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Arge obesa n. sp. (Hymenoptera, Argidae) Feeding on *Carpinus* and *Ostrya* in Japan, with Taxonomic Notes on *Hylotoma japonica*

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Abstract *Arge obesa* Hara and Shinohara, n. sp. is described from Hokkaido, Honshu, Shikoku and Kyushu, Japan. The larva feeds on *Carpinus cordata* Blume, *C. laxiflora* (Siebold et Zucc.) Blume, *C. tschonoskii* Maxim., and *Ostrya japonica* Sarg. (Betulaceae). The immature stages and life history are also described. The sawfly is a multivoltine species with polymodal adult emergence. The lectotype of *Hylotoma japonica* Marlatt, 1898, is designated in order to fix its synonymy with *A. jonasi* (Kirby, 1882).

Key words: Argidae, *Arge obesa*, new species, *Carpinus*, *Ostrya*, *Hylotoma japonica*, lectotype designation, Japan.

Introduction

Larvae of the sawfly genus *Arge* are external leaf feeders of eudicot trees and herbs such as the Berberidaceae, Betulaceae, Caplifoliaceae, Ericaceae, Rosaceae, Sabiaceae, Salicaceae, and Ulmaceae (Lorenz and Kraus, 1957; Okutani, 1967; Smith, 1989; Liston, 1995; Taeger *et al.*, 1998; Shinohara *et al.*, 2011). The Betulaceae are utilized by several species in Japan. Larvae of *A. aenea* Hara and Shinohara, 2008, *A. pullata* (Zaddach, 1859), *A. solowiyofka* (Matsumura, 1911) and some unidentified or undescribed species feed on *Betula* (Hara and Shinohara, 2008a, 2008b; Hara *et al.*, 2007; unpublished data). *Arge hakusana* Togashi, 1997, may be associated with *Alnus* (Togashi, 1997). We have found a new *Arge* whose larva feeds on *Carpinus* and *Ostrya*. This species is described here as *A. obesa* n. sp.

Hylotoma japonica Marlatt, 1898, described from five syntype specimens from Honshu, Japan (Marlatt, 1898), was regarded as a junior synonym of *A. jonasi* (Kirby, 1882) by Konow (1906) and subsequent authors (Takeuchi, 1919, 1932, 1939; Gussakovskij, 1935; Taeger *et al.*, 2010). Our examination of the syntypes has shown that three syntypes are *A. jonasi*, but the other two are *A. obesa* and a species of the *Spinarge fulvicornis* group (Hara and Shinohara, 2006), respectively. For the sake of stability, we designate a syntype identified with *A. jonasi* as the lectotype of *Hylotoma japonica*.

Materials and Methods

The material used in this study is kept in the National Museum of Nature and Science, Tsukuba, unless otherwise indicated. Abbreviations for the depositories are: HSC–H. Suda Collection, Sakura; HU–Hokkaido University, Sapporo; KU–Kobe University, Kobe; MNHAH–Museum of Nature and Human Activities, Hyogo, Sanda;

MYC–M. Yamada Collection, Kuroishi; NAC–N. Aoki Collection, Abiko; OPU–Osaka Prefecture University, Sakai; USNM–National Museum of Natural History, Washington, D. C.

Observations of morphology were made with a Leica MS5 stereo binocular microscope and measurements of each structure were taken with an ocular micrometer. Photographs were taken with a film camera, OLYMPUS OM-4, digital cameras, Canon EOS Kiss Digital X, Konica Minolta DiMAGE A200, Nikon E990, and Ricoh Caplio GX100, Keyence Digital Microscope VHX-900, and AnMo Electronics Dinolite digital microscope. The digital images were processed and arranged with Adobe Photoshop Elements 7.0 software.

Rearings were done in a room without air-conditioning in Bibai and Shintoku by Hara, in a room without air-conditioning in Nakagawa by Ibuki, and in an air-conditioned room in Tokyo by Shinohara. In the rearing rooms in Bibai and Shintoku, the temperature and light were almost the same as in the open-air condition, but the hibernating individuals were moved in March or April into an air-conditioned room, where the temperature was about 10–25°C. In the rearing room in Tokyo, the temperature was kept at 20–25°C. Both in Nakagawa and Tokyo, the light was usually on for about 16 hours a day during the feeding period; the larvae were kept indoors but without air-conditioning during winter.

Results

Arge obesa Hara and Shinohara, n. sp.

[Japanese name: Maru-unmon-churenji]

(Figs. 1–9, Table 1)

Hylotoma japonica Marlatt, 1898, p. 504 (part).
Arge abelivora Okutani, 1956, p. 97 (part).
Arge suzukii: Shinohara and Hara, 2008, p. 30 (part, not Matsumura, 1912).

Female (Fig. 1A–F). Length 6.5–9.5 mm. Black, with faint metallic bluish reflection, often faint brassy reflection on clypeus; subanal area narrowly or widely blackish centrally. Flagellum brown to blackish brown, with colorless reflection. Mandible apically reddish. Palpi dark brown, apically sometimes somewhat pale. Legs black, with colorless reflection; fore leg brownish on apex of femur; fore tibia and tarsus white to brown, each not or slightly darkened apically; middle and hind tibiae and tarsi white, each darkened apically, rarely hind tarsus darkened throughout; hind femur rarely narrowly whitish at base; hind tibia black on apical third to fourth; tibial spurs dark brown to black; claws apically brownish. Wings hyaline, slightly yellowish basally and slightly brownish apically on fore wing, and slightly brownish on hind wing, with dark transverse band below stigma, very rarely entirely brownish (Fig. 1G); dark band below stigma, if present, extending to posterior wing margin, covering all of cells Rs and 2M; stigma dark brown, basally narrowly pale, or yellow and centrally darkened; veins dark brown to black, yellow on C, Sc, and most of section of R1 basal to stigma; vein C darkened basally on anterior margin. Setae whitish, brownish dorsally and on sawsheath; wings with setae blackish, yellowish on basal membranous areas of forewing.

Surface generally smooth and polished; punctures on anterior part of head relatively dense and distinct, generally separated from each other.

Head in dorsal view (Fig. 3A) slightly concave at outer orbits, with width across eyes slightly narrower than or about as wide as width at genae. Distance between eyes 1.2–1.4 × vertical diameter of eye; eye with vertical diameter 1.5–1.7 × horizontal diameter. Postocellar area weakly convex, with anterior furrow shallow and blunt, and lateral furrow distinct anteriorly, sometimes indistinct throughout (Fig. 3A). Ocellar area weakly concave between ocelli (Fig. 3A, D). Frontal area nearly flat, not or slightly raised anteriorly (Fig. 3B, D), rarely medially or posteromedially shallowly concave as in Fig. 3E; lateral ridges converging anteriorly. Distance between median fovea and front ocellus 1.2–2.0 × width of front ocellus. Median fovea almost touching frontal area, very small or indistinct, sometimes with weak minute tubercle below

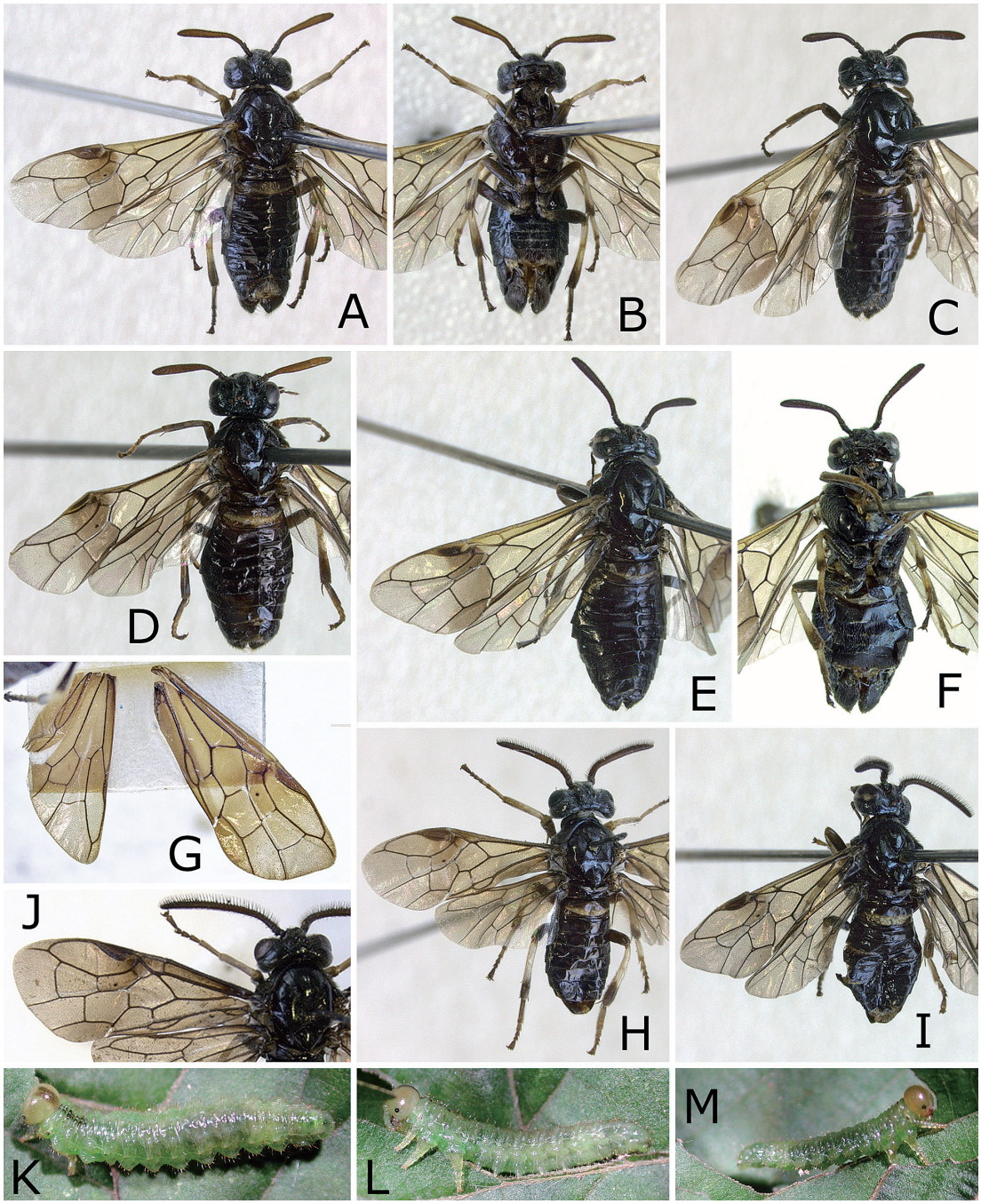
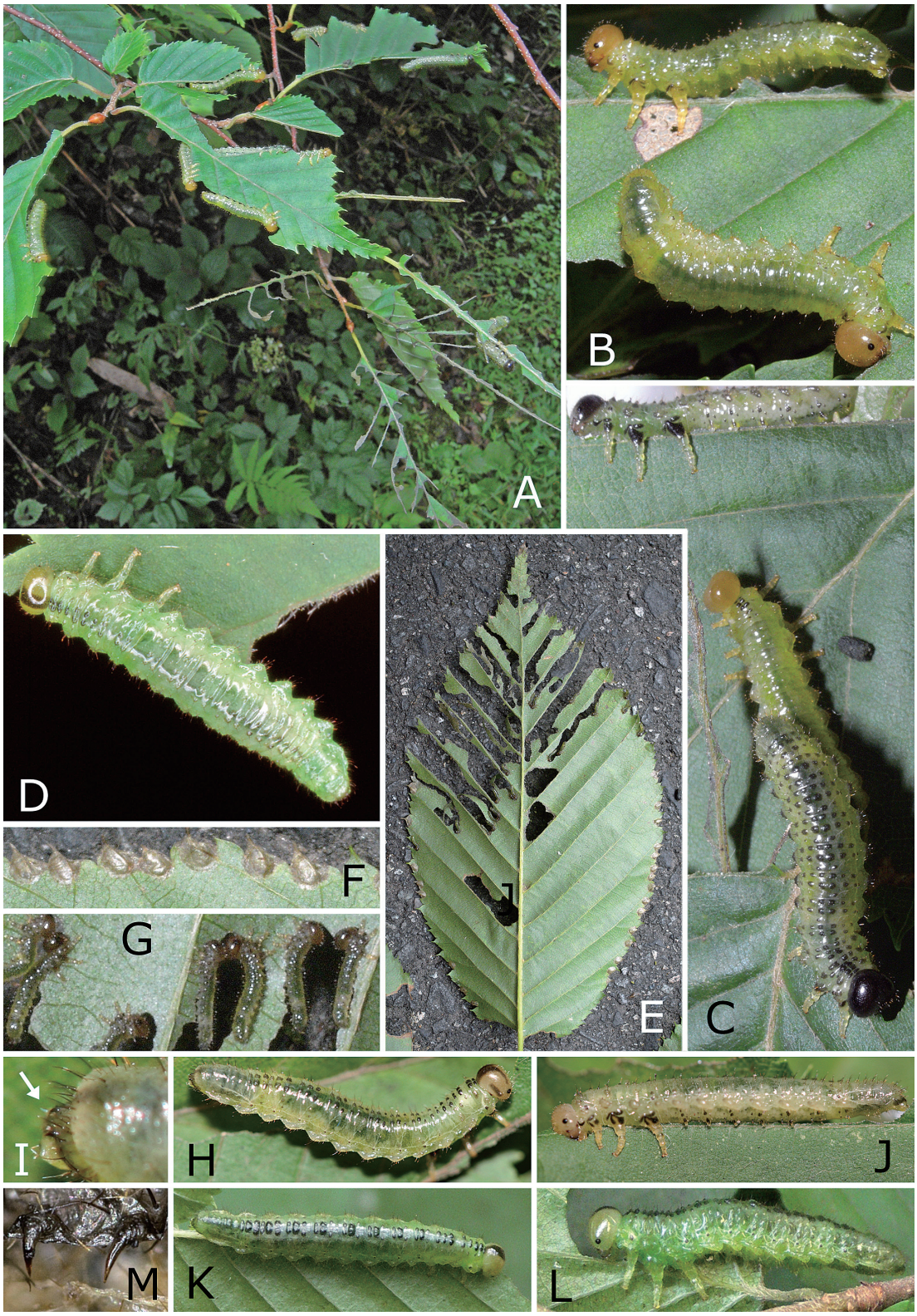


Fig. 1. *Arge obesa* n. sp. — A, B, Female, holotype (HH040810B, host *Carpinus cordata*), dorsolateral and ventral views; C, female, paratype (SI091005, host *C. cordata*), Nakagawa, dorsolateral view; D, do., (SI100707-2, host *C. tschonoskii*); E, F, female, paratype (HH100829A, host *Ostrya japonica*), Shintoku, dorsolateral and ventral views; G, female wings, paratype, Omogo; H, male, paratype (HH040810B), Iwamizawa, dorsolateral view; I, do., (HH100829A), Shintoku; J, do., Iwamizawa; K, L, final instar larva (HH040810B), Iwamizawa, dorsal and lateral views, photographed indoors on 11 August 2004; M, do., semifinal instar, lateral view. K–M, Photographs taken by H. Hara.


A
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(Fig. 3D); weak depression sometimes present below this tubercle. Interantennal carinae blunt or sharp, dorsally roundly curved medially and becoming weak or inconspicuous, fused or separated from each other, ventrally weakened and separated from each other (Fig. 3F), or fused into carinate median supraclypeal ridge (Fig. 3H). Median supraclypeal ridge rounded (Fig. 3F) or bluntly carinate (Fig. 3H); side slope from median ridge rounded or flattened medially and rounded laterally, slightly rugulose. Malar space 0.7–1.1 × width of front ocellus. Clypeus distinctly sunk below supraclypeal carina, flattened ventrally (Fig. 3B, F); ventral margin widely roundly concave medially. Antennal length 1.0–1.2 × maximum head width; flagellum (Fig. 3I, J) scarcely compressed, distinctly curved basally and narrowly rounded at apex in inner lateral (dorsal) view. Right mandible not incised on inner margin (Fig. 3H).

In forewing, cell 1Rs2 with anterior length 0.9–1.1 × posterior length and crossvein 3r-m roundly curved (Fig. 1A, C–E); in both wings, wing margin between veins Rs and Cu not ciliate, with width of marginal glabrous area about 2.0 × width of vein M and length of marginal setae about 1.5 × width of vein M (Fig. 3M).

Abdomen with first to fourth terga glabrous above; fifth and sixth, sometimes also seventh terga medially almost glabrous; more posterior terga setose. Seventh sternum with posterior margin medially roundly produced and sunk. Sawsheath in posterodorsal view (Fig. 4A–C) about as long as or wider than long, basally widely sunk, dorsally rounded, with apical margin narrowly or moderately rounded, lateral margin weakly or moderately rounded, medial margin edged at narrow base, and basal median lobe small, in lateral view (Fig. 4D–F) with ventral margin, except for basal convexity, roundly convex, dorsal margin nearly straight or slightly roundly convex, and apex rounded; inner surface spinose.

Lance without membranous areas (Fig. 4G, H) and groups of minute setae along ventral margin (Fig. 4L); apical crest somewhat roughly or finely serrate on dorsal margin (Fig. 4I–K). Lancet with dorsal margin slightly roundly convex (Fig. 5A–D), ventral margin rounded, distinctly serrate, dorsally with inconspicuous membranous area (Fig. 5I), apically with wide non-annulate area, and with about 18–20 serrulae; marginal sensillae long; longitudinal rows of minute setae present before first annulus, narrowing dorsally; basal two rows dorsally far apart from dorsal margin of lancet; sclerotized part on first annulus small, far apart from dorsal margin of lancet; sclerotized part on second annulus narrowing or disappearing dorsally; middle annuli each with three to six sensory pores except for ventral ones; basal annuli ventrally curved basally; middle and apical annuli nearly straight, oblique, with ventral end located apical to dorsal end; serrulae finely dentate (Fig. 5E–H), subtriangular with long posterior slope.

Male. Length 5.5–7.0 mm. Coloration as in female, but wings always entirely brownish, with faint dark mark below stigma (Fig. 1H–J); veins C and R1 basal to stigma sometimes mostly black (Fig. 1J); middle tibia rarely entirely pale; genital capsule brown to dark brown, with harpe black (Fig. 6C, D). Head in dorsal view with width across eyes about as long as or slightly longer than width at genae. Interantennal carinae

Fig. 2. *Arge obesa* n. sp. — A, Late instar larvae (AS100920A) and infested leaves of *Carpinus laxiflora*, Mt. Haguro-san, photographed on 20 September 2010; B, C, part of larvae in A; D, final instar larva (Ph910717B) on *Ostrya japonica*, Shintoku, photographed on 17 July 1991; E, remains of egg shells and first instar larvae (AS090927A) on *Carpinus cordata*, Nakagawa, photographed on 27 September 2009; F, G, remains of egg shells and first instar larvae, enlargement of E; H–J, final instar larva (AS090926) on *C. laxiflora*, Nasukarasuyama, photographed indoors on 7 October 2009; I., do., apex of abdomen (arrow indicate hook-shaped spines); K, L, final instar larva (AS060929) on *C. laxiflora*, Kobe, photographed on 29 September 2006; M, hook-shaped spines on subanal lobe in exuvia of final instar larva (AS100920A, male, black-headed larva). Photographs taken by A. Shinohara, except for D and M photographed by H. Hara.

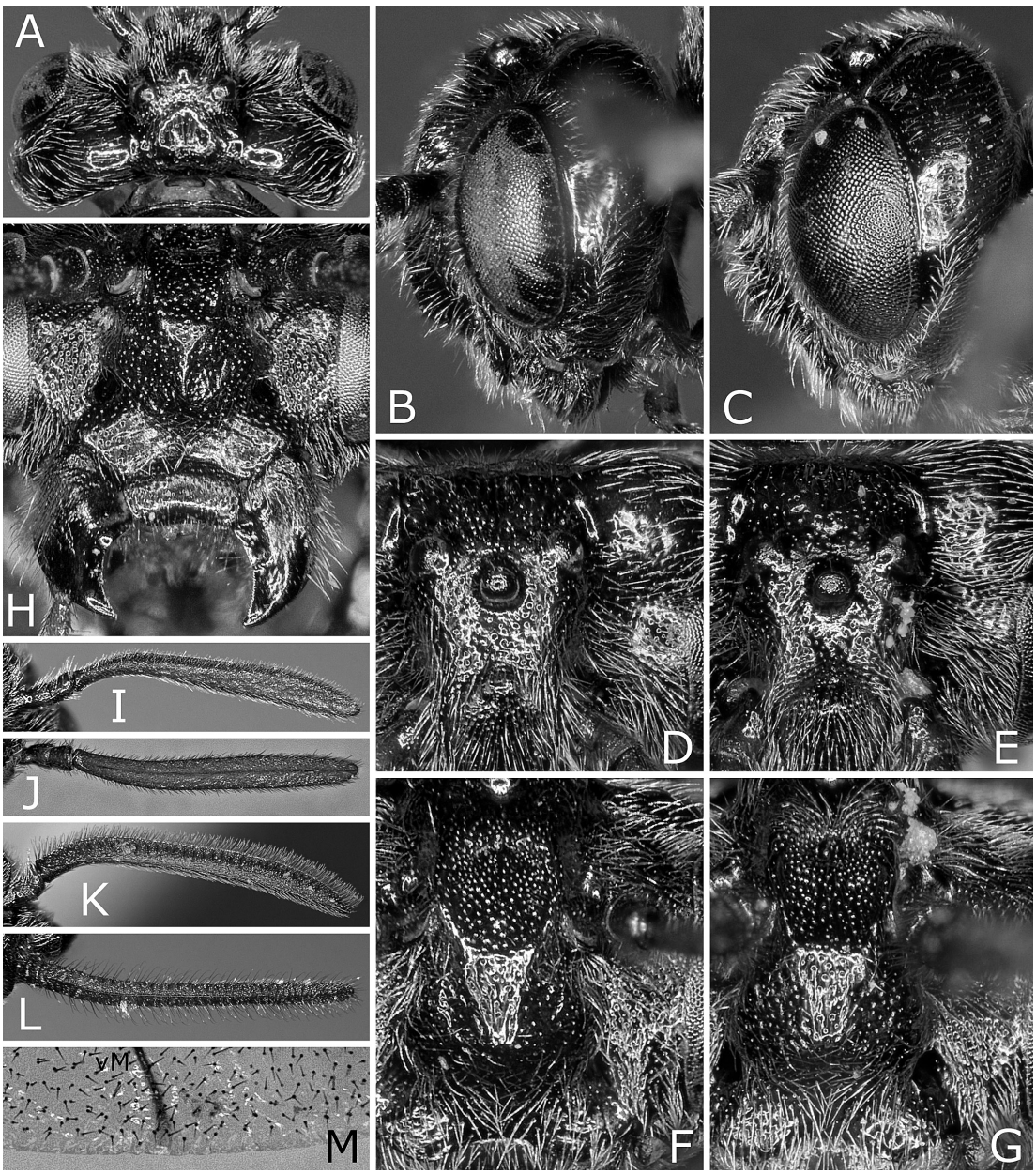

Fig. 3. A, Head, dorsal view; B, C, do., lateral view; D, E, ocellar and frontal areas, anterodorsal view; F, G, supraclypeal area and clypeus, anterior view; H, supraclypeal are to mandibles, anterior view; I, J, female antenna, inner lateral and ventral views; K, L, male antenna, inner lateral and ventral views; M, apical margin of forewing (vM: vein M). — A, B, D, F, I, J, M, Holotype; C, E, G, K, L, male paratype (brother of holotype); H, female, paratype, Iwamizawa.

sharp, dorsally blunt. Distance between eyes 1.1–1.3 × vertical diameter of eye; eye with vertical diameter 1.4–1.6 × horizontal diameter. Malar space 0.7–0.9 × width of front ocellus. Antennal length 1.3–1.7 × maximum head width; flagellum distinctly and slightly compressed (Fig. 3K, L), basally curved or gently curved throughout. In forewing, crossvein 3r-m sometimes somewhat

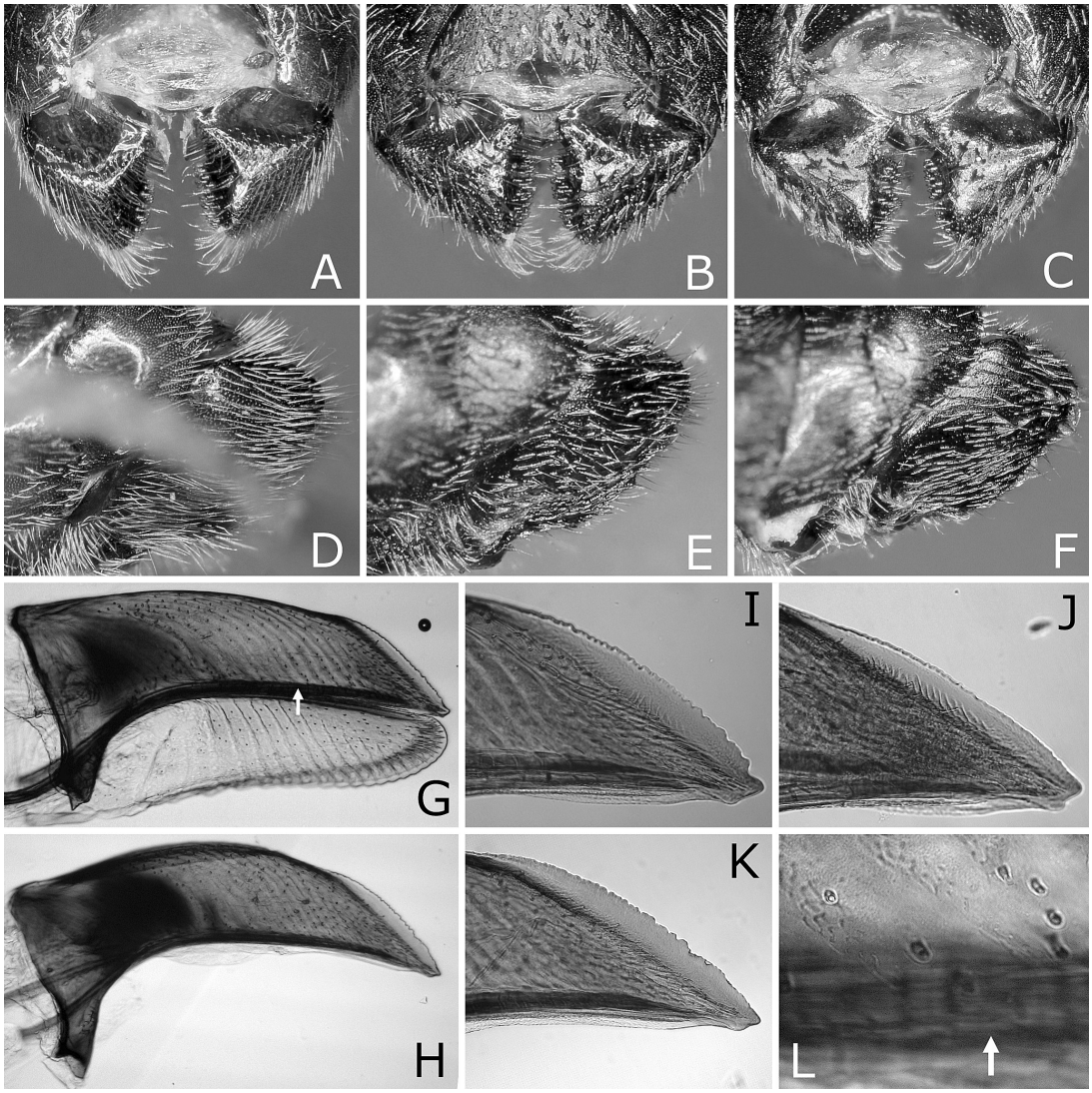

Fig. 4. A–C, Sawsheath, posterodorsal view; D–F, do., lateral view; G, ovipositor, lateral view; H, lance, lateral view; I–K, apical part of lance, lateral view; L, ventral part of middle of lance (arrowed part in G enlarged). — A, D, I, Holotype (HH040810B, host *Carpinus cordata*); B, E, paratype (SI091005, host *C. cordata*), Nakagawa; C, F, H, K, paratype (HH100829A, host *Ostrya japonica*), Shintoku; G, L, paratype (SI100707-2, host *C. tschonoskii*), Nakagawa; J, paratype (host *C. tschonoskii*), Sasayama. E, G, L, Reversed images.

angularly curved. Fifth to eighth abdominal terga sparsely setose on wide medial areas. Subgenital plate in ventral view with posterior margin apically widely truncate, slightly concave (Fig. 6D), or bilobate (Fig. 6N).

Genitalia as in Fig. 6; gonostipes in ventral view narrowing apically, with medial margin almost straight and apical width about as wide as basal width of harpe (Fig. 6B, D, F, H). Harpe in dorsal view tapering apically, about 1.5 × as long as wide, with apex pointed. Valviceps in dorsal view (Fig. 6A, C, E, G) with round lateral lobe at apex, in lateral view (Fig. 6I–M) nearly triangular, with apex nearly truncate and its dorsal and ventral ends narrowly rounded, and dorsal apodemal projection (dap) very small and far

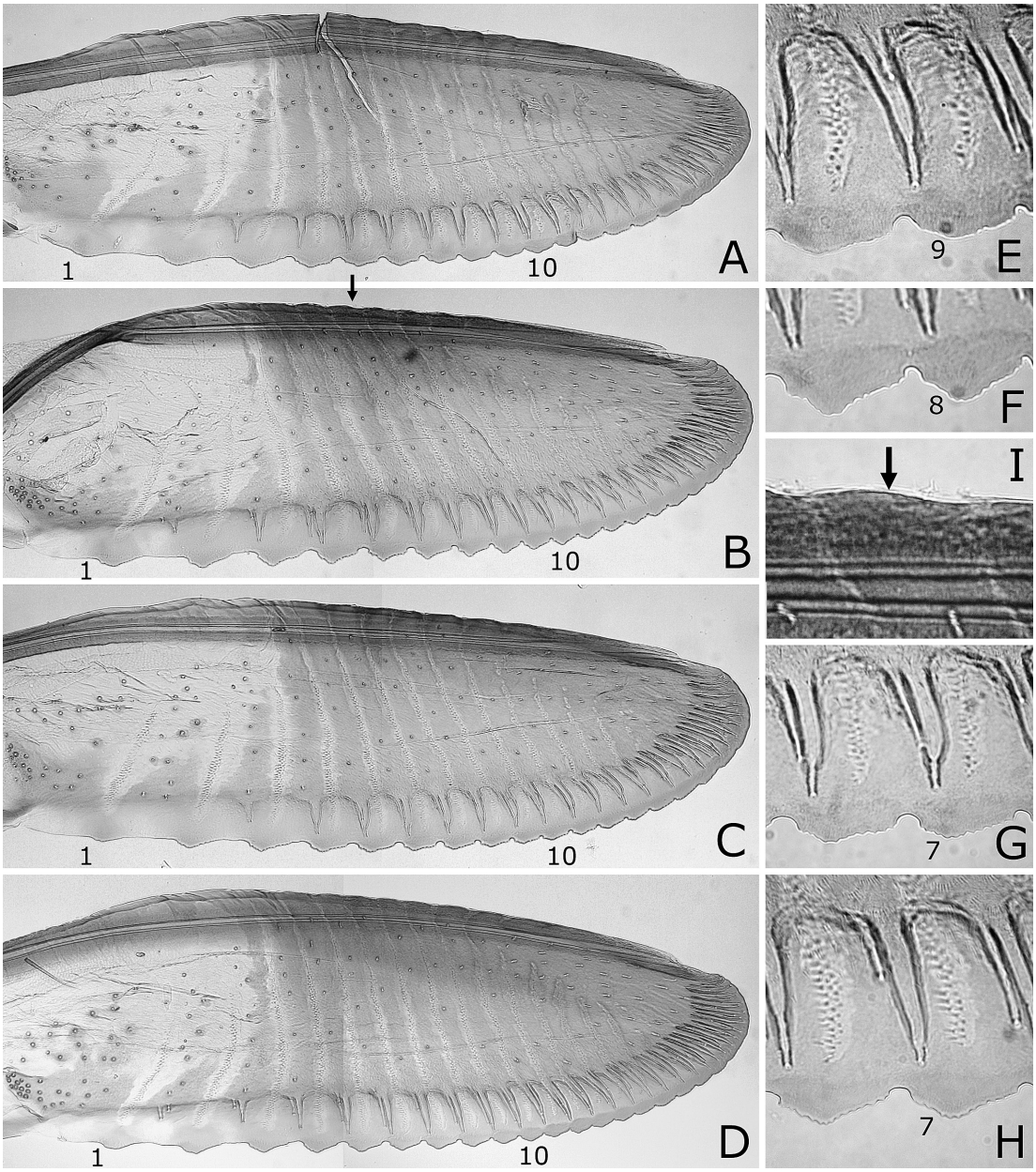

Fig. 5. A–D, Lancet; E–H, middle serrulae; I, dorsal part of lancet (arrowed part in B enlarged). — A, E, Holotype (HH040810B, host *Carpinus cordata*); B, F, I, paratype (SI091005, host *C. cordata*), Nakagawa; C, G, paratype (SI100628, host *C. laxiflora*), Nakagawa; D, H, paratype (HH100829A, host *Ostrya japonica*), Shintoku. Each numeral indicates serrula number. A–C, E–I, Reversed images.

apart from ergot (erg).

Larva. Early to middle instar (Figs. 1M, 2G): Head brownish yellow to pale brown, sometimes with dark dorsomedial stripe, rarely with dark stripe on gena; legs pale yellow, sometimes darkened on coxae; trunk pale greenish yellow to pale green, rather densely covered with pale setae, sometimes dorsally with scattered black spots and with apically blackish subspiracular lobe. Final instar (Figs. 1K, L, 2B–D, H–J, K, L): In

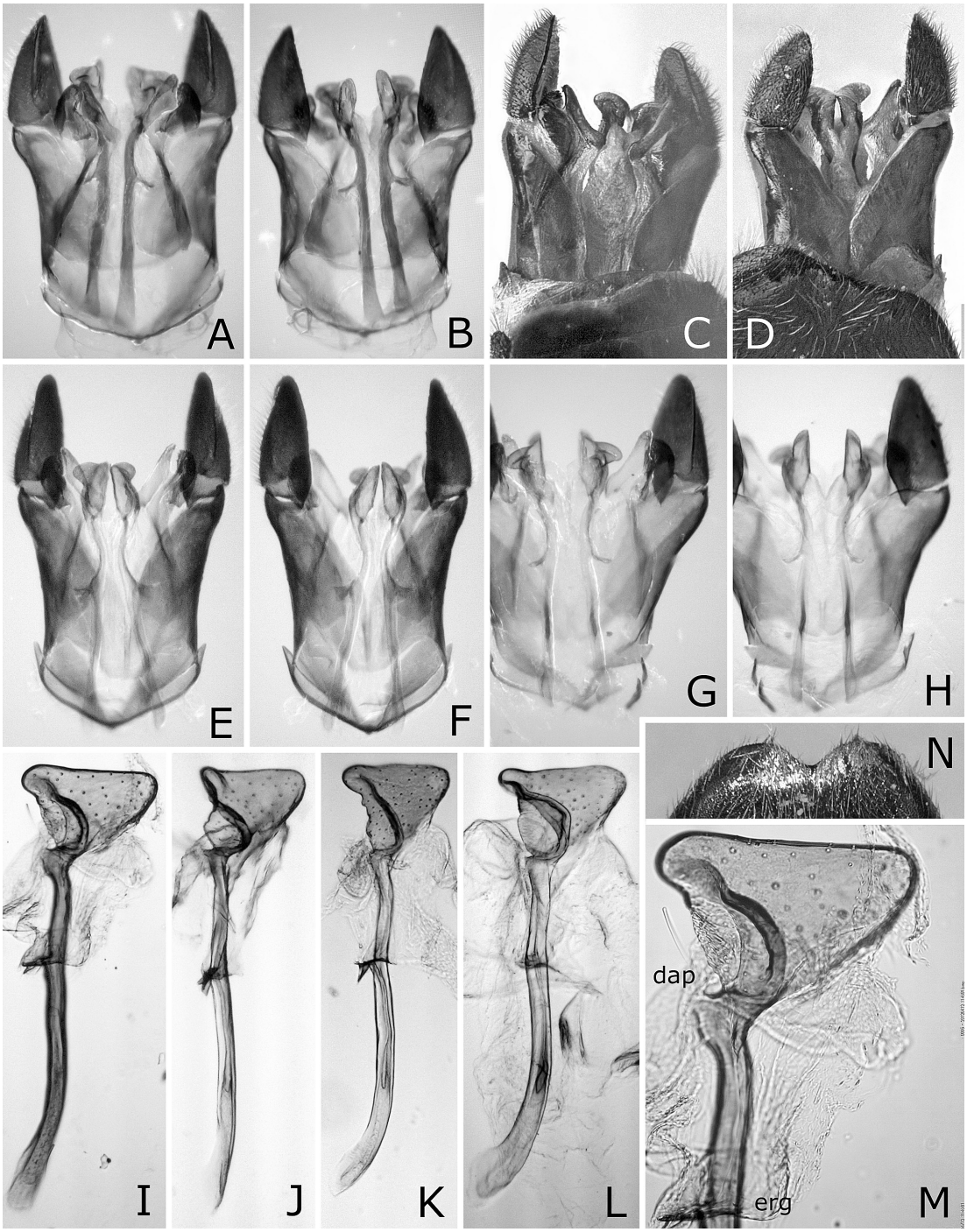

Fig. 6. A, E, G, Male genitalia, dorsal view; B, F, H, do., ventral view; C, D, male genitalia and apical abdominal segment; I–L, penis valve, lateral view (left dorsal); M, valviceps, lateral view (left dorsal) (dap: dorsal apodeme, erg: ergot); N, apex of subgenital plate, ventral view; A–N, paratypes. — A, B, I, M, Brother of holotype, HH040810B, host *Carpinus cordata*; C, D, AS100920A (emerged from black-headed larva), host *C. laxiflora*, Mt. Haguro-san; E, F, K, SI100707-2, host *C. tschonoskii*, Nakagawa; G, H, L, N, Ph910717B, host *Ostrya japonica*, Shintoku; J, SI100628, host *C. laxiflora*, Nakagawa.

pale specimens, head pale greenish yellow to brownish yellow, with or without dark dorsomedial stripe, legs pale yellow to yellowish green, sometimes slightly darkened basally, and trunk pale whitish green to yellowish green, with or without pair of dark spots along dorsomedian line of thorax (Figs. 1K, L, 2B, D); head sometimes with dark dorsomedian stripe anteriorly branching and extending towards eyes and with dark genal stripe (Fig. 2H); trunk sometimes with pair of dark spots along dorsomedian line from prothorax to eighth abdominal segment (Fig. 2H, K); in dark specimens, head black, legs pale green, basally black, trunk pale green, covered with many small black spots dorsally and ventrally, with subspiracular lobe apically blackish (Fig. 2C); setae pale brownish, often partly blackish.

Structure (late instar): Length 15.0 mm; antenna cylindrical, rather short (Fig. 7C); clypeus with two pairs of setae; labrum with two pairs of setae; mandible with three setae on outer surface; maxillary palp with four palpomeres; palpifer with two setae; labial palp with three palpomeres; first to ninth abdominal segments each with three annulets (Fig. 7A); prolegs on second to sixth and tenth segments, those on second to sixth elongate (Figs. 1L, 2J, 7A); trunk rather densely setose; subspiracular lobe distinctly roundly produced (Fig. 7E, F); tenth tergum in dorsal view rounded apically, basally with bulbous lobe (Fig. 7G, H) (this lobe usually inconspicuous as in Fig. 2H, K, probably deflating); subanal lobe slightly extending posteriorly beyond suranal lobe, and with pair of hook-shaped spines (Figs. 2I, M, 7G). In early to middle instars, spine on subanal lobe conical (Fig. 7I).

Cocoon. Creamy to pale brown. Length 8.0–11.0 mm in female, 6.0–8.0 mm in male. Elongate oval, double walled; outer wall netted; inner wall parchment like.

Distribution Japan (Hokkaido, Honshu, Shikoku, Kyushu).

Material examined. Holotype (Fig. 1A, B): ♀, labelled "JAPAN, Hokkaido, Kurisawa, Manji, em. 2004/8/28–9/2, H. HARA" and "Part. HH040810B, 11 larvae on branch of *Carpinus cordata*, col. 2004/8/10, cocoon. 8/12–13". Deposited in the National Museum of Nature and Science, Tsukuba. Paratypes: HOKKAIDO–2♂ (Ph910629C), Tokachi, Shintoku, larvae coll. 29. VI. 1991, coc. VII., em. 27. VII. 1991, Host: *Ostrya japonica*, H. Hara; 1♂ (Ph910629C), do., but em. 15. V. 1992; 1♂ (Ph910717B), same locality and host, larva coll. 17. VII. 1991, coc. 18. VII., em. 24. IV. 1992, H. Hara; 2♂, Mikasa, Tomatsu, 22–29. VII. 2002, H. Hara; 1♂, Mt. Yubari-dake, 10. VIII. 1966, T. Kumata (HU); 1♂, Iwamizawa, Manji, 7–23. VII. 2003, H. Hara & N. Ishihama; 1♀7♂, do., but 23. VII.–7. VIII. 2003; 1♀ (HH030830A), same locality, from 7 gregarious larvae coll. 30. VIII. 2003, coc. 1–5. IX., em. 20. IX. 2003, Host: *Carpinus cordata*, H. Hara; 1♀3♂(HH040810B), same data as holotype; 1♀, same locality, 2. VII. 2006, on *Carpinus cordata*, 24 eggs on leaf margins of two adjascent leaves nearby, H. Hara; 1♂ (HH050806A), Mikasa, Ikushunbetsu, from 8 gregarious larvae coll. 6. VIII. 2005, coc. 11. VIII., em. 2–4. IX. 2005, Host: *Carpinus cordata*, H. Hara; 1♀, Sapporo, 6. VII. 1954, M. Konishi (HU); 1♀, Sapporo, Moiwa, 3. VIII. 1911, Matsumura (HU); 1♂, Sapporo, Maruyama, 24. VI. 1930, K. Igarashi (HU); 1♂, Sapporo, Ashiribetsu, 5. VIII. 1962, S. Takagi (HU); 1♀, Tomakomai, 20. VIII. 1957, K. Kamijo (HU). HONSHU–Aomori Pref.: 1♀, Fukaura, "Azumagawa", 2. VII. 1989, M. Yamada (MYC). Yamagata Pref.: 1♂ (AS100920A), Tsuruoka, Mt. Haguro-san, 320m, larva coll. 20. IX. 2010, mat. 22–24. IX., em. 18. V. 2011, Host: *Carpinus laxiflora*, A. Shinohara; 1♂ (AS100920A), do., but em. 19. V. 2011; 1♂ (AS100920A), do., but em. 27. V. 2011; 1♂ (AS100920B), do., but mat. 2–3. X., em. 20. X. 2010. Tochigi Pref.: 1♀, Nasushiobara, "Uwanohara", 28. V. 2008, E. Katayama; 1♀, Utsunomiya, Mt. Hagurosan, 3. V. 1976, T. Saito; 1♀ (SI091005), Nakagawa, Bato, Sukusukunomori, 160 m, larva coll. 5. X. 2009, coc. 13. X., em. 7. VI. 2010, Host: *Carpinus cordata*, S. Ibuki; 1♀

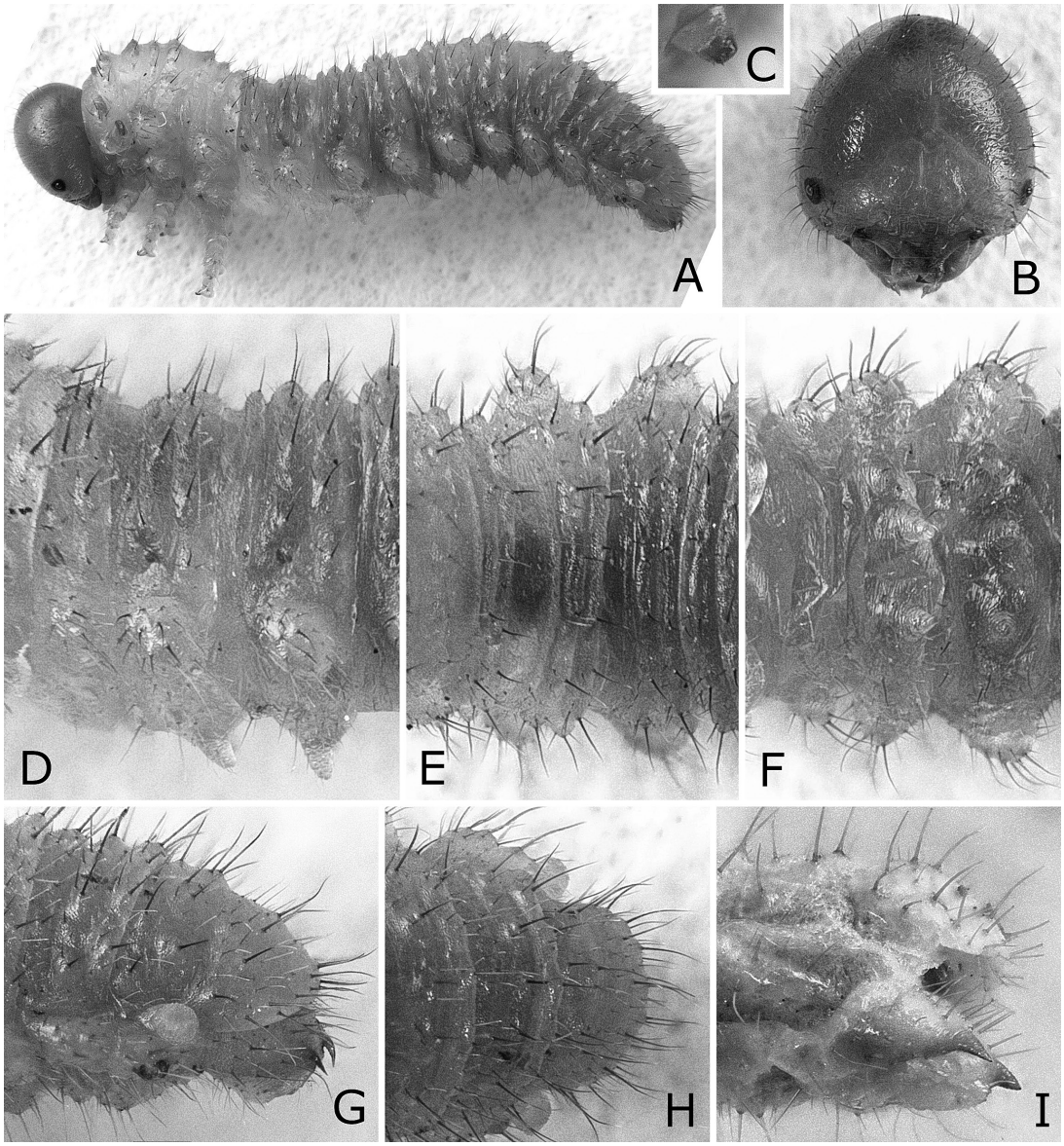

Fig. 7. A–H, Final instar larva (HH040810B), Iwamizawa; I, middle instar larva, Nakagawa. — A, Entire larva, lateral view; B, head, anterior view; C, antenna, anterior view; D–F, first to third abdominal segments, lateral, dorsal and ventral views; G, I, ninth and tenth abdominal segment, lateral view; H, do., dorsal view.

(SI091005), do., but em. 10. VI. 2010, deposited 21 eggs (hatched 26. VI. but all died); 1♂ (SI091005), do., but em. 21. VI. 2010; 1♂ (SI091005), do., but em. 23. VI. 2010; 1♀ (SI091005), do., but em. 26. VI. 2010; 6♂ (SI100911), do., but larvae coll. 11. IX. 2010, coc. 20–21. IX., em. 12. X. 2010; 1♀ (SI100628), Nakagawa, Wami, 230m, larva coll. 28. VI. 2010, coc. 9. VII., em. 31. VII. 2010, Host: *Carpinus laxiflora*, S. Ibuki; 1♀1♂ (SI100628), do., but em. 2. IX. 2010; 1♀, Nakagawa, Bato, Bicchuzawa, 150 m, 8. V. 2008, A. Shinohara; 1♀ (SI100707-2), Nakagawa, Bato, Bicchuzawa, 125m, larva coll. 7. VII. 2010 on *Carpinus tschonoskii*, reared with *Carpinus laxiflora*, coc. 16. VII., em. 12. IX. 2010, S. Ibuki;

1♂ (SI100707-2), do., but em. 16. IX. 2010; 1♀ (SI100707-3), same locality, larva coll. 7. VII. 2010 on *Carpinus tschonoskii*, reared with *Carpinus cordata*, coc. 23. VII., em. 13. IX. 2010, S. Ibuki; 1♂ (SI100912), same locality, larva coll. 12. IX. 2010, coc. 20. IX., em. 12. X. 2010, Host: *Carpinus cordata*, S. Ibuki; 1♀ (SI110914), same locality, larva coll. 14. IX. 2011, coc. 28. IX., em. 26. X. 2011, Host: *Carpinus cordata*, S. Ibuki; 1♂ (SI110914), do., coc. 27. IX., em. 15. XI. 2011; 1♂ (SI110914), do., but coc. 28. IX., em. 19. XI. 2011; 1♀ (SI110914), do., but coc. 28–29. IX., em. 25. XI. 2011; 1♂ (SI110914), do., but coc. 27–28. IX., em. 1. XII. 2011. Gunma pref.: 3♂ (AS100909), Katashina, Marunuma, 1400 m, larvae coll. 9. IX. 2010, mat. 19–20. IX., em. 5. X. 2010, Host: *Carpinus cordata*, A. & N. Shinohara; 1♂ (AS100909), do., but em. 8. X. 2010. Chiba Pref.: 2♀19♂, Sakura, Iida, 31. V. 1974, H. Suda (HSC); 1♀, Sakura, Miroku-machi–Kaburagi-machi, 5. VI. 1974, H. Suda (HSC); 1♀, Sakura, Mogami, 5. VI. 1974, H. Suda (KU); 1♂, Sakura, Yamanozaki, 31. V. 1974, H. Suda (KU); 1♀, Kashiwa, Neto, 6. IX. 2008, N. Aoki (NAC); 1♀1♂ in copulation, Matsudo, "15. 5. 30". J. Yoshikawa; 1♀, do., but "2600 5-30"; 1♂, Ichikawa, "2597 6-5", J. Yoshikawa; 1♀1♂, do., but "2600 5-29"; 12♂, do., but "15 5 29"; 1♀, Funabashi, Narashinohara, 29. VIII. 1958, H. Suda (HSC). Tokyo Met.: 1♀, Musashino, Gotenyama, 12. VII. 2000, H. Takahashi; 1♀, Hachioji, Mt. Takaosan, 1917. V. 27 (KU). Kanagawa Pref.: 1♀, Sagamihara, Kamimizo, 27. V. 1990, M. Tao; 1♀, Oiso, 28. VII. 1974, K. Kimura. Yamanashi Pref.: 1♂, "Yutsubo", 29. V. 1932, Takeuchi (OPU). Nagano Pref.: 1♀, Kamikochi, 5. VII. 1927, K. Sato; 1♂, Matsumoto, Shimashima-dani, 13. VII. 1928, K. Sato. 1♀, same locality, 30. VI. 1976, A. Shinohara. Ishikawa Pref.: 1♀, Nakanoto, Kashima, Ida, 17. VII. 1996, I. Togashi. Gifu Pref.: 1♀ (paralectotype of *Hylotoma japonica*; see below), "25, 6, 24 [Gifuyama]" "Japan Mitsukuri" (USNM). Mie Pref.: 1♀, "Hirakura, 36. 7. 8", M. Matsuura (KU). Kyoto Pref.: 1♀, "Kibune", 13. VI. 1930, Takeuchi (OPU). Hyogo Pref.: 1♀, Sayo, Onemi, 11. VI. 1995, T. Morita (MNHAH); 4♀, Sasayama, "Kogane", em. 3. VIII. 1965, Host *Carpinus tschonoskii*, T. Okutani (KU); 1♀ (paratype of *Arge abelivora* Okutani, 1956), Sasayama, Fujioka, 12. VI. 1954, T. Okutani (KU). Hiroshima Pref.: 1♀, "Sandankyo, Furinkan–Koeda", 11. VI. 1939, T. Nakani-

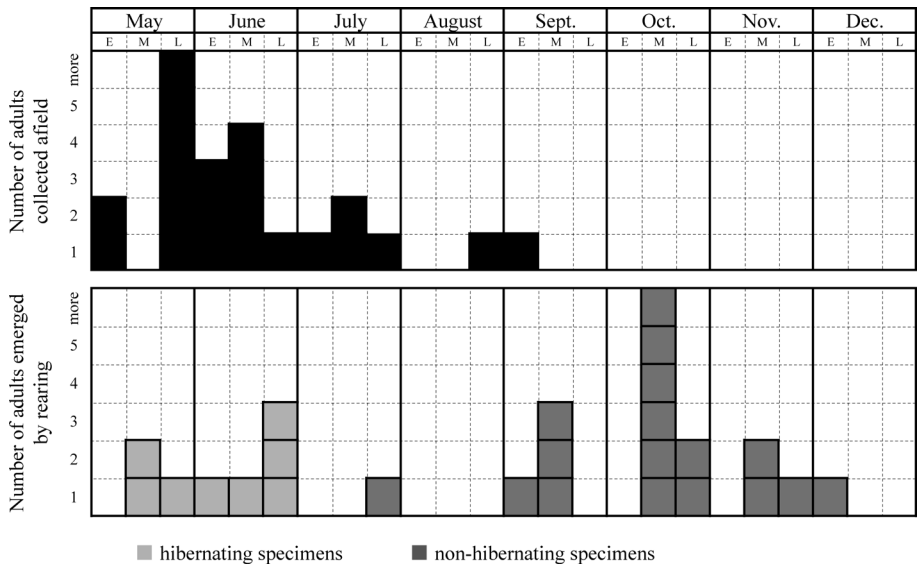

Fig. 8. Number of adults collected afield and those emerged by rearings in lowlands of Honshu, Japan.

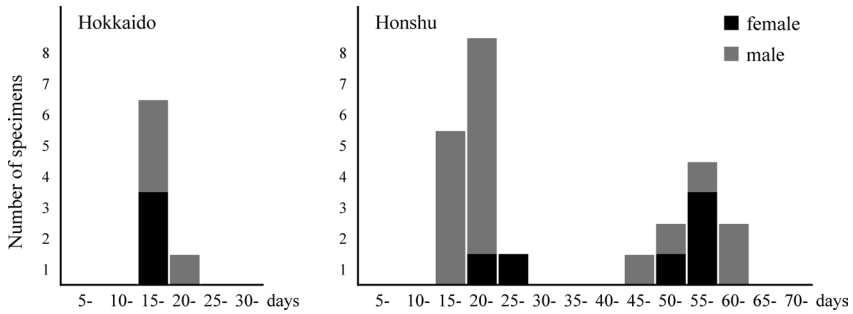

Fig. 9. Cocoon durations of non-hibernating individuals under rearing conditions.

shi (OPU). SHIKOKU–Ehime Pref.: 1♀, Omogo-kei, 27. V. 1986, A. Shinohara; 1♀, Omogo, Ishizuchi Mts., Tsuchigoya, 23. V. 1999, M. Shiraishi. KYUSHU–Nagasaki Pref.: 2♀, Sasebo, Mt. Kunimi-yama, 16. VI. 1950, T. Shirozu (OPU). Other material: Larvae in ethanol (see Table 1 for collection data): 3 late instar larvae (part of Ph910629C), fixed on 18. VII. 1991; 2 mature larva (part of HH030830A); 3 late instar larvae (part of HH040810B), fixed on 12. VIII. 2004; 3 late instar larvae (part of HH060820A); 1 middle instar larva (part of HH060820B); 2 late instar larvae (part of HH060820C); 3 late instar larvae (part of HH060820D); 3 late instar larvae (part of HH060820E); 2 mature larvae (part of HH070814A), fixed on 27. VIII. 2004; 2 late instar larvae (part of AS080614), fixed on 30. VI. 2008; 10 middle instar larvae, Nakagawa, Bato, coll. 7. VII. 2010, S. Ibuki; 10 late instar larvae (part of AS101007), fixed on 7. X. 2010.

Etymology. The specific epithet is from the Latin *obesus*, meaning plump, referring to the relatively plump body.

Host plants. Betulaceae: *Carpinus cordata* Blume, *C. laxiflora* (Siebold et Zucc.) Blume, *C. tschonoskii* Maxim. and *Ostrya japonica* Sarg.

Field observations and rearing records. Adults were collected from late June to late August in Hokkaido, and from early May to early September in Honshu, most frequently in May and June in the lowlands of Honshu (Fig. 8). Two groups of eggs or their remains were observed in the field. The number of eggs per group was 22–24. Eggs were laid along leaf margins of one or two adjacent leaves in rows (Fig. 2E). Larvae were found from late June to late August in Hokkaido, and from middle June to early July and early September to middle October in Honshu (Table 1). They were usually gregarious (n = 1–20), but separately fed on leaves in all instars (Fig. 2A, E). Early instar larvae fed on leaves leaving the lateral and main veins, while late instar larvae left only main veins. Larvae spun cocoons within soil in the laboratory.

Rearings are summarized in Table 1. In Hokkaido, larvae became adults in the same year or the following year. This variation was observed even in the same group of larvae (Ph910629C). Cocoon durations were about 17–23 days in non-hibernating individuals and about 281–306 days in hibernating individuals. In Honshu, larvae collected in June and July became adults in late July and early to middle September in the same year. Larvae collected in September and October became adults in October to December of the same year or May and June in the following year. Cocoon durations in non-hibernating individuals greatly varied, ranging from 15 to 65 days. The adult emergence was clearly bimodal (Fig. 9 right), the first cluster with almost the same cocoon duration as non-hibernating individuals of Hokkaido (Fig. 9 left). Cocoon durations in hibernating individuals were about 237–256 days. The durations were variable among the larvae of the groups SI100628 (22–55 days) and SI110914 (29–65 days), but were rather stable within each of the groups AS100920A (all hiber-

Table 1. Summary of rearings.

Locality		Host plant	Larval group code*	Found	Number of larvae	Cocooned	Emerged (number and sex**)
Prefecture	Details						
Hokkaido	Shintoku, 200 m	*Ostrya japonica*	Ph910629C	29. VI. 1991	6	VII.	27. VII. 1991 (2♂) 15. V. 1992 (1♂)
			Ph910717B	17. VII. 1991	unrecorded	18. VII.	24. IV. 1992 (1♂)
			HH100829A	29. VIII. 2010	unrecorded	1–5. IX.	6–7. VI. 2011 (1♀1♂)
	Mikasa, Ikushunbetsu, 100 m	*Carpinus cordata*	HH050806A	6. VIII. 2005	8	11. VIII.	2–4. IX. 2005 (1♂)
	Iwamizawa, Manji, 210 m	*Carpinus cordata*	HH030830A	30. VIII. 2003	7	1–5. IX.	20. IX. 2003 (1♀)
			HH040810B	10. VIII. 2004	11	12–13. VIII.	28. VIII.–2. IX. 2004 (2♀3♂)
			HH060820A	20. VIII. 2006	9	22–25. VIII.	dead in cocoons
			HH060820B	20. VIII. 2006	6	dead before maturity	
			HH060820C	20. VIII. 2006	4	dead before maturity	
			HH060820D	20. VIII. 2006	8	22–25. VIII.	dead in cocoons
			HH060820B	20. VIII. 2006	6	22–25. VIII.	dead in cocoons
	Mukawa, Hobetsu, 100 m	*Carpinus cordata*	HH070814A	14. VIII. 2007	7	24. VIII.	dead in cocoons
			HH070814B	14. VIII. 2007	4	27. VIII.	dead in cocoons
			HH070814C	14. VIII. 2007	2	24. VIII.	dead in cocoons
	Urakawa, Nishicha, 30 m	*Carpinus cordata*	HH070813A	13. VIII. 2007	9	30. VIII.	dead in cocoons
Yamagata	Mt. Haguro-san, 320 m	*Carpinus laxiflora*	AS100920A	20. IX. 2010	unrecorded	22–24. IX.	18. V. 2011 (1♂) 19. V. 2011 (1♂) 27. V. 2011 (1♂)
			AS100920B	20. IX. 2010	unrecorded	2–3. X.	20. X. 2010 (1♂)
Tochigi	Nakagawa, Sukusukunomori, 160 m	*Carpinus cordata*	SI091005	5. X. 2009	8	13. X.	7. VI. 2010 (1♀) 10. VI. 2010 (1♀) 21. VI. 2010 (1♂) 23. VI. 2010 (1♂) 26. VI. 2010 (1♀)
			SI100911	11. IX. 2010	9	20–21. IX.	12. X. 2010 (6♂)
	Nakagawa, Wami, 230 m	*Carpinus laxiflora*	SI100628	28. VI. 2010	ca. 10	9. VII.	31. VII. 2010 (1♀) 2. IX. 2010 (1♀1♂)
	Nakagawa, Bicchuzawa, 125 m	*Carpinus tschonoskii*	SI100707-1	7. VII. 2010	12	from 14. VII.	dead in cocoons
		Carpinus tschonoskii/ *C. laxiflora*	SI100707-2***	7. VII. 2010	3	16. VII.	12. IX. 2010 (1♀) 16. IX. 2010 (1♂)
		Carpinus tschonoskii/ *C. cordata*	SI100707-3***	7. VII. 2010	3	23. VII.	13. IX. 2010 (1♀)

Table 1. (Continued)

Locality		Host plant	Larval group code*	Found	Number of larvae	Cocooned	Emerged (number and sex**)
Prefecture	Details						
Tochigi	Nakagawa, Bicchuzawa, 125 m	*Carpinus cordata*	AS090927A	27. IX. 2009	10	9–13. X.	dead in cocoons
			AS091018	18. X. 2009	14	20–22. X.	dead in cocoons
			SI100715	15. VII. 2010	1	16. VII.	dipterous parasite emerged 12. IX.
			SI100912	12. IX. 2010	5	20. IX.	12. X. 2010 (1 ♂)
			AS101007	7. X. 2010	unrecorded	7–12. X.	dead in cocoons
			SI110914	14. IX. 2011	unrecorded	27–29. IX.	26. X. 2011 (1 ♀) 15. XI. 2011 (1 ♂) 19. XI. 2011 (1 ♂) 25. XI. 2011 (1 ♀) 1. XII. 2011 (1 ♂)
	Nasukarasuyama, Ryumon-no-taki, 90 m	*Carpinus laxiflora*	AS090926	26. IX. 2009	8	10–11. X.	dead in cocoons
Gunma	Katashina, Marunuma, 1400 m	*Carpinus cordata*	AS100909	9. IX. 2010	6	19–20. IX.	5. X. 2010 (3 ♂) 8. X. 2010 (1 ♂)
Saitama	Namegawa, 50 m	*Carpinus tschonoskii*/ *C. laxiflora*	AS080614	14. VI. 2008	20	25–30. VI.	dead in cocoons
Mie	Matsuzaka, Iitaka-cho, Kikaji, 400m	*Carpinus laxiflora*	AS091011	11. X. 2009	4	dead before maturity	
Hyogo	Kobe, Yamada-machi, 450m	*Carpinus laxiflora*	AS060929A	29. IX. 2006	1	1. X.	dead in cocoons

* Reared by Hara in Bibai or Shintoku (Ph, HH), by Shinohara in Tokyo (AS) and by Ibuki in Nakagawa (SI).

** Other specimens died or were fixed in larval stage.

*** Larvae collected on *C. tschonoskii*, but reared on *C. laxiflora* (SI100707-2) and *C. cordata* (SI100707-3), respectively.

nated), SI091005 (all hibernated), and AS100909 (15–19 days).

Discussion

Comparison with Related Species

Arge obesa is one of the blue-black species having hyaline wings with a black transverse band on the forewing, a basally pale hind tibia and pale setae on the mesopleuron, though the male has entirely dark wings without a conspicuous transverse band. This species is characterized by the lancet whose annuli are oblique and their ventral ends are located apical to the dorsal ends in the female (Fig. 5A–D), and the almost triangular and apically truncate valviceps (in lateral view) in the male (Fig. 6I–M). A combination of the following characters is also useful to distinguish this species: Abdomen without pale areas (Fig. 1); frontal area nearly flat, sometimes with shallow medial or posteromedial concavity, sometimes slightly raised anteriorly (Fig. 3D, E); median fovea very small, often inconspicuous; median ridge of supraclypeal area rounded or bluntly carinate (Fig. 3F–H); clypeus distinctly sunk below supraclypeal area, and flattened ventrally (Fig. 3B, C, F–H); right mandible without notch on inner margin (Fig. 3H); in both wings, wing margins between veins Rs and Cu not ciliate, with wide marginal glabrous area (Fig. 3M);

in female, seventh sternum normal; sawsheath in posterodorsal view robust and basally widely sunk (Fig. 4A–C); lance without linear membranous areas (Fig. 4G, H); in male genitalia, gonostipes narrowing apically in ventral view (Fig. 6B, D, F, H).

In Gussakovskij's (1935) key to the Palearctic species, the female of *A. obesa* may run to the couplet 151/152, containing *A. potanini* Jakowlew, 1891, and "*A. fulvicornis* Mocs." (=*Spinarge fulvicornis* (Mocsáry, 1909)), and the male to the couplet 160/161, containing *A. ciliaris* (Linné, 1767) and "*A. rufocincta* Gussakovskij, 1935" (=*A. longicornis* Kuznetzov-Ugamskij, 1927; see Shinohara *et al.*, 2012). In Takeuchi's (1939) key to East Asian species, *A. obexa* usually runs to the couplet 25, which contains *A. kobayashii* Takeuchi, 1931, and *A. jonasi* (Kirby, 1882), and a part of the male to "*A. rufocincta*" (=*A. longicornis*) or *A. mali* (Uchiyama, 1906). The female of this species is distinguished from *A. potanini* by the black, not bluish legs (green blue in the latter; see Jakowlew, 1891), from *Spinarge fulvicornis* by the fifth abdominal tergum without a median suture (with a median suture in the latter; see Hara and Shinohara, 2006), from *A. kobayashii* and *A. jonasi* by the smaller size, 6.5–9.5 mm (usually more than 10 mm in the latter two) and the apically rounded sawsheath in posterodorsal view (nearly pointed in the latter two; see Hara *et al.*, 2007). The male is distinguished from *A. ciliaris*, *A. longicornis*, *A. kobayashii*, *A. jonasi* and *A. mali* by the combination of the following characters: Reflection faintly metallic bluish; middle and hind tibiae basally pale; wings distinctly infuscated all over; frontal area not or slightly raised anteriorly; apical wing margins not ciliate; harpe narrow in dorsal view (Benson, 1951; Hara *et al.*, 2007; Shinohara *et al.*, 2012). This species is also similar to *A. sinensis* Wei, 2003 in Wei and Nie (2003) from China, but differs from the latter in having the widely white middle tibia, the robust sawsheath, and the characteristic valviceps stated above. In *A. sinensis*, the middle tibia has no white areas, the sawsheath is narrower (fig. 28-174A in Wei and Nie, 2003), and the valviceps is rounded apically and with a large ventral lobe basally in lateral view (fig. 28-174C in Wei and Nie, 2003).

The type series of *A. obesa* includes a paralectotype of *Hylotoma japonica* Marlatt, 1898 (=*A. jonasi* (Kirby, 1882); see discussion below) and a paratype of *Arge abelivora* Okutani, 1956 (=*A. suzukii* Matsumura, 1912). *Arge obesa* is separated from *A. suzukii* by the entirely black abdomen, the rounded or bluntly carinate supraclypeal ridge, the robust sawsheath, and the glabrous outer margin of the wings (Shinohara and Hara, 2008).

The larva of *A. obesa* is easily distinguished from those of Japanese congeners by the host plant and the pair of conical or hook-shaped spines on the subanal lobe (Figs. 2I, M, 7G, I). A pair of subanal spines are also found in the North American *A. coccinea* (Fabricius, 1804) associated with *Rhus* (Smith, 1989) within the genus and in the Sterictophorinae of the Argidae (Lorenz and Kraus, 1957).

The extremely dark color variant of the last instar larva as noted in the description (Fig. 2C) has been found so far on Mt. Hagurosan, Yamagata Prefecture, northern Honshu, only. Further search for the larvae in various localities covering the whole range of this species may reveal the existence of geographical variations of larval characters as in the case of *A. enkianthus* Hara and Shinohara, 2011 (Hara and Shinohara, 2011).

Life History

Arge obesa probably has a multivoltine life cycle with polymodal adult emergence. This general life history pattern is rather commonly found in the genus (Shinohara and Hara, 2008, 2009; Shinohara *et al.*, 2009; Hara and Shinohara, 2011; Kawasaki *et al.*, 2012). This species showed different polymodal adult emergence patterns between Hokkaido and Honshu populations under rearing conditions (Fig. 9). In Hokkaido, the larvae collected in the field partly became adults within the same year without dia-

pause (first cluster) and partly became adults in the following year after winter diapause or hibernation (second cluster) even in the same larval group. This bimodal pattern is therefore formed by the presence or absence of winter diapause in each individual. In Honshu, however, we observed two clusters of adult emergence before hibernation (Fig. 9) and a cluster of adult emergence after hibernation (Fig. 8). The individuals of the first cluster of emergence in Honshu had no diapause, as in those of Hokkaido population, and the cocoon durations in the first clusters were almost identical in both areas (Fig. 9). The individuals of the second cluster of emergence probably had short summer diapause. The adult emergence after hibernation (third cluster) may have possibly occurred as a result of prolonged diapause caused by low temperature.

Kawasaki *et al.* (2012) detailed a trimodal adult emergence of the summer generation of *A. nigronodosa* (Motschulsky, 1860), and considered that the first and second clusters of emergence consisted of individuals that had genetically different cocoon durations without diapause, while the third emergence occurred after summer diapause without genetically determined timing. The proportion of the third emergence within the progeny of a female was genetically determined; namely, every mother produced both non-diapausing and diapausing individuals. Our rearings of *A. obesa* showed that the cocoon durations within each larval group were stable or variable. All individuals in the groups HH100829A, AS100920A, and SI091005 went into diapause and those in the groups HH040810B and AS100909 did not, whereas both non-diapausing and diapausing individuals were contained in the groups Ph910629C, SI100628 and SI110914 (Table 1). The polymodal adult emergence in *A. obesa* may be caused by genetic polymorphism. However, our rearing material of *A. obesa* is very small and rearing conditions are not constant. More extensive and detailed study will be needed to confirm our supposition.

In lowlands of Honshu, adult occurrences in the field agree with adult emergence in rearings at least during May through September (Fig. 8). The delayed emergence in October to December in rearings apparently occurs only under laboratory conditions.

This is the first record of *Arge* associated with *Carpinus* and *Ostrya* in the Old World (cf. Lorenz and Kraus, 1957, Okutani, 1967, Liston, 1995, Taeger *et al.*, 1998). In North America, "*Arge cerulea* (Norton, 1864)" (= *A. smithi* Blank, Liston and Taeger, 2009) and *A.* sp. are associated with *Carpinus americana* Michx., and *A.* sp. with *Ostrya* sp. (Smith, 1989). All those two or three species belong to the *A. clavicornis* group, whose larvae are characterized by the presence of prolegs on the second to seventh or eighth and tenth abdominal segments. *Arge obesa* does not belong to this species group, as the larva has prolegs on the second to sixth and tenth abdominal segments.

Lectotype Designation of *Hylotoma japonica* Marlatt, 1898

In the original description of *Hylotoma japonica*, Marlatt (1898) wrote "Type. — No. 3838, U.S.N.M." "Described from five specimens, two males and three females" and "(Gifu zuzushi), (No. 12)." He did not designate a holotype. We examined five specimens preserved under the name of *H. japonica* in USNM. Actually, they consist of four females and one male of three different species, but we regard them as the syntypes of *Hylotoma japonica*. Only two females have type labels, but one of them is erroneous. One female is labeled "♀ Type No. 3838" and agrees with the original description. Another female bears the label, "♂ Type No. 3839", which is the number given to *Lophyrus japonicus* Marlatt, 1898, described in the same paper, and the sex is incorrect. The former female is the only specimen labeled *Hylotoma japonica*. We designate the female as the lectotype here, although the female is directly pinned, and, therefore, does not fit Marlatt's (1898) statement in the preface, "All of the specimens are mounted

on large flat cards". Another female having the type label and one male are also directly pinned. The pinnings were not subsequently done, judging from their conditions. In mounted specimens (two females), the locality data [Gifu] or [Gifuyama] (in Japanese letters) are written on the underside of the mount cardboard, while each of the three pinned specimens has a thinner paper label noted [Gifu], and the handwritings on the mount cardboards and the thinner paper labels are similar to each other.

Lectotype (here designated): ♀ directly pinned, with four thin paper labels, "22, 5, 20 [Gifu] (in Japanese letters) ♀" "Japan Mitsukuri" "Hylotoma japonica Marlatt ♀" and "♀ Type No. 3838 U.S.N.M.". Paralectotypes: 1♀ directly pinned, with three thin paper labels, "22, 5, 9 [Gifu] ♀" "Japan Mitsukuri" and "♂ Type No. 3839 U.S.N.M."; 1♀ mounted on a card written "26, 5, 25 [Gifu] ♀ #25"; 1♀ mounted on a card written "25, 6, 24 [Gifuyama]" and a thin paper label "Japan Mitsukuri" (the specimen was removed from a mount card and directly pinned in the present study); 1♂ directly pinned, with two thin paper labels, "20, 6, 19 [Gifu] ♂" and "Japan Mitsukuri". All in USNM.

The lectotype and the former two paralectotypes are *A. jonasi*. The third paralectotype (female) is *A. obesa* described in this paper. This paralectotype disagrees with the original description of *Hylotoma japonica* by its smaller size, length 8 mm (12 mm for the female and 8 mm for the male in the original description). Marlatt (1898) might have regarded it as a male. The last paralectotype (male) belongs to the group of *Spinarge fulvicornis* (Mocsáry, 1909), whose species are not distinguishable in males (Hara and Shinohara, 2006).

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References

Benson, R. B. 1951. Hymenoptera, Symphyta. Handbooks for the Identification of British Insects., London, 6(2a): 1–49.

Gussakovskij, V. V. 1935. Chalastogastra (pt. 1). Faune de l'URSS (n.s.1), Insectes Hyménoptères, II (1). XVIII + 453 pp. Éition de l'Academie des Sciences de l'URSS, Moscou, Leningrad. (In Russian with German summary.)

Hara, H., H. Kojima and A. Shinohara 2007. *Arge solowiyofka* (Hymenoptera, Argidae) feeding on *Betula ermanii*, newly recorded from Japan. Japanese Journal of Systematic Entomology, 13: 85–89.

Hara, H. and A. Shinohara 2006. The sawfly genus *Spinarge* (Hymenoptera, Argidae). Bulletin of the National Science Museum, Series A, 32: 61–94.

Hara, H. and A. Shinohara 2008a. The species-group of *Arge aenea* (Insecta, Hymenoptera, Argidae). Bulletin of the National Museum of Nature and Science, Series A, 34: 77–94.

Hara, H. and A. Shinohara 2008b. Taxonomy, distribution and life history of *Betula*-feeding sawfly, *Arge pullata* (Insecta, Hymenoptera, Argidae). Bulletin of the National Museum of Nature and Science, Series A, 34: 141–155.

Hara, H. and A. Shinohara 2011. *Arge enkianthus* n. sp. (Hymenoptera, Argidae) feeding on *Enkianthus campanulatus* in Japan. Bulletin of the National Museum of Nature and Science, Series A, 38: 21–32.

Jakowlew, A. 1891. Diagnoses Tenthredinidarum novarum ex Rossia Europaea, Sibiria, Asia Media et confinium. Trudy Russkago Entomologicheskago Obshchestva v S. Peterburge, 26 [1892]: 1–62.

Kawasaki, M., M. Fujita, A. Sakurai and K. Maeto 2012. Trimodal adult emergence in summer generations of the rose sawfly *Arge nigrinodosa* (Hymenoptera, Argidae). Journal of Hymenoptera Research, 25: 1–14.

Konow, F. W. 1906. Einige synonymische Bemerkungen über Blattwespen. (Fortsetzung). Zeitschrift für Systematische Hymenopterologie und Dipterologie, 6: 386–388.

Liston, A. D. 1995. Compendium of European Sawflies. List of Species, Modern Nomenclature, Distribution, Foodplants, Identification Literature. 190 pp. Chalastos Forestry, Gottfrieding.

Lorenz, H. and M. Kraus 1957. Die Larvalsystematik der

Blattwespen (Tenthredinoidea und Megalodontoidea). Abhandlungen zur Larvalsystematik der Insekten, (1): 1–339.

Marlatt, C. L. 1898. Japanese Hymenoptera of the family Tenthredinidae. Proceedings of the United States National Museum, 21(1157): 493–506.

Okutani, T. 1956. New sawflies from Japan. (Studies on Symphyta IV). Insecta Matsumurana, 20: 97–99.

Okutani, T. 1967. Food plants of Japanese Symphyta (I). Japanese Journal of Applied Entomology and Zoology, 11: 43–49. (In Japanese.)

Shinohara, A. and H. Hara 2008. Taxonomy, distribution and life history of *Abelia*-feeding sawfly, *Arge suzukii* (Hymenoptera, Argidae). Japanese Journal of Systematic Entomology, 14: 29–47.

Shinohara, A. and H. Hara 2009. *Arge indicura* n. sp. feeding on *Potentilla* and *Sanguisorba* from Japan (Insecta, Hymenoptera, Argidae). Bulletin of the National Museum of Nature and Science, Series A, 35: 55–71.

Shinohara, A., H. Hara and J.-W. Kim 2009. The species-group of *Arge captiva* (Insecta, Hymenoptera, Argidae). Bulletin of the National Museum of Nature and Science, Series A, 35: 249–278.

Shinohara A., H. Hara and H. Kojima 2012. Taxonomy, distribution and life History of *Berberis*-feeding sawfly, *Arge longicornis* (Hymenoptera, Argidae) from northeastern Asia. Japanese Journal of Systematic Entomology, 18: 105–121.

Shinohara, A., S. Ibuki and H. Hara 2011. *Arge meliosmae* n. sp. (Hymenoptera, Argidae) feeding on *Meliosma myriantha* in Japan. Bulletin of National Museum of Nature and Science, Series A, 37: 99–112.

Smith, D. R. 1989. The sawfly genus *Arge* (Hymenoptera: Argidae) in the western Hemisphere. Transactions of the American Entomological Society, 115: 83–205.

Taeger, A., E. Altenhofer, S. M. Blank, E. Jansen, M. Kraus and H. Pschorn-Walcher 1998. Kommentare zur Biologie, Verbreitung und Gefährdung der Pflanzenwespen Deutschlands (Hymenoptera, Symphyta). In Taeger, A. and S. M. Blank (eds.), Pflanzenwespen Deutschlands (Hymenoptera, Symphyta). Kommentierte Bestandsaufnahme, pp. 49–135. Verlag Goecke and Evers, Keltern.

Taeger, A., S. M. Blank and A. D. Liston 2010. World catalog of Symphyta (Hymenoptera). Zootaxa, 2580: 1–1064.

Takeuchi, K. 1919. [A list of the known sawflies from Japan.] Insect World, Gifu, 23: 182–188. (In Japanese.)

Takeuchi, K. 1932. A revision of the Japanese Argidae. Transactions of the Kansai Entomological Society, 3: 27–42.

Takeuchi, K. 1939. A systematic study on the suborder Symphyta (Hymenoptera) of the Japanese Empire (II). Tenthredo, Kyoto, 2: 393–439.

Togashi, I. 1997. Symphyta (Hymenoptera) collected by Dr. Y. Nishijima in Hokkaido, Japan. Bulletin of the Biogeographical Society of Japan, 52: 1–6.

Wei, M. and H. Nie 2003. Argidae. In Huang, B. (ed.), Fauna of Insects in Fujian Province of China, Vol. 7 (Hymenoptera), pp. 165–183, 211–212 [synopsis of new species in English]. (In Chinese.)