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Larval Trematodes of Some Freshwater Snails from Asir Province, Saudi Arabia

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Abstract

Three new forms of cercariae are described from freshwater snails in Asir Province: A xiphidiocercaria belonging to the Polyadena sub group from *Lymnaea palustris*, a pleurolophocercous cercaria from *Melanoides tuberculata*, and a gymnocephalous cercaria from *Bulinus truncatus*. These cercariae are named *Cercaria asiri* III through V, respectively. *Cecaria asiri* III has eight pairs of penetration glands, 30 flame cells, and develops within an elongated sporocyst. *Cercaria asiri* IV has seven pairs of penetration glands, 26 flame cells, and develops within a redia with a short rhabdocoel gut. *Cercaria asiri* V has a rod-like cystogenous matter, 30 flame cells, and develops in a redia with a long rhabdocoel gut. Other details on the morphology and the behavior of the cercariae as well as their development within the snail hosts are presented.

Key words: Saudi Arabia, Cercaria, *Melanoides, Bulinus, Lymnaea.*

Introduction

Freshwater snails so far found in Saudi Arabia comprise four species of prosobranch gastropods and 12 species of basommatophoran gastropods (Brown and Wright, 1980). Of these, are: *Melanoides tuberculata* Müller (1774), *Bulinus truncatus* Audouin (1827), and *Lymnaea palustris* Müller (1774). *Melanoides tuberculata* is a cosmopolitan snail. It occupies most of the inland water bodies of Southern Asia, most of Africa, and the Near East (Tchernov, 1975; Brown, 1980). In Saudi Arabia, it is the most commonly found snail (Alio, 1967). *Bulinus truncatus* is common in the Mediterranean region, Iran, most parts of North and Central Africa, and in the highlands of southwestern Saudi Arabia where it is known to be the intermediate host for *Schistosoma haematobium*. Its typical habitats in the country are pools or streams with clean water and rocky bottoms in the Sarawat mountains in Asir Province (Brown and Wright, 1980). *Lymnaea palustris* is found throughout Europe and eastward to Iran, with southern limits in Saudi Arabia and northwestern Africa (Brown and Wright, 1980). In Saudi Arabia, this snail is restricted to the streams of Sudah in Khamis Mushayt-Abha area in Asir Province (Alio, 1967).

These snails are known to act as intermediate hosts for many digenetic trematodes. More than 50 different forms of cercariae have been recovered from *M. tuberculata* (Premvati, 1953, 1954, 1956; El-Gindy and Yousif, 1963; Gupta and Taneja, 1969; Gold and Lengy, 1974; Fahmy *et al.*, 1976, 1977; Mohandas, 1976; Khalifa *et al.*, 1977; Khan and Haseeb, 1981; Saxena, 1982; Haseeb, 1984; Ismail and Saliba, 1985). Several forms of cercariae in addition to that of *S. haematobium* have been described from *B. truncatus* (Abdel-Azim, 1935a, 1935b; Porter, 1938; Lengy and Wolff, 1971).

Lymnaea palustris acts as the first intermediate host for *Moliniella anceps* and as the second intermediate host for *Cotylurus cornutus* (Nasir, 1984). In Saudi Arabia, no work has been done to study larval trematodes of these snails. Recently, Ismail *et al.* (1988) have described two new forms of cercariae, *Cercaria asiri* I and II, from the freshwater snail *Ancylus*

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fluviatilis in Asir Province. The present study describes three forms of cercariae from *M. tuberculata, B. truncatus*, and *L. palustris.*

Materials and Methods

Collections of snails were made in three different locations in Asir Province during the period September, 1986 to January, 1987. *Melanoides tuberculata* was collected from slow-running streams in Wadi Bisha, Al-Farsha. *Bulinus truncatus* snails were collected from the edge of a lake near Tamniyah Dam, Al-Shaaf District. *Lymnaea palustris* was collected from a pool of stagnant water in the village of Zabnah, Rabeeah-wa-Rufaidah District.

Examination of snails for larval trematodes and studying these trematodes were carried out as described by Ismail *et al.* (1988). Measurements were made on a minimum of 10 live and 10 fixed cercariae and are presented in microns as ranges followed by means in parentheses. Fixed specimens are deposited in the Helminthology collection of the Biology Department, College of Education, King Saud University, Abha Branch, Saudi Arabia.

Results

Three new forms of cercariae were recovered from the snails examined: a xiphidiocercaria from *Lymnaea palustris*, a pleurolophocercous cercaria from *Melanoides tuberculata*, and a gymnocephalous cercaria from *Bulinus truncatus*. These are given the names *Cercaria asiri* III, *C. asiri* IV, and *C. asiri* V, respectively.

Cercaria asiri III (Fig. 1)

Host: *Lymnaea palustris*
Locality: Al-Sudah, Asir Province, Saudi Arabia.
Description: A relatively large xiphidiocercaria. Measure- of live and fixed cercariae, respectively, are: body length 192 – 282 (255) and 192 – 240 (221); body width 80 – 128 (115) and 64 – 106 (84); tail length 96 – 240 (195) and 112 – 192 (155); tail width 19 – 32 (27) and 22 – 32 (26). The body tegument is 2 μm thick and has fine spines all-over. It is also provided with 4 sensory setae at the anterior end, 2 setae near the middle, and 2 near the posterior end of the body. The tail is highly contractile, and is recessed at the tail base into a 32 by 35 μm pocket-like depression which has a 12 μm thick wall. The oral sucker is oval in shape, and measures 45 by 51 μm. It is provided with a 32 by 6.5 μm stylet, but lacks the virgula organ. The ventral sucker is 32 by 36 μm in diameter and is located near the middle of the body. The digestive system consists of a mouth that leads into a short prepharynx. The pharynx is 12 by 16 μm and connects to the oesophagus which bifurcates halfway between the pharynx and ventral sucker into two intestinal caeca. Each caecum diverges outwards and terminates near the posterior extremity. The excretory bladder has a base and 2 long cornua. Each cornu gives rise to an ascending duct which coils in front of the ventral sucker before dividing into anterior and posterior collecting tubules. The caudal excretory duct opens near the tip of the tail. Flame cells are arranged symmetrically in the body, and are absent in the tail. The flame cell formula is 2 $[(2 + 3 + 3) + (3 + 3 + 1)] = 30$. The glandular system is made up of 8 pairs of penetration glands. Lower 4 pairs are finely granulated, while upper 4 pairs have coarse granules. All glands empty their contents into ducts that open at both sides of the stylet. Moreover, cystogenous gland cells and refractive granules are concentrated in the posterior half of the body. The genital primordium is made of a mass of cells around the ventral sucker.

Behavior: This cercaria swims actively in all directions. When it stops swimming, it sinks slowly to the bottom, and re-swims again into the water column. On the bottom, cercariae lose their tails and start crawling. Many of the cercariae were also seen crawling on the surface of the water column. The cercariae usually die within 24 hours after emerging from the snail.

Development: *Cercaria asiri* III develops within elongated sporocysts measuring 650 – 1300 by 221 – 312 μm. Sporocysts were found embedded within the tissues of the hepatopancreas,

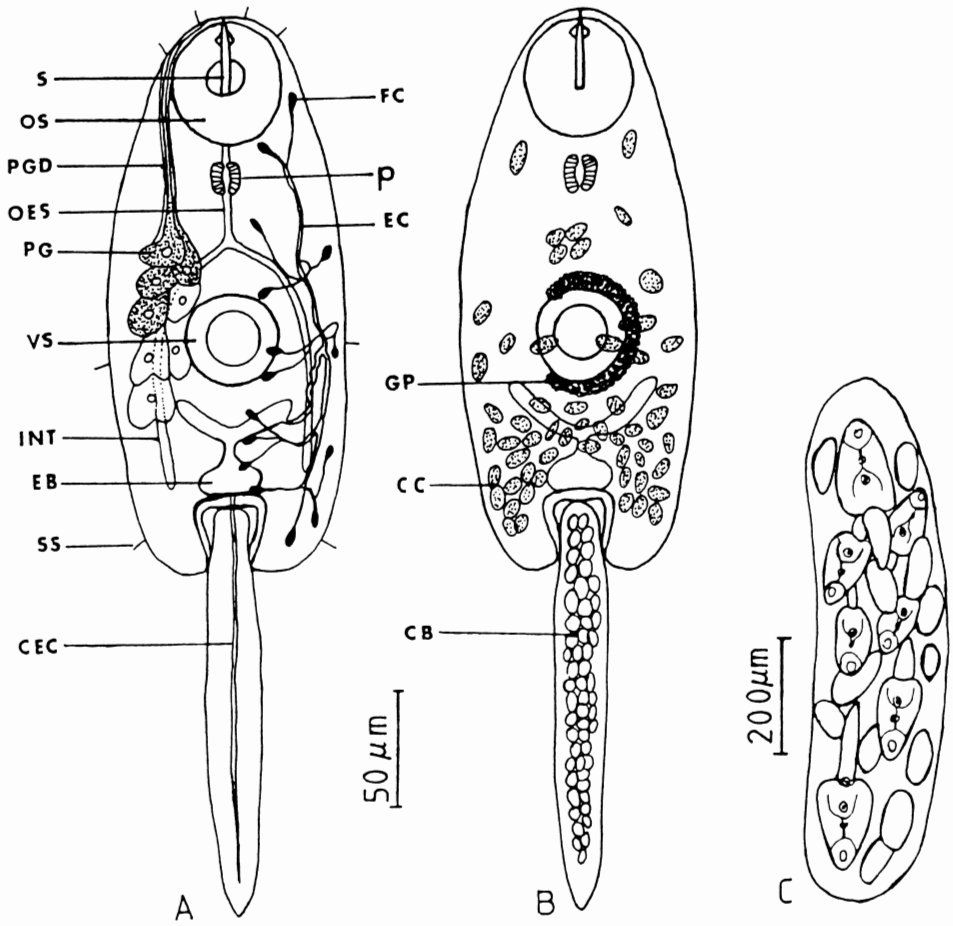

Fig. 1 *Cercaria asiri* III. A, entire specimen showing penetration glands, the excretory system, and the digestive system. B, distribution of cystogenous cells, caudal bodies, and germinal primordium. C, Sporocyst.

and usually contain several developing cercariae and germ cells.

Cercaria asiri IV (Fig. 2)

Host: *Melanoides tuberculata*

Locality: Wadi Bisha, Al-Farsha District, Saudi Arabia.

Description: This is a relatively small pleurolophocercous cercaria. Measurements of live and fixed cercariae, respectively, are: body length 163 – 225 (192) and 155 – 188 (172); body width 70 – 100 (88) and 60 – 95 (78); tail length 338 – 425 (379) and 350 – 425 (380); tail width 30 – 38 (34) and 23 – 26 (24). The anterior third of the body is covered with fine spines. A single row of stronger curved spines is present at the outer edge of the protrusible organ. In addition, longer spines are present at the interior edge of this organ. There are also five sensory setae distributed evenly on each side of the body. The tail, over twice the body length, is provided with 12 – 15 µm wide finfolds along its entire length. The anterior third of the tail has lateral finfolds, and the remaining part of the tail has dorso-ventral finfolds. Two eye spots are located at about 65 µm from the anterior body extremity. They are irregularly shaped, darkly pigmented, and measure roughly 8 by 6 µm. The oral sucker is modified into a protrusible penetration organ which measures 33 – 38 µm in diameter. The digestive system is made up of a rudimentary

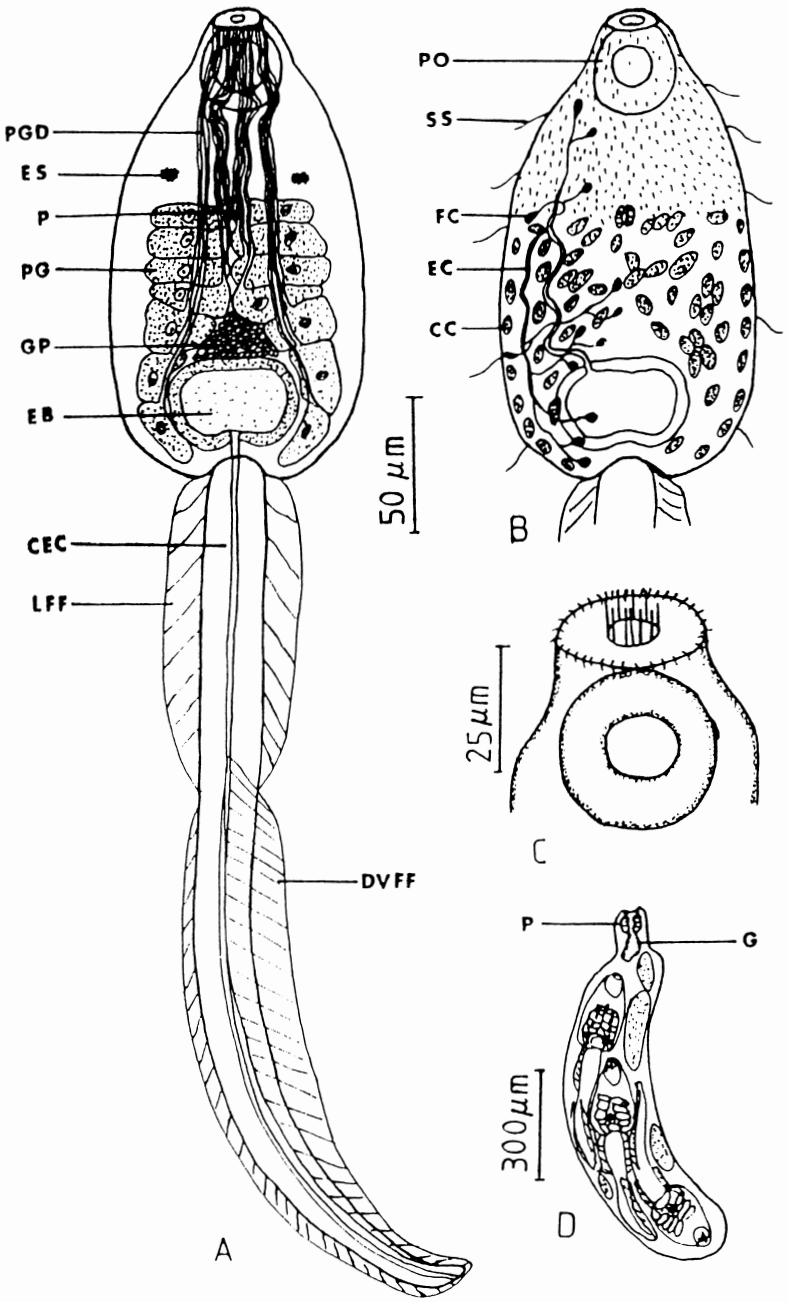

Fig. 2 *Cercaria asiri* IV. A, entire specimen showing penetration glands and tail finfolds. B, distribution of flame cells, cystogenous cells, and body spines and setae. C, distribution of spines at the anterior end of the body. D, redia.

pharynx. The excretory bladder is relatively large, measuring 45 – 55 by 33 – 38 µm, and has a 5 µm thick wall. It receives two ascending ducts which bifurcate into anterior and posterior collecting tubules at about the level of the pharynx. Caudal excretory duct opens at the tip of the tail. Flame cells are arranged symmetrically in the body, and are absent in the

tail. The flame cell formula is 2 [(2 + 2) + (3 + 3 + 3)] = 26. The glandular system consists of seven pairs of penetration glands. These glands empty their contents into two outer and two inner bundles of penetration gland ducts which open at the anterior edge of the protrusible organ. The outer bundle consists of three ducts, while the inner one consists of four ducts. In addition, the posterior two thirds of the body contains many refractile oval cells which probably contain cystogenous matter. The genital primordium consists of a mass of cells above the excretory bladder.

Behavior: This cercaria swims actively by the action of its tail. It shows positive phototaxis as well as thigmotaxis, tending to concentrate along the rim of the dish. The cercariae cast off their tails after few hours of active swimming. They continue crawling on the bottom of the dish and die 24 – 36 hours post emergence from the snail host without encystment.

Development: *Cercaria asiri* IV develops within an elongated redia which is 900 – 1200 by 150 – 250 μm. The redia possesses a relatively small pharynx (20 – 30 by 33 – 40 μm), and a short gut caecum (40 – 50 μm long). Rediae were found packed with developing cercariae and germ cells.

Cercaria asiri V (Fig. 3)

Host: *Bulinus truncatus*

Locality: Tamniyah Dam, Tamniyah, Asir, Saudi Arabia.

Description: This is a fairly large cercaria. Measurements of live and fixed cercariae, respectively, are: body length 205 – 256 (234) and 192 – 250 (214); body width 82 – 185 (119) and 86 – 125 (103); tail length 379 – 461 (424) and 350 – 470 (409); tail width 41 – 51 (47) and 20 – 48 (36). The body and tail are smooth. However, the tail has four pairs of papillae on both sides. Each papilla has two short setae. The posterior three quarters of the body are densely packed with cystogenous cells which contain rod-like cystogenous matter. The spherical oral sucker is 40 – 45 μm in diameter. The ventral sucker which is situated in the posterior half of the body, is 50 – 55 μm in diameter. The digestive system is made of a mouth that leads into a muscular pharynx at about 20 μm from the posterior border of the oral sucker. The pharynx measures 18 by 15 μm, and connects to an oesophagus which bifurcates into two intestinal caeca. Each caecum diverges outwards and runs posteriorly to the end of the body. The excretory bladder consists of a single chamber and connects to two ascending ducts. Each duct dilates and runs anteriorly to about the level of the pharynx. The duct then bifurcates into two collecting tubules, one of which continues to run anteriorly to the level of the oral sucker, and the other loops backward to the posterior end of the body. The dilated portion of the excretory duct is filled with large rounded refractile excretory granules. The caudal excretory canal bifurcates at about 120 μm from the posterior extremity of the body into two excretory canals that open into two excretory pores. Flame cells are arranged symmetrically in the body and are absent in the tail. The flame cell formula is 2 [(3) + (3 + 3 + 3 + 3)] = 30. The genital primordium consists of a small mass of cells between the excretory bladder and the ventral sucker.

Behavior: This cercaria swims actively for few hours before it loses its tail and starts crawling on the bottom. Later, cercariae develop into metacercariae measuring 120 – 145 by 82 – 105 μm. The metacercaria has a 5 – 7 μm thick wall.

Development: *Cercaria asiri* V develops within sausage-shaped rediae which vary greatly in size. There seemed to be two types of rediae, large and small: Large rediae are 360 – 565 μm long and 82 – 123 μm wide, and are provided with a relatively small pharynx (30 – 35 by 25 – 30 μm), and a long rhabdocoel gut that runs to the posterior extremity of the redia. Small rediae measure 205 – 256 μm long and 41 – 51 μm wide, and are provided with a relatively large pharynx (30 – 33 by 23 – 25 μm), and a long rhabdocoel gut that runs to the posterior extremity of the redia. Both types of rediae are provided with anterior and posterior lateral processes. The large redia has a birth

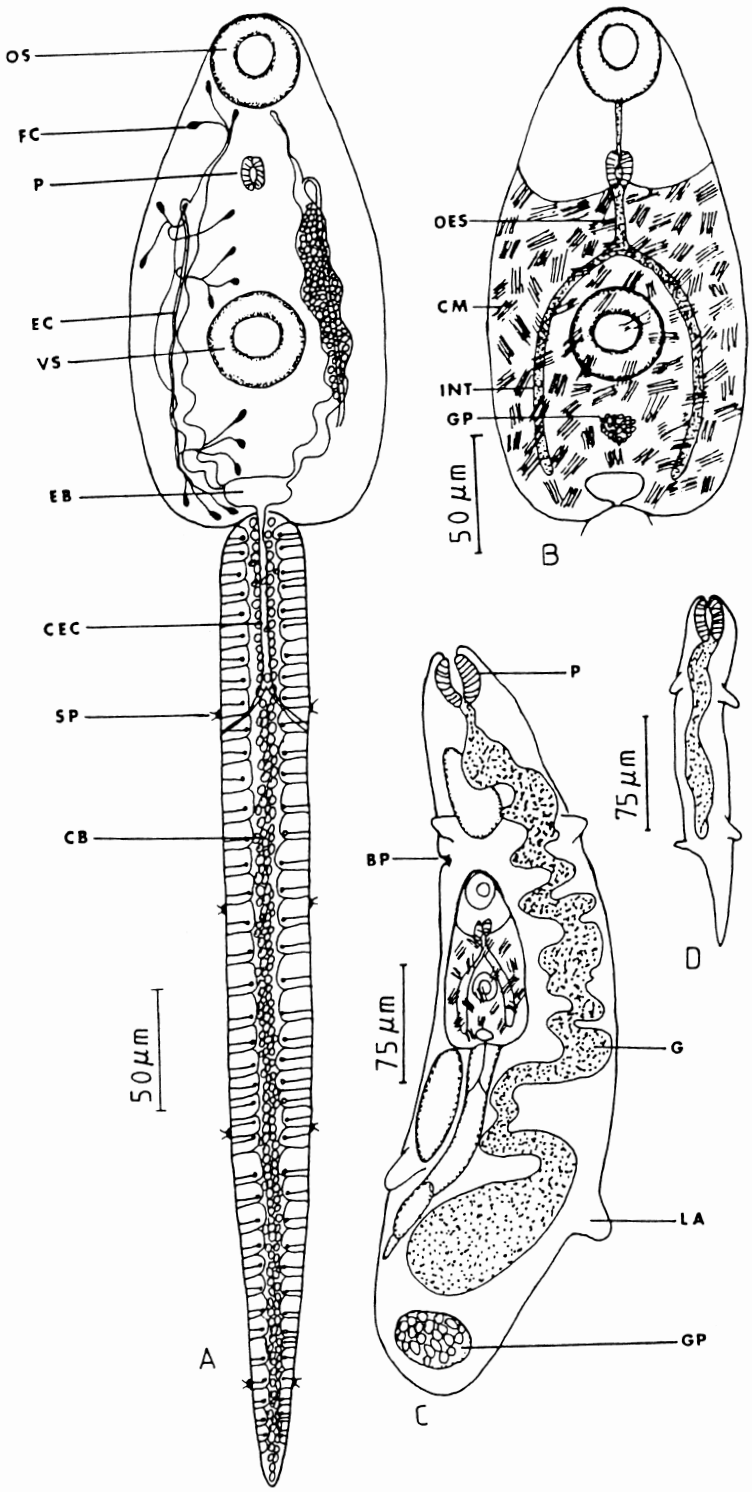

Fig. 3 *Cercaria asiri* V. A, entire specimen showing the excretory system and papillae on the tail. B, rod-like cystogenous matter and digestive system. C, large redia with developing cercariae. D, young redia.

pore at about 150 μm from the anterior extremity of the body.

Discussion

This is the first report of a natural infection of *Melanoides tuberculata, Bulinus truncatus* and *Lymnaea palustris* snails with larval trematodes in Saudi Arabia.

Cercaria asiri III belongs to Cercariae Armatae group of xiphidiocercariae (Lühe, 1909). This group includes distome cercariae with a stylet, and a tail lacking any finfold, body length exceeding 0.25 mm, acetabulum lying somewhat behind the middle of the body, and with a Y-shaped excretory bladder. The possession of stylet measuring about 0.03 mm, eight pairs of penetration-glands, and a developed digestive system indicate that *C. asiri* III belongs to polydena subgroup which was erected by Cort (1915) and redefined by Sewell (1922). The other forms of cercariae which resemble *C. asiri* III in possessing exactly eight pairs of penetration glands and intestinal caeca running to posterior extremity of the body are: *C. helvetica* IV and *C. helvetica* XXX (Dubios, 1929), *C. eta* (Brooks, 1948), cercaria of *Plagiorchis megalorchis* (Rees, 1952), *C. blukwa* (Fain, 1953), *C. baldai* (Nasir, 1964), and *C. abdulhameedi* (Nasir, 1982). All of these cercarial forms have 36 flame cells, while *C. asiri* III has 30 only. In addition, the contents of the penetration glands in these cercariae are not differentiated into fine and coarse granular cytoplasmic inclusions, while they are in *C. asiri* III.

The pleurolophocerca group to which *C. asiri* IV belongs, show a variety of peculiar features including the presence of a protrusible oral "penetration" organ, a long tail provided with a cuticular finfold, and a prepharynx and pharynx as the only constant element of the digestive system. The other forms of cercariae which resemble *C. asiri* IV in possession of seven pairs of penetration glands and a tail with lateral and dorsoventral finfold are: *Cercaria indicae* VIII (Sewell, 1922), *C. flavidusi*, and *C. gomtiensis* (Premvati, 1956), the parapleurolophocercous cercariae A and B of El-Gindy and Yousif (1963), *C. pinjorensis* (Gupta and Taneja, 1969) and *Cercaria* sp. III Kerala (Mohandas, 1976). *Cercaria asiri* IV can be separated from *C. indicae* VIII, *C. flavidusi*, and *C. gomtiensis* in the position and arrangement of the penetration glands. The latter in these cercariae do not extend beyond the excretory bladder, whereas they do in *C. asiri* IV. The tail in pleurolophocercous cercaria A is much longer than that of *C. asiri* IV. Moreover, the redia of *C. asiri* IV has a rhabdocoel gut, whereas that of pleurolophocercous cercaria A has only a pharynx and a short oesophagus. *Cercaria asiri* IV can be differentiated from the pleurolophocercous cercaria B by its larger body and longer tail. The tail of *C. pinjorensis* is not completely lined with finfolds. The lateral fins line the anterior third of the tail and the dorsoventral finfolds line the posterior half. In *C. asiri* IV, however, the entire tail is lined with finfolds. The redia of *C. pinjorensis* lacks the rhabdocoel gut which is present in the redia of *C. asiri* IV. *Cercaria* sp. III Kerala differs from *C. asiri* IV in several aspects: It has 30 flame cells, a larger body, a longer tail, and its penetration glands are not arranged in the same way as in *C. asiri* IV.

Cercaria asiri V is a lophocercous distome cercaria, in which the tail is straight, slender, and narrower than the body. The absence of a stylet and collar spines relates this cercaria to Lühe's (1909) group of gymnocephalous cercariae. A large number of the latter have previously been described. Other cercariae of this group which are non-ocellate, without a caudal finfold, with conventional digestive system, and resemble *C. asiri* V are: *Cercaria sudanensis* No. 3 (Archibold and Marshall, 1931), *C. albinea* and *C. densacutis* (Khan, 1960), *C. sanlorenzensis* (Nasir and Acuna, 1964), *C. cytogenata* and *C. llangorensis* (Probert, 1965), *C. concilia* and *C. pseudoconcilia* (Nasir *et al.*, 1968), *C. barceloica* (Nasir, 1971), *C. stenophysae, C. armikuhniani*, and *C. laurotraravassosi* (Nasir and Diaz, 1973), *C. leyteensis* no. 39 (Ito and Blas, 1978), and *C. pseudoalbinea* (Khan and Haseeb, 1980). Intestinal caeca of *C. barceloica* and *C. san-*

lorenzensis do not extend beyond the ventral sucker, whereas in *C. asiri* V the caeca extend to the posterior end of the body. The caudal excretory canal of *C. asiri* V bifurcates into two canals which run laterally to open into two excretory pores near the anterior end of the tail, while the caudal excretory canals of *C. stenophysae* and *C. sudanensis* No. 3 do not bifurcate and open at the posterior extremity of their tails. The bifurcation of the caudal excretory canal in *C. densacutis* and *C. albinea* is near the middle of the tail. In addition, the body and tail measurements and number of flame cells of *C. albinea, C. densacutis, C. leyteensis* no. 39, *C. pseudoalbinea*, and *C. armikuhniani* are different from those in *C. asiri* V. The lack of sensory setae and spines in *C. asiri* V differentiates it from *C. llangorsensis, C. cystogenata, C. laurotravassosi, C. concilia* and *C. pseudoconcilia*. With the exception of *C. llangorsensis*, the number of flame cells in these forms is different from that of *C. asiri* V. However, *C. llangorsensis* differs from *C. asiri* V in being larger in size, and its caudal excretory canal bifurcates near the posterior end of the tail.

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Abbreviations

BP	: Birth pore
CB	: Caudal bodies
CC	: Cystogenous cells
CEC	: Caudal excretory canal
CM	: Cystogenous matter
DVFF	: Dorso-ventral finfold
EB	: Excretory bladder
EC	: Excretory canal
ES	: Eye spot
FC	: Flame cell
G	: Gut
GP	: Genital primordium
INT	: Intestine
LA	: Lateral appendage
LFF	: Lateral finfold
OES	: Oesophagus
OS	: Oral sucker
P	: Pharynx
PG	: Penetration glands
PGD	: Penetration gland ducts
PO	: Penetration organ
S	: Stylet
SP	: Sensory papillae
SS	: Sensory setae
VS	: Ventral sucker