

A New Molluscan Host of *Paragonimus ohirai*  
Miyazaki, 1939 in Is. Tanegashima,  
Kagoshima Prefecture, Japan

KENJIRÔ KAWASHIMA

Laboratory of Medical Zoology, School of Health Sciences,  
Kyushu University, Fukuoka, Japan

YOSHIHISA HASHIGUCHI

Biological Laboratory, Faculty of Education,  
Kochi University, Kochi, Japan

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### Introduction

Tada and Nagano (1968) found the metacercariae of *Paragonimus* from the brackish water crab, *Sesarma dehaani* collected in Is. Tanegashima, 43 km to the south of Osumi Peninsula, Kagoshima Prefecture (Fig. 1). They identified these metacercariae as *Paragonimus ohirai* Miyazaki, 1939, based on their morphological features. Thereafter, they obtained the adults from the experimentally infected albino rats several months after inoculation with the metacercariae of this fluke, and ascertained these worms to be *P. ohirai* adults (Tada, Nagano & Sato, 1969). In the above island, however, the molluscan host of this fluke has not been found yet.

During the period from the 11th to the 14th of July, 1970, the authors had an opportunity of visiting the island to investigate the molluscan host of *P. ohirai*. At that time, a kind of the gastropod mollusc was found to be naturally infected with *P. ohirai* larvae. Subsequently, the authors tried experimental exposure of the molluscs to *P. ohirai* miracidia and ascertained that the larvae could develop into cercariae in these

molluscs. The mollusc was identified by Dr. T. Habe of the National Science Museum, Tokyo, as a variety of *Angustassiminea nitida* (Pease)<sup>1)</sup> (Fig. 2). The present paper is concerned with *A. nitida* as a new molluscan host of *P. ohirai*.

### Materials and Methods

#### Natural Molluscan Infection

The field investigation was carried out at the mouth of the river Saikyo in the northern part of Is. Tanegashima (Fig. 1) where the crabs infected with *P. ohirai* have been found. In July of 1970, the gastropod mollusc, *A. nitida* was discovered by the authors on the river banks of the area mentioned above, and more than 1,000 individuals of this mollusc were collected. The natural infection of this mollusc with *Paragonimus* larvae was examined by crushing the shell. The larvae of this fluke recovered from the mollusc were transferred to a slide and observed the living specimens

1) Dr. Habe considers that, in a broad sense, this species should be referred to *Angustassiminea nitida* group. But many systematic changes will have to be made before the definitive work of this genus is accomplished.



Fig. 1 Map of southern Kyushu, showing the location of Is. Tanegashima and the area where the field investigation was carried out by the authors.

under a cover slip.

#### Experimental Molluscan Infection

Eggs of *P. ohirai* were obtained from the liquid content of worm cysts induced in the lungs of the albino rats autopsied about one month after experimental feeding on the metacercariae collected from the liver of *S. dehaani* captured at the mouth of the river Maruyama, Hyogo Prefecture. The eggs put in water-filled watch glasses were kept in the incubator at 28°C. The water was changed every other day and after 2 weeks the miracidia were hatched by cooling at 5°C for 15 minutes.

Out of *A. nitida* collected from Is. Tanegashima, molluscs not infected with *Paragonimus* were selected by the method of cercariae shedding. These molluscs were

exposed individually to 10 miracidia of *P. ohirai* in a small Petri dish (1 cm in diameter) for 4–5 hours. For maintenance of infected molluscs, unglazed flower pots of 20 cm in diameter were used. The molluscs were put on the mud in the pot and fed on rice flour.

This experiment was carried out from September to November of 1970, the room temperature during the period being 22–27°C. The intramolluscan stages were observed by the same method as that used in the case of naturally infected molluscs.

The measurements were made on 5 living specimens from the host naturally infected, and the average for each feature was compared with that of 15 living specimens from the experimental host.

#### Results

The results of the field investigation showed that rediae (Fig. 3) and cercariae (Fig. 4) of *Paragonimus* were found in one out of 778 individuals of *A. nitida* examined (infection rate: 0.13%). These larvae were identical with those of *P. ohirai*, described by earlier workers (Yoshida & Miyamoto, 1959; Yokogawa *et al.*, 1960; Kawashima, 1965). On the other hand, in all of 30 individuals of the same species of the mollusc examined during the period from 31 to 63 days after experimental exposure to *P. ohirai* miracidia, the various intramolluscan stages were found to be parasitic (infection rate: 100%). As shown in Tables 1 and 2, there was no distinct morphological difference between the larvae naturally infected and those experimentally infected.

#### Discussion

The larval forms of *P. ohirai* are parasitic in several molluscs and crabs, occurring in river mouths. As regards the molluscan host of *P. ohirai*, two species of the gastropod molluscs, *Assimineea parasitologica*<sup>2)</sup> and *A. yoshidayukioi*<sup>3)</sup>, have been, up to the present, reported by earlier workers as the

2), 3) These species are referred to the genus *Angustassimineea*, according to Habe (1965).

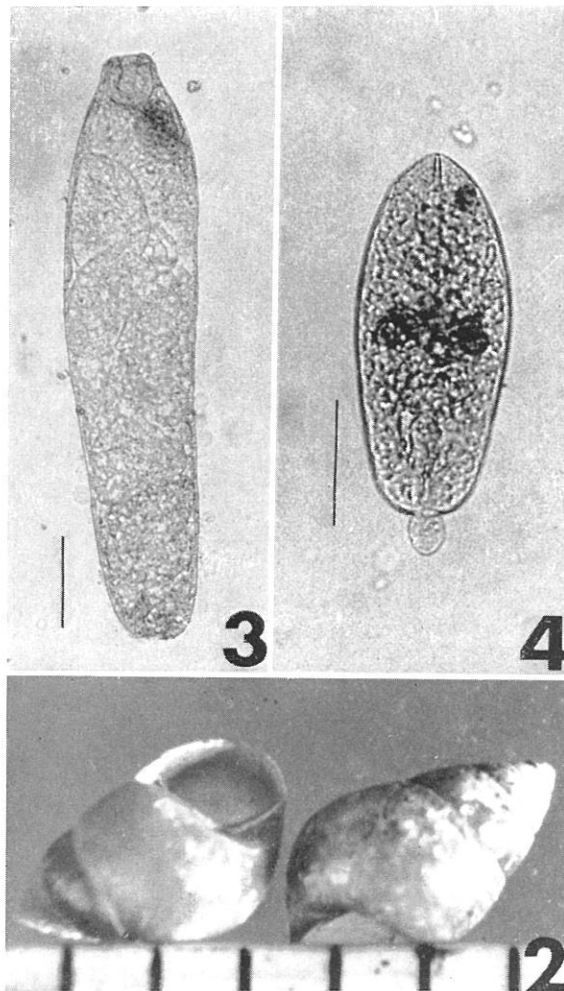


Fig. 2 The molluscs, *Angustassiminea nitida* (Pease) var. collected from the banks of Saikyo River, Is. Tanegashima. (Scale 1 mm)

Fig. 3 The second generation readia of *P. ohirai* Miyazaki, 1939 removed from naturally infected mollusc. (Scale 0.1 mm)

Fig. 4 Cercaria of *P. ohirai* Miyazaki, 1939 removed from naturally infected mollusc. (Scale 0.1 mm)

Table 1 Comparison of the sizes of the second generation readiae naturally infected and those experimentally infected (in micron)

Specimens	Body		Pharynx		Intestine length	Germ balls cercariae
	length	width	length	width		
naturally infected	623	123	48	49	68	3~6
experimentally infected	695	140	50	51	96	3~8

Table 2 Comparison of the sizes of cercariae naturally infected and those experimentally infected (in micron)

Specimens	Body		Oral sucker		Acetabulum		Stylet length	Tail length
	length	width	length	width	length	width		
naturally infected	233	86	45	45	40	45	28	23
experimentally infected	264	95	45	45	45	45	28	26

natural molluscan hosts of this fluke in the mainland of Japan (Yokogawa *et al.*, 1958; Yoshida & Miyamoto, 1959, 1960). In Is. Tanegashima, however, the above-mentioned molluscs have not been found yet by the previous investigations on the distribution of the gastropod molluscs. In consideration of the fact that in Is. Amami-Oshima the molluscan host of *P. iloktsuenensis* which is the related species of *P. ohirai* was determined by Kawashima and Hamajima (1970) to be *A. nitida*, the authors supposed that the molluscan host of *P. ohirai* in Is. Tanegashima might be the same mollusc, *A. nitida*, inhabiting in large numbers on the river banks in the area studied. In this study, the authors' supposition was verified by the findings as follow: (1) The larvae from naturally infected *A. nitida* were identical with those of *P. ohirai* described by earlier workers. (2) In the experimental infection of *A. nitida* with *P. ohirai*, this fluke developed into cercariae. (3) The larvae from the naturally infected mollusc did not differ from those from experimental molluscan hosts. (4) The brackish water crabs, *S. dehaani*, in the area studied, were infected with the metacercariae of *P. ohirai*. (5) *A. nitida* was found in the area where crabs infected with this fluke inhabited. (6) There has not been found any other species of *Paragonimus* except *P. ohirai* in the area where the field investigation was carried out by the present authors.

Therefore, it was definitely proved that *A. nitida* can serve as the molluscan host of *P. ohirai* in Is. Tanegashima.

### Summary

The authors studied the role of *A. nitida* as the molluscan host of *P. ohirai* in Is. Tanegashima, Kagoshima Prefecture and found that one out of 778 individuals of this mollusc was naturally infected with this fluke. Simultaneously, they found out that the molluscs used in the experimental exposure with *P. ohirai* were all positive for the larvae of the fluke. Accordingly, it was concluded here that *A. nitida* was a new molluscan host of *P. ohirai*.

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### References

- 1) Habe, T. (1965): Gastropods. New Illustrated Encyclopedia of the Fauna of Japan, 2, 54-55 (in Japanese).
- 2) Kawashima, K. (1965): Experimental studies on the intramolluscan development of an oriental lung fluke, *Paragonimus ohirai* Miyazaki, 1939. Japan. J. Med. Sci. Biol.,

- 18, 293-310.
- 3) Kawashima, K. and Hamajima, F. (1970) : A new molluscan host for *Paragonimus iloktsuenensis* Chen, 1940 in Is. Amami-Oshima, Kagoshima Prefecture, Japan. Jap. J. Parasit., 19, 199-205.
  - 4) Tada, I. and Nagano, K. (1968) : A new locality record for the lung fluke, *Paragonimus ohirai* Miyazaki, 1939 on Tanegashima Is. in Kagoshima. Acta Med. Univ. Kagoshima., 10, 227-229.
  - 5) Tada, I., Nagano, K. and Sato, A. (1969) : On the lung fluke, *Paragonimus ohirai* Miyazaki, 1939 parasitic in crabs from Tanegashima Is., Kagoshima, Japan. Acta Med. Univ. Kagoshima., 11, 109-115.
  - 6) Yokogawa, M., Yoshimura, H., Koyama, C., Sano, M., Tsuda, M., Suzuki, J. and Tsuji, M. (1958) : On a new intermediate host, *Paludinella devilis* (Gould, 1861) Habe, 1942, of *Paragonimus ohirai* Miyazaki, 1939. Tokyo Ijishinshi, 75, 67-72 (in Japanese).
  - 7) Yokogawa, M., Yoshimura, H. and Komiya, Y. (1960) : On the morphology of the larval forms of *Paragonimus ohirai* Miyazaki, 1939. Jap. J. Parasit., 9, 451-456 (in Japanese with English summary).
  - 8) Yoshida, Y. and Miyamoto, M. (1959) : Studies on the first intermediate host, *Assimineia parasitologica* Kuroda, 1958 (“*Paludinella devilis*”), of Yokogawa and Koyama *et al.* non Gould, of *Paragonimus ohirai* Miyazaki 1939. Jap. J. Parasit., 8, 122-129 (in Japanese with English summary).
  - 9) Yoshida, Y. and Miyamoto, M. (1960) : Another new first intermediate host, *Assimineia yoshidayukioi* Kuroda, 1959 of *Paragonimus ohirai* Miyazaki, 1939. Jap. J. Parasit., 9, 211-216 (in Japanese with English summary).

### 鹿児島県種子島における大平肺吸虫の新しい第1中間宿主について

川島健治郎

(九州大学医療技術短期大学部医動物学研究室)

橋口 義久

(高知大学教育学部生物学教室)

多田・長野 (1968) は鹿児島県種子島において採集したクロベンケイから肺吸虫のメタセルカリアを見出し、これを大平肺吸虫 *Paragonimus ohirai* Miyazaki, 1939 と同定した。更に、多田ら (1969) は、この肺吸虫のメタセルカリアを実験的に与えたダイコクネズミから成虫を得、それが大平肺吸虫であることを確認した。著者らは種子島に分布する大平肺吸虫の第1中間宿主を明らかにする目的で1970年7月11日から14日まで同島に滞在し、北部の西京川河口で調査を行なった。その結果、同地区において、大平肺吸虫の第1中間宿主と推定される小形のカイを採集し、これは国立科学博物館の波部忠重博士によりサツマクリイロカワザンショウ *Angustassimineia nitida* (Pease) var. と同定された。

同地区において著者らが採集したこのカイのうち778個体を検査したところ、1個体(0.13%)に肺吸虫幼虫の自然感染を証明した。これらは既知の大平肺吸虫幼虫の形態と一致した。更に同島産のこのカイ30個体を用いて大平肺吸虫の感染実験を行なったところ、その全個体(100%)に同肺吸虫のレアジ又はセルカリアへの発育を証明した。又、自然感染で証明された幼虫と、実験感染により得られた幼虫とは形態上の諸特徴が一致した。更に、この地区におけるカニ類やネズミ類の調査からも大平肺吸虫以外の肺吸虫の分布は認められなかつた事実などから、サツマクリイロカワザンショウを大平肺吸虫の新しい第1中間主として報告した。