

Review of the Genus *Pimpla* (Hymenoptera: Ichneumonidae: Pimplinae) from Korea

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ABSTRACT

We reviewed Korean species of the genus *Pimpla* and confirmed 12 species. In this genus, 36 species have been reported from the Eastern Palaearctic region, eight species were from Korea. Also, we report four species, *Pimpla albociliata* Kasparyan, 1974, *Pimpla femorella* Kasparyan, 1974, *Pimpla kaszabi* (Momoi, 1973) and *Pimpla melanacrias* Perkins, 1941, which were newly recorded for the first time from Korea. Among them, *Pimpla nipponica* Uchida, 1928 is recorded from United States and the Nearctic region for the first time. A key to Korean species of the genus *Pimpla*, diagnoses and illustrations of adult external structures are provided.

Keywords: Neartic, *Pimpla*, taxonomy

INTRODUCTION

The genus *Pimpla* is a relatively large ichneumonoid genus that includes 203 species worldwide. Members of this genus include 36 species in the Eastern Palaearctic region. A total of 25 species have been recorded from China and Russia, 16 species have been recorded from Japan (Yu et al., 2012). A taxonomic study of Korean *Pimpla* was initiated by Uchida (1928), who reported four species, *P. alboannulata* Uchida, *P. disparis* Viereck, *P. luctuosa* Smith and *P. pluto* Ashmead. Uchida (1955) recorded *P. aethiops* Curtis, while Kim (1955) recorded two species, *P. rufipes* (Miller) and *P. turionellae* (Linnaeus), and Townes et al. (1965) recorded *P. nipponica* Uchida from Korea. For the next 50 years, the Korean fauna received very little attention, and the existing Korean genus *Pimpla* only includes eight species. Most species of this genus are endoparasitoids of Lepidoptera larvae or pupae (Momoi, 1977), but some are parasites of larvae or pupae of Coleoptera, Diptera and Hymenoptera. Oviposition occurs in the larvae, prepupae and pupae of the host (Iwata, 1966). Parasitoids are important to the control of reproduction of injurious insects. There are many examples of insect pest outbreaks that have been suppressed by ichneumonid species, suggesting that they can be used to control pests (Bartlett et al., 1978). For example, *Pimpla* is a typical natural enemy of

Lymantria dispar, which is in Lymantriinae, a subfamily of Erebidae (Burgess, 1924). Furthermore, *P. disparis* Viereck is known as a typical natural enemy of *Ivela auripes* (Butler), which is also in Erebidae (Choi et al., 2015). In this study, we report four unrecorded species, *P. albociliata* Kasparyan, *P. femorella* Kasparyan, *P. kaszabi* (Momoi), and *P. melanacrias* Perkins. We also provide diagnoses, illustrations and a key to the Korean *Pimpla* species.

MATERIALS AND METHODS

Materials used in this study were collected by insect net sweeping and Malaise traps, after which they were deposited in the animal systematic laboratory of Yeungnam University (YNU, Gyeongsan, Korea). Specimens were examined using an AxioCam MRc5 camera attached to a stereo microscope (Zeiss Stereo Discovery, V20; Carl Zeiss, Göttingen, Germany). Illustrations were acquired using the AxioVision SE64 software (Carl Zeiss) and optimized with a Delta imaging system (i-solution; IMT i-Solution Inc., Vancouver, Canada). The morphological terminology mostly follows that of Townes (1969).

The abbreviations used in this study are as follows: TS, type species; TD, type depository; HU, Hokkaido Univer-

sity, Faculty of Agriculture, Entomological Institute, Sapporo, Japan; IZU, Instytut Zoologiczny Uniwersytetu, Siemkiewicza 21, Wrocław, Poland (Gravenhorst collection); LS, Linnaean Society, Burlington House, Picadilly, London, England, United Kingdom; NHM, The Natural History Museum, Department of Entomology, Cromwell Road, London, SW7 5BD, United Kingdom; NM, Naturwissenschaftliche Sammlungen der Stadt Krefeld, Brempter Hof, D-47829 Krefeld-Uerdingen, Germany; NMHS, Naturhistorisches Museum, Heidecksburg, Schlossbezirk 1, D-07407 Rudolstadt, Germany (O. Schmiedeknecht collection); NMV, National Museum of Victoria, Russel St., Melbourne, Victoria, Australia; USNM, United States National Museum of Natural History, Smithsonian Institute, Washington, D.C., 20560, USA; UU, Uppsala Universitet, Zoologiska Institutionen, Entomologiska Avdelningen, Villavägen 9, S-75236 Uppsala, Sweden (Thunberg collection); UZM, Universitets Zoologiske Museum, Universitetsparken 15, Copenhagen, Denmark; TMA, Termesztudományi Múzeum Allattara, Barossa-Utea 13, Budapest H-1088, Hungary; ZI, Zoologiska Institutionen, Helgonavägen 3, S-223 62 Lund, Sweden; ZM, Zoologisches Museum (Museum für Naturkunde), Humboldt Universität, Invalidenstrasse 43, D-101115 Berlin, Germany; GW, Gangwondo; GG, Gyeonggi-do; CB, Chungcheongbuk-do; CN, Chungcheongnam-do; GB, Gyeongsangbuk-do; GN, Gyeongsangnam-do; JB, Jeollabuk-do; JN, Jeollanam-do; JJ, Jeju-do.

SYSTEMATIC ACCOUNTS

Order Hymenoptera Linnaeus, 1758
 Family Ichneumonidae Latreille, 1802
 Subfamily Pimplinae Wesmael, 1845
¹*Tribe Pimplini Wesmael, 1845

²*Genus *Pimpla* Fabricius, 1804

Closterocerus Hartig, 1847: 15–19. TS: *Closterocerus sericeus* Hartig.

Dolichomitus Smith, 1877: 411. TS: *Dolichomitus longicauda* Smith.

Coccygomimus Saussure, 1892: 1–590. TS: *Coccygomimus madecassus* Saussure.

Habropimpla Cameron, 1900: 96. TS: *Habropimpla bilineata* Cameron.

Lissotheronia Cameron, 1905: 139. TS: *Lissotheronia flavipes* Cameron.

Phytodiaetoides Morley, 1913: 221. TS: *Phytodiaetoides*

megaera Morley.

Diclosterocerus Viereck, 1914: 45. TS: *Closterocerus sericeus* Hartig.

Pimplidea Viereck, 1914: 117. TS: *Pimpla pedalis* Cresson.

Coelopimpla Brèthes, 1916: 402. TS: *Coelopimpla amadeoi* Brèthes.

Dihyboplax Enderlein, 1919: 148. TS: *Dihyboplax flavipennis* Enderlein.

Liotheronia Enderlein, 1919: 147. TS: *Liotheronia kriegeri* Enderlein.

Exeristoidea Viereck, 1924: 202. TS: *Ichneumon watsoni* Viereck.

Neogabunia Brèthes, 1927: 322. TS: *Neogabunia paulistana* Brèthes.

Opodactyla Seyrig, 1932: 60. TS: *Pimpla waterloti* Seyrig.

Oxypimpla Noskiewicz & Chudoba, 1951: 42, 56. TS: *Ichneumon turionellae* Linnaeus.

Jamaicapimpla Mason, 1975: 225. TS: *Ephialtes nigroaeneus* Cushman.

Diagnosis. Clypeus separated from face by suture, with strong transverse basal ridge and flattened apical area. Fore wing with areolet closed and 2-RS longer than sections of M between 2-RS and 2m-cu. 1st metasomal tergite usually stout, with glymma and spiracle before middle. At least, ovipositor as long as hind tibia, frequently shorter, without dorsal subapical notch.

Key to species of the genus *Pimpla* from Korea (modified from Kasparyan and Khalaim, 2007)

1. Hind coxa or femur reddish brown, if black, hind tibia usually with white band 2
 – Hind leg completely black, sometimes apex of trochanter and base of femur reddish brown 14
2. Face and propodeum with black or brown hairs. Hind tibia entirely reddish brown without white band. Apical area of hind femur not darkened. Mesopleuron usually densely punctate, diameter of puncture relatively large. Coxa black to reddish black (except *P. arctica* Zetterstedt) *P. rufipes* Miller
 – Face and propodeum with white or rarely yellowish hairs. Hind tibia usually black, with white band, except *P. disparis*. Mesopleuron often finely and sparsely punctate, or impunctate. Coxa often reddish brown 3
3. Hind leg black, excluding white trochanter, band of tibia and sometimes base of femur reddish brown
 *P. alboannulata* Uchida
 – At least, hind coxa or femur reddish brown 4
4. Mesopleuron usually densely punctate. Distance from

Korean name: ¹*납작맷시벌족, ²*훗카이도오납작맷시벌속

- lateral ocellus to compound eye shorter than 0.7 of diameter of ocellus. 6th–7th antennal flagellomeres of male with tyloid 5
- Mesopleuron usually distinctly and sparsely punctate. Distance from lateral ocellus to compound eye usually longer than 0.75 of the diameter of the ocellus. Antennal flagellomere of male usually without tyloid (Fig. 3C). Length of 1st and 2nd flagellomeres in female equal to or longer than longitudinal diameter of eye 6
5. Hind tibia rarely entirely reddish brown, with white band or mark at mid area. Basal edge of pronotum (before tegula) with yellowish white mark. In female, metasomal tergite polished, distinctly punctate *P. turionellae* (Linnaeus)
- Hind tibia black or dark brown, without white band. Basal edge of pronotum yellow or black; area between basal edge of pronotum and tegula usually yellow *P. disparis* Viereck
6. Female 7
- Male 8
7. Epipleuron of 2nd–3rd metasomal tergites narrow, at least, length 3 times longer than width (Fig. 2E). Coxa reddish brown; at least, hind coxa with red mark *P. femorella* Kasparyan
- Epipleuron of 2nd metasomal tergite wide, its length usually 2 times shorter than width; length of epipleuron of 3rd metasomal tergite 1.5–2.0 times longer than width (Fig. 4G). Coxa black; sometimes apical 0.2 area of hind femur darkened 12
8. Coxa reddish brown. Apical 0.1–0.2 area of femur darkened 9
- Coxa black. Apical area of femur usually not darkened 11
9. 6th–7th antennal flagellomeres with tyloid (Fig. 4B, C) *P. melanacrias* Perkins
- Antennal flagellomere without tyloid (Fig. 3C) 10
10. Entire area of face, with dense hairs (Fig. 2B). Ventral mid and apical area of scape yellow (Fig. 2B). Scutellum with yellow mark (Fig. 2C) *P. femorella* Kasparyan
- Each side area of face, with relatively dense hairs (Fig. 3B). Scape entirely reddish black (Fig. 3B). Scutellum entirely black (Fig. 3D) *P. kaszabi* (Momoi)
11. Apical upper area of hind femur darkened (Fig. 1A) *P. albociliata* Kasparyan
- Hind femur entirely reddish brown *P. nipponica* Uchida
12. Lower lateral area of 2nd–4th metasomal tergites with reddish brown mark (Fig. 4F) *P. melanacrias* Perkins
- Lateral area of 2nd–4th metasomal tergites entirely black 13
13. Tegula darkened. Coxae black, except apical reddish brown mark *P. nipponica* Uchida
- Tegula whitish yellow. Coxae entirely reddish brown *P. kaszabi* (Momoi)
14. Female 15
- Male 17
15. Metasomal tergite densely punctate; apical margin of metasomal tergite matt. Mesopleuron densely punctate; diameter of puncture relatively large; mesh sculpture shaped; distance between punctures shorter than 0.5 of their diameter. 1st metasomal tergite convex, without two distinct protuberances at mid area *P. aethiops* Curtis
- Metasomal tergite densely punctate; apical margin of metasomal tergite polished. Mesopleuron less densely punctate; distance between punctures often equal to 0.5 of their diameter. 1st metasomal tergite often with two distinct protuberances at mid area 16
16. Basal axillary plate of fore wing entirely yellow. Mesopleural suture below level of mesopleural depression with 12–13 transverse carina. Hind tibia with indistinct red mark between basal and mid area. Hairs on face and propodeum usually white or yellowish white, rarely brown *P. luctuosa* Smith
- Upper area of basal axillary plate of fore wing dark. Mesopleural suture below level of mesopleural depression with 15–20 transverse carina. Hind tibia black. Hairs on face and propodeum black or brown *P. pluto* Ashmead
17. Only 6th–7th antennal flagellomeres with tyloids. Basal area of fore wing dark brown. Hairs whitish *P. pluto* Ashmead
- At least, 6th–9th antennal flagellomeres with tyloids 18
18. Tegula entirely yellow. Scutellum with yellow mark. Hairs whitish or brown *P. luctuosa* Smith
- At least, Upper half of tegula brown. Scutellum usually black. Hairs brown *P. aethiops* Curtis

¹**Pimpla albociliata* Kasparyan, 1974 (Fig. 1)

Pimpla albociliata Kasparyan, 1974b: 382–403. Type: ♂; TD: ZI.

Material examined. Korea: GB: 1 ♂, Gyeongsan-si, Daedong, Yeungnam Univ., 26 Jun 1996, Kwon OS.

Diagnosis. Fore leg reddish brown except basal area of coxa black; apical area of coxa with whitish mark. Hind trochanter, hind trochantellus, basal and mid area of hind femur,

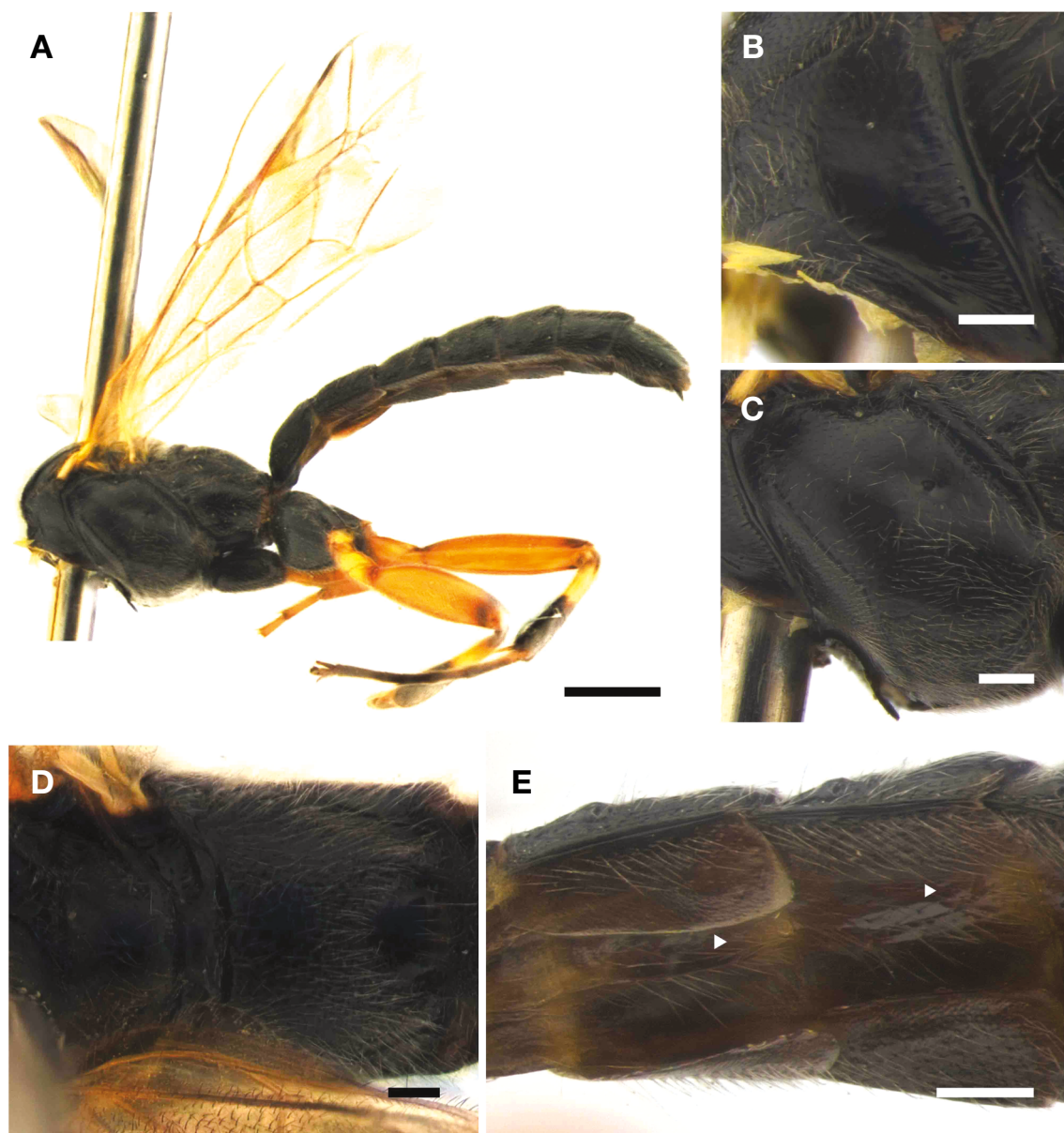


Fig. 1. A–E, *Pimpla albociliata* Kasparyan, 1974. A, Habitus of male in lateral view; B, Pronotum of male in lateral view; C, Mesopleuron of male in lateral view; D, Sculletum to propodeum of male in dorsal view; E, 2nd–3rd epipleuron of male in ventral view (area indicated by triangle shaped mark). Scale bars: A, B=1 mm, C–E=0.2 mm.

entire apical spur of hind tibia and basal half area of 1st hind tarsomere reddish brown; hind tibia with whitish yellow median band. Pronotum entirely polished, sparsely punctate, with sparse hairs; median apical area of pronotum smooth; lower apical area of pronotum with transverse wrinkle; epomia entirely indistinct (Fig. 1B). Hind wing without basal hamulus with eight distal hamuli.

Distribution. Korea (new record), China, Russia.

Region. Eastern Palaearctic.

Host. Unknown.

¹**Pimpla femorella* Kasparyan, 1974 (Fig. 2)

Pimpla femorella Kasparyan, 1974b: 382–403. Type: ♀; TD: ZI.

Material examined. Korea: GW: 1 ♀, Inje-gun, Girin-

Korean name: ¹*좁은납작맷시벌 (신칭)

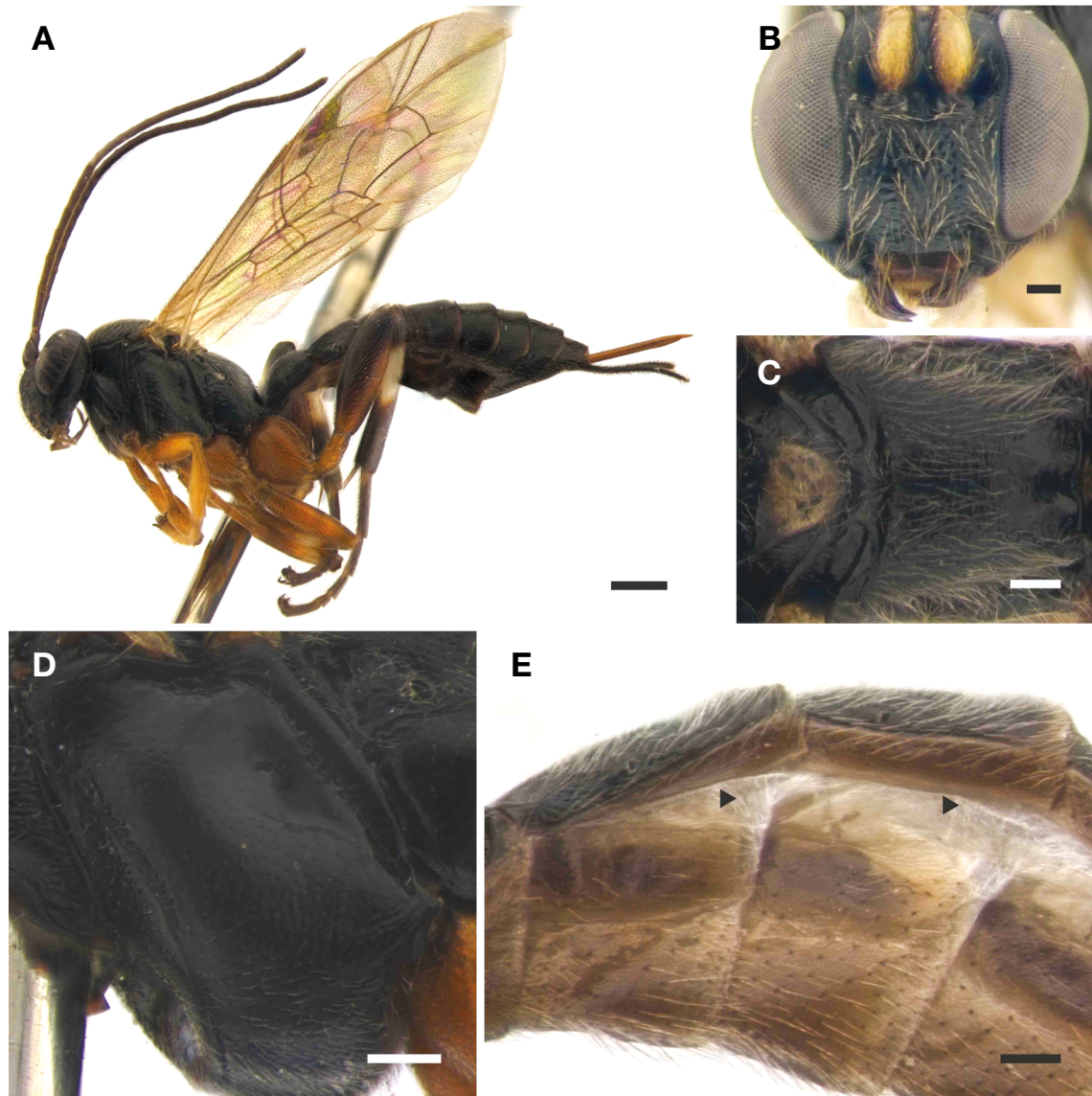


Fig. 2. A-E, *Pimpla femorella* Kasparyan, 1974. A, Habitus of female in lateral view; B, Face of male in frontal view; C, Scutellum to propodeum of male in dorsal view; D, Mesopleuron of female in lateral view; E, 2nd-3rd epipleuron of female in ventral view (area indicated by triangle shaped mark). Scale bars: A=1 mm, B-E=0.2 mm.

myeon, Bangdong-ri, Mt. Bangtaesan, Daegol, 15 Aug 1995, Ryu SM; 1 ♀, Inje-gun, Sangnam-myeon, Misan-ri, Mt. Bangdaesan, Hannidong, 24 Jun 1996, Lee JW; 1 ♀, Taebaek-si, Cheolam1-dong, 15 May 1992, Choi SJ; 1 ♀, Wonju-si, Panbu-myeon, Mt. Baekunsan, 37°16'22.87"N, 127°55'58.65"E, 19 Jun-5 Jul 2011, Lee JW; CB: 1 ♀, Danyang-gun, Danyang-eup, Cheondong-ri, Mt. Sobaeksan, Cheondong, 13 May 1994, Yeo HD; 1 ♀, Danyang-gun, Gagok-myeon, Eoeuigok-ri, Mt. Sobaeksan, Birobong, 12 May 1994, Lee HD; 1 ♀, Danyang-gun, Gagok-myeon, Mt. Sobaeksan, 30 Jul 1988, Lee JW; GB: 1 ♂, Gunwi-gun, Bugye-

eup, Dongsan-ri, San 75, 36°01'29.04"N, 128°41'31.11"E, 26 Sep-3 Nov 2014, Lee JW; 1 ♂, Gyeongsan-si, Dae-dong, Yeungnam Univ., 6 Jun 1996, Yang JD; GN: 1 ♂, Sancheong-gun, Sicheon-myeon, Jungsan-ri, Mt. Jirisan, Sunduryu, 26 Jun 1989; 1 ♂, ditto, 35°16'29.75"N, 127°33'57.57"E, 18 Jul-12 Oct 2011, Jeong JC; Gwangju: 1 ♀, Dong-gu, Jisan-dong, Mt. Mudeungsan, 16 Aug 1990; JN: 1 ♂, Gurye-gun, Gurye-eup, Mt. Jirisan, Nogodan, 35°17'47.11"N, 127°31'36.48"E, 20 May-10 Oct 2011, Jeong JC. **Additional material examined.** Russia: 1 ♀, Khabarovsk kray, Bychicha, 20 Aug 1970, Kasparyan DR; 1 ♂, from

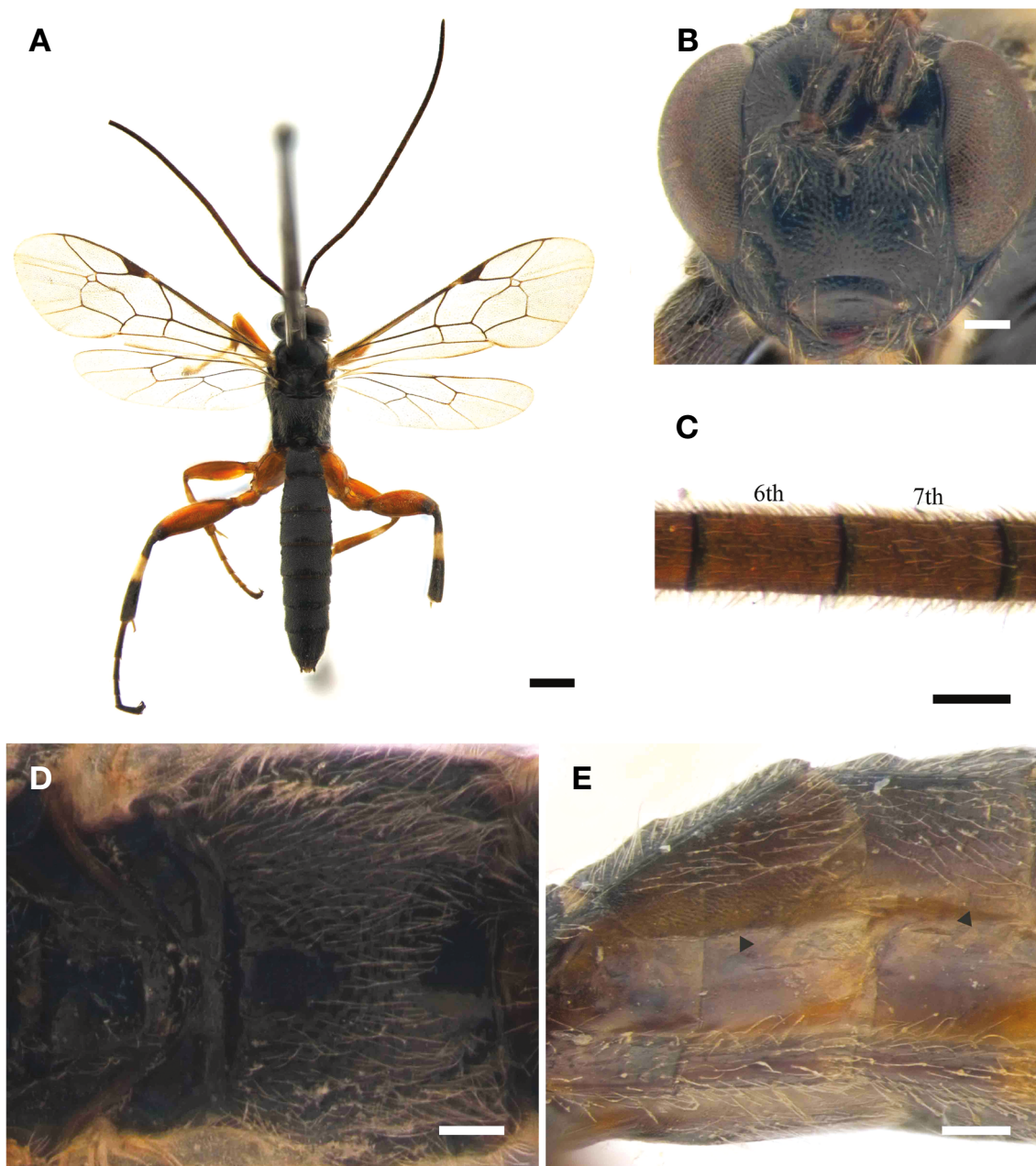


Fig. 3. A–E, *Pimpla kaszabi* (Momi, 1973). A, Habitus of male in dorsal view; B, Face of male in frontal view; C, 6th–7th antennal flagellomeres of male in lateral view; D, Scutellum to propodeum of male in dorsal view; E, 2nd–3rd epipleuron of female in ventral view (area indicated by triangle shaped mark). Scale bars: A=1 mm, B–E=0.2 mm.

Kudara-Somon bur (13 km), Dungaj, 9 Aug 1970, Kasparyan.
Diagnosis. Hind coxa, hind trochanter, hind trochantellus and basal area of hind femur reddish brown; basal median band of hind tibia whitish yellow (Fig. 2B). Pronotum entirely polished; upper area of pronotum sparsely punctate, with sparse hairs; basal lower and mid area of pronotum rugose; apical lower area of pronotum smooth; epomia

entirely distinct. Metapleuron weakly polished, smooth, except basal upper area sparsely punctate, with sparse hairs; apical upper area with wrinkle. Hind wing with a basal hamulus and nine distal hamuli.

Distribution. Korea (new record), Russia.

Region. Eastern Palearctic.

Host. Unknown.

¹**Pimpla kaszabi* (Momoi, 1973) (Fig. 3)

Coccygomimus kaszabi Momoi, 1973: 219–239. Type: ♀; TD: TMA.

Pimpla confinis Kasparyan, 1974a: 250–258. Type: ♀; TD: ZI.

Material examined. Korea: GG: 1 ♀, Pocheon-si, Soheul-eup, Jikdong-ri, Korea Nat'l Arboretum, Gwangreung Forest, Alt. 123 m, 37°45'22"N, 127°9'48.9"E, 16–30 Jun 2012, Park SY, Lim JO, Lim JS; GN: 1 ♀, Namhae-gun, Samdong-myeon, Bonghwa-ri, Namhae Butterfly Park, Alt. 198 m, 34°45'26.91"N, 128°0'40.2"E, 16–30 Jun 2012, Kang TG; 1 ♂, Sacheon-si, Gonmyeong-myeon, Yongsan-ri, 29 Apr 1989, Lee JW; Ulsan: 1 ♂, Ulju-gun, Sangbuk-myeon, Mt. Gajisan, 15 Apr 1989, Seo GW.

Diagnosis. Fore leg reddish brown, except coxa black. Hind coxa, basal and apical area of hind tibia, apical area of hind 1st tarsomere, 2nd–5th hind tarsomeres and apical area of hind tarsal claw black; basal area of hind tibia with whitish band of tibia. Pronotum entirely polished; upper area of pronotum sparsely punctate, with sparse hairs; lower and apical area of pronotum with wrinkle; epomia entirely distinct. Propodeum densely punctate, with dense hairs, except median upper and lower area smooth; lateral-median longitudinal carina indistinct, extending to basal area (Fig. 3D). Hind wing with a basal hamulus and seven distal hamuli.

Distribution. Korea (new record), Mongolia, Russia.

Region. Eastern Palaearctic.

Host. Unknown.

²**Pimpla melanacrius* Perkins, 1941 (Fig. 4)

Pimpla geniculata Hensch, 1929: 123–153. Type: ♀; TD: IZB.

Pimpla melanacrius Perkins, 1941: 645. New name for secondary homonym, *Pimpla geniculata* (Hensch, 1929).

Material examined. Korea: Seoul: 1 ♂, Yangcheon-gu, Mok-dong, 23 Nov 1983, Lee JW; GB: 1 ♀, Gyeongsan-si, Dae-dong, Yeungnam Univ., 21 May 1987, Seo GI.

Diagnosis. Antenna with 29–30 flagellomeres. Hind leg reddish brown except apical area of femur, basal and apical area of tibia black; mid area of hind tibia with whitish band. Pronotum entirely polished; upper area of pronotum sparsely punctate, with sparse hairs; lower area of pronotum with striate obliquely; epomia entirely indistinct. Propodeum densely punctate, with dense hairs; median upper area of propodeum sparsely punctate, with sparse hairs; lower median area of propodeum with wrinkle (Fig. 4D). Hind wing with a basal hamulus and eight distal hamuli.

Distribution. Korea (new record), Armenia, Austria, Europe, Georgia, Kazakhstan, Kyrgyzstan, Mongolia, Russia, Ukraine.

Region. Eastern Palaearctic, Western Palaearctic.

Host. [Lepidoptera] Tortricidae: *Acleris* sp. (Shaw, 2006).

³**Pimpla aethiops* Curtis, 1828

Pimpla aethiops Curtis, 1828: 214. Type: ♀; TD: NMV.

Pimpla aterrima Gravenhorst, 1829: 215. Type: ♀; TD: IZU.

Pimpla parnarae Viereck, 1912: 575–593. Type: ♀; TD: USNM.

Material examined. Korea: GW: 2 ♂♂, Hongcheon-gun, Bukbang-myeon, Environment Research Park, 37°45'15.6"N, 127°51'1.7"E, 1–16 May 2013, Jang SJ; GG: 2 ♂♂, Namyangju-si, Choan-myeon, Songchon-ri, Mt. Ungilsan, Alt. 99 m, 37°34'43.2"N, 127°18'40.1"E, 27 May–10 Jun 2009, Lim JO; 1 ♂, Osan-si, Geumam-dong, Mulhyanggi Arboretum, Alt. 38 m, 37°10'3.1"N, 127°3'24.2"E, 30 Aug–16 Sep 2013, Kwon YD, Ji YM; CB: 1 ♀, Cheongju-si, Seowon-gu, Chungdae-ro, Chungbuk National Univ., 4 Nov 1999, Kyeong KW; GB: 1 ♀, Yeongcheon-si, Cheongtong-myeon, Chiil-ri, San 25-1, 35°59'31.48"N, 127°45'13.92"E, 23 Oct 2014, Kang GW; JN: 1 ♂, Gurye-gun, Masan-myeon, Hwangjeon-ri, Hwaem valley, 35°15'32.08"N, 127°29'55.67"E, 20 May 2011, Jeong JC; JJ: 2 ♀♀, Seogui-po-si, Topyeong-myeon, San 15-1, Mt. Hanrasan, Baekrokdam, 5 Jun 1968, Yoon UH; 1 ♂, Unknown.

Diagnosis. Antenna with 30–35 flagellomeres. Entire fore coxa, fore trochanter, lower and basal area of fore trochantellus, outer and basal inner area of fore femur and apical area of fore tarsal claw black; apical upper area of fore trochantellus and basal outer area of fore femur reddish black; apical and mid inner area of fore femur and inner area of fore tibia yellowish brown. Mid leg entirely black. Hind leg black, except basal area of tarsal claw reddish brown. Pronotum weakly polished, densely punctate, with dense hairs; lower basal area of pronotum distinctly rugose; lower apical area of pronotum smooth. Epomia distinct. Thyridium elongated.

Distribution. Korea, Austria, China, Europe, Japan, Russia.

Region. Eastern Palaearctic, Western Palaearctic.

Host. [Lepidoptera] Erebidae: *Hyphandria cunea* (Yang et al., 2006, 2008); Geometridae: *Abraxas suspecta* (Wang, 2009); Hesperidae: *Parnara guttata* (Chen et al., 2009); Lasiocampidae: *Dendrolimus punctatus* (Chai et al., 2000), *Dendrolimus spectabilis* (Chen et al., 2009); Papilionidae: *Papilio machaon* (Shaw et al., 2009); Psychidae: *Cryptothelea minuscula* (Chen et al., 2009); Tortricidae: *Homona*

Korean name: ¹*넓은납작맷시벌 (신칭), ²*무늬납작맷시벌 (신칭), ³*민꼬리납작맷시벌

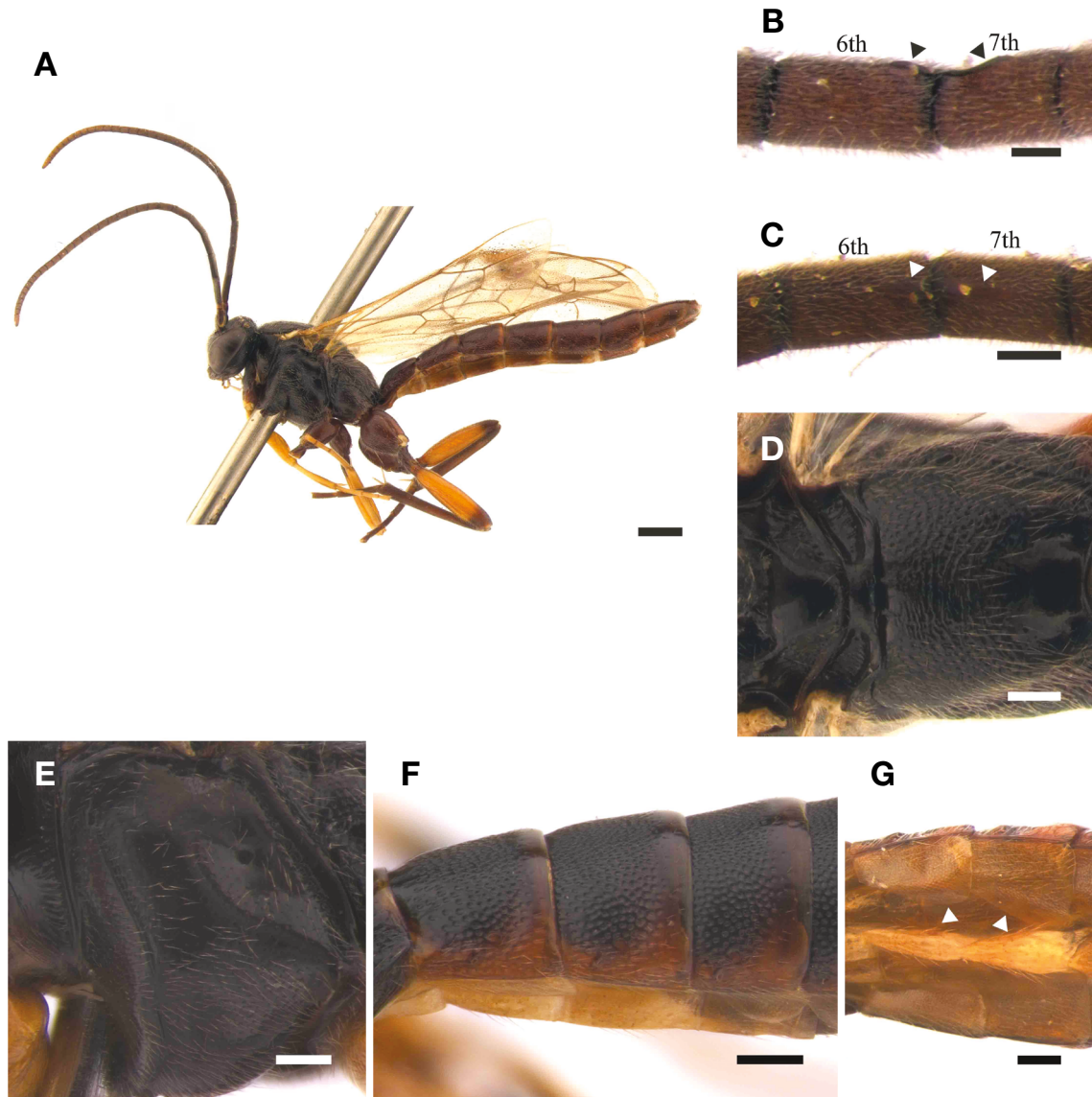


Fig. 4. A-G, *Pimpla melanacrias* Perkins, 1941. A, Habitus of male in lateral view; B, 6th-7th antennal flagellomeres of male in dorsal view (area indicated by triangle shaped mark); C, 6th-7th antennal flagellomeres of male in lateral view (area indicated by triangle shaped mark); D, Scutellum to propodeum of male in dorsal view; E, Mesopleuron of female in lateral view; F, 2nd-4th metasomal tergites of female in lateral view; G, 2nd-3th epipleuron of female in ventral view (area indicated by triangle shaped mark). Scale bars: A=1 mm, B-G=0.2 mm.

coffearia (Chen et al., 2009), *Zeiraphera griseana* (Sheng and Sun, 2010).

¹**Pimpla alboannulata* Uchida, 1928

Pimpla alboannulata Uchida, 1928: 46. Type: ♂; TD: HU.

Material examined. Data describing specimens used for morphological study are summarized in Tables 1 and 2 to

describe seasonal and regional appearance progress of species (Including 33 ♂♂ and 86 ♀♀ specimens).

Diagnosis. Antenna with 29-32 flagellomeres. Outer basal area of fore femur and basal area of fore tarsal claw reddish brown; inner mid and apical area of fore femur, inner area of fore tibia and basal mark of outer area of fore tibia whitish brown; apical outer area of fore tibia and fore tarsomeres dark brown. Mid trochanter, basal area of mid trochantellus

Korean name: ¹*흰무늬꼬리납작뱀시벌

and apical median band of mid tibia whitish yellow; entire 1st–2nd mid tarsomeres, ventral area of 3rd–4th mid tarsomeres and 5th mid tarsomere, basal area of mid tarsal claw dark brown; dorso-basal area of 3rd–4th mid tarsomeres yellowish brown. Hind trochanter, basal area of hind trochantellus and apical median band of hind tibia whitish yellow; 1st–2nd hind tarsomeres, ventral and lateral area of 3rd–5th hind tarsomeres dark brown; dorsal area of 3rd–5th hind tarsomeres reddish black; basal lateral area of hind tarsal claw reddish brown. Pronotum weakly polished, upper and apical area of pronotum densely punctate, with dense hairs; mid, lower and basal area of pronotum distinctly rugose. Epomia distinct, extending to mid area.

Distribution. Korea, China, Japan, Russia.

Region. Eastern Palaearctic, Oriental.

Remarks. We also observed a type specimen from HU, Japan.

Host. Unknown.

¹**Pimpla disparis* Viereck, 1911

Pimpla porthetriae Viereck, 1911: 480. Type: ♂; TD: USNM.

Pimpla (Pimpla) disparis Viereck, 1911: 480. Type: ♀; TD: USNM.

Material examined. Data describing specimens used for morphological study are summarized in Tables 1 and 2 to describe seasonal and regional appearance progress of species (Including 42 ♂♂ and 136 ♀♀ specimens).

Diagnosis. Antenna with 28–34 flagellomeres. Fore leg red-

dish brown, except entire coxa, trochanter and basal and mid area of trochantellus black. Mid coxa, mid trochanter, mid trochantellus, basal area of mid tibia, apical area of 5th mid tarsomere and entire mid tarsal claw black. Hind leg black, except basal and mid area of femur reddish brown. Pronotum weakly polished, upper, apical and basal mid area of pronotum densely punctate, with dense hairs; mid area of pronotum distinctly rugose; lower area of pronotum smooth. Metapleuron polished, densely punctate, with dense hairs; lower half of metapleuron with obliquely distinct wrinkle.

Distribution. Korea, Canada, China, India, Japan, Mongolia, Russia, United States.

Region. Eastern Palaearctic, Oriental, Nearctic.

Host. [Lepidoptera] Erebiidae: *Hyphandria cunea* (Yang et al., 2006, 2008), *Ivela auripes* (Choi et al., 2015), *Lymantria dispar* (Hastings et al., 2002), *Teia antiquiodes* (Li et al., 2009); Lasiocampidae: *Dendrolimus punctatus* (Chai et al., 2000); Psychidae: *Thyridopteryx ephemeraeformis* (Ellis et al., 2005); Pyralidae: *Dioryctria pryeri* (Sheng and Sun, 2010), *Dioryctria rubella* (Sheng and Sun, 2010), *Zeiraphera griseana* (Sheng and Sun, 2010); Yponomeutidae: *Yponomeuta malinella* (Lee and Pemberton, 2005).

²**Pimpla luctuosa* Smith, 1874

Pimpla luctuosa Smith, 1874: 394. Type: ♀, TD: NHM.

Apechthis bombyces Matsumura, 1912: 1–247. Type: ♀, TD: HU.

Pimpla neustriiae Uchida, 1928: 44. Type: ♂, TD: HU.

Material examined. Data describing specimens used for

Table 1. Material examined of *Pimpla alboannulata*, *P. disparis*, *P. luctuosa* and *P. pluto* (location)

	GG	GW	CB	CN	GB	GN	JB	JN	JJ	Seoul	Incheon	Daejeon	Daegu	Ulsan	Total
	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀
<i>P. alboannulata</i>	2/21	9/15	1/2	0/1	8/20	6/10	2/4	2/2	0/0	0/6	0/0	1/1	2/3	0/1	33/86
<i>P. disparis</i>	28/52	0/2	0/0	2/4	0/2	0/1	0/0	0/1	0/0	16/68	0/0	0/1	0/1	0/0	42/136
<i>P. luctuosa</i>	29/44	6/15	11/11	3/6	60/54	19/8	13/5	2/3	0/3	32/36	1/1	6/9	0/1	1/0	183/207
<i>P. pluto</i>	2/7	7/4	6/3	0/0	5/10	10/6	5/5	14/7	1/1	0/0	0/0	0/0	0/1	0/2	50/46

GG, Gyeonggi-do; GW, Gangwon-do; CB, Chungcheongbuk-do; CN, Chungcheongnam-do; GB, Gyeongsangbuk-do; GN, Gyeongsangnam-do; JB, Jeollabuk-do; JN, Jeollanam-do; JJ, Jeju-do.

Table 2. Material examined of *Pimpla alboannulata*, *P. disparis*, *P. luctuosa* and *P. pluto* (date of collection)

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀	♂/♀
<i>P. alboannulata</i>	0/1	0/0	0/0	4/2	10/25	6/22	2/9	5/7	6/19	0/0	0/1	0/0	33/86
<i>P. disparis</i>	0/1	0/0	1/35	0/2	1/8	0/2	1/2	0/2	0/1	0/7	39/76	2/3	42/136
<i>P. luctuosa</i>	0/0	0/0	0/2	10/7	73/80	34/64	48/15	4/15	8/7	5/16	1/0	0/1	183/207
<i>P. pluto</i>	1/2	1/0	0/0	2/2	12/10	3/12	17/9	2/4	0/0	12/5	0/2	0/0	50/46

Korean name: ¹*나방살이납작맷시벌, ²*검정마디꼬리납작맷시벌

morphological study are summarized in Tables 1 and 2 to describe seasonal and regional appearance progress of species (Including 183 ♂♂ and 207 ♀♀ specimens).

Diagnosis. Antenna with 32–35 flagellomeres. Inner mid and apical area of fore femur, inner area of fore tibia and lower basal area of 1st fore tarsomere brown; apical area of fore trochantellus, basal area of fore femur, outer area of fore tibia, entire 5th fore tarsomere and basal area of fore tarsal claw reddish brown; upper, lower mid and apical area of 1st fore tarsomere and 2nd–4th fore tarsomeres reddish black. Mid leg black except basal area of femur and lower area of 5th tarsomere reddish black. Hind leg black except apical area of trochantellus, basal area of femur and lower basal area of tarsal claw reddish black. Metapleuron weakly polished, distinctly rugose, except upper basal area of metapleuron distinctly reticulate. Propodeum polished, reticulate, except each edge side area of propodeum densely punctate, with dense hairs.

Distribution. Korea, China, Japan, Russia.

Region. Eastern Palaearctic, Oriental.

Host. [Lepidoptera] Lasiocampidae: *Dendrolimus punctatus* (Chai et al., 2000).

¹**Pimpla nipponica* Uchida, 1928

Pimpla supria nipponica Uchida, 1928: 45. Type: ♀, TD: HU.

Material examined. Korea: GW: 3 ♀♀, Goseong-gun, Ganseong-eup, Geonbongsa Temple, 22 May 1992, Lee JW; 1 ♀, Goseong-gun, Ganseong-eup, Heul-ri, Jinburyeong, 13 May 1993, Ryu SM; 1 ♀, Sokcho-si, Seolak-dong, Mt. Seolaksan, Gongryong neungseon, 18 Aug 1987, Cha JY; GG: 1 ♀, Bogwangsa Temple, 28 May 1978, Han CS; 1 ♀, Gunpo-si, Dundae-dong, 28 May 1999, Seo JY; 1 ♀, Namyangju-si, Gapyeong-gun, Sudong-myeon, Sang-ri, Mt. Chukryeongsan, 19 Oct 1980, Jang GS; 1 ♀, Osan-si, Geumam-dong, Mulhyanggi Arboretum, (Alt. 38 m), 37°10'3.1"N, 127°3'24.2"E, 30 Aug–16 Sep 2013, Kwon YD et al; 1 ♀, Pocheon-si, Soheul-eup, Jikdong-ri, Korea Nat'l Arboretum, Gwangreung forest, (M.T.II), (Alt. 123 m), 37°45'22"N, 127°9'48.9"E, 16–30 Sep 2013, Park et al; CB: 1 ♂, Asan-si, Yeomchi-eup, Seowon1-ri, 36°49'48.7"N, 126°57'21.7"E, (Alt. 21 m), 19 May 2006, Lee HS; 1 ♀, Danyang-gun, Gagok-myeon, Eoeuigok-ri, Mt. Sobaeksan, Pirobong, 18 Aug 1994, Kim JI; 1 ♀, Okcheon-gun, Gunbuk-myeon, Sojeong-ri, 23 Oct 1999, Kim JI; CN: 1 ♀, Cheonan-si, 31 Nov 1983, Lee JW; GB: 1 ♀, Gunwi-gun, Bugye-myeon, Dongsan-ri, San73, Mt. Palgongsan, 2 Jul 1982, Kwon YJ; 1 ♂, ditto, 22 Apr 1980, Kwon YJ; 1 ♀, Gyeongju-si, Inwang-dong,

Banwolseong, 31 May 1991, Lee KH; 1 ♀, Gyeongsan-si, Dae-dong, Yeungnam Univ., 1 May 1992, Lee MG; 1 ♀, ditto, 12 Jul 1986, Choi IM; 1 ♀, ditto, 13 May 1989, Ju CH; 1 ♂, ditto, 15 Apr 1988, Cha JY; 1 ♂, ditto, 19 Apr 1991, Kim ES; 2 ♂♂ 1 ♀, ditto, 19 Apr 1991, Kim JG; 1 ♀, ditto, 19 Apr 1991, Kim YS; 1 ♂, ditto, 2 May 1990, Lee JH; 1 ♀, ditto, 2 Jun 1997, Park HG; 1 ♀, ditto, 2 Jun 1997, Joe MR; 1 ♀, ditto, 24 May 1995, Choi HR; 1 ♀, ditto, 24 Jun 1994, Kim HM; 2 ♂♂, ditto, 26 Apr 1991, Kwon OS; 2 ♂♂, ditto, 26 Apr 1991, Kim YS; 1 ♀, ditto, 27 May 1991, Jeong DG; 1 ♂, ditto, 29 Apr 1991, Kang HJ; 1 ♂, ditto, 3 May 1988, Kim HG; 3 ♀♀, ditto, 3 Jul 1986, Lee JW; 1 ♂, ditto, 30 Aug 1988; 1 ♂, ditto, 4 Dec 1987, Choi WY; 1 ♂, ditto, 8 Apr 1987; 1 ♂, ditto, 8 May 1989, Cha JY; 5 ♀♀, ditto, 35°53'N, 128°47'E, (M.T.), 17–24 Apr 2009, Lee JW; 1 ♀, ditto, 8–15 May 2009, Lee JW; 1 ♀, Gyeongsan-si, Gye-yang-dong, 7 Jul 1986, Cha JY; 1 ♂, Kimcheon-si, Apo-eup, 7 Jun 1992, Dong KM; 1 ♀, Uljin-gun, Seo-myeon, Hawon-ri, Bulyeong valley, 10 May 1991, Bae JH; 1 ♀, ditto, 6 May 1991, Han JG; 1 ♀, Ulreung-gun, Seo-myeon, Namyang-ri, Namyang-cheon, 16 Oct 2001, Jeong JC; 1 ♀, Ulreung-gun, Seo-myeon, Taeha-ri, 30 Jul 2001, Jeon YT; 1 ♀, Ulreung-gun, Ulreung-eup, Dodong-ri, 128, Ulreungdo, 8 May 1956; 1 ♀, Ulreung-gun, Ulreung-eup, Jeodong-ri, 2 Aug 1983, Lee JW; Daegu: 1 ♀, Suseong-gu, Beommul-dong, Mt. Daedeoksan, 14 Jul 1998, Lee JW; GN: 1 ♂, Milyang-si, Danjang-myeon, Pyochungsa Temple, 7 Jun 1995, Gwak GH; 2 ♂♂, Hapcheon-gun, Daeyang-myeon, Jeongyang-ri, 18 May 2002, Jeong JC; 1 ♀, Namhae-gun, Sangju-myeon, Sangju-ri, Mt. Geumsan, 2 May 1981, Lee HD; JN: 1 ♂, Gurye-gun, Masan-myeon, Hwangjeon-ri, Hwaem valley, 35°15'32.08"N, 127°29'55.67"E, 20 May 2011, Jeong JC; 1 ♀, Gwangyang-si, Okryong-myeon, Mt. Baekunsan, 12 May 1990, Cha JY; 1 ♀, Hampyeong-gun, Daedong-myeon, Secho-ri, (Alt. 118 m), 35°07'25.6"N, 126°33'12.4"E, 30 Apr 2004, Lim JO; 1 ♀, no data.

Additional material examined. Japan: 1 ♀, Hokkai-do, Sapporo-si, Juo-gu, Maruyama, 20 Oct 1922, Uchida T; USA: 1 ♂, Florida, Gainesville, 11–20 Apr 1991, Lee JW.

Diagnosis. Antenna with 27–30 flagellomeres. Fore leg reddish brown except entire coxa black. Mid leg reddish brown except coxa black; apical area of coxa with reddish brown mark. Hind coxa, basal and apical area of hind trochantellus, basal and apical area of hind tibia, apical area of 1st–4th hind tarsomeres, entire 5th hind tarsomere and entire hind tarsal claw black; apical area of hind coxa and basal ventral mark of 5th hind tarsomere reddish brown. Pronotum weakly polished, upper area of pronotum densely punctate; basal mid area of pronotum relatively sparsely

Korean name: ¹*일본꼬리납작맵시벌

punctate; apical mid and lower area of pronotum distinctly rugose. Epomia relatively indistinct. Metapleuron polished, densely punctate, with dense hairs; upper area of metapleuron indistinctly rugose.

Distribution. Korea, China, Europe, India, Japan, Russia, United States (new record).

Region. Eastern Palaearctic, Nearctic (new record), Oriental, Western Palaearctic.

Host. [Lepidoptera] Noctuidae: *Naranga aenescens* (Chen et al., 2009); Pieridae: *Aporia crataegi* (Chen et al., 2009), *Pieris rapae crucivora* (Chen et al., 2009); Pyralidae: *Dioryctria rubella* (Sun et al., 2006; Sheng and Sun, 2010), *Dioryctria schuetzeella* (Sheng and Sun, 2010).

Remarks. We additionally observed a type specimen from HU, Japan. This species is recorded from United States and the Nearctic region for the first time.

¹**Pimpla pluto* Ashmead, 1906

Pimpla pluto Ashmead, 1906: 178. Type: ♀; TD: USNM.

Material examined. Data describing specimens used for morphological study are summarized in Tables 1 and 2 to describe seasonal and regional appearance progress of species (Including 50♂♂ and 46♀♀ specimens).

Diagnosis. Antenna with 30–33 flagellomeres. Entire fore coxa, fore trochanter, basal area of fore trochantellus, inner subbasal and outer area of fore femur black; outer mid area of fore femur, basal area of fore femur and apical area of fore trochantellus reddish brown; inner mid-apical area of fore femur, inner area of fore tibia yellow. Apical area of mid trochantellus and basal area of mid femur reddish brown; mid coxa, mid trochanter, basal-subapical area of trochantellus, basal-subapical area of mid tibia, apical area of 5th mid tarsomere and mid tarsal claw black. Hind leg black, except apical area of trochantellus and basal area of femur reddish brown. Metapleuron polished, upper and mid area of metapleuron densely punctate, with dense hairs; mid and lower area of metapleuron distinctly rugose. Propodeum weakly polished, densely punctate, with dense hairs, except mid area of propodeum distinctly reticulate.

Distribution. Korea, China, Japan, Kazakhstan, Russia.

Region. Eastern Palaearctic, Oriental.

Host. Unknown.

²**Pimpla rufipes* (Miller, 1759)

Ichneumon rufipes Miller, 1759: 10 plates. Type: Unknown, TD: Unknown.

Ichneumon hypochondriacus Retzius, 1783: 67–70. Type: ♀ (lost), TD: Sweden.

Ichneumon instigator Fabricius, 1793: 519. Type: ♀, TD: UZM.

Pimpla aegyptiaca Schmiedeknecht, 1807: 506–511. Type: ♀, TD: ZM.

Pimpla intermedia Holmgren, 1860: 1–76. Type: Unknown, TD: Unknown.

Pimpla instigator Schulz, 1906: 356. Type: Unknown, TD: Unknown.

Pimpla scutellaris Ulbricht, 1909: 1–40. Type: Unknown, TD: Unknown.

Apechthis flavipes Matsumura, 1912: 247. Type: ♀, TD: HU.

Pimpla sibirica Meyer, 1926: 260–264. Type: ♀, TD: Lost.

Pimpla ruficoxa Gregor, 1928: 13–23. Type: ♀, TD: Czechoslovakia.

Material examined. Korea: Seoul: 1♀, Dobong-gu, Dobong-dong, Mt. Dobongsan, 30 Oct 1982, Kim HS.

Additional material examined. Bulgaria: 1♀, Strandja, Vitanovo, 28 Jun 2000, Kolarov J; 1♀, Vitosha, Bosnek, (Alt. 940 m), 8 May 1999, Kolarov J; Ukraine: 1♀, Dnieper River, 7 May 1943.

Diagnosis. Antenna with 32–37 flagellomeres. Fore leg reddish brown except entire coxa black, trochanter and basal area of trochantellus reddish black. Mid leg reddish brown, except entire coxa, trochanter and basal area of trochantellus reddish black. Entire hind coxa, hind trochanter, basal and apical area of hind trochantellus, basal area of hind femur, apical area of 1st hind tarsomere and 2nd–5th hind tarsomeres reddish black. Metapleuron polished; upper basal area of metapleuron densely punctate, with dense hairs; lower and apical lower area of metapleuron with distinct transverse wrinkle. Hind wing with a basal hamulus, 12 distal hamuli.

Distribution. Korea, Afghanistan, Algeria, Armenia, Austria, Azerbaijan, China, Cyprus, Egypt, Europe, Georgia, India, Iran, Japan, Kazakhstan, Kyrgyzstan, Libya, Mongolia, Montenegro, Morocco, Russia, Sri Lanka, Tajikistan, Tunisia, Turkey, Turkmenistan, Ukraine, Uzbekistan.

Region. Palaearctic, Oriental.

Host. [Lepidoptera] Erebidae: *Calliteara fascelina* (Shaw et al., 2009), *Lymantria monacha* (Bauer, 2002); Lycaenidae: *Lycaena dispar* (Shaw et al., 2009), *Lycaena dispar batava* (Shaw et al., 2009); Noctuidae: *Acronicta rumicis* (Okyar and Yurtcan, 2007), *Lacanobia oleracea* (Okyar and Yurtcan, 2007); Nymphalidae: *Charaxes jasius* (Shaw et al., 2009), *Eurodryas aurinia* (Shaw et al., 2009; Stefanescu et al., 2009), *Vanessa atalanta* (Shaw et al., 2009); Papilionidae: *Papilio machaon* (Shaw et al., 2009); Pieridae: *Colias croceus* (Shaw et al., 2009), *Pieris brassicae* (Shaw et al.,

Korean name: ¹*꿀날꼬리납작맷시벌, ²*오렌지다리납작맷시벌

2009), *Pieris napi* (Shaw et al., 2009), *Pieris rapae* (Shaw et al., 2009); Tortricidae: *Archips rosana* (Piekarska et al., 2002).

¹Pimpla turionellae* (Linnaeus, 1758)**

Ichneumon turionellae Linnaeus, 1758: 824. Type: ♀, TD: LS.

Ichneumon fuscicornis Schrank, 1785: 313–345. Type: Unknown, TD: Unknown.

Ichneumon variegatus Schrank, 1785: 313–345. Type: Unknown, TD: Germany.

Ichneumon leucogonos Gmelin, 1790: 2705. Type: Unknown, TD: Unknown.

Ichneumon rufescens Gmelin, 1790: 2701. Type: Unknown, TD: Unknown.

Cryptus examinatus Fabricius, 1804: 85. Type: ♀, TD: UZM.

Ichneumon cingulator Thunberg, 1822: 275. Type: Unknown, TD: UU.

Ichneumon turionator Thunberg, 1822: 275. Type: Unknown, TD: Unknown.

Pimpla opacellata Desvignes, 1868: 174. Type: ♀, TD: NHM.

Pimpla moraguesi Schmiedeknecht, 1888: 445–532. Type: ♀, TD: NMHS.

Pimpla examinatrix Schulz, 1906: 104. Type: Unknown, TD: Unknown.

Pimpla pubescens Hellén, 1915: 1–89. Type: Unknown, TD: Finland.

Pimpla padellae Torka, 1918: 39–40. Type: Unknown, TD: Poland.

Pimpla rufoannulus Schmiedeknecht, 1934: 37–116. Type: Unknown, TD: Unknown.

Pimpla freyi Hellén, 1949: 1–23. Type: Unknown, TD: Spain.

Material examined. No Korean specimen was available for this study.

Additional material examined. Bulgaria: 1 ♀, Rhodope, Yellowstone, 11 Jun 1972, Kolarov J; 1 ♂, ditto, 18 Jun 1972, Kolarov J; Mongolia: 1 ♀, Mongolia National University forest, Site-4, Tov, Udeligrin Dugan, 48°26'22.68"N, 106°84'89.16"E, 4 Jul 2013, Choi JK.

Diagnosis. Antenna with 26–30 flagellomeres. Fore leg reddish brown except entire coxa black; trochanter reddish black; inner area of tibia brown. Entire mid coxa, basal and mid area of mid trochanter, basal and mid area of mid tibia black; subbasal area of mid tibia with white band. Entire hind coxa, ventral, dorso-basal and mid area of hind trochanter, ventral basal and mid area of hind trochantellus, apical area of hind femur and basal area of hind tibia black;

subbasal area of tibia with white band; mid and apical area of hind tibia reddish black. Pronotum polished; upper area of pronotum sparsely punctate, with sparse hairs; basal mid area of pronotum, with distinct transverse wrinkle; mid and lower area of pronotum smooth; apical upper area of pronotum with yellow mark. Metapleuron polished; upper and mid area of metapleuron densely punctate, with dense hairs; lower area of metapleuron relatively sparsely punctate, with sparse hairs, sometimes smooth.

Distribution. Korea, Afghanistan, Algeria, Armenia, Austria, Azerbaijan, Canada, China, Europe, India, Iran, Israel, Japan, Kazakhstan, Kyrgyzstan, Mongolia, Myanmar, Russia, Tajikistan, Tunisia, Turkey, Ukraine, Uzbekistan.

Region. Holarctic, Oriental.

Host. [Hymenoptera] Braconidae: *Macrocentrus pallipes* (Pisica and Diaconu, 2000); [Lepidoptera] Erebidae: *Hyphandria cunea* (Yang et al., 2006, 2008); Lasiocampidae: *Dendrolimus punctatus* (Chai et al., 2000); Lycaenidae: *Satyrium w-album* (Shaw et al., 2009); Pieridae: *Pieris rapae* (Shaw et al., 2009); Tortricidae: *Archips rosana* (Ozdemir and Ozdemir, 2002; Piekarska et al., 2002, 2005), *Enarmonia formosana* (Tanigoshi and Starý, 2003; Jenner et al., 2004), *Rhyacionia resinella* (Sedivy, 2001).

Remarks. No Korean specimen was available for this study. However we have specimens from Bulgaria and Mongolia.

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