Neotropical Monogenoidea. 39: a new species of *Kritskyia* (Dactylogyridae, Ancyrocephalinae) from the ureters and urinary bladder of *Serrasalmus marginatus* and *S. spilopleura* (Characiformes, Serrasalmidae) from southern Brazil with an emended generic diagnosis

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Ancyrocephalinae,
Kritskyia,
Kritskyia annakohnae n. sp.,
Teleostei,
Serrasalmidae,
Serrasalmus marginatus,
Serrasalmus spilopleura,
Rio Baia,
Paraná,
Brazil,
new species,
parasitology.

ABSTRACT
Kritskyia annakohnae n. sp. (Dactylogyridae, Ancyrocephalinae) is described from the ureters and urinary bladder of the piranhas, *Serrasalmus marginatus* Valenciennes, 1836 and *S. spilopleura* Kner, 1858 (Characiformes, Serrasalmidae) from the Rio Baia, Paraná, Brazil. The new species is characterized by having a keel-like projection on the left margin of the trunk and an accessory piece comprising two parallel subunits, proximally and distally fused. An emended diagnosis of *Kritskyia* Kohn, 1990 is provided to accommodate the new species. Although previously suggested, *Kritskyia* is probably not closely related to other Dactylogyridae lacking haptoral anchors and bars. Present knowledge on morphology and phylogeny indicates that the loss of these sclerites has occurred independently several times within the family.

RÉSUMÉ

Neotropical Monogenoidea. 39 : une nouvelle espèce de Kritskyia *(Dactylogyridae, Ancyrocephalinae) des uretères et de la vessie urinaire de* Serrasalmus marginatus *et* S. spilopleura *(Characiformes, Serrasalmidae) du Sud Brésil avec un diagnostic générique corrigé.*

Kritskyia annakohnae n. sp. (Dactylogyridae, Ancyrocephalinae) est décrit à partir d'individus parasites des uretères et de la vessie urinaire des piranhas *Serrasalmus marginatus* Valenciennes, 1836 et *S. spilopleura* Kner, 1858 (Characiformes, Serrasalmidae) du Rio Baia, Paraná, Brésil. La nouvelle espèce est caractérisée par une protubérance sur le côté gauche du tronc, ainsi que par une pièce accessoire comprenant deux sous-unités parallèles, fusionnées aux deux extrémités, proximale et distale. Une nouvelle diagnose du *Kritskyia* Kohn, 1990 est proposée. En dépit d'une proposition antérieure, *Kritskyia* ne s'apparente pas à d'autres Dactylogyridae qui n'ont ni ancres ni barres transversales haptorales. Les connaissances actuelles sur la morphologie et la phylogénie indiquent que la perte de ces sclérites a eu lieu plusieurs fois et indépendamment dans la famille.

MOTS CLÉS
Platyhelminthes,
Monogenea,
Monogenoidea,
Dactylogyridae,
Ancyrocephalinae,
Kritskyia,
Kritskyia annakohnae n. sp.,
Teleostei,
Serrasalmidae,
Serrasalmus marginatus,
Serrasalmus spilopleura,
Rio Baia,
Paraná,
Brésil,
nouvelle espèce,
parasitologie.

INTRODUCTION

Among the about 278 species of Monogenoidea described from native freshwater Neotropical fishes, only one is known to parasitize internal organs. *Kritskyia moraveci* Kohn, 1990 was collected from the ureters and urinary bladder of the "jundiá", *Rhamdia quelen* (Quoy & Gaimard, 1824), Siluriformes, from continental waters of the State of Rio Grande do Sul, Brazil. The absence of haptoral anchors and bars, and the distinct distribution of the 14 hooks have been used to suggest a more basal origin for the genus within the Monogenoidea (Kohn 1990) and an evolutionary proximity to species of other Neotropical Ancyrocephalinae with similar haptoral morphology (Kritsky *et al.* 1996).

During a survey of parasites of *Serrasalmus marginatus* Valenciennes, 1836 and *S. spilopleura* Kner, 1858 (Serrasalmidae), monogenoidean worms were collected from the ureters and urinary bladder. These worms have been identified as a new species of *Kritskyia,* which is described below. The diagnosis of the genus is emended to accommodate the new species. The sister group relationship of *Kritskyia* and other genera with species lacking haptoral anchors and bars is discussed.

ABBREVIATIONS

Type specimens are deposited in the helminthological collections of:

CHIOC	Instituto Oswaldo Cruz, Rio de Janeiro, Brazil;
INPA	Instituto Nacional de Pesquisas da Amazonia, Manaus, Brazil;
USNPC	United States National Parasitological Collection, Maryland, USA;
HWML	Harold W. Manter Laboratory, University of Nebraska State Museum, Nebraska, USA;
MNHN	Muséum national d'Histoire naturelle, Paris, France.

MATERIAL AND METHODS

Hosts, *Serrasalmus marginatus* and *S. spilopleura* (Serrasalmidae), were collected with hook and line in the Rio Baia, region of the Alto Rio Paraná, near the city of Porto Rico, State of Paraná, Brazil, from October, 1997 to September, 1998. Parasites were removed from the urinary bladder and ureters under a dissecting microscope, killed in formalin 1:4000, and preserved in 5% formalin. Methods of parasite preparation, study, measurements, and drawings are those of Kritsky *et al.* (1986). Measurements (in micrometers) are given as the average, followed

by the range and number of structures measured (n) in parentheses.

SYSTEMATICS

Family DACTYLOGYRIDAE Bychowsky, 1933
Subfamily ANCYROCEPHALINAE
Bychowsky, 1937

Genus *Kritskyia* Kohn, 1990

TYPE SPECIES. — *K. moraveci* Kohn, 1990 from *Rhamdia quelen* (Quoy & Gaimard) (Pimelodidae, Siluriformes) by original designation.

OTHER SPECIES. — *K. annakohnae* n. sp. from *Serrasalmus marginatus* Valenciennes, 1836 and *S. spilopleura* Kner, 1858 (Serrasalmidae, Characiformes).

EMENDED DIAGNOSIS. — Dactylogyridae, Ancyrocephalinae. Body elongate, fusiform, divisible into cephalic region, trunk, peduncle, haptor. Tegument smooth. Cephalic lobes, head organs variably conspicuous. Four eyes. Mouth midventral; pharynx muscular, glandular; esophagus present; intestinal caeca (2) confluent in posterior trunk, lacking diverticula. Gonads overlapping, intercaecal; testis dorsal to germarium. Vas deferens looping left cecum; seminal vesicle a dilation of vas deferens; two prostatic reservoirs. Male copulatory organ consisting of sclerotized tube with clockwise or counterclockwise rings (Kritsky *et al.* 1985); accessory piece non-articulated to base of male copulatory organ. Vaginal aperture sinistral. Genital pore midventral. Vitellaria coextensive with intestinal caeca. Haptor semicircular, armed with 14 marginal, ventral hooks, absent anteriorly. Anchors, bars, 4 A's absent. Parasites of urinary bladders and ureters of freshwater Neotropical fishes.

Kritskyia annakohnae n. sp.
(Figs 1; 2)

TYPE MATERIAL. — Holotype: CHIOC 34243a. Paratypes: CHIOC 34243b-m (n = 12), 34244 (n = 1), 34245a-b (n = 2); INPA 379a-k (n = 11), 380 (n = 1); USNPC 89639-89643 (n = 10); HWML 15269 (n=6), 15270 (n = 1), 15271 (n = 2); MNHN 828 HF (n = 5), 829 HF (n = 1).

SITE OF PARASITISM, HOST, AND LOCALITY. — Urinary bladder and ureters of *Serrasalmus marginatus* Valenciennes, 1836 and *S. spilopleura* Kner, 1858 (Serrasalmidae, Characiformes) from Brazil, State of Paraná, region of the Alto Rio Paraná, Rio Baia, near the city of Porto Rico.

ETYMOLOGY. — The species is named after Dr Anna Kohn, from the Instituto Oswaldo Cruz, Rio de Janeiro, in honor of her contributions to the study of fish helminthology in Brazil.

DESCRIPTION

Body 1242 (1060-1424; n = 10) long; greatest width 184 (121-242; n = 13) near mid-length or posterior trunk; keel-like, sinistral projection, extending from level of anterior margin of seminal receptacle to region of vaginal aperture. Cephalic lobes poorly developed; cephalic glands anterior, posterolateral to pharynx. Eyes subequal; anterior pair closer together; accessory granules rare. Pharynx spherical, 33 (27-37; n = 11) in diameter; oesophagus short. Peduncle broad, undistinguishable from trunk; haptor semicircular 65 (46-79; n = 9) long, 117 (96-160; n = 11) wide. Hooks similar, 29 (25-33; n = 39) long, each with short broad thumb, delicate point, expanded shank composed of two sub-units; FH loop as long as distal sub-unit of shank. Male copulatory organ (mco) a clockwise coil of about two rings; base with sclerotized fringe. Accessory piece 283 (250-300; n = 11) long, comprising two parallel ribbon-like units, fused proximally, distally; proximal fusion surrounded by strong bulbous musculature; slender unit of accessory piece with longitudinal groove serving as mco guide; wider unit of accessory piece medially twisted, distally expanded. Prostate large, dorsal to basis of mco; one prostatic reservoir. Testis dorsal to germarium, 68 (64-72; n = 3) long, 36 (30-42; n = 4) wide; vas deferens loops left gut at level of vaginal aperture. Germarium elongate, sinuous, 20 (18-23; n = 7) wide proximally; seminal receptacle ovate; oviduct, ootype, uterus not observed. Vagina a sclerotized tube, opening sinistral, postequatorial, posterior to body keel. Egg ovate, lacking polar filaments, 62 (59-66; n = 2) long, 39 (n = 1) wide.

DISCUSSION

Kritskyia annakohnae n. sp. is considered congeneric with *K. moraveci* by the sharing the following characters: 1) lack of anchors, bars, and 4A

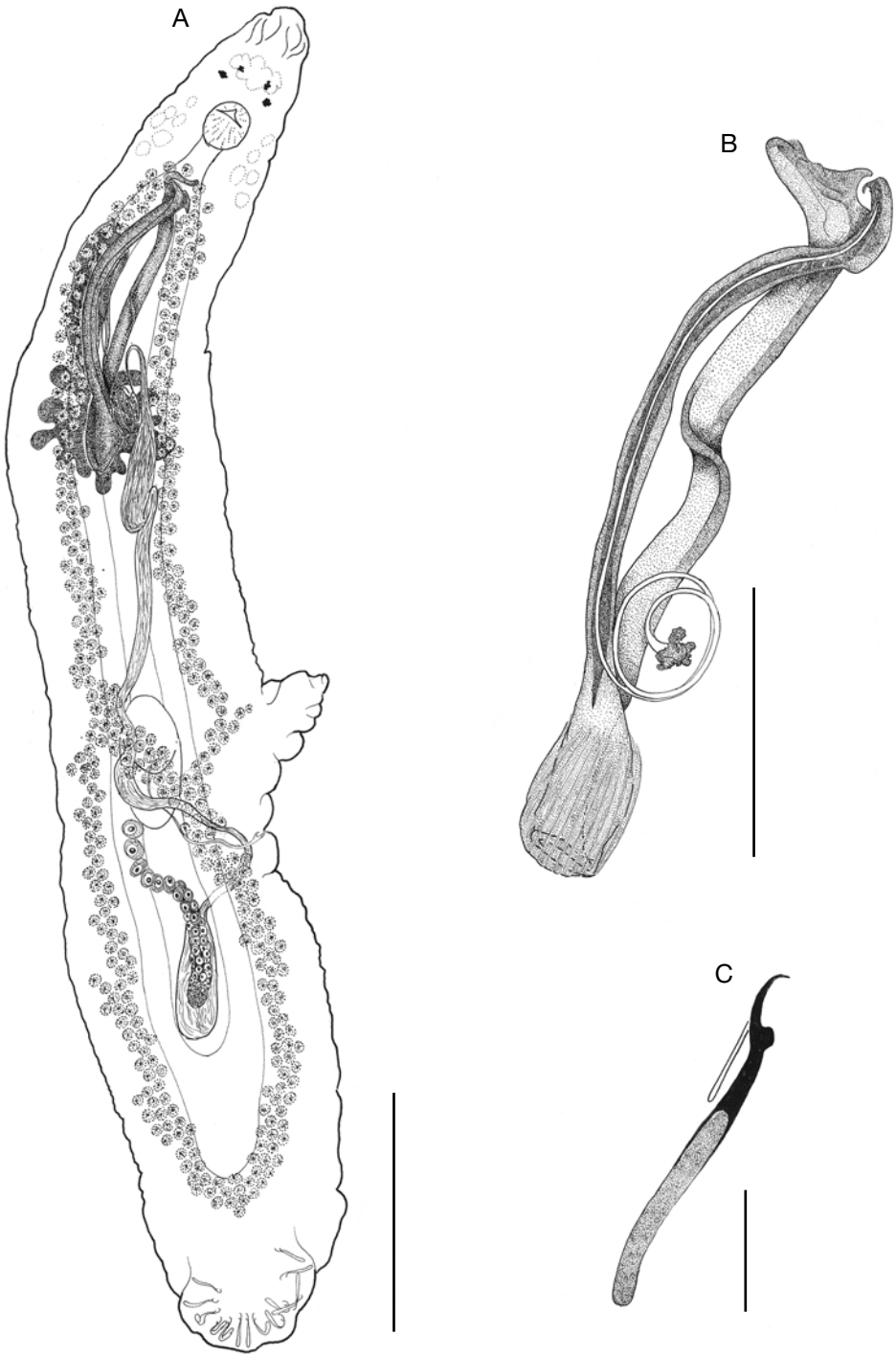

FIG. 1. — *Kritskyia annakohnae* n. sp.; **A**, holotype, ventral view; **B**, copulatory complex; **C**, hook. Scale bars: A, 200 µm; B, 100 µm; C, 10 µm.

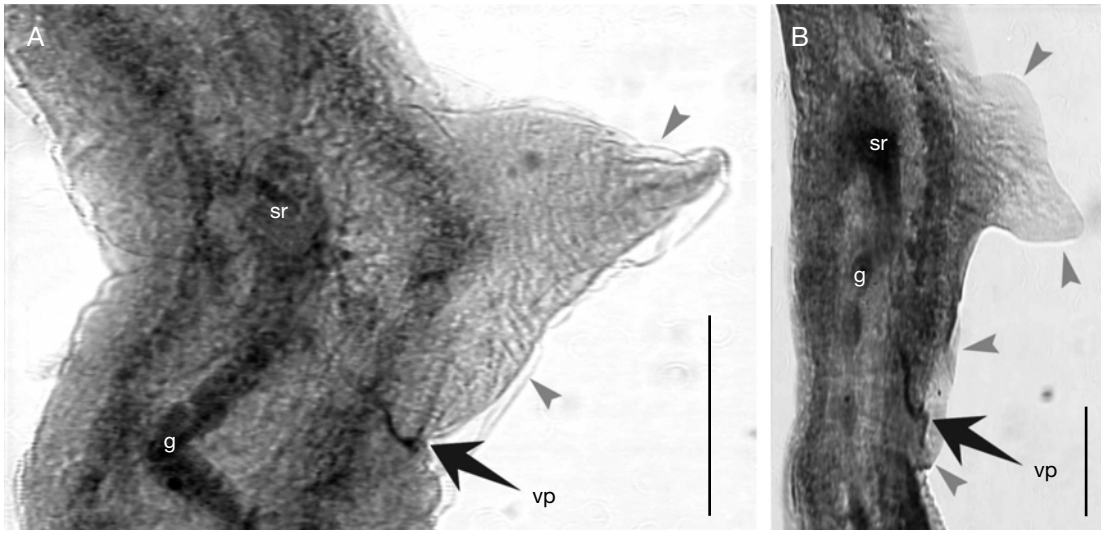

FIG. 2. — Keel-like projections of *Kritskyia annakohnae* n. sp.; **A**, worm with body contracted; **B**, worm with body relaxed. Abbreviations: **vp**, vaginal pore; **sr**, seminal receptacle; **g**, germarium. Arrows indicate the keel-like projection. Scale bars: A, 100 µm; B, 10 µm.

hooks; 2) semi-circular haptor; 3) presence of 14 ventral, marginal hooks lacking anteriorly in the haptor, with a shank composed of two subunits; 4) male copulatory organ non-articulated to accessory piece; 5) sclerotized vaginal tube with sinistral opening. The two species also share the site of parasitism, the excretory system of their hosts. These are the only two species of Polyonchoinea presently known to be endoparasites of freshwater Neotropical fishes.

The new species can be easily differentiated from *K. moraveci* by having a keel-like projection on the left margin of the trunk. Further differences are seen in the comparative morphology of the copulatory complex, especially the accessory piece and hooks. The new species has also a more posterior opening of the vagina (pre-equatorial in the type species) and a less densely distributed vitellaria than *K. moraveci.*

The relative position and general morphology of the keel-like projection of the trunk of *K. annakohnae* n. sp. varies greatly among the specimens studied. It may be subtriangular (Fig. 2A) or appear as a long keel, anteriorly wide (resembling the keel of a surfboard) and posteriorly straight (Fig. 2B). In all observed specimens, this projection is situated between the level of the anterior margin of the seminal reservoir and the region of the vaginal pore. Thus, differences in morphology appear associated with the degree of contraction of the worm, representing an artifact of the process of fixation. The configuration in Figure 2B is the usual morphological state of the structure in relaxed worms. The function of this projection is unknown but it is presumably associated with copulation, in view of its proximity to the vaginal aperture.

The gonads of *K. moraveci* have been reported as tandem by Kohn (1990) but Kritsky *et al.* (1996) could not confirm their relative positions in specimens available for redescription. Since the gonads are clearly overlapping in *K. annakohnae* n. sp., it is likely that overlapping gonads occur in the type species as well. This, coupled with other characters observed in *K. annakohnae* n. sp. which were not considered in previous generic definitions, required the emendation of the diagnosis of *Kritskyia* Kohn, 1990.

The sister group relationship of *Kritskyia* has to be evaluated with care. Kohn (1990) proposed that it is closely related to *Acolpenteron* Fischthal & Allison, 1940 and *Anonchohaptor* Mueller,

1938. Kritsky *et al.* (1996) reject this hypothesis and suggest that *Kritskyia* is phylogenetically close to *Telethecium* Kritsky *et al.*, 1996 (Ancyrocephalinae), based on the sharing of several characters. We agree with Kritsky *et al.* (1996) on the taxonomic position of *Telethecium* and *Kritskyia* within the Ancyrocephalinae. However, most of the characters utilized by Kohn (1990) and Kritsky *et al.* (1996) to support their proposals are, apparently, either symplesiomorphies shared with many other Ancyrocephalinae (e.g., general organization of internal organ systems, configuration of male copulatory organ, position of the vagina) or secondary loss of structures. According to Boeger & Kritsky (2001), the phylogenetic significance of the absence of structures is difficult to evaluate since they may represent either homologous or homoplasious loss.

The plesiomorphic states for the suborder Dactylogyrinea are the presence of two pairs of anchors (one ventral, one dorsal), two bars (ventral, dorsal), eight marginal and two central ventral hooks, and four marginal dorsal hooks (Boeger & Kritsky 1993, 1997, 2001). The lacking of bars and anchors, and the ventral position of all hook pairs, appear to be the result of secondary modifications which occurred independently in the ancestors of *Acolpenteron*, *Anonchohaptor, Telethecium* and *Kritskyia*. Some of these character changes may represent convergences associated with similar selective pressures observed in the habitats of their species. Moreover, the remaining morphological characteristics indicate that *Acolpenteron* and *Anonchohaptor* are members of distinct family-groups within the Dactylogyrinea (Dactylogyrinae and Pseudomurraytrematidae, respectively). The sites of parasitism of species of *Telethecium* and *Kritskyia* indicate that the origins of the two genera are associated with independent dispersion (colonization), combined with, or followed by, speciation into two distinct sites of the fish body, the urinary tract and the nasal cavities.

More data on species richness and host-parasite relationships are still required but speciation within *Telethecium* and *Kritskyia* appears correlated to intense host-switching. Their species are found in distantly related fish taxa. *Telethecium* spp. have been recovered from the nasal cavities of Osteoglossiformes and Clupeiformes fishes while *Kritskyia* spp. are parasites of the urinary tract of Siluriformes and Characiformes.

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