The excretory system in Echinostome Cercariae (Trematoda)

by

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Sewell (15), Rao (13, 14), Srivastava (18), Srivastava and Dutta (19), Singh (16, 17) and Jain (9, 10) in India have solved some of the life histories of certain trematodes and have described many larval forms. They have emphasized the value of the excretory system of the larval flukes as a basis of description and group relationship. The conservatism of this system is again urged in the present paper on the basis of investigations on echinostome cercariae. While the main purpose is to lay special emphasis on the excretory system, a brief description of other organs is also made as a matter of record.

The cercariae were obtained from the liver of Indoplanorbis exustus, collected from several ponds of Jabalpur in the months of July and October, 1966. The cercariae emerge between 9 and 12 A. M. and live about 24 hours in the laboratory. They swim and creep with comparatively great speed and characteristically are nearly equally distributed throughout the container until they become spent and settle to the bottom. Soon after emergence, they alternately creep and swim in intervals of 2 to 3 minutes. In behaviour and general appearance, this cercaria agrees with the description of Cercaria mehrai (Faruqui) Jain, 1958.

THE CERCARIA

These cercariae (Fig. 1), designated as the offspring of rediae, with a collar of 43 spines at the anterior end of the body, may be recognised by a pair of heavy collecting tubules extending from the excretory bladder to the region of the pharynx where they become constricted, reflex on themselves in triangular fashion and continue caudad to the posterior region of the body. This secondary portion of the tubule in the posterior region again bends forward as a tertiary

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portion and continues to the region of the pharynx. This is a pattern of excretory system found in almost all echinostome cercariae.

The body measures 0.160 × 0.112 mm. The tail is larger than the body. It measures 0.48 mm in length and tapers gradually towards the tip. The oral sucker is inclined ventral and measures 0.027 mm in diameter. The ventral sucker, which lies behind the middle of the body, measures 0.039 mm in diameter. Between the oral sucker and the pharynx is a slight prepharyngeal sphincter. Behind the pharynx is a long esophagus which normally forks just in front of the ventral sucker. The caeca reach to the subdistal region of the body, as in most echinostome larvae. On either side of the esophagus, three pairs of gland cells are the salivary glands. Their ducts pass forward and inwards to open by a series of small orifices around the anterior margin of the oral aperture.

The primordium of genital organs is represented by a mass of small rounded granular cells in front of the excretory bladder. It probably represents the rudiments of ovary and uterus. Another mass of cells lies in front of the ventral sucker. It represents the vaginal orifice according to Sewell (15). The excretory bladder, nonepithelial, somewhat oval in shape, is situated in front of the point of attachment of body and tail. The two main collecting tubules, with membranous walls, have a narrow calibre, then widen out and are filled with 5 to 6 globular refractile masses of excretory material. These render them very prominent.

There are twelve pairs of flame cells connected by minute capillaries with the tertiary portion of the tubule. The flame cell formula of the cercaria is \( 24 = 2 [(2 + 3) + (2 + 4 + 1)] \). Such an arrangement of excretory tubules is uniformly found in all echinostome cercariae. The thin walled caudal excretory canal originates on the dorsal side of the bladder through an aperture and runs back through the tail stem. It extends back up to the point where the tail gives rise to the tapering cone. It runs straight for the most part of its course, but in the posterior region it becomes somewhat wavy for a short distance. It then turns laterally to open below through a minute excretory pore to the exterior. There are no lateral branches given off from the caudal excretory canal. Flame cells are absent in the tail.

**DISCUSSION**

Lühe (12) for the first time presented a scheme of classification of the cercariae on larval characters. Lebour (11) suggested that the classification should be based on the nature of the parthinita from which the cercaria develops. Later on Sewell (15) proposed another classification for separating the echinostome cercariae into three groups, 'Echinata', 'Echinatoïdes', and 'Coronata'. The comparison of *Cercaria mehrae* (Faruqui) with these groups shows that the system is confusing. The fundamental pattern of the excretory tubules in the body of the echinostome cercariae is apparently and potentially inherent. The caudal excretory canal, of all the various systems of the trematode anatomy, seems most important for providing a basis of classification.

In consideration of the arrangement of the caudal excretory canal, the
authors feel justified in dividing the echinostome cercariae into three new groups: "Echinosolenata", "Echinobisolenata" and "Echinopolysolenata".

In 'Echinosolenata' group, the caudal excretory canal is single, median and unbranched throughout the entire course. In 'Echinobisolenata' the caudal excretory canal forks into two branches. In 'Echinopolysolenata' the caudal excretory canal forks into three branches, two lateral and one median which runs backwards in the tail.

_Cercaria trisolenata_ Faust, 1917 (fig. 2) (5); _C. chisolenata_ Faust, 1918 (6); _C. mehrai_ (Faruqui) Jain, 1958 (fig. 1) and _C. palustris_ Chatterji, 1933 (3) are placed under the first new group 'Echinosolenata'. The single caudal excretory canal runs throughout the tail to open to the exterior through a single minute excretory pore.

The simplest condition of the caudal excretory canal of the second new group 'Echinobisolenata' is seen in _C. catenata_ Cawston, 1917 (fig. 3) (1). The caudal tube forks into two short lateral branches at the very end of the tail so that two outlets are formed. It would not be out of place to mention here that a similar condition of excretory system, as seen in _C. catenata_, also exists in amphistome cercariae. Next the point of bifurcation of the lateral branches from the caudal tube has shifted cephalad as seen in _Cercaria constricta_ Faust, 1919 (fig. 4) (7). In _Cercaria arcuata_ Cawston, 1918 (fig. 5) (2), _C. trivolvis_ Cort, 1915 (4) and _C. reflexa_ Cort, 1914, the caudal tube forks into two elongated lateral branches soon after in enters into the tail. The lateral branches then continue distal and open to the exterior through two minute excretory pores in the subdistal region of the tail. In an advanced condition, the excretory apertures at the subdistal region of the tail become occluded as seen in _C. biflaxa_ Faust, 1917 (fig. 6) (5). _Cercaria secondum_ Nicoll, 1906, _C. bagulai_ Jain, 1960 (fig. 7) (10) and _C. complexa_ Faust, 1919 (8) represents a condition in which the caudal tube divides into two short lateral branches which open to the exterior on either side a little below the level of the bifurcation.

A condition of a stage in advance to the second new group 'Echinobisolenata' cited above is expressed in the caudal excretory system of _Cercaria acanthostoma_ Faust, 1918 (fig. 8) (6), _C. indica_ XII, _C. indica_ XX, _C. indica_ XXIII and _C. indica_ XLVIII Sewell, 1922 (15) placed under the third new group 'Echinopolysolenata', where the caudal tube runs posteriorwards in the tail and a pair of short lateral branches originate from about one eighth of the tube. They pass outwards to open on the dorsum.

The authors hold the view that the excretory system is the only chief feature of systematic importance in the classification of the echinostome cercariae.
<table>
<thead>
<tr>
<th>Group and Species</th>
<th>Described by</th>
<th>Date</th>
<th>Host</th>
<th>Locality</th>
<th>Parthenita</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Echinosolenata</strong></td>
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<td><em>Cercaria trizolenata</em></td>
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<td>Redia.</td>
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<td><em>Cercaria mehraii</em></td>
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<td>1958</td>
<td><em>Indoplanorbis exustus</em></td>
<td>Jabalpur, India</td>
<td>Redia.</td>
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<td><em>Cercaria paliistris</em></td>
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<td>1933</td>
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<td>Redia.</td>
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<td>Redia.</td>
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<td><em>Planorbis trifolios</em></td>
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<td>Redia.</td>
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<td>Redia.</td>
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<td><em>Cercaria bagulai</em></td>
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<td>Redia.</td>
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<td><strong>3. Echinopolysole nata</strong></td>
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<td><em>Planorbis trivolvis</em></td>
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<td>Redia.</td>
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<td>Redia.</td>
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SUMMARY

*Cercaria mehrai* (Faruqui) is redescribed, with special reference to the excretory system. The latter's importance is urged as a basis on which fundamental group relationships of the larval forms can be discovered. The echinostome cercariae are divided anew into three main groups. The close relationships of the echinostome cercariae is discussed.

RESUMEN

Se redescribe *Cercaria mehrai* (Faruqui), con mayor atención al sistema excretor. Se hace énfasis en la importancia de éste como base para la clasificación de las formas larvarias, y se propone una nueva división de las cercarias equinostomas en tres grupos principales. Se comenta la estrecha relación existente entre estas cercarias.

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17. Singh, R. U.  

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Fig. 1. *Cercaria mehrai* (Faruqui).  
Abbreviations used — Caud. exc. c., caudal excretory canal; exc. bl., excretory bladder; exc. p., excretory pore; f. c., flame cell; m. exc. c., main excretory canal; O.S., oral sucker; V.S., ventral sucker.
Fig. 2. *Cercaria trisolenata*, ventral view. ×150 After FAUST (5).

Fig. 3. *Cercaria catenata*, ventral view. ×170. After FAUST (7).

Fig. 4. *Cercaria constricta*, ventral view. ×170. After FAUST (7).

Fig. 5. *Cercaria arcuata*, ventral view. ×170. After FAUST (7).

Fig. 6. *Cercaria biflexa*, ventral view. ×105. After FAUST (5).

Fig. 7. *Cercaria bagulai*, ventral view. After JAIN (10).

Fig. 8. *C. acanthostoma* ventral view. ×170. After FAUST (6).