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Research Note

Epidemiological Survey for the First Intermediate Host of *Paragonimus ohirai* in the Kido River, Chiba Prefecture, Japan

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It has been reported that weasels captured in the eastern part of Chiba Prefecture were infected with *Paragonimus ohirai* (Yokogawa *et al.*, 1958b; Hata *et al.*, 1987). The second intermediate host crabs collected from the Kido river, *Sesarma dehaani* and *Helice tridens tridens,* showed a particularly high level of metacercarial infection (Hata *et al.*, 1987). The present survey was thus conducted for the first intermediate host snails inhabiting the Kido river.

Between 1986 and 1990, 3 species of brackish water snails, *Assiminea japonica, A. parasitologica* and *A. castanea,* were collected at the estuary area of the Kido river. Eight hundred and thirty-six snails of *A. japonica,* 199 of *A. parasitologica* and 407 of *A. castanea* were individually crushed with a hammer and examined for cercariae according to the procedure of Ito (1969) for light microscopy and that of Higo *et al.* (1980) for scanning electron microscopy. The snail meat containing the cercariae was orally inoculated to *S. dehaani* collected from the Nabaki river where *P. ohirai* has been proven non-endemic (Hata *et al.*, 1987), and then the crab was examined for metacercariae 10 weeks postinfection.

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Of 199 *A. parasitologica* snails, *P. ohirai* cercariae were detected in 2 snails (Table 1). The infection rate of 1% is very high in comparison with that in other endemic areas previously reported, such as 0.049% in the Maruyama river, Hyogo Prefecture (Yoshida and Miyamoto, 1959), and 0.052% in Minato and 0.32% in Kisami, Shizuoka Prefecture (Yokogawa *et al.*, 1958a). Since *A. parasitologica* snails are actually very few in number in the Kido river, the high level of cercarial infection in the first intermediate host may essentially be resulted into a high level of metacercarial infection in the second intermediate host crabs.

Measurements of 5 mature cercariae are presented in Table 2. The cercariae advance in a crawling manner on the bottom and never actually swim in the water. The body part of the transparent cercaria was ellipsoidal in shape. The oral sucker was well developed, ventrosubterminally located and provided a sharp and thick stylet (Figs. 1, 2). Two kinds of penetration glands were seen on both lateral sides of the anterior half of the body. Individual ducts extended anteriorly together from the glands and finally opened the anterior margin of the oral sucker lateral to the stylet. The acetabulum was located in the anteroventral three-fifths of the body and bulged from the body surface (Figs. 1, 2).

A frontal view of the cercariae showed a large-sized, median groove of the hind body (Fig. 2). A large, I-shaped excretory bladder was located

Table 1 Prevalence of cercarial infection in three species of *Assiminea* snails collected at the estuary of the Kido river, Chiba Prefecture

Species of *Assiminea* snails	No. of snails examined	No. of cercaria-positive snails	Infection rate
A. japonica	836	21(0)*	2.5%
A. parasitologica	199	2(2)*	1.0%
A. castanea	407	0	0%

( )* No. of snails infected with *P. ohirai*

Table 2 Measurement values of *P. ohirai* cercaria

Cercarial parts measured	Measurement values, mean (min–max)
body length	262.0 (250.0–275.0) μm
body width	128.5 (125.5–135.0) μm
oral sucker length	55.5 (52.5– 60.0) μm
oral sucker width	53.5 (50.0– 57.5) μm
ventral sucker length	36.5 (35.0– 37.5) μm
ventral sucker width	40.0 (37.5– 42.5) μm
stylet length	29.0 (27.5– 30.0) μm
stylet width	7.0 (5.0– 7.5) μm
tail length	30.0 (27.5– 32.5) μm
tail width	17.0 (15.0– 20.0) μm

at the inside of the hind body, and 2 main collecting ducts extended anteriorly from the anterolateral corners of the bladder. The body of the cercariae was mostly covered with small and large spines. Distribution of the large spines was concentrated in the most anterodorsal region, anteroventral region posterior to the oral sucker, periphery of the ventral sucker, the most posteroventral region and tip of the tail (Fig. 2). Sensory papillae were classified into 2 types, ciliary and nonciliary. The former type was observed to be regularly arranged around the oral sucker.

A single immature *P. ohirai* metacercaria could actually be obtained from the liver of a *S. dehaani* crab which was collected from the Nabaki river and maintained after experimental infection with the cercariae. The cercaria was thus identified as *P. ohirai,* and the cercarial morphology was comparable to the respective findings of several other reports (Yoshida and Miyamoto, 1959; Yokogawa *et al.*, 1960; Kawashima, 1965; Ito, 1969; Higo and Ishii, 1983).

A. japonica snails showed a high infection rate of cercariae which were classified into 3 species, each having a long tail. However, *P. ohirai* cercariae were not detected (Table 1). Natural infection of *P. ohirai* cercariae has not yet been demonstrated in *A. japonica* (Ogita 1954; Yokogawa *et al.*, 1958a; Yoshida and Miyamoto, 1959), although this species is sensitive to *P. ohirai* (Ogita, 1954; Ikeda, 1957; Yoshida and Miyamoto, 1959). In addition, no cercarial infection was observed in *A. castanea* (Table 1). This species has the unlikely sensibility for *P. ohirai* (Kawashima, 1961).

This survey has demonstrated a high level of cercarial infection in *A. parasitologica* snails in the Kido river. In the eastern part of Chiba Prefecture, therefore, there is a very good possibility that the life cycle of *P. ohirai* is completed throughout development in *A. parasitologica* as the first intermediate host, *Sesarma* and *Helice* as the second intermediate hosts and a weasel as the definitive host.

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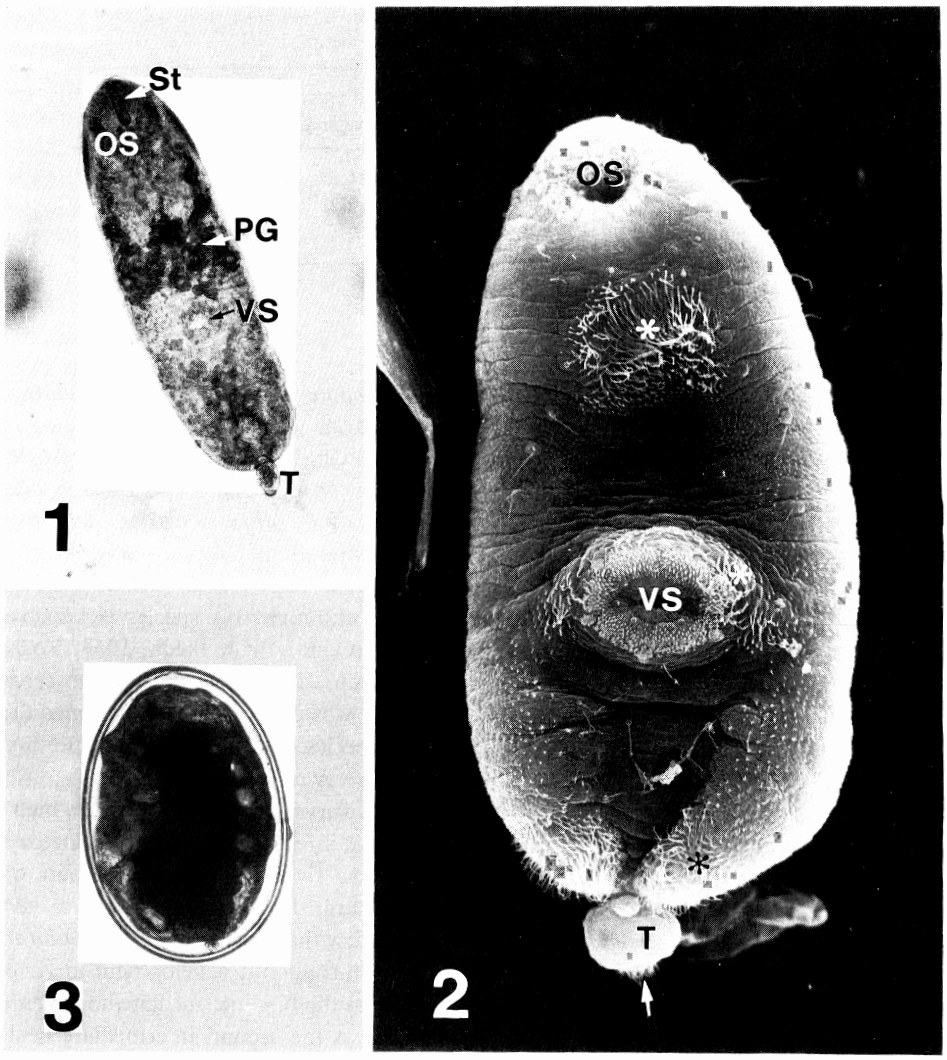

Fig. 1 Light micrograph of *Paragonimus ohirai* cercaria showing ventral view of the whole body (stained with neutral red). ×200. OS, oral sucker; PG, penetration gland; St, stylet; T, tail; VS, ventral sucker.

Fig. 2 Scanning electron micrograph of *Paragonimus ohirai* cercaria showing ventral view of the whole body. Asterisks and arrow indicating localization of large-sized spines. ×1000.

Fig. 3 An encysted metacercaria obtained from *Sesarma dehaani* experimentally infected with cercariae. ×160.

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