

**Three New Species of Cercariae from a Fresh Water Snail,  
*Potamopyrgus mirandoi* in Endemic Area of  
Paragonimiasis, Condebamba, Peru**

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*Cercaria chaquicochai*, *Cercaria condebambai*

The initial report of the first intermediate snail host of lung fluke in Central and South America was made by Brenes *et al.* (1968) who noted a kind of lung fluke cercaria from a fresh water snail, *Pyrgophorus* sp. in Costa Rica. Later on Malek and Little (1971) reported the cercaria of *Paragonimus caliensis* from a snail, *Aroapyrgus colombiensis* in Colombia. Malek *et al.* (1975) also reported that the snail identified as *Pyrgophorus* sp. by Brenes *et al.* (1968) should be emended as *Aroapyrgus costaricensis* and the cercariae be presumed as those of *P. mexicanus*. Thus, the first intermediate snail host of the lung flukes in Costa Rica and Mexico have been known to be a small fresh water snail such as *Aroapyrgus* spp., belonging to Hydrobiidae.

Most recently Miyazaki (1979) suspected that *Paragonimus peruvianus* would be synonymous with *P. mexicanus* and Brenes *et al.* (1980) proved by experimental in-

fections in animals that *Paragonimus mexicanus* and *P. peruvianus* are the same species, the former name has a priority.

In Peru, however, no reports on snail host of *P. peruvianus* have ever been made even in the heavy endemic area of paragonimiasis peruvianus.

The present investigation in Condebamba, one of the endemic areas of paragonimiasis in Peru was, therefore, carried out to determine the snail host of *P. peruvianus*, and to compare the detailed structure of the cercaria with that of *P. mexicanus*. Unfortunately, no cercaria of *P. peruvianus* could be found at that time, but three other new cercariae were detected from a fresh water snail, *Potamopyrgus mirandoi* suspected as a snail host of *Paragonimus* in the District of Condebamba in 1979. The followings are the description of these cercariae.

### Materials and Methods

#### 1. Areas surveyed

The area surveyed was Condebamba valley belonging to the Province of Cajamarca of the Department of Cajamarca, one of the endemic areas of paragonimiasis peruvianus in Peru. It is a mountain

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village in the Andes, situating at about 7° S Latitude, about 78° W Longitude, and about 2,000 m above the sea level. The Condebamba River and its small branches are running along the village. A few thousands of people are engaging in farming and/or stock farming. Snail survey in small branches of Condebamba River was carried out during the period from the middle of November to the middle of December, 1979.

## 2. Snails collected

In the District of Condebamba, four kinds of snails were commonly found in the water area. These were, *Potamopyrgus mirandoi*, *Lymnaea viator*, *Physa venustula* and *Biomphalaria tenagophylus*. Among them *Potamopyrgus mirandoi* were examined for cercariae of *P. peruvianus*. These snails were most frequently found attaching to a water plant called "Verra" by the inhabitant.

This snail is closely related species to *Aroapyrgus* spp., the intermediate snail host of *Paragonimus* in Colombia and Costa Rica.

By the reasons mentioned above, the snail, *Potamopyrgus mirandoi* was suspected to be the most probable intermediate snail host of *P. peruvianus*. Our effort was, therefore, focussed to collect and examine this snail for detecting the cercaria of *P. peruvianus*.

## 3. Snail examination

Snails were crushed between two pieces of glasses, added one drop of 0.4% NaCl solution, and observed under the binocular microscope. Obtained cercariae and parthenitae were isolated and pressed by a cover glass till the materials become very thin, flat and transparent. This material could be preserved for observation for a few hours when the margin of the cover glass was sealed with vaseline. The measurement was taken on the material fixed with 10% hot formalin. All drawings were made to scale from the measurements.

## Results

The results of cercarial examination in *Potamopyrgus mirandoi* were shown as in

Table 1 Cercarial examination of *Potamopyrgus mirandoi* in Condebamba District, Cajamarca, Peru (December, 1979)

Date and place of collection	Number of snails examined	Number of snails positive			
		Cercaria of <i>Paragonimus</i>	<i>Cercaria cystofurca</i>	<i>Cercaria chaquicochai</i>	<i>Cercaria condebambai</i>
20th Chaquicocha	560	0	9	3	0
21 " "	133	0	2	0	2
22 " "	225	0	16	0	0
23 La Grama	160	0	0	0	1
24 " "	331	0	0	0	0
24 Tabacal	217	0	5	1	0
26 " "	1,480	0	52	9	0
27 San Martin	51	0	1	0	0
27 Chaquicocha	1,092	0	1	62	0
28 " "	2,638	0	3	96	4
29 " "	2,140	0	2	69	1
30 " "	1,000	0	0	48	2
Total	10,027	0	91 (0.9%)	288 (2.9%)	8 (0.1%)

Table 1. As shown in the table, no cercaria of *Paragonimus* could be found in spite of a great effort of the examination of more than ten thousand snails.

On the other hand, three species of other cercariae were detected at the same time. One was a cystophorous-furcocerceria, the other two were xiphidiocercaria and heterophyid cercaria. As far as we are aware, no study on cercariae in this snail in Peru have ever been reported up to date. So the descriptions of these cercariae were made with a proposition of specific names in the following.

1. *Cercaria cystofurca* n. sp. (Fig. 1, Photos, 1, and 2)

Presumptive adult form: Halipegidae ?

Snail host: *Potamopyrgus mirandoi*

Date: December, 1979

Locality: Condebamba (Chaquicocha, Tabacal, San Martin)

Infection rate: 91 out of 10,027, or 0.9%

Measurements:

body	204(183-225) × 58(50-65) μm
cyst	96( 88-125) × 87(85-88) μm
tail stem	208(188-225) × 20(18-22) μm
tail furca	105(100-110) × 12(10-13) μm
fin	267(250-275) × 36(32-40) μm
ejaculatory tube	230(215-250) × 17(15-20) μm

Description: The body develops weakly, only the outline of oral and ventral sucker could faintly be recognized, so that the size of both suckers could not be measured. An ejaculatory tube protrudes from the cyst part, near the body end. The top of the tube swells out to form a pear shaped bulge. A tail and a fin are attached side by side at the posterior part of the cyst. The tail stem is provided with longitudinal and transversal muscles, but the tail furcae lack such muscle. The fin from the posterior end of the cyst is longer and broader than the tail stem, and is very delicate and fragile. The redia is large plump shape,

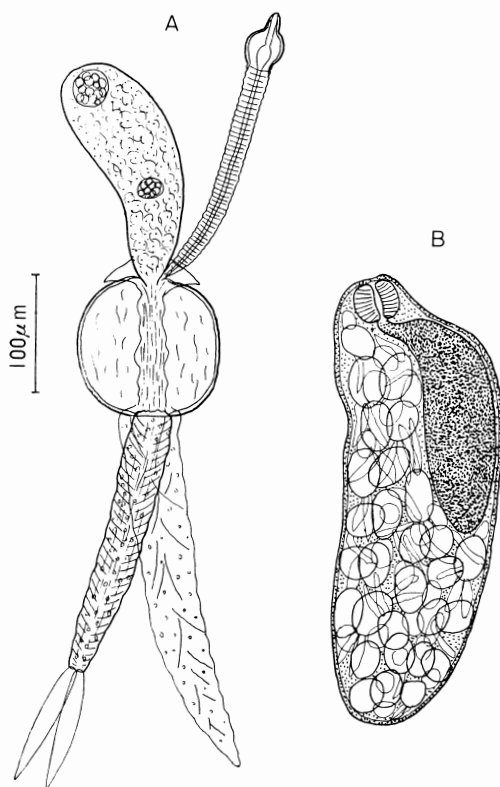


Fig. 1 *Cercaria cystofurca* n. sp.  
A. cercaria B. redia

covered with dark brownish colored thick epithelia. A well developed pharynx is at the anterior end of the body, and is followed by a large intestine compacting the digested snail tissue. Many cercariae and germ balls are contained in the redia.

2. *Cercaria chaquicochai* n. sp. (Fig. 2 and Photo. 3)

Presumptive adult form: Microphalidae

Snail host: *Potamopyrgus mirandoi*

Date: December, 1979

Locality: Condebamba (Chaquicocha, Tabacal)

Infection rate: 288 out of 10,027, or 2.9%

Measurements:

body	89(83-93) × 55(50-60) μm
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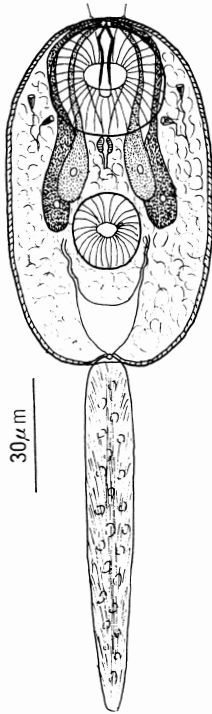


Fig. 2 *Cercaria chaquicochai* n. sp.

oral sucker	.....	28(26-30)×32(30-35) μm
ventral sucker	.....	20(18-22)×18(17-20) μm
stylet	.....	18(16-20)×2(1.5-2.5) μm
tail	.....	92(88-98)×13(12-15) μm

**Description:** Simple-tailed, nonoculate, nonvirgulate xiphidiocercaria belonging to *Microcotyle* group of Lühe (1909). The body is ellipsoidal in shape, coated with a thin cuticle with many minute spines all over the surface. A well developed oral sucker is situated at the anterior end, in which a solid, sharply pointed and shouldered stylet is embedded at its median dorsal side. The acetabulum is smaller than the oral sucker and situates slightly behind the middle of the body. Only a pharynx and a short esophagus are recognized with neither prepharynx nor cecum. Two pairs of penetration gland cells are found at the side of the acetabulum. Their ducts run forward across the lateral side of the oral sucker, and open near the apical side of

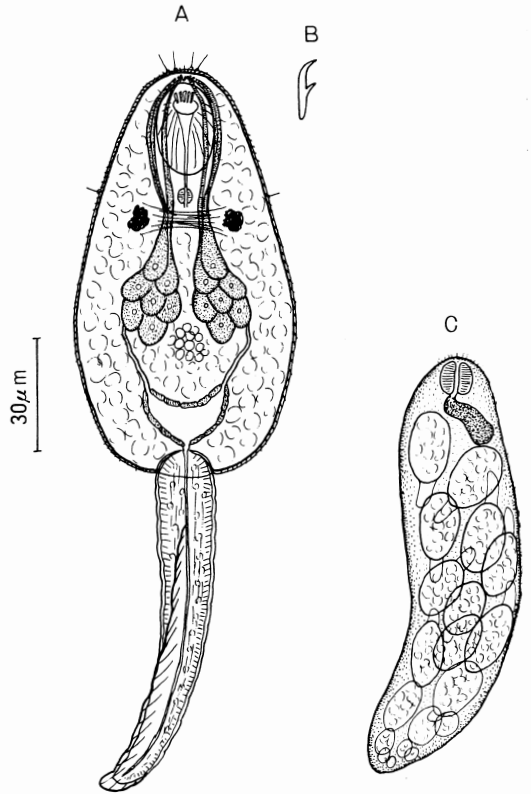


Fig. 3 *Cercaria condebambai* n. sp.  
A. cercaria B. oral spine C. redia

the stylet. The excretory vesicle is cup-shaped, from which one pair of main collecting tubes arises and runs forward, then divides into an anterior and a posterior collecting tubules. The flame cell formula could not be determined at this time. The tail is slender and longer than the body. No caudal excretory tube is observed. The sporocyst is irregularly ellipsoidal in shape with a thin aspinous smooth wall. It contains less than 10 cercariae with some germ balls.

This cercaria is rather common in Chaquicocha. On a slide glass, the cercaria crawls vigorously with a strong elongation and contraction together with the body and the tail, and also a strong swimmer in the water.

3. *Cercaria condebambai* n. sp. (Fig. 3 and Photo. 4)

Presumptive adult form: Heterophyidae (*Centrocestus*?)

Snail host: *Potamopyrgus mirandoi*

Date: December, 1979

Locality: Condebamba (Chaquicocha, La Grama)

Infection rate: 8 out of 10,027, or 0.1%

Measurements:

body	104(90-118)×57(50-60) μm
oral sucker	27(25- 28)×23(19-25) μm
tail	87(83- 90)×20(18-23) μm

Description: Biocellate, heterophyid cercaria with a simple tail. The body is oval in shape, blunt posteriorly, spinulate all over the body surface. Three pairs of sensory hairs are observed also on the body surface. The oral sucker is well developed. On the dorsal side of the mouth cavity, there are five oral spines, each of which has a small side branch to form a fishhook-like appearance. The acetabulum is rudimentary and appears as a small cell mass. The pharynx follows the oral sucker with a short prepharynx. One pair of prominent eye spots is observed at the level of anterior two fifths of the body, consisting of several small masses of dark brown pigmented granules. A transverse nervous commissure is found between two eye spots. Seven pairs of penetration gland cells are arranged in a mass between the pharynx and the excretory vesicle. Their ducts open in four groups of 3:4:4:3 in front of the oral sucker. Cystogenous gland cells are scattered in the body cavity. A cup-shaped excretory vesicle is epithelial, occupying the posterior part of the body. A detailed excretory system could not be observed at this time. The tail is shorter than the body, provided with a dorsal fin fold on the posterior three fourths of dorsal median line of the tail, extending around the tail tip to join to a ventral small fin fold.

The redia is plump or elongated fusiform,

and provided with several sensory hairs around the mouth opening. The pharynx is followed by a short gut filling with brownish pigmented ingesta. It contains germ balls and cercariae at different developmental stages.

### Discussion

Concerning to the intermediate host of *Paragonimus peruvianus*, the second intermediate host has already been proved to be a fresh water crab, *Pseudothelphusa chilensis*, whereas the first intermediate snail host is not yet known at present. The present investigation was carried out to determine the first intermediate snail host of *P. peruvianus* in Peru. In spite of a great effort of the examination of more than ten thousand snails, no cercaria of *Paragonimus* could be found by the present study. According to the report of Brenes *et al.* (1980) in Costa Rica, the infection rate of the cercaria of *Paragonimus mexicanus* in a snail, *Aroapyrgus costaricensis* was only 9 out of 5,229, or 0.2%. So, further examination of the snails for the cercaria of *P. peruvianus* should be needed.

Though more than 10 species of cystophorous cercariae were reported in the world, they were all non fork-tailed type. The present cercaria, *Cercaria cystofurca* n. sp., is seemed to be the first record of cystophorous-furcocercaria type in the world. The adult fluke of this cercaria belongs presumably to the family Halipegidae or related ones.

*Cercaria chaquicochai* n. sp. is abundant in Chaquicocha. Ibañez (1973) reported a high incidence of the metacercaria of *Microphallus garciani* in a crab, *Pseudothelphusa chilensis* in the district of Condebamba where the present survey was carried on. Ching and Ibañez (1976) also made a report on the occurrence of the metacercaria of *Megalophallides apanhorayi* from the same crab in the same locality. These meta-

cercariae were also observed frequently in the present study of the crab. Both genus of *Microphallus* and *Megalophalloides* belong to the family Microphallidae, hence it is most probable that the present cercaria will enter into the crab to develop to microphallid metacercariae.

It is worthy to note here that another heterophyid cercaria was encountered once in the course of this study. It was much larger than the present cercaria, looked like the cercaria of *Heterophyes* or *Haplorchis*. Because of the lack of time and meager of the materials, a detailed observation could not be performed at that time.

### Summary

The district of Condebamba is one of the endemic areas of paragonimiasis in Peru. In order to determine the first intermediate snail host of the lung fluke in this area, many fresh water snails, *Potamopyrgus mirandoi*, were examined. As a result, no cercaria of *Paragonimus* could be found by the present investigation despite of 10,027 snail examination.

By the present investigation, however, three new species cercariae were detected from the same snails at the same district, one cystophorous-furcocercaria, one xiphidiocercaria and one heterophyid cercaria. These were described with a proposition of new name, *Cercaria cystofurca*, *Cercaria chaquicochai*, and *Cercaria condebambai* respectively.

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ペルーの肺吸虫症流行地コンデバンバ地区の水棲巻貝 *Potamopyrgus mirandoi* より見出されたセルカリア 3 新種について

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ペルーにおける肺吸虫症の流行地の一つであるコンデバンバ地区でペルー肺吸虫の第 1 中間宿主の調査を行なった。

まず同地に生息する淡水巻貝のうちメキシコ肺吸虫の第 1 中間宿主である *Aroapyrgus* と近縁の関係にある *Potamopyrgus mirandoi* について検査を行なった。

その結果、10,027個の貝について検査を行なったに

もかかわらず、肺吸虫のセルカリアは検出できなかった。しかし同貝から *cystophorous-furcocercaria*, *xiphidiocercaria* および *heterophyid cercaria* の 3 種の新しいセルカリアを見出した。

これらをそれぞれ *Cercaria cystofurca* n. sp., *Cercaria chaquicochai* n. sp. および *Cercaria condebambai* n. sp. と命名し記載した。

### Explanation of Photos

Photo. 1 *Cercaria cystofurca* n. sp.

Photo. 2 Redia of *C. cystofurca*.

Photo. 3 *Cercaria chaquicochai* n. sp.

Photo. 4 *Cercaria condebambai* n. sp.

