

Further Studies on Cestode Parasites of Taiwanese Bats

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Abstract

Two new and four known species (including one unidentified species) of the genus *Vampirolepis* were obtained through the examination of 28 specimens of bats belonging to eight species of eight genera (including two unidentified species) collected at four regions of Taiwan during the period from March to October, 1995. The following cestodes are recovered: *Vampirolepis kengtingensis* sp. nov., *V. coelopsis* sp. nov., *V. urawaensis* Sawada, 1989, *V. hipposideri* Prudhoe et Manger, 1969, *V. taiwanensis* Sawada, 1984 and *V. sp.*

Key words: Taiwanese bats; hymenolepidid cestodes.

Introduction

Up to 1995, four papers have been published on cestode parasites of Taiwanese bats. Sawada (1984) first described *Vampirolepis taiwanensis* from *Miniopterus schreibersii fuliginosus* and *V. macrostrobiloides* from *Hipposideros armiger terasensis*. After that, Sawada and Harada (1988a, 1988b and 1988c) described *V. isensis* from *Rhinolophus monoceros*, *V. brachysoma* from *Hipposideros armiger terasensis* and *Hymenolepis scotophili* from *Scotophilus kuhli*.

This work presents new faunistic data and is to define more exactly the distribution of cestodes occurring in the bats of Taiwan.

Materials and Methods

From March to October, 1995, 28 specimens of bats belonging to eight species of eight genera (including two unidentified species) were captured alive and were autopsied immediately at the collecting sites. Their alimentary canals were cut open to extract endoparasites as soon as possible and fixed

in Carnoy's fluid. The cestodes were washed with water and stained with alum carmine, dehydrated in alcohol, cleared in xylene, and mounted in permount. All measurements are given in millimeters.

Results

Two new and four known species (including one unidentified species) of cestodes were obtained from eight species (including two unidentified species) of bats. The data concerning the species of cestodes obtained are shown in Table 1.

Vampirolepis Spassky, 1954
Vampirolepis kengtingensis sp. nov.
(Figs. 1–4)

On March 23, 1995, a specimen of Formosan horseshoe bat, *Rhinolophus formosae* was captured in a limestone cave at Kengting, Henchun Chen, Pingtung County. The bat was found infected with two specimens of the present new species.

Description. Small-sized hymenolepidid; strobila 18–26 in length and 0.8–0.9 in maximum width. Metamerism distinct, segment margins serrate. Scolex globular, 0.168–0.184 long and 0.180–0.192 wide, distinctly set off from neck region. Rostellum 0.060–0.064 long and 0.032–0.036 wide, armed with a crown of 26 small hooks, each measuring

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Table 1 Bats examined and their cestode parasites in Taiwan in 1995

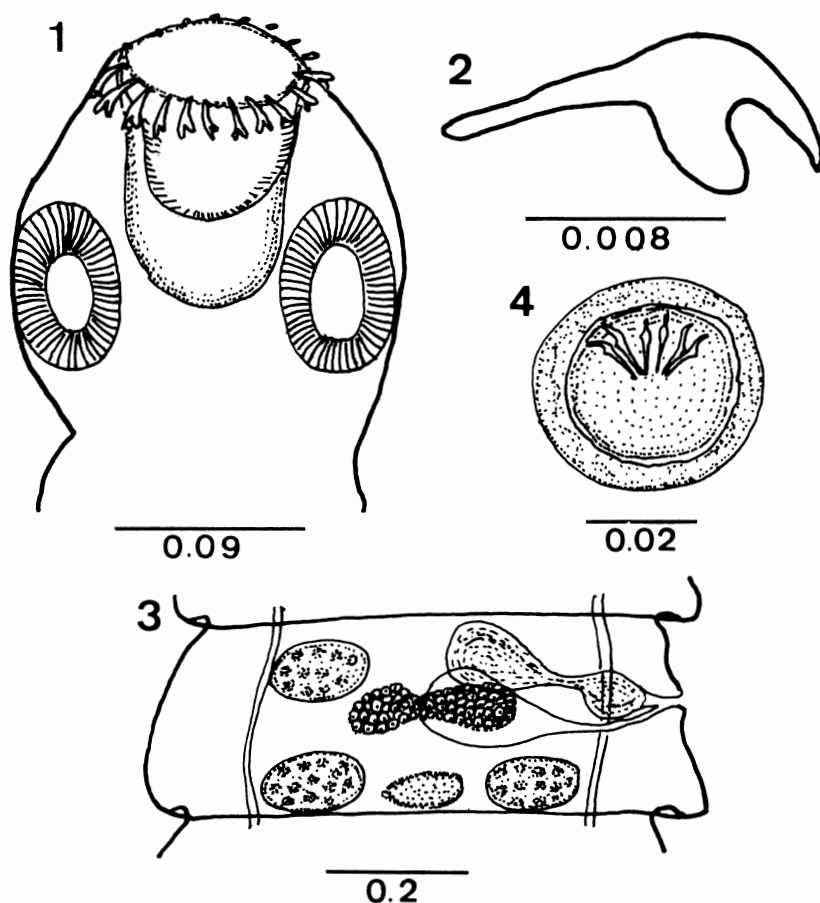
Host Locality	Date	Number of bats		Cestode infected	
		examined	infected	Species	No.
<i>Coelops frithii</i>					
Kengting, HENCHUN CHEN, PINGTUNG COUNTY	Mar. 23	3	0	–	
Kengting, HENCHUN CHEN, PINGTUNG COUNTY	Oct. 7	6	2	<i>Vampirolepis coelopsis</i> sp. nov. <i>V. hipposideri</i>	3 9
<i>Rhinolophus formosae</i>					
Kengting, HENCHUN CHEN, PINGTUNG COUNTY	Mar. 23	1	1	<i>V. kengtingensis</i> sp. nov.	2
Tsuifeng, NANTOU COUNTY	Oct. 10	1	0	–	
<i>Miniopterus schreibersii</i>					
Kengting, HENCHUN CHEN, PINGTUNG COUNTY	Mar. 20	2	0	–	
Tsuifeng, NANTOU COUNTY	Oct. 10	1	1	<i>V. taiwanensis</i>	1
<i>Pipistrellus abramus</i>					
Neipu, PINGTUNG COUNTY	Mar. 23	7	3	<i>V. urawaensis</i>	many
<i>Hipposideros terasensis</i>					
Kengting, HENCHUN CHEN, PINGTUNG COUNTY	Mar. 23	2	0	–	
Chungliso, NANTOU COUNTY	Oct. 6	2	0	–	
<i>Myotis</i> sp.					
Tsuifeng, NANTOU COUNTY	Oct. 10	1	1	<i>Vampirolepis</i> sp.	1
<i>Plecotus taivanus</i>					
Tsuifeng, NANTOU COUNTY	Oct. 10	1	0	–	
<i>Barbastella</i> sp.					
Tsuifeng, NANTOU COUNTY	Oct. 10	1	0	–	

0.016 long. Hook handle comparatively long; guard prominent, round at its end, approximately equal in length to blade or slightly longer than blade; blade sharp at its end. Rostellar sac oval, 0.072–0.080 long and 0.068–0.072 wide. Neck 0.19–0.26 long and 0.16–0.19 wide.

Genital pores unilateral, located at middle of segment margins. Testes three in number, subspherical, 0.048–0.060 by 0.028–0.032, arranged in a form of triangle, one poral and two aporal, not in contact with longitudinal osmoregulatory canals laterally. Cirrus sac pyriform, 0.060–0.068 long and 0.016–0.024 wide, expanding beyond longitudinal

osmoregulatory canal. Internal seminal vesicle 0.032–0.044 long and 0.020–0.028 wide, occupying almost whole of cirrus sac. External seminal vesicle oval, 0.040–0.046 long and 0.028–0.032 wide. Vagina initially posterior to cirrus sac, gradually expanding into seminal receptacle measuring 0.048–0.052 long and 0.024–0.028 wide. Ovary transversely elongate, bilobate, 0.060–0.064 across. Vitelline gland compact, 0.032–0.040 by 0.012–0.020. Eggs spherical or oval, 0.034–0.036 in diameter. Onchospheres spherical, 0.024–0.028 in diameter; embryonic hooks 0.014 long.

Host: Rhinolophus formosae Sanborn, 1939.



Figs. 1–4 *Vampirolepis kengtingensis* sp. nov.

1: Scolex. 2: Rostellar hook. 3: Mature segment. 4: Egg. Scales in mm.

Site of infection: Small intestine.

Locality and date: Kengting, Henchun Chen, Pingtung County; March 23, 1995.

Type specimen: Holotype, Sawada's Lab. Coll. No. 9601; paratype, No. 9602.

Remarks: Out of 74 known species of the *Vampirolepis* from bats, nine; *V. artibeii* Zdzitowiecki et Rutkowska, 1980, *V. brevihamata* Sawada, 1988, *V. haradai* Sawada, Harada et Kobayashi, 1984, *V. iraqensis* Sawada et Molan, 1988, *V. iriomotensis* Sawada, 1983, *V. longicollaris* Sawada et Harada, 1985, *V. mesopotamiana* Sawada et Mohammad, 1989, *V. taiwanensis* Sawada, 1984 and *V. yakushimaensis* Sawada, 1987, are armed with 24–28 rostellar hooks in the range of 0.013–0.019 long

(Table 2). The present new species most closely resembles *V. mesopotamiana* from *Asellia tridens murraiana* of Iraq in the shape of rostellar hooks. However, it differs from that in the arrangement of testes (triangular distribution vs. transverse row) and the morphological feature of egg inner membrane (no polar filaments vs. provided with polar filaments).

Vampirolepis urawaensis Sawada, 1989

Vampirolepis urawaensis Sawada, 1989, pp. 226–231, figs. 2–6.

On March 23, 1995, seven specimens of Japanese pipistrelle, *Pipistrellus abramus* were cap-

Table 2 A comparison of the related species of *Vampirolepis* armed with 24–28 rostellar hooks in range of 0.013–0.019 mm long from bats

Species	Rostellar hook		Host
	number	length	
1. <i>Vampirolepis artibeii</i>	20–27	0.019–0.020	<i>Artibeus jamaicensis parvipes</i>
2. <i>V. brevipalmata</i>	26	0.018	<i>Myotis nattereri bombinus</i>
3. <i>V. haradai</i>	24–25	0.0175	<i>Miniopterus magnater</i>
4. <i>V. iraqensis</i>	24	0.018	<i>Taphozous nudiventris</i>
5. <i>V. iriomotensis</i>	28	0.018–0.021	<i>Rhinolophus imaizumii</i>
6. <i>V. longicollaris</i>	28	0.018	<i>Rhinolophus coelophyllus</i>
7. <i>V. mesopotamiana</i>	27–28	0.018	<i>Asellia tridens murraiana</i>
8. <i>V. taiwanensis</i>	22–24	0.018–0.021	<i>Miniopterus schreibersii fuliginosus</i>
9. <i>V. yakushimaensis</i>	28–35	0.021	<i>Murina aurata ussuriensis</i>
<i>V. kengtingensis</i> sp. nov.	26	0.016	<i>Rhinolophus formosae</i>

tured around a house at Neipu, Pingtung County. On dissection, three were found infected with a number of specimens of this cestode. They were fully mature, but not gravid.

Description. Small-sized hymenolepidid; worm 7.2–13.6 in length and 0.5–0.8 in maximum width. Scolex 0.128–0.140 long and 0.092–0.100 wide. Rostellum mushroom-shaped, 0.072–0.080 long and 0.056–0.072 wide, armed with a single circle of 23–25 spanner-shaped hooks measuring 0.024–0.025 long (Fig. 5, a). Hook handle slender and slightly curved against guard; guard bulky, protrusive and round at its end, shorter than blade; blade remarkably curved and sharp at its end. Rostellar sac elongate, 0.108–0.120 long and 0.064–0.072 wide. Suckers discoid, 0.048–0.052 by 0.040–0.048.

Genital pores unilateral, located a little anterior to or at middle of each segment. Testes three in number, spherical or subspherical, 0.052–0.060 by 0.032–0.040, arranged in a transverse row, one poral and two aporal. Cirrus sac pyriform, 0.090–0.104 long and 0.028–0.036 wide, extending beyond osmoregulatory canal. Internal seminal vesicle 0.032–0.044 long and 0.024–0.028 wide, occupying almost whole of cirrus sac. External seminal vesicle 0.040–0.048 long and 0.028–0.032 wide. Seminal receptacle 0.060–0.072 long and 0.028–0.032 wide. Ovary prominent, frequently irregularly lobate, 0.100–0.120 across. Vitelline gland trilobate, 0.052–0.056 long and 0.028–0.032 wide.

Remarks. That *Vampirolepis urawaensis* is parasitic on *Pipistrellus abramus* in Taiwan and Japan suggests that the bat of Taiwan has distributional connection with that of Japan.

Vampirolepis coelopsis sp. nov.
(Figs. 6–8)

On October 7, 1995, six specimens of tailless leaf-nosed bats, *Coelops frithii* were captured in a tunnel at Kengting, Henchun Chen, Pingtung County. Two of them each were found infected with three specimens of *Vampirolepis coelopsis* sp. nov. and nine of specimens of *V. hipposideri* (Prudhoe et Manger, 1969). All of the former were fully mature, but not gravid.

Description. Small-sized hymenolepidid; total

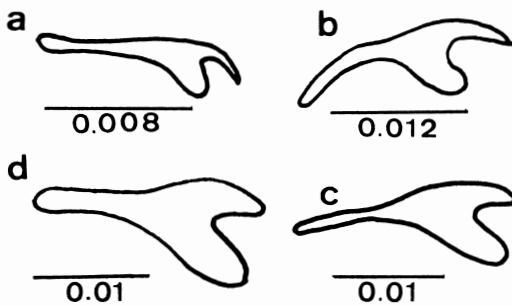


Fig. 5 Rostellar hook. a: *Vampirolepis urawaensis*. b: *V. hipposideri*. c: *V.* sp. d: *V. taiwanensis*. Scales in mm.

length of worm 1.4–1.6; maximum width 0.17–0.21. Metamerism distinct, craspedote, segments slightly serrate. All segments wider than long. Scolex 0.233–0.250 long and 0.267–0.292 wide, distinctly set off from neck region. Rostellum 0.064–0.068 long and 0.060–0.064 wide, armed with a single row of 16–18 small hooks, each measuring 0.032 long. Hook handle long and attenuate; guard prominent, round at its end, slightly longer than blade; blade sharp at its end. Rostellar sac elongate, 0.100–0.108 long and 0.072–0.076 wide. Suckers oval, 0.056–0.060 long and 0.048–0.052 wide.

Genital pores unilateral, located a little anterior to middle of each segment. Testes three in number, subspherical, 0.024–0.030 by 0.030–0.040, arranged in a form of triangle, one poral and two aporal, not in contact with longitudinal osmoregulatory canals laterally. Cirrus sac pyriform, 0.050–0.054 long and 0.030–0.036 wide, expanding beyond longitudinal

osmoregulatory canal. Internal seminal vesicle 0.030–0.034 long and 0.024–0.028 wide, occupying almost whole of cirrus sac. External seminal vesicle 0.036–0.040 long and 0.028–0.030 wide. Vagina initially posterior to cirrus sac, gradually expanding into seminal receptacle measuring 0.042–0.044 long and 0.036–0.040 wide. Ovary bilobate, 0.030–0.034 across. Vitelline gland compact.

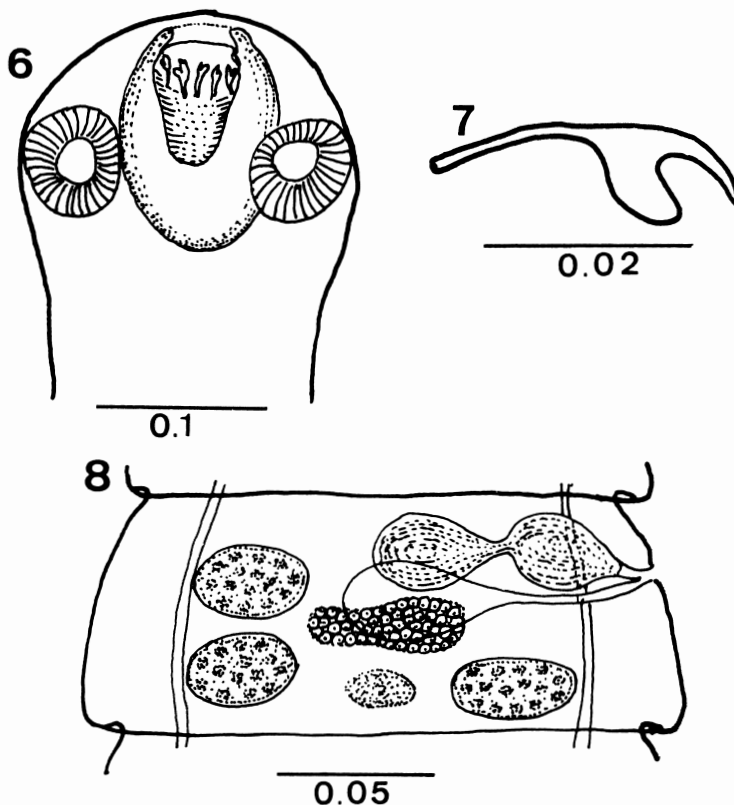
Host: Coelops frithii Blyth, 1848.

Site of infection: Small intestine.

Locality and date: Kengting, Henchun Chen, Pingtung County; October 7, 1995.

Type specimen: Holotype, Sawada's Lab. Coll. No. 9603.

Remarks. So far as known to the authors, 74 species of the genus *Vampirolepis* have been recorded hitherto from bats throughout the world (Sawada, 1990, Sawada and Yasuma, 1994). However, the present new species differs from all of them



Figs. 6–8 *Vampirolepis coelopsis* sp. nov.

6: Scolex. 7: Rostellar hook. 8: Mature segment. Scales in mm.

in the number, length and shape of rostellar hooks.

Vampirolepis hipposideri
(Prudhoe et Manger, 1969)

Hymenolepis hipposideri Prudhoe et Manger, 1969, pp. 131–143, figs. 7–8.

Description. Small-sized hymenolepidid; worm 12.3–15.6 in length and 0.9–1.2 in maximum width. Scolex 0.112–0.132 long and 0.100–0.120 wide, not demarcated from neck region. Rostellum 0.028–0.040 long and 0.028–0.032 wide, armed with a crown of 12 small hooks, each measuring 0.018 long. Hook handle comparatively long, guard round at its end, approximately equal in length to blade; blade sharp at its end (Fig. 5, b). Rostellar sac 0.060–0.068 long and 0.032–0.040 wide. Neck 0.020–0.024 long and 0.10–0.13 wide.

Genital pores unilateral, located at middle of lateral margins of segments. Testes three in number, subspherical, 0.080 by 0.040, arranged in a form of triangle, one poral and two aporal. Cirrus sac pyriform, 0.10–0.12 long and 0.040–0.048 wide, expanding beyond longitudinal osmoregulatory canal. Internal seminal vesicle 0.04–0.06 long and 0.028–0.032 wide, occupying almost whole of cirrus sac. External seminal vesicle oval, 0.060–0.072 long and 0.036–0.040 wide. Seminal receptacle prominent, 0.060–0.080 long and 0.048–0.052 wide. Ovary transversely elongate, bilobate, 0.140–0.160 across. Vitelline gland compact, 0.032–0.036 by 0.060–0.068. Eggs oval or spherical, 0.040 by 0.036. Onchospheres spherical, 0.032–0.046 in diameter; embryonic hooks 0.014 long.

Vampirolepis taiwanensis Sawada, 1984

Vampirolepis taiwanensis Sawada, 1984, pp. 327–331, figs. 3–6.

On October 10, 1995, one specimen of *Miniopterus schreibersii* was captured by mist net spread in the forest at Tsuifeng, Nantou County. On investigation, the bat was found infected with one specimen of this cestode. This species has been described in detail by Sawada (1984). Rostellum 0.084–0.088 long and 0.063–0.079 wide, armed with a single row of 22–25 hooks measuring 0.018–0.020 long (Fig. 5, c).

Vampirolepis sp.

On October 10, 1995, one specimen of *Myotis* sp. was captured by mist net spread in the forest at above-mentioned place. On dissection, the bat contained one minute juvenile cestode belonging to the genus *Vampirolepis*.

Description. Juvenile worm 10.2 long and 0.8 wide. Scolex 0.508 long and 0.525 wide. Rostellum 0.125 long and 0.101 wide, armed with a single row of 28 small hooks measuring 0.022 long (Fig. 5, d). Rostellar sac 0.192 long and 0.167 wide. Suckers round, 0.084–0.101 by 0.067–0.084. Mature and gravid segments unknown.

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