

Larval trematodes. Part II. On two new cercariae from *Indoplanorbis exustus* (Deshayes)

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Abstract. Two new cercariae namely *C. chinahatensis* and *C. chelawaensis* have been described from *Indoplanorbis exustus*. *C. chinahatensis* belongs to 'Echinatoides' group of echinostome cercariae and it differs from other cercariae of the same group in number and position of penetration glands, number of flame cells and number of collar spines. The other cercaria *C. chelawaensis* belongs to 'Pigmentata' group of amphistome cercariae and it differs from other cercariae of the pigmentata group in the presence of an oesophageal bulb, in the presence of a median diverticulum on the transverse connection of the excretory system and in the position and shape of the eye spots.

Keywords. Echinostome; amphistome cercariae; *C. chinahatensis*; *C. Chelawaensis*; *Indoplanorbis exustus*.

1. *Cercaria chinahatensis* n. sp.

A large number of the snails of different genera were collected from the environs of Lucknow and examined for the infection of larval trematodes. Out of the fifty specimens of the snail *Indoplanorbis exustus* collected from Chinahat lake, only three were found infected with this Echinostome cercaria. The cercariae emerged from the snail host throughout the day but in larger numbers during the morning hours. They swim by the wriggling movement of their tail.

The body (figure 1), aspinose, with a blunt narrow anterior and a broad round posterior end measuring 0.44–0.48 × 0.24–0.27 mm in live specimens while 0.26 × 0.10–0.11 mm in fixed specimens. Tail aspinose and equal to or slightly longer than body, measuring 0.44–0.51 mm in length and 0.06–0.08 mm in width near base in live specimens while 0.36 mm × 0.04 mm in fixed specimens. Caudal finfold absent. A large number of rounded nuclei embedded in tail parenchyma and arranged in slightly irregular parallel rows. Tail on contraction gives an appearance of transverse striations throughout whole length.

Oral sucker terminal, spherical or subspherical, measuring 0.04–0.05 × 0.05–0.06 mm in live specimens and 0.04 mm in diameter in fixed specimens. Ventral sucker larger than the oral sucker, situated slightly posterior to equatorial line of body, and measures 0.06–0.08 × 0.06–0.09 mm in live specimens and 0.06 × 0.05 mm in fixed specimens. Cephalic collar (figure 1) feebly developed and armed with 26 collar spines arranged in a single row. All spines of equal size and no end group spines present.

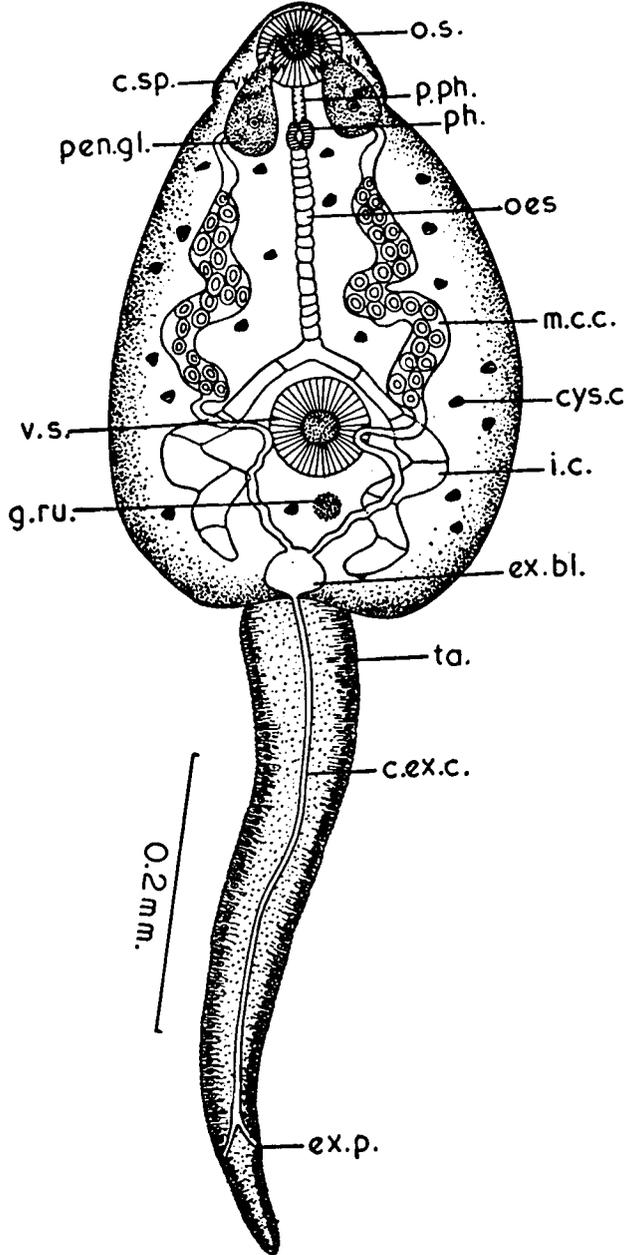


Figure 1. *Cercaria chinahatensis* n. sp.

Prepharynx short, measuring 0.04–0.05 mm in length in live specimens and 0.01 mm in length in fixed specimens. Muscular, globular pharynx measures 0.02 mm in diameter. Oesophagus long, measuring 0.14–0.15 mm in length in live specimens while 0.06–0.07 mm in length in fixed specimens, and appears to be formed of a single row of longitudinal cells; bifurcates, at a short distance in front of ventral sucker, into intestinal caeca which extend tortuously almost up to posterior end of body. A pair of oval, sac like penetration glands (figure 1) one on each side, present just posterior to oral sucker. Each gland pear-shaped and contains a nucleus and fine granules which stain light pink with neutral red, opening separately close to mouth by short ducts. Cystogenous gland cells present in whole body, oval, triangular or irregular in shape and contain small rod-like bodies, arranged in parallel way in each cell.

Rudiments of gonads (figure 1) present behind ventral sucker in form of an oval or round mass of dark staining cells.

Excretory system of echinostome type; excretory bladder (figure 2) rounded in shape, located at posterior end of body. Two main collecting canals open, one on each side, into antero-lateral border of excretory bladder. Three flame cells on each side in anterior third of body, capillaries of which unite to form anterior collecting canal. Anterior collecting canal runs posteriorly up to region of intestinal bifurcation. Flame cells, in posterior half of body, arranged in triples, in two groups: three flame cells near posterior extremity of body and three in region of ventral sucker. Thus the flame cell formula is $2(3) + (3+3) = 18$. Capillaries of

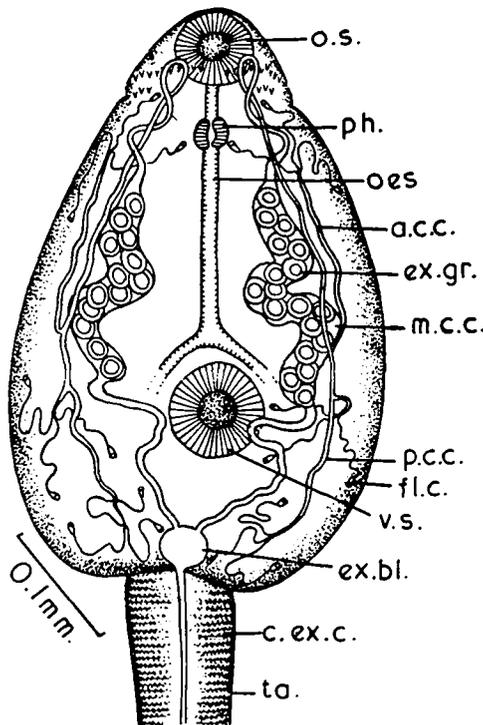


Figure 2. *Chinhatensis* n. sp. showing excretory system.

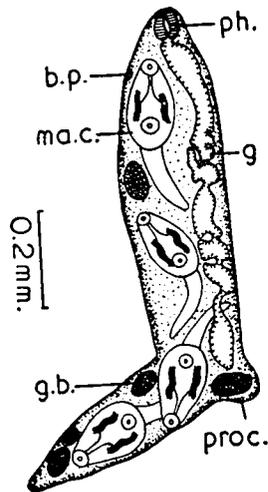


Figure 3. Redia of *C. Chinahatesis* n. sp.

flame cells of posterior half of body unite to form posterior collecting canal, which runs anteriorly up to region of intestinal bifurcation where it joins with anterior collecting canal and meets the main collecting canal. Main collecting canal, on each side, runs up to region of oral sucker, makes a loop, runs backwards up to a short distance behind pharynx, widens and runs up to middle region of ventral sucker, where it again becomes narrow and proceeds posteriorly to open at anterior border of excretory bladder. A caudal excretory canal extends into tail from posterior side of excretory bladder, up to about four-fifth of tail length, where a pair of lateral canals arises from it, which runs outwards and backwards to open outside by separate pores, a short distance anterior to distal end of tail.

The infected snail on dissection yielded a number of rediae. The rediae (figure 3) are large, elongated and show movements of contraction and expansion. They measure 1.120–1.888 mm in length and 0.240–0.288 mm in breadth in live specimens. Terminal mouth leads into a muscular pharynx, measuring 0.064×0.048 mm in live specimens. Pharynx followed by a gut which extends posteriorly up to about two-third of body length. Gut contains blackish material, proportionately much longer in developing rediae. Four to eight well developed cercariae present in each redia, besides some in developing stages. A few germ balls also present in each redia. Birth pore present at about 0.120–1.86 mm from anterior end of body and procuscula at about 0.400–0.450 mm from posterior end of body.

1.1. Discussion

The present Echinostome cercaria belongs to the 'Echinatoides' group of Sewell (1922). Of the Echinostome cercariae described under this group, the present cercaria resembles, *C. indicae* XLVIII Sewell 1922; *C. middelburgensis* Porter 1938; *C. catenata*. Porter 1938, *C. komatia* Porter, 1938 and *C. nairi* Peter 1955 in general morphology. However it differs from all these species in the number and position

of penetration glands (which are 4 pairs in *C. indicae* XLVIII and *C. catenata*; 3 pairs in *C. komatia*, *C. middelburgensis* and *C. nairi* and preacetabular in all these species where as they are one pair in the present form and situated just posterior to the oral sucker) and in the number of flame cells which are 14 pairs in *C. indicae* XLVIII, 5 pairs in *C. middelburgensis*, 10 pairs in *C. komatia*, 11 pairs in *C. Catenata* and 15 pairs in *C. nairi* where as 9 pairs in the present cercaria. It also differs from all these cercariae except *C. middelburgensis* in the number of collar spines (collar spines are 43 in *C. indicae* XLVIII, 20 in *C. Komatia* and *C. catenata*, 41 in *C. nairi* and 26 in the cercaria described here). It can be further distinguished from *C. middelburgensis*, *C. catenata* and *C. komatia* by the aspinose body and tail. It also differs from *C. indicae* XLVIII and *C. komatia* by the shape of the excretory bladder. From *C. indicae* XLVIII it differs further in the structure of oesophagus and intestinal caeca.

The author, therefore, regards the present cercaria as a new species and designates it as *Cercaria chinahatensis* n. sp.

Host: *Indoplanorbis exustus*

Locality: Chinahat, Lucknow.

2. *Cercaria chelawaensis* n. sp.

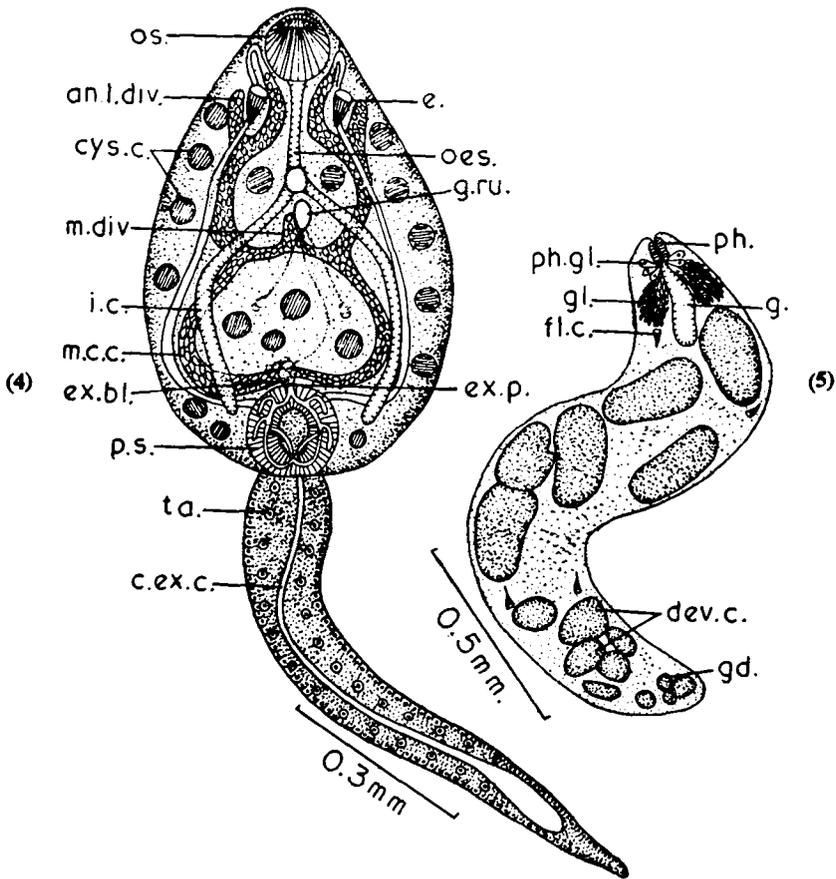
Out of the two dozen specimens of *Indoplanorbis exustus*, collected from a pond located in the village Chelawa, about four miles away from the city of Lucknow, only one snail was found infected with an amphistome cercaria belonging to the 'Pigmentata' group. As far as the author is aware, Sewell (1922), for the first time, described from India three amphistome cercariae under Pigmentata group, namely *Cercariae indicae* XXVI, *C. indicae* XXIX and *C. indicae* XXXII. Later on Srivastava (1938) and Sinha (1950) described the cercaria of *Cotyloporon cotyloporum*. Peter and Srivastava (1955) described *C. bulimusi*, *C. chungathi*, *C. gyraulsi* and *C. indoplanorbisi*. Tandon (1957) while describing life history of *Gastrothylax crumenifer* described its cercaria also in detail. In the same year Singh (1957) added one more cercaria, *C. lewerti*, to the pigmentata group of amphistome cercaria. Recently Mukherjee (1968) described *C. bhaleraoi* under this group.

The cercariae emerge out of the snail host, in large numbers, during the morning. They are positively phototropic as they crowd towards the illuminated part of the container. They swim actively with the vigorous beating of their powerful muscular tail. The swimming activities are interrupted at irregular intervals by short periods of relaxation. Occasionally they crawl on the bottom of the container. After about an hour of free swimming life, the cercariae lose their tail and encyst on the walls of the container and the leaves present in the container.

The body of the cercaria (figure 4) is thick and has brown pigment spots. It measures 0.600–0.750 mm in length and 0.450–0.480 mm in breadth in live condition and 0.330–0.420 mm in length and 0.255–0.270 mm in breadth, when fixed. The cuticle is devoid of spines. There are numerous ovoid cystogenous cells with rod-like bodies, extending all over the body. The tail is longer than the body and measures 0.855–0.960 mm in length and 0.105–0.135 mm in width in live and 0.480–0.600 mm in length and 0.045–0.060 mm in width in fixed specimens. The tail has circular and longitudinal muscles with a large number of circular caudal

bodies. Two heavily pigmented, conical eye-spots are present, just behind the oral sucker. Each eye-spot is capped with a clear lens.

The oral sucker is terminal, circular and measures 0.060–0.075 mm in diameter in live specimens and 0.048–0.056 mm in fixed specimens. The posterior sucker is strongly developed, larger than the oral sucker, and measures 0.135–0.150 × 0.120–0.150 mm in live specimens and 0.088–0.100 × 0.096–0.112 mm in fixed specimens. The ratio between the oral and posterior suckers is roughly 1 : 2. A pharynx is absent. The oesophagus is moderately long and measures 0.120–0.150 mm in length in live specimens and 0.040–0.060 mm in length in fixed specimens. An oesophageal bulb, though feebly developed, is quite conspicuous in fixed and mounted specimens. The intestinal caeca extend up to the posterior end of the body. The rudiments of gonads are represented by masses of dark staining cells located in the posterior half of the body. The two diagonally placed testes, vasa efferentia, vas deferens, ovary, mehlis gland and uterus, though poorly developed, are yet well differentiated. The genital pore is represented by a well developed mass of cells placed behind the intestinal bifurcation.



Figures 4 and 5. *Cercaria chelawaensis* n. sp. Redia of *C. chelawaensis* n. sp.

The excretory system could not be traced out completely due to the presence of pigment granules and cystogenous cells. Anterior to the posterior sucker, is present a small excretory bladder into which the main collecting canals open. The position of flame cells could not be clearly seen. A network of the capillaries was seen in the region of the posterior sucker from which two excretory canals, one on each side, were seen to arise. These canals were seen running anteriorly up to the level of the oral sucker. Then they turned back and continued up to the excretory bladder as the main collecting canals to open into the excretory bladder. Behind the eye-spots, the main collecting canal shows, on each side, a small antero-lateral diverticulum at the outer side of the body. A median diverticulum present in the region just behind the intestinal bifurcation, seems to divide after a short distance into two transverse canals. These transverse canals, one on each side, unite with the main collecting canal of its own side at about the middle region of the body. The whole space of the main collecting canals, including the antero-lateral diverticula and the transverse connection with median diverticulum, is filled with round excretory granules. A caudal collecting canal originates from the tubular network in the posterior sucker, runs backwards through the middle of the tail and terminates sub-distally as a blind dilatation.

On dissecting the infected snail, a number of rediae in various stages of development were obtained from the hepato-pancreas and gonads of the snail host. The redia is white in colour and shows movements of contraction and expansion of the body. The body (figure 5) is aspinose and measures 0.840–4.10 mm in length and 0.270–0.480 mm in the width in live specimens, and 0.720–0.945 mm in length and 0.180–0.225 mm in width in fixed specimens. The pharynx measures 0.045–0.060 mm in diameter in live specimens and 0.025–0.035 mm in diameter in fixed specimens. Pharynx is provided with two sets of pharyngeal glands. The anterior set consists of three pairs of large oval glands while the posterior set has about twenty-five pairs of elongate oval glands. These glands take light stain with neutral red and methylene blue. The birth pore is located slightly behind the pharynx but never at the level with blind end of the gut. The gut is short and measures 0.135–0.240 mm in length in live specimens and 0.112–0.128 mm in length in fixed specimens. A number of developing cercariae and germ balls are present in the rediae. The excretory bladder and excretory ducts could not be made out in the rediae. Only two pairs of flame cells could be seen. The anterior pair of flame cells is located in the region of the gut, one on each lateral side of the body. The posterior pair of the flame cells, one on each lateral side of the body is located in the third quarter of the redia. Thus the redia has only 4 flame cells.

2.1. Discussion

The present cercaria belongs to the 'Pigmentata' group of the amphistome cercariae. As far as the author is aware, till now only eleven species of the amphistome cercariae belonging to 'Pigmentata' group, have been described from India namely *Cercariae indicae* XXVI Sewell, 1922; *C. indicae* XXIX Sewell, 1922; *C. indicae* XXXII Sewell, 1922; *Cercaria* of *Cotylophoron cotylophorum* described by Srivastava (1938) and Sinha (1950); *C. bulimusi* Peter and Srivastava 1955; *C. Chungathi* Peter and Srivastava 1955; *C. gyraulusi* Peter and Srivastava 1955; *C. indoplanorbisi* Peter and Srivastava 1955; *Cercaria* of *Gastrothylax Crumenifer* described by Tandon (1957);

C. lewerti Singh 1957 and *C. bhaleraoi* Mukherjee 1968. The present form differs from all these cercariae except *C. indicae* XXXII in the presence of an oesophageal bulb. It differs from *C. indicae* XXVI, *C. indicae* XXIX, *C. indicae* XXXII, cercaria of *Cotylophoron cotylophorum*, *C. bulimusi* and cercaria of *Gastrothylax crumenifer* by the ratio of oral and ventral suckers which is 1 : 2 in the present form. It can be distinguished from *C. indicae* XXVI, *C. indicae* XXIX, *C. indicae* XXXII, *C. gyraulusi* and *C. lewerti* in the more posterior extension of the intestinal caeca. It differs from *C. indicae* XXXII, *C. bulimusi*, *C. chungathi* and cercaria of *Gastrothylax crumenifer* by the presence of median diverticulum on transverse connection of the excretory system and from *C. bhaleraoi* in the size of this median diverticulum which is very small in *C. bhaleraoi*. It can be distinguished from cercaria of *Gastrothylax crumenifer* by the presence of antero-lateral diverticula of the main collecting canal. From *C. indicae* XXXII the present form differs in the absence of oesophageal sphincter and in the smaller size of the oesophagus. From *C. bulimusi* and *C. gyraulusi* it differs by the absence of papillae around the mouth opening. From cercaria of *Cotylophoron cotylophorum* it differs by the blind termination of the caudal excretory canal with dilation, near the posterior end of the tail (the small side-branches of the caudal canal are absent in the present form). It further differs from *C. gyraulusi* and *C. indoplanorbisi* by the position of eye-spots away from the caecal bifurcation. It can be further distinguished from *C. indoplanorbisi* and *C. bhaleraoi* by the conical shape of eye-spots with clear lens and by the excretory canals being fully packed with excretory granules. It differs from *C. lewerti* also by the absence of a pharynx.

Among foreign species of the cercariae of 'Pigmentata' group, it resembles *Cercaria paramphistomi calicophorum* described by Porter (1938) and *C. stelliae* Porter 1938. However, it differs from both these species in the larger size of the body, in the ratio of oral and ventral suckers, in the conical shape of the eye-spots and in the presence of the antero-lateral diverticula of the main collecting canal. From *C. stelliae* it further differs in the presence of median diverticulum on the transverse connection of the main excretory canals.

The author, therefore, regards the present cercaria as a new species and names it *Cercaria chelawaensis* n. sp.

Host: *Indoplanorbis exustus*

Locality: Chelawa, Lucknow.

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Abbreviations used

a.c.c., anterior collecting canals, an. l. div., antero lateral diverticulum; b.p., birth pore; e. ex. c., caudal excretory canals; c. sp., collar spines; cys. c., cystogenous cells; dev. c., developing cercariae; e., eye spot; ex. bl., excretory bladder; ex. p., excretory pore; fl. c., flame cells; g., gut; g. b., germ balls; gl., glands; g. ru., rudiments of gonads; i.c., intestinal caeca; m., mouth; ma. c., mature cercaria; m. c. c., main collecting canal; m. div., median diverticulum; n., nucleus; oes., oesophagus; o. s., oral sucker; p. c. c., posterior collecting canal; pen. gl., penetration glands; p. ph. preharynx; ph., pharynx; ph. gl., pharyngeal glands; proc., proscuscula; p. s., posterior sucker; ta., tail. v. s., ventral sucker.