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ORIGINAL ARTICLE

A parapleurolophocercous cercaria and a furcocercous cercaria from the freshwater gastropods of the Western Ghats

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Abstract Two cercariae were recorded from freshwater snails, one each from *Digoniostoma pulchella* and *Indoplanorbis exustus* and named *Cercaria* sp. III Western Ghats n.sp. and *Cercaria* sp. IV Western Ghats n.sp. respectively. *Cercaria* sp. III Western Ghats n.sp. is distome, ocellate and pharyngeate with peculiar spines on the tail, belongs to the Parapleurolophocerca group. This cercaria has 10 pairs of penetration glands in two groups; thick walled large excretory bladder and 10 pairs of flame cells including a pair arising from the caudal excretory canal. *Cercaria* sp. III Western Ghats n.sp develops inside the sausage shaped redia. Developed cercariae were found outside the rediae, in the host tissue. The furcocercous cercaria, *Cercaria* sp. IV Western Ghats n.sp is elongate, non ocellate, pharyngeate and longifurcocercous with three crowns of spines beside mouth, three pairs of penetration glands, small excretory bladder and twenty-two flame cells including four flame cells in the tail stem. Asexual multiplication of the organism occurs inside the sporocyst in the hepatopancreas of *I. exustus*. The present paper reports two new cercariae with their intra-molluscan stages recovered from the snails of the Wayanad region of the Western Ghats, and their morphological and morphometric comparison with the related species to determine their systematic positions.

Keywords Cercaria · Furcocercous · Western Ghats · Wayanad · *Digoniostoma pulchella* · *Indoplanorbis exustus*

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Introduction

The Wayanad region of the Western Ghats is rich in flora and fauna. Digenean trematode fauna is least explored in this region. Earlier studies reveal that there is no record in the parapleurolophocerca group from this region so far. The present study discovered parapleurolophocerca and furcocercous cercaria from *Digoniostoma pulchella* and *Indoplanorbis exustus* respectively. In-depth examination reveals that the present cercariae are different in morphology and morphometry from the comparable cercariae and, therefore, report here as new. The cercariae were designated with Roman numerals affixed with area of collection, 'Western Ghats'.

Materials and methods

The snail hosts were collected from water bodies of different localities from the Wayanad region of the Western Ghats. Collected *Digoniostoma pulchella* and *Indoplanorbis exustus* were brought alive to laboratory. Five snails each were placed in glass beakers containing freshwater (200 ml), kept under bright sunlight and observed periodically. Each snail was isolated if cercariae were observed in the beaker/s. Cercarial behavior including time of emergence, nature of movement and duration of being active were noted down. Cercariae were studied under the Nikon Ni-U phase contrast research microscope. Diluted neutral red and Indian ink were used for understanding the internal organization and urea for examining the excretory system (Ditrich et al. 1992). For studying the intra-molluscan stages, infected snails were dissected out under the Luxeo 4Z binocular stereo zoom microscope; tissues were separated and closely observed for the presence of sporocysts/

rediae. Photomicrograph of cercaria was taken with a Nikon Y-TV55 camera attached to the Nikon ECLIPSE Ni-U research microscope with the support of Nikon NIS Elements Imaging software. Sketches were drawn using Y-IDT drawing tube attached to the Nikon ECLIPSE Ni-U research microscope. Additional details from live observations were added free hand. Measurements of 20 cercariae and 10 sporocysts/rediae were taken in µm. Permanent mounts of cercariae were prepared by fixing them in AFA and staining in acetocarmine following the procedure outlined by Cantwell (1981) and Janardanan and Prasadan (1991).

Results and discussion

Cercaria sp. III Western Ghats n.sp.

Host: *Digoniostoma pulchella* Benson, 1836.

Locality: Puthussery, Wayanad, Kerala.

Holotype: Deposited in the Helminth parasite collections, Ecological Parasitology and Tropical Biodiversity laboratory.

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(Accession number: C.P.P.1.1).

Etymology: Area from where the species was first recorded.

Period of collection: June 2018.

Prevalence: 2.86%; One out of 35 *Digoniostoma pulchella* collected during June 2018 was infected with *Cercaria* sp. III Western Ghats n.sp.

Cercarial behavior

Cercarial emergence starts during midday and continues till late afternoon. After vigorous movement to the upper water column cercariae rest, keeping the body upside down and then settle down on the substratum. Live till 24–48 h, settle at the bottom of the container and show crawling movements using the suckers. Pigmentation of cercariae was found increasing when the movements slow down.

Description (Fig. 1a, c)

Distome, pharyngeate and ocellate cercaria belongs to the Parapleurolophocerca group of distome cercariae as given by Sewell (1922). Pyriform, slightly pigmented body with spination over the oral sucker [anterior sucker]; measures 241.56–470.83 (353.91) in length and 183.21–283.63 (243.26) in breadth. Tail longer than body, provided with transparent fins on both sides, tapering towards the end. When contracted, the fin gets folded and gave the appearance of fin rays. Tail has peculiar spine like projections, four in number, at the posterior end. Tail measures 412.20–700.24 (471.04) × 41.84–168.70 (67.53). Anterior sucker round to

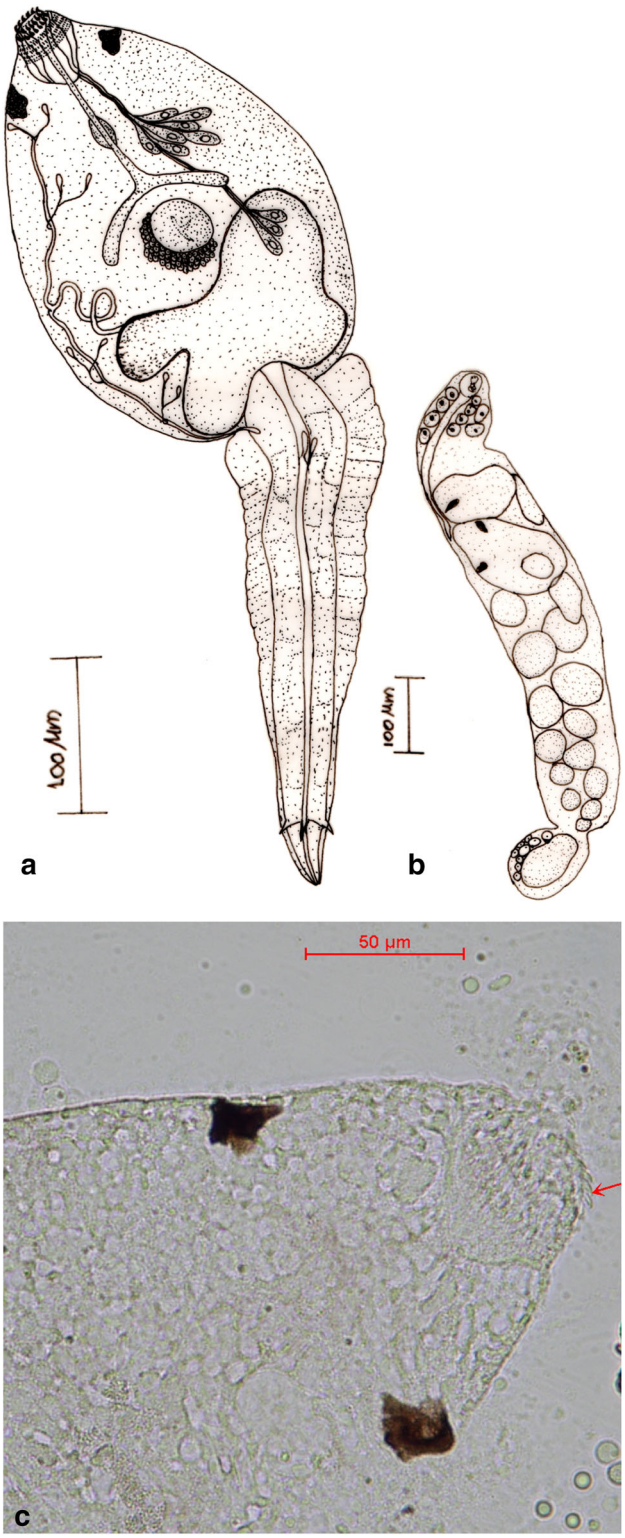

Fig. 1 *Cercaria* sp. III Western Ghats n. sp. **a** Cercaria, **b** Redia, **c** Cercaria anterior portion enlarged

oval, retractile; anterior sucker has two rows of parrot beak-like larger spines and six rows of smaller spines (Fig. 1c) with a gap between the two rows of spines; 44.77–74.95 (59.55) in length and 40.03–69.04 (56.27) in breadth. Terminal mouth surrounded by spines, followed by short pre-pharynx; round, muscular pharynx measured 10.28–33.94 (21.69) × 7.65–30.44 (19.81). Oesophagus is of same length of pre-pharynx; caeca run up to the middle of the ventral sucker, measured 57.53–96.22 (76.58) × 5.29–16.45 (9.35). Ventral sucker, smaller than oral sucker, in the middle of body, with a longitudinal slit like opening measured 39.75–55.05 (46.62) × 38.75–49.13 (45.56). A pair of darkly pigmented eye spots, just behind the level of oral sucker near the lateral margin. Two sets of penetration glands; anterior group, in between pharynx and acetabulum, consists of seven small glands with round clear nuclei and granular cytoplasm; posterior group, below acetabulum, consists of three glands; ducts run forward and open at the side of oral sucker. Genital primordia represented by a mass of smaller cells with larger nuclei in a 'C' shape, anterior to posterior margin of the ventral sucker. Large excretory bladder supported by thick granular wall at the posterior end of body. The main excretory canal arises at the antero-lateral margin of bladder, runs forward and outward to a short distance up to the ventral sucker and gives rise to anterior and posterior collecting ducts. Anterior collecting duct splits into two accessory ducts and each ends in a pair of flame cells. The posterior collecting duct provided with three accessory ducts, two with a pair of flame cells each and the third with a single flame cell at the base of tail. Excretory canal extend to the tip of tail and opens out through a small terminal pore. Tail has a pair of flame cells arising from caudal excretory canal at its base. Flame cell formula: 2 [(2 + 2) + (2 + 2 + (1))] + 2 = 20.

Redia (Fig. 1b)

Hepatopancreas of the host was infected with rediae, developing cercariae and developed cercariae. Sausage shaped rediae of 697.78–1817.14 (1083.11) × 122.74–194.49 (147.93) size, provided with a well developed pharynx and a small gut. Group of granular cells below pharynx; redia contains two to three immature cercariae and a number of germ balls. Mature cercariae never noticed inside rediae, instead were found attached to the host tissue. Probably the immature cercariae make their way out of the redia and complete their development in the tissues of the host (Sewell 1922).

Remarks

Present cercaria resembles *Cercariae keralensis* IV (Mohandas, 1974), *Cercariae indicae* L (Sewell, 1922), *Cercariae indicae* XXXI (Sewell, 1922), Cercariae of *Centrocestus formosanus* (Nishigori, 1924), *Cercaria bimtalensis* (Malaki and Singh, 1962), Cercariae of *Stellantchasmus falcatus* (Onji and Nishio, 1924) in morphological features, thus are comparable with the present cercaria.

Comparison of the present cercaria with the other six cercariae is given in the Table 1. Characters common for the present cercaria and other comparable cercariae are pyriform body with darkly pigmented eye spots below the oral sucker; long tail with transparent fin folds; well developed anterior sucker and pharynx; thick walled large excretory bladder at the posterior end of body; number of penetration glands arranged in groups; genital primordia between excretory bladder and ventral sucker. The present cercaria differs from *Cercariae keralensis* IV in the distribution pattern of spines over the oral sucker, nature of lateral fin fold on tail, absence of dark pigment granules over the body, the nature of length of pre-pharynx and oesophagus. Spinose anterior region of body, sausage shaped redia with developing immature cercariae and the primary host from which the present cercaria recovered mark the difference with the *Cercariae indicae* L. Presence of short pre pharynx, oesophagus, caeca, pair of caudal flame cells, difference in number and arrangement of penetration glands, body spination and the host make it different from *Cercariae indicae* XXXI. Unlike cercariae of *Centrocestus formosanus*, the present cercariae have well developed lateral fins on tail, ventral sucker, esophagus and caeca; sausage shaped redia; eye spots of equal size, difference in number of penetration glands and the snail host. The present cercaria is dissimilar with *Cercaria bimtalensis* and cercaria of *Stellantchasmus falcatus* in terms of its morphometry, nature of tail, ventral sucker, short pre pharynx, presence of esophagus and caeca, caudal flame cells, two groups of penetration glands, single 'C' shaped genital primordia; absence of sensory hairs on the body and the difference in the primary host and with the cercariae of *S. falcatus* on the features of *Cercaria bimtalensis* and in the absence of lateral bristles and annulated tail. Difference in morphometry, presence of spine like projection at the tail ending, well developed oesophagus and caeca, twenty flame cells including a pair in the caudal excretory canal, 10 pairs of penetration glands in two groups, 'C' shaped genital primordia make the present cercaria different from all other comparable cercariae and is, therefore, reporting here as new.

***Cercaria* sp. IV Western Ghats n.sp**

Host: *Indoplanorbis exustus* (Deshayes, 1834).

Locality: Mananthavady, Wayanad, Kerala.

Table 1 Comparison of morphology and morphometry of *Cercaria* sp. III Western Ghats n. sp. with related cercariae

Cercariae	*Cercariae keralensis* IV Mohandas, 1974	*Cercariae indicae* L Sewell, 1922	*Cercariae indicae* XXXI Sewell, 1922	Cercaria of *Centrocestus formosanus* Nishigori, 1924	*Cercaria bimtalensis* Malaki and Singh, 1962	Cercaria of *Stellantchasmus falcatus* Onji and Nishio, 1924	*Cercaria* sp. III Western Ghats n.sp.
Body	Spination restricted to posterior margin of oral sucker; 250–375 × 175–22	Pyriform; spinose; 210–263 × 123–149	Pyriform; spinose; 175–232 × 140–100 (353.91) × 183.21–283.63 (243.26)	Anterior quarter spinose; 47–122 (88) × 26–71 (50)	Oblong, anterior half spinose, sensory hairs present; 372–526 (424) × 105–162 (121)	Spinose; few lateral bristles; 55–116 (91) × 34–64 (47)	Pyriform, anterior 1/4th of oral sucker spinose; 241.56–470.83
Eye spot	Paired; lateral; behind oral sucker	Paired; conical; pigmented; anterio-lateral behind oral sucker	Paired; lateral behind the level of oral sucker	Double left ocellus and a single right	Paired; conical lenses; pigmented; near anterior end of body	Left eyespot double and the right single	Paired; darkly pigmented; just behind the level of oral sucker
Tail	Well developed fin folds; 325–425 × 87–105	Transparent fin fold on either side; Length 386	Transparent fin fold on either side; 263–298 in length (471.04) × 41.84–168.70 (67.53)	Slender; weakly developed dorso-ventral fin; 62–98 (78) × 11–15 (13)	Equal to body length; measures 453–567 (498) × 43–64 (53)	Annulated; fin begins dorsally near the body; 24–37 (32) × 11–20 (17)	Longer than body; spine like projection at the posterior 1/10th; 412.20–700.24
Oral sucker	Circular or slightly oval; 50–62 × 40–50; mouth sub terminal	54 µm diameter; mouth terminal (59.55) × 40.03–69.04 (56.27)	Retractile; terminal mouth	Well developed; 18–26 (23) × 15–23 (19)	Well developed; 43–52 (46) in diameter; sub terminal mouth	Well developed; 18–23 (21) × 16–20 (18)	Retractile; 44.77–74.95
Ventral sucker	Equatorial or slightly post equatorial; 37–50 in diameter	Equatorial; 39 in diameter (46.62) × 38.75–49.13 (45.56)	Smaller than oral sucker; in the posterior 2/3rd; 36–43 in diameter	Rudimentary	Poorly developed; occupying posterior mid-ventral portion	Rudimentary	Smaller than anterior sucker; equatorial; 39.75–55.05
Prepharynx	Long; narrow	Short	Long; narrow 15.48–64.71 × 1.71–6.58 (3.59)	Short; 1–7 (4)	Elongate; 115–127 (121)	Short; 3–11 (7)	Short;
Pharynx	Globular; 20- 25 in diameter	21 µm in diameter	Gobular; in the anterior	Spherical to pyriform; 5–9 (8) × 6–8 (8)	Muscular; 18–25 (20) in diameter	Small; 4–9 (7) × 6–9 (7)	Round; muscular; 10.28–33.94 (21.69) × 7.65–30.44 (19.81)
Oesophagus	–	–	–	Short	–	Rudimentary	Equal length of prepharynx; 14.41–63.41 (35.70) × 1.91–5.74 (3.11)
Caeca	–	–	–	Rudimentary	Absent	Rudimentary	Up to the half of ventral sucker; 57.53–96.22 (76.58) × 5.29–16.45 (9.35)
Excretory bladder	V- shaped; thick walled; triradiate	Large; thick granular and muscular wall	Large; thick walled	Thick-walled; flattened sack to X-shaped	Thick walled, 'V' shaped	Thick-walled; saccular to V-, Y-, or X-shaped	Large; with thick granular wall
Caudal excretory canal	–	Till the end of tail	Till the end of tail	–	Median caudal duct	Extends a short distance in tail and opens laterally	Till the tip of tail

Table 1 continued

Cercariae	*Cercariae keralensis* IV Mohandas, 1974	*Cercariae indicae* L Sewell, 1922	*Cercariae indicae* XXXI Sewell, 1922	Cercaria of *Centrocestus formosanus* Nishigori, 1924	*Cercaria bimalensis* Malaki and Singh, 1962	Cercaria of *Stellantchasmus falcatus* Onji and Nishio, 1924	*Cercaria* sp. III Western Ghats n.sp.
Flame cell formula	2 [(3 + 3 + 3) + (3 + 3 + 3 + 3)] = 48	2 [1 + (1 + 1)] = 6	2 [1 + 1] = 4	2 [(2 + 2) + (2 + 2)] = 16	2 [(5 + 5 + 5) + (5 + 5)] = 50	2 [(3 + 3 + 3) + (3 + 3 + 3)] = 36	2 [(2 + 2) + (2 + 2 + (1))] + 2 = 20
Caudal flame cell	Not present	Not present	Not present	Not present	Not present	Not present	2
Penetration glands	Nine pairs in three groups	15 pairs in two groups	Eight pairs in two groups	14 glands between pharynx and excretory bladder	7 pairs	7 pairs in two rows	Ten pairs in two groups
Genital Primordium	Between ventral sucker and excretory bladder	Between ventral sucker and excretory bladder	Between ventral sucker and excretory bladder	Immediately anterior to excretory bladder	Two oval bodies between ventral sucker and excretory bladder	–	C- shaped, postero-lateral to ventral sucker
Redia	Pale white; 525–1450 × 12.5–22	614 × 141	Sausage shaped	29–45 (37) × 84–120 (100)	513–704 (625) × 93–145 (111) (1083.11) × 122.74–194.49 (147.93)	Small; 112–420 (234) × 56–112 (87)	Suasage shaped; 697.78–1817.14
Host	*Digoniostoma pulchella*	*Annicola travancorica*	*Digonistoma cerameopoma*	*Stenomelania newcombi*	*Melanoides tuberculatus*	*Stenomelania newcombi*	*Digoniostoma pulchella*
Prevalence of infection	0.058%	7.69%	20%	27%	–	39%	2.86%
Place of collection	Shangumukham, Trivandrum, Kerala, India	Sulthan Bathery, Wayanad, Kerala, India	Indian Museum, Calcutta, India	Kaneohe, Oah, Hawaii	Bhimtal, Naukuchital, U. P., India	Kaneohe, Oah, Hawaii	Puthusseri, Wayanad, Kerala, India

Holotype: Deposited in the Helminth parasite collections, Ecological Parasitology and Tropical Biodiversity laboratory, Department of Zoology, Kannur University, Mananthavady Campus, Wayanad-670645, Kerala, India.

(Accession number: C.M.1.1).

Etymology: Area from where the present cercaria was first recorded.

Period of collection: July 2018.

Prevalence: 2.44%; One out of 41 snail hosts studied was infected.

Cercarial behavior

Rate of cercarial emergence was higher during late afternoon; cercariae spread out furcae and move towards the upper water column; found to keep furcae parallel to the water column while resting; move down and settles after some time and show crawling with the help of oral sucker.

Description (Fig. 2a)

Elongate, non ocellate, pharyngeate, longifurcocercous cercaria armed with four rows of larger spines at the

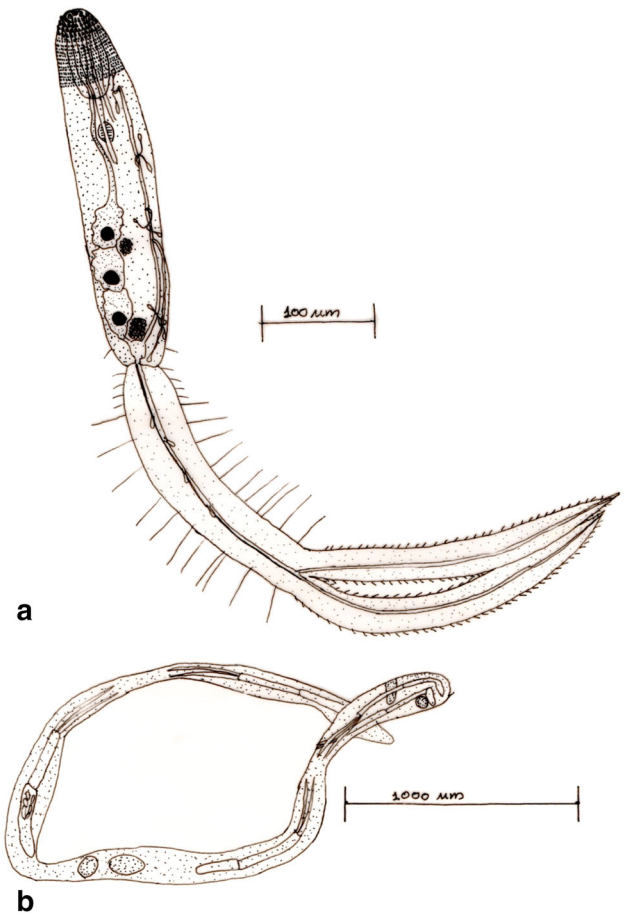

Fig. 2 *Cercaria* sp. IV Western Ghats n. sp. **a** Cercaria, **b** Sporocyst

Table 2 Comparison table of characters and measurements of *Cercaria* sp. IV Western Ghats n. sp. with related four other cercariae

Cercariae	Cercariae of *Posthodiplostomum cuticola,* Donges, 1964	Cercariae of *P. minimum,* Bedinger and Meade, 1967	Cercariae of *Posthodiplostomum*, Ritossa et al. 2013	*Cercaria* sp. IV Western Ghats n.sp.
Body	Spinose; covered with five pairs of sensory hairs; 92–120 (101) × 33–55 (45)	Cylindrical; annulations with single row of setae; 143–158 × 23–25	Cylindrical; 1 pair of sensory hair; 192–240 (219.80) × 38–58 (44.60)	Elongate; anterior end spinose; single sensory hair; 150.45–338.44 (256.53) × 36.03–82.44 (62.27)
Eye spot	Pigmented	Pigmented	Pigmented	Absent
Tail	Spinose; 11 pairs of sensory hairs; 252–276 (264) × 30–40 (35)	Cylindrical; finely annulated; 172–199 × 21–25	Long; 13 pairs of sensory hairs on tail stem; 221–365 (307.70) × 19–48 (35.50)	Long; two types of sensory hairs; 176.79–358.43 (309.33) × 26.61–59.64 (48.44)
Furcae	Spinose; 230–292 (275) × 19–22 (20)	126–176 long	With fin folds; spinose; 182–317 (244.80) × 10–29 (21.60)	Spinose; almost equal length of tail stem; 161.44–326.62 (292.95) × 18.34–38.78 (31.89)
Oral sucker	Pyriform; Mouth terminal;	32–61 long	48–62 (52.60) × 19–36 (23)	Pyriform; 36.16–83.08 (64.14) × 18.70–48.88 (37.51)
Ventral sucker	Rudiment	–	–	Mass of cells
Prepharynx	–	Not present	Not present	Short
Pharynx	Small	–	–	Small; muscular; 8.33–20.02 (13.05) × 5.75–16.40 (10.49)
Oesophagus	–	–	–	Short; rhabdocoel; 6.48–26.28 (13.89)
Caeca	Short	–	Not developed	Absent
Excretory bladder	Small	–	Small	Small
Caudal excretory canal	Ends at the 1/3rd length of furcae	Ends at the 1/3rd length of furcae	Ends at middle of furcae	Up to tip of furcal ramus
Flame cell formula	2 [(2 + 2) + ((2 + 2) + (2))] = 20	2 [(1 + 1 + 1 + 1 + 3 + 2 + 2 + 2)] = 26	2 [1 + 1 + 1 + (1 + 2) + 2 + (1 + 2) = 22	2 [(2 + 2 + 2) + (2 + 1)] + 1 + 1 + 1 + 1 = 22
Caudal flame cell formula	2 pairs	Nil	Nil	1 + 1 + 1 + 1 = 4
Penetration glands	3 pairs	3 pairs	3 pairs	3 pairs
Genital Primordium	Between penetration glands and excretory bladder	Between penetration glands and excretory bladder	–	Between penetration glands and excretory bladder
Sporocyst	360–540 × 70–100	Sausage shaped	cylindrical with round ends; 576–1136 (877.30) × 67–105 (89.60)	Long thread like; 822.54–4956.41 (2427.60) × 102.51–164.13 (134.15)
Host	*Tropidiscus carinatus* and *T. planorbis*	*Physa halei*	*Anisancylus obliquus*	*Indoplanorbis exustus*
Prevalence of infection	–	–	–	2.44%
Place of host collection	Germany	Lea in United States	Patagonia, Argentina	Mananthavady, Wayanad, Kerala, India

extreme anterior end, followed by 15 rows of slightly smaller spines. Body equipped with single sensory hair on both sides at the posterior end at the level of excretory bladder. Body measured 150.45–338.44 (256.52) × 36.03–82.44 (62.27). Tail long, with two types of sensory hairs; four pairs of smaller sensory hairs at proximal end and eleven pairs of long sensory hairs; measured 176.79–358.43 (309.33) × 26.61–59.6 (48.44). Tail bifurcates to form spinose furcae of 161.44–326.62 (292.95) length and 18.34–38.78 (31.89) width. Oral sucker modified to protrusible penetrating organ. Ducts of penetration glands broader at the oral sucker and occupy its major part. Oral sucker measured 36.16–83.08 (64.14) × 18.70–48.88 (37.51). Terminal mouth provided with three crowns of spines, a pair on both sides and a crown just in front of the mouth opening. These spines obtrude out and lie beside mouth when the organ protrudes. Mouth leads to short prepharynx to globular and muscular pharynx of 8.33–20.02 (13.05) × 5.75–16.40 (10.49) size and a short rhabdocoel oesophagus measuring 6.48–26.28 (13.89) long. A group of undifferentiated mass of cells identified at the center, below the 1st pair of penetration glands representing the acetabulum anlage [ventral sucker primordia] (Bedinger and Meade 1967). Three pairs of slightly yellowish penetration glands with large nuclei and granular cytoplasm arranged in the second half of body. Their ducts run anteriorly reaching the oral sucker and joins to form single larger duct with single opening on either side of mouth. Genital primordia represented by a mass of small cells just above the excretory bladder and between the 3rd pair of penetration glands. Small excretory bladder measures 6.77–19.88 (10.77) × 5.47–13.91 (9.59) and present at the posterior end of body below the third pair of penetration glands. Primary collecting ducts, originate at the anterolateral margin of excretory bladder run forward and splits into anterior and posterior collecting vessels at the level of ventral sucker primordia just below the 1st pair of penetration glands; prominent cilia present inside the duct, at the level of the 2nd pair of penetration glands. Anterior collecting duct gives rise to three branches; one near the posterior end of oral sucker, second below the pharynx and the third at the level of 1st pair of penetration glands, each ending in a pair of flame cells. Posterior collecting vessel gives rise to two branches, one near the 3rd pair of penetration glands having two flame cells and a branch with single flame cell at the posterior end of excretory bladder. Excretory bladder continues as caudal excretory canal, provided with four flame cells, bifurcate near furcal ramus and run till the end of the furcae. Flame cell formula: 2 [(2 + 2 + 2) + (2 + 1)] + (1 + 1 + 1 + 1) = 22.

Sporocyst (Fig. 2b)

Sporocysts developed in the snail host, *I. exustus,* were thread like measured 822.54–4956.41 (2427.60) × 102.51–164.13 (134.15). Each sporocyst enclosed about two developed cercariae and eight germ balls. Sporocysts were visible in hepatopancreas in a net like form.

Remarks

The present cercaria is similar in some morphological features to cercariae of *Posthodiplostomum cuticola* (Donges, 1964), cercaria of *Posthodiplostomum minimum* (Bedinger and Meade, 1967) and cercaria of *Posthodiplostomum* (Ritossa et al. 2013).

The comparison of morphology and morphometry of the present cercaria with the related cercariae is given in the Table 2. The characters that the present cercaria shares with the comparable cercariae are spinose oral sucker, absence of caeca, small excretory bladder and development inside the sporocyst. Difference in measurements, flame cell formula and host, absence of eye spot and caecae, distribution pattern of sensory hairs on body and tail stem, caudal excretory canal ending at the tip of furcae separate the present cercaria from cercariae of *Posthodiplostomum cuticola*. Absence of body and tail annulations, setae, eye spot, furcal fin; difference in the flame cell formula and difference in the host make the *Cercaria* sp. IV Western Ghats distinct from cercariae of *P. minimum*. In contrast to the cercariae *Posthodiplostomum*, the present one has muscular pharynx, caudal excretory canal up to the furcal tip, no eye spots or furcal fin, difference in the distribution pattern of spines in the oral sucker and tail stem and in the primary host. Besides these, presence of short pre pharynx, muscular pharynx, caudal flame cells and extension of excretory canal up to the tip of furcal ramus mark the difference of the present cercaria from the other cercariae. The present cercaria is, therefore, reported as new.

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Author's contribution Dr. PKP designed and guided the study. Mrs. KA carried out the survey, collected and studied the cercariae in detail. The manuscript was written by both the authors.

Compliance with ethical standards

Conflict of interest The authors declare that that there is no conflict of interest between them.

Ethical approval All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. All procedures performed in the study involving animals were in accordance with the ethical standards of the institution or practice at which the study was conducted.

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