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Two New Species of the Sawfly Genus *Macrophya* (Hymenoptera, Tenthredinidae) from Japan

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Abstract Two new species of sawflies of the genus *Macrophya* are described from Japan, *M. harai* n. sp. from Hokkaido and Honshu and *M. satoi* n. sp. from Honshu. *Macrophya harai* is characterized by the slender body with long antennae, the normal-shaped head (not concave between eyes in dorsal view) with a shiny upper surface, the narrow metepimeral appendage without a basin, and the white-marked hind tibia and tarsus in both sexes and the white-marked lateral sides of the abdomen in the female. *Macrophya satoi* is characterized by the robust body with short antennae, the shiny upper head, the shallow incision of the clypeus, the obtusely triangular metepimeral appendage without a basin, and the white-marked hind tibia and tarsus in both sexes and white-marked lateral sides of the abdomen in the female. *Macrophya satoi* is associated with *Fraxinus japonica*.

Key words: Tenthredinidae, *Macrophya harai*, *Macrophya satoi*, new species, *Fraxinus japonica*, Japan.

Introduction

Macrophya Dahlbom, 1835, is a large Holarctic genus of tenthredinid sawflies containing over 260 species (Li *et al.*, 2014). The Far East Asian species of the genus were revised by Takeuchi (1937), who recorded 20 species from Japan. Togashi (1974, 1975, 2005) added three species to the Japanese fauna. Inomata (1989) published a summary of Japanese *Macrophya*, where he treated *Pachyprotasis sanguinitarsis* Togashi, 1963, as a species of *Macrophya* and first recorded *M. koreana* Takeuchi, 1937, from Japan (see also Inomata and Shinohara, 1993). Inomata (1989) also treated *M. sanguinolenta* (Gmelin, 1790) and *M. poecilopus* (Aichinger, 1870) as separate species and recorded *M. sanguinolenta* from Japan for the first time. Haris (2000) treated *M. femorata* Marlatt, 1898, which was regarded as a "variety" of *M. timida* Smith, 1874, by Takeuchi (1937), as a full species. Recent catalogue and checklist treated *Pachyprotasis sanguinitarsis* in *Pachyprotasis*, not in *Macrophya* (Taeger *et al.*, 2010; Yoshida, 2014), and *M. poecilopus* as a synonym of *M. sanguinolenta* (Taeger *et al.*, 2010) or as a subspecies of *M. sanguinolenta* (Yoshida, 2014).

The occurrence of two additional species of *Macrophya* in Japan has recently come to our attention and we have concluded that they represent new species. Here we describe them under the names of *M. harai* and *M. satoi*. With the addition of the two new species and following interpretation of the species by Taeger *et al.* (2010) and Yoshida (2014), a total of 27 species of the genus are now known to occur in Japan.

Materials and Methods

The specimens used in this work, including the

holotypes of new species, are housed in the National Museum of Nature and Science, Tsukuba.

Observations of the adult morphology were made with an Olympus SZ60 stereo binocular microscope and measurements of each structure were taken with an ocular micrometer. Photographs were taken with a Keyence Digital Microscope VHX-900 (Figs. 2A–E, 4E–I), Nikon DS-Fi2 microscope camera attached to Leica MZ APO stereo binocular microscope (Figs. 2F–H, 4C–D, J), Canon EOS Kiss Digital (Fig. 4A–B), and a Dino-Eye AM423X microscope camera attached to a Nikon Eclipse E100 light microscope (Figs. 3, 5). Photographs shown in Fig. 1 were kindly provided by F. Ito. The digital images were processed and arranged with Adobe Photoshop Elements® 9 and 12 software.

For the morphological terminology, we followed Viitasaari (2002).

Results

Macrophya harai n. sp.

[New Japanese name: Shiroashi-kuro-habachi]

(Figs. 1A–E, 2–3)

Female (holotype, Fig. 1A–C). Length 9.5 mm. Black, with following creamy white: entire clypeus, labrum except for rather broad outer margins, outer surface of mandible basally, large transverse spot on mesoscutellum, apical part of dorsal surface of fore femur, fore tibia except for posterior surface, fore tarsus except for apex of each tarsomere, outer surface and very narrow both ends of middle trochanter, anterior surface of middle trochantellus, median 2/3 of outer surface of middle tibia, middle tarsus except for apex and ventral surface of each tarsomere, large oval spot on basal outer surface of hind coxa, narrow apex of hind coxa, hind trochanter, basal 1/3 of hind femur, oblong spot along median dorsal surface of hind tibia, dorsal surface of apical 3/4 of tarsomere 1, dorsal surface of tarsomeres 2–4, base of tarsomere 5 dorsally, lateral spot on each abdominal terga 2–5, those on 2 and 5 small and rounded and those on 3 and 4 large and subtriangular, and elongate longitudinal spot on abdominal tergum 9. Wings hyaline, apical 1/3 slightly infuscated, veins and stigma blackish brown to black.

Head in dorsal view distinctly roundly narrowed behind eyes and frons about as high as line connecting anterior margins of eyes; occipital carina entire, sharp above and blunt laterally; postocellar area broad, length about 0.5 × width; anterior margin of clypeus arcuately emarginate (depth about 1/3 of clypeal length), lateral lobes long and narrowly rounded at apex; malar space much narrower than diameter of median ocellus; labrum large, rounded laterally and truncate at apex. Antenna rather slender and long, length about 2.4 × head width across eyes; antennomere lengths ratio about 31 : 15 : 83 : 58 : 50 : 41 : 35 : 33 : 35. Head very shallowly rugose, shiny, with indistinct irregular punctures and pale hairs. Mesonotum densely covered with small distinct punctures, interspaces smooth and shiny; mesoscutellum weakly convex in lateral view, mesoscutellar appendage with median longitudinal carina; mesepisternum very densely covered with rather regular, partly confluent punctures with smooth interspaces; metepimeral appendage narrow and rounded, without basin, covered with irregular punctures and hairs with shiny interspaces. Abdomen with rather distinct surface microsculpture and minute punctures, weakly shiny. Forewing with cell A widely constricted at middle, without crossvein; hindwing with crossvein a joining vein 1A basal to junction of crossvein cu-a with vein 1A, thus anal cell appearing petiolate. Ovipositor sheath as in Fig. 2F. Lancet with about 21 annuli (Fig. 3A), middle serrulae each with 4–6 denticles, basal 2 widely separated and only shallowly concave between them and apical 2–4 narrowly separated by deep notch (Fig. 3B–C).

Male (paratype from Hitomai, Fig. 1D–E). Length 9 mm. Black, with following creamy white: entire clypeus and labrum, outer surface of mandible basally, very narrow dorsal posterior margin of pronotum, anterior surface and apex of

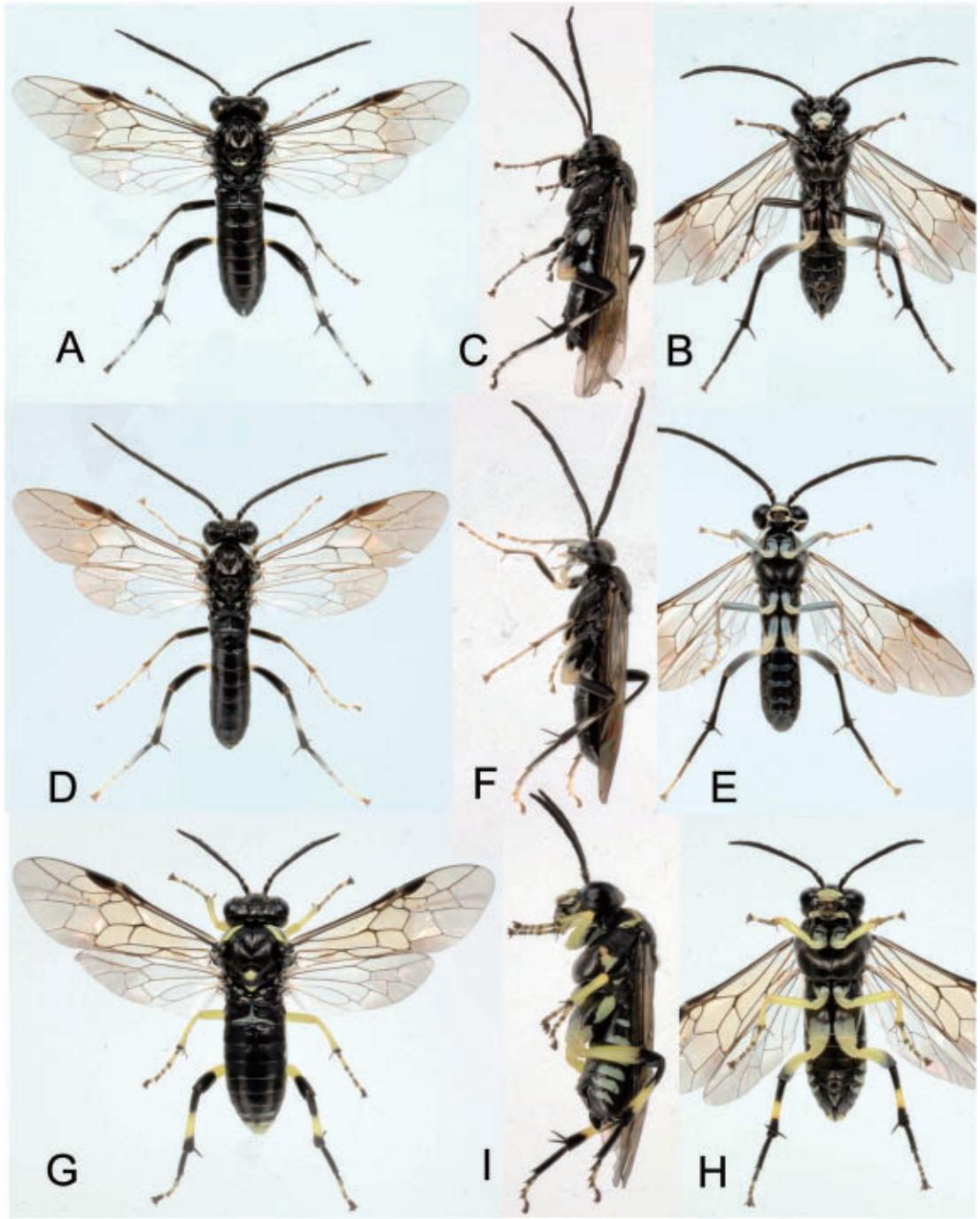

Fig. 1. *Macrophya harai* n. sp. (A–E) and *M. satoi* n. sp. (G–H).—A–C, Holotype, female; D–E, paratype, male, Hitomai; G–H, holotype, female.

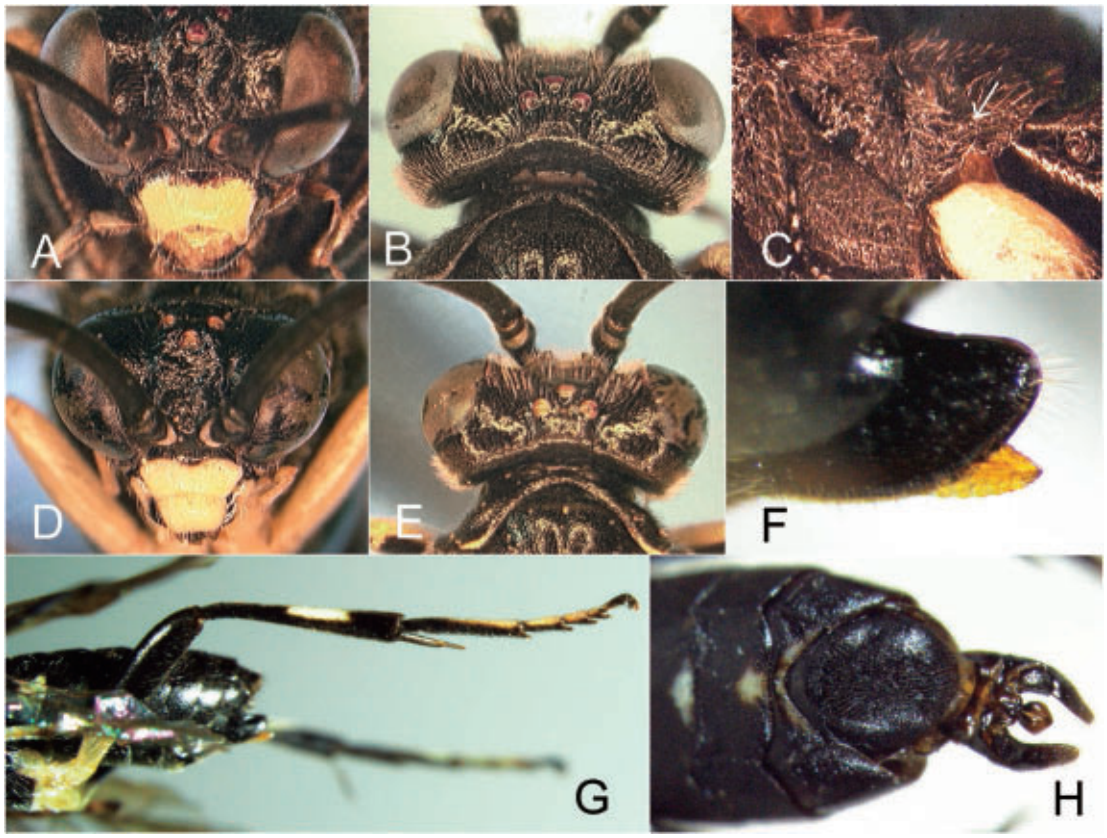

Fig. 2. *Macrophya harai* n. sp., holotype female (A–C, G), paratype male, Nakagawa-machi (D–E, H) and paratype female, Asahidake-onsen (F).—A, D, Head, frontal view; B, E, head dorsal view; C, metapleuron (metepimeral appendage arrowed); F, ovipositor sheath, lateral view; G, hind leg, lateral view; H, apex of abdomen and genital capsule, posteroventral view.

fore coxa, fore trochanter, anterior surface of fore femur and tibia, fore tarsus except for narrowly darkened apex of each tarsomere, broad ventral part and apex of middle coxa, middle trochanter, middle femur and tibia except for dorsal surface, middle tarsus except for narrowly darkened apex of each tarsomere, inner ventral surface and apex of hind coxa, hind trochanter, basal 1/3 of hind femur, oblong spot along median dorsal surface of hind tibia, dorsal surface of apical 3/4 of tarsomere 1, dorsal surface of tarsomeres 2, almost entire tarsomeres 3 and 4, tarsomere 5 except at apex, very narrow inner posterior margin of abdominal tergum 1, rather obscure spot on lateral surface of each of abdominal terga 3 and 4, and rather broad posterior margin of each abdominal sternum. Wings hyaline, apical 1/3 very slightly infuscated, veins and stigma blackish brown to black.

Similar to female in structure. Postocellar area length 0.4 × width. Antenna length about 2.7 × head width across eyes; antennomere length ratio about 25 : 10 : 88 : 66 : 59 : 44 : 39 : 35 : 35. Abdominal sternum 9 narrowed to rounded apex. Genitalia as in Fig. 3D–F.

Variation. Female: Length 9–10 mm. Two paratype females have a pair of narrow white lines separated at middle along the posterior margin of the postocellar area. The white spot on abdominal tergum 5 may be missing and abdominal tergum 8 may have an elongate longitudinal spot. Male: Length 8–9.5 mm. Abdominal tergum

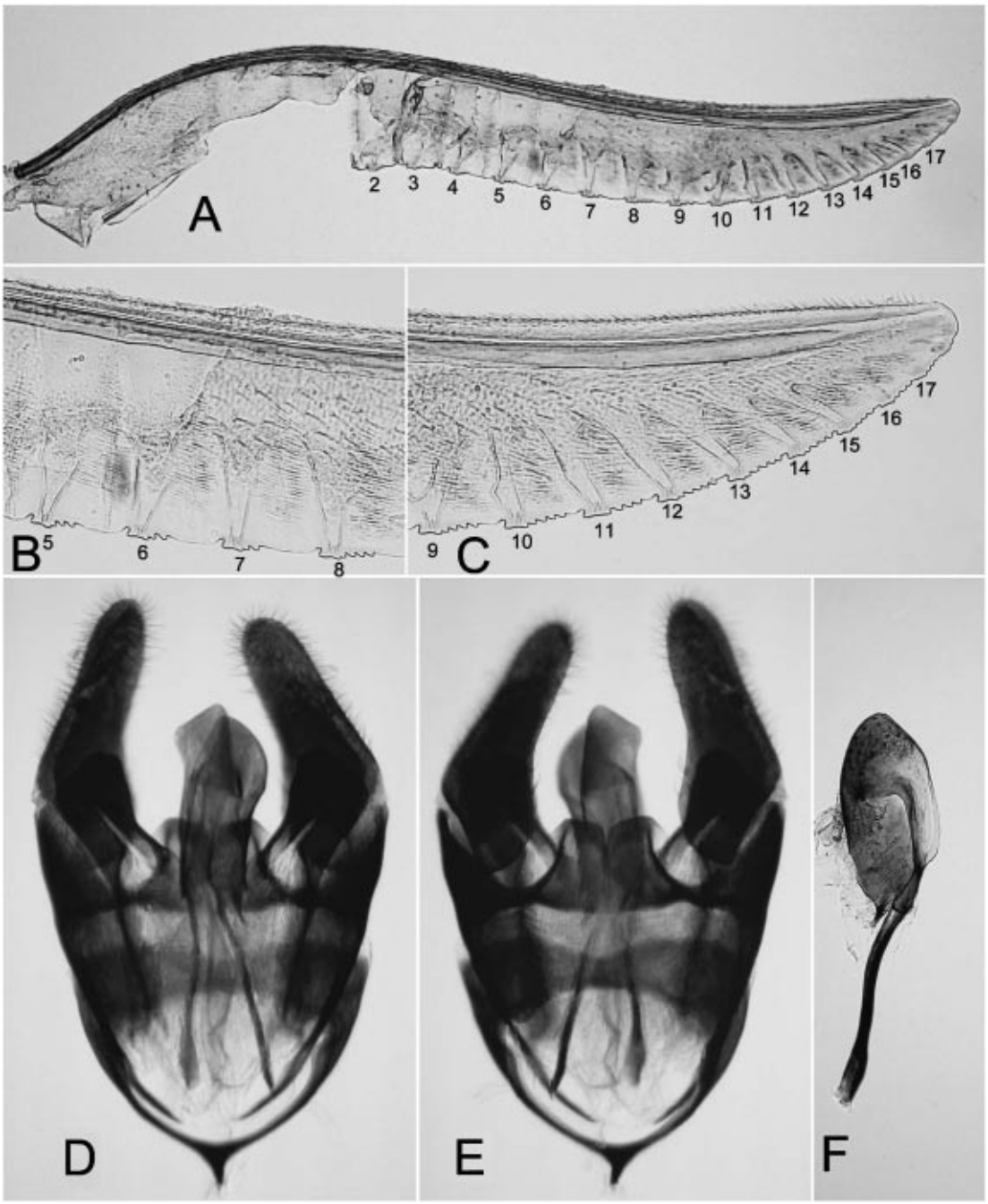

Fig. 3. *Macrophya harai* n. sp., holotype, female, lancet (A–C) and paratype, male, genitalia, Hitomai (D–F).—A, Entire lancet; B, middle part; C, apical part; D, genital capsule, dorsal view; E, same, ventral view; F, penis valve, lateral view (left ventral).

2 may also have an obscure whitish spot on each side. Abdominal sternum 9 often has the apical margin narrowly incised at the middle.

Material examined. Holotype: ♀, "Hitomai, Shimizu-cho, 10. VI. 2012, H. Hara". Paratypes: Hokkaido: 1 ♂, "Ashoro, Tokachi, 13. VI. 2011, A. Shinohara"; 1 ♂, "Nissho-toge, *ca.* 1000 m, Hidaka-cho, Hidaka, 9. VII. 2011, H. Hara"; 1 ♂ (in copula with holotype), "Hitomai, Shimizu-cho, 10. VI. 2012, H. Hara"; 1 ♀1 ♂, "Asahi-dake-onsen, *ca.* 1050 m, Higashikawa-cho, Kamikawa, 28. VI. 2013, A. Shinohara"; 1 ♂, "Mt. Yokotsudake, 960 m, 41-55-20N 140-45-50E, Oshima, 19–22. IV. 2007, H. Hara". Honshu: 1 ♂, "Takamatsutame, Wami, Nakagawa-machi, Tochigi Pref., 10. V. 2014, A. Shinohara"; 1 ♀, "Shimashima-dani, Nagano Pref., 7. VII. 2011, T. Naito".

Distribution. Japan (Hokkaido, Honshu).

Etymology. This new species is named in honor of H. Hara of the Hokkaido Forest Research Institute, Bibai, who collected the holotype.

Host plant. Unknown.

Remarks. *Macrophya harai* n. sp. runs to the couplet 15 in Takeuchi's (1937) key. The new species agrees with the first section of the couplet, which leads to *M. liukiuana* Takeuchi, 1926, from Japan (Okinawa-honto Island) and *M. falsifica* Mocsáry, 1909, from Japan (Honshu and Shikoku), by the laterally blunt occipital carina, the arcuately emarginated clypeus, and the presence of white markings on each side of the abdomen in the female, but disagrees with the first section by the slender body, the entirely black mesepisternum, and the pale-marked hind tarsi. The new species agrees with the second section, which contains *M. esakii* (Takeuchi, 1923) with its subspecies *M. esakii exilis* Takeuchi, 1933, from Japan (Hokkaido, Honshu, Shikoku and Kyushu), Kuril Islands, Sakhalin and Korea, by the slender body, the immaculate mesepisternum, and the partly white hind tarsi, but disagrees with it in the laterally blunt occipital carina, the arcuately emarginated clypeus, and the presence of white markings on each side of the abdomen in the female. *Macrophya harai* also differs from *M. esakii* in its normal-shaped head; the head of *M. esakii* in dorsal view is peculiar in its concave anterior part between the slightly protruding eyes.

In general appearance, *M. harai* resembles *M. annulitibia* Takeuchi, 1933, from Japan (Hokkaido, Honshu, Kyushu), Kuril Islands, Sakhalin and Korea. In the female of *M. harai*, the upper head is rather sparsely punctate with shiny interspaces between punctures, the labrum is marked with black laterally, the posterior margin of the postocellar area is often marked with white, the mesoscutellum is marked with white medially, the fore and middle trochanters and femora are black, the hind tibia has a dorsal white mark medially (ventrally black), hind tarsomeres 1–4 are marked with white above, hind tarsomere 5 whitish basally, crossvein a in the hindwing joins the vein 1A basal to the junction of crossvein cu-a with the vein 1A, thus the anal cell appearing petiolate, abdominal terga 2–4 or 5 have lateral whitish spots at the posterior margin, and abdominal terga 8 and 9 (or only 9) have longitudinal small spots medially. In the female of *M. annulitibia*, the upper head is densely punctate with the interspaces between punctures narrow and coriaceous, the labrum is entirely white, the postocellar area and the mesoscutellum are entirely black, the fore and middle trochanters and femora (at least basally) are white, the hind tibia has a median white ring, the entire hind tarsomeres 2–4 and the basal part of hind tarsomere 5 are white, crossvein a in the hindwing joins vein 1A distal to the junction of crossvein cu-a with vein 1A, thus the anal cell having no petiole, and the abdomen has no white markings. The male of *M. harai* is distinguished from that of *M. annulitibia* by the punctate but shiny upper part of the head and mesonotum (densely punctate and opaque in *M. annulitibia*), only very narrowly whitish dorsoposterior margins of the pronotum (broadly whitish in *M. annulitibia*), absence of a pale spot on the outer surface of the hind coxa (a large whitish spot present in *M. annulitibia*), presence of pale spots on the lateral

surfaces of the abdominal terga 3 and 4 (sometimes also 2) and along the posterior margins of the abdominal sterna (no pale spots on abdomen in *M. annulitibia*), and the black ventral surfaces of the hind tibia and hind tarsomeres 1–3 (partly white in *M. annulitibia*). The lancet and penis valve of *M. harai* (Fig. 3) are very different from those of *M. annulitibia* (Takeuchi, 1937, figs. 17, 38).

Macrophya satoi n. sp.

[New Japanese name: Toneriko-kuro-habachi]

(Figs. 1G–H, 4–5)

Female (holotype, Fig. 1G–H). Length 9.5 mm. Black, with following yellowish white: entire clypeus, labrum except for narrow outer margins, outer surface of mandible, palps, paired, very narrow transverse spots, widely separated medially, along posterior margin of postocellar area, rather broad posterior and dorsal margins of pronotum (not extending to ventral part), round spot on anterior part of mesoscutellum, entire mesoscutellar appendage, large subtriangular spot in median dorsal part of mesepisternum, lateral part of metascutellum, rather broad dorsal anterior corner of metepisternum, fore and middle legs except for narrow coxal bases and narrow apices of tibiae and tarsomeres, very large oval spot on dorsal outer surface of hind coxa, broad apical margin of hind coxa, hind trochanter, hind femur except for apical 1/3, median 1/2 of hind tibia, apical 2/3 of hind tarsomere 2, most of hind tarsomeres 3 and 4, basal 1/2 of hind tarsomere 5, round or semicircular spot along posterior margin of each of lateral part of abdominal terga 1–8, those on 1 and 8 small and obscure, very narrow posteromedian margin of abdominal tergum 1, paired, rather obscure elongate spot along posterior margin of abdominal tergum 7, paired large elongate spot along posterior margin of abdominal tergum 8, and large posteromedian part of abdominal tergum 9. Wings hyaline, entire forewing and apical 1/2 of hindwing very slightly infuscated, veins and stigma blackish brown to black.

Head in dorsal view distinctly roundly narrowed behind eyes and frons protruding beyond line connecting anterior margins of eyes; occipital carina blunt and inconspicuous; postocellar area broad, length about 0.6 × width; anterior margin of clypeus shallowly emarginate (depth about 1/5 of clypeal length), sinuate, lateral lobes short, blunt subtriangular; malar space narrower than diameter of median ocellus; labrum large, transverse, with shallowly concave apex. Antenna rather stout and short, length about 1.6 × head width across eyes; antennomere lengths ratio about 31 : 18 : 66 : 36 : 34 : 26 : 24 : 21 : 25. Head rather smooth, shiny, with indistinct irregular punctures and pale hairs. Mesonotum densely covered with small distinct punctures, interspaces smooth and shiny; mesoscutellum very weakly convex in lateral view, posterior part with longitudinal carina continuing to posterior margin of mesoscutellar appendage; mesepisternum very densely covered with rather regular, partly confluent punctures with smooth interspaces; metepimeral appendage obtusely triangular, covered with irregular punctures and hairs with rugose interspaces, not shiny, without basin. Abdomen with rather distinct surface microsculpture and minute punctures, weakly shiny. Forewing with cell A shortly constricted at middle, without crossvein; hindwing with crossvein a joining vein 1A basal to junction of crossvein cu-a with vein 1A, thus anal cell appearing petiolate. Ovipositor sheath as in Fig. 4J. Lancet with about 22 annuli (Fig. 5A), middle serrulae each with 6–8 denticles, basal 3 forming large tooth with very shallow notches between them and apical 3–5 narrowly separated by deep notch (Fig. 5B–C); cypsella between serrulae 9 and 10 much shorter than 1/2 of serrula 9 (Fig. 5B).

Male (paratype from Tokyo, Fig. 4A–B). Length 8.5 mm. Black, with following yellowish white: clypeus except for dorsal margin, labrum, outer surface of mandible, palps, narrow dorsal posterior margin of pronotum, small spot in lateral posterior part of pronotum near spiracle, lateral part of metascutellum, fore and middle legs

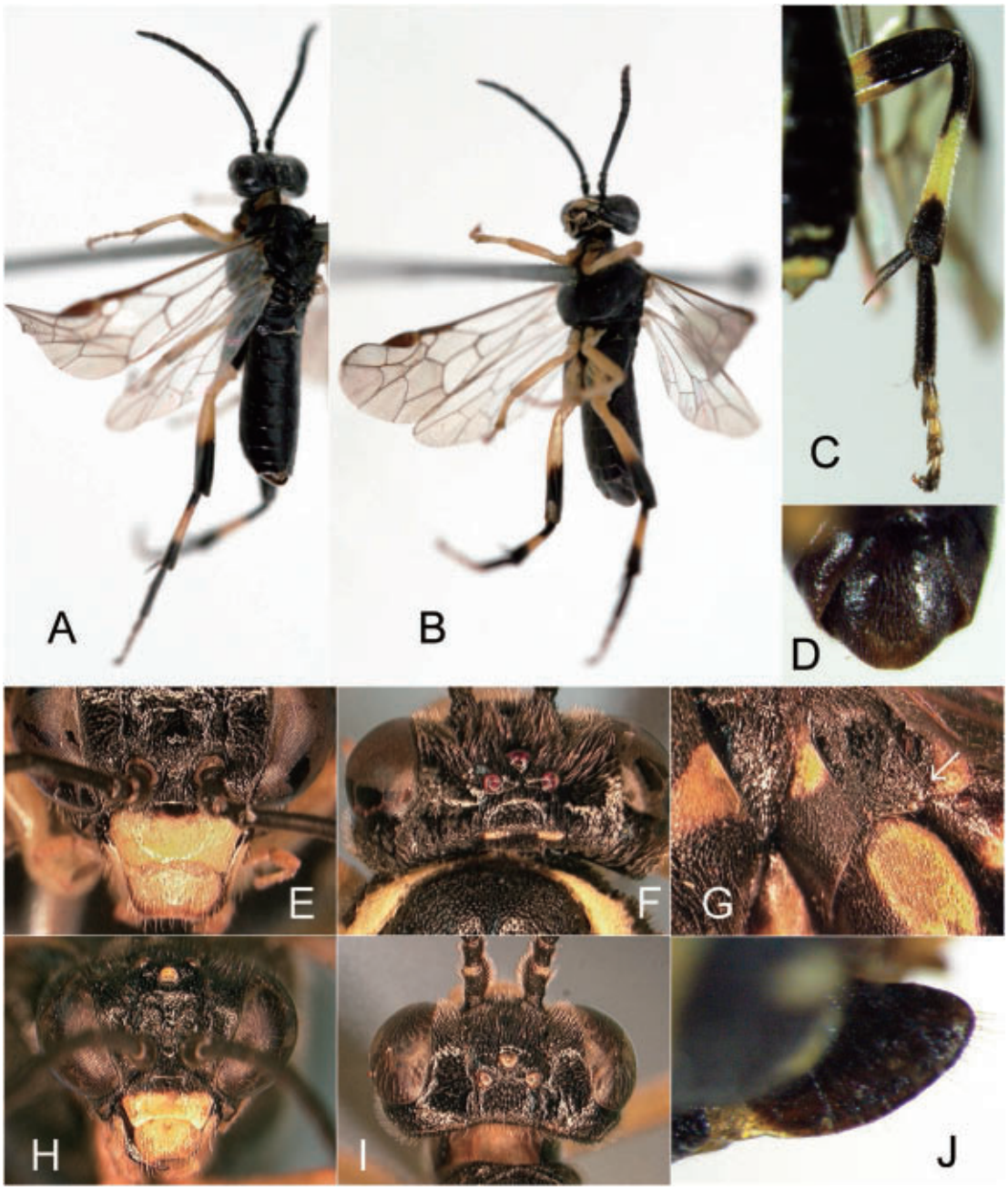

Fig. 4. *Macrophya satoi* n. sp., paratype male, Tokyo (A–B, D, H–I), holotype female (C, E–F, J) and paratype female, Tokyo (G).—A–B, Entire insect; C, right hind leg; D, abdominal sternum 9, ventral view; E, H, head, frontal view; F, I, dorsal view; G, metapleuron (metepimeral appendage arrowed); J, ovipositor sheath, lateral view.

except for narrow coxal bases, elongate spot on apical dorsal part of each femur, and narrow apices of tibiae and tarsomeres, ventral apical part of hind coxa, hind trochanter, hind femur except for apical 1/2, median 1/2 of hind tibia, narrow apex of hind tarsomere 1, most of hind tarso-

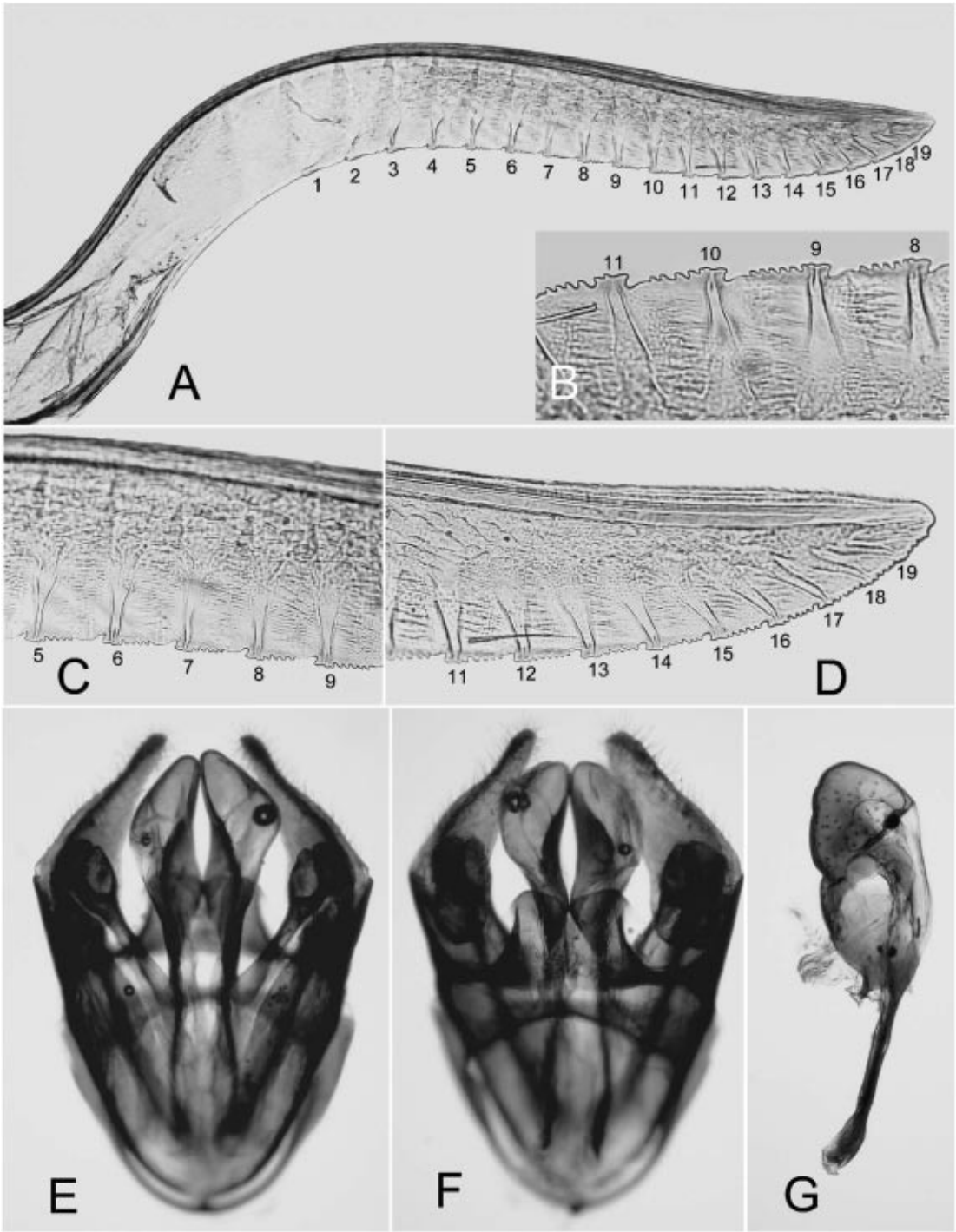

Fig. 5. *Macrophya satoi* n. sp., holotype, female, lancet (A–D) and paratype, male, genitalia, Tokyo (E–G).—A, Entire lancet; B, serrulae 8 to 11, 180° rotated image for easy comparison with fig. 73d in Wei and Nie (2002); C, middle part; D, apical part; E, genital capsule, dorsal view; F, same, ventral view; G, penis valve, lateral view (left ventral).

meres 2 to 4, hind tarsomere 5 except at apex, and narrow inner posterior margin of abdominal tergum 1; abdominal sternum 9 with large posterior obscure pale spot. Wings hyaline, entire forewing and apical 1/2 of hindwing very slightly infuscated, veins and stigma blackish brown to black.

Similar to female in structure. In dorsal view, frons about as high as line connecting anterior margins of eyes; occipital carina rather sharp all around; postocellar area length 0.7 × width. Antenna length about 2 × head width across eyes; antennomere length ratio about 26 : 14 : 69 : 41 : 37 : 28 : 27 : 24 : 24. Mesoscutellum with inconspicuous posterior longitudinal carina. Abdominal sternum 9 broadly rounded at apex. Genitalia as in Fig. 5E–G.

Variation. Female: Length 7.5–9.5 mm. All paratypes from Tokyo have the metascutellum entirely yellowish white and the hind tarsomere 1 whitish above. The median mesoscutal lobes sometimes have a pair of small whitish spots. The median longitudinal carina at posterior mesoscutellum is distinct in the holotype but indistinct in most paratypes. Male: Length 7.0–8.5 mm. The pale marking on abdominal sternum 9 is often missing.

Material examined. Holotype: 1 ♀, "Hayama, Tsugehayama-cho, Nara-shi, Nara Pref., 1. V. 2013, F. Ito". Paratypes: 4 ♀1 ♂, "Asakawa, Tokyo-fu, IV-1936, M. Ikuno" "Reared with *Fraxinus* sp."; 3 ♀6 ♂, "Tokyo, Japan, IV-22, 1956, coll. K. Sato" "on *Fraxinus*, Toneriko [= *Fraxinus japonica*]"; 1 ♀, "?Tokyo, Japan, M. Yano"; 5 ♀, "Meguro, Tokyo, Japan, 25-V, 1934, coll. K. Sato"; 1 ♀, "Mt. Takao, Tokyo-fu, 20-IV-1930, H. Sugiura"; 1 ♀, "Meguro, 1917. V. 24".

Distribution. Japan (Honshu).

Etymology. This new species is named in honor of the late K. Sato, one of the pioneers of sawfly taxonomy in Japan. He left a wonderful collection of East Asian sawflies in the National Museum of Nature and Science, Tsukuba, including all the paratypes of this new species.

Host plant. Oleaceae: *Fraxinus japonica* Blume *ex* K. Koch. Several paratypes are labeled "Reared with *Fraxinus* sp." or "on *Fraxinus*, Toneriko [= *Fraxinus japonica*]".

Remarks. In Takeuchi's (1937) key, the female of *Macrophyra satoi* n. sp. runs to couplet 15 and agrees with the first section leading to couplet 16, except that the hind tarsus is partly yellowish white in this species Couplet 16 contains *M. liukiuana* and *M. falsifica*. *Macrophya satoi* shares with *M. liukiuana* the entirely black antenna but differs from *M. liukiuana* in the moderately convergent inner margins of eyes and absence of the large white spot on abdominal tergum 1. *Macrophya satoi* shares with *M. falsifica* the moderately convergent inner margins of the eyes and the mostly or entirely black abdominal tergum 1 but differs from *M. falsifica* by the entirely black antenna. From *M. liukiuana*, *M. satoi* is distinguished also by the entirely black lateral mesoscutellar lobes, the entirely yellowish-white mesoscutellar appendage, the laterally or entirely yellowish-white metascutellum, the yellowish-white dorsal corner of the metepisternum, the largely yellowish-white hind tarsomeres 2–4 and the entirely black dorsal sterna. From *M. falsifica*, *M. satoi* is separated also by the shallow incision of the clypeus (Fig. 4E), the entirely black lateral mesoscutal lobes, the pale-marked abdominal tergum 8, and the largely yellowish-white hind tarsomeres 2–4. The male of *M. satoi* also keys to couplet 15 in Takeuchi (1937) but does not agree with either of the sections.

Judging from the description, *M. fraxina* Zhou and Huang, 1980, from China (Sichuan) is similar to *M. satoi*. However, in *M. fraxina*, the anterior margin of the labrum is rounded (truncate or shallowly concave in *M. satoi*), the postocellar area is nearly quadrate, with the posterior margin dark brown (distinctly shorter than broad and posterior margin with a pair of elongate yellowish-white spots in *M. satoi*), the posterior margin of the lower angle of the pronotum is pale yellow (lower part of pronotum entirely black in *M. satoi*), the median mesoscutal lobes have paired pale yellow marks along the median groove (such marks missing or obscure and small in *M. satoi*), the mesopleuron and metapleuron are

black, the former with an indistinct yellowish spot (mesepisternum and metepisternum each with a distinct triangular yellowish-white spot in *M. satoi*), hind tarsomeres 2–5 are pale yellow (usually apex of the tarsomere 1 is also yellowish white above in *M. satoi*), and the serrulae in the medioapical part of the lancet has the basal-most tooth very narrow (Zhou and Huang, 1980, fig. 2) (broad in *M. satoi*, Fig. 5D). *Macrophya quadriclypeata* Wei and Nie, 2002, from China (Guizhou) is also similar to the new species, but the former differs from the latter in the white posterior angles of the median mesoscutal lobes (pale spots missing or obscure in *M. satoi*), the entirely black metepisternum (dorsal corner triangularly yellowish white in *M. satoi*), and the long cypsella between the serrulae 9 and 10, which is much longer than 1/2 of the serrula 9 (Wei and Nie, 2002, fig. 73d) (much shorter than 1/2 of the serrula 9 in *M. satoi*, Fig. 5B).

Acknowledgments

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