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Epiphragma crane flies (Diptera: Limoniidae) of Korea

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Short-palped crane flies belonging to the genus *Epiphragma* Osten Sacken, 1860 (Diptera: Limoniidae: Limnophilinae) have a worldwide distribution except the Afrotropics, with the highest diversity in Neotropics and Oriental Region. They are divided into four subgenera: *Eupolyphragma* Alexander, 1948, *Epiphragma* s. str., *Lipophragma* Alexander, 1978, and *Parepiphragma* Alexander, 1960. Diagnostic characters and wing photographs of all subgenera are given. Genus *Epiphragma* was previously unknown from the Korean Peninsula. Species *Epiphragma* (*Epiphragma*) *gracilistylus* Alexander, 1933 is newly recorded for North Korea, *E.* (*E.*) *subfascipenne* Alexander, 1920 is newly recorded for South and North Korea, and *E.* (*E.*) *subinsigne* Alexander, 1920 is newly recorded for South Korea. These species are taxonomically revised, and the taxonomic status of *E.* (*E.*) *gracilistylus* is discussed. We present an identification key and redescriptions and illustrations of both sexes from all species in Korea. Redescription of larva and pupa of *E.* (*E.*) *subfascipenne* is presented. Elevation range, period of activity, habitat information, general distribution, and a distribution map in Korean Peninsula is given for each species.

Keywords: habitat, larva, Limnophilinae, new records, North Korea, pupa, South Korea, taxonomy

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Introduction

The first collection of *Epiphragma* Osten Sacken, 1860 crane flies (Diptera: Limoniidae: Limnophilinae) from the Korean Peninsula were in 1937 and 1938 by A.M. Yankovsky (Table 1). His specimens are from the northern part of North Korea and they are the only *Epiphragma* specimens that are known from the North Korea so far. Investigation of South Korean *Epiphragma* was initiated by G.W. Byers in 1954. He was followed by the researchers from Korea University starting in 1973, and entomologists from the National Institute of Biological Resources started collecting *Epiphragma* in 2011. Since then, *Epiphragma* crane flies have been collected annually throughout the country in different localities, at different times, and using different methods. The aim of the study was to document, redescribe, illustrate, and prepare keys for all Korean *Epiphragma* crane flies identified to date. Despite first specimens being collected more than 80 years ago, this genus was not recorded from the Korean Peninsula. This study is a continuation of our previous work on Limoniidae crane flies in Korea. In this article we provide photographs of both sexes of all Korean species, illustrations, and redescription of *E.* (*E.*) *subfascipenne* Alexander, 1920 larva.

Materials and Methods

Epiphragma crane flies, that were available for this study (Table 1), are preserved in these scientific collections:

Specimens collected in 1937−1938 in northern part of the Korean Peninsula are deposited in the collections of the United States National Museum (USNM), Smithsonian Institution, Washington DC, USA;

Specimens collected in 1954 in South Korea are deposited in the Snow Entomological Museum, University of Kansas (SMEK), Lawrence, KS, USA and at USNM;

Specimens collected in 1973−2015 in South Korea, are deposited in the collection of the Korea University (KU), Seoul, South Korea;

Table 1. Collecting sites in Korea.

Localities	Years	N*	E*	Collectors	Collecting Methods	Depositories
N. Korea, Chonsani Paiktusan (Yanggang-do, Daehongdan-gun)	1937	41.99360	128.75250	A.M. Yankovsky	Net	USNM
N. Korea, Seren Mts. (Hamgyeonbuk-do, Gyeongsung-gun)	1938	41.68730	129.30918	A.M. Yankovsky	Net	USNM
S. Korea, #8, #9 #11, Central National Forest, 18 miles NE Seoul (Gyeonggi-do, Namyangju-si, Sudong-myeon, Naebang-ri)	1954	37.74813	127.29364	G.W. Byers	Net	SMEK, USNM
S. Korea, Gyeonggi-do, Paju-si, Gwangtan-myeon, Yeongjang-ri, Bogwangsa	1973 1993	37.75322	126.91969	P.K. Yang, J.C. Sohn		KU
S. Korea, Gangwon-do, Chuncheon-si, Namsan-myeon, Kukok-pokpo (waterfall)	1999	37.79222	127.60925	J.C. Sohn		KU
S. Korea, Gangwon-do, Pyeongchang-gun, Daegwallyeong-myeon, Yongsan-ri, Mt. Balwangsan	2008	37.63092	128.65385	J.D. Yeo, M.J. Jeon, K.G. Kim	Malaise trap	KU
S. Korea, Gangwon-do, Pyeongchang-gun, Daehwa-myeon, Daehwa-ri, Mt. Gariwangsan	2009	37.53028	128.49833	J.D. Yeo, J.D. Yoon	Malaise trap	KU
S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Jangjeon-ri, Mt. Gariwangsan	2009	37.48778	128.54528	J.D. Yeo & J.D. Yoon, W.Y. Choi	Malaise trap	KU
S. Korea, Gangwon-do, Jeongseon-gun, Imgye-myeon, Dojeon-ri	2011	37.53583	128.90278	H.-W. Byun *et al*.	Malaise trap	NIBR
S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Topdong-ri, Odaesan National Park,	2012 2013	37.72722 37.71503	128.55222 128.55658	S.J. Park, L.J. Hur, S.-B. Oh	Malaise trap	NIBR
S. Korea, Gangwon-do, Pyeongchang-gun, Odaesan National Park	2012	37.74913 37.73920	128.57723 128.59398	S. Podenas	Net	NIBR
S. Korea, Gyeonggi-do, Paju-si, Gunnae-myeon, Baegyeon-ri, Tongilchon, (Beef Farm)	2015	37.90725	126.73441	T.A. Klein, H.-C. Kim	Mosquito Magnet	NIBR
S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley	2013 2015 2016	35.26580 35.27448 35.27177 35.27333 35.26586 35.27123 35.26590	127.58128 127.56378 127.57146 127.56924 127.58090 127.57133 127.58096	S. Podenas, H.-M. Baek, V. Podeniene	Adults by net and at light, larvae by hand	NIBR
S. Korea, Gangwon-do, Pyeonchang-gun, Jinbu-myeon, Dongsan-ri, Odaesan National Park	2015	37.73767	128.59166	S. Kim, S. Podenas	Net	NIBR
S. Korea, Gangwon-do, Gapyeong-gun, Buk-myeon, Jeokmok-ri	2015	37.97627	127.44160			KU
S. Korea, Gyeongsangbuk-do, Gyeongju, Jinhyeon-dong, Tohamsan (Mt.)	2016	35.78755	129.34274	H.-M. Baek, S. Podenas	Net	NIBR
S. Korea, Gyeongsangbuk-do, Gyeongju, Yangbuk-myeon, Janghang-ri	2016	35.76236	129.36407	H.-M. Baek, S. Podenas	Net	NIBR
S. Korea, Jeju-do, Seogwipo, Sanghyo-dong	2017	33.30857	126.55944	S. Podenas	Net	NIBR
S. Korea, Jeju-do, Hallasan National Forest	2017	33.43222	126.59776	S. Podenas, V. Podeniene	Net	NIBR
S. Korea, Gyeonggi-do, Gunpo-si, Suri-dong	2017	37.35022	126.91527	S. Podenas	Net	NIBR

*Coordinates for old collecting sites are approximate

Specimens collected in 2011−2017 in South Korea, are deposited in the collections of the National Institute of Biological Resources (NIBR), Incheon, South Korea.

Adult crane flies were collected using insect nets, Malaise traps, at light, and Mosquito Magnet® traps. Some specimens were preserved dry in envelopes in the field

and later mounted in the laboratory on their side on a paper point with legs generally surrounding the insect pin. Other specimens were preserved in 96% ethanol (EtOH). Later specimens were slide mounted in Euparal, with genitalia of males and ovipositors of females cleared overnight in approximately 10% KOH, and then preserved in microvials filled with glycerol. Larvae and pupae were collected by hand. Some were reared to adults, other preserved in 70% ethanol. Later, the head capsules of two specimens and spiracular fields were slide-mounted in glycerin jelly. In total, over 170 Korean *Epiphragma* crane flies were used for this study. Specimens were studied with Olympus SZX10 dissecting microscope. Photographs of insects were taken with digital camera Canon EOS 80D through a Canon MP-E 65 mm macro lens. Photographs of larval head capsules were redrawn by hand.

Information in the "Examined material" sections is given exactly as it is on the labels regardless of style, measurement units, and geographic information. Additional labels kept with the specimen, or additional notes on same label, such as "Metatype", are written by Ch. P. Alexander, who originally described species. If specimens were collected by S. Podenas and his colleagues, usually the collecting date on the label is followed by the number in the brackets. This number indicates the different number of places where insects were collected on the same date. Collecting localities with at least approximate coordinates are summarized in Table 1. Information from Table 1 was used to generate geographical distribution maps (Fig. 7). Identification key, illustrations, and redescriptions are based on morphological characters observed in Korean specimens. Photograph and description of *Epiphragma subinsigne* male terminalia are based on specimens collected outside Korea. Analysis of mitochondrial DNA Cytochrome c oxidase subunit I barcoding region was performed in cases of distinct morphological variation patterns in *E. subfascipenne*.

Terminology of adult morphological features generally follows that of McAlpine (1981). Terminology of larval and pupal morphological features generally follows that of Oosterbroek and Theowald (1991) and Teskey (1981).

General distribution of species is given according Oosterbroek (2019).

Taxonomy

Epiphragma Osten Sacken, 1860

Limnophila (*Epiphragma*) Osten Sacken, 1860: 238.

Epiphragma Edwards, 1938: 63, 66; Alexander, 1948: 168; Ishida, 1959: 2; Savchenko, Krivolutskaya, 1976: 53; Savchenko, 1983: 47; 1986: 222; 1989: 73–74.

Type species *Limnophila pavonina* Osten Sacken, 1860 (designation: Coquillett, 1910) (=*fasciapenne* (Say, 1823)).

Adult.

General: Medium-sized crane flies with body length between 7.0 and 14.0 mm. Body coloration varies from yellowish-brown to brown sparsely dusted with gray.

Head: Vertex with small tubercle. Eyes dorsally widely separated in both sexes. Antenna simple, 16-segmented, nearly reaching base of wing in male, if bent backwards, slightly shorter in female, flagellomeres rounded, oval or elongate, verticils long. Two basal flagellomeres cone-shaped. Flagellum distinctly colored, orange in most Holarctic and Oriental species, but could be distinctly brown, together with pedicel, in Neotropic species, for example, *E. varium* (Wiedemann, 1828). Rostrum and mouth parts short. Palpus four-segmented.

Thorax: Tubercular pits missing, pseudosutural foveae small. Mesonotal prescutum usually with three longitudinal stripes. Katepisternum naked. Meron small, thus second and third pairs of legs close to each other. Wing wide and elongate with distinct dark-brown ocellate pattern. Spots uniformly colored or with darker margins. Arculus missing. Costal cell with one or more additional crossveins. Radial sector long, angulate and short-spurred at base. Cell r_3 long, R_{2+3+4} short, cell m_1 present, discal cell closed and elongate. Basal deflection of CuA_1 distinctly beyond base of discal cell, usually at about one-third or middle length of it. Anal angle widely rounded. Fore tibia with single spur, middle and posterior tibiae with two spurs each. Claw with subbasal spine.

Abdomen: Tergites caudally with transverse invaginations. Male genitalia slightly enlarged. Ninth tergite transverse with small tubercle at middle of posterior margin. Gonocoxite elongate without additional lobes. Two pairs of terminal gonostyles. Outer gonostylus narrow with sclerotised apex. Inner gonostylus fleshy. Interbase species-specific, sometimes complicated, sometimes extended into long rod. Penis simple long and straight. Ovipositor with long arched and sclerotised cercus and long hypovalva.

Larva.

General: Body white.

Head: Head capsule egg shaped, depressed dorsoventrally and slightly reduced, dorsal suture absent, coronal suture reaching one-third of head length, internolateralia fused with frons. Caudal end of frons dentate. Clypeus stripe shaped, slightly sclerotised and separated from frons and labrum by fissures. Labrum consist of two triangular lobes and bump-shaped structure between them. Antenna short, reaching apical part of clypeus. Mandible cone-shaped, with single large apical tooth and few smaller teeth on ventral and dorsal sides. Maxilla well developed and consists of more prominent outer lobe (palpiger)

and smaller inner lobe (lacinia + galea). Hypostoma heavily sclerotised and bears three blunt teeth. Labium consists of two small cone-shaped lobes. Basal part of hypopharynx consists of two arcuate curved lateral rods, upper part membranous.

Abdomen: with dorsal and ventral creeping welts on II–VII segments. Spiracular field surrounded by five (in some species four) spiracular lobes. Spiracular field without sclerites.

Pupa.

General: Head, thorax, wings, and tergites of second and third abdominal segments brown.

Head: Cephalic crest absent, but head bears 2 spines directed forward and downward. Antennal sheaths short, only slightly extending beyond base of wing.

Thorax: Respiratory horns arcuate curved and slightly widened basally. Apices of leg sheaths end nearly at same level.

Abdomen: White. Abdominal segments with transverse row of sclerotised pointed spines situated dorsally. Terminal end of male rounded, with several small tubercles. Terminal end of female elongated. Sheaths of cerci much longer than valves, directed upward.

143 extant species belong to genus *Epiphragma*. It has worldwide distribution except Afrotropics with the highest diversity in Neotropics (64 species) and Oriental Region (49 species). East Palearctic is represented by 10 species and only one species occurs in Westpalearctic (Oosterbroek, 2019). Four subgenera belong to the genus *Epiphragma*, but two of them *Lipophragma* Alexander, 1978 and *Parepiphragma* Alexander, 1960 are monotypic. *Eupolyphragma* Alexander, 1948 is represented by 25 species and the largest is nominative subgenus with 115 species. Discrimination of subgenera are based on peculiarities of adult wing venation, but these characters aren't consistent through all species. Nominative subgenus *Epiphragma* s. str. has one supernumerary cross-vein in cell *c* (Fig. 1A), *Eupolyphragma* has few cross-veins in cell *c* and supernumerary cross-vein in cell *cu* (Fig. 1B), *Lipophragma* has no supernumerary cross-veins (Fig. 1C), and *Parepiphragma* has one supernumerary cross-vein in cell *c* and supernumerary cross-vein in cell *m* (Fig. 1D). Premature stages are known only for nominative subgenus. Two fossil species are included in genus *Epiphragma*, one of them from Eocene/Oligocene coal deposits in England, another from Miocene Dominican amber (Evenhuis, 2014).

Check list of Korean *Epiphragma* crane flies

Epiphragma (*Epiphragma*) *gracilistylus* Alexander, 1933
Epiphragma (*Epiphragma*) *subfascipenne* Alexander, 1920
Epiphragma (*Epiphragma*) *subinsigne* Alexander, 1920

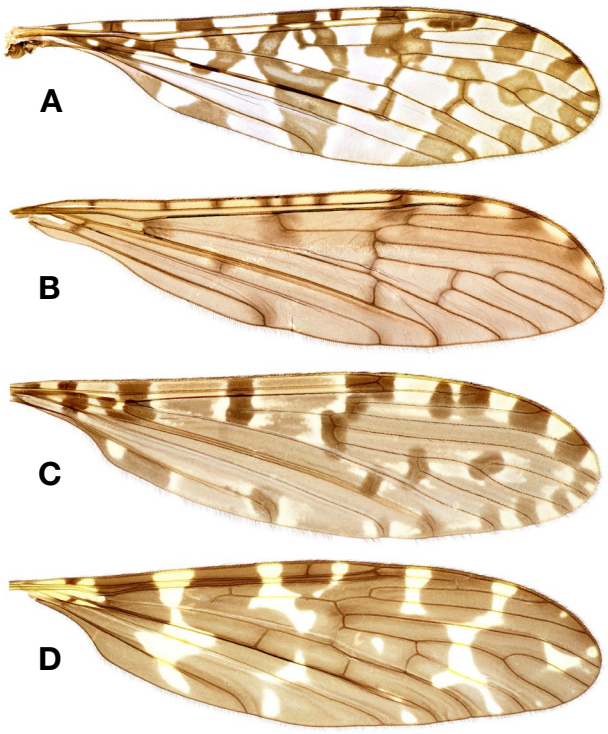

Fig. 1. Wings of *Epiphragma* sp. showing diagnostic characters of subgenera. A. *E.* (*Epiphragma*) *adoxum* Alexander, 1953, holotype. B. *E.* (*Eupolyphragma*) *angusticrenulum* Alexander, 1931, holotype. C. *E.* (*Lipophragma*) *garrigoui* (Alexander, 1948), holotype. D. *E.* (*Parepiphragma*) *perideles* Alexander, 1960, paratype.

Key to Korean species of the genus *Epiphragma*

1. Femur with one dark ring at apex. Halter with pale yellow knob. Wing spots with darker margins ····· *Epiphragma* (*Epiphragma*) *subfascipenne* Alexander, 1920
– Femur with two dark rings. Halter with dark brown base of knob. Wing spots with or without darker margins ····· 2
2. Wing spots without darker margins ····· *Epiphragma* (*Epiphragma*) *gracilistylus* Alexander, 1933
– Wing spots with darker margins ····· ·· *Epiphragma* (*Epiphragma*) *subinsigne* Alexander, 1920

Epiphragma (*Epiphragma*) Osten Sacken, 1860

Limnophila (*Epiphragma*) Osten Sacken, 1860: 238.
Epiphragma Edwards, 1938: 63, 66–67; Alexander, 1948: 168–170; Ishida, 1959: 2, 4; Savchenko, Krivolutskaya, 1976: 53; Savchenko, 1983: 47; 1986: 222–226; 1989: 73–74.
Type species *Limnophila pavonina* Osten Sacken, 1860 (designation: Coquillett, 1910) (=*fasciapenne* (Say, 1823)).

Main set of characters as in genus. Antenna with scape

and pedicel dark, brown or blackish, flagellum orange or yellow at base, verticils long. Wing with ocellate pattern, additional cross-vein in cell *c*. Differs from other subgenera by having single cross-vein in cell *c* and no cross-veins in cells *m* or *cu*, legs covered with simple setae, not scales.

A total of 115 recent species belong to the subgenus *Epiphragma* (*Epiphragma*). Distribution as in the whole genus with lower numbers in Oriental Region and Australia.

Larva and pupa as described for the genus. They are known only for five species *E*. (*E*.) *fasciapenne* (Say, 1823), *E*. (*E*.) *imitans* Alexander, 1913, *E*. (*E*.) *ocellare* (Linnaeus, 1760), *E*. (*E*.) *solatrix* (Osten Sacken, 1860) and *E*. (*E*.) *subfascipenne* (Alexander, 1920; Bruch, 1939; Brindle, 1967; Krivosheina, 2009).

Epiphragma (*Epiphragma*) *gracilistylus* Alexander, 1933

Epiphragma ocellaris gracilistylus Alexander, 1933: 141.
Epiphragma (*Epiphragma*) *ocellaris gracilistyla* Savchenko, Krivolutskaya, 1976: 53; Savchenko 1983: 47; 1989: 75; Starý, Oosterbroek, 2008.
Epiphragma (*Epiphragma*) *gracilistylus* Kato, Nakamura, 2014.

General: Body coloration: thorax brown, abdomen yellowish-brown. Body length of male 9.8 mm, of female 13.3 mm, wing length of male 11.6 mm, of female 12.1 mm.

Head: Brown densely covered with brownish-gray pruinosity, rusty-brown line along middle of vertex more distinct on tubercle, narrowly light gray along eye margin, with long erect setae dorsally. Head distinctly narrows posteriorly. Eyes widely separated. Antenna 2.5 mm long in male, reaching to about wing base if bent backward. Scape elongate, nearly three times as long as wide, nearly cylindrical, dark brown covered with scarce gray pruinosity. Pedicel less than half the length of scape, widened distally, concolorous with scape. Flagellum orange at base, turning brownish towards distal end. Basal flagellomere widened, remaining flagellomeres elongate, getting longer towards apex. Apical flagellomere approximately as long as penultimate. Longest verticils up to 1.5 times as long as respective segments. Rostrum brown to rusty-brown. Palpus dark brown dusted with brownish-gray. Labellum light brown dorsally, dark brown ventrally.

Thorax: Cervical sclerites dark brown. Pronotum dark brown with shallow median incision, frontal and posterior margins brownish-yellowish gray. Mesonotal prescutum generally brown dusted with brownish-gray, widely brown along humeral-cephalic-humeral margin and with three indistinct longitudinal dark gray stripes. Median stripe lighter frontally and with distinct but short dark brown line at frontal margin of sclerite. Areas between stripes covered with erect setae. Scutal lobe dark brown dusted with gray, narrowly light brown along median margin. Area between lobes brown. Scutellum and mediotergite dark brown dusted with gray. Pleuron dark brown spotted with lighter areas and dusted with silvery-gray. Wing (Fig. 2A) with intense brown ocellate spots, yellowish in costal area and at base. Spots without darker margins. Veins yellowish-brown. Venation: *Sc* long, tip of Sc_1 reaching beyond branching point of *Rs*. Sc_2 beyond tip of Sc_1. *Rs* long, angulate and short spurred at base. Distal part of R_1 short, oblique, beyond R_2. R_2 nearly transverse. R_3 and R_4 slightly diverging towards wing margin, R_5 slightly diverging from R_4 at wing margin. Discal cell elongate, nearly twice as long as wide. Basal deflection of CuA_1 distinctly beyond branching point of *M*, at one-third length of discal cell. A_1 straight, distal end of A_2 slightly arched. Anal angle widely rounded, medium-wide. Length of male halter 1.8 mm, of female 2.1 mm. Halter brownish-yellow, knob dark brown at base and whitish at apex. Coxae yellow, just fore coxa slightly infuscate frontally, dusted with light gay. Trochanters brownish-yellow. Femur yellow with two dark rings, one wider at apex, another narrower just beyond middle. Tibia yellow with narrowly darkened apex. Three basal tarsomeres yellowish-brown with narrowly darkened apices, fourth and fifths tarsomeres brown to dark brown. Male femur I: 7.0 mm long, II: 7.0 mm, III: 7.9 mm, tibia I: 9.1 mm, II: 8.4 mm, III: 10.2 mm, tarsus I: 10.0 mm, II: 7.1 mm, III: 6.9 mm. Female femur I: 7.2 mm long, II: 6.9 mm, III: 7.8 mm, tibia I: 9.5 mm, II: 9.0 mm, III: 11.0 mm, tarsus I:

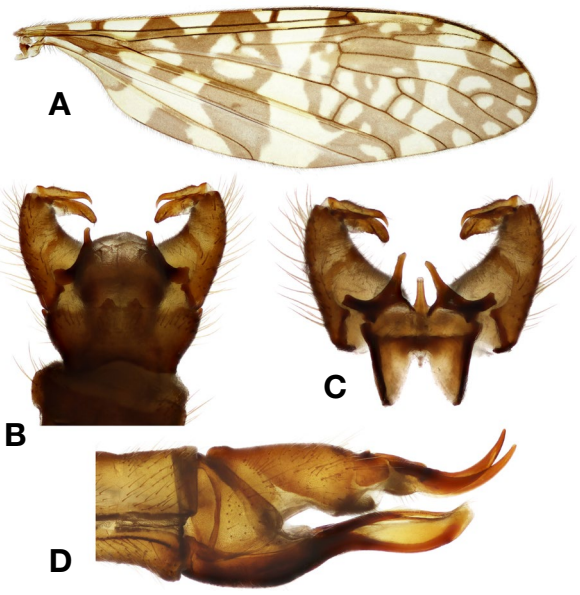

Fig. 2. *Epiphragma* (*Epiphragma*) *gracilistylus*. A. wing. B. male genitalia, dorsal view. C. male genitalia with removed ninth tergite, dorsal view. D. ovipositor, lateral view.

10.5 mm, II: 7.8 mm. Claw with long subbasal spine.

Abdomen: Tergites brownish-yellow with indistinct darker lines along middle and along lateral margin. Central line gets darker towards tip of abdomen. Basal sternites pale yellow, distal brownish-yellow with narrowly pale posterior margin. Male terminalia (Fig. 2B, C) dark brown sparsely dusted with gray. Ninth tergite distinctly wider than longer with two small tubercles at the middle of posterior margin. Shape of tubercles slightly varies individually. Gonocoxite elongate, simple, wider at base, narrower beyond middle, without additional lobes. Outer gonostylus long, narrow, setose, apex spine-shaped and curved inwards. Inner gonostylus long, narrow, fleshy and setose. Interbase comparatively short and wide, strongly sclerotised. Penis narrow and straight. Ovipositor (Fig. 2D) yellowish-brown. Ninth tergite elongate, tenth tergite wider than longer. Cercus darker than tenth tergite, long and narrow, strongly arched, distal part raised upwards, point-apexed. Hypovalva long, narrow at base, widened beyond middle with raised distal part, yellowish along middle, slightly sinuous, with few setae on tip, round-apexed, reaching to middle of cercus.

Elevation range in Korea: From 1150 m to about 1500 m.

Period of activity: From mid-June to mid-July.

Habitats: Mixed and deciduous forests.

General distribution: Far East of Russia and Japan. Recorded from the Korean Peninsula for the first time.

Remarks: *E. gracilistylus* was described by Alexander (1933) as a subspecies of *E. ocellare* (Linnaeus, 1760). Description was based on a single specimen from the Eastern Siberia. Alexander noted just slight differences from the typical *E. ocellaris* in male hypopygium. Savchenko, Krivolutskaya (1976) and Savchenko (1989) mentioned *E.* (*E.*) *ocellaris gracilistyla*, based on Alexander (1933) for the Far East of Russia, but all E. N. Savchenko's specimens were identified as *E. ocellare*. He just made a remark, that *E.* (*E.*) *ocellaris gracilistyla* probably is just an indistinct local geographic variation. Starý and Oosterbroek (Starý, Oosterbroek, 2008) decided that Savchenko "obviously did not accept subspecific status of *E. ocellare gracilistyla*". Kato and Nakamura (2014) raised it to species rank and all Japanese specimens were identified as *E. gracilistylus*. North Korean specimen, that we were able to study, was collected not far from the type locality of *E. ocellaris gracilistylus*. At the moment *E. ocellare* and *E. gracilistylus* are treated as separate species (Oosterbroek, 2019), but so far, no special study was done on taxonomical status of *E. gracilistylus*.

Examined material (Fig. 7A): Holotype, male (antenna, fore leg and part of genitalia slide-mounted), E. Siberia, Tigrowaja, Suchan distr., Ussuri, VI-16, 1927, A. Stackelberg (USNM); 1 female (pinned), North Korea, Seren Mts., alt. 3800 ft., July 10–11, 1938, Yankovsky (USNM); 1 male (pinned), North Korea, Seren Mts., 5000 ft., VI-21, 1938, Yankovsky (USNM). Also compared with 1 female (pinned), Japan, Hokkaido Isl., Shiretoko Peninsula, N 44.108358, E 145.09114, alt. ~300 m, 2011.06.20, coll. K. Skrupskelis (NRC).

Epiphragma* (*Epiphragma*) *subfascipenne
Alexander, 1920

Epiphragma subfascipennis Alexander, 1920: 10–11.

Epiphragma (*Epiphragma*) *subfascipenne* Savchenko, Krivolutskaya, 1976: 53; Savchenko, 1983: 47; 1989: 75.

Adult.

General: Body coloration brown dusted with gray. Body length of male 8.1–12.4 mm, of female 10.8–14.0 mm. Wing length of male 10.4–13.7 mm, of female 10.4–13.5 mm.

Head: Background color dark brown, but covered with dense grayish-yellowish brown pruinosity and changes color depending on light, narrowly light gray along eye margin and above the base of antenna, dark brown ventrally. Vertex with small tubercle, covered with semi-erect dark brown setae. Head posteriorly gets distinctly narrower, like in *Pseudolimnophila*. Eyes widely separated in both sexes. Antenna (Fig. 3A) 2.2–2.4 mm long in male, 2.5–3.4 mm in female, reaching to about wing base if bent backwards in male and somewhat less than that in female. Scape elongate, nearly three times as long as wide, nearly cylindrical, dark brown covered with grayish brown pruinosity. Pedicel half the length of scape, bowl-shaped, brown, with denser gray pruinosity only along distal margin. Flagellum orange at base, pale yellow at middle and brownish at distal end. Basal flagellomere cone-shaped, second flagellomere oval, succeeding segments getting elongate. Length of apical flagellomere slightly exceeds that of penultimate. Longest verticils 1.7 times as long as respective segments. Rostrum dark brown to black. Pal-

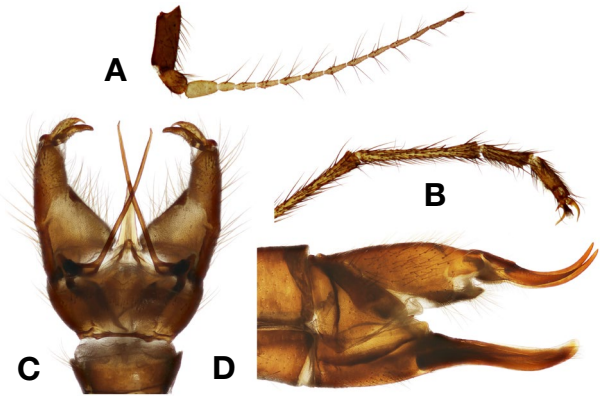

Fig. 3. *Epiphragma* (*Epiphragma*) *subfascipenne*. A. male antenna. B. distal tarsomeres. C. male genitalia, dorsal view. D. ovipositor, lateral view.

pus and mouth parts black, covered with scarce brownish pruinosity.

Thorax: Cervical sclerites brown, covered dorsally by large dark brown pronotum. Frontal margin of pronotum light brown with shallow median incision. Mesonotal prescutum generally brown dusted with grayish, widely castaneous brown along humeral-cephalic-humeral margin and with four longitudinal darker stripes covered with yellowish-gray dusting. Median stripes separated by narrow grayish line. Areas between stripes covered with erect golden setae. Scutal lobe grayish-brown with small indistinct darker spot covered with erect setae. Area between lobes yellowish. Scutellum brown, sparsely dusted with grayish, covered laterally with erect golden setae. Mediotergite light brown, sparsely dusted with gray. Pleuron brown spotted with grayish, dusted and semi-polished uncovered areas with indistinct darker stripe extending from head to the base of abdomen. Wing with small translucent areas inside intense brown ocellate spots, yellowish in stigmal area and at base. Dark pattern varies individually (Fig. 4), but most specimens have distinct complete light transverse band at middle, less distinct and narrower complete light band beyond stigma. Spots with narrow darker margins. Veins yellowish brown. Venation: *Sc* long, tip of Sc_1 nearly reaching branching point of *Rs*. Sc_2 slightly beyond tip of Sc_1, in front of branching point of *Rs*. *Rs* long, angulate and short-spurred at base. Distal part of R_1 slightly elongate, oblique, beyond R_2. R_2 transverse. R_3 and R_4 slightly diverging towards wing margin, R_5 slightly arched, distal part turned backwards. Discal cell elongate, twice as long as wide. Basal deflection of CuA_1 distinctly beyond branching point of *M*, position varies from about one-third to about middle of discal cell length. Distal end of A_2 slightly arched. Anal angle widely rounded, medium-wide. Length of male halter 1.6–2.0 mm, of female 1.6–2.1 mm. Halter pale yellow with slightly infuscate base. Coxae light brown, dusted with grayish and covered with erect setae. Fore trochanter yellow, middle and posterior trochanters concolorous with coxae. Femur yellow with widely dark brown distal part. Tibia yellow with narrowly darkened apex. Two basal tarsomeres brownish yellow with darkened apices, third segment brown, fourth and fifths tarsomeres dark brown. Male femur I: 6.5–7.0 mm long, II: 6.2–7.2 mm, III: 6.7–7.6 mm, tibia I: 7.6–8.9 mm, II: 6.7–8.6 mm, III: 8.1–10.6 mm, tarsus I: 8.2–10.2 mm, II: 5.9–8.1 mm, III: 6.6–7.6 mm. Female femur I: 5.9–8.2 mm long, II: 6.3–7.9 mm, III: 6.8–8.5 mm, tibia I: 8.1–9.8 mm, II: 7.5–9.3 mm, III: 8.8–10.7 mm, tarsus I: 7.2–8.9 mm, II: 5.7–7.6 mm, III: 6.1–7.8 mm. Claw with long subbasal spine and small tooth at its base (Fig. 3B).

Abdomen: Tergites brown with caudal margins broadly gray pruinose, lateral margins narrowly and indistinctly darkened. Darkening more intense on posterior tergites. Sternites brownish yellow. Male terminalia (Fig. 3C) dark brown sparsely dusted with gray. Ninth tergite distinctly wider than longer with small tubercle at the middle of posterior margin. Shape of tubercle slightly varies individually from narrow triangle-shaped to low shallowly split at apex. Gonocoxite elongate, simple, wide at base, but distinctly narrower beyond middle, without additional lobes. Outer gonostylus long, narrow, setose, apex spine-shaped and curved inwards. Inner gonostylus long, narrow, fleshy and setose. Interbase very long and narrow, rod-shaped with slightly curved apex. Penis long, narrow and straight. Ovipositor (Fig. 3D) brown with reddish-brown cerci and hypovalvae. Tenth tergite elongate. Cercus long and narrow, strongly arched, distal part raised upwards, point-apexed. Hypovalva long, comparatively narrow, slightly sinuous, with subapical brush of setae, round-apexed, reaching beyond middle of cercus.



Fig. 4. Variation of Korean *Epiphragma* (*Epiphragma*) *subfascipenne* wing pattern.

Larva.

General: Body color white. Length 11.5–16.5 mm,

width 1.2−2.1 mm (Fig. 5A−C).

Head. Head capsule 2.0−2.1 mm long and 1.8 mm wide, egg shaped, depressed dorsoventrally and slightly reduced, dorsal suture absent (Fig. 5D). Genae divided into externolateralia and internolateralia, externolateralia slightly oblique, internolateralia fused with frons. Both internolateralia and externolateralia similar in length. Coronal suture reaching one-third of head length and widely separates apical part of internolateralia. Frons with two sensory pits and two long setae on anterior part, two sensory pits on each anterio-lateral side and two sensory pits below the base of antenna. Two sensory pits located in the middle of frons. Caudal end of frons dentate (Fig. 5E). Clypeus stripe shaped, slightly sclerotised and separated from frons and labrum by fissures. Labrum consist of two triangular lobes and bump-shaped structure between them. Each of triangular lobes bears sclerotised ring with three sensory papillae, one medium-long and one short seta located above sensory ring and two sensory pits located outwards from sensory ring (Fig. 5F). Epipharynx covered with short dense setae. Antenna short, reaching apical part of clypeus (Fig. 5G). Basal antennal segment cylindrical, twice as long as wide with sensory pit near the base, very short button-shaped apical papilla and several short sensory papillae (exact number is difficult to establish) on the apex. Mandible cone-shaped, with single large apical tooth (Fig. 5H), two smaller triangular teeth on ventral side (similar in shape and size) and two triangular teeth on dorsal side (upper tooth is more prominent). There is a short seta at the base of mandible. Maxillae well developed and consist of more prominent outer lobe (palpiger) and smaller inner lobe (lacinia + galea) (Fig. 5I). Palpiger cylindrical, with large sclerite at the base, sensory pit in the middle and cushion of prominent bristles on inner margin. Palpus large, cylindrical, with few sensory structures (exact number is difficult to establish) and sensory pit in the middle. Inner lobe (lacinia + galea) rounded, membranous, with small narrow sclerite at the base, apical part covered by short firm setae, with three prominent papillae. Cardo wedge-shaped and bears three setae: a long seta at the base, long seta at the apex, medium-long seta and a sensory pit in the middle. Hypostoma heavily sclerotised and bearing three blunt teeth (Fig. 5J), the middle tooth is the smallest, remaining subequal. Labium consists of two small cone-shaped broad and rounded lobes, each with five sensory papillae apically. Basal part consists of two arcuate curved lateral rods and membranous part above. Membranous part of hypopharynx covered with numerous small spines (Fig. 5K).

Thorax. All thoracic segments wider than longer.

Abdomen. First abdominal segment wider than longer. Seventh and last abdominal segment just slightly longer than wider. Abdominal segments II−V 1.5 times as long as wide. Segments II−VII with dorsal and ventral creeping welts (Fig. 5B). Creeping welts spineless.

Anal division. Spiracular disc with five short and oblong lobes, which are wide at the base and narrowing toward apex. Lateral and ventral pairs well developed, ventral pair is slightly longer (Fig. 5B). Dorsal lobe is vestigial, two long setae located at the apex and two sensory pits in the middle of the lobe. Dorsal margin of spiracular field with two long setae. Lateral lobes almost as wide as long, not covered with sclerites, there is a cushion of three short setae near the apex of the lobe. Ventral lobe 1.5 times as long as width at the base, not covered with sclerites. Three long setae located at the apex of each lobe and single short seta close to the apical part of lobe. Spiracular field fringed with long hairs except small area between lateral and ventral lobes (Fig. 5L). Spiracle small, circular, peritreme pale, yellowish, central disc darkened. Distance between spiracles almost twice the diameter of a spiracle. Anal field consists of two pairs of long, skittle-shaped, white, fleshy anal papillae.

Male pupa.

General: Body color yellowish-white. Head, thorax, pronotal horns, wings and tergites of second and third abdominal segments brown. Length 13 mm, width 2 mm.

Head: Cephalic crest absent, surface smooth. Antennal sheath short, only slightly extending beyond wing base. Labrum trapezoidal with bluntly rounded apex. Labial lobe diamond-shaped. Maxillary palpus broad, transversal with pointed apex.

Thorax: Pronotal horns elongated, arcuate curved and bent inwards, slightly widened basally and pointed apically. Apices of all leg sheaths reach to about the same level at the middle of segment V.

Abdomen: Abdominal segments II−VII with row of more than 20 transverse sclerotised pointed spines on dorsum, more than 20 spines on venter, and about 10 on pleuron (exact number of spines is difficult to establish). Spiracles hardly visible. Terminal segment of male blunt and narrow, anterior part of venter with two transverse rows of about 15 spines each, separated by narrow bare area in the middle. Ventral lobes (anal spines) small with rounded apices, tips of ventral lobes close to each other and reach the base of posterotergal spines, which are small, sharply pointed, directed outward and with two apical setae. Anterodorsal and mediodorsal spines small, similar in shape and size, bearing few setae on the tips, situated almost in the middle of tergum of terminal segment.

Elevation range in Korea: Altitudes from sea level to nearly 1900 m.

Period of activity: Adults are active and flying from late May through beginning of August.

Habitats: Most specimens were collected in wet deciduous and mixed forests, often near small streams surrounded by old trees and shrubs, at the bottom of shaded valleys densely covered with trees, rather common in

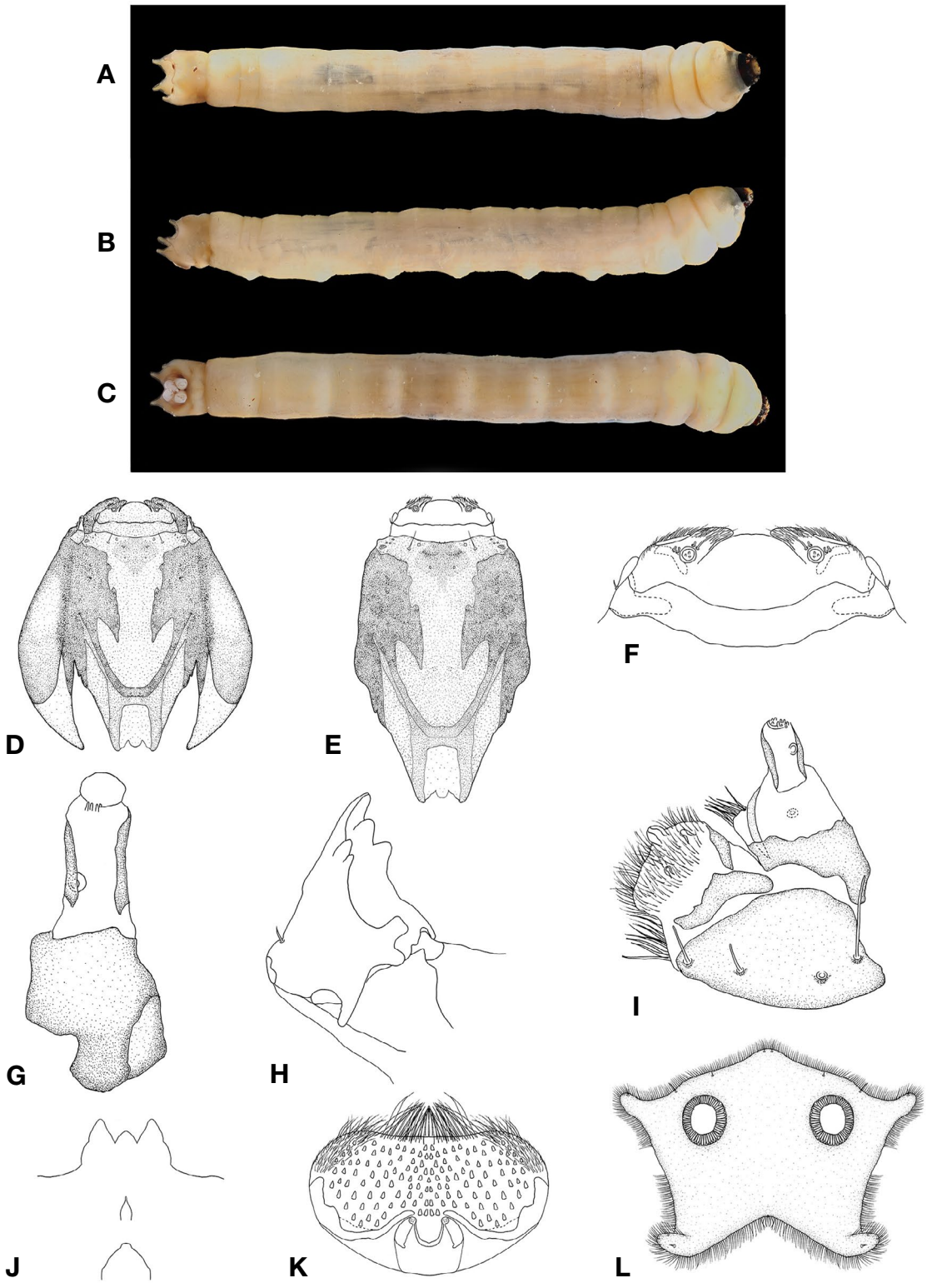

Fig. 5. Larva of *Epiphragma* (*Epiphragma*) *subfascipenne*. A. general view, dorsal aspect. B. general view, lateral aspect. C. general view, ventral aspect. D. general view of head capsule, dorsal aspect. E. frons, dorsal view. F. labrum and clypeus, dorsal view. G. right antenna, dorsal view. H. left mandible, dorsal view. I. right maxilla, ventral view. J. hypostoma, ventral view. K. labium and hypopharynx, ventral view. L. spiracular disc.

villages, especially in places with old trees having dead branches. Species is attracted to light. Larvae and pupa were collected in mixed forest. They were found in rotten deciduous tree logs and branches and in exposed rotten roots.

General distribution: Species is recorded from the Far East of Russia and all largest islands of Japan. Recorded from the Korean Peninsula for the first time.

Remark: Mitochondrial DNA Cytochrome c oxidase subunit I barcoding region of specimens with distinct "unusual" wing pattern variation were checked and compared with "typical" specimens. Analysis of sequences showed insignificant differences and identification was confirmed (GenBank accession numbers MN723538−MN723539).

Examined material (Fig. 7B): Holotype, male (wing and genitalia slide-mounted), Japan, Saitama, May 30, 1919, R. Takahashi (USNM); metatype, male (antenna, wing, leg and genitalia slide-mounted), Japan, Shikoku, Mt. Ischizuchi, VI-10, 1950, Issiki-Ito (USNM); 1 female (pinned), N. Corea, Chonsani Paiktusan, alt. 3400 ft., VII-16, 1937, Yankovsky (USNM); 1 male (pinned), North Korea, Seren Mts., alt. 5500 ft., VI-14, 1938, Yankovsky (USNM); 1 male (pinned), North Korea, Seren Mts., alt. 5000 ft., VI-17, 1938, Yankovsky (USNM); 8 males (pinned), S. Korea, #8, Central National Forest, 18 miles NE Seoul, alt. 400−500 ft., 28 May, 1954, G.W. Byers (SMEK, USNM); 1 male, 1 female (pinned), S. Korea, #9, Central National Forest, 18 miles NE Seoul, alt. 400−500 ft., 29 May, 1954, G.W. Byers (SMEK); 1 male, 1 female (pinned), S. Korea, #11, Central National Forest, 18 miles NE Seoul, alt. 350−500 ft., 4 June, 1954, G.W. Byers (SMEK); 1 female (pinned), S. Korea, Gyeonggi-do, Paju-si, Gwangtan-myeon, Yeongjang-ri, Bogwangsa, N 37.75322, E 126.91969, alt. 219 m, 1973.06.06, P.K. Yang (KU); 1 female (pinned), S. Korea, Gyeonggi-do, Paju-si, Gwangtan-myeon, Yeongjang-ri, Bogwangsa, N 37.75322, E 126.91969, alt. 219 m, 23.V.1993, J.C. Sohn (KU); 1 female (pinned), S. Korea, Gangwon-do, Chuncheon-si, Namsan-myeon, Kukok-pokpo [waterfall], N 37.79222, E 127.60925, alt. 279 m, 29.V.1999, J.C. Sohn (KU); 2 females (in ethanol), S. Korea, Gangwon-do, Pyeongchang-gun, Daegwallyeong-myeon, Yongsan-ri, Mt. Balwangsan, [N 37.63092, E 128.65385, alt. 811 m], 2008.VII.19, J.D. Yeo, M.J. Jeon, K.G. Kim, Malaise Trap (NIBR); 2 females (in ethanol), S. Korea, Gangwon-do, Pyeongchang-gun, Daehwa-myeon, Daehwa-ri, Mt. Gariwangsan, N 37.53028, E 128.49833, [alt. 1761 m], 2009.06.03−06.16, J.D. Yeo, J.D. Yoon, Malaise Trap (KU); 1 female (in ethanol), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Jangjeon-ri, Mt. Gariwangsan, N 37.48778, E 128.54528, [alt. 1693 m], 2009.06.04−06.17, J.D. Yeo & J.D. Yoon, Malaise Trap (KU); 1 female (in ethanol), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Jangjeon-ri, Mt. Gariwangsan, N 37.48778, E 128.54528, [alt. 1693 m], 2009.06.17−07.04, W.Y. Choi, Malaise Trap (KU); 1 female (in ethanol), S. Korea, Gangwon-do, Jeonseon-gun, Ingye-myeon, Dojeon-ri, N 37.53583, E 128.90278, alt. 761.8 m, 2011.05.24−06.23, H.-W. Byun *et al*., Malaise Trap (NIBR); 2 females (in ethanol), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Topdong-ri, Odaesan National Park, N 37.72722, E 128.55222, [alt. 1877 m], 2012.05.29−06.28, S.J. Park, L.J. Hur, Malaise Trap (NIBR); 1 female (in ethanol), S. Korea, Gangwon-do, Pyeongchang-gun, Odaesan National Park, N 37.74913, E 128.57723, alt. 726 m, 2012.06.22, S. Podenas (NIBR); 1 male (pinned), 5 larvae (in ethanol), 1 male pupa exuvium (male emerged 2013.05.20), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26580, E 127.58128, alt. 378 m, 2013.05.10, V. Podeniene (NIBR); 1 male, 3 females (in ethanol), S. Korea, Gangwon-do, Pyeongchang-gun, Jinbu-myeon, Tapdong-ri, Odaesan National Park, St.1, [N 37.71503, E 128.55658, alt. 759 m], 2013.05.27−07.04, J.-S. Park, S.-B. Oh, Malaise Trap (NIBR); 4 larvae (in ethanol), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2015.04.24 (1), V. Podeniene (NIBR); 2 larvae (in ethanol), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.27177, E 127.57146, alt. 490 m, 2015.04.27 (2), V. Podeniene (NIBR); 2 larvae (in ethanol), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.28589, E 127.55605, alt. 773 m, 2015.04.30 (1), V. Podeniene (NIBR); 1 male (pinned), S. Korea, Tongilchon, (Beef Farm), N 37.90725, E 126.73441, alt. 32 m, 2015.05.29, T.A. Klein, H.-C. Kim, (NIBR); 1 male (pinned), 1 male (in ethanol), 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 (in ethanol), 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 male (pinned), 1 male, 2 females (in ethanol), 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 female (in ethanol), S. Korea, Gangwon-do, Gapyeong-gun, Buk-myeon, Jeokmok-ri, N 37.97627, E 127.44160, [alt. 1316 m], 2015.08.[?]−09.27, Malaise Trap (KU); 1 male, 1 female (pinned), S. Korea, Gyeongsangbuk-do, Gyeongju, Jinhyeon-dong, Tohamsan (Mt.), N 35.78755, E 129.34274, alt. 320 m, 2016.05.27 (1), H.-M. Baek, S. Podenas (NIBR); 1 female (pinned), S. Korea, Gyeongsangbuk-do, Gyeongju, Yangbuk-myeon, Janghang-ri, N 35.76236, E 129.36407, alt. 333 m, 2016.05.28 (1), H. Baek, S. Podenas (NIBR); 6 males (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Jirisan

National Park, Piagol valley N 35.26590, E 127.58096, alt. 446 m, 2016.06.02, S. Podenas, (NIBR); 2 females (in ethanol), 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); 2 females (pinned), 1 male, 3 females (in ethanol), 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); 3 males, 5 females (in ethanol), 1 female (pinned), 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 (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26586, E 127.58090, alt. 448 m, 2016.06.04 (2), S. Podenas (NIBR); 1 male (in ethanol), 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 (NIBR); 7 males, 3 females (in ethanol), 1 female (pinned), 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); 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. Baek, S. Podenas (NIBR); 1 female (in ethanol), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Piagol valley, N 35.26590, E 127.58096, alt. 446 m, 2016.06.04 (6), V. Podeniene, at light (NIBR); 1 female (pinned), S. Korea, Jeollanam-do, Gurye-gun, Toji-myeon, Naeseo-ri, Jirisan National Park, Piagol valley N 35.27333, E 127.56924, alt. 546 m, 2016.06.05, coll. S. Podenas, (NIBR); 1 male (in ethanol), 1 male (pinned), S. Korea, Jeju-do, Seogwipo, Sanghyo-dong, N 33.30857, E 126.55944, alt. 497 m, 2017.05.22 (2), S. Podenas (NIBR); 15 males, 3 females (pinned), 38 males, 3 females (in ethanol), S. Korea, Jeju-do, Hallasan National Forest, N 33.43222, E 126.59776, alt. 577 m, 2017.05.24 (1), S. Podenas, V. Podeniene (NIBR); 6 males (pinned), S. Korea, Gyeonggi-do, Gunpo-si, Suri-dong, N 37.35022, E 126.91527, alt. 138 m, 2017.05.27 (1), S. Podenas (NIBR).

***Epiphragma* (*Epiphragma*) *subinsigne* Alexander, 1920**

Epiphragma subinsignis Alexander, 1920: 11–12.

Epiphragma (*Epiphragma*) *subinsigne* Savchenko, Krivolutskaya, 1976: 53–54; Savchenko, 1989: 75.

General: Body coloration: thorax dark brown, abdomen yellowish-brown. Body length of female 12.3 mm, wing length 12.0 mm.

Head: Ground color dark brown but densely covered with brownish gray pruinosity, posteriorly light brown. Vertex with dark brown tubercle and covered with long erect dark brown setae. Eye narrowly marginated by light gray. Head distinctly narrows posteriorly. Eyes widely separated. Antenna 3.2 mm long in female, reaching slightly before wing base if bent backward. Scape elongate, nearly three times as long as wide, nearly cylindrical, dark brown covered with brownish gray pruinosity. Pedicel less than half the length of scape, widened distally, concolorous with scape. Four basal flagellar segments yellow, just base of first flagellomere orange. Flagellomeres 5–10 indistinctly bicolorous, brownish with yellow base. Remaining flagellomeres brownish. Two basal flagellomeres fused together and cone-shaped, remaining flagellomeres elongate, getting longer towards apex. Apical flagellomere nearly as long as penultimate. Longest verticils about 1.5 times as long as respective segments. Rostrum brown. Palpus dark brown, blackish at base, dusted with brownish-gray. Labellum light brown dorsally, dark brown ventrally.

Thorax: Cervical sclerites dark brown. Pronotum dark brown, grayish frontally and laterally, with transverse suture across middle and with shallow median incision at frontal margin. Mesonotal prescutum with anterior half rusty brown, the posterior half dark brown dusted with brownish gray, with three indistinct longitudinal dark brown stripes. Median stripe getting lighter frontally and with distinct but short dark brown longitudinal line along the middle at frontal margin of sclerite. Areas between stripes covered with sparse erect setae. Scutal lobe dark brown dusted with gray, narrowly light brown along median margin. Area between lobes frontally polished dark brown, V-shaped. Scutellum brown dusted with gray. Mediotergite brown with dark brown lateral and posterior margins, dusted with gray. Pleuron brown with dark brown spot at middle of anepimeron and dark brown ventral part of katepisternum, dusted with silvery-gray. Wing (Fig. 6A) with intense brown ocellate spots, yellowish in stigmal area and at base. Spots with narrowly darkened margins. Veins brownish. Venation: *Sc* long, tip of Sc_1 reaching branching point of *Rs*. Sc_2 slightly beyond tip

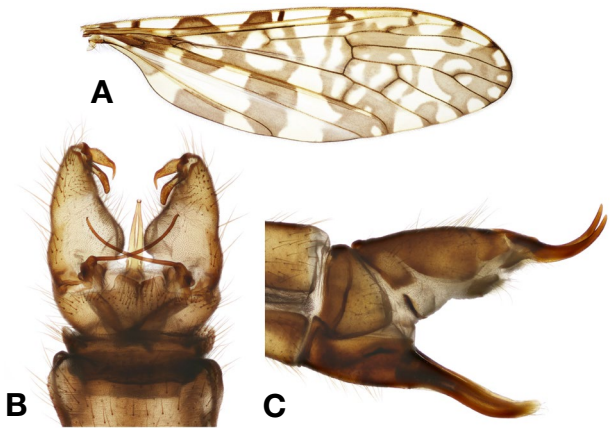

Fig. 6. *Epiphragma* (*Epiphragma*) *subinsigne*. A. wing. B. male genitalia, dorsal view. C. ovipositor, lateral view.

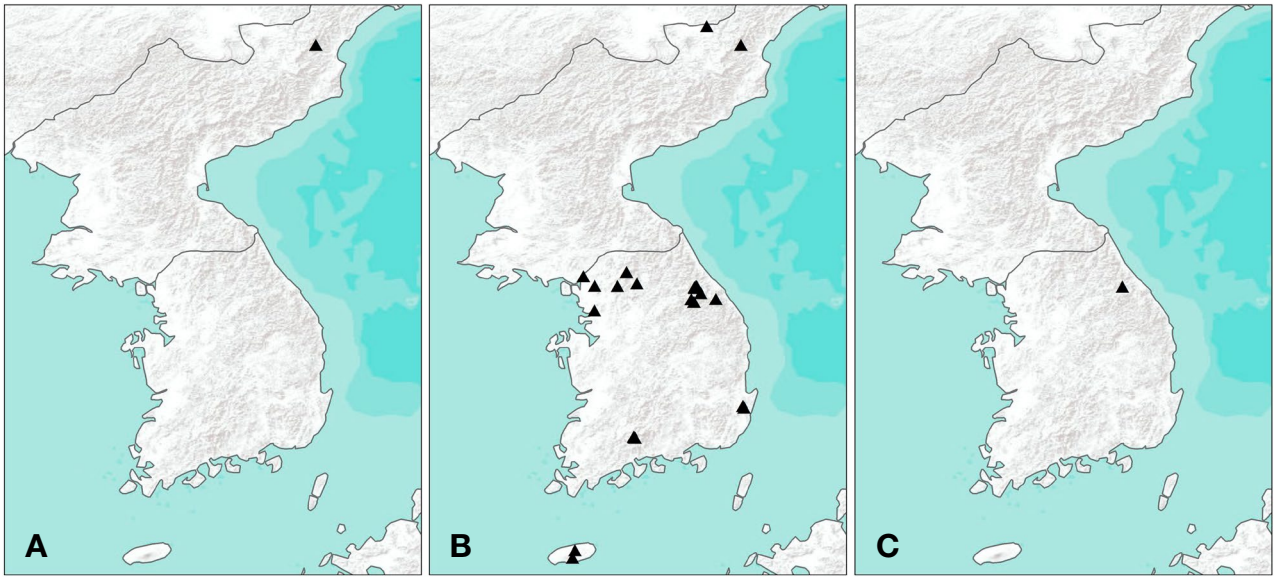

Fig. 7. Distribution maps of Korean *Epiphragma* (*Epiphragma*). A. *E.* (*E.*) *gracilistylus*. B. *E.* (*E.*) *subfascipenne*. C. *E.* (*E.*) *subinsigne*.

of Sc_1. *Rs* long, angulate and short spurred at base. Distal part of R_1 short, oblique, beyond R_2. R_2 transverse. R_3 and R_4 slightly diverging towards wing margin, R_5 slightly diverging from R_4 at wing margin. Discal cell elongate, 1.7 times as long as wide. Basal deflection of CuA_1 distinctly beyond branching point of *M*, at one-third length of discal cell. Distal end of A_2 slightly arched. Anal angle widely rounded, medium-wide. Length of female halter 1.8 mm. Halter yellow with dark brown base of knob. Coxae and trochanters brownish-yellow dusted with light gay. Femur yellow with two dark rings, distal before apex, another just beyond middle, apex narrowly brownish yellow. Tibia yellow with indistinctly darkened apex. Three basal tarsomeres light brown, fourth and fifths brown. Female femur II: 6.5 mm long, III: 7.3 mm, tibia II: 9.0 mm, III: 9.2 mm, tarsus II: 7.2 mm, III: 7.2 mm. Claw simple without subbasal spine.

Abdomen: Tergites indistinctly bicolorous with basal half brownish, distal yellowish and with narrowly darkened lateral margin. Basal sternites yellow, distal brownish yellow with narrowly pale posterior margin. Male genitalia (Fig. 6B) same width as remaining abdominal segments. Ninth tergite with two low triangular lobes at posterior margin. Gonocoxite elongate and strongly widened ventro-medially. Interbase with long barbed rod-shaped distal part. Outer gonostylus distinctly narrows distally, apical portion strongly arched. Inner gonostylus elongate, nearly parallel-sided, slightly arched. Penis long and narrow, bipartite. Female terminalia (Fig. 6C) dark brown dusted with gray. Tenth tergite elongate. Cercus reddish brown long and narrow, strongly arched, distal part raised upwards, point-apexed. Hypovalva long, comparatively narrow, slightly sinuous, with subapical brush of setae, round-apexed, reaching distinctly beyond middle of cercus.

Elevation range in Korea: About 800 m.

Period of activity in Korea: Adults are flying at the end of June.

Habitats: Wet mixed forest on mountain slope, and shaded nearly dry river valley with only pools left.

General distribution: Species is known from the Sakhalin and Kuril Islands, Far East of Russia and all four main islands of Japan. Recorded from the Korean Peninsula for the first time.

Examined material (Fig. 7C): Holotype, male (wing and genitalia slide-mounted), Japan, Saitama, May 29, 1919, R. Takahashi (USNM); male and specimen with unclear sex (on same pin), Japan, Kyushu, Idaodake, 800 m, V-16, 1952, Ito-Issiki (USNM); 3 males (on same pin), Japan, Shikoku, Omogo, VI-6, 1952, T. Yano (USNM); metatype, male (pinned), Japan, Shikoku, Omogo V., VIII-22, 1953, Miyatake (USNM); metatype, male (antenna, wing, leg and genitalia slide-mounted), Japan, Honshu, Mt. Amakazari, 900 m, VI-25, 1955, AM 96 (USNM); metatypes, male and female (on same pin), [Russia], E. Siberia, Kunashir, Tretjakovo, August 8, 1971, C. Parhomenko (USNM); 1 female (pinned), S. Korea, Gangwon-do, Pyeongchang-gun, Odaesan National Park, N 37.73920, E 128.59398, alt. 794 m, 2012.06.22 (1), S. Podenas (NIBR).

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