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Coelomic helminths of five colubrid snake species (Serpentes, Colubridae) from Costa Rica

Stephen R. Goldberg[1] and Charles R. Bursey[2]

[1] Department of Biology, Whittier College, Whittier, California 90608, USA. E-mail: sgoldberg@whittier.edu.

[2] Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA. E-mail: cxb13@psu.edu.

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The yellowbelly snake, *Coniophanes fissidens* ranges from San Luis Potósi (Atlantic versant) and Michoacán (Pacific versant), Mexico southward to central Ecuador where it inhabits leaf litter of forests; the thick graceful brown snake, *Rhadinea calligaster,* is known from parts of Costa Rica to extreme western Panama where it frequents vegetation or ground cover in pastures and secondary forest; the adorned graceful brown snake, *Rhadinea decorata,* is known from San Luis Potosí south to Oaxaca and Chiapas, Mexico to Ecuador where it inhabits leaf litter; the ringed glasstail, *Urotheca euryzona* occurs from northern Nicaragua to central Panama to Colombia and Ecuador where it inhabits leaf litter or is found near water, the false fer-de-lance, *Xenodon rabdocephalus* is known from the lowlands of tropical Mexico, south through central America to northwestern Ecuador, the upper Amazon portion of Brazil, Peru and Bolivia where it occurs in primary and secondary forests, agricultural areas, near creeks and ponds and in rural settlements (Savage 2002, Solórzano 2004). The diets of these species (except for *X. rabdocephalus* which is a toad specialist) consists mainly of frogs, toads, lizards and in some cases, salamanders and occasional invertebrates (Savage 2002, Solórzano 2004). We know of no reports of helminths from these species of snakes. The purpose of this note is to establish the initial helminth list for *C. fissidens, R. calligaster, R. decorata, U. euryzona* and *X. rabdocephalus* from Costa Rica.

A total of 121 colubrid snakes from the herpetology collection of the Natural History Museum (LACM), Los Angeles, California, USA was examined for coelomic helminths. Samples were collected 1959-1992 and consisted of 25 *C. fissidens* (mean snout-vent length, SVL = 258 mm ± 80 SD, range: 98-348), 15 *R. calligaster* (SVL = 284 mm ± 83 SD, range: 120-380 mm), 30 *R. decorata* (SVL = 185 mm ±

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44 SD, range: 90-260 mm), 12 *U. euryzona* (338 mm ± 98 SD, range: 131-472 mm) and 39 *X. rabdocephalus* (SVL = 534 mm ± 155 SD, range: 232-840 mm). Catalogue numbers and provinces for these snakes are in the Appendix I. A mid-ventral incision was made in the body wall, and organ surfaces were visually checked for helminths. Helminths were removed and identified from temporary mounts in undiluted glycerol.

All helminths found (Cestoda, Nematoda, Acanthocephala) were immature (juveniles) which were typically attached to coelomic mesenteries or the body wall (Table 1). They were deposited in the United States National Parasite Collection, (USNPC), Beltsville, Maryland as: *Coniophanes fissidens, Mesocestoides* sp. (USNPC 99517), *Porrocaecum* sp. (USNPC 99518), centrorhynchid cystacanth (USNPC 99519), oligacanthorhynchid cycstacanth (USNPC 99520); *Rhadinea calligaster,* centrorhynchid cystacanth (USNPC 99521); *Rhadinea decorata, Mesocestoides* sp. (USNPC 99522), *Porrocaecum* sp. (USNPC 99523); *Urotheca euryzona, Mesocestoides* sp. (USNPC 99524), *Porrocaecum* sp. (USNPC 99525), oligacanthorhnychid cystacanth (USNPC 99526); *Xenodon rabdocephalus, Mesocestoides* sp. (USNPC 99585), oligacanthorhynchid cystacanth (USNPC 99586).

Mesocestoides is a cosmopolitan genus of cestodes with a unque larval form, the tetrathyridium, commonly found in reptiles, birds and mammals which is infective in the predatory definitive hosts (Schmidt 1986). Reports of tetrathyridia of *Mesocestoides* sp. in amphibians and reptiles were summarized in Goldberg *et al*. (2004). Tetrathyridia of *Mesocestoides sp.* were found in the following snakes: *C. fissidens*, LACM 150453; *R. decorata* LACM 154307, 154322; *U. euryzona*, LACM 154215, 154216, 154218, 154225; *X. rabdocephalus*, (LACM 154474). Bolette (1997) suggested that snakes may serve as paratenic (= transport) hosts. Should the snake be eaten by a carnivore, the tetrathyridium may

Table 1 - Number, prevalence (%), mean intensity ± SD and range for coelomic helminths from five species of snakes from Costa Rica.

HOST	*C. fissidens* (25)				*R. calligaster* (15)				*R. decorata* (30)				*U. euryzona* (12)				*X. rabdocephalus* (39)			
Helminth	#	%	$\bar{x}$ ±SD	*r*	#	%	$\bar{x}$ ±SD	*r*	#	%	$\bar{x}$ ±SD	*r*	#	%	$\bar{x}$ ±SD	*r*	#	%	$\bar{x}$ ±SD	*r*
Cestoda																				
Mesocestoides sp.	6	4	6.0	–					2	7	1.0	–	4	33	1.0	–	2	3	2	–
Nematoda																				
Porrocaecum sp.	32	16	8.0±11.7	1-24					21	10	7.0±4.6	3-12	8	25	2.7±1.5	1-4				
Acanthocephala																				
Centrorhynchid cystacanths	3	8	1.5±0.71	1-2	1	7	1.0	–												
Oligacanthorhynchid cystacanths	1	4	1.0	–									1	8	1.0	–	2	3	2	–

develop to an adult (Padgett and Boyce 2004). *Mesocestoides* sp. in *C. fissidens, R. decorata, U. euryzona, X. rabdocephalus* are new host records.

Species of *Porrocaecum* are intestinal bird parasites, which utilize earthworms as intermediate hosts (Anderson 2000). Juveniles of *Porrocaecum* sp. were found in the following snakes: *C. fissidens,* LACM 150452, 150453, 150457, 150458; *R. decorata:* LACM 154307, 154308, 154310; *U. euryzona:* LACM 154216, 154217, 154221. Small mammals that feed on earthworms serve as paratenic hosts, which transfer the nematode to the definitive avian host (Anderson 2000). There is a report of earthworms in the stomach conents of *R. decorata* from Mexico (Taylor 1949). Juveniles of *Porrocaecum* sp. have previously been reported in nine other species of snakes from Costa Rica (Goldberg and Bursey 2004, 2005). It is likely that these snakes serve as paratenic hosts. *Porrocaecum* sp. in *C. fissidens, R. decorata* and *U. euryzona* are new host records.

The life cycles of acanthocephalan species require two hosts (Schmidt 1985). The cycle begins with egg ingestion by an arthropod in which development to an infective juvenile (cystacanth) occurs. Should the infected arthropod be ingested by a defintive host, the cystacanth develops to maturity in the digestive tract. If an inappropriate host ingests the infected arthropod, the cystacanth migrates from the digestive tract into the body cavity, re-encysts and awaits an appropriate host (Schmidt 1985). Adults of species of centrorhynchid and oligacanthorhynchid acanthocephalans occur in birds of prey (Nickol 1985). Snakes are most likely paratenic hosts. Centrorhynchid cystacanths were found in: *C. fissidens* (LACM 150453, 154058) and *R. calligaster* (LACM 154286); oligacanthorhynchid cystacanths were found in *C. fissidens* (LACM 150458), *U. euryzona* (LACM 154216) and *X. rabdocephalus* (LACM 154474). Thirteen other species of snakes from Costa Rica have been reported to harbor oligacanthorhynchid cystacanths (Goldberg and Bursey 2004, 2005). Centrorhynchid and oligacanthorhynchid cystacanths are common in snakes from western North America (Ernst and Ernst 2006) and centrorhynchid cystacanths have been reported from snakes of Mexico (Pérez-Ponce de León *et al*. 2001). *Coniophanes fissidens* and *R. calligaster* are new host records for centrorhynchid cystacanths; *C. fissidens, U. euryzona* and *X. rabdocephalus* are new host records for oligacanthorhynchid cystacanths.

The significance of snakes as paratenic hosts in the epidemiology of vertebrate endoparasites is yet to be determined, but they may bridge an ecological gap between intermediate and definitive host (Roberts and Janovy 2005).

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Appendix I – LACM Specimens Examined from Costa Rica by Province

Coniophanes fissidens – Alajuela 150470, Cartago 150447, 150451, 150452, 150456, 150459, 150460, 150469, Heredia 150455, 150458, 150461-150464, 150468, 150471, Limón 150448, 150449, 150457, 150473, Puntarenas 150453, 150454, 150466, 150467, 150472.

Rhadinea calligaster – Cartago 154286, 154292, 154294, Heredia 154283-154285, 154287, 154291, 154293, 154297, Puntarenas 154289, 154290, 154295, 154296, San José 154288.

Rhadinea decorata – Alajuela 154327, Cartago 154316, 154325, 154330, Heredia 154306, 154307, 154313, 154315, 154317, 154318, 154320, 154322, 154324, 154326, 154329, 154334, Limón 131127, 154309, 154311, 154312, 154323, 154328, 154333, Puntarenas 154308, 154310, 154314, 154319, 154321, 154332, San José 154331.

Urotheca euryzona – Alajuela 154214, 154222, 154223, Guanacaste 154215, 154225, Heredia 154216, 154218, 154220, 154228, Cartago 154217, Limón 154221, 154226.

Xenodon rabdocephalus – Alajuela 154458, 154459, 154475, 154484, 154487, 154492, 154493, 154502, Cartago 154463, 154478, 154479, 154481, 154482, 154490, 154504, Guanacaste 154486, 154491, 154503, Heredia 154474, Limón 131132-131134, 154477, 154489, 154496, 154501, Puntarenas 154460, 154480, 154483, 154497, 154500, San José 154472, 154473, 154494-154499.