

Gastrointestinal Helminths of Six Sympatric Species of *Leptodactylus* from Tocantins State, Brazil

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ABSTRACT: A total of 107 leptodactylid frogs representing 6 species, *Leptodactylus fuscus* ($n = 15$), *Leptodactylus leptodactyloides* ($n = 9$), *Leptodactylus mystaceus* ($n = 2$), *Leptodactylus ocellatus* ($n = 31$), *Leptodactylus petersii* ($n = 31$), and *Leptodactylus pustulatus* ($n = 19$), collected in the Brazilian state of Tocantins, were examined for helminths. One species of Digenea (*Catadiscus marinholutzi*), 6 species of Nematoda (adults of *Cosmocerca podicipinus*, *Ochoterenella scalaris*, *Oswaldocruzia proencai*, and *Schrankiana larvata* and larvae of *Brevimulticaecum* sp. and *Physaloptera* sp.), and 1 species of Acanthocephala (as cystacanths) were found. The mean number of helminth species infecting each frog species was 3.3 ± 2.1 SD, with a range of 1–7. Ten new host records are reported.

KEY WORDS: *Leptodactylus*, Digenea, Nematoda, Acanthocephala, Anura, Tocantins, Brazil.

The Brazilian state of Tocantins is exceptionally diverse because of its location at the interface between the Amazonian rainforest and the Brazilian cerrado, a savanna-like biome. The frog genus *Leptodactylus* (family Leptodactylidae) is composed of 81 species, many of which occur in these 2 biomes (Frost et al., 2006). The purpose of this study is to report gastrointestinal helminths from 6 species of leptodactylid frogs at 1 locality in Tocantins during fieldwork from 5 September to 21 October 2005: whistling frog, *Leptodactylus fuscus*; Andersson's thin-toed frog, *Leptodactylus leptodactyloides*; Amazonian white-lipped frog, *Leptodactylus mystaceus*; spotted thin-toed frog, *Leptodactylus ocellatus*; Peters' thin-toed frog, *Leptodactylus petersii*; and pustulated thin-toed frog, *Leptodactylus pustulatus*. There are reports of helminths in *L. fuscus*, *L. mystaceus*, and *L. ocellatus* but, to our knowledge, no reports of helminths in *L. leptodactyloides*, *L. petersii*, or *L. pustulatus*. Although we encountered the 6 species of *Leptodactylus* in the same general area, we noted some habitat differences among them. *Leptodactylus fuscus* occurred in cerrado areas with sparsely scattered, small trees and in disturbed areas around the campsite. *Leptodactylus mystaceus* was generally confined to the gallery forest with large trees. *Leptodactylus pustulatus* occurred around a large pond in an open field, where it was heard calling every night in September and October.

Leptodactylus leptodactyloides and *L. petersii* were found in the igapo forest and sandy river banks of the Rio Cocos and along small tributaries of this river with forested shorelines. *Leptodactylus ocellatus* was commonly found along the sandy river banks of the Rio Cocos.

MATERIALS AND METHODS

A total of 107 frogs collected at Parque Estadual do Cantão (9°20'54.1"S; 49°56'37.3"W) Caseara Municipality, Tocantins, Brazil, in September–October 2005, were borrowed from the Sam Noble Oklahoma Museum of Natural History (OMNH), University of Oklahoma, Norman, Oklahoma, and examined for helminths: *L. fuscus* ($n = 15$, OMNH 41037–41051); *L. leptodactyloides* ($n = 9$, OMNH 41054–41065); *L. mystaceus* ($n = 2$, OMNH 41066–41067); *L. ocellatus* ($n = 31$, OMNH 41068–41098); *L. petersii* ($n = 31$, OMNH 41099–41129), and *L. pustulatus* ($n = 19$, OMNH 41130–41150). Specimens were fixed in 10% neutral-buffered formalin at the time of collection and stored in 70% ethanol. The abdominal cavity of each specimen was opened and the digestive tract was removed. The digestive tract was opened and examined for helminths under a dissecting microscope. Digeneans were removed and regressively stained in hematoxylin, cleared in xylene, and mounted in Canada balsam for identification. Nematodes were removed, placed on a glass slide in lactophenol, and coverslipped for examination under a compound microscope. Selected nematodes and Acanthocephala cystacanths, in vials of 70% ethanol, and a stained slide of the digenean *Catadiscus marinholutzi* were deposited in the United States National Parasite Collection (USNPC), Beltsville, Maryland. Amphibian taxonomy is in accordance with Frost et al. (2006), Grant et al. (2006), Chaparro et al. (2007), and Hedges et al. (2008).

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Digenea

***Catadiscus marinhoi*
Freitas and Lent, 1939**

Host: *Leptodactylus ocellatus*, OMNH 41095.

Prevalence and intensity: 1 of 31 (3%) *L. ocellatus*, 2 gravid individuals.

Site of infection: Large intestine.

Additional Brazilian records: *Leptodactylus ocellatus* (reported as *Leptodactylus caliginosus*, Freitas and Lent, 1939).

Type host and locality: *Leptodactylus ocellatus*; Camisão, Mato Grosso state, Brazil (Freitas and Lent 1939).

Other reported hosts: None.

Geographic range: Brazil (Freitas and Lent, 1939).

Specimens deposited: *L. ocellatus* (USNPC 100711).

Remarks

This is the second report of *L. ocellatus* as a host for *C. marinhoi*.

Nematoda

***Cosmocerca podicipinus*
Baker and Vaucher, 1984**

(Syn. *Cosmocerca panamensis* Martínez and Maggenti, 1989)

Hosts: *Leptodactylus fuscus*, OMNH 41041, 41047, 41049, 41051; *L. leptodactyloides*, OMNH 41054–41056, 41060, 41061, 41064, 41065; *L. ocellatus*, OMNH 41075, 41079, 41082, 41083, 41085, 41091, 41095; *L. petersii*, OMNH 41099, 41100, 41102–41104, 41107, 41114, 41115, 41118, 41121–41125, 41128, 41129; *L. pustulatus*, OMNH 41132.

Prevalence and intensity: Four of 15 (27%) *L. fuscus*, 1, 3, 4, 6 individuals per respective host; 7 of 9 (78%) *L. leptodactyloides*, 1, 2, 2, 3, 3, 5, 5 individuals per respective host; 7 of 31 (23%) *L. ocellatus*, 1, 1, 1, 2, 2, 3, 3 individuals per respective host; 16 of 31 (52%) *L. petersii*, 1, 1, 1, 2, 2, 2, 3, 3, 3, 4, 6, 7, 7, 8, 10 individuals per respective host; 1 of 19 (5%) *L. pustulatus*, 1 individual.

Site of infection: Intestines.

Additional Brazilian records: Brown-bordered snouted treefrog, *Scinax fuscomarginatus* (Goldberg et al., 2007).

Type host and locality: Dark-bellied frog, *Leptodactylus podicipinus*, Capitán Bado, Amambay Province, Paraguay (Baker and Vaucher, 1984).

Other reported hosts: Pacific fat sleeper, *Dormitator latifrons* (Garrido-Olvera et al., 2004); brilliant-thighed poison frog, *Allobates femoralis* (reported as *Epipedobates femoralis*, Bursey et al., 2001); dull rocket frog, *Allobates marchesianus* (reported as *Colostethus marchesianus*, Bursey et al., 2001); Condoto stubfoot toad, *Atelopus spurrelli* (Goldberg and Bursey, 2003); no common name, *Rhinella bergi* (González and Hamann, 2007); polymorphic robber frog, *Craugastor rhodopis* (reported as *Eleutherodactylus rhodopis*, Goldberg, Bursey, Salgado-Maldonado et al., 2002); Chaco frog, *Leptodactylus chaquensis* (Baker and Vaucher 1984; Hamann, Kehr et al., 2006); Elena's thin-toed frog, *Leptodactylus elenae* (Baker and Vaucher, 1984); *Leptodactylus fuscus* (Baker and Vaucher, 1984); small oven frog, *Leptodactylus latinus* (Hamann, González et al., 2006); *Leptodactylus leptodactyloides* (Bursey et al., 2001); Miranda's white-lipped frog, *Leptodactylus macrosternum* (Baker and Vaucher, 1984); black-backed thin-toed frog, *Leptodactylus melanonotus* (Goldberg and Bursey, 2002a; Goldberg, Bursey, Salgado-Maldonado et al., 2002); Forrer's grass frog, *Lithobates forreri* (reported as *Rana forreri*, Goldberg and Bursey, 2002a); *Lithobates* cf. *forreri* (reported as *Rana* cf. *forreri*, Bursey and Goldberg, 2005; Cabrera-Guzmán et al., 2007); Rancho Redondo frog, *Lithobates vibicarius* (reported as *Rana vibicaria*, Bursey and Goldberg, 2006); Warszewitsch's frog, *Lithobates warszewitschii* (Bursey and Goldberg, 2007); harlequin poison frog, *Oophaga histrionica* (reported as *Dendrobates histrionicus*, Goldberg and Bursey, 2003); strawberry poison frog, *Oophaga pumilio* (reported as *Dendrobates pumilio*, Martínez and Maggenti, 1989); imitator robber frog, *Pristimantis imitatrix* (reported as *Eleutherodactylus imitatrix*, Bursey et al., 2001); South American leaf toad, *Rhinella margaritifera* (reported as *Bufo typhonius*, Bursey et al., 2001); blue-spotted Mexican treefrog, *Smilisca cyanosticta* (Goldberg, Bursey, Salgado-Maldonado et al., 2002).

Geographic range: Argentina (Hamann, Kehr et al., 2006; Hamann, González et al. 2006); Brazil (Goldberg et al., 2007), Colombia (Goldberg and Bursey, 2003), Costa Rica (Bursey and Goldberg, 2005), Mexico (Goldberg and Bursey, 2002a), Panama (Martínez and Maggenti, 1989), Paraguay (Baker and Vaucher, 1984), Peru (Bursey et al., 2001).

Specimens deposited: *Leptodactylus fuscus* (USNPC 100704); *L. leptodactyloides* (USNPC 100707); *L. ocellatus* (USNPC 100712); *L. petersii* (USNPC 100718); *L. pustulatus* (USNPC 100720).

Remarks

This is the second report of *Leptodactylus fuscus* as host for *C. podicipinus*.

***Ochoterenella scalaris* (Travassos, 1929) Esslinger, 1986**

(Syn. *Foleyella scalaris* Travassos, 1928).

Host: *Leptodactylus pustulatus*, OMNH 41131.

Prevalence and intensity: One of 19 (5%) *L. pustulatus*, 3 individuals.

Site of infection: Body cavity.

Additional hosts from Brazil: *Leptodactylus ocellatus* (Travassos, 1928).

Type host and type locality: *Leptodactylus ocellatus*, Brazil (Travassos, 1928).

Other reported hosts: None.

Geographic range: Brazil (Travassos, 1928).

Specimens deposited: *Leptodactylus pustulatus* (USNPC 100721).

Remarks

Leptodactylus pustulatus represents a new host record for *O. scalaris*.

***Oswaldocruzia proencai* Ben-Slimane and Durette-Desset, 1995**

(Syn. *Oswaldocruzia mazzai* sensu Lent, Freitas and Proenca, 1946 nec Travassos, 1935)

Hosts: *Leptodactylus fuscus*, OMNH 41042; *L. ocellatus*, OMNH 41075, 41077, 41088, 41092, 41096; *L. pustulatus*, OMNH 41136, 41141.

Prevalence and intensity: One of 15 (7%) *L. fuscus*, 1 individual; 5 of 31 (16%) *L. ocellatus*, 1, 1, 2, 4, 5 individuals per respective host; 2 of 19 (11%) *L. pustulatus*, 1 individual in each of 2 hosts.

Site of infection: Gastrointestinal tract.

Type host and type locality: Schneider's toad, *Rhinella schneideri* (reported as *Bufo paracnemis*), Assunção Province, Paraguay (Lent et al., 1946).

Additional hosts from Brazil: None.

Other reported hosts: Argentine toad, *Rhinella arenarum* (Ramallo et al., 2007); oven frog, *Leptodactylus bufonius* (Lent et al., 1946); *Leptodactylus ocellatus* (Lent et al., 1946).

Geographic range: Argentina (Ramallo et al., 2007); Brazil (this article); Paraguay (Ben-Slimane and Durette-Desset, 1995).

Specimens deposited: *Leptodactylus fuscus* (USNPC 100705); *L. ocellatus* (USNPC 100713); *L. pustulatus* (USNPC 100722).

Remarks

Leptodactylus fuscus and *L. pustulatus* represent new host records for *O. proencai*; Brazil is a new locality record.

***Schrankiana larvata* (Vaz, 1933) Fahel, 1952**

(Syn. *Schrankia larvata* Vaz, 1933).

Hosts: *Leptodactylus fuscus*, OMNH 41050, 41051; *L. mystaceus*, OMNH 41067; *L. ocellatus*, OMNH 41070.

Prevalence and intensity: Two of 15 (13%) *L. fuscus*, 6 individuals in each of 2 hosts; 1 of 2 (50%) *L. mystaceus*, 42 individuals; 5 of 31 (16%) *L. ocellatus*, 5 individuals.

Site of infection: Large intestine.

Additional hosts from Brazil: *Leptodactylus fuscus* (Fahel, 1952; Freitas, 1959); *Leptodactylus labyrinthicus*, Fahel, 1952; Freitas, 1959); *L. pentadactylus* (Vaz, 1933; Fahel, 1952; Freitas, 1959; Guimarães et al., 1976).

Type host and type locality: Smoky jungle frog, *Leptodactylus pentadactylus*, São Paulo, Brazil (Vaz, 1933).

Other reported hosts: Pepper frog, *Leptodactylus labyrinthicus* (Baker and Vaucher, 1988); *Leptodactylus mystaceus* (Burseley et al., 2001); *Leptodactylus pentadactylus* (Burseley et al., 2001).

Geographic range: Brazil (Vaz, 1933; Freitas, 1959), Paraguay (Baker and Vaucher, 1988), Peru (Burseley et al., 2001).

Specimens deposited: *Leptodactylus fuscus* (USNPC 100706); *L. mystaceus* (USNPC 100710); *L. ocellatus* (USNPC 100714).

Remarks

Leptodactylus ocellatus represents a new host record for *S. larvata*.

***Brevimulticaecum* sp. (larvae in cysts)**

Hosts: *Leptodactylus ocellatus*, OMNH 41068, 41070, 41072, 41073, 41075, 41082, 41084, 41086, 41089, 41092, 41094, 41096, 41098; *L. pustulatus*, OMNH 41131, 41132, 41133.

Prevalence and intensity: Thirteen of 31 (42%) *L. ocellatus*, 1, 1, 1, 1, 1, 2, 2, 2, 3, 3, 4, 5, 7 individuals per respective host; 3 of 19 (16%) *L. pustulatus*, 4, 11, 13 individuals per respective host.

Site of infection: Cysts in gastrointestinal wall.

Additional Brazilian records: None.

Type host and locality: See remarks.

Other reported neotropical amphibian hosts: Gunther's banded treefrog, *Hypsiboas fasciata* (reported as *Hyla fasciata*, Bursey et al., 2001); Demerara Falls treefrog, *Hypsiboas cinerascens* (reported as *Hyla granosa*, Bursey et al., 2001); lesser treefrog, *Dendropsophus minutus* (reported as *Hyla minuta*, Moravec and Kaiser, 1994); Bolivian jungle frog, *Leptodactylus bolivianus* (Bursey et al., 2001); *Leptodactylus macrosternum* (Goldberg, Bursey, Trujillo et al., 2002); South American bullfrog, *Leptodactylus pentadactylus* (Bursey et al., 2001); Surinam golden-eyed treefrog, *Trachycephalus venulosus* (reported as *Phrynohyas venulosa*, Bursey et al., 2001); *Lithobates* cf. *forreri* (Bursey and Goldberg, 2005); Madre de Dios treefrog, *Scarthyla goinorum* (reported as *Scarthyla ostinodactylus*, Bursey et al., 2001); Orinoco lime treefrog, *Sphaenorhynchus lacteus* (Bursey et al., 2001).

Geographic range: Brazil (this article), Costa Rica (Bursey and Goldberg, 2005), Peru (Bursey et al., 2001), Trinidad (Moravec and Kaiser, 1994).

Specimens deposited: *Leptodactylus ocellatus* (USNPC 100715); *L. pustulatus* (USNPC 100723).

Remarks

Sprent (1979) assigned 5 species occurring in caimans and alligators of the New World to *Brevimulticaecum*: *B. baylisi* (Travassos, 1933); *B. gibsoni* Sprent, 1979; *B. pintoi* Sprent, 1979; *B. stekhoveni* (Baylis, 1947); *B. tenuicolle* (Rudolphi, 1819). Of these, *B. baylisi*, *B. gibsoni*, *B. pintoi*, and *B. stekhoveni*

have been found in caiman hosts collected in Brazil (Sprent, 1979). Walton (1937) collected larvae encysted in the stomach wall of *L. catesbianus*, *L. sphenoccephalus* and *Siren lacertina* from Florida (USA) and fed 50 to a young alligator that later died and was found to harbor individuals resembling *B. tenuicolle*. Walton (1937) suggested, but could not prove, an alternation of hosts for *Brevimulticaecum*, larval stages in Amphibia and the adult form in the Crocodylidae. It should also be noted that larvae of *Brevimulticaecum* have been found in freshwater fishes of Mexico and Nicaragua (Aguirre-Macedo et al., 2001). This is the first report of encysted larvae of *Brevimulticaecum* in Brazil.

***Physaloptera* sp. (larvae in cysts)**

Hosts: *Leptodactylus leptodactyloides*, OMNH 41058–41060, 41064; *L. ocellatus*, OMNH 41069–41071, 41073–41075, 41077, 41078, 41080, 41084, 41087, 41091, 41094, 41096, 41098; *L. petersii*, OMNH 41101, 41102, 41107, 41118, 41119, 41121, 41129.

Prevalence and intensity: Four of 9 (44%) *L. leptodactyloides*, 1, 1, 1, 2 individuals per respective host; 15 of 31 (48%) *L. ocellatus*, 1, 1, 1, 1, 2, 2, 2, 2, 2, 4, 6, 18, 40 individuals per respective host; 7 of 31 (23%) *L. petersii*, 1, 1, 1, 1, 1, 1, 2 individuals per respective host.

Site of infection: Stomach.

Type host and type locality: See remarks.

Additional amphibian hosts from Brazil: *Leptodactylus marmoratus* (reported as *Adenomera marmorata*, De Fabio, 1982); *Leptodactylus ocellatus* (reported as *Leptodactylus caliginosus*, De Fabio, 1982); *Leptodactylus mystaceus* (De Fabio, 1982); *Physalaeus signiferus* (De Fabio, 1982); *Physalaeus soaresi* (De Fabio, 1982); *Proceratophrys appendiculata* (Boquimpani-Freitas et al., 2001).

Other reported amphibian hosts: Neotropical hosts: cane toad, *Rhinella marina* (reported as *Chaunus marinus*, Galicia-Guerrero et al., 2000; Bursey et al., 2001; Goldberg, Bursey, Salgado-Maldonado et al., 2002; Espinoza-Jiménez et al., 2007); Peru coast toad, *Rhinella limensis* (reported as *Bufo limensis*, Freitas and Ibanez, 1965); South American common toad, *Rhinella margaritifera* (reported as *Bufo typhonius*, Bursey et al., 2001); dull rocket frog, *Allobates marchesianus* (reported as *Colostethus marchesianus*, Bursey et al., 2001); brown egg frog, *Cteno-*

phryne geayi (Burseley et al., 2001); Perez's snouted frog, *Edalorhina perezii* (Burseley et al., 2001); La Paz robber frog, *Oreobates cruralis* (reported as *Eleutherodactylus cruralis*, Burseley et al., 2001); Río Mamore robber frog, *Pristimantis fenestratus* (reported as *Eleutherodactylus fenestratus*, Burseley et al., 2001); Bolivian bleating frog, *Hamptophryne boliviana* (Burseley et al., 2001); rusty treefrog, *Hypsiboas boans* (reported as *Hyla boans*, Burseley et al., 2001); Gunther's banded treefrog, *Hypsiboas fasciatus* (reported as *Hyla fasciata* (Burseley et al., 2001); Demerara Falls treefrog, *Hypsiboas cinerascens* (reported as *Hyla granosa*, Burseley et al., 2001); Leal's treefrog, *Dendropsophus leali* (reported as *Hyla leali*, Burseley et al., 2001); Bereis' treefrog, *Dendropsophus leucophyllatus* (reported as *Hyla leucophyllata*, Burseley et al., 2001); marbled treefrog, *Dendropsophus marmoratus* (reported as *Hyla marmorata*, Burseley et al., 2001); yellow treefrog, *Dendropsophus microcephalus* (reported as *Hyla microcephala*, Goldberg, Burseley, Salgado-Maldonado, 2002); *Leptodactylus bolivianus* (Burseley et al., 2001); *Leptodactylus fuscus* (Goldberg, Burseley, Trujillo et al., 2002); *Leptodactylus leptodactyloides* (Burseley et al., 2001); *Leptodactylus mystaceus* (Burseley et al., 2001); *Leptodactylus pentadactylus* (Burseley et al., 2001); Peru white-lipped frog, *Leptodactylus rhodonotus* (Burseley et al., 2001); gold-striped frog, *Leptodactylus lineatus* (reported as *Lithodytes lineatus*, Burseley et al., 2001); *Lithobates* cf. *forreri* (reported as *Rana* cf. *forreri*, Cabrera-Guzman et al., 2007); *Lithobates vaillanti* (Goldberg and Burseley, 2007); Manaus slender-legged treefrog, *Osteocephalus taurinus* (Burseley et al., 2001); *Trachycephalus coriaceus* (reported as *Phrynohyas coriacea*, Burseley et al., 2001); *Trachycephalus venulosus* (reported as *Phrynohyas venulosa*, Burseley et al., 2001); tiger-striped leaf frog, *Phyllomedusa tomopterna* (Burseley et al., 2001); weeping frog, *Physalaemus biligonigerus* (Gutierrez et al., 2005); swimming frog, *Pseudis paradoxa* (Burseley et al., 2001); yellow-snouted treefrog, *Scinax ictericus* (Burseley et al., 2001); red-snouted treefrog, *Scinax ruber* (reported as *Scinax rubra*, Burseley et al., 2001); and Nearctic hosts: black salamander, *Desmognathus fuscus* (Walton, 1935; Rankin, 1937; Reiber et al., 1940); northern slimy salamander, *Plethodon glutinosus* (Walton, 1935; Reiber et al., 1940); mountain triton, *Pseudotriton montanus* (Rankin, 1937); western cricket frog, *Acris crepitans* (Morgan, 1941; Ashton and Rabalais, 1978); common American toad, *Anaxyrus americanus* (reported as *Bufo americanus*, Ashton and Rabalais, 1978); western toad, *Anaxyrus boreas* (reported as *Bufo boreas*, Goldberg, Burseley, Hernandez, 1999); plains toad, *Anaxyrus cognatus* (reported as *Bufo cognatus*, Morgan, 1941; Goldberg and Burseley 1991; Goldberg et al., 1995); Sonora toad, *Anaxyrus debilis* (reported as *Bufo debilis*, Goldberg et al., 1995); Houston toad, *Anaxyrus houstonensis* (reported as *Bufo houstonensis*, Thomas et al., 1984); little Mexican toad, *Anaxyrus kelloggi* (reported as *Bufo kelloggi*, Goldberg and Burseley, 2002a); Sonora green toad, *Anaxyrus retiformis* (reported as *Bufo retiformis*, Goldberg, Burseley, Sullivan et al., 1996); Sinaloa toad, *Ollotis mazatlanensis* (reported as *Bufo mazatlanensis* (Goldberg and Burseley, 2002a); southwestern toad, *Anaxyrus microscaphus* (reported as *Bufo microscaphus*, Parry and Grundmann, 1965; Goldberg, Burseley, Malmos et al., 1996); oak toad, *Anaxyrus quercicus* (reported as *Bufo quercicus*, Goldberg and Burseley, 1996); Sonoran toad, *Anaxyrus speciosus* (reported as *Bufo speciosus*, Morgan, 1941); Woodhouse's toad, *Anaxyrus woodhousii* (reported as *Bufo woodhousii*, Morgan, 1941; Parry and Grundmann, 1965; Goldberg, Burseley, Malmos et al., 1996); Fowler's toad, *Anaxyrus fowleri* (reported as *Bufo woodhousii fowleri*, Brandt, 1936; Campbell, 1968); Arizona tree frog, *Hyla arenicolor* (Parry and Grundmann, 1965; Goldberg, Burseley, Gergus et al., 1996); California tree frog, *Pseudacris cadaverina* (reported as *Hyla cadaverina*, Goldberg and Burseley, 2001a); Pacific tree frog, *Pseudacris regilla* (reported as *Hyla regilla*, Goldberg and Burseley 2001b; Goldberg et al., 2001); common tree frog, *Hyla versicolor* (Campbell, 1968); mountain tree frog, *Hyla wrightorum* (Goldberg, Burseley, Gergus et al., 1996); Mexican giant tree frog, *Pachymedusa dacnicolor*, Goldberg and Burseley, 2002a); Brimley's chorus frog, *Pseudacris brimleyi* (Brandt, 1936); spring peeper, *Pseudacris crucifer* (Brandt, 1936; Morgan, 1941); burrowing tree frog, *Smilisca fodiens* (reported as *Ptyernohyla fodiens*, Goldberg, Burseley, Galindo, 1999); plains leopard frog, *Lithobates blairi* (reported as *Rana blairi*, Goldberg et al., 2000); common bullfrog, *Lithobates catesbeianus* (reported as *Rana catesbeiana*, Walton, 1931; Brandt, 1936; Morgan, 1941; Campbell, 1968; Ashton and Rabalais, 1978; Goldberg, Burseley, Cheam, 1998; Goldberg and Burseley, 2002c); Chiricahua leopard frog, *Lithobates chiricahuensis* (reported as *Rana chiricahuensis*, Goldberg, Burseley, Cheam, 1998) green frog, *Lithobates clamitans* (reported as *Rana clamitans*, Campbell, 1968; Burseley and DeWolf, 1998); Forrer's grass frog, *Lithobates*

forreri (reported as *Rana forreri* Goldberg and Bursey, 2002a); northwest Mexico leopard frog, *Lithobates magnaocularis* (reported as *Rana magnaocularis*, Goldberg and Bursey, 2002a); leopard frog, *Lithobates pipiens* (reported as *Rana pipiens*, Morgan, 1941; Parry and Grundmann, 1965; Ashton and Rabalais, 1978; Goldberg, Bursey, McKinnell et al., 2001); Tarahumara frog, *Lithobates tarahumarae* (reported as *Rana tarahumarae*, Bursey and Goldberg, 2001); southern leopard frog, *Lithobates sphenoccephalus* (reported as *Rana utricularia*, Morgan, 1941); lowland leopard frog, *Lithobates yavapaiensis* (reported as *Rana yavapaiensis*, Goldberg, Bursey, Cheam, 1998); Colorado River frog, *Ollotis alvaria* (reported as *Bufo alvarius*, Goldberg and Bursey, 1991); eastern spadefoot, *Scaphiopus holbrookii* (Brandt, 1936); Mexican tree frog, *Smilisca baudinii* (Goldberg and Bursey, 2002a); plains spadefoot, *Spea bombifrons* (Goldberg and Bursey, 2002b); Great Basin spadefoot, *Spea intermontana* (Goldberg and Bursey, 2002b); southern spadefoot, *Spea multiplicata* (Goldberg et al., 1995).

Geographic range: The genus *Physaloptera* has cosmopolitan distribution (Morgan, 1946).

Specimens deposited: *Leptodactylus leptodactyloides* (USNPC 100708); *L. ocellatus* (USNPC 100716); *L. petersii* (USNPC 100719).

Remarks

Species of the *Physaloptera* genus reach maturity in reptiles, birds, and mammals; they require an insect intermediate host, and infection can be acquired from ingesting insects containing infective larvae (Anderson, 2000). Larvae ingested by possible paratenic hosts generally attach to the gastric mucosa and can persist for varying periods of time; alternately, infective larvae have been found encapsulated in the stomach wall of various paratenic hosts (Anderson, 2000). In the list of hosts above, unencysted larvae occur; thus, it is not possible to determine whether the anuran represents a paratenic host or the presence of the larva is a byproduct of diet.

Acanthocephala Cystacanth (Centrorhynchidae)

Hosts: *Leptodactylus leptodactyloides*, OMNH 41055; *L. ocellatus*, OMNH 41094.

Prevalence and intensity: One of 9 (11%) *L. leptodactyloides*, 1 individual; 1 of 31 (3%) *L. ocellatus*, 1 individual.

Site of infection: Body cavity.

Type host: The definitive hosts for species of the Acanthocephala are vertebrates (Near, 2002).

Additional amphibian hosts from Brazil: *Rhinella crucifer* (reported as *Bufo crucifer*, Rodrigues, 1986); *Dendropsophus microcephalus* (reported as *Hyla microcephala*, Azevedo-Ramos et al., 1998); *Scinax nebulosus* (reported as *Scinax nebulosa*, Azevedo-Ramos et al., 1998); *Scinax trilineatus* (reported as *Scinax trilineata*, Azevedo-Ramos et al., 1998).

Other reported neotropical amphibian hosts: *Oophaga histrionica* (reported as *Dendrobates histrionicus*, Goldberg and Bursey, 2003); *Leptodactylus chaquensis* (Hamann, Kehr et al., 2006); *Leptodactylus latinasus* (Hamann, González et al., 2006). A list of amphibians and reptiles reported to serve as paratenic hosts was provided by Schmidt (1985).

Geographic range: The Acanthocephala has cosmopolitan distribution.

Specimens deposited: *Leptodactylus leptodactyloides* (USNPC 100709); *L. ocellatus* (USNPC 100717).

Remarks

The life cycle of species assigned to the Acanthocephala generally requires 2 hosts; arthropods are the usual intermediate hosts in which the infective stage, the cystacanth, develops, and a vertebrate definitive host in which maturity occurs (Near, 2002). When the infected arthropod is eaten by an appropriate vertebrate host, the cystacanth excysts and develops to maturity in the digestive tract; in an inappropriate host, cystacanths excyst then migrate from the digestive tract into the body cavity and again encyst.

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