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Helminth Fauna of Bats in Japan XVII

With 9 Text-figures

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ABSTRACT Three species of nematodes, *Strongylacantha pretoriensis*, *S. rhinolophi* and *Molinostrongylus rhinolophi*, were isolated from the common cave bats, *Rhinolophus ferrumequinum*, *R. cornutus* and *Miniopterus schreibersii*, collected in limestone caves in various parts of Japan. Morphological structure of *S. rhinolophi* is redescribed on new materials.

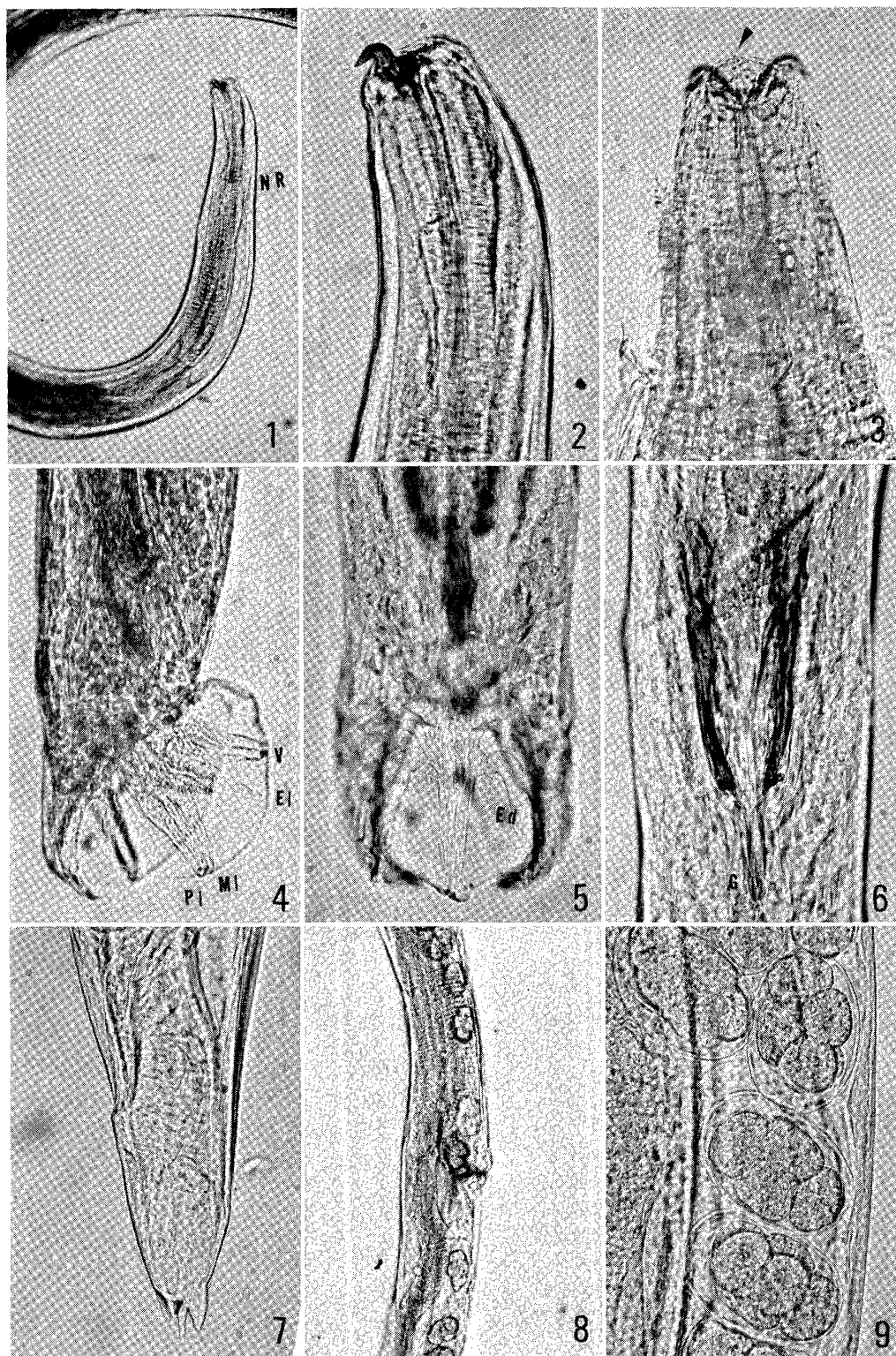
In their previous papers, the authors (1973 a, b) reported on the two nematode species found in the small intestine of common cave bats collected in Southwest Japan. Since then, a number of bats had been obtained from various parts of Japan and dissected for examination of nematodes. Many of them were found to harbour some nematodes as shown in Table 1. They were fixed in 70% ethyl alcohol, cleared in glycerin-alcohol, and studied under microscope.

These nematodes are classified into three species belonging to two genera. One of them will be redescribed in the present paper. Some additional accounts of the remaining two species will also be given.

Strongylacantha rhinolophi Yamaguti, 1935

Description. Strongylacanthinae, Nematoda. Thirteen males and ten females were found in the small intestine of *Rhinolophus cornutus*, collected in the prefectures of Fukuoka, Miyazaki, Okayama, Gifu, Kôchi, Aomori and Hokkaido, and of *Miniopterus schreibersii* collected in Fukuoka Prefecture.

Body, slender, 3.59 to 7.12 mm by 0.09 to 0.17 mm in the male and 5.56 to 10.42 mm by 0.17 to 0.25 mm in the female, more or less strongly curved toward the ventral side at the anterior extremity. Cuticle thin and exceedingly finely cross-striated. Cephalic cuticle not inflated (Fig. 1). Mouth oval. From the ventral margin of the



Figs. 1-9. *Strongylacantha rhinolophi*.

Table 1
Localities of bats from various districts of Japan and
number of parasitic nematodes.

Date	Localities	No. of nematodes harbored			
		Male	Female	Larva	Total
<i>Miniopterus schreibersii</i>					
7-V-1970	Himeyama-no-iwa-ana, Shûhō-chô, Yamaguchi Pref.	1	2		3*
23-VIII-1972	Chichi-no-iwaya, Takachiho-chô, Miyazaki Pref.	3	4		7*
5-XII-1974	Kashi-no-ana, Mitsushima-chô, Nagasaki Pref.	3	2		5#
12-VI-1975	Iharayama-haikô, Itoshima-gun, Fukuoka Pref.	4			4*
12-VI-1975	Iharayama-haikô, Itoshima-gun, Fukuoka Pref.	2			2***
10-VIII-1975	Kashi-no-ana, Mitsushima-chô, Nagasaki Pref.			1	1*
<i>Rhinolophus cornutus</i>					
26-V-1965	Dugout, Chitose, Hokkaido	4	2		6***
26-XI-1972	Matsuginari-no-ana, Shiiba-son, Miyazaki Pref.	2	3		5***
7-XII-1973	Korakan-ana, Nomura-chô, Ehime Pref.	2			2**
11-XI-1974	Enkokakura-kutsu, Sannohe-chô, Aomori Pref.		2		2***
15-XII-1974	Kashi-no-ana, Mitsushima-chô, Tsushima, Nagasaki Pref.			1	1###
15-XII-1974	Kashi-no-ana, Mitsushima-chô, Tsushima, Nagasaki Pref.	1			1***
6-III-1975	Rakan-ana, Nomura-chô, Ehime Pref.		1		1***
8-III-1975	Ja-no-ana, Yusuhara-chô, Kôchi Pref.	2			2***
12-VI-1975	Iharayama-haikô, Itoshima-gun, Fukuoka Pref.		1		1**
2-XI-1975	Seiryû-dô, Nariha-chô, Okayama Pref.	1			1***
2-XI-1975	Ôtauchi-dô, Hachiman-chô, Gifu Pref.		1		1***
23-XI-1975	Nojiri-dô, Wara-mura, Gifu Pref.	1			1***
<i>Rhinolophus ferrumequinum</i>					
5-V-1968	Kochino-dô, Mugegawa-chô, Gifu Pref.	10	15		25**
7-III-1969	Akiyoshi-dô, Shûhō-chô, Yamaguchi Pref.		1		1**
6-III-1969	Hakusan-gongen-no-ana, Nozu-chô, Ôita Pref.	7	6		13**
2-XI-1969	Kimen-dô, Niimi-shi, Okayama Pref.	5	6		11**
2-XI-1969	A dead pit of copper ore, Takahashi-shi, Okayama Pref.	2	1		3**
4-VIII-1970	Oni-no-iwaya, Tôjô-chô, Hiroshima Pref.	3	3		6**
6-VIII-1970	Inuze-tunnel, Jinseki-chô, Hiroshima Pref.	1	1		2**
3-XI-1970	Ryûga-dô, Tosayamada-chô, Kôchi Pref.	1			1**
15-III-1971	Bitchû-kanachi-ana, Hokubô-chô, Okayama Pref.	2	2		4**

Date	Localities	No. of nematodes harbored			
		Male	Female	Larva	Total
15-III-1971	Rashômon, Niimi-shi, Okayama Pref.		3		3**
15-III-1971	Uyama-dô, Niimi-shi, Okayama Pref.		1		1**
21-VII-1971	Oni-no-ana, Katsuyama-chô, Okayama Pref.		1		1**
25-VIII-1971	Fûshin-dô, Mifune-chô, Kumamoto Pref.		1		1**
26-VIII-1971	Ôhse-dô, Kuma-son, Kumamoto Pref.	1	1		2**
31-X-1971	Rashômon, Niimi-shi, Okayama Pref.	3	3		6**
31-X-1971	Uyama-dô, Niimi-shi, Okayama Pref.	5			5**
31-X-1971	Futatsuki-no-ana, Niimi-shi, Okayama Pref.	2	6		8**
22-XI-1971	Nichikô-dô, Sakamoto-son, Kumamoto Pref.	5	7		12**
22-XI-1971	Yamaguchi-dô, Itsuki-son, Kumamoto Pref.	4	3		7**
22-XI-1971	Seme-no-ana, Itsuki-son, Kumamoto Pref.	5	12		17**
23-XI-1971	Hakiai-dô, Itsuki-son, Kumamoto Pref.	1			1**
23-XI-1971	Tsuzurase-dô, Itsuki-son, Kumamoto Pref.	1			1**
29-I-1972	Saruta-dô, Hidaka-son, Kôchi Pref.	1	1		2**
29-I-1972	Tsukiike-daini-dô, Sakawa-chô, Kôchi Pref.	1	1		2**
28-X-1972	Karyû-dô, Honjô-son, Ôita Pref.	18	17		35**
28-X-1972	Onagara-dô, Saiki-shi, Ôita Pref.	2	1		3**
28-X-1972	Onagara-dô, Saiki-shi, Ôita Pref.	1	11		12**
24-XI-1972	Tsugenotaki-dô, Takachiho-chô, Miyazaki Pref.	3	5		8**
24-XI-1972	Drainage canal, Takachiho-chô, Miyazaki Pref.		3		3**
25-XI-1972	Dôshidaki-no-ana, Morozuka-chô, Miyazaki Pref.	14	15		29**
25-XI-1972	Nakatô-shin-dô, Shiiba-son, Miyazaki Pref.	4	3		7**
2-XII-1972	Tsuchihashi-no-ana, Niimi-shi, Okayama Pref.	3	12		15**
3-XII-1972	Iwaya-dô, Hokubô-chô, Okayama Pref.	6	3		9**
6-V-1973	Gongen-ana, Kawanabe-chô, Kagoshima Pref.	1	1		2**
20-V-1973	Byôbuiwa-no-ana, Suzuka-shi, Mie Pref.		1		1**
29-VIII-1973	Kômorikutsu, Oga-shi, Akita Pref.	2	1		3**
30-VIII-1973	Enkokakura-kutsu, Sannohe-chô, Aomori Pref.	1	4		5**
1-XI-1973	Hakusan-gongen-no-ana, Nozu-chô, Ôita Pref.	15	7		22**
2-XI-1973	Obirano-dô, Miyakonojô-shi, Miyazaki Pref.	5	4		9**
2-XI-1973	Kurokawa-dô, Fukiage-chô, Kagoshima Pref.		2		2**
2-XI-1973	Kurokawa-dô, Fukiage-chô, Kagoshima Pref.	1			1**
3-XI-1973	Kakurenenbutsu-no-ana, Fukiage-chô, Kagoshima Pref.	6	10		16**
4-XI-1973	Gongen-ana, Kawanabe-chô, Kagoshima Pref.	1			1**
4-XI-1973	Kumaso-ana, Kinpô-chô, Kagoshima Pref.	3	3		6**
4-XI-1973	Kumaso-ana, Kinpô-chô, Kagoshima Pref.	1	2		3**
9-XI-1973	Anaseko-no-ana, Kawakami-chô, Okayama Pref.	5	4		9**

Table 1 (continued)

Date	Localities	No. of nematodes harbored			
		Male	Female	Larva	Total
11-XI-1973	Shinchi-no-ana, Misumi-chô, Kumamoto Pref.	5	9		14**
18-XI-1973	Yato-dô, Tsukumi-shi, Ôita Pref.	44	46	4	94**
19-XI-1973	Shizushi-dô, Mizuho-chô, Kyoto Pref.		1		1**
26-II-1974	Oni-no-iwaya, Tôjô-chô, Hiroshima Pref.	3	1		4**
26-II-1974	Oni-no-iwaya, Tôjô-chô, Hiroshima Pref.	18	12	6	36**
23-VII-1974	Jigokugokuraku-dômon, Kasumi-chô, Hyôgo Pref.		1		1###
23-VII-1974	Jigokugokuraku-dômon, Kasumi-chô, Hyôgo Pref.			1	1###
23-VII-1974	Jigokugokuraku-dômon, Kasumi-chô, Hyôgo Pref.	2	2		4**
23-VII-1974	Jigokugokuraku-dômon, Kasumi-chô, Hyôgo Pref.	5	4		9**
23-VII-1974	Jigokugokuraku-dômon, Kasumi-chô, Hyôgo Pref.	2	5		7**
10-XI-1974	Enkokakura-kutsu, Sannohe-chô, Aomori Pref.	1	1		2**
15-XII-1974	Kashi-no-ana, Mitsushima-chô, Nagasaki Pref.	2			2**
15-XII-1974	Kashi-no-ana, Mitsushima-chô, Nagasaki Pref.		1		1**
21-III-1975	Yato-dô, Tsukumi-shi, Ôita Pref.	1			1**
21-III-1975	Hikarimizu-dô, Kitakyûshû-shi, Fukuoka Pref.	1	2		3**
21-III-1975	Hikarimizu-dô, Kitakyûshû-shi, Fukuoka Pref.	1	2		3**
22-III-1975	Seiryû-kutsu, Kitakyûshû-shi, Fukuoka Pref.	2	1		3**
8-VIII-1975	Dugout, Tsushima, Nagasaki Pref.	2	5		7**
9-XI-1975	Inunaki-C-dô, Hachiman-chô, Gifu Pref.	1	3		4**
9-XI-1975	Inunaki-C-dô, Hachiman-chô, Gifu Pref.	1			1*
23-XI-1975	Nojiri-B-dô, Wara-mura, Gifu Pref.	1	2		3**
23-XI-1975	Nojiri-B-dô, Wara-mura, Gifu Pref.		1		1**
23-XI-1975	Nojiri-D-dô, Wara-mura, Gifu Pref.	3	3		6**
23-XI-1975	Nojiri-D-dô, Wara-mura, Gifu Pref.	1			1**

* *Molinostrongylus rhinolophi*. ** *Strongylacantha pretoriensis*. *** *Strongylacantha rhinolophi*.

Unidentified due to damaged condition. ## Unidentified for larval form. ### *Rictularia* sp. (will be described as a new species in the next paper).

Table 2
Comparison of *Strongylacantha pretortensis* and *S. rhinolophi* from bats in Japan.

Species	<i>S. pretortensis</i>				<i>S. rhinolophi</i>			
	Kagei & Sawada (1973)		Kagei & Sawada (1973)		Kagei & Sawada (1973)		Yamaguti (1935)	
Reporter	Male	Female	Male	Female	Male	Female	Male	Female
Sex	41	42	11	7				
No. of examples								
Body length	5.30-8.84 mm	6.05-10.66 mm	3.59-7.12 mm	5.56-10.42 mm	5.7-6.6 mm	6.3-10.44 mm		
Body width	0.21-0.36	0.20-0.46	0.09-0.17	0.17-0.25	0.14-0.18	0.14-0.2		
Mouth hook length	52.6 (49.7-57.3) μ		37.1-41.4 μ		34-39 μ			
Esophagus length	0.70-0.90	0.70-0.95	0.49-0.58	0.56-0.65	0.5-0.59			
Esophagus width	0.08-0.15	0.10-0.18	0.05-0.08	0.08	0.06-0.08			
Nerve ring	0.23-0.32	0.23-0.34	0.21-0.26	0.21-0.23				
Spicules (Right)	0.30-0.40		140-160 μ		162-165 μ			
(Left)	0.31-0.44		150-155 μ					
Gubernaculum	0.13-0.19		50-70 μ		78-95 μ			
Vulva		3.94-6.90 (58.5-67.1)		3.32-6.44 (57.5-61.8)				
Tail		0.10-0.16		0.11-0.15				
Eggs (length)		99.7 (94.0-108.8) μ		90.7 (88.6-92.9) μ				0.11-0.14
(width)		56.5 (52.2-60.9) μ		56.7 (53.6-58.6) μ				86-95 μ
Host	<i>Rhinolophus ferrumequinum</i>		<i>Rhinolophus cornutus</i>					53-59 μ
	<i>R. cornutus</i>		<i>Miniopterus schreibersii</i>					<i>Rhinolophus cornutus</i>

mouth arise two brownish strongly curved teeth directed outward and backward: 37.1–41.4 μ long (Figs. 1–3). Anteriorly directed small lanceolate tooth present on the dorsal wall of the mouth (arrow in Fig. 3). Excretory pore situated very forward, just behind the buccal aperture (52.0 μ from the anterior end). Nerve ring (NR in Fig. 1) 0.21–0.26 mm from the head. The posteriorly enlarged esophagus is 0.49–0.58 mm long by 0.08 mm broad in the female.

Male. The ventral ray of the bursae (ventroventral and lateroventral; V in Fig. 4) is cleft; the externolateral (El in Fig. 4) arises from a common trunk; the mediolateral (Ml in Fig. 4) and the posterolateral (Pl in Fig. 4) are separated and parallel; the externodorsal (Ed in Fig. 5) arises separately from the base of the dorsal ray, whose ends form six small branches near its bifid tip (Fig. 5). The arrangement and size of these branches are variable. Spicules (Fig. 6) fairly thick, brown, and nearly equal (140–160 and 150–155 μ long), each bifurcated for its half.

The simple gubernaculum (G in Fig. 6) with pointed end is 50–70 μ long, and has a posteriodorsally directed muscular band attached to its slender anterior end.

Female. Tail conical, 0.11–0.15 mm long and terminated in a delicate terminal point surrounded by four (a large dorsal, a ventral and two subventral) projections; ventral projection is an acute slender spine (Fig. 7). Vulva (Fig. 8) divided the body length for its 57.5–61.8 per cent (3.32–6.44 mm) from the anterior end. There are 80–130 eggs in each uterus divided into anterior and posterior parts. The elongated oval, thin-shelled eggs in the four cell stages are 90.77 (88.6–92.0) μ long by 56.6 (53.6–58.6) μ broad under cover glass pressure (Fig. 9).

Discussion. This species differs from *S. pretoriensis* Ortlepp, 1932, chiefly in the body size, the shape, colour and size of the ventral hooks, and the length of the spicules and gubernaculum, as shown in Table 2.

This is the first record in Japan of the present species found from *Miniopterus shreibersii*.

Strongylacantha pretoriensis Ortlepp, 1932

Many worms, both adults and larvae, of this species were found in the small intestine of *Rhinolophus ferrumequinum* collected from various parts of Japan, and also of *R. cornutus* collected in Ehime Prefecture and Hokkaido (Table 1). From these results, it seems probable that the definitive host of *S. pretoriensis* is *R. ferrumequinum*. This species was re-described by the authors (1973 a), and the measurements for these nematodes are shown in Table 2.

Molinostrongylus rhinolophi Yamaguti, 1941

Eight males, six females and one larva of this species were found in the small intestine of *Miniopterus shreibersii* collected in the prefectures of Miyazaki, Yamaguchi, Nagasaki and Fukuoka (Table 1). Although it was redescribed by the present authors (1973 b), some accounts are supplemented as given below.

There are 2-3 eggs in each uterus of the female; they are into anterior and posterior. The elongated oval, thin-shelled eggs in the one-cell stage are 85.0 (76.8-95.0) μ by 46.0 (37.7-55.7) μ broad in uterus under cover glass pressure.

ERRATUM

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Part 3—→Part 4

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