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STUDIES ON SCHISTOSOMIASIS (*S. mansoni*) IN PORTO RICO

III. Cercariae from *Planorbis guadeloupensis*

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Planorbis guadeloupensis has been shown to be the intermediate host of *S. mansoni* in Porto Rico. In the search for specimens infested with *S. Mansoni* the differentiation of the cercariae of the several trematodes for which this snail is the intermediate host, is a matter of considerable practical importance.

In the course of field studies on schistosomiasis we have found in Porto Rico four different kinds of cercariae in *Planorbis guadeloupensis*. Two of these are fork-tailed and the other two are echinostome cercariae.

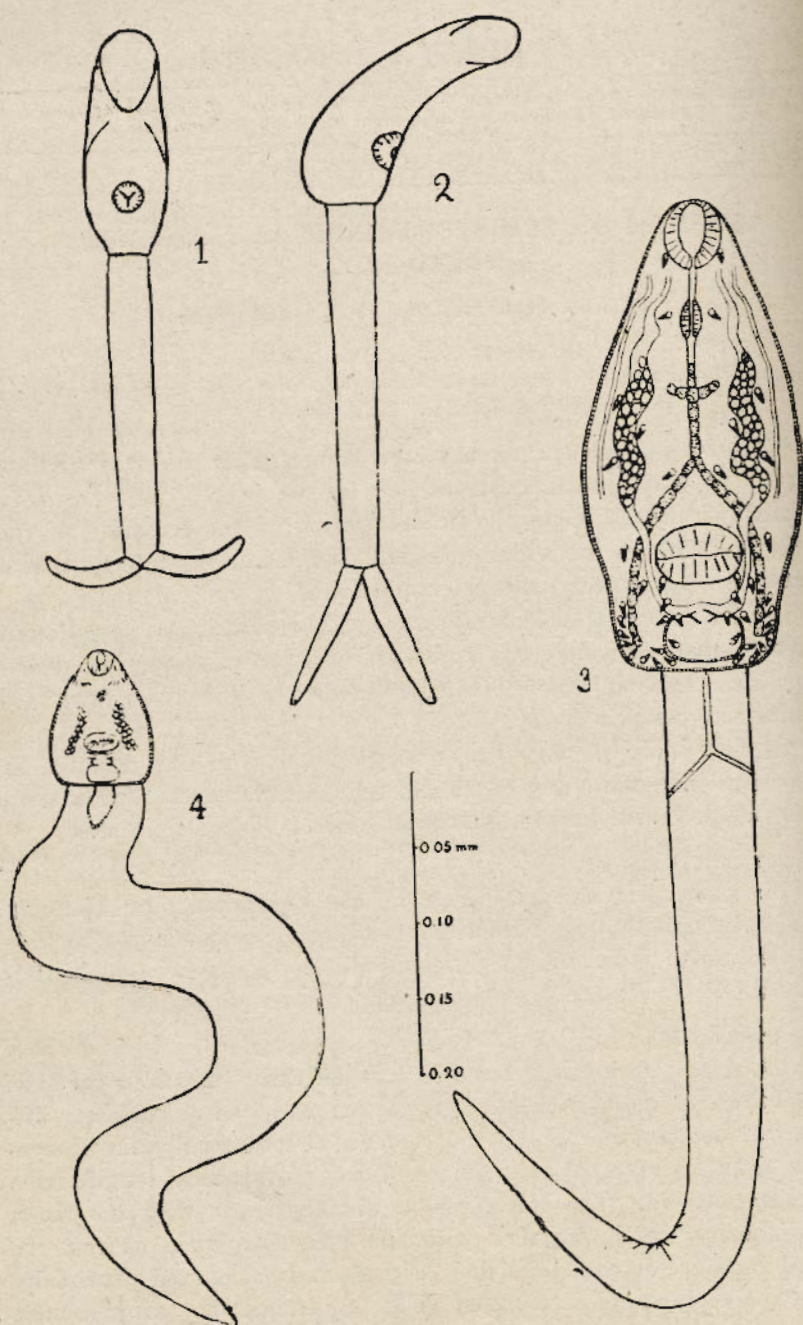
Although only the first two need be taken into consideration in connection with the study of human schistosomiasis, all four will be briefly described on account of their general biological interest.

P. R. Cercaria I.

This fork-tailed cercaria (Fig. 1) has been shown by Hoffman (1927) through the experimental infestation of mammals to be that of *Schistosoma mansoni*. An account of its occurrence and distribution in Porto Rico is given in the paper just referred to.

P. R. Cercaria II.

This second fork-tailed cercaria may be easily mistaken for that of *Schistosoma mansoni* when it is viewed with the naked eye. Microscopic examination shows the cercaria to possess a pair of eyespots situated laterally at about one-third of the body length from the anterior end. The tail forms a distinct angle with the body, a peculiarity which, together with the fact that when at rest the furcal rami are extended distally (Fig. 2) and not curved proximally as in the cercaria of *S. mansoni* (Fig. 1), enables one after a little



Cercariae from *Planorbis Guadeloupensis* in Porto Rico.

practice to distinguish it with the naked eye from that of *S. mansoni*. It is also larger and not nearly so active as the cercaria of *S. mansoni*.

This ocellated cercaria was obtained on two different occasions from snails collected in the irrigation ditches near Guayama during the latter half of the month of August 1927. It has never been obtained since, even though a total of several thousand snails have been collected from the same place on nine different occasions at intervals of about twenty days. Snails from other parts of the Island have never shown this fork-tailed cercaria.

The cercaria closely resembles *Dicranocercaria ocellifera* from Brazil figured by Lutz (1919).

P. R. Cercaria III.

This cercaria (Fig. 3) emerges from the snail during the night only. If the snails are placed in a dark room during the day the cercariae will come out. They swim rapidly through the water with their bodies curled ventrally. In a semi-contracted condition the body is shaped like a slipper; further contraction makes it pyriform. The body measures about 0.310 mm. in length by about 0.15 mm. in breadth. The tail is about 0.600 mm. long and has a diameter of about 0.050 mm. at its base. There is an oral sucker at the extreme anterior end and a larger ventral sucker situated from one-quarter to one-third of the total body-length from the posterior end. Beneath the cuticle there are numerous rounded cystogenous cells containing in their protoplasm tiny spherical granules of cystogenous material.

The mouth is subterminal. It leads back into the cavity of the oral sucker, which is succeeded by a rather long prepharynx. This opens into an ovoidal pharynx. Behind the pharynx the narrow oesophagus, with a lumen for about one-third of its length, becomes solid for a short distance. It then sends off two short branches laterally at right angles to itself, the trunk going on to a point in front of but not close to the acetabulum, where it bifurcates into two solid narrow intestinal caeca which pass backwards and outwards laterally to the acetabulum as far as the excretory bladder. The two branches of the oesophagus which, I have reason to presume, later develop into diverticula, form the characteristic feature of this cercaria, distinguishing it at once from all other similar cercariae figured or described in the literature available in our library.

The excretory vesicle is large and seen longitudinally has the shape of a rectangle with corners rounded off. The two main ex-

cretory tubes arise from a common secondary vesicle just in front of and in apposition to the main excretory vesicle and course outwards and forwards past the acetabulum. The tubes then become dilated and continue forward to the region of the pharynx; the dilated portion of the tubes contains many spherical refractile excretory granules. Opposite the pharynx the tubes become once again constricted and are lost to view. Starting from this region, however, there is on each side a narrow tube which runs backwards to the acetabular region. This tube is presumably the direct continuation of the main duct. There are in all twenty-two pairs of flame-cells in the position shown (Fig. 3). I was unable to trace the distribution of the fine ducts and the capillary vessels. The excretory vesicle opens into a caudal canal which runs back in the tail for a short distance and then bifurcates into two lateral tubes which pass outwards and open on the surface.

When cercariae of this kind were placed in a jar together with small fish from regions where *Planorbis guadeloupensis* had not been found, they crowded on the fish, especially on the head region, and many of them made their way into the mouth and gills. Dissection of the fish after a few days revealed encysted cercariae in the bony portions of the gills and in the abdominal cavity. These metacercaria showed the two characteristic oesophageal diverticula described for the cercaria, and in addition exhibited a double collar of spines, thirty-four in the anterior ring and thirty-eight in the posterior one. The large total number of spines is another feature pointing to this larval trematode as a new species. Metacercariae identical with these were found in the small fish living in association with *P. guadeloupensis* in the irrigation ditches of Guayama. It is because of the presence of a collar of spines in the metacercaria that I have classified the cercaria as an echinostome. The evidence is, however, not conclusive.

This cercaria has been found in snails from the vicinities of Guayama, Caguas, Río Piedras, Utuado, Mayagüez, Lajas, and Cabo Rojo. About four per cent of the snails from Guayama have been found infested. There is no apparent seasonal variation in the incidence of infestation.

The cercaria develops in rediae which measure about 1.050 mm. in length and 0.0150 mm. in breadth and are of an orange color. There is no ridge or circular groove representing the collar. A pair of short blunt locomotor processes is present about one-fifth of the total length from the anterior end. Another similar pair is

present about one-third of the total length from the posterior end. The terminal mouth leads into a small, but well-developed pharynx which is succeeded by a long broad stomach extending backwards for a distance of one-half the length of the redia or over. The stomach is filled with a mass of black granular material.

P. R. Cercaria IV.

The body of this cercaria (Fig. 4) is roughly pyriform and measures about 0.090 mm. in length by 0.068 mm. in breadth. A subterminal mouth leads into an oral sucker. The acetabulum is larger and situated at about one-third the total length of the body from the posterior end. The main excretory ducts are made conspicuous by the refractile excretory concretions inside of them. The ducts seem to arise jointly from a smaller secondary excretory vesicle which is immediately followed by the larger main excretory vesicle. At the base of the tail there is a large contractile sac which probably has something to do with excretion. There is a collar of nineteen spines. The three ventral ones at each end of the incomplete ring are set at an angle with the remainder, pointing backwards and inwards. Beneath the cuticle are numerous oval or rounded cystogenous cells containing in their protoplasm a number of rod-like masses of cystogenous material, all the rods in one cell lying parallel to each other.

The tail of this cercaria is about 0.51 mm. and for most of its length is as wide or wider in diameter than the body of the cercaria. This latter fact is of interest because echinostome cercariae are supposed to have tails narrower than the bodies. In Luhe's classification of cercariae as given by Brumpt (1927) the echinostome cercariae are put under the leptocercous cercaria, a fact which probably makes P. R. Cercaria IV a new species.

This cercaria develops in rediae very similar to those of P. R. Cercaria III except that they are smaller, measuring about 0.825 mm. in length by 0.120 mm. in breadth.

SUMMARY

Four different kinds of cercariae have been so far obtained from *Planorbis guadeloupensis*, the intermediate host of *S. mansoni* in Porto Rico.

P. R. Cercaria I is that of *Schistosoma mansoni*.

P. R. Cercaria II is a fork-tailed cercaria with a pair of eyespots and a tail at a distinct angle with the body of the cercaria.

P. R. Cercaria III is an echinostome cercaria without a collar of spines. Small fish are probably its second intermediate host.

P. R. Cercaria IV is an echinostome cercaria which possesses a tail broader than the body of the cercaria, a condition which is apparently unknown to exist among echinostome cercariae.

Evidence is presented suggesting that P. R. Cercariae III and IV have not been previously identified though it is possible the adult trematodes may be known.

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