Revision of the genus *Woldstedtius* Carlson, 1979 (Hymenoptera, Ichneumonidae, Diplazontinae) from Japan

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Abstract

Japanese species of the genus *Woldstedtius* Carlson, 1979 are revised. Nine species are recorded from Japan, including two new species, *W. alpicola* sp. nov. and *W. punctatus* sp. nov. *Woldstedtius biguttatus* (Gravenhorst, 1829) is newly recorded from Japan. Taxonomic status of *W. flavolineatus kuroashii* (Uchida, 1957) is changed from the subspecies of *W. flavolineatus* (Gravenhorst, 1829) to a separated species. *Woldstedtius holarcticus* (Diller, 1969) is newly synonymized under *W. kuroashii* (Uchida, 1957). A key to Japanese species of this genus is provided.

Key Words

Asia, fauna, new species, parasitoid wasps, taxonomy

Introduction

The Ichneumonid subfamily Diplazontinae comprises 23 genera and more than 350 species worldwide (Yu et al. 2016). The host range of species in this subfamily appears to be notably narrow, with all confirmed hosts being species of hoverfly (Diptera, Syrphidae). The only exceptions in this regard are two species in the ichneumonid genus *Bioblapsis* Förster (Klopfstein 2014). The genus *Woldstedtius* Carlson, 1979 is a relatively large taxon comprising 44 species distributed in the Australasian, Holarctic, Neotropical, Oceanic, and Oriental regions (Balueva and Lee 2016; Vas 2016; Yu et al. 2016; Johansson 2020). Although the genus has been revised by Klopfstein (2014) for the Western Palearctic species, by Dasch (1964) for the Nearctic species and by Gauld et al. (1997) for the Costa Rican species, members in the Eastern Palearctic region have only been partially studied. Manukyan (2007), for example, provided a key to the six species of this genus known from Far East Russia, and Balueva and Lee (2016) have reviewed the South Korean species. In Japan, seven species have been formally recorded to date (Yu et al. 2016), however, we have found specimens of some unidentified species and identified a number of unresolved taxonomic problems. Nevertheless, given the large number of previous studies in other regions, this genus may be an adequate taxon for comparison of the fauna with that in other parts of the world.

The purpose of this study was to undertake a taxonomic review of the Japanese species of *Woldstedtius*. We have also produced a key to the Japanese species of this genus, which is presented herein.

Materials and methods

In this study, the dried specimens deposited in the following collections were examined:

- **AEIC**: American Entomological Institute, Logan, Utah, USA;
- **KPMNH**: Kanagawa Prefectural Museum of Natural History, Odawara, Kanagawa, Japan;
- **MU**: Meijo University, Nagoya, Aichi, Japan;
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Many Japanese species have been recorded elsewhere in Japan. We compared the Japanese specimens of W. flavolineatus kuroashii (Uchida 1957), which has been collected from Hokkaido and the paratype of W. f. flavolineatus kuroashii (identified by Diller). On the basis of these comparisons, we detected no significant differences with respect to other character states of these specimens, and accordingly conclude that the observed variation is intraspecific variation within a single species.

In this study, we identified specimens of W. biguttatus from Japan for the first time. This species closely resembles W. flavolineatus, and indeed, some W. biguttatus specimens have been incorrectly recorded as W. flavolineatus e.g., Konishi et al. (2014) and Morishita et al. (2021). In contrast, we were unable to find any specimens of W. flavolineatus that have been collected in Japan. Given that some of the voucher specimens of the previous studies could not be reliably identified owing to inadequate labeling, we have certain reservations as to the Japanese distribution records of W. flavolineatus, and accordingly recommend a further re-examination of the distribution of this species.

On the basis of the aforementioned taxonomic treatments, we conclude that a total of nine species in the genus Woldstedtius have been found in Japan to date.

**Taxonomy**

**Subfamily Diplazontinae Viereck, 1918**

**Genus Woldstedtius Carlson, 1979**

**Type.** Bassus biguttatus Gravenhorst, 1829: 332. Original designation.

**Diagnosis.** According to Klopfstein (2014), this genus can be distinguished from other genera by the following combination of character states: antenna without tyloids in males; mesoscutum without notaum; fore wing areolet absent; hind tibia usually black with a white base, in males with light coloration often extending to half the length of the tibia, rarely hind tibia all dark or yellow or orange with a dark apex; ovipositor sheaths transversely truncate and open towards apex; very even, weakly coriaceous microsculpture.

**Remarks.** Japanese species can be identified by the following key.
Key to Japanese species of *Woldstedtius* (males of *W. takagii* and *W. yokohamensis* are unknown)

1. Hind coxa white with a brown dorsal stripe in females (Fig. 4A). Face blackish-brown to black with a white median spot, this spot connected with white clypeus in females (Fig. 4B), entirely white in males (Fig. 4F). Scutellum with large white marking (Fig. 4C). Latero-median carina of T I short, along less than basal 0.3 of T I (Fig. 9H) .......................................................... *W. karafutensis* (Uchida, 1957) (female and male)

- Above combination of character states lacking. Hind coxa entirely black or entirely orange in females (Figs 1A, 2A, 3A, 5A, 6A, 7A, 8A). Coloration of face various in females. Scutellum entirely black or black with a whitish-yellow to yellow apical spot (Figs 1C, 2C, 3C, 5C, 6C, 7C, 8C). Latero-median carina of T I long, along more than basal 0.4 of T I (Fig. 9E–G, I–K) .......................................................... *W. yokohamensis* (Uchida, 1957) (female and male)

2. Hind coxa entirely black in both sexes (Figs 1A, 5A, 6A, 7A, 8A) .......................................................... 3

- Hind coxa entirely orange in females (Figs 2A, 3A). Entirely or largely yellow to reddish-yellow and usually with a blackish-brown dorsal stripe in males (Figs 1E, 2E, 3E, 5E) .......................................................... 7

3. Inner orbits divergent downward (Figs 7B, 9C). Face 2.6–2.9 × as broad as high. Basal 0.2 of propodeum weakly protruded in lateral view (Fig. 9D). Yellow shoulder marks of mesoscutum absent (Fig. 7A) ............................................................................. *W. takagii* (Uchida, 1957) (female)

- Inner orbits almost parallel (Figs 1B, 5B, 6B, 8B). Face less than 2.5 × as broad as high. Basal 0.2 of propodeum not protruded in lateral view. Yellow shoulder marks of mesoscutum present (Figs 1A, 5A, 6A, 8A) .......................................................... 4

4. Scutellum coarsely and densely punctate (separated by ca. 0.8–1.3 × their diameter) and entirely black (Fig. 6C). Propodeum rugulose (Fig. 6D) ............................................................................. *W. punctatus* sp. nov. (female and male)

- Scutellum finely and sparsely punctate (separated by ca. 1.5–2.5 × their diameter) and black with a whitish-yellow to yellow apical spot (Figs 1C, 5C, 8C). Propodeum coriaceous or at least finely rugulose .......................................................... 5

5. Face black with a pair of yellow spots along inner orbits (Fig. 8B). Scutellum finely and densely punctate (separated by ca. 1.0 × their diameter) ............................................................................. *W. yokohamensis* (Uchida, 1957) (female)

- Face black with a whitish-yellow to yellow median spot (Figs 1B, 5B). Scutellum finely and sparsely punctate (separated by ca. 1.5–2.5 × their diameter) (Figs 1C, 5C) .......................................................... 6

6. T I 1.4–1.5 × as long as maximum width. Propodeum finely rugulose (Fig. 1D). Hind trochanter black (Fig. 1A). Pleural carina of propodeum entirely present .......................................................... *W. alpica* sp. nov. (female)

- T I 1.1–1.25 × as long as maximum width. Propodeum coriaceous (Fig. 5D). Hind trochanter white (Fig. 5A). Pleural carina of propodeum absent posteriorly .......................................................... *W. kuroashi* (Uchida, 1957) (female)

7. Inner orbits divergent downward. Antenna with 19–21 (rarely 22) flagellomeres. Metasoma entirely black or black with some orange markings in females .......................................................... *W. citropectoralis* (Schmiedeknecht, 1926) (female and male)

- Inner orbits almost parallel in females (Figs 2B, 3B), weakly divergent downward in males (Figs 1F, 2F, 3F, 5F). Antenna with 22–25 flagellomeres. Metasoma entirely black in females .......................................................... 8

8. Mesoscutum without yellow shoulder marks in females (Fig. 2A). Face entirely black or black with a small median yellow or brown spot in females (Fig. 2B). Mesopleuron with a yellow ventral marking (Fig. 2E) in males. Mesosternum black in males (Fig. 2E) ............................................................................. *W. biguttatus* (Gravenhorst, 1829) (female and male)

- Mesoscutum with yellow shoulder marks in females (Fig. 3A). Face black with a large yellow median spot in females (Fig. 3B). Mesopleuron with a large whitish-yellow to yellow marking; it is enlarged anteriorly in males (Figs 1E, 3E, 5E). Mesosternum yellow in males (Figs 1E, 3E, 5E) ............................................................................. 9

9. Propodeum finely rugulose (e.g., Fig. 1D), with a complete pleural carina. Bases of T IV to T VII each with a transverse yellow band ............................................................................. *W. alpica* sp. nov. (male)

- Propodeum coriaceous (e.g., Figs 3D, 5D), with a pleural carina absent posteriorly in both sexes. Coloration of T IV to T VII various in males .......................................................... 10

10. Bases of T III and T IV each with a transverse yellow basal band in males. T I entirely coriaceous .......................... *W. flavolineatus* flavolineatus (Gravenhorst, 1829) (female and male)

- T III with a pair of whitish-yellow apical spots (sometimes these spots connected each other). T IV and T V each with a transverse whitish-yellow apical band. T I coriaceous, with irregular rugae laterally .......................... *W. kuroashi* (Uchida, 1957) (male)

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**Description.** Female (n = 3). Body length 8.5–9.2 (HT: 8.5) mm, polished, coriaceous and covered with silver setae.
Figure 1. *Woldstedtius alpicola* sp. nov. (A–D. female, holotype; E, F. male, paratype) — A, E. Habitus; B, F. Head, frontal view; C. Mesonotum, dorsal view; D. Propodeum, dorsal view.
**Head** 0.51–0.54 (HT: 0.53) × as long as wide. Clypeus 2.0–2.35 (HT: 2.0) × as broad as high, slightly convex basally in lateral view. Face 2.1–2.4 (HT: 2.4) × as broad as high, densely punctate, convex medially in lateral view and separated from clypeus by shallow clypeal sulcus. Inner orbits almost parallel (Fig. 1B). Length of malar space 0.9–1.15 (HT: 0.9) × as long as basal mandibular width. POL 1.9–2.1 (HT: 1.9) × as long as OD. OOL 0.9–1.18 (HT: 0.9) × as long as OD. POL 1.86–1.95 (HT: 1.86) × as long as OOL. Antenna with 24–25 (HT: 24) flagellomeres. FL I 1.29–1.35 (HT: 1.35) × as long as FL II. MP I 1.42–1.53 (HT: 1.53) × as long as MP V.

**Mesosoma.** Lateral aspect of pronotum strigose anteriorly. Mesoscutum finely and densely punctate (separated by ca.1.0 × their diameter) (Fig. 1C). Scutellum finely and sparsely punctate (separated by ca.1.5–2.5 × their diameter) (Fig. 1C). Anterior part and lower half of mesopleuron coarsely and densely punctate. Speculum smooth. Sternal carinae deeply impressed. Propodeum finely rugulose (Fig. 1D), rounded in lateral view and pleural carina entirely present. Fore wing length 7.4–8.5 (HT: 7.4) mm. Nervellus intercepted below middle. Hind femur 4.7–5.3 (HT: 4.7) × as long as maximum depth in lateral view. Hind tibia 7.5–8.0 (HT: 8.0) × as long as maximum depth in lateral view. Ratio of length of hind first to fifth tarsomeres 1.0: 0.6: 0.4: 0.2: 0.2–0.3 (HT: 0.2).

**Metasoma.** T I rectangular in dorsal view (Fig. 9E), 1.4–1.5 (HT: 1.4) × as long as maximum width, irregular rugulose laterally, sometimes striate between latero-median carinae. Latero-median carina present basally. Clypeus 0.51–0.54 (HT: 0.53) × as long as wide. Clypeus with a large yellow median spot of face present (absent in males of W. pallidus). Clypeal sulcus distinctly present. Clypeus 0.45–0.51 (HT: 0.51) × as long as base of hind femur. Clypeal sulcus distinctly present in anterior part of clypeus. Clypeal sulcus distinctly present in anterior part of clypeus. Clypeal sulcus distinctly present in anterior part of clypeus.

**Coloration (Fig. 1A–D).** Body (excluding wings and legs) black. Face with a large yellow spot medially. Palpi, subterminal ridge and mesepisternum yellow. Mandible yellow, except for apex and base. Lateral aspect of pronotum with a yellow spot posteriorly. Mesoscutum with yellow shoulder marks. tegula, subterminal ridge and mesepisternum yellow. Mandible yellow, except for apex and base. Lateral aspect of pronotum with a yellow spot posteriorly. Mesoscutum with a large yellow marking, it enlarged anteriorly. Scutellum with a yellow spot apically. T IV to T VII with a transverse yellow band posteriorly. Wings hyaline. Veins and pterostigma brown to blackish-brown except for yellow wing base. Legs yellow to yellowish-brown. Hind coxa and trochanters each with a blackish-brown stripe dorsally. Hind trochantellus and tibia tinged with blackish-brown.

**Distribution.** Japan (Honshu).

**Bionomics.** Host unknown. Adults were collected in broad-leaved forest at altitudes of ca. 1,000–2,000 meters.

**Etymology.** The species name refers that this species inhabits alpine region.

**Remarks.** This species resembles W. kuroashii but can be distinguished from the latter by the following combination of character states: pleural carina of propodeum entirely present in both sexes (absent posteriorly in both sexes of W. kuroashii); propodeum finely rugulose in both sexes (coriaceous in both sexes of W. kuroashii); T I 1.4–1.5 × as long as maximum width in both sexes (1.1–1.25 in females, 1.14–1.26 in males of W. kuroashii). This species also resembles a Korean species, W. pallidus Bahueva & Lee, 2016 (male is unknown), but can be distinguished by the following combination of character states in females: a large yellow median spot of face present (absent in W. pallidus); antenna with 24–25 flagellomeres (22–23 in W. pallidus); scutellum finely and sparsely punctate on coriaceous background (entirely coriaceous in W. pallidus); propodeum finely rugulose (coriaceous in W. pallidus).

**Woldstedtius biguttatus** (Gravenhorst, 1829)

*Figs 2A–F, 9F*

**Bassus biguttatus** Gravenhorst, 1829: 332.

**Bassus rufipes** Gravenhorst, 1829: 337. Name preoccupied.

**Bassus confusus** Wahlst. 1874: 63. Synonymized by Morley (1906).

**Syrrhochtonus flavolineatus** Konishi et al. 2014: 491. Misident (at least in part).


Figure 2. Woldstedtius biguttatus (Gravenhorst, 1829) (A–D. female; E, F. male) — A, E. Habitus; B, F. Head, frontal view; C. Mesonotum, dorsal view; D. Propodeum, dorsal view.

Description. Female (n = 100). Body length 4.5–7.2 mm, weakly polished, coriaceous and covered with silver setae.

Head 0.5–0.54 × as long as wide. Clypeus 2.0–2.2 × as broad as high, slightly convex basally in lateral view. Face 2.0–2.35 × as broad as high, densely punctate, convex medially in lateral view, separated from clypeus by shallow clypeal sulcus. Inner orbits almost parallel (Fig. 2B). Length of malar space 1.0–1.1 × as long as basal mandibular width. POL 1.8–2.3 × as long as OD. OOL 1.0–1.3 × as long as OD. POL 1.7–2.1 × as long as OOL. Antenna with 22–25 flagellomeres. FL I 1.25–1.33 × as long as FL II. MP IV 1.25–1.33 × as long as MP V.

Mesosoma. Lateral aspect of pronotum rugulose anteriorly. Mesoscutum finely and sparsely punctate (separated by ca. 1.5–3.0 × their diameter) (Fig. 2C). Scutellum finely and sparsely punctate (separated by ca. 1.5–2.5 × their diameter) (Fig. 2C). Anterior and lower parts of mesopleuron coarsely and sparsely punctate. Sternaulus weakly impressed. Propropodeum rounded in lateral view, without rugae (Fig. 2D), without carinae except for anterior part of pleural carina. Fore wing length 3.8–6.5 mm. Nervellus intercepted below middle. Hind femur 4.22–4.5 × as long as maximum depth in lateral view. Hind femur 8.0–8.5 × as long as maximum depth in lateral view. Ratio of length of hind first to fifth tarsomeres 1.0: 0.6: 0.4–0.5: 0.2–0.3: 0.3.

Metasoma. T I rectangular in dorsal view (Fig. 9F), 1.0–1.2 × as long as maximum width, rugulose laterally. Latero-median carina present basal ca. 0.5 of T I. T II 0.66–0.88 × as long as maximum width, striate anteriorly and strigose laterally.


Male (n = 71). Similar to female. Inner orbits weakly divergent downward (Fig. 2F). Length of malar space 0.83–1.0 × as long as basal mandibular width.


Distribution. Japan (Hokkaido, Honshu, Shikoku, and Kyushu). Outside Japan, this species is widely distributed in Palearctic region (Yu et al. 2016).

Bionomics. Host unknown in Japan. Outside of Japan, the following three hoverfly species have been recorded as hosts: Euepeodes lapponicus (Zetterstedt, 1838); Neocomodon fulvinus (Zetterstedt, 1843); Sphaerophoria scripta (Linnaeus, 1758) (Yu et al. 2016). Anthonomus pomorum (Linnaeus, 1758) and Loxostege sticticalis (Linnaeus, 1761) have also been recorded as hosts (Yu et al. 2016), but are considered doubtful records. Most adults were collected from various open habitats (e.g., grasslands, meadows and paddy fields).

Remarks. This is the first record of this species from Japan. This species resembles W. flavolineatus, but can be distinguished from the latter by the following combination of character states: face entirely black or black with a small yellow or brown median spot in females (black with a large yellow median spot in females of W. flavolineatus); pronotum black with yellow ventral corner in males (black with yellow ventral and hind parts in males of W. flavolineatus); yellow shoulder marks absent in females (present in females of W. flavolineatus); mesopleuron with a yellow marking ventrally in males (with a large yellow marking; it is enlarged anteriorly in males of W. flavolineatus).
**Woldstedtius citropectoralis** (Schmiedeknecht, 1926)


**Material examined.** No specimens available.

**Distribution.** Japan (Kunashiri Is.). Outside Japan, this species is widely distributed in Holarctic region (Yu et al. 2016).

**Remarks.** This species was recorded from Japan by Manukyan (2007), but no additional specimens were found in this study.

**Woldstedtius flavolineatus** (Gravenhorst, 1829)

**Remarks.** This species is divided into two subspecies, *W. flavolineatus flavolineatus* and *W. f. nigroscutella-tus* (Habermehl, 1925). The latter subspecies has been recorded from Germany and Netherlands (Habermehl 1925; Teunissen 1948). Klopfstein (2014) noted this subspecies could not be examined by her because type specimens were not available. Judging from the original description of the latter (Habermehl 1925), this subspecies could readily be synonymized under the former.

**Woldstedtius flavolineatus flavolineatus** (Gravenhorst, 1829)

*Figs 3A–F, 9G*


*Bassus interruptus* Holmgren, 1858: 359. Synonymized by Thomson (1890).

*Bassus bimaculatus* Holmgren, 1858: 360. Synonymized by Thomson (1890).


**Diagnosis.** Body weakly polished. Inner orbits almost parallel in females, weakly divergent downward in males. Antenna with 22–24 flagellomers in females, 22–25 in males. Propodeum without rugae (Fig. 3D), without carinae except for anterior part of pleural carina. T I entirely coriaceous, rectangular in dorsal view (Fig. 9G). Latero-median carina of T I present basal ca. 0.5 of T I. Face black with a large yellow median spot in females (Fig. 3B), entirely yellow in males (Fig. 3F). Lateral aspect of pronotum black with ventral and posterior yellow spots in females (Fig. 3A), black with yellow ventral and posterior areas in males (Fig. 3E). Mesopleuron entirely black in females (Fig. 3A), black with a large yellow marking, it enlarged anteriorly in males (Fig. 3E). Shoulders of mesoscutum yellow in both sexes (Fig. 3C, E). Scutellum black with an apical yellow spot in both sexes (Fig. 3C). Hind coxa entirely orange in females (Fig. 3A), yellow with brown base in males (Fig. 3E). Hind trochanter yellow in females (Fig. 3A), yellow with a brown dorsal spot in males (Fig. 3E). Metasoma entirely black in females, bases of T III and T IV each with a transverse yellow band in males.

**Distribution.** Japan (Hokkaido, Honshu, Shikoku, and Kyushu). Outside Japan, this species is widely distributed in Holarctic, Oriental, Oceanic, and Neotropical region (Yu et al. 2016).

**Bionomics.** In Japan, one hover fly species, *Episyrphus balteatus* (De Geer, 1776) is recorded as a host (Uchida 1957).

**Remarks.** No additional specimen of this species from Japan was found in this study. Some or all previous records of this species from Japan may be based on mis-identification of *W. biguttatus*.

**Woldstedtius karafutensis** (Uchida, 1957)

*Figs 4A–F, 9H*

*Homocidus karafutensis* Uchida, 1957: 252.


**Description.** Female (n = 14). Body length 4.1–6.0 mm, polished, coriaceous, covered with silver setae.

**Head** 0.5 × as long as wide. Clypeus 2.1–2.4 × as broad as high, flat in lateral view. Face 1.88–2.2 × as broad as high, densely punctate, convex medially in lateral view, separated from clypeus by shallow clypeal sulcus. Inner orbits almost parallel (Fig. 4B). Length of malar space 1.1–1.15 × as long as high, flat in lateral view. Face 1.88–2.2 × as broad as high, densely punctate, convex medially in lateral view, separated from clypeus by shallow clypeal sulcus. Inner orbits almost parallel (Fig. 4B). Length of malar space 1.1–1.15 × as long as high, flat in lateral view.

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as basal mandibular width. POL 2.0–2.1 × as long as OD. OOL 1.0–1.2 × as long as OD. POL 2.0–2.2 × as long as OOL. Antenna with 20–21 flagellomeres. FL I 1.15–1.35 × as long as FL II. MP IV 1.45–1.66 × as long as MP V.

**Mesosoma.** Lateral aspect of pronotum rugulose anteriorly. Mesoscutum densely punctate (separated by ca. 0.5–1.0 × their diameter) (Fig. 4C). Scutellum finely and sparsely punctate (separated by ca. 1.5–2.0 × their diameter). Lower part of mesopleuron coarsely and sparsely punctate. Sternaulus indistinct. Propodeum without rugae and carinae (Fig. 4D), rounded in lateral view. Fore wing length 4.0–5.0 mm. Nervellus intercepted below middle.

**Figure 3.** *Woldstedtius flavolineatus flavolineatus* (Gravenhorst, 1829) (A–D. female; E, F. male) — A, E. Habitus; B, F. Head, frontal view; C. Mesonotum, dorsal view; D. Propodeum, dorsal view.
Figure 4. Woldstedtius karafutensis (Uchida, 1957) (A–D. female; E, F. male) — A, E. Habitus; B, F. Head, frontal view; C. Mesonotum, dorsal view; D. Propodeum, dorsal view.
Hind femur 3.75–4.0 × as long as maximum depth in lateral view. Hind tibia 8.0–9.5 × as long as maximum depth in lateral view. Ratio of length of hind first to fifth tarsomeres 1.0: 0.6: 0.5: 0.3: 0.25–0.3.

Metasoma. T I square in dorsal view (Fig. 9H), 1.0–1.1 × as long as maximum width, rugulose laterally. Lateral view. Hind tibia tinged with brown. Legs whitish-yellow. Hind coxa with a dorsal blackish-brown stripe. Hind femur brown. Hind tibia and tarsomere black. Base of hind tibia tinged with white.

Male (n = 2). Similar to female. Inner orbits weakly divergent downward (Fig. 4F).

Coloration (Fig. 4A–D). Body (excluding wings and legs) black to blackish-brown. Clypeus, palpi, face, ventral surface of antenna, malar space, propleuron, epicnemium, mesosternum, tegula, subtergular ridge, upper mesepisternum and scutellum white. Genae tinged with white ventrally. Mandible white except for apex and base. Lateral aspect of pronotum with a white spot posteriorly. Antenna brown. Veins and pterostigma yellowish-brown to brown. Legs whitish-yellow. Hind coxa with a dorsal blackish-brown stripe. Hind femur brown. Hind tibia and tarsomere black. Base of hind tibia tinged with white.

Distribution. Japan (Hokkaido and Honshu). Outside Japan, this species has been recorded from Russia and South Korea (Balueva and Lee 2016 and Yu et al. 2016).

Bionomics. Host unknown.

Remarks. This is the first record of this species from Honshu.

Woldstedtius kuroashii (Uchida, 1957)
Figs 9A–F, 9B, I

Homocidus flavolineatus var. kuroashii Uchida, 1957: 251.


Description. Female (n = 33). Body length 5.5–8.5 mm, polished, coriaceous. covered with silver setae.
Figure 5. *Woldstedtius kuroashii* (Uchida, 1957) (A–D. female; E, F. male) — A, E. Habitus; B, F. Head, frontal view; C. Mesonotum, dorsal view; D. Propodeum, dorsal view.
**Head** 0.5–0.53 × as long as wide. Clypeus 2.0–2.3 × as broad as high, convex basally in lateral view. Face 2.2–2.3 × as broad as high, densely punctate, convex medially in lateral view (Fig. 9B), separated from clypeus by shallow clypeal sulcus. Inner orbits almost parallel (Fig. 5B). Length of malar space 1.0–1.2 × as long as basal mandibular width. POL 2.16–2.3 × as long as OD. OOL 1.0–1.38 × as long as OD. POL 1.86–2.1 × as long as OOL. Antenna with 23–25 flagellomeres. FL I 1.25–1.3 × as long as FL II. MP IV 1.2–1.29 × as long as MP V.

**Mesosoma.** Lateral aspect of pronotum rugulose or rarely strigose anteriorly. Mesoscutum finely and densely punctate (separated by ca. 1.0 × their diameter) (Fig. 5C). Scutellum finely and sparsely punctate (separated by ca. 1.5–2.5 × their diameter) (Fig. 5C). Mesopleuron coarsely and sparsely punctate except for speculum. Sternaulus weakly impressed. Propodeum rounded in lateral view, without rugae (Fig. 5D), without carinae except for anterior part of pleural carina. Fore wing length 5.8–6.9 mm. Nervellus intercepted below middle. Hind femur 4.0–4.5 × as long as maximum depth in lateral view. Hind tibia 7.8–8.4 × as long as maximum depth in lateral view. Ratio of length of hind first to fifth tarsomeres 1.0: 0.6: 0.4–0.5: 0.3: 0.2–0.3.

**Metasoma.** T I rectangular in dorsal view (Fig. 9I), 1.1–1.25 × as long as maximum width, rugulose laterally. Latero-median carina present on basal ca. 0.5 of T I (Fig. 9I). T II 0.65–0.8 × as long as maximum width, striate anteriorly and strigose laterally.

**Coloration (Fig. 5A–D).** Body (excluding wings and legs) black. Face with a large whitish-yellow median spot (this spot rarely obscured). Palpi, tegula, subtegular ridge and mesepisternum yellow. Mandible whitish-yellow except for apex. Lateral aspect of pronotum tinged with whitish-yellow ventrally and posteriorly. Mesopleuron with a large whitish-yellow marking, it enlarged anteriorly. Scutellum with a whitish-yellow spot apically. T III with a pair of whitish-yellow spots anteriorly (sometimes these spots united into a single spot). T IV and T V each with a transverse whitish-yellow band anteriorly. Wings hyaline. Veins and pterostigma brown to blackish-brown except for yellow wing base. Legs yellow to yellowish-brown. Hind coxa and trochanter each with a dorsal blackish-brown stripe. Hind trochantellus and tibia tinged with blackish-brown.

**Distribution.** Japan (Hokkaido and Honshu). Outside Japan, this species is widely distributed in the Holarctic and Oriental regions (Yu et al. 2016).

**Bionomics.** Host unknown. Most adults were collected from the treetops of broad-leaved trees.

**Remarks.** This is the first record of this species from Hokkaido.

**Woldstedtius punctatus sp. nov.**
http://zoobank.org/4934EAC1-4504-45A8-9848-B1F7BF26301B


**Description.** Female (n = 6). Body length 7.5–10.7 (HT: 7.5) mm, polished, coriaceous, covered with silver setae.

**Head** 0.5–0.53 (HT: 0.5) × as long as wide. Clypeus 1.9–2.0 (HT: 1.92) × as broad as high, slightly convex basally in lateral view. Face 2.3–2.5 (HT: 2.4) × as broad as high, densely punctate, convex medially in lateral view and separated from clypeus by shallow clypeal sulcus. Inner orbits almost parallel (Fig. 6B). Length of malar space 1.0–1.2 (HT: 1.1) × as long as basal mandibular width. POL 2.1–2.3 (HT: 2.1) × as long as OD. OOL 0.88–1.0 (HT: 1.0) × as long as OD. POL 2.1–2.5 (HT: 2.3) × as long as OOL. Antenna with 23–25 (HT: 24) flagellomeres. FL I 1.3–1.4 (HT: 1.3) × as long as FL II. MP IV 1.25–1.5 (HT: 1.25) × as long as MP V.

**Mesosoma.** Lateral aspect of pronotum strigose anteriorly. Mesoscutum finely and densely punctate (separated by ca. 1.0 × their diameter) (Fig. 6C). Scutellum coarse-
Figure 6. *Woldstedtius punctatus* sp. nov. (A–D. female, holotype; E, F. male, paratype) — A, E. Habitus; B, F. Head, frontal view; C. Mesonotum, dorsal view; D. Propodeum, dorsal view.
ly and densely punctate (separated by ca. 0.8–1.3 × their diameter) (Fig. 6C). Mesopleuron coarsely and sparsely punctate except for speculum. Sternaulus weakly impressed. Propodeum rounded in lateral view, rugulose (Fig. 6D), without carinae except for pleural carina. Fore wing length 6.9–8.9 (HT: 7.0) mm. Nervellus intercepted below middle. Hind femur 4.25–4.5 (HT: 4.25) × as long as maximum depth in lateral view. Hind tibia 7.1–7.7 (HT: 7.1) × as long as maximum depth in lateral view. Ratio of length of hind first to fifth tarsomeres 1.0: 0.6: 0.4: 0.25: 0.3.

**Metasoma.** T I rectangular in dorsal view (Fig. 9J), 1.2–1.26 (HT: 1.25) × as long as maximum width, rugulose laterally. Latero-median carina present basally ca. 0.5 of T I (Fig. 9J). T II 0.6–0.75 (HT: 0.6) × as long as maximum width, strigose anteriorly and laterally.

**Coloration** (Fig. 6A–D). Body (excluding wings and legs) black. Sometimes face with a small brown spot medially. Palpi and upper mesepisternum yellow. Mandible yellowish-brown except for apex and base. Lateral aspect of pronotum with a yellow spot posteriorly. Mesoscutum with small yellow shoulder marks. Tegula tinged with yellow anteriorly. Wings hyaline. Veins and pterostigma blackish-brown except for yellowish-brown wing base. Legs black. Apex of fore and mid trochanters, base of fore trochantellus and base of hind tibia tinged with white. Fore and mid femora, tibiae and tarsi orange. Apex of hind trochantellus and base of hind femur tinged with reddish-brown.

**Male** (n = 11). Similar to female. Body length (excluding antennae) 5.5–9.8 mm. Length of malar space 0.9–1.1 × as long as basal mandibular width. Inner orbits weakly divergent downward (Fig. 6F). Fore wing length 5.0–8.0 mm.


**Distribution.** Japan (Honshu).

**Bionomics.** Host unknown. Most adults were collected in broad-leaved forests of mountainous regions. One paratype collected from the Nagano Prefecture was collected by light trap.

**Etymology.** The species name refers to the scutellum having coarse punctures.

**Remarks.** This species can be easily distinguished from any other species by the entirely black scutellum and the coarse and dense punctures on scutellum (separated by ca. 0.8–1.3 × their diameter).

**Woldstedtius takagii** (Uchida, 1957)

Figs 7A–D, 9C, D, K

**Homocidus yokohamensis var. takagii** Uchida, 1957: 251


**Description. Female** (n = 3). Body length 7.7–7.9 mm, polished, coriaceous, covered with silver setae. **Head** 0.47–0.52 × as long as wide. Clypeus 1.78–2.0 × as broad as high, convex basally in lateral view. Face 2.6–2.9 × as broad as high, densely punctate, convex medially in lateral view, separated from clypeus by shallow clypeal sulcus. Inner orbits strongly divergent downward (Figs 7B, 9C). Length of malar space 1.0–1.1 × as long as basal mandibular width. POL 2.0–2.15 × as long as OD. OOL 1.05–1.25 × as long as OD. POL 1.8–1.9 × as long as OOL. Antenna with 25–26 flagellomeres. FL I 1.2–1.33 × as long as FL II. MP IV 1.25–1.4 × as long as MP V.

**Metasoma.** Lateral aspect of pronotum strigose anteriiorly. Mesoscutum finely and densely punctate (separated by ca. 0.8–1.0 × their diameter) (Fig. 7C). Scutellum finely and densely punctate (separated by ca. 0.8–1.0 × their diameter) (Fig. 7C). Mesopleuron coarsely and densely punctate except for the areas on and below speculum. Sternaulus weakly impressed. Propodeum weakly protruded basal 0.2 in lateral view (Fig. 9D), rugulose (Fig. 7D), without carinae except for pleural carina. Fore wing length 6.5–7.4 mm. Nervellus intercepted below middle. Hind femur 4.2–4.3 × as long as maximum depth in lateral view. Hind tibia 7.5 × as long as maximum depth in lateral view. Ratio of length of hind first to fifth tarsomeres 1.0: 0.6–0.7: 0.4: 0.2–0.3: 0.3.

**Metasoma.** T I nearly square in dorsal view (Fig. 9K), 0.95–1.05 × as long as maximum width, rugulose laterally. Latero-median carina present basally ca. 0.5 of T I (Fig. 9K). T II 0.65–0.75 × as long as maximum width, striate anteriorly.

**Coloration** (Fig. 7A–D). Body (excluding wings and legs) black. Face with a large yellow spot medially (this spot sometimes obscured). Palpi, tegula and mesepisternum yellow (mesepisternum sometimes darkened ventrally). Mandible yellow except for apex and base. Lateral aspect of pronotum with a yellow spot posteriorly. Scutellum with a yellow spot apically. Subtegular ridge often tinged with yellow. Wings hyaline. Veins and pterostigma blackish-brown except for yellowish-brown wing base. Legs yellow to
brown. Fore and mid trochanters often tinged with black. Coxae, hind trochanter, hind tibia and hind tarsomeres black. Hind trochantellus and femur reddish-brown to blackish-brown. Base of hind tibia tinged with white.

**Male.** Unknown.

**Distribution.** Japan (Hokkaido and Honshu).

**Bionomics.** Host unknown. Adults were collected in broad-leaved forests of mountainous regions.

**Remarks.** This species resembles *W. kuroashii*, but can be distinguished from the latter by the following combination of character states in females: inner orbits divergent downward (almost parallel in *W. kuroashii*); propodeum weakly protruded basal 0.2 in lateral view (rounded in *W. kuroashii*); yellow shoulder marks of mesoscutum absent (present in *W. kuroashii*).

**Woldstedtius yokohamensis** (Uchida, 1930)

*Homocidus yokohamensis* Uchida, 1930: 258

**Materials examined.** **Type series:** JAPAN: [Honshu] 1 F (holotype), Yokohama, 26 Apr 1928, K. Sato leg. (SEHU).

**Description. Female (n = 1: holotype).** Body length 9.1 mm, polished, coriaceous, covered with silver setae.

**Head** 0.5 × as long as wide. Clypeus 2.0 × as broad as high, convex basally in lateral view. Face 2.0 × as broad as high, finely and densely punctate, convex medially in lateral view, separated from clypeus by shallow clypeal sulcus. Inner orbits almost parallel (Fig. 8B). Length of malar space 1.1 × as long as basal mandibular width. POL 2.1 × as long as OD. OOL 1.25 × as long as OD. POL 2.0 × as long as OOL. Antenna with 26 flagellomeres. FL I 1.35 × as long as FL II. MP IV 1.33 × as long as MP V.

**Mesosoma.** Lateral aspect of pronotum strigose anteriorly. Mesoscutum finely and densely punctate (separated by ca. 1.0 × their diameter) (Fig. 8C). Scutellum finely and densely punctate (separated by ca. 1.0 × their diameter). Mesopleuron finely rugulose and densely punctate except for the areas on and below speculum. Sternaulus very weakly impressed. Propodeum rounded in lateral view, rugulose (Fig. 8D), without carinae except for pleural carina. Fore wing length 7.1 mm. Nervellus intercepted below middle. Hind femur 4.4 × as long as maximum depth in lateral view. Hind tibia 8.5 × as long as maximum depth in lateral view. Ratio of length of hind first to fifth tarsomeres 1.0: 0.7: 0.4: 0.2: 0.26.
Metasoma. T I rectangular in dorsal view, 1.3 × as long as maximum width. Latero-median carina present basal ca. 0.5 of T I. T II 0.72 × as long as maximum width, striate anteriorly and strigose laterally.


Male. Unknown.

Distribution. Japan (Honshu). Outside Japan, this species has been recorded from South Korea (Balueva and Lee 2016).

Bionomics. Unknown.

Remarks. This species may be rare in Japan. We could only examine the holotype. No additional specimen of this species from Japan was found.

Notes on the distribution and habitat of Japanese Woldstedtius

In the Japanese Diplazontinae, the proportion of the species with holarctic distribution shows a strong bias by genus (e.g., 44% in Diplazon, 14% in Promethes and 17% in Sussaba). Our findings revealed that 33% (three of nine species) of Japanese Woldstedtius are also distributed in the Holarctic region. In addition, given that W. karafutensis and W. yokohamensis, which were previously known only from Japan, have subsequently been recorded in Korea by Balueva and Lee (2016), we speculate that the currently known Japanese endemics, namely, W. alpicola, W. punctatus, and W. takagii, may also be distributed in other parts of the Eastern Palearctic Region.

Woldstedtius biguttatus is the most commonly collected species of Woldstedtius in Japan, and is typically found in different types of open habitat (e.g., grasslands, meadows, and paddy fields). In contrast, those species characterized by black coxae, namely, W. alpicola, W. kuroashii, W. punctatus, and W. takagii, are generally collected from the canopies of broad-leaved trees, and compared with W. biguttatus, fewer specimens of these species have been collected. We specu-
late that these differences in habitat usage could be attributable to the habitat requirements of the respective host species.

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References


Figure 9. Japanese Woldstedtius A, G. *W. f. flavolineatus* (Gravenhorst, 1829); B, I. *W. kuroashii* (Uchida, 1957); C, D, K. *W. takagii* (Uchida, 1957); E, W. alpicola sp. nov.; F. *W. biguttatus* (Gravenhorst, 1829); H. *W. karafutensis* (Uchida, 1957); J, *W. punctatus* sp. nov. (E, J. holotype; B, I. paratype) — A, B. head, lateral view; C. head, frontal view; D. propodeum, lateral view; E–K. T I, dorsal view.