

# Seven New Records of the Family Proctotrupidae (Hymenoptera: Proctotrupoidea) from South Korea

Bia Park<sup>1</sup>, Jong-Wook Lee<sup>2,\*</sup>

<sup>1</sup>Institute for Phylogenomics and Evolution, Kyungpook National University, Daegu 41566, Korea

<sup>2</sup>Geolim Entomological Institute, Daegu 42281, Korea

## ABSTRACT

The South Korean species of family Proctotrupidae Latreille, 1802 (Hymenoptera: Proctotrupoidea) are studied. Here, seven proctotrupid species are newly added in the South Korean fauna: *Cryptoserphus aculeator* (Haliday), *Disogmus basalis* (Thomson), *Mischoserphus arcuator* (Stelfox), *M. samurai* (Pschorn-Walcher), *Nothoserphus scymni* (Ashmead), *Proctotrupes gravidator* (Linnaeus), and *Tretoserphus laricis* (Haliday). Which of them, four genera belonging to the tribes Cryptoserphini and Proctotrupini (*Cryptoserphus*, *Mischoserphus*, *Proctotrupes*, and *Tretoserphus*) are also newly recorded from South Korea. A key to genera of South Korean Proctotrupidae, diagnosis, photographs, distribution, and recorded hosts for each species are presented. All proctotrupid specimens were kept in the collections of the Geolim Entomological Institute, Daegu, South Korea.

**Keywords:** *Cryptoserphus*, key, *Mischoserphus*, *Proctotrupes*, Proctotrupinae, *Tretoserphus*

## INTRODUCTION

Family Proctotrupidae is a relatively small-sized but the most diverse group within the superfamily Proctotrupoidea. It contains about 600 extant species in 30 genera worldwide (Townes and Townes, 1981; Johnson, 1992; He and Xu, 2015; Kolyada and Mostovski, 2017). The members of proctotrupids prefer areas with a temperate and humid climate, and they usually found in shadowed forests (Kolyada and Mostovski, 2017). The proctotrupid species are the endoparasitoids of Coleoptera that are agricultural and forestry insect pests, as well as Diptera, Lepidoptera, and Chilopoda (e.g., Townes and Townes, 1981; Early and Dugdale, 1994; Abuin and López, 2016, and references cited therein). The following key characters can easily distinguish the general morphology of proctotrupids: antenna with 13 segments, and fore wing with strong costal, subcostal, radial vein, and stigma in both sexes.

In South Korea, Lee et al. (1988) recorded for the first time *Nothoserphus afissae* of the family Proctotrupidae as a pest control. However, taxonomic research of this group has been conducted mainly by Lee et al. (2008), Choi et al. (2012, 2016), Kim et al. (2016), and Park et al. (2017). Currently, there are six genera and 13 proctotrupid species from South

Korea. In the present study, four genera and seven species are newly added to the list of South Korean Proctotrupidae: *Disogmus basalis* (Thomson) of tribe Disogmini, *Cryptoserphus aculeator* (Haliday), *Mischoserphus arcuator* (Stelfox), *M. samurai* (Pschorn-Walcher), *Nothoserphus scymni* (Ashmead), and *Tretoserphus laricis* (Haliday) of tribe Cryptoserphini, and *Proctotrupes gravidator* (Linnaeus) of tribe Proctotrupini. A key to genera of South Korean Proctotrupidae, diagnosis, photographs, distribution and recorded hosts for each species are also presented.

## MATERIALS AND METHODS

Specimens used in this study were collected using sweep nets and Malaise traps (MT), after which they were deposited in the collections of the Geolim Entomological Institute (GEI), Daegu, South Korea.

The morphological terminology follows Townes and Townes (1981). Observations of the adults were made with a Stemi 2000 stereomicroscope (Carl Zeiss, Germany). The images were captured with an AxioCam HRc camera through a SteREO Discovery V20 stereomicroscope (Carl Zeiss) and were produced with AxioVision40AC software (Carl Zeiss).

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**\*To whom correspondence should be addressed**

Tel: 82-53-810-2376, Fax: 82-53-811-2376  
E-mail: [jwlee1@ynu.ac.kr](mailto:jwlee1@ynu.ac.kr)

Final plates were prepared in Adobe Photoshop CS6 (Adobe Systems Incorporated, San Jose, CA, USA).

The following abbreviations are used throughout the text: BMNH, Natural History Museum, London, UK; EIHU, Entomological Institute, Hokkaido University, Sapporo, Japan; KUEC, Entomological Laboratory, Kyushu University, Fukuoka, Japan; LSUK, Linnean Collections, Linnean Society of London, London, UK; MCSN, Museo Civico di Storia Naturale “Giacomo Doria”, Genoa, Italy; MCZC, Museum of Comparative Zoology, Cambridge, USA; MNHN, Museum National d’Histoire Naturelle, Paris, France; MZLU, Museum of Zoology, Lund University, Lund, Sweden; NMID, National Museum of Ireland, Dublin, Ireland; ULQC, University of Laval, Québec, Canada; USNM, Smithsonian Institution, Washington, D.C., USA; ZMAS, Zoological Museum, USSR Academy of Sciences, Leningrad, Russia; TD, type depository; TL, type locality.

**SYSTEMATIC ACCOUNTS**

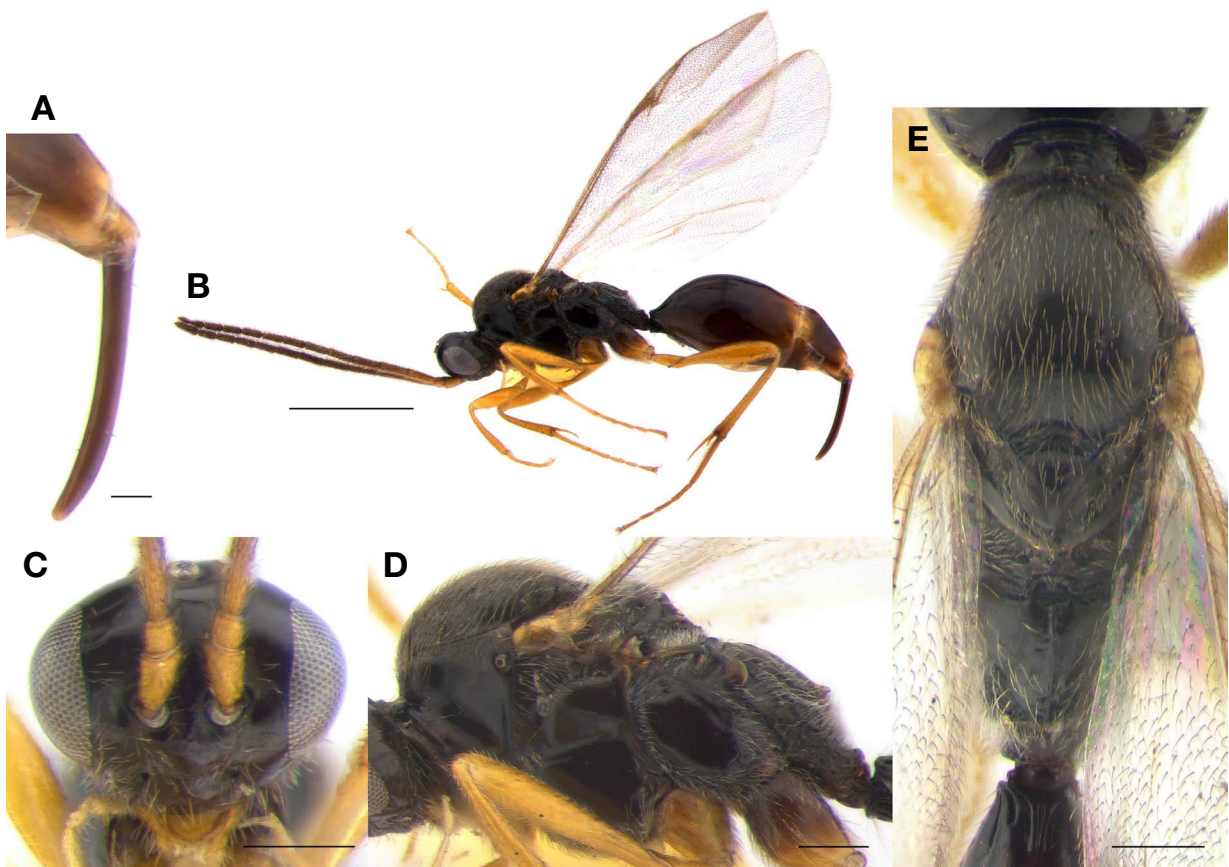
Order Hymenoptera Linné, 1758  
 Family Proctotrupidae Latreille, 1802

**Key to genera of South Korean Proctotrupidae (modified by Townes and Townes, 1981)**

- 1. Radial vein originating from apical 1/3 of stigma (Fig. 8B); intercubitus distinct and almost complete; lower half of syntergite without setae laterally; occipital carina present on only upper part of head..... *Disogmus* (tribe Disogmini)
- Radial vein originating from about 1/2 of stigma (Fig. 8A, C–F); intercubitus usually indistinct or incomplete; lower half of syntergite usually with setae laterally; occipital carina usually extending to lower half of head ..... 2
- 2. Metasoma usually without a metasomal stalk (Figs. 1E, 3G, 4E, 7E); metapleuron usually with a large smooth area (Figs. 1D, 3F, 4D, 5F, 7D); notaulus often present, usually short with pits in the margin of mesoscutum; mandible often with two teeth ..... 3 (tribe *Cryptoserphini*)
- Metasoma with a metasomal stalk (Choi et al., 2016; Fig. 8); metapleuron with or without a small smooth area anteriorly (Fig. 6F); notaulus absent or with a weak groove; mandible usually with a single tooth or with two teeth only in *Parthenocodrus* ..... 7 (tribe *Proctotrupini*)
- 3. Radial vein curved vertically toward costal vein directly from lower part of stigma (Choi et al., 2012; Fig. 5); stigma very deep; epomia present and connected dorsally with a carina or weak striations to pronotal shoulders (Choi et al., 2012; Fig. 2) ..... *Brachyserphus*

- Radial vein descend vertically from lower part of stigma, then curved toward costal vein (Fig. 8); stigma variable; epomia present or absent ..... 4
  - 4. Cheek with a strong vertical ridge and temple extremely short (Fig. 5); mandible very small and indistinct ..... *Nothoserphus*
  - Cheek without a strong vertical ridge and temple long; mandible distinct ..... 5
  - 5. Mandible with two teeth; mesopleuron strongly foveolate along hind margin (Fig. 7D)..... *Tretoserphus*
  - Mandible with a single tooth; mesopleuron foveolate or not foveolate along hind margin..... 6
  - 6. Costal vein not continued beyond end of radius (Fig. 8A); mesopleuron not foveolate along hind margin (Fig. 1D); ovipositor sheath 0.6–1.1 times as long as length of hind tibia and with very sparse setae or none (Fig. 1A)..... *Cryptoserphus*
  - Costal vein continued beyond end of radius (Fig. 8C); mesopleuron foveolate above only the horizontal groove or not foveolate along hind margin (Figs. 3F, 4D); ovipositor sheath 0.9–1.8 times as long as length of hind tibia ..... *Mischoserphus*
  - 7. Mandible with two teeth, the upper tooth shorter than lower tooth (Kim et al., 2016; Fig. 1C); propodeum with a weak median longitudinal carina dorsally (Kim et al., 2016; Figs. 1D, 2D) ..... *Parthenocodrus*
  - Mandible with a single tooth; propodeum with a strong median longitudinal carina dorsally..... 8
  - 8. Area between toruli with a median vertical carina (Choi et al., 2016; Fig. 1); syntergite without setae laterally..... *Phaneroserphus*
  - Area between toruli without a median vertical carina; syntergite with dense setae laterally..... 9
  - 9. Lower half of frons with a median rounded bulge (Park et al., 2017; Figs. 1D, 2E, 3E, 4A); longer spur of hind tibia 0.6–0.7 times as long as length of hind basitarsus in male and 0.5 times in female; syntergite black or dark brown; ovipositor sheath 0.3 times as long as length of hind tibia..... *Codrus*
  - Lower half of frons without a distinct median rounded bulge; longer spur of hind tibia 0.3 times as long as length of hind basitarsus; syntergite nearly red or partly red or reddish brown (Fig. 6A, B); ovipositor sheath 0.6–1.5 times as long length of hind tibia ..... *Proctotrupes*
- 1. <sup>1\*</sup>*Cryptoserphus aculeator* (Haliday, 1839) (Figs. 1, 8A)**  
*Codrus ater* Nees, 1834: 359. Types: ♂, ♀; TL: Sickershausen, Germany; TD: unknown (destroyed).

Korean name: <sup>1\*</sup>매끈가슴먹좀벌



**Fig. 1.** *Cryptoserphus aculeator* (Haliday), female. A, Ovipositor sheath; B, Habitus in lateral view; C, Head in frontal view; D, Thorax in lateral view; E, Thorax in dorsal view. Scale bars: A=0.1 mm, B=2.0 mm, C-E=0.2 mm.

*Proctotrupes aculeator* Haliday, 1839: 14. Lectotype: ♀; TL: Dublin, Ireland; TD: NMID.

*Serphus* (*Cryptoserphus*) *Perrisi* Kieffer, 1908: 318. Type: ♀; TL: Mont-de-Marsan, France; TD: Perris collection (Montpellier, France) (lost).

*Cryptoserphus deshii* Drake, 1969: 327. Type: ♀; TL: Fukuoka, Japan; TD: KUEC.

**Material examined.** [South Korea] Gangwon-do: 1♀, Donghae-si, Samhwa-dong, Mureung valley, 16 Oct–25 Nov 2005 (MT); Gyeonggi-do: 2♀♀, Namyangju-si, Choanmyeon, Songchon-ri, Mt. Ungilsan, alt. 134 m, 37°34'43.3"N, 127°18'37.5"E, 16 Oct–18 Nov 2009 (MT), Lim JO; Seoul: 1♀, Noweon-gu, Sanggye4-dong, Mt. Suraksan, 7 Sep–6 Oct 2007 (MT), Lim JO.

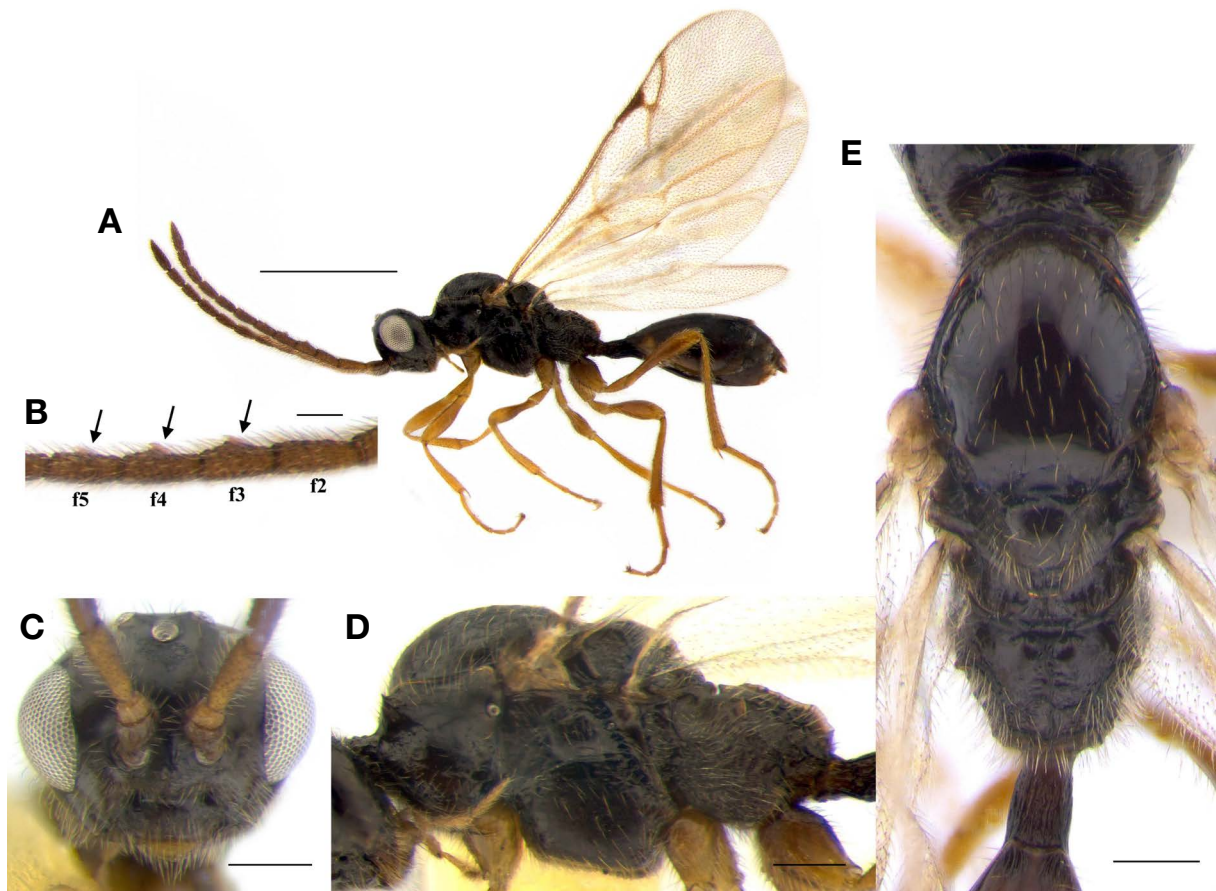
**Diagnosis.** Female (Fig. 1). Body length 3.4–4.5 mm; fore wing length 3.1–4.1 mm. Clypeus transverse, and its length 0.5–0.6 times as long as width of face (Fig. 1C). Metapleuron with a large bare area and a metapleural epicoxal carina incompletely (Fig. 1D). Propodeum rugose with a smooth

area dorsally (Fig. 1E); length of smooth area 1.9–2.4 times as long as its width. Syntergite with a median longitudinal groove and 2–3 strong additional grooves laterally. Ovipositor sheath a little narrowly rounded apically (Fig. 1A), and its length 0.7–0.9 times as long as length of hind tibia. Head and mesosoma reddish dark brown, except antenna yellowish brown to brown, labrum yellowish brown and mandible, palpi, and stigma yellow; legs yellow, except middle coxa, hind tibia and tarsus yellowish brown, and hind coxa dark brown basally; metasoma reddish brown or partly brown (Fig. 1B).

Male. Unknown in South Korea (see description in Townes and Townes, 1981).

**Host.** [Diptera] Fungivoridae (Nees, 1834; Masner, 1968).

**Distribution.** South Korea (new record), Austria, China, Czech Republic, Denmark, France, Germany, Hungary, Iceland, India, Iran, Ireland, Italy, Japan, Moldova, Nepal, Philippines, Russia, Spain, Sweden, UK (Townes and Townes, 1981; He and Fan, 1991; Kolyada, 1998; Johnson, 2013; He and Xu, 2015; Izadzadeh et al., 2016).



**Fig. 2.** *Disogmus basalis* (Thomson), male. A, Habitus in lateral view; B, Tyloids (arrows); C, Head in frontal view; D, Thorax in lateral view; E, Thorax in dorsal view. Scale bars: A=1.0 mm, B=0.1 mm, C-E=0.2 mm.

**2. <sup>1\*</sup>*Disogmus basalis* (Thomson, 1858) (Figs. 2, 8B)**

*Proctotrupes basalis* Thomson, 1858: 416. Lectotype: ♂; TL: Skåne, Sweden; TD: MZLU.

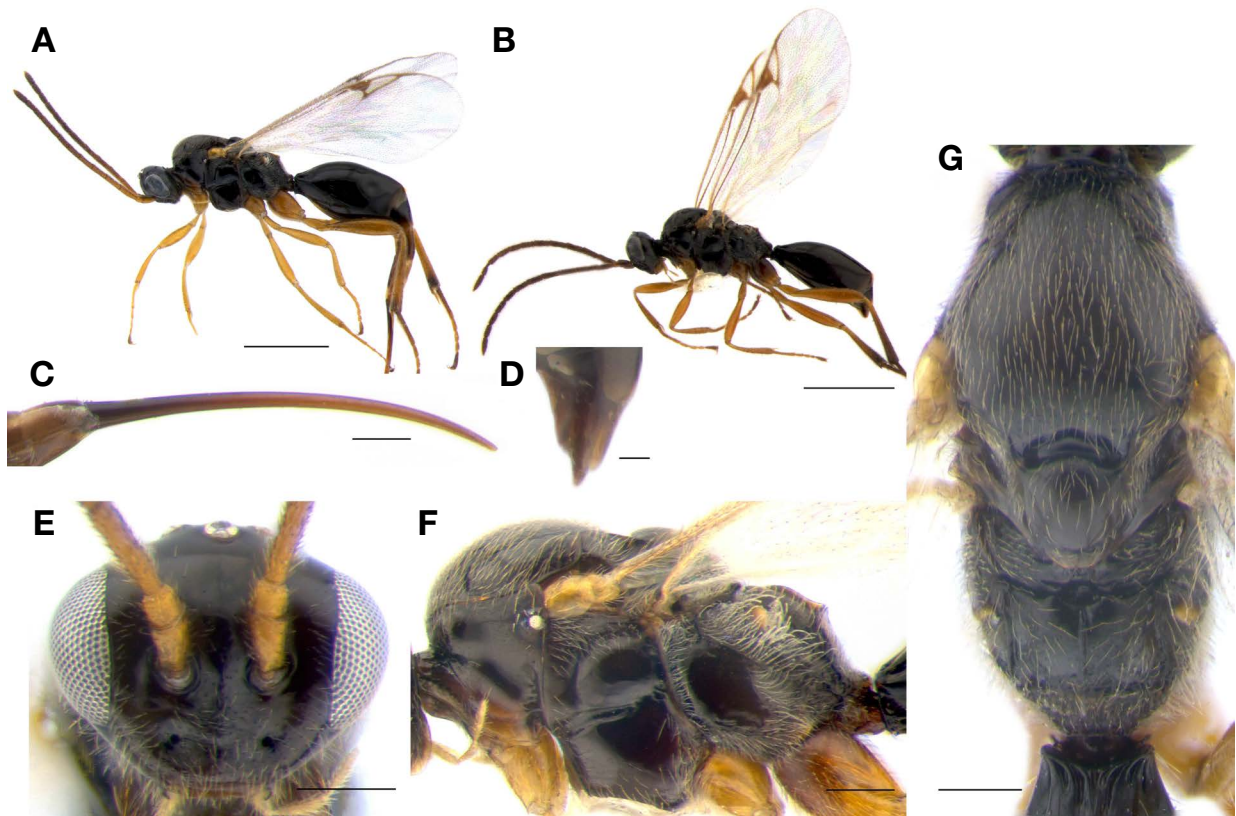
*Disogmus Carinatus* var. *Fuscitarsis* Kieffer, 1907: 282. Type: ♂; TL: Berisal, Switzerland; TD: MNHN.

**Material examined.** [South Korea] Chungcheongbuk-do: 1♂, Boeun-gun, Songnisan-myeon, Sanae-ri, Mt. Songnisan, Beopjusanmaepyoso, 36°32'06"N, 127°49'40"E, 4–11 Jun 2007 (MT), Lee JW; Daejeon: 1♂, Dong-gu, Daejeon Univ., 36°20'06"N, 127°27'38"E, 12 Apr–12 May 2007 (MT), Lee JW; Gangwon-do: 1♂, Pyeongchang-gun, Jinbu-myeon, Mt. Odaesan, 37°47'46"N, 128°40'45"E, 6 Jun–26 Jul 2013 (MT), Kim KB; 1♂, Wonju-si, Heungeop-myeon, Maeji-ri, Yeonse Univ. Wonju campus, 37°16'24"N, 127°54'02"E, 4–24 May 2007 (MT), Lee JW; Gyeonggi-do: 1♂, Namyangju-si, Choan-myeon, Songchon-ri, Mt. Ungilsan, alt. 134 m, 37°34'43.3"N, 127°18'37.5"E, 1–26 May 2009 (MT), Lim

JO; 1♂, same locality, 27 May–10 Jun 2009 (MT), Lim JO; 2♂♂, Gapyeong-gun, Cheongpyeong-myeon, Goseong-ri, Mt. Homyeongsan, 37°43'15.0"N, 127°29'18.9"E, 1–26 May 2009 (MT), Lim JO; 1♂, Gwangju-si, Docheong-myeon, Mt. Taehwasan, alt. 219 m, 37°18'5.3"N, 127°19'1.5"E, 8 May–7 Jun 2007 (MT), Lim JO; Gyeongsangnam-do: 5♂♂, Sanchong-gun, Samjang-myeon, Yupyong-ri, Wangdeungjae, 35°23'8.81"N, 127°46'44.11"E, 16 Jun–20 Sep 2008 (MT), Lee JW; [Russia] 1♂, Primorsky-Krai, Nadezhdinsky-District, Volno-Nadezhdinskoye, 43°22'31.6"N, 131°01'43.1"E, 22 Jun 2008, Lee JW.

**Diagnosis.** Male (Figs. 2, 8B). Body length 3.1–4.6 mm; fore wing length 2.9–4.0 mm. Tyloids present on flagellar segments 3–6 (f3–6; Fig. 2B); the tyloids in the form of an ascending claw, its length 0.3–0.4 times as long as that of each segment. Notaulus present, usually reaching past center of mesoscutum (or at least traceable), or sometimes very short (Fig. 2E). Radial vein descending vertically from lower corner

Korean name: <sup>1\*</sup>뽕족큰맥먹좀벌



**Fig. 3.** *Mischoserphus arcuator* (Stelfox): A, C, E-G, female; B, D, male. A, B, Habitus in lateral view; C, Ovipositor sheath; D, Clasper; E, Head in frontal view; F, Thorax in lateral view; G, Thorax in dorsal view. Scale bars: A, B=1.0 mm, C, E-G=0.2 mm, D=0.1 mm.

of stigma, then curved toward costal vein (Fig. 8B); radial cell 1.7–2.0 times as long as the maximal length of stigma. Metasoma with a metasomal stalk with dense longitudinal grooves on dorsal surface (Fig. 2E); length of the metasomal stalk 1.2–1.3 times as long as its median width, and 1.2–1.6 times as long as its median height. Body dark brown (sometimes mesosoma and metasoma partly reddish brown), except antenna and stigma brown and labrum, mandible, and palpi yellowish brown; legs yellowish brown or partly brown, except all coxae brown and fore tibia and tarsus yellow (Fig. 2A).

Female. Unknown in South Korea (see description in Townes and Townes, 1981).

**Host.** Unknown.

**Distribution.** South Korea (new record), Denmark, Germany, Ireland, Lithuania, Russia, Sweden, Switzerland, UK (Townes and Townes, 1981; Notton, 2007; Johnson, 2013; Broad, 2016).

**Remarks.** The male of this species is similar to the known

species, *D. areolator* (Haliday, 1839). The main difference between these two species is the number of tyloids on the flagellum: flagellar segments 3–6 with tyloids in *D. basalis*, but segments 4–6 in *D. areolator*.

### 3. <sup>1</sup>*Mischoserphus arcuator* (Stelfox, 1950) (Fig. 3)

*Cryptoserphus arcuator* Stelfox, 1950: 314. Type: ♀; TL: Blessington, Ireland; TD: USNM.

*Cryptoserphus ione* Kozlov, 1971: 8. Type: ♀; TL: Primorskiy Kray, Russia; TD: ZMAS.

**Material examined.** [South Korea] Chungcheongbuk-do: 1♀, Danyang-gun, Danyang-eup, Cheondong-ri, 36°57' 25.1"N, 128°25'47.6"E, 26 May–11 Jun 2009 (MT), Lee JW; 1♀, same locality, Mt. Sobaeksan, Cheondong valley, 36°57'N, 128°26'E, 30 Apr–21 May 2007 (MT), Lee JW; Gangwon-do: 1♀, Donghae-si, Samhwa-dong, Mureung valley, 9–19 Aug 2005 (MT), Lee JW; 4♀♀, same locality, 16 Oct–25 Nov 2005 (MT), Lee JW; 1♀, Hongcheon-gun,

Korean name: <sup>1</sup>\*긴꼬리먹좀벌

Nae-myeon, Mt. Gyeongbongsan, 24 Jun–19 Jul 2013 (MT), Lee JW; 1♀, Inje-gun, Girin-myeon, Jinbu-ri, Mt. Jeombongsan, Gombaeryeong, 26 Jun–28 Jul 2012 (MT), Park JY; 1♀, same locality, 29 Jul–13 Aug 2012 (MT), Park JY; 1♀, Pyeongchang-gun, Jinbu-myeon, Mt. Odaesan, 37°47'46"N, 128°40'45"E, 6 Jun–26 Jul 2013 (MT), Oh SH; 2♀♀, Pyeongchang-gun, Yongpyeong-myeon, Mt. Gyeongbongsan, 28 Jun–12 Aug 2012 (MT), Park JY; 1♀, Wonju-si, Heungeop-myeon, Maejiri, Yeonse Univ. Wonju campus, 37°16'53"N, 127°54'02"E, 31 Oct–28 Nov 2009 (MT), Han HY; 1♀, Yeongwol-gun, Sangdong-eup, Deokgu-ri, 27 Jul 2012, Lee JW; Gyeongsangbuk-do: 1♀, Cheongdo-gun, Unmun-myeon, Ssalbawi, Mt. Unmunsan (U7), 35°38'08"N, 129°01'27"E, 1 Aug–21 Sep 2012 (MT), Lee JW; 1♂1♀, Ulleung-gun, Ulleung-eup, Seonginbong, 37°30'11.75"N, 130°51'58.15"E, 3 Jul 1997, Lee JW; Gyeongsangnam-do: 1♀, Hadong-gun, Cheongam-myeon, Mt. Jirisan, Jinjuam, Cheonghakdong Samsanbong, 35°14'37"N, 127°42'12"E, 8 Jul–1 Sep 2001 (MT), Lee JW; 1♀, Sancheong-gun, Samjang-myeon, Yupyeong-ri, Mt. Jirisan, Wangdeungjae 22, 35°23'8.81"N, 127°46'44.11"E, 16 Jun–20 Sep 2011 (MT), Lee JW; 1♂, Sancheong-gun, Sicheon-myeon, Jungsan-ri, Mt. Jirisan, Cheonwangbong, 36°21'55.81"N, 127°41'53.58"E, 10 May 2002, Lee JW; Jeollabuk-do: 1♀, Sunchang-gun, Paldeok-myeon, Mt. Gangcheonsan parking lot, 35°37'56"N, 127°4'18.97"E, 19 Aug 2009, Lee JW; Jeju-do: 1♀, Jeju-si, Jejudaehak-ro, Jeju National Univ., 33°27'21"N, 126°33'38"E, 19–26 May 2008 (MT), Lee JW; Jeollanam-do: 1♀, Namwon-si, Sannae-myeon, Jeongnyeongchi 44, Mt. Jirisan National Park, 35°21'54.49"N, 127°30'59.00"E, 2 Jun–6 Sep 2011 (MT), Lee JW; Seoul: 1♀, Noweon-gu, Sanggye-dong, Mt. Suraksan, 26 Oct–8 Nov 2007 (MT), Lim JO.

**Diagnosis.** Female (Fig. 3A, C, E–G). Body length 3.0–4.6 mm; fore wing length 2.9–4.1 mm. Cheek with a weak groove incompletely from eye to mandible. Mesopleuron distinctly foveolate only above the horizontal groove (Fig. 3F). Length of smooth area of propodeum 1.6–1.9 times as long as its width (Fig. 3G). Anterior upper corner of syntergite with 30–35 setae laterally; the median longitudinal groove of the syntergite 2.7–3.0 times longer than length of first thyridium, and reaching 0.6–0.8 times as long as the distance to first thyridium. Ovipositor sheath narrow apically (Fig. 3C), and its length 1.3–1.5 times as long as length of hind tibia. Body reddish dark brown (sometimes metasoma partly reddish brown), except ovipositor sheath darkened basally, antenna yellowish brown to brown, stigma brown, labrum and mandible yellowish brown, and palpi yellow; legs yellowish brown, sometimes the fifth tarsal segment brown, and hind tibia often brownish toward the apex (Fig. 3A).

Male (Fig. 3B, D). Body length 3.4–3.9 mm; fore wing length 3.1–3.3 mm. Similar to female, but cheek with or without a weak groove from eye to mandible. Tyloids present on flagellar segments 5–9, and the tyloids in the form of nearly circular. Clasper as in Fig. 3D.

**Host.** Unknown.

**Distribution.** South Korea (new record), Alaska, Canada, Iran, Ireland, Japan, Russia, Sweden, USA (Townes and Townes, 1981; Kolyada, 1998; Johnson, 2013; Izadizadeh et al., 2016).

#### 4. <sup>1</sup>\**Mischoserphus samurai* (Pschorn-Walcher, 1964) (Figs. 4, 8C)

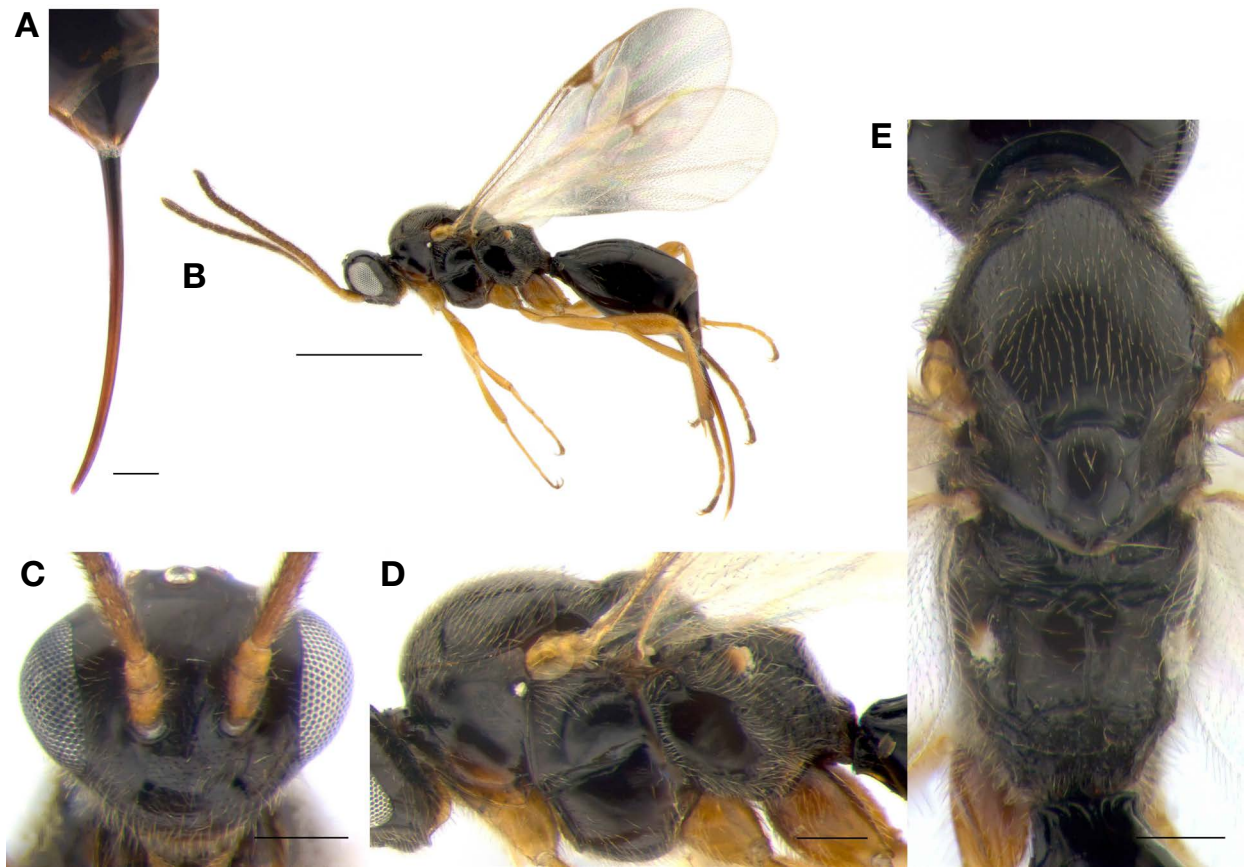
*Cryptoserphus samurai* Pschorn-Walcher, 1964: 2. Type: ♀; TL: Sapporo, Japan; TD: EIHU.

**Type material examined.** [Japan] ♀, holotype of *Cryptoserphus samurai* Pschorn-Walcher, "Sapporo, Hokkaido, 21.X. 1959, Takagi S." (EIHU).

**Material examined.** [South Korea] Gangwon-do: 1♀, Inje-gun, Girin-myeon, Mt. Bangtaesan, 27 Aug–26 Sep 2013 (MT), Lee JW; 1♀, Pyeongchang-gun, Jinbu-myeon, Ganyeong-ri, Mt. Odaesan National Park, 1,109 m, 37°47'16"N, 128°33'26"E, 1 Jul–30 Aug 2013 (MT), Park JY; 2♀♀, Pyeongchang-gun, Yongpyeong-myeon, Mt. Gyeongbongsan, 28 Jun–12 Aug 2012 (MT), Park JY; Gyeongsangbuk-do: 1♀, Cheongdo-gun, Unmun-myeon, Ssalbawi, Mt. Unmunsan (U7), 35°38'08"N, 129°01'27"E, 13 Jul–16 Aug 2013 (MT), Lee JW; Gyeongsangnam-do: 1♀, Sancheong-gun, Samjang-myeon, Yupyeong-ri, Wangdeungjae, 35°23'8.81"N, 127°46'44.11"E, 16 Jun–20 Sep 2008 (MT), Lee JW; Jeollanam-do: 2♀♀, Gurye-gun, Gurye-eup, Mt. Jirisan National Park, Nogodan 106, 35°17'47.11"N, 127°31'36.45"E, 2 Jun–10 Oct 2011 (MT), Lee JW.

**Diagnosis.** Female (Fig. 4). Body length 3.1–4.5 mm; fore wing length 2.9–4.1 mm. Cheek without a groove from eye to mandible. Mesopleuron with a horizontal groove completely and obliterated pits along hind margin (Fig. 4D). Length of smooth area of propodeum 1.3–1.4 times as long as its width (Fig. 4E). Anterior upper corner of syntergite with 21–25 setae laterally; the median longitudinal groove of the syntergite 2.0–2.6 times longer than length of first thyridium, and reaching 0.6–0.7 times as long as the distance to first thyridium. Ovipositor sheath narrow apically (Fig. 4A), and its length 1.4–1.5 times as long as length of hind tibia. Body reddish dark brown (sometimes metasoma partly reddish brown), except scape brown and rest of antenna, labrum, mandible, palpi, and stigma yellowish brown; legs yellowish brown, except middle coxa and hind coxa mostly brown (Fig. 4B).

Korean name: <sup>1</sup>\*사무라이머컴벌



**Fig. 4.** *Mischosephus samurai* (Pschorn-Walcher), female. A, Ovipositor sheath; B, Habitus in lateral view; C, Head in frontal view; D, Thorax in lateral view; E, Thorax in dorsal view. Scale bars: A, C-E=0.2 mm, B=1.0 mm.

Male. Unknown in South Korea (see description in Townes and Townes, 1981).

**Host.** Unknown.

**Distribution.** South Korea (new record), China, Japan, Russia (Townes and Townes, 1981; He and Xu, 2015).

**Remarks.** This species is similar to *M. arcuator* (Stelfox, 1950). The main differences between these two species are as follows: upper half of mesopleuron indistinct or obliterated pits in *M. samurai* (distinctly foveolate in *M. arcuator*); anterior upper corner of syntergite with 21–25 setae laterally (30–35 setae, more than *M. samurai*).

**5. <sup>1\*</sup>*Nothoserphus scymni* (Ashmead, 1904) (Figs. 5, 8D)**

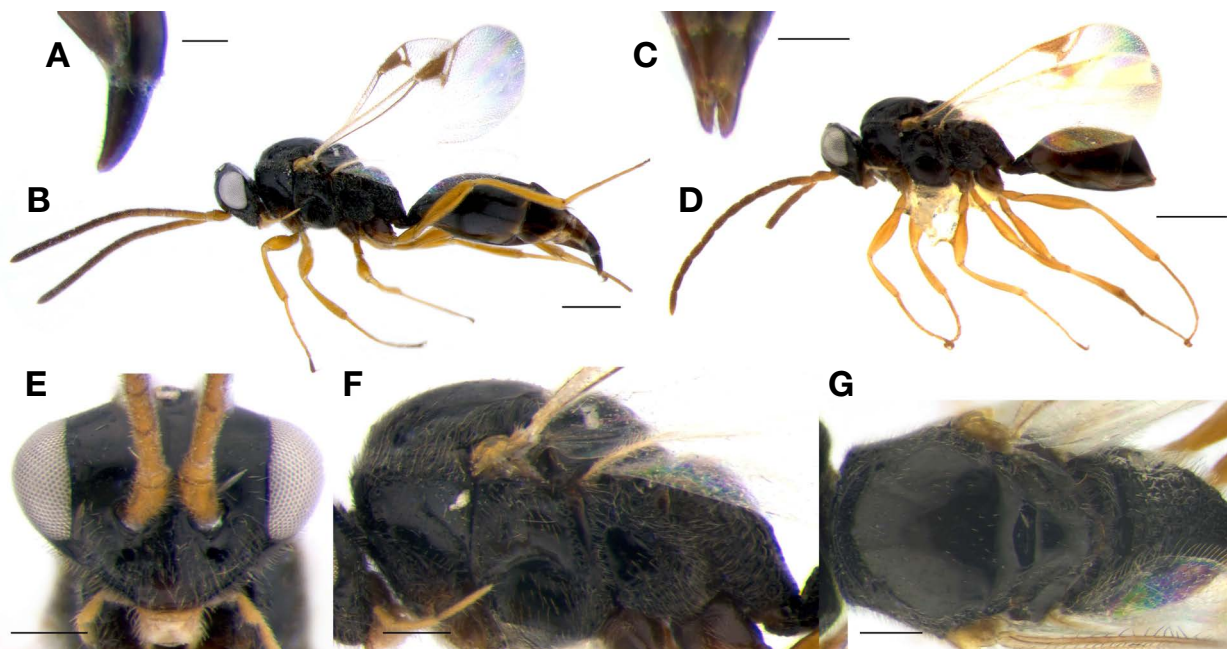
*Proctotrypes scymni* Ashmead, 1904: 67. Type: ♀; TL: Gifu, Japan; TD: USNM.

**Material examined.** [South Korea] Chungcheongnam-do:

1♂, Seosan-si, Haemi-myeon, Daedok-ri, Hanseo Univ., 16 Jul–3 Aug 2013 (MT), Kim JK; Gangwon-do: 2♂♂, Donghae-si, Samhwa-dong, Mureung valley, 16–28 Jun 2005 (MT), Lee JW; Gyeonggi-do: 1♂, Gwacheon-si, Maggye-dong, Mt. Cheonggyesan, 4 Jul 1989, Lee JW; Incheon: 1♀, Bupyeong-gu, Cheongcheon1-dong, Incheon butterfly Park, 30 Aug–1 Sep 2011 (MT), Lee JW.

**Diagnosis.** Female (Fig. 5A, B, E–G). Body length 3.9 mm; fore wing length 2.4 mm. Top of head without a pair of erect blade-like processes (Fig. 5E). Epomia interrupted and connected dorsally with a carina to pronotal shoulder; metapleuron rugose, except anterior half of metapleuron with bare area (Fig. 5F). Notaulus very short and indistinct; prescutellar groove without longitudinal ridges; propodeum areolate-rugose with dense sculptures posteriorly (Fig. 5G). Ovipositor sheath triangular shaped and a little rounded apically (Fig. 5A), and its length 0.3 times as long as length of hind tibia. Body black (sometimes metasoma dark brown), except antenna yellow-

Korean name: <sup>1\*</sup>짧은뺨먹좀벌



**Fig. 5.** *Nothoserphus scymni* (Ashmead): A, B, E–G, female; C, D, male. A, Ovipositor sheath; B, D, Habitus in lateral view; C, Clasper; E, Head in frontal view; F, Thorax in lateral view; G, Thorax in dorsal view. Scale bars: A, C=0.1 mm, B, D=0.5 mm, E–G=0.2 mm.

ish brown to brown, tegula and stigma yellowish brown, and labrum, mandible, and palpi yellow; legs yellowish brown, except all coxae mostly dark brown (Fig. 5B).

Male (Fig. 5C, D). Body length 2.9–3.0 mm; fore wing length 2.2–2.7 mm. Similar to female, but tyloids present on flagellar segments 3–8, the tyloids in the form of nearly circular. Clasper as in Fig. 5C. Body reddish dark brown (Fig. 5D).

**Host.** [Coleoptera] Coccinellidae: *Scymnus dorcatomoides* Weise, 1879 (Townes and Townes, 1981).

**Distribution.** South Korea (new record), China, Japan, Russia (Townes and Townes, 1981; He and Xu, 2015).

**Remarks.** This species belonging to *boops*-group is similar to *N. boops* (Thomson, 1858). The main difference between these two species is as follows: trochanters and femora yellow to yellowish brown in *N. scymni* (dark brown in *N. boops*); tyloids 0.4 times as long as length of the segments (0.7 times); ovipositor sheath a little shorter than *N. boops*.

**6. <sup>1</sup>\**Proctotrupes gravidator* (Linnaeus, 1758) (Figs. 6, 8E)**

*Ichneumon gravidator* Linnaeus, 1758: 565. Type: ♂; TL: London, UK; TD: LSUK.

*Proctotrupes meridionalis* Gribodo, 1880: 8. Type: ♀; TL: Ravello, Italy; TD: unknown (lost).

*Proctotrupes rufigaster* Provancher, 1881: 263. Lectotype: ♀; TL: Ottawa, Canada; TD: ULQC.

*Proctotrupes collaris* Szépligeti in Mocsáry and Szépligeti, 1901: 156. Type: ♀; TL: Kazan, Russia; TD: unknown (lost).

*Serphus* (*Serphus*) *Gravidator* var. *Petiolaris* Kieffer, 1908: 297. Lectotype: ♀; TL: Scotland, UK; TD: BMNH.

*Serphus* (*Serphus*) *Gravidator* var. *Nigrescens* Kieffer, 1908: 298. Lectotype: ♂; TL: Tragöss, Austria; TD: unknown.

*Serphus* (*Serphus*) *Gravidator* var. *Indivisus* Kieffer, 1908: 298. Lectotype: ♂; TL: Paris, France; TD: MNHN.

*Serphus* (*Serphus*) *Gravidator* var. *Collaris* Kieffer, 1908: 298. Lectotype: ♂; TL: Genoa, Italy; TD: MCSN.

*Proctotrupes suzukii* Matsumura, 1912: 156. Type: ♀; TL: Kyoto, Japan; TD: EIHU.

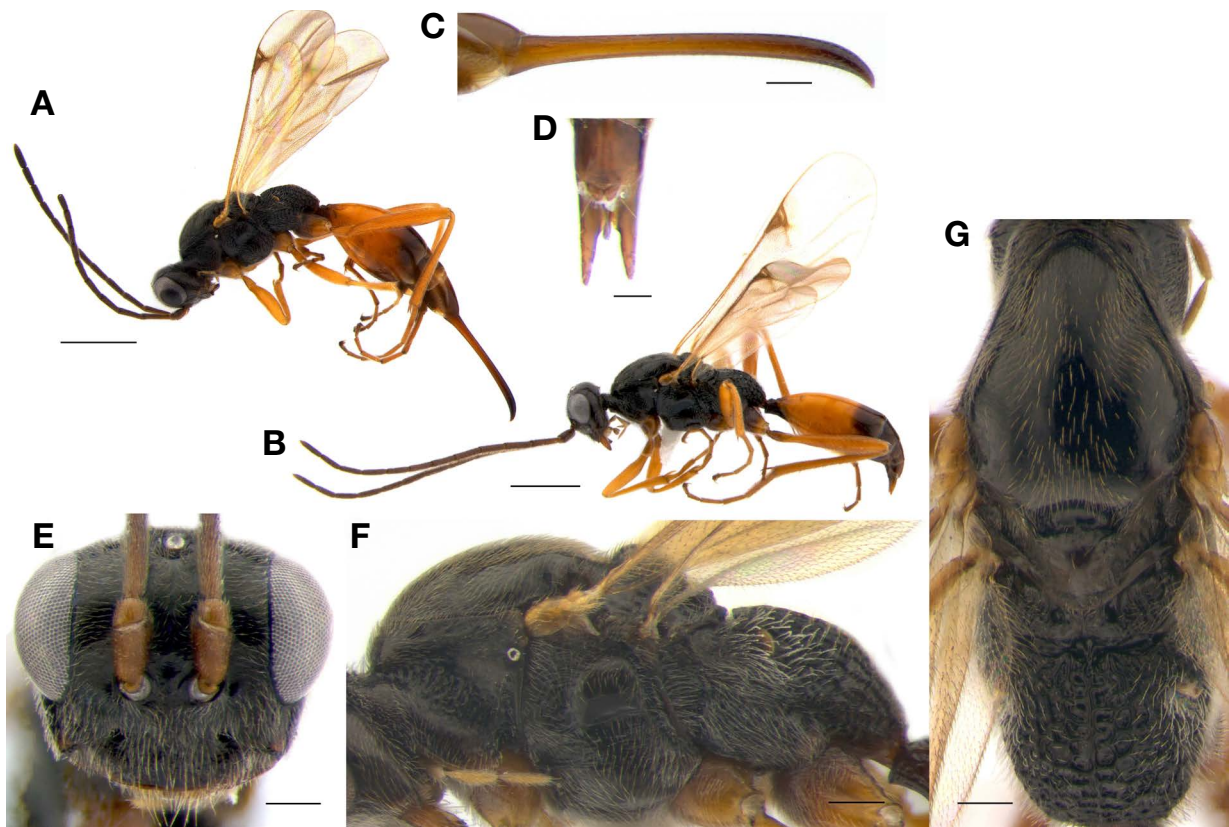
*Serphus zabriskiei* Brues, 1919: 3. Type: ♀; TL: New York, USA; TD: MCZC.

**Type material examined.** [UK] ♀, holotype of *Serphus gravidator* var. *petiolaris* K. (B.M. TYPE HYM. 9.126), “Scotland, Thornhill, 1914–110, P. Cameron coll.” (BMNH).

**Material examined.** [South Korea] Daegu: 1♀, Dalseong-gun, Yuga-myeon, Yang-ri, Mt. Biseulsan, Yugasa, 10 May 1995, Lee JW; Gangwon-do: 1♀, Hongseong-gun, Gap-

Korean name: <sup>1</sup>\*주홍배먹좀벌





**Fig. 6.** *Proctotrupes gravidator* (Linnaeus): A, C, E-G, female; B, D, male. A, B, Habitus in lateral view; C, Ovipositor sheath; D, Clasper; E, Head in frontal view; F, Thorax in lateral view; G, Thorax in dorsal view. Scale bars: A, B=1.0 mm, C, E-G=0.2 mm, D=0.1 mm.

cheon-myeon, Hadae-ri 594, 37°31'34.14"N, 128°09'5.03"E, 15–21 Jul 2009 (MT), Lee KW; Gyeongsangbuk-do: 1♀, Cheongdo-gun, Gakbuk-myeon, Namsan1-ri, 21 Apr–2 May 2007 (MT), Lee JW; 1♂, Gyeongsan-si, Dae-dong, Yeungnam Univ., 35°58'N, 128°47'E, 6–15 Jul 2006, Lee JW; 1♀, same locality, 17 Oct–18 Dec 2008 (MT), Lee JW; 3♂♂, Yeongdeok-gun, Ganggu-myeon, Sowol-ri, 5 May 2000, Lee JW; Jeollabuk-do: 1♀, Muju-gun, Anseong-myeon, Gongjeong-ri, Mt. Deogyusan, Chiryeonpokpo, 15 May 1999, Lee JW.

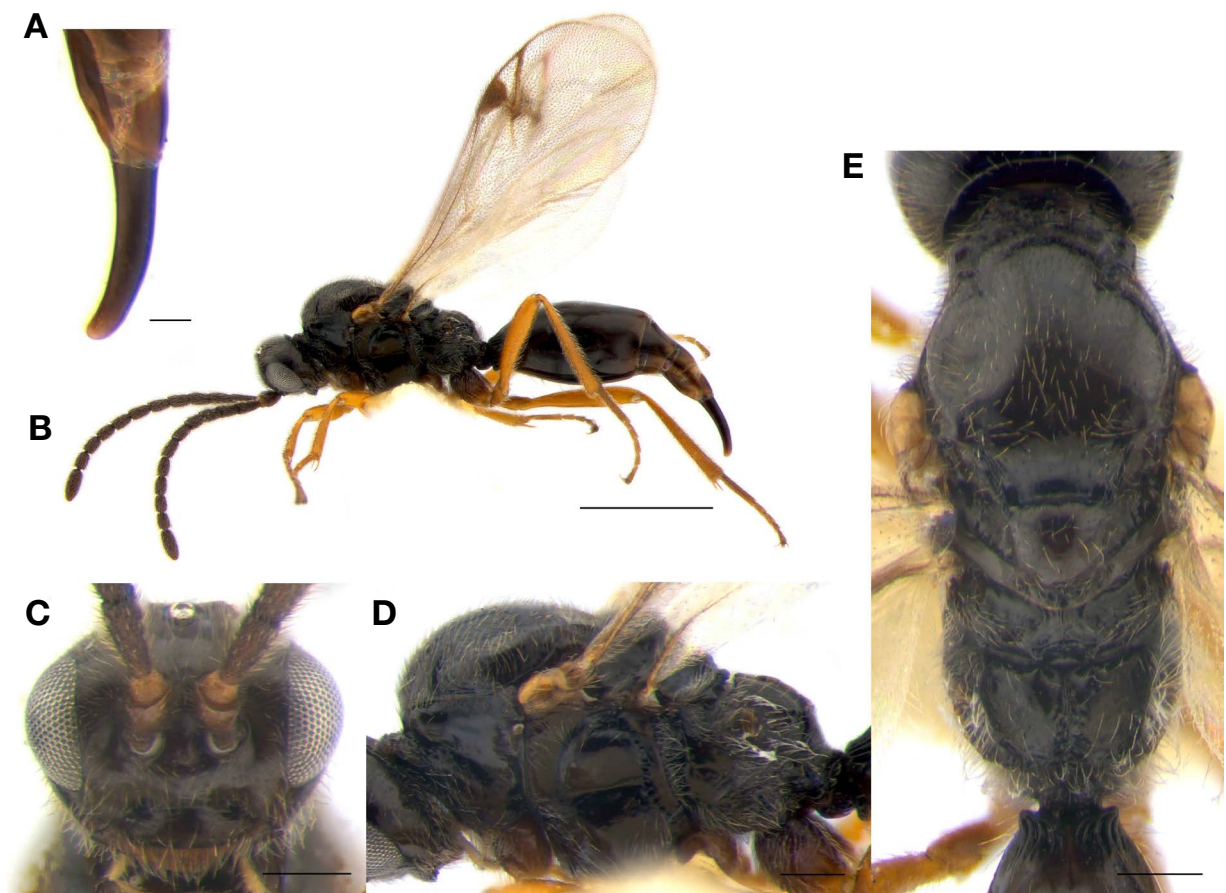
**Diagnosis.** Female (Fig. 6A, C, E-G). Body length 4.7–7.3 mm; fore wing length 3.2–4.7 mm. Occipital carina complete. Lateral side of pronotum without a bare area, scrobe of pronotum rugulose; metapleuron areolate-rugose entirely without a metapleural epicoxal carina (Fig. 6F). Notaulus absent; propodeum areolate-rugose with a median longitudinal carina and without a smooth area (Fig. 6G). Mid and hind tibiae with spurs normally shaped, straight, and thin. Metasoma with a metasomal stalk, and its dorsal surface rugose; length of the metasomal stalk 0.6–0.7 times as long as its median width, and 0.5–0.7 times as long as its median height. Ovipositor

sheath long, narrow and curved apically, and its length 0.9–1.0 times as long as length of hind tibia; its surface smooth and covered with short setae (Fig. 6C). Head and mesosoma black, except antenna dark brown, labrum, mandible, and stigma brown, and palpi yellowish brown; legs yellowish brown, except all coxae dark brown basally; metasoma reddish dark brown, except 2/3 of syntergite yellowish brown anteriorly and ovipositor sheath brown anteriorly (Fig. 6A).

Male (Fig. 6B, D). Body length 5.6–6.0 mm; fore wing length 4.5–4.7 mm. Similar to female, but tyloids present on flagellar segments 3–11, the tyloids in the form of a weak short ridge. Clasper as in Fig. 6D.

**Host.** Unknown.

**Distribution.** South Korea (new record), Austria, Belgium, Canada, China, Croatia, Czech Republic, Denmark, Finland, France, Germany, Hungary, Iran, Ireland, Italy, Japan, Jordan, Mongolia, Norway, Poland, Romania, Russia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, UK, USA (Townes and Townes, 1981; Kolyada, 1998; Johnson, 2013; He and Xu, 2015; Izadizadeh et al., 2016).



**Fig. 7.** *Tretoserphus laricis* (Haliday), female. A, Ovipositor sheath; B, Habitus in lateral view; C, Head in frontal view; D, Thorax in lateral view; E, Thorax in dorsal view. Scale bars: A=0.1 mm, B=1.0 mm, C-E=0.2 mm.

**7. <sup>1\*</sup>*Tretoserphus laricis* (Haliday, 1839) (Figs. 7, 8F)**

*Proctotrupes laricis* Haliday, 1839: 14. Types: ♂, ♀; TL: Dublin, Ireland; TD: NMID.

*Serphus (Cryptoserphus) Nigricauda* Kieffer, 1908: 324. Type: ♀; TL: Paris, France; TD: MNHN.

*Cryptoserphus melanderi* Burues, 1919: 8. Type: ♂; TL: Washington, USA; TD: MCZC.

**Material examined.** [South Korea] Chungcheongbuk-do: 1♀, Danyang-gun, Cheondong-ri, Mt. Sobaeksan, Bukbusa, 19 Apr–24 May 2006 (MT), Lee JW; Jeollabuk-do: 1♀, Jeongeup-si, Naejang-dong, Mt. Naejangsan, Geumseong valley (site-14), 35°29'14.58"N, 126°53'37.53"E, 25 Apr–9 May 2008 (MT), Lee JW.

**Diagnosis.** Female (Fig. 7). Body length 4.3–5.0 mm; fore wing length 3.4–4.3 mm. Cheek with a strong groove completely from eye to mandible. Epomia interrupted and not con-

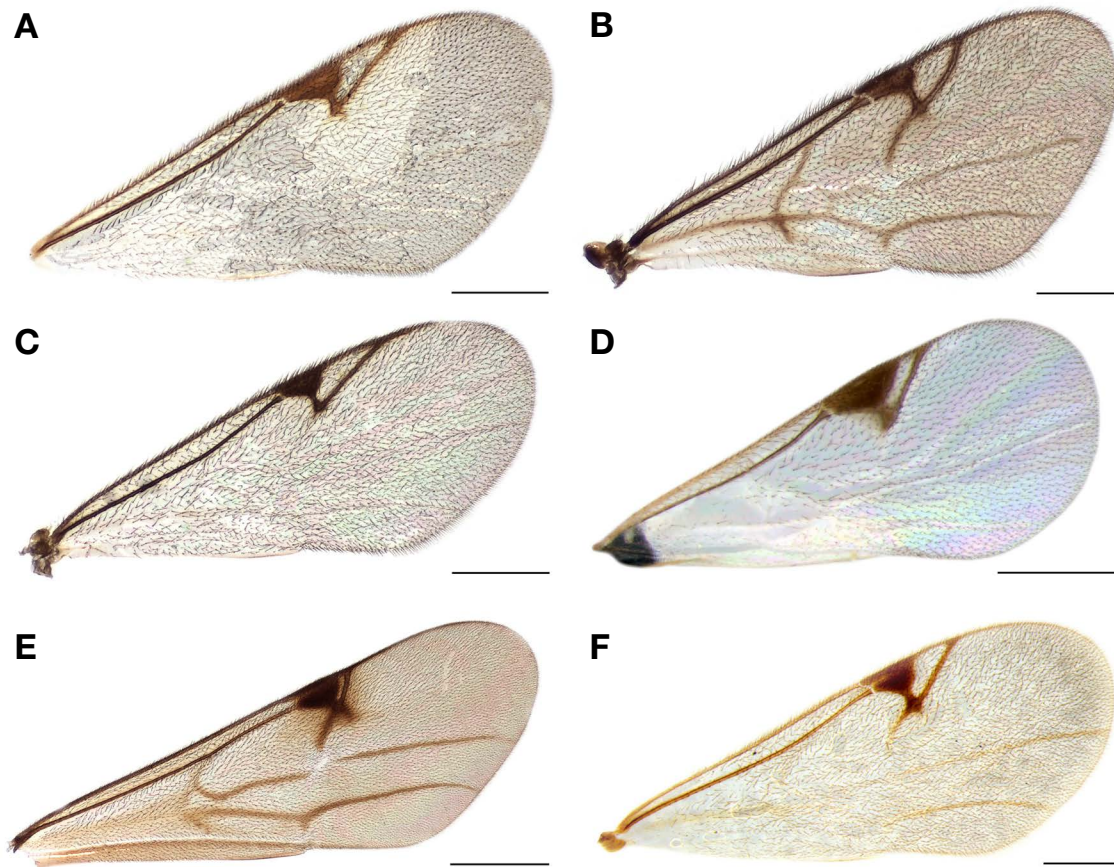
nected dorsally to pronotal shoulder; anterior upper corner of metapleuron with bare area, its surface subdivided into unequal parts by weak striations; rest of metapleuron with irregular striations and covered with long setae (Fig. 7D). Notaulus present (Fig. 7E), and its length 1.0–1.2 times as long as length of tegula. Ovipositor sheath slightly narrow and rounded apically, and its length 0.5 times as long as length of hind tibia; its surface smooth with weak punctures and covered with sparse short setae (Fig. 7A). Body dark brown (sometimes metasoma partly reddish brown), except antenna and labrum brown, pedicel and stigma yellowish brown, and palpi and tegula yellow; legs yellowish brown, except all coxae mostly dark brown (Fig. 7B).

Male. Unknown in South Korea (see description in Townes and Townes, 1981).

**Host.** Unknown.

**Distribution.** South Korea (new record), Canada, China,

Korean name: <sup>1\*</sup>가슴구멍먹좀벌



**Fig. 8.** Fore wings of the proctotrupid species. A, *Cryptoserphus aculeator*; B, *Disogmus basalis*; C, *Mischoserphus samurai*; D, *Nothoserphus scymni*; E, *Proctotrupes gravidator*; F, *Tretoserphus laricis*. Scale bars: A-D, F=0.5 mm, E=1.0 mm.

Germany, France, Iran, Ireland, Japan, Russia, Sweden, UK, USA (Watanabe, 1949; Townes and Townes, 1981; Johnson, 2013; He and Xu, 2015; Samin et al., 2018).

## ORCID

Bia Park: <https://orcid.org/0000-0002-6416-1255>

Jong-Wook Lee: <https://orcid.org/0000-0002-8684-3935>

## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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