

Infection Status of Freshwater Crabs and Crayfish with Metacercariae of *Paragonimus westermani* in Korea

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Abstract: The present study investigated the infection status of *Paragonimus westermani* metacercariae in freshwater crabs (n = 363) and crayfish (n = 31) from October 2007 to October 2008 using the crush method. All of the freshwater crabs, *Eriocheir japonicus*, were negative for *P. westermani* metacercariae while 10 (32.3%) of the 31 examined crayfish were positive. The 10 positive crayfish were caught in Haenam, Jeollanam-do, and there were 8-59 (mean 28.4) metacercariae per infected crayfish. These results suggest that *P. westermani* metacercariae are still transmitted by crayfish enzootically in southern Korea, and that freshwater crabs may transmit metacercariae only on rare occasions.

Key words: *Paragonimus westermani*, metacercariae, freshwater crab, crayfish

Since the 1970s, the population density and the infection rate of crayfish and freshwater crabs with metacercariae of *P. westermani* have decreased drastically and continuously in many endemic areas. However, paragonimiasis patients still appear in Korea, and the major source of infection is presumed eating soybean sauced freshwater crabs (Kejang). Infection status of freshwater crab and crayfish with metacercariae of *P. westermani* is an important epidemiological index which represents the status of human infection sources [1-3]. It is required to estimate the importance of freshwater crabs as an infection source of human paragonimiasis in Korea to manage the disease.

In order to estimate the current status of *P. westermani* transmission by the crabs or crayfish in Korea, we examined the intermediate hosts for the metacercariae from October 2007 to October 2008. A total of 363 freshwater crabs (*Eriocheir japonicus*) from 10 localities and 31 crayfish (*Cambaroides similis*) from 6 localities were collected. The collection sites were selected according to geographical distribution (Fig. 1). The freshwater crabs and crayfish were brought to the laboratory and were examined for the metacercariae under a stereomicroscope using the crush method.

All of the 363 freshwater crabs were negative for *P. westermani* metacercariae (Table 1) which suggests that transmission of the

metacercariae by freshwater crabs is rare and that a larger sample size is needed to detect metacercaria carrying crabs. In 1990, 11.8% of crabs purchased at markets in Seoul were positive with a mean of 2.1 metacercariae per positive crab [3]. In the markets, wild and aquacultured crabs are sold together but wild crabs have more risk of the transmission than aquacultured ones do because they have more chances of contact with the first intermediate host. Wild crabs are now produced more than before because of improved preservation of the environment in Korea. However, it is now becoming difficult to detect infected crabs in markets as is observed in this study. This finding suggests that transmission of *Paragonimus* by freshwater crabs is very rare in Korea compared to that in 1990s [3]. Nonetheless, scores of new paragonimiasis patients appear over the country every year and, therefore, there must be infected crabs at a very low frequency. In this context, further studies employing large number of wild crabs are necessary.

The crayfish collected at Haenam, Jeollanam-do were positive for metacercariae (Table 2; Fig. 1). The number of the metacercariae per crayfish ranged from 8 to 59, with a mean of 28.4. For years, transmission of *P. westermani* metacercariae by crayfish has only been observed at this locality [4-6]. The life cycle maintenance by crayfish may be enzootic rather than endemic.

In conclusion, *P. westermani* metacercariae are still transmitted by crayfish enzootically in southern Korea, and freshwater crabs may transmit the metacercariae on rare occasions.

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Table 1. Examination findings of freshwater crabs for *P. westermani* metacercariae by localities

Localities of collection (month/year)	No. of examined	Length (cm)		Weight (g)		No. of positive
		Range	Average	Range	Average	
Paju, Gyeonggi-do (Oct/2007)	47	12-18	15	75-89	83.0	0
Paju, Gyeonggi-do (Oct/2008)	113	21-35	26.2	55-249	98.9	0
Buyeo, Chungnam (Oct/2007)	22	17-30	22.9	34.2-157.6	80.3	0
Buyeo, Chungnam (Oct/2008)	54	7.5-29	21.6	26.1-119.3	63.0	0
Iksan, Jeonbuk (Oct/2008)	10	21-25	22.9	52-83.9	67.6	0
Gurye, Jeonnam (Nov/2007)	7	12-18	15.0	69-86	79.5	0
Gokseong, Jeonnam (Oct/2008)	29	25-31	28.0	86.4-194.6	133.8	0
Hadong, Gyeongnam (Sep/2008)	19	Not measured		Not measured		0
Noryangjin Fisheries Market, Seoul (Oct/2007)	14	12-18	15.0	75-89	83.0	0
Noryangjin Fisheries Market, Seoul (Oct/2008)	48	25-30.5	27.3	78.6-114.8	94.0	0
Total	363					0

Table 2. Infection status of crayfish with *P. westermani* metacercariae (MC) by localities

Localities of collection (Month/year)	No. of examined	Length (cm)		Weight (g)		No. of Positive	Mean (range) No. of MC/crayfish
		Range	Mean	Range	Mean		
Hadong, Gyeongnam (May/2008)	4	5.2-10	7.8	1.9-11.7	6.28	0	0
Miryang, Gyeongnam (May/2008)	6	3.8-7.5	5.6	0.6-7	2.98	0	0
Gochang, Jeonbuk (May/2008)	4	6-8.5	7	2.9-9.8	5.7	0	0
Gwangyang, Jeonnam (May/2008)	3	6.7-7.8	7.2	3.6-6.3	4.7	0	0
Boseong, Jeonnam (May/2008)	4	6.5-9.5	7.75	3.6-12.1	6.95	0	0
Haenam, Jeonnam (Jun/2008)	10	5.2-7.2	5.77	1.8-5.4	2.890	10	28.4 (8-59)
Total	31					10	28.4 (8-59)

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REFERENCES

1. Rim HJ, Lee JS, Chung HS, Hyun IL, Jung KH. Epidemiological change on paragonimiasis in Kang Hwa Gun. *Korean J Parasitol* 1975; 13: 139-151.
2. Hong YA, Joo CY, Pyun YS. Infestation status of *Paragonimus westermani* metacercariae in the second intermediate host in Ulchin county, Kyungpook Province. *Korean J Parasitol* 1986; 24: 194-200.
3. Cho SY, Kang SY, Kong Y, Yang HJ. Metacercarial infection of *Paragonimus westermani* in freshwater crabs sold in markets in Seoul. *Korean J Parasitol* 1991; 29: 189-191.
4. Shin MH, Min DY. Infection status of *Paragonimus westermani* metacercariae in crayfish (*Cambaroides similis*) collected from Bogildo (Islet), Wando-gun, Chollanam-do, Korea. *Korean J Parasitol* 1999; 37: 55-57.
5. Ahn YK, Han JK, Chung JH. Epidemiological survey on *Paragonimus* infection in Wando and Bogil islet, Wando-Gun (Cheon-nam Province, Korea). *New Med J* 1979; 22: 1051-1056.
6. Kim JJ, Chang JK, Chung PR, Soh CT. A study on the intermediate hosts of *Paragonimus westermani* in Bogil-islet, Chonranam-Do, Korea. *Korean J Malacol* 1985; 1: 19-23.

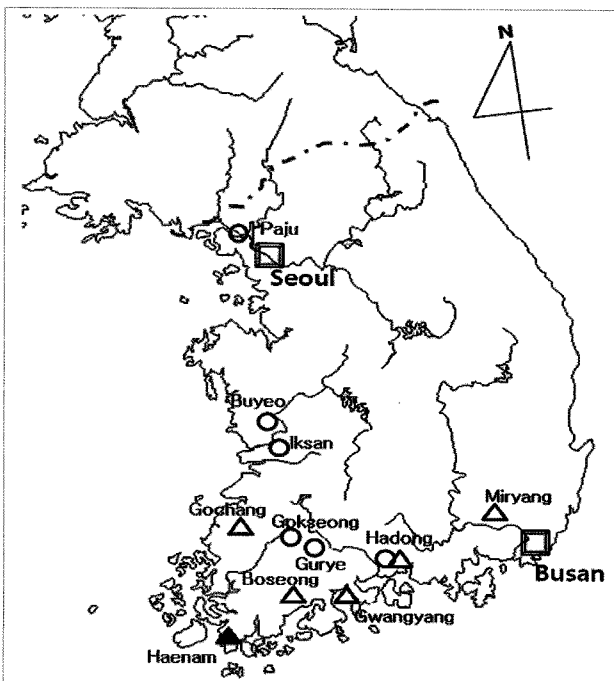


Fig. 1. Surveyed areas of the Republic of Korea to collect the second intermediate hosts of *P. westermani*. Open circles (○), areas of negative freshwater crabs; open triangles (△), areas of negative crayfish; closed triangle (▲), area of positive crayfish.