

New data on Limoniinae and Limnophilinae crane flies (Diptera: Limoniidae) of Korea

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This study is based on crane fly specimens collected from 1936–2019 and are in collections maintained at the United States National Museum, Smithsonian Institution, Washington DC, USA; the Snow Entomological Museum, University of Kansas, Lawrence, KS, USA; the Hungarian Natural History Museum in Budapest, Hungary, and the National Institute of Biological Resources, Incheon, South Korea. The genus *Dicranophragma* Osten Sacken, 1860 with two species *D. (Brachylimnophila) transitorium* (Alexander, 1941) and *D. (Dicranophragma) melaleucum melaleucum* (Alexander, 1933), is a new record for the Korean Peninsula. New findings of *Dicranomyia (Erostrata) submelas* Kato *et al.*, 2018, *Dicranoptycha venosa* Alexander, 1924a, *Austrolimnophila (Archilimnophila) subunicoides* (Alexander, 1950b), *A. (A.) unica* (Osten Sacken, 1869), *A. (Austrolimnophila) asiatica* (Alexander, 1925), *Conosia irrorata* (Wiedemann, 1828), *Eloeophila persalsa* (Alexander, 1940), *E. serenensis* (Alexander, 1940), *E. subaprilina* (Alexander, 1919), *E. ussuriensis ussuriensis* (Alexander, 1933), *E. yezoensis* (Alexander, 1924b), *Paradelphomyia chosonica* Alexander, 1950b, and *P. macracantha* Alexander, 1957 are discussed. General information on genera and subgenera morphological characters, redescriptions of species based on Korean specimens, illustrations of both sexes, elevation range, period of activity, habitat information, general distribution, and a distribution map for the Korean Peninsula (including North Korea) are presented for each species.

Keywords: habitat, larva, new record, North Korea, pupa, South Korea, taxonomy

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INTRODUCTION

Investigation of Limoniidae (Diptera) crane flies on the Korean Peninsula was initiated by S. Podenas and H.-W. Byun in 2012. Subsequently, crane flies were collected annually at different localities and different seasons using various collection methods. The aim of the study was to document, redescribe, illustrate, and prepare keys for all Korean crane fly species identified to date. This publication is a continuation of previous studies on short palped crane flies (Limoniidae) from Korea, which are mostly concentrated in subfamily Limoniinae. Currently, the Limoniinae species list for Korea is close to finalization with a total of 120 species, while studies of members of the subfamily Limnophilinae are just be-

ginning. This study includes the genus *Dicranophragma* Osten Sacken, 1860, which is a new record for the Korean Peninsula. New findings of *Dicranomyia (Erostrata) Savchenko*, 1976 (Savchenko and Krivolutskaya, 1976), *Dicranoptycha* Osten Sacken, 1860, *Austrolimnophila* Alexander, 1920a, *Conosia* van der Wulp, 1880, *Eloeophila* Rondani, 1856, and *Paradelphomyia* Alexander, 1936a are discussed. Despite original and subsequent descriptions of East Palearctic species over a long period of time, some species were known only from original descriptions and no illustrations were available. Herein, photographs of important taxonomical details, e.g., antennae, wings, male and female terminalia, and distribution maps of Korean species are provided.

MATERIALS AND METHODS

Crane flies available for this study (Table 1) were preserved in the following scientific collections:

Specimens collected in 1936–1940 in the northern part of the Korean Peninsula (now North Korea) by A. M. Yankovsky and in 1946 in Gwangju (now South Korea) by S. Kramer, are deposited in the collections of the United States National Museum (USNM), Smithsonian Institution, Washington DC, USA;

Specimens collected in 1954 in South Korea by Dr. G. W. Byers, are deposited in the Snow Entomological Museum, University of Kansas (SMEK), Lawrence, KS, USA and in USNM;

Specimens collected in 1979 in North Korea by T. Vászrhelyi, are deposited in the Hungarian Natural History Museum (HNHM) in Budapest, Hungary;

Specimens collected in 2008–2019 in South Korea are deposited in the collections of the National Institute of Biological Resources (NIBR), Incheon, South Korea.

Non-Korean specimens used for comparison: the Academy of Natural Sciences of Drexel University, Philadelphia, PA, U. S. A. (ANSP).

Adult crane flies were collected by insect nets, Malaise traps, LED and incandescent black light traps, Mosquito Magnet® traps (Pro Model, Woodstream Corp., Lititz, PA), New Jersey light traps, or at light sources. Some specimens were preserved dry in envelopes in the field and were later mounted at the laboratory in the Nature Research Centre, Vilnius, Lithuania, on their side on a paper point, with legs generally surrounding the insect pin. Other specimens were preserved in 96% ethanol (EtOH). Wings and antennae of selected specimens were slide mounted in Euparal, genitalia of males and ovipositors of females were cleared overnight in approximately 10% potassium hydroxide (KOH) and preserved in micro vials filled with glycerol on the same pin as the dry insect, or on a separate pin, if the specimen was preserved in EtOH.

Information of examined materials is given exactly as it is on the labels regardless of style, measurement units and other information. Additional labels and additional notes on the same label, such as “metatype” written by Dr. Ch. P. Alexander, who originally described species are maintained with the corresponding specimen. For specimens collected by S. Podenas and his colleagues, collection date on the label is followed by the unique collection number in brackets. Different places, where insects were collected on the same date, were given unique collection numbers and all information in the field notes and databases, photographs and other locality information were marked with that number. Specimens are arranged according to the collecting date.

Crane flies were observed using an Olympus SZX10

Table 1. Collecting sites in Korea.

Locality	Year	N*	E*	Collector	Method	Collection
N. Korea, Kankyo Nando, Pukso Pyaksan (now, Yanggang-do, Pungseo-gun, Mt. Buksubaeksan)	1936 1939	40.69985	127.71601	A. M. Yankovsky	Net	USNM
N. Korea, Ompo (Onbo, Hamgyeongbuk-do, Gyeongsung-gun)	1937 1938	41.51357	129.57812	A. M. Yankovsky	Net	USNM
N. Korea, Seren Mts. (Hamgyeongbuk-do, Gyeongsung-gun)	1938	41.68730	129.30918	A. M. Yankovsky	Net	USNM
N. Korea, Toorisani (North Pyongan, Tort-san)	1939	40.10000	125.76667	A. M. Yankovsky	Net	USNM
N. Korea, Pontani Paiktusan (Mt. Baekdusan)	1940	42.00670	128.10650	A. M. Yankovsky	Net	USNM
N. Korea, Chonsani (Yanggang-do, Daehongdan-gun)	1940	41.99360	128.75250	A. M. Yankovsky	Net	USNM
S. Korea, Kwangju (Gwangju)	1946	35.15641	126.83745	S. Kramer	Net	USNM
S. Korea, #12, Hwy. #20, 8 mi. SW of Kangnung (Gangwon-do, Gangneung, Seongsan-myeon, Eoheul-ri)	1954	37.70000	128.78334	G. W. Byers	Net	USNM, SMEK
S. Korea, #20, 2 mi. S. Pup'yeong-ri, 16 mi. NE Seoul (Gyeonggi-do, Namyangju-si, Jinjeop-eup, Janghyeon-ri, Korea National Arboretum)	1954	37.73900	127.18910	G. W. Byers	Net	SMEK
S. Korea, #17, #18, #19, #23, #24, #25, #28, #39, Central National Forest, 18 mi. NE Seoul (Gyeonggi-do, Namyangju-si, Sudong-myeon, Naebang-ri)	1954	37.74813	127.29364	G. W. Byers	Net	USNM, SMEK

Table 1. Continued.

Locality	Year	N*	E*	Collector	Method	Collection
S. Korea, #6, #27, Hwy #13, 6 mi. E of Seoul, 1 miles West of Han River (Gyeonggi-do, Namyangju-si, Joan-myeon, Sambong-ri)	1954	37.59600	127.33250	G. W. Byers	Net	USNM, SMEK
N. Korea, Pyongyang City, Mt. Daesong-san	1979	39.03492	125.76013	T. Vászárhelyi	Net	HNHM
S. Korea, Gangwon-do, Pyeongchang-gun, Daegwallyeong-myeon, Yongsan-ri, Mt. Balwangsán	2008	37.45139	128.86833	J. D. Yeo, M. J. Jeon, K. G. Kim	Malaise trap	NIBR
S. Korea, Gangwon-do, Jeongseon-gun, Jeongseon-eup, Hoedong-ri, Mt. Gariwangsan	2009	37.48778	128.54528	J. D. Yeo, J. D. Yoon	Malaise trap	NIBR
S. Korea, Gyeongsangnam-do, Gyeje-si, Irun-myeon, Mangchi-ri, Mt. Bukhyeong-san, temple Yeongwon-sa	2009	37.45833	128.50444	J. D. Yeo <i>et al.</i>	Malaise trap	NIBR
S. Korea, Gangwon-do, Samcheok-si	2012	37.14899	129.35933	S. Podenas		NIBR
S. Korea, Gangwon-do, Pyeonchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan National Park	2012	37.73920 37.74913	128.59398 128.57723	S. Kim, S. Podenas	Net	NIBR
	2015	37.71187 37.72425 37.73767	128.60077 128.59814 128.59166			
S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley	2013	35.26580	127.58128	H. M. Baek,	Net,	NIBR
	2015	35.26590	127.58096	S. Podenas,	At light	
	2016	35.27177	127.57146	V. Podeniene		
	2019	35.27123 35.26586 35.27333 35.27448	127.57133 127.58090 127.56924 127.56378			
S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Jangjeon-ri	2014	37.47153	128.54305	S. Kim, S. Podenas	Net	NIBR
S. Korea, Gyeongsangnam-do, Masanhappo-gu, Gusan-myeon	2014	35.12904	128.57147	S. Podenas		NIBR
S. Korea, Gangwon-do, Hongcheon-gun, Nae-myeon, Yuljeon-ri	2014	37.73849	128.34566	S. Kim, S. Podenas	Net	NIBR
S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Hwaak-ri	2014	37.98402	127.52676	S. Kim	Net	NIBR
S. Korea, Gangwon-do, Hongcheon-gun, Hwachon-myeon, Yasidae-ri	2015	37.82514	127.95530	S. Kim, S. Podenas	Net	NIBR
S. Korea, Gangwon-do, Hongcheon-gun, Duchon-myeon, Cheonhyeon-ri, near Mt. Garisan	2015	37.84840	127.98879	S. Kim, S. Podenas	Net	NIBR
S. Korea, Gangwon-do, Yangyang-gun, Seo-myeon, Garapi-ri	2015	38.07933	128.52042	S. Kim, S. Podenas	Net	NIBR
S. Korea, Gangwon-do, Goseong-gun, Ganseong-eup, Jinbu-ri	2015	38.26678	128.35706	S. Kim, S. Podenas, V. Podeniene	Net	NIBR
S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, Eoryong-ri, Neutral Nations Supervisory Commission Camp	2015	37.95467	126.67997	T. A. Klein, H.-C. Kim	Mosquito Magnet	NIBR
S. Korea, Gangwon-do, Inje-gun, Buk-myeon, Hangye-ri, Jayang 3 gyo (bridge), Seoraksan NP	2015	38.10415	128.37973	S. Kim, S. Podenas	Net	NIBR
S. Korea, Gangwon-do, Yangyang, Seo-myeon, Osae-ri, Heullim 1 gyo (bridge), Seoraksan NP	2015	38.09512 38.08420	128.41309 128.45026	S. Kim, S. Podenas	Net	NIBR
S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Baegyeon-ri, Tongilchon	2015	37.90725	126.73441	T. A. Klein, H.-C. Kim	Mosquito Magnet	NIBR

Table 1. Continued.

Locality	Year	N*	E*	Collector	Method	Collection
S. Korea, Gyeonggi-do, Gimpo-si, Haseong-myeon, Jeollyu-ri	2015	37.70883	126.64269	T. A. Klein, H.-C. Kim	Black light trap	NIBR
S. Korea, Gyeonggi-do, Paju-si, Munsan-eup, Majeong-ri	2015	37.88153	126.75692	T. A. Klein, H.-C. Kim	LED light trap	NIBR
S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Jeongmok-ri	2015	37.97627 37.97583	127.44160 127.44144	Y. J. Bae	Malaise trap	KU
S. Korea, Gangwon-do, Chuncheon, Dongsan-myeon, KNU Experimental Forest	2015 2018	37.78194 37.77909	127.81973 127.81580	S. Podenas	At light	NIBR
S. Korea, Gyeonggi-do, Paju-si, Jindong-myeon, Dongpa-ri, Camp Bonifas	2015 2017	37.93430 37.92582	126.72097 126.77410	T. A. Klein, H.-C. Kim	Mosquito Magnet	NIBR
S. Korea, Gyeongsangbuk-do, Gyeongju, Jinhyeon-dong, Tohamsan (Mt.)	2016	35.78755 35.78706	129.34274 129.34211	H.-M. Baek, S. Podenas	Net	NIBR
S. Korea, Gyeongsangbuk-do, Gyeongju-si, Yangbuk-myeon, Bulguk-ro, upper stream of Daejong-cheon Janghang 7-gyo (Brdg.)	2016	35.76236 35.76239	129.36407 129.36400	H.-M. Baek, S. Podenas	Net	NIBR
S. Korea, Gyeongsangbuk-do, Gyeongju, Bulguk-dong	2016	35.79079	129.32555	H.-M. Baek, S. Podenas	At light	NIBR
S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Josan-ri, Daeseongdong village	2016 2017	37.94120	126.67705	T. A. Klein, H.-C. Kim	Mosquito Magnet	NIBR
S. Korea, Seoul, Yongsan-gu, Yongsandong 5(o)-ga, Yongsan (US Army Garrison)	2017	37.52633	126.97136	T. A. Klein, H.-C. Kim	NJ trap	NIBR
S. Korea, Gyeonggi-do, Paju-si, Jeokseong-myeon, Jangjiwa-ri, Dagmar North Training Area	2017	37.97469	126.84456	T. A. Klein, H.-C. Kim	Mosquito Magnet	NIBR
S. Korea, Jeju-do, Jeju-si, Jochon-eup, Seonheul-ri	2017	33.50994	126.71541	S. Podenas	At light	NIBR
S. Korea, Gyeonggi-do, Gumpo-si, Suri-dong	2017	37.35022	126.91527	S. Podenas	Net	NIBR
S. Korea, Gyeonggi-do, Yangpyeong, Cheongun-myeon, Dowon-ri	2017	37.54507	127.79483	S. Podenas	At light	NIBR
S. Korea, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, Rodriguez Live Fire Complex	2017 2019	38.03644	127.23226	T. A. Klein, H.-C. Kim	NJ trap	NIBR
S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeongja-ri, Warrior Base Training Area	2017 2019	37.91777	126.74159	T. A. Klein, H.-C. Kim	NJ trap	NIBR
S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, 633 Eoryong-ri, Neutral Nations Supervisory Commission Camp - Trap #1	2017 2019	37.95478	126.67998	T. A. Klein, H.-C. Kim	Mosquito Magnet	NIBR
S. Korea, Jeju-do, Seogwipo-si, Andeok-myeon, Gamsan-ri	2019	33.23694	126.35728	S. Podenas, V. Podeniente	Net	NIBR
S. Korea, Jeollanam-do, Gurye-gun, Gwangui-myeon, Nodogan-ro	2019	35.29250	127.49548	S. Podenas	Net	NIBR
S. Korea, Gyeonggi-do, Gapyeong-gun, Oeseo-myeon, Samhoe-ri, Mt. Hwayasan	2019	37.67186	127.40536	S. Podenas	Net	NIBR

*Coordinates for old collecting sites are approximate

dissecting microscope. Photographs were taken with a Canon EOS 80D digital camera through a Canon MP-E 65 mm macro lens and through Mitutoyo M Plan Apo 10× lens mounted on same camera.

Terminology of adult morphological features generally follows that of Cumming and Wood (2017).

General distribution of species is given according Oosterbroek (2020).

TAXONOMY

Subfamily Limoniinae

Dicranomyia (Erostrata) Savchenko, 1976 (Savchenko, Krivolutskaya, 1976)
(generic and subgeneric characteristic in Podenas *et al.*, 2019)

Check list of Korean *Dicranomyia (Erostrata)* crane flies

Dicranomyia (Erostrata) globithorax Osten Sacken, 1869
Dicranomyia (Erostrata) globulithorax Alexander, 1924a
Dicranomyia (Erostrata) submelas Kato, Tachi, Gelhaus, 2018
Dicranomyia (Erostrata) tabashii (Alexander, 1934a)
Dicranomyia (Erostrata) yazuensis Kato, Tachi, Gelhaus, 2018

Key to Korean species of the subgenus *Dicranomyia (Erostrata) Savchenko* (updated from Podenas *et al.*, 2019)

1. Vein *Sc* long, reaching to about middle of *Rs* (Fig. 1B). Male gonostylus with densely spinose mesal surface (Fig. 1C, D). Hypovalva of ovipositor with smooth dorsal and ventral margins 2
 - Vein *Sc* shorter, reaching to about one-third of *Rs* length at most. Male gonostylus without spines. Hypovalva of ovipositor with serrate dorsal and ventral margins 4
2. Posterior margin of ninth tergite of male genitalia with wide and shallow emargination, gonostylus elongate with rounded distal part *Dicranomyia (Erostrata) globithorax* Osten Sacken, 1869
 - Posterior margin of ninth tergite of male genitalia with deep emargination, gonostylus widened, lateral margin extended into an angle (Fig. 1C, D) 3
3. Gonostylus of male genitalia elongate, outer margin arched subapically, apical angle small, about one-fifth of gonostylus length *Dicranomyia (Erostrata) globulithorax* Alexander, 1924a
 - Gonostylus of male genitalia wide, nearly as long along mesal margin as wide, outer margin nearly straight,

apical angle large, about one-third of gonostylus length (Fig. 1C, D).....

- *Dicranomyia (Erostrata) submelas* Kato *et al.*, 2018
- 4. Brownish yellow species. Male gonostylus obtuse-apexed.....
- *Dicranomyia (Erostrata) tabashii* (Alexander, 1934a)
- Body dark brown dorsally, pale yellow ventrally. Distal part of male gonostylus elongate, beak-shaped.....
- *Dicranomyia (Erostrata) yazuensis* Kato *et al.*, 2018

Dicranomyia (Erostrata) submelas Kato, Tachi and Gelhaus, 2018

Dicranomyia (Erostrata) submelas Kato, Tachi and Gelhaus, 2018: 187–189.

General: Body coloration dark brown. Body length of male 4.0 mm, wing length 5.0 mm.

Head: Dark brown, nearly black. Vertex with small tubercle covered with a few semi-erect blackish setae. Eyes widely separated. Antenna (Fig. 1A) 1.05 mm long, reaching beyond middle of prescutum if bent backwards. Scape brown, elongate, widening distally. Pedicel dark brown, subglobular, slightly shorter than scape. Flagellum entirely dark brown. Flagellomeres with short pale apical pedicels, seven basal segments subglobular, remaining segments elongate. Apical flagellomere narrow, approximately as long as penultimate. Longest verticils slightly exceeding in length respective segments. Rostrum brown and very short. Palpus dark brown, very short, one-seg-

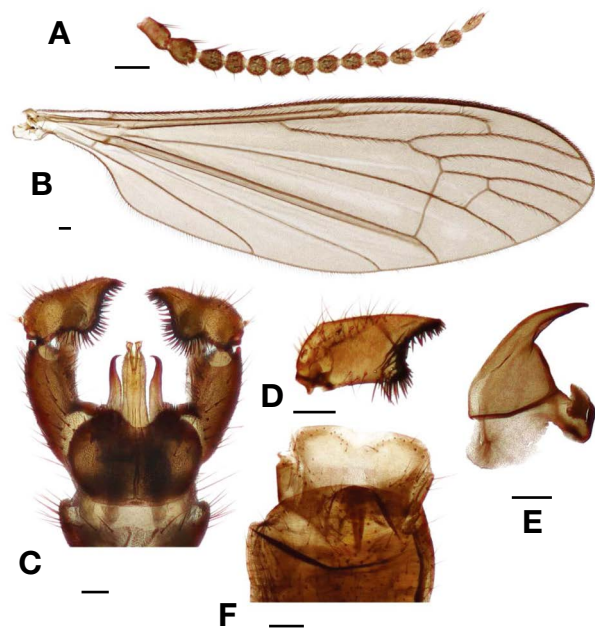


Fig. 1. *Dicranomyia (Erostrata) submelas* Kato *et al.*, 2018, male. A. antenna. B. wing. C. male genitalia, dorsal view. D. gonostylus. E. paramere. F. seventh sternite with internal sac. Scale bars: 0.1 mm.

mented with few long setae at apex.

Thorax: Cervical sclerites and pronotum dark brown to blackish. Mesonotal prescutum dark brown, paler along lateral margin. Scutal lobe dark brown with paler brown postero-lateral angle, area between lobes pale-brown. Scutellum brown frontally, dark brown posteriorly. Mediotergite uniformly grayish brown. Pleuron grayish brown with very indistinct longitudinal stripe. Wing (Fig. 1B) tinged with blackish brown, stigma indistinct, nearly lacking. Veins dark brown. Venation: *Sc* long, reaching slightly before the middle of *Rs*, *sc-r* at tip of *Sc*. *Rs* long, nearly straight, just slightly arched at base. *R*₁ indistinct, transverse. *R*₂ distinctly beyond tip of *R*₁. *R*₄ and *R*₅ long, slightly arched and parallel to each other. Cross-vein *r-m* at base of discal cell. Discal cell 1.4 times as long as wide, *m-cu* at base of discal cell. *CuP* and anal vein slightly diverging, nearly straight, just slightly arched before wing margin. Anal lobe medium-wide, widely rounded. Halter 0.8 mm long, blackish with yellowish base of stem. Coxae generally grayish brown, but frontal coxa slightly darker and posterior lighter than middle coxa. Trochanters pale brown. Coxae ventrally and trochanters bearing long setae. Leg dark brown with paler base of femur.

Abdomen: Tergites dark brown, nearly black. Two basal sternites pale brown, remaining dark brown, seventh sternite with a long and narrow internal sac at posterior margin (Fig. 1F). Male terminalia (Fig. 1C) same color as rest of abdomen. Ninth tergite slightly wider than longer with deep and wide notch at middle of posterior margin and lateral setose lobes on both sides. Gonocoxite elongate, cylindrical with long blunt-apexed setose ventro-mesal lobe at distal end. One pair of gonostyli. Gonostylus (Fig. 1D) large, nearly as long as gonocoxite, distinctly extended along outer margin, slightly arched, distal margin densely covered with strong blackish spines, outer margin near base with small tubercle armed with two spines. Paramere (Fig. 1E) generally triangle-shaped, very wide and flat at base, distal part with long and narrow prolongation, with hook-shaped apex in dorsal view. Penis long and narrow, nearly cylindrical, covered with fine setae, shortly bilobed at apex.

Elevation range in Korea: Close to sea level.

Period of activity: It was collected in mid-June in Korea, but adults are only observed to be active August–September in Japan.

Habitats: Small groove of deciduous trees and shrubs surrounded by buildings from one side, road and agricultural fields from the other, short distance from small stream and 1.2 km from large river.

General distribution: Previously known from Honshu, Shikoku, and Kyushu Islands, Japan. Recorded from the Korean Peninsula for the first time.

Examined material (Fig. 16A): 1 male (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeongja-ri,

Warrior Base Training area, N 37.91778, E 126.74159, alt. 18 m, 2019.06.26, T. A. Klein, H.-C. Kim, NJ trap (NIBR).

Dicranoptycha Osten Sacken, 1860

(generic characteristic in Podenas *et al.*, 2015)

Check list of Korean *Dicranoptycha* crane flies

Dicranoptycha buksubaeksaniana Podenas, Byun, Kim, 2015

Dicranoptycha diacantha Alexander, 1938a

Dicranoptycha gyebangsaniana Podenas, Byun, Kim, 2015

Dicranoptycha prolongata Alexander, 1938a

Dicranoptycha venosa Alexander, 1924a

Key to Korean species of the genus *Dicranoptycha* Osten Sacken (updated from Podenas *et al.*, 2015)

1. Abdomen brown or dark brown.....2
 - Abdomen light brown or yellow. Posterior margin of aedeagal process rounded or very shallowly concave...3
2. Posterior margin of outer gonostylus distinctly serrated (Fig. 2C), posterior margin of aedeagal process rounded.....*Dicranoptycha venosa* Alexander, 1924a
 - Posterior margin of outer gonostylus smooth, posterior margin of aedeagal process deeply concave, “M”-shaped...*Dicranoptycha prolongata* Alexander, 1938a
3. Radial sector of wing very short. Antenna light brown or yellow, distal flagellomeres yellow.....
 - Radial sector long. Antenna dark brown or blackish, distal flagellomeres at least brownish.....4
4. Prescutum with three dark brown to blackish longitudinal stripes, that are more or less confluent posteriorly. Head light gray. Male body length above 9 mm.....
 - Prescutum with four dark brown, blurred, but not interrupted longitudinal stripes. Head brown or dark gray. Male body length less than 9 mm.....
 - *Dicranoptycha buksubaeksaniana* Podenas *et al.*, 2015

***Dicranoptycha venosa* Alexander, 1924a**

Dicranoptycha venosa Alexander, 1924a: 561; Savchenko, Krivolutskaya, 1976: 117.

General: Thorax dark gray, abdomen dark brown. Body length of male 10.0 mm, wing length 10.5 mm.

Head: Dark gray, pruinose. Vertex wide. Male antenna 1.8 mm long. Scape cylindrical, dark brown at base, turning yellowish brown towards distal end. Pedicel widening distally, obscure yellow. Flagellum 14-segmented (Fig. 2A), basal flagellomere widely yellow at base, brown at

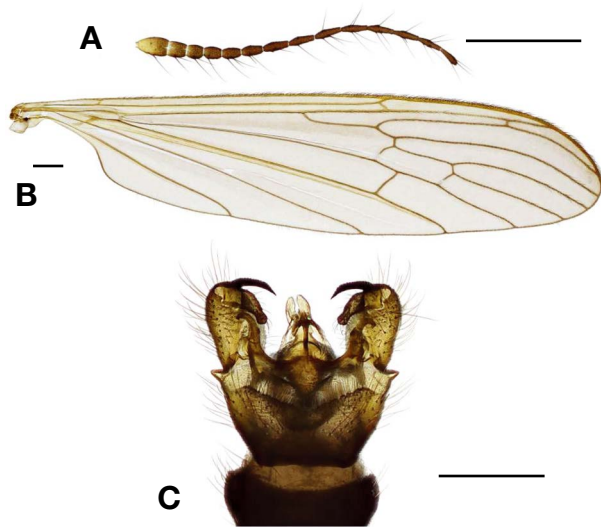


Fig. 2. *Dicranoptycha venosa* Alexander, 1924, male. A. antenna. B. wing. C. male genitalia, dorsal view. Scale bars: 0.5 mm.

distal end. Second flagellomere narrowly yellowish at base, remainder brown. Third segment brown, indistinctly yellowish at base. Remainder of flagellum brown to dark brown. Basal flagellomere elongate, narrowed at base. Second to fifth segments short, nearly cylindrical, remaining segments spindle shaped, getting longer towards distal end of antenna. Apical flagellomere elongate, approximately as long as penultimate. Verticils short, twice as short as length of respective segment. Rostrum dark brown to black. Palpus short, black, covered with erect brown setae. Mouth parts pale brown.

Thorax: Generally dark gray. Mesonotal prescutum with four indistinct darker stripes. Scutellum and mediotergite concolorous with prescutum. Pleuron dark brownish gray, areas above second and third coxae indistinctly yellowish. Wing (Fig. 2B) yellowish to brownish, unpatterned. Stigma indistinct. Veins brown. Venation: *Sc* long, reaching beyond branching point of *Rs*, *sc-r* close to *Sc* tip. *Rs* long, slightly arched at base. *R*₃ and *R*₄ long and parallel to each other, slightly arched before wing margin. Discal cell long and narrow, three times as long as wide. Cross-vein *m-cu* distinctly beyond branching point of *M*, at about one-third of discal cell length. *CuP* nearly straight, anal vein slightly arched at apex. Anal lobe medium-wide. Halter 1.4 mm long, pale, knob slightly infusate. Fore coxa dark brown, postero-ventral margin yellowish. Medial and posterior coxae obscure yellow. Trochanters yellow with dark brown distal rim, which do not extends onto dorsal surface. First femur dark brown with about the basal third yellow. Second and third femur yellow, distal end narrowly dark brown. Tibia brownish yellow, distal end narrowly darkened. Basal tarsomere brownish yellow, with dark brown distal end, remaining

tarsomeres dark brown. Legs covered with short, semi-erect brown setae. Femur III and tibia III: 9.2 mm long.

Abdomen: Grayish brown with dark brown distal segments. Male terminalia (Fig. 2C) obscure yellow. Ninth tergite with widely concave and densely setose posterior margin. Gonocoxite simple, elongate-oval. Outer gonostylus sickle-shaped, wider at base, pointed at apex, posterior margin distinctly serrated. Inner gonostylus fleshy, wider at base, narrower at distal end, blunt-apexed and covered with sparse setae. Lateral process of lateral apodeme of vesica with distinctly arched distal part and small subbasal lobe. Aedeagus bifid at apex.

Elevation range in Korea: Species was found at about 225 m altitude.

Period of activity: Species was discovered at the end of May in Korea.

Habitats: Mixed grooves, pine with broad leaved deciduous trees, on slope of nearly dry mountainous stream. Species is attracted to light.

General distribution: Species is known from Sakhalin and Kuril Islands of the Russian Far East and Hokkaido Island, Japan. This is the first record from the continent.

Examined material (Fig. 16B): 1 male (in EtOH), S. Korea, Gyeonggi-do, Yangpyeong, Cheongun-myeon, Dowon-ri, N 37.54507, E 127.79483, alt. 224 m, 2017.05.28, S. Podenas, at light (NIBR). Also compared with *D. venosa* specimens listed in Podenas *et al.*, 2015 and specimens from Japan and the Russian Far East: 1 male (wing slide mounted), Japan, Maoka, Saghalien, 1922.07.28, Teiso Esaki (USNM); 1 male (wing slide mounted), Japan, Shikotsu, Hokkaido, 1922.09.24, Teiso Esaki (USNM); 1 male, 1 female (wings, legs and genitalia slide mounted), Saghalien, Ochiai, 1932.09.08, M. Hori (USNM); 1 female (pinned), Akita Psn, Tamagawa, 500 m, 1951.06.18, Issiki-Ito (USNM); 1 female, 1 specimen of unknown sex (broken abdomen) (pinned), Akita PW, Yuze, 250 m, 1951.06.22, Issiki-Ito; 1 male (pinned), Alps, Nakabusa, 1951.07.24, Inove (USNM); 1 female (pinned), N. Alps, Yoshikiya, 1951.07.28, Inove (USNM); 4 females (pinned), N. Alps, Kamikochi, 1951.07.29, Inove (USNM).

Subfamily Limnophilinae

Austrolimnophila Alexander, 1920a

Limnophila (*Austrolimnophila*) Alexander, 1920a: 4–5.

Austrolimnophila Edwards, 1938: 63, 67; Alexander, 1948: 153; Ishida, 1959: 2; Savchenko, Krivolutskaya, 1976: 53; Savchenko, 1983: 48; 1986: 227–229; 1989: 62–64.

Type species: *Limnophila eutaeniata* Bigot, 1888 (South America).

Adult.

Medium-sized crane flies with body length 6.5–11.1 mm and wing length 7.5–10.5 mm. Body coloration varies from yellow to brown.

Head: Rounded posteriorly without neck-like extension. Vertex wide without tubercle, or with very small and indistinct tubercle. Antenna with 14-segmented flagellum, usually longer in males, reaching wing base or base of abdomen, if bent backwards. Flagellomeres elongate, apical segment subequal in length to preceding. Verticils long and distinct, usually longer than respective segment.

Thorax: Prothorax elongate. Mesonotal prescutum without or with indistinct small tubercular pits, pseudosutural fovea small and indistinct, longitudinal stripes present, but number varies, one, two or four. Pleuron with bare katepisternum and small reduced meron, thus middle and posterior coxae close to each other. Wing long and narrow, patternless or with dark spots surrounding cross-veins, stigma present. *Arculus* missing, vein *Sc* long, reaching wing margin close to the branching point of *Rs*, *sc-r* slightly before tip of *Sc*. *R*₁ short and transverse, or elongate, *R*₃ and *R*₄ nearly parallel to each other, just slightly diverging at wing margin. Cell *m*₁ long with short stem, sometimes stem missing. Discal cell always present, elongate. Cross-vein *m-cu* distinctly beyond base, usually close to the middle of discal cell. Anal vein long, slightly sinuous, reaching wing margin close to the level of *Rs* base. Anal angle distinct. Wing cells without macrotrichiae. Wing squama setoseless. All legs with tibial spurs, usually foreleg with single spur, middle and posterior legs with two spurs each.

Abdomen: Tergites with paired transverse sutures close to the anterior margin of sclerite. Male terminalia approximately as wide as the rest abdominal segments, slightly elongate. Sclerites of ninth abdominal segment connected into genital ring in male. Ninth tergite wider than longer, posterior margin modified, with additional lobes or indentations. Gonocoxite with interbase, elongate, with or without ventro-mesal lobe, two pairs of terminal gonostyli, shape of which is species-specific. Aedeagus species-specific, could be short and straight, but elongate in some species. Ovipositor with long and narrow cerci and hypovalvae, distal part of cercus slightly raised upwards, point-apexed.

Larva.

Body white. Head capsule oval, depressed dorsoventrally and slightly reduced (Wood, 1952; Lindner, 1959; Krivosheina, 2009; Krivosheina and Krivosheina, 2011). Frons triangular, separated from internolateralia by frontal sutures. Coronal suture wide, dorsal sutures reaching one-third of head capsule length. Clypeus separated from frons, fused with labrum. Labrum consists of two membranous areas with sensory structures which are separated by elongated outgroove. Antenna cylindrical, three times as long as wide at base. Apical papilla button-shaped.

Mandible large, heavily sclerotized, with two well developed apical teeth. Ventral and dorsal margins with several smaller teeth. Maxilla well developed, sclerotized at the base and setose at the apex, cardo large. Hypostoma with five teeth. Hypopharynx shaped as a hemispherical cushion with numerous short spines, laterally supported by H-shaped hypopharyngeal bar. Prementum reduced. Abdominal segments II–VII with ventral and dorsal creeping welts. Spiracular lobes reduced. Spiracular field surrounded by five sclerites: dorsal and two pairs of lateral. Spiracle oval. Anal field with two pairs of white fleshy anal papillae. Larvae are terrestrial, developing in decomposing fungi and decaying wood (Lindner, 1959; Krivosheina, 2009; Krivosheina and Krivosheina, 2011).

Pupa.

Body yellowish brown. Head: Cephalic crest consists of two pairs of short outgrooves. Mesonotal spines absent. Antenna short, reaching base of wing. Thorax: Pronotal horns elongated, with acute apices directed ventrally. Sheaths of legs reaching middle of fifth abdominal segment. Abdomen: Abdominal segments divided by fissures into short anterior and long posterior parts. Segments III–VII with dorsal and ventral transversal rows of spines (Wood, 1952).

A total of 190 species belong to *Austrolimnophila* worldwide (Oosterbroek, 2020). They are divided into five subgenera *A. (Archilimnophila)* Alexander, 1934b, *A. (Austrolimnophila)* Alexander, 1920a, *A. (Limnophilaspis)* Alexander, 1950a, *A. (Mediophragma)* Alexander, 1954, and *A. (Phragmocrypta)* Alexander, 1956. Nominative subgenus with 175 species has worldwide distribution, *Archilimnophila*, 6 species with only a Holarctic distribution, *Limnophilaspis* with only two species recorded from the Oriental Region, *Mediophragma* with only two species recorded from the Neotropics, *Phragmocrypta* with five species that only have a Afrotropic distribution (Oosterbroek, 2020). One fossil species is described from Lower Cretaceous Burmese amber and one species is recorded from Dominican Miocene amber (Evenhuis, 2014).

Check list of Korean *Austrolimnophila* crane flies

Austrolimnophila (Archilimnophila) subunicoides (Alexander, 1950b)

Austrolimnophila (Archilimnophila) unica (Osten Sacken, 1869)

Austrolimnophila (Austrolimnophila) asiatica (Alexander, 1925)

Key to Korean species of the genus *Austrolimnophila* Alexander

1. Wing stigma distinct, dark brown (Fig. 4A). Inner or outer gonostylus of male genitalia modified (with spine,

- extra-lobe or strongly curved) (Fig. 4B), ninth sternite simple, without extra lobe..... *Austrolimnophila (Archilimnophila) 2*
- Wing stigma indistinct, pale brown. Both gonostyli of male genitalia unmodified..... *Austrolimnophila (Archilimnophila) asiatica* (Alexander, 1925)
2. Wing with distinct dark spots at base of R_s , at cord and distal end of discal cell (Fig. 3A). Outer gonostylus of male genitalia short and strongly curved, inner gonostylus elongate, unmodified (Fig. 3B)..... *Austrolimnophila (Archilimnophila) subunicoides* (Alexander, 1950b)
- Wing with indistinct darkening at cord (Fig. 4A). Outer gonostylus of male genitalia elongate, unmodified, inner gonostylus with spine-shaped lobe at middle (Fig. 4B)..... *Austrolimnophila (Archilimnophila) unica* (Osten Sacken, 1869)

Austrolimnophila (Archilimnophila) Alexander, 1934b

Archilimnophila Alexander, 1934b: 47.

Austrolimnophila (Archilimnophila) Ishida, 1959: 2; Savchenko, Krivolutskaya, 1976: 55; Savchenko, 1986: 231.

Type species: *Limnophila unica* Osten Sacken, 1869 (Holarctic) (original designation).

Adult.

Medium-sized crane flies with body length 8.0–11.0 mm and wing length 8.2–10.5 mm. Body coloration dark brown.

Head: Antenna with 14-segmented flagellum, usually longer in male, reaching wing base or even beyond base of abdomen, if bent backwards. Basal flagellomere twice as long as scape.

Thorax: Wing patternless or with dark spots surrounding cross-veins, stigma distinct, dark brown. Vein R_2 far beyond branching point of R_{2+3} and R_4 , cell r_3 with long stem, vein R_{2+3+4} approximately as long as cell r_3 , cross-vein $r-m$ distinct, well developed. Anal angle widely rounded.

Abdomen: Male terminalia: ninth tergite wider than longer, posterior margin with two lobes, sometimes also with tooth-shaped lateral lobe. Gonocoxite with large ventro-mesal lobe, often distinctly wider at base, narrower towards apex. Outer gonostylus with large tooth or finger-shaped apical lobe. Two pairs of large blackened spine-shaped parameres. Aedeagus short and wide.

Subgenus with 6 described species has Holarctic distribution (Oosterbroek, 2020).

Larva and pupa. Undescribed.

***Austrolimnophila (Archilimnophila) subunicoides* (Alexander, 1950b)**

Archilimnophila subunicoides Alexander, 1950b: 428.

Austrolimnophila (Archilimnophila) subunicoides Sav-

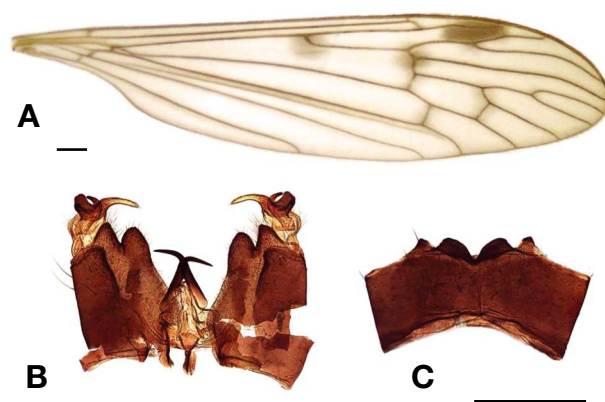


Fig. 3. *Austrolimnophila (Archilimnophila) subunicoides* (Alexander, 1950), holotype, male. A. wing. B. male genitalia, dorsal view. C. ninth tergite. Scale bars: 0.5 mm.

chenko, 1978: 378–379; 1989: 65.

General: Body coloration dark gray. Male body length 9.3 mm, wing length 9.1–10.4 mm.

Head: Dark gray, sparsely covered with dark brown erect setae. Vertex without tubercle. Eyes widely separated in both sexes, distance between them at base of antennae exceeds length of scape. Antenna dark brown with yellowish base of first flagellomere, 2.4–3.0 mm long in male, extending to base of halter, if bent backward. Scape elongate, nearly cylindrical, twice as long as wide, pedicel widened distally. Flagellomeres elongate, narrower towards apex of antenna, densely covered with whitish pubescence. Apical segment slightly exceeds preceding segment in length. Verticils dark brown, longest verticils approximately as long as respective segments. Rostrum dark brown dorsally, brown laterally, densely dusted with gray. Palpus dark brown, mouth parts brown.

Thorax: Cervical sclerites dark brown densely dusted with gray. Pronotum gray. Mesonotal prescutum gray with four blackish stripes, medial pair narrowly separated with gray. Tubercular pits indistinct, pseudosutural fovea small. Scutal lobe gray with darker elongate spot closer to medial margin. Scutellum dark brown, densely dusted with gray, lateral and posterior margin narrowly obscure brownish yellow. Mediotergite brownish gray. Dorsopleural membrane yellowish brown. Pleuron gray, katepisternum slightly infuscated ventrally. Wing (Fig. 3A) iridescent with brownish tinge, darker spots surrounding base of R_s , along cord and distal margin of discal cell. Stigma distinct, dark brown, elongate. Veins brown, yellowish at wing base. Venation: Sc long, reaching wing margin at branching point of R_s , $sc-r$ from before to beyond tip of Sc depending on specimen. R_s long, arched and sometimes short-spurred at base. Free end of R_1 very short, R_2 at the apex of R_1 , far beyond branching point of R_{2+3} and

*R*₄, *R*₃ and *R*₄ diverging at wing margin, cell *r*₃ with long stem, which is approximately as long as discal cell. Cross-vein *r-m* distinct, at base of discal cell. Discal cell 2.3–2.6 times as long as wide. Cross-vein *m-cu* at about one-third length of discal cell. Anal vein long, slightly arched at wing margin, apex at the level of *R*_s base. Anal angle long and narrow, widely rounded. Length of male halter 1.7 mm, stem obscure yellow, knob slightly darkened. The fore coxa blackish at base frontally, remainder obscure yellow, middle and posterior coxae obscure yellow with narrowly dark brown base. Trochanters yellow with darkened ventro-posterior margin. Forefemur brown with yellow base and dark brown distal part. Middle and posterior femur yellow turning narrowly dark brown towards apex. Tibia brown with dark brown apex. Tarsomeres dark brown with base of first tarsomere brown. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 5.6 mm long, II: 5.8 mm, III: 6.3–6.4 mm, tibia I: 6.5 mm, II: 6.25 mm, III: 7.0–8.5 mm, tarsus I: 7.3 mm, II: 6.5 mm, III: 6.0 mm. Claw simple, spineless.

Abdomen: Abdominal segments dark brown to blackish, covered with dense gray pruinosity, sparsely setose. Tergites with paired transverse sutures slightly before middle of sclerite. Male terminalia (Fig. 3B) concolorous with the rest of abdomen. Ninth tergite (Fig. 3C) wider than longer, posterior margin with four lobes, medial lobes low and wide, separated by wide but shallow V-shaped emargination, lateral lobe small with narrow, finger-shaped apical part, which is at right angle to the rest of the lobe and turned inwards. Gonocoxite elongate with large ventro-mesal blunt-apexed lobe. Outer gonostylus short and strongly curved with subacute apex. Inner gonostylus small and rough, bearing long, narrow slightly arched yellow rostral lobe. Paramere long rod-shaped, strongly curved. Left and right parameres asymmetrical. Aedeagus short and straight.

Elevation range in Korea: From 1100 to 1400 m.

Period of activity in Korea: Beginning of June.

Habitats: Unknown.

General distribution: Northern part of Korean Peninsula, Mongolia, and Eastern part of Russia.

Examined material (Fig. 16C): holotype, male (head, hind leg, wing and terminalia slide mounted), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 4000 ft. [1230 m], 1939.06.05, A. Y. Yankovsky (USNM); paratype, male (two legs, wing and terminalia slide mounted), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 4500 ft. [1385 m], 1939.06.04, A. Y. Yankovsky (USNM). Also compared with: 1 male (pinned), Mongolia, Tov Aimag, Erdene Soum, Gorkhi Terelj National Park, stream 0.5 km N of Gorkhi Davaa (Pass), N 47.94981 E 107.45511, elev. 1593 m, 2011.07.11, coll. S. Podenas, MAIS 2011071101 (ANSP).

Austrolimnophila* (*Archilimnophila*) *unica
(Osten Sacken, 1869)

Limnophila unica Osten Sacken, 1869: 205–206; Tjeder, 1969: 254.

Limnophila humilis Meigen, 1830: 275–276.

Limnophila prolixicornis Lundström, 1907: 26–27; Lack-schewitz, 1940: 85.

Limnophila unicoides Alexander, 1924a: 574–575.

Austrolimnophila (*Archilimnophila*) *unica* Savchenko, Krivolutskaya, 1976: 55; Savchenko, 1978: 375; 1986: 231; 1989: 65.

General: Body coloration dark brown densely dusted with gray. Body length of male 8.0–9.2 mm, of female 8.2–11.0 mm. Wing length of male 8.2–9.0 mm, of female 8.8–10.5 mm.

Head: Dark brown, dusted with gray, sparsely covered with dark brown erect setae, distinctly narrower posteriorly. Vertex without tubercle. Eyes widely separated in both sexes, distance between them at base of antennae about as long as both basal antennomeres taken together. Antenna brown to dark brown, 2.0–2.5 mm long in male, 2.0–2.5 in female, extending to base of abdomen, if bent backward. Scape elongate, nearly cylindrical, twice as long as wide, pedicel widened distally, yellowish. Flagellomeres elongate, nearly cylindrical, narrower towards apex of antenna, densely covered with whitish pubescence. Apical segment approximately as long as preceding segment. Verticils dark brown, longest verticils approximately as long as respective segments. Rostrum brown, dusted with gray. Palpus and mouth parts brown.

Thorax: Cervical sclerites dark brown dusted with gray. Pronotum yellowish brown. Mesonotal prescutum brown, sparsely dusted with yellowish and with wide dark brown median stripe. Tubercular pits missing, pseudosutural fo-

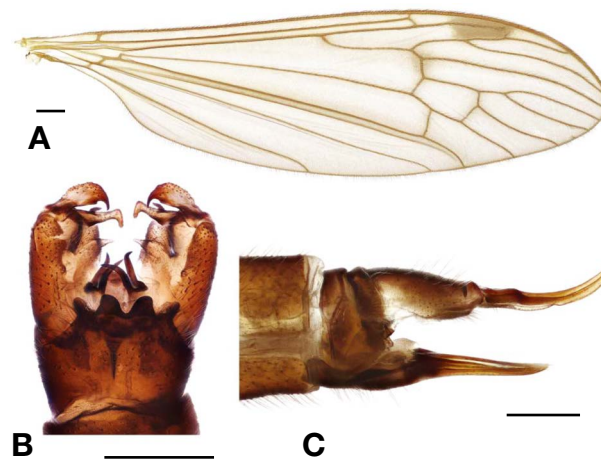


Fig. 4. *Austrolimnophila* (*Archilimnophila*) *unica* (Osten Sacken, 1869). A. wing. B. male genitalia, dorsal view. C. ovipositor, lateral view. Scale bars: 0.5 mm.

vea small and indistinct. Scutal lobe dark brown with yellow postero-lateral margin, area between lobes grayish. Scutellum dark brown, densely dusted with gray. Mediotergite dark brown densely covered with gray pruinosity. Pleuron brown, covered with gray pruinosity, katepisternum slightly infuscated ventrally. Wing (Fig. 4A) iridescent, translucent, patternless with distinct elongate dark brown stigma (could be faded in old specimens). Veins brownish, yellowish at wing base. Venation: *Sc* long, reaching wing margin approximately at branching point of *Rs*, *sc-r* at tip of *Sc*. *Rs* medium-long, distinctly arched at base. Free end of *R*₁ short, oblique, *R*₂ its own length from the apex of *R*₁, far beyond branching point of *R*₂₊₃ and *R*₄. *R*₃ and *R*₄ slightly arched, parallel to each other, cell *r*₃ with long stem, but stem is shorter than cell itself. Cross-vein *r-m* distinct, at base of discal cell. Discal cell twice as long as wide. Cross-vein *m-cu* slightly before middle of discal cell. Anal vein long, slightly arched at wing margin, apex before the level of *Rs* base. Anal angle long and narrow, widely rounded. Length of male halter 1.4–1.5 mm, of female 1.5–2.0 mm, stem light brown with pale base, knob darkened. Coxae obscure yellow, fore coxa slightly darkened frontally. Trochanters obscure yellow with darkened ventro-posterior margin. Femur brown with obscure brownish yellow base, narrowest on foreleg, broadest on hind femur. Tibia and tarsus brown, distal tarsomeres dark brown. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 5.0–6.5 mm long, II: 5.0–5.5 mm, III: 5.0–6.2 mm, tibia I: 6.5–7.8 mm, II: 6.0–7.0 mm, III: 7.0–7.5 mm, tarsus I: 6.7–7.7 mm, II: 6.0–7.3 mm, III: 7.0–7.5 mm. Female femur I: 4.5–5.2 mm long, II: 5.0–5.2 mm, III: 4.5–6.0 mm, tibia I: 6.0–6.7 mm, II: 5.7–6.2 mm, III: 5.5–6.6 mm, tarsus I: 5.5–7.2 mm, II: 5.5–5.7 mm, III: 5.0–5.2 mm long. Claw simple, without spines.

Abdomen: Abdominal segments semi-polished, covered with sparse yellowish setae. Tergites dark brown, sparsely dusted with gray, with paired transverse sutures at about middle of sclerite. Sternites obscure brownish yellow. Subgenital segment in both sexes dark brown. Male terminalia (Fig. 4B) black. Ninth tergite wider than longer, posterior margin with four distinct blackened lobes, two submedially with deep U-shaped incision between them and finger-shaped lobe on postero-lateral angles. Gonocoxite approximately twice as long as wide, with large ventro-mesal blunt-apexed lobe. Outer gonostylus setose, wide with blackened arched postero-mesal spine and small tooth-shaped lobule beyond middle of mesal margin. Inner gonostylus setose, long and narrow, with spine-shaped lobe on middle of posterior margin, distal part curved at right angle. Ninth sternite simple. Two pairs of dark brown, arched, spine-shaped parameres. Aedeagus short and wide. Ovipositor (Fig. 4C) dark brown

at base, cercus and hypovalva brown with pale apices. Cercus elongate, distal part slightly raised upwards, apex point-shaped. Hypovalva long and straight, point-apexed, reaching to about middle of cercus.

Elevation range in Korea: From 150 to nearly 1900 m.

Period of activity in Korea: From middle of May through early August.

Habitats: Unknown in Korea. Collected in Europe by the senior author at river and stream margins covered with deciduous trees, in gardens, in birch, and in mixed forests.

General distribution: Widely distributed Holarctic species.

Examined material (Fig. 16D): 1 male (pinned), North Korea, Ompo, 600 ft., 1938.05.18, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), [N.] Korea, Seren Mts., alt. 3000 ft., 1938.06.14, A. Y. Yankovsky (USNM); 1 male (pinned), [N.] Korea, Seren Mts., alt. 2800 ft., 1938.06.15, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), [N.] Korea, Seren Mts., alt. 3000 ft., 1938.06.15, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), [N.] Korea, Seren Mts., alt. 3800 ft., 1938.06.29–30, A. Y. Yankovsky (USNM); 1 male (pinned), [N.] Korea, Seren Mts., alt. 2500 ft., 1938.07.03, A. Y. Yankovsky (USNM); 1 male (pinned), [N.] Korea, Seren Mts., alt. 3000 ft., 1938.07.05, A. Y. Yankovsky (USNM); 2 females (pinned), [N.] Korea, Seren Mts., alt. 4500 ft., 1938.07.10, A. Y. Yankovsky (USNM); 1 male (pinned), [N.] Korea, Seren Mts., alt. 3800 ft., 1938.07.10, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), [N.] Korea, Seren Mts., alt. 5000 ft., 1938.07.12, A. Y. Yankovsky (USNM); 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 4200 ft., 1939.06.04, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5500 ft., 1939.06.21, A. Y. Yankovsky (USNM); 1 male (pinned), Korea, Toori, alt. 6000 ft., 1939.06.25 (USNM); 2 females (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.07.16, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.07.24, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned, ovipositor in microvial with glycerol, wing slide-mounted), North Korea, Puksu Pyaksan, alt. 5500–6000 ft., 1939.08.02, A. Y. Yankovsky (USNM); 1 female (pinned), North Korea, Puksu Pyaksan, alt. 5500–6000 ft., 1939.08.03 (USNM); 1 male (pinned), North Korea, Puksu Pyaksan, alt. 5000 ft., 1939.08.08 (USNM); 2 males, 2 females (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5000 ft., 1939.08.09, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Chonsani, 4000 ft., 1940.06.18, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), N. Korea, Chonsani, 5000 ft., 1940.06.25, A. Y. Yankovsky (USNM); 2 males, 1 female (pinned), N. Korea, Pontani Paiktusan, 6000 ft., 1940.07.25, A. Y. Yankovsky (USNM).

Austrolimnophila (Austrolimnophila) Alexander, 1920a*Limnophila (Austrolimnophila) Alexander, 1920a: 4.**Austrolimnophila (Austrolimnophila) Ishida, 1959: 2; Savchenko, Krivolutskaya, 1976: 55; Savchenko, 1986: 229; 1989: 66.*Type species: *Limnophila eutaeniata* Bigot, 1888 (South America) (original designation).**Adult.**

Medium-sized crane flies with body length 6.5–11.1 mm and wing length 7.5–10.5 mm. Body coloration yellowish brown, light brown or brown.

Head: Antenna with 14-segmented flagellum, longer in male, reaching somewhat beyond wing base at most, if bent backwards. Scape approximately twice as long as first flagellomere.

Thorax: Wing patternless or with abundant small spots [e.g., *A. (A.) accola* Alexander, 1961 from Indonesia or *A. (A.) agathicola* Alexander, 1952 from New Zealand], stigma indistinct or missing. Radial sector comparatively short, vein R_{2+3} few times as long as R_2 , cell r_3 with short stem, cell r_3 few times longer than vein R_{2+3+4} , cross-vein $r-m$ distinct, well developed. Anal angle long and narrow.

Abdomen: Male terminalia: ninth tergite wider than longer, posterior margin with two small lobes and wide but shallow median incision between them, but without lateral lobes. Gonocoxite without large ventro-mesal lobe. Outer gonostylus slightly arched. Two pairs of small elongate semi-membranous plate-shaped parameres.

Subgenus includes 175 described species and has worldwide distribution (Oosterbroek, 2020).

Larva and pupa as described for the genus.

Austrolimnophila (Austrolimnophila) asiatica (Alexander, 1925)*Pseudolimnophila ochracea* var. *asiatica* Alexander, 1925: 7.*Austrolimnophila (Austrolimnophila) ligulata* Savchenko, Krivolutskaya, 1976: 55–56.*Austrolimnophila (Austrolimnophila) asiatica* Savchenko, 1983: 49; 1989: 66.**Adult.**

General: Body coloration grayish brown. Body length of male 6.5–9.7 mm, of female 9.8–11.1 mm. Wing length of male 7.5–10.0 mm, of female 9.1–10.5 mm.

Head: Gray, indistinctly darkened dorsally, light gray along eye margin, sparsely covered with dark brown erect setae, distinctly narrower posteriorly. Vertex with small indistinct tubercle. Eyes widely separated in both sexes, distance between them at base of antennae slightly less than length of scape. Antenna (Fig. 5A) 1.7–2.0 mm long in male, 1.8–2.5 mm in female, extending to wing base

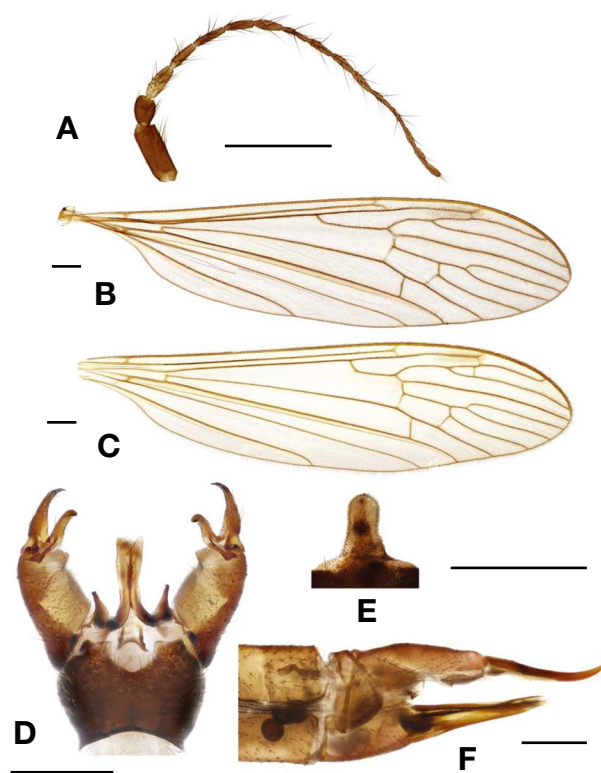


Fig. 5. *Austrolimnophila (Austrolimnophila) asiatica* (Alexander, 1925). A. male antenna. B. wing. C. wing, variation of venation. D. male genitalia, dorsal view. E. ninth sternite of male genitalia, ventral view. F. ovipositor, lateral view. Scale bars: 0.5 mm.

if bent backward. Both basal antennomeres dark brown, sparsely dusted with gray, scape elongate, nearly cylindrical, twice as long as pedicel, pedicel oval. Basal flagellomere yellow at base, 1.5 times as long as pedicel, remainder of flagellum brown to dark brown. Flagellomeres elongate, decreasing in length and width from the basal to the outermost. Apical segment nearly as long as preceding. Verticils dark brown, longest verticils 1.2 times as long as respective segments. Rostrum brown, dorsally dusted with gray. Palpus dark brown, mouth parts brown.

Thorax: Cervical sclerites brownish gray. Pronotum brown, dusted with gray pruinosity, narrowly yellowish brown frontally and posteriorly. Mesonotal prescutum grayish brown with two median dark brown stripes widely separated by gray area and less distinct lateral stripe. Tubercular pits very small and indistinct at frontal margin of sclerite, pseudosutural fovea brown, semi-polished. Scutal lobe brown, dense gray pruinose and with darker longitudinal spot closer to medial margin, area between lobes yellowish. Scutellum yellowish brown, dusted with gray. Mediotergite yellowish brown densely covered with gray pruinosity. Pleuron brown, densely covered with gray pruinosity, anepisternum slightly infuscated. Wing (Fig. 5B, C) iridescent, translucent, patternless with in-

distinct stigma. Veins brown, yellowish at wing base. Venation: *Sc* long, reaching wing margin slightly before branching point of *Rs*, *sc-r* slightly beyond tip of *Sc*. *Rs* medium-long, arched at base. Free end of *R*₁ short, oblique, *R*₂ twice its own length before the apex of *R*₁, far beyond branching point of *R*₂₊₃ and *R*₄. Cell *r*₃ nearly parallel-sided, just slightly widening towards wing margin, with long stem, which is approximately as long as discal cell. Cross-vein *r-m* distinct, at base of discal cell which is twice as long as wide. Position of cross-vein *m-cu* slightly varies from about at one-third to the middle of discal cell. Anal vein long, slightly sinuous, apex slightly before the level of *Rs* base. Anal angle widely rounded. Length of male halter 1.1–1.4 mm, of female 1.2–1.5 mm, stem yellowish with pale base, knob slightly infuscated. Coxae yellow, dusted with gray, forecoxa slightly darkened frontally. Trochanters obscure yellow. Femur yellow with indistinctly darkened distal part, tibia yellow with slightly darker apex. Tibia of foreleg with single apical spur, tibiae of second and third pairs of legs with two apical spurs each. Basal tarsomere brown with yellowish basal part, remaining tarsomeres dark brown. Male femur I: 5.2–6.6 mm long, II: 6.0–7.0 mm, III: 5.5–7.5 mm, tibia I: 6.4–7.7 mm, II: 6.4–8.1 mm, III: 6.9–8.5 mm, tarsus I: 6.5–8.2 mm, II: 6.5–9.0 mm, III: 6.5–8.2 mm. Female femur I: 5.3–6.5 mm long, II: 5.5–7.2 mm, III: 6.2–7.7 mm, tibia I: 7.4–8.0 mm, II: 6.2–7.8 mm, III: 7.0–9.0 mm, tarsus I: 6.3–8.0 mm, II: 6.1–8.2 mm, III: 6.5–8.0 mm long. Claw simple, without spines.

Abdomen: Tergites brown, semi-polished, sparsely dusted with gray, covered with sparse yellowish setae, with paired transverse sutures at about one-third. Sternites yellowish brown. Ninth segment of male dark brown (Fig. 5D), semi-polished, gonocoxite brownish-yellow. Ninth tergite wider than longer, posterior margin with deep median U-shaped incision and right-angled lateral lobe. Gonocoxite twice as long as wide, slightly narrower towards apex, without additional lobe. Outer gonostylus setose, elongate, arched, sclerotized towards apex, point-apexed. Inner gonostylus setose, long and narrow, blunt-apexed. Ninth sternite with tongue-shaped median lobe at posterior margin (Fig. 5E). Aedeagus long and narrow with V-shaped apex. Paramere dark brown spine-shaped. Ovipositor (Fig. 5F) dark brown at base, distal part of tenth tergite and postero-lateral area of eight sternite yellow. Cercus dark brown at base, yellowish towards apex, elongate, distal part slightly raised upwards, apex point-shaped. Hypoalva dark brown, long and straight, point-apexed, reaching beyond middle of cercus.

Elevation range in Korea: From sea level up to 1700 m.

Period of activity in Korea: From late May through mid July.

Habitats: Shaded margins of rocky, mountainous rivers and streams surrounded by shrubs and mixed forest, with

rocks densely covered by moss, margins of channels under leafy vegetation, parks. Species is attracted to light.

General distribution: Eastern part of Russia. Recorded here for the first time from the Korean Peninsula and for the first time outside Russian territory.

Examined material (Fig. 16E): holotype (as *Pseudolimnophila ochracea asiatica*), female (wing slide-mounted), [Russia], Siberia, Okeanskaya, 1923.06, T. D. A. Cockerell (USNM); 1 specimen with broken abdomen (pinned), Korea, Pyaksan, 4700 ft., 1936.06.06 (USNM); 1 male (pinned), N. Korea, Ompo, 1937.05.28, A. Y. Yankovsky (USNM); 4 males, 1 female (pinned), N. Korea, Ompo, 170 ft., 1937.06.03, A. Y. Yankovsky (USNM); 4 females (pinned), N. Korea, Ompo, 40 ft., 1937.06.15, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), [N.] Korea, Ompo, 200–500 ft., 1938.05.28, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Ompo, 400 ft., 1938.06.13, A. Y. Yankovsky (USNM); 2 females (pinned), North Korea, Ompo, 400–600 ft., 1938.06.11, A. Y. Yankovsky (USNM); 3 males (pinned), [N.] Korea, Ompo, 200–500 ft., 1938.06.03, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5000–5500 ft., 1939.06.08, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5500 ft., 1939.06.11, A. Y. Yankovsky (USNM); 1 male (pinned), [S.] Korea, #9, Central National Forest, 18 miles NE of Seoul, 1954.05.29, G. W. Byers (USNM); 1 male (pinned), [S.] Korea, #11, Central National Forest, 18 miles NE of Seoul, 1954.06.04, G. W. Byers (USNM); 5 males, 1 female (pinned), [S.] Korea, #12, Hwy. #20, 8 mi. SW of Kangnung, 128°47'E, 37°42'N, 1925 ft., 1954.06.08, G. W. Byers (SMEK); 2 males (pinned), [S.] Korea, #13, Hwy. #20, 8 mi. SW of Kangnung, 128°47'E, 37°42'N, 1925 ft., 1954.06.09, G. W. Byers (SMEK); 1 female, 1 specimen with broken abdomen (pinned), [S.] Korea, #19, Central National Forest, 18 miles NE of Seoul, 1954.07.07, G. W. Byers (USNM); 1 male, 1 female (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Daegwallyeong-myeon, Yongsan-ri, Mt. Balwangsang, 2008.07.19, J. D. Yeo, M. J. Jeon, K. G. Kim, Malaise trap (NIBR); 1 female (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Jangjeon-ri, Mt. Gariwangsang, N 37.48778, E 128.54528, 2009.06.17–07.04, J. D. Yeo, J. D. Yoon, Malaise trap (NIBR); 2 males, 3 females (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP, N 37.73920, E 128.59398, alt. 794 m, 2012.06.22 (01), S. Kim, S. Podenas (NIBR); 1 male, 1 female (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP, N 37.74913, E 128.57723, alt. 726 m, 2012.06.22 (02), S. Kim, S. Podenas (NIBR); 1 male (in EtOH), S. Korea, Paju, (Cowshed), 37°52'53.52"N, 126°45'24.89"E,

2015.05.25 (NIBR); 1 female (in EtOH), S. Korea, Gimpo (Cowshed), 37°42'31.76"N, 126°38'33.73"E, 2015.05.25 (NIBR); 1 male (in EtOH), S. Korea, Bonifas (South MDL), 37°56'3.53"N, 126°43'15.46"E, 2015.05.29 (NIBR); 1 male (pinned), S. Korea, Tongilchon, (Beef Farm), N 37°54'26.14", E 126°44'3.88", 2015.05.29 (NIBR); 1 female (in EtOH), S. Korea, Tongilchon, (Beef Farm), N 37°54'26.14", E 126°44'3.88", alt. 32 m, 2015.06.09 (NIBR); 1 male, 3 females (in EtOH), S. Korea, Gangwon-do, Pyeonchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan National Park, N 37.73767, E 128.59166, alt. 730 m, 2015.07.06 (1), S. Kim, S. Podenas (NIBR); 1 male (in EtOH), S. Korea, Gangwon-do, Pyeonchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP, N 37.72425, E 128.59814, alt. 648 m, 2015.07.06 (02), S. Kim, S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gangwon-do, Inje-gun, Buk-myeon, Hange-ri, Jayang 3 gyo (bridge), Seoraksan National Park, N 38.10415, E 128.37973, alt. 704 m, 2015.07.07 (4), S. Kim, S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gangwon-do, Goseong-gun, Ganseong-eup, Jinbu-ri, N 38.26678, E 128.35706, alt. 497 m, 2015.07.08 (1), S. Kim, S. Podenas (NIBR); 1 male (pinned), 2 males, 4 females (in EtOH), S. Korea, Gyeongsangbuk-do, Gyeongju-si, Jinhyeon-dong, Tohamsan (Mt.), N 35.78755, E 129.34274, alt. 320 m, 2016.05.27 (1), H. M. Baek, S. Podenas (NIBR); 1 male (in EtOH), S. Korea, Gyeongsangbuk-do, Gyeongju-si, Yangbuk-myeon, Bulguk-ro, upper stream of Daejong-cheon Janghang 7-gyo (Brdg.), N 35.76236, E 129.36407, alt. 333 m, 2016.05.28 (1), S. Podenas, H. M. Baek (NIBR); 1 female (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27123, E 127.57133, alt. 534 m, 2016.06.04 (5), H. M. Baek, S. Podenas, at light (NIBR); 1 female (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Josan-ri, Daeseongdong, N 37.94120, E 126.67705, alt. 20 m., 2016.06.10, T. A. Klein, H.-C. Kim, Mosquito Magnet (NIBR); 1 male (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, 633 Eoryong-ri, NNSC-1, N 37.95478, E 126.67998, alt. 14 m, 2017.05.19–06.13, T. A. Klein, H.-C. Kim, Mosquito Magnet (NIBR); 5 males (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Jeokseong-myeon, Jangjwa-ri, Dagmar North, N 37.97469, E 126.84456, alt. 17 m, 2017.05.19–06.16, T. A. Klein, H.-C. Kim, Mosquito Magnet (NIBR); 1 male (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Jindong-myeon, 1417 Dongpa-ri, Bonifas, alt. 19 m, N 37.92582, E 126.77410, 2017.05.23, T. A. Klein, H.-C. Kim, Mosquito Magnet (NIBR); 1 male (pinned), S. Korea, Gyeonggi-do, Gungpo-si, Suri-dong, N 37.35022, E 126.91527, alt. 138 m, 2017.05.27 (1), S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Josan-ri, Daeseongdong (Village), N 37.94120, E 126.67705, alt. 20 m, 2017.06.02–17, Mosquito Magnet (NIBR); 1

male (in EtOH), S. Korea, Seoul, Yongsan-gu, Yongsandong 5(o)-ga, Yongsan (US Army Garrison), N 37.52633, E 126.97136, alt. 27 m, 2017.06.13, T. A. Klein, H.-C. Kim, NJ trap (NIBR); 1 male (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, 633 Eoryong-ri, NNSC-1, N 37.95478, E 126.67998, alt. 14 m, 2019.06.03, T. A. Klein, H.-C. Kim, Mosquito Magnet (NIBR); 1 male (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58090, alt. 448 m, 2019.06.24 (2), S. Podenas, at light (NIBR); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27333, E 127.56924, alt. 546 m, 2019.06.25 (1), S. Podenas (NIBR).

Conosia van der Wulp, 1880

Conosia van der Wulp, 1880: 159–160; Wood, 1952: 253–254; Ribeiro, 2008: 677–678.

Type species: *Limnobia irrorata* Wiedemann, 1828 (monotypic).

Adult.

General: Medium to larger sized crane flies with body length ranging from 9.5 to 17.0 mm, wing length 7.0–13.0 mm. Females usually larger than males. Wing shorter than body length, especially in females. Body coloration varies from yellowish brown to brown sparsely dusted with gray.

Head: Vertex with small tubercle. Eyes widely separated dorsally in both sexes, but meet each other ventrally. Antenna 12-segmented with large, strongly elongate scape, comparatively big pedicel, first flagellomere distinctly smaller than pedicel, subglobular, but distinctly wider than remaining elongate flagellomeres. Apical flagellomere very short, button-shaped. Antenna short, reaching slightly beyond frontal margin of prescutum in both sexes, if bent backwards. Longest verticils three times as long as respective segments on basal flagellomeres, twice as long as respective segments on distal flagellomeres. Rostrum short, labella slightly elongate. Palpomeres partially fused.

Thorax: Pronotum small. Mesonotal prescutum large, raised over pronotum frontally, tubercular pits missing, pseudosutural foveae small, surface covered with abundant small dark spots, usually with darker median stripe, divided longitudinally by narrow dark line. Katepisternum naked. Meron small, thus second and third pairs of legs close to each other. Wing usually wider in males and narrower in females. Male wing often with large projection at apex of anal vein. Wing pattern includes numerous small spots scattered through the whole surface and larger spots along frontal margin. Venation: arculus present, numerous cross-veins in costal cell, R_2 short distance from base of R_3 , $r-m$ at the base of M_{1+2} , discal cell elongate,

m-cu oblique, short distance beyond base of discal cell. Anal angle small, widely rounded. Tibial spurs lacking. Claw simple, spineless.

Abdomen: Elongate, usually with abundant small dark spots scattered on tergites and sternites. Male genitalia narrow. Gonocoxite elongate, simple, without ventro-mesal lobe, two pairs of terminal gonostyli. Interbase long and narrow, sometimes with modified apex. Penis simple, long and narrow. Ovipositor with long arched and sclerotized cercus and distinctly shorter hypovalva, usually reaching to about middle of cercus.

Larva.

General: Body slender, terete, yellowish, covered with dense golden hairs.

Head: Elongate-oval, depressed dorsoventrally and very reduced. Genae reduced to one pair of sclerotized internolateralia and two pairs of sclerotized externolateralia. Labrum and clypeus separated. Labrum membranous, elongate-oval with several symmetric sensory structures, anterior part produced into two truncate lobes confluent medially. Clypeus trapezoid, slightly sclerotized, anterior part with symmetrical sensory rings and cushions of long hairs. Frons reduced. Antenna reaching half the length of the mandible. Basal segment of antenna cylindrical, five times as long as width at the base. Apical segment short and sculptured. Mandible sickle-shaped, with a single sharp, curved apical tooth and small tooth at base. Maxilla elongated, approximately as long as one-third of head capsule, inner and outer parts of maxilla fused. Ventral part of head capsule connected with hypopharyngeal bar.

Abdomen: Posterior margins of each abdominal segment elevated into a transverse ridge of hairs, segments II–VII divided into anterior and posterior parts. Terminal segment narrower than penultimate. Spiracular field surrounded by four flattened elongate lobes, dorsal lobe completely reduced. Lateral lobe almost as long as width at base. Ventral lobe more than twice as long as lateral, it is almost three times as long as width at base. Each lobe with long apical hairs, these on lateral lobe almost five times as long as lobe itself, on ventral lobe almost ten times as long as lobe itself. Lateral lobe almost entirely covered with dark sclerite. Ventral lobe with two elongated, narrow, dark sclerites, outer sclerite wider and longer and reaching almost middle of spiracle. Spiracle small and circular. Area separating spiracles as wide as spiracle itself. Anus surrounded by four short, white and fleshy anal papillae. Larvae are developing at the bottom of small springs covered with sand and silt.

Pupa.

General: Body brown.

Head: Cephalic crest absent. Antennal sheath short, reaching base of wing. Labrum trapezoid with blunt rounded apex. Labial lobe diamond-shaped with out-groove on inner margin. Maxillary palpus broad, transver-

sal with small tubercles.

Thorax: Pronotal breathing horn elongated with flattened and rounded distal part. Apex of wing reaching posterior margin of second abdominal segment. Legs almost reaching posterior margin of third abdominal segment.

Abdomen: Tergites and sternites with transverse rows of acute spines anteriorly and posteriorly. Segments II–VII with numerous transverse wrinkles, pleurites II–VII with acute spines posteriorly. Terminal segment of male pupa acute and narrow. Ventral lobe (anal spine) well developed with acute tip directed upward. Posterotergal spine smaller, point-apexed, directed upward. Terminal segment of female pupa elongate. Sheath of cercus longer than valve, directed upward with acute apical spine.

Nine extant species belong to the genus *Conosia*. The highest diversity is in the Afrotropical Region with seven species, while Oriental Region and Australia/Oceania have two species each. One species, *C. irrorata* (Wiedemann, 1828) has a very wide distribution, extending from Australia, Africa, Oceania islands, Oriental Region, West and East Palearctic. No fossil species of *Conosia* have been described (Evenhuis, 2014).

Check list of Korean *Conosia* crane flies

Conosia irrorata (Wiedemann, 1828)

***Conosia irrorata* (Wiedemann, 1828)**

Limnobia irrorata Wiedemann, 1828: 574.

Limnobia substituta Walker, 1848: 39.

Limnophila crux Doleschall, 1857: 388–390.

Conosia irrorata van der Wulp, 1880: 161; Alexander, 1955: 341–342; 1964: 377.

General: Body coloration yellowish brown to grayish brown dusted with gray pubescence, covered with abundant small dark brown spots. Body length of male 9.1–13.9 mm, of female 12.1–14.5 mm, wing length of male 7.2–9.7 mm, of female 8.3–11.2 mm.

Head: Grayish brown densely covered with pruinosity, indistinct rusty brown line along middle of vertex less distinct on tubercle, grayish along eye margin, with semi-erect setae dorsally. Vertex with small tubercle. Head narrows posteriorly. Eyes widely separated dorsally in both sexes, but meet each other ventrally. Antenna 12-segmented (Fig. 6A), 1.1–1.3 mm long in male, 1.2 mm in female, reaching slightly beyond frontal margin of prescutum, if bent backward, with large, strongly elongate dark brown scape densely covered with gray pruinosity, comparatively big dark brown pedicel, first flagellomere dark brown, distinctly smaller than pedicel, subglobular, but distinctly wider than remaining elongate flagellomeres. Apical flagellomere very short, button-shaped. Longest verticils three times as long as respective segments on basal flag-

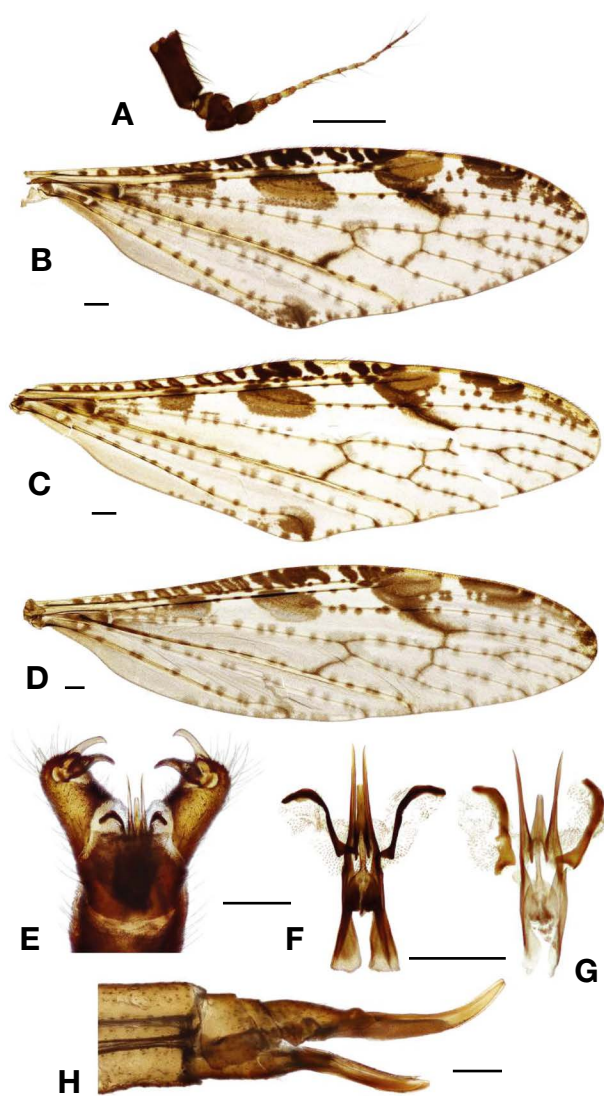


Fig. 6. *Conosia irrorata* (Wiedemann, 1828). A. male antenna. B. male wing. C. male wing, variation. D. female wing. E. male genitalia, dorsal view. F, G. eedeagal complex. H. ovipositor, lateral view. Scale bars: 0.3 mm.

ellomeres, twice as long on distal flagellomeres. Rostrum short dark brown, dusted with gray. Palpus dark brown, as long as scape, one segment strongly elongate, remaining palpomeres strongly reduced. Labella dark brown, covered with yellowish setae.

Thorax: Pronotum small, reduced, covered by frontal margin of prescutum dorsally. Mesonotal prescutum large, tubercular pits missing, pseudosutural fovea small and brown. Surface of prescutum covered with abundant small dark spots, and with three darker longitudinal stripes. Median stripe, divided longitudinally by narrow dark line. Scutal lobe same color as prescutal stripe, area between lobes lighter, without dark line along middle. Scutellum yellowish with dense cover of pubescence,

with erect golden setae posteriorly and with distinct dark brown line along middle. Katepisternum grayish with distinct dark brown line along middle. Pleuron slightly darker dorsally, lighter ventrally. Katepisternum naked. Meron small, thus second and third pairs of legs close to each other. Wing differs in male and female (Fig. 6B–D), wider in male narrower in female. Male wing with large projection of posterior margin at apex of vein A_2 . Wing pattern includes numerous small spots scattered through the whole surface and larger spots along frontal margin. Venation: arculus present, numerous cross-veins in costal cell, R_2 short distance from base of R_3 , $r-m$ at the base of M_{1+2} , cell m_1 about 1.5 times as long as its stem, discal cell elongate (distinctly shorter in Australian specimen), $m-cu$ oblique, short distance beyond base of discal cell. Distal part of anal vein distinctly arched. Anal angle small, widely rounded. Length of male halter 1.0–1.5 mm, of female 1.1–1.5 mm. Tibial spurs lacking. Male femur I: 3.6–5.3 mm long, II: 4.7–6.1 mm, III: 5.3–7.7 mm, tibia I: 4.4–6.3 mm, II: 4.2–4.8 mm, III: 5.3–6.5 mm, tarsus I: 3.4–6.0 mm, II: 2.9–4.1 mm, III: 2.7–4.3 mm. Female femur I: 4.9 mm long, tibia I: 6.25 mm. Claw simple spineless.

Abdomen: Distinctly elongate and extending beyond wing apices in both sexes, grayish-brownish yellow with abundant small dark spots scattered on tergites and sternites. Spots becoming denser towards distal end. Male genitalia (Fig. 6E) narrow, not wider than remaining abdominal segments. Gonocoxite elongate, simple without ventro-mesal lobe, two pairs of terminal gonostyli. Interbase long and narrow, sometimes with modified apex. Penis simple long and narrow (Fig. 6F, G). Ovipositor (Fig. 6H) with long arched and sclerotized cercus and distinctly shorter hypovalva, usually reaching to about middle of cercus.

Elevation range in Korea: From sea level to more than 1800 m.

Period of activity in Korea: Adults are active from early April to late September.

Habitats: Meadow at pond margin at the edge of broad-leaved forest. The localities it especially favors are along small streams away from trees (Wood, 1952). Larvae were found in the wet, sandy gravel and reddish silt on the edge of a small trickle of water two to three inches in depth (Wood, 1952). Adults are attracted to light.

General distribution: Species is widely spread across warm territories of Palearctic and Oriental Regions, Australia, and Oceania islands. This species was already recorded from North and South Korea.

Examined material (Fig. 16F): 1 male (pinned), N. Korea, Seren Mts., 2000 ft., 1938.08.18, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Seren Mts., 2000–2500 ft., 1938.08.21–22, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Kankyo Nando, Puksu Pyak-

san, alt. 6000 ft., 1939.07.29, A. Y. Yankovsky (USNM); 2 females (pinned), N. Korea, Chonsani, 4000–4500 ft., 1940.07.08, A. Y. Yankovsky (USNM); 1 female (pinned), N. Korea, Chonsani, 4500 ft., 1940.07.12, A. Y. Yankovsky (USNM); 1 female (pinned), [S.] Korea, Kwangju, 1946.04.3–8, S. Kramer (USNM); 2 males (pinned), Korea, #6, Hwy, #13, 6 mi., E. Seoul, 1 mi., W. Han River, alt. 150 ft., 1954.05.20, G. W. Byers (SMEK); 1 male (pinned), S. Korea, #27, Hwy, #13, 6 mi, E. Seoul, 1 mi., W. Han River, alt. 150 ft., 1954.08.19, G. W. Byers (SMEK); 1 male (pinned), Korea, 1959.08, Davis Trap 8 (USNM); 1 male (pinned), Korea, 1959.08, Davis Trap 16 (USNM); 1 female (pinned), N. Korea, Pyongyang City, Mt. Daesong-san, No 554, 1979.09.20, T. Vásárkelyi (HNHM); 3 females (pinned), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, Eoryong-ri, Neutral Nations Supervisory Commission Camp, N 37.95467, E 126.67997, alt. 32 m, 2015.07.08, T. E. Klein, H.-C. Kim, Mosquito Magnet, (NIBR); 1 male (pinned), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, Eoryong-ri, Neutral Nations Supervisory Commission Camp, N 37.95467, E 126.67997, alt. 32 m, 2015.08.05, T. E. Klein, H.-C. Kim, Mosquito Magnet, (NIBR); 1 male, 1 female (pinned), S. Korea, Jeju-do, Cheju, Jochon-eup, Seonheul-ri, N 33.50994, E 126.71541, alt. 151 m, 2017.05.23 (3), coll. S. Podenas, at light (NIBR); 1 female (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Jindong-myeon, Dongpa-ri, Bonifas, N 37.92582, E 126.77410, alt. 19 m, 2017.08.16, T. A. Klein, H.-C. Kim, NJ trap (NIBR); 1 female (in EtOH), S. Korea, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N 38.03644, E 127.23226, alt. 150 m, 2017.08.22, T. A. Klein, H.-C. Kim, NJ trap (NIBR); 1 male (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeongja-ri, Warrior Base Training Area, N 37.91777, E 126.74159, alt. 18 m, 2017.08.28, T. A. Klein, H.-C. Kim, NJ trap (NIBR); 1 male (in EtOH), S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Jeongja-ri, Warrior Base Training Area, N 37.91777, E 126.74159, alt. 18 m, 2019.06.26, T. A. Klein, H.-C. Kim, NJ trap (NIBR). Compared also with: 2 males (pinned) Japan, Kyoto, 1914.05.25, A. Nohira (USNM); 1 female (pinned), [Japan], Kamuikotan, Hokkaido, 1922.08.22, T. Esaki; 2 males (slide-mounted), Philippines, Lucban, Luzon, Tayabas Prov., 1926.05, R. C. Mc Gregor (USNM); 1 male (pinned), South China, Canton, Honem Island, P'an-yu District, 1936.09.28, J.K. To (USNM); 1 male (slide-mounted), N. Solomon Island, Bougainville I., alt. 1000 ft., 1944.IX–XI, J. Laffoon (USNM); 1 male (pinned), Japan, Hokkaido, Sapporo, Kotoni, 1953.08.10, S. Kuwayama (USNM); 1 male (slide-mounted), Angola, Alto Chicapa, Tchimbona river, 1954.08, ANG. 3739.1, Machado (USNM); 1 male (slide-mounted), S. Rhodesia [Zimbabwe], Salisbury, 1956.04.07, Smithers (USNM); 1 male (slide-mounted), India, Kumam, Almora, Ba-

gheswar, alt. 3200 ft., 1958.09.23, J. Schmid (USNM); 1 female (slide-mounted), Java, Buitenzorg, 1969.01.10, B. & P. (USNM); 1 male (pinned), Australia, Queensland, Babinda, 1920.01, scrub leaves (ANSP); 1 male (pinned) China, Soochow, From N GistGee (ANSP); 1 male (pinned), China, Anhui Province, Wuhu City, Nanling County, 2017.01.01, Q. Men (NRC).

Dicranophragma Osten Sacken, 1860

Limnophila (*Dicranophragma*) Osten Sacken, 1860: 240–241; Alexander, 1943: 381–382.

Dicranophragma Starý, Reuch, 2009: 209.

Type species: *Limnophila fuscovaria* Osten Sacken, 1860 (North America).

Adult.

Small crane flies with body length 4.5–7.5 mm and wing length 5.4–8.2 mm. Body coloration varies from yellow, gray, brown, to dark brown.

Head: Rounded posteriorly without neck-like extension. Vertex wide without or with small indistinct tubercle. Antenna 16-segmented, usually longer in male, reaching from frontal margin of prescutum to wing base, if bent backwards. Verticils long and distinct, longer than respective segments.

Thorax: Prothorax elongate. Mesonotal prescutum with small distinct separate tubercular pits at frontal margin, pseudosutural fovea distinct, sclerite usually with longitudinal stripes. Pleuron with bare katapisternum and small reduced meron, thus middle and posterior coxae close to each other. Wing long and narrow, cells without macrotrichiae. Venation: *arculus* missing, vein *Sc* long, reaching wing margin at or beyond branching point of *Rs*; *Rs* long, arched at base; cell *r*₃ with short stem; cell *m*₁ present, deep in some species, very small in other, sometimes missing in some specimens; discal cell always present, elongate; cross-vein *m-cu* close to the middle of discal cell. Anal vein long, slightly sinuous, reaching wing margin close to the level of *Rs* base. Anal cell long and narrow. Wing squama setoseless. All legs with tibial spurs, usually foreleg with single spur, middle and posterior legs with two spurs each.

Abdomen: Tergites with paired transverse sutures. Male terminalia approximately as wide as the rest abdominal segments, slightly elongate. Ninth tergite wider than longer, simple, without additional structures. Gonocoxite strongly elongate, more than twice as long as wide, interbase well developed, often spoon-shaped, two pairs of terminal gonostyli, outer gonostylus long and narrow, usually bidentate at apex, inner gonostylus fleshy and setose. Aedeagus usually short and straight, curved in *D. (Mixolimnomyia)* Savchenko, 1979. Ovipositor with long and narrow cerci and hypovalvae, distal part of cercus slightly raised upwards.

A total of 49 species belong to *Dicranophragma* worldwide (Oosterbroek, 2020). They are divided into three subgenera, two of them, *D. (Brachylimnophila)* Alexander, 1966 and *D. (Dicranophragma)* Osten Sacken, 1860 occur in Korea, another, *D. (Mixolimnomyia)* (Savchenko, 1979) has only one species, recorded from Caucasus Mountains only. No fossil species are described (Evenhuis, 2014).

Larva.

Light brown, up to 8 mm long. Head capsule heavily reduced. Mandible large, sickle shaped. Maxilla elongate, inner and outer lobes fused. Hypopharyngeal bar present on ventral side. Spiracular disk surrounded by five short lobes and entirely fringed with short marginal hairs. Ventral lobe is the longest, dorsal short and blunt, sclerites on lateral and ventral lobes V-shaped, dorsal lobe not pigmented, but lined with longitudinal stripes, ventral lobe with long apical seta.

Pupa.

Length up to 6 mm. Head, pronotal horns, sheaths of wings and legs dark brown, abdomen light brown. Cephalic crest prominent. Pronotal horns short, cylindrical, slightly narrowed apically. Mesonotum unarmed. Wing sheaths short, reaching distal margin of second abdominal segment. Sheaths of legs reaching base of fourth abdominal segment. Abdominal segments divided by transverse groove into anterior and posterior parts, anterior part with eight slender tubercles on dorsal surface, posterior part with a transverse row of spines. Spiracles present. Terminal end of male blunt, with additional spines. Terminal segment of female elongated, with additional spines.

Preimaginal stages develop in rich organic mud.

Check list of Korean *Dicranophragma* crane flies

Dicranophragma (Brachylimnophila) transitorium (Alexander, 1941)

Dicranophragma (Dicranophragma) melaleucum melaleucum (Alexander, 1933)

Key to Korean species of the genus *Dicranophragma* Osten Sacken

1. Wing patternless, without dark spots except stigma, cell m_1 small, few times shorter than its stem, sometimes lacking (Fig. 7B–D) *Dicranophragma (Brachylimnophila) transitorium* (Alexander, 1941)
- Wing with abundant dark spots, cell m_1 long, at least as long as its stem, usually longer (Fig. 8A, B) *Dicranophragma (Dicranophragma) melaleucum melaleucum* (Alexander, 1933)

Dicranophragma (Brachylimnophila) Alexander, 1966
Limnophila (Brachylimnophila) Alexander, 1966: 119–

121; Savchenko, Krivolutskaya, 1976: 65.

Neolimnomyia (Brachylimnophila) Savchenko, 1983: 61; 1986: 323–324.

Neolimnomyia (Brachylimnophila) Savchenko, 1989: 95–96.

Dicranophragma (Brachylimnophila) Starý, Reusch, 2009: 208–209.

Type species: *Limnophila brevifurca* Osten Sacken, 1860 (North America).

Adult.

Small crane flies with body length 5.8–7.3 mm and wing length 7.1–8.2 mm. Body coloration varies from gray or bluish-gray to brown.

Head: Vertex with small tubercle. Head broadly rounded posteriorly. Antennal flagellum 14-segmented. Verticils exceeding length of respective segments.

Thorax: Pronotum large. Mesonotal prescutum with small but distinct and separate tubercular pits at frontal margin. Pseudosutural fovea large. Wing setoseless, usually without pattern, sometimes with brownish spots at cord and at base of *Rs* (*D. adjuncta* (Walker, 1848)). Stigma light, setoseless. Vein *Sc* long, reaching distinctly beyond branching point of *Rs*, *sc-r* at or slightly beyond branching point of *Rs*, cell r_3 without additional cross-vein, discal cell always present, cell m_1 very small, missing in some specimens, anal vein nearly straight, anal cell long and narrow with widely rounded posterior margin. Wing squama setoseless.

Abdomen: Abdominal tergites with paired transverse sutures. Male terminalia: ninth tergite wider than longer, posterior margin nearly straight, gonocoxite elongate with large interbase and without ventro-mesal lobe. Two pairs of gonostyli. Outer gonostylus long and slender, sclerotized, smooth, shortly bidentate at apex. Inner gonostylus elongate, fleshy and setose. Interbase spoon-shaped. Parameres separate. Aedeagus simple, straight elongate tube.

Subgenus includes 13 species worldwide and has Holarctic and Oriental distribution. Five species recorded from East Palearctic, five from West Palearctic, four from Oriental and two from Nearctic Regions (Oosterbroek, 2020), no fossil species (Evenhuis, 2014).

Larva. As described for the genus, except frons, which is reduced to a trapezoidal plate and abdominal segments VI–VII having ventral creeping welts.

Pupa. As described for the genus.

Dicranophragma (Brachylimnophila) transitorium (Alexander, 1941)

Limnophila transitoria Alexander, 1941: 56–57.

Dicranophragma (Brachylimnophila) transitorium Kato, Tachi, 2018: 32–33.

Adult.

General: Body coloration brownish gray. Body length of male 5.8–6.6 mm, female 6.3–7.3 mm. Wing length of male 7.5–8.2 mm, female 7.1–7.3 mm.

Head: Light gray frontally and along eye margin, darker posteriorly, densely covered with pruinosity, sparsely covered with long brownish setae. Vertex with small darkened tubercle. Eyes widely separated in both sexes, distance between them at base of antennae slightly exceeds length of scape. Antenna (Fig. 7A) 1.2–1.3 mm long in male, 1.3 mm in female, reaching frontal margin of prescutum at most, if bent backward. Scape elongate, nearly cylindrical, twice as long as pedicel, brown, dusted with brownish-gray. Pedicel widened distally, brown. Basal flagellomeres oval, distal elongate. Basal flagellomere yellow, third segment brownish yellow, remainder of flagellum brown. Apical flagellomere subequal to preceding segment. Verticils dark brown, longest verticils approximately 1.5 times as long as respective segments. Rostrum brown dorsally, gray laterally because of dense pruinosity. Palpus dark brown, sparsely covered with gray pruinosity.

Thorax: Cervical sclerites dark brown ventrally, densely dusted with gray laterally. Pronotum gray with few erect brownish setae. Mesonotal prescutum gray with four dark brown longitudinal stripes. Medial stripes not reaching posterior margin of sclerite. Tubercular pits small but distinct at frontal margin of sclerite. Pseudosutural fovea distinct, polished dark brown. Scutal lobe light gray with dark spot in the middle, area between lobes dark brown. Scutellum uniformly brownish gray. Mediotergite gray to bluish gray. Dorsopleural membrane yellowish gray. Pleuron gray, anepisternum and ventral margin of katepisternum slightly darkened. Wing (Fig. 7B–D) iridescent, semi-translucent with brownish tinge and no other darker spots except indistinct pale-brownish stigma. Veins light brown, yellowish at wing base. Venation: *Sc* long, reaching wing margin distinctly beyond branching point of *Rs*, *sc-r* at branching point of *Rs*. *Rs* long, arched at base. Free end of *R*₁ long, four times as long as *R*₂. *R*₂ transverse, far beyond branching point of *R*₂₊₃ and *R*₄. *R*₃ and *R*₄ slightly diverging towards wing margin, cell *r*₃ with very short stem. Cross-vein *r-m* distinct, at base of discal cell. Cell *m*₁ very small, its stem 3.5–7.0 times as long as cell itself, sometimes cell *m*₁ completely missing. Discal cell 2.2 times as long as wide. Cross-vein *m-cu* slightly before middle of discal cell. Anal vein long, slightly sinuous, apex far beyond the level of *Rs* base. Anal angle long and narrow, widely rounded. Length of male and female halter 0.9–1.0 mm, stem grayish yellow, knob slightly infuscated at apex. Coxa brownish yellow sparsely dusted with gray. Trochanter grayish yellow. Femur brownish yellow indistinctly darkened distally. Tibia brownish yellow, narrowly darkened at apex. Basal tarsomere pale yellow with brown distal end, remainder of tarsum brown to

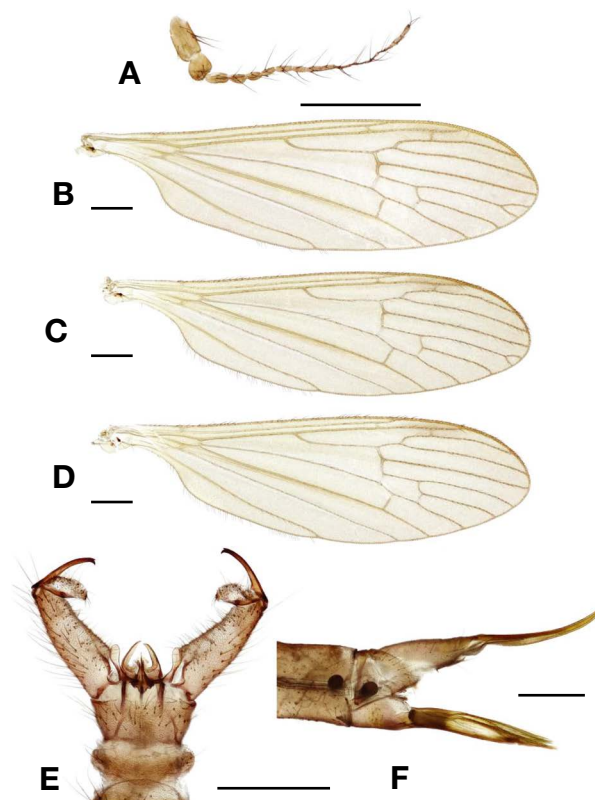


Fig. 7. *Dicranophragma (Brachylimnophila) transitorium* (Alexander, 1941). A. male antenna. B–D. wings. E. male genitalia, dorsal view. F. ovipositor, lateral view. Scale bars: 0.5 mm.

dark brown. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 3.8–4.0 mm long, II: 4.1–4.5 mm, III: 4.5–4.8 mm, tibia I: 4.5–4.9 mm, II: 4.0–4.3 mm, III: 4.2–4.8 mm, tarsus I: 4.8–5.2 mm, II: 4.4–4.8 mm, III: 3.2–3.9 mm. Female femur I: 3.8 mm long, II: 4.0 mm, III: 4.5 mm, tibia I: 3.8 mm, II: 3.5 mm, III: 4.0 mm, tarsus I: 3.5 mm, II: 3.5 mm, III: 3.3 mm long. Claw simple, spineless.

Abdomen: Abdominal tergites semi-polished yellowish brown, sparsely covered with erect yellowish setae. Tergites with paired transverse sutures at about one-third length of sclerite. Sternites brownish yellow with darker brown lateral margins, and erect yellowish setae. Pregenital segments (VII–VIII) darker brown. Male terminalia (Fig. 7E) yellow. Ninth tergite wider than longer, posterior margin nearly straight. Gonocoxite elongate, 2.7 times as long as width at base, interbase spoon-shaped, ventro-mesal lobe absent. Outer gonostylus long and narrow, blackened distally, slightly arched with bidentate apex. Inner gonostylus wide, fleshy and setose. Paramere long stick-shaped, just slightly arched. Aedeagus short and straight. Ovipositor (Fig. 7F) light brown with yellow apex of cercus. Cercus very long and narrow, distal part slightly raised upwards. Hypoalva long and straight,

point-apexed, tip reaching to about two-thirds of cercus, dorsal margin with long dense setae distally.

Larva and pupa: Unknown.

Elevation in Korea: From 640 to 1900 m.

Period of activity in Korea: From middle of June to late August.

Habitats: Comparatively dry, young deciduous forest with sparse, grassy vegetation on the ground, dominated by *Sasa borealis* (Hack.) and *Equisetum*; mixed forest with water pools near mountainous river. Species was not collected at light.

General distribution: Was recorded only from Honshu and Shikoku Islands of Japan.

Examined material (Fig. 16G): 3 males (pinned), N. Korea, Chonsani Paiktusan, 4700 ft., 1937.07.09, A. Y. Yankovsky (USNM); 4 males, 1 female (pinned), N. Korea, Chonsani Paiktusan, 4700 ft., 1937.07.16, A. Y. Yankovsky (USNM); 1 female (pinned), N. Korea, Chonsani Paiktusan, 3500 ft., 1937.07.23, A. Y. Yankovsky (USNM); 1 female (pinned), Korea, Pyaksan, 5500 ft., 1939.06.13 (USNM); 2 females (pinned), P. Korea, 5800 ft., 1939.06.14 (USNM); 1 specimen with broken abdomen (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5500 ft., 1939.06.14, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.06.15, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5000 ft., 1939.06.21, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.07.17, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5000 ft., 1939.07.17, A. Y. Yankovsky (USNM); 2 females (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.07.19, A. Y. Yankovsky (USNM); 2 males, 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.07.27, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.07.29, A. Y. Yankovsky (USNM); 2 males, 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.08.02, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5000 ft., 1939.08.02, A. Y. Yankovsky (USNM); 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5000 ft., 1939.08.03, A. Y. Yankovsky (USNM); 3 males, 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.08.03, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.08.06, A. Y. Yankovsky (USNM); 1 male (pinned), P.P. Korea, 5000 ft., 1939.08.08 (USNM); 1 male (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 4000 ft., 1939.08.08 A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Kankyo Nando,

Puksu Pyaksan, alt. 5000 ft., 1939.08.08, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5000 ft., 1939.08.11, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5000 ft., 1939.08.21, A. Y. Yankovsky (USNM); 1 specimen with broken abdomen (pinned), N. Korea, Chonsani, 4500 ft., 1940.06.13, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, 6200 ft., 1940.07.23, A. Y. Yankovsky (USNM); 3 males (in EtOH), S. Korea, Gangwon-do, Hongcheon-gun, Nae-myeon, Yuljeon-ri, N 37.73849, E 128.34566, alt. 798 m, 2014.08.21 (1), S. Podenas, S. Kim (NIBR); 4 males, 3 females (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP, N 37.72425, E 128.59814, alt. 641 m, 2015.07.06 (2), S. Kim, S. Podenas (NIBR). Also compared with: paratype (as *Limnophila transitoria*), male (antenna, hind leg, wing and male terminalia slide mounted), Japan, Honshiu, Kamikochi, Alps, alt. 5000 ft., 1939.06.18, E. Suenson (USNM); paratype (as *Limnophila transitoria*), male (antenna, fore leg, wing and male terminalia slide mounted), Japan, Honshiu, Kamikochi, Alps, alt. 5000 ft., 1939.06.19, E. Suenson (USNM).

Dicranophragma (Dicranophragma) Osten Sacken, 1860
Limnophila (Dicranophragma) Osten Sacken, 1860: 240; Ishida, 1959: 3; Alexander, 1943: 378, 381–382; 1965a: 65; Savchenko, Krivolutskaya, 1976: 63; Savchenko, 1989: 90.

Dicranophragma (Dicranophragma) Kato, Tachi, 2018: 29.

Type species: *Limnophila fuscovaria* Osten Sacken, 1860 (North America).

Adult.

Small crane flies with body length 4.5–7.5 mm and wing length 5.4–7.5 mm. Body coloration brown to dark brown.

Head: Vertex without tubercle. Head rounded posteriorly.

Thorax: Mesonotal prescutum with small but distinct tubercular pits and pseudosutural fovea. Wing setoseless, wider in male with posterior margin widened at distal part of anal vein, patterned with abundant dark spots and cloudy areas, stigma distinct, dark brown. Vein *Sc* long, reaching beyond branching point of *Rs*, cell *r*₃ with additional cross-vein, discal and *m*₁ cells present, cell *m*₁ deep, anal vein strongly arched at wing margin, anal cell long and narrow, especially in male.

Abdomen: Abdominal tergites with paired transverse sutures. Male terminalia: ninth tergite wider than longer, gonocoxite elongate, nearly cylindrical, without ventro-mesal lobe. Two pairs of gonostyli. Outer gonostylus long and narrow, sclerotized, bifid at apex. Inner gonosty-

lus elongate, fleshy and setose. Parameres fused and making plate below the aedeagus. Aedeagus simple, elongate tube.

Subgenus includes 35 extant species worldwide (Oosterbroek, 2020), no fossil species (Evenhuis, 2014). The highest diversity observed in Oriental Region (24 species) and East Palearctic (7 species), only few representatives are known from the Afrotropical and Nearctic Regions.

Larva and pupa described for North American species only.

Larva generally as described for the genus, except entirely reduced frons and missing creeping welts. Pupa generally as described for the genus.

The early stages are spent in rich organic mud (Alexander, 1920b).

***Dicranophragma (Dicranophragma) melaleucum melaleucum* (Alexander, 1933)**

Limnophila (Dicranophragma) melaleuca Alexander, 1933: 143–144.

Dicranophragma (Dicranophragma) melaleucum melaleucum Kato, Tachi, 2018: 36–37.

Adult.

General body coloration brown. Body length of male 4.5–5.8 mm, of female 5.7–7.5 mm. Wing length of male 5.5–6.3 mm, of female 5.4–7.5 mm.

Head: Dark brown densely covered with brownish-gray pruinosity, sparsely covered with long golden setae. Vertex with two large dark brown spots, one anteriorly, another posteriorly. Eyes widely separated in both sexes, distance between them at base of antennae approximately same as length of scape. Antenna 0.8–1.3 mm long in male, 1.0–1.2 mm in female, extending slightly beyond frontal margin of prescutum, if bent backward. Scape elongate, nearly cylindrical, twice as long as pedicel, brown, dusted with brownish-gray. Pedicel widened distally, obscure yellow. Basal flagellomeres oval, distal elongate. Two basal flagellomeres pale yellow, third segment brownish yellow, remainder of flagellum dark brown. Apical flagellomere as long as preceding segment. Verticils dark brown, longest verticils approximately 1.5 times as long as respective segments. Rostrum brown, densely dusted with brownish gray. Palpus black.

Thorax: Cervical sclerites brown densely dusted with brownish gray. Pronotum grayish brown with narrow longitudinal dark brown line laterally. Mesonotal prescutum grayish brown with three wide longitudinal stripes narrowly bordered by dark brown except posterior margin. Dark brown fills all interspaces between stripes and reaches posterior margin of sclerite. Medial stripe darker brownish gray, lateral yellowish. Tubercular pits small and black at frontal margin of sclerite. Pseudosutural fovea small but distinctly black. Scutal lobe, area between

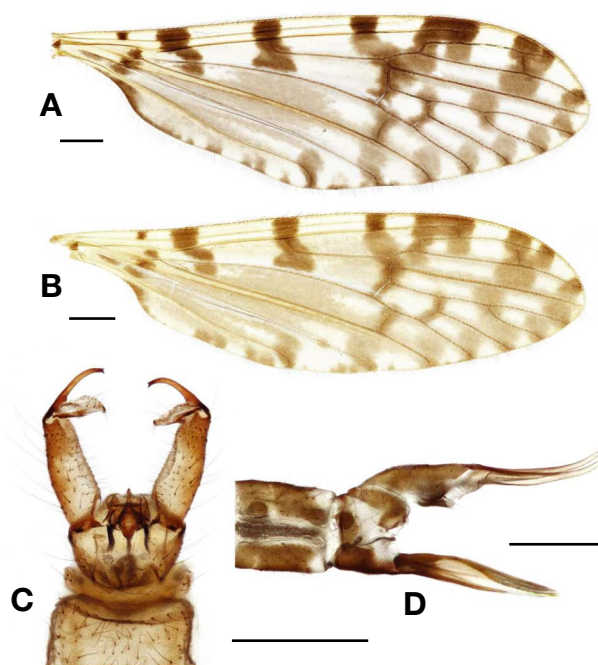


Fig. 8. *Dicranophragma (Dicranophragma) melaleucum melaleucum* (Alexander, 1933). A. male wing. B. female wing. C. male genitalia, dorsal view. D. ovipositor, lateral view. Scale bars 0.5 mm.

lobes and scutellum concolorous with medial stripe. Mediotergite brownish gray medially, yellowish laterally. Dorsopleural membrane pale frontally. Pleuron dark brown, semi-polished, sparsely dusted with brownish gray. Wing iridescent with abundant large brown spots at frontal wing margin, at base of *Rs*, at tips of longitudinal veins and around cross-veins, with brownish cloudy areas along middle and few small dot-shaped spots along posterior margin. Wing narrower in female, wider in male (Fig. 8A, B). Stigma distinct, dark brown, elongate. Veins grayish brown to dark brown in darkened areas, yellow at wing base. Venation: *Sc* long, reaching wing margin slightly beyond branching point of *Rs*, *sc-r* slightly before branching point of *Rs*. *Rs* long, distinctly arched or angulated at base. Free end of *R*₁ short, just slightly exceeds length of *R*₂. *R*₂ transverse, far beyond branching point of *R*₂₊₃ and *R*₄. *R*₃ and *R*₄ nearly parallel to each other, cell *r*₃ with short stem and additional cross-vein at distal end. Cross-vein *r-m* distinct, at base of discal cell. Discal cell twice as long as wide. Cross-vein *m-cu* slightly before middle of discal cell. Anal vein long, slightly sinuous, apex at the level of *Rs* base. Anal angle long and narrow, widely rounded. Posterior wing margin distinctly widened in male. Length of male halter 0.8–0.9 mm, of female 0.8–1.1 mm, stem pale yellow, knob dark brown at base, pale yellow at apex. Coxa semi polished, dark brown ventrally, grayish-yellowish brown dorsally. Trochanters yellowish dorsally, brown ventrally. Femur yellow with

indistinct darker subapical ring and narrowly whitish apex. Tibia yellow with slightly darker distal end. Basal tarsomere yellow, slightly darker towards distal end, remaining tarsomeres brown to dark brown. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 3.4–3.8 mm long, II: 3.5–4.2 mm, III: 3.5–4.5 mm, tibia I: 3.6–4.0 mm, II: 3.6–4.0 mm, III: 4.0–4.8 mm, tarsus I: 3.6–4.5 mm, II: 3.0–3.5 mm, III: 2.8–3.1 mm. Female femur I: 3.0–4.5 mm long, II: 4.0–4.5 mm, III: 3.3–5.0 mm, tibia I: 3.3–5.0 mm, II: 4.0–4.2 mm, III: 3.7–5.0 mm, tarsus I: 2.7–4.4 mm, II: 3.1–3.7 mm, III: 2.5–3.0 mm long. Claw simple, spineless.

Abdomen: Abdominal segments semi-polished dark brown with narrowly gray posterior margins, sparsely setose. Tergites with paired transverse sutures at about one-third of sclerite. Male terminalia (Fig. 8C) dark brown. Ninth tergite distinctly wider than longer, posterior margin slightly concave. Gonocoxite elongate, 2.8 times as long as width at base, interbase spoon-shaped with rounded distal part, ventro-mesal lobe absent. Outer gonostylus sclerotized, long and narrow, strongly curved with shallowly bidentate apex. Inner gonostylus elongate, wide and fleshy, setose. Parameres fused ventrally. Aedeagus short and straight. Ovipositor (Fig. 8D) dark brown at base, cercus and hypovalva brownish yellow. Cercus very long and narrow, distal part slightly raised upwards, point-apexed. Hypovalva long and straight, point-apexed, reaching to about four-fifths of cercus.

Larva and pupa: Unknown.

Elevation in Korea: From less than 100 to 750 m.

Period of activity in Korea: The highest activity is observed from late June to late August, but it is possible that adults start flying from mid May since pupa were collected at that time. The latest specimen was collected in mid October.

Habitats: Slopes to mountainous, rocky streams densely covered with deciduous trees and shrubs. Sometimes could be collected at light.

General distribution: Species previously known only from Kyushu Island, Japan.

Examined material (Fig. 16H): 1 female (pinned), [S.] Korea, #20, 2 mi S. Pup'young-ni, 16 mi. NE Seoul, 300–450 ft., 1954.07.11, G. W. Byers (SMEK); 1 female (in EtOH), S. Korea, Gyeongsangnam-do, Geoje-si, Irun-myeon, Mangchi-ri, Mt. Bukbyeong-san, temple Yeongwon-sa, N 37.45833, E 128.50444, alt. 749 m, 2009.10.10, J. D. Yeo *et al.* (NIBR); 1 female pupa (reared, adult pinned), S. Korea, Jeollanam-do, Gurye, Toji-myeon, Naedong-ri, N 35.26580, E 127.58128, alt. 378 m, 2013.05.10, V. Podeniene (NIBR); 1 female (in EtOH), S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Hwaak-ri, N 37.98402, E 127.52676, alt. 579 m, 2014.08.20 (2), S. Kim (NIBR); 2 males (pinned), S. Korea, Jeol-

lanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.06.26, S. Podenas (NIBR); 4 males, (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (1), S. Podenas (NIBR); 1 female (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (2), S. Podenas (NIBR); 3 males, 1 female (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.29 (1), S. Podenas (NIBR); 1 male (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.07.03 (1), V. Podeniene (NIBR); 2 males, 2 females (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58093, alt. 414 m, 2019.06.24 (1), S. Podenas (NIBR); 1 male (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27333, E 127.56924, alt. 546 m, 2019.06.25 (1), S. Podenas (NIBR); 1 male (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58090, alt. 448 m, 2019.06.26 (2), S. Podenas, at light (NIBR). Also compared with: holotype (as *Limnophila (Dicranophragma) melaleuca*), male (foreleg and wing slide mounted), Japan, Kyushu, Wakasugi, Chikuzen, 1931.08.7–9, Esaki & others (USNM); allotype (as *Limnophila (Dicranophragma) melaleuca ignava*), female (wing slide mounted), W. China, Szechwan, Mt. Omei, alt. 4500 ft., 1931.08.12, Franck (USNM).

Eloeophila Rondani, 1856

Eloeophila Rondani, 1856: 182–183; Savchenko, Krivolutskaya, 1976: 59; Savchenko, 1983: 50; 1986: 302–306; 1989: 81–82.

Ephelia Schiner, 1863: 222; Lackschewitz, 1940: 72.

Trichephelia Alexander, 1938b: 73.

Limnophila (Elaeophila) Edwards, 1938: 77–78; Ishida, 1959: 2–3.

Type species: *Limnobia marmorata* Meigen, 1818 (= *maculata* (Meigen, 1804)) (Palearctic).

Adult.

Small to medium-sized crane flies with body length 3.5–10.0 mm and wing length 5.5–10.5 mm. Body coloration varies from yellow to brown and dark brown, often densely dusted with gray.

Head: Rounded posteriorly without neck-like extension. Vertex wide without tubercle, or with very small and indistinct tubercle. Antenna with 14-segmented flagellum, usually longer in male, reaching wing base or base of abdomen, if bent backwards. Flagellomeres elongate, sometimes oval, especially in female, apical segment subequal

in length to preceding. Verticils long and distinct, usually longer than respective segment.

Thorax: Prothorax elongate, frontal margin nearly straight. Mesonotal prescutum with small tubercular pits, pseudosutural fovea contrastingly polished black or brown, four longitudinal stripes, usually more distinct posteriorly. Pleuron with bare katepisternum, meron distinct, thus middle and posterior coxae removed from each other. Wing iridescent, long and narrow, usually with distinct pattern of many dark spots at wing base, at frontal margin, around branching points of veins and at apices of longitudinal veins. *Arculus* present, vein *Sc* long, reaching wing margin close to the branching point of *Rs*, *sc-r* slightly before tip of *Sc*. *R₁* short, longitudinal or oblique, *R₃* and *R₄* diverging. Cell *m₁* long with long stem. Discal cell always present, elongate. Cell *bm* always with additional cross-vein, *m-cu* distinctly beyond base, usually from one-third to the middle of discal cell. Anal vein long, sinuous, reaching wing margin beyond the level of *Rs* base. Anal angle wide, posterior margin widely rounded. Wing cells without macrotrichiae. Wing squama setoseless. Legs with tibial spurs, usually foreleg with single spur, middle and posterior legs with two spurs each.

Abdomen: Tergites with paired transverse sutures. Male terminalia elongate, approximately as wide as the rest abdominal segments. Ninth tergite wider than longer, posterior margin usually with wide but shallow emargination. Gonocoxite elongate, without interbase, often enlarged at base on ventro-mesal surface, two pairs of terminal elongated gonostyli, outer gonostylus sclerotised with one – three apical spines, inner gonostylus fleshy and setose. Aedeagus simple, short and straight. Ovipositor with long and narrow cercus and hypovalva, distal part of cercus usually slightly raised upwards.

Last instar larva.

Body covered with light brown pubescence, length up to 14 mm. Last abdominal segment (anal segment) constricted, penultimate inflated.

Head capsule: elongate-oval, depressed dorsoventrally and strongly reduced. Labrum trapezoid, sensory structures placed anteriorly. Clypeus distinctly divided from labrum, trapezoid, slightly sclerotized with a tuft of long hairs anteriorly, with fissure separating lateral part into a prominent lobe. Frons reduced. Antenna elongated, longer than mandible, basal segment cylindrical with upper part directed outward, apical segment short and sculptured, placed subterminally. Mandible sickle shaped, with a single sharp, curved apical tooth and few prominent teeth at the base. Maxilla narrows toward the tip with apical part directed outward and elongate, fusion of inner and outer parts incomplete, basal part sclerotized, apex with sensory structures. Cardo reduced into small sclerite. Ventral part of head capsule joined-up with the hypopharyngeal bar, consisting of two large lateral plates and a transversal bar.

Labial palpus well developed. Posterior part of head capsule consists of one pair of internolateralia and two pairs of externolateralia, internolateralia wider than externolateralia.

Spiracular disc: Spiracular field surrounded by four cylindrical, elongate and pointed lobes. Dorsal lobe reduced and inconspicuous. Ventral pair of lobes longer or subequal to lateral pair. Spiracular lobes could be sclerotized or without sclerites. Spiracles small, circular and widely separated.

Anal field: Anus surrounded by four short, white and fleshy anal papillae.

Pupa.

Length up to 12 mm. Body coloration brown. Head and thorax much darker than the rest of the body.

Head: Cephalic crest inconspicuous, consisting of four unequal lobes. Antennal sheaths short, reaching one-third of wing length.

Thorax: Respiratory horns elongated with minute annulations along entire length, apex slightly flattened and rounded. Dorsum of thorax smooth. Tip of wing reaching posterior margin of second abdominal segment. Legs reaching posterior margin of third abdominal segment, hind pair slightly longer than other pairs.

Abdomen: Segments II–VII with inconspicuous annuli. Tergites and sternites with transverse rows of small spinose tubercles and few scattered spines in between them on posterior and anterior parts. The middle part of pleurite forming sharp edge with two spines. Terminal segment of female pupa elongate, that of male blunt.

A total of 86 species belong to the genus *Eloeophila* worldwide (Oosterbroek, 2020). No recognized subgenera. The most diversity belongs to the Palearctic fauna with 35 species (20 species in West Palearctic and 17 in East Palearctic), Nearctic Region with 22 species, Oriental with 20 species, and Afrotropical Region with 9 species. Genus is not present in Australian and Neotropical Regions. One fossil species is described from Eocene period in Baltic amber (Podenas, 2003).

Check list of Korean *Eloeophila* crane flies

Eloeophila persalsa (Alexander, 1940)
Eloeophila serenensis (Alexander, 1940)
Eloeophila subaprilina (Alexander, 1919)
Eloeophila ussuriana ussuriana (Alexander, 1933)
Eloeophila yezoensis (Alexander, 1924b)

Key to Korean species of the genus *Eloeophila* Rondani

1. Basal half of wing with indistinct darkening at arcus at most (Fig. 12B). Antenna reaching beyond wing base, if bent backwards. Basal flagellomere at least as

- long as scape, remaining flagellomeres at least three times as long as their width (Fig. 12A).....
 *Eloeophila ussuriana ussuriana* (Alexander, 1933)
- Basal half of wing with five spots (sometimes merged into larger spots) (Figs. 9A, 10B, 11B, 13B). Antenna reaching wing base at most, if bent backwards. Basal flagellomere distinctly shorter than scape, remaining flagellomeres 1.5–2 times as long as wide (Figs. 9B, 10A, 11A, 13A) 2
2. Halter with brown knob and yellow stem 3
- Entire halter yellow 4
3. Scape dark brown, basal flagellomere pale brown. Femur with tip broadly dark brown
 *Eloeophila subaprilina* (Alexander, 1919)
- Scape pale brownish yellow, basal flagellomere light yellow. Femur scarcely tipped with darker
 *Eloeophila yezoensis* (Alexander, 1924b)
4. Basal flagellomeres yellow or brownish yellow. Mesonotal prescutum with separate medial and lateral stripes
 *Eloeophila persalsa* (Alexander, 1940)
- Basal flagellomeres dark brown, same as the remainder of flagellum. Mesonotal prescutum with medial and lateral stripes reaching each other
 *Eloeophila serenensis* (Alexander, 1940)

Eloeophila persalsa (Alexander, 1940)

Limnophila (*Elaeophila*) *persalsa* Alexander, 1940: 46.

Eloeophila (*Eloeophila*) *persalsa* Savchenko, Krivoluts-kaya, 1976: 62.

Eloeophila persalsa Savchenko, 1983: 51; 1989: 84.

General: Body coloration dark brown dusted with gray. Male body length 4.5–5.0 mm, wing length 6.7–7.5 mm. Female body length 5.0–5.7 mm, wing length 7.5–8.5 mm.

Head: Dark brown, densely dusted with gray and covered with sparse short erect brownish setae. Vertex without tubercle, but with darkening fronto-dorsally. Eyes widely separated in both sexes, distance between them at base of antennae slightly exceeds length of both basal antennomeres taken together. Antenna (Fig. 9B) 1.0–1.2 mm long in male, reaching to wing base, if bent backward. Antenna of female 1.0–1.2 mm long. Scape dark brown densely dusted with gray, elongate, nearly cylindrical, twice as long as pedicel. Pedicel brown, widened distally. Flagellomeres elongate, narrower towards apex of antenna, covered with whitish pubescence. Basal flagellomeres brownish yellow, distal brown to grayish brown. Apical segment subequal in length to preceding. Verticils dark brown, more than twice as long as respective segments. Rostrum, palpus, and mouth parts dark brown.

Thorax: Cervical sclerites and pronotum dark brown densely dusted with gray. Mesonotal prescutum dark brown dorsally brown laterally, dusted with gray, with

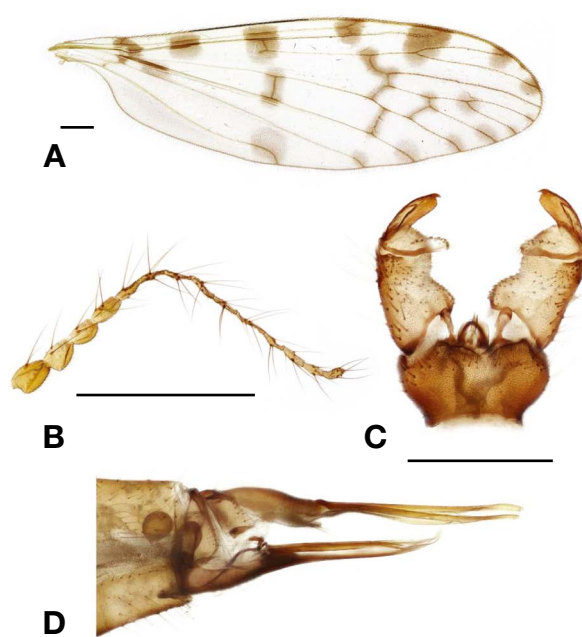


Fig. 9. *Eloeophila persalsa* (Alexander, 1940). A. wing. B. flagellum of male antenna. C. male genitalia, dorsal view. D. ovipositor, lateral view. Scale bars 0.5 mm.

four indistinct longitudinal stripes that are getting darker towards posterior margin of sclerite, medial pair narrowly separated with gray along middle, both stripes coming together posteriorly. Tubercular pits indistinct at frontal margin of sclerite, pseudosutural fovea distinct polished brown to dark brown. Scutal lobe grayish brown because of dense pruinosity with indistinct darker spot at middle. Area between lobes grayish brown, polished brown frontally. Scutellum grayish brown with few erect yellowish setae posteriorly. Mediotergite grayish brown. Pleuron uniformly brown covered with dense brownish-gray pruinosity. Wing (Fig. 9A) iridescent with grayish tinge, yellowish at base. Stigma distinct, dark brown, slightly elongate. Brownish spots at base of wing, surrounding branching points of veins and cross-veins and at tips of all longitudinal veins along wing margin. Veins brown in darkened areas, pale in light areas, yellowish at wing base. Venation: *Sc* long, reaching wing margin at branching point of *Rs*, *sc-r* about three times its length before tip of *Sc*. *Rs* long, angulate and short-spurred at base. Free end of *R*₁ short and oblique, *R*₂ indistinct, about twice its length before tip of *R*₁, less than its length beyond branching point of *R*₂₊₃ and *R*₄. *R*₃ and *R*₄ diverging, cell *r*₃ with long stem, which is approximately as long as discal cell. Cross-vein *r-m* distinct, slightly beyond base of discal cell. Discal cell 2.8 times as long as wide. Cross-vein *m-cu* at about one-third of discal cell. Additional cross-vein in cell *bm* slightly before base of *Rs* and distinctly before tip of anal vein. Anal vein long, slightly sinuous.

Anal angle wide. Halter yellow, knob same color as stem. Length of male halter 0.8–1.1 mm, that of female 1.0–1.1 mm. Coxae light brown, sparsely dusted with gray. Trochanters yellow to yellowish brown. Femur pale grayish yellow, narrowly but distinctly dark brown at apex. Tibia pale yellow with narrowly dark brown apex. Basal tarsomere pale yellow with darkened distal part, remainder of tarsus brown to dark brown. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 4.0–4.3 mm long, II: 4.4–4.5 mm, III: 4.0–5.5 mm, tibia I: 5.0–5.1 mm, II: 4.2–4.5 mm, III: 4.5–5.5 mm, tarsus I: 4.0–4.8 mm, II: 3.7–4.0 mm, III: 3.5–4.0 mm. Female femur I: 4.0–4.5 mm long, II: 4.5–4.7 mm, III: 4.5–5.0 mm, tibia I: 5.0–5.2 mm, II: 4.5–4.7 mm, III: 5.2–5.5 mm, tarsus I: 4.4–4.7 mm, II: 4.2–4.6 mm, III: 4.0–4.2 mm. Claw simple, without spines.

Abdomen: Abdominal segments brown, dusted with gray, covered with sparse yellowish erect setae. Tergites widely dark brown along posterior margin. Basal segments of female abdomen with yellowish markings at base of tergites and sternites. Male terminalia (Fig. 9C) dark brown. Ninth tergite wider than longer, posterior margin widely concave at middle. Gonocoxite elongate with large rounded ventro-mesal bump at base. Outer gonostylus elongate, sclerotised, finely serrated along outer margin, with single claw-shaped apical lobule. Inner gonostylus long and narrow, fleshy and setose. Paramere club-shaped. Aedeagus short and straight. Ovipositor (Fig. 9D) brownish yellow. Cercus long, narrow and slightly arched, blunt-apexed. Hypoalva long and straight, point-apexed, reaching before middle of cercus.

Elevation in Korea: From 300 to more than 1800 m.

Period of activity in Korea: From late June-late August.

Habitats: Unknown in Korea. Adults are active in affluent alder and willow groves and in moist mixed and coniferous forests along streams in Kurile Islands, Russia (Savchenko and Krivolutskaya, 1976).

General distribution: North Korea, Eastern part of Russia including Kurile and Sakhalin Islands.

Examined material (Fig. 16I): paratype (as *Limnophila (Elaeophila) persalsa*), male (wing and genitalia slide mounted), N. Korea, Seren Mts., alt. 3700 ft., 1938.06.30, A. Y. Yankovsky (USNM); paratype (as *Limnophila (Elaeophila) persalsa*), male (wing and genitalia slide mounted), N. Korea, Seren Mts., alt. 3000 ft., 1938.07.05, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Seren Mts., alt. 3700 ft., 1938.06.30, A. Y. Yankovsky (USNM); 1 specimen with broken abdomen (pinned), North Korea, Seren Mts., alt. 3500 ft., 1938.07.02, A. Y. Yankovsky (USNM); 1 female (pinned), North Korea, Seren Mts., alt. 2500 ft., 1938.07.03, A. Y. Yankovsky (USNM); 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1938.07.19, A. Y. Yan-

kovsky (USNM); 2 females (one genitalia in microvial with glycerol) (pinned), North Korea, Seren Mts., alt. 1000 ft., 1938.08.18, A. Y. Yankovsky (USNM); 1 female, 1 specimen with broken abdomen (pinned), North Korea, Seren Mts., alt. 2500 ft., 1938.08.21, A. Y. Yankovsky (USNM); 1 male (genitalia in microvial with glycerol), 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5500 ft., 1939.06.23, A. Y. Yankovsky (USNM); 1 male (genitalia in microvial with glycerol), 2 females, 1 specimen with broken abdomen (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6000 ft., 1939.07.14, A. Y. Yankovsky (USNM).

***Eloeophila serenensis* (Alexander, 1940)**

Limnophila (Elaeophila) serenensis Alexander, 1940: 47.

Eloeophila serenensis Savchenko, 1983: 51; 1989: 84.

General: Body coloration dark brown dusted with gray. Male body length 3.7–5.4 mm, wing length 5.5–6.6 mm. Female body length 4.5–7.0 mm, wing length 5.8–7.5 mm.

Head: Dark brown, densely dusted with gray and covered with sparse short erect brown setae. Vertex without tubercle. Eyes widely separated in both sexes, distance between them at base of antennae approximately same as length of both basal antennomeres taken together. Antenna (Fig. 10A) dark brown, 1.7–1.8 mm long in male, nearly reaching wing base, if bent backward. Female antenna 1.0–1.7 mm long. Scape dusted with gray, elongate, nearly cylindrical, twice as long as pedicel. Pedicel widened distally. Flagellomeres elongate, narrower towards apex of antenna, covered with dense whitish pubescence. Apical segment subequal in length to preceding. Verticils dark brown, longest twice as long as respective segments. Rostrum and palpus dark brown, labella brown.

Thorax: Cervical sclerites and pronotum dark brown dusted with gray. Mesonotal prescutum dark brown, dusted with gray, with four indistinct longitudinal stripes that are getting darker towards posterior margin of sclerite, medial and lateral stripe reaching each other. Tubercular pits indistinct at frontal margin of sclerite, pseudosutural fovea distinct polished black, surrounded by yellowish-brown area. Scutal lobe brown, dusted with gray, with indistinct darker spot at middle. Area between lobes brownish gray. Scutellum grayish brown. Mediotergite grayish brown, darker posteriorly. Pleuron brown, densely dusted with gray, katapisternum darkened ventrally. Wing (Fig. 10B) iridescent with brownish tinge, yellowish at base. Stigma distinct, dark brown, slightly elongate. Brownish spots at base of wing, along frontal margin, surrounding branching points of veins and cross-veins and at tips of all longitudinal veins along wing margin. Veins brownish, darker in darkened areas, yellowish at wing base. Venation: *Sc* long, reaching wing margin slightly

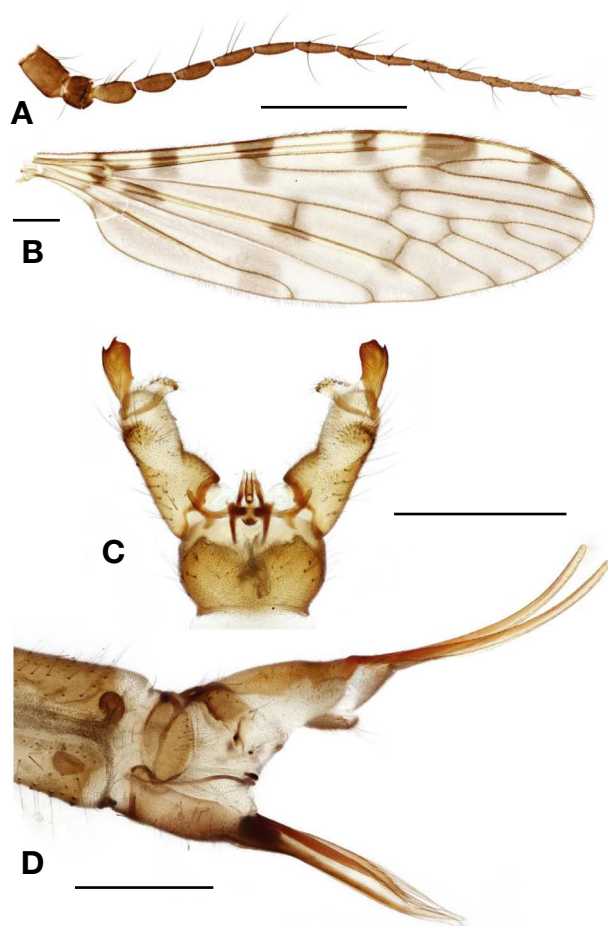


Fig. 10. *Eloeophila serenensis* (Alexander, 1940). A. male antenna. B. wing. C. male genitalia, dorsal view. D. ovipositor, lateral view. Scale bars 0.5 mm.

before branching point of *Rs*, *sc-r* four–five times its own length before tip of *Sc*. *Rs* long, arched at base. Free end of *R*₁ short, slightly arched, *R*₂ indistinct, about its own length before tip of *R*₁, less than its own length beyond branching point of *R*₂₊₃ and *R*₄. *R*₃ and *R*₄ diverging, cell *r*₃ with long stem, which is approximately as long as *m-cu*. Cross-vein *r-m* distinct, slightly beyond base of discal cell. Discal cell twice as long as wide. Cross-vein *m-cu* slightly before middle of discal cell. Additional cross-vein in cell *bm* distinctly beyond base of *Rs* and before tip of anal vein. Anal vein long, slightly sinuous. Anal angle wide, posterior margin widely rounded. Halter pale yellow, knob same color as stem. Length of male and female halter similar, ranging from 0.8 to 1.0 mm. Frontal coxae brown, yellowish ventrally, remaining coxae obscure yellow, sparsely dusted with gray. Trochanters obscure yellow. Femur yellow, narrowly but distinctly dark brown at apex, but just indistinctly darkened in other. Tibia yellow with narrowly dark brown apex, darkening varies depending on specimen. Basal tarsomere yellowish

basally, brown distally, remainder of tarsus brown to dark brown. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 3.0–4.5 mm long, II: 4.0–4.3 mm, III: 4.0–4.7 mm, tibia I: 4.4–4.5 mm, II: 4.5–4.8 mm, III: 4.0–5.0 mm, tarsus I: 4.2–4.4 mm, II: 3.8–4.4 mm, III: 3.2–3.5 mm. Female femur I: 3.7–4.0 mm long, II: 4.5–4.7 mm, III: 4.8–5.0 mm, tibia I: 4.1–4.5 mm, II: 4.2–4.7 mm, III: 5.0–5.1 mm, tarsus I: 3.5–4.0 mm, II: 3.5–3.7 mm, III: 3.4–3.6 mm. Claw simple, without spines.

Abdomen: Tergites dark brown, dusted with gray, covered with sparse yellowish erect setae. Sternites yellow, pale yellow at base of abdomen, with wide dark brown lateral and posterior margins. Male terminalia (Fig. 10C) brownish yellow. Ninth tergite wider than longer, posterior margin widely concave at middle. Gonocoxite elongate, widened ventro-medially at base. Outer gonostylus sclerotised, blade-shaped, with two apical spines, sometimes partly worn or broken in older specimens. Inner gonostylus fleshy, elongate, setose. Paramere simple, elongate, stick-shaped. Aedeagus short and straight. Ovipositor (Fig. 10D) brownish-grayish yellow. Cercus long, narrow and slightly arched, blunt-apexed. Hypovalva long and straight, point-apexed, reaching to about middle of cercus.

Elevation in Korea: From sea level to more than 2100 m.

Period of activity in Korea: Adults are active from early May through mid October.

Habitats: Small, clean streams and springs with moss-covered rocks surrounded by dense deciduous trees and shrubs in mountainous areas, sometimes around channels running through agricultural fields, marshy areas densely covered with willow shrubs. Species is attracted to light.

General distribution: North Korea, Russian Far East.

Examined material (Fig. 16J): holotype (as *Limnophila (Elaeophila) persalsa*), male (antenna, fore leg, wing and genitalia slide mounted), N. Korea, Seren Mts., alt. 4000 ft., 1937.10.10, A. Y. Yankovsky (USNM); 2 males, 2 specimens with broken abdomen (pinned), North Korea, Ompo, 100 ft., 1937.06.10, A. Y. Yankovsky (USNM); 2 males (pinned), Korea, Seren, alt. 2500 ft., 1938.08.17–18, A. Y. Yankovsky (USNM); 1 male (pinned), Korea, Seren, alt. 2000 ft., 1938.08.17–18, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Seren Mts., alt. 2500 ft., 1938.08.21, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Seren Mts., alt. 1500 ft., 1938.08.28, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 7000 ft., 1939.06.08, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Chonsani, alt. 3500 ft., 1940.07.02, A. Y. Yankovsky (USNM); 2 females (pinned), N. Korea, Pontani Paiktusan, alt. 4500 ft., 1940.07.17, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 5500 ft., 1940.07.31, A. Y. Yankovsky

(USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 5000–6000 ft., 1940.07.31, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 6000 ft., 1940.07.31, A. A. Y. Yankovsky (USNM); 2 males, 2 females (pinned), N. Korea, Pontani Paiktusan, alt. 6200 ft., 1940.07.31, A. Y. Yankovsky (USNM); 4 males (pinned), N. Korea, Pontani Paiktusan, alt. 6300 ft., 1940.08.01, A. Y. Yankovsky (USNM); 1 specimen with broken abdomen (pinned), N. Korea, Pontani Paiktusan, alt. 6000 ft., 1940.08.04, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 5500–6300 ft., 1940.08.06, A. Y. Yankovsky (USNM); 1 female (pinned), N. Korea, Pontani Paiktusan, alt. 6000–6370 ft., 1940.08.27, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), Korea, #12, Hwy. #20, 8 mi. SW of Kangnung, 1954.06.08, G. W. Byers (USNM, SMEK); 3 male, 1 female (pinned), Korea, #17, Central National Forest, 18 mi. NE Seoul, 350–500 ft., 1954.06.20, G. W. Byers (USNM, SMEK); 2 males (pinned), Korea, #18, Central National Forest, 18 mi. NE Seoul, 350–500 ft., 1954.07.06, G. W. Byers (SMEK); 1 female (pinned), Korea, #19, Central National Forest, 18 mi. NE Seoul, 1954.07.07, G. W. Byers (USNM); 1 female (pinned), Korea, #20, 2 mi. S. Pup'yong-ni, 16 mi. NE Seoul, 300–450 ft., 1954.07.11, G. W. Byers (SMEK); 1 male (pinned), Korea, #23, Central National Forest, 18 mi. NE Seoul, 1954.07.27, G. W. Byers (USNM); 1 male (pinned), Korea, #24, Central National Forest, 18 mi. NE Seoul, 400–500 ft., 1954.07.27, G. W. Byers (SMEK); 2 males, 1 female (pinned), Korea, #25, Central National Forest, 18 mi. NE Seoul, 400–500 ft., 1954.08.14, G. W. Byers (SMEK); 1 male (pinned), Korea, #28, Central National Forest, 18 mi. NE Seoul, 350–500 ft., 1954.08.22, G. W. Byers (SMEK); 1 female (pinned), Korea, #39 Central National Forest, 18 mi. NE Seoul, 350–500 ft., 1954.09.26, G. W. Byers (SMEK); 1 male, 3 females (in EtOH), S. Korea, Gangwon-do, Pyeonchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP, N 37.73920, E 128.59398, alt. 794 m, 2012.06.22 (1), S. Podenas (NIBR); 1 male (in EtOH), S. Korea, Gangwon-do, Pyeonchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP, N 37.71187, E 128.60077, alt. 633 m, 2012.06.22 (4), S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gangwon-do, Samcheok-si, N 37.14899, E 129.35933, alt. 629 m, 2012.06.23 (1), S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye, Toji-myeon, Naedong-ri, N 35.26580, E 127.58128, alt. 378 m, 2013.05.10, S. Podenas (NIBR); 1 male, 1 female (in EtOH), S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Hwaak-ri, N 37.98402, E 127.52676, alt. 579 m, 2014.08.20 (2), S. Kim, S. Podenas (NIBR); 1 male (in EtOH), S. Korea, Gangwon-do, Hongcheon-gun, Nae-myeon, Yuljeon-ri, N 37.73849, E 128.34566, alt. 798 m, 2014.08.21 (1), S. Podenas, S. Kim (NIBR); 1 male (in EtOH), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Jangjeon-ri, N 37.47153, E 128.54305, alt. 769 m, 2014.08.22 (2), S. Podenas, S. Kim (NIBR); 2 males (pinned and in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2014.08.24 (1), S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gyeongsangnam-do, Masanhappo-gu, Gusan-myeon, N 35.12904, E 128.57147, alt. 58 m, 2014.08.29, S. Podenas (NIBR); 2 females (pinned and in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.06.26, S. Podenas (NIBR); 3 females (pinned and in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.27 (1), S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (1), S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (2), S. Podenas (NIBR); 2 males, 3 females (pinned and in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.29 (1), S. Podenas (NIBR); 1 male (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.07.01 (3), S. Podenas (NIBR); 2 females (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27448, E 127.56378, alt. 593 m, 2015.07.01 (1), S. Podenas (NIBR); 1 male (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.07.02 (2), S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.07.03 (1), S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gangwon-do, Pyeonchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP, N 37.73767, E 128.59166, alt. 730 m, 2015.07.06 (1), S. Podenas (NIBR); 3 males (in EtOH), S. Korea, Gangwon-do, Pyeonchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan NP, N 37.72425, E 128.59814, alt. 648 m, 2015.07.06 (2), S. Podenas (NIBR); 2 males (in EtOH), S. Korea, Gangwon-do, Yangyang-gun, Seo-myeon, Garapi-ri, N 38.07933, E 128.52042, alt. 160 m, 2015.07.07 (1), S. Kim, S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gangwon-do, Yangyang, Seo-myeon, Osaek-ri, Heullim 1 gyo (bridge), Seoraksan National Park, N 38.08420, E 128.45026, alt. 415 m, 2015.07.07 (2), S. Kim, S. Podenas (NIBR); 2 males (in EtOH), S. Korea, Gangwon-do, Inje-gun, Buk-myeon, Hangye-ri, Jayang 3 gyo (bridge), Seoraksan National Park, N 38.10415, E 128.37973, alt. 704 m, 2015.07.07 (4), S. Kim, S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gangwon-do, Goseong-gun, Gan-

seong-eup, Jinbu-ri, N 38.26678, E 128.35706, alt. 497 m, 2015.07.08 (1), S. Kim, S. Podenas (NIBR); 1 male, 1 female (in EtOH), S. Korea, Gangwon-do, Hongcheon-gun, Duchon-myeon, Cheonhyeon-ri, near Mt. Garisan, N 37.84840, E 127.98879, alt. 304 m, 2015.07.08 (3), S. Kim, S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gangwon-do, Hongcheon-gun, Hwachon-myeon, Yasi-dae-ri, N 37.82514, E 127.95530, alt. 279 m, 2015.07.08 (4), S. Kim, S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gangwon-do, Chuncheon, Dongsan-myeon, KNU Experimental Forest, N 37.78194, E 127.81973, alt. 197 m, 2015.07.09, S. Kim, S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Jeongmok-ri, N 37.97627, E 127.44160, 2015.08.?–09.27, Malaise Trap (KU); 1 male (in EtOH), S. Korea, Gyeonggi-do, Gapyeong-gun, Buk-myeon, Jeokmok-ri, N 37.97583, E 127.44144, GERC-H, 2015.08.09–15, Y. J. Bae, Malaise trap (KU); 1 male (pinned), S. Korea, Gyeongsangbuk-do, Gyeongju, Jinhyeon-dong, N 35.78755, E 129.34274, alt. 320 m, 2016.05.27 (1), S. Podenas, H. M. Baek (NIBR); 1 male (in EtOH), S. Korea, Gyeongsangbuk-do, Gyeongju, Bulguk-dong, N 35.79079, E 129.32555, alt. 210 m, 2016.05.27 (3), S. Podenas, H. M. Baek, at light (NIBR); 2 males, 2 females (in EtOH), S. Korea, Gyeongsangbuk-do, Gyeongju-si, Jinhyeon-dong, Tohamsan (Mt.), 1.3 km southeast from Seokgulam, 35°47'16.7"N 129°20'21.1"E, 2016.05.27, coll. S. Podenas, H. M. Baek (NIBR); 2 males, 3 females (in EtOH), S. Korea, Gyeongsangbuk-do, Gyeongju-si, Jinhyeon-dong, Tohamsan (Mt.), 1 km southeast from Seokgulam, 35°47'13.4"N, 129°20'31.6"E, 2016.05.27, S. Podenas, H. M. Baek (NIBR); 1 male (in EtOH), S. Korea, Gyeongsangbuk-do, Gyeongju-si, Yangbuk-myeon, Bulguk-ro, upper stream of Daejong-cheon, Janghang 7-gyo (Brdg.), 35°45'44.6"N, 129°21'50.4"E, 2016.05.28, S. Podenas, H. M. Baek (NIBR); 2 males, 1 female (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2016.06.02, S. Podenas, at light (NIBR); 2 males, 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2016.06.03 (2), S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27333, E 127.56924, alt. 546 m, 2016.06.03 (3), S. Podenas (NIBR); 6 males, 5 females (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58090, alt. 448 m, 2016.06.03 (4), S. Podenas, at light (NIBR); 1 male, 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2016.06.04 (4), S. Podenas (NIBR); 3 males, 2 females (pinned and in EtOH), S. Korea, Gyeonggi-do, Yangpyeong, Cheongun-myeon, Dowon-ri, N 37.54507, E 127.79483, alt. 224 m, 2017.

05.28, S. Podenas, at light (NIBR); 1 male (pinned), S. Korea, Gyeonggi-do, Yangpyeong, Cheongun-myeon, Dowon-ri, N 37.54507, E 127.79483, alt. 224 m, 2017.05.29, S. Podenas (NIBR); 1 male (in EtOH), S. Korea, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N 38.03644, E 127.23226, alt. 150 m, 2019.06.11, T.A. Klein, H.-C. Kim, NJ trap (NIBR); 1 male, 1 female (pinned and in EtOH), S. Korea, Jeju-do, Seogwipo-si, Andeok-myeon, Gamsan-ri, N 33.23694, E 126.35728, alt. 21 m, 2019.06.21, V. Podeniene, S. Podenas (NIBR); 1 male (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58090, alt. 448 m, 2019.06.25 (3), S. Podenas, at light (NIBR); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Gwangui-myeon, Nodogan-ro, N 35.29250, E 127.49548, alt. 696 m, 2019.06.28 (1), S. Podenas (NIBR); 1 male (pinned), S. Korea, Gyeonggi-do, Gapyeong-gun, Oeseo-myeon, Samhoe-ri, Mt. Hwayasan, N 37.67186, E 127.40536, alt. 196 m, 2019.07.09 (2), S. Podenas (NIBR).

***Eloeophila subaprilina* (Alexander, 1919)**

Limnophila (*Ephelia*) *subaprilina* Alexander, 1919: 340.

Eloeophila subaprilina Oosterbroek, 2020.

General: Body coloration brown. Male body length 4.2–5.6 mm, wing length 5.7–7.3 mm. Female body length 6.0–8.1 mm, wing length 6.2–8.7 mm.

Head: Brown, densely dusted with gray, narrowly light gray to yellowish gray along eye margin, covered with sparse short erect brown setae. Vertex with indistinct tubercle marked with darker line along middle. Eyes widely separated in both sexes, distance between them at base of antennae approximately same as length of both basal antennomeres taken together. Antenna (Fig. 11A) 1.4–1.8 mm long in male, reaching to about middle of prescutum, if bent backward. Female antenna 1.1–1.6 mm long. Scape dark brown, densely dusted with gray, elongate, nearly cylindrical, twice as long as pedicel. Pedicel brown, widened distally. Three basal flagellomeres slightly dilated ventrally, pale brown. Remaining flagellomeres darkened, elongate, narrower towards apex of antenna, covered with dense whitish pubescence. Apical segment subequal in length to preceding. Verticils dark brown, longest 2.0–2.5 times as long as respective segments. Rostrum brown, dusted with gray, palpus dark brown to blackish, labella brown.

Thorax: Cervical sclerites and pronotum brown dusted with brownish gray. Mesonotal prescutum dark brown, dusted with gray, with four longitudinal stripes. Median stripes broken at middle, lateral with transverse line frontally, making a T-shaped structure. Tubercular pits indistinct at frontal margin of sclerite, pseudosutural fovea distinct polished brown. Scutal lobe brown, densely

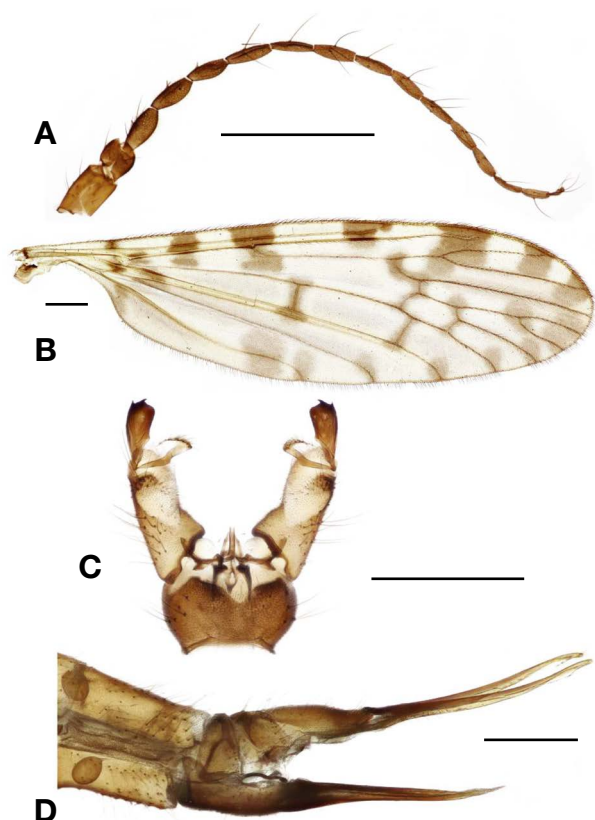


Fig. 11. *Eloeophila subaprilina* (Alexander, 1919). A. male antenna. B. wing. C. male genitalia, dorsal view. D. ovipositor, lateral view. Scale bars 0.5 mm.

dusted with brownish gray and with darker spot at middle. Area between lobes brownish gray, frontal margin narrowly polished brown. Scutellum brownish gray, yellowish along posterior margin. Mediotergite brown, grayish pruinosity denser frontally. Mesopleural membrane yellowish. Pleuron brown, dusted with brownish gray. Wing (Fig. 11B) iridescent with brownish tinge, yellowish at base. Stigma distinct, dark brown, elongate. Brown spots at base of wing, along frontal margin, surrounding branching points of veins and cross-veins and at tips of all longitudinal veins along wing margin. Veins brownish yellow, darker in darkened areas, yellowish at wing base. Venation: *Sc* long, reaching wing margin slightly before branching point of *Rs*, *sc-r* four–five times its own length before tip of *Sc*. *Rs* long, arched at base. Free end of *R*₁ short, nearly longitudinal, *R*₂ indistinct, at the middle between tip of *R*₁ and branching point of *R*₂₊₃ and *R*₄. *R*₃ and *R*₄ diverging, cell *r*₃ with long stem, which is as long as stem of *m*₁. Cross-vein *r-m* distinct, slightly beyond base of discal cell. Discal cell 2.5 times as long as wide. Cross-vein *m-cu* slightly before middle of discal cell. Additional cross-vein in cell *bm* at the middle between base of *Rs* and tip of anal vein. Anal vein sinuous. Anal angle

wide, posterior margin widely rounded. Halter with pale stem, yellowish at base, knob light brown. Length of male halter 0.8–0.9 mm, that of female 0.8–1.1 mm. Coxae brown, dusted with gray. Trochanters brown to yellowish brown. Femur yellow, distal part widely dark brown. Tibia yellow with narrowly brown apex. Basal tarsomere yellow with brownish distal part, remainder of tarsus brown to dark brown. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 3.7–4.5 mm long, II: 4.3–4.7 mm, III: 4.6–5.5 mm, tibia I: 5.0–5.2 mm, II: 4.5–4.8 mm, III: 5.0–5.7 mm, tarsus I: 4.0–4.7 mm, II: 3.9–4.0 mm, III: 3.7–4.2 mm. Female femur I: 4.0–5.5 mm long, II: 4.5–4.8 mm, III: 4.4–5.2 mm, tibia I: 4.5–5.7 mm, II: 4.0–4.5 mm, III: 4.4–4.5 mm, tarsus I: 4.0–5.3 mm, II: 4.0–4.2 mm, III: 3.2–3.7 mm. Claw simple, without spines.

Abdomen: Tergites reddish yellow with widely dark brown or blackish posterior and lateral margins, covered with sparse yellowish erect setae. Sternites obscure yellow, with widely dark brown or blackish posterior and lateral margins, covered with sparse yellowish erect setae. Male terminalia (Fig. 11C) light brown. Ninth tergite wider than longer, posterior margin widely concave at middle. Gonocoxite elongate, slightly narrower at middle of mesal surface. Outer gonostylus sclerotised, blade-shaped, with two apical spines. Inner gonostylus elongate, fleshy and setose. Paramere simple, elongate, stick-shaped. Aedeagus short and straight. Ovipositor (Fig. 11D) brownish-grayish yellow. Cercus long and narrow, nearly straight, blunt-apexed. Hypoalva long and straight, point-apexed, reaching slightly beyond middle of cercus. Spermatheca oval.

Elevation in Korea: Less than 50 to nearly 2000 m.

Period of activity in Korea: Adults were active from late April to early October.

Habitats: Margins of small and medium-sized mountainous streams surrounded by mixed forest. Species is attracted to light.

General distribution: North Korea, Honshu and Shikoku Islands of Japan.

Examined material (Fig. 16K): paratype (as *Limnophila (Ephelia) subaprilina*), male (wing and genitalia slide mounted), Japan, Meguro, Tokyo, 1919.04.20, R. Takahashi (USNM); 1 female (pinned), [N.] Korea, Seren, alt. 3000 ft., 1938.06.29–30, A. Y. Yankovsky (USNM); 2 males, 3 females (pinned), North Korea, Seren Mts., alt. 2000 ft., 1938.08.17, A. Y. Yankovsky (USNM); 3 males (pinned), [N.] Korea, Seren, alt. 2000–2500 ft., 1938.08.17–18, A. Y. Yankovsky (USNM); 1 male, 1 female (pinned), [N.] Korea, Seren, alt. 2000–2500 ft., 1938.08.21–22, A. Y. Yankovsky (USNM); 1 male (genitalia in microvial with glycerol) (pinned), N. Korea, Chonsani, alt. 4000 ft., 1940.04.29, A. Y. Yankovsky (USNM); 2 males (pinned), N. Korea, Chonsani, alt.

3500 ft., 1940.07.02, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Chonsani, alt. 4000 ft., 1940.07.04, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 6000 ft., 1940.07.26, A. Y. Yankovsky (USNM); 2 males (pinned), N. Korea, Pontani Paiktusan, alt. 6200 ft., 1940.07.29, A. Y. Yankovsky (USNM); 2 males (pinned), N. Korea, Pontani Paiktusan, alt. 5500 ft., 1940.07.31, A. Y. Yankovsky (USNM); 3 males (pinned), N. Korea, Pontani Paiktusan, alt. 6200 ft., 1940.07.31, A. Y. Yankovsky (USNM); 1 male, 1 specimen with broken abdomen (pinned), N. Korea, Pontani Paiktusan, alt. 6000 ft., 1940.07.31, A. Y. Yankovsky (USNM); 2 males, 2 females (pinned), N. Korea, Pontani Paiktusan, alt. 5000–6100 ft., 1940.07.31, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 5500–6300 ft., 1940.08.01, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 6300 ft., 1940.08.01, A. Y. Yankovsky (USNM); 2 males (pinned), N. Korea, Pontani Paiktusan, alt. 6000 ft., 1940.08.02, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 6000 ft., 1940.08.04, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 6200 ft., 1940.08.06, A. Y. Yankovsky (USNM); 2 males (pinned), N. Korea, Pontani Paiktusan, alt. 6370 ft., 1940.08.06, A. Y. Yankovsky (USNM); 2 males, 2 females (pinned), S. Korea, #6, Hwy. #13, 6 mi. E of Seoul, 1 mi. W. Han River, 150 ft., 1954.06.20, G. W. Byers (USNM, SMEK); 1 male, 1 female (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseori, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (1,2), S. Podenas (NIBR); 1 male (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseori, Piagol valley, N 35.27448, E 127.56378, alt. 593 m, 2015.07.01 (1), S. Podenas (NIBR); 1 female (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseori, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2016.06.02, S. Podenas, at light (NIBR); 1 male (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseori, Piagol valley, N 35.27333, E 127.56924, alt. 546 m, 2016.06.03 (3), S. Podenas (NIBR); 1 specimen with broken abdomen (in EtOH), S. Korea, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N 38.03644, E 127.23226, alt. 150 m, 2017.07.03, T. A. Klein, H.-C. Kim, NJ trap, (NIBR); 1 male (in EtOH), S. Korea, Gangwon-do, Chuncheon, Dongsan-myeon, KNU Experimental Forest, N 37.77909, E 127.81580, alt. 225 m, 2018.10.09, S. Podenas, at light (NIBR); 1 specimen with broken abdomen (in EtOH), S. Korea, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N 38.03644, E 127.23226, alt. 150 m, 2019.05.21, T. A. Klein, H.-C. Kim, NJ trap (NIBR); 1 female (in EtOH), S. Korea, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N 38.03644, E 127.23226, alt. 150 m, 2019.06.10, T. A. Klein, H.-C. Kim, NJ trap

(NIBR); 1 female (in EtOH), S. Korea, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N 38.03644, E 127.23226, alt. 150 m, 2019.06.18, T. A. Klein, H.-C. Kim, NJ trap (NIBR); 2 males (in EtOH), S. Korea, Gyeonggi-do, Pocheon-si, Yeongjung-myeon, Yeongpyeong-ri, MPRC, N 38.03644, E 127.23226, alt. 150 m, 2019.06.24, T. A. Klein, H.-C. Kim, NJ trap (NIBR).

***Eloeophila ussuriana ussuriana* (Alexander, 1933)**

Limnophila (*Idioptera*) *ussuriana* Alexander, 1933: 142.
Eloeophila (*Eloeophila*) *ussuriana* Savchenko, Krivolutskaya, 1976: 62.

Eloeophila ussuriana Savchenko, 1983: 51–52; 1989: 85.

Eloeophila ussuriana ussuriana Oosterbroek, 2020.

General: Body coloration dark brown to black, dusted with gray. Male body length 5.3–6.5 mm, wing length 7.5–9.0 mm. Female body length 6.5–9.5 mm, wing length 8.0–10.2 mm.

Head: Dark brown, densely dusted with gray and covered with sparse short erect setae. Vertex without tubercle. Eyes widely separated in both sexes, distance between them at base of antennae slightly exceeds length of both basal antennomeres taken together. Antenna (Fig. 12A) brown with yellow base of basal flagellomere and dark brown distal flagellomeres, 1.8–2.5 mm long in male, extending to base of abdomen, if bent backward, antenna of female 1.7–1.8 mm long. Scape dark brown, elongate, nearly cylindrical, twice as long as pedicel. Pedicel brown, widened distally. Flagellomeres elongate, narrower towards apex of antenna, densely covered with whitish pubescence. Apical segment subequal to preceding. Verticils dark brown, not reaching length of respective segments. Rostrum, palpus and mouth parts dark brown dusted with gray.

Thorax: Cervical sclerites and pronotum dark brown densely dusted with gray. Mesonotal prescutum dark brown, dusted with gray, with four indistinct longitudinal stripes that are getting darker towards posterior margin of sclerite, medial pair narrowly separated with gray. Tubercular pits indistinct at frontal margin of sclerite, pseudosutural fovea distinct polished black. Scutal lobe grayish dark brown because of dense pruinosity. Area between lobes with sparser pruinosity, semi-polished. Scutellum with indistinctly reddish brown posterior margin. Mediotergite brown with dense gray pruinosity, darker along middle. Pleuron uniformly dark brown covered with dense brownish-gray pruinosity. Wing (Fig. 12B) iridescent with brownish tinge, yellowish at base. Stigma distinct, dark brown, elongate. Brownish spots surrounding branching points of veins and cross-veins. Veins light brown, yellowish at wing base. Venation: *Sc*

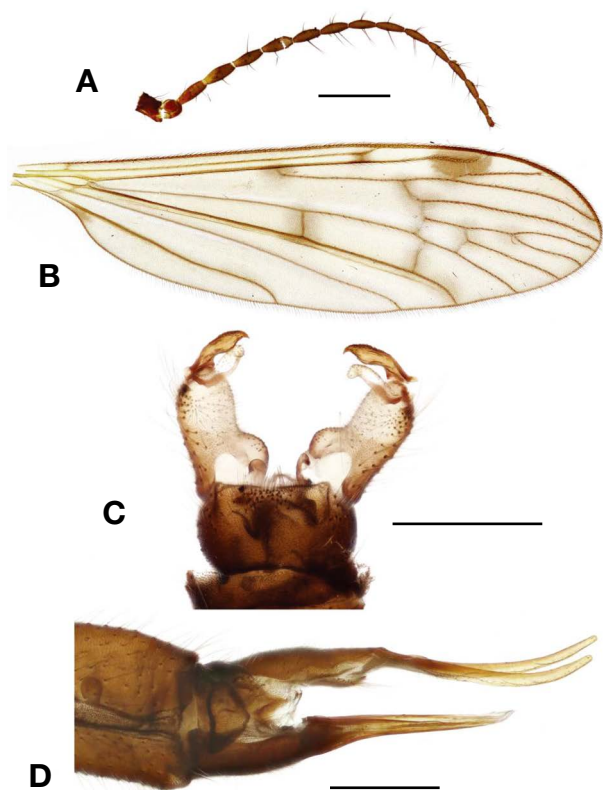


Fig. 12. *Eloeophila ussuriana ussuriana* (Alexander, 1933). A. male antenna. B. wing. C. male genitalia, dorsal view. D. ovipositor, lateral view. Scale bars 0.5 mm.

long, reaching wing margin nearly at branching point of *Rs*, *sc-r* about three times its own length before tip of *Sc*. *Rs* long, slightly arched, sometimes angulate and short-spurred at base. Free end of *R*₁ short and oblique, *R*₂ indistinct, about three times its own length before tip of *R*₁, far beyond branching point of *R*₂₊₃ and *R*₄. *R*₃ and *R*₄ diverging, cell *r*₃ with long stem, which is approximately as long as *m-cu*. Cross-vein *r-m* distinct, at base of discal cell. Discal cell twice as long as wide. Cross-vein *m-cu* slightly before middle of discal cell. Additional cross-vein in cell *bm* beyond apex of anal vein. Anal vein long, distinctly arched apically, reaching wing margin at the level between base of *Rs* and additional cross-vein in cell *bm*. Anal angle long and narrow, widely rounded. Halter pale brownish yellow. Length of male halter 0.9–1.3 mm, that of female 1.1–1.3 mm long. Coxae yellow, brownish at base, more intensely on frontal pair. Trochanters yellow. Femur yellow, narrowly dark brown at apex. Tibia brownish yellow with narrowly dark brown apex. Basal tarsomere brown with yellowish base, remainder of tarsus dark brown. Tibia of fore leg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 4.3–4.8 mm long, II: 4.5–5.0 mm, III:

5.5–5.7 mm, tibia I: 4.5–5.8 mm, II: 5.5–6.0 mm, III: 5.3–6.0 mm, tarsus I: 3.0–5.5 mm, II: 6.1–6.2 mm, III: 4.5–5.2 mm. Female femur I: 4.5–4.6 mm long, II: 4.5–4.6 mm, III: 4.5–5.5 mm, tibia I: 4.7–5.5 mm, II: 4.3–4.5 mm, III: 5.0–5.7 mm, tarsus I: 4.7–5.4 mm, II: 4.2–4.5 mm, III: 3.8–4.3 mm. Claw simple, without spines.

Abdomen: Abdominal segments semi-polished, covered with sparse whitish erect setae. Tergites reddish brown at base and along middle, widely dark brown laterally and posteriorly in male. Female tergites uniformly dark brown. Sternites dark brown, narrowly grayish along posterior margin, marked with yellowish at base of abdomen. Male terminalia (Fig. 12C) dark brown. Ninth tergite rectangular, wider than longer, posterior margin nearly straight, setose at middle. Gonocoxite elongate with large rounded ventro-mesal bump at base. Outer gonostylus elongate, sclerotised, serrated along outer margin, widened distally, apex claw-shaped. Inner gonostylus long and narrow, fleshy and setose. Paramere strongly arched. Aedeagus short and straight. Ovipositor (Fig. 12D) dark brown at base, turning yellowish towards apex. Cercus long, narrow and slightly arched, blunt-apexed. Hypovalva long and straight, point-apexed, reaching two-thirds of cercus length.

Elevation in Korea: From 40 to more than 1200 m.

Period of activity in Korea: Early May to June.

Habitats: Unknown in Korea, adults are active among grassy vegetation along streams and rivulets in the forests, near canals and holes filled with water in the Russian Far East close to the border with North Korea, sanctuary Kedrovaya Padj (Savchenko, 1983).

General distribution: North Korea, Russian Far East.

Examined material (Fig. 16L): holotype (as *Limnophila (Idioptera) ussuriana*), male (antenna, gonocoxite with gonostyli slide mounted), Eastern Siberia (Ussuri), Tigrowaja, Suchan district, 1927.06.09, Stackelberg (USNM); allotype, female (antenna and wing slide mounted together with holotype) (USNM); metatypes (as *Limnophila ussuriana*), male and female (on same pin, female with missing tip of abdomen), North Korea, Ompo, 1937.06.08, A. Y. Yankovsky (USNM); 3 males (pinned), North Korea, Ompo, 170 ft., 1937.06.07, A. Y. Yankovsky (USNM); 2 males, 1 female (pinned), North Korea, Ompo, 1937.06.08, A. Y. Yankovsky (USNM); 2 males (one genitalia in microvial with glycerol), 1 female (pinned), [N.] Korea, Ompo, alt. 600 ft., 1938.05.08, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Ompo, alt. 300 ft., 1938.05.09, A. Y. Yankovsky (USNM); 4 males, 2 females (pinned), [N.] Korea, Ompo, alt. 700 ft., 1938.05.09, A. Y. Yankovsky (USNM); 2 males, 2 females (pinned), North Korea, Ompo, alt. 150 ft., 1938.05.12, A. Y. Yankovsky (USNM); 1 female (genitalia in microvial with glycerol) (pinned), [N.] Korea, Ompo, alt. 200 ft., 1938.05.12, A. Y. Yankovsky (USNM); 1 fe-

male (pinned), [N.] Korea, Ompo, alt. 600 ft., 1938.05.18, A. Y. Yankovsky (USNM); 1 female (pinned), [N.] Korea, Ompo, alt. 200 ft., 1938.05.24, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Ompo, alt. 400 ft., 1938.05.29, A. Y. Yankovsky (USNM); 1 male (pinned), North Korea, Ompo, alt. 300 ft., 1938.05.29, A. Y. Yankovsky (USNM); 2 males (pinned), [N.] Korea, Ompo, alt. 300 ft., 1938.06.06, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Ompo, alt. 600 ft., 1938.06.11, A. Y. Yankovsky (USNM); 1 male, 1 specimen with broken abdomen (pinned), North Korea, Ompo, alt. 350 ft., 1938.06.11, A. Y. Yankovsky (USNM); 2 females (pinned), [N.] Korea, Ompo, alt. 600 ft., 1938.06.11, A. Y. Yankovsky (USNM); 2 males (pinned), North Korea, Seren Mts., alt. 4000 ft., 1938.06.25, A. Y. Yankovsky (USNM).

***Eloeophila yezoensis* (Alexander, 1924b)**

Limnophila (*Ephelia*) *subaprilina yezoensis* Alexander, 1924b: 72.

Eloeophila (*Eloeophila*) *subaprilina yezoensis* Savchenko, Krivolutskaya, 1976: 61.

Eloeophila subaprilina yezoensis Savchenko, 1983: 50; 1989: 85.

Eloeophila yezoensis Oosterbroek, 2020.

General: Body coloration brown, dusted with gray. Male body length 4.2–5.2 mm, wing length 5.8–6.7 mm. Female body length 5.5 mm, wing length 5.5 mm.

Head: Brown, indistinctly darkened along dorso-medially, densely dusted with gray, narrowly light gray to yellowish gray along eye margin, covered with sparse short erect brown setae. Vertex with indistinct tubercle marked with darker line along middle. Eyes widely separated in both sexes, distance between them at base of antennae approximately same as length of both basal antennomeres taken together. Male antenna (Fig. 13A) 1.8 mm long, reaching to about middle of prescutum, if bent backward, female antenna 1.3 mm long. Scape pale brownish yellow, dusted with gray, elongate, nearly cylindrical, twice as long as pedicel. Pedicel brown, widened distally. Basal flagellomere light yellow, second and third segments pale brown, remaining flagellomeres dark brown, slightly elongate in male, oval in female, narrower towards apex of antenna, covered with dense whitish pubescence. Apical segment subequal in length to preceding. Verticils dark brown, about twice as long as respective segments. Rostrum brown dorsally, dark brown ventrally, dusted with gray, palpus dark brown to blackish, labella brown.

Thorax: Cervical sclerites and pronotum brown dusted with brownish gray. Mesonotal prescutum brown, dusted with gray, with four longitudinal stripes. Median stripes partly broken at middle, lateral indistinct with short transverse spot frontally. Tubercular pits indistinct at frontal margin of sclerite, pseudosutural fovea distinct polished

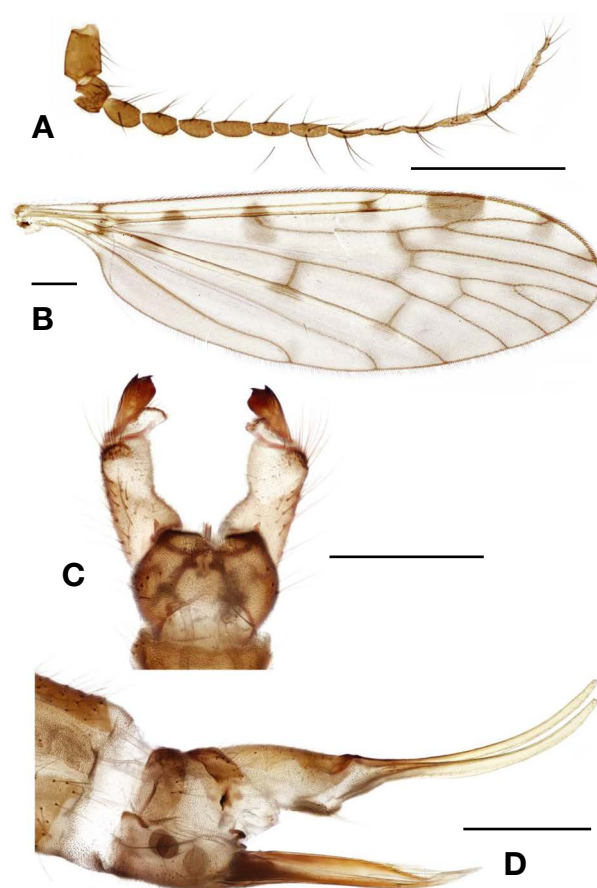


Fig. 13. *Eloeophila yezoensis* (Alexander, 1924). A. male antenna. B. wing. C. male genitalia, dorsal view. D. ovipositor, lateral view. Scale bars 0.5 mm.

brown. Scutal lobe brown, densely dusted with brownish gray and with darker spot at middle. Area between lobes brownish gray, frontal margin narrowly polished brown. Scutellum brownish gray. Mediotergite brown, densely covered with brownish gray pruinosity, darker along posterior margin. Pleuron yellowish brown, dusted with brownish gray. Wing (Fig. 13B) iridescent with brownish tinge, yellowish at base. Stigma distinct, dark brown. Brown spots at base of wing, along frontal margin, surrounding branching points of veins and cross-veins and at tips of all longitudinal veins along wing margin. Veins brownish yellow, darker in darkened areas, yellowish at wing base. Venation: *Sc* long, reaching wing margin slightly before branching point of *Rs*, *sc-r* three to four times its own length before tip of *Sc*. *Rs* long, arched at base. Free end of *R*₁ short, nearly longitudinal, *R*₂ indistinct, at the middle between tip of *R*₁ and branching point of *R*₂₊₃ and *R*₄. *R*₃ and *R*₄ diverging, cell *r*₃ with long stem, which is as long as *m-cu*. Cross-vein *r-m* distinct, slightly beyond base of discal cell. Discal cell twice as long as wide. Cross-vein *m-cu* from slightly before to

middle of discal cell. Additional cross-vein in cell *bm* at the middle between base of *R*s and tip of anal vein. Anal vein sinuous. Anal angle wide, posterior margin widely rounded. Halter with pale stem, yellowish at base, and brownish knob. Length of male halter 0.8–0.9 mm, that of female 0.7 mm. Coxae brown, dusted with gray. Trochanters yellowish brown. Femur yellow, apical part indistinctly darkened. Tibia yellow with narrowly brownish apex. Three basal tarsomeres yellow with indistinctly darkened apices, remainder of tarsus brown. Tibia of fore leg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 4.5 mm long, II: 4.2–4.5 mm, III: 4.7–5.0 mm, tibia I: 5.3 mm, II: 5.0–5.2 mm, III: 4.5–5.2 mm, tarsus I: 5.0 mm, II: 4.4–4.5 mm, III: 3.2–3.5 mm. Female femur I: 3.5 mm long, II: 3.7 mm, III: 3.8 mm, tibia I: 3.5 mm, II: 3.5 mm, III: 3.8 mm, tarsus I: 3.2 mm, II: 2.9 mm, III: 3.0 mm. Claw simple, without spines.

Abdomen: Tergites reddish yellow or yellow with widely dark brown posterior and lateral margins, covered with sparse yellowish erect setae. Sternites yellow, with widely dark brown posterior and lateral margins, covered with sparse yellowish erect setae. Male terminalia (Fig. 13C) light brown. Ninth tergite wider than longer, posterior margin widely concave at middle. Gonocoxite elongate, slightly narrower at middle of mesal surface. Outer gonostylus sclerotised, blade-shaped, with two apical spines. Inner gonostylus elongate, fleshy and setose. Paramere simple, elongate, stick-shaped. Aedeagus short and straight. Ovipositor (Fig. 13D) brownish-grayish yellow. Cercus long and narrow, nearly straight, blunt-apexed. Hypoalva long and straight, point-apexed, reaching slightly beyond middle of cercus.

Elevation in Korea: From less than 50 to more than 1800 m.

Period of activity in Korea: Early July through mid August.

Habitats: small springs surrounded by willows and grassy vegetation in mountainous areas, wet surface of rocks covered with algae.

General distribution: North Korea, Honshu and Hokkaido Islands of Japan, Russian Far East including Kuril and Sakhalin Islands.

Remarks: Original description of *E. yezoensis* as a subspecies of *E. subaprilina* was based on a single female. It was given status of subspecies based only on subtle color differences of antennae and femur. Ch. Alexander later identified male specimen from North Korea as *E. subaprilina yezoensis* and slide mounted genitalia, but details of genitalia show no difference from typical *E. subaprilina*. Oosterbroek (2020) raised *E. yezoensis* to species status. On the other hand, both species *E. subaprilina* and *E. yezoensis* are very similar to *E. serenensis* originally described from North Korea. Similarities were observed in

the wing pattern, male and female terminalia. Differences were observed in coloration of separate structures, like antennae, halteres, and legs. At the moment, it is difficult to say, if these three species deserve species status, or are just color variations of same taxon. Comparison of DNA barcoding results of freshly collected males of *E. serenensis* from North Korea, *E. subaprilina* from Honshu Island of Japan, and *E. yezoensis* from Hokkaido Island of Japan would be helpful to resolve their taxonomic status.

Examined material (Fig. 16M): holotype (as *Limnophila (Ephelia) subaprilina yezoensis*), female (wing slide mounted), Japan, Jozankei [Ishikari-no-kuni], alt. 1000 ft., 1923.08.16, T. Esaki (USNM); metatype (as *Limnophila (Elaeophila) subaprilina yezoensis*), male (wing and genitalia slide mounted), N. Korea, Seren Mts., alt. 2000 ft., 1938.08.08, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Chonsani, alt. 4000 ft., 1940.07.04, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 6000 ft., 1940.07.26, A. Y. Yankovsky (USNM); 1 male (pinned), N. Korea, Pontani Paiktusan, alt. 6000 ft., 1940.08.04, A. Y. Yankovsky (USNM); 1 female (pinned), S. Korea, #27, Hwy. #13, 6 mi. E of Seoul, 1 mi. W. Han River, 150 ft., 1954.08.19, G. W. Byers (SMEK); 1 male, 1 female (in EtOH), S. Korea, Gangwon-do, Yangyang, Seo-myeon, Osaek-ri, Heullim 1 gyo (bridge), Seoraksan NP, N 38.09512, E 128.41309, alt. 800 m, 2015.07.07 (3), S. Kim, S. Podenas (NIBR).

***Paradelphomyia* Alexander, 1936a**

Paradelphomyia Alexander, 1936a: 184; 1948: 151; 1965b: 46; Savchenko, 1986: 212; 1989: 57–58; Starý, 2019: 57–58.

Haploneura Meunier, 1899: 393 (nec. Alexander, 1931: 90).

Gonomyiella Kuntze, 1919: 141 (praeocc. Meunier, 1899).

Type species: *Adelphomyia (Paradelphomyia) crossospila* Alexander, 1936a (China: Sichuan).

Medium-sized crane flies with body length 6.0–8.0 mm and wing length 6.0–7.5 mm. Coloration varies from yellow to dark brown or black.

Head: Widely rounded posteriorly. Antenna with 14-segmented flagellum. Three basal flagellomeres slightly dilated ventrally, remaining flagellomeres elongate. Verticils variable, up to 2.5 times as long as respective segment.

Thorax: Pronotum elongate with extended postero-lateral angles. Mesonotal prescutum with indistinct tubercular pits far from frontal margin of sclerite. Katepisternum usually bare, sometimes with few small setae. Meron small. Wing usually medium-wide, like in most *Limnophilinae*, but some species have wing strongly widened posteriorly, usually patternless, but some species with darkenings surrounding cross-veins and distal parts of

longitudinal veins, rarely whole wing spotted. *Arculus* present, vein *Sc* long, reaching wing margin close to branching point of *Rs*, *sc-r* up to four times its own length before tip of *Sc*. *R*₁ elongate, *R*₂ missing in some species, long distance before apex of *R*₁ in other. Radial sector long and arched, cell *r*₃ long with short stem, widening towards wing margin. Cell *m*₁ very short, at least twice as short as its stem, just as exception missing. Discal cell always present, usually elongate. Cross-vein *m-cu* at middle of discal cell. Anal vein reaching wing margin at approximately same level as base of *Rs*. Anal angle long and narrow. Distal wing cells always with macrotrichiae. Wing squama setoseless. All legs with small single tibial spur each, some species with spurs missing (like in subfamily Chioneinae).

Abdomen: Male terminalia approximately as wide as rest abdominal segments. Ninth tergite and sternite fused into complete genital ring, tergite split medially into two separate plates, sternite with large medial lobe at posterior margin. Gonocoxite simple: elongate with no additional lobes. Two pairs of terminal or subterminal gonostyli. Outer gonostylus sclerotized with 2–3 apical teeth or spines, inner gonostylus fleshy and setose. Aedeagus short and straight, one pair of elongate parameres. Ovipositor with long and narrow cerci and hypovalvae, distal part of cercus slightly raised upwards.

A total of 81 species of *Paradelphomyia* are known worldwide (Oosterbroek, 2020). They are recorded in all biogeographical regions except the Australian Region; the highest diversity is observed in the Oriental Region with 30 species and the East Palearctic Region with 11 species.

Check list of Korean *Paradelphomyia* crane flies

Paradelphomyia chosenuca Alexander, 1950b

Paradelphomyia macracantha Alexander, 1957

Key to Korean species of the genus *Paradelphomyia* Alexander

1. Dark brown species. Cross-vein *m-cu* at middle of discal cell (Fig. 14B).....
.....*Paradelphomyia chosenuca* Alexander, 1950b
- Yellow species. Cross-vein *m-cu* close to the base of discal cell (Fig. 15B).....
.....*Paradelphomyia macracantha* Alexander, 1957

Paradelphomyia chosenuca Alexander, 1950b

Paradelphomyia chosenuca Alexander, 1950b: 427; Oosterbroek, 2020.

Paradelphomyia (Oxyrhiza) chosenuca Savtshenko, Kri-volutskaya, 1976: 51–52; Savchenko, 1989: 59; Pili-penko, Sidorenko, 2006: 265.

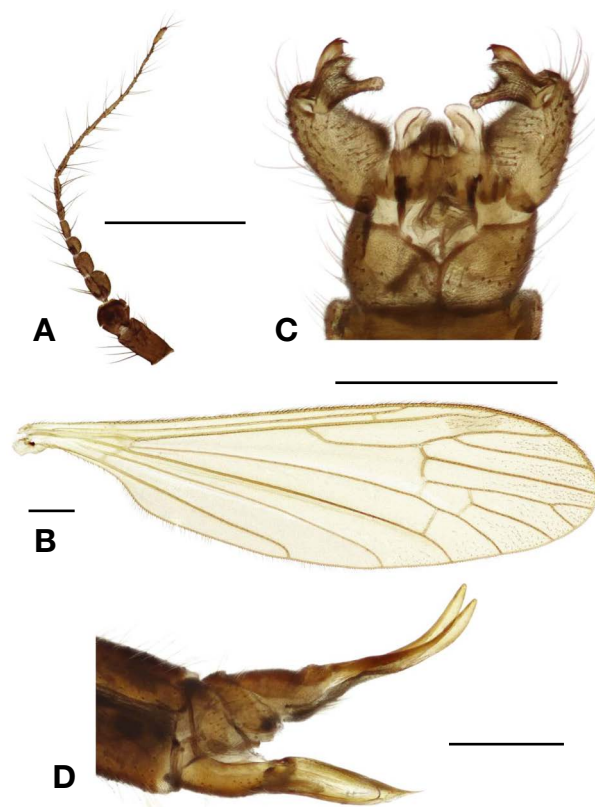


Fig. 14. *Paradelphomyia chosenuca* Alexander, 1950. A. male antenna. B. wing. C. male genitalia, dorsal view. D. ovipositor, lateral view. Scale bars 0.5 mm.

General: Body coloration dark brown to black, semi-polished. Body length of male 5.3–6.0 mm, of female 6.8–7.6 mm. Wing length of male 6.3–6.7 mm, of female 7.4–7.5 mm.

Head: Dark brown to black, sparsely dusted with gray, widely rounded posteriorly. Eyes widely separated in both sexes, distance between them at base of antennae about three times exceeds length of scape. Antenna (Fig. 14A) 1.1–1.5 mm long in male, 1.1 mm in female, extending to wing base if bent backward. Scape dark brown, elongate, nearly cylindrical, 1.5 times as long as wide, pedicel rounded, as long as width of scape. Flagellum dark brown. Three basal flagellomeres widened ventrally, remaining elongate. Apical segment as long as preceding. Verticils brown, longest verticils up to 1.8 times as long as respective segments. Rostrum palpus and mouth parts dark brown to black.

Thorax: Cervical sclerites and pronotum dark brown to black. Posterior margin of pronotum with few erect long brown setae dorsally. Mesonotal prescutum semi-polished, dark brown to black, darker frontally, slightly paler along lateral margin, sparsely dusted with gray, without stripes. Tubercular pits indistinct, pseudosutural fovea

concolorous with prescutum. Scutal lobe same color as prescutum, area between lobes brown. Scutellum brown frontally, darker posteriorly, sparsely dusted with gray. Mediotergite brown, more densely covered with gray pruinosity fronto-laterally. Pleuron uniformly dark brown, covered with gray pruinosity, katepisternum with 1–3 small yellowish setae. Wing (Fig. 14B) brownish, yellowish at base. No other darkenings except stigma, which is also indistinct, pale-brown. Veins brown, yellowish at wing base. Macrotrichiae more abundant in radial cells, they are present in other marginal cells along postero-apical wing margin, few macrotrichiae present also in cell *cua* at wing margin. Venation: *Sc* long, nearly reaching branching point of *Rs*, *sc-r* four times its own length from tip of *Sc*. *Rs* long, arched at base. Free end of *R*₁ longitudinal, *R*₂ missing. *R*₃ and *R*₄ diverging towards wing margin, cell *r*₃ with short stem. Cross-vein *r-m* distinct, at base of discal cell. Discal cell 1.8 times as long as wide. Cross-vein *m-cu* at middle of discal cell. Anal vein long, slightly arched at apex, reaching wing margin slightly before the level of *Rs* base. Anal angle narrow, widely rounded. Length of male halter 1.0–1.1 mm, of female 1.1–1.2 mm. Halter pale. Fore coxa dark brown dorsally and frontally, yellowish ventrally and posteriorly, middle coxa dark brown, yellowish ventrally, posterior coxa brownish yellow. Trochanters yellow, fore and middle slightly darkened posteriorly. Femur yellow with indistinctly darkened distal part, tibia yellow with slightly darker apex. Basal tarsomere brown with yellowish basal part, remaining tarsomeres dark brown. Small tibial spurs present on all legs. Male femur I: 3.6 mm long, II: 4.5 mm, III: 4.6 mm, tibia I: 4.8 mm, II: 4.4 mm, tarsus I: 3.1 mm, II: 4.3 mm. Female femur I: 3.7–4.1 mm long, II: 3.9–4.4 mm, III: 4.5 mm, tibia I: 4.0–4.9 mm, II: 4.2–4.4 mm, III: 4.8–5.1 mm, tarsus I: 3.5–5.0 mm, II: 3.8–4.5 mm, III: 3.8–4.1 mm long. Claw simple, without spines.

Abdomen: Segments brown to dark brown or blackish, semi-polished, covered with sparse yellowish setae. Male pregenital segments darkened, terminalia brown. Ninth tergite (Fig. 14C) with medial suture, separating it into two sclerites, deep wide V-shaped emargination at posterior margin. Gonocoxite elongate, wider at base, narrower towards apex, without additional lobe. Outer gonostylus elongate, with three spines at apex, two of them together at outer margin and one separated from them. Inner gonostylus large fleshy and setose, two-branched. Outer branch triangle-shaped, inner branch elongate, thumb-shaped. Ninth sternite strongly elongate posteriorly with setose apex. Aedeagus short and straight, with two arched elongate lobes ventrally. Parameres darkened, short. Ovipositor (Fig. 14D) light brown. Cercus elongate, blunt-apexed, distal half slightly raised upwards. Hypoalva long and wide, point-apexed, reaching to about middle of cercus.

Elevation: From nearly 500 to 1850 m.

Period of activity: From early June through mid July.

Habitats: Small muddy pool at small spring on mountain slope, densely covered with deciduous shrubs and trees and sparse grassy vegetation along margin. Despite many attempts they were not collected at light.

General distribution: Species was described from the northern part of the Korean Peninsula, recorded from Sakhalin and Kuril Islands of the Russian Far East. Recorded from South Korea for the first time.

Remarks: This species was described from single female. Many specimens collected from the Sakhalin and Kuril islands of the Russian Far East were identified as *P. chosenuca* by Savchenko (Savtshenko and Krivolutsкая, 1976) with some reservation because males from Korea were unknown at that time. Specimens from South Korea, that were available for our study, belong to same species as specimens from Sakhalin and Kuril Islands, females show no differences from the type specimen.

Examined material (Fig. 16N): holotype (as *Oxydiscus* (*Oxydiscus*) *chosenuca*), female (pinned, wing slide-mounted), North Korea, Kankyo Nando, Puksu Pyaksan, Toorisani, 6000 ft., 1939.06.30, A. Y. Yankovsky (USNM); 1 female (pinned), [S.] Korea, #13, Hwy. #20, 8 mi. SW Kangnung, 128°47'E, 37°42'N, alt. 1925 ft., 1954.06.09, G. W. Byers (USNM); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.28 (2), S. Podenas, net (NIBR); 1 male (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.06.29 (1), S. Podenas, net (NIBR); 1 male (in EtOH), S. Korea, Gangwon-do, Goseong-gun, Ganseong-eup, Jinbu-ri, N 38.26678, E 128.35706, alt. 497 m, 2015.07.08 (1), V. Podeniene, net (NIBR); 1 female (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27333, E 127.56924, alt. 546 m, 2016.06.04 (3), S. Podenas, net (NIBR). Also compared with: *P. cerina* (Alexander, 1936b) (as *Adelphomyia cerina*): holotype, male (antenna, wing and genitalia slide-mounted), W. China, Mt. Omei, Chu Lao Tong Temple, 6000–7000 ft., 1935.07.27, G. M. Franck, light (USNM); *P. crossospila* (Alexander, 1936a) (as *Adelphomyia* (*Paradelphomyia*) *crossospila*): holotype, male (antenna, leg, wing and genitalia slide-mounted), W. China, Mt. Omei, Chu bao Tong Temple, 6000–7000 ft., 1935.07.27, G.M. Franck (USNM); *P. dissita* Alexander, 1960 (as *P. (Oxyrhiza) dissita*): holotype, male (leg, wing and genitalia slide-mounted), Pakistan-NW7P, Kaghan, 6688 ft., 1953.06.27, F. Schmid (USNM); paratype, male (antenna, leg, wing and genitalia slide-mounted), Pakistan, Mwoore Hills, 7242 ft., 1953.06.10, F. Schmid (USNM); *P. latissima* (Alexander, 1932) (as *Adelphomyia latissima*): holotype, male (antenna, leg, wing and genitalia slide-mounted), W. China,

Mt. Omei, Srech, 3500 ft., 1931.08.17, Franck (USNM); *P. majuscula* (Alexander, 1936c) (as *Adelphomyia majuscula*): holotype, female (foreleg and wing slide-mounted), W. China, Beh Luh Din, Szechwan, 4000 ft., 1934.10.10–24, D. C. Graham (USNM); *P. nimbicolor* Alexander, 1950b (as *P. (Oxyrhiza) nimbicolor*): holotype, male (antenna, leg, wing and genitalia slide-mounted), Japan, Honshiu, Funakosi, 1947.09.26, N. Yamamoto (USNM); (as *Paradelphomyia nimbicolor*): metatype, male (head, legs, wing and genitalia slide-mounted), Japan, Kuri-ake, 400 m, 1955.10.16, K. Baba (USNM); *P. nipponensis* (Alexander, 1924b) (as *Adelphomyia nipponensis*): holotype, female (leg and wing slide-mounted), Japan, Yumoto, alt. 5820 ft., 1923.07.23, Teiso Esaki (USNM); metatype, male (wing and genitalia slide-mounted), Japan, Honshiu, Konseitoge, 7000 ft., 1934.08.06, S. Issiki (USNM); *P. senilis* (Haliday, 1833) (as *P. (Oxyrhiza) senilis*): male (wing and genitalia slide-mounted), N. Wales, Caernavon, Bangar-Vaynol Wood, 1966.09.22, R. I. Vane-Wright (USNM); (as *Adelphomyia senilis*): female (wing slide-mounted), Germany, Frankfurt, Oder, 1913.09.17, Riedel (USNM); male (wing slide-mounted), England, Radwell, Herto, 1920.09, F. W. Edwards (USNM).

***Paradelphomyia macracantha* Alexander, 1957**

Paradelphomyia (Oxyrhiza) macracantha Alexander, 1957: 357–358.

Paradelphomyia macracantha Oosterbroek, 2020.

General: Body coloration yellow. Body length of female 4.2–5.2 mm, wing length 4.3–5.1 mm.

Head: Yellow with brownish vertex. Eyes widely separated, distance between them at base of antennae about three times exceeds length of scape. Antenna (Fig. 15A) 1.0–1.1 mm long in female, extending to wing base if bent backward. Scape yellow, elongate, nearly cylindrical, about 1.5 times as long as wide, pedicel dark brown, slightly widening distally, about two-thirds as long as scape. Flagellum dark brown. Basal flagellomeres oval, remaining elongate. Apical segment nearly as long as preceding. Verticils dark brown, longest up to 1.5 times as long as respective segments. Rostrum pale yellow, palpus dark brown, mouth parts brownish yellow.

Thorax: Cervical sclerites pale yellow. Pronotum yellow, dorsally infuscated with brown, with few erect setae postero-laterally. Mesonotal prescutum yellow, testaceous frontally, without stripes. Tubercular pits indistinct, pseudosutural fovea concolorous with prescutum. Scutal lobe same color as prescutum, area between lobes pale. Scutellum yellow, mediotergite brownish yellow. Pleuron uniformly yellow, vaguely patterned with brownish at wing base. Wing (Fig. 15B) brownish, yellowish at base. No other darkening except stigma, which is also indistinct, pale-brown. Veins brownish, yellowish at wing

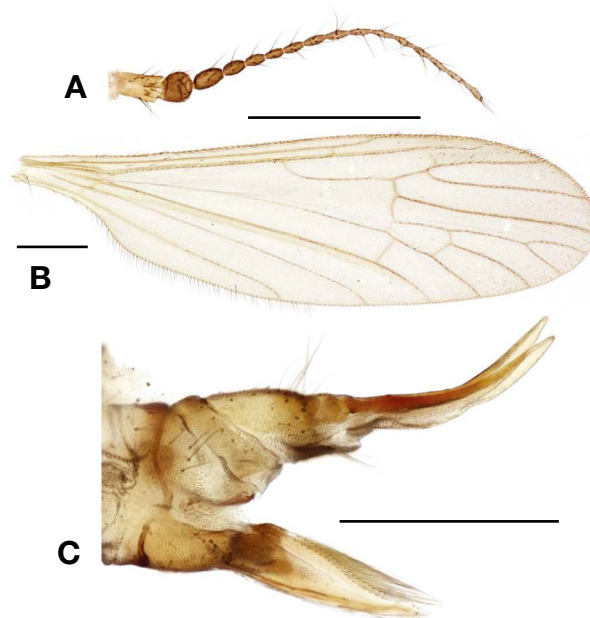


Fig. 15. *Paradelphomyia macracantha* Alexander, 1957. A. female antenna. B. wing. C. ovipositor, lateral view. Scale bars 0.5 mm.

base. Macrotrichiae more abundant in radial cells, they are present in other marginal cells along postero-apical wing margin. Venation: *Sc* long, reaching branching point of *Rs*, *sc-r* long distance from tip of *Sc*, slightly before middle of *Rs*. *Rs* long, arched at base. Free end of *R*₁ longitudinal, slightly arched, *R*₂ distinct, transverse, slightly beyond base of cell *r*₃. *R*₃ and *R*₄ diverging towards wing margin, cell *r*₃ with stem which 2.3 times as long as *R*₂. Cross-vein *r-m* distinct, at base of discal cell. Discal cell long and narrow, nearly three times as long as wide. Position of cross-vein *m-cu* variable: two Korean specimens with *m-cu* nearly at the middle of discal cell, like in holotype, one specimen with *m-cu* much closer to the base of discal cell. Anal vein long, slightly arched at apex, reaching wing margin slightly beyond the level of *Rs* base. Anal angle narrow, widely rounded. Halter pale yellow at base, weakly infuscated towards knob. Length of female halter 0.6–0.9 mm. Coxae and trochanters yellow, forecoxa testaceous frontally and dorsally. Remainder of legs testaceous yellow. Tibial spurs long.

Abdomen: Tergites brown, covered with sparse brown setae. Sternites yellowish brown. Ovipositor (Fig. 15C) yellow, cercus elongate, point-apexed, distal half slightly raised upwards. Hypovalva long, straight, narrower towards apex, reaching to about middle of cercus.

Elevation: From nearly 450 to 500 m.

Period of activity: From beginning of June through mid July.

Habitats: Small to medium-sized mountainous streams and rivers densely covered with deciduous shrubs, trees

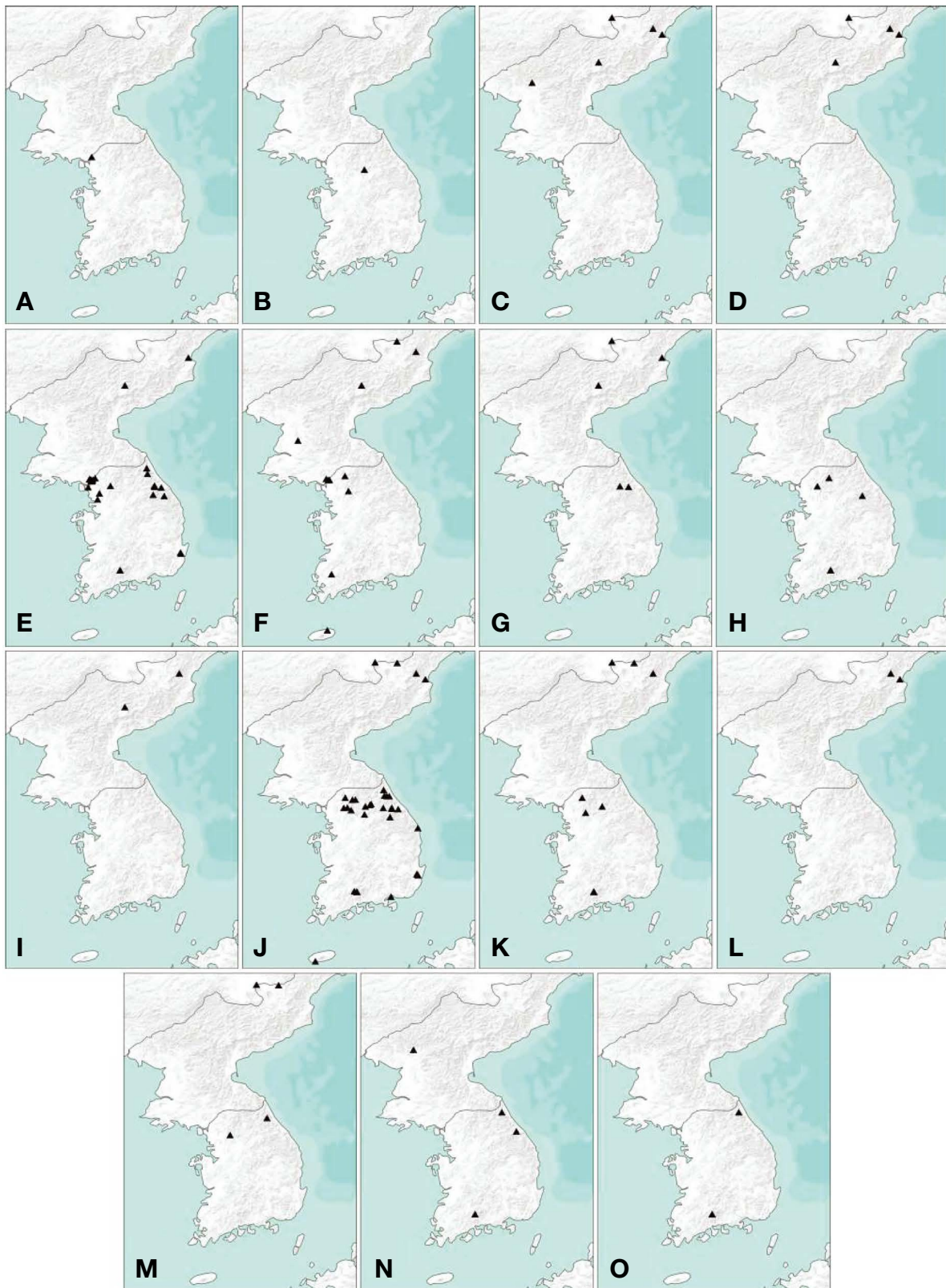


Fig. 16. Distribution maps of Korean Limoniidae crane flies. A. *Dicranomyia (Erostrata) submelas*. B. *Dicranoptycha venosa*. C. *Austrolimnophila (Archilimnophila) subunicoides*. D. A. (A.) *unica*. E. A. (*Austrolimnophila*) *asiatica*. F. *Conosia irrorata*. G. *Dicranophragma (Brachylimnophila) transitorium*. H. D. (*Dicranophragma*) *melaleucum melaleucum*. I. *Eloephila persalsa*. J. *E. serenensis*. K. *E. subaprilina*. L. *E. ussuriana ussuriana*. M. *E. yezoensis*. N. *Paradelphomyia chosenica*. O. *P. macracantha*.

and dense grassy vegetation along margin. Adults are attracted to light.

General distribution: Specimens were described and previously known only from Honshu Island, Japan.

Examined material (Fig. 16O): holotype (as *P. (Oxyrhiza) macracantha*), male (leg, wing and genitalia slide-mounted), Japan, Honshu, Kami-Ishikawa, Echigo, 1954.06.27, H. Koike (USNM); 1 female (in EtOH), S. Korea, Gangwon-do, Goseong-gun, Ganseong-eup, Jinbu-ri, N 38.26678, E 128.35706, alt. 497 m, 2015.07.08 (1), coll. S. Kim, S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2016.06.03 (2), coll. S. Podenas (NIBR); 1 female (in EtOH), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58090, alt. 448 m, 2016.06.03 (4), coll. S. Podenas, at light (NIBR).

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