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Pozo-Zamora, Glenda M.; Yáñez-Muñoz, Mario H.
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Nota

First infestation record of *Epicrates cenchria cenchria* (Squamata: Boidae) by *Porocephalus* (Pentastomida: Porocephalidae) in Ecuador

Primer registro de infestación de *Epicrates cenchria cenchria* (Squamata: Boidae) por *Porocephalus* (Pentastomida: Porocephalidae) en Ecuador

Glenda M. Pozo-Zamora and Mario H. Yáñez-Muñoz

Abstract

Endoparasites of the genus *Porocephalus*, which mainly affect lungs of snakes, are distributed in Asia, Africa and America. In Ecuador, these parasites have been reported only for *Boa constrictor*. Here, we report the first record of infestation of *Porocephalus* in *Epicrates cenchria cenchria* from the Ecuadorian Amazon, based on examination of museum specimens. We found 26 parasitic individuals in 4 infected snakes, with a maximum of 16 individuals in a juvenile snake, and a minimum of 2 in an adult snake. Morphometric characters of the Ecuadorian populations of *Porocephalus* do not agree with those described for the genus. Therefore, we recommend a thorough analysis to define the taxonomic identity of these parasites.

Keywords. Ecuadorian Amazon. Hematophagous endoparasites. Lungs. Rainbow Boa. Snakes.

Resumen

Los endoparásitos del género *Porocephalus*, que infectan principalmente los pulmones de serpientes, se encuentran distribuidos en Asia, África y América. En Ecuador este parásito ha sido reportado únicamente en *Boa constrictor*. En el presente estudio reportamos los primeros registros de infestación de *Porocephalus* en *Epicrates cenchria cenchria* para la Amazonía ecuatoriana, basados en la revisión de especímenes de museo. Encontramos 26 individuos parásitos en 4 serpientes infectadas, con un máximo de 16 individuos en una serpiente joven y un mínimo de 2 en una serpiente adulta. La variabilidad morfológica de las poblaciones ecuatorianas no encaja con las especies descritas de *Porocephalus*, por lo que recomendamos un análisis profundo para definir la identidad de estos parásitos.

Palabras clave. Amazonía ecuatoriana. Boa arcoíris. Endoparásitos hematófagos. Pulmones. Serpientes.

Introduction

Pentastomida is a lineage of small worm parasites that comprises seven families (Christoffersen & De Assis, 2013). These parasites are morphologically related to Ecdysozoa, but their phylogenetic relationships are still controversial (Christoffersen & De Assis, 2015). The group is considered as modified crustaceans, and is probably related to the subclass Branchiura (Martínez *et al.*, 1999; Lavrov *et al.*, 2004). One of the families, Porocephalidae, is characterized by an indirect life cycle, which is completed when the intermediate host is consumed by the definitive host (Riley, 1986; Paré, 2008; Poore, 2012).

The genus *Porocephalus* consists of hematophagous endoparasites that affect the respiratory tract of several wild and domestic mammals (Riley, 1986) like primates, bats, dogs, mice, and opossums (Brookins *et al.*, 2009; Pereira *et al.*, 2010). The final hosts seem to be exclusively snakes (Fain, 1961; Riley & Henderson, 1999; Gómez-Puerta *et al.*, 2011; Poore, 2012; Christoffersen & De Assis, 2013). *Porocephalus* includes 11 formally described species: 2 in Africa, 3 in Asia and 6 endemic to the American continent (Poore, 2012; Christoffersen & De Assis, 2013).

The Brazilian Rainbow Boa, *Epicrates cenchria cenchria*, is a conspicuous snake with lateral ocelli on its body (Carvajal-Campos & Rodríguez-Guerra, 2017). It is widely distributed in South America East of the Andes, from eastern Guyanas, South of Venezuela to Bolivia (Passos & Fernandes, 2008; Carvajal-Campos & Rodríguez-Guerra, 2017).

Two species of *Porocephalus* have been reported as parasites of *Epicrates cenchria cenchria* in Peru, Brazil and Argentina: *P. clavatus* and *Porocephalus* sp. (Riley & Self, 1979; Martínez *et al.*, 1999; Gómez-Puerta *et al.*, 2011; Chávez *et al.*, 2015). In Ecuador, Riley & Self (1979) recorded *P. clavatus* in an individual of the Red-tailed Boa (*Boa constrictor*), without details of its specific location. In 2017, we examined rainbow snakes in the herpetological collection at the Instituto Nacional de Biodiversidad (INABIO) in Quito, Ecuador. We discovered the presence of *Porocephalus* in *E. c. cenchria*. Here we present the first formal record of this parasite in *E. c. cenchria* from the Ecuadorian Amazon.

Materials and methods

We dissected 13 specimens of *Epicrates cenchria cenchria* with a longitudinal incision at the pulmonary and ventral regions. The specimens are deposited at the herpetological division (DHMECN) in INABIO (Appendix 1). We measured and weighed the individuals infected with endoparasites (Table 1). Then we counted the removed parasites, deposited them in microtubes (5 ml) in 70 % ethanol solution, and examined the parasite specimens with a stereo microscope (Boeco 30x). Length was measured using a Buffalo digital caliper with a precision of 0.01 mm. For taxonomic identification, we followed the parameters suggested by Riley & Self (1979) and Christoffersen & De Assis (2013).

Table 1. Measurements and weight of specimens of *Epicrates cenchria cenchria* infected by *Porocephalus* in the Ecuadorian Amazon. LHB: Length head-body, T: tail, HW: Head width.

Specimens	Localities	Sex	Age	LHB (mm)	T (mm)	HW (mm)	Weight (kg)	Number of parasites
11884 DHMECN	Zamora Chinchipe	F	SUB	1110	136	25.20	0.55	16
11280 DHMECN	Zamora Chinchipe	M	SUB	930	104	18.48	0.219	3
11189 DHMECN	Zamora Chinchipe	F	SUB	1090	110	24.53	0.4	5
0071 DHMECN	Sucumbíos	F	ADU	1710	185	23.83	1.15	2

Results

Four of the 13 individuals of *Epicrates cenchria cenchria* were infected with pentastomids. The snakes were collected in two Amazonian provinces: one female from Sucumbíos, in northeastern Ecuador, at 400 m a. s. l.; two females and one male from Zamora Chinchipe, in southeastern Ecuador, between 832 and 1398 m a. s. l. We found a maximum of 16 parasites in a subadult female from Zamora

Chinchipe and a minimum of 2 in an adult female from Sucumbíos (Table 1).

A total of 26 parasites were counted, of which 23 were females and 3 were males. All of them were “hooked” to the lung walls (Figure 1A). The body length of female parasites was shorter in southern snakes (N = 21) than in northern snakes (N = 2) (Table 2, Figure 1B). The males presented genital pores and the females showed sensorial papillae (Figure 1C).

Table 2. Sex, measurements and number of annuli of *Porocephalus* species found in specimens of *Epicrates cenchria cenchria* from Ecuador. Min-max (average) \pm standard deviation.

Specimens	Localities	Number of <i>Porocephalus</i> individuals	Sex of parasite	Length (mm)	Number of annuli
11884 DHMECN	Zamora Chinchipe	2	♂	13-19 (16) \pm 4.2	34
		14	♀	15-24 (20) \pm 3.1	32-37
11280 DHMECN	Zamora Chinchipe	3	♀	16.5 – 26.5 (22.8) \pm 5.5	35-36
11189 DHMECN	Zamora Chinchipe	1	♂	14.4	32
		4	♀	15.6 - 40 (25) \pm 11.5	34-37
0071 DHMECN	Sucumbíos	2	♀	44.9 – 63.7 (54.3) \pm 13.3	31-35

We assigned the obtained parasites to the genus *Porocephalus* based on the presence of an inflated head, not separated from the body by a neck on females, ringed body, mouth with a keyhole shape located between the hooks-line, and presence of internal simple-hooks and external double-hooks (cuticle extension) (Riley & Self, 1979; Riley

& Walters, 1980). However, the assignation of a proper species rank was limited by the overlapping of certain measurements (*e. g.* body length and number of corporal segments), making difficult the differentiation between South American species of *Porocephalus* (*P. crotali* and *P. clavatus*) (Vargas, 1970; Riley & Self, 1979).

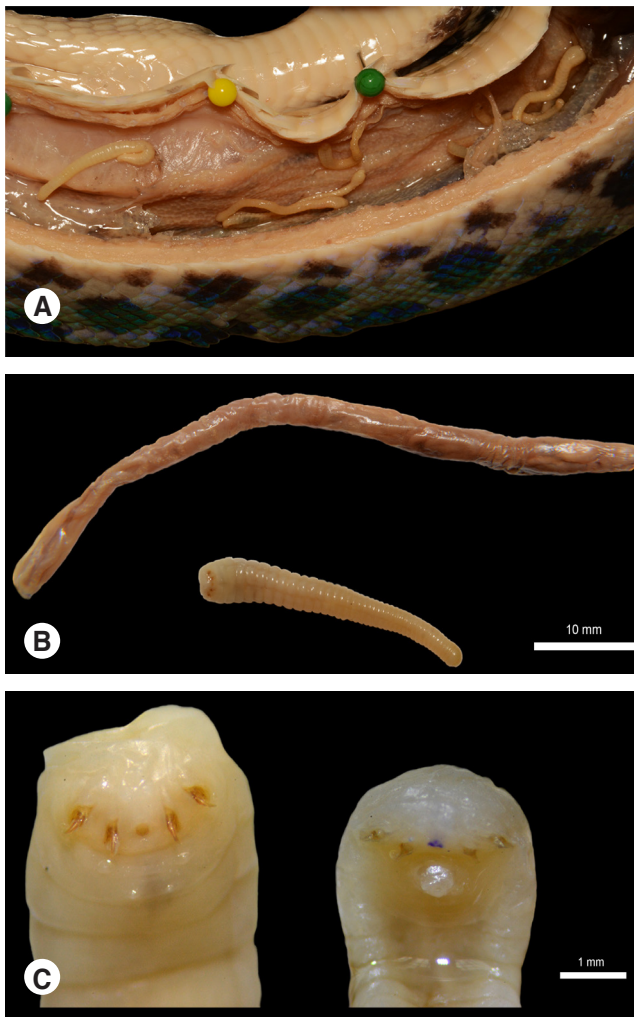


Figure 1. A. Specimens of *Porocephalus* sp. found in lung walls of *Epicrates cenchria cenchria* from the Ecuadorian Amazon. B. Difference in length between female of *Porocephalus* sp. from Sucumbíos (above), and Zamora Chinchipe (below). C. View of anterior end of female (left) and male (right) of *Porocephalus* sp. Photos by Mario H. Yáñez-Muñoz.

Discussion

The size and number of annuli on the males and females of *Porocephalus* from the southern Ecuadorian Amazon are smaller (13-40 mm; 32-37 annuli), than the previous records reported for others species from South America (*P. basilicus*, *P. stilesi*, *P. clavatus*, *P. crotali*, *P. tortuguensis*). The length range and number of annuli of the above-

mentioned species are 44-102 mm and 35-49 annuli (Riley & Self, 1979). Furthermore, the *Porocephalus* species from Northern Ecuador (Sucumbios Province) reached lengths (44.9-63.7 mm) that overlap with those of females of *P. clavatus* (48-78 mm) and *P. crotali* (44-78 mm) (Riley & Self, 1979). However, the number of annuli is smaller than that reported for these two species: 31-35 vs. 36-40 mm, respectively.

We found a maximum of 16 individuals of *Porocephalus* infesting *Epicrates cenchria cenchria*, whereas in Bolivia, Ramos Tórrez *et al.* (2015) reported 40 individuals of *Porocephalus stilesi* in a sample of *Lachesis muta*. This is the highest documented number of these parasites per individual host for South America. The parasites in *L. muta* were found in the stomach and intestines; in our research *Porocephalus* specimens were extracted from the pulmonary region. The different regions where the parasites can be found might be related to the ontogenetic migratory behaviour of pentastomids (Martínez *et al.*, 1999).

Porocephalus populations from Ecuadorian Amazon require a proper identification, as they do not fit with any described species of the genus.

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Appendix 1. Specimens of *Epicrates cenchria cenchria* examined at the herpetological collection of the Instituto Nacional de Biodiversidad (INABIO) in Quito, Ecuador.

Epicrates cenchria cenchria (ECUADOR): *Provincia Napo*: Tena: DHMECN 0017, 0018, 0019: 563 m a.s.l.; *Provincia Sucumbios*: Lago Agrio, Cascales, Iwe, Reserva Ecológica Cofán Bermejo: DHMECN 8325: 312 m a.s.l.; Lago Agrio: DHMECN 0021, 0071: 400 m a.s.l.; Putumayo, Puerto Rodríguez: DHMECN 8693; 184 msnm; *Provincia Orellana*: Joya de los Sachas: DHMECN 6862: 274 m a.s.l.; *Provincia Zamora Chinchipe*: El Pangui, Concepción, ECSA: DHMECN 11189, 11279, 11280, 11884, 11885: 832-1398 m a.s.l.

Glenda M. Pozo-Zamora

Instituto Nacional de Biodiversidad
Quito, Ecuador
glenda.pozo@yahoo.es
<http://orcid.org/0000-0003-0043-2834>

Mario H. Yáñez-Muñoz

Instituto Nacional de Biodiversidad
Quito, Ecuador
mayamu@hotmail.com
<http://orcid.org/0000-0003-3224-1987>

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