

North American Monogenetic Trematodes. VIII. The Family Hexostomatidae*

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This paper is a continuation of the series dealing with the North American monogenetic trematodes and of a general revision of the Monogenea. The purpose and organization of this installment are the same as for previous sections (Price, 1937, 1938, 1939a, 1939b, 1942, 1943a and 1943b). Following the appearance of Part VII, in 1943, work on this series had to be suspended because of other duties. Since that time a great deal of work has appeared by other workers, notably, Bychowsky, Sproston, Hargis, Mizelle and his associates, Yamaguti, Caballero and his associates, Chauhan, Tripathi, Jain, and others, which has necessitated a reconsideration of some ideas previously held regarding relationships and classification. While some changes in viewpoint are incorporated in this paper, and will be in others to follow, the major revision will be reserved until the completion of the present series.

HEXOSTOMATIDAE PRICE, 1936

DIAGNOSIS: Opisthaptor not distinct from body proper, usually with four pairs of sessile, sucker-like clamps containing three dissimilar sclerites, two small, irregular and tending to be bipartite, one on either side of lateral wall of capsule, and a larger, more or less saddle-shaped sclerite in middle; anchors two pairs, dissimilar, located between most posterior pair of clamps. Intestine reticulate. Genital atrium and cirrus unarmed; testes numerous, postovarial. Ovary U-shaped, with both limbs directed posteriad. Vagina present, aperture dorsal and median; terminal portion expanded and containing a pair of opposing hemispherical bodies armed on their free margins with backwardly directed spines. Parasites of the gills of scombroid fishes.

TYPE GENUS: *Hexostoma* Rafinesque, 1815.

KEY TO GENERA OF HEXOSTOMATIDAE

Posterior end of body truncate; opisthaptor clamps in a more or less straight transverse row *Hexostoma* Rafinesque
 Posterior end of body not truncate; opisthaptor clamps in two more or less vertical rows *Neohexostoma*, n.g.

GENUS *Hexostoma* RAFINESQUE, 1815

SYNONYMS: *Polystoma* Zeder, 1800, in part; *Hexacotyla* Blainville, 1828; *Hexacotyle* Blainville, 1828; *Plagiopeltis*, Diesing, 1850; *Exacotyle* Monticelli, 1888.

DIAGNOSIS: Body conspicuously attenuated anteriorly, widest and more or less truncate posteriorly. Prohaptor suckers shallow, sometimes poorly defined; opisthaptor clamps sucker-like, oval, usually four pairs with innermost much smaller than others (except in *H. auxisi* Palombi (1943), arranged in a transverse row across posterior end of body. Testes numerous, in posterior half of body. Vitelline follicles extend into post-testicular zone.

TYPE SPECIES: *Hexostoma thynni* (De la Roche, 1811) Rafinesque, 1815,

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from *Thynnus brachypterus* (= *Scomber thynnus*), *T. thynnus*, *Parathynnus obesus*, and *Pelamys sarda* (= *Sarda sarda*).

INCLUDED SPECIES: *Hexostoma acutum* (Goto, 1894) Sproston, 1946, from *Parathynnus sibi*; *H. auxisi* Palombi, 1943, from *Auxis thazard* (= *A. bisus*, = *A. rochei*); *H. dissimile* (Yamaguti, 1937) Sproston, 1946,** from *Thynnus thynnus*; *H. grossum* (Goto, 1894) Sproston, 1946, from *Thynnus* sp. (= *Parathynnus sibi*, vide Ishii and Sawada (1938)), *Katsuwonus vagans*, *Thunnus orientalis* and *Seriola quinqueradiata*; and *H. lintoni*, n. sp., from *Sarda sarda*.

The only North American representative of *Hexostoma* (s. str.) is *H. lintoni*, a description of which follows:

Hexostoma lintoni, new species (Figs. 1-4)

SYNONYM: *Hexacotyle thynni* of Linton, 1901.

DESCRIPTION: Body elongate, 7.4 mm long by 2.2 mm wide, divided into three parts, a neck-like region, body, and haptor. Prohaptor in form of two elliptical suckers, each 0.038 mm long by 0.015 mm wide, opening into oral cavity. Opisthohaptor not distinct from body proper, 1.8 mm wide, bearing 4 pairs of sucker-like clamps and 2 pairs of anchors. Clamps of outer 2 pairs equal in size, 0.51 mm long by 0.34 mm wide, those of next pair 0.42 mm long by 0.34 mm wide, and those of innermost pair 0.21 mm long by 0.12 mm wide; anchors of outer pair 0.074 mm long and those of inner pair about 0.030 mm long. Oral aperture terminal; pharynx oval, 0.068 mm long by 0.042 mm wide; esophagus bifurcating at or near level of genital aperture; remainder of digestive tract not discernible. Excretory apertures dorsolateral, about 0.34 mm from anterior end of body. Genital aperture median, about 0.7 mm from anterior end; cirrus unarmed. Testes relatively numerous, number not ascertainable, postovarial, in median field. Ovary inverted U-shape, with greatly contorted limbs; genitointestinal canal with proximal portion somewhat expanded and thick walled, opening into right intestinal branch near level of posterior end of ovary. Vaginal aperture median, dorsal, opening about 1 mm from anterior end of body; terminal portion of vagina expanded, provided with 2 somewhat hemispherical bodies armed with posteriorly directed, stout, sawtooth-like spines, located in lateral walls; posterior to hemispherical bodies a group of blunt spines projects into vaginal cavity from its dorsal wall. Uterus slender, relative straight, median. Eggs not present.

HOST: *Sarda sarda*.

LOCATION: Mouth.

DISTRIBUTION: United States (Woods Hole, Massachusetts).

SPECIMEN: U.S.N.M. Helm. Coll. No. 6676 (holotype).

Linton (1901) described this worm as "*Hexacotyle thynni* De la Roche (?)" from a single specimen collected August 7, 1900, from the mouth of *Sarda sarda* by Mr. R. P. Cowles. The description was very brief. The above description is from the original specimen which was not in good condition, being very dark from contact with a cork enclosure of the vial.

***Hexostoma dissimile* was described by Yamaguti (1937) from a single specimen. It differed from other species in the asymmetry of distribution of the opisthohaptor clamps, there being four on the left side and only two on the right. This asymmetry, especially since only one specimen was available, suggests that the specimen was anomalous. A somewhat similar situation was observed in the holotype of *Kuhnina macracantha* (Meserve). In this case the most anterior of the clamps on the left side is not present and only a feebly developed one on the right.

The specimen was bleached and stained, but owing to age, bleaching, and other considerations, it did not stain well. The internal organs, while identifiable, could not be made out in detail. However, a comparison of this specimen with the description of *H. thynni* and with a specimen of that species (U.S.N.M. Helm. Coll. No. 9641), apparently from the Parona collection, collected from *Thynnus vulgaris* at Trieste, shows that the two forms are not identical.

This species differs from the other species of *Hexostoma* (*s. str.*) in the relative size of the opisthohaptoral clamps, the innermost of the 3 larger pairs being smaller than the others. Another difference appears to be in the presence of a dorsal group of spines in addition to the armed hemispherical bodies in the terminal portion of the vagina.

Neohexostoma, n. gen.

SYNONYM: *Hexostoma* Rafinesque of authors, in part.

DIAGNOSIS: Body elongate, widest in ovarian region, with elongate, waist-like constriction in testicular region. Opisthohaptor with 4 pairs of sucker-like clamps arranged as 2, more or less vertical rows, those of posterior pair only slightly smaller than those of anterior 3 pairs. Viellaria not extending posteriorly beyond distal portion of testicular zone.

TYPE SPECIES: *Neohexostoma thunninae* (Parona and Perugia, 1889) n. comb., from *Thynnus thunnina*.

INCLUDED SPECIES: *Neohexostoma euthynni* (Meserve, 1938) n. comb. (syn. *Hexostoma macracanthum* Fujii, 1944, vide Millemann (1956)), from *Euthynnus alletteratus* and *E. lineatus*; *N. extensicaudum* (Dawes, 1940) n. comb., from *Thynnus thynnus*; *N. pricei* (Koratha, 1955) n. comb., from *Sarda sarda*; and *N. robustum* n. sp., from *Parathynnus sibi*.

Of these species, only *N. euthynni* (Meserve) and *N. pricei* (Koratha) have been recorded from North American hosts. In addition to a consideration of these species, the description of *N. robustum*, a new exotic species, is included.

Neohexostoma euthynni (Meserve, 1938), n. comb.

SYNONYMS: *Hexostoma euthynni* Meserve, 1938; *H. macracanthum* Fujii, 1944.

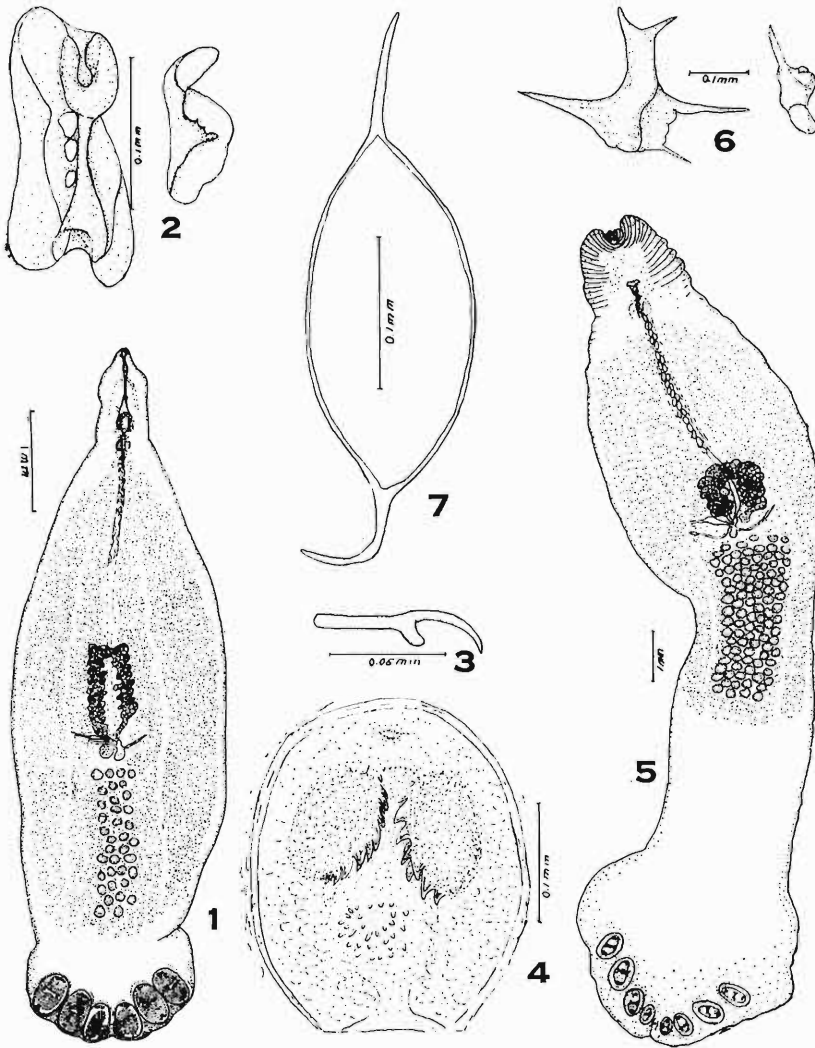
Neohexostoma euthynni was described by Meserve (1938) from a specimen collected from the gills of *Euthynnus alletteratus* at James Island, Galapagos Islands. A similar and apparently identical species was described by Fujii (1944) as *H. macracanthum* from the same host at Tortugas, Florida. Only the specimen of *H. macracanthum* (U.S.N.M. Helm. Coll. No. 36890) was available to the writer, the specimen of *H. euthynni* (U.S.N.M. Helm. Coll. No. 9176) being on loan from the Museum Collection, consequently no direct comparison of the two forms could be made. However, Millemann (1956) has compared the types of both species with specimens from *Euthynnus lineatus* which had been "caught off the coast Baja California between Abreojas and San Juanico, in 1952" and concluded that they were identical. In the absence of the specimens mentioned above, and of Millemann's material for comparison, the decision that they are identical species has been tentatively accepted.

Neohexostoma pricei (Koratha, 1955), n. comb.

SYNONYM: *Hexostoma pricei* Koratha, 1955.

This species was described by Koratha (1955) from specimens collected

from the gills of the "Common Bonito," *Sarda sarda*. The description was incomplete, as no information on the reproductive system was given. Specimens of this form (U.S.N.M. Helm. Coll. No. 54761) were not available for study, as they were on loan to another investigator and had not been returned. This species, so far as can be determined from the original descrip-



Figs. 1-4. *Hexostoma lintoni*. 1, complete worm, ventral view; 2, sclerites of opisthohaptoral clamps; 3, large opisthohaptoral anchor; 4, terminal portion of vagina, ventral view.

Figs. 5-7. *Neohexostoma grossum*. 5, complete worm, ventral view; 6, sclerites of opisthohaptoral clamps; 7, egg.

(The number of testes shown in figs. 1 and 5 are not to be considered as representing the actual number present, which could not be determined in the specimens available; they are intended only to represent their distribution.)

tion, appears to be very similar to *N. euthynni* in body shape and size. Apparently the only distinctive features are the size of the opisthohaptoral anchors, inequality in size of the vaginal hemispherical bodies, and host.

Neohexostoma robustum, n. sp. (Figs. 5-7)

DESCRIPTION: Body elongate, robust, 17 mm long by 4 mm wide in ovarial region, and 4.7 mm wide anterior to opisthohaptoral clamps. Anterior end apparently attenuated but contracted in specimen studied. Prohaptoral suckers not observable. Opisthohaptor roughly triangular, bearing 4 pairs of oval sucker-like clamps varying slightly in size; clamps of anterior pair about 0.50 mm by 0.75 mm, second pair 0.60 mm by 0.85 mm, third pair 0.50 mm by 0.67 mm, and fourth or posterior pair 0.35 mm by 0.50 mm, each provided with 3 sclerites, large or median sclerite more or less saddle-shaped and smaller, lateral sclerites irregular. Opisthohaptoral anchors not clearly visible, large anchors apparently about 0.1 mm long and smaller, median pair about 0.040 mm long. Oral aperture apparently terminal; esophagus bifurcating near level of genital aperture; intestine reticulate as in other representatives of family, extending to posterior end of body. Genital aperture median, about 1.5 mm from anterior end; cirrus and genital atrium unarmed; testes numerous, number not ascertainable, occupying interintestinal field of middle third of body, separated from ovary by a narrow zone. Ovary roughly U-shaped, with limbs greatly convoluted and directed posteriad; genito-intestinal canal enlarged proximally and emptying into right branch of intestine at or about level of posterior portion of ovary. Vitelline follicles numerous, extending from a short distance posterior to genital aperture to slightly distal to testes. Vaginal aperture dorsal, median, about 0.45 mm posterior to level of genital pore; terminal portion of vagina expanded, containing a pair of hemispherical bodies armed with relatively short, backwardly directed spines. Eggs oval, about 0.22 mm long by 0.11 mm wide, with a relatively short, stout filament at each pole.

HOST: *Parathynnus sibi*.

LOCATION: Gills.

DISTRIBUTION: Tropical Pacific.

SPECIMEN: U.S.N.M. Helm. Coll. No. 31833 (holotype).

The material on which this species is based consisted of a single specimen in the U.S.N.M. Helminthological Collection labeled *Hexostoma grossum*. The data accompanying this specimen show that it was collected by "E.S.I.," October 10, 1955, from a bigeye tuna, *Parathynnus sibi*, at 02° 45' N., 158° 05' W., and sent to Dr. H. W. Manter, University of Nebraska, by Albert L. Tester of the Fish and Wildlife Service in Honolulu.

Neohexostoma robustum appears to be more closely related to *N. extensicaudum*, which was described by Dawes (1940) from the gills of a tunny caught in the North Sea, than to any of the other species referable to *Neohexostoma*. It differs from the latter species in body size, arrangement and size of the opisthohaptoral clamps, distance between the ovary and most anterior testes, and host.

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***Paratylenchus steineri* (Criconematidae) a new species of plant nematode**

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Among several different kinds of nematodes present in soil and plant material originating at a nursery near Moscow, USSR, was a new species belonging in the Criconematidae. This species, with a long curved stylet, evidently is closely related to the three *Paratylenchus* species recently described by Brown (1959) from Canada. Although only seven females were found, they have certain morphological characters which distinguish them from other described species of Criconematidae.

Paratylenchus steineri, n. sp.

MEASUREMENTS: 7 females—Length .282 mm (.243-.309); a = 20.2 (17.3-21.1); b = 2.6 (2.4-2.8); c = 12.0 (11.1-13.1); V = 77% (75-78%); Stylet .067 mm (.065-.069).

Males unknown.

FEMALE: Very small nematode. Body cylindrical, tapering gradually anteriorly and more so posteriorly, markedly curved ventrally when dead (Fig. 1B). Head not offset, without distinct annules but with slight labial protrusion anteriorly (Fig. 1A). Annulation on body fine but distinct, the

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