

## *Phylidorea* crane flies (Diptera: Limoniidae) of Korea

Sigitas Podenas<sup>1,\*</sup>, Sun-Jae Park<sup>2</sup> and Hye-Woo Byun<sup>2</sup>

<sup>1</sup>Nature Research Centre, Akademijos str. 2, LT-08412 Vilnius and Life Sciences Center of Vilnius University, Sauletekio str. 7, LT-10257 Vilnius, Lithuania

<sup>2</sup>Animal Resources Division, National Institute of Biological Resources, Incheon 22689, Republic of Korea

\*Correspondent: sigitas.podenas@gamtc.lt

This study is based on crane fly specimens collected during more than 80 years, from 1937 through 2019, and are in collections maintained at the United States National Museum, Smithsonian Institution, Washington DC, USA; at Korea University collection, Seoul, South Korea, and the National Institute of Biological Resources, Incheon, South Korea. Three species belonging to genus *Phylidorea* Bigot, 1854 originally were described from North Korea and in total four species were known from the Peninsula. *Phylidorea* (*Phylidorea*) *multidentata* (Alexander, 1938) is a Korean endemic. We are adding *P. (P.) melanommata* (Alexander, 1921) to the list of Korean species, which was previously recorded from Japan and Far East of Russia. We present general information on genus and subgenera, 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) for each species.

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

© 2022 National Institute of Biological Resources  
DOI:10.12651/JSR.2022.11.1.047

### INTRODUCTION

Investigations of Limoniidae (Diptera) crane flies on the Korean Peninsula were 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 (Podenas, 2013; Podenas, 2015; Podenas, 2016a; 2016b; 2016c; Podenas and Byun, 2013; 2014a; 2014b; 2016; 2018; Podenas *et al.*, 2014; 2015a; 2015b; 2016; 2017; 2019a; 2019b; 2019c; 2020a; 2020b; 2020c; 2020d; Podenas and Podeniene, 2017). It includes the genus *Phylidorea* Bigot, 1854.

*Phylidorea* Bigot, 1854 crane flies develop in wet muddy places at the margins of water pools, in swampy areas, or along slow running channels or streams. Such habitats prevail at lower altitudes, along valleys or in flat fields. These places usually are used for agriculture and human settlement, thus natural swampy areas became scarce in densely populated areas with intense agriculture. Despite *Phylidorea* crane flies being collected for more than 80 years on the Korean Peninsula, only 30 specimens were

located at the scientific collections. An additional six specimens were added to the collection of the National Institute of Biological Resources by authors of this publication, all of them belong to unrecorded species.

Three species belonging to genus *Phylidorea* originally were described from the North Korea: two of them, *P. (Macrolabina) pernigrata* (Alexander, 1938) and *P. (Phylidorea) longicornis pietatis* (Alexander, 1950), were later recorded from adjacent territories of Russia, *P. (P.) multidentata* (Alexander, 1938) remains endemic to North Korea, *P. (P.) umbrarum* (Krogerus, 1937) was recorded from North Korea as *Limnophila (Phylidorea) megapygia* Alexander, 1938 and *P. (P.) melanommata* (Alexander, 1921) is a new record for the Korean Peninsula. It was known from the neighboring countries, Japan and Far East of Russia.

We provide photographs of important taxonomical details, e.g., antennae, wings, male and female terminalia and distribution maps of Korean species.

### MATERIALS AND METHODS

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

Specimens collected in 1937–1939 in the northern part of the Korean Peninsula (now Democratic People's Re-

public of Korea (North Korea)) by A. M. Yankovsky are deposited in the collections of the United States National Museum (USNM), Smithsonian Institution, Washington DC, USA;

Specimens collected in 2015 in the southern part of the Korean Peninsula (now Republic of Korea (South Korea)) are deposited in the Korea University collection (KU), Seoul, South Korea;

Specimens collected in 2017 and 2019 in South Korea are deposited in the collections of the National Institute of Biological Resources (NIBR), Incheon, South Korea.

Adult crane flies were collected by insect nets, Malaise traps, LED and incandescent black light traps, Mosquito Magnet® trap (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 crane fly was preserved in EtOH.

Information of examined material 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. Distribution maps (Fig. 6) mark all known locations of the species in the peninsula because we were able to locate and examine most of the specimens mentioned in publications that list Korean specimens, and these specimens cover all known Korean localities.

Crane flies were observed using an Olympus SZX10 dissecting microscope. Photographs were taken with a Canon EOS R5 digital camera through a Canon MP-E 65 mm macro lens and through Mitutoyo M Plan Apo 10× and 20× lenses mounted on same camera.

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

General distribution and classification of species is given according Oosterbroek (2021).

## TAXONOMY

### *Phylidorea* Bigot, 1854

*Phylidorea* Bigot, 1854: 456; Savchenko and Krivoluts-kaya, 1976: 65–66; Savchenko, 1983: 59; 1986: 276–280; 1989: 99–100.

*Philydorea* Bigot, 1854: 472 (incorrect spelling).

*Veruina* Wallengren, 1882: 180–181. Type species - *Limnobia bifurcata* Zetterstedt, 1837.

*Limnophila* (*Phylidorea*) Edwards, 1938: 63 (Key), 69–71; Ishida, 1959: 3.

Type species - *Limnobia ferruginea* Meigen, 1818, by subsequent designation of Coquillett, 1910 (Palearctic).

#### Adult.

Medium- to larger-sized crane flies (Fig. 2A) with body length 4.2–15.2 mm, largest Korean specimens only up to 10 mm long, and wing length 5.8–14.5 mm. Wing length of largest Korean specimens not exceeding 10 mm. Body coloration varies from brownish yellow to black.

Head: Rounded posteriorly. Vertex wide, width above base of antenna approximately equal length of scape and pedicel taken together, vertical tubercle small and rounded, just slightly raised above head surface. Antenna medium-long or long, reaching at least base of wing, usually beyond base of abdomen, if bent backwards. Flagellum 14-segmented, flagellomeres elongate. Verticils short, longest verticils slightly exceed length of respective segments, usually less than that.

Thorax: Prothorax small, frontal margin nearly straight, without indentation. Prescutum and presutural scutum with small tubercular pits, that are hardly distinguishable in species that have polished prescutum, pseudosutural fovea distinct. Disc of prescutum with or without longitudinal stripes. Episternum naked, without setae. Meron small, thus middle and posterior coxae close to each other. Wing long and narrow, often translucent without darker pattern, or with few dark spots along frontal margin and darker areas surrounding cross-veins. Stigma usually distinct. *Arculus* present, vein *Sc* long, reaching wing margin close to the branching point of *Rs*, *sc-r* close to tip of *Sc*. Radial sector often short or very short, arched or angulate and short-spurred at base. *R*<sub>1</sub> short and oblique, nearly transverse, *R*<sub>3</sub> and *R*<sub>4</sub> diverging towards wing margin. Cell *m*<sub>1</sub> long with long stem, length of cell usually exceeds that of its stem. Discal cell usually present, but missing in few species. Cross-vein *m-cu* distinctly beyond base and usually close to the middle of discal cell. Anal vein long, slightly sinuous, reaching wing margin distinctly before the level of *Rs* base. Anal angle distinct. Wing cells without macrotrichiae. Wing squama bare. All legs with tibial spurs, foreleg with single, middle and posterior legs with two spurs each.

Abdomen: Tergites without paired transverse sutures. Male terminalia slightly wider than remaining abdominal segments. Sclerites of ninth abdominal segment connected into genital ring in male. Posterior margin of epandrium (tergite 9) with medial emargination or with paired lobes. Gonocoxite oval or slightly elongate, with ventromesal lobe, some species also with dorsal lobe. Two pairs of apical gonostyli. Outer gonostylus long and narrow, sclerotized, setoseless, blunt-apexed or with bifid apex. Inner gonostylus dilated basally with long and narrow, slightly curved, blunt-apexed distal part. Aedeagus usually elongate, sometimes bifid at apex. One pair of parameres. Outer structure surrounding aedeagus is interpreted as second pair of parameres, thus interbase is missing according to Savchenko (1989), or it is interpreted as interbase by Ribeiro (2008). Ovipositor with long and narrow cerci and hypovalvae, distal part of cercus slightly raised upwards, blunt-apexed, dorsal margin of hypovalva with long parallel setae.

Last instar larva (Podeniene and Gelhaus, 2010).

Body: Covered with long yellowish-brown setae, which gives body a golden color.

Head capsule: Elongate-oval in shape, depressed dorsoventrally and reduced. Labrum membranous, elongate-oval in shape and inconspicuously separated from clypeus. Lateral part of clypeus with separate lobe. Frons reduced. Antenna short. Mandible sickle-shaped. Maxilla elongated, slightly narrowing toward tip, apical part directed outward. Cardo reduced into small sclerite. Ventral part of head capsule is connected with hypopharyngeal bar.

Abdomen: Last abdominal segment (anal) constricted. Penultimate abdominal segment inflated. Tergum of anal segment with a tuft of long setae on anterior side. Spiracular field surrounded by four flattened elongate and sclerotized lateral and ventral lobes with dorsal lobe vestigial. Spiracles large, circular. Anus surrounded by four short, oval-shaped white and fleshy anal papillae.

Pupa (Podeniene and Gelhaus, 2010).

Body: Coloration brown. Head and thorax much darker than abdomen.

Head: Cephalic crest inconspicuous, consisting of four unequal lobes. Antennal sheaths short.

Legs: Almost reaching the end of abdominal segment III.

Abdomen: Segments II–VII with inconspicuous annuli. Tergites and sternites on posterior and anterior parts have transverse rows of small tubercles with spines. Terminal segment of male blunt and narrow. Terminal segment of female pupa elongate.

Genus *Phylidorea* has only a Palaearctic distribution and includes 30 extant species (Oosterbroek, 2021). They are divided into three subgenera: *P. (Macrolabina)* Savchenko, 1986 with six species, five of which are recorded from East Palaearctic, *P. (Paraphylidorea)* Savchenko, 1986

with two species, and nominate subgenus *P. (Phylidorea)* Bigot, 1854 with 21 species, 16 of which occur in Eastern and 10 in Western Palaearctic. Two fossil species belong to *Phylidorea* and both are known only from Eocene Baltic amber. They are unplaced to extant subgenera (Evenhuis, 2014).

#### Check list of Korean *Phylidorea* crane flies

*Phylidorea (Macrolabina) pernigrata* (Alexander, 1938)

*Phylidorea (Phylidorea) longicornis pietatis* (Alexander, 1950)

*Phylidorea (Phylidorea) melanommata* (Alexander, 1921)

*Phylidorea (Phylidorea) multidentata* (Alexander, 1938)

*Phylidorea (Phylidorea) umbrarum* (Krogerus, 1937)

#### Key to Korean species of the genus *Phylidorea* Bigot

1. Wing with long radial sector (*Rs*) that is few times longer than stem of cell *r*<sub>3</sub> (Figs. 1A, 2C, 4B, 5B)..... 2
  - Wing with short radial sector (*Rs*) that just slightly exceeds length of cell *r*<sub>3</sub> stem (Fig. 3B)..... *Phylidorea (Phylidorea) melanommata* (Alexander, 1921)
2. Body gray or brown ..... 3
  - Body yellow or brownish yellow (Fig. 2A) ..... 4
3. Prescutum and presutural scutum with three distinct polished black longitudinal stripes. Wing with dark spot in the middle between arculus and base of *Rs*, distinct dark areas surround base of *Rs* and cord (Fig. 1A). Male gonocoxite with large dorsal lobe (Fig. 1B). Larger species, male body length 9–10 mm..... *Phylidorea (Macrolabina) pernigrata* (Alexander, 1938)
  - Prescutum and presutural scutum with very indistinct longitudinal stripes or stripes missing completely. Wing without dark spot between arculus and base of *Rs*, dark areas surrounding base of *Rs* and cord indistinct (Fig. 4B). Male gonocoxite without dorsal lobe (Fig. 4C). Smaller species, male body length up to 7.5 mm..... *Phylidorea (Phylidorea) multidentata* (Alexander, 1938)
4. Abdomen with blackish lateral spots making interrupted line. Outer gonostylus of male genitalia with straight apical spine (Fig. 2D)..... *Phylidorea (Phylidorea) longicornis pietatis* (Alexander, 1950)
  - Abdomen without dark lateral line. Outer gonostylus of male genitalia with strongly curved apex (Fig. 5C) ... *Phylidorea (Phylidorea) umbrarum* (Krogerus, 1937)

#### *Phylidorea (Macrolabina) Savchenko, 1986*

*Phylidorea (Macrolabina)* Savchenko, 1986: 20; 1989: 103.

Type species - *Limnobia nigronotata* Siebke, 1870, by original designation (Palaearctic).

Adult.

Medium-sized crane flies with body length 9.0–10.0

mm, wing length 9.0–10.0 mm. Body coloration dark brown or gray.

Head: Apical flagellomere of male antenna large, nearly as long as preceding segment.

Thorax: Prescutal stripes and spots on scutal lobes distinct, polished dark brown or black. Wing with dark spots along frontal margin, stigma distinct, dark.

Abdomen: Gonocoxite with very large elongate blunt-apexed, sometimes bilobed, dorsal lobe (Fig. 1B) is the main diagnostic character of subgenus. Aedeagus short, straight, always with simple distal part.

Subgenus has only Palearctic distribution. It includes only six species, five of which are recorded from the Eastern Palearctic (Oosterbroek, 2021). No fossil species are ascribed to this subgenus (Evenhuis, 2014).

Larva and pupa generally as in the characters of the genus mentioned above.

***Phylidorea (Macrolabina) pernigrita* (Alexander, 1938)**

*Limnophila (Phylidorea) pernigrita* Alexander, 1938: 156.

*Phylidorea (Phylidorea) pernigrita* Savchenko, 1983: 60.

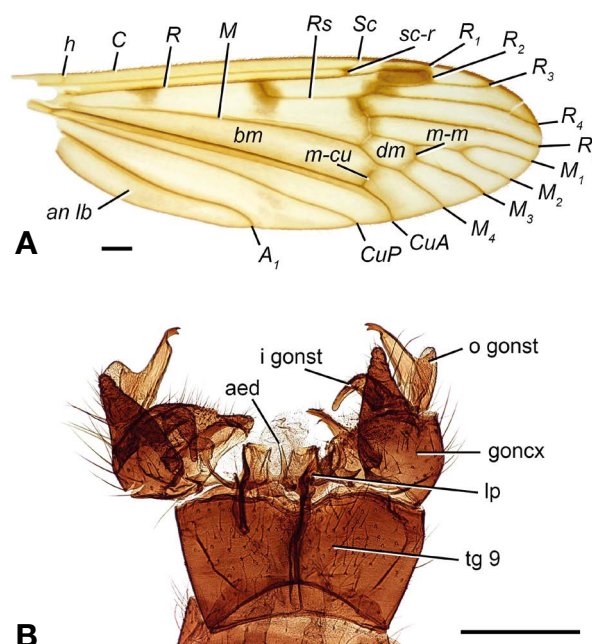
*Phylidorea (Macrolabina) pernigrita* Savchenko, 1986: 23; 1989: 103.

**Male.**

General: Body coloration gray because of dense pruinosity. Male body length 9.0–10.0 mm, wing length 8.8 mm.

Head: Brownish gray, narrowly light gray along eye margin and frontally above bases of antennae. Antenna black, 3.6 mm long, reaching to about base of abdomen if bent backward. Scape long, nearly cylindrical, about twice as long as succeeding segment. Pedicel subglobular. Six basal flagellomeres subglobular to short-oval, slightly dilated ventrally, remaining flagellomeres oval. Apical segment elongate. Longest verticils slightly exceed length of respective flagellomeres. Rostrum and palpus black.

Thorax: Pronotum brownish gray. Prescutum and presutural scutum brownish gray because of dense pruinosity, with three distinct polished black longitudinal stripes and black lateral margin. Median stripe wide, not reaching posterior margin of sclerite. Pseudosutural fovea distinct, polished black. Scutal lobe with polished black spot which makes extension of lateral prescutal stripe. Scutellum and mediotergite brownish gray because of dense pruinosity. Pleuron densely dusted with gray. Wing (Fig. 1A) with brownish tinge and pattern of brown spots: small spot behind *R* at about middle between arculus and base of *Rs*, more distinct spots at base of *Rs* and along cord; stigma distinct dark brown; brownish areas surround cross-veins and branching points, along veins *M*, *CuA* and anal vein. Veins brown, yellowish at wing base. Venation: *Sc* long, reaching wing margin at branching point of *Rs*, *sc-r* three times its own length before tip of



**Fig. 1.** *Phylidorea (Macrolabina) pernigrita* (Alexander, 1938), paratype. A. wing. B. male genitalia, dorsal view. Scale bars 0.5 mm. Abbreviations: aed - aedeagus; an lb - anal lobe; bm - basal medial cell; C - costal vein; CuA - anterior branch of cubital vein; dm - discal medial cell; goncx - gonocoxite; h - humeral vein; i gonst - inner gonostylus; lp - lateral process of aedeagal sheath; M - medial vein, or media; M<sub>1</sub> - first branch of media; M<sub>2</sub> - second branch of media; M<sub>3</sub> - third branch of media; M<sub>4</sub> - fourth branch of media; m-cu - medial-cubital crossvein; m-m - medial crossvein; o gonst - outer gonostylus; R - radius, or radial vein; R<sub>1</sub> - anterior branch of radius; R<sub>2</sub> - second branch of radius; R<sub>3</sub> - lower branch of second branch of radius; R<sub>4</sub> - upper branch of third branch of radius; R<sub>5</sub> - lower branch of third branch of radius; Rs - radial sector; Sc - subcostal vein; tg - tergite.

*Sc*. Radial sector long, angulate at base. Free end of *R*<sub>1</sub> very short, nearly transverse. *R*<sub>2</sub> indistinct, at tip of *R*<sub>1</sub>. *R*<sub>3</sub> and *R*<sub>4</sub> diverging towards wing margin, cell *r*<sub>3</sub> with short stem, which slightly exceeds length of *R*<sub>2</sub>. Cross-vein *r-m* distinct, at base of discal cell. Discal cell slightly less than twice as long as wide. Cell *m*<sub>1</sub> long, slightly longer than stem. Cross-vein *m-cu* at middle length of discal cell. Anal vein long, slightly sinuous, reaching wing margin slightly before the level of *Rs* base. Anal lobe long and narrow, widely rounded. Halter uniformly yellow. Coxae black, dusted with gray. Trochanters obscure yellow. Basal half of fore femur yellow, distal part dark brown. Distal darkening narrower on middle and posterior femora. Tibia brownish yellow with narrowly dark brown apex. Tarsomeres dark brown with base of first tarsomere lighter brown. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Femur I: 5.7 mm long; tibia I: 7.2 mm.

Abdomen: Black. Epandrium wider than long, posterior margin slightly concave at middle. Gonocoxite with

large setose, blunt-apexed conical lobe dorsally (Fig. 1B). Outer gonostylus distinctly widened laterally at base, widening densely setose with small setulae; distal part of gonostylus distinctly narrower, apex bifid. Inner gonostylus fleshy and setose, wider at base, narrowing towards distal end, apex rounded. Lateral process of aedeagal sheath wide plate-shaped with 3–4 spines distally. Aedeagus short and narrow, tube-shaped.

Female: Unknown from Korea.

Elevation range in Korea: Slightly above 1,000 m.

Period of activity in Korea: Mid-July.

Habitats: Moss-covered margins of streams and swampy shallow gullies in wet broad-leaved forests in southern part of the Far East of Russia close to the border with North Korea (Savchenko, 1983).

General distribution: Northern Korea (Fig. 6A) and Far East of Russia.

Examined material: paratype (topotypic), male (antenna, wing, fore leg and genitalia slide-mounted), N. Korea, Chonsani Paiktusan, alt. 3,500 ft. [1,067 m], July 18, 1937, coll. A. M. Yankovsky (USNM).

#### ***Phylidorea (Phylidorea) Bigot, 1854***

*Phylidorea* Bigot, 1854: 456.

*Phylidorea (Phylidorea) Alexander*, 1972: 31–32; Savchenko, Krivolutsкая, 1976: 66; Savchenko, 1986: 281; 1989: 105; Ribeiro, 2008: 679.

Type species - *Limnobia ferruginea* Meigen, 1818, by subsequent designation of Coquillett, 1910 (Palearctic).

Adult.

Medium-sized crane flies. Korean species with body length 4.5–9.0 mm (Fig. 2A) and wing length 5.8–9.5 mm. Body coloration varies from yellow to gray or brown.

Head: Apical antennomere small to very small, distinctly shorter than preceding segment.

Thorax: Prescutum and presutural scutum with indistinct longitudinal stripes or stripes completely missing. Wing iridescent, long and narrow, posterior margin evenly rounded, without angulate extension. Wing with darker areas surrounding base of *Rs*, at cord and along distal margin of discal cell. Apex of *Sc* and *sc-r* close to branching point of *Rs*. Radial sector usually long, longer than stem of cell *r*<sub>3</sub> or vein *R*<sub>2+3</sub>, only as an exception, radial sector short, like in type species *P. ferruginea*, or Korean species *P. melanommata*. Anal vein slightly sinuous, reaching wing margin before level of *Rs* base.

Abdomen: Epandrium wider than long. Gonocoxite usually with ventro-mesal lobe at base. Apex of outer gonostylus usually simple, bifid in some species. Inner gonostylus fleshy and setose, wider at base, narrower at apex. One pair of parameres. Aedeagus simple, not

branched, slightly arched and tube-shaped, apex curved upwards. Ovipositor with long, slightly arched cercus, hypovalva wedge-shaped with long parallel setae along dorsal margin.

Subgenus has only Palearctic distribution. It includes 21 extant species, 16 of which occur in Eastern and 10 in Western Palearctic (Oosterbroek, 2021). No fossil species are ascribed to this subgenus (Evenhuis, 2014).

Larva and pupa generally as in the characters of the genus mentioned above.

#### ***Phylidorea (Phylidorea) longicornis pietatis* (Alexander, 1950)**

*Limnophila pietatis* Alexander, 1950: 431–432.

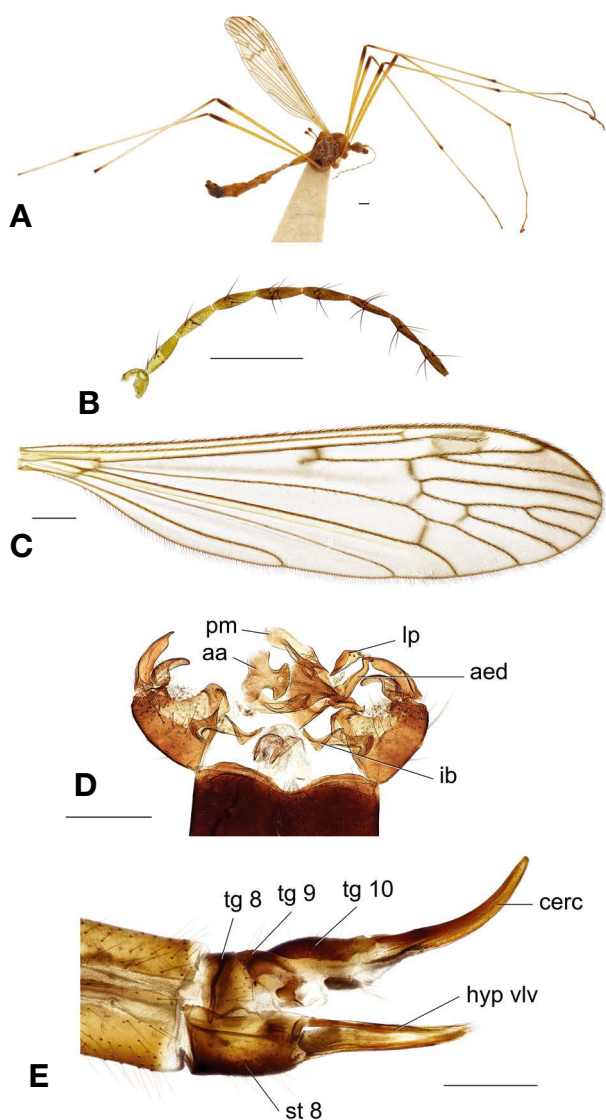
*Phylidorea (Phylidorea) glabricula pietatis* Savchenko, 1983: 59; 1989: 106.

*Phylidorea (Phylidorea) longicornis pietatis* Oosterbroek, 2021.

General: Body coloration brownish yellow (Fig. 2A). Male body length 6.5–7.5 mm, female 8.5–9.0 mm, male wing length 6.8–7.5 mm, female 7.4–8.0 mm.

Head: Yellow posteriorly, anterior vertex grayish yellow because of dense light gray pruinosity, narrowly light gray along eye margin, sparsely covered with yellowish setae. Head darker in male than in female. Vertical tubercle low, indistinct. Eyes widely separated in both sexes, distance between them at base of antennae approximately equal length of scape and pedicel taken together. Antenna 2.2–3.2 mm long in male, 1.5–1.8 mm in female, reaching approximately to the base of third abdominal tergite if bent backwards in male, short distance beyond wing base in female. Antennal scape elongate, nearly cylindrical, yellow with darker base and bearing few short semi-erect brown setae. Pedicel yellow, subglobular. Flagellomeres (Fig. 2B) elongate, spindle shaped. Basal flagellomere pale, 2–4 flagellomeres brown with yellow base and apex, remainder of flagellum dark brown. Flagellomeres covered with erect whitish pubescence. Verticils dark brown, longest 0.7 length of respective segments. Rostrum orange yellow dorsally, obscure yellow ventrally. Palpus dark brown, mouth parts grayish brown.

Thorax: Cervical sclerites brownish yellow. Pronotum wide, yellow with darker frontal margin and paler laterally. Prescutum and presutural scutum brownish yellow without longitudinal stripes. Tubercular pits very small, brownish, indistinct, at frontal margin of sclerite, pseudosutural fovea indistinct, surrounded by paler area. Scutal lobe, scutellum and mediotergite concolorous with prescutum. Dorsopleural membrane pale yellow. Pleuron yellow with paler areas frontally and postero-dorsally. Episternum bare, setoseless. Meron small, reduced. Wing (Fig. 2C) iridescent with grayish tinge, darker along distal mar-



**Fig. 2.** *Phylidorea (Phylidorea) longicornis pietatis* (Alexander, 1950). A. general view, male. B. basal flagellomeres. C. wing. D. male genitalia, dorsal view, paratype, slide-mounted. E. ovipositor, lateral view. Scale bars 0.5 mm. Abbreviations: aa - aedeagal apodeme; aed - aedeagus; cerc - cercus; hyp vlv - hypogynial valve; ib - interbase; lp - lateral process of aedeagal sheath; pm - paramere; st - sternite; tg - tergite.

gin. Narrow darker areas at base of *Rs*, at cord and distal margin of discal cell. Stigma brownish with narrowly darker margins. Veins brown, yellowish at wing base. Venation: *Sc* long, reaching branching point of *Rs*, *sc-r* at tip of *Sc*. *Rs* as long as free end of *M*<sub>3</sub>, angulate and spurred at base. Distal end of *R*<sub>1</sub> very indistinct or completely missing, not reaching wing margin. *R*<sub>2</sub> missing. *R*<sub>3</sub> and *R*<sub>4</sub> diverging, cell *r*<sub>3</sub> with short stem which is approximately as long as width of discal cell. Cross-vein *r-m* distinct, at base of discal cell. Discal cell 2.2 times as long as wide. Cell *m*<sub>1</sub> long, stem slightly shorter than cell itself. Cross-

vein *m-cu* at middle length of discal cell. Anal vein long, slightly sinuous, apex reaching wing margin before the level of *Rs* base. Anal angle long and narrow. Length of male halter 1.2–1.3 mm, that of female 1.0–1.1 mm, stem brownish yellow, widely pale at base, knob darker brown. Coxa yellow, trochanter paler. Femur yellow, paler at base, tip with wide dark brown ring. Tibia pale yellow, narrowly brownish at base with distinct narrow apical blackish ring. Basal tarsomere pale with brownish distal part, remaining tarsomeres brown, turning dark brown towards distal end of leg. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 4.2–5.4 mm long, II: 4.6–5.3 mm, III: 4.6–6.0 mm, tibia I: 5.6–6.5 mm, II: 5.2–5.5 mm, III: 4.8–6.5 mm, tarsus I: 5.3–6.3 mm, II: 4.2–5.2 mm, III: 4.0–4.8 mm. Female femur II: 4.8 mm, tibia II: 4.8 mm, tarsus II: 4.2 mm. Claw simple, spineless, dark brown.

Abdomen: Tergites and sternites yellow, covered with whitish setae. Both tergites and sternites, starting from second, with distinctly blackish area along anterior lateral angle, darker spot narrows behind and usually not reaches posterior margin of sclerite. Darker area more distinct on tergite, less so on sternite. Darker pattern slightly varies individually, usually more distinct in female. Male terminalia (Fig. 2D) and pregenital segment dark brown to black, gonocoxite brownish. Epandrium slightly wider than long, posterior margin widely concave at middle. Gonocoxite slightly elongate, with large ventro-mesal lobe. Outer gonostylus long and narrow, slightly arched, apex narrowed into spine along outer margin. Inner gonostylus fleshy and setose, basal half wide, narrow distally, apex rounded. Aedeagal sheath with lateral process forming transverse apically-medial blade armed with 7–8 acute points. Interbase distally flattened and bifid at apex. Parameres flattened. Aedeagus stout, dilated at base, tube-shaped. Aedeagal apodeme flattened, with shallow median incision. Distal segments of female abdomen same color as the rest of abdomen, brownish yellow. Tenth tergite elongate, yellow, cercus long and arched, darker at base, paler at tip, round-apexed (Fig. 2E). Hypoalva long and straight, brownish.

Elevation range in Korea: From slightly above 1,200 m to 1,900 m.

Period of activity in Korea: August.

Habitats: Swampy open areas surrounded by broad-leaved and mixed forests and wet meadows on the seacoast in the southern areas of the Far East of Russia close to the border with North Korea (Savchenko, 1983).

General distribution: Far East of Russia, Mongolia, and North Korea (Fig. 6B).

Examined material: holotype, male (antenna, leg, wing and male genitalia slide-mounted), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5,000 ft. [1,524 m], August 21, 1939, A. Yankovsky (USNM); paratype, male (anten-

na, leg, wing and male genitalia slide-mounted), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5,000 ft. [1,524 m], August 9, 1939, A. Yankovsky (USNM); 1 specimen of unclear sex (pinned, tip of abdomen broken), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5,000 ft. [1,524 m], August 5, 1939, A. Yankovsky (USNM); 2 males, 2 females (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 4,000 ft. [1,219 m], August 6, 1939, A. Yankovsky (USNM); 1 specimen of unclear sex (pinned, tip of abdomen broken), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6,200 ft. [1,890 m], August 11, 1939, A. Yankovsky (USNM); 1 male, 1 female (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5,000 ft. [1,524 m], August 14, 1939, A. Yankovsky (USNM).

***Phylidorea (Phylidorea) melanommata* (Alexander, 1921)**

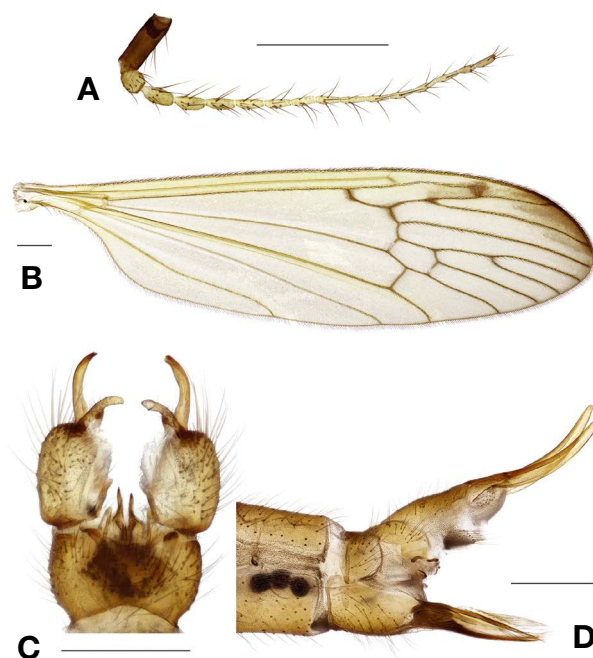
*Limnophila (Phylidorea) melanommata* Alexander, 1921: 120.

*Phylidorea (Phylidorea) melanommata* Savchenko and Krivolutskaya, 1976: 66–67; Savchenko, 1989: 107 (misspelled as *P. melananta*).

**General:** Body coloration brownish yellow. Body length: male 8.0–8.1 mm, female 7.8–9.0 mm. Wing length: male 8.5–9.0 mm, female 7.2–8.8 mm.

**Head:** Dark brown to black, densely covered with silvery pruinosity, sparsely covered with short dark brown semi-erect setae. Vertex with low wide tubercle. Eyes widely separated in both sexes, distance between them at base of antennae approximately equal length of scape. Antenna (Fig. 3A) 1.2–1.7 mm long in male, 0.9 mm in female, reaching about base of wing if bent backwards. Antennal scape long, nearly cylindrical, dark brown, sparsely dusted with brownish gray and bearing few short brown to whitish raised setae. Pedicel three times as short as scape, yellow, subglobular. Flagellum yellow turning darker towards apex, covered with short whitish pubescence. Flagellomeres elongate, wider at base, narrower at distal end. Verticils dark brown, longest slightly exceeds length of respective segments. Apical segment large, 1.3 times as long as preceding segment. Rostrum dark brown, blackish at base, few long setae at apex. Palpus dark brown, mouth parts brown.

**Thorax:** Cervical sclerites brownish yellow, blackened dorsally. Pronotum elongate, widened posteriorly, brownish yellow with dark brown to blackish stripe dorso-medially. Prescutum and presutural scutum polished brownish yellow with narrow dark brown median line, widest and blackish at frontal margin of sclerite, getting narrower posteriorly and disappearing before posterior margin of sclerite. Tubercular pit very small and indistinct at frontal margin of sclerite and hidden by median dark line. Pseudosutural fovea indistinct, concolorous



**Fig. 3.** *Phylidorea (Phylidorea) melanommata* (Alexander, 1921). A. antenna. B. wing. C. male genitalia, dorsal view. D. ovipositor, lateral view. Scale bars 0.5 mm.

with prescutum. Scutal lobe slightly darker than prescutum, area separating scutal lobes paler yellow. Scutellum pale yellow with scattered erect yellow setae. Mediotergite brownish yellow. Dorsopleural membrane and pleuron pale-brownish-yellow, episternum setoseless, meron pale. Wing (Fig. 3B) iridescent, with brownish tinge, yellowish in costal area. Small brown spots surround both ends of radial sector, extends along basal portion of  $R_5$ , branching point of  $R_{2+3}$  and  $R_4$ ,  $R_2$  together with free end of  $R_1$ . Larger but less distinct darker area extends along wing margin from tip of  $R_1$  through middle of cell  $r_4$ . Veins brown before wing middle, dark brown beyond cord, yellow at wing base and in costal area. Venation:  $Sc$  long, reaching wing margin at branching point of  $Rs$ ,  $sc-r$  at tip of  $Sc$ .  $Rs$  approximately as long as distance from base of  $Rs$  to  $sc-r$ , angulate at base. Free end of  $R_1$  very short and oblique, indistinct, as long as  $R_2$ .  $R_2$  transverse, indistinct.  $R_3$  and  $R_4$  diverging, cell  $r_3$  with short stem, which is approximately as long as radial sector. Cross-vein  $r-m$  long and distinct, at base of discal cell. Discal cell nearly twice as long as wide. Cell  $m_1$  long, 1.6 times as long as its stem. Cross-vein  $m-cu$  at middle of discal cell. Anal vein long, slightly sinuous, apex far before the level of  $Rs$  base. Anal lobe long and narrow, widely rounded. Length of male halter 1.2–1.3 mm, that of female 1.0–1.2 mm, stem brownish yellow, knob paler at base, indistinctly blackish distally. Coxae brownish yellow, covered with scattered gold-

en setae, trochanters paler yellow. Femur widely pale yellow at base, brownish yellow beyond middle, very apex narrowly and indistinctly darkened. Tibia brownish yellow with very narrowly and indistinctly darker apex. Tarsus dark brown with lighter brown base of basitarsus. Tibia of foreleg with single apical spur, tibiae of middle and hind pairs of legs with two apical spurs each. Male femur I: 5.8 mm long, II: 5.6–5.7 mm, III: 6.5 mm, tibia I: 6.8 mm, II: 5.7–6.1 mm, III: 7.0 mm, tarsus I: 6.3 mm, II: 5.2–6.0 mm, III: 5.3 mm. Claw simple, without spines or teeth at base, dark brown to black.

Abdomen: Abdominal tergites and sternites grayish obscure yellow, covered with short sparse erect yellowish setae, pregenital sternite dark brown. Male terminalia (Fig. 3C) yellow. Epandrium distinctly wider than longer, posterior margin slightly concave medially. Gonocoxite oval with small ventro-mesal lobe. Outer gonostylus long and narrow, sclerotized, yellow with blackened apex, very tip bifid. Inner gonostylus long and narrow, wider at base, distal part narrow and slightly arched. Lateral process of aedeagal sheath long and narrow, distal part slightly curved. Aedeagus short and straight, tube-shaped. Female terminalia (Fig. 3D) brownish yellow. Cercus long and narrow slightly arched, distal part raised upwards, blunt-apexed. Hypoalva polished reddish brown, cercus long and arched, darker at base, yellow at tip, round-apexed. Hypoalva wedge-shaped, distinctly dark brown at basal third and along ventral margin, dorsal margin with long parallel setae along two thirds of distal part.

Elevation range in Korea: From sea level to 1,100 m.

Period of activity in Korea: From middle of May through second half of September.

Habitat: Open marshy meadow on margins of slow flowing small stream with lots of volcanic rocks surrounded by deciduous forest, low shrubs and dense *Sasa quepaertensis* grassland (highland wetland) on Jeju Island. Swampy areas, especially willow and alder forests, also mixed forests in floodplains, less common in rocky areas covered by birch forests in South Kurile Islands and Southern Sakhalin (Savchenko and Krivolutskaya, 1976).

General distribution: Japan and Far East of Russia. Recorded here for the first time for Korea (Fig. 6C).

Examined material: 2 males (in ethanol), S. Korea, Jeju-do, Seogwipo-si, Saekdal-dong, Mt. Halla, N 33.35771, E 126.46289, alt. 1,100 m, May 16, 2015, coll. H. Baek (KU); 1 female (in ethanol), S. Korea, Gyeonggi-do, Paju-si, Jeokseong-myeon, Jangjiwa-ri, Dagmar North, N 37.97469, E 126.84456, alt. 17 m, September 15, 2017, T. A. Klein, H.-C. Kim, MM (NIBR); 1 specimen of unknown sex (in ethanol), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, 633 Eoryong-ri, NNSC-1, N 37.95478, E 126.67998, alt. 14 m, September 19, 2017, T. A. Klein, H.-C. Kim, MM (NIBR); 1 female (in ethanol), S. Korea, Gyeonggi-do, Pyeongtaek, Paengseong-eup, 48-3 Bon-

jeong 2-gil, Humphreys, N 36.95009, E 127.01670, alt. 16 m, May 28, 2019, T. A. Klein, H.-C. Kim, MM (N) (NIBR); 1 female (in ethanol), S. Korea, Gyeonggi-do, Paju-si, Jinseo-myeon, 633 Eoryong-ri, NNSC-1, N 37.95478, E 126.67998, alt. 14 m, June 3, 2019, T. A. Klein, H.-C. Kim, MM (NIBR); 1 male (pinned), S. Korea, Jeju-do, Seogwipo-si, Saekdal-dong, Mt. Halla, N 33.35773, E 126.46283, alt. 1,086 m, June 17, 2019, coll. S. Podenas (NIBR); 1 female (in ethanol), S. Korea, Jeju-do, Seogwipo-si, Saekdal-dong, Mt. Halla, N 33.35761, E 126.46422, alt. 1,101 m, June 19, 2019 (3), coll. S. Podenas, at light (NIBR).

Remark: *P. melanommata* is ascribed to the subgenus *Phylidorea* s.str. (Oosterbroek, 2021), but its taxonomical position still raises discussions. Antennal structure and male genitalia of *P. melanommata* show more resemblance to that of the genus *Euphylidorea* Alexander, 1972, than to the genus *Phylidorea*. Both these genera are closely related, *Euphylidorea* was classified as subgenus of *Phylidorea* s.l. (Savchenko, 1989), just later raised to separate genus level (Savchenko *et al.*, 1992). Petersen *et al.* (2012) made a note, that *P. melanommata* is strikingly similar in the morphology of the *similis*-group (genus *Euphylidorea*). He also mentions that future revisionary work in the *similis*-group, and for *Euphylidorea* as a whole, should include a simultaneous review of *Phylidorea* s.str. Such work needs to be done in a separate publication and is far beyond the scope of this paper.

***Phylidorea (Phylidorea) multidentata* (Alexander, 1938)**  
*Limnophila (Phylidorea) subpoetica multidentata* Alexander, 1938: 155.

*Phylidorea (Phylidorea) multidentata* Oosterbroek, 2021.

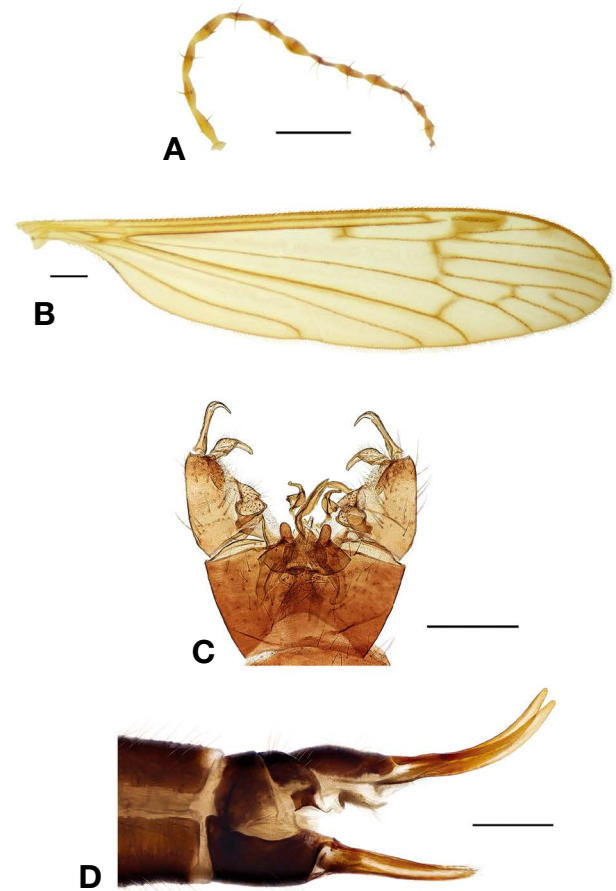
General: Body coloration brown, sparsely dusted with light gray. Male body length 7.3–7.5 mm, female 7.5–9.0 mm, male wing length 7.8–8.5 mm, female 8.0–9.5 mm.

Head: Gray because of dense pruinosity, narrowly light gray along eye margin, sparsely covered with short, longer dorsally, brownish and yellowish semi-erect setae. Vertex with low wide tubercle, that is marked with narrow blackish medial line. Eyes widely separated in both sexes, distance between them at base of antennae approximately equal length of scape and pedicel taken together. Antenna 2.3–2.8 mm long in male, reaching about middle of third abdominal segment, if bent backwards, 2.0–3.8 mm in female. Antennal scape dark brown, lighter distally, elongate, nearly cylindrical, sparsely dusted with gray. Pedicel short subglobular, distinctly bicolored, dark brown at base, yellow at apex. Flagellum (Fig. 4A) dark brown, covered with dense erect whitish pubescence, base of first flagellomere yellow, bases and apices of succeeding 2–3 flagellomeres narrowly and weakly yellowish. Flagellomeres elongate, six basal flagellomeres slightly dilat-



ed ventrally. Verticils dark brown, slightly shorter than length of respective segments. Apical segment very small, much shorter than preceding segment. Rostrum, palpus and mouth parts dark brown.

Thorax: Cervical sclerites dark brown, densely covered with gray pruinosity. Pronotum elongate, widened posteriorly, reddish brown with yellowish posterior margin. Prescutum and presutural scutum semi-polished dark brown, grayish laterally, with very indistinct two or four darker longitudinal stripes, which are visible just at certain angle. Tubercular pits resemble two small black dots at frontal margin of sclerite. Pseudosutural fovea semi-polished, brown. Scutal lobe dark brown dusted with gray, lighter gray laterally. Area separating scutal lobes gray. Scutellum dark brown frontally, densely dusted with gray, yellowish along posterior margin. Mediotergite brownish yellow, darker medially, dusted with gray. Dorsopleural membrane yellowish. Pleuron bluish-gray because of dense pruinosity, except darker brown ventral margin of katapisternum. Episternum setoseless, meron very small, pale-brown. Wing (Fig. 4B) iridescent, with brownish tinge, yellowish at base and in costal area. Darker areas surround base of  $R_s$ , cord, distal margin of discal cell, vein  $CuA$ ,  $sc-r$  and apex of  $R_3$  at wing margin. Stigma distinct, elongate, brown. Veins brown yellowish at wing base. Venation:  $Sc$  long, reaching wing margin slightly before branching point of  $R_s$ ,  $sc-r$  beyond tip of  $Sc$ , at branching point of  $R_s$ . Radial sector as long as  $R_3$  measured from the base of  $R_{2+3}$  to the wing margin, angulate and short-spurred at base. Free end of  $R_1$  indistinct, disappearing at wing margin.  $R_2$  missing.  $R_3$  and  $R_4$  diverging, cell  $r_3$  with short stem, which is approximately as long as basal deflection of  $R_5$ . Cross-vein  $r-m$  long and distinct, at base of discal cell. Discal cell long and narrow, 3.5 times as long as wide. Cell  $m_1$  longer than its stem, basal part of vein  $M_2$  missing in holotype. Cross-vein  $m-cu$  slightly before middle of discal cell. Anal vein long, slightly sinuous, apex reaching wing margin before the level of  $R_s$  base. Anal lobe long and narrow, widely rounded. Length of male halter 1.2–1.3 mm, that of female 1.2–1.5 mm, stem brownish yellow with widely pale base, knob darker brown. Coxae yellow, sparsely dusted with light gray, base of fore coxa brownish. Surface of coxae covered with sparse long yellow setae ventrally and frontally. Trochanters yellow to pale yellow with narrowly blackened apex. Approximately basal third of femur yellow, remaining two-thirds dark brown in darker specimens, half yellow and half dark brown in lighter specimens. Only one studied male, that was collected next day as holotype and in same place, has yellow femora with narrowly darkened tips like in original description. Tibia brownish yellow with narrowly darkened tip. Tarsus 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:



**Fig. 4.** *Phylidorea (Phylidorea) multidentata* (Alexander, 1938). A. antennal flagellum, holotype. B. wing, holotype. C. male genitalia, dorsal view, holotype. D. ovipositor, lateral view. Scale bars 0.5 mm.

5.2–5.8 mm long, II: 5.0–6.0 mm, III: 5.5–6.5 mm, tibia I: 5.6–6.5 mm, II: 5.5–6.6 mm, III: 6.2–7.0 mm, tarsus I: 5.3–6.3 mm, II: 5.4–6.8 mm, III: 4.8–5.5 mm. Female femur I: 4.0–4.2 mm long, II: 4.0–4.5 mm, III: 4.5–6.2 mm, tibia I: 4.3–5.0 mm, II: 4.0–4.3 mm, III: 5.0–5.7 mm, tarsus I: 4.2–4.5 mm, II: 4.8–5.2 mm, III: 4.4–5.5 mm. Claw simple, without spines, dark brown.

Abdomen: Abdominal tergites brown to reddish brown with narrowly gray posterior margin, two basal tergites yellowish. Sternites brownish yellow. Segments covered with comparatively dense short brownish to whitish setae. Female abdomen darker than male, darker brown, sparsely dusted with gray. Genital and pregenital segments dark brown in male. Male terminalia with epandrium distinctly wider than longer, posterior margin with two elongate round apexed lobes medially (Fig. 4C). Gonocoxite elongate with large ventro-mesal lobe. Outer gonostylus long and narrow, rod-shaped, sclerotized, arched distally. Inner gonostylus setose, wider at base, distal part narrow and slightly arched. Paramere arched

with laterally extended ventral region. Lateral process of aedeagal sheath short and strongly curved. Aedeagal apodeme shallowly bifid, resembling fish tail. Aedeagus elongate, tube-shaped. Ovipositor (Fig. 4D) brownish yellow with yellow to pale yellow tip of cercus. Cercus long and narrow slightly arched, distal part raised upwards, blunt-apexed. Hypoalva reddish brown, narrowly darker along ventral margin, long and narrow, slightly arched at distal end, with few setae at tip, apex rounded.

Elevation range in Korea: From 1,100 m to slightly above 1,800 m.

Period of activity in Korea: From mid-July through early August.

Habitat: Unknown.

General distribution: Endemic to North Korea (Fig. 6D).

Examined material: holotype, male (antenna, hind leg, wing and genitalia slide mounted), N. Corea, Chonsani, Paiktusan, alt. 3,800 ft. [1,158 m], July 23, 1937, coll. A. Yankovsky (USNM); 1 male (pinned), N. Corea, Chonsani, Paiktusan, alt. 3,700 ft. [1,128 m], July 24, 1937, coll. A. Yankovsky (USNM); 1 male, 2 females (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5,500–6,000 ft. [1,676–1,829 m], July 19, 1939, coll. A. Yankovsky (USNM); metatype, male (antenna, fore and hind legs, wing and genitalia slide mounted), No. Korea, Kankyo Nando, Puksu Pyaksan, alt. 6,000 ft. [1,829 m], August 3, 1939, coll. A. Yankovsky (USNM); 2 females, 1 specimen of unclear sex (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 6,000 ft. [1,829 m], August 5, 1939, coll. A. Yankovsky (USNM); 2 males (pinned), North Korea, Kankyo Nando, Puksu Pyaksan, alt. 5,000 ft. [1,524 m], August 9, 1939, coll. A. Yankovsky (USNM).

***Phylidorea (Phylidorea) umbrarum* (Krogerus, 1937)**

*Limnophila umbrarum* Krogerus, 1937: 57–58; Tjeder, 1969: 256.

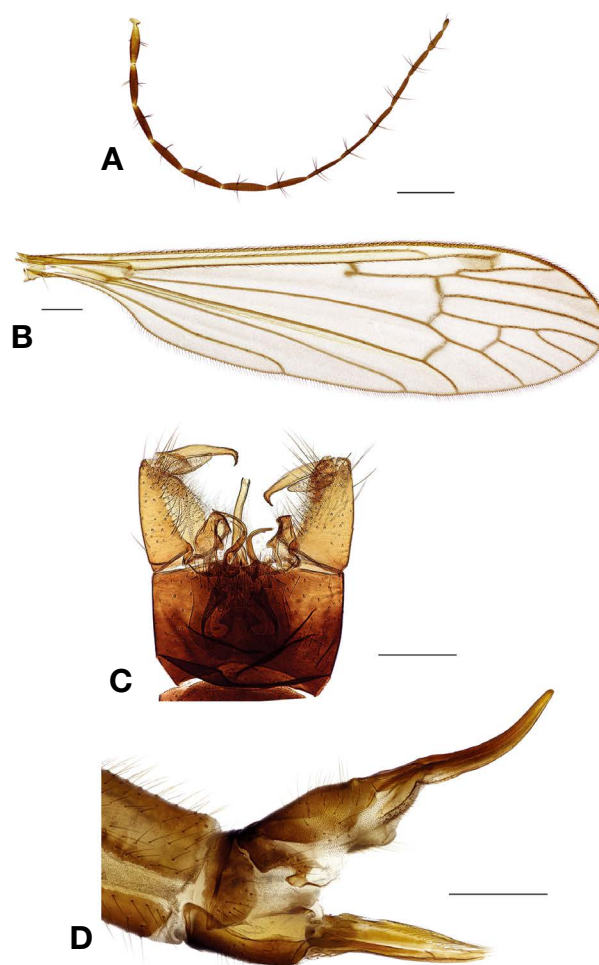
*Limnophila megapygia* Alexander, 1938: 154.

*Limnophila subglabricula* Lackschewitz, 1964: 730.

*Phylidorea (Phylidorea) umbrarum* Savchenko, 1983: 59–60; 1989: 108.

General: Body coloration yellow with contrastingly dark brown tip of abdomen in male. Male body length 4.7–6.7 mm, female 7.8–8.5 mm, male wing length 5.8–7.3 mm, female 7.0–8.0 mm.

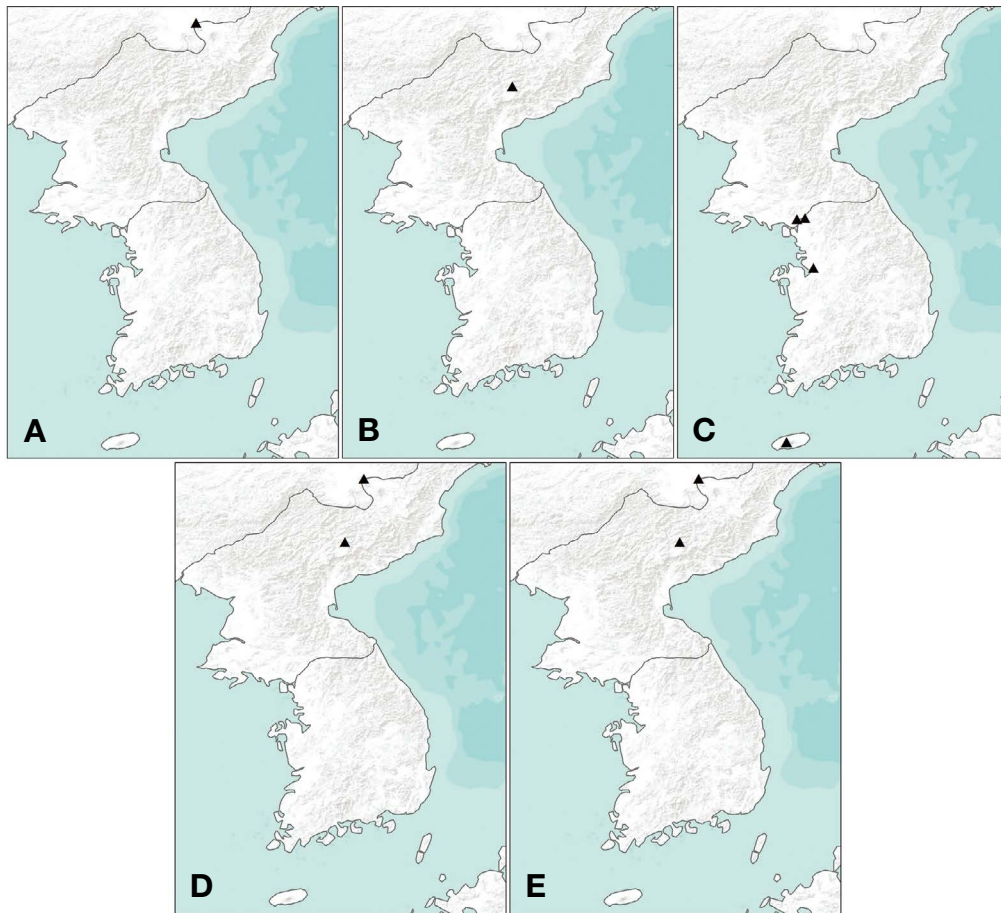
Head: Light brownish-gray frontally, yellowish posteriorly, pale yellow ventrally, narrowly light gray along eye margin, sparsely covered with short, yellowish semi-erect setae. Vertex with low wide indistinct tubercle. Eyes widely separated in both sexes, distance between them at base of antennae approximately equal length of scape and pedicel taken together. Antenna 2.8–4.2 mm long in male, reaching about middle of third abdominal segment, if bent



**Fig. 5.** *Phylidorea (Phylidorea) umbrarum* (Krogerus, 1937). A. male antennal flagellum. B. wing. C. male genitalia, dorsal view, paratype of *Limnophila megapygia* (syn. of *P. umbrarum*). D. ovipositor, lateral view. Scale bars 0.5 mm.

backwards, 1.4 mm in female. Scape yellow, elongate, nearly cylindrical, sparsely dusted with gray, approximately twice as long as succeeding segment. Pedicel sub-globular, yellow. Basal flagellomere yellow, flagellomeres 2–5 dark brown, narrowly and indistinctly yellowish at base. Flagellomeres (Fig. 5A) fusiform, covered with dense whitish pubescence. Verticils dark brown, approximately as long as respective segments. Apical segment small, distinctly shorter than preceding segment. Rostrum brownish yellow, palpus and mouth parts dark brown.

Thorax: Cervical sclerites brownish yellow. Pronotum widened posteriorly, brownish dorsally, pale yellow laterally. Prescutum and presutural scutum semi-polished brownish yellow, paler laterally, longitudinal stripes missing, prescutum of some specimens indistinctly darker medially. Tubercular pits indistinct, close to each other and surrounded with darker area. Pseudosutural fovea indistinct, slightly depressed. Scutal lobes and



**Fig. 6.** Distribution maps of Korean *Phylidorea* crane flies. A. *P. (Macrolabina) pernigrita*. B. *P. (Phylidorea) longicornis pietatis*. C. *P. (P.) melanommata*. D. *P. (P.) multidentata*. E. *P. (P.) umbrarum*.

area between them uniformly brownish yellow. Scutellum light yellow. Mediotergite brownish yellow, paler yellow fronto-laterally. Dorsopleural membrane light yellow. Pleuron brownish yellow, paler posteriorly. Episternum setoseless, meron very small, pale yellow. Wing (Fig. 5B) iridescent, with brownish tinge, yellowish at base and in costal area. Darker areas narrowly surround base of  $R_s$  and cord. Stigma distinct, elongate, brown. Veins brown, yellowish at wing base. Venation:  $Sc$  long, reaching wing margin approximately at branching point of  $R_s$ ,  $sc-r$  at tip of  $Sc$ . Radial sector long, angulate and short-spurred at base. Free end of  $R_1$  indistinct, disappearing at wing margin.  $R_2$  indistinct.  $R_3$  and  $R_4$  diverging, cell  $r_3$  with short stem, which is approximately as long as basal deflection of  $R_5$ . Cross-vein  $r-m$  long and distinct, at base of discal cell. Discal cell long and narrow, 2.7 times as long as wide. Cell  $m_1$  distinctly longer than its stem. Cross-vein  $m-cu$  slightly before middle of discal cell. Anal vein long, slightly sinuous, apex reaching wing margin slightly before the level of  $R_s$  base. Anal lobe long and narrow, widely rounded. Length of

male halter 1.0–1.2 mm, that of female 1.1–1.2 mm, stem pale yellow, knob darker brown. Coxae brownish yellow, sparsely dusted and bearing few erect yellow setae. Trochanters pale yellow to obscure yellow. Femur yellow with pale base and distinct dark brown apical ring. Whole surface covered with dense short semi-adjacent brown setae. Tibia light yellow with narrowly dark brown apex. Basal tarsomere yellow basally brown distally, remaining 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: 4.2–5.0 mm long, II: 4.5–4.6 mm, III: 5.0–5.3 mm, tibia I: 4.5–5.7 mm, II: 4.5–5.0 mm, III: 4.2–6.3 mm, tarsus I: 4.5–5.7 mm, II: 3.8–5.3 mm, III: 4.0–4.6 mm. Female femur I: 4.0 mm long, II: 4.0 mm, III: 4.5–4.6 mm, tibia I: 4.5 mm, II: 4.0 mm, III: 4.2–5.0 mm, tarsus I: 4.0 mm, II: 3.5 mm, III: 3.6–3.7 mm. Claw simple, without spines, dark brown to black.

Abdomen: Tergites and sternites polished, yellow at base of abdomen, reddish yellow towards distal end, covered with erect scarce yellow setae. Posterior margins of

tergites narrowly grayish. Male terminalia (Fig. 5C) and pregenital segment distinctly dark brown, female terminalia not darkened. Epandrium of male genitalia dark brown to black, distinctly wider than long, posterior margin with small incision at middle surrounded with small bumps on both sides. Gonocoxite brownish yellow, elongate with small blunt ventro-mesal lobe. Outer gonostylus long and narrow, sclerotized, apex strongly curved with small serration along outer margin. Inner gonostylus setose, wider at base, round-apexed, distinctly shorter than outer gonostylus. Lateral process of aedeagal sheath long and narrow, rod-shaped, arched and bearing very narrow setae-shaped branch at middle. Interbase plate-shaped, apex right-angled, medial margin with curved lobule at middle. Aedeagal apodeme transverse, plate-shaped with shallow emargination at anterior margin. Aedeagus long stout tube, extending distinctly beyond tip of lateral process of aedeagal sheath. Ovipositor (Fig. 5D) brownish yellow. Tenth tergite elongate, brownish yellow. Cercus long, brown with paler tip, distal part slightly raised upwards, blunt-apexed. Hypoalva yellow with brown base, wedge-shaped, with row of long strong setae along dorsal margin, only about one-fifth from base setoseless.

Elevation range in Korea: From 1,000 m to more than 1,800 m.

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

Habitat: Same as for *P. longicornis pietatis* (Savchenko, 1983).

General distribution: Finland, Russia, and North Korea (Fig. 6E).

Examined material: paratype of *Limnophila megapygia*, male (antenna, leg, wing and genitalia slide mounted), N. Korea, Chonsani, Paiktusan, alt. 3,500 ft. [1,067 m], July 15, 1937, coll. A. Yankovsky (USNM); paratype of *Limnophila megapygia*, male (antenna, fore leg, wing and genitalia slide mounted), N. Korea, Chonsani, Paiktusan, alt. 3,700 ft. [1,128 m], July 21, 1937, coll. A. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando Puksu Pyaksan, alt. 6,000 ft. [1,829 m], July 24, 1939, coll. A. Yankovsky (USNM); 1 female (pinned), North Korea, Kankyo Nando Puksu Pyaksan, alt. 4,000 ft. [1,219 m], August 6, 1939, coll. A. Yankovsky (USNM); 1 female (pinned), North Korea, Kankyo Nando Puksu Pyaksan, alt. 5,000 ft. [1,524 m], August 17, 1939, coll. A. Yankovsky (USNM); 1 male (pinned), North Korea, Kankyo Nando Puksu Pyaksan, alt. 5,000 ft. [1,524 m], August 21, 1939, coll. A. Yankovsky (USNM).

## ACKNOWLEDGEMENTS

Our warmest thanks to all Korean friends and colleagues who helped us during our visits to South Korea

and all those who helped to collect crane flies. We are very grateful for Dr. F. Shockley and Dr. T. Dikow (USNM), Dr. J.K. Gelhaus (Academy of Natural Sciences of Drexel University, U. S. A.) for the possibility to use specimens from the USNM collections. Special thanks are extended to Dr. M. Dags for his help to prepare distribution maps and Dr. Rasa Aukstikalniene for technical assistance, both Nature Research Center, Vilnius and four anonymous reviewers for their comments and improvement of the text.

This work was supported by a grant from the National Institute of Biological Resources (NIBR), funded by the Ministry of Environment (MOE) of the Republic of Korea (NIBR202102111).

## REFERENCES

- Alexander, C.P. 1921. Undescribed species of Japanese crane-flies (Tipulidae, Diptera). Part II. *Annals of the Entomological Society of America* 14:111-134.
- Alexander, C.P. 1938. New or little-known Tipulidae from eastern Asia (Diptera). *XL. Philippine Journal of Science* 67:129-166.
- Alexander, C.P. 1950. New or insufficiently-known crane-flies from the Nearctic region (Diptera, Tipulidae). Part XIII. *Bulletin of the Brooklyn Entomological Society* 45:156-160.
- Alexander, C.P. 1972. New subgenera of North American crane flies (Tipulidae: Diptera). *Entomological News* 83:29-37.
- Bigot, J.M.F. 1854. *Essai d'une classification generale et synoptique de l'ordre des insectes dipteres (3e memoire). Tribu de Tipulidii (mihi)*. *Annales de la Societe Entomologique de France* (3)2:447-482.
- Coquillett, D.W. 1910. The type-species of the North American genera of Diptera. *Proceedings of the United States National Museum* 37:499-647.
- Cumming, J.M. and D.M. Wood. 2017. Adult morphology and terminology. In: A.H. Kirk-Spriggs and B.J. Sinclair (eds.), *Manual of Afrotropical Diptera*. Volume 1. Introductory chapters and keys to Diptera families. *Suricata* 4. South African National Biodiversity Institute: 89-133.
- Edwards, F.W. 1938. British short-palped craneflies. *Taxonomy of adults*. *Transactions of the Society for British Entomology* 5:1-168.
- Evenhuis, N.L. 2014. Family Limoniidae. In: *Catalog of the fossil flies of the world (Insecta: Diptera)* [Available from: <http://hbs.bishopmuseum.org/fossilcat/fossilimoniidae.html> Version 16 Feb 2014].
- Ishida, H. 1959. The catalogue of the Japanese Tipulidae, with the keys to the genera and subgenera (Diptera). V. Limoniinae, Tribe Hexatomini. *Science Report of the Hyogo University of Agriculture, Serie Natural Sciences* 4(1):3-11.
- Krogerus, R. 1937. Zwei neue Diptera Polyneura aus Finn-

- land. *Notulae Entomologicae* 17:57-59.
- Lackschewitz, P. 1964. New and little-known palaeartic crane-flies of the family Limoniidae (Diptera, Tipuloidea). *Entomologicheskoe Obozrenie* 43:710-733 (in Russian).
- Meigen, J.W. 1818. Systematische Beschreibung der bekannten europaischen zweiflugeligen Insekten. F.W. Forstmann, Aachen, 1:i-xxxvi, 1-324.
- Oosterbroek, P. 2021. Catalogue of the Craneflies of the World (CCW) [Available from: <https://ccw.naturalis.nl/litresults.php>].
- Petersen, J.D., M.J. Petersen and G.W. Courtney. 2012. Description of a new subgenus Neophylidorea (Diptera: Tipulidae) and a new species. *Zootaxa* 3555:40-54.
- Podenas, S. 2013. Infraorder Tipulomorpha. In: S.-K. Kim (ed.), National list of species of Korea (Insecta: Diptera I). Dongjin Publishing Company, Seoul: 1-36.
- Podenas, S. 2015. A new species of Antocha crane fly *Osten Sacken, 1860* (Diptera: Limoniidae) for North Korea. *Proceedings of the Academy of Natural Sciences of Philadelphia* 164:3-7.
- Podenas, S. 2016a. New *Geranomyia* crane flies (Diptera: Limoniidae) from Korea and Kunashir Island. *Zootaxa* 4121:555-565.
- Podenas, S. 2016b. The crane flies genus *Libnotes* Westwood, 1876 (Diptera: Limoniidae) for Korea including two new species and an identification key. *Zootaxa* 4158:126-136.
- Podenas, S. 2016c. New Limoniinae crane flies (Diptera: Limoniidae) of Korea. *Zoology and Ecology* 27:47-53.
- Podenas, S., R. Aukstikalniene, H.-W. Byun, T.A. Klein, H.C. Kim, T.-W. Kim, T.-H. Kang and H.-Y. Seo. 2017. Limoniinae crane flies (Diptera: Limoniidae) new to Korea II. *Journal of Species Research* 6:258-279.
- Podenas, S. and H.-W. Byun. 2013. *Antochini* crane flies (Diptera: Limoniidae: Limoniinae) of Korea. *Journal of Species Research* 2:167-184.
- Podenas, S. and H.-W. Byun. 2014a. New Limoniinae crane flies (Diptera: Limoniidae) of Korea. *Journal of Species Research* 3:167-182.
- Podenas, S. and H.-W. Byun. 2014b. New species of *Antocha* *Osten Sacken, 1860* crane flies (Diptera: Limoniidae) for South Korea. *Zootaxa* 3900:117-126.
- Podenas, S. and H.-W. Byun. 2016. *Metalimnobia* crane flies (Diptera: Limoniidae) from Korea. *Zootaxa* 4132:330-346.
- Podenas, S. and H.-W. Byun. 2018. *Libnotes* crane flies (Diptera: Limoniidae) from Jeju Island (South Korea). *Zootaxa* 4483:375-384.
- Podenas, S., H.-W. Byun and S.-K. Kim. 2015a. New *Dicranoptycha* *Osten Sacken, 1859* crane flies (Diptera: Limoniidae) of North and South Korea. *Zootaxa* 3925:257-270.
- Podenas, S., H.-W. Byun and S.-K. Kim. 2015b. Limoniinae crane flies (Diptera: Limoniidae) new to Korea. *Journal of Species Research* 4:61-96.
- Podenas, S., H.-W. Byun and S.-K. Kim. 2016. *Rhipidia* crane flies (Diptera: Limoniidae) from Korea. *Zootaxa* 4136:515-536.
- Podenas, S., H.-W. Byun, S.-K. Kim and V. Podeniene. 2014. Crane flies (Diptera: Tipuloidea) of the Korean peninsula. Abstract, 8th International Congress of Dipterology: 261.
- Podenas, S., S.-J. Park, H.-W. Byun, A.-Y. Kim, T.A. Klein, H.C. Kim and R. Aukstikalniene. 2020a. New data on Limoniinae and Limnophilinae crane flies (Diptera: Limoniidae) of Korea. *Journal of Species Research* 9:492-531.
- Podenas, S., S.-J. Park, A.-Y. Kim and Aukstikalniene, R. 2020b. New species of *Lipsothrix* (Diptera: Limoniidae) from South Korea. *Zootaxa* 4802:534-540.
- Podenas, S., M. Petersen, A.-Y. Kim, S.-J. Park, H.-W. Byun and H.-Y. Seo. 2019a. New *Lipsothrix* (Diptera: Limoniidae) from Korea. *Zootaxa* 4688:561-568.
- Podenas, S. and V. Podeniene. 2017. *Limonia* crane flies (Diptera: Limoniidae) of Korea. *Zootaxa* 4231:1-37.
- Podenas, S., V. Podeniene, S.-J. Park, H.-Y. Seo, T.-W. Kim, A.-Y. Kim, H.-W. Byun and R. Aukstikalniene. 2019b. *Epiphragma* crane flies (Diptera: Limoniidae) of Korea. *Journal of Species Research* 8:407-420.
- Podenas, S., V. Podeniene, H.-Y. Seo, A.-Y. Kim, S.-J. Park, H.-W. Byun, H.-C. Kim and R. Aukstikalniene. 2020c. New *Atypophthalmus* (Diptera: Limoniidae) from South Korea. *Zootaxa* 4732:281-294.
- Podenas, S., V. Podeniene, H.-Y. Seo, A.-Y. Kim, S.-J. Park, H.-W. Byun, H.-C. Kim and Aukstikalniene R. 2020d. A new species of *Elephantomyia* crane fly (Diptera, Limoniidae) from Jeju Island, South Korea. *ZooKeys* 966:41-55.
- Podenas, S., H.Y. Seo, T. Kim, J.M. Hur, A.-Y. Kim, T.A. Klein, H.C. Kim, T.H. Kang and R. Aukstikalniene. 2019c. *Dicranomyia* crane flies (Diptera: Limoniidae) from Korea. *Zootaxa* 4595:1-110.
- Podeniene, V. and J.K. Gelhaus. 2010. The last instar larvae and pupae of Mongolian Limnophilinae crane flies from genera *Eloeophila*, *Limnophila* and *Phylidorea* (Diptera, Limoniidae). *Proceedings of the Academy of Natural Sciences of Philadelphia* 159:185-204.
- Ribeiro, G.C. 2008. Phylogeny of the Limnophilinae (Limoniidae) and early evolution of the Tipulomorpha (Diptera). *Invertebrate Systematics* 22:627-694.
- Savchenko, E.N. and G.O. Krivolutskaia. 1976. Limoniidae of the south Kuril Islands and south Sakhalin. *Akad. Nauk. Ukr. SSR, Kiev*: 1-160 (in Russian).
- Savchenko, E.N. 1983. Limoniidae of South Primorye. *Akademyi Nauk Ukrainskoy SSR, I.I. Schmalhausen Institute of Zoology of Academy of Sciences of Ukraine, Naukova Dumka, Kiev*: 1-156 (in Russian).
- Savchenko, E.N. 1986. Komary-limoniidy [limoniid-flies]. (General description, subfamilies Pediciinae and Hexatominae). *Fauna Ukrainy* 14(2):1-380 (in Russian).
- Savchenko, E.N. 1989. Komary-limoniidy fauna SSSR [Limoniidae fauna of the USSR]. Determination tables of superspecies taxa with catalogue survey of species. *Akad-*

- imiya Nauk Ukrainian SSR, I.I. Schmalhausen Institute of Zoology of Academy of Sciences of Ukraine, Naukova Dumka, Kiev: 1-377 (in Russian).
- Savchenko, E.N., P. Oosterbroek and J. Sary. 1992. Family Limoniidae. Catalogue of Palearctic Diptera 1:183-369.
- Siebke, H. 1870. Beretning om en i Sommeren 1869 foretagen entomologisk Reise gjennem Ringerike, Hallingdal og Valdres. Nyt Magazin for Naturvidenskapene 17:246-314.
- Tjeder, B. 1969. *Limnophila prolixicornis* Bergroth in Lundstrom, 1907, and *L. umbrarum* Krogerus, 1957. Notes and lectotype designations (Diptera, Tipulidae). Notulae Entomologicae 49:254-256.
- Wallengren, H.D.J. 1882. Revision af Skandinaviens Tipulidae. Entomologisk Tidskrift 2(1):177-208.
- Zetterstedt, J.W. 1837. Conspectus familiarum, generum et specierum Dipteroorum, in fauna insectorum Lapponica descriptorum. Isis von Oken 1837(1):28-67.

Submitted: October 15, 2021

Revised: January 14, 2022

Accepted: January 14, 2022