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***Caecincola longiscens* n. sp. (Digenea: Cryptogonimidae) from the White Crappie, *Pomoxis annularis*, in Mississippi, U.S.A.**

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ABSTRACT: A new cryptogonimid trematode is described from the white crappie, *Pomoxis annularis* Rafinesque, 1818, collected from Lake Chotard, an oxbow lake directly connected to the Mississippi River in Issaquena County, and from a small ephemeral oxbow periodically connected with the Pascagoula River in Jackson County, both in Mississippi, U.S.A. *Caecincola longiscens* n. sp. is characterized by having an elongated body with a length to width ratio of 5.5–7.5:1, tandem testes, an elongated tubular seminal vesicle, and vitelline follicles confined to the hindbody.

KEY WORDS: Digenea, Cryptogonimidae, *Caecincola longiscens* n. sp., white crappie, *Pomoxis annularis*, Lake Chotard, Pascagoula River, Mississippi, U.S.A.

We encountered specimens of an unknown digenean species from the white crappie, *Pomoxis annularis* Rafinesque, 1818, while surveying fish for parasites at 2 inland locations in Mississippi, U.S.A. The species belongs in Cryptogonimidae Ward, 1917 because it has scale-like body spines, eyespots, an elongated Y-shaped excretory vesicle with the main stem branching in the testicular zone, and arms extending anteriorly to the pharynx level (see Price [1940]), and the genital pore and ventral sucker are contained within a ventrogenital sac (Manter, 1926; Cable and Hunninen, 1942; Pearson, 2002; Miller and Cribb, 2008). Because the species lacks a gonotyl or circumoral spines associated with the oral sucker, the oral sucker is broad and funnel-shaped, the ovary is trilobed, and the ceca terminate in the testicular zone, it conforms reasonably to the diagnoses for *Caecincola* Marshall and Gilbert, 1905 provided by Gibson (1996) and Miller and Cribb (2008). The species is described as the fourth species in the genus from a centrarchid.

MATERIALS AND METHODS

Specimens of *P. annularis* were collected from 2 locations in Mississippi, U.S.A. Four fish were caught from Lake Chotard, Issaquena County, Mississippi, U.S.A., on 29 January 2001, and an additional fish from the same location was caught on 20 March 2002. Eighteen fish were caught from a small oxbow periodically contiguous with the Pascagoula River, Jackson County, Mississippi, U.S.A., on 18 June 2007. Fish were dissected while freshly dead, and digeneans were collected and washed in 0.75% saline solution and killed with hot water. Digeneans were then placed in 5% neutral buffered formalin solution and later

stained using Van Cleave's hematoxylin. The stained worms were partially dehydrated in a graded ethanol series, buffered by adding 3 drops of saturated lithium carbonate in 80% ethanol and 2 drops of butylamine in 80% ethanol, and then fully dehydrated in absolute ethanol. Dehydrated worms were cleared in clove oil and mounted in Canada balsam. Drawings were made with the aid of a Wild drawing tube. Measurements are presented in micrometers as mean values followed by range values in parentheses.

Specimens of *Caecincola latostoma* Greer and Corkum, 1979 were collected from the largemouth bass, *Micropterus salmoides* (Lacepède, 1802), from Reelfoot Lake, Obion County, Tennessee, U.S.A. (36°23'03''N, 89°21'54''W) on 18 October 2003. These were prepared using the same techniques and used for comparison with the new species. Four voucher specimens of *C. latostoma* were deposited at the United States National Parasite Collection (USNPC), Beltsville, Maryland, U.S.A. (USNPC No. 100836).

***Caecincola longiscens* n. sp. (Figs. 1–4)**

Description

Based on 8 specimens. Body elongated, 1,476 (1,347–1,650) long, 265 (184–318) wide, covered by scale-like spines; ratio of body length to width 5.5–7.5:1. Oral sucker terminal, funnel-shaped in well fixed specimens; cup-shaped in poorly-fixed specimens or those rolled while applying coverslip; 179 (117–210) long, 178 (148–218) wide. Pharynx 50 (35–63) long, 49 (35–57) wide. Eyespot remnants dispersed in pharyngeal region. Prepharynx about as long as or slightly longer than pharynx. Esophagus about 1.5–2.5 times pharynx length. Ventral sucker 49 (43–60) long, 56 (48–64) wide, recessed in ventrogenital sac. Gonotyl lacking. Forebody 368 (318–396) long, representing 23–28% of body length. Intestine bifurcating in forebody; ceca thick-walled, terminating blindly in middle third of hindbody.

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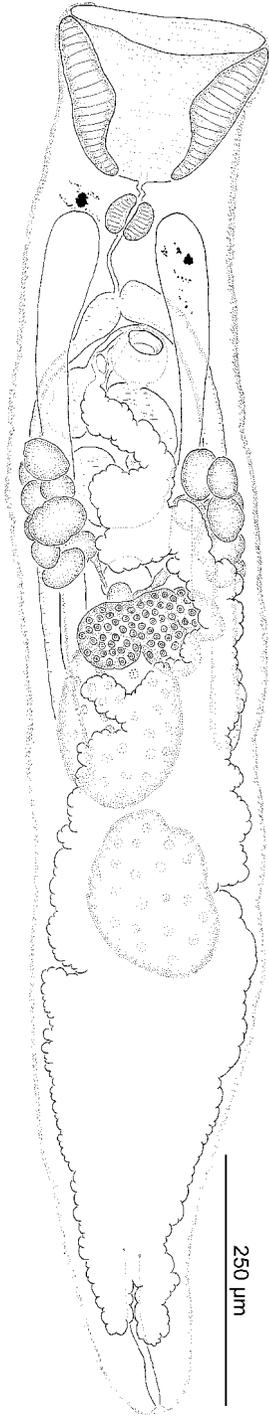


Figure 1. Ventral view of holotype of *Caecincola longiscens* n. sp. from Lake Chotard, Mississippi, U.S.A.

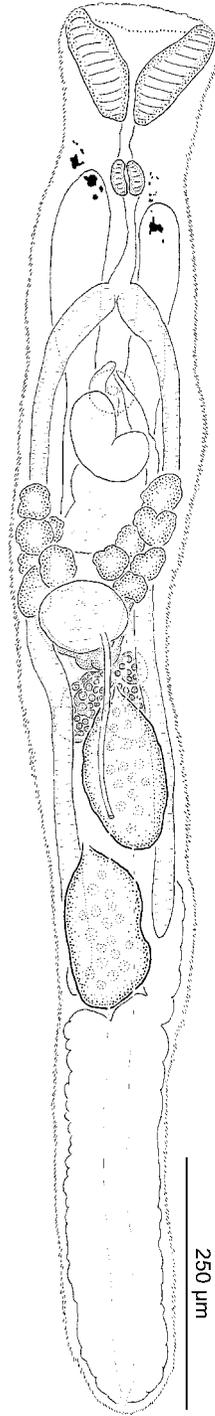


Figure 2. Dorsal view of paratype of *Caecincola longiscens* n. sp. from the Pascagoula River, Mississippi, U.S.A.

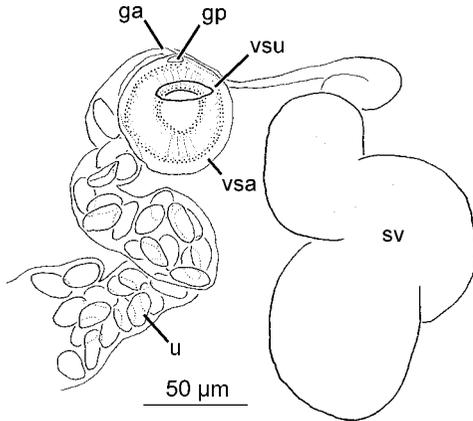


Figure 3. Terminal genitalia of *Caecincola longiscens* n. sp., ventral view, (ga, genital atrium; gp, genital pore; sv, seminal vesicle; u, uterus; vsa, ventrogenital sac; vsu, ventral sucker).

Postcecal space 533 (413–730) long, representing 28–44% of body length.

Testes tandem, entire; anterior testis 197 (153–233) long, 133 (82–167) wide; posterior testis 229 (150–290) long, 157 (74–240) wide. Posttesticular space 382 (313–427) long, representing 22–30% of body length. Cirrus sac lacking. Seminal vesicle elongated, looping, longer than body width, 54–114 wide at widest portion, opening into tubular genital atrium; genital atrium 40–60 long. Pars prostatica lacking.

Ovary trilobed, 105 (88–133) long, 158 (113–224) wide, pretesticular, medial. Seminal receptacle canalicular; proximal portion swollen, 64 (59–68) long, 88 (82–94) wide, lying dorsal and anterior to ovary; distal portion narrowing, forming an elongated Laurer's canal; Laurer's canal extending posteriorly and opening on dorsal surface at level of anterior testis, distal-most portion surrounded by glandular cells. Vitellarium consisting of 2 lateral groups of subspherical follicles surrounding ceca in hindbody; groups confined to preovarian region of hindbody. Both groups communicating with common vitelline reservoir through transverse vitelline ducts; vitelline reservoir immediately preovarian, lying between ovary and seminal receptacle. Uterus extending posteriorly from ovarian complex, occupying most of ventral portion of hindbody, filling most of posttesticular region, then extending anteriorly and ventrally to genital atrium, distal portion not muscular but lying ventral to seminal vesicle, almost entirely filled with eggs; eggs operculated, with distal-most ones darkly tanned, 23.5 (20–26) long, 10.5 (9–11) wide.

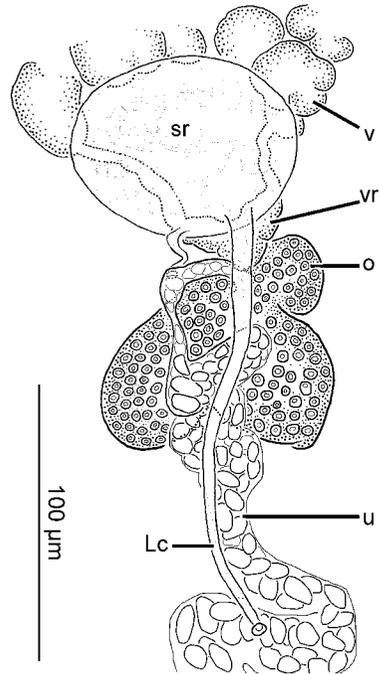


Figure 4. Ovarian complex from paratype of *Caecincola longiscens* n. sp., dorsal view, (Lc, Laurer's canal; o, ovary; sr, canalicular seminal receptacle; u, uterus; v, vitellaria; vr, vitelline reservoir).

Excretory vesicle Y-shaped; main stem bifurcating at midtesticular level; arms extending dorsal relative to ovary then extending ventral relative to vitelline follicles before continuing anteriorly and ventrally in body, extending to pharynx level; pore terminal.

Taxonomic summary

Type host: White crappie, *Pomoxis annularis* Rafinesque, 1818 (Perciformes: Centrarchidae).

Type locality: Lake Chotard, Issaquena County, Mississippi, U.S.A. (32°35'25''N, 91°01'24''W); other locality at Pascagoula River, Jackson County, Mississippi, U.S.A. (30°36'41''N, 88°38'18''W).

Sites: Pyloric ceca and intestine.

Specimens deposited: *Caecincola longiscens* (Holotype) USNPC No. 100837; (2 paratypes) USNPC Nos. 100838–100839.

Specimens examined: *Cryptogonimus spinovum* (Holotype) USNPC 74808; (2 paratypes) USNPC No. 74809; *Caecincola latostoma* (Holotype) USNPC No. 74810; (2 paratypes) USNPC No. 74811.

Etymology: The Latin adjectival present participle *longiscens* means elongating and refers to the elongating body of the species.

Remarks

Caecicola longiscens n. sp. shares features common to both *Cryptogonimus* Osborn, 1903 and *Caecicola*. Gibson (1996) considered the presence of a gonotyl in *Cryptogonimus* the only feature useful for separating the 2 genera. As *Caecicola* is distinguished by the absence of a trait, Gibson (1996) implied that the 2 genera may be synonymous, and we agree. In their recent key to the genera of cryptogonimids, Miller and Cribb (2008) retained *Cryptogonimus* and *Caecicola* as distinct genera pending molecular study of the problem. Miller and Cribb (2008) presented diagnoses for *Caecicola* and *Cryptogonimus*, and according to these the genera differ in 6 main ways: 1) species in *Caecicola* are less elongated, having a body length to width ratio of 2–3:1, whereas species in *Cryptogonimus* have a body length to width ratio of 3–5:1; 2) the oral sucker is wider than long in species of *Caecicola* but longer than wide in species of *Cryptogonimus*; 3) the ceca may terminate in the anterior hindbody in species of *Caecicola* and never extend beyond the testes, whereas the ceca terminate more variably in *Cryptogonimus*, ranging from near the level of the ventral sucker to the posterior extremity depending on the species; 4) the seminal vesicle is bipartite in species of *Caecicola* and tubular in species of *Cryptogonimus*; 5) a gonotyl is lacking in species of *Caecicola* and present in species of *Cryptogonimus*; 6) vitelline follicles are mainly in the forebody but may extend to the posterior margin of the ventral sucker in species of *Caecicola*, and they extend from about the middle of the forebody to the level of the gonads in species of *Cryptogonimus*. We investigated these 6 features in specimens of *C. longiscens* and found that the new species conforms to *Cryptogonimus* for some features and *Caecicola* for others. *Caecicola longiscens* n. sp. has a body length to width ratio (5.5–7.5:1) that exceeds that for both *Cryptogonimus* and *Caecicola*. The oral sucker is wider than long, consistent with the diagnosis for *Caecicola*. The ceca terminate at the testicular level or approximately in the middle of the hindbody, consistent with the diagnosis for *Caecicola*, but similar to the arrangement found in *Cryptogonimus chili* Osborn, 1903. The seminal vesicle is elongated, not bipartite, and consistent with the diagnosis for *Cryptogonimus*. A gonotyl is lacking, consistent with the diagnosis for

Caecicola. Finally, the vitelline follicles are pre-ovarian and confined to the hindbody, an arrangement that is distinct among species of *Caecicola* or *Cryptogonimus*. We chose to place *C. longiscens* n. sp. in *Caecicola* because it lacks a gonotyl, has a distinctly trilobed ovary, and has a funnel-shaped oral sucker that is wider than long. Clearly, the diagnoses for *Caecicola* and *Cryptogonimus* include ambiguous features. Placement of the new species in *Caecicola* should be evaluated using molecular techniques.

Before the present study, 3 species of *Caecicola* were known. *Caecicola longiscens* n. sp. is most easily distinguished from its 3 congeners by body shape and size, configuration of the testes, position of the vitellaria, and egg shape. It has a much larger, more elongated body than any of its congeners, measuring 1,347–1,650 μm long by 184–318 μm wide compared with 260–560 μm long by 107–230 μm wide for *Caecicola parvulus* Marshall and Gilbert, 1905, 310–610 μm long by 150–200 μm wide for *Caecicola wakullata* Premvati, 1967, and 516–856 μm long by 200–336 μm wide for *C. latostoma* (see Marshall and Gilbert [1905]; Van Cleave and Mueller [1934]; Lundahl, [1941]; Premvati [1967]; Greer and Corkum [1979]). Six specimens of *C. latostoma* from our collection measured 809–888 μm long by 247–360 μm wide and had a much smaller body length to width ratio (2.4–3.5:1) compared with the new species (5.5–7.5:1). The elongated, relatively narrow body of *C. longiscens* confines the testes to a tandem arrangement. In contrast, the 3 congeners have a relatively less narrow hindbody, and all have oblique testes. *Caecicola longiscens* differs most notably from its congeners by having the vitelline follicles confined wholly to the hindbody rather than having most of the follicles contained within the forebody as in *C. parvulus* and *C. latostoma*, or wholly distributed in the forebody as in *C. wakullata*. Eggs of *C. longiscens*, *C. latostoma*, and *C. wakullata* lack the spinous process on the abopercular end that is present in eggs of *C. parvulus*.

Species in *Caecicola* parasitize centrarchid fishes in North America. *Caecicola parvulus* was described from *M. salmoides* taken from various small lakes near Madison, Wisconsin, U.S.A. (Marshall and Gilbert, 1905). That species also has been reported from the smallmouth bass, *Micropterus dolomieu* Lacepède, 1802, from Lake Pepin in Wisconsin, U.S.A. (see Pearse [1924]) and the rock bass, *Ambloplites rupestris* (Rafinesque, 1817), from Lake Michigan off Wisconsin, U.S.A. (see Pearse [1924]); however, Lundahl (1941) considered *A. rupestris* a facultative host. Van Cleave and Mueller (1934)

reported the species from *M. salmoides* in Oneida Lake (New York, U.S.A.) but found it absent in *M. dolomieu* and *A. rupestris* from the same lake. Lundahl (1941) reported *C. parvulus* from *M. salmoides* from the vicinity of Ann Arbor, Michigan, U.S.A., and from *M. dolomieu* from Douglas Lake in Michigan, U.S.A. Olson et al. (2003) reported *M. parvulus* from *M. salmoides* from the Pascagoula River, Mississippi, U.S.A., and we have since collected *C. latostoma*, but not *C. parvulus*, from *M. salmoides* at that location. *Caecicola latostoma* was described from *M. salmoides* and the spotted bass, *Micropterus punctulatus* (Rafinesque, 1819), from the False River in Pointe Coupee Parish, Louisiana, U.S.A. (Greer and Corkum, 1979). Greer and Corkum (1980) later reported *C. latostoma* from *M. salmoides* from Beaver Pond Branch in Livingston Parish, Louisiana, U.S.A. We collected *C. latostoma* from a single specimen of *M. salmoides* from Reelfoot Lake in Tennessee, U.S.A., in the present study. The third species, *C. wakullata*, was described from *M. salmoides* from the Wakulla River in Florida, U.S.A. (Premvati, 1967).

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