



# Taxonomic review of the genus *Empria* Lepeletier & Serville (Hymenoptera, Tenthredinidae) in South Korea: morphological and molecular identification of two new species

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## Abstract

The sawfly genus *Empria* Lepeletier & Serville (Hymenoptera: Tenthredinidae: Allantinae) is reviewed in South Korea and four species are reported as new in the country: *Empria lycroi* Prous & Park, **sp. nov.** (also Russia); *E. nigroterga* Park & Lee, **sp. nov.** (also Russia); *E. wui* Wei & Nie (also Japan); and *E. zhangi* Wei & Yan (also Russia). *Tenthredo magnicornis* Eversmann, 1864, **syn. nov.** is treated as a synonym of *E. candidata* (Fallén, 1808). A key to the six species currently known from South Korea and photographs of the diagnostic characters for each species are presented. In addition, phylogenetic analysis based on one mitochondrial (COI) and two nuclear (NaK, POL2) genes are reported for 20 species of *Empria*.

## Keywords

Allantinae, COI, key, new record, nuclear genes, Symphyta

## Introduction

The genus *Empria* Lepeletier & Serville, a member of the subfamily Allantinae, currently includes 56 described world species. They are separated into six species groups: *candidata* group, *hungarica* group, *immersa* group, *longicornis* group, *quadrimaculata*

group, and *wui* group. 40 species have been recorded in the Palaearctic, 11 species in the Nearctic, four species in the Oriental, two species in the Neotropic, and one fossil species (Taeger et al. 2018). The native habitat of the genus is the Northern Hemisphere and most occur at higher latitudes (mostly north of 30–40°N) (Prous and Heidemaa 2012). The larvae of *Empria* species feed on species of the families Betulaceae, Ericaceae, Rosaceae, and Salicaceae (Shinohara et al. 2015). The general morphology of *Empria* is very similar to that of *Monsoma*, but it can be easily distinguished by the following key characters: clypeus incised with distinct middle tooth or terga with pairs of pale patches. Identification of *Empria* species using only external morphology can often be difficult and members of some species groups can hardly be separated. It is essential to dissect female ovipositors and male genitalia for reliable identification (Prous et al. 2011a, b).

Although this group is widely distributed in the Holarctic, very little is known about the South Korean species. Until recently, only two species (*E. candidata* and *E. tridentis*) had been identified (Lee and Ryu 1996; Prous et al. 2011a). Here we report four additional species, two of them described as new: *Empria lycroi* Prous & Park, sp. nov., *E. nigroterga* Park & Lee, sp. nov., and *E. zhangi* Wei & Yan from South Korea and Russia, and *E. wui* Wei & Nie from South Korea and Japan. *Tenthredo magnicornis* Eversmann, 1864, syn. nov. is synonymized under *E. candidata* (Fallén, 1808). A key is provided to distinguish the six species from South Korea. In addition, phylogenetic analysis based on one mitochondrial (COI) and two nuclear (NaK, POL2) genes are reported for 20 species of *Empria*.

## Materials and methods

Morphological terminology follows Viitasaari (2002). Ratios for species identifications were based on measurements following Prous et al. (2011b). The parenthesis used in the species descriptions indicate character states for variations between specimens in the new species, and character states for color variations in other species. Names of the mentioned host plants follow ‘The Plant List’ (<http://www.theplantlist.org/>). Photos were taken with a digital camera attached to a microscope. Composite images were created from stacks of images using AxioVision40AC, IMT iSolution Lite software, or CombineZP (Alan Hadley; <http://www.hadleyweb.pwp.blueyonder.co.uk/>), and final plates were prepared in Adobe Photoshop CS6 (Adobe Systems Incorporated, San Jose, CA, USA).

Newly obtained sequences of cytochrome oxidase subunit I (COI), nuclear sodium/potassium-transporting ATPase subunit alpha (NaK) and DNA dependent RNA polymerase II subunit RPB1 (POL2) (sequenced as described in Liston et al. 2019 and references therein) were submitted to NCBI GenBank (accession numbers [MN294991–MN295013](#)). Nuclear internal transcribed spacer (ITS) sequences mentioned for *Empria wui* were published by Prous and Heidemaa (2012). To facilitate

comparison with data in BOLD (<http://www.boldsystems.org/>) and unless otherwise stated, COI p-distance values are based on the barcode region (658 bp), but in the phylogenetic analyses in combination with nuclear genes, 1078–1089 bp COI fragment was used instead. Nuclear distances are based on the combined NaK and POL2. Distances were taken from BOLD or calculated in R (R Core Team 2018) with the package *ape* (Paradis and Schliep 2018). Phylogenetic analyses using maximum likelihood (ML) were performed using IQ-TREE 1.5.6 (<http://www.iqtree.org/>) (Nguyen et al. 2015). By default, IQ-TREE runs ModelFinder (Kalyaanamoorthy et al. 2017) to find the best-fit substitution model and then reconstructs the tree using the model selected according to the Bayesian information criterion (BIC). We complemented this default option with an SH-like approximate likelihood ratio (SH-aLRT) test (Guindon et al. 2010) and ultrafast bootstrap (Hoang et al. 2018) with 1000 replicates to estimate robustness of reconstructed splits. Analyzed sequences are from Prous and Heidemaa (2012), Liston et al. (2019), Prous et al. (2019), and this study.

Pinned specimens including the studied types come from the following institutional collections: CSCS, Central South University of Forestry and Technology (Changsha, China); NIBR, National Institute of Biological Resources (Incheon, South Korea); NNIBR, Nakdonggang National Institute of Biological Resources (Sangju, South Korea); NSMT, National Museum of Nature and Science (Tsukuba, Japan); SDEI, Senckenberg Deutsches Entomologisches Institut (Müncheberg, Germany); USNM, National Museum of Natural History, Smithsonian Institution (Washington DC, USA); YNU, Yeungnam University (Gyeongsan, South Korea); ZIN, Russian Academy of Sciences, Zoological Institute (St. Petersburg, Russia).

The following abbreviations are used throughout the text: OOCL (ocellar-occipital carina line), the shortest distance between posterior margin of a lateral ocellus and the hind margin of the head; POL (postocellar line), the shortest distance between medial margins of the two lateral ocelli; MT, Malaise trap.

## Results and discussion

### Genus *Empria* Lepeletier & Serville, 1828

#### Key to the species from South Korea

- 1 Head largely pale in female; clypeus mostly pale without median keel (Fig. 1I, J); posterior margin of sternum 9 with a notch or truncated (Prous et al. 2011a; fig. 7); valviceps about 1.6 times as long as valvula (Fig. 7A) .... *E. candidata* (Fallén)
- Head mostly black in both sexes; clypeus entirely black with median keel (Figs 1K, L, 2I–L); posterior margin of sternum 9 rounded or truncated (Figs 3J, 4J); valviceps shorter or almost equal in length to valvula (Fig. 7B–F) ..... 2

- 2 Vein 2A+3A in fore wing incomplete (Prous and Heidemaa 2012; fig. 14); cell M in hind wing open; posterior margin of sternum 9 truncated ..... *E. wui* Wei & Nie
- Vein 2A+3A in fore wing complete; cell M in hind wing closed (Fig. 4A, B); posterior margin of sternum 9 rounded or truncated ..... 3
- 3 Tegula mostly black; abdominal terga with indistinct pairs of whitish (pale) patches (Fig. 4A, B) ..... *E. nigroterga* Park & Lee, sp. nov.
- Tegula usually entirely white; abdominal terga with distinct pairs of whitish (pale) patches (Figs 1C, D, 2C, D, 3A, B) ..... 4
- 4 Malar space 1.7–1.9 times as long as diameter of median ocellus in female, 1.4–1.6 times in male (Fig. 1K, L); flagellum 2.3–2.5 times as long as head width in female, 3.6–3.7 times in male; ovipositor sheath not extending or slightly extending beyond apex of abdomen; each serrula subtriangularly protruding basally (Fig. 6B) ..... *E. tridentis* Lee & Ryu
- Malar space 1.1–1.7 times as long as diameter of median ocellus in female, 0.8–1.0 times in male (Figs 2K, L, 3F, I); flagellum 1.4–2.0 times as long as head width in female, 1.8–2.4 times in male; ovipositor sheath not extending to distinctly extending beyond apex of abdomen; each serrula subtriangularly or circularly protruding basally (Fig. 6D, E) ..... 5
- 5 All trochanters and trochantelli black; ovipositor sheath distinctly extending beyond apex of abdomen (Fig. 2F); each serrula circularly protruding basally (Fig. 6D) ..... *E. zhangi* Wei & Yan
- All trochanters and trochantelli pale; ovipositor sheath not extending or slightly extending beyond apex of abdomen (Fig. 3C); each serrula subtriangularly protruding basally (Fig. 6E) ..... *E. lycroi* Prous & Park, sp. nov.

### *Empria candidata* (Fallén, 1808)

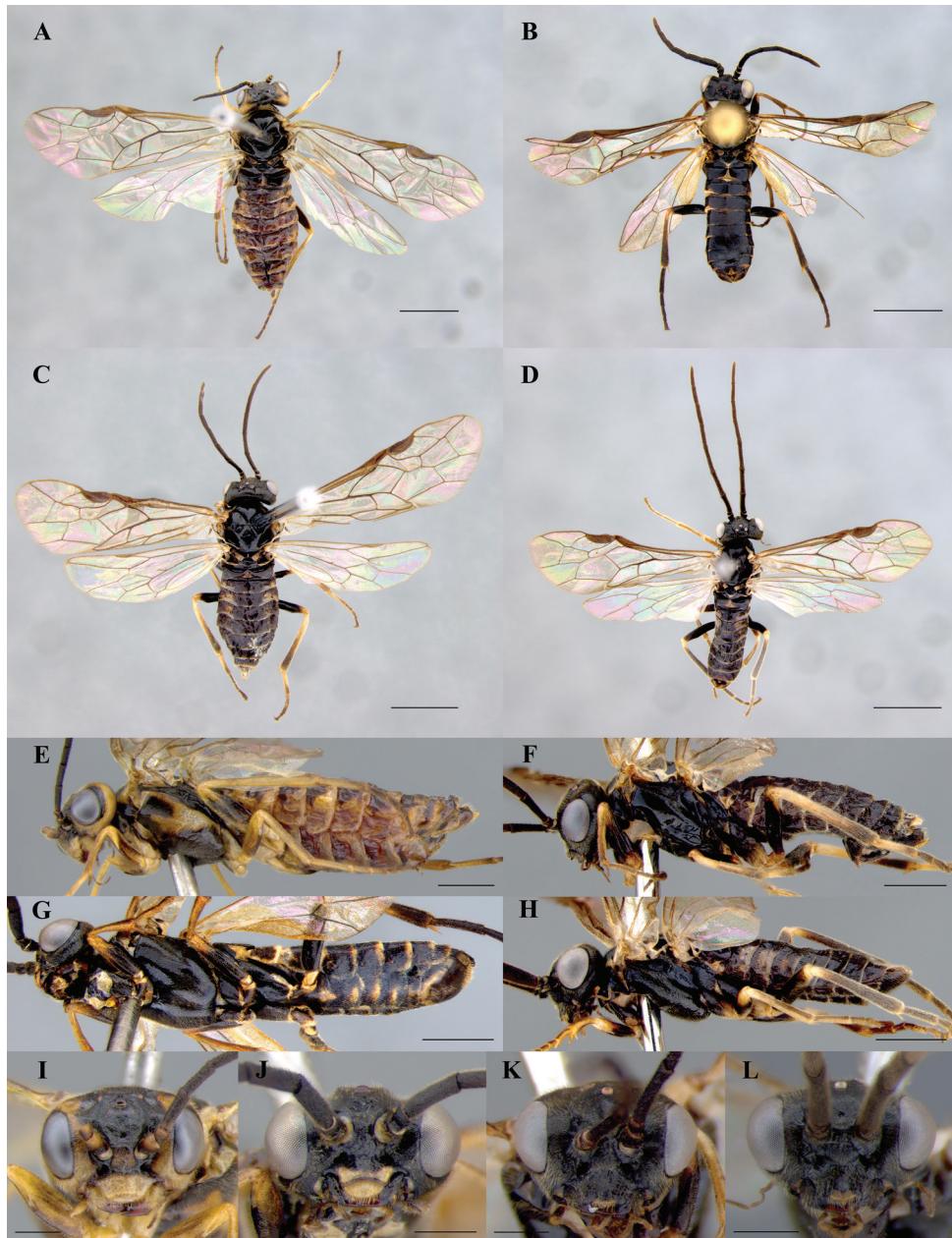
Figs 1A, B, E, G, I, J, 6A, 7A

*Tenthredo candidata* Fallén, 1808: 105–106.

*Tenthredo (Allantus) repanda* Klug, 1816: 77–78.

*Tenthredo magnicornis* Eversmann in Kawall, 1864: 297, syn. nov.

**Diagnosis. Female** (Figs 1A, E, I, 6A). Body length 7.2–8.0 mm. Head and thorax black, except clypeus, labrum, basal half of mandible, facial orbit, gena, temple, genal orbit, labial and maxillary palps, pronotum dorsally, tegula, mesepisternum medially, postspiracular sclerite, all outer coxae, all trochanters and trochantelli, all femora, tibiae and tarsi anteriorly pale; rest of mandible reddish brown with black margins apically; supraclypeal area, scape and pedicel (brown to black), cencrus, all tibiae and tarsi posteriorly (entirely) brown; abdomen dark brown, segments with posterior pale margins (sterna without pale margins, but 4–6 with pale patches medially) and abdominal terga with 3–5 pairs of pale patches (Fig. 1A, E, I). Clypeus weakly rugulose without median keel. Malar space 1.2–1.4 times as long as diameter of median ocel-



**Figure 1.** *Empria* spp.: **A, B, E, G, I, J** *E. candidata* from Gangwon, South Korea **C, D, F, H, K, L** *E. tridentis*, female from Jeonnam and male from Gangwon, South Korea **A, C** dorsal habitus, female **B, D** dorsal habitus, male **E, F** lateral habitus, female **G, H** lateral habitus, male **I, K** frontal head, female **J, L** frontal head, male. Scale bars: 2 mm (**A–D**); 1 mm (**E–H**); 0.5 mm (**I–L**).

lus (Fig. 1I, J). Flagellum 1.3–1.4 times as long as head width. Lancet with about 19 serrulae, membrane between serrulae flat; each serrula weakly protruding basally (Fig. 6A), with a basal denticle and 8–11 distal denticles.

**Male** (Figs 1B, G, J, 7A). Body length 5.5–6.4 mm. Similar to female, but body black, except lower half of clypeus and labrum pale (white); patches of abdominal terga fading towards the apex; posterodorsal margin of pronotum, cenchrus, all tibiae and tarsi posteriorly, and basal 2/3 of hind tibia posteriorly yellowish brown; all femora at apex and all tibiae at base with yellowish brown ring (Fig. 1B, G, J). Flagellum about 2.0 times as long as head width. Posterior margin of sternum 9 weakly concave at middle (truncated). Penis valve as in Fig. 7A, valviceps about 1.6 times as long as valvula.

**Genetic data.** Based on the mitochondrial COI barcode sequences available in BOLD (15 specimens within [BOLD:ABV8001](#), [BOLD:ADS7820](#), and [BOLD:AAG3534](#)), the maximal distance between the specimens is 3.5%. The nearest neighbour, diverging by a minimum of 7.4%, is the North American *E. multicolor* (Norton). Based on the nuclear data of two specimens (Sweden and Russia, Liston et al. 2019), the distance between them is 1.0%. The nearest neighbour, diverging by a minimum of 5.2%, is *E. multicolor* (Norton).

**Specimens examined.** SOUTH KOREA: 1♀, Gangwon-do, Mt. Odaesan, Mirugam (Pugdaesa), 1300 m, 31.V.1991, A. Shinohara (CSCS; NSMT187), specimen in exchange from NSMT; 1♀1♂, same locality, 28.V.1992, A. Shinohara (NSMT; 1♀, NSMT-HYM65594/NSMT186; 1♂, NSMT-HYM65597/NSMT191); 1♂, same locality, 29.V.1992, A. Shinohara (NSMT; NSMT-HYM65596/NSMT190); 1♂, same locality, 28.V.1993, A. Shinohara (CSCS; NSMT221), specimen in exchange from NSMT; 1♂, same data (NSMT; NSMT-HYM65598/NSMT192); 1♀1♂, same data (YNU; 1♀, NSMT-HYM65591/NSMT189; 1♂, NSMT-HYM65599/NSMT196), specimens in exchange from NSMT VI/2018; 1♀, same data (NSMT; NSMT-HYM65592/NSMT188); 1♀, same locality, 29.V–1.VI.1996, A. Shinohara (NSMT; NSMT-HYM65595/NSMT185); 1♀, Gangwon-do, Taebaek-si, Sododong, Mt. Taebaeksan, Danggol, 6.V.1999, S.M. Ryu (YNU); CZECH REPUBLIC: 1♂, Bohemia, Decinsky Sneznik, 50.8N, 14.11666E, 29.IV.1994, E. Kula (SDEI; DEI-GISHym88921); 1♂, same locality, 5.V.1995 (SDEI; DEI-GISHym21037); 1♀, same locality, 26.V.1995 (SDEI; DEI-GISHym21036); 1♂, same locality, 20.IV.2007 (SDEI; DEI-GISHym21032); 1♀, same locality, 24.IV.2007 (SDEI; DEI-GISHym21033); 1♀, same locality, 27.IV.2007 (SDEI; DEI-GISHym21034); FINLAND: 1♀, Northern Ostrobothnia, Hailuoto, Kesikylae, 65.022N, 24.743E, 10 m, 31.V.2018, A. Liston & M. Prous, (SDEI; DEI-GISHym84426); 1♀, Northern Ostrobothnia, Hailuoto, Potti, 65.059N, 24.884E, 1 m, 31.V.2018, A. Liston & M. Prous, (SDEI; without ID number); 1♀, Lapin Laeaeni, Leppaelae 20 km S, 69.52N, 27.22E, 10.VI.2001, A. Taeger & Ch. Kutzscher (SDEI; without ID number); 1♂, Lapin Laeaeni, Nuorbenjarga 46 km SW Utsjoki, 69.685N, 25.94E, 9.VI.2001, A. Taeger & Ch. Kutzscher (SDEI; without ID number); 1♀, Lapin Laeaeni, Nuorbenjarga 46 km SW Utsjoki, 69.685N, 25.94E, 13.VI.2001, A. Taeger & Ch. Kutzscher (SDEI; DEI-GISHym14907); 1♀, Lapin Laeaeni, Nuorgam 17 km SSE, 69.944N, 28.041E, 12.VI.2001, A. Taeger & Ch. Kutzscher (SDEI; DEI-GISHym4835); 1♀, Lapland, Tolva 7 km W, 66.223N, 28.552E, 330–450 m, 9.VI.2018, SDEI Hym-group (SDEI; DEI-GISHym84427); GERMANY: 1♂, Sachsen, Erzgebirge,

Altenberg Umg., 13.V.1986, S. Walter (SDEI; DEI-GISHym20803); 1♀, Sachsen, Syrau, NSG Syrau-Kauschwitzter Heide, 50.53121N, 12.07119E, 21.V.2008, F. Burger (SDEI; DEI-GISHym19044); 1♀, Brandenburg, Waldsieversdorf, 52.55N, 14.03333E, 24.IV.2005, A.D. Liston (SDEI; DEI-GISHym19068); JAPAN: 1♀, Hokkaido, Nissho-toge, Hidaka Mts., Hidaka/Tokachi, 1100 m, 23.VI.2004, A. Shino-hara (NSMT; NSMT-HYM69256/NSMT184); 1♂, Hokkaido, Nisshotoge, Hidaka Mts. Hidaka, 42.971N, 142.752E, 1050 m, 2–12.VI.2010, N. Kuhara (USNM; USNM2057434\_02); PORTUGAL: 1♀, Viana do Castelo, Paredes de Coura 6 km NNE, 41.947N, 8.50619W, 480 m, 13.V.2012, Blank, Jacobs, Liston & Taeger (SDEI; DEI-GISHym15216); RUSSIA: 2♀♀, Khabarovskiy Kray, Boitsovo N Bikin, Bolshoi Solntsepyok Hill SE Boitsovo, 47.03333N, 134.35E, 300 m, 26.V.1993, A. Taeger (SDEI; without ID number, DEI-GISHym14908); 1♀, Primorsky Krai, Anisimovka, Gribanovka, 1 km N, 43.126N, 132.797E, 450 m, 8.V.2019, M. Prous (SDEI; DEI-GISHym80656); 3♀♀, same locality, 9.V.2019, M. Prous (SDEI; DEI-GISHym80795, DEI-GISHym80661, DEI-GISHym80665); 5♀♀2♂♂, same locality, 2 km N, 43.14N, 132.791E, 360 m, 10.V.2019, M. Prous (SDEI; 5♀♀, two without ID numbers, DEI-GISHym80682, GISHym80691, DEI-GISHym80819; 2♂♂, DEI-GISHym80839, DEI-GISHym80854); 1♀, Primorskiy Kray, Biological station 30 km SE Chuguyevka (Sichote Alin), 44.08333N, 134.2E, 650 m, 31.V.1993, A. Taeger (SDEI; DEI-GISHym14909); 1♀, Primorskiy Kray, Gornotajozhnoe, 1 km E, 43.694N, 132.168E, 150 m, 11.V.2019, M. Prous (SDEI; DEI-GISHym80694); 1♂, Primorskiy Kray, Gornotajozhnoe, Observatory, 43.699N, 132.166E, 270 m, 18.V.2016, K. Kramp, M. Prous & A. Taeger (SDEI; DEI-GISHym80252); SWEDEN: 1♂, Norrbotten, Överkalix, 22 km W, 140 m, 66.295N, 22.356E, 2.VI.2014, leg. A. Liston & M. Prous (YNU; S343), specimen presented from SDEI XII/2014; 1♀, Norrbotten, Råneå, 10 SW, 10 m, 65.788N, 22.156E, 30.V.2014, leg. A. Liston & M. Prous (YNU; S334), specimen presented from SDEI XII/2014; 1♂, Norrbottens Laen, Abisko National Park, E10, 68.353N, 18.815E, 390 m, 16.VI.2012, A.D. Liston, A. Taeger & S.M. Blank (SDEI; without ID number); 1♂, Norrbottens Laen, Aengestraesk 11 km NEE, 66.052N, 22.386E, 140 m, 28.V.2014, A. Liston & M. Prous (SDEI; without ID number); 2♀♀, same locality, 3 km N, 66.035N, 22.16E, 40 m, 28.V.2014, A. Liston & M. Prous (SDEI; without ID numbers); 1♀, same locality, 6 km NE, 66.048N, 22.239E, 140 m, 28.V.2014, A. Liston & M. Prous (SDEI; without ID number); 3♀♀1♂, Norrbottens Laen, Bjoerkfors, 65.92N, 23.46E, 10 m, 1.VI.2014, A. Liston & M. Prous (SDEI; without ID numbers); 1♀, Norrbottens Laen, Gaellivare 18 km SEE, 67.082N, 21.051E, 320 m, 11.VI.2014, A. Liston & M. Prous (SDEI; without ID number); 1♀, Norrbottens Laen, Gaellivare Dundret, 67.105N, 20.641E, 450 m, 11.VI.2014, A. Liston & M. Prous (SDEI; without ID number); 1♀, Norrbottens Laen, Haparanda 13 km NW, 65.926N, 23.918E, 60 m, 27.V.2014, A. Liston & M. Prous (SDEI; without ID number); 1♀, same locality, 5 km W, 65.82N, 24.033E, 2 m, 3.VI.2014, A. Liston & M. Prous (SDEI; without ID number); 1♂, Norrbottens Laen, Hietaniemi 10 km SW, 66.166N, 23.495E, 90 m, 1.VI.2014, A. Liston & M. Prous (SDEI; without ID number); 1♀, Norrbottens Laen,

Kalix, Palaenge, 65.815N, 22.975E, 50 m, 26.V.2014, A. Liston & M. Prous (SDEI; without ID number); 1♀, Norrbottens Laen, Kamlunge, 65.993N, 22.858E, 40 m, 28.V.2014, A. Liston & M. Prous (SDEI; without ID number); 1♀1♂, Norrbottens Laen, Kiruna nr. airport, 67.84N, 20.35E, 450 m, 21.V.2012, A.D. Liston, A. Taeger & S.M. Blank (SDEI; without ID numbers); 3♀♀1♂, Norrbottens Laen, Kitkiojaervi, 6 km SE, 67.77N, 23.265E, 240 m, 7.VI.2014, A. Liston & M. Prous (SDEI; 3♀♀, without ID numbers; 1♂; DEI-GISHym80016); 3♂♂, Norrbottens Laen, Lantjaerv, 4 km N, 65.89N, 23.347E, 30 m, 1.VI.2014, A. Liston & M. Prous (SDEI; without ID number, DEI-GISHym31012, DEI-GISHym31064); 2♀♀, Norrbottens Laen, Oeverkalix 22 km W, 66.295N, 22.356E, 140 m, 2.VI.2014, A. Liston & M. Prous (SDEI; without ID numbers); 2♀♀, Norrbottens Laen, Pajala, 67.204N, 23.409E, 150 m, 5.VI.2014, A. Liston & M. Prous (SDEI; without ID numbers); 1♀, Norrbottens Laen, Ranea 10 SW, 65.788N, 22.156E, 10 m, 30.VI.2014, A. Liston & M. Prous (SDEI; without ID number); 1♂1♀, Norrbottens Laen, Taerendoe, 67.166N, 22.642E, 160 m, 6.VI.2014, A. Liston & M. Prous (SDEI; without ID numbers); 1♀, Norrbottens Laen, Tornetraesk station, 68.215N, 19.74E, 400 m, 21.VI.2012, A.D. Liston & A. Taeger (SDEI; without ID number); 1♀, Torne Lappmark, Abisko, 6 km E, 68.348N, 18.969E, 400 m, 4.VII.2016, A. Liston & M. Prous (SDEI; without ID number); 1♀, Vaesterbottens Laen, Loevanger 3 km N, 64.402N, 21.301E, 60 m, 25.V.2014, A. Liston & M. Prous (SDEI; without ID number); UNITED KINGDOM: 1♀, Scotland, Claybokie, near Braemar, 56.99237N, 3.50222W, 4.VI.2010, A.D. Liston (SDEI; DEI-GISHym19067).

**Host plants.** Betulaceae: *Betula pendula* Roth, *Betula* sp. (Lorenz and Kraus 1957; Verzhutskii 1966, 1981).

**Distribution.** Austria, Belgium, Bulgaria, Canada, China, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Hungary, Japan, Lithuania, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovakia, South Korea, Sweden, Switzerland, United Kingdom, USA (Prous et al. 2011a; Taeger et al. 2018).

**Discussion.** Belongs to *E. candidata* group. This species was first recorded from South Korea by Prous et al. (2011a). Significant sexual dimorphism is represented in the body color as noted above.

Macek and Kula (2015) distinguished two forms, *E. candidata* (Fallén, 1808) and *E. magnicornis* (Eversmann, 1864) which we are unable to confirm. Color of mesepisternum in females varies from almost completely black (small round or vaguely triangular posterior fleck) to almost completely pale. Commonly there are two, anterior and posterior triangular or vaguely triangular flecks, which are clearly separated, or connected in various degrees. The vague differences in shape of head, thorax, and body mentioned by Macek and Kula (2015) vary continuously too and in various combinations. No clear correlation was detected between these characters and coloration. In males, there is no clear correlation between coloration of clypeus and head shape. Penis valves vary significantly (partly because of variations in slide preparations) and not in correlation with coloration or head shape. For example, a specimen from Russian Far

East with nearly completely pale clypeus and with head shape more like *E. candidata* sensu Macek and Kula (2015) has a penis valve more like *E. magnicornis* ([https://sdei.de/ecatSYM/ecat\\_bild.php?NameNr=1003677&DateiName=24088.JPG](https://sdei.de/ecatSYM/ecat_bild.php?NameNr=1003677&DateiName=24088.JPG)).

Although two specimens at the extremes of variation can look strikingly different, most specimens cannot be identified as belonging to one or the other form identified by Macek and Kula (2015). The variation is too large and the characters too ill-defined by Macek and Kula (2015) to have any practical value in separating two forms in *E. candidata*. There are various other and equally legitimate starting points to divide morphological variation in *E. candidata* into more than one group (e.g. the presence or absence of pale flecks in the middle of abdominal terga), but it is not clear if any of them have taxonomic value. Because morphological variation in *E. candidata* is better explained by variation in widely distributed species, we treat *E. magnicornis* (Eversmann, 1864) as a synonym of *E. candidata*.

### *Empria tridentis* Lee & Ryu, 1996

Figs 1C, D, F, H, K, L, 6B, 7B

*Empria tridentis* Lee & Ryu, 1996: 23.

**Diagnosis. Female** (Figs 1C, F, K, 6B). Body length 5.8–6.1 mm. Head and thorax black (clypeus pale in lower margin), except labrum, posterodorsal margin of pronotum, tegula, apex of all femora, basal 1/3 of fore and middle tibiae, basal 2/3 (mostly) of hind tibia, basal half of middle and hind tarsomere 1 white (pale); crenulus, all trochanters and trochantelli yellowish brown; apical 2/3 of fore tibia, fore tarsus and middle tibia anteriorly brown; mandible at apex reddish dark brown; labial and maxillary palps dark brown; abdomen dark brown, abdominal terga with 3–4 pairs of whitish (pale) patches (the tergum 5 with small-sized or indistinct patch) (Fig. 1C, F, K). Malar space 1.7–1.9 times as long as diameter of median ocellus (Fig. 1K). Flagellum 2.3–2.5 times as long as head width. Ovipositor sheath only reaching beyond apex of abdomen; dorsal and ventral margins slightly convergent and apex obliquely truncated (Fig. 1F). Lancet with about 17 serrulae, membrane between serrulae weakly convex; each serrula subtriangularly protruding basally (Fig. 6B), with a basal denticle and 2–7 distal denticles.

**Male** (Figs 1D, H, L, 7B). Body length 4.7–5.1 mm. Similar to female, but fore leg much paler than female; middle tibia anteriorly and hind tibia at base white (pale); middle and hind tarsomere 1 entirely dark brown; sometimes abdominal segments with narrow posterior whitish margins (Fig. 1D, H, L). Malar space 1.4–1.6 times as long as diameter of median ocellus (Fig. 1L). Flagellum 3.6–3.7 times as long as head width. Posterior margin of sternum 9 rounded. Penis valve as in Fig. 7B, valvulae almost equal in length to valvula.

**Genetic data.** Based on the barcode region of two available COI sequences (Japan), the distance between them is 0.2%. The nearest neighbours are species of the

*E. longicornis* group, diverging by a minimum of 4.9%. Based on the nuclear data of one specimen (Japan), the nearest neighbours are species of the *E. longicornis* group, diverging by a minimum of 2.4%.

**Type specimens examined.** SOUTH KOREA: ♀, holotype of *Empria tridentis* (YNU-Sym-0011), “Gangwon-do, Goseong-gun, Hyangnobong, 38°19'N, 128°18'E, 13.V.1992, S.M. Ryu” (YNU); 8♀♀, paratypes of *Empria tridentis* (YNU-Sym-1115–1121, 1123), “same data as holotype” (1♀ in CSCS, 2♀♀ in NNIBR, 5♀♀ in YNU).

**Additional specimens examined.** SOUTH KOREA: 1♂, Gangwon-do, Pyeongchang-gun, Mt. Balwangsan, 11.VI.2000, J.W. Lee (YNU); 1♀4♂♂, Gangwon-do, Wonju-si, Mt. Baegunsan, 37°15'30.5"N, 127°58'55.11"E, 19.V–6.VI.2011, H.Y. Han (YNU); 2♂♂, same data, J.W. Lee (YNU); 2♂♂, Gangwon-do, Wonju-si, Panbu-myeon, Mt. Baegunsan, 28.IV–24.V.2012, H.Y. Han (YNU); 1♀1♂, Jeollanam-do, Jangseong-gun, Bukha-myeon, Hyangnobong, 37°27'00"N, 126°51'00"E, 13.V.1992, J.W. Lee (YNU); 3♀♀1♂, same locality, 13.VI.1992, J.W. Lee (1♀1♂ in NSMT, 2♀♀ in YNU).

**Host plants.** Rosaceae: *Filipendula camtschatica* (Pall.) Maxim., *Geum japonicum* (Shinohara et al. 2015).

**Distribution.** Japan, Russia (Prous et al. 2011a), South Korea (Lee and Ryu 1996).

### *Empria wui* Wei & Nie, 1998

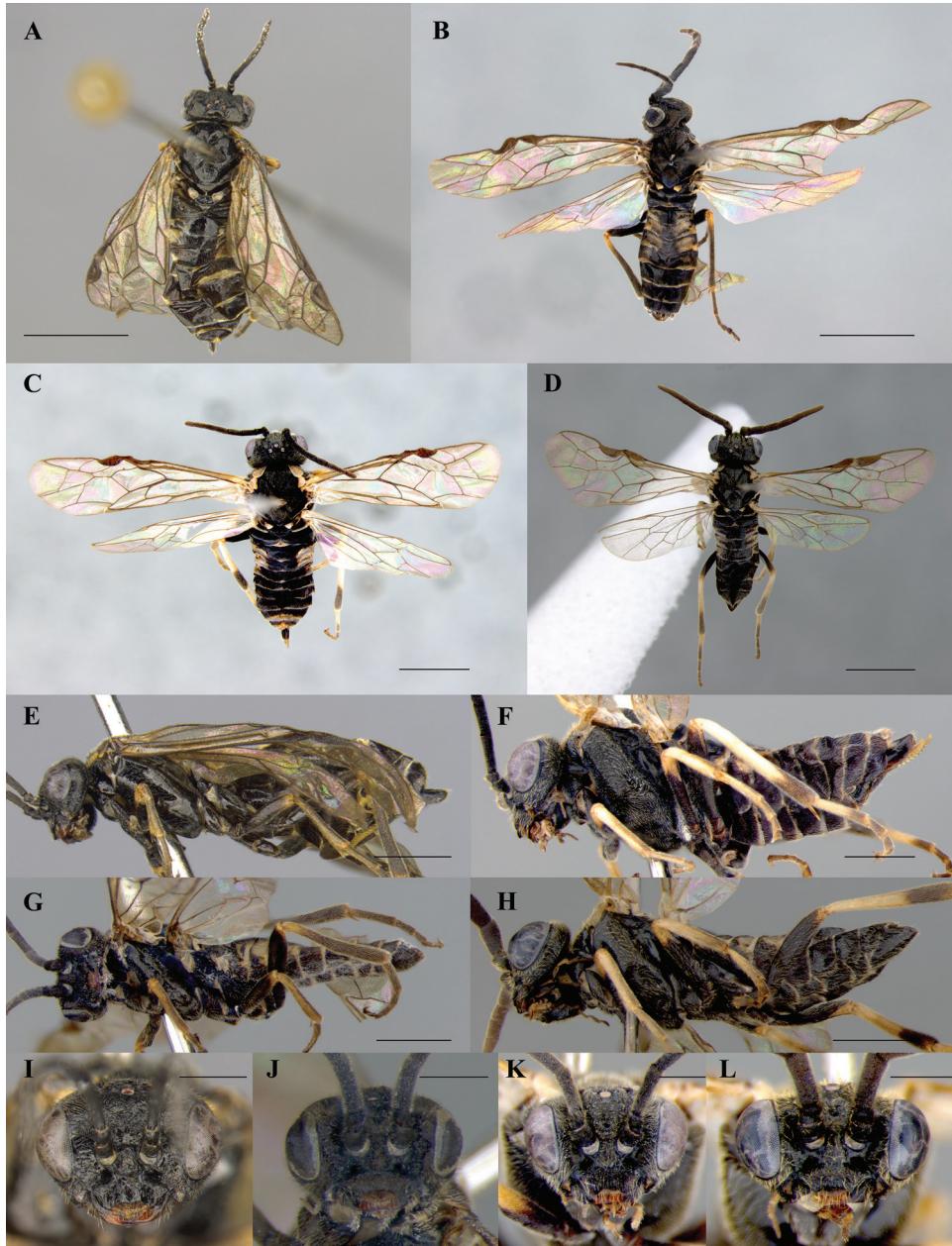
Figs 2A, B, E, G, I, J, 5A–G, 6C, 7C

*Empria wui* Wei & Nie, 1998: 363–386.

**Diagnosis. Female** (Figs 2A, E, I, 5A–G, 6C). Body length 5.2–6.0 mm. Head and thorax black, except cenchrus white; posterodorsal margin of pronotum, apical 1/3 of fore femur, apex of middle and hind femora slightly, fore and middle tibiae anteriorly, basal 2/3 or less of hind tibia yellowish brown; labrum, labial and maxillary palps dark brown at apex; apical half of mandible reddish dark brown; abdomen dark brown, segments with posterior whitish (pale) margins and abdominal terga with 3–4 pairs of large pale patches (Figs 2A, B, E, G, I, J, 5B, C, E). Malar space about 1.2 times as long as diameter of median ocellus (Figs 2I, J, 5E). Flagellum 1.5–1.8 times as long as head width. Vein 2A+3A in fore wing incomplete; vein m-cu in hind wing absent, cell M open (Fig. 2A, B). Claws simple or with small denticle (Fig. 5A). Ovipositor sheath extending beyond apex of abdomen (Figs 2E, 5D). Lancet with 16–18 serrulae, membrane between serrulae weakly convex; each serrula subtriangularly protruding basally (Figs 5G, 6C), with a basal denticle and roughly 4–10 distal denticles.

**Male** (hitherto undescribed) (Figs 2B, G, J, 7C). Body length 4.5–5.0 mm. Similar to female, but flagellum 1.9–2.1 times as long as head width. Posterior margin of sternum 9 truncated. Penis valve as in Fig. 7C, valviceps almost equal in length to valvula.

**Genetic data.** Based on the barcode region of two COI sequences available in GenBank, the distance between the specimens from China and Japan is 2.6% (same distance based on the complete COI). The nearest neighbour, diverging by 2.3–2.7%



**Figure 2.** *Empria* spp.: **A, B, E, G, I, J** *E. wui*, female from Shanxi, China and male from Gyeongbuk, South Korea **C, D, F, H, K, L** *E. zhangi* from Gangwon, South Korea **A, C** dorsal habitus, female **B, D** dorsal habitus, male **E, F** lateral habitus, female **G, H** lateral habitus, male **I, K** frontal head, female **J, L** frontal head, male. Scale bars: 2 mm (**A–D**); 1 mm (**E–H**); 0.5 mm (**I–L**).

(or 2.5–3.1% based on the complete COI), is possibly an undescribed species from China (sp. 2 in Prous and Heidemaa 2012). Based on the nuclear ITS, the distance between the specimens from China and Japan is 0.7%. The nearest neighbour based on

nuclear ITS, diverging by 1.4%, is sp. 2 in Prous and Heidemaa (2012). Nuclear NaK and POL2 are only available for one specimen from Japan and the nearest neighbour being *E. liturata* (Gmelin), diverging by 5.3%, but this data is unavailable for sp. 2 from Prous and Heidemaa (2012).

**Type specimen examined.** CHINA: ♀, holotype of *Empria wui* (CSCSEmp6), “Zhejiang, Longwangshan, 30.4N, 119.4E, 7.IV.1996, Hong Wu” (CSCS).

**Additional specimens examined.** SOUTH KOREA: 1♂, Gyeongsangbuk-do, Yeongju-si, Dansan-myeon, Marak-ri, San 46-5, Mt. Sobaeksan, Euipungji, 5.IV–3.V.2016, E.J. Hong (NIBR); CHINA: 1♀, Shanxi, Alt. 1703 m, 37.8314N, 111.4861E, 30.V.2008 (CSCS; W08-03a); JAPAN: 1♂, Ibaraki, Mt. Tsukuba, Alt. 800 m, 36.2256N, 140.1038E, 20–21.IV.1989 (MT), M.J. Sharkey (USNM; USNM2051678\_022); 2♂♂, Tochigi, Tamozawa, Nikkō-shi, 2–13.IV.2009 (MT), T. Nakamura (USNM; 1♂, USNM2057434\_01; 1♂, USNM2057434\_27).

**Host plant.** Unknown.

**Distribution.** South Korea (new record), Japan (new record), China (Wei and Nie 1998).

**Remarks.** Belongs to *E. wui* group (Prous and Heidemaa 2012). Prous and Heidemaa (2012) already treated this species (along with related species), but they suggested that some of the specimens treated here might represent species different from *E. wui*. Because the differences are similar to intraspecific variation in other *Empria* species, we consider the sp. 1 and sp. 3 mentioned in Prous and Heidemaa (2012) to be conspecific with *E. wui*. The previously unknown male of *E. wui* is described for the first time. No females were collected in Korea and Japan, so the description is based on CSCS specimens (holotype of *E. wui*, Fig. 5, and sp. 3) from China. This species has an incomplete vein 2A+3A in the fore wing, which is unusual among *Empria* species.

### *Empria zhangi* Wei & Yan, 2009

Figs 2C, D, F, H, K, L, 6D, 7D

*Empria zhangi* Wei & Yan in Yan et al. 2009: 248–250.

**Diagnosis. Female** (Figs 2C, F, K, 6D). Body length 6.0–8.0 mm. Head and thorax black, except pronotum dorsally, tegula, cenchrus, apical half of fore femur, middle femur at apex, fore and middle tibiae anteriorly, basal 2/3 of hind tibia, basal half of hind tarsomere 1 white; labrum, labial and maxillary palps, fore and middle tibiae posteriorly (sometimes at apex), fore and middle tarsi brown; mandible at apex reddish brown; apical half of hind tarsomere 1 and tarsomeres 2–5 dark brown; abdomen black, segments with narrow posterior whitish (pale) margins, and abdominal terga with 3 pairs of whitish patches (the tergum 4 with small-sized or indistinct patch) (Fig. 2C, D, F, H, K, L). Malar space 1.2–1.7 times as long as diameter of median ocellus (Fig. 2K). Flagellum 1.7–2.0 times as long as head width. Claws simple or with

small denticle. Ovipositor sheath extending beyond apex of abdomen; dorsal and ventral margins subparallel and apex truncated (Fig. 2F). Lancet with about 18 serrulae, membrane between serrulae weakly convex; each serrula circularly protruding basally (Fig. 6D), with a basal denticle and 3–6 distal denticles.

**Male** (Figs 2D, H, L, 7D). Body length 4.8–6.0 mm. Similar to female, but malar space 0.8–1.0 times as long as diameter of median ocellus (Fig. 2L). Flagellum 1.8–2.4 times as long as head width. Posterior margin of sternum 9 rounded. Penis valve as in Fig. 7D, valviceps almost equal in length to valvula.

**Genetic data.** Based on the COI barcode region of four specimens (China and Russia), the maximal distance between them is 3.8%. The nearest neighbour, diverging by a minimum of 5.0%, is *E. nigroterga*. Based on the nuclear data of three specimens (China and Russia), the maximal distance between them is 0.7%. The nearest neighbour, diverging by a minimum of 1.4%, is *E. nigroterga*.

**Type specimens examined.** CHINA: ♀, holotype of *Empria zhangi* (CSC-SEmp7), “Hunan, Nantianmen, Mt. Heng, Alt. 1000–1110 m, 27.2333N, 112.85E, 11.IV.2004, Wei-Xing Liu” (CSCS); 1♀2♂, paratypes of *Empria zhangi* (zhangi\_paratypus\_01~03), “1♀, same locality as holotype, Alt. 1050 m, 10.IV.2004, Shao-Bing Zhang”, “1♂, same data as holotype”, “1♂, Hunan, Mt. Mufu, Pingjiang, Alt. 1200 m, 28.9667N, 113.8167E, 7.V.2001, Meicai Wei” (CSCS).

**Additional specimens examined.** SOUTH KOREA: 1♀1♂, Gangwon-do, Hongcheon-gun, Bukbang-myeon, Gwangwon Prov. Environment Research Park, Alt. 220 m, 37°45'15.6"N, 127°51'1.7"E, 30.IV.2012, S.J. Jang (YNU); 1♂, Gangwon-do, Jeongseon-gun, Mt. Hambaeksan, Sanaegol, 6.V.1999, S.M. Ryu (YNU); 1♂, Gangwon-do, Taebaek-si, Mt. Taebaeksan, 14.V.1992 (NIBR); 1♂, Jeollanam-do, Jangseong-gun, Bukha-myeon, Cheongryangwon (s-25), 8–26.IV.2006 (MT), J.W. Lee (YNU); 1♂, same locality, 26.IV–4.VI.2006 (MT) (YNU); 1♀, Jeollanam-do, Jangseong-gun, Buki-myeon, Jahadonggol (s-23), 8–26.IV.2006 (MT), J.W. Lee (YNU); CHINA: 1♀, Hunan, Mt. Yunshan, near Wugang, Alt. 1250 m, 26.65N, 110.61666E, 14.IV.2012, A. Shinohara (NSMT; NSMTHYM2012111005); 1♂, Zhejiang, Tianmushan, Kaishan Laodian, Alt. 1150 m, 30.33331N, 119.43335E, 9.IV.2014, A. Shinohara (NSMT; NSMTHYM20141216-17); RUSSIA: 1♀, Primorsky Krai, Biological station 30 km SE Chuguyevka (Sichote Alin), Alt. 650 m, 44.083N 134.2E, 31.V.1993, A. Taeger (SDEI); 1♀, Primorsky Krai, Gornotajozhnoe, 1 km E, Alt. 150 m, 43.694N, 132.168E, 19.V.2016, K. Kramp, M. Prous & A. Taeger (SDEI; DEI-GISHym86113); 3♀♀, Primorsky Krai, Gornotajozhnoe, Dendrarium, Alt. 150 m, 43.691N, 132.153E, 21.V.2016, K. Kramp, M. Prous & A. Taeger (SDEI; 1♀, DEI-GISHym86163; 2♀♀, without ID numbers); 1♀1♂, Primorsky Krai, Ussuri Nature Reserve, Alt. 150 m, 43.644N, 132.346E, 20.V.2016, K. Kramp, M. Prous & A. Taeger (SDEI; 1♀, without ID number; 1♂, DEI-GISHym86136); 1♀, same locality, 23.V.2016, K. Kramp, M. Prous & A. Taeger (SDEI; DEI-GISHym86235); 1♀, Primorsky Krai, Vladivostok, Sedanka, Alt. 100 m, 43.21N, 131.973E, 17.V.2016, K. Kramp, M. Prous & A. Taeger (SDEI; DEI-GISHym86082).

**Host plant.** Unknown.

**Distribution.** South Korea (new record), Russia (new record), China (Yan et al. 2009).

**Remarks.** Based on morphology, Prous (2012) suggested that this species belongs to *E. quadrimaculata* group, which is here confirmed based on the genetic data. Compared to specimens from South Korea and Russia (Primorsky Krai), specimens studied from China (Hunan and Zhejiang) have longer antenna (flagellum about 2.0 times as long as head width in female, 2.3–2.4 times in male) and are larger (females 6.5–8.0 mm, males about 6.0 mm), but this could be due to geographic differences rather than indicating the presence of different species.

***Empria lycroi* Prous & Park, sp. nov.**

<http://zoobank.org/2081DF3F-61FC-404D-A52D-21AA6739B22D>

Figs 3, 6E, 7E

**Type specimens examined.** [Holotype] RUSSIA: ♀, Primorsky Krai, Vladivostok, Sedenka, Alt. 100 m, 43.21N, 131.973E, 17.V.2016, K. Kramp, M. Prous & A. Taeger (ZIN; DEI-GISHym86081); [Allotype] RUSSIA: ♂, Primorsky Krai, Novonezhino 4 km W, Alt. 70 m, 43.227N, 132.544E, 7.V.2019, M. Prous & S. Tuerk (SDEI; DEI-GISHym80769); [Paratypes] SOUTH KOREA: 1♀, Gangwon-do, Mt. Odaesan, Mirugam (Pugdaesa), Alt. 1300 m, 37.8N, 128.56667E, 30.V.1992, A. Shinohara (NSMT; NSMT231); 1♀, same locality, 28.V.1998, A. Shinohara (NSMT; NSMT207); RUSSIA: 1♀, Primorsky Krai, Anisimovka, Alt. 300 m, 43.16666N, 132.8E, 1.VI.1994, A. Shinohara (NSMT; NSMT232); 1♀, same locality, 3.VI.1995, A. Lelej (NSMT; NSMT141); 1♂, same locality, 10 km NW, Alt. 150 m, 43.195N, 132.665E, 9.V.2019, M. Prous & S. Tuerk (SDEI; DEI-GISHym80812); 1♀, Primorsky Krai, Gornotajozhnoe, 1 km E, Alt. 150 m, 43.694N, 132.168E, 19.V.2016, K. Kramp, M. Prous & A. Taeger (SDEI; DEI-GISHym80068); 1♀, same locality, 12.V.2019, M. Prous (SDEI; DEI-GISHym80704); 1♀, Primorsky Krai, Kamenushka 5 km E, Alt. 140 m, 43.636N, 132.294E, 13.V.2019, M. Prous (SDEI; DEI-GISHym80712); 1♀1♂, Primorsky Krai, Novonezhino 4 km W, Alt. 70 m, 43.227N, 132.544E, 7.V.2019, M. Proshchalykin (ZIN; without ID numbers); 4♀3♂, same data, M. Prous & S. Tuerk (3♀, 3♂ in SDEI; 1♀, DEI-GISHym80776; 2♀, without ID numbers; 3♂, DEI-GISHym80642, DEI-GISHym80770, DEI-GISHym83873; 1♀ in YNU; without ID number); 1♀, Primorsky Krai, Tigrovoy, Alt. 300 m, 43.18333N, 132.9E, 5.VI.1995, A. Shinohara (NSMT; NSMT233).

**Description. Female** (holotype, DEI-GISHym86081) (Figs 3A, C, E–G, K, 6E). Body length 5.9 (5.2–6.8) mm.

**Color.** Body black, except labial and maxillary palps, posterodorsal margin of pronotum, tegula, and cenchrus white; labrum yellow (yellowish brown); mandible at apex reddish brown; apex of all coxae slightly, all trochanters and trochantelli, fore and middle femora anteriorly and posteriorly, apex of hind femur slightly (black to extensively pale), fore and middle tibiae anteriorly and posteriorly, basal 1/3 (1/4–2/3)



**Figure 3.** *Empria lycroi* sp. nov. from Primorsky Krai, Russia: **A, C, E–G, K** holotype, DEI-GISHym86081 **B, D, H–J, L** allotype, DEI-GISHym80769. **A, B** dorsal habitus **C, D** lateral habitus **E, H** dorsal head **F, I** frontal head **G** ventral abdomen at apex **J** sternum 9 **K**, **L** claw. Scale bars: 2 mm (**A, B**); 1 mm (**C, D**); 0.5 mm (**E–J**); 0.1 mm (**K, L**).

of hind tibia, fore and middle tarsi anteriorly, and basal 1/3 (1/4–2/3) of hind tarsomere 1 pale; abdominal segments with narrow posterior whitish (pale) margins, and abdominal terga with 4 (3–5) pairs of whitish (pale) patches. Wings hyaline; venation brown; body with yellowish setae (Fig. 3A, C, F, G).

**Head.** Length of postocellar area much shorter than width, 2.9 (2.6–2.9) times as long as diameter of lateral ocellus, and POL: OOCL = 1: 0.9 (0.9–1.1) (Fig. 3E). Clypeus weakly rugulose with median keel. Malar space 1.1 (1.1–1.4) times as long as diameter of

median ocellus (Fig. 3F). Maximal temple length 1.3 (1.2–1.3) times as long as minimal temple length in lateral view. Flagellum 1.4 (1.4–1.6) times as long as head width.

**Thorax.** Propleura not meeting in front. Vein 2A+3A in fore wing complete; vein m-cu in hind wing present, cell M closed. Claws without denticle (Fig. K, L).

**Abdomen.** Ovipositor sheath not or slightly extending beyond apex of abdomen; dorsal and ventral margins parallel basally and ventral margin apically narrowing towards dorsal margin (Fig. 3C). Lancet with 16–17 serrulae, membrane between serrulae flat; each serrula subtriangularly protruding basally (Fig. 6E), and with indistinct denticles apically.

**Male** (allotype, DEI-GISHym80769) (Figs 3B, D, H–J, L, 7E). Body length 4.4 (4.4–5.2) mm. Similar to female, but abdominal terga with 3 pairs of whitish patches (Fig. 3B, D, I). Length of postocellar area 2.4 (2.2–2.4) times as long as diameter of lateral ocellus (Fig. 3H). Malar space 0.9 (0.8–0.9) times as long as diameter of median ocellus (Fig. 3I). Flagellum 1.8 (1.7–1.9) times as long as head width. Posterior margin of sternum 9 truncated (Fig. 3J). Penis valve as in Fig. 7E, valviceps shorter than valvula.

**Genetic data.** The COI sequences of three specimens are identical. The nearest neighbour, diverging by a minimum of 7.0%, is *E. liturata* (Gmelin). Based on the nuclear data of three specimens (Russia), the maximal distance between them is 0.03% (0.07% when counting heterozygous positions in the holotype female). The nearest neighbour, diverging by a minimum of 2.0%, is the North American *E. coryli* (Dyar).

**Host plant.** Unknown.

**Distribution.** South Korea, Russia.

**Etymology.** The species name is an arbitrary combination of letters, to be treated as a noun.

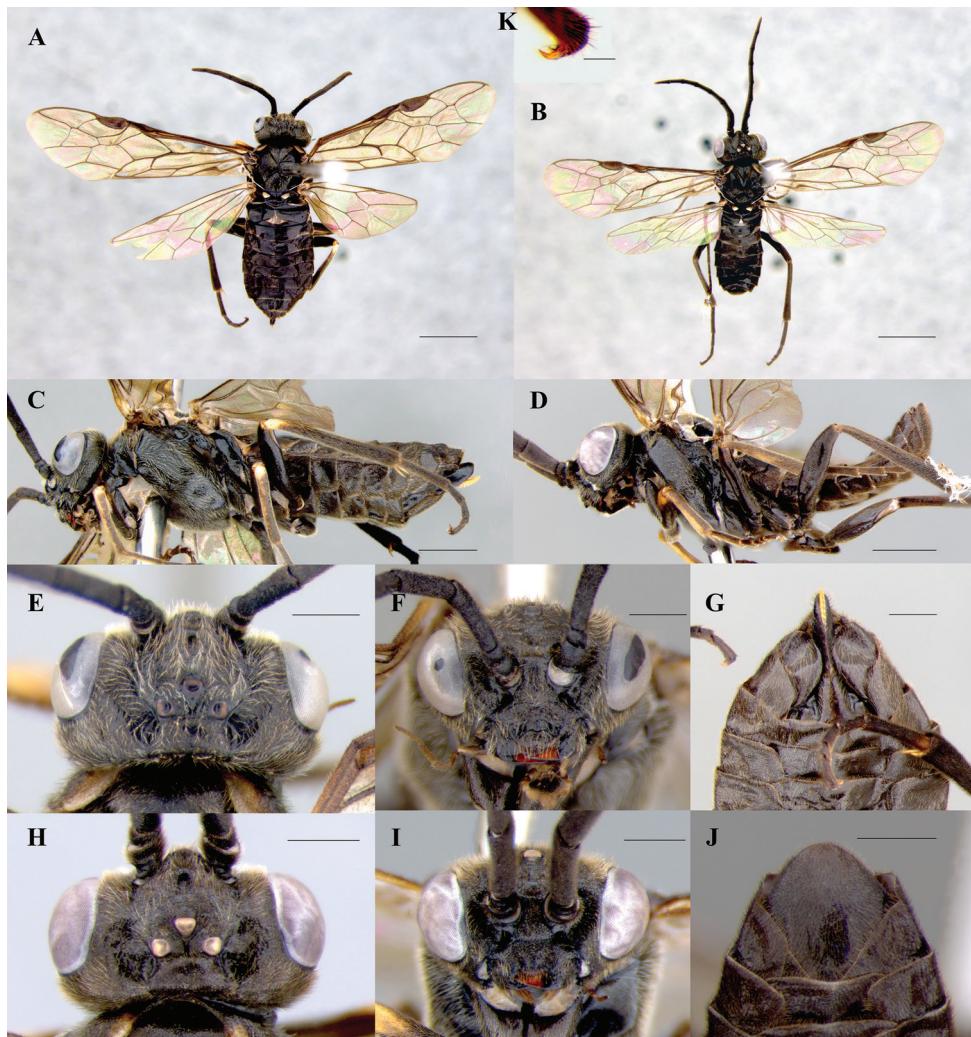
**Remarks.** The most similar species is *E. coryli* from North America. Females of *E. coryli* (based on Smith 1979) are even paler than *E. lycroi* (character states for this species in the parenthesis): mesepisternum partly pale (completely black) and abdominal terga with 5–6 pairs of whitish patches (3–5). Males of *E. coryli* apparently also have more pairs of whitish patches (Smith 1979) than *E. lycroi*. The penis valve of *E. coryli* has large irregular spines on the dorsal margin of valviceps that are lacking in *E. lycroi*.

### *Empria nigroterga* Park & Lee, sp. nov.

<http://zoobank.org/62C8E656-35EE-4614-9A6F-33CC56D0B714>

Figs 4, 6F, 7F

**Type specimens examined.** [Holotype] SOUTH KOREA: ♀, Chungcheongnam-do, Seosan-si, Haemi-myeon, Daegok-ri 880, Hanseo Univ., 36°41'30"N, 126°34'50"E, 22.IV–6.V.2009 (MT), J.W. Lee (YNU; YNU-Sym0023); [Allotype] SOUTH KOREA: ♂, same locality as holotype, 14–22.IV.2009 (MT), J.W. Lee (YNU; YNU-Sym1160); [Paratypes] SOUTH KOREA: 1♂, Chungcheongbuk-do, Danyang-gun, Danyang-eup, Cheondong-ri, 36°57'25.1"N, 128°25'47.6"E, 22.IV–4.V.2009,



**Figure 4.** *Empria nigroterga* sp. nov. from Chungnam, South Korea: **A, C, E–G** holotype, YNU-Sym0023 **B, D, H–K** allotype, YNU-Sym1160 **A, B** dorsal habitus **C, D** lateral habitus **E, H** dorsal head **F, I** frontal head **G** ventral abdomen at apex **J** sternum 9 **K** claw. Scale bars: 2 mm (**A, B**); 1 mm (**C, D**); 0.5 mm (**E–J**); 0.1 mm (**K**).

J.W. Lee (YNU; YNU-Sym1161); 1♀1♂, same locality, Mt. Sobaeksan, Cheon-dong valley, 36°57'00"N, 128°26'00"E, 19–30.IV.2007 (MT), J.W. Lee (YNU; 1♀, YNU-Sym1162; 1♂, YNU-Sym1163); 1♀, Chungcheongnam-do, Seosan-si, Haemi-myeon, Daegok-ri 880, Hanseo Univ., 36°41'30"N, 126°34'50"E, 2–14.IV.2009 (MT), J.W. Lee (YNU; YNU-Sym1164); 1♀, same locality, 22.IV–6.V.2009 (MT), J.W. Lee (YNU; YNU-Sym1165); 1♀, Daegu-si, Nam-gu, Mt. Apsan, 18.V.1996, Y.J. Jang (YNU; YNU-Sym1166); 1♀, Daejeon-si, Dong-gu, Daejeon Univ., 36°20'05"N, 127°27'38"E, 1–17.V.2006 (MT), J.W. Lee (YNU;

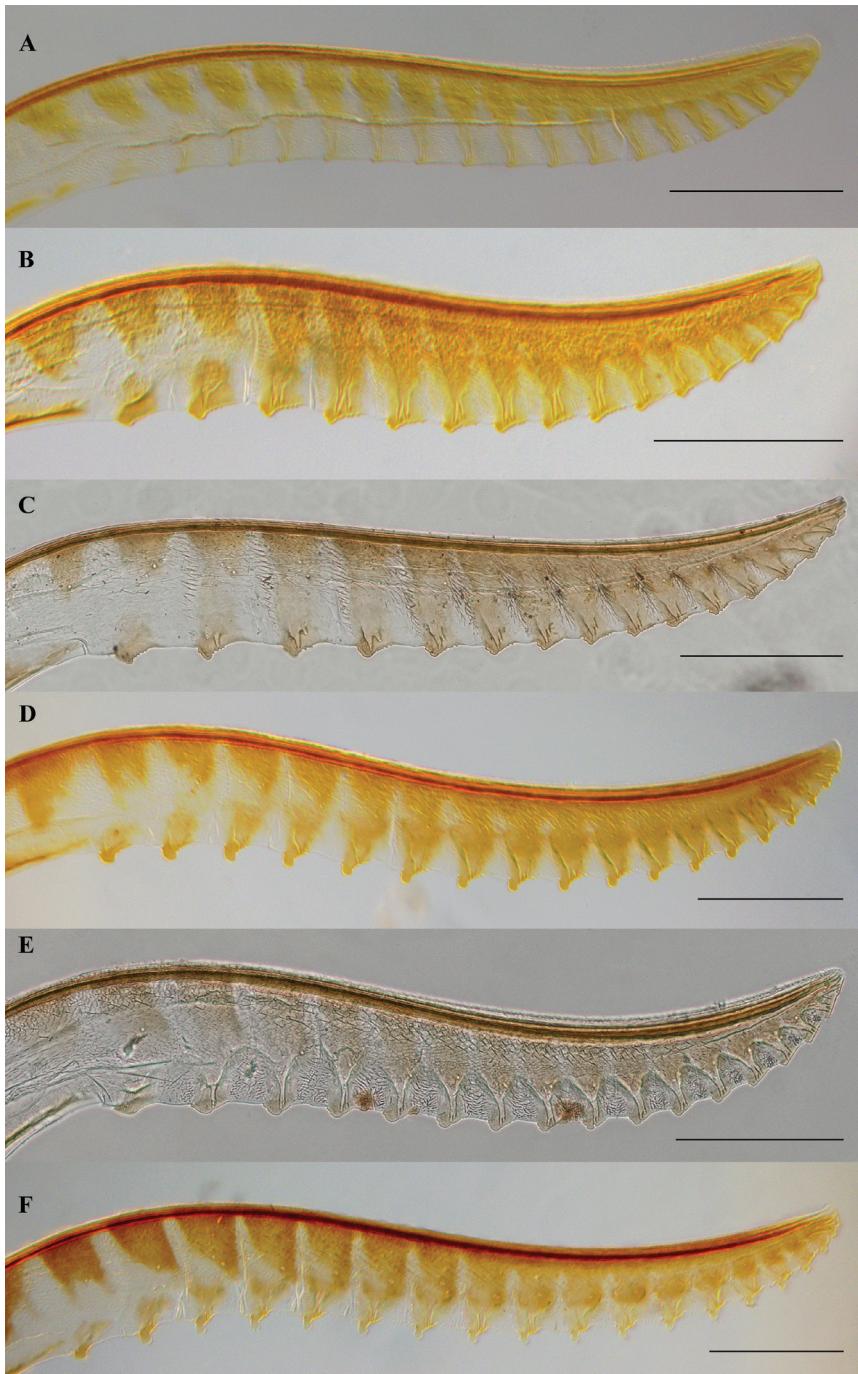
YNU-Sym1176); 2♀♀, Gangwon-do, Chuncheon nr. Chongpyongsa, 23.V.1992, A. Shinohara (NSMT; 1♀, NSMT240; 1♀, NSMTHYM2012111008); 1♂, Gangwon-do, Hongcheon-gun, Seo-myeon, Magok-ri, 37.7162N, 127.5908E, 3–17.V.2006 (MT), P. Tripotin (USNM; USNM2051678\_017); 1♀, Gangwon-do, Mt. Odaesan, Mirugam (Bukdaesa), Alt. 1300 m, 28.V.1991, A. Shinohara (NSMT; NSMTHYM2012111007); 1♀, same locality, 29.V.1992, A. Shinohara (NSMT; NSMTHYM2012111009); 1♀, same locality, 25.V.1993, A. Shinohara (NSMT; NSMT237); 1♂, same locality, 1.VI.1993, A. Shinohara (NSMT; NSMT142); 1♀, same locality, 22.V.2002, A. Shinohara (NSMT; NSMT238); 1♂, same locality, 25.V.2002, A. Shinohara (NSMT; NSMT236); 1♀, same locality, 28.V.2002, A. Shinohara (NSMT; NSMT239); 1♀, same locality, 25.V.2008, A. Shinohara (NSMT; NSMTHYM2012111006); 1♂, Gangwon-do, Sokcho-si, Mt. Seoraksan National Park, Misiryeong services (Sinseongbong direction), 1.IV–24.VI.2010 (MT), J.C. Jeong (YNU; YNU-Sym1167); 3♂♂, Gyeonggi-do, Gapyeong-gun, Cheongpyeong-myeon, Goseong-ri, Mt. Homyeongsan, Alt. 168 m, 37°43'15.0"N, 127°29'18.9"E, 8–31.IV.2009 (MT), J.W. Lee (YNU; YNU-Sym1168–1170); 1♀, Gyeonggi-do, Yangpyeong-gun, Yongmun-myeon, Yeonsu-ri, Mt. Youngmunsan, Alt. 324 m, 37°31'49.5"N, 127°34'18.8"E, 1–26.V.2009 (MT), J.W. Lee (YNU; YNU-Sym1171); 1♀, Gyeongsangbuk-do, Birosa, 5.V.1999, S.M. Ryu (YNU; YNU-Sym1172); 2♂♂, Gyeongsangbuk-do, Chilgok-gun, Dongmyeong-myeon, Hakmyeong-ri, San 25 (Site-15), 36°02'46.08"N, 128°33'45.41"E, 8.V.2014, J.W. Lee (1♂, YNU-Sym1174 in NIBR; 1♂, YNU-Sym1175 in YNU); 2♂♂, Gyeongsangbuk-do, Gunwi-gun, Bugye-myeon, Dongsan-ri, San75, Odoam, 36°01'29.04"N, 128°41'31.11"E, 25.IV–9.V.2015 (MT), J.W. Lee (YNU; YNU-Sym1173, 1177); 1♀, Gyeongsangbuk-do, Mt. Sobaeksan, Huibang valley, 3.V.1997, S.H. Park (YNU; YNU-Sym1178); 1♀, Jeollabuk-do, Muju-gun, Mt. Deokyusan, 16.V.1999, S.M. Ryu (YNU; YNU-Sym1179); 1♀, Jeollabuk-do, Wanju-gun, Dongsang-myeon, Daea-ri, San 1-2, Daea Arboretum, 35°58'24.24"N, 127°18'13.53"E, 16–30.IV.2013, J.M. Park (YNU; YNU-Sym1180); RUSSIA: 1♂, Primorsky Krai, Anisimovka, Alt. 300 m, 1.VI.1994, A. Shinohara (NSMT; NSMT234); 2♀♀, Primorsky Krai, Anisimovka, 70 km E Vladivostok, Alt. 250 m, 43.16666N, 132.8E, 7.VI.1993, A. Taeger (SDEI; without ID numbers); 1♂, Primorsky Krai, Foot, Mt. Litvoka, Anisimovka, Alt. 400 m, 30.V.1994, A. Shinohara (NSMT; NSMT235); 1♀, same data (NSMT; NSMT241); 1♀, Primorsky Krai, Tikhoye nr. Razdolnoye, 36 km S Ussuriysk, Alt. 100 m, 43.6N, 131.86667E, 22.V.1993, A. Taeger (SDEI; DEI-GISHym15184); 2♀♀, Primorsky Krai, Ussuri Nature Reserve, Alt. 150 m, 43.644N, 132.346E, 20.V.2016, K. Kramp, M. Prous & A. Taeger (SDEI; 1♀, DEI-GISHym86132; 1♀, without ID number); 1♀, Primorsky Krai, Ussurijskij Res., 9–12.VI.1995, A. Lelej (NSMT; NSMT205); 1♀, Primorsky Krai, Vladivostok, Sedenka, Alt. 100 m, 43.21N, 131.973E, 17.V.2016, K. Kramp, M. Prous & A. Taeger (SDEI; DEI-GISHym86721).

**Description. Female** (holotype, YNU-Sym0023) (Figs 4A, C, E–G, 6F). Body length 7.4 (7.0–8.7) mm.

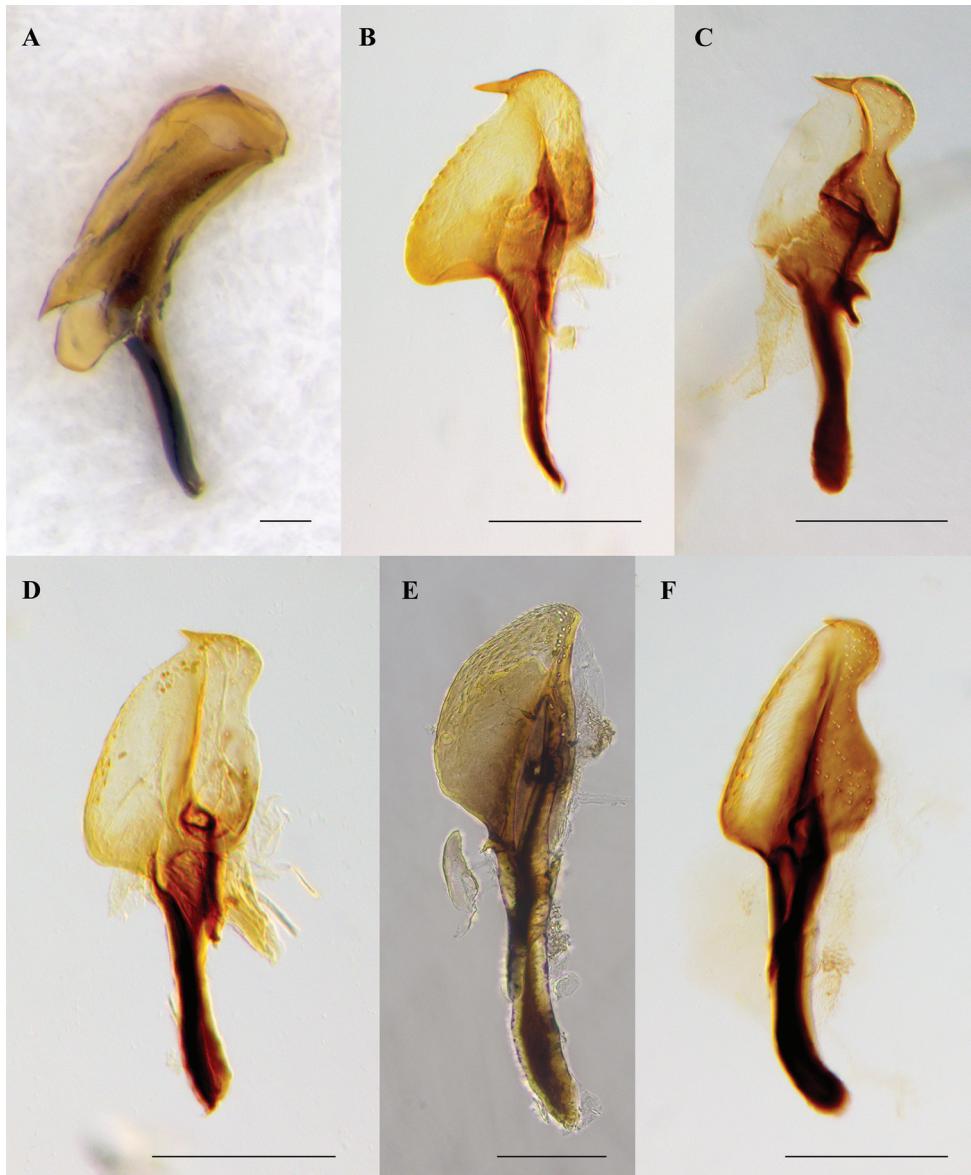


**Figure 5.** *Empria wui*, holotype (CSCSEmp6). **A** claw **B** dorsal habitus **C** lateral habitus **D** lateral abdomen **E** frontal head **F** labels **G** ovipositor. Scale bars: 2 mm (**B**); 1 mm (**C, D**); 0.5 mm (**E**); 0.1 mm (**A, G**).

**Color.** Body black, except posterodorsal pronotum, cenchrus, apical half of fore femur anteriorly, most of fore and middle tibiae anteriorly white; all tibiae with white ring at base; mandible at apex reddish brown; labial and maxillary palps dark brown; abdominal terga with 1 (0–2) pairs of whitish (pale) patches. Wings subhyaline; venation dark brown; body with yellowish setae (Fig. 4A, C, F, G).



**Figure 6.** Female lancets. **A** *Empria candidata* from Gangwon, South Korea **B** *E. tridentis* from Gangwon, South Korea **C** *E. wui* from Shanxi, China (W08-03a) **D** *E. zhangi* from Jeonnam, South Korea **E** *E. lycroi*, sp. nov. from Primorsky Krai, Russia (paratype, NSMT232) **F** *E. nigroterga*, sp. nov. from Daejeon, South Korea (paratype, YNU-Sym1176). Scale bars: 0.1 mm (**A-F**).



**Figure 7.** Male penis valves. **A** *Empria candidata* from Gangwon, South Korea **B** *E. tridentis* from Gangwon, South Korea **C** *E. wui* from Gyeongbuk, South Korea **D** *E. zhangi* from Jeonnam, South Korea **E** *E. lycroi*, sp. nov. from Primorsky Krai, Russia (paratype, DEI-GISHym83873) **F** *E. nigroterga*, sp. nov. from Gyeongbuk, South Korea (paratype, YNU-Sym1173). Scale bars: 0.1 mm (**A-F**).

**Head.** Length of postocellar area much shorter than width, 1.8 (1.8–2.3) times as long as diameter of lateral ocellus, and POL: OOCL = 1: 0.9 (0.8–1.0) (Fig. 4E). Clypeus strongly punctate with median keel. Malar space 1.5 (1.3–1.7) times as long as diameter of median ocellus (Fig. 4F). Maximal temple length 1.3 (1.1–1.3) times as

long as minimal temple length in lateral view. Flagellum 2.0 (1.9–2.0) times as long as head width.

**Thorax.** Propleura meeting (not meeting) in front. Vein 2A+3A in fore wing complete; vein m-cu in hind wing present, cell M closed. Claws with small denticle (Fig. 4K).

**Abdomen.** Ovipositor sheath extending beyond apex of abdomen; dorsal and ventral margins parallel and apex rounded (obliquely truncated) (Fig. 4C). Lancet with 18–19 serrulae, membrane between serrulae flat basally and weakly convex apically; each serrula circularly protruding basally (Fig. 6F), and with a basal denticle and 3–5 distal denticles.

**Male** (allotype, YNU-Sym1160) (Figs 4B, D, H–K, 7F). Body length 6.4 (5.1–6.6) mm. Similar to female, but abdominal segments entirely black (with narrow posterior whitish margins) (Fig. 4B, D, I). Length of postocellar area 1.8 (1.8–2.0) times as long as diameter of lateral ocellus (Fig. 4H). Malar space 1.0 (0.9–1.3) times as long as diameter of median ocellus (Fig. 4I). Maximal temple length 1.3 (1.3–1.4) times as long as minimal temple length in lateral view. Flagellum 2.6 (2.5–2.7) times as long as head width. Posterior margin of sternum 9 rounded (Fig. 4J). Penis valve as in Fig. 7F, valvices almost equal in length to valvula.

**Genetic data.** Based on the COI barcode region of two specimens (Russia and South Korea), the distance between them is 0.5%. The nearest neighbour, diverging by a minimum of 5.0%, is *E. zhangi* Wei & Yan. Based on the nuclear data of one specimen (Russia), the nearest neighbour, diverging by a minimum of 1.4%, is *E. zhangi* Wei & Yan.

**Host plant.** Unknown.

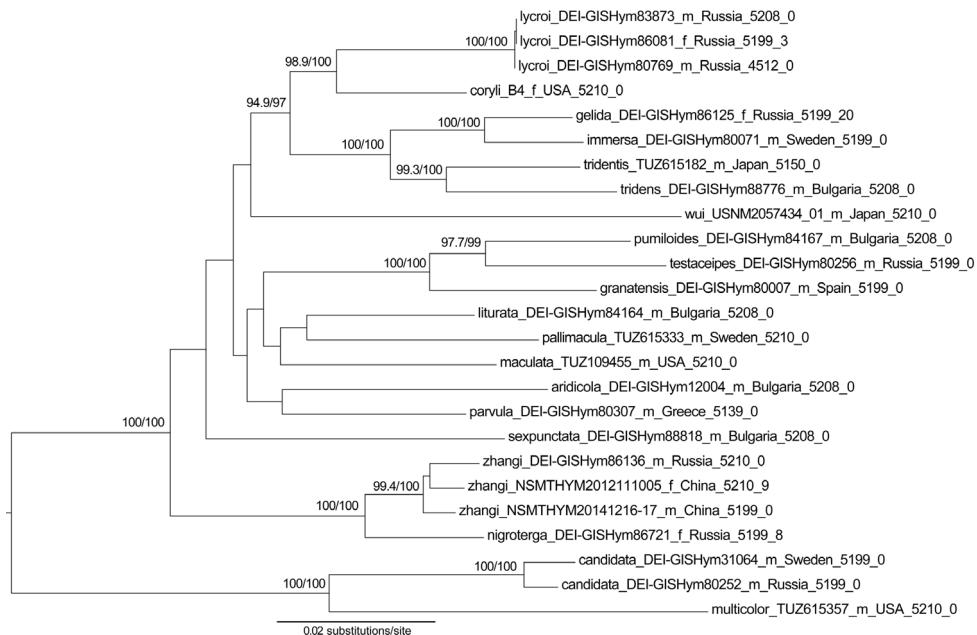
**Distribution.** South Korea, Russia.

**Etymology.** The species name, a noun, is formed from the Latin *nigro* and *terga*, and refers to black color of abdomen.

**Remarks.** Belongs to *E. quadrimaculata* group (as sp7 in Prous 2012). Numerous additional specimens (36 females, 76 males in YNU) studied from South Korea were not included in the type series. Although most *Empria* species have pairs of pale patches on the abdominal terga (one of the general morphological characters of *Empria*), this new species has the abdominal terga with reduced pale patches.

## Phylogenetic analyses

A result of maximum likelihood analysis of 20 species (including all species treated here) of *Empria* combining all three genes (COI, NaK, and POL2) is shown in Fig. 8. Even with data of more than 5000 bp of sequences, most of the relationships are poorly supported. Well supported are separation of *E. candidata* and *E. multicolor* from other species, monophyly of *quadrimaculata* group (*E. nigroterga* and *E. zhangi*), *hungarica* group (*E. granatensis*, *E. testaceipes*, and *E. pumiloides*), grouping of *E. coryli* and *E. lycroi*, and grouping of *E. gelida*, *E. immersa*, *E. tridentis*, and *E. tridens* (see more detailed results regarding *immersa* and *longicornis* groups in Prous et al. 2019).



**Figure 8.** Maximum likelihood tree of *Empria* based on mitochondrial COI and nuclear NaK and POL2. Best-fit model chosen according to the Bayesian information criterion was GTR + R3. Numbers above nodes show SH-aLRT support (%) / ultrafast bootstrap support (%) values. Support values for weakly supported branches (< 90) are not shown. Letters “f” and “m” stand for “female” and “male”. Numbers at the end of the tip labels refer to the length of the sequence and the number of heterozygous positions in nuclear DNA. *Empria candidata* and *E. multicolor* were used to root the tree.

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