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REVISION OF THE GENUS YAMATOCALLIS MATSUMURA IN JAPAN (HEMIPTERA: APHIDIDAE)

By SHUN'ICHIRO SUGIMOTO

Abstract

SUGIMOTO, S., 2017. Revision of the genus *Yamatocallis* Matsumura in Japan (Hemiptera: Aphididae). *Ins. matsum. n. s.* 73: 39–63, 7 figs.

The aphid genus *Yamatocallis* Matsumura, 1917 in Japan is revised. The following 5 species, *Y. nikkoensis* sp. nov., *Y. hirayamae* Matsumura, *Y. tokyoensis* (Takahashi), *Y. acericola* Higuchi and *Y. takagii* (Takahashi), are described with their host records and distributions. Among the previously known species, the fundatrices of *Y. hirayamae* and *Y. tokyoensis*, and the sexual morphs of *Y. acericola* and *Y. takagii* are described for the first time. A key to Japanese species is provided. Moreover, based on the collection data of each aphid, the host preference is discussed.

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Introduction

The genus *Yamatocallis* comprises 8 species, all of which are associated with *Acer* speies (Sapindaceae) except for one species described from an unidentified plant (Blackman & Estop, 1994; Qiao & Zhang, 2001). The taxonomic studies of the genus *Yamatocallis* in Japan have been made by Matsumura (1917), Shinji (1923, 1933, 1941), Takahashi (1923, 1963) and Higuchi (1972, 1974). Up to now, the following 4 species have been recognized: *Y. acericola* Higuchi, 1974, *Y. hirayamae* Matsumura, 1917, *Y. takagii* (Takahashi, 1963), and *Y. tokyoensis* (Takahashi, 1923). These species are easily distinguishable from one another by using Higuchi (1974)'s key for alate viviparous females. However, the life cycles of these species are little known; the sexual morphs of *Y. harayamae* are described in the Japanese (Shinji, 1933, 1941) and Korean (Paik, 1972) languages, and those of *Y. tokyoensis* are also done in the Japanese language (Shinji, 1933, 1941). During my survey of *Acer*-infesting aphids, I have found an undescribed species from *Acer tenuifolium* at Nikkô, Tochigi Prefecture, the northern Kantô District, central Japan and some hitherto unknown morphs of the previously known species. In the present paper, a new species, *Yamatocallis nikkoensis* and newly discovered morphs of the previously known species are described. In addition, the host preference of each aphid species is discussed based on the collection data.

Materials and Methods

A field survey for *Yamatocallis* species has been conducted at several localities in Japan from 2009. Especially, the following localities were visited repeatedly to collect undescribed morphs appearing in their life cycle: Nikkô (above the sea 600–640 m), the northern part of Tochigi Prefecture; Mt. Takao (250–599 m), the western part of Tôkyô Metropolis; Hadano and Atsugi (100–200 m), the central part of Kanagawa Prefecture; Hakone (660–780 m), the western part of Kanagawa Prefecture. The specimens were preserved in 70% ethanol at collection. They were mounted on microscope slides in balsam based on Martin's (1983) methods, and a part of first instar larvae were stained with acid fucshin before the dehydration by glacial acetic acid. The *Acer* plants on which a *Yamatocallis* species was collected were identified at the specific level based on photographs and explanations given by Igari (2010). All the specimens examined in this study are collected by the author unless otherwise stated. The holotype and paratypes of a new species are deposited in the collection of the Laboratory of Systematic Entomology, Hokkaido University (SEHU). Other specimens examined are also deposited in SEHU.

Taxonomy

Genus *Yamatocallis* Matsumura

Yamatocallis Matsumura, 1917: 366. Type species: *Y. hirayamae* Matumura, 1917.

Chaitophoraphis Shinji, 1923: 307. Type species: *C. acerifloris* Shinji, 1923.

Megalocallis Takahashi, 1963: 160. Type species: *M. takagii* Takahashi, 1963.

Megalophyllaphis Ghosh, Ghosh & Raychaudhuri, 1970: 383. Type species: *M. obscurus* Ghosh, Ghosh & Raychaudhuri, 1970.

The generic character of *Yamatocallis* has hitherto been provided based on the morphology of alate viviparous female (Matsumura, 1917; Higuchi, 1972; Ghosh & Quednau, 1990; Qiao & Zhang, 2001). Herein the diagnoses of the oviparous female and male are described.

Oviparous female. Apterous. Body oval. Dorsal setae minute except on frons of head and on abdominal segments VII–VIII, or all of dorsal setae more than 1.5 times as long as the basal width of antennal segment III. Head with a spinal longitudinal suture; rudimentary ocelli present near each compound eye. Antennae 6-segmented, 0.8–1.5 times as long as body, usually without secondary rhinaria, but in some species segment III with 1 or 2 rounded rhinaria on basal part. Pronotum with a pair of spinal tubercles mid-posteriorly, of which surface are corrugated. Hind tibiae somewhat swollen, with numerous scent plaques. Abdominal tergite VIII with more setae than in alate viviparous females. Cauda broadly rounded.

Male. Alate. Differs from the alate viviparous female in the following characters: antennal segments III–V with small elliptical secondary rhinaria; abdomen with marginal sclerites on each of segment I–VII, and a dorsal spinal band on each of segments I–VIII.

Key to species of *Yamatocallis* in Japan

Alate viviparous female

Wing coloration in life (Fig. 1) is an important character to distinguish the alate viviparous females of *Yamatocallis* species in Japan. The following key gives the other characters based on the mounted specimens and host information.

1. Body medium in size, usually at most 3.5 mm long. Siphunculi swollen on basal 2/3, shorter than head width across eyes. On the plants of the section *Palmata* in the genus *Acer*..... 2
– Body large in size, usually 3.5–4.8 mm long. Siphunculi somewhat cylindrical, as long as head width across eyes. On the plants of the section *Indivisa* or *Platanoidea*..... 4
2. Siphunculi dark brown. Antennae with secondary rhinaria arranged partly in irregular or two rows on segment III (Fig. 2Aa). On *A. tenuifolium* ..... *Y. nikkoensis* sp. nov.
– Siphunculi pale brown. Antennae with secondary rhinaria arranged in a row on segment III (Figs 2B, 2C)..... 3
3. Fore and middle femora pale brown to brown as in hind ones. Antennal segment III with 10–25 (mean 16.6) secondary rhinaria on basal 1/3–2/5 (Fig. 2B). On *A. amoenum* .... *Y. hirayamae*
– Fore and middle femora dark brown, darker than hind ones. Antennal segment III with 6–16 (mean 10.4) secondary rhinaria on basal 1/5–3/10 (Fig. 2C). Mainly on *A. palmatum* .... *Y. tokyoensis*
4. Antennal segment III with 21–36 (mean 28) secondary rhinaria on basal half (Fig. 2D). Tibiae pale brown except on extremely base. On *A. carpinifolium*..... *Y. acericola*
– Antennal segment III with 14–26 (mean 17) secondary rhinaria on basal 1/3 (Fig. 2E). Tibiae dark brown except on apical 1/3. On *A. pictum*..... *Y. takagii*

Oviparous female

1. Body 2.3–3.6 mm long. Siphunculi shorter than head width across eyes. Dorsal setae on body shorter than basal width of antennal segment III..... 2
– Body 3.5–4.9 mm long. Siphunculi as long as head width across eyes. Dorsal setae on body

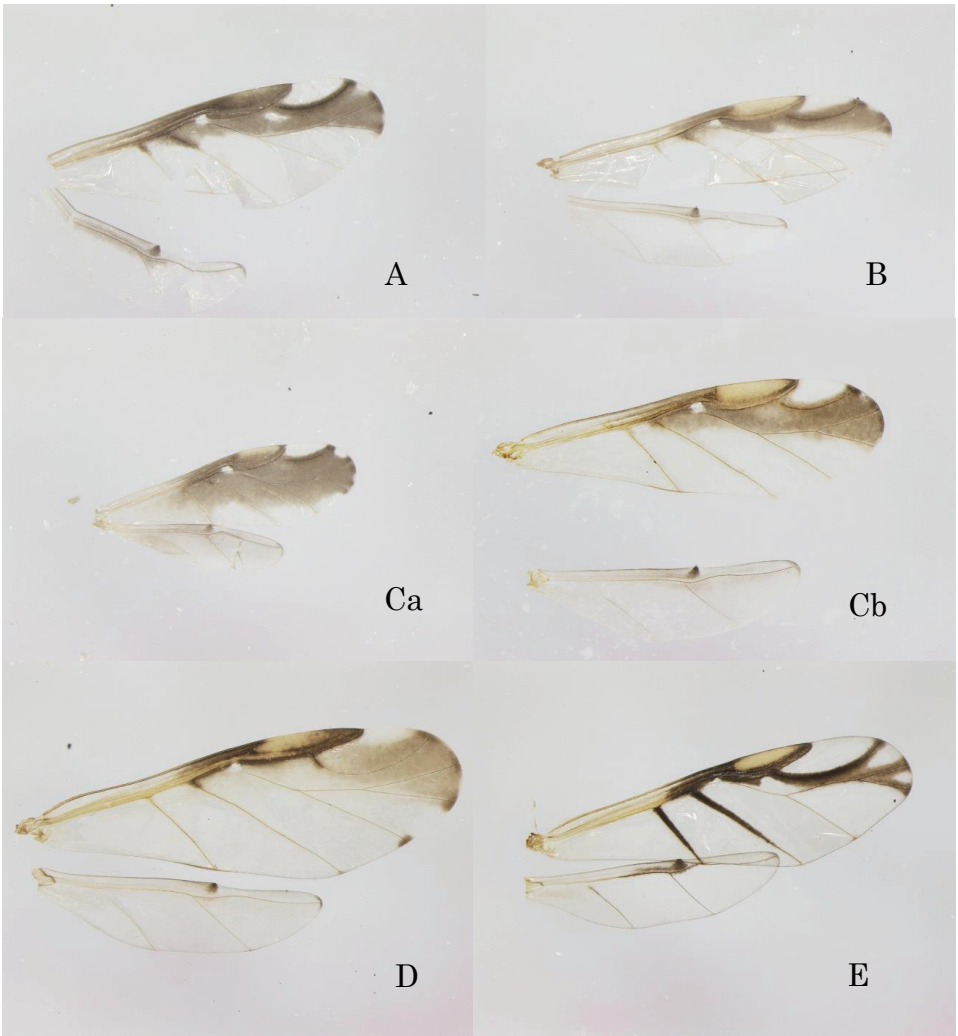

Fig. 1. Wings in life specimen (Al: alate viviparous female, F: fundatrix). A: *Y. nikkoensis* sp. nov. (Al), B: *Y. hirayamae* (Al), C: *Y. tokyoensis* (a: Al, b: F), D: *Y. acericola* (Al), E: *Y. takagii* (Al).

1.5–3.6 times as long as basal width of antennal segment III..... 4

2. Siphunculi dark brown on whole length, about 2.0 times as long as the basal width, 0.4–0.5 times as long as head across eyes..... *Y. nikkoensis* sp. nov.

– Siphunculi pale brown at least basal 2/3, 1.0–1.6 times as long as the basal width, 0.2–0.4 times as long as head across eyes..... 3

3. Processus terminalis of antennal segment VI 2.1–2.6 (mean 2.3) times as long as base of the segment. Siphunculi 1.4–1.6 times as long as the basal width, 0.3–0.4 times as long as head across eyes..... *Y. hirayamae*

– Processus terminalis of antennal segment VI 1.8–2.0 (mean 1.9) times as long as base of the segment. Siphunculi almost as long as the basal width, 0.2–0.25 times as long as head across

eyes..... *Y. tokyoensis*

4. Dorsal abdomen without large pigmentations, at most with pale brown scleroites at the base of spinal and pleural setae..... *Y. acericola*

– Doral abdomen with a brown spinal band on each segment I–VI..... *Y. takagii*

Male

Wing coloration in life is the same as in the alate viviparous females (cf. Fig. 1). The following key gives other characters based on the mounted specimens.

1. Siphunculi short, at most 0.4 mm long. Antennal segment IV with 13–47 secondary rhinaria 2

– Siphunculi long, 0.6–0.8 mm long. Antennal segment IV with more than 80 secondary rhinaria 4

2. Siphunculi dark brown. Fore and middle femora pale brown to brown as in hind ones..... ..... *Y. nikkoensis* sp. nov.

– Siphunculi pale brown, if dark brown, then fore and middle femora darker than hind ones 3

3. Fore and middle femora pale brown to brown as in hind ones. Processus terminalis of antennal segment VI 1.6–2.4 (mean 1.9) times as long as the base of segment ... *Y. hirayamae*

– Fore and middle femora darker than hind ones. Processus terminalis of antennal segment VI 1.3–1.7 (mean 1.5) times as long as the base of segment ..... *Y. tokyoensis*

4. Dorsal bands and marginal sclerites paler than siphunculi ..... *Y. acericola*

– Dorsal bands and marginal sclerites as dark as siphunculi ..... *Y. takagii*

First instar larva (individual with 4-segmented antennae)

1. Body at most 1.0 mm long. Siphunculi shorter than ultimate rostral segment. Dorsal setae on body minute, shorter than basal width of antennal segment III 2

– Body more than 1.2 mm long. Siphunculi longer than ultimate rostral segment. Dorsal setae on body longer than basal width of antennal segment III 4

2. Antennal segment III 1.0–1.2 times as long as head width across eyes. Longest seta on frontal margin of head and abdominal tergite VII 0.6–1.0 and 0.4–1.0 times as long as basal width of antennal segment III, respectively..... *Y. nikkoensis* sp. nov. / *Y. hirayamae*

– Antennal segment III 0.8–0.9 times as long as head width across eyes. Longest seta on frontal margin of head and abdominal tergite VII 0.33–0.67 and 0.17–0.33 times as long as basal width of antennal segment III, respectively. ..... *Y. tokyoensis*

3. Processus terminalis of ultimate antennal segment 3.3–3.4 times as long as base of the segment. Tibiae pale brown except on extremely base. ..... *Y. acericola*

– Processus terminalis of ultimate antennal segment 2.8–3.0 times as long as base of the segment. Tibiae dark brown except on apical 1/3. ..... *Y. takagii*

Yamatocallis nikkoensis sp. nov.
[Japanese name: Nikkô-kamagata-aburamushi]

Alate viviparous female (Figs 1A, 2Aa, 3A). Color in life specimen: body green; siphunculi black; forewings dark brown on the anterior half except on the cell surrounded by radial sector. In mounted specimen: head, thorax, legs and cauda pale brown; antennae pale brown, but segments III–IV brown each at tip; siphunculi dark brown.

Body 2.05–2.93 mm long. Head smooth dorsally and ventrally; antennal tubercles

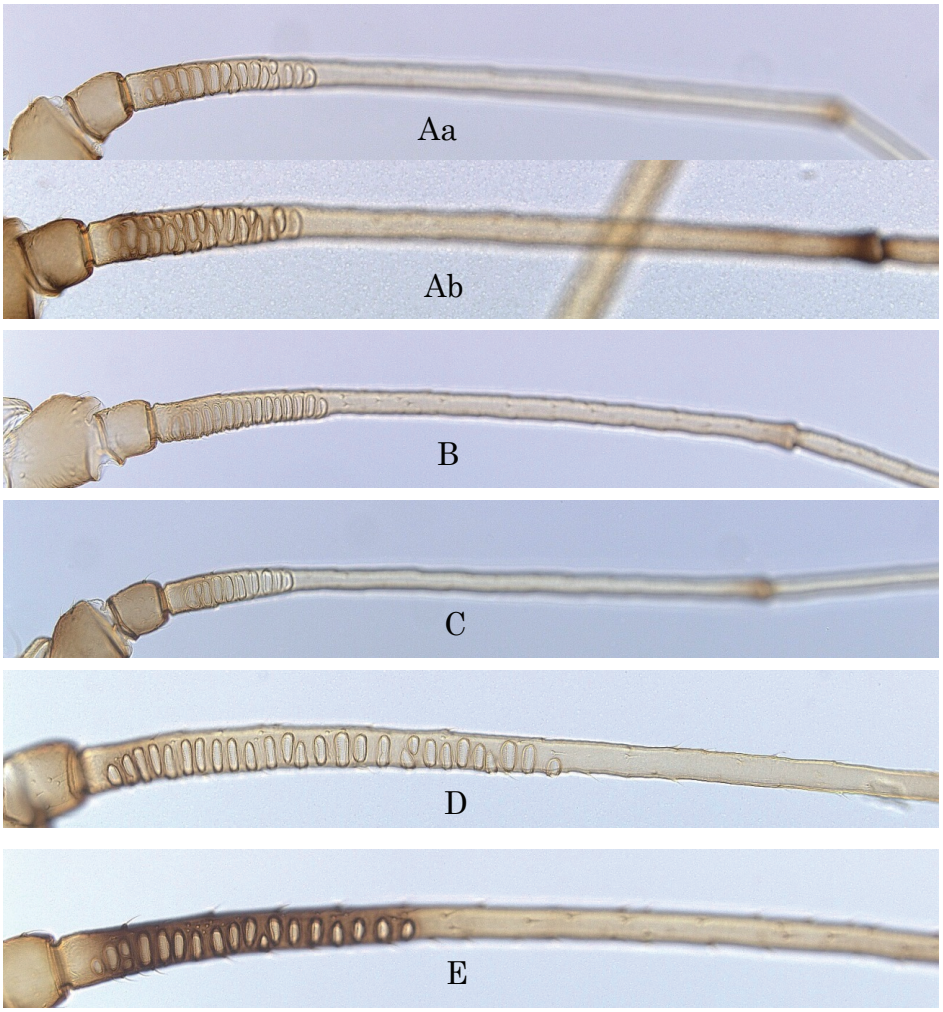

Fig. 2. Secondary rhinaria on antennal segment III (Al: alate viviparous female, F: fundatrix). A: *Y. nikkoensis* sp. nov. (a: Al, b: F), B: *Y. hirayamae* (Al), C: *Y. tokyoensis* (Al), D: *Y. acericola* (Al), E: *Y. takagii* (Al).

developed and diverging at inner side; median tubercle low; frons with one pair of setae; dorsum with 6 setae arranged in one anterior and two posterior pairs, of which the longest seta is 1.8–2.0 time as long as the basal width of antennal segment III; venter with 4 (rarely 6) setae, of which one pair (rarely 2 pairs) is arranged near the frontal ocellus. Antennae 6-segmented, 1.4–1.5 times as long as body; segment I almost smooth except on anterior inner sides, with 17–23 setae; II imbricated on inner sides, with 4–7 setae ventrally; III weakly imbricated, with 12–22 elliptical secondary rhinaria arranged in a row, sometimes partly in irregular or two rows on basal 1/4–3/10; IV–VI imbricated; setae short, of which the longest seta on segment III is at most 0.5 times as long as the basal width of segment III; primary rhinaria with cilia; length ratio of III–VI

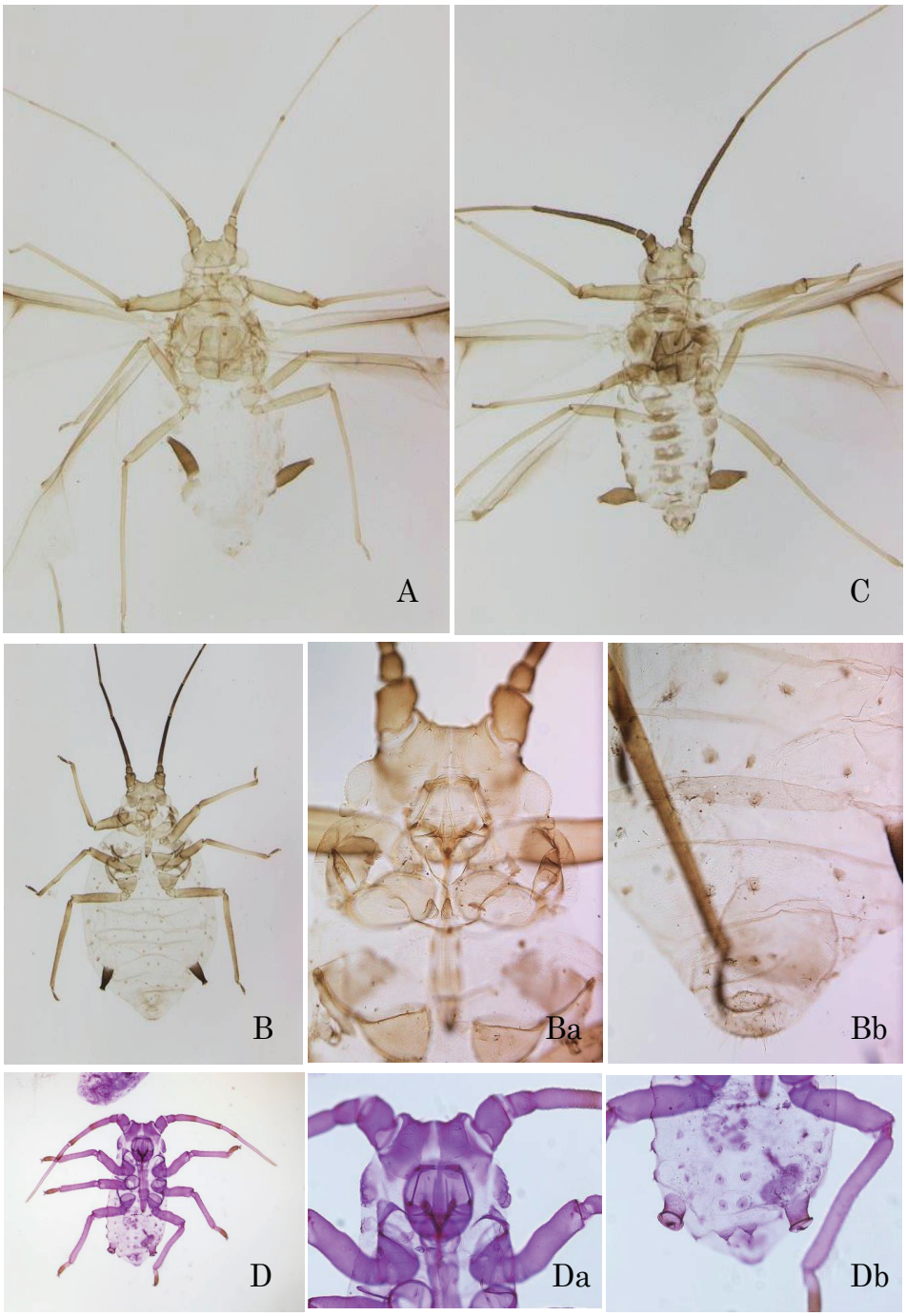

Fig. 3. *Yamatocallis nikkoensis* sp. nov. A: alate viviparous female, B: oviparous female, C: male, D: first instar larvae, a: dorsum of head and thorax, b: posterior part of abdomen.

100:90:92:32+64; processus terminalis of segment VI 1.7–2.1 times as long as base of the segment. Rostrum not reaching middle coxae; ultimate segment 0.75–0.86 times as long as segment II of hind tarsus, with 6–9 secondary setae. Forewings 3.33–4.55 mm long. Fore femora stouter than middle or hind ones. Hind tibiae imbricated along basal 3/5 of inner side, spinulated on distal 2/5, with 3 or 4 stout conical spines at tip; setae on basal 2/3 are shorter than the middle width of the tibiae, and those on apical 1/3 are at most as long as the same width. First tarsal chaetotaxy 7:7:7. Abdomen membranous, with marginal sclerites each on segment I–VI; tergites I–V with a pair of spinal and pleural setae, VI–VII with a pair of spinal setae and VIII with 4 setae; tergites I–VII with 4–6 pair of marginal setae, of which one pairs on II–VI is longer than the remaining setae; the longest spinal seta (usually on tergite I or II) 2.0–2.2 times as long as basal width of antennal segment III; spinal setae on I–V and longer marginal setae on II–V arising on small tubercles. Genital plate with 10–17 setae along the hind margin, 4–6 setae anteriorly. Siphunculi bottle-shaped, swollen on the middle, narrowed on the distal and at the base, somewhat curved, 0.30–0.42 mm long, 0.58–0.65 times as long as head width across eyes, imbricated dorsally, wrinkled ventrally especially on basal part, with reticulation in 3 or 4 rows at apex, with a flange. Cauda 0.13–0.17 mm long, knobbed, with 5–9 setae.

Fundatrix (Fig. 2Ab). Body large, 3.38–3.40 mm long. Antennae about 1.3 times as long as body; segment III with 24–29 secondary rhinaria arranged in two rows; length ratio of III–VI 123:99:97:35+63; processus terminalis of segment VI 1.8–2.2 times as long as basal part of the segment. Forewings 5.25–5.73 mm long. Siphunculi 0.50–0.55 mm long, about 0.74 times as long as head width across eyes. Cauda 0.19–0.20 mm long. Other characters are the same as in the alate viviparous female.

Oviparous female (Fig. 3B). Apterous. Color in life specimen: body dark reddish green, siphunculi black. In mounted specimen: head, legs and cauda pale brown; antenna dark brown, but segments I, II and base of III and IV pale brown; abdomen with pale brown scleroites at the base of spinal, pleural and marginal setae; siphunculi dark brown.

Body 2.80–3.30 mm long, 1.6–1.8 times as long as its maximum width. Head somewhat corrugated frontally, smooth dorsally and ventrally; antennal tubercles low and diverging at inner side; frons with one pair of spatulate setae which are 0.7–1.2 times as long as the basal width of antennal segment III; dorsum with 3 pairs of spatulate setae, of which one anterior pair are little shorter than the frontal ones, and two pairs between compound eyes minute; venter with 2 pairs of setae, of which one anterior pair is spatulated and as long as frontal ones, and one posterior pair is blunt at apices and 1.1–1.5 times as long as basal width of antennal segment III. Antennae 0.82–0.98 times as long as body; segments I and II smooth, imbricated on inner side, with 10–16, 3 or 4 setae, respectively; III–VI imbricated; length ratio of III–VI 68:51:56:26+53; processus terminalis of segment VI 2.0–2.3 times as long as base of the segment. Pronotum with a pair of dome-like tubercles mid-posteriorly, of which length is 1.1–1.6 times as long as basal width of the tubercles. Hind tibiae imbricated along basal 4/5 of inner side, spinulated along apical half of outer side, with 48–156 scent plaques which are usually divided into 2–4 facets. Abdomen membranous; tergites I–V with 3 pairs (spinal, pleural and marginal) and VI–VII with 2 pairs (spinal and marginal) of setae, which are all minute and spatulate, and arising on screloites; tergite VIII with 12–17 setae arranged in a transvers row, of which spinal 4 are spatulated and other ones pointed at apices; each margin on tergite I–VII with 3–5 pairs of additional setae, which are thinner than a pair

of marginal setae arising on scleroites. Siphunculi bottle-shaped, 0.29–0.38 mm long, 0.40–0.50 times as long as head width across eyes, strongly imbricated basal 2/3, with a flange; apical reticulation indistinct. Cauda 0.09–0.11 mm long, about 1/2 of its basal width, with 18–26 setae.

Male (Fig. 3C). Alate. Body 2.18 mm long. Antennae 1.8 times as long as body; segments I–III darker than head; segments III–V with small elliptical secondary rhinaria, III numerous, IV 27 and 32, V 15 and 18 in number; length ratio of III–VI 105:87:85:33+68; processus terminalis of segment VI 2.1 times as long as base of the segment. Forewings 4.43 mm long. Abdomen with a spinal band on each of tergite I–VIII and marginal sclerites on each of tergite I–VII, these bands and marginal sclerites are dark brown. Siphunculi dark brown, 0.38 mm long. Cauda 0.14 mm long. Other characters are the same as in the alate viviparous female.

First instar larva (Fig. 3D): Color in life specimen: body pale green.

Body 0.74–0.98 mm long, with short or minute capitated setae dorsally and marginally. Head with antennal tubercles somewhat diverging at inner side; longest seta on frons 0.57–0.83 times as long as basal width of antennal segment III. Antenna 4-segmented, 1.0–1.2 times as long as body; inner side of segments I–II imbricated; segment III composed by stout part on basal half and somewhat slender part on apical half, imbricated on whole length, 0.9–1.0 times as long as head width across eyes; segment IV imbricated on whole length; processus terminalis of segment IV 2.5–2.9 time as long as base of the segment. Pronotum with a pair of small tubercles mid-posteriorly. Ultimate rostral segment 0.9–1.0 times as long as segment II of hind tarsus. Abdomen with minute setae on tergites I–VI and little longer setae on tergites VII and VIII, of which the longest one on VII is 0.4–1.0 times the basal width of antennal segment III. Siphunculi 0.04–0.05 mm long, with a flange.

Specimens examined. All the specimens were collected from a single tree of *Acer tenuifolium* at Nikkô Botanical Garden in Tochigi Prefecture. Holotype: an alate viviparous female, 21.ix.2014. Paratypes: 5 alate viviparous fmales, the same data as the holotype; 2 alate viviparous females, 21.vi.15. Other specimens examined: *Fundatrix*: 2exs., 3.v.2015. *Alate viviparous female*: 2exs., 21.ix.2014; 2exs., 30.viii.2015; 5exs., 22.ix.2015. *Oviparous female*: 7exs., 8.xi.2014. *Male*: 1ex., 18.x.2015. *First instar larva deposited by alate viviparous female*: 4exs., 22.ix.2015.

Host plants. *Acer tenuifolium*.

Distribution. Japan: Honshû.

Remarks. In general appearance, this species resembles *Y. hirayamae* and *Y. tokyoensis*, but differs from the latter two species in having black siphunculi in life. The alate viviparous female of this species were found on the samaras of *A. tenuifolium* at the collection.

Etymology. The specific name refers to the type locality.

Yamatocallis hirayamae Matsumura
[Japanese name: Hirayama-kamagata-aburamushi]

Yamatocallis hitayamae Matsumura, 1917: 367.

Yamatocallis hirayamae: Shinji, 1933: 158; Higuchi, 1972: 80; Paik, 1972: 238; Sorin, 1977: 152; Pashtshenko, 1988: 569; An & Park, 1993: 58; Qiao & Zhang, 2001: 100; Quednau & Lee, 2001: 217.

Chaitophoraphis acerifloris Shinji, 1923: 307.

Chaitophoraphis acerifoliae Shinji, 1932: 247.
Drepanaphis hirayamae: Shinji, 1941: 389; Moritsu, 1958: 80.

Matsumura (1917) gives a brief description of the alate viviparous female. After that Shinji (1933, 1941) and Pike (1972) give descriptions of the alate viviparous female, male and oviparous female in the Japanese and Korean languages, respectively. Based on the present specimens, redescriptions of the alate viviparous female, oviparous female and male, and a brief description of the fundatrix are given below.

Alate viviparous female (Figs. 1B, 2B, 4A). Color in life specimen: body usually pale green or green, in some spring specimens pinkish brown; siphunculi pale brown to pale green; forewings dark brown on the anterior half except on the cell surrounded by radial sector. In mounted specimen: head, antennae, thorax, legs, siphunculi and cauda pale brown.

Body 2.30–3.45 mm long. Head with 2 frontal, 6 dorsal and 6 ventral setae, of which the ventral 2 pairs are arranged near the frontal ocellus; longest seta on dorsum at most as long as basal width of antennal segment III. Antennae 1.3–1.8 times as long as body; segment III with 10–25 elliptical secondary rhinaria on basal 1/3–2/5; length ratio of III–VI 100:91:82:30+72; processus terminalis of segment VI 1.8–2.5 times as long as base of the segment. Ultimate rostral segment 0.65–0.85 times as long as segment II of hind tarsus, with 6–9 secondary setae. Forewings 3.03–4.98 mm long. Abdomen with 6–9 marginal setae, of which one pair each on tergite II–V is longer than the remaining setae; spinal setae on I–V and longer marginal setae on II–V arising on small tubercles. Siphunculi bottle-shaped, swollen on the middle, narrowed on the distal and at the base, bent inward toward apex, 0.25–0.45 mm long, 0.40–0.66 times as long as head width across eyes, weakly imbricated or sparsely spinulated dorsally, wrinkled ventrally especially on basal part, with reticulation in 3–5 rows at apex, with a flange. Cauda 0.13–0.18 mm long, knobbed, with 4–10 setae.

Fundatrix. Body large, 3.25–3.95 mm long. Antennae 1.0–1.3 times as long as body; length ratio of III–VI 138:100:95:31+63; processus terminalis of segment VI 2.0–2.3 times as long as base of the segment. Forewings 4.63–5.50 mm long. Siphunculi 0.37–0.45 mm long, 0.51–0.61 times as long as head width across eyes. Cauda 0.16–0.24 mm long. Other characters are the same as in the alate viviparous female.

Oviparous female (Fig. 4B). Apterous. Color in life specimen: body dark reddish green. In mounted specimen: head, antennae, legs, siphunculi and cauda pale brown.

Body 2.80–3.60 mm long. Head somewhat corrugated frontally, smooth dorsally and ventrally; frons with 2 spatulate setae which are 0.7–1.5 times as long as the basal width of antennal segment III; dorsum with 3 pairs of spatulate setae, of which one anterior pair is shorter than the frontal one, and 2 posterior pairs between compound eyes are minutes; venter with 3 pair of setae arranged longitudinally, of which the anterior pair is short and pointed at apices, the middle pair is almost as long as the posterior ones and blunt at apices, and the posterior pair is 1.4–2.0 times as long as basal width of antennal segment III and blunt at apices. Antennae 0.88–1.2 times as long as body; length ratio of III–VI 81:66:67:25+65; processus terminalis of segment VI 2.1–2.6 times as long as base of the segment. Pronotum with a pair of dome-like tubercles mid-posteriorly, of which length is 1.2–2.0 times as long as basal width of the tubercles. Hind tibiae imbricated along basal half of inner side, spinulated along apical 1/4 of outer side, with 128–285 scent plaques which are usually divided into 2–4 facets. Abdomen membranous; tergites I–V with 3

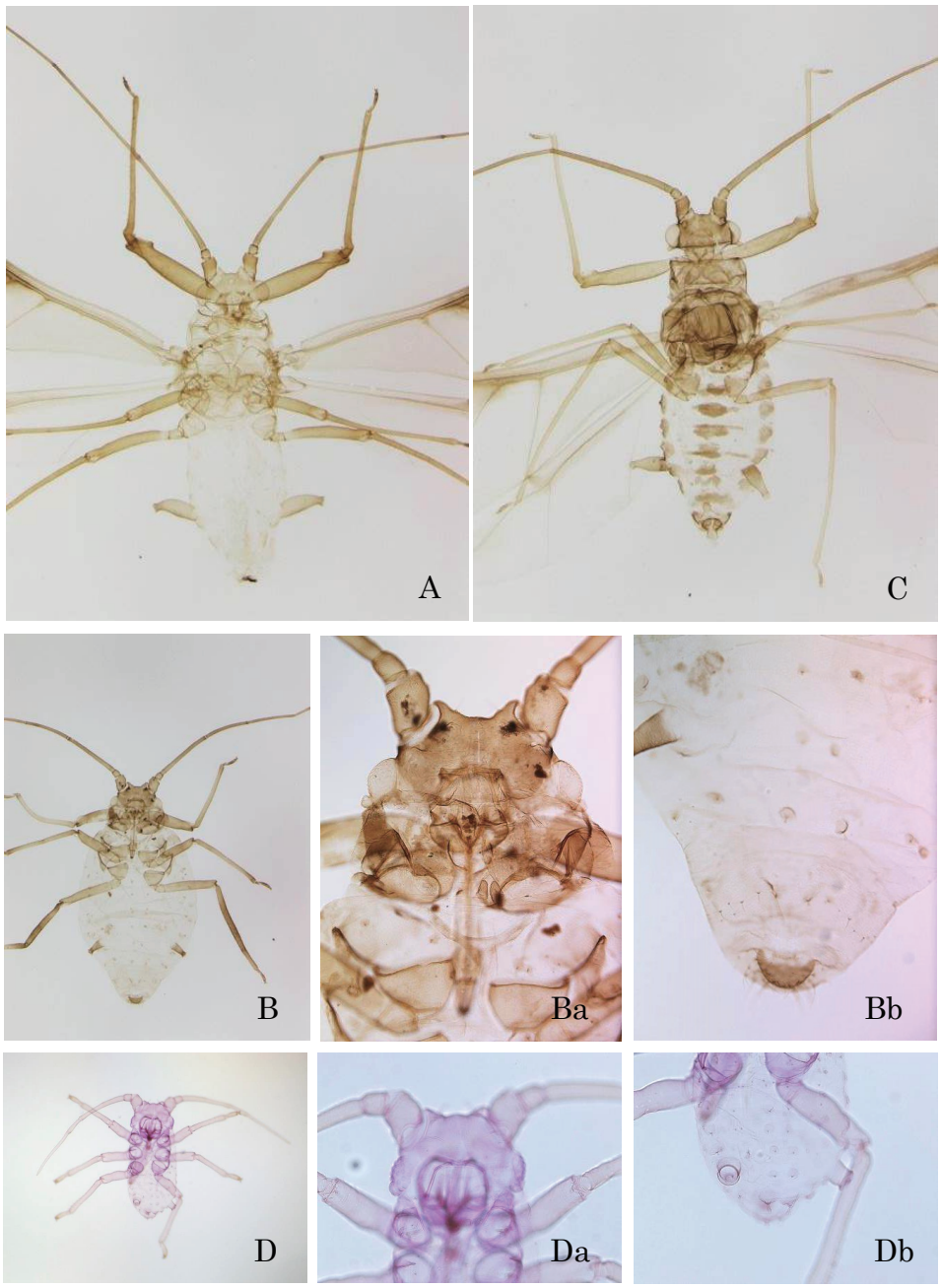

Fig. 4. *Yamatocallis hirayamae*. Symbols as in Fig. 3.

pairs (spinal, pleural and marginal) and VI–VII with 2 pairs (spinal and marginal) of setae, which are all minute and spatulate, and arising on small screloites; tergite VIII with 8–16 setae arranged in a transvers row, of which spinal 4 are spatulated and other ones pointed at apices; each margin on tergite I–VII with 3–5 pairs of additional setae, which are thinner than a pair of marginal setae arising on scleroites. Siphunculi tapering toward apex, 0.20–0.28 mm long, 0.30–0.40 times as long as head width across eyes, strongly imbricated at basal 2/3, with reticulation in 2 or 3 rows, with a flange. Cauda 0.10–0.13 mm long, about 1/2 of its basal width, with 18–23 setae.

Male (Fig. 4C). Alate. Body 2.70–3.25 mm long. Antennae 1.4–1.6 times as long as body, dark brown on whole length; segment III–V with small elliptical secondary rhinaria, III numerous, IV 13–47 and V 12–24 in number; length ratio of III–VI 119:100:99:43+75; processus terminalis of segment VI 1.6–2.2 times as long as base of the segment. Forewings 4.05–5.10 mm long. Abdomen with a spinal band on each of tergite I–VIII and marginal sclerites on each of tergite I–VII, these bands and marginal sclerites are dark brown. Siphunculi dark brown, 0.28–0.40 mm long, about 0.5 times as long as head width across eyes. Cauda 0.14–0.20 mm long. Other characters are the same as in the alate viviparous female.

First instar larva (Fig. 4D): Color in life specimen: body pale green.

Body 0.83–1.03 mm long, with short or minute capitated setae dorsally and marginally. Head with antennal tubercles somewhat diverging at inner side; longest seta on frons 0.83–1.0 times as long as basal width of antennal segment III. Antenna 4-segmented, 1.0–1.2 times as long as body; inner side of segments I–II imbricated; segment III 1.1–1.2 times as long as head width across eyes, imbricated on whole length; segment IV imbricated on whole length; processus terminalis of segment IV 2.8–3.0 time as long as base of the segment. Pronotum with a pair of small tubercles mid-posteriorly. Ultimate rostral segment 0.86–0.95 times as long as segment II of hind tarsus. Abdomen with minute setae on tergites I–VI and little longer setae on tergites VII and VIII, of which the longest one on VII is 0.6–1.0 times as long as the basal width of antennal segment III. Siphunculi 0.04–0.06 mm long, with a flange.

Specimens examined. All the specimens were collected from *Acer amoenum*. *Fundatrix*: Motohakone, Hakone, Kanagawa Pref. (1ex., 29.iv.2015; 9exs., 3.v.2015). *Alate viviparous female*: Hitsujigaoka, Sapporo, Hokkaido (1ex., 23.vi.2016, Y. Seino leg.): Yasukawa-chô, Nikkô, Tochigi Pref. (2exs., 30.viii.2015); Mt. Takao, Hachiôji, Tôkyô (3exs., 18.v.2014; 4exs., 15.vi.2014; 2exs., 15.ix.2014; 2exs., 18.x.2014; 3exs., 30.v.2015); Masugata, Tama-ku. Kawasaki, Kanagawa Pref. (2exs., 29.vi.2014); Mitsuike, Tsurumi-ku, Yokohama, Kanagawa Pref. (1ex., 19.iv.2014); Mt. Kôbô-yama, Hadano, Kanagawa Pref. (4exs., 23.ix.2014; 2exs., 26.x.2014); Nanasawa, Atsugi, Kanagawa Pref. (1ex., 23.xii.2014); Motohakone, Hakone (2exs., 1.vi.2014; 6exs., 14.vi.2015; 4exs., 6.ix.2015); Mt. Shosha, Himeji, Hyôgo Pref. (3exs., 28.vi.2015); Mt. Hikosan, Soeda-machi, Fukuoka Pref. (1ex., 15.v.2016). *Oviparous female*: Gojyô-dôri, Asahikawa, Hokkaidô (1ex., 23.x.2015, T. Matsuzawa leg.); Mt. Kôbô-yama, Hadano (4exs., 9.xi.2014; 2exs. 23.xi.2014); Nanasawa, Atsugi (1ex. 23.xi.2014; 3exs., 7.xii.2014). *Male*: Mt. Kôbô-yama, Hadano (8exs., 7.xi.2014); Nanasawa, Atsugi (1ex., 23.xi.2014; 2exs., 7.xii.2014). *First instar larva deposited by alate viviparous female*: Motohakone, Hakone (7exs., 6.ix.2015).

Host plants. *Acer amoenum*. The following *Acer* species are recorded as a host plant: *A. diabolicum*, *A. japonicum* and *A. pictum* (= *A. mono*) from Japan (Shinji, 1923; Higuchi, 1972), *A. buergerianum* from Korea (Paik, 1972), *A. palmatum* from Korea (An & Park, 1993), *A. pseudosieboldianum* from Korea (Paik, 1972, as *A.*

pseudosieboldianum var. *koreanum*; An & Park, 1993) and Russia (Pashtshenko, 1988).

Distribution. Japan: Hokkaidô, Honshû, Kyûshû. China (Qiao & Zhang, 2001); Korea (Paik, 1972; An & Park, 1993; Quednau & Kee, 2001); the Far East Russia (Pashtshenko, 1988).

Remarks. In general appearance, this species closely resembles *Y. tokyoensis*, but it differs from the latter in the following characters: (1) In the alate morphs, fore, middle and hind femora all pale brown to brown (fore and middle femora darker than hind ones in *Y. tokyoensis*), (2) In the alate viviparous female and male, forewings colored only on the anterior margin (on the whole except on the posterior margin in *Y. tokyoensis*), (3) In the oviparous female, processus terminalis and siphunculi longer than those of *Y. yokyoensis*. It is difficult to distinguish between the fundatrix and alate viviparous female of this species. However, the fundatrix in this study is described based on individuals that emerged from the last instar larvae collected on the undeveloped winter buds of *A. amoenum* at Hakone on 29 April and 3 May, 2015. The alate viviparous females were collected on the samaras of *A. amoenum* from June to middle November.

As mentioned in the host plant, *Y. hirayamae* has been recorded from six *Acer* plants except *A. amoenum*. Among the six *Acer* plants, there were many opportunities to examine five *Acer* plants except *A. pseudosieboldianum* in this study, however, *Y. hirayamae* was never found from them. Therefore, these *Acer* plants may be rare as a host or accidental records for *Y. hirayamae*. On the other hand, *A. pseudosieboldianum* is native to Korea and Manchuria, and *A. amoenum* is endemic to Japan (Ogata, 1967). Therefore, *Y. hirayamae* may utilize *A. pseudosieboldianum* instead of *A. amoenum* in Korea and the Far East Russia. However, the alate viviparous female of *Y. hirayamae* given by Paik (1972) and Pashtshenko (1988) differs from the present equivalent morph in the ratio of the processes terminalis to the base of antennal segment VI of alate viviparous females (1.5 in Paik; 2.5–3.0 in Pashtshenko; 1.8–2.5 in this study), Moreover, that of *Y. hirayamae* by An & Park (1993) differs from the present morph in body length (more than 3.1 mm; 2.3–3.5 (mean 2.8) mm in this study) and siphunculi length (more than 0.4 mm; 0.25–0.45 (mean 0.34) mm in this study). Thus, since there are some differences in the host preference and morphology between the Japanese and continental populations of *Y. hirayamae*, further comparative studies are needed.

Yamatocallis tokyoensis (Takahashi)
[Japanese name: Tôkyô-kamagata-aburamushi]

Drepanphis (sic) *tokyoensis* Takahashi, 1923: 66.

Yamatocallis tokyoensis: Higuchi, 1972: 80; Sorin, 1977: 152; Moritsu, 1983: 52 & 253; An & Park, 1993: 58; Qiao & Zhang, 2001: 100.

Chaitophoraphis tokyoensis: Shinji, 1932: 248.

Yamatocallis moriokae Shinji, 1933: 159.

Drepanaphis moriokae: Shinji, 1941: 394.

Takahashi (1923) gave a brief description of the alate viviparous female. After that Shinji (1933) described the alate viviparous female, male and oviparous female as *Y. moriokae* in the Japanese language. Based on the present specimens, redescriptions of the alate viviparous female, oviparous female and male, and a brief description of the

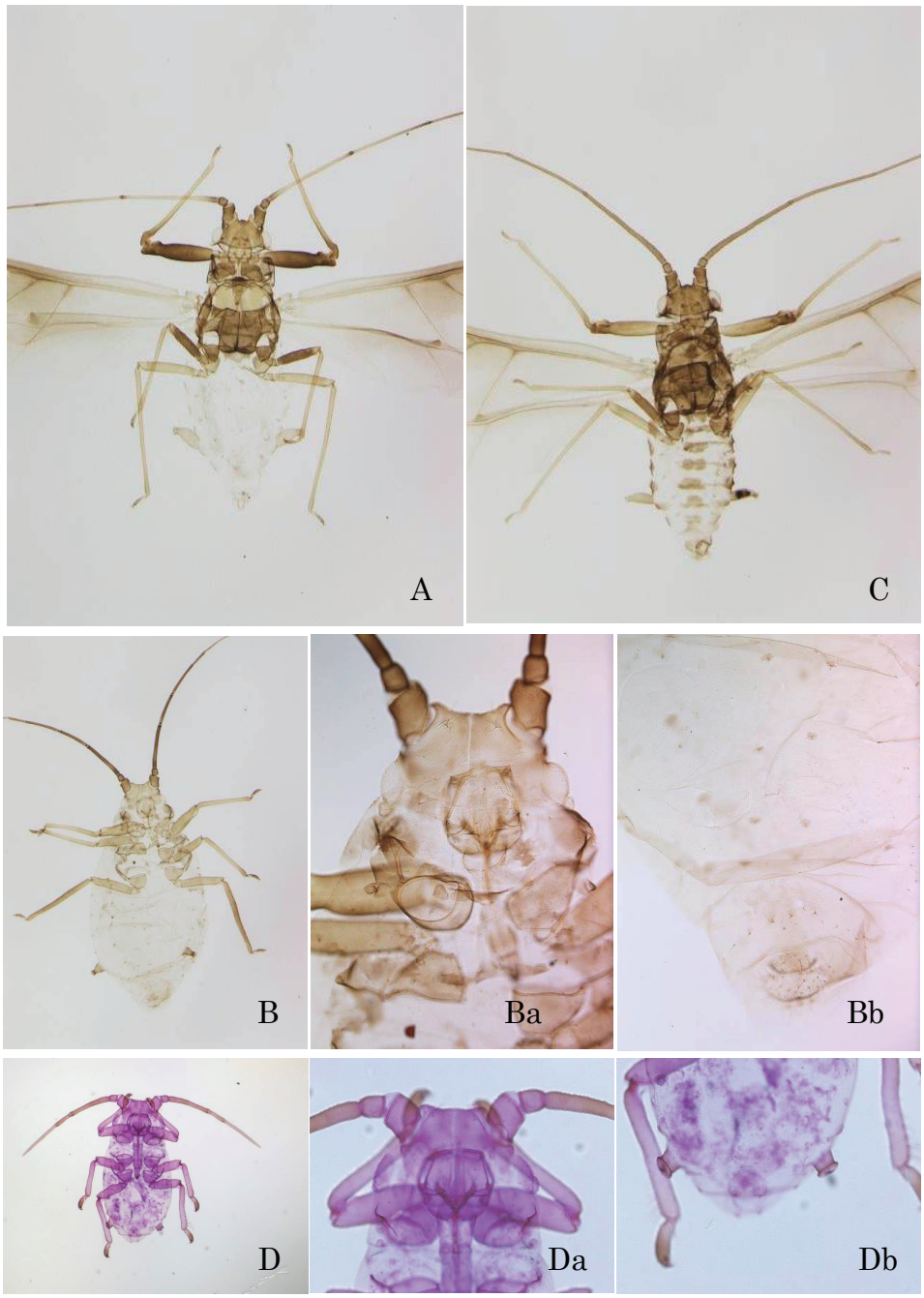

Fig. 5. *Yamatocallis tokyoensis*. Symbols as in Fig. 3.

fundatrix are given below.

Alate viviparous female (Figs. 1Ca, 2C, 5A). Color in life specimen: body usually pale green, head and thorax brown to dark brown, in some spring specimens body pinkish brown; siphunculi pale brown or pale green; forewings dark brown except along posterior margin. In mounted specimen: head and thorax brown; antennae pale brown except basal two segments; legs pale brown, but fore and middle femora dark brown; siphunculi and cauda pale brown.

Body 1.53–2.75 mm long. Head with 2 frontal, 6 dorsal and 6 ventral setae, of which the ventral 2 pairs are arranged near the frontal ocellus; the longest seta on dorsum 0.8–1.6 times as long as basal width of antennal segment III. Antennae 1.3–1.8 times as long as body; segment III with 6–16 (mean 10.4) elliptical secondary rhinaria on basal 1/5–3/10; length ratio of III–VI 80:71:75:33+59; processus terminalis of segment VI 1.6–2.1 times as long as base of the segment. Ultimate rostral segment 0.56–0.78 times as long as segment II of hind tarsus, with 5–9 secondary setae. Forewings 2.35–3.90 mm long. Abdomen with 5–8 marginal setae, of which one each on segment II–V is longer than the remaining setae; spinal setae on tergites I–V and longer marginal setae on II–V arising on small tubercles. Siphunculi bottle-shaped, swollen on the middle, narrowed on the distal and at the base, strongly bent inward toward apex, 0.20–0.35 mm long, 0.40–0.50 times as long as head width across eyes, imbricated or spinulated dorsally, wrinkled ventrally especially on basal part, with reticulation in 2–4 rows at apex, with a flange. Cauda 0.12–0.18 mm long, knobbed, with 6–9 setae.

Fundatrix (Fig. 1Cb). Body large, 2.75–3.40 mm long. Antennae 1.1–1.4 times as long as body; segment III with 11–18 (mean 14.1) secondary rhinaria; length ratio of III–VI 100:81:82:34+48; processus terminalis of segment VI 1.4–1.8 times as long as basal part of the segment. Forewings 3.95–4.75 mm long, pigmented at most on anterior half as in the alate viviparous female of *Y. nikkoensis* sp. nov. Siphunculi 0.30–0.38 mm long, 1/2–3/5 of head width across eyes. Cauda 0.17–0.22 mm long. Other characters are the same as in the alate viviparous female.

Oviparous female (Fig. 5B). Apterous. Color in life specimen: body dark reddish green. In mounted specimen: head, legs and cauda pale brown; antenna brown to dark brown; siphunculi pale brown, but apical part brown.

Body 2.80–3.10 mm long. Head somewhat corrugated frontally, smooth dorsally and ventrally; frons with 2 spatulate setae which are 0.56–1.1 times as long as the basal width of antennal segment III; dorsum with 3 pairs of spatulate setae, of which one anterior pair is shorter than the frontal one, and 2 posterior pairs between compound eyes are minutes; venter with 3 pair of setae arranged longitudinally, these are all pointed at apices, of which the anterior pair is short, the middle and posterior pairs are 1.2–1.8 times as long as basal width of antennal segment III. Antennae 0.81–1.1 times as long as body; length ratio of III–VI 60:43:48:25+47; processus terminalis of segment VI 1.8–2.0 times as long as base of the segment. Pronotum with a pair of cone-like tubercles mid-posteriorly, of which length is 0.83–1.1 times as long as basal width of the tubercles. Hind tibiae imbricated along basal 1/2–2/3 of inner side, spinulated along apical 2/5 of outer side, with 84–139 scent plaques which are usually divided into 2–4 facets. Abdomen membranous; tergites I–V with 3 pairs (spinal, pleural and marginal) and VI–VII with 2 pairs (spinal and marginal) of setae, which are all minute and spatulate, and arising on small screloites; tergite VIII with 11–14 setae arranged in a transvers row, of which spinal 4 are spatulated and other ones pointed at apices; each margin on tergite I–

VII with 3–6 pairs of additional setae, which are thinner than a pair of marginal setae arising on scleroites. Siphunculi tapering toward apex, 0.13–0.18 mm long, 0.20–0.25 times as long as head width across eyes, strongly imbricated basal 2/3, with a flange; apical reticulation indistinct. Cauda 0.07–0.09 mm long, about 1/2 of its basal width, with 15–19 setae.

Male (Fig. 5C). Alate. Body 2.35–2.70 mm long. Antennae 1.4–1.6 times as long as body, dark brown on whole length; segment III–V with small elliptical secondary rhinaria, III numerous, IV 13–39 and V 11–14 in number; length ratio of III–VI 100:84:88:37+57; processus terminalis of segment VI 1.4–1.7 times as long as base of the segment. Forewings 3.90–4.30 mm long. Abdomen with a spinal band on each of tergite I–VIII and marginal sclerites on each of tergite I–VII, these bands and marginal sclerites are dark brown. Siphunculi dark brown, 0.25–0.29 mm long, about 2/5 as long as head width across eyes. Cauda 0.14–0.16 mm long. Other characters are the same as in the alate viviparous female.

First instar larva (Fig. 5D): Color in life specimen: body pale green or pinkish brown.

Body 0.72–1.00 mm long, with short or minute capitated setae dorsally and marginally. Head with antennal tubercles somewhat diverging at inner side; longest seta on frons 0.33–0.67 times as long as basal width of antennal segment III. Antenna 4-segmented, 0.9–1.1 times as long as body; inner side of segments I–II imbricated; segment III 0.8–0.9 times as long as head width across eyes, imbricated on whole length; segment IV imbricated on whole length; processus terminalis of segment IV 2.5–2.7 time as long as base of the segment. Pronotum with a pair of small tubercles mid-posteriorly. Ultimate rostral segment 0.81–0.94 times as long as segment II of hind tarsus. Abdomen with minute setae on tergites I–VI and slightly longer setae on VII and VIII, of which the longest one on VII is 0.16–0.33 times as long as the basal width of antennal segment III. Siphunculi 0.025–0.04 mm long, with a flange.

Specimens examined. The specimens are collected from *Acer palmatum* unless otherwise stated. *Fundatrix*: Mt. Takao, Hachiôji, Tôkyô (6exs., 20.iv.2014); Mt. Kôbô-yama, Hadano, Kanagawa Pref. (14exs., 11.iv.2015); Nanasawa, Atsugi, Kanagawa Pref. (10exs., 4.iv.2015); Motohakone, Hakone, Kanagawa Pref. (2exs., 2.v.2015); Shinzaike, Nada-ku, Kôbe, Hyôgo Pref. (6exs., 4.iv.2009); Shôjyô-ike, Chûô-ku, Kôbe, Hyôgo Pref. (1ex., 4.v.2014); Ochiai, Soeda-machi, Fukuoka Pref. (3exs., 24.iv.2016). *Alate viviparous female*: Nikkô Botanical Garden, Nikkô, Tochigi Pref. (5exs., 21.vi.2015): Yasukawa-chô, Nikkô, Tochigi Pref. (5exs., 22.ix.2015; 4exs., 18.x.2015); Mt. Takao, Hachiôji (3exs., 24.vii.2014); Mt. Kôbô-yama, Hadano (4exs., 23.ix.2014; 8exs, 9.xi.2014; 2exs., 23.xi.2014; 2exs., 6.ix.2015); Nanasawa, Atsugi (2exs., 26.x.2014; 1ex., 23.xii.2014); Lake Tanzawa, Yamakita, Kanagawa Pref. (3exs., 6.vii.2014); Motohakone, Hakone (2exs., 12.x.2014; 3exs., 14.vi.2015) ; Konki-chô, Hikone, Shiga Pref. (2exs., 29.vi.2015); Imadegawa, Kamigyô-ku, Kyôto Pref. (4exs., 3.v.2014); Shôjyô-ike, Kôbe (3exs., 3.x.2009) ; Mt. Shosha, Himeji, Hyôgo Pref. (2exs., 28.vi.2015); Hirose-chô, Yasugi, Shimane Pref. (2exs., 14.ix.2015; 2exs., 14.ix.2015, on *Acer amoenum*); Yokoyama, Iwakuni, Yamaguchi Pref. (1ex. 12.ix.2015); Katsuyama Park, Kokurakita-ku, Fukuoka Pref. (3exs., 20.iv.2016); Ochiai, Soeda-machi (1ex., 24.iv.2016; 6exs., 29.iv.2016); Mt. Hikosan, Soeda-machi, Fukuoka Pref. (3ex., 15.v.2016). *Oviparous female*: Mt. Kôbô-yama, Hadano (1ex., 23.xi.2014; 6exs., 30.xi.2014); Nanasawa, Atsugi (2exs., 23.xi.2014); Funako, Atsugi, Kanagawa Pref. (1ex., 6.xii.2014). *Male*: Mt. Kôbô-yama, Hadano (1ex., 9.xi.2014; 3exs., 23.xi.2014; 2exs., 30.xi.2014); Nanasawa, Atsugi (2exs., 7.xii.2014). *First instar larva deposited by alate viviparous female*: Yasukawa-chô, Nikkô,

(3exs., 22.ix.2015; 3exs., 18.x.2015).

Host plants. *Acer amoenum*, *A. palmatum*; *Acer* sp. (Takahashi, 1923; Higuchi, 1972).

Distribution. Japan: Honshû, Shikoku (Adachi & Yoshitomi, 2012), Kyûshû. Korea (An & Park, 1993).

Remarks. The fundatrix of this species resembles the fundatrix and alate viviparous female of *Y. hirayamae* in the pigmentation of forewings, but the former differs from the letter in having darker fore and middle femora. A brief rearing experiment using a bonsai-tree of *A. palmatum* in the laboratory showed that the offspring of fundatrices collected on 11 April, 2015 at Hadano grew to alate viviparous females having forewings pigmented except on the hind margin. The alate viviparous females were collected on the samaras of *A. amoenum* and *A. palmatum* from June to middle November. As mentioned in the specimen examined, however, *Y. tokyoensis* is collected mostly from *A. palmatum* except one instance from *A. amoenum* in Shimane Prefecture. At Nikkô, Mt. Takao, Atsugi, Hadano and Hakone in the Kantô District, it was collected only from *A. palmatum*, although the both *Acer* species had been planted or grown in their localities. This situation suggests that *Y. tokyoensis* prefers *A. palmatum* to *A. amoenum*.

Yamatocallis acericola Higuchi
[Japanese name: Chidorinoki-kamagata-aburamushi]

Yamatocallis acericola Higuchi, 1974: 227.

Higuchi (1974) gives a detailed description of the alate viviparous female. Based on the present specimens, the morphometric variation range of this morph and a description of the sexual morphs are given below.

Alate viviparous female (Figs. 1D, 2D, 6A). Body 3.10–4.80 mm long. Antennae 1.4–1.9 times as long as body; segment III with 21–36 secondary rhinaria; processus terminalis of segment IV 2.6–3.1 times as long as base of the segment. Ultimate rostral segment with 10–17 secondary setae. Forewings 5.00–7.50 mm long. Siphunculi 0.64–0.91 mm long, 0.8–1.1 times as long as head width across eyes. Cauda 0.32–0.46 mm long, with 7–19 setae. Other characters are given in Higuchi (1974).

Oviparous female (Fig. 6B). Apterous. Color in life specimen: body green, siphunculi black. In mounted specimen: head pale brown; antennae pale brown, segments III–IV dark brown each at tip; legs pale brown, femora dark brown at tip, tibiae dark brown on basal part; scleroites at the base of spinal, pleural and marginal setae on abdomen pale brown; siphunculi dark brown.

Body 3.48–4.30 mm long. Head somewhat corrugated frontally, smooth dorsally and ventrally; antennal tubercles low and diverging at inner side; frons with one pair of capitate or blunt setae which are 1.9–2.2 times as long as the basal width of antennal segment III; dorsum with 3 pairs of setae which are the same in shape and length as frontal ones; venter with 3 pairs of setae, of which one anterior pair is slightly shorter than two posterior pairs, and the longest seta is 2.0–2.3 times as long as basal width of antennal segment III. Antennae 1.1–1.4 times as long as body; segments I and II smooth, imbricated on inner side, with 12–20, 4–6 setae, respectively; III smooth on basal 4/5, weakly imbricated on apical 1/5; IV–VI imbricated; length ratio of III–VI

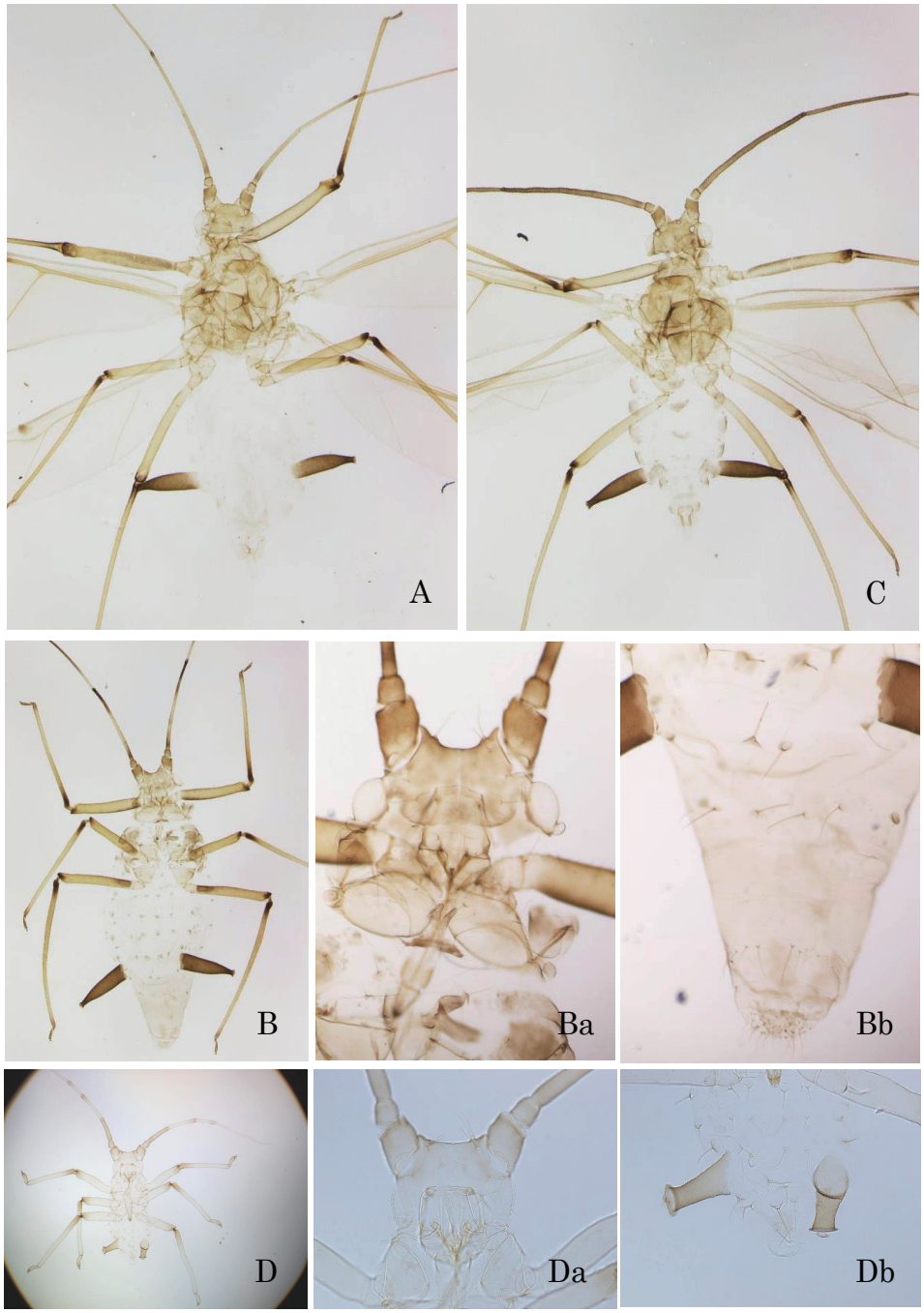

Fig. 6. *Yamatocallis acericola*. Symbols as in Fig. 3.

132:105:102:46+121; processus terminalis of segment VI 1.8–2.8 times as long as base of the segment. Pronotum with a pair of finger-like tubercles mid-posteriorly, of which length is 1.7–2.3 times as long as basal width of the tubercles. Hind tibiae imbricated along basal half of inner side, spinulated on apical 1/5, with 86–215 scent plaques. Abdomen elongated on the posterior segments, membranous with scleroites at the base of spinal, pleural and marginal setae on tergites I–VI, these setae all long and stout, and spatulated or blunt apices, of which the longest one on III is 1.7–2.4 times as long as the basal width of antennal segment III; tergites I–V with 6–10 pairs of additional short and thin setae on each side; tergite VII with 4 dorsal long pointed setae and 3–5 pairs of additional short and thin setae on each side; tergite VIII with 10–12 pointed setae arranged in a transvers row, of which the longest one is 2.3–3.6 times as long as the basal width of antennal segment III. Siphunculi stout, long bottle-shaped, 0.80–1.00 mm long, 0.93–1.1 times as long as head width across eyes, smooth in surface, with reticulation in 3–5 rows at apex, with a flange. Cauda 0.10–0.15 mm long, 1/2–2/3 of its basal width, with 38–45 setae.

Male (Fig. 6C). Alate. Body 3.08–3.53 mm long. Antennae 1.7–1.9 times as long as body, brown on whole length; segments III–V with small elliptical secondary rhinaria, III numerous, IV 80–112 and V 21–41 in number; length ratio of III–VI 140:113:130:55+128; processus terminalis of segment VI 2.3–3.1 times as long as base of the segment. Forewings 5.08–5.88 mm long. Abdomen with a spinal band on each of tergite I–VIII and marginal sclerites on each of tergite I–VII, these bands and marginal sclerites are pale brown. Siphunculi dark brown, 0.62–0.80 mm long, slightly shorter than head width across eyes. Cauda 0.25–0.31 mm long. Other characters are the same as in the alate viviparous female.

First instar larva (Fig. 6D): Color in life specimen: body green. In mounted specimen, the following parts dark brown: basal half and primary rhinarial area of antennal segment III; primary rhinarial area of antennal segment IV; basal 2/3 of tibiae; tip of femora; basal 1/6 of tibiae; tarsi; siphunculi.

Body 1.20–1.45 mm long, with long capitated setae dorsally and marginally. Head with antennal tubercles somewhat diverging at inner side; longest seta each on frons and dorsum 2.0–2.6 and 1.3–1.8 times as long as basal width of antennal segment III. Antenna 4-segmented, 1.2–1.4 times as long as body; inner side of segments I and II imbricated; segment III composed by stout part on basal half and somewhat slender part on apical half, imbricated on whole length, 1.4–1.7 times as long as head width across eyes; segment IV imbricated on whole length; processus terminalis of segment IV 3.3–3.4 time as long as base of the segment. Pronotum with a pair of small tubercles mid-posteriorly. Ultimate rostral segment 0.88–0.96 times as long as segment II of hind tarsus. Abdomen with longer setae dorsally and marginally, of which the longest one is each on tergite II and VII 1.0–1.3 and 2.0–2.5 times as long as basal width of antennal segment III. Siphunculi 0.20–0.25 mm long, with a flange.

Specimens examined. All the specimens were collected from *Acer carpinifolium*. *Alate viviparous female*: Tamozawa, Nikkô, Tochigi Pref. (1ex., 8.xi.2014; 8exs., 3.v.2015; 3exs., 30.viii.2015; 4exs., 22.ix.2015); Mt. Takao, Hachiôji, Tôkyô (the type locality of this species) (4exs., 5.v.2014; 6exs., 15.vi.2014; 4exs., 20.vii.2014; 3exs., 18.x.2014; 3exs., 30.v.2015; 1ex., 16.viii.2015); Shiroyama-rindô, Hachiôji, Tôkyô (1ex., 23.v.2015) ; Motohakone, Hakone, Kanagawa Pref. (1ex., 6.ix.2015). *Oviparous female*: Tamozawa, Nikkô (7exs., 8.xi.2014; 3exs., 18.x.2105); Kamitanigami, Kita-ku, Kôbe, Hyôgo Pref. (1ex., 4.xi.2013). *Male*: Tamozawa, Nikkô

(3exs., 18.x.2014). *First instar larva deposited by alate viviparous female*: Tamozawa, Nikkô, (3exs., 30.viii.2015); Motohakone, Hakone, Kanagawa Pref. (3exs., 6.ix.2015).

Host plants. *Acer carpinifolium*.

Distribution. Japan: Honshû.

Remarks. The alate viviparous females of this species were found usually on the upper side of the leaves as Higuchi (1974) has already mentioned. The oviparous females and males were also found on the main vain of the upper side of the leaves.

Yamatocallis takagii (Takahashi)
[Japanese name: Takagi-kamagata-aburamushi]

Megalocallis takagii Takahashi, 1963: 161.
Yamatocallis takagii: Higuchi, 1972: 80; Sorin, 1977:12.
Yamatocallis palgongsanensis An & Park, 1993: 58.

Takahashi (1963) gives a detailed description of the alate viviparous female. Based on the present specimens, the variation range of morphometric data of this morph and descriptions of the oviparous female and male are given below.

Alate viviparous female (Figs 1E, 2E, 7A). Color in life specimen; body pale green to green, sometimes thorax pale brown; siphunculi black, outer margin of basal half brown.

Body 3.33–4.20 mm long. Antennae 1.6–1.9 times as long as body; segment III with 14–21 (rarely 26) secondary rhinaria; processus terminalis of segment IV 2.0–2.4 times as long as base of the segment. Ultimate rostral segment with 8–13 secondary setae. Forewings 4.90–5.80 mm long. Siphunculi 0.75–0.97 mm long, 0.93–1.1 times as long as head width across eyes. Cauda 0.18–0.25 mm long, with 8–11 setae. Other characters are given in Takahashi (1963).

Oviparous female (Fig. 7B). Apterous. Color in life specimen: body green with dorsal black bands, siphunculi black. In mounted specimen: head brown; antennae pale brown to brown, but segments III–V each on apical 1/2–2/3 dark brown; legs brown, but tibiae dark brown on basal 1/3–1/2; spinal bands, scleroites at the base of pleural setae, and marginal sclerites on abdomen brown; siphunculi dark brown.

Body 4.10–4.90 mm long. Head somewhat corrugated frontally, smooth dorsally and ventrally; antennal tubercles low and diverging at inner side; frons with one pair of capitate or blunt setae which are 1.5–2.1 times as long as the basal width of antennal segment III; dorsum with 3 pairs of setae which are the same in shape and length as frontal ones; venter with 3 pairs of setae, of which the anterior pair is slightly shorter than two posterior pairs, the middle pair is blunt at apices, and the posterior pair is pointed; longest seta on venter 1.8–2.0 times as long as basal width of antennal segment III. Antennae 1.2–1.5 times as long as body; segments I and II smooth, imbricated on inner side, with 12–21, 3–7 setae, respectively; III smooth, with I or 2 small and round secondary rhinaria near base; IV imbricated, but basal half weakly; IV–VI imbricated; length ratio of III–VI 134:119:108:49+122; processus terminalis of segment VI 2.1–2.7 times as long as base of the segment. Pronotum with a pair of finger-like tubercles mid-posteriorly, of which length is 1.5–2.7 times as long as basal width of the tubercles. Hind tibiae imbricated along basal half of inner side, spinulated on apical 1/5, with 96–251 secnt plaques. Abdomen elongated on the posterior segments, membranous with

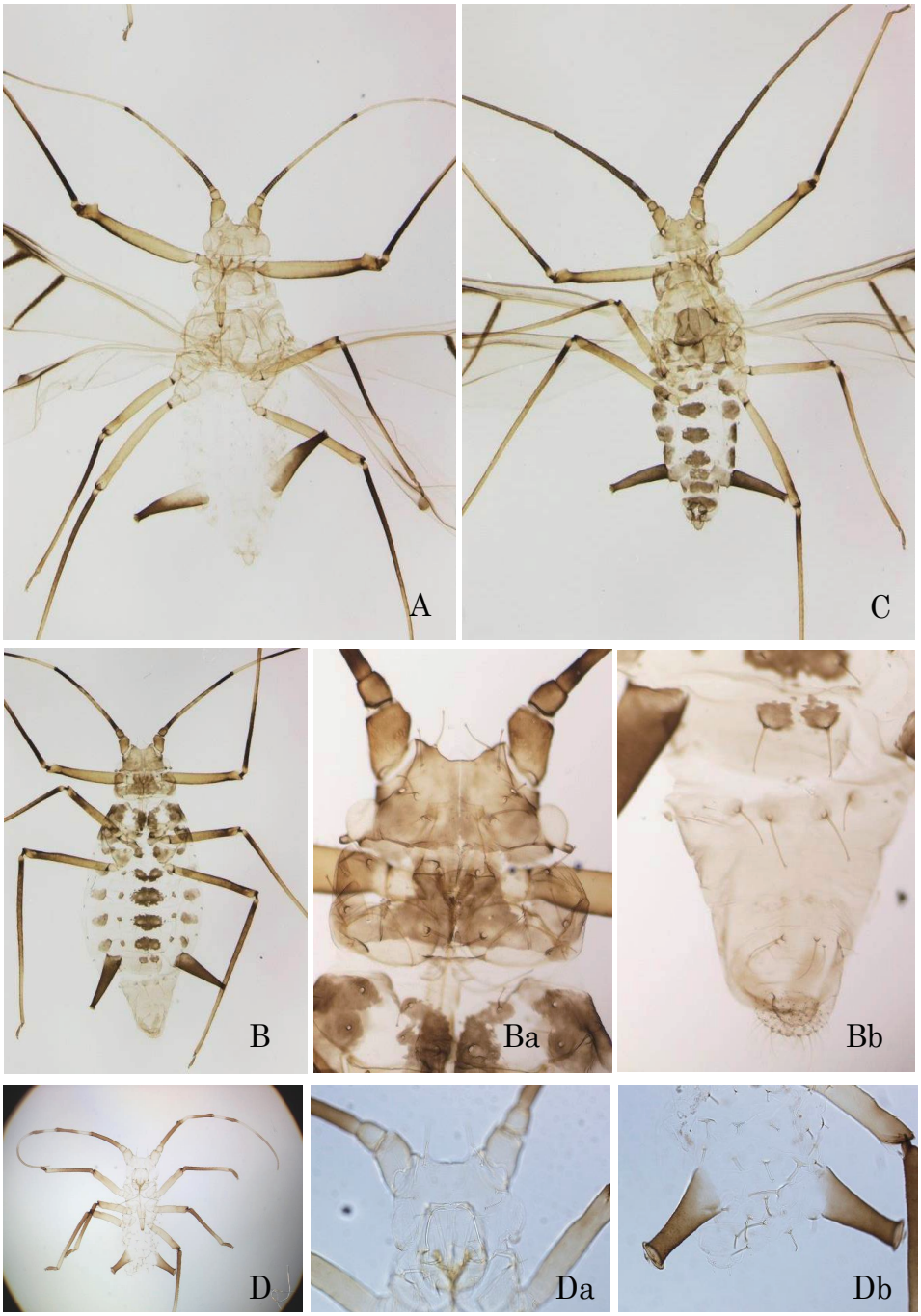

Fig. 7. *Yamatocallis takagii*. Symbols as in Fig. 3.

scleroites at the base of spinal, pleural and marginal setae on tergites I–VI; the spinal scleroites on tergites II–V often connected to each other, forming spinal bands; these setae all long and stout, and spatulated or blunt apices, of which the longest one on III is 1.7–2.4 times as long as the basal width of antennal segment III; tergites I–V with 3–5 pairs of additional short and thin setae on each side; tergite VII with 4 dorsal long setae (2 spinal ones spatulated or blunt apices, 2 marginal ones pointed) and 3–5 pairs of additional short and thin setae on each side; tergite VIII with 11–27 pointed setae arranged in a transvers row, of which the longest one is 2.3–2.7 times as long as the basal width of antennal segment III. Siphunculi stout, long bottle-shaped, 0.83–1.01 mm long, 0.9–1.1 times as long as head width across eyes, smooth in surface, with reticulation in 3–5 rows at apex and with a flange. Cauda 0.11–0.14 mm long, about 1/2 of its basal width, with 38–50 setae.

Male (Fig. 7C). Alate. Body 3.43–3.67 mm long. Antennae 1.7–1.8 times as long as body, pale brown except on segment III dark brown; segments III–V with small elliptical secondary rhinaria, III numerous, IV 92–145 and V 30–47 in number; length ratio of III–VI 140:135:125:53+129; processus terminalis of segment VI 2.4–2.5 times as long as base of the segment. Forewings 5.15–5.50 mm long. Abdomen with a spinal band on each of tergite I–VIII and marginal sclerites on each of tergite I–VII; these bands and sclerites are dark brown. Siphunculi 0.63–0.70 mm long, about 4/5 as long as head width across eyes. Cauda 0.18–0.24 mm long. Other characters are the same as in the alate viviparous female.

First instar larva (Fig. 7D): Color in life specimen: body green. In mounted specimen, the following parts dark brown: basal half and apical 1/4 of antennal segment III; primary rhinarial area of antennal segment IV; basal 2/3 of tibiae; tarsi; siphunculi.

Body 1.30–1.42 mm long, with long capitated setae dorsally and marginally. Head with antennal tubercles somewhat diverging at inner side; longest seta on each frons and dorsum 2.0–2.6 and 1.5–1.9 times as long as basal width of antennal segment III. Antenna 4-segmented, about 1.5 times as long as body; inner side of segments I–II imbricated; segment III composed by stout part on basal half and somewhat slender part on apical half, of which the border looks like a pseudo-segment, imbricated on whole length, 1.7–2.0 times as long as head width across eyes; segment IV imbricated on whole length; processus terminalis of segment IV 2.8–3.0 time as long as base of the segment. Pronotum with a pair of small tubercles mid-posteriorly. Ultimate rostral segment 1.11 times as long as segment II of hind tarsus. Abdomen with longer setae dorsally and marginally, of which the longest one is each on tergite II and VII 0.6–0.9 and 2.1–3.1 times as long as basal width of antennal segment III. Siphunculi 0.27–0.31 mm long, with a flange.

Specimens examined. The specimens were collected from *Acer pictum* subsp. *pictum* at Mt. Takao, Hachiôji in Tôkyô Metropolis unless otherwise stated. *Alate viviparous female*: 5exs., 20.vii.2014; 3exs., 17.viii.2014; 3exs., 15.ix.2014; 3exs., 18.x.2014; 1ex., 5.v.2015; 2exs., 16.viii.2015. *Oviparous female*: 4exs., 17.xi.2013; 2exs., 16.xi.2014; 2exs., 22.x.2015, Nikkô Botanical Garden, Nikkô, Tochigi Pref., on *Acer miyabei*. *Male*: 4exs., 17.xi.2013. *First instar larva deposited by alate viviparous female*: 3exs., 20.vii.2014; 2exs., 16.viii.2015.

Host plants. *Acer pictum*, *Acer* sp. (Takahashi, 1963 Higuchi, 1972).

Distribution. Japan: Hokkaidô (Takahashi, 1963; Higuchi, 1972), Honshû. Korea (An & Park, 1993; as *Y. palgongsanensis*).

Remarks. Although Blackman & Eastop (1994) mentioned that this species lives

on the twigs, the alate viviparous females were collected not only from the twigs but also from the stem and underside of the leaves. Two oviparous females collected on *Acer miyabei* at Nikkô are indistinguishable from the equivalent morph of *Y. takagii* on *A. pictum* at Mt. Takao. Through several observations at Nikkô Botanical Garden in 2014–2015 (21 September in 2014, and 3 May, 21 June, 30 August and 22 September in 2015), no other aphids that should be identified with *Yamatocallis* have been discovered from an *A. miyabei* tree on which the oviparous females were collected. Since the *A. miyabei* tree was surrounded by many *Acer pictum* trees at the garden, the two oviparous females on the *A. miyabei* tree may have moved from the fallen leaves of *A. pictum* infested with the oviparous females of *Y. takagii*, although those *A. pictum* trees are so tall that *Y. takagii* has not been confirmed on their foliage or twigs in the past observations. Therefore, *A. miyabei* was excluded from the host plants of *Y. takagii* in above text.

Discussion

My observations on *Yamatocallis* species in the field showed that each aphid species was collected from a specific *Acer* species, even though several *Acer* species were planted or grown with the *Acers* species on which a certain *Yamatocallis* species was collected: *Y. nikkoensis* sp. nov. from *A. tenuifolium*; *Y. hirayamae* from *A. amoenum*; *Y. tokyoensis* mostly from *A. palmatum* except for one instance collected from *A. amoenum*; *Y. acericola* from *A. carpinifolium*; *Y. takagii* from *A. pictum*. These observations suggest that each *Yamatocallis* species prefers to a specific *Acer* species in the natural condition.

As shown in the key, the Japanese *Yamatocallis* are divided into two groups. One group comprises 3 species: *Y. nikkoensis* sp. nov., *Y. hirayamae* and *Y. tokyoensis* (hereafter *hirayamae*-group), which are characterized by the small to medium body size and the shorter siphunculi in the alate viviparous female, by the minute dorsal setae in the oviparous female and first instar larva, and by the association with *Acer* plants belonging to the section *Palmata* (Ogata, 1965, 1967). Another one comprises 2 species: *Y. acericola* and *Y. takagii* (hereafter *takagii*-group), which are characterized by the large body and the elongate siphunculi in the alate viviparous female, by the longer dorsal setae in the oviparous female and first instar larva, and by the elongated abdomen on posterior segments in the oviparous female. The morphological differences between the *hirayamae*-group and *takagii*-group are applicable to the two Indian species, *Y. brevicauda* Chakrabarti and *Y. obscura* (Ghosh, Ghosh & Raychaudhuri). Although the body length of these species is intermediate between the Japanese two groups [3.3–3.8 mm in *brevicauda*, 3.4–4.1 mm in *obscura* (after Ghosh & Quednau, 1990)], the former species has elongate siphunculi in the all morphs, longer dorsal setae in the embryo, alatoid nymph and oviparous female, and elongated abdomen on the posterior segments in the oviparous female (Chakrabarti, 1988), which accord with the characters of *takagii*-group. On the other hand, the latter species has shorter siphunculi in the alate viviparous female and minute or short dorsal setae on the head to abdominal segment VI in the embryo and alatoid nymph (Ghosh & Quednau, 1990), which accord with those of *hirayamae*-group. These morphological differences suggest that *Megalocallis*, which was elected for *M. takagii* by Takahashi (1963) and was synonymized with *Yamatocallis* by Higuchi (1972), should be reinstated as a full genus

for the *takagii*-group. However, for the remaining two species, *Y. acerisucta* Qiao & Zhang from China and *Y. sauteri* Takahashi from Taiwan, there is no information about their embryo, first instar larva and oviparous female. Therefore, in this paper, the *takagii*-group is treated as the members of *Yamatocallis* in accordance with Higuchi (1972).

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