

## Human Infections by *Heterophyes heterophyes* and *H. dispar* Imported from Saudi Arabia

Jong-Yil Chai, Byong-Seol Seo\*, Soon-Hyung Lee, Sung-Jong Hong  
 and Woon-Mok Sohn

*Department of Parasitology and Institute of Endemic Diseases, College of Medicine,  
 Seoul National University, Seoul 110, Korea*

### INTRODUCTION

In Korea, there is an increasing tendency of overseas man power communications, especially with tropical and subtropical countries. As a result, imported cases of tropical diseases, especially parasitic infections, has been increasing and become one of newly facing health problems in this country. Imported parasitic diseases reported so far are malaria (Ahn *et al.*, 1982), leishmaniasis (Chi *et al.*, 1983), schistosomiasis (Min *et al.*, 1982), angiostrongylosis (Lee *et al.*, 1981), hydatid disease (Lee *et al.*, 1986) and pentastomiasis (Park *et al.*, 1985). We add here heterophyiasis in the list of imported tropical diseases.

Heterophyiasis is caused by flukes belonging to the genus *Heterophyes*. Seven species of the genus *Heterophyes* that have been described as *H. heterophyes* (v. Siebold, 1852) Stiles and Hassal, 1900, *H. dispar* Looss, 1902, *H. aequalis* Looss, 1902, *H. nocens* Onji and Nishio, 1916, *H. superspinatus* Leonov and Belogurov, 1965, *H. bitorguatus* Pearson and Pearson, 1981, and *H. chinii* Pearson and Pearson, 1981 are known to infect mammals such as dogs and cats, and/or birds (Taraschewski, 1984). Human heterophyiasis has been known from two species, *H. heterophyes* and *H. nocens*; the former in Egypt and in the Middle East (Taraschewski,

1984) and the latter in the Far East such as Japan and Korea (Yokogawa *et al.*, 1965; Seo *et al.*, 1981; Chai *et al.*, 1984 & 1985).

Recently the authors experienced two cases of imported *H. heterophyes* and *H. dispar* infection among Korean workers who had been in Saudi Arabia. *H. dispar* in this paper is the first authentic human infection in the literature.

### CASE DESCRIPTION

**Case 1:** YSG, 38-year old male residing in Seoul, had been in three areas of Saudi Arabia as a driver during July 1979~July 1983. He recalled he had eaten raw flesh of mullets in Yanbu, a coastal city of the Red Sea. In Saudi Arabia and after return home, he has experienced several episodes of abdominal pain and other gastrointestinal troubles. On September 13, 1984 he visited our Department to examine any parasitic infections. The stool examination revealed heterophyid eggs, 0.026~0.029×0.013~0.015 mm, ovoid to ellipsoid, and a little attenuated at their anterior and/or posterior ends. The EPG (eggs per gram of feces) was 100. He was treated with 10mg/kg single dose of praziquantel and purged with 30g of MgSO<sub>4</sub>. The procedures of treatment and worm collection were as described by Chai *et al.* (1984).

**Case 2:** YSW, 40-year old male, a brother of Case 1. He had also been in two areas of Saudi Arabia, as an officer of a construction company, during June 1980 (in Riyadh) and October

\* Present Address: Department of Parasitology, College of Medicine, Inha University, Incheon, Korea

1982~November 1984 (in Damman). He has favored to eat raw flesh of various kinds of marine fishes both at home and in Saudi Arabia. He has experienced vague abdominal discomfort accompanied by diarrhea approximately once or twice a month. He was referred to our Department by Case 1, on November 22, 1984 to check heterophyid infections. Stool revealed only the eggs of *Trichuris trichiura* without heterophyid eggs. However, he wanted to receive medication with praziquantel so as to treat possible heterophyid infection.

### PARASITOLOGICAL DESCRIPTIONS

A total of 19 specimens of *H. heterophyes* and 140 of *H. dispar* were collected from the diarrheal stools of two patients (Table 1). Microscopic observations were made on the fresh, fixed, and acetocarmine-stained specimens.

The specimens of *H. heterophyes* (v. Siebold, 1852) were ovoid in general shape and having oral, ventral and genital suckers (Fig. 1 & 2). The size of 18 measured worms (from Case 1) in fresh state was 1.36~2.06mm (average 1.74 mm) long and 0.60~0.88mm (0.74mm) wide. Their genital sucker was 0.24~0.34mm (0.28 mm) in diameter and armed with 68~85 (average 74.1) rodlets around its outer margin (Fig.

3). The intrauterine eggs were ovoid or ellipsoid (Fig. 4) and 0.023~0.030×0.013~0.016mm (average 0.026×0.014mm). Other morphology and measurements (Table 2) were all compatible with those given by Witenberg (1929) and Taraschewski (1984).

The specimens of *H. dispar* Looss, 1902 (Fig. 5 & 6) had similar body shape to *H. heterophyes*, but differed in their smaller body size, 0.97~1.71mm (1.26mm) long and 0.49~0.63mm (0.55mm) wide in 30 measured specimens (from Case 1 & 2) in fresh state. Their genital sucker was also smaller than *H. heterophyes*, to be 0.094~0.20mm (0.13mm) in diameter. The number of rodlets was only 27~35 (31.0) around its outer margin (Fig. 7). The intrauterine eggs of *H. dispar* were 0.019~0.026×0.013~0.016mm (0.023×0.014mm). Other measurements and morphology (Table 3) were well agreed to those described by Witenberg (1929) and Taraschewski (1984).

**Table 1.** No. of heterophyid flukes collected from the present cases

Species	Case 1	Case 2	Total
<i>H. heterophyes</i>	18	1	19
<i>H. dispar</i>	129	11	140
Total No. of worms	147	12	159

**Table 2.** Comparative measurements of *H. heterophyes* with those of other workers

Item(*)	Present specimens**	Witenberg(1929)	Taraschewski(1984)
Body (L)	1.36~2.06	0.6~2.7	not longer than 2.0
(W)	0.06~0.88	0.2~0.9	--
Oral sucker (D)	0.083~0.145	0.05~0.18	0.063~0.092
Pharynx (D)	0.067~0.121	0.03~0.06	--
Esophagus (L)	0.067~0.214	0.08~0.43	--
Ventral sucker (D)	0.241~0.362	0.08~0.34	0.093~0.295
Genital sucker (D)	0.188~0.340	0.11~0.31	0.101~0.235
No. rodlets	68~85	73~87	58~92
Ovary (D)	0.072~0.308	0.07~0.15	--
Right testis (D)	0.075~0.241	0.05~0.29	--
Left testis (D)	0.040~0.263	--	--
Egg (L)	0.0230~0.0295	0.023~0.027	0.0243
(W)	0.0134~0.0156	0.013~0.015	0.0141

\* L; length, W; width, D; diameter

\*\* 18 specimens were measured.

**Table 3.** Comparative measurements of *H. dispar* with those of other workers

Item(*)	Present specimens**	Witenberg(1929)	Taraschewski(1984)
Body (L)	0.97~1.71	0.4~1.4	not longer than 1.5
(W)	0.49~0.63	0.2~0.4	—
Oral sucker (D)	0.063~0.117	0.03~0.08	0.052~0.079
Pharynx (D)	0.047~0.079	0.03~0.04	—
Esophagus (L)	0.071~0.201	0.08~0.12	—
Ventral sucker (D)	0.198~0.348	0.05~0.25	0.064~0.224
Genital sucker (D)	0.078~0.174	less than half of V.S.	0.045~0.098
No. rodlets	27~35	25~30	22~33
Ovary (D)	0.051~0.139	0.03~0.09	—
Right testis (D)	0.071~0.237	0.04~0.18	—
Left testis (D)	0.079~0.182	0.04~0.15	—
Eggs (L)	0.0190~0.0248	0.021~0.023	0.0224
(W)	0.0129~0.0153	0.013~0.015	0.0140

\* L: length, W: width, D: diameter

\*\* 30 specimens were measured.

## DISCUSSION

*H. heterophyes* (v. Siebold, 1852) Stiles and Hassal, 1900 was first found in the small intestine of an Egyptian child in 1851 and named as *Distoma heterophyes*. In 1866 Cobbold created a genus for this fluke, *Heterophyes*, which was adopted as the type genus of the family Heterophyidae by Odhner in 1914 (Ransom, 1920). This species has been repeatedly reported from man (by worms and/or eggs in stool) and carnivorous mammals and birds such as dogs, cats, foxes and pelicans (reviewed by Taraschewski, 1984).

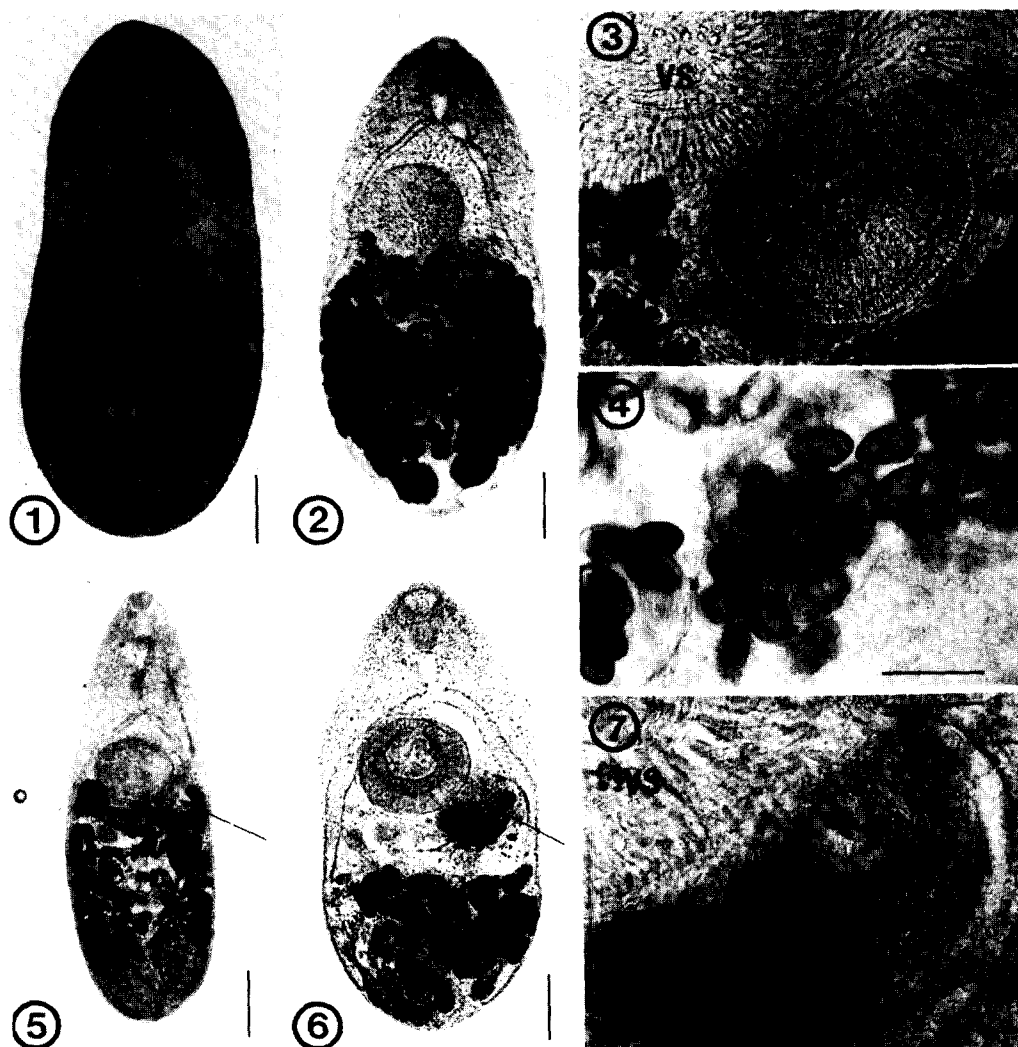
*H. dispar* was first found in the intestine of dogs and cats in Egypt (Looss, 1902) and has been reported from a variety of carnivorous mammals, including foxes and wolves (Ransom, 1920; Witenberg, 1929; Wells and Randall, 1956; Taraschewski, 1984 & 1985). However, it has not been reported from human. The taxonomic significance of *H. dispar*, especially in relation to *H. aequalis*, has sometimes been debated by a few workers (Kuntz and Chandler, 1956; Fahmy and Selim, 1959). However, Taraschewski (1984), after his extensive works on *Heterophyes* species, asserted that the two species should be distinctly different. Besides some differences in

their habitats in the small intestine of host animals, *H. dispar* has 22~33 rodlets on its gonotyl and long intestinal ceca, while *H. aequalis* has 14~25 rodlets and relatively short ceca.

The present specimens of *H. heterophyes* and *H. dispar* were compatible with the descriptions given by many of previous workers. *H. heterophyes* was characterized by its large number (68~85) of rodlets on gonotyl compared with other *Heterophyes* spp, especially *H. nocens*,\* which indigenously exists in Korea. *H. dispar* was smaller than *H. heterophyes*, armed with 27~35 rodlets on gonotyl, and had long intestine(s).

The second intermediate hosts for both *H. heterophyes* and *H. dispar* are known to be various kinds of marine fishes, *Mugil* sp., *Liza* sp., *Tilapia* sp., *Lichia* sp., *Barbus canis*, *Sciaena aquilla*, *Solea vulgaris* and so on (Witenberg, 1929; Wells and Randall, 1956; Paperna and Overstreet, 1981). Considered the history of Case 1, the source of infection in this case seemed *Mugil* spp. (*M. cephalus*, *M. capito*, *M. auratus*, *M. saliens* or *M. chelo*; Paperna and

\* The name *H. nocens* instead of *H. heterophyes nocens* was used based on a comparative taxonomic study with *H. heterophyes* by the senior author, Dr. Horst Taraschewski and Dr. Robin M. Overstreet, the results of which will be published later.



**Figs. 1-4.** *Heterophyes heterophyes* collected from a Korean worker returned from Saudi Arabia. 1. A formalin-fixed specimen (from Case 1) showing its genital sucker (GS) and other structures (Scale: 0.2mm). 2. Another specimen (acetocarmine-stained) showing the position and morphology of male and female genital organs (Scale: 0.2mm). 3. Magnification of its middle portion, where the ventral sucker (VS), genital sucker (GS) and total 73 chitinous rodlets are observed (Scale: 0.04mm). 4. Magnification of a portion of the uterine loop containing many eggs, 0.023~0.030mm long and 0.013~0.016mm wide (Scale: 0.04mm).

**Figs. 5-7.** *Heterophyes dispar* collected from the same person. 5. A formalin-fixed specimen (from Case 1) showing smaller body and smaller genital sucker (arrow) than *H. heterophyes*. Two intestinal ceca extend long but not as much posterior as in *H. heterophyes* (Scale: 0.2 mm). 6. Another specimen (acetocarmine-stained) showing a small genital sucker (arrow) and various genital organs (Scale: 0.2mm). 7. Magnification of its middle portion showing the ventral sucker (VS), genital sucker (GS) and total 31 rodlets (Scale: 0.04mm).

Overstreet, 1981). The Case 2 could not recall the name(s) of fishes he had eaten.

The life span of *H. heterophyes* or *H. dispar* was reported to be 1 to 4 months in canine or

feline hosts (Taraschewski, 1985). In the present human case (Case 1), however, the age of infection of worms was at least longer than 14 months. He consumed raw mullets in Saudi

Arabia but stopped it after returning home until the worms were removed by treatment. It is suggested that man may be a more suitable host than animals for these fluke infections, however, studies are needed on this point.

Imported cases of heterophyiasis has sometimes been recorded in the world literature. In France *H. heterophyes* and *H. nocens* were introduced from Egypt (Rousset and Pasticier, 1972) and from Japan (Lamy *et al.*, 1976) respectively. In Japan *H. heterophyes* cases were imported from Egypt (Kagei *et al.*, 1980). In Korea, only the indigenous *H. nocens* infection has been recently known to occur (Seo *et al.*, 1981; Chai *et al.*, 1984 & 1985). This report firstly recorded importation of heterophyiasis (*H. heterophyes* and *H. dispar*) from the Middle East to Korea.

Imported heterophyiasis cases may be of considerable number in Korea. According to Seo (1979), who examined stools from 408 Korean workers in the Middle East (Saudi Arabia, Bahrain and Kuwait), detected as many as 101 (24.8%) positive cases of heterophyid eggs. He stated that the eggs resembled those of *H. heterophyes*, though adult worms were not identified. Efforts to obtain adult worms would prove further imported cases of *H. heterophyes* and/or *H. dispar* infection in Korea.

The flukes belonging to the family Heterophyidae can cause abdominal pain and/or diarrhea in human host (Seo, 1978). The symptoms experienced by the present cases were also gastrointestinal troubles. But certain kinds of heterophyids (*Haplorchis*, *Stellantchasmus*, *Procerovum* spp.) were reported to have produced erratic parasitisms in the heart, brain or spinal cord, which were frequently fatal (Africa *et al.*, 1940). Such erratic parasitism was also reported for two species of *Heterophyes*. Egg and/or worm granuloma, presumably due to *H. heterophyes*, was reported from the human brain (Gallais *et al.*, 1956; Collomb *et al.*, 1960) and a pulmonary complication probably due to this species was also reported (Gomaa, 1962). The tissue examination of an inflamed human appendix revealed the eggs of *H. nocens* (Nakano and Inoue, 1955).

A case of intestinal *H. nocens* infection was reported to have suffered from heart arrhythmia, suggesting an erratic parasitism in heart (Chai *et al.*, 1984), however, its etiology was not clarified. Clinical attentions should be paid to these heterophyid infections.

## SUMMARY

Two human cases of *Heterophyes heterophyes* and *H. dispar* infections were proven by the recovery of their adult worms. The cases were 38-year and 40-year old Korean workers who had been in Saudi Arabia for 4~6 years and returned home in 1983 or 1984 with gastrointestinal troubles. In Saudi Arabia they had eaten raw brackish water fishes such as the mullet. After the treatment with 10 mg/kg praziquantel and purgation with magnesium salt, a total of 19 specimens of *H. heterophyes* and 140 of *H. dispar* were collected. It is of interest that the worms persisted in a patient although he had been back in Korea for 14 months. This is the first report on imported heterophyiasis in Korea. Human infection by *H. dispar* is the first record in the literature.

## ACKNOWLEDGEMENT

The authors would like to express heartfelt thanks to Dr. H. Taraschewski, Ruhr-Universität, Bochum, West Germany, and to Dr. Robin M. Overstreet, Gulf Coast Research Laboratory, Mississippi, USA, who kindly reviewed some of our specimens and/or manuscript, and gave valuable comments in the species determination.

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man in Chiba Prefecture. *Japanese J. Parasit.*, 14 (6):577-585 (in Japanese).

＝국문초록＝

## 사우디아라비아에서 感染된 異形異形吸蟲(*Heterophyes heterophyes*) 및 *H. dispar* 症例報告

서울大學校 醫科大學 寄生蟲學教室 및 風土病研究所  
蔡鍾一·徐丙高·李純炯·洪性琮·孫運睦

사우디아라비아에서 귀국한 한국인 근로자에서 異形異形吸蟲 및 *H. dispar* 感染 2例를 成蟲을 얻어 확인하였다. 환자는 38세 및 40세된 남자로 사우디아라비아에서 4~6년간 근무한 후 1983年 및 1984년에 귀국하였고 사우디아에서 송어등 반염수산 어류를 生食한 바 있었으며 복통, 설사등 소화기 증상을 경험하였다. 이 중 1例에서 異形吸蟲類 蟲卵이 대변에서 檢출되었으나 다른 1例에서는 檢출되지 않았다.

이들에 대해 praziquantel 10mg/kg와 MgSO<sub>4</sub>하제를 투여하여 蟲體排出을 시도한 바 異形異形吸蟲 총 19마리와 *H. dispar* 총 140마리를 실사변으로부터 수집할 수 있었다. 이들 중 1例는 귀국 후 14개월이 경과하였음에도 불구하고 蟲體가 남아 있어 흥미있는 점으로 생각되었다. 이들 症例는 외국에서 感染되어 국내로 들어온 異形吸蟲類 (heterophyids)로서의 최초 보고이며 특히 *H. dispar*의 人體感染은 문헌상 최초 症例에 해당된다.