

Occurrence of the Lung Fluke, *Paragonimus peruvianus* in Costa Rica

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Introduction

Caballero (1956) and Caballero and Montero (1961) reported *Paragonimus rudis* (Diesing, 1850)** from a grey fox, *Urocyon cinereoargenteus costaricensis*, and from a four-eyed opossum, *Philander opossum fuscogriseus*, respectively. Both mammals were captured in Alajuela Province, Costa Rica. Sogandares-Bernal and Smalley (1965) first found a metacercaria of *Paragonimus* sp. from a preserved specimen of a crab, *Ptychophallus tristani* (= *Pseudothelphusa tristani*) collected from the same province where the above-mentioned mammals were captured. In 1967 the same authors further examined four species of freshwater crabs in Costa Rica, and obtained the same larvae from the heart of one of 15 *P. tristani* and two of 13 *Potamocarcinus magnus* (= *Pseudothelphusa magna*). The three infected crabs were also captured in Alajuela Province. Brenes, Zeledón and Rojas (1968) collected 47 adult *Paragonimus* of the "*kellicotti-miyazakii*" group from two four-eyed opossums, a raccoon (*Procyon lotor*) and a grey fox, as well as from four of six domestic cats in Costa Rica. In addition, they reported *Paragonimus* cercariae in a tiny snail probably of the genus *Pyrgophorus* and its metacercariae from the liver of 19 of 150 *P. tristani* and

one of five *P. magnus* without giving the specific name to the fluke. In the same year, Morera (1968) reported two cases of human paragonimiasis for the first time in Costa Rica and suggested more cases of the disease in the country.

On the other hand, Miyazaki and Ishii (1968) described a new lung fluke, *Paragonimus mexicanus* in two opossums, *Didelphis marsupialis* from Colima, Mexico, and suggested the existence of the same fluke in Guatemala, Costa Rica and Panama. However, its metacercaria has never been verified in any country so far. Miyazaki (1972) found *Paragonimus* metacercariae from a kind of crab, *Potamocarcinus richmondi* (= *Pseudothelphusa richmondi*) in Achote, Panama, and separated them morphologically into two forms, A and B. He identified form A as *Paragonimus peruvianus* Miyazaki, Ibáñez et Miranda, 1969, and presumed that form B might belong to *P. mexicanus*. In the next year he demonstrated living specimens of these two forms at the seminar entitled "*Paragonimus*, lung flukes in the Western hemisphere", which was held at the Middle America Research Unit, Canal Zone on the 27th of February 1973. Dr. R. Zeledón of the University of Costa Rica, who attended the seminar, stated the presence of both forms in Costa Rica. Accordingly, the author visited the University in San José in February 1974 and performed an examination of freshwater crabs by the courtesy of Dr. P. Morera, and then he had an opportunity to discuss taxonomy of Costa Rican lung flukes at the seminar entitled "Biological aspects of paragonimiasis in America"

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** Regarded as a *species inquirenda* at present.

that was held in the same university on the 8th of February 1974. In this paper the author wishes to record the existence of *Paragonimus peruvianus* in Costa Rica.

Materials and Methods

By the help of Dr. Morera and his assistants, freshwater crabs were collected from mountain streams in two localities, Balsa de Mora and El Fierro located near San José. Crabs were searched for *Paragonimus* metacercariae through a binocular dissecting microscope by pressing the liver, heart, gill and other organs of the crabs between glass plates. The muscle was not examined. The living metacercariae were investigated particularly for the cyst around the larval body, color of the intestines, length of the excretory bladder and red granules in the body. Then, they were fixed with 10% formalin under coverglass pressure, and brought to Japan. The preserved specimens were photographed and figured by projection method. Finally, they were stained with alum-carmin and mounted in balsam for further study and measurement.

Results

Only a single metacercaria was found from one of 16 crabs at Balsa de Mora, and six larvae from five of 30 crabs at El Fierro. Five of six infected crabs were identified as *Ptychophallus tristani* and the other one as *Potamocarcinus magnus*. However, the infection rate of each crab species was unknown on account of some confusion in identifying uninfected crabs at the beginning of this survey.

Morphologically, the seven metacercariae obtained were all identical, showing the following features in life: 1) they were non-encysted, moving freely in the liver, 2) their intestines were yellowish in color, 3) the anterior extremity of their excretory bladder reached to the bifurcation of intestines, and 4) red granules were recognized exclusively on the ventral side. After

fixation with formalin red granules in the larval body disappeared rapidly, but yellow color of the intestines remained for a long time. Extension of the excretory bladder was similar to that of the living larvae, as shown in figures 1-5.

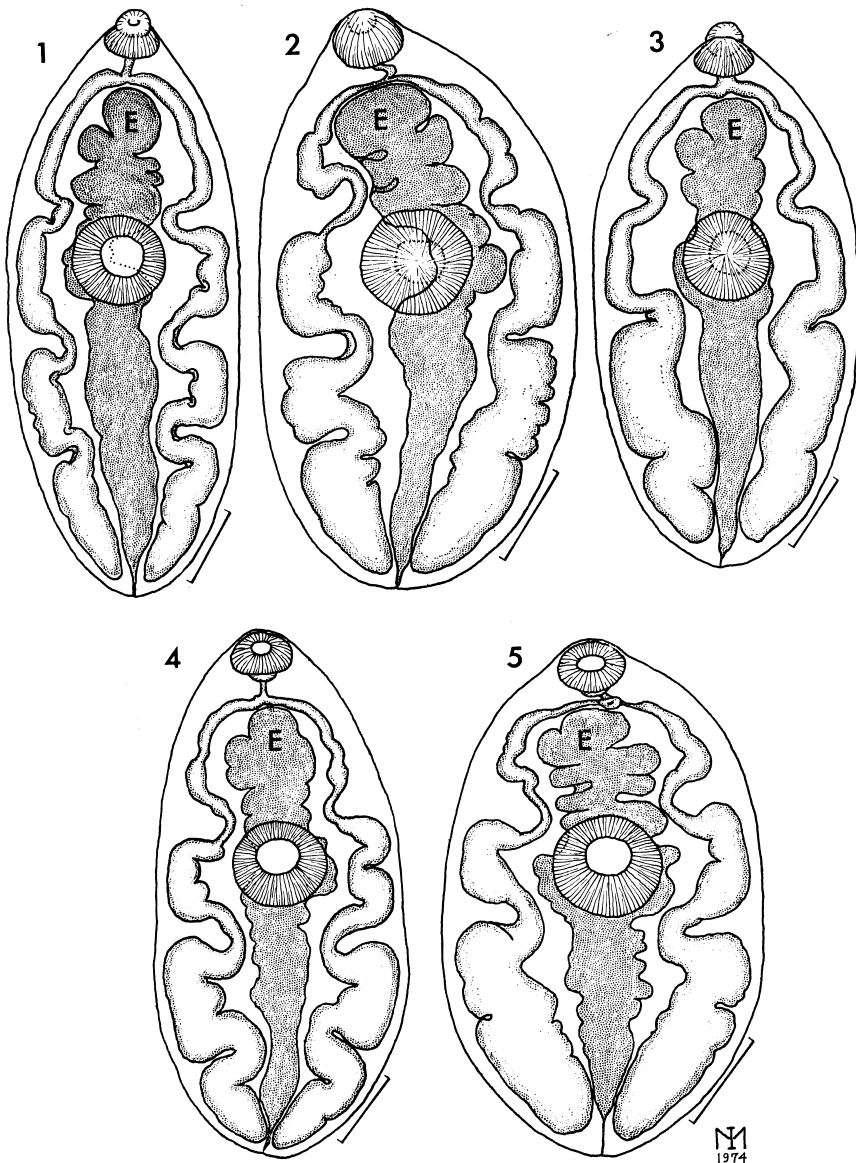
Measurements in millimeters were made in five mounted specimens excluding two badly fixed larvae: body 1.00 to 1.36 in length and 0.54 to 0.62 in width, averaging 1.17 by 0.58. Oral sucker 0.13 to 0.15 wide by 0.09 to 0.11 long (aver. 0.14 by 0.10). Ventral sucker 0.20 to 0.22 wide by 0.19 to 0.22 long (aver. 0.21 by 0.21). A small stylet was recognized in two of six oral suckers.

Ultimately, the features of the present metacercariae completely agreed with those of larval *Paragonimus peruvianus* in Panama (Miyazaki, 1972) and in Cajamarca, Peru, the type locality of this lung fluke (Miyazaki *et al.*, 1971).

Discussion

Since Morera (1968) reported human cases of paragonimiasis, the disease has begun to attract medical attention in Costa Rica, but its causative agent has not been determined as yet. Accordingly, a taxonomic study of the genus *Paragonimus* has become indispensable in that country.

The present metacercariae were easily identified as *P. peruvianus* by their morphological features, although their number was not enough to get adult worms by experiment. It was to be regretted that the author did not encounter the metacercaria of form B in his survey. After the author presented the results of his examination at the seminar mentioned previously, Dr. R. Brenes and Dr. R. Zeledón of the University of Costa Rica emphasized that *P. peruvianus* was synonymous with *P. mexicanus* and so the Costa Rican lung fluke should have the latter name. In addition, they maintained that the metacercariae of form A and form B were the same species, both of which they found not only in Costa Rica but also



Figs. 1-5. Formalin-fixed metacercariae of *P. peruvianus* in Costa Rica. Scales: 0.2 mm. 1, 4 and 5: ventral view. 2 and 3: dorsal view. Note anterior extremity of excretory bladder (E) in 1-5, and prolapsed esophagus in 1 and 3.

in Colima, Mexico, the type locality of *P. mexicanus*. These discrepancies of opinion will be solved in the near future by getting adults of form B from experimental mammals. At any rate, the author was particularly interested in the fact that form B was found in Colima, Mexico, because he

has a presumption that form B may belong to *P. mexicanus*. Incidentally, form B was not found by Miyazaki *et al.* (1971) in Cajamarca, Peru, the type locality of *P. peruvianus*.

It is strange to the author that Sogandares-Bernal and Smalley (1967) found all of

Paragonimus metacercariae on or in the heart tissues of crabs and that they stated in the same paper "the cysts of *Paragonimus* metacercariae". As a matter of fact, the author occasionally noticed a kind of encysted metacercaria in the heart tissue of crabs examined in Costa Rica and Panama, but he did not identify it as *Paragonimus* sp.

It is presumed that more human cases of paragonimiasis may be occurring in Costa Rica, because freshwater crabs are occasionally eaten by inhabitants and the larvae of *P. peruvianus* parasitic in the crabs are provided with a high infectivity to mammalian hosts. This lung fluke seems to be widely distributed from Peru to Mexico and is suspected to cause the human disease in Costa Rica like in Cajamarca, Peru. It is likely that at least two species of *Paragonimus* are occurring in Costa Rica.

Summary

By the author's survey in February 1974, seven metacercariae of *Paragonimus peruvianus* were collected from six of 46 freshwater crabs in two localities near San José, Costa Rica. Five of six infected crabs were identified as *Ptychophallus tristani* and the remainder as *Potamocarcinus magnus*. This lung fluke seems to be widely distributed in Central America and the northern part of South America, and is suspected to cause human paragonimiasis in some countries such as Peru, Ecuador and Costa Rica.

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The author wishes to express his sincere thanks to Prof. Pedro Morera of the University of Costa Rica, who gave to the author a good opportunity to examine freshwater crabs and to participate in the seminar at the University. The author is also grateful to Prof. Rodrigo R. Brenes and Prof. Rodrigo Zeledón of the same university for their invaluable opinions and interesting data regarding the Costa Rican lung fluke. Thanks

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コスタリカに分布するペルー肺吸虫

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Morera (1968) が、この国で初めてヒトの肺吸虫症例を報告して以来、医学的関心がたかまつてきた。それより前、米国の Sogandares ら (1965, 67) やコスタリカの Brenes ら (1968) によつて、肺吸虫の幼虫あるいは成虫が確認されているが、その種名は全くわからなかつた。もつとも、Caballero (1956, 61) が2種の哺乳動物から *Paragonimus rudis* を報告したが、これは最古の学名を用いたにすぎない。著者 (1972) はパナマでみつけたメタセルカリアをA、Bの2型にわけ、Aをペルー肺吸虫と同定、Bをメキシコ肺吸虫だろうと推定した。そして、これら2型が隣のコスタリカでも見られる、ときいたので、本年2月、この調査を行なつたのである。その結果、2種のカニから7つのメタセルカリアをえたが、すべてをA型、すなわちペルー肺吸虫と同定するこ

とができた。しかし、B型は確認できなかつた。採集数が少なかつたためであろう。肺吸虫の種名については、ペルー肺吸虫をメキシコ肺吸虫のシノニムとみなし、かつ、A型もB型も同じ種類であると主張する Brenes 派とは、最後まで意見の一致をみなかつたが、これは、やがてB型の成虫が判明することによつて、解決されるであろう。彼らがA型とB型の幼虫を、コスタリカのみならず、メキシコ肺吸虫の模式産地でも確認した事実は、著者にとつて非常に興味ぶかい。コスタリカには、少なくとも2種の肺吸虫が分布し、そのうち、ヒトを侵すものは、感染力の強いペルー肺吸虫であろう、と著者は推定している。

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