Endemic Foci of *Paragonimus westermani* in Chilgok, Kyungpook Province, Korea

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The present prevalence of *Paragonimus westermani* in Kyungpook Province has been surveyed by Kim, Choy and Choi (1974). Except for the report of Park and Choi (1974), there were no additional reports concerning the newly found endemic foci of *P. westermani* in the Province.

In Kyungpook Province, only four studies have been made on the endemic foci of *P. westermani*. The first survey was made by Miyairi around 1915 in the stream Komoon, Kasan myun, Chilgok county, where human paragonimiasis had been prevalent.

Miyairi (1917) reported that the intermediate host of lungfluke in Korea was found to be crayfish and the crayfish collecting station, Komoon stream is a focus of *P. westermani* in Kyungpook Province, Korea.

In 1924, Ichinomiya made a survey for paragonimiasis in Kyungpook Province. Approximately 4 per cent of the residents in Chilgok county were found to be infected. Four endemic foci were found in the county.

Park (1962) presented several endemic foci of *P. westermani* in the vicinity of Taegu, and in Kyungpook Province. That was the third survey of paragonimiasis in the Province.

Quite recently, the high prevalence of *P. westermani* in man and in crayfish host (Park and Choi, 1974) suggested that human infection

with the fluke was widespread in Kyungpook Province, Korea.

During the course of the present survey of *P. westermani* in Chilgok county, Kyungpook Province, three endemic foci of the fluke were found.

The present paper presents the distribution pattern of *Semisulcospira* snails and *Astacus* crayfish in the streams and the prevalence of *P. westermani* among the residents in the newly found endemic foci of *P. westermani*.

GEOGRAPHICAL CONDITION OF SURVEYED AREAS

From the foci of *P. westermani* found there were selected for investigation (Fig. 1). The three may be considered representative of mountainous areas of Kyungpook Province. Two villages, Haksan first dong and Haksan second dong, are located along the narrow stream Komoon, 800 meters above sea level in the southern Yuhak mountain range. The farms where rice and barley are the main cultivating crops are restricted to the area near the stream. There is little flowing water in the stream and the stream bed contains freshwater snails and crayfish.

The third village, Setton is located on the eastern wing of Kumhwa village in Kasan

Fig. 1. Map of study areas in Kasan myun Chilgok county.

myun. The area is drained by a small stream originating in the west wing of Palgong mountain range. There is a mine near the upper portion of this stream and untreated sewage enters into the water. There are a few fresh-water snails in the stream bed and no crayfish.

MATERIALS AND METHODS

The endemic foci of *P. westermani* in the present study were defined as a result of comparative survey of the fluke in Chilgok county, Kyungpook Province.

The study areas selected in the county were

Haksan first dong (village), Haksan second dong, and Settom located near Kumhwa dong.

The survey results in each focus were obtained using the intradermal test. The *Paragonimus* antigen, Lot No. 770401, made in the National Institute of Health, Tokyo, Japan was used. The residents (0 to 67 year-old) in each village were tested with the antigen.

The general technics of intradermal test have already been described (Choi et al., 1973).

The presence and abundance of *Semisulcospira* snails in the stream bed was observed and recorded. The density of the snail population was estimated by the approximate number of snails collected per square meter of stream bed. The snails collected by hand were forwarded to the laboratory and examined for the presence of *Paragonimus* cercaria using both immersing and crushing technics (Miyazaki, 1961).

Fresh-water crayfish, *Astacus similis*, caught by hand in the stream were brought to the laboratory and dissected into the liver and heart, the gills, the thoracic muscle, and the rest. They were then compressed between two large slides (50×90mm) and examined for the presence of the metacercaria of *P. westermani*.

RESULTS

Table 1 presents the general population and the number of residents tested with *Paragonimus* antigen in the three endemic foci of *P. westermani* in Chilgok county, Kyungpook Province. Although there was a considerable fluctuation in the number of residents tested, data for the three areas have been combined. A total of 222 residents (38.3% of population) were tested. Of these, the proportion of individuals tested in the population varied from 29.4 per cent at Haksan first dong to 64.0 per cent at Settom. The ratio of male and female tested was almost equal.

Table 1. General population and number tested in three endemic foci of *Paragonimus westermani* in Chilgok county, Kyungpook Province (1977)

Endemic foci surveyed	Population			Number tested			Per cent tested
	Male	Female	Total	Male	Female	Total	
Haksan 1st dong	171	179	350	51	52	103	29.4
Haksan 2nd dong	92	86	179	41	46	87	48.6
Settom	22	28	50	17	15	32	64.0
Total	285	293	579	109	113	222	38.3

Table 2. Prevalence of *Paragonimus westermani* among residents in three different foci of Chilgok county in 1977, revealed by *Paragonimus* intradermal test

Endemic foci surveyed	Male			Female			Total		
	No. tested	No. positive	% positive	No. tested	No. positive	% positive	No. tested	No. positive	% positive
Haksan first dong	51	13	25.5	52	10	19.2	103	23	22.3
Haksan second dong	41	9	22.0	46	12	26.1	87	21	24.1
Settom	17	4	23.5	15	4	26.7	32	8	25.0
Total	109	26	23.9	113	26	23.0	222	52	23.4

Table 3. Prevalence of *Paragonimus westermani* by sex and age among residents in 1977, revealed by *Paragonimus* intradermal test

Age group (Year)	Male			Female			Total		
	No. tested	No. positive	% positive	No. tested	No. positive	% positive	No. tested	No. positive	% positive
0~9	46	18	39.1	31	11	35.5	77	29	37.7
10~19	19	4	21.1	23	5	21.7	42	9	21.4
20~29	6	0	0	9	1	11.1	15	1	6.7
30~39	7	0	0	12	3	25.0	19	3	15.8
40~49	17	3	17.6	17	3	17.6	34	6	17.6
50~59	9	0	0	15	3	20.0	24	3	12.5
60~	5	1	20.0	6	0	0	11	1	9.1
Total	109	26	23.9	113	26	23.0	222	50	23.4

Table 2 presents the prevalence of *P. westermani* among the residents in the endemic areas. Of 222 residents, 52 or 23.4 per cent were found to be positive. In general, the positive rate for the fluke among the residents in the foci was constant. In Haksan first dong, 22.3 per cent of 103 individuals revealed positive reaction, and similarly, 25.0 per cent in Settom. No significant difference in the positive rates

among the three endemic foci was encountered ($P > 0.05$).

The results of the intradermal test with *Paragonimus* antigen among the 222 residents by sex and age at the three endemic foci in Chilgok county are summarized in Table 3.

The overall positive rate for *P. westermani* in 222 residents was found to be 23.4 per cent. The rate for the younger age groups were re-

Table 4. Distribution of *Semisulcospira* snails and *Astacus* crayfish in three endemic foci of *Paragonimus westermani* in Chilgok county (1977)

Endemic foci surveyed	Distribution of intermediate hosts	
	<i>Semisulcospira</i> snails	<i>Astacus</i> crayfish
Haksan first dong	Abundant	Abundant
Haksan second dong	Rare	Rare
Settom	None	None

markably high, 37.7 per cent in the 0-9 age group and 21.4 per cent in the 10-19 age group. The positive rates for the over 20 age groups were somewhat lower compared with those for the younger ages. There was no difference in the rate of infection between males and females, 23.9 per cent of positive residents were males and 23.0 per cent were females.

The densities of snails and crayfish, the first and second intermediate hosts of *P. westermani*, were classified by the rough estimation of the number of snails and crayfish in the streams (Table 4).

In Haksan first dong, *Semisulcospira* snails and *Astacus* crayfish were found in abundance in the stream, but in the Haksan second dong both snails and crayfish were rare. In Settom there was no crayfish in the stream.

Total 31 crayfishes were examined for the presence of the metacercaria of *P. westermani*, and one was found to be infected with the larvae, which were recovered from the gill.

DISCUSSION

Although the intradermal test performed among the residents and the intermediate host survey was not completely representative of the three areas, the results seem to indicate: 1) that *Semisulcospira* snails and *Astacus* crayfish until recently found in abundance in the stream are now rare intermediate hosts, 2) that infection

with *P. westermani* is very prevalent and widespread in Haksan first and second villages, and in Settom, near Kumhwa village, and 3) that demonstration of *P. westermani* larvae from the snails and crayfish has become apparently difficult in recent years.

These intradermal data do not agree with the intermediate host surveys in which only 3.2 per cent of *P. westermani* metacercariae were found in 31 crayfishes collected in the stream of Haksan first village. However, in the other two areas, no *Paragonimus* metacercaria was found from the few crayfish collected.

The pattern of *P. westermani* infections, which were characterized in such terms as "Togil" (Miyairi, 1917; and Ichinomiya, 1924), suggested that the disease was very endemic in that area.

It is of interest to note that the cercaria of *P. westermani* has not been recovered from *Semisulcospira* snails in an endemic area in spite of the continued presence of metacercariae in the crayfish intermediate host, *Astacus similis*.

There is no explanation for the maintenance of *P. westermani* metacercariae in the crayfish after the disappearance of the cercariae of this fluke from the snails caught in the same community.

It is apparent from the data obtained by Kim and Choi (1977), that the positive rates for paragonimiasis among the residents in the three endemic areas were significantly higher than the rates in the surrounding non-endemic areas. However, a tendency towards a decrease in prevalence was observed in Kasan myun, Chilgok county, Kyungpook Province.

The intense pesticide spray application on the farms and inside the houses might be offered as a possible reason for part of the change in these areas surveyed.

Other factors might be sought as contributing to the decrease. The improvement of the socio-

economic status and in the spread of anti-parasitic health education among the residents during recent years should be emphasized in this connection.

The data pointed to the importance of age in the epidemiology of paragonimiasis. As shown in Table 3, more than 50 per cent of the school children showed positive intradermal reaction. Upon entering adulthood, the rates decreased markedly unless infection was related to occupation.

The low positive rate recorded for 20-29 years of age group (Table 3) may be due to sampling error since residents in this age group were the least cooperative and the majority of them had a job in surrounding cities.

SUMMARY

By performing the county-wide surveys of *Paragonimus westermani* infections in several areas in the Chilgok county, Kyungpook Province, three endemic foci of *Paragonimus westermani* were found.

The foci found in this survey were Haksan first dong, Haksan Second dong, and Settom in Kumbwa village, all in Kasan myun, Chilgok county.

In the three communities, the positive rates for the fluke among the residents by the intradermal test with *Paragonimus* antigen varied from 22.3 per cent to 25.0 per cent; school children from these areas showed infection rates above 50 per cent. The rate in males and females was 23.9 and 23.0 per cent, respectively. This difference was not significant.

The presence and number of *Semisulcospira* snails and *Astacus* crayfish, the intermediate hosts of *Paragonimus westermani* in the stream communities and the high infection rates for the fluke in the residents were the supporting

factors in determining the foci.

LITERATURE CITED

- Choi, D.W., C.Y. Joo, S.D. Park, and J.W. Kian (1973). Changing pattern of *Clonorchis sinensis* infection among school children in Gumho basin, Kyungpook Province, Korea. Korean J. Parasit., 11:27-33.
- Ichinomiya, K. (1924a). Distribution of endemic disease, paragonimiasis in Kyungpook Province, Korea (in Japanese). Mansen Med. J. (Mansen No Ikai), 37:17-32.
- Ichinomiya, K. (1924b). Distribution of endemic disease, paragonimiasis in Kyungpook Province, Korea 2 (in Japanese). Mansen Med. J., 38:17-28.
- Kim, Y.M., C.H. Choy, and D.W. Choi (1974). Epidemiological surveys of *Paragonimus westermani* in Kyungpook Province, Korea. Kyungpook Univ. Med. J., 15:165-171.
- Kim, J. H. and D.W. Choi (1977). *Paragonimus westermani* infection among residents from northern Chilgok, Kyungpook province, Korea. Kyungpook Univ. Med. J. (in press).
- Miyairi, K. (1917). Second intermediate hosts of lung fluke known by nowadays (in Japanese). Jikken Iho, 2:22.
- Miyazaki, I. (1961). Paragonimiasis, with special reference to its taxonomy, life-cycle, and distribution (in Japanese). Thoracic Diseases, 5:953-962.
- Park, C.M. (1962). Epidemiological aspect of paragonimiasis in Korea. Yonsei Med. J., 3: 85-92.
- Park, S.D. and D.W. Choi (1974). Distribution of metacercariae in second intermediate host of lung fluke. *Paragonimus westermani*. Kyungpook Univ. Med. J., 15:117-127.

＝국문초록＝

慶北 漆谷郡에서의 肺吸蟲의 浸潤地

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慶北 漆谷郡民들에서의 肺吸蟲 感染狀을 調査하던 중 새로운 肺吸蟲 浸潤地를 發見하였다.

發見된 浸潤地는 漆谷郡 가산면 학산 1동, 학산 2동 및 금화동에 隣接한 셋뚝의 3地域이었다.

이 地域 住民들에서의 肺吸蟲 피내반응검사에 의한 양성율은 22.3—25.0%이었다. 이 가운데서 國民學校 學童이 50% 以上을 차지하고 있었다. 性別 양성율에 있어서는 男子에서는 23.9%, 女子에서는 23.0%이었으며, 양자 사이에 유의적 차를 認定할 수 없었다.

이 세 浸潤地 河川에 肺吸蟲의 중간 숙주인 다슬기와 가재가 서식하고 있는 점과 이곳 住民들에서 肺吸蟲의 感染率이 높다는 것에 의거하여 肺吸蟲 浸潤地임을 알았다.