

## Altitudinal Distribution of Ephemeroptera, Plecoptera, and Trichoptera in a Mountain Stream of Chiaksan

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**ABSTRACT:** Altitudinal distributions of the larvae of Ephemeroptera, Plecoptera, and Trichoptera were investigated from a typically preserved mountain stream of Chiaksan by qualitative samplings at 12 different sites seasonally from January 1996 to December 1997. Thirty-seven species of Ephemeroptera, 27 species of Plecoptera, and 32 species of Trichoptera occurred from the stream. Relatively even number of species of Ephemeroptera occurred from the upper to lower stream sections, whereas more species of Plecoptera and Trichoptera occurred in the upper and lower stream section, respectively. More discussions on the species with particular distributions were provided.

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**Key words :** Altitudinal distribution, Ephemeroptera, Plecoptera, Trichoptera, Chiaksan, Korea

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### INTRODUCTION

Chiaksan (Chiak Mt., 1288 m) is located at the central area of the Korean peninsula (Fig. 1). The mountain area has been relatively well preserved since it was designated as a national park in 1984. Streams of Chiaksan are typically preserved mountain streams in Korea, although human activities have been increased recently in the lower section of the streams.

Aquatic insects are abundant, and most representative Korean species occur in the mountain streams. Although there have been many faunistic or community studies on aquatic insects in Korea since 1960s, comprehensive investigations on the altitudinal distributions of aquatic insects in a typically preserved stream were wanting (see Bae, 1996).

In this study, we investigated detailed altitudinal distributions of each species of major aquatic insect groups from a mountain stream of Chiak-

san. This study may provide basic ecological data for further population or community level studies of aquatic insects in Korea.

### MATERIALS AND METHODS

Qualitative samplings were seasonally taken from January 1996 to December 1997 from a stream in Chiaksan area. The study stream (Fig. 1), Chupochon (Chupo creek, ca. 34 km), originates from Namdaebong (1187 m), the southernmost peak in Chiaksan area, and runs to the south along small village areas, and finally flows to Chungjuho (Chungju lake). The upper section of the stream above the altitude of 340 m belongs to the national park.

Twelve sampling sites (Fig. 1) were chosen in consideration of altitude and stream order as follows.

800 m (order 1, headwater): width 0.5-1 m; boulder (50%), cobble (30%), pebble (20%); leaves abundant, algae absent; completely canopied; preserved.

750 m (order 1): width 1-2 m; boulder (30%), cobble (30%), pebble (30%), gravel and sand (10%);

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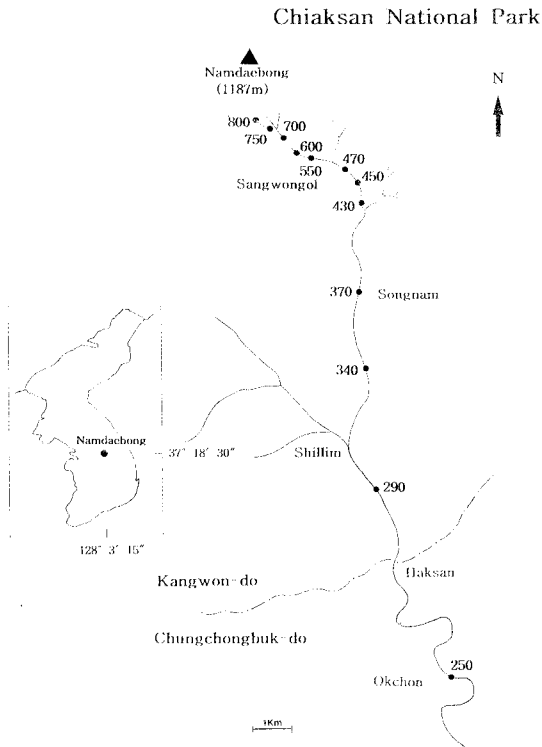


Fig. 1. Sampling sites in the study stream of Chiaksan.

leaves abundant, algae absent; completely canopied; preserved.

700 m (order 2): width 3–5 m; boulder (40%), cobble (30%), pebble (20%), gravel and sand (10%); leaves abundant, attached algae rare; 80% canopied; preserved.

600 m (order 2): width 5–10 m; boulder (40%), cobble (30%), pebble (20%), gravel and sand (10%); leaves abundant, attached algae rare; 50% canopied; preserved.

550 m (order 2): width 5–10 m; boulder (30%), cobble (30%), pebble (30%), gravel and sand (10%); leaves abundant, attached algae present; 40% canopied; preserved.

470 m (order 3): width 8–15 m; boulder (20%), cobble (40%), pebble (30%), gravel and sand (10%); leaves abundant, attached algae present; 20% canopied; a few farm houses near site.

450 m (order 3): width 10–15 m; boulder (20%), cobble (40%), pebble (30%), gravel and sand (10%); leaves present, attached algae increasing; 10% canopied; a few farm houses near site.

430 m (order 3): width 10–15 m; boulder (20%), cobble (40%), pebble (30%), gravel and sand (10%); leaves present, attached algae increasing; 10% canopied; a few farm houses near site.

370 m (order 4): width 15–20 m; boulder (20%), cobble (40%), pebble (30%), gravel and sand (10%); attached algae abundant; 5% canopied; farm land, small village above site.

340 m (order 4): width 20–30 m; boulder (10%), cobble (50%), pebble (30%), gravel and sand (10%); attached algae abundant, organic matter increasing; 0% canopied; farm land, small village above site.

290 m (order 5): width 30–40 m; boulder (10%), cobble (40%), pebble (30%), gravel and sand (20%); attached algae abundant, organic matter increasing; 0% canopied; farm land, small town above site, traffic road beside.

250 m (order 5): width 30–50 m; boulder (10%), cobble (40%), pebble (30%), gravel and sand (20%); attached algae abundant, organic matter increasing; 0% canopied; farm land, small village above site, traffic road beside.

At each site, aquatic insect larvae were collected by hand screen, Surber net, and scoop-type hand net at riffle, run, and pool areas. Other particular microhabitats, e.g., stream margins, waterfalls, etc., were also checked.

Among the aquatic insects collected from the stream, only Ephemeroptera, Plecoptera, and Trichoptera were included in this paper because those groups have been relatively well known and larval keys are available. Larvae were determined by Yoon (1988, 1995) and other taxonomic references, preserved in alcohol, and deposited at Seoul Women's University.

## RESULTS AND DISCUSSION

### Ephemeroptera

Thirty-seven species of Ephemeroptera in 8 families occurred from the study stream (Table 1). Three major groups of Ephemeroptera, Baetidae, Heptageniidae, and Ephemerellidae, were most abundant in the stream. Ameletids (*Ameletus costalis* and *A. montanus*), some species of heptageniids (*Iron aesculus*, *Cinygmula* KUa, *Ecdyonurus dracon*, and *Heptagenia kihada*), *Paraleptophlebia chocorata*, and *Ephemerella separigata* were the representatives of the uppermost stream sec-



Table 1. continued.

Species	Order I		Order II			Order III			Order IV		Order V	
	800 m	750 m	700 m	600 m	550 m	470 m	450 m	430 m	370 m	340 m	290 m	250 m
<b>Order Plecoptera</b>												
<b>Family Scopuridae</b>												
<i>Scopura laminata</i>	*	*	*									
<b>Family Taeniopterygidae</b>												
<i>Taenionema</i> KUa			*		*	*						
<i>Taenionema</i> KUc			*				*					
<b>Family Nemouridae</b>												
<i>Amphinemura coreana</i>			*	*	*	*			*			
<i>Amphinemura</i> sp.					*							
<i>Nemoura tau</i>			*						*		*	*
<i>Nemoura</i> KUa									*			
<i>Protonemura</i> KUa									*			
<b>Family Capniidae</b>												
<i>Capnia</i> KUa			*		*				*			
<i>Paracapnia</i> sp.					*				*			
<i>Eucapnopsis</i> sp.				*	*							
<b>Family Leuctridae</b>												
<i>Rhopalopsale mahunkai</i>					*							
<b>Family Peltoperlidae</b>												
<i>Yoraperla</i> KUa			*		*							
<i>Yoraperla</i> sp.	*		*	*								
<b>Family Perlodidae</b>												
<i>Archynopteryx</i> KUa			*		*				*			*
<i>Megarcsys ochracea</i>	*								*			
<i>Isoperla</i> KUa				*	*							
<i>Stavsolus</i> KUa								*				
<i>Stavsolus</i> sp.							*		*			
<b>Family Perlidae</b>												
<i>Kiotina decorata</i>					*	*	*					
<i>Oyamia coreana</i>					*	*			*			
<i>Oyamia nigribasis</i>					*	*			*			
<i>Neoperla coreensis</i>						*			*			
<i>Neoperla quadrata</i>						*			*			
<i>Kamimuria coreana</i>	*		*	*	*	*			*			
<i>Kamimuria</i> KUa								*	*			
<b>Family Chloroperlidae</b>												
<i>Sweltsa nikkoensis</i>	*		*	*	*	*	*		*			
<b>Order Trichoptera</b>												
<b>Family Stenopsychidae</b>												
<i>Stenopsyche griseipennis</i>						*			*		*	*
<i>Stenopsyche bergeri</i>						*		*			*	*
<b>Family Philopotamidae</b>												
<i>Wormaldia</i> KUa					*				*			

Table 1. continued.

Species	Order I		Order II			Order III			Order IV		Order V	
	800 m	750 m	700 m	600 m	550 m	470 m	450 m	430 m	370 m	340 m	290 m	250 m
<b>Family Psychomyiidae</b>												
<i>Psychomyia</i> KUa											*	*
<b>Family Polycentropodidae</b>												
<i>Plectrocnemia</i> KUa					*				*		*	*
<b>Family Hydropsychidae</b>												
<i>Arctopsyche ladogensis</i>									*			
<i>Hydropsyche</i> KUa									*		*	*
<i>Hydropsyche</i> KUb									*		*	*
<i>Hydropsyche</i> KUC						*		*	*		*	*
<i>Hydropsyche</i> KUE						*		*	*		*	*
<i>Cheumatopsyche brevilineata</i>									*		*	*
<i>Cheumatopsyche</i> KUa								*			*	*
<i>Cheumatopsyche</i> KUb												*
<b>Family Rhyacophilidae</b>												
<i>Rhyacophila articulata</i>	*		*		*	*			*			
<i>Rhyacophila brevicephala</i>					*							
<i>Rhyacophila clemens</i>									*			
<i>Rhyacophila shikotsuensis</i>					*				*		*	*
<i>Rhyacophila retracta</i>									*			*
<i>Rhyacophila</i> KUa			*		*	*			*		*	*
<i>Apsilochorema</i> KUa					*	*						
<b>Family Glossosomatidae</b>												
<i>Glossosoma</i> KUa			*		*				*		*	*
<i>Agapetus</i> KUa											*	*
<b>Family Hydroptilidae</b>												
<i>Hydroptila</i> KUa												*
<b>Family Brachycentridae</b>												
<i>Micracema</i> KUa					*							
<b>Family Phryganeidae</b>												
<i>Semblis phalaenoides</i>									*			
<b>Family Limnephilidae</b>												
<i>Goera</i> sp.1										*		
<i>Hydatophylax nigrovittatus</i>	*	*	*	*	*	*			*		*	*
<i>Neophylax</i> sp.1						*			*		*	*
<i>Notopsyche</i> KUa									*		*	*
<b>Family Lepidostomatidae</b>												
<i>Goerodes</i> KUa			*									
<i>Goerodes</i> KUb									*			
<b>Family Odontoceridae</b>												
<i>Psilotreta kisoensis</i>	*					*			*	*		

tion (order 1 and 2) and most of them were found at the headwater stream (order 1). Baetids and

ephemerellids were most diverse and abundant in the stream sections of lower than 600 m altitude.

*Iron aesculus*, *Ecdyonurus bajkova*, *E. kibunensis*, *Paraleptophlebia chocolata*, and *Cincticostella levanidovae* showed wide range of altitudinal distributions, but they were relatively abundant in the middle section of the stream (order 2-4). *Siphonurus chankae*, *Acentrella sibirica*, *Baetiella tuberculata*, *Epeorus pellucidus*, *Ephemera orientalis*, and *Potamanthus yooni* occurred in relatively lower stream section (order 4-5). As studied by Bae (1995) and Lee *et al.* (1995, 1996), each species of ephemerids showed discrete range of altitudinal distribution in order of *Ephemera separigata*, *E. strigata*, and *E. orientalis* from the headwater.

### Plecoptera

Twenty-seven species of Plecoptera in 9 families occurred from the study stream (Table 1). As usual, most Plecoptera species were found from higher altitude (order 1-3). In particular, *Scopura laminata*, *Yoraperla* sp., *Megaracys ochracea*, *Kamimuria coreana*, and *Sweltsa nikkoensis* occurred at the headwater (order 1). *Nemoura tau*, *Archynopteryx* KUa, *Kamimuria coreana*, and *Sweltsa nikkoensis* showed relatively wide altitudinal range.

### Trichoptera

Thirty-two species of Trichoptera in 13 families occurred from the study stream (Table 1). In general, most Trichoptera species were found relatively lower stream section (order 3-5). The family Stenopsychidae, Hydropsychidae, Hydropsilidae, Phryganeidae, and Limnephilidae were the representatives of the lower stream section (order 3-5). The family Rhyacophilidae showed relatively wide altitudinal range. Only widely distributed species, e.g., *Rhyacophila articulata*, *Hydatophylax nigrovittatus*, and *Psilotreta kisoensis*, were found at the headwater (order 1).

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국문적요 : 치악산 계류의 수서곤충 (하루살이목, 강도래목, 날도래목) 고도분포. 박선진, 박선영, 김종선, 배연재 (서울여자대학교 생물학과) 1996년 1월부터 1997년 12월까지 매계절 1회씩 우리나라에서 전형적으로 잘 보존된 산간계류인 치악산 계류의 12개 지점에서 정성채집을 실시하여 하루살이목, 강도래목, 날도래목 각종의 고도 및 하순별 분포를 조사하였다. 조사하천에서 하루살이목 37종, 강도래목 27종 및 날도래목 32종이 출현하였고, 하루살이목은 상류로부터 하류까지 비교적 고르게 출현하였으나 강도래목은 상류에서, 날도래목은 하류에서 더 많은 종이 출현하였다. 각 고도에 따라 특이하게 출현하는 종에 대하여 논하였다.

검색어 : 고도분포, 하루살이, 강도래, 날도래, 치악산, 한국