

Nematodes of Elasmobranch Fishes from the Southern Coast of Brazil

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New records for nematode species recovered from elasmobranch fishes in Brazil are established and new systematical arrangements proposed. Parascarophis sphyrnae Campana-Rouget, 1955 from the spiral valve of Sphyrna zygaena is referred for the first time in South America as a new host record. Procamallanus (S.) pereirai Annereaux, 1946, from the spiral valve of Raja castelnaui is reported parasitizing an elasmobranch host. Nematode larvae of the genera Anisakis, Contraecum, Pseudoterranova and Raphidascaris are listed from the stomach and spiral valves of several hosts. Anisakidae larvae previously referred in Brazil in the genus Phocanema should be reallocated in Pseudoterranova. Nematodes of the genera Anisakis, Contraecum, Pseudoterranova and Raphidascaris are reported for the first time parasitizing elasmobranchs in Brazil.

Key words: Nematoda - new records - elasmobranch fishes - Brazil

The present investigation adds new data to the study of helminth parasites of elasmobranch fishes from Brazilian marine waters. In Brazil, the only reports on parasites of these hosts are related to the cestodes of the orders Tetraphyllidea and Trypanorhyncha (Rego et al. 1974, Rego 1977, São Clemente & Gomes 1989a,b, 1992, São Clemente et al. 1991) and to the anisakid nematodes, represented by two species: *Terranova trichiuri* Chandler, 1935 and *T. rochalimai* (Pereira, 1935) Johnston and Mawson, 1945 (Vicente et al. 1985, Vicente & Pinto 1999).

MATERIALS AND METHODS

In November 1984, June 1985 and July 1986, 217 elasmobranch fishes: 6 *Notorynchus pectorosus* (Garman, 1884) (90-130 cm of total length-tl), 14 *Squalus megalops* (MacClay, 1881)

(45-59 cm tl), 37 *Mustelus canis* (Mitchill, 1815) (70.5-113 cm tl), 35 *M. schmitti* Springer, 1939 (56-98 cm tl), 37 *Galeorhinus vitaminicus* Buen, 1950 (86-146 cm tl), 7 *Carcharhinus brachyurus* (Günther, 1870) (80-108 cm tl), 16 *Sphyrna zygaena* (Linnaeus, 1758) (81-147 cm tl), 5 *S. lewini* (Linnaeus, 1758) (75-165 cm tl), 20 *Squatina guggenheim* (Marini, 1936) (64-87 cm tl), 20 *Squatina* sp. (81-125 cm tl), 12 *Raja castelnaui* Ribeiro, 1907 (70-103 cm tl), 1 *Dasyatis say* (Lesseur, 1817) (58 cm tl) and 1 *D. centroura* (Mitchill, 1815) (103 cm tl) were captured in the coast of the State of Rio Grande do Sul (30°40'S-33°40'S and 50°40'W-53°20'W; 12-100 m depth), by professional fishermen of the oceanographic ship Atlântico Sul. In March 1998, 46 elasmobranch fishes: 1 *Hexanchus griseus* (Bonnaterre, 1788) (132 cm tl), 7 *Heptranchias perlo* (Bonnaterre, 1788) (87-107.4 cm tl), 16 *Squalus* sp. (41-67 cm tl), 9 *Scyliorhinus haeckeli* (Ribeiro, 1907) (41.5-54.5 cm tl), 5 *Carcharhinus signatus* (Poey, 1868) (120-150 cm tl) and 8 *Dipturus trachyderma* (Kreff and Stehmann, 1975) (133.5-176 cm tl) were captured about 125 miles off the littoral of State of Paraná (25°50'S-25°52'S and 45°23'W-45°25'W; 200-500 m depth), by professional fishermen of the fishing boat Icanhema VI. Parasites were collected, fixed, stained and mounted following Amato et al. (1991). The classification of the nematode parasites considered herein is that of Yamaguti (1961), Chabaud (1975 a, b), Hartwich (1974), Anderson (1992). The prevalence, intensity and mean intensity of infec-

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tion are indicated in accordance to Bush et al. (1997). The drawings were made with a camera lucida connected to an Olympus BH-2 microscope. All measurements are in millimeters; ranges of measurements are followed by mean values (when indicated) within parentheses. Voucher specimens were deposited in the Coleção Helminológica do Instituto Oswaldo Cruz (CHIOC), Fiocruz, Rio de Janeiro, RJ, Brazil. Deposited anisakidid larvae refer to one sample from each host species. Host specimens collected between 1984 and 1986 were determined on board by Dr Carolus Maria Vooren and were not deposited. Host specimens collected in 1998 and 1999 were determined by Drs Alberto Ferreira Amorim and Carlos Arfelli and at least one specimen of each species of these fishes was deposited as voucher host in the Coleção Ictiológica do Instituto de Pesca, Santos, SP, Brazil: *D. trachyderma* no. IP1961; *C. signatus* no. IP1962; *H. perlo* no. IP1963; *H. griseus* no. IP1964; *Squalus* sp. no. IP1965; *S. haeckeli* no. IP 1966.

RESULTS

Spiruroidea

Cystidicolidae Skrjabin, 1945

Parascarophis sphyrnae Campana-Rouget, 1955
(Figs 1-3)

Description of specimen (based on one female). Female: body 30.0 long, maximum width 0.144. Head with a cap-like cuticular expansion which extends backwards rather dorsally than ventrally, dorsal face 0.050 long and ventral face 0.020 long. Buccal capsule 0.220 long. Esophagus 4.0 long without a clear distinction between muscular and glandular portions. Nerve ring 0.216 from anterior extremity. Vulva at the mid anterior portion of the body, 19.7 from anterior extremity. Ovijector directed upwards and then turning downwards, near its connection with the opposed uterus. Eggs thin-shelled, embryonated, 0.025-0.029 long by 0.011-0.014 wide, without polar filaments. Anus 0.160 from posterior extremity. Excretory pore not observed.

Host: *Sphyrna zygaena* (Sphyrnidae)

Site of infection: spiral valve

Locality: littoral of the State of Rio Grande do Sul, Brazil

Prevalence (P) = 6.2%

Intensity of infection (I) = 1

Number of specimens recovered: 1 female

Specimen deposited: CHIOC No. 34263 (voucher) - whole mount.

Camallanoidea

Camallanidae Railliet & Henry, 1915

Procamallanus (S.) pereirai Annereaux, 1946
(Figs 4-7)

Description of specimens (based on one male and five females). Male: body 10.67 long, maximum width near midlength 0.158. Buccal capsule 0.090 long by 0.061 wide, 14 spiral bands. Esophagus 1.09 long, muscular anterior portion of esophagus 0.489 long and glandular posterior portion 0.604 long. Nerve ring 0.226 from anterior extremity. Caudal alae wide, continuous anteriorly with symmetrical pair of pedunculated papillae; precloacal pairs three, postcloacal six pairs. Spicules unequal and similar. Longer spicule 0.420 and shorter spicule 0.220 long. Cloaca 0.144 from posterior extremity. Tail possessing two small spines. Female: body 13.3 - 17.8 long, maximum width at its middle, 0.273-0.360. Buccal capsule 0.100 - 0.108 long by 0.086 - 0.090 wide, with 14 spiral bands. Muscular anterior portion of esophagus 0.518 - 0.576 long and glandular posterior portion 0.763 - 0.864 long. Nerve ring 0.237 - 0.316 from anterior extremity. Vulva 6.99 from anterior extremity. Ovijector long directed downwards. Rectum 0.108 - 0.144 long. Anus 0.140 - 0.180 from posterior extremity. Tail with two spines.

Host: *Raja castelnaui* (Rajidae)

Site of infection: spiral valve

Locality: coast of the State of Rio Grande do Sul, Brazil

Prevalence (P) = 25%

Mean intensity of infection (MI) = 2

Number of specimens recovered: 1 male, 5 females

Specimens deposited: CHIOC No. 34264, 34265a, b, c and 34266 (vouchers) - whole mounts.

Ascaridoidea

Anisakidae Skrjabin & Karokhin, 1945

Data on the number of specimens of Anisakidae nematode larvae (infrapopulation) in elasmobranch hosts collected between 1984 and 1986 (State of Rio Grande do Sul) and 1998 (State of Paraná) in the Southern Brazil and their number of deposit in the CHIOC are presented in Table I. Prevalence, intensity or mean intensity of infection in elasmobranch hosts are on the Tables II and III for those necropsies performed in 1984-1986 and 1998, respectively. Fishes collected in March 1999 from State of Santa Catarina were negative to Anisakidae nematode larvae.

Anisakinae Railliet & Henry, 1912

Anisakis Dujardin, 1845

Anisakis sp.

Hosts: *Hexanchus griseus* (Hexanchidae); *Heptranchias perlo* (Heptranchidae); *Squalus megalops* (Squalidae); *Mustelus canis* (Triakidae); *Galeorhinus vitaminicus* (Triakidae); *Carcharhinus signatus* (Carcharhinidae); *Dipturus trachyderma* (Rajidae); *Squatina* sp. (Squatinae).

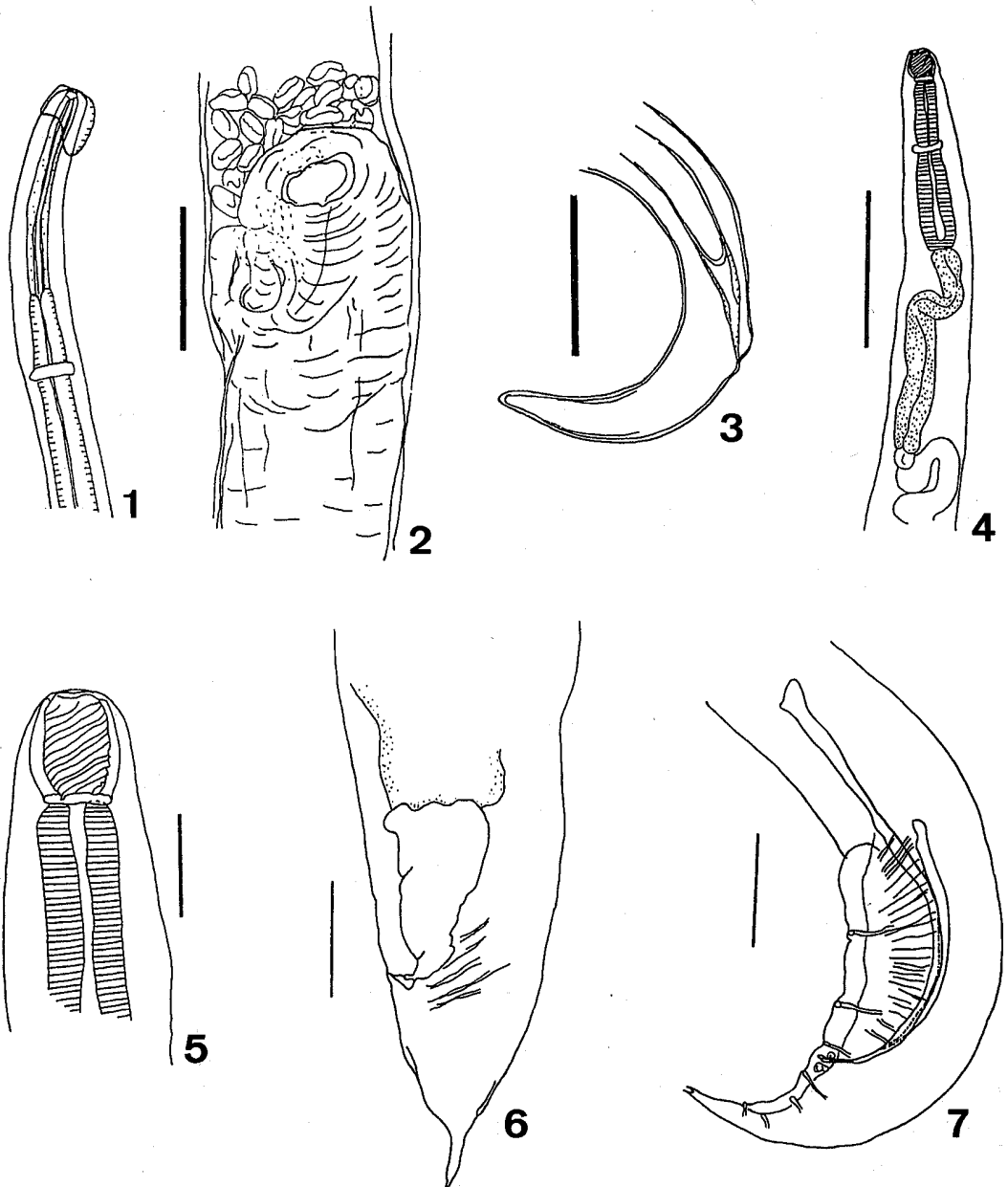
Contracaecum Raillet & Henry, 1912
Contracaecum sp.

Hosts: *Hexanchus griseus* (Hexanchidae); *Heptranchias perlo* (Heptranchidae); *Scyliorhinus haeckeli* (Scyliorhinidae); *Mustelus canis* (Triakidae); *Mustelus schmitti* (Triakidae); *Galeorhinus vitaminicus* (Triakidae); *Carcharhinus brachyurus* (Carcharhinidae); *Carcharhinus*

signatus (Carcharhinidae); *Sphyrna zygaena* (Sphyrnidae); *Dipturus trachyderma* (Rajidae); *Squatina* sp. (Squatinae).

Pseudoterranova Mosgovoy, 1950
Pseudoterranova sp.

Hosts: *Squalus megalops* (Squalidae); *Mustelus canis* (Triakidae); *Mustelus schmitti* (Triakidae); *Galeorhinus vitaminicus* (Triakidae).



Parascarophis sphyrnae. Fig. 1: anterior region of female, lateral view. Fig. 2: vulvar region, ventral view. Fig. 3: posterior end of female, lateral view (bars of Figs 1-3 = 0.1 mm). *Procamallanus* (*S.*) *pereirai*. Fig. 4: anterior region of female, lateral view (bar = 0.5 mm). Fig. 5: buccal capsule of female, lateral view. Fig. 6: posterior region of female, lateral view. Fig. 7: posterior region of male, lateral view (bars of Figs 5-7 = 0.1 mm).

TABLE I

Number of the specimens (inrapopulation) of the anisakid nematode larvae burden in each positive elasmobranch host collected between 1984 and 1998 in the states of Rio Grande do Sul and Paraná and Coleção Helmintológica do Instituto Oswaldo Cruz (CHIOC) deposit number

Hosts	Host sex	Larvae spp.	No. of specimens	Site of infection	Vouchers CHIOC no.
<i>Hexanchus griseus</i>	Female	<i>Anisakis</i>	10	Spiral valve	33880
		<i>Anisakis</i>	5	Stomach	—
		<i>Contracaecum</i>	3	Stomach	33881
<i>Heptranchias perlo</i>	Female	<i>Contracaecum</i>	1	Stomach	—
<i>H. perlo</i>	Female	<i>Contracaecum</i>	2	Spiral valve	33882
<i>H. perlo</i>	Female	<i>Anisakis</i>	1	Spiral valve	33883
<i>Squalus megalops</i>	Female	<i>Pseudoterranova</i>	2	Stomach	34276
<i>S. megalops</i>	Female	<i>Pseudoterranova</i>	7	Stomach	—
<i>S. megalops</i>	Female	<i>Anisakis</i>	1	Spiral valve	33878
<i>Scyliorhinus haeckeli</i>	Male	<i>Contracaecum</i>	1	Stomach	—
<i>S. haeckeli</i>	Male	<i>Contracaecum</i>	1	Spiral valve	33884
<i>S. haeckeli</i>	Female	<i>Raphidascaris</i>	1	Spiral valve	33885
<i>Mustelus canis</i>	Female	<i>Anisakis</i>	1	Spiral valve	34271
		<i>Pseudoterranova</i>	1	Spiral valve	34273
<i>M. canis</i>	Female	<i>Pseudoterranova</i>	1	Spiral valve	—
<i>M. canis</i>	Female	<i>Pseudoterranova</i>	3	Spiral valve	—
<i>M. canis</i>	Female	<i>Anisakis</i>	1	Spiral valve	—
<i>M. canis</i>	Female	<i>Contracaecum</i>	22	Stomach	34272
<i>M. canis</i>	Female	<i>Pseudoterranova</i>	2	Spiral valve	—
<i>M. schmitti</i>	Female	<i>Contracaecum</i>	4	Spiral valve	34274
<i>M. schmitti</i>	Female	<i>Contracaecum</i>	5	Spiral valve	—
<i>M. schmitti</i>	Male	<i>Pseudoterranova</i>	6	Spiral valve	34275
<i>Galeorhinus vitaminicus</i>	Male	<i>Anisakis</i>	6	Spiral valve	34267
<i>G. vitaminicus</i>	Male	<i>Contracaecum</i>	9	Spiral valve	34268
<i>G. vitaminicus</i>	Male	<i>Anisakis</i>	3	Spiral valve	—
<i>G. vitaminicus</i>	Male	<i>Anisakis</i>	3	Spiral valve	—
<i>G. vitaminicus</i>	Female	<i>Pseudoterranova</i>	13	Spiral valve	34269
<i>G. vitaminicus</i>	Female	<i>Contracaecum</i>	10	Spiral valve	—
		<i>Raphidascaris</i>	6	Spiral valve	34270
		<i>Pseudoterranova</i>	4	Spiral valve	—
<i>G. vitaminicus</i>	Female	<i>Pseudoterranova</i>	4	Spiral valve	—
<i>Carcharhinus brachyurus</i>	Female	<i>Contracaecum</i>	1	Spiral valve	34278
<i>Carcharhinus signatus</i>	Male	<i>Anisakis</i>	1	Stomach	—
<i>C. signatus</i>	Male	<i>Anisakis</i>	2	Spiral valve	33886
		<i>Contracaecum</i>	2	Spiral valve	—
		<i>Anisakis</i>	1	Stomach	—
<i>C. signatus</i>	Female	<i>Contracaecum</i>	7	Stomach	33887
		<i>Contracaecum</i>	1	Spiral valve	—
		<i>Contracaecum</i>	1	Spiral valve	—
<i>Sphyrna zygaena</i>	Female	<i>Contracaecum</i>	9	Stomach	33879
		<i>Contracaecum</i>	1	Spiral valve	—
<i>S. zygaena</i>	Male	<i>Contracaecum</i>	2	Spiral valve	—
<i>Squatina</i> sp.	Male	<i>Anisakis</i>	1	Spiral valve	34279
<i>Raja castelnaui</i>	Female	<i>Raphidascaris</i>	2	Spiral valve	—
<i>R. castelnaui</i>	Female	<i>Raphidascaris</i>	1	Spiral valve	34277
<i>R. castelnaui</i>	Male	<i>Raphidascaris</i>	4	Spiral valve	—
<i>Dipturus trachyderma</i>	Male	<i>Contracaecum</i>	5	Stomach	—
<i>D. trachyderma</i>	Male	<i>Contracaecum</i>	4	Stomach	33889
<i>D. trachyderma</i>	Male	<i>Anisakis</i>	1	Spiral valve	33888
<i>D. trachyderma</i>	Female	<i>Contracaecum</i>	1	Spiral valve	—
<i>D. trachyderma</i>	Male	<i>Contracaecum</i>	1	Spiral valve	—
		<i>Raphidascaris</i>	1	Spiral valve	33890
<i>D. trachyderma</i>	Male	<i>Anisakis</i>	1	Spiral valve	—
		<i>Contracaecum</i>	2	Spiral valve	—

TABLE II

Prevalence (P) and intensity (I) or mean intensity (MI)^a of the anisakid nematode larvae burden in elasmobranch hosts collected between 1984 and 1986 (State of Rio Grande do Sul)

Larvae spp.	Hosts	P (%)	I or MI ^a
<i>Anisakis</i>	<i>Squalus megalops</i>	7.1	1
	<i>Mustelus canis</i>	5.4	1 ^a
	<i>Galeorhinus vitaminicus</i>	8.1	4 ^a
	<i>Squatina</i> sp.	3.8	1
<i>Contracaecum</i>	<i>M. canis</i>	2.7	22
	<i>M. schmitti</i>	5.7	4.5 ^a
	<i>G. vitaminicus</i>	5.4	9.5 ^a
	<i>Carcharhinus brachiurus</i>	2.5	1
<i>Pseudoterranova</i>	<i>Sphyrna zygaena</i>	12.5	6 ^a
	<i>S. megalops</i>	14.3	4.5 ^a
	<i>M. canis</i>	10.8	1.7 ^a
	<i>M. schmitti</i>	2.9	6
<i>Rhaphidascaris</i>	<i>G. vitaminicus</i>	5.4	8.5 ^a
	<i>G. vitaminicus</i>	2.7	6
	<i>Raja castelnaui</i>	25	2.3 ^a

TABLE III

Prevalence (P) and intensity (I) or mean intensity (MI)^a of the anisakid nematode larvae burden in elasmobranch hosts collected in 1998 (State of Paraná)

Larvae spp.	Hosts	P (%)	I or MI ^a
<i>Anisakis</i>	<i>Hexanchus griseus</i>	100	15
	<i>Heptranchias perlo</i>	14.3	1
	<i>Carcharhinus signatus</i>	60	1.3 ^a
	<i>Dipturus trachyderma</i>	25	1 ^a
<i>Contracaecum</i>	<i>H. griseus</i>	100	3
	<i>H. perlo</i>	28.6	1.5 ^a
	<i>Scyliorhinus haeckeli</i>	22.2	1 ^a
	<i>C. signatus</i>	40	5 ^a
	<i>D. trachyderma</i>	62.5	2.6 ^a
<i>Rhaphidascaris</i>	<i>S. haeckeli</i>	11.1	1
	<i>D. trachyderma</i>	12.5	1

Rhaphidascarinae Hartwich, 1954
Rhaphidascaridinea Chabaud, 1965
Rhaphidascaris Railiet & Henry, 1915
Rhaphidascaris sp.

Hosts: *Scyliorhinus haeckeli* (Scyliorhinidae);
Galeorhinus vitaminicus (Triakidae); *Raja castelnaui* (Rajidae); *Dipturus trachyderma* (Rajidae).

REMARKS

Description of *P. sphyrnae* was based on female specimens parasitizing the spiral valve of *S. diplana* from the coast of Senegal (Campana-Rouget 1955a, b). Our specimen from the spiral valve of *S. zygaena* is 2.5 times longer than those from Senegal, but in accordance to established morphological parameters for the species. This is the first report of *P. sphyrnae* in South America and in the new host species. *Procamallanus* (*S.*)

pereirai has been reported from a variety of hosts and different geographical localities (Annereaux 1946, Sogandares-Bernal 1955, Noble & King 1960, Hutton 1964, Joy 1971, 1974, Yin 1983, Sood 1989, Frost & Dailey 1994). In Brazil this nematode was referred parasitizing *Paralichthys brasiliensis* (Pinto et al. 1984, Vicente et al. 1985). Larval stages of *P. (S.) pereirai* have been reported in Brazil for the teleosts *Stellifer brasiliensis*, *Nebris microps*, *Porichthys porosissimus*, *Symphurus tessellatus* and *Menticirrus americanus* (Santos et al. 1999). *Procamallanus* (*S.*) *pereirai* is here referred for the first time from an elasmobranch host. The Anisakidae larvae reported herein represent the genera *Anisakis*, *Contracaecum*, *Pseudoterranova* and *Rhaphidascaris*. Considering the life-cycle of these nematodes (Anderson 1992) it is possible to suppose that the third-stage larvae are ingested with the intermediate fish hosts. Several anisakid species have been referred from freshwa-

ter and marine fishes in Brazil (Vicente et al. 1985, Barros & Amato 1993, São Clemente et al. 1994, 1995a, b, 1996, Vicente & Pinto 1999). According to Gibson (1983), *Pseudoterranova* must be recognized as the oldest available name for *Phocanema* and based on this fact, species previously referred to the genus *Phocanema* should be reallocated in *Pseudoterranova*. This is the first report of anisakid nematodes of the genera *Anisakis*, *Contracaecum*, *Pseudoterranova* and *Raphidascaris* parasitizing elasmobranchs in Brazil, considering that only *T. trichuri* Chandler, 1935 and *T. rochalimai* (Pereira, 1935) Johnston and Mawson, 1945 were previously referred from these hosts (Vicente et al. 1985). Thus, the occurrence of the larvae studied herein, represents new records for Brazilian hosts.

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