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Two new species of *Creptotrema* (Digenea: Allocreadiidae) from South America

Dos especies nuevas de *Creptotrema* (Digenea: Allocreadiidae) de America del Sur

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Abstract. Two new digenean species belonging in *Creptotrema* Travassos, Artigas and Pereira, 1928 are described from specimens stored in the invertebrate collection at the Museum of Natural History, Geneva, Switzerland. *Creptotrema lamothei* n. sp. is described from *Ageneiosus brevifilis* Valenciennes in Cuvier and Valenciennes, 1840 (Siluriformes: Ageneiosidae), *Auchenipterus nuchalis* (Spix and Agassiz, 1829) (Siluriformes: Auchenipteridae), and *Bryconops melanurus* (Bloch, 1794) (Characiformes: Characidae) in the Paraguay River, Paraguay. *Creptotrema sucumbiosa* n. sp. is described from *Tetragonopterus argenteus* Cuvier, 1816 (Characiformes: Characidae) in Río Aquarico, Ecuador. *Creptotrema lamothei* differs from its congeners by having testes with irregular rather than entire outlines. *Creptotrema sucumbiosa* differs from its congeners by having a bilobed rather than entire ovary. Both *C. lamothei* and *C. sucumbiosa* differ from their other congeners by having relatively longer posttesticular spaces in their bodies, representing 25-30% and 24-28% of body length respectively, compared with approximately 6-19% in other species.

Key words: *Creptotrema lamothei* n. sp., *Creptotrema sucumbiosa* n. sp., Paraguay, Ecuador.

Resumen. Dos especies nuevas de digéneos pertenecientes a *Creptotrema* Travassos, Artigas y Pereira, 1928 fueron descritas de ejemplares depositados en la colección de invertebrados del Museo de Historia Natural de Ginebra, Suiza. *Creptotrema lamothei* n. sp. fue descrita en *Ageneiosus brevifilis* Valenciennes in Cuvier y Valenciennes, 1840 (Siluriformes: Ageneiosidae), *Auchenipterus nuchalis* (Spix y Agassiz, 1829) (Siluriformes: Auchenipteridae), y *Bryconops melanurus* (Bloch, 1794) (Characiformes: Characidae) en el río Paraguay, Paraguay. *Creptotrema sucumbiosa* n. sp. fue descrita de *Tetragonopterus argenteus*, Cuvier 1816 (Characiformes: Characidae) en el río Aquarico, Ecuador. *Creptotrema lamothei* difiere de sus congéneres por tener testículos con contornos irregulares en contraste con los que presentan contornos enteros. *Creptotrema sucumbiosa* difiere de sus congéneres por tener un ovario bilobulado en contraste con los que presentan ovarios enteros. Ambas especies difieren de sus congéneres por tener espacios post-testiculares relativamente más largos, representando 25-30% y 24-28% del largo del cuerpo, respectivamente, comparado con aproximadamente 6-19% en otras especies.

Palabras clave: *Creptotrema lamothei* n. sp., *Creptotrema sucumbiosa* n. sp., Paraguay, Ecuador.

Introduction

Creptotrema Travassos, Artigas and Pereira, 1928 contains allocreadiids that have 1 pair of muscular ventrolateral papillae associated with the oral sucker and a uterus that does not descend posteriorly beyond the testes (Caira and Bogéa, 2005). Six named species were recognized from the genus prior to the present study. Preserved lots of South American trematode specimens borrowed from the Museum of Natural History, Geneva, Switzerland (MHNG), contained 2 undescribed species of *Creptotrema*. The species are herein described.

Materials and methods

Digenean specimens collected from freshwater fishes from Ecuador, Brazil, and Paraguay and stored in 70% ethanol were borrowed from MHNG. Various specimens were hydrated and stained in aqueous Van Cleave's hematoxylin. Stained specimens were subsequently partially dehydrated in a graded ethanol series. Drops of lithium carbonate saturated in 80% ethanol, plus a small amount of butylamine, were added to make the specimens basic. They were then fully dehydrated through a graded ethanol series and cleared in clove oil and mounted in Canada balsam on glass slides under cover slips. Drawings were made with the aid of a drawing tube. Measurements presented in the descriptions are ranges in micrometers. The type-material for *C. funduli* Mueller, 1934 was

borrowed for comparison from the United States National Parasite Collection, Beltsville, Maryland, USA (USNPC No. 032543: 1 slide containing 10 syntypes).

Descriptions

Creptotrema lamothei n. sp. (Figs. 1-2)

Description based on 9 specimens (measurements obtained from 4 specimens). Body 1 150-1 405 long, 359-457 wide. Tegument smooth, lacking spines. Eyespot remnants present. Oral sucker subterminal, 223-258 long, 173-228 wide, surmounted by 2 muscular ventral papillae. Ventral sucker 173-240 long, 189-223 wide. Ratio of oral sucker to ventral sucker length 1:0.9-1.1. Ratio of oral sucker to ventral sucker width 1:0.9-1.1. Forebody measuring 29-32% of body length. Prepharynx absent or very short. Pharynx 62-100 long, 57-78 wide. Esophagus reflexing, about as long as pharynx. Intestine bifurcating in forebody, ceca terminating near posterior body end. Post-cecal space 111-156 long, representing 9.6-11.0% of body length.

Testes oblique, entire in smaller individuals, with irregular outline in larger individuals, intercecal, contiguous or nearly so, with anterior most testis on left or right side. Left testis 91-153 long, 97-159 wide. Right testis 108-142 long, 85-156 wide. Post-testicular space measuring 318-362 long, representing 25-30% of body length. Cirrus sac arcuate, extending to posterior margin of ventral sucker, containing elongated looping seminal vesicle, pars prostatica, and unspined looping cirrus. Cirrus opening into flask-shaped genital atrium. Genital pore opening medially on forebody, at level of intestinal bifurcation.

Ovary subspherical, pretesticular, submedian, amphitipic, contiguous with ventral sucker margin or nearly so, 72-99 long, 79-102 wide. Seminal receptacle immediately post-ovarian, subspherical, 71-85 long, 42-56 wide. Mehlis' gland opposite ovary. Laurer's canal lying ventral to seminal receptacle, extending laterally toward ceca and vitelline field, distal end not observed. Vitellaria follicular; follicles clustering from level of pharynx to posterior extremity, largely extracecal but also encroaching in intercecal space. Uterus occupying pre-testicular intercecal region of body; distal portion connecting to genital atrium ventrally relative to cirrus sac. Eggs operculate, thin-shelled, 51-62 long, 31-34 wide.

Excretory vesicle I-shaped, extending to anterior margin of testicular field. Pore terminal.

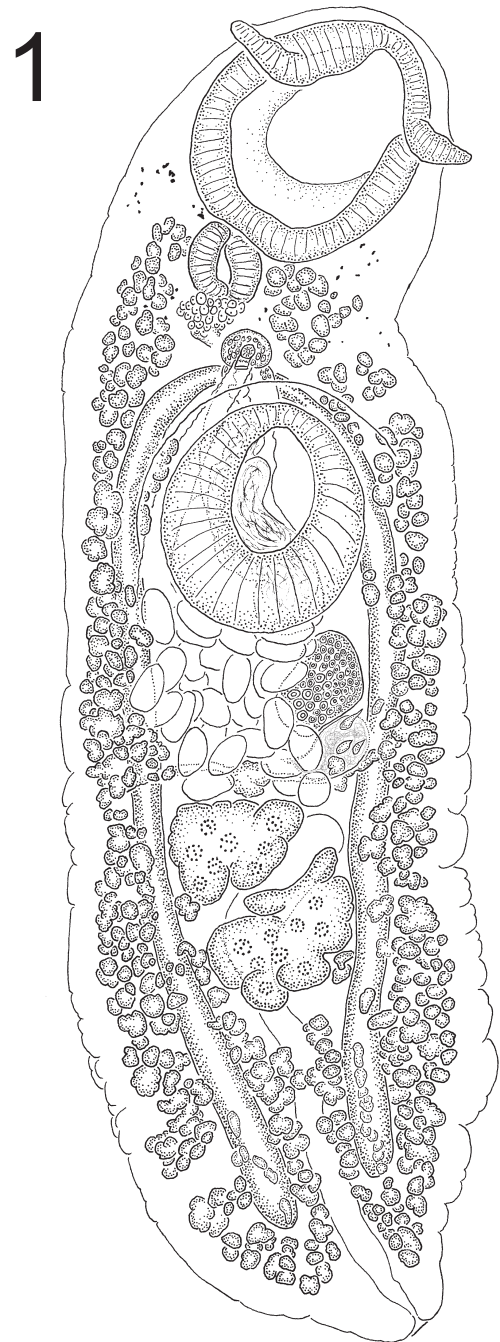


Figure 1. *Creptotrema lamothei* n. sp. Ventral view of holotype. Scale bar=500 μ m.

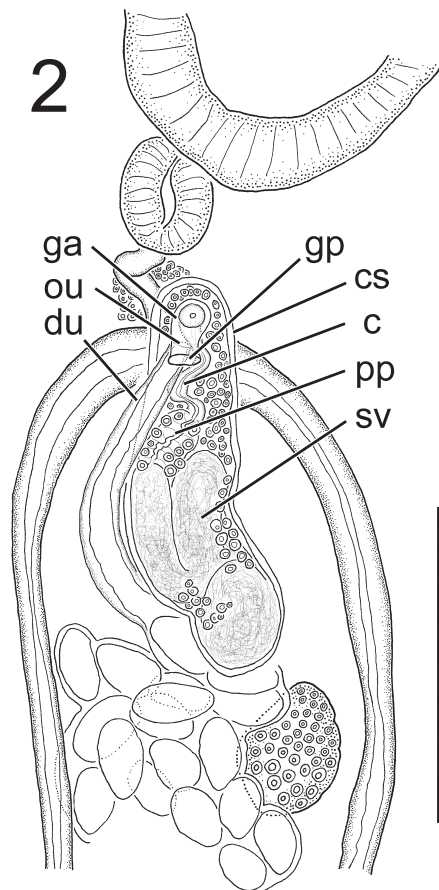


Figure 2. Terminal genitalia from holotype of *C. lamothei* n. sp. ga=genital atrium, ou=opening of uterus, du=distal uterus, gp=genital pore, cs=cirrus sac, c=cirrus, pp=pars prostatica, sv=seminal vesicle. Scale bar=250 μ m.

Taxonomic summary

Type-host: *Ageneiosus brevifilis* Valenciennes in Cuvier and Valenciennes, 1840 (Siluriformes: Ageneiosidae).

Site of infection: intestine.

Type-locality: Paraguay River near San Antonio, Paraguay (23° 54' 02" S, 57° 11' 04" W).

Other hosts and localities: *Auchenipterus nuchalis* (Spix and Agassiz, 1829) (Siluriformes: Auchenipteridae) from Paraguay River near Paso Correa, Paraguay. *Bryconops melanurus* (Bloch, 1794) (Characiformes: Characidae) from Paraguay River, arroyo Tagatiha-Guaza at 4 Km south of l'estancia Santa María at Isla Real, Paraguay.

Specimens deposited: Holotype MHNG INVE 60889; 8 paratypes MHNG INVE 60890-60897.

Etymology: the specific name *lamothei* is given to honor

the eminent Professor Rafael Lamothe-Argumedo.

Remarks

Creptotrema lamothei n. sp. is unique among species in the genus because the testes have an irregular outline. Further, the posttesticular space in *C. lamothei* measures 25-30% of overall body length and is therefore relatively longer than in any other previously described species from the genus (Table 1). In addition, the oral sucker and ventral sucker are nearly equal in size (width ratio=1:0.9-1.1), whereas the oral sucker is always smaller than the ventral sucker in *C. creptotrema* Travassos, Artigas and Pereira, 1928, *C. funduli*, *C. lynchi* Brooks, 1976, *C. pati* Lunaschi, 1985, and *C. agonostomi* Salgado-Maldonado, Cabañas-Carranza, and Caspeta-Mandujano, 1998, and always larger than the ventral sucker in *C. paraensis* Vicente, dos Santos, and de Souza, 1978. *Creptotrema lamothei* differs further from *C. creptotrema* by having a body nearly twice as large, measuring 1 150-1 405 long by 359-457 μ m wide compared with 466-622 long by 240-390 μ m wide, and by having slightly smaller eggs, measuring 51-62 long by 31-34 μ m wide compared with 60-78 long by 38-50 μ m wide (Travassos et al., 1928; Kohn, 1984). The cirrus sac is arcuate in both *C. lamothei* and *C. creptotrema* but extends only to the posterior margin of the ventral sucker in the former and slightly posterior to the ventral sucker in the latter. *Creptotrema lamothei* differs further from *C. funduli* by having oblique rather than tandem testes, the genital pore at the same level as the intestinal bifurcation rather than posterior to it, and smaller eggs compared with 63 long by 35 μ m wide. *Creptotrema lamothei* differs further from *C. lynchi* by having a relatively shorter cirrus sac that does not extend posterior to the posterior margin of the ventral sucker and by having the genital pore at the level of the intestinal bifurcation rather than anterior to it. *Creptotrema lamothei* differs further from *C. pati* by having intercecal testes rather than extracecal testes, the cirrus sac dorsal to the ventral sucker rather than lateral to it, and by having the genital pore at the level of the intestinal bifurcation rather than posterior to it. It should be noted that *C. pati* was described based on 4 compressed specimens and thus the configuration of the gonads and location of the cirrus sac may be due to the compression used at fixation. *Creptotrema lamothei* differs further from *C. paraensis* by having oblique rather than tandem testes and the genital pore opening at the level of the intestinal bifurcation rather than posterior to it. *Creptotrema lamothei* differs further from *C. agonostomi* because the cirrus sac extends further posteriorly (to the posterior margin of the ventral sucker rather than the middle or posterior

Table 1. Comparison of *Creptotrema* spp.

<i>Digenean species</i>	<i>Teste shape</i>	<i>Teste position</i>	<i>Post-testicular space</i>	<i>Cirrus sac posterior extent</i>	<i>Genital pore position</i>	<i>Relative sucker size</i>	<i>Egg size (µm)</i>
<i>C. creptotrema</i>	Entire, sub-spherical	Symmetrical or oblique	9-18% of body length	Slightly below VS posterior margin	Anterior to intestinal bifurcation	Oral smaller than ventral	60-78 long, 38-50 wide
<i>C. funduli</i>	Entire, sub-spherical	Tandem	≈ 12% of body length	Slightly below VS posterior margin	At or slightly posterior to bifurcation	Oral smaller than ventral	63 long, 35 wide
<i>C. lynchi</i>	Entire, elongated	Oblique	15-19% of body length	Posterior to VS posterior margin	Anterior to intestinal bifurcation	Oral smaller than ventral	54-67 long, 33-38 wide
<i>C. paraensis</i>	Entire, sub-spherical	Tandem	≈ 9% of body length	Posterior to VS posterior margin	Posterior to intestinal bifurcation	Oral larger than ventral	56 long, 42 wide
<i>C. pati</i>	Entire, elongated	Symmetrical, extracecal	NA	Posterior to VS posterior margin	Posterior to intestinal bifurcation	Oral smaller than ventral	54-67 long, 30-35 wide
<i>C. agonostomi</i>	Entire, sub-spherical to elongated	Oblique	≈ 6% of body length	Not extending to VS posterior margin	Anterior to intestinal bifurcation	Oral smaller than ventral	41-57 long, 30-35 wide
<i>C. lamothei</i> n. sp.	Irregular	Oblique	25-30% of body length	VS posterior margin	At intestinal bifurcation	Nearly equal	51-62 long, 31-34 wide
<i>C. sucumbiosa</i> n. sp.	Entire, elongated	Oblique	24-28% of body length	Posterior to VS posterior margin	At intestinal bifurcation	Oral slightly smaller than ventral	54-59 long, 28-37 wide

VS= ventral sucker; NA= not applicable

half of the ventral sucker).

Creptotrema sucumbiosa n. sp. (Figs. 3-4)

Description based on 4 whollemounted specimens. Body elongated, 1 750-1 880 long, 472-584 wide, with conical posterior end. Tegument smooth, lacking spines. Eyespot remnants present. Oral sucker slightly subterminal, 212-296 long, 234-279 wide (201 long but compressed in 1 specimen), surmounted by 2 muscular ventral papillae. Ventral sucker 250-340 long, 284-307 wide. Ratio of oral sucker to ventral sucker length 1:1.1-1.4. Ratio of

oral sucker to ventral sucker width 1:1.0-1.2. Forebody 307-340 long, representing 15.8-19.0% of body length. Prepharynx absent or very short. Pharynx 89-100 long, 67-83 wide. Esophagus length about equal to pharynx length. Intestine bifurcating in forebody, ceca terminating blindly in posterior half of hindbody. Post-cecal space 229-351 long, representing 13.0-18.6% of body length.

Testes oblique, elongated, entire, contiguous; left testis 307-390 long, 150-178 wide; right testis 307-334 long, 139-195 wide. Post-testicular space 435-525 long, representing 24.0-28.0% of body length. Cirrus sac elongated, reaching to mid-ovarian level, containing

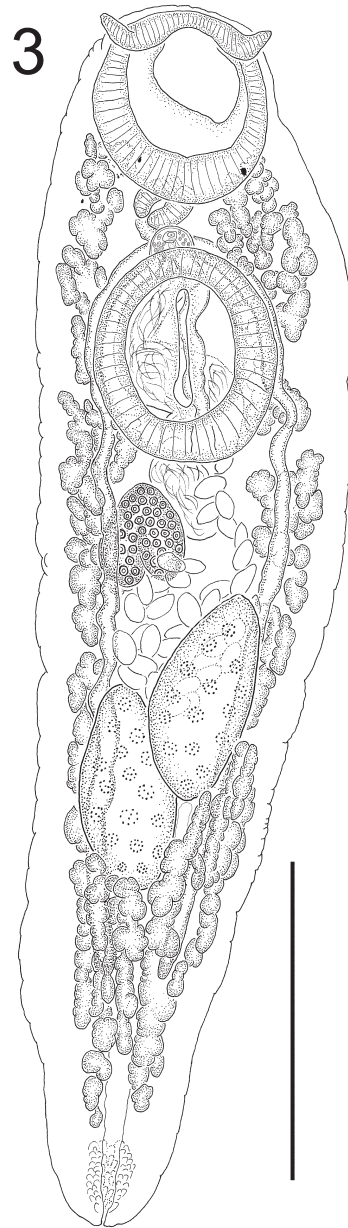


Figure 3. *Creptotrema sucumbiosa* n. sp. Ventral view of holotype. Scale bar=500 μ m.

elongated, looping seminal vesicle, relatively short pars prostatica, and unarmed cirrus. Cirrus opening into genital atrium. Genital pore opening medially at the level of the intestinal bifurcation.

Ovary bilobed, 156-170 long, 122-140 wide, submedian, amphitypic. Seminal receptacle post-ovarian on the ovarian side, subspherical, 111-153 long, 61-110

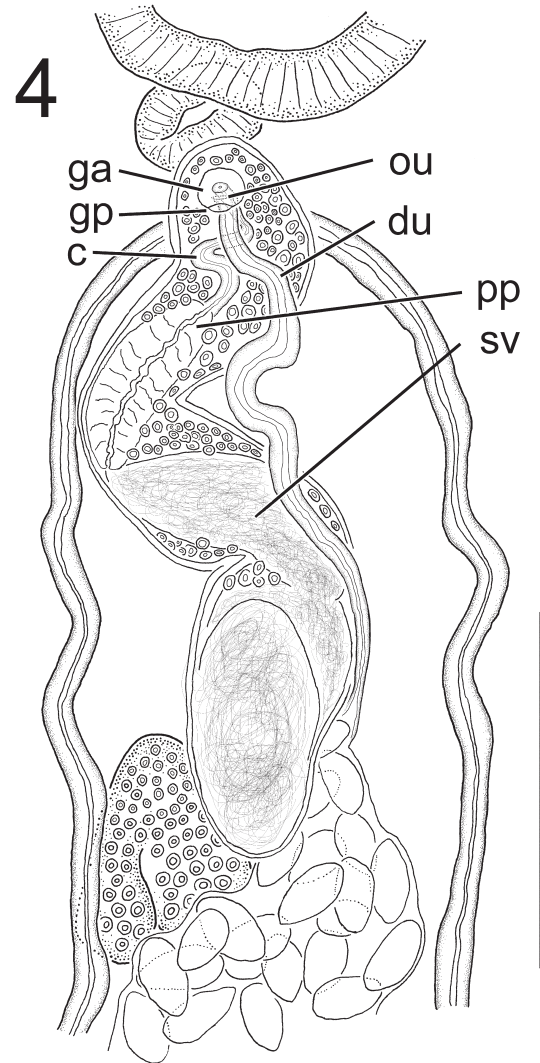


Figure 4. Terminal genitalia from holotype of *C. sucumbiosa* n. sp. ga=genital atrium, gp=genital pore, c=cirrus, ou=opening of uterus, du=distal uterus, pp=pars prostatica, sv=seminal vesicle. Scale bar=250 μ m.

wide. Mehlis' gland opposing ovary. Laurer's canal not observed. Vitelline follicles extensive, in 2 lateral fields surrounding ceca; fields confluent in hindbody, not confluent in forebody. Uterus occupying pre-testicular intercecal region of hindbody; distal portion connecting to genital atrium ventrally relative to cirrus sac. Eggs operculate, 54-59 long, 28-37 wide.

Excretory vesicle I-shaped, extending to mid-testicular field. Pore terminal or slightly dorso-subterminal.

Taxonomic summary

Type-host: *Tetragonopterus argenteus* Cuvier, 1816 (Characiformes: Characidae).

Site of infection: Intestine.

Type-locality: Río Aquarico, near San Pablo de Kantesiya, Provincia de Sucumbíos, Ecuador (0° 15' 15" S, 76° 25' 26" W).

Specimens deposited: Holotype MHNG INVE 60898; 3 paratypes MHNG INVE 60899-60901.

Etymology: The species name *sucumbiosa* is given for the region from which it was collected, Sucumbíos Province in Ecuador's Amazon Drainage.

Remarks

Creptotrema sucumbiosa n. sp. is unique among species in the genus because the ovary is bilobed rather than entire and subsperical. *Creptotrema sucumbiosa* has a relatively long post-testicular space in the hindbody measuring 24-28% of overall body length, a feature shared only with *C. lamothei* among its congeners (Table 1). *Creptotrema sucumbiosa* differs further from *C. creptotrema* by possessing a more elongated body, elongated rather than subspherical testes, a relatively longer cirrus sac, and slightly smaller eggs, measuring 54-59 long by 28-37 µm wide compared with 60-78 long by 38-50 µm wide. *Creptotrema sucumbiosa* differs further from *C. funduli* by possessing a more elongated body, elongated oblique rather than subspherical tandem testes, a relatively longer cirrus sac, nearly equal sucker sizes rather than having the oral sucker being much smaller than the ventral sucker, and slightly smaller eggs compared with 63 by 35 µm wide. *Creptotrema sucumbiosa* differs further from *C. lynchi* by having an elongated rather than pyriform body and nearly equal sucker sizes rather than having the oral sucker being much smaller than the ventral sucker. *Creptotrema sucumbiosa* differs further from *C. pati* by having intercecal rather than extracecal testes and by having a much longer cirrus sac that does not lie lateral to the ventral sucker, and by having the genital pore at the level of the intestinal bifurcation rather than posterior to it. It should be again noted that these features might have been influenced by the compression during fixation of *C. pati*. *Creptotrema sucumbiosa* differs further from *C. paraensis* by having elongated oblique rather than subspherical tandem testes, by having the genital pore opening at the level of the intestinal bifurcation rather than posterior to it, and by not having the oral sucker larger than the ventral sucker. *Creptotrema sucumbiosa* differs further from *C. agonostomi* by having the cirrus sac extend well past the ventral sucker to the ovarian level rather than

not extending to the posterior margin of the ventral sucker. *Creptotrema sucumbiosa* differs further from *C. lamothei* by having elongated rather than irregular testes and a conical rather than a broadly flattened posterior end.

Discussion

With the addition of 2 new species *Creptotrema* presently contains 8 named species: 1 from northern North America, 1 from Mexico, and now 6 from South America. No species have been reported from Central America and nothing has been reported concerning larval stages of *Creptotrema*. *Creptotrema funduli* occurs in *Fundulus diaphanous menona* Jordan and Copeland, 1877 (Cyprinodontiformes: Fundulidae) from New York, USA and immature adult specimens were reported from *Cottus bairdii* Girard, 1850 (Scorpaeniformes: Cottidae) in Wyoming, USA (Mueller, 1934; Bangham, 1951). Manter (1962) examined the type material for *C. funduli* (USNPC No. 032543: 1 slide containing 10 syntypes) and concluded that the presence of oral papillae was doubtful and suggested that the species was allied with Opecoelidae related to *Plagioporus* Stafford, 1904. I observed the type material for *C. funduli*, and confirmed the presence of ventrolateral oral papillae; furthermore, the distal uterus lies ventral to the cirrus sac and joins with the genital atrium ventrally relative to where the cirrus sac joins. These features combined with the presence of diffuse eyespots and a uterus largely confined to the pre-testicular hindbody, confirm that the species is an allocreadiid belonging in *Creptotrema* and not an opecoelid. *Creptotrema agonostomi* occurs in *Agonostomus monticola* (Bancroft, 1834) (Perciformes: Mugilidae) and *Ictalurus balsanus* (Jordan and Snyder, 1899) (Siluriformes: Ictaluridae) in Mexico (Salgado-Maldonado et al., 1998). *Creptotrema creptotrema* occurs in *Leporinus elongatus* Valenciennes, 1850 (Characiformes: Anostomidae) in São Paulo, Brazil (Travassos et al., 1928), and in *L. obtusidens* (Valenciennes, 1837) and *Trachelyopterus galeatus* (Linnaeus, 1766) (Siluriformes: Auchenipteridae) in northern Argentina (Hamann, 1988; Lunaschi and Sutton, 1995). *Creptotrema paraensis* occurs in *Pimelodus* sp. (Siluriformes: Pimelodidae) in the Brazilian Amazon (Vicente et al., 1978). *Creptotrema lynchi* was originally described from *Bufo marinus* (Linnaeus, 1758) (Anura: Bufonidae) in Colombia (Brooks, 1976). Kohn et al. (1985) reported *C. lynchi* from *Leporinus copelandii* Steindachner, 1875 (Characiformes: Anostomidae) and *L. octofasciatus* Steindachner, 1915 in São Paulo, Brazil, and Lunaschi and Sutton (1995) reported *C. lynchi* from *L. obtusidens* in Argentina. I collected *C. lynchi* from *Aequidens tetramerus*

(Heckel, 1840) (Perciformes: Cichlidae) in the Peruvian Amazon. Absence of subsequent reports of *C. lynchi* from anurans suggests the cane toad may have been an accidental host for the species. Lunaschi (1985) described *C. pati* from *Luciopimelodus pati* (Valenciennes, 1835) (Siluriformes: Pimelodidae) in northern Argentina.

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