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Bionomics of black flies (Diptera: Simuliidae) in Costa Rica. V. Description of *Neomesomermis travisi* sp.n. (Nematoda: Mermithidae)*

by

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Abstract: *Neomesomermis travisi* sp. n., a mermithid parasite of larvae of *Simulium panamense* and *Simulium metallicum*, is described from Costa Rica, Central America. This species, the first mermithid described from the Neotropical Region, is very close to *Neomesomermis flumenalis* Welch, 1962 but can be differentiated by the distinct serrations on the tips of the spicules; those of *N. flumenalis* being distinctly smooth, and the tail of the female adults more bluntly rounded than in *N. flumenalis*. Narrow chords, small amphids, bulbous vagina, large eggs in two rows, and the genital structures of the male of *N. travisi* also differ from those of other, closely allied, Holoarctic species of *Neomesomermis*. Detailed measurements of taxonomically important structures of different life stages are presented and illustrated.

Information on the predators and parasites of Neotropical Simuliidae has been limited to a few records in the literature (Vargas, 1945, Dalmat, 1955). The importance of the feasibility of using pathogens and parasites in the biological control of this medically important group of insects should encourage basic studies leading to a better understanding of the problem, both from a systematic approach and because of the ecological aspects involved.

In this paper we describe a new species of *Neomesomermis*, a mermithid parasite of *Simulium* larvae in Costa Rica.

Type specimens: Holotype (♂) and allotype (♀) deposited in the collection of the Department of Parasitology, School of Microbiology, University of Costa Rica, and paratypes at the Zoology Institute of the Academy of Sciences, Leningrad, U.S.S.R.

Biology: Biological aspects of the life cycle and bionomics of this species of *Neomesomermis* will be discussed in a separate paper.

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Hosts: This mermithid was found parasitizing larvae of two species of simuliids in Costa Rica: *Simulium metallicum* and *Simulium panamense.* The holotype and paratypes were reared from black fly larvae collected in stream N° 4 (Qda.Parruás), Aserrí, Province of San José, Costa Rica.

This species is dedicated to the former leader of black fly studies in Costa Rica, Dr. Bernard V. Travis, Professor Emeritus, Cornell University, U.S.A.

MATERIAL AND METHODS

Parasitized larvae of two black fly species: *Simulium panamense* and *S. metallicum,* were collected from Parruás stream, Province of San José, described in detail by Vargas & Travis (1973).

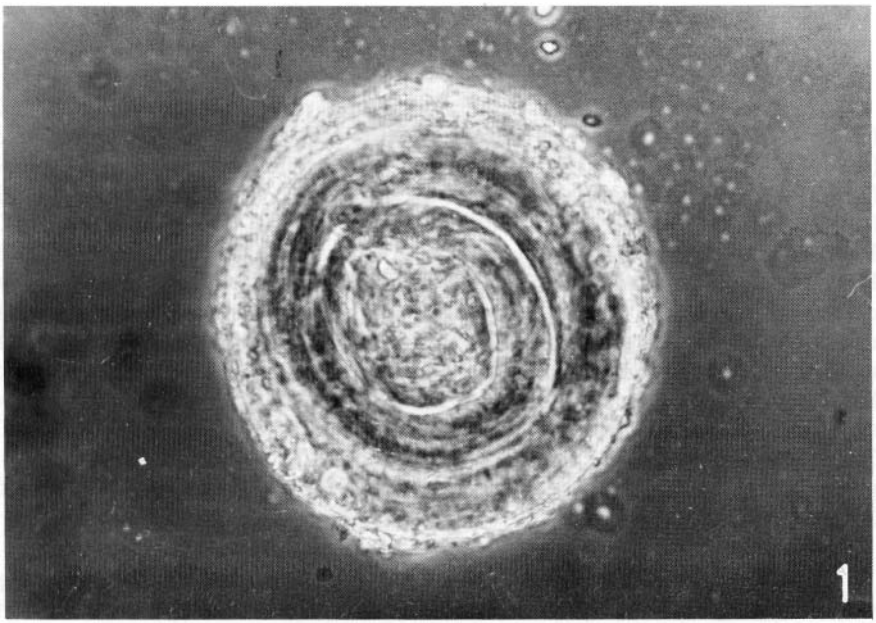
The *Simulium* larvae were brought to the laboratory in plastic containers, and placed in sorting pans with aereated water. Emerged postparasitic stages of the mermithids were isolated for one day in petri dishes with standing water and the more active ones kept for rearing. They were transferred to small plastic boxes with coarse sand and sterile water. Mature males, females, eggs and preparasites were readily obtained by this method. The nematodes were killed, fixed and stained by placing them in polivynil alcohol directly, and studied under ordinary and phase contrast microscopy. No adult specimens were collected from stream samples. Preparasites were also studied *in vivo,* stained with green malachite. Adult worms fixed and preserved in formalin were sectioned for detailed anatomical study. Measurements of all life stages were made with an ocular micrometer. Measurements consist of the mean of the total number measured, followed in parentheses by the range, and are given in μm unless otherwise indicated.

RESULTS

NEOMESOMERMIS TRAVISI sp. n.

♂, (n = 18); L = 7.57 (4.81 – 9.71) mm; a = 77.83; c = 39.67

Description: Male. Body thin and slender, tapering towards the caudal end. Nerve ring located at 160.50 (147.05–190.30) from apical end. Genital opening located 191.02 (138.0–213.90) from the caudal end. Trophosome length not determined. Diameter of cephalic region at amphid level (n = 12) 49.85 (46.71–53.63); at nerve ring 80.44 (65.74–103.80); at genital opening 97.36 (75.90–117.30). Amphids more or less rounded (Figs. 10 and 17: 1,2); length of pouch (n = 6) 28.25 (24.22–34.60); width of pouch (diameter) 25.05 (17.30–32.87). Spicules equal, separated, slender, uniformly wide, arch-shaped and short (Figs. 11 and 17:4). Tips with serrations at innerside (Fig. 17:3), length (n = 17) 228.76 (190.30–259.50). Genital papillae arranged in three rows, with the addition of a short fourth row present anteriorly and posteriorly to the genital pore. Number of pairs of lateral rows of pregenital papillae (n = 17) 15 (11–19), number of pairs of rows of postgenital papillae (n = 17) 13.5 (10–17). The excretory pore was not located in the specimens studied.



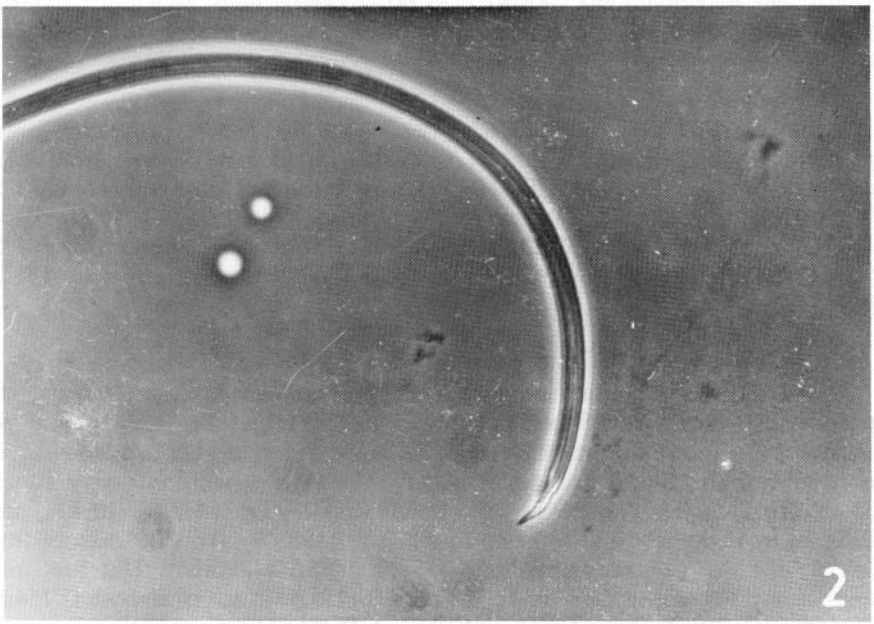


Fig. 1. Egg.

Fig. 2. Tail of preparasitic larva.

♀ (n = 16); L = 10.95 (7.35–15.75) mm; a = 55.80; b = 5.6;
V = 50.41 % (40.33–55.55) %

Female. Length of body 10.95 mm. Width of body at amphid level 72.27 (43.25–103.50); at nerve ring 126.89 (98.61–158.70); at genital pore 196.37 (155.70–255.30). Distance from cephalic end to nerve ring 188.98 (150.51–276.0). Amphids very small (Figs. 12 and 17:5); length of pouch (depth) (n = 7) 17.30 (13.84–20.76); width (diameter) (n = 7) 15.32 (12.11–17.30). Diameters of aperture (n = 5) 16.26 (8.65–19.03) X 15.22 (6.92–20.76). Pharingeal tube sinuous, especially at the cephalic end (Fig. 13). Although it is well defined anteriorly, it becomes very indistinct at the posterior end and could not be measured in most specimens. Length 1947.69 (1535–2490), (n = 13). The excretory pore was not located. Vagina short, 93.61 (69.20–172.50) long and 84.07 (69.20–86.50) wide located at 5526.21 (3850–7612.50) from the anterior end. The vagina is aligned almost at right angle to the body axis. (Figs. 14, and 17: 7,11). Vulva a transverse slit with lips. Posterior end of body rounded, without a projection (Figs. 15, 16 and 17: 6). R_1 = 16.83 (12.11–19.03). R_2 = 28.65 (19.03–34.60).

Postparasitic form (juvenile, stage IV), with male genital primordium (Figs. 8,9): Body length (n = 6) 9.0 (8.13–10.15) mm. Distance from apical end to nerve ring 171.02 (155.70–190.30); from caudal end to genital pore 166.02 (155.70–207.60); from apical end to trophosome 203.89 (173.0–224.90); from caudal end to trophosome 188.80 (181.60–250.80). Body width at nerve ring 77.10 (69.20–91.69); at cephalic region 53.90 (43.25–64.01); at genital pore 87.65 (72.66–103.80).

Postparasitic form (juvenile stage, IV) (Figs. 6, 7, 17: 10), with female genital primordium: Body length (n = 7) 11.70 (9.45–13.12) mm. Distance from apical end to nerve ring 175.96 (155.70–216.25); from apical end to genital pore 6311.50 (5810–7087.50); from apical end to trophosome 198.20 (173–259.50); from caudal end to trophosome 38.80 (25.95–55.36). Body width at nerve ring 101.57 (81.31–129.75); at cephalic end 63.02 (55.36–69.20); at genital pore 155.74 (138–207).

Mature parasitic form, with male genital primordium: At this stage the genital primordium can be easily seen and sexing was possible. The male genital primordium shows a rudimentary cuticular slit and a group of cells in a cone-shaped arrangement, the caudal end tapers slightly. In some specimens a very minute pointed appendage is present. Length of body (n = 13) 9.136 (8050–10.325) mm. Distance from cephalic end to nerve ring 172.73 (138.40–216.25). Distance from caudal end to genital primordium 187.37 (155.70–216.25). Distance from trophosome to apical end 254.17 (190.30–458.45); to caudal end 254.84 (224.90–363.30). Body width at cephalic end 46.97 (34.50–60.55); at nerve ring 73.59 (60.55–89.96); at genital primordium 75.58 (60.55–91.69). Homorocyte very large (n = 1) 42.37. Stichosome is well developed but its position varies depending on the pressure exerted by the trophosome, making measurement difficult. Stichosome with 2 rows of stichocytes, each composed of 12 cells. Size of stichocytes (n = 12) 22.0 X 16.04.

Mature parasitic form, with female genital primordium: The female genital primordium is located near the middle of the body and shows a small transverse slit surrounding a small group of cells. Posterior end of body rounded. Body length (n = 9) 10.33 (6.70–11.98) mm. Length of stichosome (n = 7) 828.23 (717.95–968.80). Distance from apical end to the nerve ring 176.07 (134.94–242.20). Distance from stichosome to apical end (n = 8) 1453.26 (1072.60–1634.85). Distance from trophosome to apical end 224.70 (155.70–311.40); from trophosome to caudal end (n = 8) 50.81 (17.30–86.50). Body width at cephalic end 49.20 (43.25–60.55); at nerve ring 79.0 (60.55–103.80).

Parasitic form, (Stage II, Medium of Phelps and De Foliart): Body elongate, slender, tubular, anterior end truncate, slightly tapering towards the posterior end; cuticle thin with crisscross fibers. Anterior end with large group of cells. Homorocyte and stichosome well developed. Primordial cells in development. Body length (n = 6) 3.95 (2.51–5.45) mm. Width of body at middle 52.90 (48.30–62.10).

Parasitic form, (Stage II, small of Phelps and De Foliart): Body slender, tubular, sausage-like (Fig. 3). Stylet present. Anterior and posterior body region with a very large group of small rounded cells (Figs. 4,5). Intestine apparently divided in sections. Caudal end with a very minute pointed appendage. Length of body (n = 2) 0.705 (0.658–0.752) mm. Width of body at middle 42.30 (32.90–51.70).

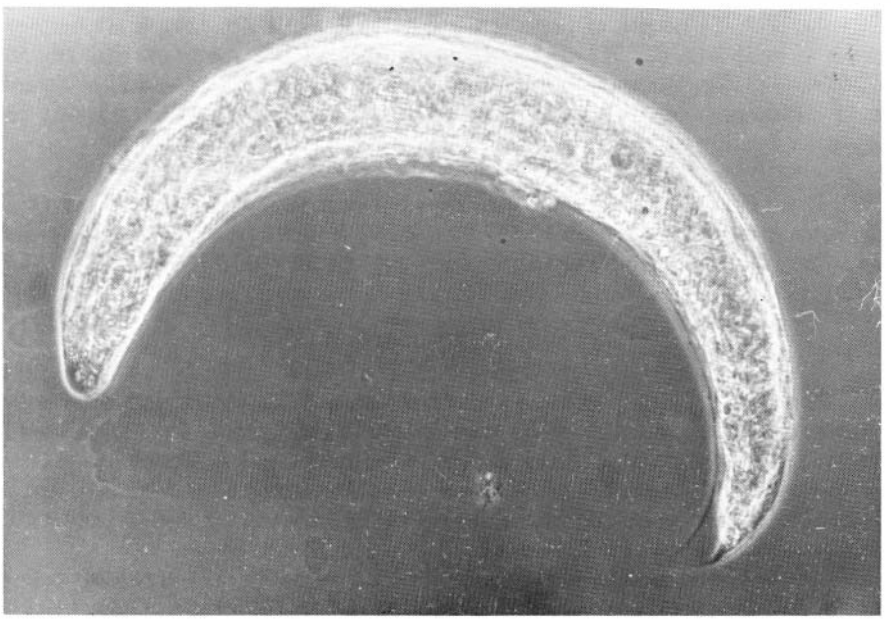


Fig. 3. Parasitic form, second stage.

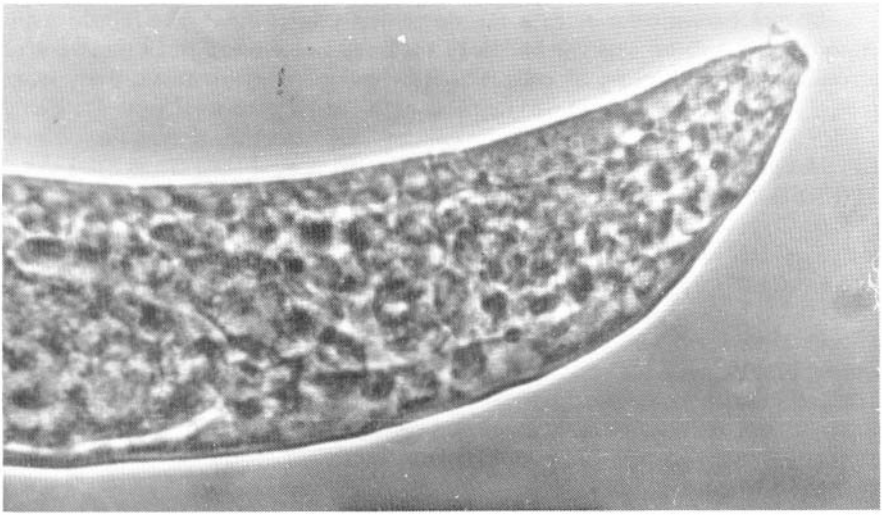


Fig. 4. **Parasitic form, second stage, anterior end.**

Preparasitic larva: Body slender, cephalic end rounded, tapering towards the posterior end, with a very peculiar spike-like structure (Fig. 2). The anterior portion of the body presents two large masses of glandular cells that overlap the pharingeal glands, making it impossible to determine their length. Small stylet present. Length of body (n = 12) 0.953 (0.690–1.138) mm. Length of stichosome 261.23 (224.90–302.75) Length of flagellum 610 (475.75–709.30). Length of pharingeal glands (n = 2) 34.6 (25.95–43.25). Distance from stichosome to anterior end 593 (426.64–723.30). Distance from head to nerve ring 83.18 (77.85–88.23). Distance from posterior end to genital primordium (n = 5) 427.31 (397.90–441.15). Couturier coefficient: 64.

Eggs: Eggs are rounded with no apparent ornamentations (Figs. 1 and 17:8). Diameter of eggs in uterus 66.16 (57.09–74.39) X 66.99 (60.55–77.85) (n = 29). Size of eggs already oviposited (n = 29) 64.36 (60.55–74.39) X 64.66 (57.09–77.85).

DISCUSSION

Nickle (1972) proposed the genus *Neomesomermis* considering *Mesomermis flumenalis* Welch, 1962 as its type species. According to Rubtsov, (1972) there are 25 species of this genus known from Europe, Asia, Africa and America. Strong (cited by Vargas, 1945) reported in 1934 the genus *Mesomermis* in *Simulium* spp. in Guatemala. In the same country, Dalmat (1955) recorded mermithid parasites of both larvae and adults of *Simulium metallicum* and *S. ochraceum.*

The species described in this paper is very close to the only previously known species of this genus in America, *Neomesomermis flumenalis* Welch. *Neomesomermis melusinae, N. vernalis* and *N. biseriata* are also considered close by Rubtsov (1972) to *N. flumenalis,* but differences in the shape and position of the vagina, shape and length of the spicules and size of the amphids differentiate the above mentioned species.

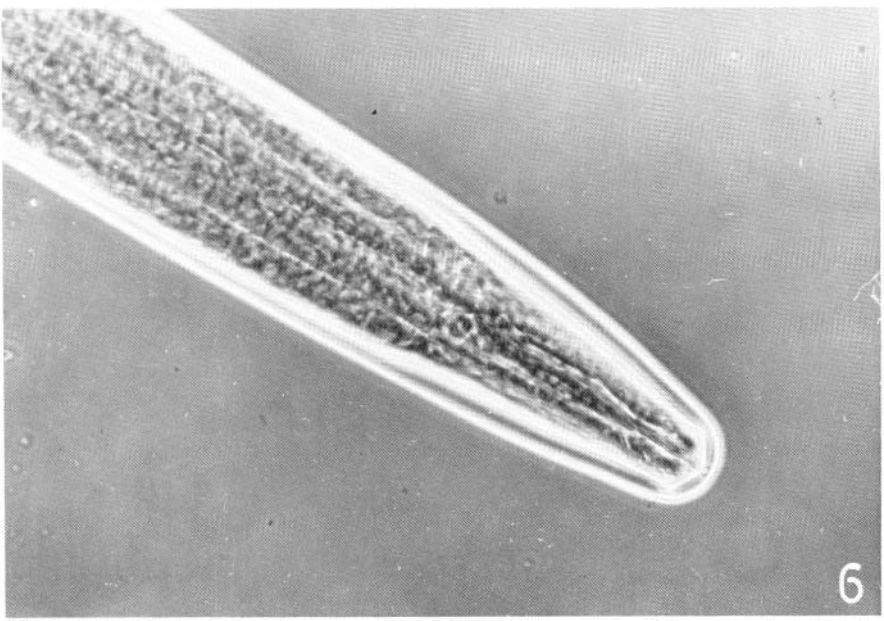


Fig. 5. Parasitic form, posterior end.

Fig. 6. Postparasitic form with female genital primordium. Anterior end.

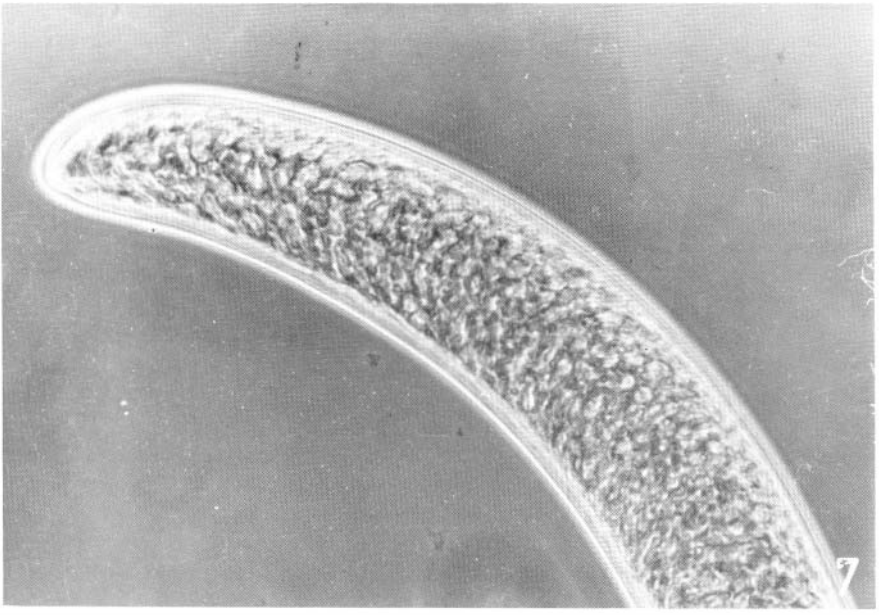
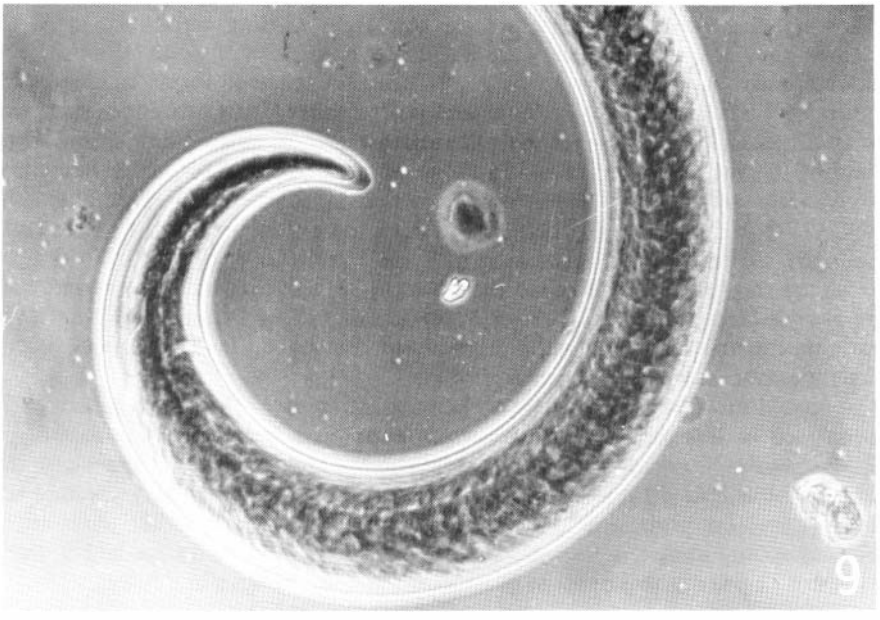


Fig. 7. Postparasitic form, with female genital primordium. Posterior end.

Fig. 8. Postparasitic form, with male genital primordium. Anterior end.



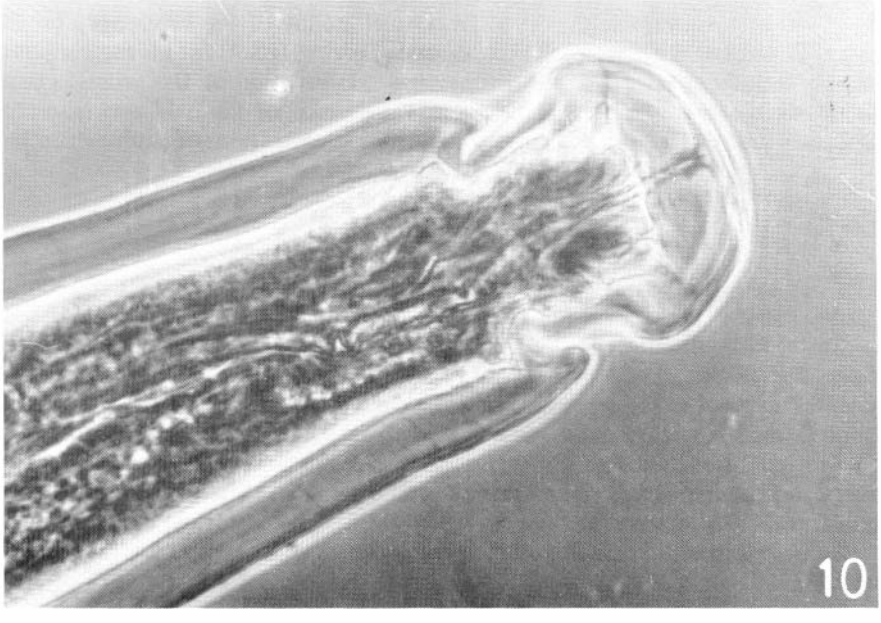


Fig. 9. Postparasitic form, with male genital primordium. Posterior end.

Fig. 10. Male. Anterior end.

We consider our material as a new species of *Neomesomermis* based on the following diagnostic characters: spicule tips show distinct serrations: in *N. flumenalis* they are typically smooth. Tail in female adults of Costa Rican material more bluntly rounded than in *N. flumenalis.* Postparasitic forms lacking caudal appendage, characteristic of *N. flumenalis* postparasites. The Costa Rican specimens differ from Holoarctic species in having narrow chords, small amphids and in the form of the vulva and vagina and in the genital structures of the males. Spicules of *N. biseriata* are smooth; length of *N. vernalis* spicules is 150–170, and 228.7 (190–254) in our material. The distance from the genital pore to the caudal end is distinctly different in *N. melusinae* (1.7–2.4) and 0.091 (0.13–0.43) in Costa Rican specimens. In *N. melusinae* the outer and inner portions of the vaginal canal are at right angles to each other. In *N. vernalis* and in our material this is not so; in both species the inner and outer portions of the vaginal canal make an obtuse angle. Females of *N. biseriata* are not known.

Based on the tail appendage of the parasitic forms of the closely allied species mentioned in this paper, *Neomesomermis travisi* sp.n. may be differentiated from *N. flumenalis, N. melusinae* and *N. vernalis* by the long filiform tail appendage that exceeds from 2 to 5 times the body diameters of these species. In *N. travisi* a very minute pointed projection may or may not be present. Another character of taxonomic importance is the number of stichocytes; in *N. melusinae* and *N. travisi* there are 12 pairs in two rows; in *N. vernalis* there are 16 pairs in 2 rows.

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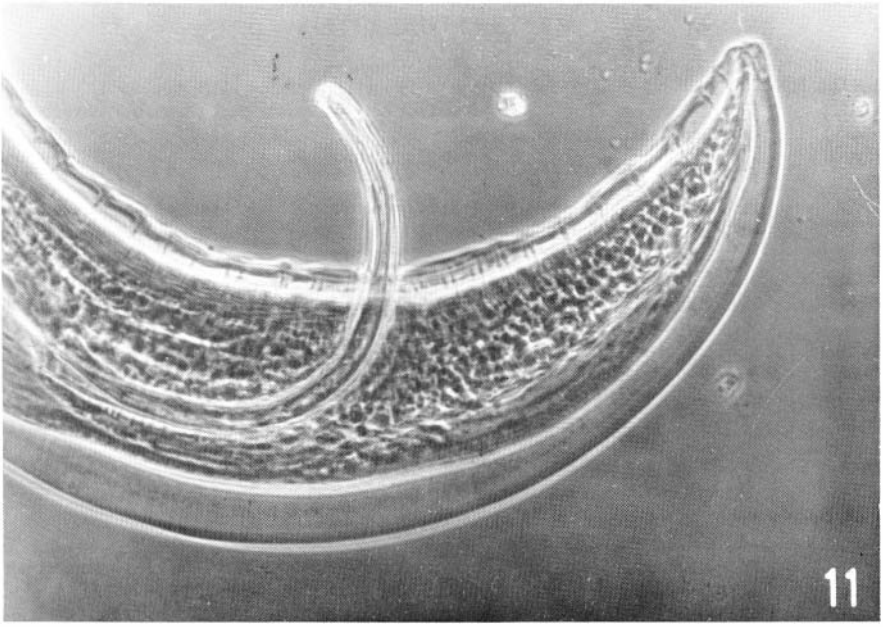
RESUMEN

Un mermítido (*Neomesomermis travisi* sp.n.), parásito de larvas de *Simulium panamense* y *S. metallicum* por primera vez se describe para la región Neotrópica, en Costa Rica, América Central. Esta especie es muy cercana a *Neomesomermis flumenalis,* Welch, 1962 pero puede ser diferenciada de esta última por los siguientes caracteres: a) serración en los extremos de las espículas; b) cola de la hembra marcadamente más redondeada; c) cordones angostos; ch) anfides pequeños; d) forma bulbar de la vagina; e) huevecillos grandes, dispuestos en dos hileras; f) las estructuras genitales del macho también difieren de otras especies similares de *Neomesomermis* de la región Holoártica. Se incluyen ilustraciones y medidas de estructuras de importancia taxonómica de diferentes estadios de desarrollo.

Fig. 11. Male. Posterior end.

Fig. 12. Female. Anterior end.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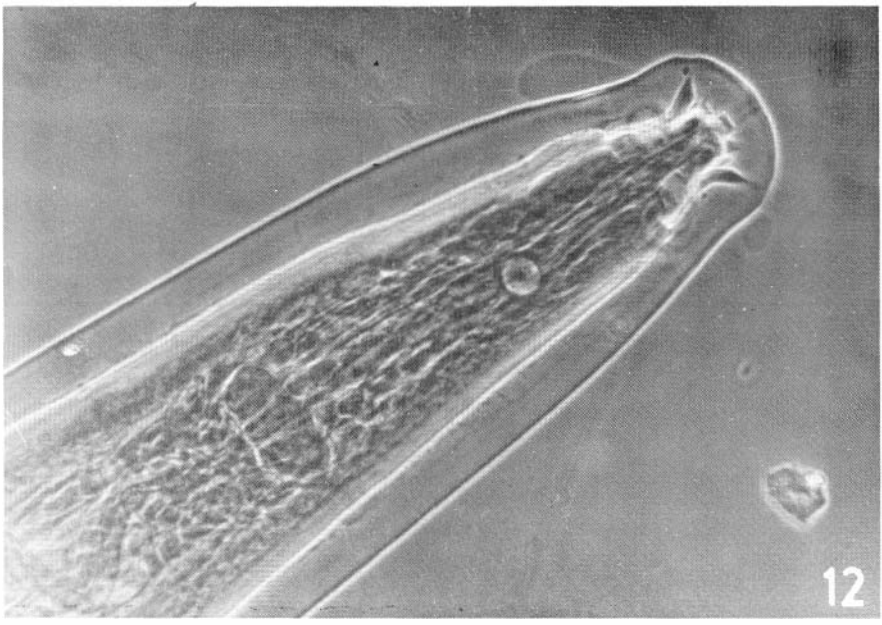
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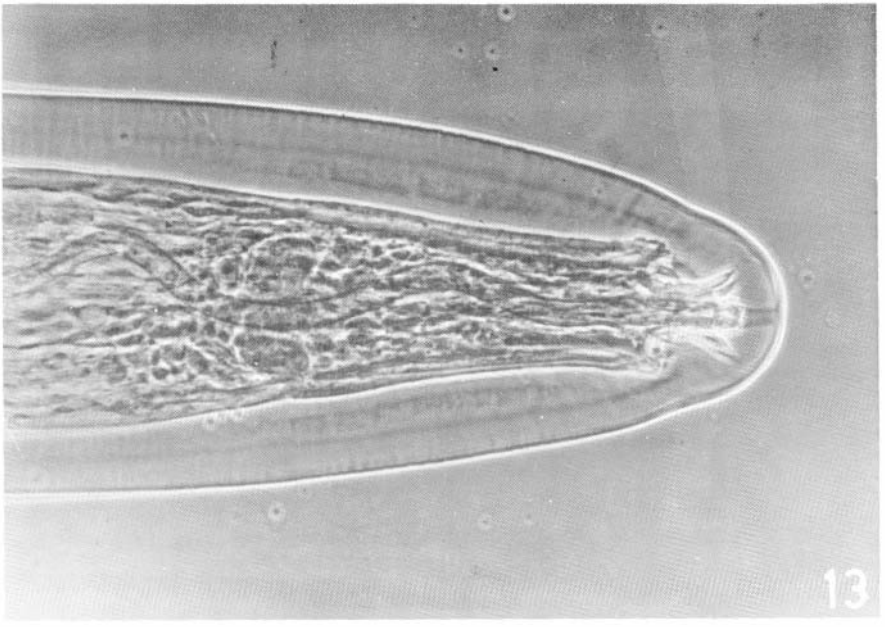
Fig. 13. Female. Anterior end, showing convolluted oesophageal tube.

Fig. 14. Female showing impregnated vagina.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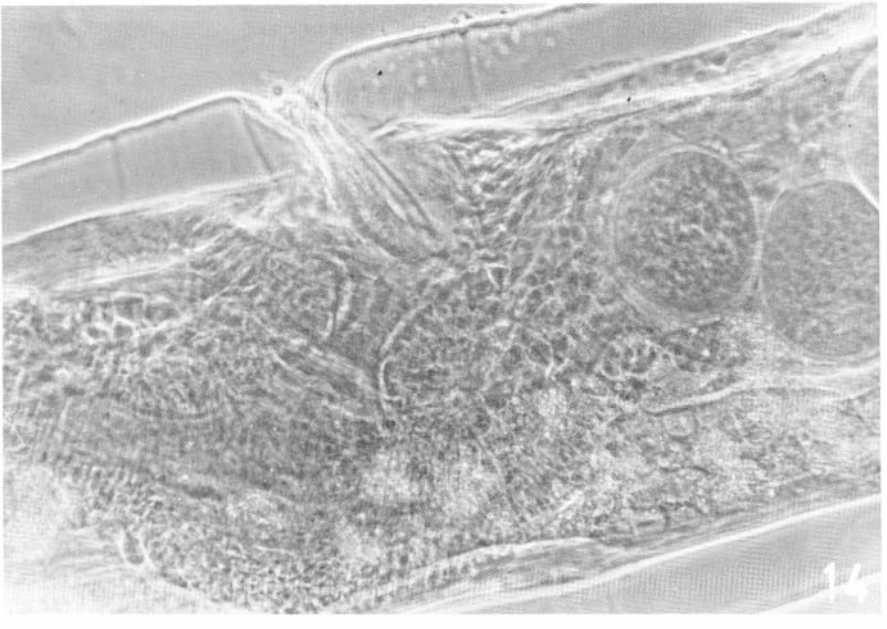
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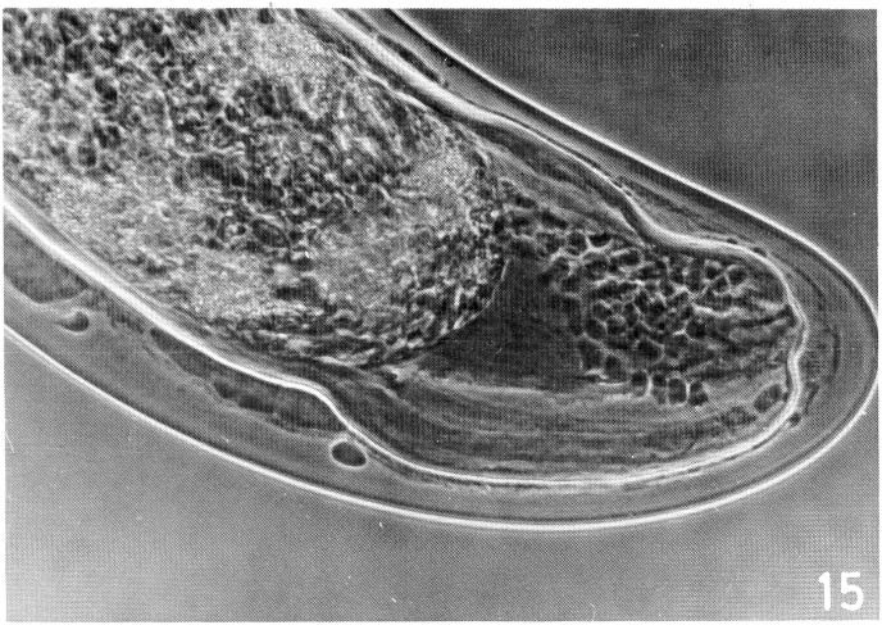
Fig. 15. Female. Posterior end.

Fig. 16. Female. Posterior end.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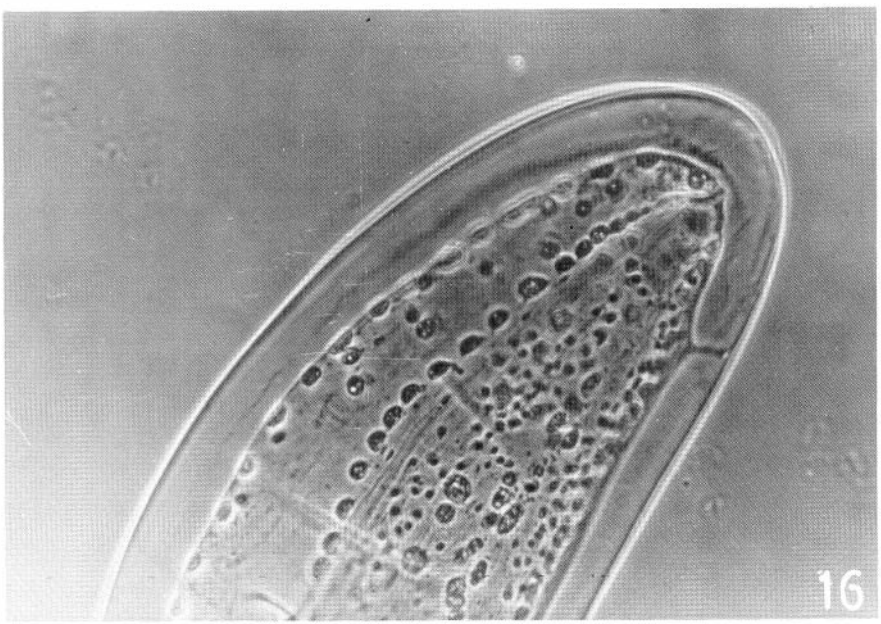
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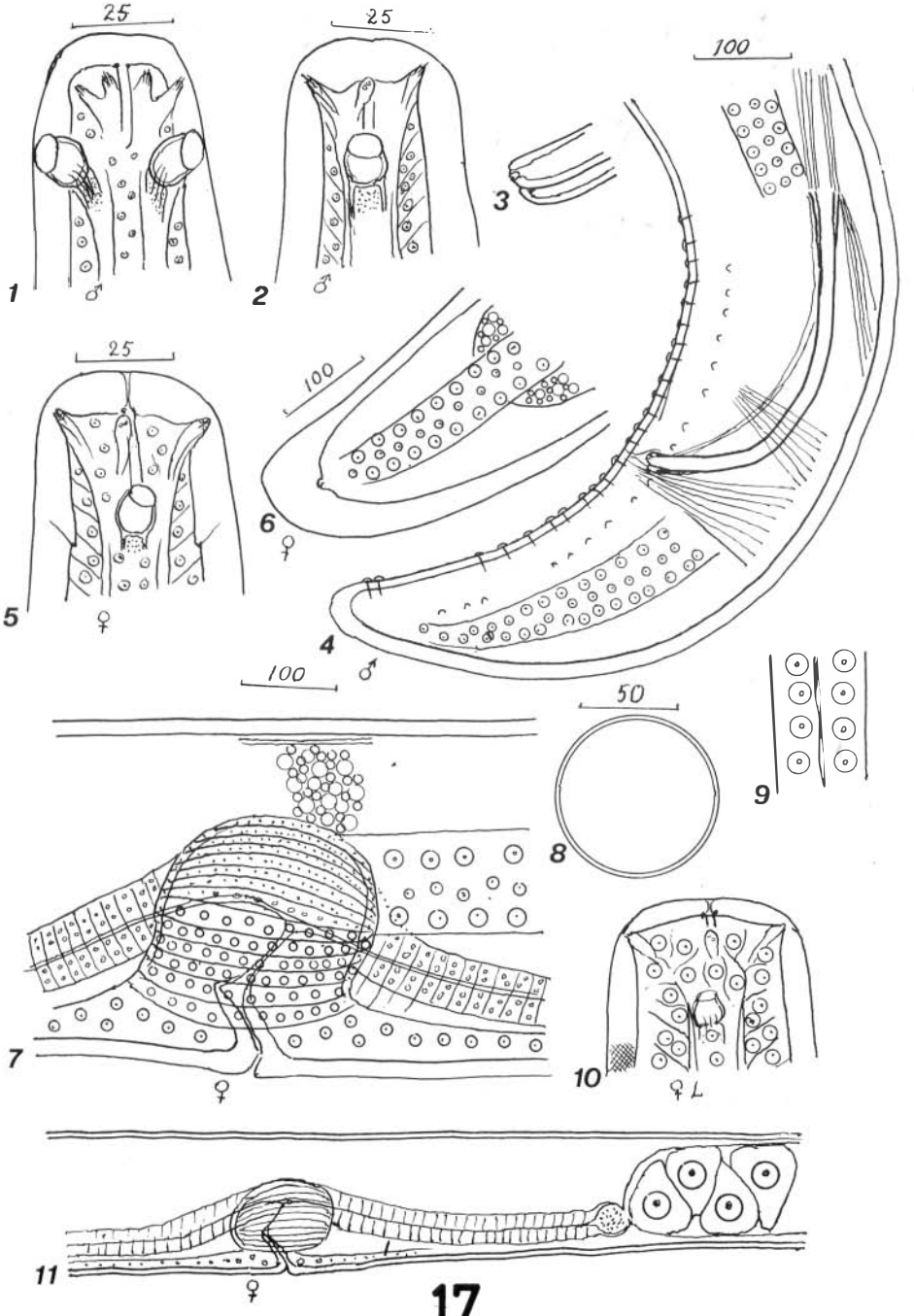
Fig. 17. Some morphological aspects of *Neomesomermis travisi* sp. n.

1. Dorsal view of anterior end of adult male.
2. Lateral view of anterior end of male.
3. Lateral view of spicule tips.
4. Posterior end of adult male.
5. Lateral view of anterior end of adult female.
6. Lateral view of posterior end of adult female.
7. Vulvar region.
8. Egg.
9. Lateral cords.
10. Lateral view of anterior end of larva
11. Genital region of adult female.



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