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Arge takanebara n. sp. (Hymenoptera, Argidae) Feeding on *Rosa acicularis* in Hokkaido, Japan

Hideho Hara[1] and Akihiko Shinohara[2]

[1] Forestry Research Institute, Hokkaido Research Organization,
Bibai, Hokkaido, 079–0198 Japan
E-mail: hara-hideho@hro.or.jp
[2] Department of Zoology, National Museum of Nature and Science,
4–1–1 Amakubo, Tsukuba-shi, Ibaraki, 305–0005 Japan
E-mail: shinohar@kahaku.go.jp

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Abstract *Arge takanebara* n. sp. is described from Hokkaido, Japan. This sawfly was discovered in a serpentine area. Larvae are solitary leaf-feeders on *Rosa acicularis* Lindl. (Rosaceae). The immature stages and life history are also described.
Key words: Argidae, *Arge takanebara*, new species, *Rosa acicularis*, serpentine area, Japan.

Introduction

Composition of plant communities is strongly affected by the local geological substrates. In particular, areas of serpentine have characteristic vegetation (e.g. Toyokuni, 1982), and their phytophagous insect fauna may therefore be expected to be distinctive. We have investigated sawflies in the "Takadomari Serpentinites" area (Igarashi *et al.*, 1985), at an altitude of about 400 meters, Fukagawa City, Hokkaido, Japan since 2005, and recognized occurrences of some sawflies which are rarely found in Japan. Among them are *Pamphilius balteatus* (Fallén) (Shinohara and Hara, 2006), *Arge berberidis* Schrank, 1802 (Hara, 2010), and an undescribed species of *Arge* associated with *Rosa acicularis* Lindl. (Rosaceae). This *Arge* species was first thought to be the European *A. ciliaris* (Linné, 1767), whose larvae feed on *Filipendula* spp. (Rosaceae), but a close examination of the ovipositors has revealed that the Japanese species is clearly different from *A. ciliaris*. Here we describe the new species under the name of *A. takanebara* and give notes on its life history.

Materials and Methods

The material used in this work is kept in the National Museum of Nature and Science, Tsukuba, unless otherwise indicated. The specimens of *A. takanebara* are listed under the material examined section. We also examined and dissected the genitalia of the following specimens of *A. ciliaris* (Linné, 1767) for comparison: Sweden: 1 ♂, "Stockholm, Tullinge, *Malaise*" (kept in OPU = Osaka Prefecture University, Sakai); 1 ♀, "Stockholm, Rönninge, *Malaise*" (OPU). Denmark: 1 ♂, "Danmark, ex coll. Schiødte"; 1 ♀, "Danmark, ex coll. Schiødte" "♀ 4/6. 75, Horsens, Jensen". Germany: 1 ♀, "D-BW-Vaihingen, Vaihingen/Enz, Stromberg MV93, Hainerhaslach, leg Schmidt-Egger, 1990 H" "1,8,92 H-B"; 1 ♀, "Starnberg, Seegebiet, leg. F. Stöcklein" "Percha, 27. 5.44"; 1 ♀1 ♂, "Berlin, 4/5" (OPU). Estonia: 1 ♀, "Estonia Lääne-Virumaa, Võhu, leg. V. Soon 1.07.2000". Latvia: 1 ♀, "Latvia, KR. Walk, Lejasciems, 10 V 1934, O. Conde leg.".

Observations on morphology were made with a Leica MS5 stereo binocular microscope and an Olympus BH light microscope. Measurements of

each structure were taken by an ocular micrometer. Photographs were taken with digital cameras, Nikon E990 and Panasonic DMC-FZ30, a Keyence Digital Microscope VHX-900 and an AnMo Electronics Dinolite digital microscope. The digital images were processed and arranged with Adobe Photoshop Elements 7.0 software.

Rearings were done in Bibai and Shintoku by Hara and in Tokyo by Shinohara. In the rearing in Bibai, the temperature was usually 18–25℃ and the light was usually on for about 16 hours a day; for hibernation, the containers with larvae were placed in the shade outdoors from late September to March or April of the next year. In the rearing in Shintoku, the temperature and light conditions were almost the same as in the open-air; the hibernating individuals were moved in March into an air-conditioned room where the temperature was about 10–25℃. In the rearing room in Tokyo, the temperature was kept at 20–25℃ and 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.

For morphological terminology, we follow Viitasaari (2002).

Results

Arge takanebara n. sp.

[Japanese name: Takanebara-churenji]

(Figs. 1–6; Table 1)

Female (Fig. 1A–B). Length 6.5–8.5 mm. Black, with weak bluish reflection; interantennal carinae, facial orbit and clypeus with slight purplish to coppery reflection (Fig. 1C); subanal area black. Antenna black; flagellum sometimes with slight brownish tint. Mandible black, apically reddish, with slight purplish reflection basally. Palpi yellowish brown to dark brown, basally black. Legs black, with faint bluish reflection; narrow apices of femora and fore and middle tibiae ocher to blackish brown; hind tibia white, darkened on apical half to fifth; tarsi dark brown to black, usually basally pale; tibial spurs brown. Wings hyaline, very slightly darkened, never yellowish; forewing with or without faint brownish spot below stigma (Fig. 1A); stigma and veins black, distinctly or indistinctly pale grayish or brownish on narrow base and apex of C or rarely all of C, apical transverse section of Sc, extreme base of stigma and adjacent part of basal section of R1, apical section of R1 beyond stigma and base of A in forewing, and on C, R1 and wide base of A in hind wing. Setae whitish; setae on wings blackish, whitish on basal membranous areas.

Surface generally smooth and polished.

Head in dorsal view (Fig. 2A) very slightly concave at outer orbits, with width across eyes slightly or distinctly narrower than width at genae. Distance between eyes 1.3–1.4 × vertical diameter of eye; eye with vertical diameter 1.7–1.8 × horizontal diameter. Postocellar area weakly convex, with anterior furrow weak or indistinct and lateral furrow indistinct, rarely distinct in anterior half (Fig. 2A, D). Ocellar area weakly concave between ocelli and median ocellus weakly or distinctly elevated (Fig. 2D). Frontal area short, nearly flat or rarely widely and shallowly concave medially, and distinctly raised anterolaterally. Distance between median fovea and front ocellus 1.5–2.0 × width of median ocellus. Median fovea punctiform, often ventrally with small tubercle. Interantennal carinae dorsally widened and becoming dull, roundly curved medially (Fig. 2D), ventrally converging, becoming low, fused at middle of supraclypeal area or disappearing (Fig. 2F). Supraclypeal area medially rounded, rarely bluntly carinate, with side slope slightly rounded and somewhat rough. Malar space 1.4–2.0 × width of front ocellus. Clypeus distinctly sunk below supraclypeal carina and ventrally widely flattened (Fig. 2B, H); ventral margin roundly concave medially. Antennal length 1.3–1.4 × maximum width of head; flagellum (Fig. 2I, J) not compressed, curved basally and rounded at apex. Right mandible not notched on inner margin (Fig. 2H). In forewing, cell 2Rs with anterior length 1.0–1.1 × posterior length and crossvein 3r-m

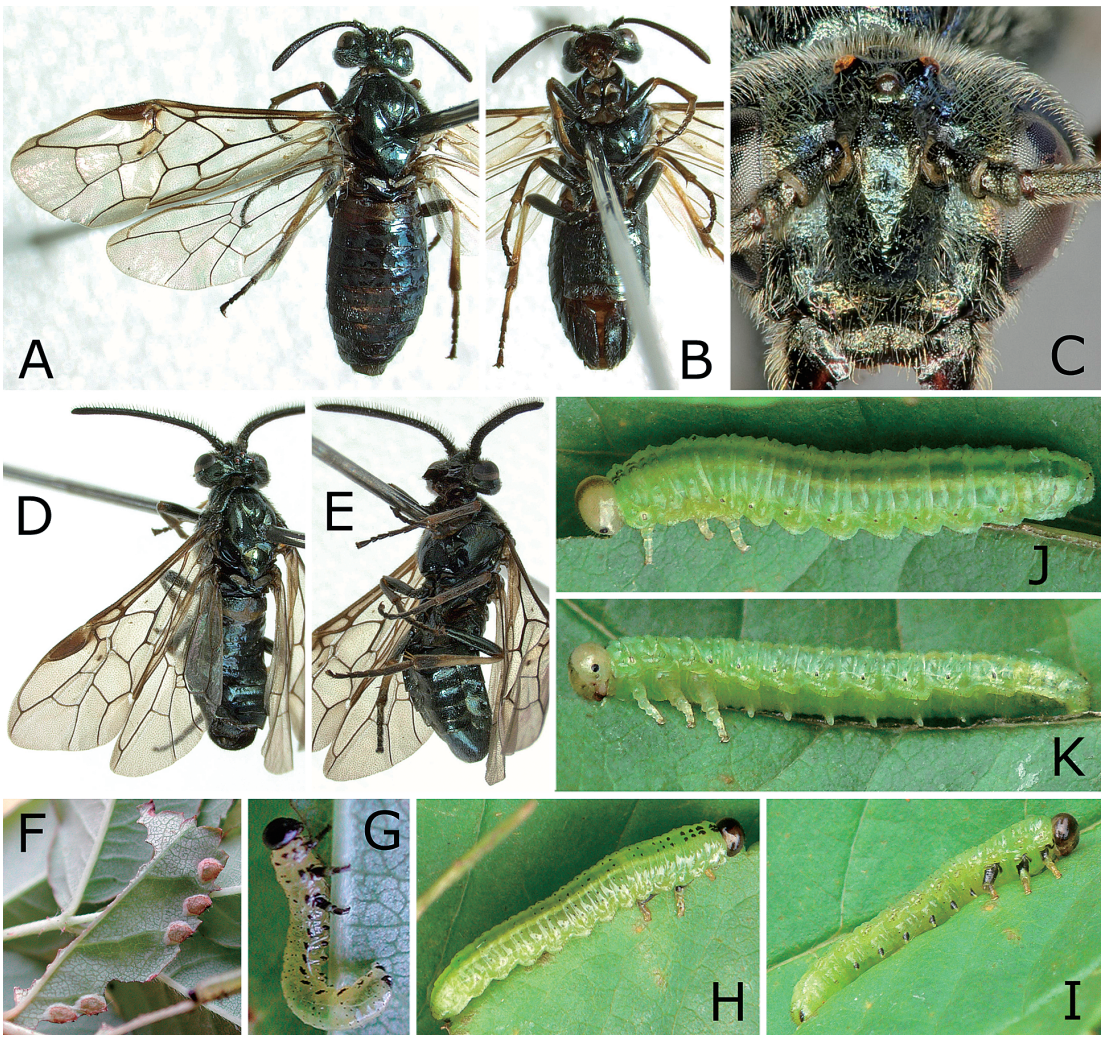

Fig. 1. *Arge takanebara*. —— A–C, Holotype, female, dorsal and ventral views, and head, anterior view; D, E, male paratype, dorsolateral and ventrolateral views; F, remains of eggs found near larvae (HH070614C), July 16, 2007; G, early instar larva (HH070614C), July 16, 2007; H, I, semifinal instar larva (HH060723A), July 23, 2006; J, K, final instar larva (HH060723A), July 26, 2006. F–K photographed by H. Hara.

gently curved throughout (Fig. 1A); in both wings, wing margin between veins Rs and Cu very sparsely ciliate, with marginal glabrous area narrower than width of vein M and length of marginal setae about 1.5 × width of vein M (Fig. 2M).

Abdomen with second to fourth terga nearly glabrous above; fifth tergum widely setose; sixth tergum to apex setose. Posterior margin of seventh sternum medially roundly convex and bent dorsally. Sawsheath in posterodorsal view (Fig. 3A, B) about as long as wide, with lateral margin roundly convex, mesal margin slightly convex and spinose, and apex narrowly rounded or nearly pointed; basal median lobe small; dorsal surface weakly convex, sunk basally; in lateral view (Fig. 3C), dorsal margin nearly straight, ventral margin, except for basal convexity, roundly convex, and apex rounded. Lance with several linear membranous areas dorsally at middle (Fig. 3D) and with groups of minute setae along ventral margin at middle (Fig. 3E); apical

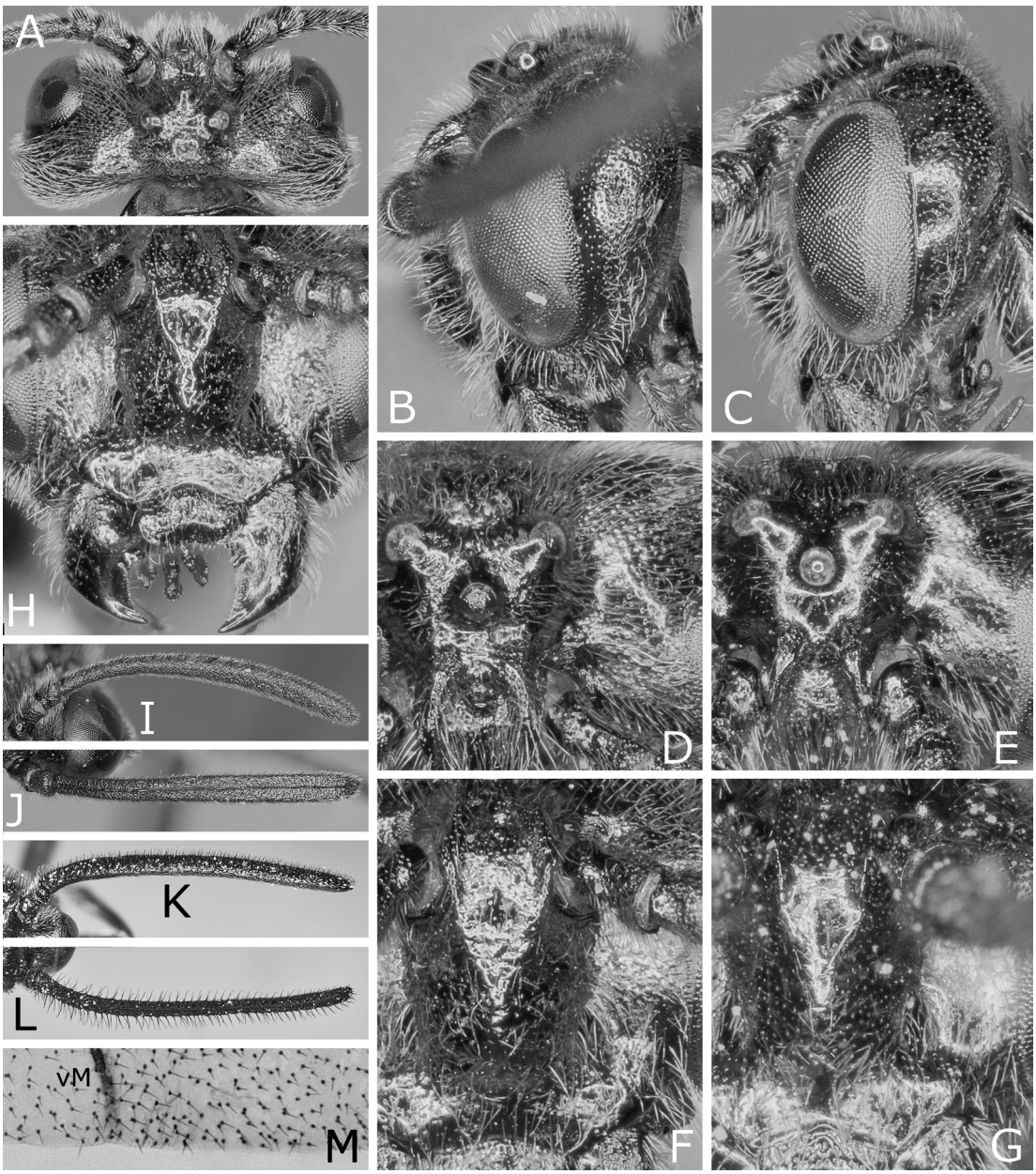

Fig. 2. Heads (A–H), antennae (I–L) and apical margin of forewing (M), holotype (A, B, D, F, H–J, M) and paratype (C, E, G, K, L) —— A, Dorsal view; B, C, lateral view; D, E, frontal area, dorsofrontal view; F, G, frontal view; H, ventrofrontal view; I, K, inner lateral view; J, L, ventral view; M, dorsal view near vein M (vM = vein M).

crest low, finely serrate on dorsal margin. Lancet (Fig. 4) with dorsal margin weakly roundly convex and ventral margin roundly convex midapically, with apical non-annulate area indistinct or absent, with about 18–20 serrulae; basal annuli nearly straight and more apical annuli arched toward apex of lancet; marginal sensillae long; dorsal membranous area narrow, with groups of setae at intervals, often indistinct; narrow longitudinal rows of setae present between annular

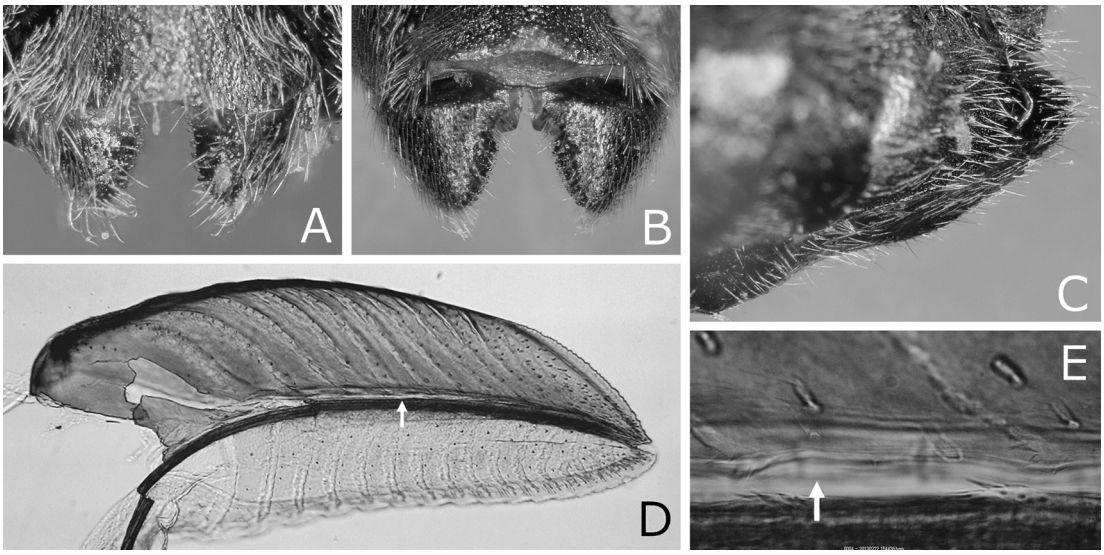

Fig. 3. Ovipositor sheaths, posterodorsal view (A, B), do., lateral view (C), ovipositor, lateral view (D) and ventral part of middle of lance (arrowed part in D enlarged), lateral view (E). —— A, C, holotype; B, D, E, paratypes.

plates and before second annular plate; first annular plate disappearing dorsally; middle annular plates with two to five sensory pores; basal and middle serrulae nearly triangular, finely dentate; first serrula small; apical serrulae slightly convex.

Male (Fig. 1D, E). Length 6.5–7.0 mm. Coloration as in female; genital capsule black. Head as in Fig. 2C, E and G, in dorsal view with width across eyes about as long as or slightly narrower than width at genae. Distance between eyes 1.3–1.4 × vertical diameter of eye; eye with vertical diameter 1.6 × horizontal diameter. Antennal length 2.0 × maximum width of head; flagellum (Fig. 2K, L) slightly compressed. Ninth abdominal sternum broadly rounded or apically narrowly truncate on posterior margin in ventral view. Genitalia (Fig. 5): Gonostipes in ventral view wide and truncate apically, with apical width more than twice as long as basal width of harpe (Fig. 5A, B, D). Harpe about as long as ventral medial length of gonostipes, in dorsal view widest at apical third, rounded apically. Valviceps in dorsal view (Fig. 5A, D) apically with large rounded lateral lobe, basally roundly convex, in lateral view (Fig. 5C, E), basally with large subtriangular ventral lobe (vl) and long dorsal apodemal projection (dap).

Larva. Early instar (Fig. 1G): Head black; trunk pale green, covered with minute black spots dorsally, those on thorax large, with subspiracular lobes and suranal and subanal areas black; thoracic legs mostly black. Semifinal instar (Fig. 1H, I): Head brown to dark brown, dorsomedially with wide blackish marking anteroventrally branching and extending to eyes; trunk pale green, dorsally with pair of yellowish longitudinal lines, dorsally covered with minute black spots; thorax anteriorly with paired rows of black spots along middorsal line; thoracic legs greenish yellow, black on coxae; prolegs black except for apices, and anal proleg laterally blackish. Final instar (Fig. 1J, K): Head pale amber, with blackish middorsal band; trunk pale green, dorsally with pair of yellowish longitudinal lines; prothorax with paired rows of black spots along middorsal line; thoracic legs pale green; prologs concolorous with trunk.

Structure (final instar): Length 14–16 mm; antenna flat (Fig. 6A); clypeus with two pairs of

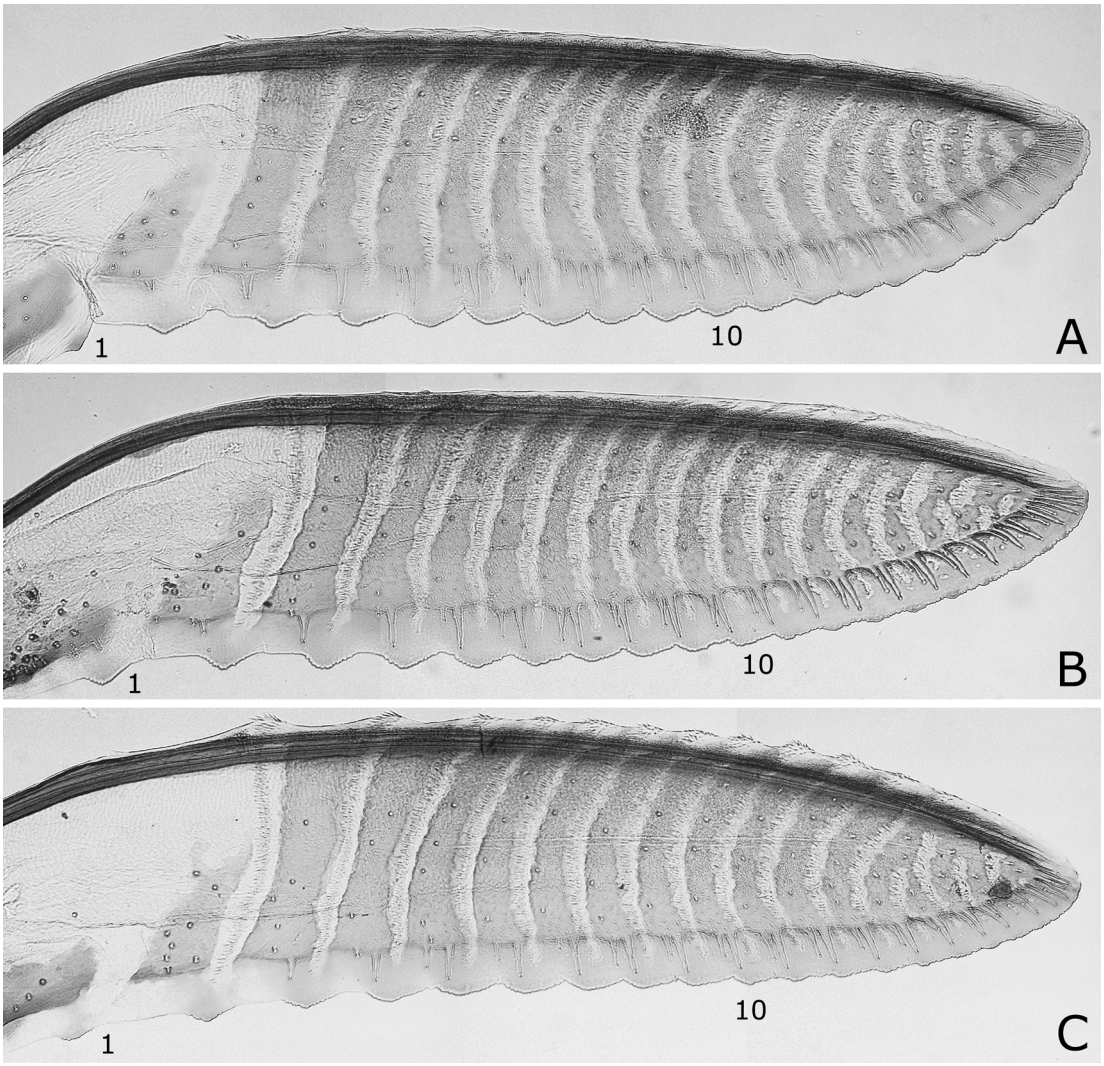

Fig. 4. Lancets, reversed images.——A, Holotype; B, paratype, reared (HH100703); C, paratype, reared (AS100703).

setae; labrum with two pairs of setae; mandible with two to four setae on outer surface; maxillary palp with four palpomeres; palpifer with three to sixth setae; labial palp with three palpomeres; first to ninth abdominal segments each with three annulets (Fig. 6); prolegs on second to seventh and tenth segments, those on second to seventh elongate (Fig. 1I, K); trunk setose, but not so densely (Figs. 1G–J, 6); tenth tergum in dorsal view broadly squared (Fig. 6F); subanal lobe not extending posteriorly beyond suranal lobe (Fig. 6E).

Cocoon. Creamy. Length 9.5–10 mm. Elongate oval, double walled; outer wall netted; inner wall parchment like.

Distribution. Japan (Hokkaido). Known only in a serpentine area in Takadomari, Fukagawa.

Material examined. Holotype (Figs. 1A–C, 2A, B, D, F, H–J, 3A, C, 4A): ♀, "JAPAN: Hokkaido, Sorachi, Fukagawa, Takadomari, 11. VI. 2006, H. Hara". Deposited in the National Museum of Nature and Science, Tsukuba. Para-

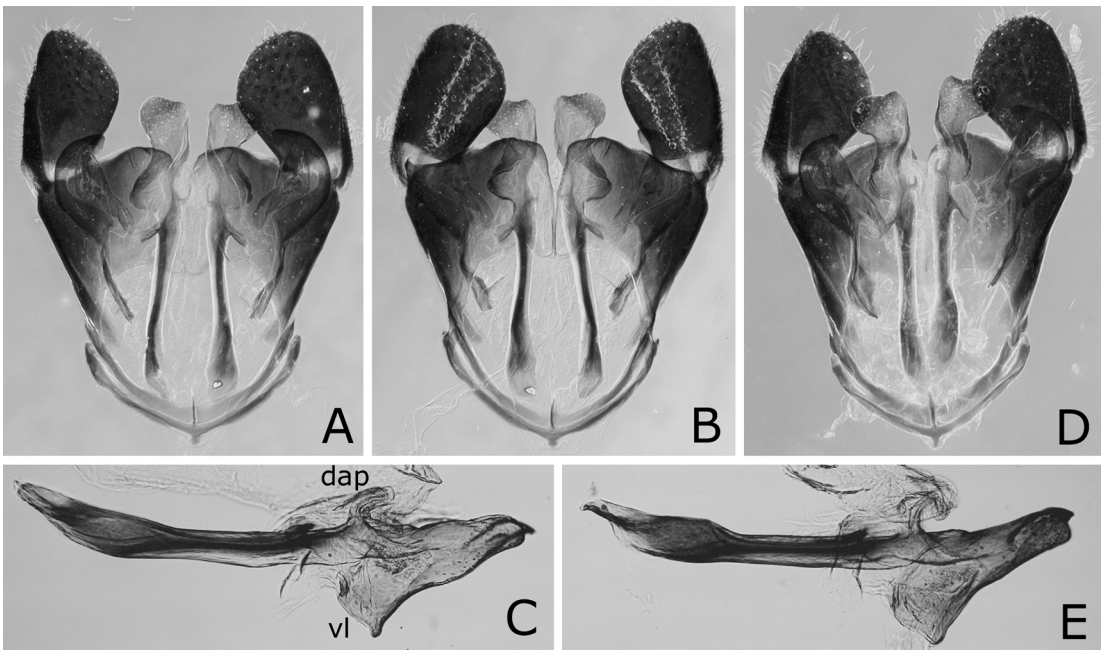

Fig. 5. Male genitalia, paratypes, reared (HH100703). —— A, D, Dorsal view; B, ventral view; C, E, penis valves, lateral view, above dorsal (dap, dorsal apodemal projection; vl, ventral lobe).

types: 1 ♀, same data as holotype; 1 ♀, same data as holotype, but 6. VI. 2007 (HH070606A); 1 ♀, same data as holotype, but 9. VI. 2007; 1 ♂, same data as holotype, but from 13 middle instar larvae coll. 24. VI. 2007, coc. 3–6. VII., em. 21. IV. 2008, Host: *Rosa acicularis* (HH070624A); 1 ♀, same data as holotype, but from 9 middle instar larvae coll. 24. VI. 2007, coc. 2–6. VII., em. 4. IV. 2008, Host: *Rosa acicularis* (HH070624Y); 1 ♀, same data as holotype, but from solitary middle instar larva coll. 24. VI. 2007, coc. 6. VII., em. 3. IV. 2008, Host: *Rosa acicularis* (HH070624); 1 ♀, same data as holotype, but from larva coll. 3. VII. 2010, mat. 8. VII., em. 25. IV. 2011, Host: *Rosa acicularis*, A. Shinohara (AS100703); 2 ♂, same data as holotype, but from larvae coll. 3. VII. 2010, coc. 6–15. VII., em. 28. IV. 2011, Host: *Rosa acicularis* (HH100703); 1 ♀, do., but em. 9. V. 2011; 1 ♀, same data as holotype, but 14. VI. 2011. Other material examined: 1 final instar larva, same data as holotype, but coll. 8. VII. 2006, Host: *Rosa acicularis* (HH060708G); 2 final instar larvae, do., but coll. 14. VI. 2007 (HH070614C); 2 final instar larvae, do., but coll. 3. VII. 2010, fixed 7. VII. (AS100703).

Etymology. The specific epithet is derived from "Ō-takane-bara", the Japanese name for *Rosa acicularis* and is a noun in apposition.

Host plant. Rosaceae: *Rosa acicularis* Lindl.

Field observations and rearing records. Adults were collected in early and middle June, and larvae from middle June to late July. Rearings are summarized in Table 1. In rearing rooms, larvae made cocoons in early and middle July and passed the winter, and adults emerged in the following year. This species probably has a univoltine life cycle.

In captivity, a female laid five eggs in a margin of a leaflet in a row (HH070606A). In the field, remains of eggs (Fig. 1F) were often found near larvae (Table 1, observations). They were laid in rows in one to three adjacent leaflets. The number was one to 11. Many larvae were often found in one to several adjacent leaves, but they were not gregarious. Larvae made cocoons between

Table 1. Summary of rearings and observations.

Larvae found (L)/ Eggs deposited (E)	Rearing codes*	Number of larvae/eggs	Cocooned	Emerged**	Observations
8. VII. 2006 L	HH060708F	1	dead before maturity		an egg shell near larva
8. VII. 2006 L	HH060708G	6	14–. VII.	dead in cocoon	larvae found on adjacent leaves, not gregarious
8. VII. 2006 L	HH060708J	5	13–14. VII.	dead in cocoon	as above
23. VII. 2006 L	HH060723A	1	dead before maturity		
6-. VI. 2007 E	HH070606A	5 (hatched 13. VI.)	dead before maturity		eggs laid in row on margin of one leaflet
14. VI. 2007 L	HH070614C	10	1–2. VII.	6 braconids	larvae found on adjacent leaves, not gregarious; 11 egg shells on margins of three adjacent leaflets in rows near larvae
24. VI. 2007 L	HH070624A	13	3–6. VII.	21. IV. 2008 (1 ♂) 5 braconids	larvae found on adjacent leaves, not gregarious; two egg shells near larvae
24. VI. 2007 L	HH070624Y	9	2–6. VII.	4. IV. 2008 (1 ♀) 5 braconids	not gregarious
24. VI. 2007 L	HH070624	1	6. VII.	3. IV. 2008 (1 ♀)	
1. VII. 2007 L	HH070701	1	15–16. VII.	1 braconid	
3. VII. 2010 L	AS100703	8	6–8. VII.	25. IV. 2011 (1 ♀)	not gregarious
3. VII. 2010 L	HH100703	5 +	6–15. VII.	28. IV. 2011 (2 ♂) 9. V. 2011 (1 ♀)	not gregarious

* Reared by Hara in Bibai or Shintoku (HH) and by Shinohara in Tokyo (AS).
** Other specimens died or were fixed in larval stage.

leaves or within soil in captivity.

Discussion

Comparison with the Related Species

Arge takanebara is characterized by the combination of the following characters: Black with weak bluish reflection; setae whitish; wings hyaline, not yellowish, without distinct dark markings (at most with faint cloud below stigma) and vein C mostly or entirely black (rarely pale brown throughout); antenna black; hind leg black, white on wide base of tibia, usually yellowish or brownish on base of tarsus; frontal area short, anterolaterally distinctly raised; interantennal carinae dorsally not fused; supraclypeal area with median ridge rounded, rarely bluntly carinate; malar space 1.4–2.0 × width of front ocellus; in both wings, wing margins between veins Rs and Cu not or sparsely ciliate, with very narrow marginal glabrous area (Fig. 2M); fifth abdominal tergum widely setose; in female, sawsheath in posterodorsal view about as long as wide (Fig. 3A, B), and lancet with middle and apical annuli arched and apically without nonannulate area (Fig. 4); in male genitalia (Fig. 5), gonostipes in ventral view very wide apically, harpe in dorsal view narrow and rounded apically, and valviceps in dorsal view apically with large lateral lobe, in lateral view basally with large ventral lobe.

In Gussakovskij's (1935) key, this species goes to the couplets 160/161, containing *A. ciliaris* (Linné, 1767) and the male of *A. rufocincta* Gus-

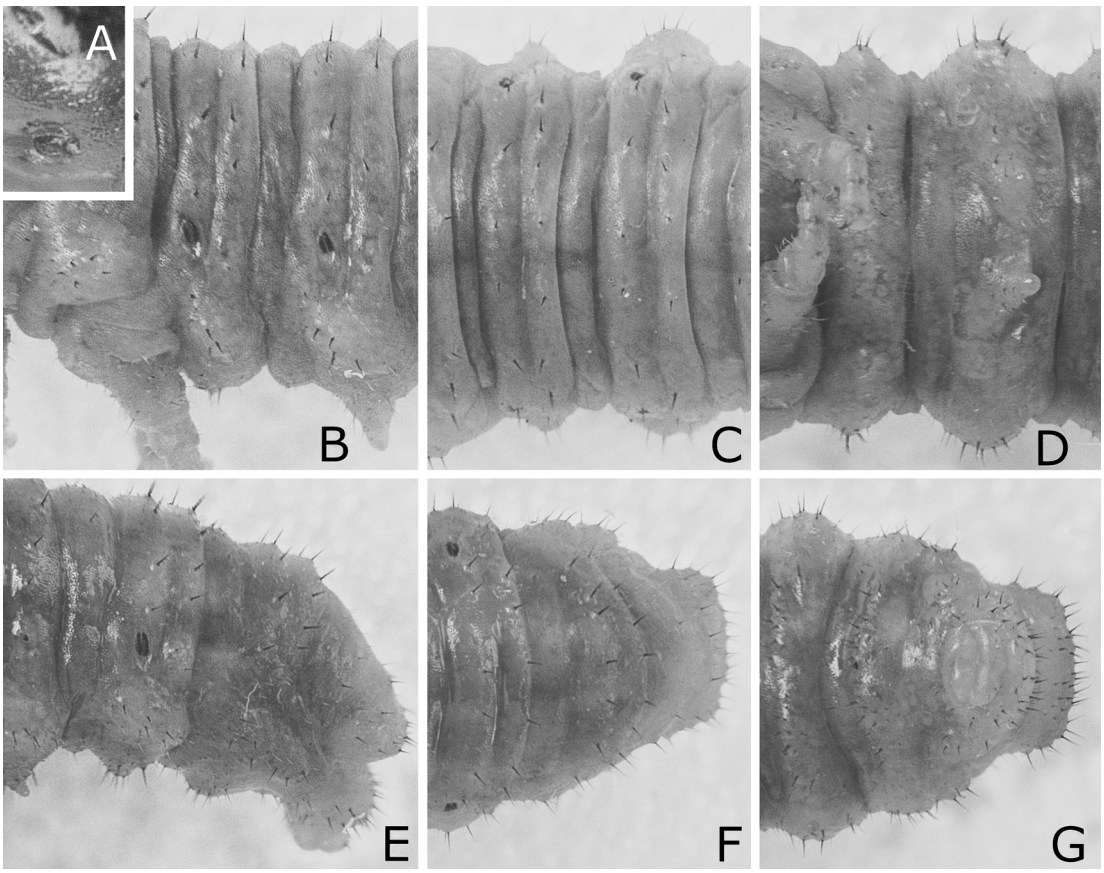

Fig. 6. Final instar larva (HH070614C). —— A, Left antenna, lateral view; B–D, first and second abdominal segments, lateral, dorsal and ventral views; E–G, eighth to tenth abdominal segments, lateral, dorsal and ventral views.

sakovskij, 1935 (synonymized with *A. longicornis* Kuznetzov-Ugamskij, 1927 by Shinohara *et al.*, 2012). Because of the color pattern and the absence of a conspicuous dark marking in the wings, this species runs to *A. ciliaris* also in the keys by Benson (1951) and Zhelochovtsev (1988). *Arge takanebara* is hardly distinguishable from *A. ciliaris* in external characters. However, the females of the two species are distinctly different in the lancet, which is narrower in the former (Fig. 4) than in the latter (Fig. 7A, B); middle serrulae are nearly triangular, each without notch in its anterior end in the former, while those are apically rounded and each of them notched in its anterior end in the latter. On the other hand, their male genitalia show only a slight difference (Figs. 5, 7C–H). In dorsal view, the apical lateral lobe of the valviceps is broader in *A. takanebara* (Fig. 5A, C) than in *A. ciliaris* (Fig. 7C–E). Their host plants are different, *Rosa acicularis* in *A. takanebara*, but *Filipendula* spp. in *A. ciliaris* (Liston, 1995). The male of *A. longicornis* is distinguished from that of *A. takanebara* in having a narrower malar space (0.5–0.8 × the median ocellus width) and densely ciliate wing margins. The male genitalia and the female of *A. longicornis* are quite different from those of *A. takanebara* (see Shinohara *et al.*, 2012).

From Japanese congeners, besides *A. longicornis* as stated above, *A. takanebara* is easily distinguished by the coloration.

Three other species of the Arginae are known

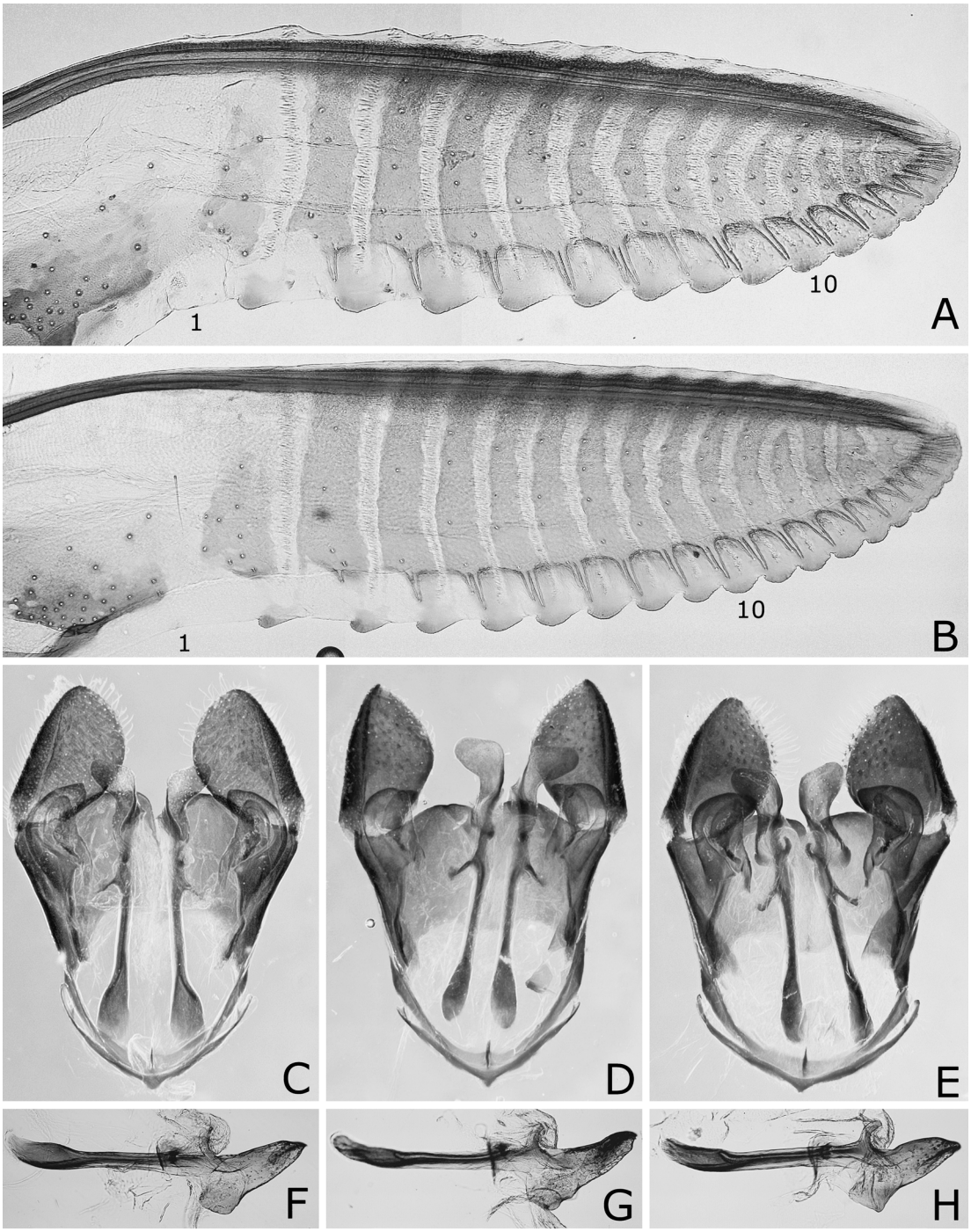

Fig. 7. *Arge ciliaris*, lancets, lateral view (A, B), male genitalia, dorsal view (C–E), and penis valves, lateral view (F–H). —— A, Vaihingen, Germany, revered image; B, Lääne-Virumaa, Estonia; C, F, Denmark; D, G, Berlin; E, H, Stockholm.

to feed on *Rosa* in Japan: *A. nigronodosa* (Motschulsky, 1859), *A. nipponensis* Rohwer, 1910 and *A. pagana* (Panzer, 1798) (Okutani, 1967). The larva of *A. takanebara* is distinguished from the larvae of those three species by the following features: Apex of abdomen in dorsal view broadly truncate (Fig. 6F, G) (rounded in the others); six pairs of prolegs (excluding anal pair), each on second to seventh abdominal segment (Fig. 1I, K) (five pairs, each on second to sixth segment in the others) (Okutani, 1959; Hara, 2010; unpublished observations).

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