TWO NEW SPECIES OF XIPHIDIOCERCARIAE FROM THE THIARID SNAIL *PALUDOMUS TANSCHAURICUS* IN MALABAR, KERALA

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ABSTRACT

Two new species of Xiphidiocercariae larvae, Cercaria III Malabar *sp. nov. and* Cercaria IV Malabar *sp. nov. infecting the thiarid snail,* Paludomus tanschauricus*, collected from Kanhileri in the Kannur district of Malabar are described and their systematic position discussed.*

KEYWORDS

Cercaria*, Malabar, new species, sporocyst, snail,*

During an expolarative study on the cercarial fauna of freshwater snails in Malabar, we came across two species of Xiphidiocercariae in the thiarid snail*, Paludomus tanschauricus* collected from Kanhileri in the Malabar region of Kerala. Detailed studies revealed that they are hitherto undescribed species and are, therefore, reported here as new species. The new species are denoted by Roman numerals, followed by Malabar, the region of collection.

MATERIALS AND METHODS

The thiarid snails*, Paludomus tanschauricus*, collected from the irrigation canals at Kanhileri (Kannur district), were brought alive to the laboratory and examined for cercariae. The cercariae emerged naturally from the snails were subjected to detailed studies on their morphology and behaviour. Intramolluscan stages were also studied. Measurements were taken from 10% formalin fixed larvae. Measurements are given in micrometres (µm) with mean values in parentheses. Sketches were drawn with the aid of a camera lucida.

Cercaria III Malabar sp. nov.

(Fig. 1)

The cercariae emerged in small numbers throughout day and night, but in large numbers during afternoon hours. Cercariae swam actively by wriggling movements of body and tail. At rest they remained suspended in the water column. Cercariae exhibited creeping movements at the bottom of the container.

Snail host: *Paludomus tanschauricus* (Gmelin)
Site of infection: Hepatopancreas
Locality: Kanhileri in Kannur district (Kerala)
Period of collection: June-July 2004.
Prevalence: Five of 200 (2.5%) snails examined were infected.
Type: Smear slide DZUC 17, Department of Zoology, University of Calicut

Description

(Fig. 1) Virgulate xiphidiocercaria. Body elongate-oval, spinose, 92-149 (122) long, 56-85 (72) wide. Tail spinose, spines larger than body spines; attached postero-ventrally, 56-93 (75) long, 13-24 (18) wide. Oral sucker subterminal, large, round, 29-37 (33) in diameter. Stylet prominent, inserted into the roof of oral sucker, 13-14 (13.2) long, 3-3.5 (3.3) wide, stylet walls thick, shoulders moderately developed; virgula organ located at the posterior half of oral sucker; large, bilobed, fused medially, 13-24 (17) long and 13-24 (18) wide. Acetabulum post-equatorial, smaller than oral sucker, 16-24 (18) in diameter. Mouth subterminal, ventral. Pharynx well-developed, muscular. Oesophagus short, weakly developed; caeca not traceable. Penetration glands four pairs; anterior pair pre-acetabular, second pair para-acetabular and posterior two pairs post-acetabular; contents of anterior two pairs coarsely granular and posterior two pairs finely granular. Ducts of penetration glands open individually near stylet shoulders. Genital primordium consists of a mass of round cells located near posterior margin of acetabulum.

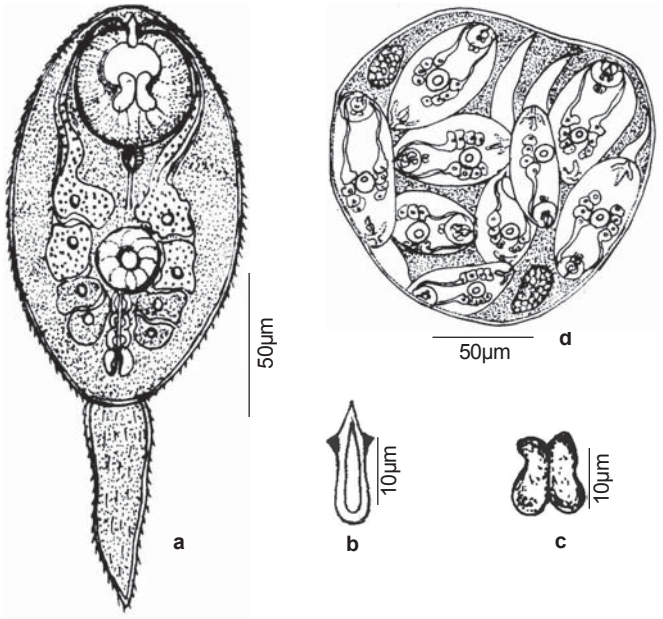

Figure 1. **Cercaria III Malabar *sp. nov.***
a - Cercaria; b - Stylet; c - Virgula; d - Sporocyst

Excretory bladder large, 'I'-shaped, with thick wall lined by cells; excretory pore located dorsally at body tail junction. Flame cell formula 2[(2+2+2) + (2+2+2)] = 24.

Sporocyst

Sporocysts were recovered from the hepatopancreas of *Paludomus tanschauricus*. Sporocysts colourless, oval to spherical, saccular, 72-215 (168) long, 69-175 (128) wide,

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Table 1. Comparative characters of cercariae

Species	Body	Tail organ	Stylet glands	Virgula	Penetration	Excretory bladder	Flame cells	Snail host
Cercaria of *Allossogonoporus vespertilionis* Macy, 1940	142-177 x 55-67	75-105 x 15-20 aspinose	dorsally prominent, ventrally diminishing shoulder	bilobed; medially folded, poseriorly free	anterior pairs hyaline, posterior pairs finely granular	vesicular	24	*Fluminicola virens*
Cercaria of *Pleurogenoides orientalis* (Srivastava,1934) Yamaguti, 1958	144-152 x 80-88	98-116 x 20-28 aspinose	pointed nib with collar; flat base	trilobed	anterior pairs coarsely granular, posterior pair finely granular	'U'-shaped	24	*Alocinma travancorica*
Cercariae indicae LXIX Murty, 1976	128-168 x 72-100	100-132 x 24-28 aspinose	pointed tip with thick collar	triangular	all finely granular	'U'-shaped	36	*Amnicola travancorica*
Cercaria leyteensis no.4 Ito *et al*., 1977	94-101 x 49-62	59-81 x 16-23 aspinose	pointed tip,moderate shoulder	flat-shaped	all finely granular	Cup shaped	—	*Oncomelania quadrasi*
Cercaria sp. XII Kerala Mohandas, 1977	138-200 x 75-100	75-97 x 20-25 spinose	shoulder prominent, without basal bulb	urn-shaped	all coarsely granular	'V'-shaped	20	*Diagnostoma pulchella*
Cercaria microvirgula Haseeb and Khan, 1987	109-143 x 57-71	71-129 x 18-23 spinose	fine tip, prominent shoulder, round base	reniform	all coarsely granular	'V'-shaped	10	*Lymnaea rufescens*
Cercaria of *Mehraorchis ranarum* Srivastava, 1934	144-152 x 86-92	96-100 x 20-22 aspinose	nib with lateral projections	bilobed, inverted 'V'- shaped	anterior pairs coarsely granular , posterior pairs finely granular	'V'-shaped	24	*Alocinma travancorica*
Cercaria of *Peurogenoides ovatus* Rao, 1977	96-122 x 66-84	45-74 x 18-24 aspinose	pointed nib moderate shoulder,round base, walls reinforced except at base	bilobed each lobe retort shape	Anterior pair finely granular, remaining pairs coarsely granular	'V'-shaped	24	*Digoniostoma pulchella*
Cercaria III Malabar sp. nov.	92-149 x 56-85	56-93 x 13-24 spinose	thick walled, moderately developed shoulder	bilobed, fused medially	anterior pairs coarsely granular, posterior pairs finely granular	'I'-shaped	24	*Paludomus tanschauricus*

containing 7-14 developing cercariae and a few germ balls at various stages of development.

Remarks

Of the known virgulate Xiphidiocercariae with spinose body and four pairs of penetration glands, the present form comes close to cercaria of *Allossogonoporus vespertilionis* Macy, 1940 (Burns, 1961), cercaria of *Pleurogenoides orientalis* (Srivastava, 1934; Yamaguti, 1958; Murty, 1976; Madhavi *et al*., 1987), *Cercariae indicae LXIX* Murty, 1976, *Cercaria leyteensis no.4* Ito *et al*., 1977, *Cercaria sp. XII Kerala* Mohandas, 1977, *Cercaria microvirgula* Haseeb and Khan, 1987, cercaria of *Mehraorchis ranarum* Srivastava, 1934 (Ratnakumari *et al*., 1991) and that of *Pleurogenoides ovatus* Rao, 1977 (Janardanan & Prasadan, 1991).

Comparative characters of the cercariae presented in Table 1 shows that cercaria of *A. vespertilionis* differs from the present form in the shape of stylet and virgula organ, nature of penetration gland contents and in having aspinose tail. Cercariae of *P. orientalis, M. ranarum* and *P. ovatus, Cercariae indicae LXIX*, *Cercaria leyteensis* no.4, *Cercaria sp. XII Kerala* and *C. microvirgula* have oval or 'V'-shaped excretory bladder, whereas that of the present form is 'I'-shaped. Cercaria of *P. orientalis, C. leyteensis* no. 4, *Cercaria sp. XII Kerala* and *C. microvirgula* further differ from the present cercaria in the nature of penetration gland contents. In the shape of stylet and virgula organ also *C. indicae LXIX* and cercariae of *M. ranarum* and *P. ovatus* differ from the present cercaria. Besides, the snail host of the present form is different from that of above cercariae. Hence it appears reasonable to consider the present cercaria as new and the name *Cercaria III Malabar* sp. nov. is proposed for it.

Cercaria IV Malabar sp. nov.

(Fig. 2)

The cercariae emerged throughout day time, but peak emergence was noticed during afternoon hours. Newly emerged cercariae swam for a short period by vigorous lashing activity of tail, then sank to the bottom of the container and encysted there.

Snail host: *Paludomus tanschauricus* (Gmelin)
Site of infection: Hepatopancreas
Locality: Kanhileri in Kannur district (Kerala)
Period of collection: June-July 2004
Prevalence: Three of 200 (1.5%) snails examined were infected
Type: Smear slide DZUC 18, Department of Zoology, University of Calicut

Description

(Fig. 2) Non-virgulate xiphidiocercaria. Body elongate-oval, spinose, 85-170 (109) long, 49-66 (57) wide. Tail shorter than body, spinose, highly contractile, attached postero-ventrally; 59-80 (72) long, 9-17 (13) wide. Oral sucker round, 19-33 (27) in

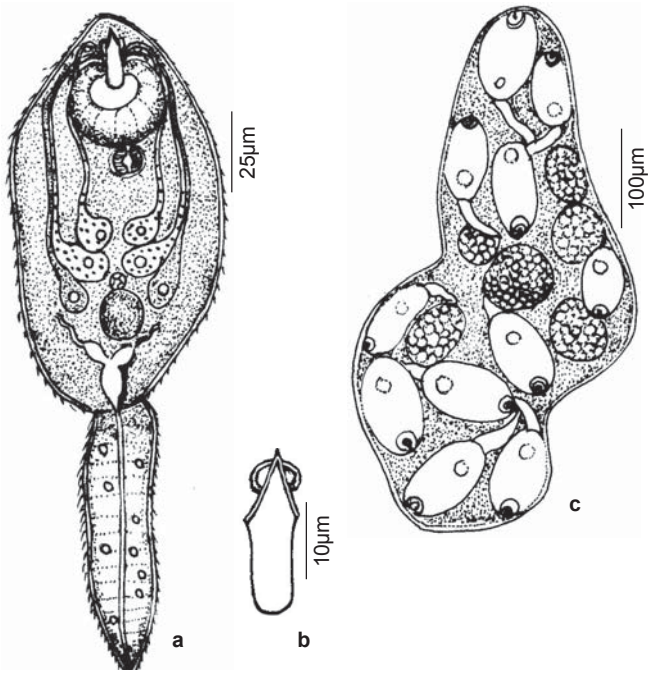

Figure 2. **Cercaria IV Malabar** ***sp. nov.***
a - Cercaria; b - Stylet; c - Sporocyst

diameter. Stylet prominent, inserted into the roof of oral sucker, spear-shaped with fine tip, round base and prominent shoulders at its anterior one-third; 18-20 (19.6) long, and 3.3-4.1 (3.5) thick at shoulder region. Acetabulum rudimentary, located in posterior half of body.

Mouth ventral, subterminal. Pharynx well-developed, muscular, 6-10 (8) in diameter. Penetration glands three pairs; anterior two pairs pre-acetabular and posterior pair para-acetabular with their ducts opening near stylet shoulders. Glands round to oval with fairly large nuclei. Contents of anterior two pairs coarsely granular and posterior pair finely granular. Cystogenous glands numerous, filled with refringent granules, distributed all over the body. Genital primordium represented by a round mass of cells situated anterior to acetabular rudiment.

Excretory bladder 'Y'-shaped with a round base and two broad cornuae; each cornua gives rise to an ascending main excretory duct which takes a convoluted course upto the level of acetabulum and divides into anterior and posterior collecting tubules. Flame cell formula 2[(2+2) + (2+2)] = 16. Excretory pore situated at body-tail junction. Caudal excretory canal extend to the tip of tail.

Sporocyst

Sporocysts were recovered from the hepatopancreas of *Paludomus tanschauricus*. Sporocysts oval to elongate, sac-like, 346-577 (473) long, 154-285 (205) wide; enclose 6 to 17 developing cercariae and a few germ balls at various stages of development.

Remarks

Distome non-virgulate xiphidiocercariae with three pairs of medially placed penetration glands and poorly developed acetabulum showing close resemblance to the present cercaria are *Cercariae indicae LII* Sewell, 1922, *Cercaria leyteensis no.5* Ito *et al.*, 1977, *C. leyteensis no.27* Ito, 1977 and *C. visakhapatnamensis 5* Dhanumkumari *et al.*, 1990. A comparison of characters of the present cercaria is given in Table 2. The present form differs from all these cercariae in one or more of the following characters: body size, stylet shape and size, position and shape of penetration glands and the nature of their contents, number of flame cells, shape of excretory bladder and presence or absence of spines on tail. *C. indicae LII* is distinctly different from the present cercaria in shape and size of stylet, arrangement of penetration glands and nature of their contents, shape of excretory bladder and in having aspinose tail with a cap of spines at its tip. *C. leyteensis no.5* has stylet with indistinct shoulders, well developed oesophagus, four pairs of sensory hairs on the body and 'U'-

Table 2. Comparative characters of cercariae

Species	Body	Tail	Stylet glands	Penetration bladder	Excretory cells	Flame	Snail host(s)
Cercariae indicae LII Sewell, 1922	82- 89 x 21-25 spinosewithout sensory hairs	82-89 x? aspinose with cap of spines at tip	narrow elongate with thick shoulder	outer pair coarsely granular, other pairs finely granular	spherical	--	*Amnicola travanorica*
Cercaria leyteensis no.5 Ito *et al.*, 1977	70-83 32-35 spinose with 4 pairs of sensory hairs	50-58 x 15-20 spinose bent ventrally	solid, pointed with indistinct shoulder;	all coarsely granular	'U'-shaped	--	*Oncomelania quadrasi*
Cercaria leyteensis no.27 Ito *et al.*, 1977	70-95 x 30-40 spinose without sensory hairs	60-80 x 10-15 aspinose	sharply pointed with conspicuous shoulders	anterior pairs finely granular, posterior pair coarsely granular	'V'-shaped	16	*Pila ampullacea, P. luzonica, Bellamya philippinensis*
Cercaria visakhapatnamensis 5 Dhanumkumari *et al.*, 1990	112-126 x 78-90 spinose without sensorty haris	72-81 x 15-21 aspinose	solid with thick shoulder, broad base	anterior pairs finely granular, posterior pair coarsely granular	'V'- shaped	--	*Thiara tuberculata*
Cercaria IV Malabar sp. nov.	85-170 x 49-66 spinose without sensoryhairs	59-80 x 9-17 spinose	spear shaped with fine tip, prominent shoulder, round base	anterior pairs coarsely granular, posterior pair finely granular	'Y'- shaped	16	*Paludomus tanschauricus*

shaped excretory bladder. These characters make *C. leyteensis no.5* different from the present form. *C. leyteensis no.27* and *C. visakhapatnamensis 5* also differ from the present cercaria in having aspinose tails, fine granular secretion in anterior two pairs of penetration glands and coarse granular secretion in posterior pair. Further, the snail hosts of the above mentioned cercariae are also different. As the present cercaria cannot be identified with any other known cercaria, it is considered as new and the name *Cercaria IV Malabar* sp. nov. is proposed for it.

References

Burns, W.C. (1961). Six virgulate xiphidiocercariae from Oregon, including redescription of *Allossogonoporus vespertilionis* and *Acanthatrium oregonense*. *Journal of Parasitology* 47(6): 919-925.

Janardanan, K.P. and P.K. Prasadan (1991). Studies on the life-cycle of *Pleurogenoides ovatus* Rao, 1977 (Trematoda: Pleurogenetinae). *Journal of Helminthology* 65: 43-50.

Madhavai, R., C. Dhanumkumari and T.B. Retnakumari (1987). The life history of *Pleurogenoides orientalis* (Srivastava,1934) (Trematoda: Lecithodendriidae). *Parasitology Research* 73: 41-45.

Murty, A.S. (1976). Studies on Indian cercariae III. Virgulate Plagiorchioid cercariae. *Proceedings of the Indian Academy of Science* 83(1): 12-17.

Retnakumari, T.B., R. Madhavi and C. Dhanumkumari (1991). The life cycle of *Mehraorchis ranarum* Srivastava, 1934 (Trematoda, Lecithodendriidae). *Acta Parasitologica Polonica* 36(1): 5-10.

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ADDITIONS TO THE MAMMALIAN AND AVIAN DIVERSITY OF NALLAMALA HILLS, WITH TWO NEW MAMMAL RECORDS

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Srinivasulu & Nagulu (2002) catalogued the mammalian and avian diversity of the Nallamala Hills, Andhra Pradesh and reported the presence of 74 species of mammals and 302 species of birds based on literature and faunistic surveys conducted by the present author from 1996 to 2000. Since then, further surveys conducted by the author and others have resulted in addition to hitherto unknown mammals and birds. Recent taxonomic revision in colobines of South Asia warrants recognition of two different species of langurs in the region (Brandon-Jones, 2004). This note adds six mammals and one bird species to the known diversity of the mammals and birds increasing the diversity to 80 species and 303 species, respectively, with two new mammalian records for the Nallamala Hills. Brief notes on the new species are provided below.

Mammals

Of the mammalian diversity reported by Srinivasulu & Nagulu (2002) one species, namely, the Common (Hanuman) Langur *Semnopithecus entellus* is now represented by two species in the Nallamala Hills. Further comments are provided against the new species of langur below. The details of the six mammalian species are provided below.

1. *Eonycteris spelaea* Dawn Bat (Chiroptera: Pteropodidae) - One female specimen mist netted and collected from the forested tracts near Potharajupenta, Kurnool district on 23 May 1995 (Chakraborty *et al.*, 2004; Ghosh, *pers. comm.*) puts on record its presence from Nallamala Hills, Eastern Ghats. Until now the Dawn Bat was known only from Vishakapatnam district, Andhra Pradesh (Bates & Harrison, 1997; Srinivasulu & Srinivasulu, 2004). This constitutes its range extension from northern Eastern Ghats in the Ananthagiri Hills to the central Nallamala Hills in Kurnool district.

2. *Rhinolophus lepidus* Blyth's Horseshoe Bat (Chiroptera: Rhinolophidae) - A total of 14 specimens were collected from Akkamahadevi Bilam Cave, Mahbubnagar district on two occasions - 26 March 2002 and 9 June 2003. This species had been earlier collected from Cuddapah, Vishakapatnam and East Godavari districts from the state (Bates & Harrison, 1997; Chakraborty *et al.*, 2004; Srinivasulu & Srinivasulu, 2004). This constitutes the first record of *Rhinolopus lepidus* in the Nallamala Hills, Eastern Ghats.

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