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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 cercariæ. 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 cercariæ were obtained from the liver of *Indoplanorbis exustus*, collected from several ponds of Jabalpur in the months of July and October, 1966. The cercariæ 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 cercariæ (Fig. 1), designated as the offspring of rediæ, 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 cercariæ.

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 larvæ. 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 cercariæ. 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 cercariæ 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 cercariæ into three groups, 'Echinata', 'Echinatoides', and 'Coronata'. The comparison of *Cercaria mehrai* (Faruqui) with these groups shows that the system is confusing. The fundamental pattern of the excretory tubules in the body of the echinostome cercariæ 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 cercariæ 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 cercariæ. 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. biflexa* Faust, 1917 (fig. 6) (5). *Cercaria secundum* 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. indicæ* XII, *C. indicæ* XX, *C. indicæ* XXIII and *C. indicæ* 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 cercariæ.

TABLE 1

Important biological data on Echinostome Cercariæ

Group and Species	Described by	Date	Host	Locality	Parthenita.
1. Echinosolenata					
Cercaria trisolenata	Faust	1917	*Physa gyrina* *Planorbis trivolvis*	Bitter Root River, Montana.	Redia.
Cercaria chisolenata	Faust	1918	*Physa gyrina*	Pine Creek of Rock River, Illinois	Redia.
Cercaria mehrai (Faruqui) Jain, 1958	Jain	1958	*Indoplanorbis exustus*	Jabalpur, India.	Redia.
Cercaria palustris	Chatterji	1933	*Indoplanorbis exustus*	Allahabad, India.	Redia.
2. Echinobisolenata					
Cercaria catenata	Cawston	1917	*Planorbis pfefferi* *Lymnaea natalensis* *Physopsis africana*	Durban, Natal, South Africa.	Redia.
Cercaria constricta	Faust	1919	*Physopsis africana*	Natal, South Africa.	Redia.
Cercaria arcuata	Cawston	1918	*Lymnea natalensis*	Natal, South Africa.	Redia.
Cercaria trivolvis	Cort	1915	*Planorbis trivolvis*	Normal School Pond, De Kalb; drainage ditch, Urbana, Illinois	Redia.
Cercaria reflexæ	Cort	1914	*Lymnaea reflexa*	Chicago, Illinois.	Redia.
Cercaria biflexa	Faust	1917	*Physa gyrina*	Bitter Root River, Montana	Redia.
Cercaria secundum	Nicoll	1906	——	——	——
Cercaria complexa	Faust	1919	*Planorbis trivolvis*	Urbana.	Redia.
Cercaria bagulai	Jain	1960	*Lymnaea luteola*	Allahabad, India.	Redia.
3. Echinopolysolenata					
Cercaria acanthostoma	Faust	1918	*Planorbis trivolvis* *Physa gyrina*	Urbana.	Redia.
Cercaria indicæ XII	Sewell	1922	*Indoplanorbis exustus*	N. Wynaad and near Sultan's Battery, Manntoddy.	Redia.
Cercaria indicae XX	Sewell	1922	*Indoplanorbis exustus*		Redia.
Cercaria indicæ XXIII	Sewell	1922	*Indoplanorbis exustus*		Redia.
Cercaria indicæ XLVIII	Sewell	1922	*Indoplanorbis exustus*		Redia.

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 cercariæ are divided anew into three main groups. The close relationships of the echinostome cercariæ 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 exis-existente entre estas cercarias.

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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.

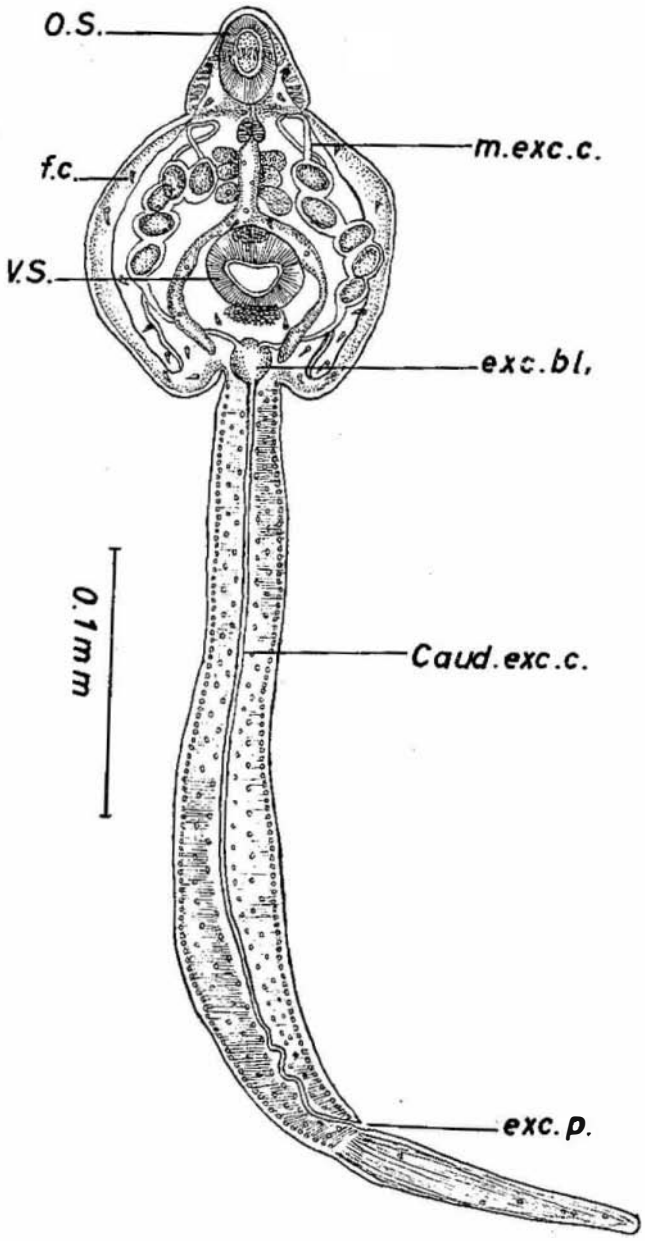


Fig. 1.

Fig. 2. *Cercaria trisolenata,* ventral view. × 150 After FAUST (5).

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

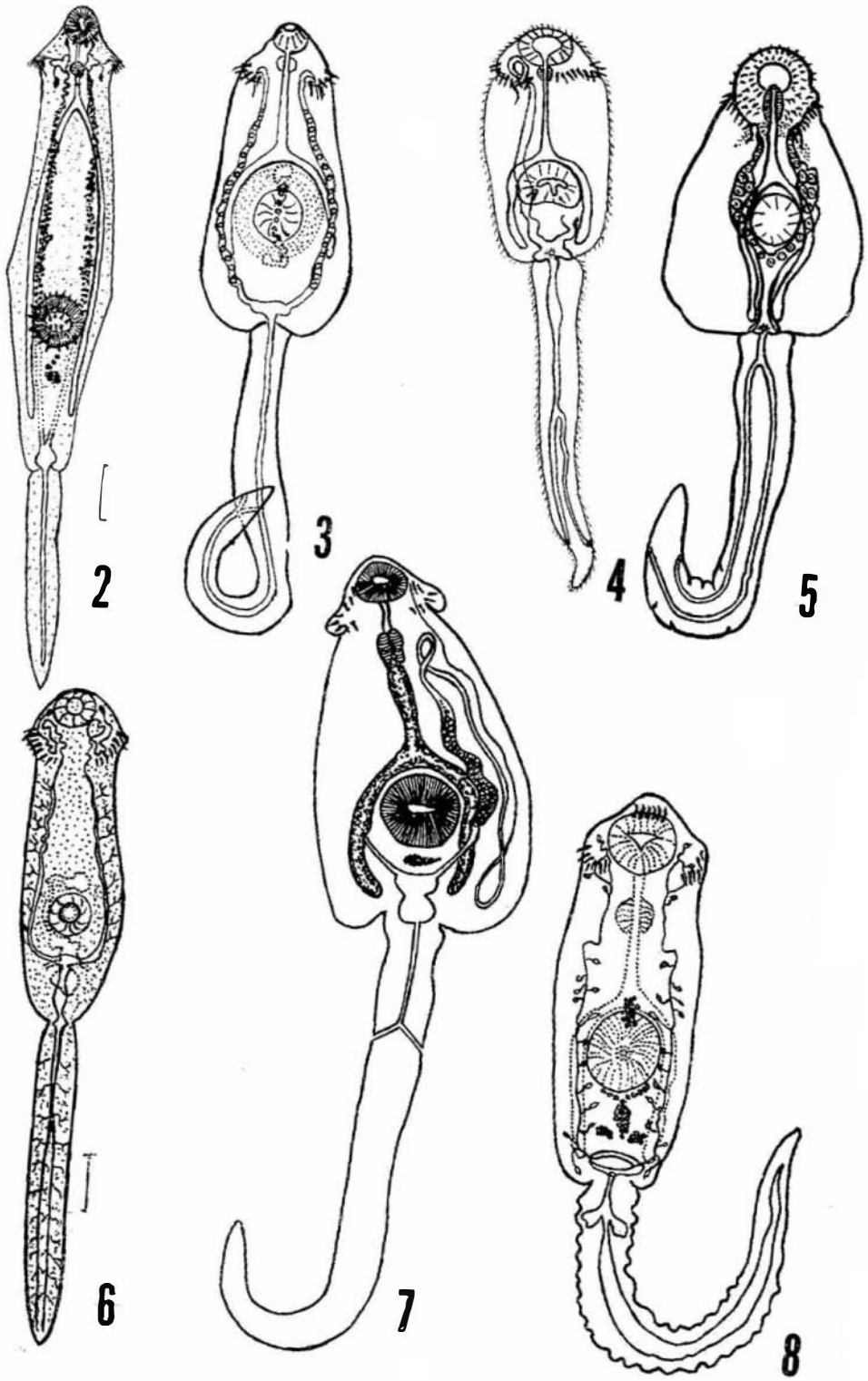
Fig. 4. *Cercaria constricta,* ventral view. × 170. After FAUST (7).

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).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