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〈Short communication〉

Acanthoparyphium tyosenense Infection in Great Knots and Turnstone on the Western Coast of Korea

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ABSTRACT: Waders inhabiting an area in which *A. tyosenense* is endemic were examined to determine if they serve as reservoir hosts for the parasite. Of the waders examined, 4 individuals from 2 species were found to be hosts for 18 to 1820 adult worms. Common and velvet scoters, which are known to be the final hosts of *A. tyosenense*, are rare in the infected areas, while waders are prevalent and prey on the bivalves known to be intermediate hosts of *A. tyosenense*. Thus, from the experimental results and circumstances presented herein, we conclude that waders are definitive and reservoir hosts of *A. tyosenense* in nature.

Key words: *Acanthoparyphium tyosenense,* Rreservoir host, Trematode, Wader

INTRODUCTION

Acanthoparyphium tyosenense is a trematode known to conduct its life cycle in the Mankyung River Estuary on the western coast of Korea and to use shellfish as a second intermediate host, and scoters as a definitive host (Yamaguti 1939, Chai et al. 2001). Research on the development and life history of the worm was initiated once it was found to infect local residents (Han et al. 2003, Kim et al. 2004). However, past researcher have relied on Yamaguti's (1939) description of final hosts for the parasite, without conducting further research on reservoir hosts in nature. Common scoters (*Melanitta nigra*) and velvet scoters (*Melanitta fusca*), which have been depicted as the definitive hosts for *A. tyosenense*, are rare in the wader-ridden Mankyung River Estuary (Lee 2005). The Mankyung River Estuary, however, is recognized as Korea's most extensive wader habitat, with hundreds of thousands of waders making an annual stop-over (Lee 2001). Many wader species feed on bivalves which are intermediate hosts of *A. tyosenense* (Swennen 1990). Thus, waders may face higher exposure to *A. tyosenense* infection, and may be more likely to serve as a reservoir host of the parasite, than any other taxon. This research seeks to fill the aforementioned gaps by determining if waders can function as a reservoir host to *A. tyosenense*.

MATERIALS AND METHODS

This research was conducted in conjunction with a banding project performed by the Korean Ministry of Environment in spring and autumn of 1998 and 2000 in the Mankyung River Estuary. During the banding efforts, 16 individual waders from 4 species preying on shellfish were captured and immediately transferred to the laboratory. Their small intestines were dissected and opened longitudinally in a petri dish containing saline, and investigated for parasitic worms using a stereomicroscope.

RESULTS

Acanthoparyphium tyosenense was found in three great knots (*Calidris tenuirostris*) and one ruddy turnstone (*Arenaria interpres*) (Fig. 1). A total of 1,017 individuals of *A. tyosenenses* were found in the three great knots, while about 1,820 *A. tyosenenses* were found in the ruddy turnstone (Table 1). The parasites found in wader intestines ranged from the juvenile to the adult developmental stages.

DISCUSSION

The western coast of Korea, and especially the Mankyung River Estuary, is an enormously important habitat for waders. The Mankyung River region serves as an annual stop-over for some 500,000 individual waders, with as many as 30 species and 100,000 individuals being observed in the region per day (Lee 2001). Many of the wader species, including the great knot, the red-necked stint (*Calidris ruficollis*), the dunlin (*C. alpine*) and the turnstone, prey on shellfish including *Mactra veneriformis* and *Meretrix petechialis*, which are intermediate hosts of *A. tyosenense* (Kim 1995, Park 2002).

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Table 1. Numbers of birds examined and infection rates with *A. tyosenense*

Species	Number of birds examined (juvenile/adult)	Number of infected birds (juvenile/adult)	Total no. of *A. tyosenense*
Ruddy turnstone	1 (0/1)	1	1820
Dunlin	7 (5/2)	0	0
Red-necked stint	4 (1/3)	0	0
Great knot	4 (2/2)	3 (1/2)	1017(18+234+765)

Fig. 1. An adult worm of *Acanthoparyphium tyosenense* recovered from a intestine of a great knot (scale bar = 0.2 mm)

This study has revealed wader species that primarily prey on shellfish to contain *A. tyosenense*. Shellfish previously studied in the Mankyung River Estuary showed a metacercaria infection rate of close to 100 percent (Chai et al. 2002), so waders that live on these shellfish should show similar infection levels. However, not all waders investigated were infected by *A. tyosenense*. Furthermore, parasites were not detected in dunlin and red-necked stint, perhaps because the shellfish examined and those eaten by the waders differed greatly in size from those known to be intermediate hosts for metacercaria. Chai et al. (2001) studied large shellfish, and while waders such as turnstones and great knots typically consume shellfish of around 1 cm in size, dunlins and red-necked stints feed on shellfish 2～3 mm in size (Kim 1995). Thus, the metacercaria infection rate for these waders could be low due to the limited time or opportunity for cercaria exposure.

The number of infected shellfish eaten by waders likely increases with duration of stay in the estuary, thus the infection rate likely varies with the duration of stay. Given the fat retention rate of the adult ruddy turnstone examined in this study, this individual was determined to have been a long- term resident in the Mankyung River Estuary, and the number of *A. tyosenense* individuals infecting the bird seemed appropriately large. One of the three infected great knots was a juvenile captured from a population completing its autumn migration south to Australia from its breeding grounds in Siberia. The bird was likely on its first visit to the Mankyung River Estuary, so its time and opportunity for parasite exposure were minimal. Accordingly, the number of infecting parasites was found to be small.

The final natural hosts of *A. tyosenense* known so far are the black-tailed gull (*Larus crassirostris*), the common scoter and velvet scoter (Yamaguti 1939, Kim 1988). The black-tailed gull lives primarily on sardines, anchovies, fish eggs and other food sources during the breeding season, while it lives on fish, crustaceans and various other prey on coasts and mud flats during the non-breeding season (Watanuki 1984, del Hoyo et al. 1996). The bird does not commonly prey on shellfish, but may scavenge them as a secondary food source. Thus, the identification by Kim (1988) of black-tailed gulls as definitive hosts may be more correctly regarded as an aberrant infection. Additionally, while the common scoter and velvet scoter commonly prey upon shellfish, they are rarely observed on the western coast of Korea, being most often found on the eastern and southern coasts. From related documents published in the last 6 years, the number of common and velvet scoter individuals observed in Korea was extremely small (K.N.I.E.R., 2000, 2001, 2002, 2003, 2004, 2005). Therefore, despite their role as final hosts for *A. tyosenense*, these species may not be regarded as the primary reservoir hosts enabling the *A. tyosenense* infections found in residents of Korea's west coast.

Given the findings from our field and laboratory analyses, as well as the aforementioned circumstantial evidence (that waders are prevalent in the infected areas and that they primarily prey on shellfish, which are secondary hosts of *A. tyosenense*), we propose that waders are the definitive and reservoir hosts of *A. tyosenense* in nature.

LITERATURE CITED

Chai JY, Han EK, Park YK, Guk SM Lee SH. 2001. *Acanthoparyphium tyosenense*: The discovery of human infection and identification of its source. J Parasitol 87: 794-800.

Han ET, Kim JL, Chai JY. 2003. Recovery, growth, and development of *Acanthoparyphium tyosenense* (Digenea: Echinostomatidae) in experimental chicks. J Parasitol 89: 176-179.

Kim HB. 1995. Ecology of waders migrating to Sammok Island on the west coast of Korea. (MS thesis). Kyunghee University, Seoul, Korea. [In Korean]

Kim YG. 1988. Studies on the trematode parasitized on bivalves. V. On metacercaria of echinostomatidae detected from *Mactra veneriformis*, *Cyclina sinensis* and *Solen strictus*. J Fish Pathol 1: 21-24.

Kim YG, Yu JE, Chung EY, Chung PR. 2004. *Acanthoparyphium tyosenense* (Digenea: Echinostomatidae): experimental confirmation of the cercaria and its complete life history in Korea. J Parasitol 90: 97-102.

del Hoyo J, Elliott A, Sargatal J. 1996. Handbook of the bird of the world. Vol. 3. Hoatzin to Auks. Lynx Edicions, Barcelona.

Lee JY. 2001. Ecology of waders migrating to the west coast of Korea. (PhD thesis). Kyunghee University, Seoul, Korea. [In Korean]

Lee WS, Koo TH, Park JY. 2005. Field guide to the bird of Korea. LG Evergreen Foundation, Seoul, Korea.

KNIER (Korean National Institute of Environmental Research). 2000. 2000 Census report on wintering birds around the Korea. NIER press, Seoul, Korea. [In Korean]

KNIER (Korean National Institute of Environmental Research). 2001. 2001 Census report on wintering birds around the Korea. NIER Press. Seoul, Korea. [In Korean]

KNIER (Korean National Institute of Environmental Research). 2002. 2002 Census report on wintering birds around the Korea. NIER Press. Seoul, Korea. [In Korean]

KNIER (Korean National Institute of Environmental Research). 2003. 2003 Census report on wintering birds around the Korea. NIER Press. Seoul, Korea. [In Korean]

KNIER (Korean National Institute of Environmental Research). 2004. 2004 Census report on wintering birds around the Korea. NIER Press. Seoul, Korea. [In Korean]

KNIER (Korean National Institute of Environmental Research). 2005. 2005 Census report on wintering birds around the Korea. NIER Press. Seoul, Korea. [In Korean]

Park SK. 2002. Effects of reclamation and ecology shorebirds migrating to intertidal mudflats of Yongjong and Sammok Islands reclaimed for construction of Incheon International Airport, west coast of Korea (PhD thesis). Kyunghee University, Seoul, Korea. [In Korean]

Swennen C, Poole CM, Park EM, Park JY. 1990. Study of intertidal benthos in South Korea 1989. AWB Publ., Kuala Lumpur, Malaysia, No. 63: 23p.

Watanuki Y. 1984. Food intake and pellet of black-tailed gull *Larus crassirostris*. J Yamashina Institute Ornithol 16: 168-169.

Yamaguti S. 1939. Studies on the helminth fauna of Japan. Part 25. Trematodes of birds. Jap J Zool 8: 144-145.

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