

New Records of the Limnephiloidea (Insecta: Trichoptera) from Korea

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ABSTRACT

A historical review of Trichoptera systematics in Korea and diagnoses for 10 newly recorded species of Limnephiloidea are provided: two species, *Gumaga orientalis* (Martynov) and *Ganonema extensum* Martynov, are newly recorded from the Korean peninsula, seven species, *Goera interrogationis* Botosaneanu, *G. parvula* Martynov, *Apatania sinensis* Martynov, *Ecclisomyia kamtshatica* (Martynov), *Hydatophylax magnus* (Martynov), *Goerodes albardanus* (Ulmer), and *Dinarthrum coreanum* (Kumanski and Weaver), are newly recorded from South Korea, and the adult stage of *Neophylax ussuriensis* (Martynov) is newly recorded from South Korea.

Key words: Trichoptera, Limnephiloidea, taxonomy, Korea

INTRODUCTION

The order Trichoptera is one of the primary aquatic insect groups including more than 7000 species in the world (Wiggins, 1982). The superfamily Limnephiloidea (tubecase-making caddisflies) is the most diverse caddisfly taxon containing over one-third of all known caddisfly species. The larvae of Limnephiloidea construct portable cases, essentially tubular in form, of various shapes and materials (Wiggins, 1997). The adults have maxillary palpi frequently reduced in number in males, but five-segmented in females.

In 1930s and 1940s, Doi (1932a; 1932b), Kamijo (1933), Yamada (1938), and Tsuda (1942)

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studied Korean Trichoptera. All but Tsuda (1942) were faunistic studies. Since then, Botosaneanu (1970), Olah (1985), Kobayashi (1989), Mey (1989), Kumanski (1990; 1991a; 1991b; 1992), Kumanski and Weaver (1992), and Malicky (1993) investigated Korean Trichoptera fauna (Table 1). All but Kobayashi (1989) intensively dealt with North Korean Trichoptera fauna. Schmid (1965) and Kuwayama (1973) included a few North Korean species in their studies of Asian Trichoptera. Botosaneanu (1970) conducted the first comprehensive taxonomic study on North Korean Trichoptera. Kumanski (1990; 1991a; 1991b; 1992) and Kumanski and Weaver (1992) published serial studies of the Trichoptera fauna of North Korea in early 1990s. They recorded 122 species of Trichoptera in 18 families, excluding undetermined species, from North Korea.

As Korean Trichoptera taxonomists, Kim (1974) and Yoon and Kim (1988; 1989a; 1989b) treated the larvae of South Korean caddisflies (Table 1). Because those studies were based on the larval stage, major part of the larvae have not been determined to species. Ko and Park (1988) and Hwang and Yoon (1996) recently revised Korean Rhyacophilidae and Hydropsychidae, respectively, based on adult materials. According to Kumanski (1990), 31 species of Trichoptera were listed from North Korea by a North Korean entomologist, T. L. Chu, in 1969. Kumanski (1990), however, remarked that Chu's list was not appropriate.

In Limnephiloidea, as results of the above investigations (Table 1), 95 species in 11 families were known in the adult stage and 11 species in seven families were known in the larval stage from Korea. Among the known Korean limnephiloids, 74 species in nine families were recorded from North Korea and 10 species in six families were recorded from South Korea. In total, 100 species in 12 families of Limnephiloidea have been known from Korea up to date.

The purpose of this study is to record the species of Limnephiloidea new to Korean fauna.

MATERIALS AND METHODS

Adult materials of the Limnephiloidea collected throughout South Korea since 1980s and deposited at Seoul Women's University are used for this study. External morphology of the adults was examined under dissect microscope (10-80x). Adult diagnoses are provided with line-drawings of key characters. The higher classification of Trichoptera is based on Ross (1967). The abbreviations used in material examined are as follows: M (male adult), F (female adult); CCB (Chungchongbuk-do), CLB (Chollabuk-do), CLN (Chollanam-do), KB (Kyongsangbuk-do), KG (Kyonggi-do), and KW (Kangwon-do).

SYSTEMATIC ACCOUNT

Family Goeridae

***Goera interrogationis* Botosaneanu (Figs. 1, 2)**

Goera interrogationis Botosaneanu, 1970, p. 305; Olah, 1985, p. 137.

Material examined. 1F: Chongpyong, KG, 5 IX 1985; 1M and 4F: Mokdong, Kapyong, KG, 5 X 1985; 9M and 81F: Mt. Woraksan, Chechon, CCB, 30 V 1987, 24 VI 1994; 1M and 2F:

Table 1. Contributed authors to the Korean Trichoptera fauna

Authors	¹ Features of publication	Taxa included	² Stages treated	³ Areas included
Doi (1932a)	F	17 spp. in 7 fam.	A	N, S
Doi (1932b)	F	4 spp. in 3 fam.	A	N, S
Kamijo (1933)	F	2 spp. in Phryganeidae	A	N
Yamada (1938)	F	5 spp. in 3 fam.	A	S
Tsuda (1942)	D	15 spp. in 10 fam. (5 n.sp.)	A	N
Schmid (1965)	D	2 spp. in Limnephilidae (1 n.sp.)	A	N
Botosaneanu (1970)	D	61 spp. in 17 fam. (21 n.sp.)	A	N
Kuwayama (1973)	D	4 spp. in Phryganeidae	A	N
Kim (1974)	D	17 spp. in 8 fam.	L	S
Olah (1985)	F, D	9 spp. in 8 fam. (3 n.sp.)	A	N
Yoon and Kim (1988)	D, K	24 spp. in 10 fam.	L	S
Ko and Park (1988)	D, K	9 spp. in Rhyacophilidae	A	S
Kobayashi (1989)	F, D	19 spp. in 10 fam. (4 n.sp.)	A	S
Mey (1989)	D	27 spp. in 10 fam. (3 n.sp.)	A	N
Yoon and Kim (1989a)	D, K	3 spp. in 2 fam.	L	S
Yoon and Kim (1989b)	D, K	12 spp. in 2 fam.	L	S
Kumanski (1990)	F, D	25 spp. in 4 fam. (8 n.sp.)	A	N
Kumanski (1991a)	F, D	24 spp. in Leptoceridae (6 n.sp.)	A	N
Kumanski (1991b)	F, D	27 spp. in 7 fam. (1 n.sp.)	A	N
Kumanski (1992)	F, D	38 spp. in 6 fam. (8 n.sp.)	A	N
Kumanski and Weaver (1992)	D	8 spp. in Lepidostomatidae (3 n.sp.)	A	N
Malicky (1993)	F, D	17 spp. in 10 fam. (1 n.sp.)	A	N
Hwang (1995)	D, K	9 spp. in Hydropsychidae	A	S

¹F: Faunistic check list, D: Description, K: key; ²A: Adult, L: Larva, ³N: North Korea, S: South Korea.

Talgung, Mt. Chirisan, Sannae-myon, Namwon, CLB, 23 VI 1986, 25 VI 1986; 2M: Mt. Chogyesan, Suncheon, CLN, 21 V 1988.

Diagnosis. Male adults of *G. interrogationis* can be characterized by the characters of the abdominal segment IX which possesses dorsoventrally unbranched phallus (Fig. 1); abdominal sternite IX which is produced an elongate process tapering to an acute point in lateral view (Fig. 2). The process is at least two-thirds as long as the main body of the abdominal segment IX and apex of the process is expanded to flat and truncate lobe in ventral view (Fig. 2). Female adults have an apicomeral process in the genitalia which is somewhat triangular and apically blunt.

Remarks. According to T. Nozaki (pers. comm.), *G. interrogationis* Botosaneanu (1970) could be a junior synonym of *G. squamifera* Martynov known in Far East Russia based on the characters of genitalia. *G. squamifera* was treated as a junior synonym of *G. japonica* Banks by Tsuda and Akagi (1955), but Arefina (in Kononenko, 1997) treated the same species under the name of *G. japonica* in the Russian key book. In any case, neither *G. interrogationis* nor *G. squamifera*

agrees with *G. japonica* (Nozaki, pers. comm.).

***Goera parvula* Martynov (Figs. 3, 4)**

Goera parvula Martynov, 1935 (for full citation and synonymy see Fischer, 1973); Botosaneanu, 1970, p. 305; Kumanski, 1991b, p. 25.

Material examined. 1M: Mt. Chonmasan, Namyangju, KG, 10 V 1986; 1M: Mt. Chogyesan, Suncheon, CLN, 21 V 1988.

Diagnosis. Adults of *G. parvula* possess light brown wings. Male adults of the species can be separated from other *Goera* species by the characters of two large medial processes and two small processes on the abdominal sternite VI; inferior appendages are apically claw-shaped (Figs. 3, 4) and are absent long and slender processes as shown in *G. interrogationis*.

Family Limnephilidae

***Apatania sinensis* Martynov (Figs. 5, 6)**

Apatania sinensis Martynov, 1914 (for full citation and synonymy see Fischer, 1973); Kumanski, 1991b, p. 19.

Material examined. 1M and 1F: Chilson valley at Chilson Br., Mt. Chirisan, CLB, 16 X 1997.

Diagnosis. Male adults of *A. sinensis* can be separated from those of other *Apatania* by the characters of lacking flat processes in the abdominal segment IX; their gonostyli are triangular, turned upward, and shorter than gonocoxites (Fig. 5); their lateral processes are apically enlarged (Fig. 5). In female adults, abdominal segment IX and X are fused and together tubular in shape and ventrally notched (Fig. 6).

***Ecclisomyia kamtshatica* (Martynov) (Figs. 7, 8)**

Praecosmoecus kamtshaticus Martynov, 1914 (for full citation and synonymy see Fischer, 1973).

Ecclisomyia kamtshatica (Martynov): Levanidova *et al.*, 1994, p. 9; Mey, 1989, p. 303; Kumanski, 1991b, p. 18.

Material examined. 1F: Sorak waterfall, Osaek, Mt. Soraksan, Yangyang, KW, 20 VI 1995.

Diagnosis. Female adults of *E. kamtshatica* can be characterized by the abdominal segment X which is somewhat elongated and apically concave (Figs. 7, 8).

***Hydatophylax magnus* (Martynov) (Fig. 9)**

Stenophylax magnus Martynov, 1914 (for full citation and synonymy see Fischer, 1973).

Hydatophylax magnus (Martynov): Schmid, 1950 (for full citation see Fischer, 1973); Kumanski, 1991b, p. 21.

Material examined. 1M: Mokdong, Kapyong, KG, 5 X 1985; 2M: Taehyon-ri, Ponghwa, KB, 25 VII 1986.

Diagnosis. Adults of *H. magnus* are similar to those of *H. formosus*, but can be distinguished by the characters of light brown body color, absence of dots in wings, and black area around the basal radius of wings. In the male adults, the abdominal segment X has a pair of long black curved and stick-shaped processes (Fig. 9); their genitalia is yellow, apically somewhat thickened, and divided

into an outer short black process and inner longer branch (Fig. 9); and their phalli are very slender.

Remarks. We also examined male adult and larval materials of *Hydatophylax nigrovittatus* (McLachlan) from South Korea. This species was previously recorded from Korea by Botosaneanu (1970), Kobayashi (1989), Yoon and Kim (1988), and Kumanski (1991b). Male adults of *Hydatophylax nigrovittatus* can be distinguished from those of other *Hydatophylax* by the characters of the maculated forewings and apically black and untapered genitalia.

***Neophylax ussuriensis* (Martynov) (Fig. 10)**

Halesinus ussuriensis Martynov, 1914 (for full citation and synonymy see Fischer, 1973).

Neophylax ussuriensis (Martynov): Schmid, 1955 (for full citation see Fischer, 1973); Yoon and Kim, 1988, p. 527; Kumanski, 1991b, p. 19.

Material examined. 3M: Chilson valley at Chilson Br., Mt. Chirisan, CLB, 16 X 1997.

Diagnosis. Male adults of *N. ussuriensis* can be distinguished from those of *N. relictus* by the characters of a few light spots in the pterostigma of forewings and slightly upcurved abdominal sternite IX (Fig. 10). Foretibiae, midtibiae, and hindtibiae of the adults of *N. ussuriensis* possess 1, 3, and 3 spurs, respectively.

Remarks. The adult stage of *N. ussuriensis* is newly recorded from South Korea.

Family Lepidostomatidae

***Goerodes albardanus* (Ulmer) (Fig. 11)**

Maniconeura albardana Ulmer, 1906 (for full citation and synonymy see Kumanski and Weaver, 1992).

Dinarthrodes kurentzovi Martynov, 1935 (for full citation and synonymy see Kumanski and Weaver, 1992).

Dinarthrodes albardanus (Ulmer): Fischer, 1970 (for full citation see Fischer, 1973); Kumanski and Weaver, 1992, p. 154.

Goerodes kurentzovi (Martynov): Ito, 1992, p. 104.

Goerodes albardanus (Ulmer): Imo (in Kononenko), 1997, p. 145.

Material examined. 3M: Mt. Woraksan, Chechon, CCB, 30 V 1987; 23M: Talgung, Mt. Chirisan, Sannae-myon, Namwon, CLB, 23–25 VI 1986.

Diagnosis. Male adults of *G. albardanus* are similar to those of *G. elongatus* but can be distinguished by the male genitalia (Fig. 11). The abdominal segment X of *G. albardanus* possesses a pair of broad mesal processes and a pair of slender, pointed, and incurved processes. The lateral processes of the abdominal segment X are slightly longer than the mesal processes. The inferior appendages of the abdominal segment IX are basally trapezoid and possess processes (Fig. 11). The dorsal processes of the inferior appendages are much broader and shorter than the ventral processes.

Remarks. This species was originally described by Ulmer (1906) as *Maniconeura albardana*. Ulmer (1907b) elected the genus *Dinarthrodes* based on *M. albardana* as the type species. Ulmer (1907a), prior to the election of *Dinarthrodes* Ulmer, also elected the genus *Goerodes* based on *G. corniger* Ulmer as the type species. Ito (1992) discussed the generic status of *Dinarthrodes* Ulmer and transferred some species previously known as *Dinarthrodes* Ulmer, including *D.*

kurentzovi Martynov, to *Goerodes* Ulmer. After that, Kumanski and Weaver (1992), however, synonymized *Goerodes kurentzovi* (Martynov) with *D. albardanus* (Ulmer) maintaining the generic status of *Dinarthrodes* Ulmer. Imo (in Kononenko, 1997) transferred *D. albardanus* (Ulmer) to *Goerodes* Ulmer. The generic concepts of *Goerodes* Ulmer and *Dinarthrodes* Ulmer should be reviewed based on both adult and larval stages.

We also examined male adult materials of *Goerodes elongatus* (Martynov) from South Korea. *G. elongatus* was previously recorded from Korea by Kobayashi (1989) and Kumanski and Weaver (1992). *G. elongatus* can be distinguished from *Dinarthrodes itoae* Kumanski and Weaver (1992) by the male scapes and genitalia. Male scapes of *G. elongatus* are twice as long as those of *D. itoae*.

***Dinarthrum coreanum* (Kumanski and Weaver) (Figs. 12, 13)**

Indocrunoecia coreana Kumanski and Weaver, 1992, p. 162.

Dinarthrum coreanum (Kumanski and Weaver): Ito, 1998.

Material examined. 1M: Talgung, Mt. Chirisan, Sannae-myon, Namwon, CLB, 25 VI 1986.

Diagnosis. In male adults of *D. coreanum*, the scapes possess a blunt basomesal lobe and the abdominal segment X has three pairs of long slender processes (Fig. 12). Its superior mesal processes are longest and fingerlike; the intermedial mesal processes are 2/3 times length of the superior mesal process; and the inferior lateral processes are apically curved. The inferior appendages of the segment IX have three pairs of processes (Figs. 12, 13).

Remarks. Only the adult stage of *Indocrunoecia coreana* Kumanski and Weaver (1992) was originally described from North Korea. Ito (1998) recently transferred the species to the genus *Dinarthrum* McLachlan based on additionally known larval characters.

Family Sericostomatidae

***Gumaga orientalis* (Martynov) (Fig. 14)**

Oecismus orientalis Martynov, 1935 (for full citation and synonymy see Wiggins, 1991b).

Gumaga orientalis (Martynov): Levanidova, 1982.

Material examined. 95M: Han R. below Chunchon dam, Chunchon, KW, 23 VI 1974; 2M: Mt. Woraksan, Chechon, CCB, 30 V 1987.

Diagnosis. Male adults of *Gumaga orientalis* can be separated from those of other *Gumaga* by the characters of shallowly forked apical parts of the intermediate appendages in the abdominal segment X. The inferior appendages are curved inward and apically branched (Fig. 14).

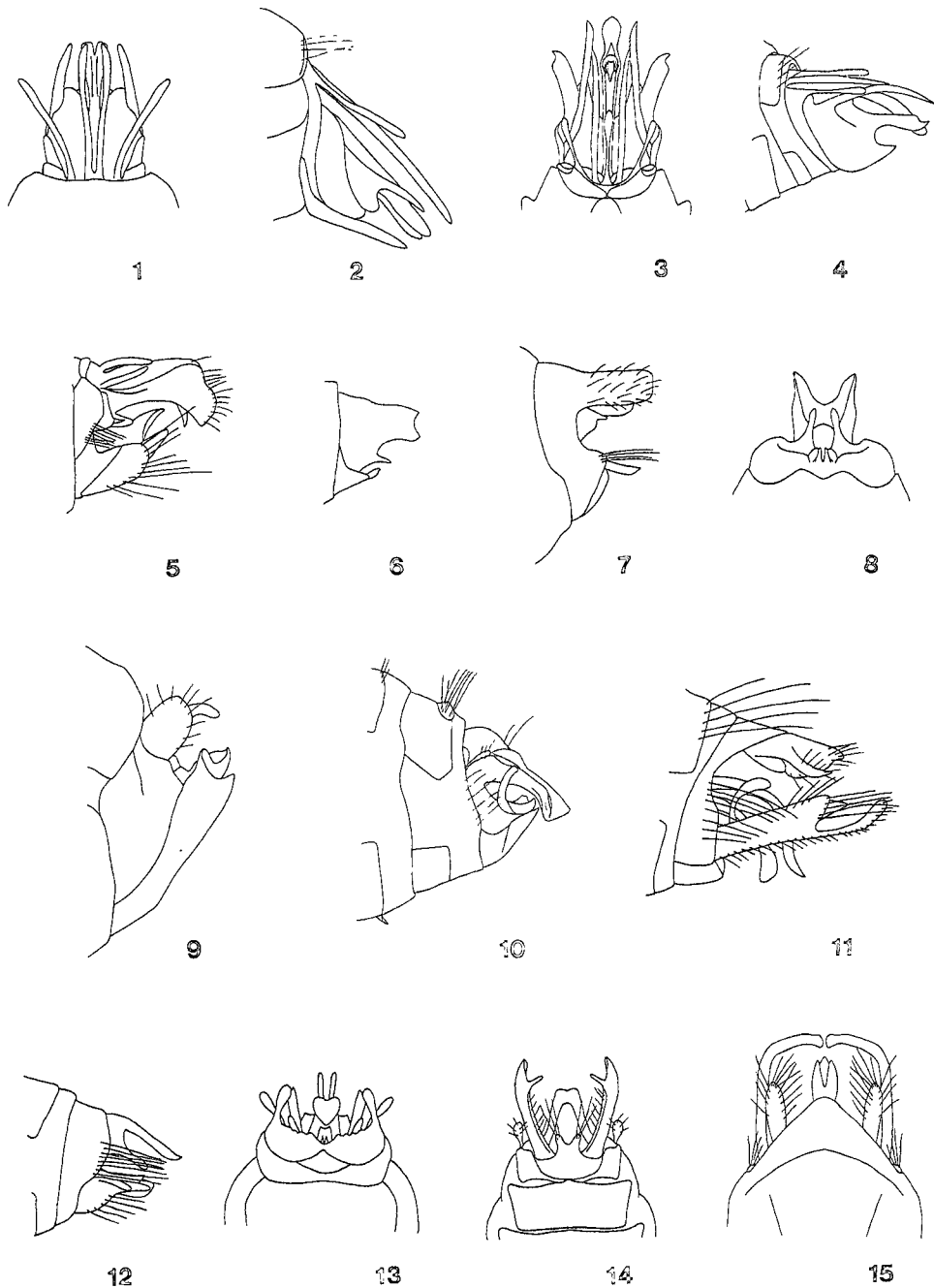
Remarks. Based on larval characters, Levanidova (1982) transferred *Oecismus orientalis* to the genus *Gumaga*. Kumanski (1991b) discussed a close similarity between *G. orientalis* and *G. okinawaensis*.

Family Calamoceratidae

***Ganonema extensum* Martynov (Fig. 15)**

Ganonema extensum Martynov, 1935 (for full citation and synonymy see Fischer, 1973).

Material examined. 16M: Kumsansa waterfall, Kumsansa valley, Mt. Moaksan, Kimje, CLB, 23 V 1992.



Figs. 1-15. Adult genitalia. 1, *Goera interrogationis*, male, dorsal; 2, *G. interrogationis*, male, lateral; 3, *G. parvula*, male, dorsal; 4, *G. parvula*, male, lateral; 5, *Apatania sinensis*, male, lateral; 6, *A. sinensis*, female, lateral; 7, *Ecclisomyia kamtshatica*, female, lateral; 8, *E. kamtshatica*, female, ventral; 9, *Hydatophylax magnus*, male, lateral; 10, *Neophylax ussuriensis*, male, lateral; 11, *Goerodes albardanus*, male, lateral; 12, *Dinarthrum coreanum*, male, lateral; 13, *D. coreanum*, male, ventral; 14, *Gumaga orientalis*, male, dorsal; 15, *Ganonema extensum*, male, dorsal.

Diagnosis. Adults of *G. extensum* can be distinguished by the characters of the fused R and RS₁ in forewings. Their foretibiae, midtibiae, and hindtibiae possess 1, 3, and 3 spurs, respectively. In male adults, abdominal segment X is forked (Fig. 15); and its apical part is about 1/2 as long as the whole segment, and bent downward in lateral view. The inferior appendages are slender, long, and arched inward (Fig. 15).

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한국산 우묵날도래 상과 (곤충 강: 날도래 목)의 미기록종

박 선 진 · 배 연 재

(서울여자대학교 생물학과)

요 약

한국산 날도래 목의 분류사와 우묵날도래상 과에 속하는 10종의 미기록종을 다음과 같이 기록하였다. 한반도 미기록종 2종, *Gumaga orientalis* (Martynov)와 *Ganonema extensum* Martynov; 남한 미기록종 7종, *Goera interrogationis* Botosaneanu, *G. parvula* Martynov, *Apatania sinensis* Martynov, *Ecclisomyia kamtshatica* (Martynov), *Hydatophylax magnus* (Martynov), *Goerodes albardanus* (Ulmer), *Dinarthrum coreanum* (Kumanski and Weaver); 성충에 대한 남한 미기록종 1종, *Neophylax ussuriensis* (Martynov).