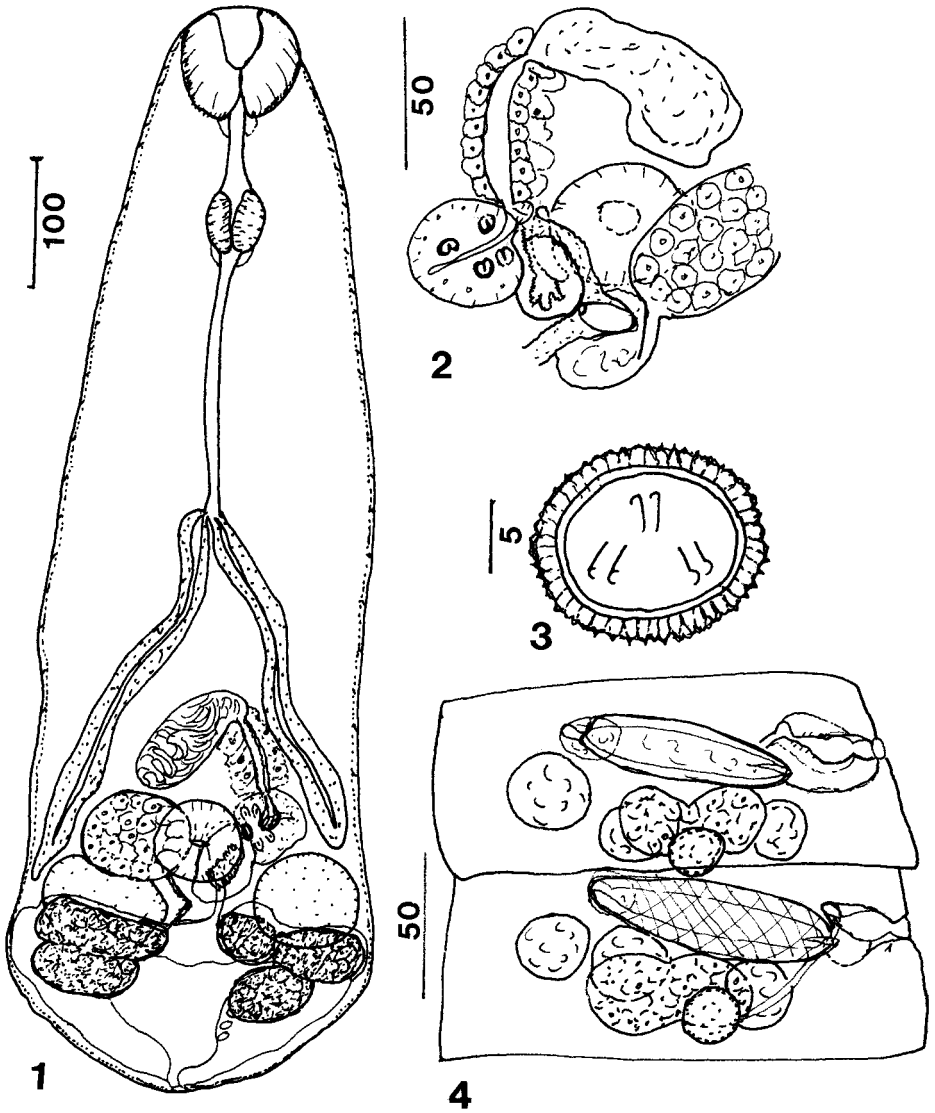
masthla leptosoma (Echinostomatidae) was found in the posterior half of the intestine of dunlins from all collection sites with immature worms comprising 13% of 86 specimens in February, 23% of 31 in March (Bodega Bay) and 89% of 26 specimens in March (Bolinas Lagoon). Loos-Frank (1967) has reported this species in dunlins in Europe.

Levinseniella gymnopocha (Microphallidae) was found exclusively in the ceca and was originally described from 4 specimens taken from 1 dunlin in Ohio (Coil, 1956). This microphallid is characterized by uneven ceca, a female pouch with fine internal folds, a male pouch with 4 simple pockets, a large seminal receptacle, and massive vitellaria (Figs. 1, 2). Because the specimens were proportionately larger in size than originally reported, 10 were measured: body length 736–1,122 (912), body width at the level of the ventral sucker 164–265 (237). Transverse width of oral sucker 54–100 (80), ventral sucker diameter, 43–64 (55) with sucker ratio, 1:0.5–1:0.8. Prepharynx length 49–98 (67); pharynx 33–51 by 28–91 (40 × 35); esophagus length 151–286 (221). Ceca long, reaching to level of ovary and testes, right longer than left. Gonads spherical, ovary 54–92 (72); left testis 61–110 (84), right testis 51–94 (77). Seminal vesicle elongate, 54–89 (70), male pouch 33–56 (46) in diameter, female pouch slightly smaller. Vitellaria massed laterally in 2 and 3 clumps. Uterus on left with older eggs. Eggs 18–20 by 10–11. Flame cells visible in preserved specimens, with typical microphallid pattern of 2[(2 + 2) + (2 + 2)]. Excretory bladder V-shaped.

The temporal and spatial distributions of digeneans show some patterns of presence and absence. *Ascorhytis* and *Levinseniella* were absent in February but present in March in dunlins at Bodega Bay, but were rarely present in Bolinas Lagoon. *Himasthla* were present in all dunlin populations and were most mature in February but were immature in March at Bolinas Lagoon. *Austrobilharzia, Cloacitrema,* and *Parorchis* were not found in Bodega Bay but were present in Bolinas Lagoon, where a high level of infected snails was found (Sousa, 1983).

Cestoda

Three species of *Aploparaksis* (Hymenolepidae) were identified using the descriptions by Spasskii (1963) and Deblock and Rausch (1968).



Figures 1–4. 1. Whole mount of *Levinseniella gymnopocha*, ventral view. 2. Terminal genitalia of *L. gymnopocha*, dorsal view. 3. Egg of *Aploparaxis crassirostris*. 4. Segments of *Nadjedolepis paranitidulans*. Bar numbers are in micrometers.

Webster (1955) described *A. schilleri* and *A. rauschi* from dunlins in Alaska; these are recognized as synonyms respectively of *A. brachyphallos* and *A. crassirostris* (Deblock and Rausch, 1968). They were found together in the posterior half of the intestine but with more of *A. crassirostris*. Six hosts had infections in which the scolices of *A. crassirostris* were embedded in red intestinal mucosa surrounded by fibrous tissue. The eggs of *A. crassirostris* averaged 32 by 26 with a finely notched surface not previously described (Fig. 3). The third species, *A. retroversa*, was ex-

Table 2. Parasites of 9 western willet, *Catoptrophorus semipalmatus inornatus*, Bodega Bay, California, 1986.

Parasite	No. birds infected, no. parasites	USNM coll. no.
Digenea		
Ascorhytis charadriformis (Young, 1949)	9, 1,936	
Cloacitrema michiganense McIntosh, 1938	1, 1	80790
Levinseniella gymnopocha Coil, 1956	8, 344	80791
Maritrema laricola Ching, 1963	9, 3,098	80792
Odhneria odhneri Travassos, 1921	1, 8	80793
Parorchis acanthus (Nicoll, 1906)	1, 1	80794
Parvatrema borealis Stunkard and Uzmann, 1958	1, 100	
Cestoda		
Cysticercoid stage	8, 54	
Hymenolepidae	1, 1	
Acanthocephala		
Polymorphidae	1, 1	
Nematoda		
Thominx cecumitis sp. n.	7, 20	80787

clusively found in the ceca and has been reported from the short-billed dowitcher (*Limnodromus griseus*) in Alaska by Schmidt and Neiland (1968) and shorebirds in the Yakutskaya region of the Soviet Union by Spasskii (1963).

Dicranotaenia amphitricha (Hymenolepidae) was identified from the description by Deblock and Rose (1962) and, probably because of the varied appearance of the strobila (Belopolskaia, 1970), has had a complex taxonomic history (Schmidt, 1986).

Two small cestodes were found in coinfections in the anterior fourth part of the intestine. *Echinocotyle nitida* has been described from sandpipers from the Barents Sea and France by Deblock and Rose (1962). This species has fine spines on its suckers and should not be confused with *Echinocotyle dubininae* (syn. of *Hym. (Ech.) nitida* of Clerc, 1902) which has tiny aploparaxoid-shaped hooks on its suckers. The size range of *E. nitida* was 5–10 mm, whereas *Nadjedolepis paranitidulans* at the same site was smaller, 3–7 mm, and more numerous. Four species of *Nadejdolepis* have been reported from dunlins, and the pointed rostellum and rostellar hook shape of *N. paranitidulans*, as in the figure of the scolex by Spasskii and Bobova (1962), were most similar to my specimens. The rostellar hook measurements given were 40–42; my measurements of 28 were slightly larger, 45–50 (48), handle 19–23 (22), blade 22–31 (27). Segments of *N. paranitidulans* are shown for reference purposes (Fig. 4).

Trichocephaloides macrocephala and *Retinometra deblock* (Hymenolepidae) were found in low intensity in the anterior half of the intestine. The former has been reported from sandpipers in North America, Europe, and the Soviet Union (Schmidt, 1986), and the latter was described from *Limnodromus griseus* in Alaska by Schmidt and Neiland (1968). Schmidt (1986) transferred *Hymenolepis (H.) deblocki* to *Retinometra* even though this species has an accessory sac and other members of the genus do not. Use of Schmidt's key could also result in allocation of this species to *Sobolevicanthus*, but its species have skrjabinoid-shaped rostellar hooks. The rostellar hooks of *R. deblocki* are nitidoid-shaped and large; 25 were 102–115 (108 ± 4.6). Specimens were shorter than the type specimen, <22 mm in length with ½ the numbers of proglottids. The spined, copulatory portion of the vagina was enlarged, 32–42 (38) anteroventral to the cirrus sac. Eggs were not mature but 36–70 were counted per proglottid, with maximum size of 31 × 26. Dr. Eric Hoberg identified this tapeworm for me.

The cestode populations were evenly distributed in numbers in both localities. There appeared to be fewer tapeworms and no *A. brachyphallos* at Bolinas Lagoon.

Acanthocephala and Nematoda

The acanthocephalans, *Arhythmorhynchus comptus* and *A. eroliae* were found in the third quarter of the intestine; the former was originally described from dunlin in Alaska by Van Cleave and Rausch (1950) and the latter from the same host in Japan by Yamaguti (1939). Both species

occurred at Bolinas Lagoon; *A. eroliae* consisted of 2 immature, 1 male, and 1 nongravid female specimens. The new species of nematode occurred in the ceca of 6 dunlins sampled in March at Bodega Bay. Its description will follow.

Parasites of western willet

Eleven parasite taxa were found in the intestine of western willets (Table 2). The taxa consisted of 8 digeneans, 2 cestodes including a cysticercoid stage, 1 acanthocephalan, and 1 nematode. Four helminths were common to dunlin. Microphallid trematodes (*Ascorhytis, Maritrema, Levinseniella*) occurred in high prevalence and intensity; the first 2 species use the same intermediate hosts, which are shorecrabs in muddy bays and rocky shores (Ching, 1963a, b). Other parasites were comparatively rare including *Parvatrema borealis* (Gymnophallidae), with 100 minute specimens estimated to be present in 1 western willet. A dunlin was experimentally infected after feedings with the clam intermediate host, *Nuticola tantilla* (Gould). Shorebirds are new hosts on the Pacific coast of North America. The cysticercoid stage, partial specimen of hymenolepid and single sample of polymorphid acanthocephalan could not be further identified. According to Bush (1989), western willets can have varied and abundant helminth populations; those from California can be considered depauperate.

Thominx cecumitis sp. n. (Figs. 5–9)

Description

GENERAL: Body hairlike, long, extremely slender. Bacillary bands extend length of body. Anterior end pointed with no cuticular swelling, posterior end bluntly rounded. Esophagus with short, weakly muscular, long glandular portions. Eggs operculate with cuticular plug at each end. Males with single spicule at posterior end, spicule enclosed in spinous sheath.

MALE (N = 5): Body length 5–12 (8) mm, anterior width 8–10, width at midbody and posterior end, 33–43 (Fig. 5). Esophagus with maximum of 47 stichocytes. Spicule 777–979 (878) in length, composed of 4 cuticular rods somewhat cuboidal in cross section, uniformly wide 6–13 (8.7), terminating at posterior end with bluntly rounded bladelike tip. Spicule protrudes more than ½ its length from posterior end, when fully withdrawn, 44–132 from posterior end (Fig. 6). Sheath transversely wrinkled, finely spinous. Cuticular, bursa-like extensions at posterior end; median ball at tip. Pair of postanal papillae present. Lateral alae narrow, somewhat asymmetrical extending anteriorly to level of withdrawn spicule (Fig. 7).

FEMALE (N = 15): Body length 12.8–29.5 mm, immature worms 11–13.8 mm. Anterior end narrow, width 8–13, width at vulva 51–64, posterior end blunt, width 33–51, with median cuticular ball. Glandular esophagus with maximum of 64 stichocytes. Anus subterminal, caudal papillae present. Vulva 25–39% from cephalic end, 43–47% from cephalic end in immature specimens. Vulva with cuticular appendage shorter than width of body; when expanded, goblet-shaped with cuticular supports 32–59 by 20–38 (Fig. 8). Vagina muscular, uterus with 27–86 (51) eggs. Eggs with cuticular plugs, slightly flexed at middle like peanut shells, with homogeneous granular surface (Fig. 9), 100 measured 49–69 × 23–33 (62 × 30).

TYPE HOSTS: *Calidris alpina* (L.), dunlin; *Catoptrophorus semipalmatus inornatus* (Brewster), western willet.

SITE OF INFECTION: Ceca.

TYPE LOCALITY: Bodega Bay, California.

SPECIMENS DEPOSITED: Holotype male, USNM Helm. Coll. No. 80785; allotype female, USNM Coll. No. 80786, paratypes USNM Coll. No. 80787.

Remarks

Capillarid species with a spinous spicule sheath were placed in the genus *Thominx* Dujardin, 1845, by Skrjabin et al. (1957). Of 51 species listed, 6 were reported from avian hosts. The new species differs from *T. anatis* (Schrank, 1790), *T. contorta* (Creplin, 1839), *T. raillieti* (Lopez-Neyra, 1946), and *T. spinulosum* (Linstow, 1890) in having a vulvar appendage, peanut shell shape of the eggs, and presence, in both males and females, of a median cuticular ball at the posterior end. It is similar to *T. ellisi* (Johnston and Mawson, 1945) and *T. nyrococinarum* (Madsen, 1945), which have a vulvar appendage. However, it dif-

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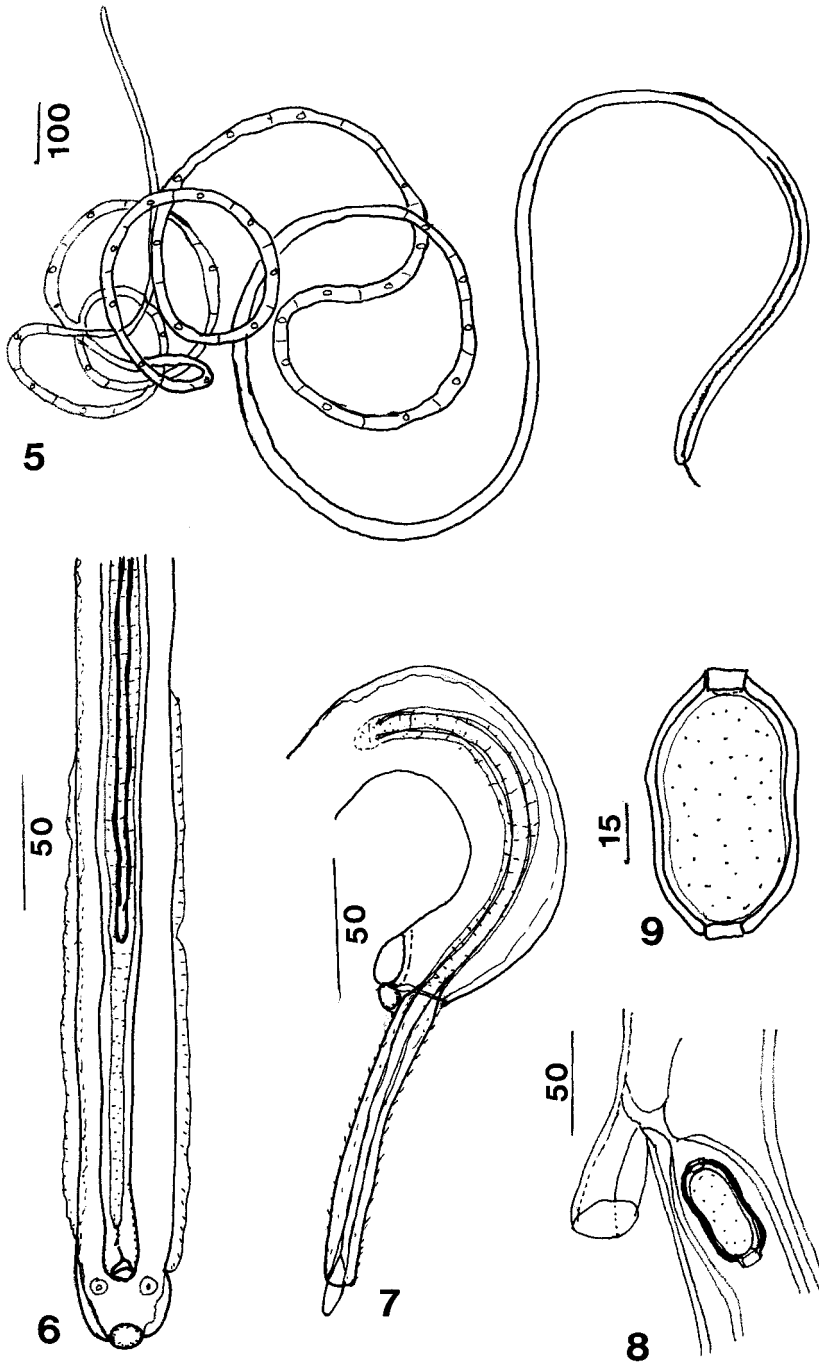
Figures 5–9. ***Thominx cecumitis*** **sp. n. 5. Whole mount of male holotype. 6. Posterior portion of male. 7. Everted spicule of male. 8. Vulvar appendage of female. 9. Egg. Bar numbers are in micrometers.**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fers from *T. ellisi* in the shorter proportions of the vulvar appendage and shorter length of the spicule (1.4 mm in *T. ellisi* vs. <1 mm in *T. cecumitis*). It differs from *T. nyrococinarum* in the symmetry of the eggs and presence of lateral alae in males. According to McDonald's (1974) key to species of *Capillaria,* 4 capillarids from the ceca and small intestine of waterfowl are similar to the *T. cecumitis* in having a short vulvar appendage. *Capillaria pudendotecta* Liubimova, 1947, has a globular-shaped vulvar appendage but its eggs are asymmetrical, and the female has a terminal anus. The male of *C. pudendotecta* has not been described. *Capillaria mergi* Madsen, 1945, has a small vulvar appendage, and eggs with the inner shell reflexed at the ends. The male of *C. mergi* has a nonspinous, transversely striated spicule sheath and no genital bursa. *Capillaria bursata* Freitas and Almeida, 1934, has eggs with fine longitudinal ridges and shell layers with terminal curves. The male has a nonspinous, transversely striated spicule-sheath, genital bursa, and lateral alae. *Capillaria exilis* (Dujardin, 1845) has eggs with a lattice pattern and prominent striae at the ends. The male has a nonspinous spicule-sheath, sharply pointed spicule, and small genital bursa and caudal alae.

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