Saccocoelioides agonostomus sp.n. (Digenea: Haploporidae) from the Mountain Mullet and the Serajo Goby in Puerto Rico, with a Summary of the Genus

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ABSTRACT.—Saccocoelioides agonostomus sp. n., is described from the mountain mullet, Agonostomus monticola (Bancroft), and the serajo goby, Sicydium plumieri (Bloch), from Río Cañas, Puerto Rico. The new species is distinguishable through a combination of features: the possession of an oral sucker larger than the acetabulum, lateral vitellaria that converge posterior to the testis, a testis located in the posterior third of the body, a short posttesticular space, and the size of the eggs.

INTRODUCTION

While digenean surveys of marine fishes of Puerto Rico have been well documented (Dyer et al., 1998), we are unaware of reports concerning digeneans of freshwater fishes from this region. In a recent helminthological survey of Puerto Rican freshwater fishes, three specimens of the mountain mullet, Agonostomus monticola (Bancroft), and one specimen of the serajo goby, Sicydium plumieri (Bloch), were found to harbor the new species of Saccocoelioides described herein.

METHODS

Fourteen Agonostomus monticola, 23 Sicydium plumieri, four Gobiomorus dormitor Lacapede, 1800 and three Awaous banana (Valenciennes, 1837) collected by backpack electrofishing in Río Cañas near Ponce, Puerto Rico on 18 June 1996 were housed in containers of aerated stream water until necropsy. Digeneans were fixed in hot alcohol-formalin-acetic acid solution, stained in Harris’ hematoxylin, dehydrated, cleared in beechwood creosote, and mounted in Canada balsam. Measurements were made with an eyepiece micrometer with the mean followed by the range in parentheses. Illustrations were made with the aid of a camera lucida. Specimens are deposited in the US National Parasite Collection (USNPC), US Department of Agriculture, Beltsville, Maryland.

For comparison the following specimens were examined: Saccocoelium beauforti Thomas, 1960, holotype (USNPC 39427), Saccocoelioides sogandaresi Lumsden, 1963, holotype (USNPC 59879), Saccocoelioides chauhani Lamothe, 1974, paratype (UNAM 227-5), Colección Helminológica, Instituto de Biología de la Universidad Nacional Autónoma de México, Mexico City and Saccocoelioides godoyi Kohn and Miranda Fróes, 1986, paratypes, No. 32-185 bh, Coleção Helminológica, Instituto Oswaldo Cruz, Rio de Janeiro, Brasil.

RESULTS

Three of 14 specimens of Agonostomus monticola were infected with 2, 2 and 4 specimens of Saccocoelioides agonostomus sp.n., respectively and one of 23 specimens of Sicydium plumieri was infected with 32 specimens of the same digenean. Gobiomorus dormitor and Awaous banana were negative for digeneans.
Saccocoelioides agonostomus sp.n. (Figs. 1, 2)

Description (based on 8 adults from A. monticola and 12 from S. plumieri): With characteristics of the genus. Body pyriform, 543 μm (451-647 μm) long and 234 μm (167-310 μm) wide at midbody. Tegument spined. Oral sucker subterminal, 88 μm (81-101 μm) long and 94 μm (68-114 μm) wide. Acetabulum, 84 μm (72-99 μm) long and 90 μm (77-112 μm) wide. Prepharynx absent; pharynx oval, 75 μm (68-77 μm) long and 76 μm (68-80 μm) wide; esophagus twice length of pharynx; cecal bifurcation dorsal to acetabulum, terminating blindly at anterior level of testis. Genital pore median, immediately anterior to acetabulum. Hermaphroditic duct, prostate gland cells, terminal genital ducts, and internal seminal vesicle enclosed in hermaphroditic sac. Hermaphroditic sac elongate, 152 μm (121-176 μm) long and 87 μm (85-100 μm) wide, dextral, extending posteriorly to posterior level of acetabulum, connecting with genital pore. Testis smooth, oval, in posterior third of body, close to posterior end, 112 μm (86-114 μm) long and 81 μm (67-136 μm) wide. External seminal vesicle saccular, inserting into posterior wall of hermaphroditic sac. Internal seminal vesicle oval, located in posterior half of hermaphroditic sac. Pars prostatica tapering to form ejaculatory duct. Prostatic gland cells in peripheral regions of hermaphroditic sac. Ovary smooth, round, posterior to and sometimes overlapping anterior margin of testis, 42 μm (40-43 μm) long and 40 μm (35-46 μm) wide. Neither seminal receptacle nor Laurer's canal observed. Uterus mostly in hindbody, distally inserting into hermaphroditic sac. Metraterm muscular, within hermaphroditic sac, joining ejaculatory duct to form long thick-walled highly muscular and protrusable hermaphroditic duct leading to genital pore. Vitelline follicles relatively large, extending from posterior level of acetabulum to posterior end of body, lateral in acetabular zone, converging in posttesticular region. Eggs elliptical, 70 μm (66-77 μm) long.
and 40 µm (35-46 µm) wide. Excretory vesicle Y-shaped, bifurcating at testicular level, pore terminal.

**TAXONOMIC SUMMARY**

Type host: *Agonostomus monticola* (Bancroft, 1836) (Perciformes: Mugilidae).

Type locality: Río Cañas near Ponce, Puerto Rico, 17° 58' 30" N, 67° 02' 45" W.

Site of infection: intestine.

Etymology: The specific epithet is derived from the genus of the type host.

Type material: US National Parasite Collection, holotype 960618-768a, paratypes 960618-15a.

Other host: *Sicydium plumieri* (Bloch, 1786) (Perciformes: Gobiidae).

**SUMMARY OF THE KNOWLEDGE OF SACCOCOELIOIDES**

Szidat (1954) established *Saccocoelioides* for haploporid digeneans of anastomid fish from the Plata River drainage in Argentina. Four species were described: *Saccocoelioides nanii*, type species from *Prochilodus lineatus* Valenciennes, *S. elongatus* from *Prochilodus* (probably *P. platensis* Holmb), *S. magniovatatus* from *Leporinus obtusidens* Cuvier and Valenciennes, and *S. magnus* from *Curimata platana* Günther. Szidat also described but did not name two additional forms designated as "*Saccocoelioides sp. (5)*" an immature specimen from *Loricaria anus* Cuvier and Valenciennes and "*Saccocoelioides sp. (6)*" from *Schizodon fasciatus* Agassiz. He also reported but did not describe "*Saccocoelioides sp. (7)*" from *Pyrrhulina brevis* Steindaucher. Although several species have been subsequently included, the validity of this genus remains controversial.

The first record of *Saccocoelioides* in fish of North America was the report by Lumsden (1963), who described *S. sogandaresi* from *Mollienisia latipinna* Lesueur from brackish water near Galveston Bay, Texas. Lumsden viewed the taxonomic scheme of the Haplororidae as highly artificial because of the overlap and convergence of adult characters used to describe the various genera comprising the family. He concluded that a
valid revision of the Haploporidae awaits knowledge of the larval stages of these trematodes. While Yamaguti (1958) considered *Saccocoeloides* as a subgenus of *Lecithobothrys* Looss, 1902, Lumsden provisionally retained it at the generic level pending life history studies. Travassos et al. (1969) recognized *Saccocoeloides* as valid and named Szidat’s “*S*. sp. (6)” *Saccocoeloides szidati*. Later Szidat (1970) described *Saccocoeloides octavus* from *Astyanax fasciatus* (Cuvier) taken in the brackish waters of Chascomús Lake, Argentina. Overstreet (1971) redescribed *Saccocelium beauforti* Hunter and Thomas, 1961 from *Mugil cephalus* Linnaeus caught in Louisiana, Mississippi, Alabama, Georgia, and the Gulf of Mexico, and tentatively transferred it to *Saccocoeloides* as *S. beauforti* (Hunter and Thomas, 1961). He concurred with Lumsden (1963) on the confusion concerning the validity of genera within Haploporidae and considered the classification artificial, since so little was known about the biological variation, geographic ranges, and life histories of most species of haploporids. The sixth named species of *Saccocoeloides* described by Szidat (1973) was *S. bacilliformis* from *Astyanax bipunctatus* Eigenmann in Río Reconquista, Buenos Aires. Martin (1973) described *Saccocoeloides pearsonii* from *Mugil cephalus* and *Trachystoma petardi* (Castelnau) caught in the Brisbane River and Lake Manchester, Queensland, Australia and elucidated its life history. Martin compared Szidat’s (1954) Figure 10 of *S. nannii* (type) to Szidat’s Figure 12 of *S. magniovatus* and concluded that since the latter showed a more restricted distribution of vitellaria and eye-spotted miracidia in the eggs, it should be transferred to *Lecithobothrys* as *L. magniovatus* (Szidat, 1954) comb.n. Lamothe Argumendo (1974) described *Saccocoeloides chauhani* from *Astyanax fasciatus aneneus* Günther taken in Laguna de Catemaco, Veracruz, Mexico.

Nasir and Gomez (1976) agreed that *Saccocoeloides magniovatus* should be transferred to *Lecithobothrys*, pointing out that the sole diagnostic character distinguishing *Saccocoeloides* from other haploporid genera is the greater development of the vitelline glands, which comprise numerous, generally elongated follicles located on either side of the acetabulum in the posterior region of the body. In *Lecithobothrys* the vitellaria consist of two symmetrical bunches. *Saccocoeloides* was recognized as a synonym of *Lecithobothrys* and the following species were reallocated: *S. nannii*, *S. beauforti*, *S. pearsonii*, *S. elongatus*, *S. magnus*, *S. szidati*, and *S. octavus*. *Saccocoeloides bacilliformis* was recognized as an intraspecifically varied form of *S. elongatus* and “*S*. sp. (6)” Szidat (1954) a synonym of *S. szidati*. “*Saccocoeloides* sp. (5)” Szidat (1954) and “*S. sp. (7)” Szidat (1954) were relegated to the status of “subjudice” pending a description accompanied by illustrations of mature adults. *Saccocoeloides sogandaresi* and *S. chauhani* were not discussed.

Thatcher (1978) described three new species of *Saccocoeloides* from freshwater fishes of Colombia: *S. magnorchis* and *S. saccodonensis* from *Saccodon caucae* Miles and *Leporinodus* from *Leporinodus vitatus* Eigenmann. He redefined *Saccocoeloides* to include, in addition to the three new species, *S. nannii*, *S. magniovatus*, *S. szidati*, *S. octavus*, *S. beauforti*, and *S. pearsonii*. Szidat’s “*S. sp. (5)” was named *S. quintus* and both *S. elongatus* and *S. magnus* were considered “species inquirenda.” *Saccocoeloides sogandaresi* was excluded from the genus without elaboration of its status. *Saccocoeloides bacilliformis* and *S. chauhani* were not mentioned. Thatcher apparently was not aware of the publications by Szidat (1973), Nasir and Gomez (1976), and Lamothe Argumendo (1974).

Madhavi (1979) described *Saccocoeloides martini* from *Mugil waigiensis* Quoy and Gaimard of Waltair Coast, Bay of Bengal, India and the life cycle was elucidated by Shameen and Madhavi (1991). Lunaschi (1984) described *Saccocoeloides carolae* from *Cichlasoma facetum* (Jenyns) from Laguna de Chascomús, Buenos Aires and *Saccocoeloides antonio* and *S. platensis* from *Curimatobsis platensis* (Günther) of Boca Cerrada, Buenos Aires. *Saccocoeloides carolae* was redescribed and its life cycle was elucidated by Martorelli (1988).

Kohn (1985) examined syntypes of the species of *Saccocoeloides* described by Szidat in 1954. She concluded that *S. nannii*, *S.
magniovatus, S. magnus, S. elongatus, and S. szidati [=S. sp. (6)] should be retained in Saccocoelioides mainly because of the extensive vitellaria. Further, S. quintus [=S. sp. (5)] should be considered “species inquera-enda.” She also considered S. leporinodus as a synonym of S. saccodontis, since only slight differences in measurements of the suckers and pharynx, and the distribution of the vitellaria, seem to distinguish the two species.

Kohn and Fróes (1986) described Saccocoelioides godoyi from Leporinus elongatus Valenciennes from the Guaiia estuary of the Rio Grande, Brazil. Bargiela (1987) described Saccocoelioides overstreeti and S. papernai from Mugil cephalus in Chile. Finally, Díaz and González (1990) described Saccocoelioides tarpazensis from the freshwater guppy, Poecilia reticulata Peters from Tar- pay, Venezuela and elucidated the life cycle.

It is obvious from the above presentation that much confusion exists about the systematics of haploporid digeneans. We concur with Overstreet (1971) that “little is known about the biological variation, geographic ranges, and life histories of most species of haploporids” and we also agree with Lumsden (1963) that Saccocoelioides should be retained as a genus until studies of larval stages indicate otherwise.

The new species described here clearly falls within Saccocoelioides Szidat, 1954. The new species is distinguished from all previously described species except S. magnus, S. octavus, S. bacilliformis, and S. chauhani in having an oral sucker larger than the acetabulum. It may be differentiated from S. magnus and S. octavus in having vitellaria that converges posterior to the testes and from S. bacilliformis in having the testis located in the posterior third of the body. Saccocoelioides chauhani is generally similar to S. agonostomus but has an oval-shaped external seminal vesicle, an elongated ovary, and a larger egg (101-105 μm × 56-63 μm compared with 66-77 μm × 35-46 μm).

Mugilid fish have been reported from fresh and salt waters of warm temperate and tropical areas, and some species (such as Mugil cephalus) serve as host to many trematodes (Doss and Farr, 1969). Manter (1957) concluded that mullets may bridge the ecological gap between trematodes of fresh water and marine fish of coastal waters. Agonostomus monticola is one of the few mugilids in the tropics capable of ascending streams to their headwaters (Gilbert and Kelso, 1971). This species ranges from southeastern United States (from North Carolina to Texas), Mexico, Central America, and the West Indies south to northern South America (Colombia and Venezuela) (Suttkus, 1956; Rohde, 1980; Pe- zold and Edwards, 1983). The reproductive pattern of the mountain mullet has yet to be completely elucidated (Loftus, 1972). Coruo-Jo-Flores (1980) suggested that mountain mullet migrate downstream to spawn in or around the estuaries of Puerto Rican rivers. Loftus et al. (1984) concluded that amphidromy is the most likely pattern for A. monticola, based on the observation that ripe adults have been taken only in fresh waters, whereas migrations of adults into the sea have not been reported and only larvae and juveniles have been found in marine environments. The occurrence of Saccocoelioides agonostomus in a single serajo goby, Sicydium plumieri, indicates that it may show a broader range of host specificity than is now evident.

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LITERATURE CITED


