

A new endemic focus of *Heterophyes nocens*, *Pygidiopsis summa*, and other intestinal flukes in a coastal area of Muan-gun, Chollanam-do

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Abstract: A small coastal village of Muan-gun, Chollanam-do, was surveyed for intestinal fluke infections, especially heterophyids such as *Heterophyes nocens* and *Pygidiopsis summa* by fecal examination on 108 inhabitants. The egg positive rate of heterophyids was very high, 75.0%, and that of other parasites was comparatively low, 0.9-3.7% by parasite species. After treatment of 20 patients showing high E.P.G. with praziquantel and purging with MgSO₄, total 3,864 specimens of *H. nocens* were collected from the diarrheic stools of all the patients treated (3-1,338 individually) and total 703 *P. summa* were harvested from 18 patients (1-170 individually), together with several other species of flukes. Other flukes included *Stictodora fuscata* (164 specimens from 4 patients), *Heterophyopsis continua* (2 from 2 patients), and *Gymnophalloides seoi* (4 from 3 patients). From this study, the surveyed coastal area of Muan-gun, Chollanam-do was proven to be a new endemic focus of *H. nocens* and *P. summa*. The occurrence of a few infected cases suggests that this area should also be a low-grade endemic area of *S. fuscata*, *H. continua*, and *G. seoi*.

Key words: intestinal flukes, heterophyids, Muan-gun, *Heterophyes nocens*, *Pygidiopsis summa*, *Stictodora fuscata*, *Heterophyopsis continua*, *Gymnophalloides seoi*

INTRODUCTION

National or local prevalence, or infection cases, of intestinal trematodes such as 8 species of heterophyids including *Metagonimus yokogawai* (family Heterophyidae), 3 species of echinostomes (Echinostomatidae), and a

species each of neodiplostome (Neodiplostomidae), plagiorchiid (Plagiorchidae) and gymnophallid (Gymnophallidae), have been reported in Korea (Chai and Lee, 1990; Seo, 1990; Lee *et al.*, 1993 & 1994; Hong *et al.*, 1996b). Most of these trematodes are contracted to humans by eating raw fresh or brackish water fishes, thus human infections will be distributed along the riverside or coastal areas. Among them, heterophyid flukes are the most important group, which include *M. yokogawai*, *M. takahashii*, *Heterophyes nocens*, *Pygidiopsis summa*, *Heterophyopsis continua*, *Stellantchasmus falcatus*, *Centrocestus armatus*, and *Stictodora fuscata* (Chai, 1994).

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Except for *M. yokogawai*, however, geographical distribution as well as endemicity of these fluke infections, have seldom been studied (Chai and Lee, 1990). In the case of *H. nocens* infection, an endemic focus was discovered from a coastal area of Shinan-gun, Chollanam-do (Chai *et al.*, 1994).

In this study, a small village of Muan-gun, Chollanam-do was selected for an evaluation on the infection status with intestinal trematodes, and has been found to be a new endemic focus of *H. nocens*, *P. summa*, and other intestinal flukes.

MATERIALS AND METHODS

Surveyed Area

The surveyed village is located on a south-western coastal area of Muan-gun, Chollanam-do (Fig. 1), 100 km north to the known endemic area of *H. nocens* (Chai *et al.*, 1994) and *G. seoi* (Lee *et al.*, 1994). The inhabitants favored eating raw mullets or oysters, the potential source of infection with various species of heterophyids or *G. seoi*.

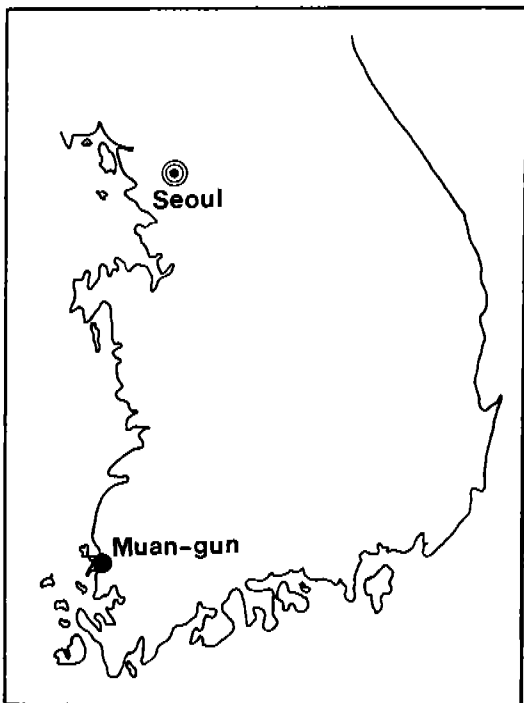


Fig. 1. Map showing the surveyed area, Muan-gun, Chollanam-do.

Fecal examination

A total of 108 fecal specimens was collected from the inhabitants in early January, 1995, and examined by both cellophane thick smear and formalin-ether sedimentation techniques.

Worm collection

After the fecal examination, twenty-five heterophyid egg positive cases with high E.P.G. (data not shown) were selected for recovery of adult flukes, and 20 of them were cooperative through the whole procedure. They were treated orally with praziquantel in 10 mg/kg single dose and purged with 30 g of magnesium sulfate. After one hour, the whole diarrhetic stools were collected individually and washed several times with tap water. The sediment was fixed with 1% formalin, and transported to the laboratory. Adult trematodes were collected under a stereomicroscope and fixed with 10% formalin under coverslip pressure. They were stained with Semichon's acetocarmine for identification.

RESULTS

Egg positive rate

Of 108 fecal specimens examined, the total number of helminth egg and/or protozoan cyst positive cases was 82 (75.9%), and 9 people (8.3%) were infected with more than two kinds of parasites (Table 1). Eggs of heterophyid flukes, mostly *H. nocens* and *P. summa* as confirmed later by recovery of adult flukes, occupied the overwhelming majority (81 persons; 75.0%). The number of other egg positive cases was 1 (0.9%) for *Trichuris trichiura*, 3 (2.8%) for *Trichostrongylus orientalis*, and 4 (3.7%) for *Gymnophalloides seoi*. Cysts of *Entamoeba coli* were found from 1 case (0.9%), and those of *Endolimax nana* from 1 case (0.9%) (Table 1).

By age, the egg positive rate of heterophyid flukes was the highest among 20-29 years group (100%), followed by 50-59 years (90.9%) and over 60 years (90.9%) groups, 30-39 years group (80.0%), and 40-49 years group (68.4%) (Table 2). Females showed a significantly higher positive rate (83.6%) than males (66.0%; $p < 0.05$).

Table 1. Results of fecal examination on the inhabitants of Muan-gun (January, 1995)

Parasite	No. positive (%)
No. examined	108
No. overall egg and/cr cyst positive cases	82 ^a (75.9)
heterophyids ^b	81 (75.0)
<i>Trichuris trichiura</i>	1 (0.9)
<i>Trichostrongylus orientalis</i>	3 (2.8)
<i>Gymnophalloides seoi</i>	4 (3.7)
<i>Entamoeba coli</i>	1 (0.9)
<i>Endolimax nana</i>	1 (0.9)

a) Nine cases were infected with more than two kinds of parasites.

b) The majority of cases was found infected with *Heterophyes nocens* and *Pygidiopsis summa* after treatment and collection of adult flukes.

Worm recovery

After praziquantel treatment and purgation, a total of 4,737 adult flukes was collected from 20 patients (average 236.9 flukes per person;

Table 2. Egg positive rate of heterophyid flukes according to age and sex of the inhabitants

Age group.	No. exam.	No. egg positive cases		
		Male	Female	Total (%)
0- 9	6	0	2	2 (33.3)
10-19	22	6	5	11 (50.0)
20-29	7	5	2	7 (100.0)
30-39	10	2	6	8 (80.0)
40-49	19	2	11	13 (68.4)
50-59	22	11	9	20 (90.9)
over 60	22	9	11	20 (90.9)
Total	108	35	46	81 (75.9)

5-1,436 in range). Among the flukes, *H. nocens* was the most prevalent and heavily infected species. The adult flukes of *H. nocens* were recovered from all of the 20 people examined (Table 3), and the number of recovered worms ranged from 3 to 1,338, and 3,864 in total (average 193.2 per infected case). The second frequent species was *P. summa*. The number of recovered worms ranged from one to 143, and

Table 3. Number of flukes collected from heterophyid egg positive cases after praziquantel treatment

Patient code	Age & sex	No. worms collected				
		<i>H. nocens</i>	<i>P. summa</i>	<i>H. continua</i>	<i>S. fuscata</i>	<i>G. seoi</i>
1	58M	3	20			
2	71F	5				
3	46F	8	170			
4	33F	9	1			
5	62M	17	3			1
6	49M	20	13			
7	51M	22	13			
8	40F	23	1			
9	46F	25				
10	60M	34	2			
11	61M	44	2			
12	50M	80	70		34	
13	35F	100	21			
14	60F	121	13			
15	70M	137	111		49	2
16	61M	209	44	1		
17	40M	295	25		5	
18	56F	325	30			
19	33F	1,049	143	1		
20	43F	1,338	21		76	1
Total		3,864	703	2	164	4

703 in total from 18 persons (average 39.1) (Table 3).

Other flukes collected included 164 specimens of *S. fuscata* from 4 cases, 2 *H. continua* from 2 cases, and 4 *G. seoi* from 2 cases (Table 3).

DISCUSSION

As for *H. nocens*, Seo *et al.* (1980) first confirmed the existence of its life cycle in three southern coastal areas in Korea, by observing the metacercariae in the muscle of mullets, *Mugil cephalus*. After that, a human case of *H. nocens* infection was incidentally found from Okku-gun, Chollabuk-do (Seo *et al.*, 1981), and 12 cases were added from scattered areas (Chai *et al.*, 1984 & 1985; Sohn *et al.*, 1989). Subsequently, Chai *et al.* (1994) reported an endemic focus of *H. nocens* infection from a small coastal village of Shinan-gun, Chollanam-do.

In the present study, another endemic focus of this fluke infection has been discovered from a coastal area of Muan-gun, which is located 100 km north to Shinan-gun, the known endemic area (Chai *et al.*, 1994). The infection rate of the inhabitants was much higher in Muan-gun (75.0%) than in Shinan-gun (42.9%), although the intensity of infection was a little lighter in Muan-gun (average worm burden 193.2) than in Shinan-gun (average worm burden 263.0). From these results, it is speculated that *H. nocens* infection is distributed widely along the southwestern coastal areas of Korea. Nationwide surveys for the prevalence of *H. nocens* infection are required.

The existence of *P. summa* in Korea was first documented by Chun (1963), who observed *P. summa* metacercariae in the gill and muscle of the mullet. Eight cases of natural human infection were first reported from Okku-gun, Chollabuk-do by recovery of adult flukes after chemotherapy (Seo *et al.*, 1981), which is regarded as the first report of an endemic focus. Seo *et al.* (1983) further found 9 egg positive cases of *P. summa* during fecal examination of western seashore villagers, from whom adult flukes were recovered later.

The present study confirmed a second

endemic area of *P. summa* infection. The prevalence was estimated around 50-60%, although its exact figure was difficult to draw because of mixed-infection of most cases with *H. nocens*. The average worm burden was 39.1, which was much lower than the figure in Okku-gun of 977 (Seo *et al.*, 1981).

Human infection with *H. continua* was reported from 3 cases so far (Seo *et al.*, 1984; Hong *et al.*, 1996a). The present paper adds two more cases infected with this fluke. As for *S. fuscata*, only one case of human infection has been published under the name of *Stictodora* sp. (Chai *et al.*, 1988). The present 4 cases become the 2nd-5th cases of *S. fuscata* infection.

As for the source of human infection with heterophyids, brackish water fishes such as the mullet (*M. cephalus*), goby (*Acanthogobius flavimanus*), or perch (*Lateolabrax japonicus*) have been known to carry their metacercariae (Chai and Lee, 1990). The inhabitants of Muan-gun favored eating raw flesh of young mullets and gobies caught from the estuary nearby the village, which are considered the main sources of human infection. The age-prevalence pattern shown in this study, higher prevalence among over 20 years of age than among children group, could represent more chance for adult ages to eat raw mullets or gobies than children.

There are two major reasons for few published reports on endemic areas of heterophyid flukes in Korea, abide by *M. yokogawai* (Chai and Lee, 1990). One is morphological similarity of heterophyid eggs such as *H. nocens* and *P. summa* with those of *M. yokogawai* and *C. sinensis*, respectively. They could be differentiated using such keys as the length (L), width (W), L/W ratio, together with other morphological characters (Lee *et al.*, 1984). However, it is practically difficult to give definite diagnosis for each case during mass fecal examinations. Especially when the cases are mixed-infected with different species of heterophyids, recovery of adult flukes are indispensable for final diagnosis. In the present study, it was difficult to discriminate eggs of each heterophyid species only by fecal examination, especially in cellophane thick smears, because this technique does not reveal clear egg morphology. Another

reason is very small number of eggs produced by heterophyid flukes including *M. yokogawai*. Unless they are infected with more than 100 *M. yokogawai* worms, for example, their eggs could be detected in fecal examination with great difficulty (Chai and Lee, 1990).

Up to present, *G. seoi* has been known to distribute in only two districts; very popularly in Shinan-gun, Chollanam-do (Lee *et al.*, 1994), 100 km south from Muan-gun, and in a very low grade in Puan-gun, Chollabuk-do (Lee *et al.*, 1996), 110 km north from Muan-gun. Since Muan-gun is located between these two areas, this area has been suspected to have *G. seoi* endemic foci. In this study, eggs of *G. seoi* were detected from 4 inhabitants, and adult flukes were recovered from 3 out of 20 treated patients. Therefore, Muan-gun is suspected as a medium endemic area of *G. seoi*. However, oysters caught from this area did not reveal metacercariae of *G. seoi* (Lee *et al.*, 1996). Further investigation should be done to clarify this point.

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=초록=

전라남도 무안군 해안 지역에서 발견한 유해이형흡충, 표주박이형흡충 및 기타 장흡충류의 새 유행지

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전라남도 무안군의 한 해안 마을이 각종 장흡충류, 특히 유해이형흡충 (*Heterophyes nocens*) 및 표주박이형흡충 (*Pygidiopsis summa*)을 비롯한 이형흡충류의 새로운 유행지임을 확인하였다. 마을 주민 108명의 대변을 수집하여 셀로판후층 도말법 및 포르말린-에테르 집란법을 실시하여 검사한 결과 이형흡충류의 총란이 81명 (75.0%)에서 양성하였고, 다른 기생충들은 낮은 양성률을 보였다. 증체 동정을 위해 프라지판텔과 하제를 투여한 후 설사변으로부터 성충을 회수한 결과 하제 투여에 협력한 20명 전원에서 유해이형흡충 총 3,864마리 (개인별로 3-1,338마리), 18명에서 표주박이형흡충 총 703마리 (1-170마리), 그리고 몇 가지 다른 장흡충류를 검출할 수 있었다. 다른 장흡충류로는 자루이형흡충 (*Stictodora fuscata*) 164마리를 4명에서, 긴이형흡충 (*Heterophyopsis continua*) 2마리를 2명에서, 참굴큰입흡충 (*Gymnophalloides seoi*) 4마리를 3명에서 각각 회수하였다. 이상의 결과로 대상 지역인 전남 무안군의 해안 마을이 유해이형흡충 및 표주박이형흡충의 새로운 유행지임을 확인하였다. 또한, 다른 장흡충류 감염자도 몇 명씩 발견할 수 있었던 점으로 보아 이 지역은 자루이형흡충, 긴이형흡충 및 참굴큰입흡충의 낮은 유행지임도 함께 시사하고 있다.

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