

Helminths of the horned leaf frog, *Proceratophrys appendiculata*, from southeastern Brazil

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Abstract

The helminth fauna of the horned leaf frog, *Proceratophrys appendiculata* (Anura: Leptodactylidae), was studied from 17 adult individuals from an island in Rio de Janeiro state, southeastern Brazil. A total of five nematode species (*Aplectana delirae*, *Cosmocerca brasiliense*, *Schulzia travassosi*, *Rhabdias androgyna* and *Physaloptera* sp.) and an unidentified cestode were recovered from the digestive tract, lungs and gall bladder of *P. appendiculata* and all the nematode species are new host records. *Aplectana delirae* had the highest values for the prevalence and intensity of infection and can thus be considered a core species in the helminth community of *P. appendiculata*. *Aplectana crossodactyli* Baker, 1980 is synonymized with *Aplectana delirae* (Fabio, 1971). The helminth fauna of *P. appendiculata* presents characteristics typical of those in amphibians.

Introduction

The genus *Proceratophrys* (Leptodactylidae) comprises predominantly diurnal, rough-skinned frogs found mainly from northeastern Brazil to northern Argentina (Frost, 1985; Duellman, 1993), though one species was recently described from Amazonian Brazil (Giaretta *et al.*, 2000). *Proceratophrys appendiculata* (Günther, 1873) is a litter-dwelling frog inhabiting coastal rainforest areas of Rio de Janeiro, São Paulo and Paraná states (Izecksohn *et al.*, 1998), in southeastern and southern Brazil. We know of no reports of endoparasites from this or any other species in the genus *Proceratophrys*. In this paper, we report some helminths of this little known anuran and make some comments on their taxonomy and host distribution.

Materials and methods

During a study of the ecology of *P. appendiculata* in the region of Vila Dois Rios (23°15'S, 44°15'W), in Ilha Grande, a large island near the coast of Angra dos Reis, Rio de Janeiro state, Brazil, 17 individuals were collected between September 1996 and January 2000. The snout-urostyle length (SUL) of frogs averaged 56.6 ± 5.4 (range 45.7–62.1; $n = 11$) mm for males and 66.7 ± 4.3 (range 60.2–72.2; $n = 6$) for females. The frogs were fixed in 10% formalin and preserved in 70% ethanol after being killed with ether. The digestive tract, body cavity, liver and lungs of each individual were removed and analysed under a stereomicroscope. The helminths found were mounted temporarily on slides and cleared in phenol for identification. A regression analysis was done to test for a possible correlation between host size (SUL) and overall infection intensity. Terminology used throughout the text follows Bush *et al.* (1997).

The frogs used for this study are presently deposited at

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Table 1. Prevalence (in percentage and absolute values) and intensity of infection (mean \pm SD, with range in parentheses) of helminths found in *Proceratophrys appendiculata* (n = 17) from Ilha Grande, Brazil.

Helminth	Prevalence % (n)	Mean intensity (range)	Site of infection
Nematoda			
<i>Aplectana delirae</i>	76.5 (13)	6.9 \pm 3.6 (1–13)	Stomach, intestine
<i>Cosmocerca brasiliense</i>	29.4 (5)	1.2 \pm 0.4 (1–2)	Intestine
<i>Schulzia travassosi</i>	17.6 (3)	1.7 \pm 0.6 (1–2)	Gall bladder, lung
<i>Physaloptera</i> sp.	5.9 (1)	1.0	Stomach
<i>Rhabdias androgyna</i>	17.6 (3)	1.3 \pm 0.6 (1–2)	Lung
Cestoda			
Unidentified	11.8 (2)	1.0	Small intestine

the Museu Nacional, Rio de Janeiro (MNRJ), with the numbers MNRJ 25101-17.

Results

Overall helminth prevalence for *P. appendiculata* was 94.1% (16/17). There was no correlation between host SUL and total nematode intensity ($r = 0.13$; $P = 0.62$; $n = 16$). Helminths encountered in *P. appendiculata* included nematodes belonging to five species: *Aplectana delirae* (Fabio, 1971) and *Cosmocerca brasiliense* Travassos, 1925 (Cosmocercidae: Cosmocercidae), *Schulzia travassosi* Durette-Desset, Baker and Vaucher, 1985 (Trichostrongyloidea: Molineidae), *Rhabdias androgyna* Kloss, 1971 (Rhabditoidea: Rhabdiasidae), and *Physaloptera* sp. (Physalopteroidea: Physalopteridae) and also some unidentified cestodes which lacked scoleces (table 1). Voucher specimens of nematodes were deposited in the helminthological collection of the Instituto Oswaldo Cruz (CHIOC) and at the United States National Parasite Collection (USNPC): *A. delirae* (CHIOC 33869; 33874; USNPC 89849), *C. brasiliense* (CHIOC 33873; USNPC 89850), *S. travassosi* (CHIOC 33871-2; USNPC 89852), *R. androgyna* (CHIOC 33870; USNPC 89851), *Physaloptera* sp. (CHIOC 33866). Although *A. delirae* occurred in two different sites (see table 1), it was more frequent in the intestine (100% of cases; intensity range = 1–13), than in the stomach (16.7% of cases; intensity = 1) of hosts. The mean helminth richness per individual host was 1.53 \pm 0.72.

Discussion

Proceratophrys appendiculata represents a new host record for all the nematode genera and species cited above.

Aplectana delirae was originally described (as *Neyraplectana delirae*) from the toad *Bufo crucifer* (Bufonidae) from Rio de Janeiro (Fabio, 1971). Baker (1980) pointed out the similarity between *A. delirae* and *A. crossodactyli* (Vicente & Santos, 1970) Baker, 1980 and stated that, based on original descriptions (he did not examine type materials), those species cannot be readily distinguished, suggesting that they may be conspecific. However, he continued to provisionally treat them as distinct species in his comprehensive synopsis of nematodes of reptiles and amphibians (Baker, 1987) After examining and comparing the types of both species (housed at the Instituto Oswaldo Cruz Helminthological Collection –

CHIOC), we conclude that both forms are indeed, indistinguishable. Some of the characters used by Fabio (1971) to distinguish these two species, i.e. spicule dimensions, number and position of caudal papillae, dimensions of eggs are, in our opinion, insufficient for specific differentiation due to their great variability: spicule sizes given in original descriptions of *A. crossodactyli* (0.13–0.14) and *A. delirae* (smaller: 0.14–0.15; larger: 0.15–0.17) are too similar to represent strongly diagnostic features, and considerable variation in egg shape and dimensions occurred in specimens of both type series. Fabio (1971) also distinguished *A. delirae* from *A. crossodactyli* by the presence of some structures in the former that were absent in the latter, i.e. caudal papillae in females, pharynx, buccal capsule, but those structures are actually also present in *A. crossodactyli*, though they were not mentioned by Vicente & Santos (1970) in their description. This strongly suggests that Fabio (1971) did not compare her material with the types of *A. crossodactyli*, and appeared to rely solely on the original description by Vicente & Santos (1970) for comparison. Moreover, both *A. delirae* and *A. crossodactyli* were described from exactly the same locality (Açude da Solidão, in Tijuca Forest, Rio de Janeiro), albeit from different hosts. Thus, we agree with Baker's (1980) suggestion and consider both species to be synonymous. *Aplectana crossodactyli* was originally described by Vicente & Santos (1970) as *Neyraplectana travassosi* (type-host: *Crossodactylus gaudichaudi* (Leptodactylidae) from Rio de Janeiro), but when Baker (1980) synonymized *Neyraplectana* Ballesteros-Marquez, 1945 with *Aplectana* Railliet & Henry, 1916, the resulting combination became a homonym of *A. travassosi* (Gomes & Motta, 1967). Thus, Baker (1980) proposed the new name *crossodactyli*. However, the name *Neyraplectana delirae* Fabio, 1971 has priority of date over *crossodactyli*. The correct name for the species is thus *A. delirae* (Fabio, 1971), and *Neyraplectana travassosi* Vicente & Santos, 1970 and *Aplectana crossodactyli* Baker, 1980 are its senior and junior synonyms, respectively. *Proceratophrys appendiculata* represents the third reported host species for this cosmocercoid nematode.

Cosmocerca brasiliense had been previously reported from *Bufo crucifer*, *Eleutherodactylus guentheri* and *Thoropa miliaris* (Leptodactylidae) from Brazil (including the Angra dos Reis region; see Vicente et al., 1990), and from various anuran species of different genera and families from Ecuador (see Baker, 1987). Thus, a new genus, *Proceratophrys*, is included here in the host list of *C. brasiliense*.

Schulzia travassosi was originally described from the small intestine of *Bufo crucifer* from Angra dos Reis, Brazil by Durette-Desset *et al.* (1985) based on material erroneously identified by Travassos (1925, 1937) as *Strongylus subventricosus* Schneider, 1866 (now *Maciela subventricosa*; see Durette-Desset *et al.*, 1985). Those authors also reported *S. travassosi* to occur in *Thoropa miliaris* from Rio de Janeiro and in *Bufo granulosus major* (Bufonidae) and *Leptodactylus bufonius* (Leptodactylidae) from Paraguay. Other hosts mentioned by Travassos (1925, 1937) (i.e. *Eleutherodactylus parvus* and *Leptodactylus ocellatus* (Leptodactylidae) from Rio de Janeiro state, Brazil) should be considered dubious (see Durette-Desset *et al.*, 1985; Baker, 1987). *Proceratophrys appendiculata* thus represents the fifth anuran species to be confirmed as host to *S. travassosi*. It is interesting to note that, although Travassos (1937) regarded this nematode as a predominantly intestinal form, occurring occasionally in the gall bladder of hosts in cases of high infection intensities, we did not find any specimens of *S. travassosi* in the intestine of *P. appendiculata*.

Nematodes of the genus *Physaloptera* parasitize all classes of terrestrial vertebrates, though only larvae are normally found in amphibians, indicating that these nematodes are unlikely to complete their life-cycles in amphibian hosts. Nematodes of this genus have been recorded from Brazilian anurans of different families (Vicente *et al.*, 1990).

Rhabdias spp. are common lung parasites in amphibians (Anderson, 1992) and have been recorded from numerous species of bufonids and leptodactylids in the Neotropics (Baker, 1987). *Proceratophrys* is the fifth genus of South American anurans to be reported as host to the genus *Rhabdias*. *Rhabdias androgyna* has so far been reported only from the type-host, *Bufo typhonius* (Bufonidae) from Belém, in Amazonian Brazil (Baker, 1987; Vicente *et al.*, 1990). Thus, we not only add a new host record to this nematode species, but also extend its geographic range to southeastern Brazil.

The richness of the helminth fauna (six) and the mean number of species per host individual (1.53) for the population of *P. appendiculata* here studied were above the mean values (3.54 and 0.98, respectively) but within the ranges (0–9 and 0–2.08, respectively) reported for 83 species/populations of anurans (mostly North American taxa) by Aho (1990). Only one helminth species, *A. delirae*, attained core status with a prevalence of 50% or more and it was also the species with the highest mean intensity of infection. In spite of typically occurring at low densities in the study area (Rocha *et al.*, 2001), *P. appendiculata* has a high prevalence of infection. This may be explained by the helminth fauna being composed of generalist species and, as already shown, all species found in *P. appendiculata* also infect frogs of other species and different families. Thus, it is possible that some, if not all, of those nematode species may also infect other leaf-litter frogs (including common ones) sympatric and syntopic with *P. appendiculata* at Ilha Grande, which would account for the high prevalences of helminths in a locally uncommon frog. The results of the present study therefore agree with those of Aho (1990) on helminth communities of amphibians and reptiles, such as the relatively low species richness (compared to other

vertebrate hosts), the low number of core species per host population and the dominance of host-generalist species.

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