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Infection Statue of *Prosthogonimus* Metacercaria in Dragonfly from Korea

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Functional Bilateral Ovarian Granulosa Cell Tumor in a Yorkshire Terrier Dog

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초 록: 우리나라에 서식하고 있는 잠자리를 채집하여 *Prosthogonimus*의 제2중간숙주 역할을 하는 잠자리의 종을 조사하였다. 총 8종의 잠자리(*Sympetrum drawinianum, Orthetrum albistylum, Lyriothemis pachygastra, Sympetrum eroticum, Crocothemis servilia, Pantala flavescens, Sympetrum pedemontanum, Deielia phaon*) 3,453 마리에서 26,316개의 피낭유충을 회수하였으며 7종의 피낭유충을 분리하였다. 마리당 피낭유충의 감염은 *Sympetrum eroticum, Sympetrum drawinianum, Sympetrum pedemontanum, Deielia phaon, Lyriothemis pachygastra, Orthetrum albistylum, Pantala flavescens, Crocothemis servilia* 순으로 높았고, 감염율은 각각 11.71, 8.58, 4.56, 2.36, 2.17, 1.83, 1.66 및 0.47 순으로 *Sympetrum eroticum*가 가장 높은 감염율을 보였으며 *Crocothemis servilia*가 가장 낮은 감염율을 보였다. 4종의 피낭유충(*Loxogenes liberum, Pleurogenoides japonicus, Plagiorchis muris* and *Prosthogonimus* spp.)은 종을 동정을 할 수 있었으나 나머지 3종은 동정할 수 없었다. *Prosthogonimus* spp.는 오직 *Deielia phaon*에서만 관찰되었으며 총 57마리에서 8개의 피낭유충만이 회수되어 감염율은 매우 저조 하였다. 따라서 우리나라에서 *Prosthogonimus* spp.의 제2 중간숙주 역할을 하는 잠자리는 *Deielia phaon*(밀잠자리붙이)로 구명되었다.

주요어 : 잠자리, *Prosthogonimus*, 피낭유충

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Introduction

Prosthogonimus spp. was found in a freshly laid hen's egg two specimens of a fluke by Hanow[1] which is now known as *Prosthogonimus ovatus*. Luhe[2] establish the genus *Prosthogonimus* (Family: Prosthogonimidae) in 1899, designating Rudolphi's ovatus as the type. At the present time a total of 16 species of the genus is known, and there are found in Europe, Asia, Africa, and North and South America[3].

Prosthogonimus spp. requires two intermediate hosts, the first is a water snail and the second is the nymphal stage of various species of dragonflies. Sporocysts are formed which produce cercaria without undergoing redial development and these, being liberated from the snail, swim about in the water. They are then drawn into the anal openings of the dragonfly naiads by the cercaria is lost in the respiratory chamber of the naiad and the metacercaria penetrates into the muscles and encysts in the haemocele of the nymph. Metacercariae may persist in the insect until it is mature and the final host is infected by eating either the adult dragonfly or the nymphal stage. In the final host the liberated immature trematodes migrate to the cloaca and the bursa of Fabricius where they become adult. In the mature fowl, in which the bursa is atrophied, the parasites enter the oviduct[4].

Several species of dragonflies may serve as the second intermediate host. We surveyed the second intermediate host of *Prosthogonimus* in Korea.

Materials and Methods

Adult dragonflies were captured in quantities on damp days or early mornings by sweeping vegetation near the lake-shore, villages and streams in Chungnam and Chonbuk province, and Daejeon city in Korea from June 2002 to September 2008. Captured dragonflies were identified according to Shin's method[5] and grouped in species of dragonfly. Each group of dragonfly was digested by artificial digestion method after discard of wings. The dragonflies were digested for 2 hr in artificial gastric juice(pepsin 6g, HCl 7ml in 1L D.W.) at 37℃. The digests were washed 0.45% saline, sedimented at room temperature and repeated several times to clarify.

The metacercariae were collected from the sediment of digest under the dissecting microscope and grouped under the light microscope.

Results

Eight species of dragonflies, *Sympetrum drawinianum*, *Orthetrum albistylum*, *Lyriothemis pachygastra*, *Sympetrum eroticum*, *Crocothemis servilia*, *Pantala flavescens*, *Sympetrum pedemontanum*, and *Deielia phaon*, were serveyed in this experiment. The total number of dragonflies were 3,453 in this experiment and 26,316 metacercarial burden were harvested. The metacercarial infection of dragonflies were *Sympetrum eroticum*, *Sympetrum drawinianum*, *Sympetrum pedemontanum*, *Lyriothemis pachygastra*, *Orthetrum albistylum*, *Pantala flavescens*, *Deielia phaon*, *Crocothemis servilia* in order of number and the number of metacercaria were 11.71, 8.58, 4.56, 2.36, 2.17, 1.83, 1.66 and 0.47 per a dragonfly, respectively (Table 1). Seven types of metacercaria were harvested from dragonflies. The metacercariae were named by A, B, C, D, E, F and G type and then named in scientific name after isolation of adult worm. The 4 species of metacercaria were *Loxogenes liberum*, *Pleurogenoides japonicus*, *Plagiorchis muris* and *Prosthogonimus* spp. But 3 species were not identified and named D type, E type, F type. The adult worm of *Prosthogonimus* spp. can not harvested from the infected fowl. The wall of metacercaria is thick and striated

Table 1. Infection statue of metacercariae in adult dragonflies from Korea between 2002-2008

Species of dragonfly		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Total
No. of dragonfly		2,118	62	57	620	334	180	25	57	3,453
[illegible]	*P. muris*	583	29	3	85	25	2	72	30	829
	L. liberum	13,121	18	84	1,143	102	45	5	43	14,561
	P. japonicus	338			28				7	373
	Prostho-gonimus								8	8
	D type	4,036	26	37	5,973	29	274	37	47	10,459
	E type	89			31		3			123
	F type		30		7,229	2	5			7,266
Total		18,167	73	87	7,260	156	324	114	135	26,316
No. of metacercaria per dragonfly		8.58	1.66	2.17	11.71	0.47	1.83	4.56	2.36	33.34

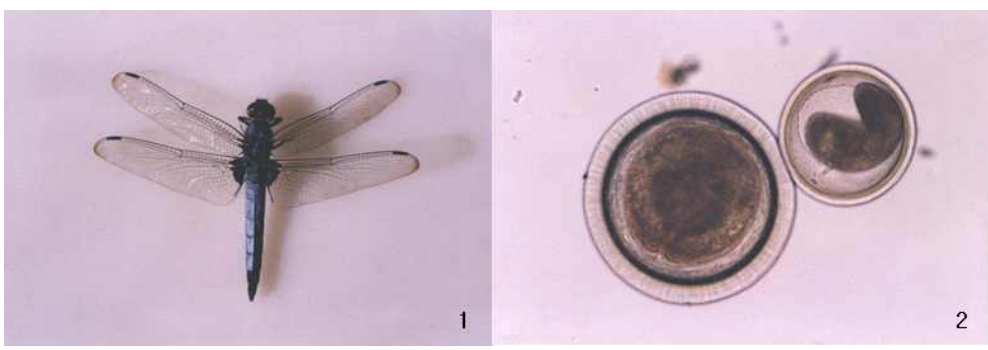

Fig 1. The male adult of *Deielia phaon*. **2.** The matacercaria of *Prosthogonimus* spp. harvested from *Deielia phaon* (Large: mature, Small: immature).

(Fig 2). The size of metacercaria were measured 189 by 490㎛. The metacercaria of *Prosthogonimus* spp. were only detacted in *Deielia phaon* (Fig. 1). The number of metacercaria was 8 and the detection rate was very low.

Discussion

In genus of *Prosthogonimus*, two intermediate hosts are required, the first a water snail and the second the nymphal stage of various species of

dragonflies. *Amnicola limosa porata* is the first intermediate host for *P. macrorchis*, *Bithynia teutaculata* serves *P. pellucidus* as such and *B. leachi*, *Gyraulus allbus and G. gredleri* are the snail host for *P. ovatus*. Sporocysts are formed which produce cercariae without undergoing redial development and these, being liberated from the snail about in the water. They are then drawn into the anal openings of dragonfly naiads by the breathing movements of these insects. The tail of the cercaria is lost in the respiratory chamber of the naiad and the metacercaria penetrates into the muscles and encyst in the haemocele of the nymph. Matacercaria may persist in the insect until it is mature and the final host is infected by eating either the adult dragonfly or the nymphal stage[4].

Several species of dragonflies may serve as the second intermediate host of various fluke. Also dragonflies are concerned in the species of *Prosthogonimus*. In North America those of the genera of *Tetragoneuria*, *Leucorhynia*, *Epicordulia* and *Mesotheronis* are concerned[3] and in Europe *Libellula*, *Platycnemis* and *Epicordulia*[6].

In our survey, 8 species of dragonflies, *Sympetrum drawinianum*, *Orthetrum albistylum*, *Lyriothemis pachygastra*, *Sympetrum eroticum*, *Crocothemis servilia*, *Pantala flavescens*, *Sympetrum pedemontanum*, and *Deielia phaon*, were conducted. The total number of dragonflies were 3,453 in this experiment and 26,373 metacercarial burden were harvested. The metacercarial infection of dragonflies were *Sympetrum drawinianum*, *Sympetrum pedemontanum*, *Lyriothemis pachygastra*, *Deielia phaon*, *Orthetrum albistylum*, *Pantala flavescens*, *Crocothemis servilia* in order of number and the number of metacercaria were 11.71, 8.58, 4.56, 2.36, 2.17, 1.83, 1.66 and 0.47 per a dragonfly, respectively. *Sympetrum eroticum* show highest infection rate and *Crocothemis servilia* lower. The metacercaria of Prosthogonimus spp. were only detected in *Deielia phaon*. Therefore *Deielia phaon* serve as the second intermediate host of *Prosthogonimus* spp. in Korea.

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