NEOTROPICAL MONOGENEA. 9. STATUS OF
TRINIGYRUS HANEK, MOLNAR, AND FERNANDO, 1974
(DACTYLOGYRIDAE) WITH DESCRIPTIONS OF
TWO NEW SPECIES FROM LORICARIID CATFISHES
FROM THE BRAZILIAN AMAZON

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Abstract. — The generic diagnosis of Trinigyrus Hanek, Molnar, and Fernando, 1974, is emended to incorporate the following characters: presence of confluent intestinal caeca, overlapping gonads (testis dorsal or dorsoposterior to ovary), a ventral anchor/bar complex, and a haptor with 4 pairs of appendages on which hook pairs 2, 3, 4, 6, and 7 are located. The genus is transferred from the Dactylogyridae to the Ancyrocephalinae based on the presence of the ventral anchor/bar complex, the absence of hook pair 4A, and its relationship to Hamatopeduncularia Yamaguti, 1953. Two new species of Trinigyrus are described from the gills of Loricariidae: T. acuminatus from Acanthicus hystrix Spix, and T. tentaculoides from Hypoptopoma thoracatum Günther.

Hanek, Molnar, and Fernando (1974) proposed Trinigyrus for their new species, T. hypostomatis, infesting the gills of Hypostomus robinii (Valenciennes), Loricariidae, in Trinidad. The genus was originally placed in the Dactylogyridae of the Dactylogyridae presumably because of the presence of a single anchor/bar complex in the haptor. Gussev (1978) postulated that members of this subfamily would be rare or absent in the native Neotropical fauna since their primary hosts (cyprinid fishes) do not occur naturally in the region. Gussev (1978), who felt the types of T. hypostomatis were probably damaged specimens in which the second anchor/bar complex had been torn away, suggested that Trinigyrus belongs to the Ancylodiscoidinae Gussev, 1961, based on the morphology of the anchors and bar and on the reported host. However, he did not formally make the transfer. In the present study, Trinigyrus is emended and reasigned at the subfamily level, and two new species of the genus are described.

Hosts were collected from the environs of Manaus, Amazonas, Brazil, during September and November 1984. Methods of host and parasite collection, preparation of helminths for study, measurement, and numbering of haptoral hook pairs are those used by Kritsky, Thatcher, and Boeger (1986). Measurements are in micrometers; averages are followed by ranges in parentheses. Cirrus length was approximated using a Minerva curvimeter on camera lucida drawings. Type specimens are deposited in the collections of the Instituto Nacional de Pesquisas da Amazônia (INPA), the U.S. National Museum Helminthological Collection (USNM), and the University of Nebraska State Museum (HWML) as indicated below.

Trinigyrus Hanek, Molnar, and Fernando, 1974

Emended diagnosis. — Dactylogyridae, Ancyrocephalinae. Body divisible into cephalic region, trunk and haptor (peduncle absent). Testum thin, smooth. Cephalic lobes, head organs, cephalic glands present. Eyes absent. Mouth subterminal, midven-
implies occurrence of sequence from anterior gonads. Gonads intercaecal, overlapping; testis dorsal or dorso-posterior to ovary. Vas deferens looping left intestinal caecum; seminal vesicle a dilation of vas deferens; prostatic reservoirs 2; copulatory complex comprising accessory piece and tubular cirrus. Oviduct short; uterus delicate or well developed; vagina dextral; seminal receptacle lying diagonally to right of midline. Genital pore midventral. Vitellaria consisting of 2 bilateral bands in trunk and anterior portion of haptor. Haptor with variable number of glandular reservoirs, ventral anchor/bar complex, 7 pairs of similar hooks. Haptor exhibiting 4 pairs of hook-bearing appendages: 2 bilateral pairs bearing hooks pairs 2, 7; single posteroventral pair branched, bearing hook pairs 3, 4; pair of posterodorsal appendages bearing hook pair 6; hook pairs 1, 5 sessile. Parasites of gills of Loricariidae, Siluriformes.

Type species, host, and locality.—*Trinigyrus hypostomatis* Hanek, Molnar, and Fernando, 1974, from *Hypostomus robinii* (Valenciennes), Talparo River near Talparo, Trinidad.

Other species.—*Trinigyrus acuminatus*, n. sp. from *Acanthicus hystrix* Spix, Rio Negro near Manaus, Amazonas, Brazil; *T. ten-taculoides*, n. sp. from *Hypoptopoma thor-acatum* Günther, Rio Solimões near Marchantaria Island, Manaus, Amazonas, Brazil.

Remarks.—In adults of *Trinigyrus* species described below, we observed that the testis is seldom developed, although the ovary exhibits large oocytes and the seminal vesicle and receptacle are filled with spermatozoa. These observations suggest that some form of protandry exists in *Trinigyrus*, though we could not determine the developmental sequence from available specimens. The occurrence of spermatozoa in the seminal vesicle of specimens apparently lacking a testis implies that this gonad develops and sub-sequently regresses before the ovary matures. Bychowsky (1957) reports that the testes form prior to the ovary in *Microcotyle spinicirrus*, but that both gonads apparently remain in the fully developed adult. Protandry has also been reported in hexabothrids by Brinkmann (1952) and Mayes, Brooks, and Thorson (1981).

*Trinigyrus acuminatus*, new species

Figs. 1–7

**Host and locality.**—*Acanthicus hystrix* Spix, Loricariidae; Rio Negro near Manaus, Amazonas, Brazil, 1 Nov 1984.

**Type specimens.**—Holotype, INPA PA 284-1; paratypes, INPA PA 284-2 + PA 284-4, USNM 79139, HWML 23306.

**Description** (based on 32 specimens).—Body subconical, 320 (190–407) long; greatest trunk width immediately anterior to haptor. Cephalic region elongate, with 2 terminal lobes and subterminal dilation; head organs poorly developed, present in cephalic lobes and expanded cephalic area; cephalic glands indistinct, lying posterolateral to pharynx. Pharynx spherical, 26 (16–33) in diameter. Haptor 164 (110–196) wide, 93 (63–129) long, an expanded portion of body; haptoral appendages short; glandular reservoirs variable, conspicuous. Anchor 41 (33–45) long, with short shaft, elongate point, sharply recurved tip, base lacking roots; base 9 (7–11) wide; anchor filament double. Bar 66 (60–79) long, with ventral longitudinal groove, tapered ends. Hooks similar, delicate; each 13 (11–16) long, with erect thumb, enlarged proximal shank; FH loop ½ shank length. Cirrus 98 (94–101) long, an elongate slender tube with sinistral loop, base reduced; accessory piece 24 (19–36) long, comprising a proximal rod, distal dumbbell-shaped appendage. Gonads subovate. Testis 25 (21–30) wide, 46 (39–53) long; seminal vesicle elongate, fusiform; prostatic reservoirs ova, with thick walls. Ovary 52–53 wide, 26–27 long; oviduct, ootype, uterus not observed; numerous conspicuous glands surrounding presumed.
Figs. 1–7. *Trinigyrus acuminatus*: 1, Composite drawing of whole mount (ventral); 2, 3, Copulatory complexes; 4, Hook; 5, Vagina and distal portion of seminal receptacle; 6, Bar; 7, Anchor. All figures are reproduced to the same scale (30 micrometers) except Fig. 1 (100 micrometers).
ototype; vagina with exterior flower-like appendage, short internal sclerotized tube directed posteriorly; seminal receptacle ovate, ventral in trunk, extending posteriorly to midline. Vitellaria coextensive with intestinal caeca, vitelline commissure indistinct.

Remarks.—Trinigyrus acuminatus differs notably from T. hypostomatis Hanek, Molnar, and Fernando, 1974, and T. tentaculoides by possessing an elongate cirrus and a complex accessory piece. In T. hypostomatis and T. tentaculoides, the cirrus comprises a short curved tube associated with a simple rod-shaped accessory piece. Based on the morphology of the haptoral armament, T. acuminatus is most closely related to T. hypostomatis in that the anchor/bar complexes are similar.

Etymology.—The specific name is from Latin (acumin/o = pointed) and refers to the elongate anchor point with recurved tip.

Trinigyrus tentaculoides, new species
Figs. 8–14

Host and locality.—Hypoptopoma thoracatum Günther, Loricariidae; Rio Solimões near Marchantaria Island, Manaus, Amazonas, Brazil, 13 and 26 Sep 1984.

Type specimens.—Holotype, INPA PA 285-1; paratypes, INPA PA 285-2, PA 285-3, USNM 79138, HWML 23305.

Description (based on 19 specimens).—Body robust, stout, 222 (165–307) long; greatest trunk width immediately anterior to haptor. Cephalic margin rounded or with 2 terminal, 2 bilateral cephalic lobes; head organs well developed in lobes and adjacent cephalic area; cephalic glands comprising small spherical cells posterolateral to pharynx. Pharynx subspherical, 21 (16–30) in diameter. Haptor 110 (81–145) wide, 59 (42–73) long; posteroventral appendages conspicuously bifurcated; glandular reservoirs poorly developed. Anchor 47 (43–50) long, easily distorted by coverslip pressure (Fig. 14), roots absent, base tear-drop shaped, shaft and point a continuous smooth curve, tip of point recurved; base 10 (8–11) wide; anchor filament delicate. Bar 75 (60–93) long, with tapered ends, ventral longitudinal groove, flat posteromedial projection. Hooks 10 (7–12) long, delicate; each with erect thumb, proximal dilation of shank; FH loop ½ shank length. Cirrus 29–30 long, a curved shaft arising from simple base; accessory piece 28 (22–33) long, rod-shaped, recurved distally. Gonads ovate. Testis 33 (30–36) wide, 41 (40–43) long; seminal vesicle fusiform, lying medially anterior to gonads; prostatic reservoirs subovate, with thick wall. Ovary 35 (27–45) wide, 49 (36–57) long; oviduct, ootype not observed; well-developed glands surrounding presumed ootype; uterus with thick muscular wall distally; vagina comprising a small funnel and irregularly sclerotized tube reaching to ovate seminal receptacle; vitellaria coextensive with intestinal caeca, commissure indistinct. Egg distorted, with exceptionally elongate proximal filament.

Remarks.—Based on comparative morphology of the haptoral sclerites and copulatory complex, T. tentaculoides is most similar to the type species, T. hypostomatis Hanek, Molnar, and Fernando, 1974. These species are easily differentiated by T. tentaculoides possessing conspicuous haptoral appendages, which are short in T. hypostomatis.

Trinigyrus tentaculoides also shares features of the haptoral armament with several species of the marine genus Hamatopeduncularia Yamaguti, 1953. A flat posteromedial projection of the bar similar to that of T. tentaculoides occurs in H. arii Yamaguti, 1953 of Bychowsky and Nagibina (1969), and H. thalassini Bychowsky and Nagibina, 1969. Glandular reservoirs in the haptor have been described in most Hamatopeduncularia species. These features and the fact that all species of Hamatopeduncularia and Trinigyrus occur on siluriform fishes suggest a close relationship of the two genera (see discussion).
Figs. 8-14. *Trinigyrus tentaculoide* 8, Ventral view of whole mount (composite); 9, Vagina; 10, Copulatory complex; 11, Bar; 12, Hook; 13, Anchor; 14, Typically distorted anchor as a result of coverslip pressure. All figures are drawn to the 30-micrometer scale except Fig. 8 (100 micrometers).
Etymology.—The specific name is from Neolatin \( \text{tentacul/o} = \text{tentacle} + \text{oides} = \text{like} \) and refers to the well-developed haptoral appendages.

Discussion

**Trinigyrus** was briefly diagnosed by Hanek, Molnar, and Fernando (1974) based on observations of unstained specimens of the type species, *T. hypostomatis*. Our discovery of two new species of the genus from Loricariidae in the Brazilian Amazon, some specimens of which were prepared for study of the internal anatomy, provided new information which necessitated an emended generic diagnosis. Findings that supplement the original diagnosis include: (1) the presence of a bifurcated gut with intestinal caeca confluent posterior to the gonads (not observed by Hanek et al. 1974); (2) overlapping gonads with the testis lying dorsal or dorsoposterior to the ovary (described as tandem by the original authors); (3) an anchor/bar complex that is ventral in the haptor with the bar lying on the superficial (ventral) surface of the anchor bases (anchors and bar are said to be dorsal by Hanek et al. 1974) and (4) a haptor with short to well-developed appendages on which hook pairs 2, 3, 4, 6 and 7 are located (haptoral appendages were not reported in the type species). We examined a paratype of *T. hypostomatis* (USNM 73183) and have verified the presence of short haptoral appendages and a ventral anchor/bar complex in this species. The cleared, unstained and highly contracted paratype precluded determination of the position of the gonads and the pattern of the haptoral appendages.

Although reduced hooks (pair 4A of Mizelle and Price 1963) are absent, Hanek, Molnar, and Fernando (1974) considered **Trinigyrus** a member of the Dactylogyridae apparently because of the presence of a single anchor/bar complex. Our finding that the complex is ventral in the haptor, along with the fact that 4A hooks are absent, suggests that the genus belongs in the Ancyrocephalinae as a group expressing derived characters which include the loss of the dorsal anchor/bar complex and eyes, and the development of haptoral appendages. Thus, **Trinigyrus** is the only genus of Ancyrocephalinae characterized by species possessing a single anchor/bar complex.

The transfer of **Trinigyrus** from the Dactylogyridae to the Ancyrocephalinae is further supported by the apparent relationship of **Trinigyrus** species with those of the ancyrocephaline genus *Hamatopeduncularia* Yamaguti, 1953. As far as we are aware, the characteristic flat posteromedial projection of the bar in **Trinigyrus tentaculoides** is also found only in species of *Hamatopeduncularia* (*H. arii* of Bychowsky and Nagibina 1969, and *H. thalassini* Bychowsky and Nagibina, 1969). Although not unique to the genus, nearly all *Hamatopeduncularia* species have been described with conspicuous glandular reservoirs (usually four) in the haptor. These structures seem similar to those we report from *T. acuminatus* and *T. tentaculoides*, in the former of which they are well developed. The relationship is further substantiated by the fact that species of both genera possess haptoral appendages and parasitize fishes of the Order Siluriformes.

“Fahrenholz Rule” states that the natural classification of some parasite groups usually corresponds directly with the natural relationships of their hosts (Eichler 1948). The Ariidae include primarily marine catfishes believed derived from freshwater siluriform ancestors (Darlington 1957); and the *Hamatopeduncularia* are known only from marine arid hosts. Our conclusion that the species of **Trinigyrus** and *Hamatopeduncularia* are related suggests that the *Hamatopeduncularia* and species of related marine genera (*Chauhanellus* Bychowsky and Nagibina, 1969; and *Hargitrema* Tripathi, 1959) represent derived taxa whose common ancestors secondarily invaded the
marine environment. This invasion likely occurred concomitantly with the same event for their hosts. The *Hamatopeduncularia* apparently retain more of the primitive characters of their ancestor than do the *Trinigyrus* species. For example, the loss of the dorsal anchor/bar complex and eyes and the development of confluent intestinal caeca in *Trinigyrus* likely occurred after isolation of the two ancestral populations. Divergence in the marine population appears less dramatic, although it has also progressed to the generic level as expressed in the related genera *Hamatopeduncularia*, *Chauhanellus*, and *Hargitrema*.

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Literature Cited

Brinkmann, A., Jr. 1952. Fish trematodes from Norwegian waters.—Universitet i Bergen Arbok, Naturvitenskapelig Rekke, 134 pp.


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