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First record of the genus *Chorisops* Rondani (Diptera, Stratiomyidae) from South Korea, with a description of a new species

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First record of the genus *Chorisops* Rondani (Diptera, Stratiomyidae) from South Korea, with a description of a new species

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Abstract

Background

The soldier fly, the family Stratiomyidae, is one of the largest and comparatively diverse groups among the Dipteran. Currently, about 2,700 described species of soldier flies are distributed throughout all the zoogeographic regions worldwide, except polar areas. To date, there have been a few sporadic reports of new records in the Korean fauna, but compared to the faunistic surveys of other countries, there are many species that have not yet been reported. Therefore, the authors have conducted extensive field expeditions in Korea for revealing hitherto unknown Korean soldier flies.

New information

In the present taxonomic study, the soldier fly genus *Chorisops* Rondani is reported for the first time from the Korean Peninsula based on the following two species: *C. bifurca* **sp. nov.** and *C. maculiala* Nagatomi, 1964. Herein, the description, diagnosis, external photographs, and taxonomic characteristics of the two species are presented. Furthermore, an identification key for Northeastern species is provided.

Keywords

Beridinae, *Chorisops*, new species, Korea, Stratiomyidae, taxonomy

Introduction

The genus *Chorisops* Rondani, 1856 is a relatively small taxon of soldier flies in the subfamily Beridinae. This genus was erected by Rondani (1856) based on the type species *Beris tibialis* Meigen [= *Chorisops tibialis* (Meigen, 1820)]. Adults are mainly characterized by a shiny metallic green to violet tinge on their body and yellow patterns on the abdomen (Yang et al. 2014). The adults are similar in external appearance to adults of the genus *Actina* Meigen but can be morphologically distinguished by the presence of hairless compound eyes and scape less than two times as long as the pedicel, as opposed to densely pilose compound eyes and scape over two times as long as the pedicel in *Actina* species (Woodley 2001, Yang et al. 2014). The larvae are characterized by well-developed setae on the ventral surface (Rozkošný 1982). They inhabit terrestrial habitats, such as plant litter or topsoil (Rozkošný 1998). From August to September, adult males swarm near bushes or shrubs for mating (Mason 2013).

Most species of this genus are observed mainly in the Palearctic and Oriental regions. Until the 21st century, a total of nine *Chorisops* species were officially reported globally: five species from Europe and North Africa (*C. caroli*, *C. masoni*, *C. nagatomi*, *C. tibialis* and *C. tunisiae*) (Mason 2013, Rozkošný 1979, Rozkošný 1982), three species from Northeast Asia (*C. maculiala*, *C. separata*, and *C. unita*) (Nagatomi 1964, Nartshuk and Rozkošný 1975, Yang and Nagatomi 1992) and one species from Oriental region (*C. marginata*) (Frey 1961, Woodley 2001). Recently, seven new species (*C. bilobata*, *C. brevis*, *C. fanjingshana*, *C. longa*, *C. tianmushana*, *C. striata*, and *C. zhangae*) have been additionally described in various areas of the Chinese mainland by Chinese entomologists (Li et al. 2009b, Li et al. 2009a, Qi et al. 2011, Yang and Nagatomi 1992, Yang et al. 2014).

In the course of extensive field surveys in the Korean peninsula from 2020 to 2021, the authors discovered two unknown soldier flies. Based on the morphological investigation, they were recognized as a new biodiversity unit from this country. Here, we present the first record of the genus *Chorisops* from the Korean Peninsula based on two species, namely *C. bifurca* **sp. nov.** and *C. maculiala* Nagatomi, 1964. As a result, 17 species of this genus are now known worldwide. Herein, descriptions and illustrations of *C. bifurca* **sp. nov.** and *C. maculiala* are provided, along with the identification key for Northeast Asian species.

Materials and methods

The type and voucher specimens examined in the present study are deposited in the arthropod collection of the Laboratory of Systematic Entomology, School of Applied Biosciences, Kyungpook National University, Daegu, Korea. External morphological features were investigated and photographed using a stereomicroscope (Olympus SZX 16; Olympus, Tokyo, Japan), compound microscope (Olympus BX50), and the Michrome 16 CMOS camera (Tucsen, China) (Lee and Suh 2022). The terminologies used for diagnosis and description follow Cumming and Wood (2017) and Yang et al. (2014).

Taxon treatments

Chorisops Rondani, 1856

Nomenclature

Chorisops Rondani, 1856 - Rondani 1856: 173

Type species

Beris tibialis Meigen, 1820

Diagnosis

This genus can be distinguished from other genera of subfamily Beridinae by the combination of the following characteristics: Antennal flagellum slender, distinctly longer than the scape and pedicel combined; scape less than two times as long as the pedicel. In males, hair on the head are short and not densely pilose (Nagatomi 1964, Rozkošný 1982, Yang and Nagatomi 1992, Yang et al. 2014).

Chorisops bifurca, sp. n.

Materials

Holotype:

- a. scientificName: *Chorisops bifurca*; vernacularName: U-ri-su-yeom-meot-dong-ae-deung-e; country: Republic of Korea; stateProvince: Gyeongsangbuk-do; locality: Gunwi-gun, Hyoryeong-myeon, Hwagye-ri, 36°06'48" N, 128°38'32" E; samplingProtocol: Sweeping; eventDate: VI/20/2020; individualCount: 1; sex: male; lifeStage: adult; identifiedBy: J Lee; dateIdentified: 2022; language: en; institutionCode: KNU; basisOfRecord: PreservedSpecimen; occurrenceID: 1D36CE55-D78E-59A3-8DF9-AE09AFB7F451

Paratypes:

- a. scientificName: *Chorisops bifurca*; vernacularName: U-ri-su-yeom-meot-dong-ae-deung-e; country: Republic of Korea; stateProvince: Gyeongsangbuk-do; locality: Gunwi-gun, Hyoryeong-myeon, Hwagye-ri, 36°06'48" N, 128°38'32" E; samplingProtocol: Sweeping; eventDate: VI/20/2020; individualCount: 2; sex: 1 male, 1 female; lifeStage: adult; identifiedBy: J Lee; dateIdentified: 2022; language: en; institutionCode: KNU; basisOfRecord: PreservedSpecimen; occurrenceID: 1C327744-0566-579A-A22C-C6B3A0A23DF3
- b. scientificName: *Chorisops bifurca*; vernacularName: U-ri-su-yeom-meot-dong-ae-deung-e; country: Republic of Korea; stateProvince: Jeollanam-do; locality: Haenam-gun, Hwawon-myeon, Yeongho-ri, Mt. Jiryeongsan, 34°42'20" N, 126°19'50" E; samplingProtocol: Sweeping; eventDate: IV/29/2021; individualCount: 1; sex: female; lifeStage: adult; identifiedBy: J Lee; dateIdentified: 2021; language: en; institutionCode: KNU; basisOfRecord: PreservedSpecimen; occurrenceID: 2B89386F-CA8C-549B-9FEE-F8921C48B276

- c. scientificName: *Chorisops bifurca*; vernacularName: U-ri-su-yeom-meot-dong-ae-deung-e; country: Republic of Korea; stateProvince: Daegu-si; locality: Gachang-eup, Jeongdaeri, Mt. Biseulsan, 35°43'54" N, 128°32'53" E; samplingProtocol: Sweeping; eventDate: VI/30/2021; individualCount: 1; sex: male; lifeStage: adult; identifiedBy: J Lee; dateIdentified: 2022; language: en; institutionCode: KNU; basisOfRecord: PreservedSpecimen; occurrenceID: 28A1A59B-3CD7-5B57-8199-24A5431AE8B9

Description

Male (based on the holotype and two paratypes). Body length (excluding antennae): 5.2–5.3 mm; wing length: 4.5–4.6 mm. **Head.** Black with metallic blue to violet tinge; compound eyes narrowly separated and practically bare; occiput and vertex with pale recumbent hairs; postocular areas toward the lower margin of the eye, covered with pale pollens; upper margin of the face prominently pale pruinose and middle part with erect black hairs; ocellar tubercle with long black hairs; frons with short yellowish-brown hairs and lower part with pale pubescence; maxillary palpus entirely black tinged; antennae long and slender, mostly dark brown to black, but antennal socket, pedicel, and inner surface of flagellomeres 1–5 tinged yellowish brown; flagellum 2.0–2.1 times as long as the scape and pedicel combined; relative ratio of each antennal segment (scape:pedicel:flagellum):36 (33–38):18 (17–19):112 (104–120) (Fig. 1C). **Thorax:** Metallic green to blue; scutum tomentose with pale yellow hairs; postpronotal lobe tinged pale yellow; anepisternum, except the posterior part, posterior parts of katepisternum, katepimeron, and meron nearly bare; apical half of scutellar spines pale yellow (Fig. 2B). **Legs:** Mainly yellow, but the following parts tinged dark brown: base of fore coxa, hind coxa, base of hind trochanter, extreme apex of hind femur, hind tibia, except base, fore tarsus, and mid- and hind tarsomeres 3–5; hairs on tarsomeres 3–5 dark brown; relative ratio of each hind leg segment (coxa:trochanter:femur:tibia:tarsomere 1:tarsomeres 2–5 including claw): 21 (20–22):13 (12–14):119 (110–128):90 (80–100):50 (45–55):49 (46–52) (Fig. 1A,B). **Wings:** Hyaline, but stigma, r₄, and base of r₅ tinged pale brown; the base of M₁ and M₂ separated but sometimes convergent (Figs. 1B, 2A); squama pale yellow; halter knob and stem pale yellow, base yellowish-brown. **Abdomen:** Dark brown and matt; lateral margins of tergites with conspicuous long, pale hairs; anterior margin of tergite 1 somewhat pruinose; tergites 5–7 covered with semi-erect pale hairs; epandrium long, anterior margin semi-circular (Fig. 2C); gonocoxite wider than long; gonostyli bilobate, dorso-distal lobe protruding outward, ventro-distal lobe curved inward and bifurcate (Fig. 2D,E); phallus tripartite, with median lobe short and bifid and lateral lobes nearly 4.0 times as long as the median lobe (Fig. 2F).

Female (based on two paratypes). Male-like, but differing as follows. Body length (excluding antennae): 5.1–5.4 mm; wing length: 4.5–4.7 mm. **Head:** Face and ocellar tubercle with short yellowish-brown hairs; lower frons with broad pale pubescence; vertex and median occipital region with dense long yellow hairs; scape, except the extreme base, tinged brown; flagellum 1.9–2.3 times as long as the scape and pedicel combined; relative ratio of each antennal segment (scape:pedicel:flagellum): 34 (31–36):22 (20–25):117 (114–120) (Fig. 1E). **Thorax:** Hairs on the side of scutum shorter

than those in males; postpronotal lobe tinged yellowish-brown. **Legs:** Hind coxa and trochanter entirely pale yellow; basal half of hind tibia yellowish brown; apical parts of hind femur and tarsomeres 3–5 tinged pale brown; relative ratio of each hind leg segment (coxa:trochanter:femur:tibia:tarsomere 1:tarsomeres 2–5, including claw): 20 (18–22):15 (14–16):104 (101–107):88 (85–90):42 (41–44):43 (40–46) (Fig. 1D). **Abdomen:** Sternites 3–8 entirely brown with recumbent pale yellow hairs.

Diagnosis

Chorisops bifurca **sp. nov.** can be distinguished from other congeners based on the combination of the following key diagnostic characters: maxillary palpus entirely tinged black; scutellum and scutellar spines (except apex) entirely metallic blue; fore tarsus and hind coxa dark brown to black in males; M_3 absent; terga without metallic tinge; median lobe very short and bifurcate.

Etymology

The specific epithet is derived from the Latin word “*bifurca*,” which means “forked or divided into two branches,” corresponding to the bifurcation of the median lobe.

Distribution

South Korea (Gyeongsangbuk-do, Daegu-si, Jeollanam-do).

Taxon discussion

Chorisops bifurca sp. nov. closely resembles *C. brevis* Li, Cui and Yang, 2009, *C. tianmushana* Li, Zhang and Yang, 2009, and *C. zhangae* Li, Zhang and Yang, 2009 from Mainland China, with similar genital structures (lateral lobes remarkably longer than the median lobe). However, *C. bifurca* sp. nov. can be readily distinguished from these Chinese congeners based on the combination of the following morphological characteristics: maxillary palpus entirely black; scutellum, including posterior margin completely metallic blue; apex of scutellar spines pale yellow; fore tarsus and hind coxa dark brown to black in males; M_3 invisible; terga matt; and median lobe distinctly short and bifurcate. In contrast, the Chinese species are characterized by the following features: (1) In *C. brevis*, the posterior margin of the scutellum and spines is pale yellow; fore tarsomere 1 yellow; abdomen tinged metallic green; and median lobe is not bifurcate; (2) In *C. tianmushana*, moderately long M_3 present; all coxae yellow in males; and abdomen tinged metallic green; (3) In *C. zhangae*, the apex of the maxillary palpus yellowish; posterior margin of the scutellum and spines pale yellow; abdomen tinged metallic green; and gonostylus with the finger-like apical process (Li et al. 2009b, Li et al. 2009a, Yang and Nagatomi 1992, Yang et al. 2014).

Notes

A single male individual collected from the Dalseong-gun Province (Daegu-si) showed the following intraspecific variation of wing venation: both wings of M_1 and M_2 convergent basally, not separate (Fig. 1B).

Chorisops maculiala Nagatomi, 1964

Nomenclature

Chorisops maculiala Nagatomi, 1964 - Nagatomi 1964: 19 (Type-locality: Japan).

Materials

- a. scientificName: *Chorisops maculiala*; vernacularName: Su-yeom-meot-dong-ae-deung-e; country: Republic of Korea; stateProvince: Gangwon-do; locality: Inje-gun, Girin-myeon, Jindong-ri, Jochimnyeong, 37°59'36"N, 128°29'49"E; samplingProtocol: Sweeping; eventDate: VI/10/2020; individualCount: 5; sex: 2 males, 3 females; lifeStage: adult; identifiedBy: J Lee; dateIdentified: 2021; language: en; institutionCode: KNU; basisOfRecord: PreservedSpecimen; occurrenceID: 8F028E8B-0973-5E11-B13C-3BA00C21517C
- b. scientificName: *Chorisops maculiala*; vernacularName: Su-yeom-meot-dong-ae-deung-e; country: Republic of Korea; stateProvince: Gangwon-do; locality: Girin-myeon, Bangdong-ri, Mt. Bangtaesan, 37°54'41"N, 128°24'16"E; samplingProtocol: Sweeping; eventDate: VII/1/2021; individualCount: 5; sex: 5 males; lifeStage: adult; identifiedBy: J Lee; dateIdentified: 2021; language: en; institutionCode: KNU; basisOfRecord: PreservedSpecimen; occurrenceID: 9F0C7870-DA5E-555B-B919-C7C0A60AEF98

Description

Male (based on seven specimens). Body length (excluding antennae): 4.9–6.0 mm; wing length: 4.0–4.8 mm. **Head:** Black, with metallic green-to-blue tinge; compound eyes narrowly separated and practically bare; occiput and vertex with pale recumbent hairs; postocular areas toward the lower margin of eyes covered with pale pollens; face and ocellar tubercle with black hairs; frons with short black hairs and the lower part with pale pubescence; maxillary palpus tinged pale yellow but apex darkened; antenna long and slender, mostly yellowish brown, but basal half of the scape and flagellomeres 5–8 tinged black; flagellum 2.2–2.4 times as long as the scape and pedicel combined; somewhat pale dusted on the inner surface (Fig. 3C). **Thorax:** Metallic green, scutum tomentose with yellow hairs; postpronotal lobe tinged yellowish-brown; anepisternum, posterior part of katepisternum, anepimeron, katepimeron, and meron nearly bare; apical margin (1/3) of the scutellum and scutellar spines pale yellow. **Legs:** Predominantly pale yellow, but the following parts tinged dark brown: median part and apex of the hind femur and entire tarsomere 5; the hair on hind tibia black (Fig. 3A). **Wings:** Tinged dark brown; the base of M_1 and M_2 convergent (Fig. 3H). **Abdomen:** Dark brown, but the following parts tinged yellow: triangular spots on the anterior

margin of tergites 2–5, sternites 2–4 (or 2–5); lateral margin of tergites with conspicuous long pale yellow and brown hairs; sternites 5–7 with black hairs (Fig. 3G); epandrium broad, anterior margin circular (Fig. 3E); gonocoxite wider than long; gonostyli trilobate, dorso-distal lobe apically acute; ventro-distal lobe apically obtuse; phallus apically acuminate (Fig. 3F).

Female (based on three specimens). Male-like, but differing as follows. Body length (excluding antennae): 5.0–5.2 mm; wing length: 4.0–5.0 mm. **Head:** Face, frons, and ocellar tubercle with short pale hairs; lower frons with broad pale pubescence; flagellum 2.4–2.6 times as long as the scape and pedicel combined (Fig. 3D). **Thorax:** Hairs on the side of the scutum shorter than those in males. **Legs:** Hairs on hind tibia entirely pale yellow (Fig. 3B). **Abdomen:** Hairs on sternite 5 pale yellow.

Diagnosis

This species can be distinguished from other congeners by the combination of the following key diagnostic characters: tarsus, except tarsomere 5, tinged very pale yellow; wings, except stigma, with darkened parts; abdominal tergites 2–5 predominately with median basal yellow spots (Nagatomi 1964, Nartshuk and Rozkošný 1975, Rozkosný 1979). This species morphologically resembles to the Italian species, *C. caroli* Troiano, 1995, because of the similarity of yellow patterns on the abdomen. However, the latter species differs from *C. maculiala* by the following characteristics: tarsomeres 2–5 tinged dark brown; wings except for stigma hyaline; moderately long M_3 present (Mason 2013).

Distribution

Korea (new record: Gangwon-do and Gyeongsangbuk-do), China (Liaoning), Japan (Honshu, Kyushu) and Russia (Far East: Siberia).

Notes

Chorisops maculiala exhibits intraspecific variations in the shape and color of mid-spots on each abdominal segment. These triangular spots are normally present on the anterior margin of tergites 2–5. Sometimes, however, the spots on tergites 2 and 5 are faint. Occasionally, these spots are tinged pale yellow to yellowish brown, with virtually ovoid band-like shapes rather than triangular shapes (Fig. 3G).

Identification keys

Key to the <i>Chorisops</i> species from Northeast Asia		
Identification key for five European species, see Mason (2013). The presented key is mainly modified by Yang and Nagatomi (1992) and Yang et al. (2014), and some species are originally described based on only one sex. According to Mason (2013), reliable and accurate identification for species-level in this genus is possible through genitalia examination, the authors decided to include genital characters in the identification key.		
1	Male (Compound eye narrowly separated)	2
—	Female (Compound eye broadly separated, frons 1.8-2.0 times wider than in males)	8
2	M ₃ short or invisible	3
—	M ₃ moderately long, at least 1/3 of M ₂	<i>C. tianmushana</i>
3	Abdominal segments without yellow spots	4
—	Abdominal segments with yellow spots	<i>C. maculiala</i>
4	Hind femur mostly dark brown to black	5
—	Hind femur mostly yellow	6
5	Short M ₃ visible; palpus entirely dark brown to black; gonostylus without finger-like process; phallus bilobate	<i>C. bilobata</i>
—	M ₃ absent; palpus black but apex yellowish brown; gonostylus with finger-like process; phallus trilobite	<i>C. zhangae</i>

6	Short M ₃ visible; lateral lobes slightly longer than median lobe	<i>C. fanjingshana</i>
–	M ₃ absent; lateral lobes significantly longer than median lobe	7
7	Posterior margin of scutellum pale yellow; abdomen tinged with metallic green; fore tarsomere 1 yellow	<i>C. brevis</i>
–	Scutellum completely metallic blue; abdomen matt; fore tarsomere 1 dark brown to black	<i>C. bifurca</i> sp. nov.
8	M ₃ vert short or absent	9
–	M ₃ moderately long, at least 2/3 of M ₂	<i>C. longa</i>
9	Abdominal segments without yellow spots	10
–	Abdominal segments with yellow spots	12
10	Maxillary palpus partly yellow; abdomen with metallic tinge	11
–	Maxillary palpus entirely black; abdomen matt	<i>C. bifurca</i> sp. nov.
11	Hind femur mostly yellow	<i>C. separata</i>
–	Hind femur mostly dark brown to black	<i>C. zhangae</i>
12	Fore tarsus entirely dark brown	13
–	Fore tarsus except tarsomere 5 distinctly pale yellow	<i>C. maculiala</i>

13	Each abdominal tergites 2-5 with large yellow mid spot basally	<i>C. unita</i>
–	Each abdominal tergites 2-6 with narrow transverse yellow mid spot basally	<i>C. striata</i>

Discussion

According to Li et al. (2009a), the authors described taxonomic remarks of *C. tianmushana* Li, Zhang and Yang as the convergence of vein M₁ and M₂ basally (= posterior veins of discal cell X-shaped) based on only one male specimen from Zhejiang province. However, like in the case of *C. bifurca* sp. nov., some individuals show that the base of M₁ and M₂ are sometimes separated, not touched. The authors think carefully that the separation or touching of the base of M₁ and M₂ is not a reliable key diagnostic feature of the genus *Chorisops*, and it is reasonable that this feature is dealt with intraspecific variation. Therefore, additional specimen sampling of *C. tianmushana* Li, Zhang and Yang is required for the determination of species-level.

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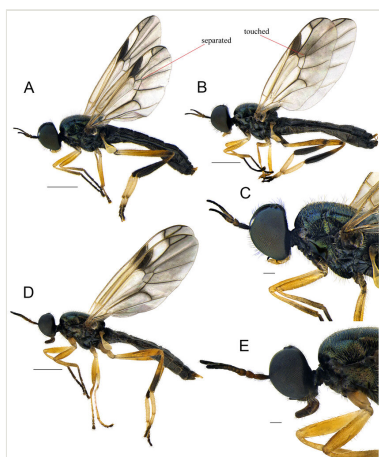


Figure 1.

Chorisops bifurca sp. nov. A. Male habitus, lateral view; B. Male habitus, lateral view (variation type); C. Male head, lateral view; D. Female habitus, lateral view; E. Female head, lateral view. Scale: A-B and D. 1.0 mm; C and E. 0.2 mm.

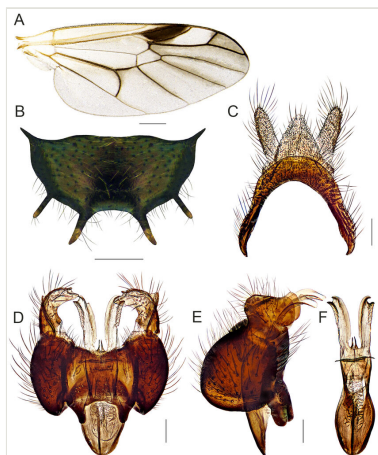


Figure 2.

Chorisops bifurca **sp. nov.** A. Male wing; B. Male scutellum, dorsal view; C. Epandrium, cerci, and proctiger, dorsal view; D. Genital capsule, dorsal view; E. Ditto, lateral view; F. Phallus, dorsal view. Scale: A. 0.5 mm; B. 0.2 mm; C-F. 0.1 mm.

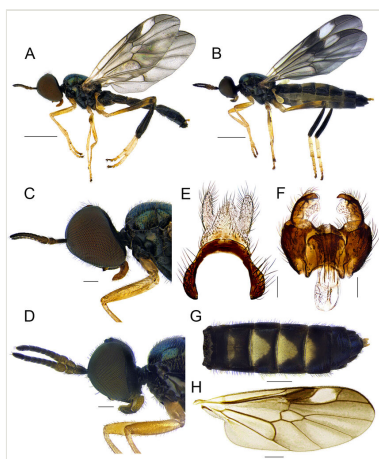


Figure 3.

Chorisops maculiala Nagatomi, 1964. A. Male habitus, lateral view; B. Female habitus, lateral view; C. Male head, lateral view; D. Female head, lateral view; E. Epandrium, cerci, and proctiger, dorsal view; F. Genital capsule, dorsal view; G. Male abdomen, dorsal view; H. Female wing. Scale: A-B. 1.0 mm; C-D. 0.2 mm; E-F. 0.1 mm; G-H. 0.5 mm.