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Research Note

Gastrointestinal Helminths of Three Introduced Anoles: *Anolis bimaculatus leachi, Anolis grahami,* and *Anolis roquet* (Polychridae) from Bermuda

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ABSTRACT: *Anolis bimaculatus leachi* ($N = 4$), *Anolis grahami* ($N = 59$), and *Anolis roquet* ($N = 11$) from Bermuda were examined for gastrointestinal helminths. *Anolis bimaculatus leachi* harbored *Parapharyngodon cubensis* and larvae of *Abbreviata* sp; *Anolis grahami* harbored *Atractis scelopori, Parapharyngodon cubensis,* and *Protrellus aurifluus* (a parasite of cockroaches); *Anolis roquet* harbored *Atractis scelopori* and larvae of *Abbreviata* sp. *Anolis bimaculatus leachi* is a new host record for *Abbreviata* sp.; *Anolis grahami* is a new record for *Protrellus aurifluus*; *Anolis roquet* is a new host record for *Atractis scelopori* and *Abbreviata* sp.

KEY WORDS: Nematoda, *Atractis scelopori, Parapharyngodon cubensis, Protrellus aurifluus, Abbreviata* sp., *Anolis bimaculatus leachi, Anolis grahami, Anolis roquet,* Polychridae.

The terrestrial herpetofauna of Bermuda is limited to 1 endemic skink, *Eumeces longirostris* Cope, 1861, and 3 introduced anoles, *Anolis bimaculatus leachi* Duméril and Bibron, 1837, *Anolis grahami* Gray, 1845, and *Anolis roquet* Lacépède, 1788. Each anole originated from a different West Indian island: *Anolis bimaculatus leachi* is native to Antigua and Barbuda; *Anolis grahami* is native to Jamaica; and *Anolis roquet* is native to Martinique (Schwartz and Henderson, 1991). However, only the introduction of *Anolis grahami* is documented. It was deliberately introduced from the Kingston area of Jamaica in September 1905 in an attempt to control the fruit fly *Ceratitis capitata,* and by 1909 it was well established in Bermuda (Wingate, 1965). Apparently, there are no accounts of helminths from *Eumeces longirostris* or *Anolis roquet,* but Bundy et al. (1987) reported helminths of *Anolis grahami* from Jamaica and Dobson et al. (1992) reported helminths of *Anolis bimaculatus leachi* from Antigua. The purpose of this note is to report the helminth faunas of *Anolis bimaculatus leachi, Anolis grahami,* and *Anolis roquet* from Bermuda.

Four *Anolis bimaculatus leachi* (mean snout–vent length [SVL] = 79.3 mm ± 20.7 SD, range 65–110 mm) were collected at Warwick Pond, vicinity Middle Road, Warwick Parish (69°49′N, 32°16′W), 18 August 1992. Fifty-nine *Anolis grahami* (mean SVL = 58.9 mm ± 11.1 SD, range 22–76 mm) were collected at the Bermuda Biological Station for Research, St. George's Parish (64°42′N, 32°22′W), 14–18 August 1992. Eleven *Anolis roquet* were collected (mean SVL = 57.6 mm ± 8.9 SD, range 49–71 mm). Six were collected at the Bermuda Maritime Museum, Sandy's Parish (64°52′N, 32°18′W), 17 August 1992; 5 were collected at Long Bay, Sandy's Parish (64°52′N, 32°22′W), 18 August 1992. All specimens were collected by hand-held noose and preserved in 10% formalin. The abdominal wall was slit to allow rapid penetration of fixative. The body was opened by a longitudinal incision from throat to vent and the gastrointestinal tract was removed by cutting across the esophagus and rectum. The esophagus, stomach, and small and large intestine were examined separately under a dissecting microscope. Nematodes were removed and identified utilizing the standard glycerol wet-mount procedure.

Helminth fauna for these anoles were limited to 2 monoxenous nematodes, *Atractis scelopori* (Gedoelst, 1919) and *Parapharyngodon cubensis* (Barus and Coy Otero, 1969) Barus, 1973. Also found were encysted larvae of *Abbreviata* sp. and *Protrellus aurifluus* (Chitwood, 1932) Chitwood, 1933, presumably a pseudoparasite in anoles since it is commonly found as a parasite of cockroaches (see Skryabin et al., 1951). Data on infection prevalence, intensity, and location are given in Table 1. *Anolis bimaculatus leachi* is a new host record for *Abbreviata* sp. *Anolis grahami* is a new record for *Protrellus aurifluus. Anolis roquet* is a new host record for *Atractis scelopori* and *Abbreviata* sp. Voucher specimens were deposited

in the U.S. National Parasite Collection, Beltsville, Maryland 20705: *Anolis bimaculatus leachi*; *Abbreviata* sp. (larvae, 83868); *Parapharyngodon cubensis* (83867). *Anolis grahami*; *Atractis scelopori* (83864); *Parapharyngodon cubensis* (83865). *Protrellus aurifluus* (83866). *Anolis roquet*; *Abbreviata* sp. (larvae, 83870); *Atractis scelopori* (83869). Anoles were deposited in the herpetology collection of the Natural History Museum of Los Angeles County (LACM): *Anolis bimaculatus leachi* (140346–140349); *Anolis grahami* (140361–140420); and *Anolis roquet* (140350–140360).

The nematodes reported here are shared with other herptile species. *Parapharyngodon cubensis* is widely distributed in the Caribbean (see Baker, 1987; Bundy et al., 1987; Dobson et al., 1992), where it has been reported from 21 other anole species as well as amphisbaenid, gekkonid, teiid, and tropidurid lizards and colubrid snakes. *Atractis scelopori* is broadly distributed in the Caribbean, Mexico, and Central and North America (see Baker, 1987), where it has been recorded from 22 other anole species as well as gekkonid, polychrid, teiid, and tropidurid lizards. Encysted larvae of *Abbreviata* sp. have been reported from 4 other anole species as well as gekkonid, teiid, and tropidurid lizards from Cuba (Coy Otero and Barus, 1979) and a eleutherodactylid frog from Bermuda (Goldberg et al., 1995). The *Abbreviata* sp. larvae were encysted in organ surfaces, which suggests to us that these herptiles were paratenic hosts rather than definitive hosts. No adult *Abbreviata* sp. has been reported from any species of *Anolis* (see Baker, 1987).

Because no parasite list exists for the endemic skink *Eumeces longirostris,* it is not known whether the preceding nematodes were previously in Bermuda or they arrived with the introduced anoles. It is of interest to note that both *Atractis scelopori* and *Parapharyngodon cubensis* have previously been reported in *Anolis grahami* from Jamaica (Bundy et al., 1987). Thus, it is conceivable that these nematode species were present in the introduced *Anolis grahami.*

Both *Anolis bimaculatus leachi* and *Anolis roquet* are sympatric with *Anolis grahami*; therefore, it would not be unexpected that contact between these different anole species or soil contaminated with their feces would promote infection by the monoxenous nematodes *Atractis scelopori* and *Parapharyngodon cubensis.* Species of *Abbreviata,* heteroxenous nematodes, are com-

Table 1. Helminths from *Anolis bimaculatus leachi, Anolis grahami,* and *Anolis roquet* from Bermuda.

Nematode	*Anolis bimaculatus leachi* ($N = 4$)			*Anolis grahami* ($N = 59$)			*Anolis roquet* ($N = 11$)		
	Prevalence	$\bar{x}$ intensity (range)	Location*	Prevalence	$\bar{x}$ intensity (range)	Location	Prevalence	$\bar{x}$ intensity (range)	Location
Oxyurida									
Parapharyngodon cubensis	75%	4.7 (1–9)	c	10%	1.5 (1–3)	c	—	—	—
Ascaridida									
Atractis scelopori	—	—	—	19%	40.9 (2–138)	b, c	18%	6.0 (5–7)	c
Protrellus aurifluus	—	—	—	2%	2	b	—	—	—
Spirurida									
Abbreviata sp. (larvae)	50%	1.5 (1–2)	a	—	—	—	9%	7	a

* Abbreviations: a = stomach; b = small intestine; c = large intestine.

mon parasites of mammals and reptiles but do not occur as parasites in birds (Morgan, 1946). Roca (1993) suggested that the importance of lizards as prey can be ascertained by the prevalence of larval helminths in the lizard population. More work will be required to elucidate the life cycle of these encysted *Abbreviata* and to determine whether or not the anoles are prey items in any mammals of Bermuda.

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Research Note

Helminths of an Introduced Population of the Giant Toad, *Bufo marinus* (Anura: Bufonidae), from Bermuda

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ABSTRACT: Forty-five giant toads, *Bufo marinus*, from Bermuda were examined for helminths. Two nematode species were found: *Aplectana* sp. (87% prevalence) and *Rhabdias fuelleborni* (71% prevalence). One toad harbored the trematode *Mesocoelium monas* (2% prevalence). Bermuda represents a new distributional record for *M. monas* and *R. fuellerborni*.

KEY WORDS: Trematoda, *Mesocoelium monas*, Nematoda, *Aplectana* sp., *Rhabdias fuelleborni*, *Bufo marinus* (Bufonidae).

The giant toad, *Bufo marinus* (Linnaeus, 1758), originally ranged from southern Texas to central Brazil but has since been introduced into the Caribbean Islands, Hawaii, Fiji, Philippines, Taiwan, Ryukyus, New Guinea, Australia, and many Pacific islands (Frost, 1985). Specimens from Guiana were introduced into Bermuda about 1885 (Wingate, 1965). The purpose of this