Helminths infecting *Mabuya agilis* (Lacertilia, Scincidae) in a “restinga” habitat (Grumari) of Rio de Janeiro, Brazil

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The nematode fauna associated to the Brazilian skink *Mabuya agilis* (Raddi, 1823) has been recently studied in three different localities, all of them “restinga” habitats in southeastern Brazil (Van Sluys et al., 1997; Ribas et al., 1998b; Vrcibradic et al., 2000). These studies evidenced a relatively poor nematode fauna, with only two to four species per locality (sample sizes in those studies ranged from eight to 33). In the present study, we investigate the helminth fauna of a population of *M. agilis* inhabiting yet another restinga area of southeastern Brazil, based on a relatively large sample. Unlike the previous studies already mentioned, we do not restrict our survey to nematodes. We attempt to: a) verify the species composition and richness of the helminth community; b) address the prevalence and mean infection intensity for each helminth species; c) verify the patterns of infection of the commonest parasite species according to host size and sex.

Lizards were collected at the restinga habitat of Grumari (23°03'S, 43°32'W), in Rio de Janeiro municipality, Rio de Janeiro state, southeastern Brazil. Restinga habitats are characterized by sandy soil covered by grassy-herb and dense-scrub vegetation, and are part of the Atlantic rainforest biome (Eiten, 1992). The area is close to the southern limit of distribution of *M. agilis* (see Vanzolini, 1988). Other lizards occurring sympatrically (and, in most cases, syntopically) with *M. agilis* at this area include the tropidurids *Tropidurus torquatus* (Wied, 1820) and *Liolema laticeps* Mertens, 1938, the teiids *Ameiva ameiva* (Linnaeus, 1758) and *Tupinambis merianae* (Duméril and Bibron, 1839), the gekkonoids *Gymnodactylus darwini* (Gray, 1845) and *Hemidactylus mabouia* (Moreau de Jonnés, 1818), and the scincid *Mabuya macrorrhyncha* Hoge, 1946. Along with *T. torquatus* and *A. ameiva*, *M. agilis* is one of the three most abundant lizards in the area.

Collections were made between December 1995 and December 1998, always during months of the “wet season” in the area (October through April; Araújo and Henriques, 1984); dry season months were not sampled in order to avoid possible variations in infection parameters due to environmental seasonality. Lizards were collected with an air rifle; animals not killed instantly by the shots were transferred to a plastic bag containing cotton balls soaked with ether, to be euthanized. In the laboratory, after fixation of the lizards with 10% formalin, we measured the snout-vent length (SVL) of each individual, using digital calipers (to the nearest 0.1 mm). Each lizard was then dissected for sex determination and examination of the digestive tract (stomach and small and large intestines), liver, lungs and body cavity, for which the presence of helminths was checked (animals whose digestive tract had been damaged during collection were ignored). Nematodes were mounted on slides and identified under

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a microscope, after diaphanization with phenol. Cestodes and acanthocephalans were stained in hematoxylin, dehydrated in a graded series of ethanol, cleared in xylene, and mounted in balsam for identification.

Parasitological terminology used throughout the text follows Bush et al. (1997). Voucher specimens of helminths were deposited at the U.S. National Parasite Collection (USNPC # 89075-89081) and at the Coleção Helmintológica do Instituto Oswaldo Cruz (CHIOC # 34424-5).

A total of 57 individuals of *M. agilis* (SVL range 32-80 mm) were examined, 46 of which were infected by at least one helminth (i.e., an overall prevalence of 80.7%). Seven helminth species were found associated to *M. agilis*, including two acanthocephalans (one indeterminate echinorhynchid and one indeterminate oligacanthorhynchid; both forms found only as cystacanths), one cestode (*Oochoristica ameiva* Beddard, 1914 — Linstowiidae), and four nematodes (*Parapharyngodon sceleratus* (Travassos, 1923) and *P. lagitor* Alho and Rodrigues, 1963 — Oxyuroidea; Pharyngodonidae, *Physaloptera* sp. — Spiruroidea; Physalopteridae, and an indeterminate acuarid (*Acutarioidea*); the latter two forms were found only as larvae) (table 1). Two nematodes could not be properly identified due to their damaged state (though they were probably either acuarid or physalopteran larvae).

Analyses of infection patterns and their correlates were restricted to the two commonest helminths (the nematode *P. sceleratus* and the echinorhynchid acanthocephalan), since prevalences of the remaining species were too low. Prevalences of the two aforementioned helminth species tended to increase with size (SVL) class of hosts (table 2). Infection intensity of echinorhynchids was positively and significantly correlated to host SVL (log-transformed data: \( r = 0.63; P < 0.001; n = 45 \); fig. 1). Echinorhynchid loads were greater for females (mean = 48.43, \( s = 33.8; n = 21 \)) than for males (mean = 27.08, \( s = 31.29; n = 24 \)); however, when infection intensities (log-transformed) were compared between sexes by Analysys of Covariance (ANCOVA), using host SVL (log-transformed)

<table>
<thead>
<tr>
<th>helmminth species</th>
<th>Prevalence (%)</th>
<th>Mean intensity ± s (range)</th>
<th>Sites of infection frequency of occurrence, in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acanthocephala</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Echinorhynchidae indet.</td>
<td>45 (78.9)</td>
<td>37.04 ± 33.90 (1-143)</td>
<td>SW (97.8), PM (64.4), IW (42.2), LV (31.1), BW (6.7), LU (6.7)</td>
</tr>
<tr>
<td>Oligacanthorhynchidae indet.</td>
<td>6 (10.5)</td>
<td>1.33 ± 0.82 (1-3)</td>
<td>BW (66.7), BC (33.3)</td>
</tr>
<tr>
<td>Cestoda</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Oochoristica ameiva</em></td>
<td>7 (12.3)</td>
<td>2.43 ± 2.15 (1-6)</td>
<td>SI (100.0)</td>
</tr>
<tr>
<td>Nematoda</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Parapharyngodon lagitor</em></td>
<td>1 (1.8)</td>
<td>1.0</td>
<td>LI (100.0)</td>
</tr>
<tr>
<td><em>Parapharyngodon sceleratus</em></td>
<td>42 (73.7)</td>
<td>3.19 ± 2.09 (1-9)</td>
<td>LI (84.6), SI (15.4)</td>
</tr>
<tr>
<td><em>Physaloptera</em> sp. (larvae)</td>
<td>1 (1.8)</td>
<td>2.0</td>
<td>ST (100.0)</td>
</tr>
<tr>
<td>Acuaridiidae indet. (larvae)</td>
<td>4 (7.0)</td>
<td>1.50 ± 1.0 (1-3)</td>
<td>SW (75.0), BW (25.0)</td>
</tr>
<tr>
<td>Unidentified larvae</td>
<td>2 (3.5)</td>
<td>1.0</td>
<td>ST (100.0)</td>
</tr>
</tbody>
</table>
Figure 1. Relationship between infection intensity of echinorhynchid cystacanths and host SVL (both log-transformed) for *Mahuya agilis* in the area of Grumari, Rio de Janeiro, Brazil.

Table 2. Prevalence (in absolute numbers and proportions) of infection per host size (SVL) class for each of the two commonest helminth species infecting *Mahuya agilis* at Grumari, Rio de Janeiro, Brazil.

<table>
<thead>
<tr>
<th>Size class (SVL range)</th>
<th>n</th>
<th>Echinorhynchidae indet</th>
<th>Parapharyngodon sceleratus</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40.0 mm</td>
<td>8</td>
<td>1 (12.5)</td>
<td>2 (25.0)</td>
</tr>
<tr>
<td>40-49.9 mm</td>
<td>7</td>
<td>3 (42.9)</td>
<td>3 (42.9)</td>
</tr>
<tr>
<td>50-59.9 mm</td>
<td>2</td>
<td>2 (100.0)</td>
<td>1 (50.0)</td>
</tr>
<tr>
<td>60-69.9 mm</td>
<td>21</td>
<td>20 (95.2)</td>
<td>19 (90.5)</td>
</tr>
<tr>
<td>70-80 mm</td>
<td>19</td>
<td>19 (100.0)</td>
<td>17 (89.5)</td>
</tr>
</tbody>
</table>

as covariate, no significant difference was detected ($F_{1,42} = 2.77, P = 0.10$). Infection intensity of *P. sceleratus* was not significantly correlated to host SVL ($r = 0.24; P = 0.13; n = 42$; log-transformed data), and did not differ between sexes of hosts (ANOVA; $F_{1,40} = 0.54, P = 0.47$).

Overall infection rates were relatively high for the population of *M. agilis* studied here. Nevertheless, two species dominated the helminth fauna, whereas the remaining ones had prevalences of less than 15%. Nematode richness (four) was equal to that of another previously surveyed *M. agilis* population, though only two species (*P. sceleratus* and *Physaloptera* sp.) were common to both populations (Ribas et al., 1998b).

Echinorhynchid cystacanths (probably of the same species recorded here) have been previously reported from *Tropidurus torquatus* by Vicente (1978), and are common in lizards from restinga habitats of eastern Brazil (D. Vrcibradic, unpubl. data). The occurrence of Echinorhynchidae and Oligacanthorhynchidae in *M. agilis* represent new host records.

*Oochoristica ameiva* has so far been reported only from the teiids *Ameiva ameiva* [= *A. surinamensis* (Laurenti, 1768)] and *Cnemidophorus littoralis* Rocha, Araújo, Vrcibradic
and Costa, 2000 (Travassos, 1965; Rocha et al., 2000). It is here reported for the first time from M. agilis.

Two species of the genus Parapharyngodon Chatterji, 1933 were found in the intestines of M. agilis from Grumari. One of them, P. largitor, was previously known only from the gekkonid Hemidactylus mabouia and the teiid Ameiva ameiva (Vicente et al., 1993), thus its presence in M. agilis is a new host record. Nevertheless, the individual (an adult female) harboring that nematode contained remains of one H. mabouia in its stomach and intestines, which raises the possibility that the gekko may have been infected with the nematode, which ended up in the skink’s gut after it swallowed and digested its saurian prey.

Physalopterans and acuariids were rare and occurred only as larvae in M. agilis. Physaloptera spp. are apparently ubiquitous parasites of Tropidurus torquatus (Vicente, 1981; Van Sluys et al., 1997; Ribas et al., 1998a; Vrcibradic et al., 2000), but appear to be rare or absent from Mabuya spp. living sympatrically with those tropidurids (Van Sluys et al., 1997; Ribas et al., 1998b; Vrcibradic et al., 2000). Thus, it seems that Mabuya spp. are not suitable hosts for those nematodes. Larvae of acuariids have sometimes been found in lizards, which serve as intermediate or paratenic hosts for these nematodes (Roca et al., 1986; Roca and Hornero, 1991; Roca, 1995; Vrcibradic et al., 2000). We suggest M. agilis may also be an intermediate or paratenic host for such predominantly avian parasites.

Bush et al. (1997) caution against the indiscriminate use of the terms “core” and “satellite” species in helminthological studies, usually as synonyms for high and low prevalence, respectively. These authors state that the core-satellite hypothesis will apply only in cases where there is a bimodal distribution (prevalence pattern) of species within a geographical region and where species distribution is positively correlated with local abundance (intensity). In the present study, there is a clearly bimodal distribution of species comprising the helminth community of M. agilis from Grumari, with two species having high prevalences (>70%) and the remaining five having low ones (ca. 2-12%), with no species having intermediate values. Moreover, the two most prevalent species also had the highest infection intensities, supporting their qualification as core species [infection intensities of P. sceleratus were much lower than those of echinorhynchids, but there must be a limit to the number of those relatively large (up to ca. 9 mm) and plump nematodes that can inhabit the intestines of a lizard the size of M. agilis].

Most of the helminth species infecting the studied population of M. agilis, including the abundant echinorhynchid, have heteroxenic life cycles (i.e. require an invertebrate intermediate host to infect the lizards), but the two pharyngodonid (including the also abundant P. sceleratus) are monoxenic, being acquired by the lizard via direct ingestion. Mabuya agilis is primarily terrestrial and usually forages actively (often flicking its tongue; pers. obs.) among the leaf-litter and low vegetation, which makes it susceptible to ingest pharyngodonid eggs scattered on the ground (see Ribas et al., 1998a, b). This skink is also a generalist insectivore whose diet includes a wide variety of invertebrate prey (Vrcibradic and Rocha, 1995, 1996), being likely to ingest the primary host(s) of acanthocephalans with
relative frequency. Thus, both foraging habits and diet composition appear to be important in determining the parameters of the helminth community of M. agilis in the area studied.

Acknowledgements. This study is a portion of the results of the “Programa de Ecologia, Conservação e Manejo de Ecossistemas do Sudeste Brasileiro” and of the Eastern Brazilian Vertebrate Ecology Project, both of the Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro. We thank P.F. Teixeira-Filho, M. Cunha Barros, H.L.T. Zaluvar and L.C. Prado for their help during fieldwork, and L. Luissell for his critical review of the original manuscript. The first author benefited from a graduate fellowship (Process 143607/98-7 NV) from the Conselho Nacional do Desenvolvimento Científico e Tecnológico (CNPq). This study was also partially supported by research grants from the fundação de Amparo à Pesquisa do Estado do Rio de Janeiro — FAPERJ (Process E-26/170,385/97) and from CNPq (Processes 300819/94-3 NV and 461970/00-7 APQ). Field collections of lizards were made under permit of the Instituto Brasileiro do Meio Ambiente e Recursos Naturais Renováveis — IBAMA (Process 03486699-85).

References


Body temperature and sexual dimorphism of
Sce1oporus aeneus and Sce1oporus palaci1osi from México

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For many lizard genera, and even species, various aspects of their natural history vary from population to population. This is particularly apparent in the well-studied genus Sce1oporus. Variation in life history traits in Sce1oporus undulatus is a long-standing example of interpopulation variation (reviewed in Niewiarowski, 1994). Other examples are variation among species of Sce1oporus in body temperature (Lemos-Espinal et al., 1997a; Andrews, 1998) and sexual dimorphism (Fitch, 1978). Variation occurs between geographically proximate conspecific populations of Sce1oporus in such traits as growth rate, age at maturity, thermal biology, microhabitat use, body size, and sexual dimorphism (e.g., Adolph, 1990; Grant and Dunham, 1990; Smith et al., 1994, in press; Ballinger et al., 1996; Lemos-Espinal et al., 1997b). While we know a great deal about several populations and species of Sce1oporus, there are still several species (particularly those from México) which remain poorly studied.

We report on sexual size dimorphism, microhabitat use, and body temperatures of two species of Sce1oporus, the southern bunchgrass lizard (S. aeneus) and Palacios’s bunchgrass lizard (S. palaci1osi). Some aspects of the biology of S. aeneus, such as reproduction (e.g., most recently Andrews et al., 1999; Andrews, 2000 and references therein), are fairly well known. The biology of S. palaci1osi is much less studied. Most of