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Studies on the Cestode Fauna of Bats from Sabah, East Malaysia

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Key words: chiroptera, cestode fauna, *Vampirolepis*, East Malaysia

Introduction

The helminths of chiroptera in Borneo are little known, and it is therefore not surprising to find that four of the five species of cestodes obtained in North Borneo appear to be new. The bats were collected on Sabah, East Malaysia by Harada and Kobayashi, in 1979 and 1981, who kindly gave the first author an oppotunity to examine cestodes from bats.

Materials and Methods

The bats examined in the present study are 15 species from Sabah. The detailed locarities where the bat collections were made are shown on the map (Fig. 1). The bats captured were immediately autopsied at the collecting sites. Their alimentary canals were cut open as soon as possible, fixed in Carnoy's fluid, and brought to Japan. After the alimentary canals were soaked in 45 % acetic acid for 30 minutes for expanding, they were stored in 70 % alcohol. Cestodes, obtained from the alcohol-preserved alimentary canals, were stained with Heidenhain's iron hematoxylin, dehydrated in alcohol, cleared in xylene, and mounted in Canada balsam. Measurements are given in millimeters.

Results

Bats examined and cestodes obtained are shown in Table 1. The cestodes found were the following species: *Vampirolepis copihamata* sp. n., *V. haradai* sp. n., *V. kobayashii* sp. n., *V. tadaridae* sp. n. and *V. hipposideri* (Prudhoe and Manger, 1969) comb. n. Jenzen and Howell, 1983.

Vampirolepis copihamata sp. n.
(Figs. 2-5)

A specimen of this cestode occured in the intestine of *Tadarida plicata* caught at Gommanton cave, Sabah, April 3, 1979.

Description. Small-sized hymenolepidid; mature strobila 14-18 in length and 1.6-2.1 in maximum width. Metamerism distinct, margins slightly serrate. All proglottides wider than long. Genital pores unilateral, located a little posterior to middle of proglottid margins. Scolex semewhat round when the rostellum is invaginated, 0.224 by 0.259, not demarcated from neck. Rostellum spherical, 0.105 in diameter, armed with a single circle of numerous small hooks. Hooks measuring 0.005-0.007; hook handle long; guard bluntly round at its end, slightly shorter than blade; blade sharp at its end. Rostellar sac oval, 0.161 by 0.119, extending posteriorly to suckers. Suckers discoidal, unarmed, 0.070-0.084 in diameter. Testes three in number, spherical, 0.035 by 0.084, arranged in a transverse row, one poral and two aporal. Cirrus sac pyriform, 0.091-0.098 long and 0.028 wide, not overreaching to the poral longitudinal osmoregulatory canal. Cirrus aspinose. Internal seminal vesicle, 0.049-0.063 by 0.028. External seminal vesicle elongated, 0.098 by 0.035. Vagina posterior to cirrus sac and external seminal vesicle. Seminal reseptacle elongated 0.070 by 0.035. Ovary transversely elongated, bilobed in ante-

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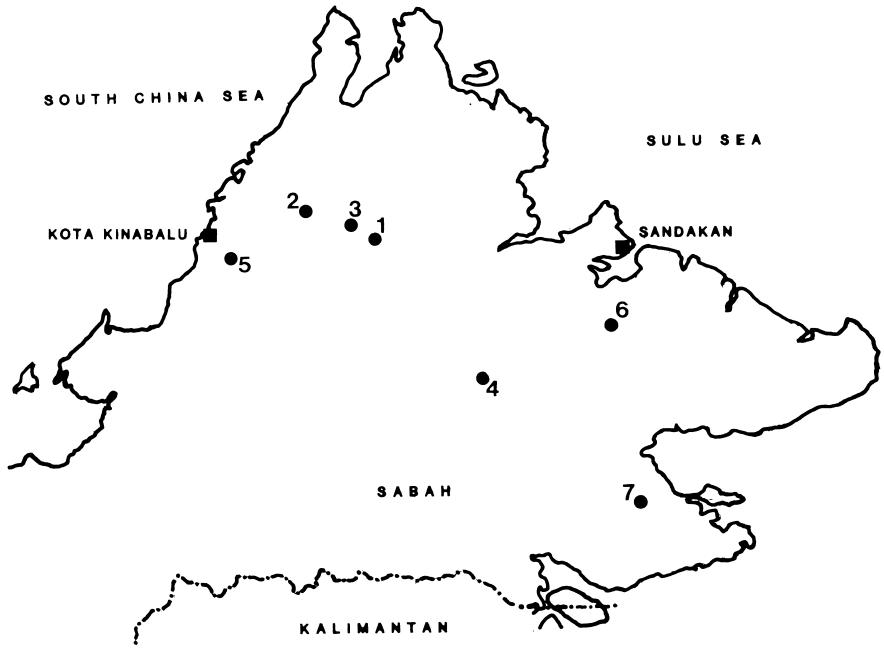


Fig. 1 Sketch map showing the collecting sites of bats on Sabah, Esat Malaysia. For the locality numbers, see Table 1.

rior half of proglottid. Vitelline gland compact, 0.035 by 0.018, just posterior to ovary. Uterus arising directly from ovarian lobes as a lobe sac, gradually enlarging, filling entire whole part of proglottid. Eggs spherical, 0.039 in diameter, surrounded by four envelopes, outer most chorion thick, with rough surface. Onchosphere spherical, 0.025 in diameter; embryonic hooks 0.014 long.

Type host. *Tadarida plicata*.

Site of infection. Small intestine.

Type locality and date. Gommanton cave, Sabah; March 3, 1979.

Type specimens. Holotype NUE Lab. Coll. No. 8401.

Remarks. The present new species closely resembles *Vampirolepis tadaridae* sp. n. from *Tadarida plicata* which is to be described later in the form of the scolex and the size of the eggs. However, it can be separated from *V. tadaridae* in the number and the size of the rostellar hooks (numerous vs. 45 and 0.005-0.007 vs. 0.028), in the position of genital pores (located a little posterior to middle of the proglottid margins vs. located a little anterior to middle of the proglottid margins) and in the arrangement of the testes (transverse row vs. triangular distribution).

Vampirolepis haradai sp. n.
(Figs. 6-9)

Seven bats, *Miniopterus magnater*, were collected at Head Quarters, Kinabalu, March 20, 1979. One of them was found infected with four specimens of this cestode.

Description. Small-sized hymenolepidid; mature worms 25-30 long and 0.8-1.2 wide. Metamerism distinct, craspedote, margins serrate. All proglottides wider than long. Scolex round when the rostellum is invaginated, 0.440-0.518 wide. Neck absent, segmentation commencing almost immediately posterior to scolex. Suckers round, 0.084-0.105 in diameter, unarmed, strongly muscular. Rostellum 0.095 by 0.056, armed with a single circle of 24-25 hooks 0.0175 long; hook handle long; guard bluntly round at its end, equal to blade in length. Rostellar sac 0.119 by 0.070, muscular, pyriform, not extend posterior suckers. Suckers round, 0.084-0.105

Table 1 Cestodes obtained from bats collected on Sabah, East Malaysia in 1979 and 1981

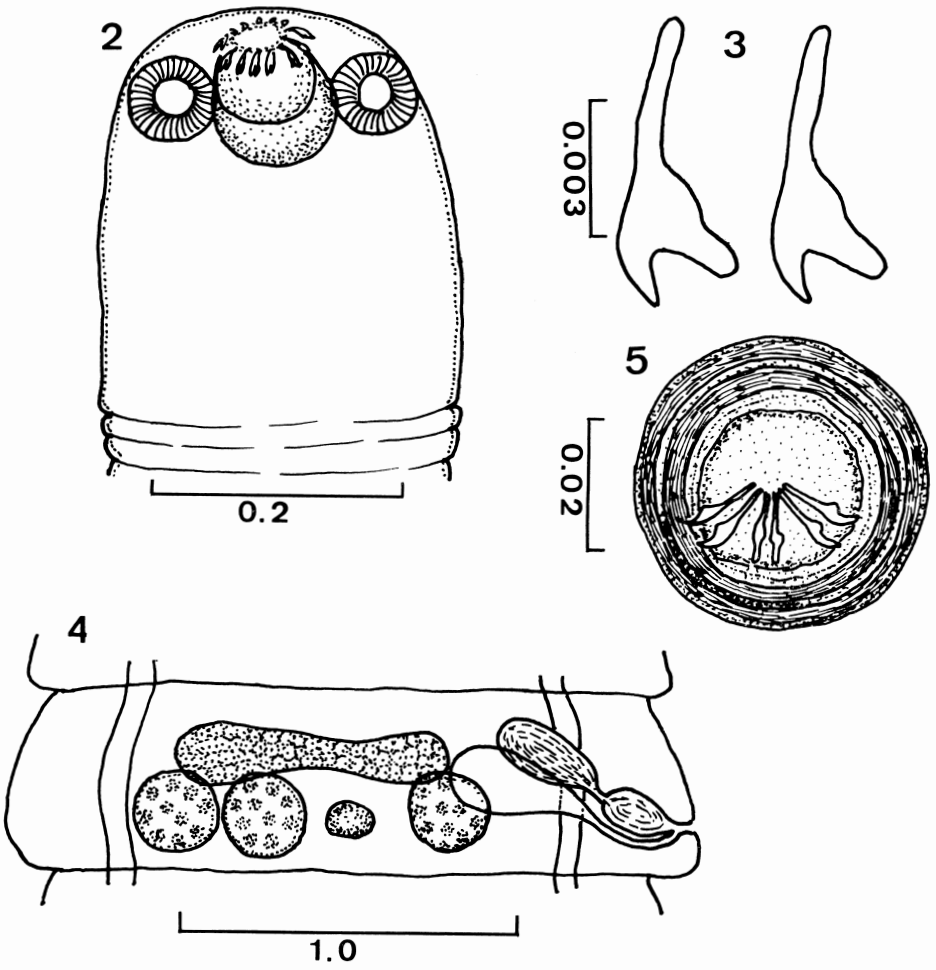
Serial no. of locality in Fig. 1	Locality	Date	Bat species	No. of bats examined	No. of bats infected	%	Cestode species
1	Fissure of rock-heap Ranau	19.III.1979	*Myotis siligorensis*	1	0	0	
2	Forest, Head Quarters Kinabalu	20.III.1979	*Aethalops alecto*	7	1	14	unidentified (no scolex)
			Miniopterus magnater	2	1	50	*Vampirolepis haradai* n. sp.
3	Lime grotto Poring	23.III.1979	*Macroglossus lagochilus*	2	0	0	
			Hipposiderus galeritus	12	1	8	*V. hipposideri*
			Emballonura rivalis	4	0	0	
		24.III.1979	*H. galeritus*	6	1	17	unidentified (no scolex)
		29.III.1979	*E. rivalis*	2	0	0	
		26.VIII.1979	*Penthetor lucasi*	3	0	0	
		27.VIII.1979	*H. diadema*	2	0	0	
4	Lime grotto Batu Puteh	24.III.1979	*E. rivalis*	1	0	0	
		1.IV.1979	*E. rivalis*	2	0	0	
			Rhinolophus creaghi	21	0	0	
			H. galeritus	1	0	0	
		1.VIII.1981	〃	12	1	8	*V. kobayashii* sp. n.
5	A gerret Penanpang	29.III.1979	*Scophilus temmincki*	1	0	0	
		31.III.1979	*H. galeritus*	5	0	0	
		29.VIII.1979	*S. temmincki*	16	2	13	unidentified (no scolex)
6	Lime grotto Gommanton	1.IV.1979	*H. diadema*	1	0	0	
		3.IV.1979	*Cynopterus bracyotis*	1	0	0	
			H. diadema	1	0	0	
			Tadarida plicata	9	2	22	*V. copihamata* sp. n. *V. tadaridae* sp. n.
7	Lime grotto Madai	10-VIII-1979	*R. philippinensis*	2	0	0	
		11-VIII-1979	〃	2	0	0	
			M. australis	2	0	0	
		12-III-1979	〃	4	0	0	
		13-III-1979	*R. creaghi*	4	0	0	

in diameter. Genital pores unilateral, located a little anterior to middle of proglottid margins, not protrude.

Teates three in number, spherical, 0.028–0.032 by 0.025–0.028, arranged in a transverse row, one poral and two aporal. Cirrus sac pyriform, 0.060 by 0.025, extending anterolaterally beyond osmoregulatory canal. Internal seminal vesicle, gradually enlarging to fill proximal portion of cirrus sac, measuring 0.025–0.028 by 0.018–0.020. External seminal vesicle, 0.053 by 0.018, directly dorsal to seminal receptacle, situated in anterior field of proglottid. Vagina initially posterior to cirrus sac, passing behind cirrus sac, gradually expanding into voluminous seminal receptacle measuring 0.025 by 0.014. Ovary transversely elongated and bilobed in mature proglottid, 0.075 by 0.035–0.089. Vitelline gland compact, lobed 0.018 by 0.018, situated near midline in space between first and second testes in posterior field of proglottid. Uterus saccular, filling enthire whole area of gravid proglottid. Eggs subspherical, 0.032 by 0.035–0.039; outermost chorion thick, with smooth surface; embryonic hooks 0.011 long.

Type host. *Miniopterus magnater*.

Site of infection. Small intestine.



Figs. 2-5 *Vampirolepis copihamata* sp. n.
2 : Scolex 3 : Rostellar hooks 4 : Mature proglottid 5 : Egg (Scales in mm)

Type locality and date. Head Quarter, Kinabalu ; March 20, 1979.

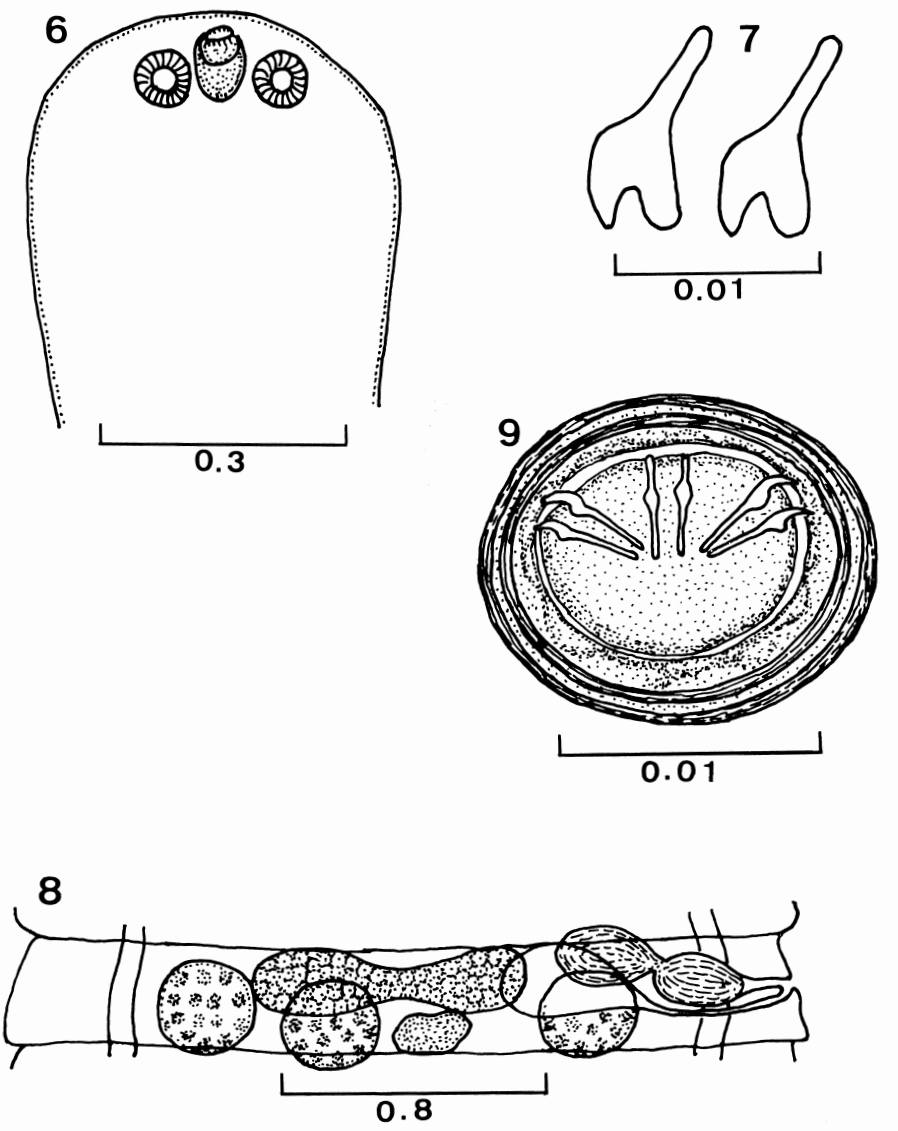
Type specimens. Holotype NUE Lab. Coll. No. 8402, Paratypes NUE Lab. Coll. No. 8403.

Remarks. *Vampirolepis haradai* closely resembles *V. taiwanensis* Sawada, 1984 from *M. schreibersii fuliginosus* in the form of scolex, in the number and the length of the rostellar hooks and the size of the suckers. However, it differs from *V. taiwanensis* in the arrangement of the testes (transverse row vs. triangular distribution), in the size of the onchosphere (0.021-0.028 by 0.041-0.018 vs. 0.028) and in the size of embryonic hooks (0.011 vs. 0.014).

Vampirolepis kobayashii sp. n.
(Figs. 10-12)

Of twelve bats, *Rhinolophus creaghi*, collected from lime grotto at Batu Putch on August 1, 1981, one was found infected with one specimen of this cestode. It was fully mature but gravid.

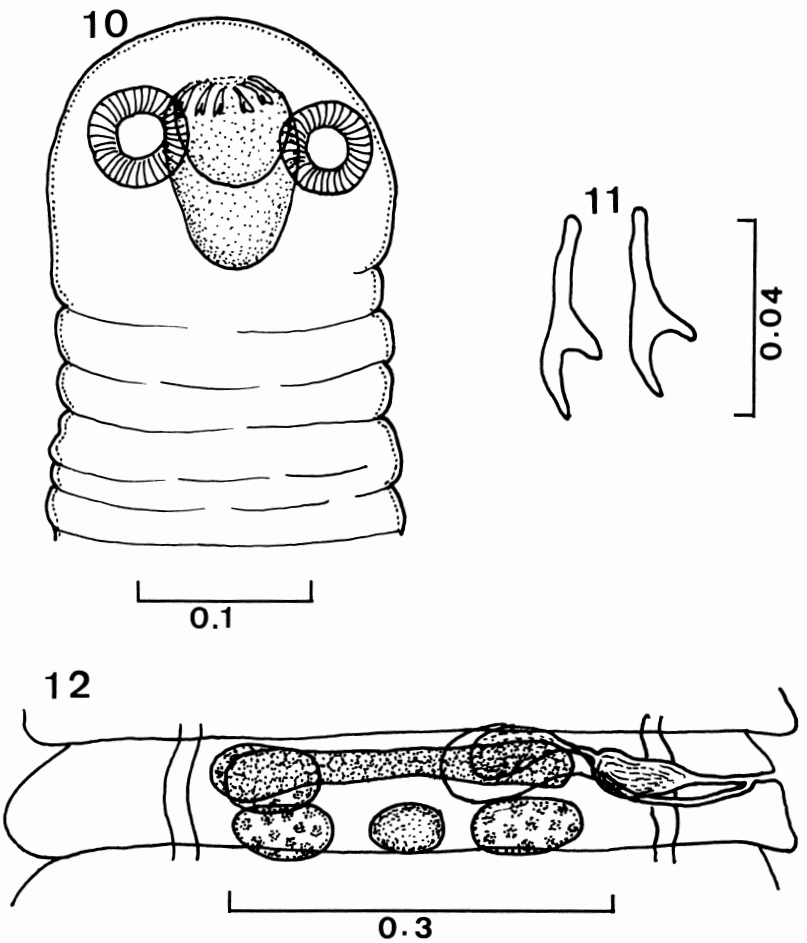
Description. Small-sized hymenolepidid ; strobila 15 long and 0.6 wide. Metamerism distinct, craspedote, margins slightly serrate. Scolex 0.210 by 0.182, not distinctly set off from neck. Rostellum spherical, 0.070 in diameter, armed with a single circle of 20 hooks



Figs. 6-9 *Vampirolepis haradai* sp. n.
6 : Scolex 7 : Rostellar hooks 8 : Mature proglottid 9 : Egg (Scales in mm)

0.0385 long. Hooks handle long ; guard slightly round at its end, shorter than blade ; blade sharp at its end. Rostellar sac 0.084 by 0.070, muscular, pyriform, extending posterior to suckers. Suckers round, 0.063 in diameter.

Genital pores unilateral, located a little anterior to middle of proglottid margins, not protrude. Testes three in number, oval, arranged in the form of triangle. External seminal vesicle, 0.070 by 0.028, directly dorsal to seminal receptacle, situated in anterior half of proglottid. Internal seminal vesicle, 0.070 by 0.035, gradually enlarges until filling proximal portion of cirrus sac. Cirrus sac, 0.105 by 0.028, extending beyond osmoregulatory canals. Ovary transversely elongated, 0.140-0.152 by 0.042, situated in anterior half posterior to ovary. Gravid proglottides unknown.



Figs. 10-12 *Vampirolepis kobayashii* sp. n.
10 : Scolex 11 : Rostellar hooks 12 : Mature proglottid (Scales in mm)

Type host. *Rhinolophus creaghi*.

Site of infection. Small intestine.

Type locality and date. Batu Putch, Sandakan ; August 1, 1981.

Type specimen. Holotype NUE Lab. Coll. No. 8404.

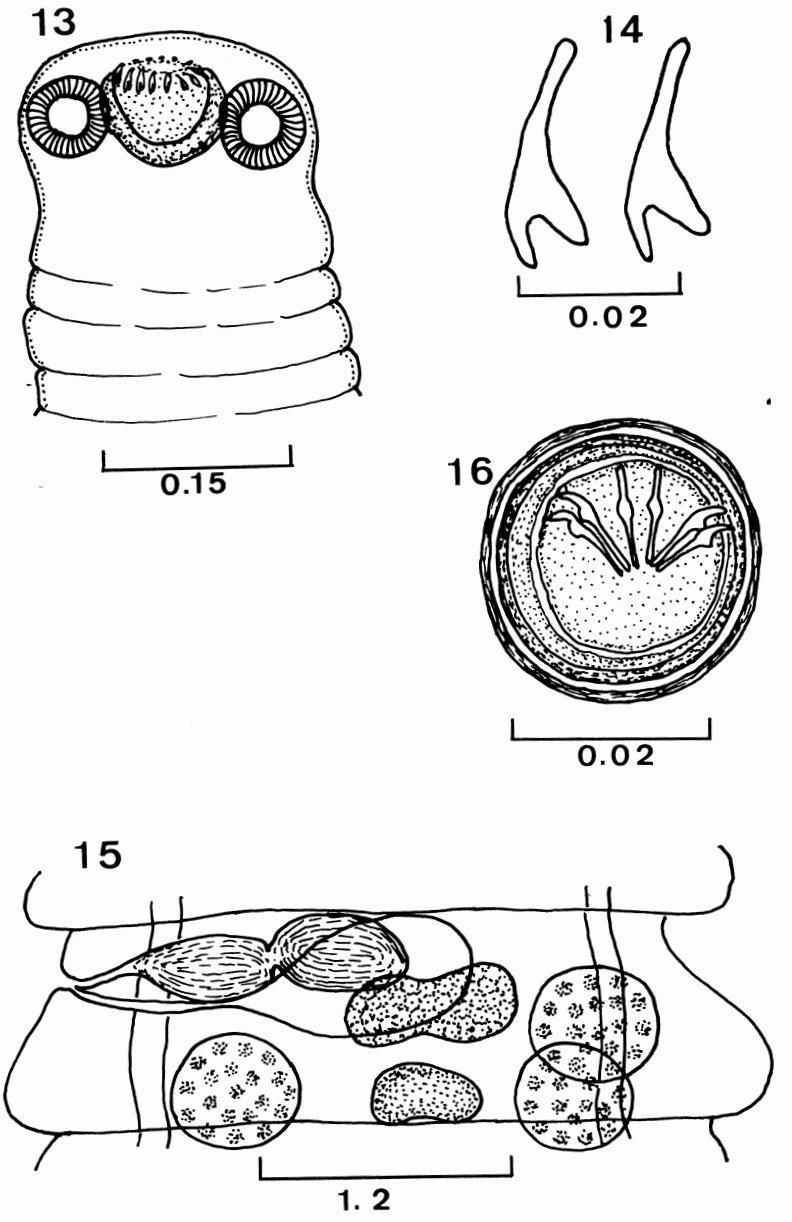
Remarks. The present new species closely resembles *V. isensis* Sawada, 1966 from *Rhinolophus cornutus cornutus* and *R. ferrumequinum nippon* in the form of scolex, rostellum and rostellar hooks. However, *V. kobayashii* can be separated from *V. isensis* in that it possesses fewer rostellar hooks (20 vs. 22-25), longer rostellar hooks (0.0385 vs. 0.032) shorter rostellar sac (0.084 vs. 0.140-0.175) and wider ovary (0.140-0.152 vs. 0.035-0.039).

Vampirolepis tadaridae sp. n.

(Figs. 13-15)

Of nine bats, *Tadarida plicata*, collected in lime grotto, Gommanton, on April 3, 1979, one was found infected with two mature specimens of this cestode.

Description. Small-sized hymenolepidid ; strobila length 20-30, maximum width 1.6-1.8. Scolex 0.140 long and 0.259 wide, not distinctly set off from neck. Rostellum 0.063 by 0.077, armed with a single row of 45 hooks measuring 0.028 long. Hook handle long ;



Figs. 13-16 *Vampirolepis tadaridae* sp. n.
13 : Scolex 14 : Rostellar hooks 15 : Mature proglottid 16 : Egg (Scales in mm)

guard bluntly round at its end, shorter than blade ; blade slightly sharp at its end. Rostellar sac oval, 0.077 by 0.091, not extending posterior to suckers. Suckers round, 0.070 in diameter.

Genital pores unilateral, located a little anterior to middle of proglottid margins, not proturde. Testes three in number, round or oval, 0.049-0.077 by 0.035-0.045, arranged in the form of triangle. Vagina initially posterior to cirrus sac, gradually expands into voluminous seminal receptacle measuring 0.105-0.112 by 0.056-0.063. Cirrus sac pyriform, 0.105 long and 0.070-0.111 wide, extending

anterolaterally behind osmoregulatory canal. Internal seminal vesicle, 0.049 by 0.021, enlarging to fill proximal portion of cirrus sac. External seminal vesicle oval, 0.063 by 0.035–0.042. Ovary bilobed, 0.077–0.084 wide, situated in middle field of proglottid. Vitelline gland compact, 0.021 by 0.035, situated in posterior field of proglottid near midline. Uterus arising directly from ovarian lobes as a lobe sac, which is gradually enlarging, filling entire gravid proglottid. Eggs oval or spherical, 0.028 in diameter, sorrounded by four envelopes, outermost chorion slightly thick and with rough surface. Onchospheres spherical, 0.021 in diameter and embyonic hooks 0.021 long.

Type host. *Tabarida plicata*.

Site of infection. Small intestine.

Type locality and date. Gommanton, Sabah; April 3, 1979.

Type specimen. Holotype NUE Lab. Coll. No. 8405.

Remarks. The present new species closely resembles *V. decipens* (Diesing, 1850) from *Tadalida laticaudata* of Brazil, *Chilonycteris rubiginosa* and *Molossus perotis* of Australia in the number and the size of rostellar hooks. But, it differs from *V. decipens* in the form of the rostellar hooks (guard blunty round at its end and the gurad shorter than the blade vs. guard remarkably round at its end, and the gurad and blade appoximately equal in length), in the arrangement of the testes (triangular distribution vs. transverse row) and in smaller onchosphere (0.021 vs. 0.029–0.034 in diameter) and in shorter embryonic hooks (0.014 vs. 0.016 in length).

Vampirolepis hipposideri (Prudhoe and Manger, 1969)

Twelve bats, *Hipposideros galeritus*, were collected at Poring cave, Sabah, May 23, 1979. One of them was found infected with three specimens of this cestode.

Description. Strobila length 30–36, maximum width 1.0–1.3. Scolex 0.245–0.266 by 0.210–0.245. Rostellum 0.056 long and 0.063–0.070 wide, armed with a single row of 18–19 hooks, 0.021–0.025 long. Sucker round, 0.063–0.077 by 0.070–0.077. Neck 0.43 long and 1.9 wide. Genital pores unilateral, located anterior to middle of proglottid margins. Testes three in number, 0.077 by 0.035, arranged in the form of triangle. Internal and external seminal vesicles present. Cirrus sac 0.070 by 0.028. Ovary tranversely elongated and bilobed in mature proglottid, 0.140–0.161 wide. Vitelline gland compact, 0.070–0.077 0.035. Seminal receptacle 0.084 by 0.028. Eggs spherical or oval, 0.032 by 0.035, sorrounded by four envelopes, with rough surface. Onchosphere spherical, 0.026 in diameter and embryonic hook 0.014 long.

Remarks. *V. hipposideri* n. comb., syn. *Hymenolepis hipposideri* was first recorded from *Hypposideros pomona*, *H. cinereus* and *H. armiger* in Indo-Malaysia. This is the first cestode to be reported from *H. galeritus* in Sabah, East Malaysia.

Summary

Five district species of cestodes were obtained from 15 species of bats from Sabah, East Malaysia. *Vampirolepis copihamata* sp. n. of *Tadarida plicata* from Gommanton is described. The numerous and shorter rostellar hooks, the position of genital pores and the arrangement of testes distinguish this cestode from *V. tadaridae*. *V. haradai* sp. n. of *Miniopterus magnator* from Kinabalu is described. This cestode differs from *V. taiwanensis* in the arrangement of the testes, in the size of onchosphere and embryonic hooks. *V. kobayashii* sp. n. of *Rhinolophus creaghi* from Batu Puteh is described. The fewer and longer rostellar hooks, shorter rostellar sac and wider ovary distinguish this cestode from *V. isensis*. *V. tadaridae* sp. n. of *Tadarida plicata* from Gommanton is described. This cestode differs from *V. decipens* in the form of rostellar hooks, the arrangement of the testes, smaller onchosphere and shorter embynic hook. *V. hipposideri*, syn. *Hymenolepis hipposideri* of *Hipposideros galeritus* from Poring is redescribed.

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東マレーシヤ，サバ州産コウモリの条虫相

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東マレーシヤ，サバ州で採集された15種のコウモリの小腸内を剖検したところ，4種の新種と1種の既知の条虫が寄生していた．*Tadarida plicata* には *Vampirolepis copihamata* sp. n. および *V. tadaridae* sp. n., *Miniopterus magnater* には *V. haradai* sp. n., *Rhinolophus creaghi* には *V. kobayashii* sp. n. さらに *Hipposiderus galeritus* には *V. hipposideri* がそれぞれ寄生していた．