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ADDITIONAL NOTE ON THE GENUS TRICHAITOPHORUS IN JAPAN (HEMIPTERA: APHIDIDAE)

By SHUN'ICHIRO SUGIMOTO

Abstract

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Trichaitophorus kominecola sp. nov. is described from *Acer micranthum* (Sapindaceae) with its life cycle. Moreover, additional morphological characters of *T. japonicus*, and new localities and new host record of *T. koyaensis* are provided. Based on host records of the Japanese and the foreign *Trichaitophorus* species, the host association of this genus is discussed.

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Introduction

Among the species of the genus *Trichaitophorus* in Japan, the morphology of *T. koyaensis* has been examined in detail. The apterous viviparous female of this species has a considerable variation especially in the setal length and shape on the body depending on the season when that morph appears (Sugimoto, 2013). In the subsequent survey of *Acer*-infesting aphids by the author, one new species of *Trichaitophorus* from *Acer micranthum* (Sapindaceae) was found. It is described here as *T. kominecola* sp. nov., with its life cycle. Moreover, additional morphological characters of *T. japonicus*, and new localities and new host record of *T. koyaensis* are provided. Finally, based on host records of the Japanese and the foreign *Trichaitophorus* species, the host association of this genus is discussed.

Materials and Methods

The aphid specimens collected by the author were preserved in 70% ethanol, and were mounted on microscope slides in balsam by Martin's (1983) methods. Among the specimens, some of apterous viviparous females and larvae were stained by acid fucshin before the dehydration by glacial acid. The syntypes of *Trichaitophorus japonicus* Sorin were borrowed from the National Institute of Agro-Environmental Sciences (NIAES). The holotype and paratypes of a new species and all the specimens of *T. koyaensis* examined in this study are deposited in the collection of the Laboratory of Systematic Entomology, Hokkaido University (SEHU). Systematics of the plant genus *Acer* follows Ogata (1965, 1967).

Description

Trichaitophorus kominecola sp. nov.
[Japanese name: Kominekaede-ke-aburamushi]

Fundatrix (Figs 1–2). Apterous. Color in life specimen: body dark brown to black. In mounted specimen, the following parts brown: head, antennae, legs, scleroites at the base of dorsal setae, dorsal transvers bands on posterior part of abdomen, marginal sclerites and cauda; siphunculi dark brown.

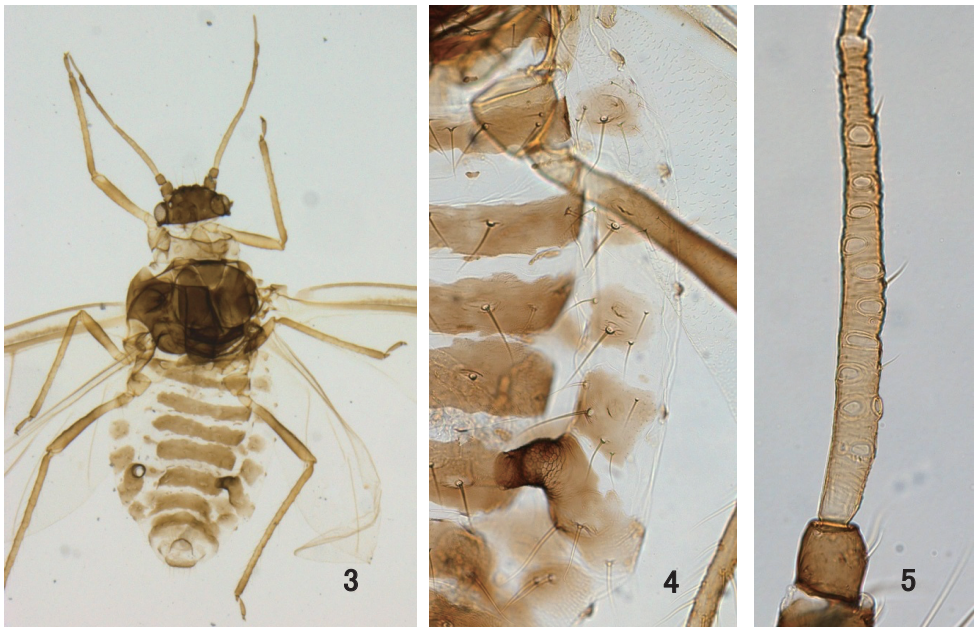
Body oval, 3.00–3.25 mm long. Head weakly divided by a spinal suture, fused with pronotum; dorsum with 24–32 setae which are different length and thickness; longer and stouter setae present on small tubercles; longest seta on dorsum 5.7–7.3 times as long as the basal width of antennal segment III. Antennae 6-segmented, about 0.33 times as long as body; flagella imbricated; segments I–V each with 2–4, 2, 2–5, 0 or 1, and 1 setae; longest seta on segment III 1.0–1.6 times as long as the basal width of the segment; primary rhinaria with minute cilia; processus terminalis of segment VI 1.0–1.1 times as long as the base of the segment. Ultimate rostral segment 0.75–0.81 times as long as segment II of hind tarsus. Tibiae smooth on whole length; longest seta on hind tibiae 2.3–2.6 times as long as the width of the mid-point of tibia. First tarsal chaetotaxy 5:5:5–4. Abdomen membranous, with scleroites at the base of dorsal setae, marginal sclerites on tergites I–VII and a transvers band on tergite VIII; dorsum with numerous setae which vary in length and thickness, but a pair of spinal and pleural ones on each of tergite I–

Figs 1–2. Fundatrix. 1: general aspect; 2: margin of abdomen.

VI are longer and stouter than the others on the tergite; tergite VIII with 6 setae along the posterior margin of the transvers band and 1–3 additional setae on the anterior part of the band; marginal sclerites on segments I–VI each with 5–8 setae and on VII with 2–4 setae; longest seta on anterior part of abdominal dorsum and on marginal sclerites 5.7–6.9 and 6.7–7.4 times as long as the basal width of antennal segment III, respectively. Siphunculi truncated, with reticulation in 2–4 rows at apex, with a small flange. Cauda broadly rounded, with 11–15 setae. Genital plate oval, with 15–22 setae along hind margin and 9–12 setae on anterior part.

Alate viviparous female (Figs 3–5). Color in life specimen: head, thorax and siphunculi black; abdomen yellow to yellowish green with black dorsal bands. In mounted specimen: head, antennal segments I, II and VI, thorax, and siphunculi dark brown; antennal segments III–V, legs, cauda and dorsal bands on abdomen brown.

Body 2.26–2.28 mm long. Head smooth dorsally; frontal margin with one pair and dorsum with 4 pairs of long thin setae, which occur from small tubercles; longest seta on dorsum 4.7–7.2 times as long as the basal width of antennal segment III. Antenna 6-segmented, about 0.5 times as long as body; segment III with 10–17 round to oval-shaped secondary rhinaria on whole length and with 3–5 setae, of which the longest one is 0.8–1.1 times as long as the basal width of the segment; segment IV usually with no rhinarium (rarely with 1 or 2); primary rhinaria protuberant, with minute cilia; processus terminalis of segment VI 1.5–1.9 times as long as the base of the segment. Ultimate rostral segment 0.82–0.90 times as long as segment II of hind tarsus. Tibiae smooth with



Figs 3–5. Alate viviparous female. 3: general aspect; 4: margin of abdomen; 5: antennal segments II and III.

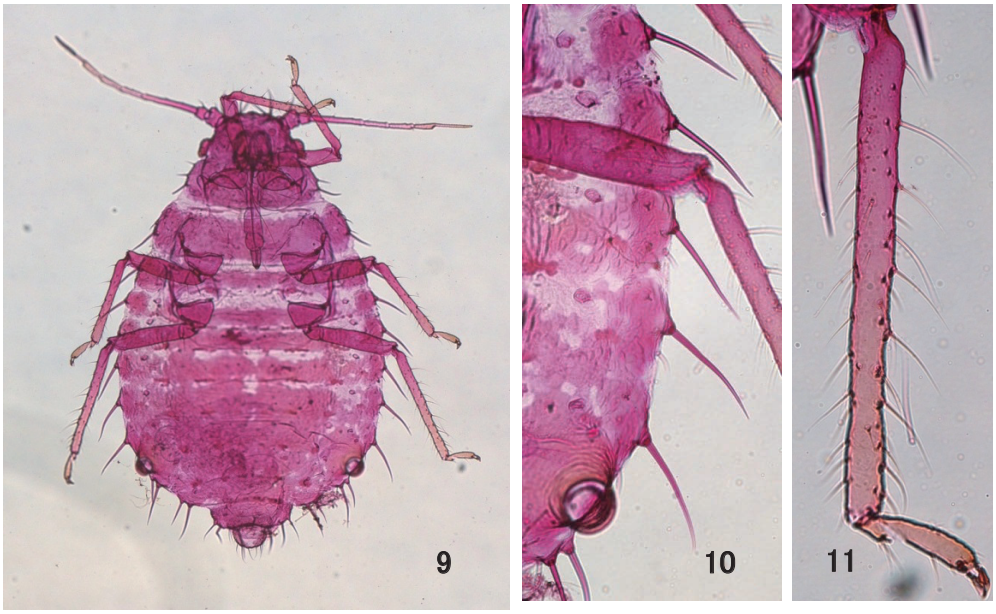
spinules on apical 1/3–1/2, with many long and thin setae on whole length; longest seta on hind tibiae 2.4–3.8 times as long as the width of the mid-point of tibia. First tarsal chaetotaxy 5:5:5. Abdomen with a dorsal band on each tergite and with marginal sclerites on tergites I–VII; tergites I–VI each with 6–10, and VII with 4–6 long and thin setae, which are arranged in a transverse row on the middle of each sclerotic band; tergite VIII with 5–8 setae along hind margin of dorsal band; marginal sclerites on I–VI each with 4–9 setae, and on VII with 2 (rarely 3) setae; longest seta on anterior part of dorsal abdomen and on marginal sclerites 4.0–7.2 and 5.2–7.2 times as long as the basal width of antennal segment III, respectively. Siphunculi truncated, reticulated on whole length, with a flange. Cauda rounded, with 9–13 setae.

Apterous viviparous female (Figs 6–14). Color in life specimen: body yellow. In mounted specimen: body, antennae and legs pale brown; processus terminalis of antennae, tarsi and siphunculi a little darker than body.

Summer form (individuals collected from May to early September in this study, figs 6–8). Body oval, 0.89–1.80 mm long (in individuals having 5-segmented antennae, body 0.89–1.25 mm; in those having 6-segmented antennae, 1.27–1.80 mm), 1.5–1.8 times as long as its maximum width; dorsum corrugated. Head fused with pronotum; frontal margin with one pair of long, stout and a little curved setae; cephalic dorsum with 2 pairs of long and stout setae anteriorly, which occur from small tubercles, and with 2 pairs of minute and blunt setae posteriorly; longest seta on dorsum 3.3–5.5 times as long as the basal width of antennal segment III; cephalic ventrum with one pair of long and stout setae near frontal margin and 1 or 2 pairs of long and thin setae between

Figs 6–8. Apterous viviparous female (summer form). 6: general aspect; 7: margin of abdomen; 8: hind leg (tibia and tarsus).

both antennal segments I. Antennae 5- or 6-segmented, 0.33–0.45 times as long as body; flagella imbricated except for basal half of segment III, 0.9–1.4 times as long as head width across eyes; segment III with 1–5 setae which are minute and blunt at tip; primary rhinaria with minute cilia; processus terminalis of ultimate segment 0.9–1.8 times as long as the base of the segment (in individuals having 5-segmented antennae, 0.9–1.3 times; in those having 6-segmented antennae, 1.2–1.8 times). Prothorax with 4–6 pairs of minute setae dorsally (one pair antero-pleurally, one pair mid-spinally and 2 or 3 pairs posteriorly), and with 3 or 4 setae marginally on each side, of which the posterior one is long and stout. Mesothorax with totally 10–12 minute setae dorsally, and with 6–11 setae marginally on each side, of which the posterior one is long and stout. Metathorax with 6–8 setae dorsally arranged transversely. Rostrum reaching middle coxae; ultimate segment 0.67–0.90 times as long as segment II of hind tarsus (in individuals having 5-segmented antennae, 0.67–0.79 times; in those having 6-segmented antennae, 0.75–0.90 times). Tibiae smooth on whole length; outer setae on basal 2/3 more or less stout with blunt apices and those on apical 1/3 thin with fine apices; longest seta on hind tibiae 0.8–1.8 times as long as the width of the mid-point of tibia. First tarsal chaetotaxy 5–3:5–3:5–3 (in individuals having 5-segmented antennae, usually 3:3:3). Abdomen clearly separated from metanotum; tergites I–VII fused together, but a faint trace of division present between I and II; dorsal setae minute except for those on tergite VIII; tergites I–V each with 8 setae arranged transversely; tergite VI with 6 setae between siphunculi; tergite VII with 4 setae; tergite VIII with 6 long and stout setae along hind margin; marginal sclerites on tergites I–V each with 2–4 setae, of which one is long and stout,



Figs 9–11. Apterous viviparous female (autumn form resembling the summer form). 9: general aspect; 10: margin of abdomen; 11: hind leg (tibia and tarsus).

and those on tergites VI and VII each with 2 long and stout setae, of which the posterior one is longer than the anterior one; longest seta on marginal sclerites 3.5–6.0 times as long as the basal width of antennal segment III. Siphunculi striated. Cauda rounded, with 8–13 setae. Genital plate oval, with 8–18 setae along hind margin and 4–9 setae on anterior part.

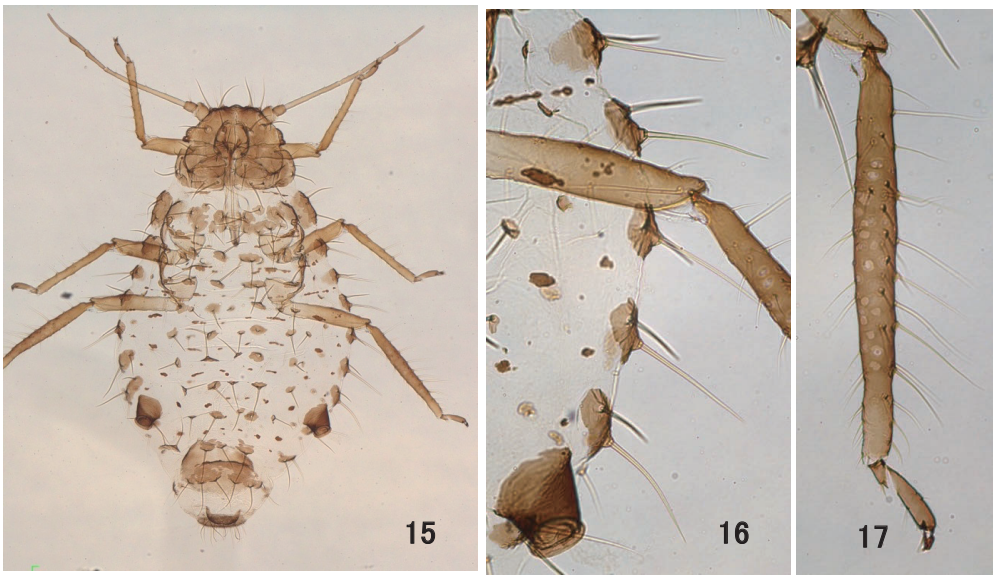
Autumn form (individuals collected on October in this study, figs 9–14). Body 1.43–1.79 mm long. Head with long and stout setae arranged as in the summer form, but in some individuals postero-dorsal setae also long and stout; longest seta on cephalic dorsum 4.4–5.8 times as long as the basal width of antennal segment III. Antennae 6-segmented, 0.44–0.51 times as long as body; flagella 1.5–1.7 times as long as head width across eyes; segment III with 3 or 4 setae which are a little longer than those of summer form, of which the longest ones is 0.4–0.8 times as long as the basal width of the segment; processus terminalis of ultimate segment 1.6–1.8 times as long as the base of the segment. Tibial setae thin with fine apices on whole length; longest seta on hind tibiae 2.0–3.0 times as long as the width of the mid-point of tibia. Abdominal tergites I–VII fused together, but with a faint trace of division between I and II and also sometimes between the posterior tergites; dorsal setae usually minute, but in some individuals partly with long and stout spinal setae; longest seta on abdominal dorsum and on marginal sclerites 3.2–5.4 and 5.5–7.6 times as long as the basal width of antennal segment III, respectively. Other characters are as in the summer form.

Oviparous female (Figs 15–17). Apterous. Color in life specimen: body brown to dark brown, blackish green. In mounted specimen, the following parts brown: head,

Figs 12–14. Apterous viviparous female (autumn form resembling the oviparous female). 12: general aspect; 13: margin of abdomen; 14: hind leg (tibia and tarsus).

antennae, pronotum, legs, scleroites at the base of dorsal setae, dorsal transvers bands on abdominal segment VIII, marginal sclerites, siphunculi and cauda.

Body 1.78–2.00 mm long. Head weakly divided by a spinal suture, fused with pronotum; frontal margin with one pair of setae and dorsum with 4 pairs of setae (2 pairs anteriorly and 2 pairs posteriorly), these setae occurring from small tubercles; longest seta on cephalic dorsum 6.7–7.8 times as long as the basal width of antennal segment III. Antennae 6-segmented, 0.4–0.5 times as long as body; flagella imbricated; segment III with 2–5 setae, of which the longest ones is 1.0–1.5 times as long as the basal width of the segment; primary rhinaria with minute cilia; processus terminalis of segment VI 1.4–1.9 times as long as the base of the segment. Ultimate rostral segment 0.75–0.86 times as long as segment II of hind tarsus. Thorax with long and stout setae dorsally arranged as in the apterous viviparous female. Hind tibiae swollen, with 21–48 scent plaques. First tarsal chaetotaxy 5–3:4–3:4–3. Abdomen membranous, with scleroites at the base of dorsal setae, marginal sclerites on tergites I–VII and a transvers band on tergite VIII; tergites I–V each with 4 or 5 pairs of setae arranged transversely; tergite VI with 5–8 setae between siphunculi; tergite VII with 2 or 3 setae; tergite VIII with 6 setae along the posterior margin of transvers band and 4 or 5 pairs of short and thin setae on each side; marginal sclerites on tergites I–VII each with 2 or 3 setae, of which one is longer than the others; longest seta on dorsal abdomen and on marginal sclerites 6.0–7.8 and 6.6–10.2 times as long as the basal width of antennal segment III, respectively. Siphunculi as in the fundatrix. Cauda with 14–17 setae. Genital plate oval, with 28–41 setae along hind



Figs 15–17. Oviparous female. 15: general aspect; 16: margin of abdomen; 17: hind leg (tibia and tarsus).

margin and 23–41 setae on anterior part.

Male (Figs 18–20). Apterous. Color in life specimen: dark green. In mounted specimen, the following parts brown: head, antennae, pronotum, mesonotum, metanotum, legs, scleroites at the base of dorsal setae, short cross bands on each abdominal segment, marginal sclerites, siphunculi and cauda, but anterior part of head and siphunculi darker than the others.

Body 1.32–1.43 mm long. Head fused with pronotum; longest seta on dorsum 6.5–8.0 times as long as the basal width of antennal segment III. Antennae 6-segmented, about 0.67 time as long as body; segments III–V each with 9–18, 8–11, and 0 or 1 secondary rhinaia; longest seta on segment III 1.0–1.5 times as long as the basal width of the segment; primary rhinaria with minute cilia; processus terminalis of segment VI 1.9–2.0 times as long as the base of the segment. Ultimate rostral segment 0.80–0.86 times as long as segment II of hind tarsus. Tibiae smooth on whole length; longest seta on hind tibiae 2.6–3.1 times as long as the width of the mid-point of tibia. First tarsal chaetotaxy 5–4:4–3:4–3. Abdominal sclerotization as in the oviparous female, but tergites I–V each with a short cross band which are formed by the fusing of spinal scleroites on each side; tergites I–V each with 4–6 setae arranged transversely; tergite VI with 4–6 setae between siphunculi; tergite VII with 2 or 3 setae; tergite VIII with 6 setae along the posterior margin of transvers band and 4 or 5 pairs of short and thin setae on each side; marginal sclerites on tergites I–VII each with 2 setae, of which one is longer than the others; longest seta on dorsum abdomen and on marginal sclerites 6.5–8.0 and 8.0–9.4 times as long as the basal width of antennal segment III, respectively.

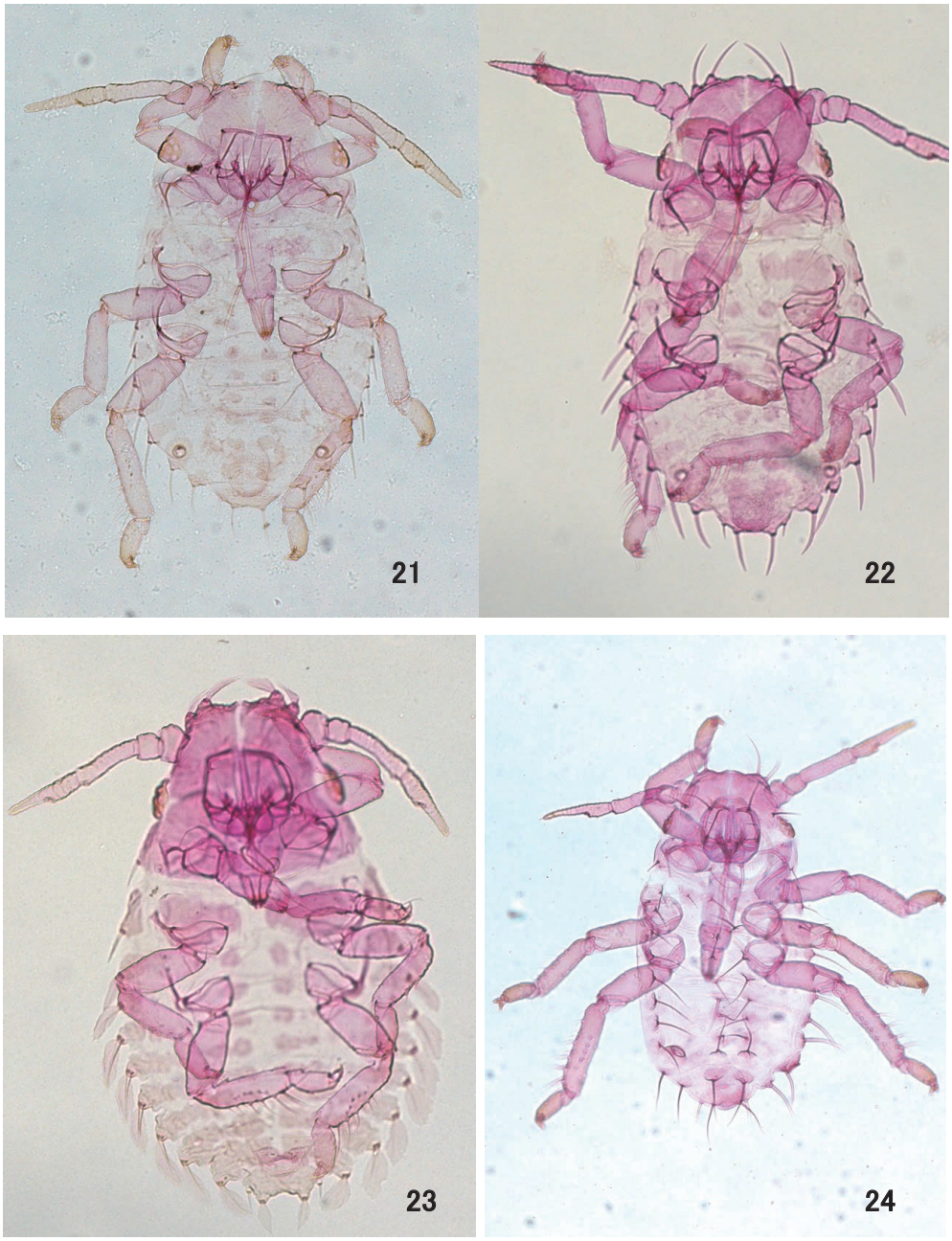
First instar larva (Figs 21–24). Color in life specimen: pale yellow. In mounted specimen, the following parts brown: head, antennae, pronotum, legs, scleroites at the

Figs 18–20. Male. 18: general aspect; 19: margin of abdomen; 20: antennal segments II–V.

base of dorsal setae on abdomen, marginal sclerites, siphunculi and cauda.

Body 0.51–0.65 mm long. Head fused with pronotum. Antennae 4-segmented, 0.51–0.65 times as long as body; processus terminalis of segment VI 1.1–1.6 times as long as the base of the segment. Rostrum beyond hind coxae in larvae produced by fundatrix and autumn form, and reaching middle coxae in those produced by summer form; ultimate rostral segment 0.73–0.92 times as long as segment II of hind tarsus. Setal length and shape depending on the time of appearance. In larvae from fundatrix (Fig. 21), head with 2 pairs of long frontal setae which are lanceolate or stout with blunt apices, and with 2 pairs of minute dorsal setae; abdominal segments I–VII each marginally with one long setae as in the frontal ones in shape, and dorsally with minute setae; abdominal segment VIII with 4 long setae along posterior margin, of which an anterior pair of setae is shorter and thinner than the posterior ones. In larvae from summer form (Figs 22–23), the arrangement and shape of long setae as in those from fundatrix, but in some individuals the long setae sometimes lamellate in shape. In larvae from autumn form (Fig. 24), long setae thin with fine apices, and arranged on cephalic front, the margin of body, cephalic dorsum, and spinally on each of prothorax to abdominal segment VII. Among marginal setae on abdominal tergites II–IV, longest one 2.8–3.3 times as long as basal width of antennal segment III.

Specimens examined. All collected from *Acer micranthum* by the author. Holotype: an apterous viviparous female, 10.v.2014, on leaf undersurface (Moto-Hakaone, Hakone-machi, Kanagawa Pref.). Paratypes: 12 apterous viviparous females, the same data as the holotype; 4 apterous viviparous females, 4.vi.2017, on samara (Mt. Hikosan, Soeda-machi, Fukuoka Pref.). Other specimens examined: *Fundatrix*: 3exs., 29.iv.2014, on twig (Moto-Hakone); 2exs., 29.iv.2017, on twig (Mt. Hikosan). *Alate viviparous female*: 10exs., 14.v.2017, on leaf undersurface



Figs 21-24. First instar larvae. 21: individual produced by the fundatrix; 22: individual with lanceolate or stout marginal setae; 23: individual with lamellate marginal setae; 24: individual produced by the autumn form.

(Mt. Hikosan). *Apterous viviparous female*: 5exs., 1.vi.2014, on leaf undersurface (Moto-Hakone); 1ex., 6.vii.2014, on leaf undersurface (Moto-Hakone); 1ex., 24.vii.2016, on samara (Mt. Hikosan); 9exs., 15.x.2016, on samara (Mt. Hikosan); 4exs., 4.vi.2017, on leaf undersurface (Mt. Hikosan); 2exs., 8.ix.2017, on samara (Mt. Hikosan); 3exs., 14.x.2018, on leaf undersurface (Mt. Tsurumi-dake, Beppu, Ôita Pref.). *Oviparous female*: 16exs. 30.x.2016, on leaf undersurface (Mt. Hikosan). *Male*: 3exs. 30.x.2016, on leaf undersurface (Mt. Hikosan). *First instar larva*: 6exs., 29.iv.2014 (Moto-Hakone); 3exs., 10.v.2014 (Moto-Hakone); 1ex., 1.vi.2014 (Moto-Hakone); 3exs., 6.vii.2014 (Moto-Hakone); 1ex., 15.x.2016 (Mt. Hikosan); 1ex., 14.v.2017 (Mt. Hikosan).

Host plant. *Acer micranthum*.

Distribution. Japan (Honshû, Kyûshû).

Remark. This species has a holocyclic life cycle on *A. micranthum*. When I collected the fundatices at Mt. Hikosan, all of the young larvae on bursting buds had wing buds. This suggests that the second generation of this species is the alate morph as in *T. koyaensis* observed by Sugimoto (2013). The apterous viviparous female is similar to the equivalent morph of *T. japonicus* in having one long and stout seta on mesothorax postero-marginally, but differs from the latter by body color in life [yellow in this species vs. green in *T. japonicus* (after Sorin, 1979)], body shape (oval vs. elongated), the ratio of flagella to head width across eyes (flagella longer vs. shorter than head width across eyes) and the number of antennal segments (usually 6-segmented vs. 5-segmented). The apterous viviparous female of this new species also had variation in setal length and shape as in those of *T. koyaensis*, but differs from the latter in having one long and stout seta on mesothorax postero-marginally. The fundatrix, oviparous female, and male are also similar to the equivalent morphs of *T. koyaensis*, but differs from the latter by the ratio of processus terminalis to the base of ultimate antennal segment (in *T. kominecola* sp. nov., fundatrix 1.0–1.1, oviparous female 1.4–1.9, male, 1.9–2.0; in *T. koyaensis*, fundatrix 1.3–1.6, oviparous female 2.0–2.6, male, 2.1–2.2).

So far as my field observation is concerned at Moto-Hakone (about 780 m. in elevation) in the Kantô District, and at Mt. Hikosan (710–1180 m.) and Mt. Tsurumi-dake (950 m.) in the Kyûshû District, this species was collected only from *Acer micranthum*, even though *A. micranthum* grew with other maples such as *A. amoenum*, *A. diabolicum* *A. palmatum*, *A. pictum* and *A. rufinerve* at the same observation site. This suggests that this aphid is strongly associated with *A. micranthum*. According to Ogata (1965), *A. micranthum* occurs from 700 to 1800 m in elevation in the Kantô District, suggesting that this aphid is found in mountain regions depending on the vertical distribution of the host plant.

Etymology. The species name is derived from the Japanese name “Komine-kaede” of the host plant.

Trichaitophorus japonicus Sorin
[Japanese name: Minekaede-ke-aburamushi]

Trichaitophorus japonicus Sorin, 1979: 122.

Apterous viviparous female (Fig. 25). This morph is described by Sorin (1979) in detail. Based on three specimens examined, the following characters are added: Body elongated, 1.54–1.57 mm long, 1.8–2.0 times as long as its maximum width. Antennae short, 0.29 times as long as body; flagella shorter than head width across eyes (0.92–0.94

Fig. 25. Apterous viviparous female. General aspect.

times); processus terminalis of ultimate segment 1.0–1.1 times as long as the base of the segment.

Specimens examined. *Apterous viviparous female*: 3exs., 16.viii.1969, on *Acer tschonoskii* (Midagahara, Toyama Pref.), M. Sorin leg., syntypes of *T. japonicus* (preserved in NIAES).

Host plant. *Acer tschonoskii*.

Distribution. Japan (Honshû).

Remark. Up to now, no other morphs and no collection sites of this species have been reported. The type locality Midagahara is located in the Chûbu District, central Japan, and its elevation is about 1600–2000 m. According to Ogata (1965), in the Kantô District (near the Chûbu District), *Acer tschonoskii* occurs from 1400 m in elevation, continuously from 1600 m, to the forest limit. This suggests that this species is found in high mountain regions rather than the previous new species depending on the vertical distribution of the host plant.

Trichaitophorus koyaensis Takahashi
[Japanese name: Urihadakaede-ke-aburamushi]

Trichaitophorus koyaensis Takahashi, 1961: 248.
Trichaitophorus koyaensis: Higuchi, 1972: 98; Sugimoto, 2013: 29.
Trichaitophorus takahashii Sorin, 2002: 184.

Periphyllus montanus Sorin, 1979: 120.

This species has already been revised by Sugimoto (2013). After that the following specimens are examined additionally.

Specimens examined. *Fundatrix*: 1ex., 29.iv.2014, on *Acer crataegifolium* (Moto-Hakone, Hakone-machi, Kanagawa Pref.); 3exs., 29.iv.2017, on *Acer rufinerve* (Mt. Hikosan, Soeda-machi, Fukuoka Pref.). *Apterous viviparous female*: 3exs., 3.viii.2013, on *A. crataegifolium* (Senoo, Nikkô, Tochigi Pref.); 3exs., 18.viii.2013, on *Acer capillipes* (Yabitsu-Pass, Hadano, Kanagawa Pref.); many individuals, 10.v., 1.vi., 3.viii., 6.ix., & 12.x.2014, on *A. crataegifolium* (Moto-Hakone); many individuals, 1.vi., 6.vii, 3.viii., 6.ix., & 12.x.2014 on *A. rufinerve* (Moto-Hakone); 2exs., 15.v.2016, on *A. rufinerve* (Mt. Hikosan); 1ex., 19.viii.2017, on *A. rufinerve* (Mt. Sarakura, Kita- Kyûshû, Fukuoka Pref.); 2exs., 14.x.2018, on *A. rufinerve* (Mt. Tsurumi-dake, Beppu, Ôita Pref.). *Alate viviparous females*: 3exs., 29.iv.2014, on *A. crataegifolium* (Moto-Hakone); 2exs., 10.v.2014, on *A. crataegifolium* (Moto-Hakone); 2exs., 10.v.2014, on *A. rufinerve* (Moto-Hakone); 3exs., 29.iv.2015, on *A. rufinerve* (Moto-Hakone); 14exs., 14.x.2018, on *A. rufinerve* (Mt. Tsurumi-dake). *Oviparous female*: 3exs., 2.xi.2014, on *A. crataegifolium* (Moto-Hakone); 1ex., 2.xi.2014, on *A. rufinerve* (Moto-Hakone); 1ex., 14.x.2018, on *A. rufinerve* (Mt. Tsurumi-dake). *Male*: 2exs., 2.xi.2014, on *A. crataegifolium* (Moto-Hakone); 1ex., 2.xi.2014, on *A. rufinerve* (Moto-Hakone); 1ex., 14.x.2018, on *A. rufinerve* (Mt. Tsurumi-dake). All collected by the author.

Host plant. *Acer capillipes*, *A. crataegifolium, A. rufinerve*.

Distribution. Japan [Honshû, Shikoku (after Adachi & Yoshitomi, 2013), Kyûshû].

Remark. In this study, this species is newly recorded from Tochigi and Kanagawa Prefectures in the Kantô District, eastern Japan, and from Fukuoka and Ôita Prefectures in the Kyûshû District, western Japan and from *Acer capillipes* as a host plant. So far as my field observation is concerned, it has more or less a wider host range than the previous two species, but it has been collected only from above three *Acer* species, even though they grew with other maples such as *A. amoenum*, *A. diabolicum*, *A. palmatum*, *A. pictum* and *A. seiboldianum* at the same observation site. Monthly observation at Moto-Hakone (about 780 m in elevation) in 2014 showed that this species has a holocyclic life cycle not only on *A. rufinerve* but also on *A. crataegifolium*. The elevation of other collection sites mentioned above is as follows: Senoo 430 m; Yabitsu-Pass 761 m; Mt. Hikosan 600–850 m; Mt. Sarakura 600 m; Mt. Tsurumi-dake 950 m ASL. Moreover, the elevation of the Rokkô Mountains in my previous paper (Sugimoto, 2013) is 430–900 m, and that of Mt. Hakusan in Togashi's (2002) work is 1300–1500 m. According to Ogata (1965), the vertical distribution of each maple shown in the above host plant is as follows: *A. capillipes* 600–1300 m; *A. crataegifolium* 200–1100 m; *A. rufinerve* 300–2000 m. These suggest that this species is found from low to high mountain regions depending on the vertical distribution of the host plants.

Discussion

As mentioned above, three Japanese *Trichaitophorus* species are associated with specific *Acer* species: *T. kominecola* sp. nov. - *A. micranthum*; *T. japonicus* - *A. tschonoskii*; *T. koyaensis* - *A. capillipes*, *A. crataegifoium* & *A. rufinerve*. In foreign *Trichaitophorus* species, *T. aceris* Takahashi from Taiwan is associated with *A. rubescens* (after Takahashi, 1937) and *T. aenigmatosus* Pashtshenko from the Far East Russia with *A. tegmentosum* (after Pashtshenko, 1988). From the point of view of plant taxonomy,

these *Acer* species all belong to the section Macrantha by Ogata's (1967) system. Among 21 *Acer* species belonging the section in the world, 20 are confined to East Asia (Tanai, 1978). For example, *A. capillipes*, *A. crataegifolium*, *A. rufinerve* and *A. micranthum* are endemic to Japan and *A. tschonoskii* occur in the Southern Kuriles to Central Honshû of Japan (Ogata, 1965), and *A. rubescens* (as *Acer morrisonense*) occurs in Taiwan and *A. tegmentosum* in Heilongjiang, Jinlin and Liaoning of China, Korea, and East Russia (Xu *et al*., 2008). On the other hand, so far as I have read the original description with figures of *T. aceris* and *T. aenigmatosus*, the three Japanese species resemble them morphologically. These suggest that the five East Asian *Trichaitophorus* species may have separated from a common ancestor which had been associated with an ancient *Acer* species belonging to the section Macrantha in East Asia. In fact, some fossil *Acer* species belonging to the section have been discovered from Japan, North Korea and Kamchatka (Tanai, 1983).

On the other hand, there are three *Trichaitophorus* species associated with maples besides member of the section Macrantha. The first one is the Chinese species *T. ginnalarus* Qiao, Zhang & Zhang, 2004 which is described from *A. ginnala* (section Trilobata). Judging from the original description by Qiao *et al*. (2004), the apterous viviparous female of this species does not show typical characters of the genus *Trichaitophorus* in having short setae on the front of head and on the margin of body and in having longer setae on antennae. The second one is *T. recurvispinus* Hille Ris Lambers & Basu, 1966 described form India. In the original description, its host plant was unidentified (Hille Ris Lambers & Basu, 1966). After that, under the name *T. aceris* instead of the name *T. recurvispinus*, Chakarabarti & Mandal (1986) recorded its host plants as follows: *Acer acuminatum* (section Arguta*)*, *Acer villosum* (section Lithocarpa), *Acer* sp., *Actinidia callosa* (Actinidiaceae) and *Elaeocarpus sikkimensis* (Elaeocarpaceae). Among them, the true host plants of *T. recurvispinus* are considered to be *Acer* spp. (Blackman & Eastop, 1994). The third one is *T. acerifolius* Chakrabarti, Das and Sarkar, 2018, which is described from *Acer* sp. in Bhutan by Chakarabarti *et al*. (2018). Because of no information about the apterous viviparous female of this species, there is no evidence to support the hypothesis that this species is the true member of the genus *Trichaitophorus*. Moreover, there are aphids identified as *T. aceris* from *Acer pictum* (section Platanoidea) in India by Ghosh (1980). However, so far as the literature is examined, this *T. aceris* is different from *T. aceris* originally described from Taiwan in having pale body color and in having one long marginal setae on mesothorax.

Many *Acer* species occur in China and its adjacent regions including the northern India (Tanai, 1978). Therefore, the host range of the *Trichaitophorus* species occurring in those regions may differ from that of the five East Asian species. On the other hand, the morphological study of *T. kominecola* sp. nov., and of *T. koyaensis* (Sugimoto, 2013) showed that these apterous viviparous females have variation in setal length and shape depending on the season of appearance. Therefore, the further morphological and biological studies are needed for other species.

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References

Adachi, S. & Yoshitomi, H. 2013. Aphids of Ehime Prefecture, Shikoku, Japan (Hemiptera, Aphididae) II. *Bulletin of Omogo Mountain Museum* 5: 11–22. (In Japanese.)

Blackman, R. L. & Eastop, V. F. 1994. *Aphids on the World's Trees; an Identification and Information Guide*. CAB International. Wallingford, UK.

Chakrabarti, S. & Mandal, A. K. 1986. An account of *Trichaitophorus* and *Yamatochaitophorus* (Homoptera: Aphididae) with a note on their phylogeny. *Zoological Journal of the Linnean Society* 88: 329–338.

Chakrabarti, S., Das, D. & Sarkar, S. 2018. *Acer* infesting aphids (Hemiptera: Aphididae) of the Himaraya with description of a new species of *Trichaitophorus* Takahashi from Bhutan. *Oriental Insects* 53: 131–141.

Ghosh, A. K. 1980. *The Fauna of India and the Adjacent Countries, Homoptera: Aphidoidea, Part 1: General Introduction and Sub-family Chaitophorinae*. Zoological Survey of India, Calcutta.

Higuchi, H. 1972. A taxonomic study of the subfamily Callipterinae in Japan (Homoptera: Aphididae). *Insecta Matsumurana* 35: 19–126.

Hille Ris Lambers, D. & Basu, A. N. 1966. Some new and little known genera, subgenera, species and subspecies of Aphididae from India (Homoptera, Aphididae). *Entomologische Berichten*, 26: 27–36.

Martin, J. H. 1983. The identification of common aphid pests of tropical agriculture. *Tropical Pest Management* 29: 395–411.

Ogata, K. 1965. A dendrological study on the Japanese Aceraceae, with special reference to the geographical distribution. *Bulletin of the Tokyo University Forests* 60: 1–99.

Ogata, K. 1967. A systematic study of the genus *Acer*. *Bulletin of the Tokyo University Forests* 63: 89–206.

Pashtshenko, N. F. 1988. [*Suborder Aphidinea*.] In: Lehr P. A. (ed.) [*Keys to the Insects of the Far East of the USSR, vol. 2, Homoptera and Heteroptera*], pp. 546–686. Nauka Publishing House, Leningrad. (In Russian.) (English translation in 2001 by U. S. Department of Agriculture.) Available at: http://www.ndsu.nodak.edu/ndsu/rider/IHS/PDFs/KEYS_To_Aphidinea.PDF (Accessed on 11 May 2015)

Qiao, G-X., Zhang, Y-C, & Zhang, G-X. 2004. The genus *Trichaitophorus* Takahashi (Hemiptera: Aphididae: Chaitophorinae) from China with description of a new species. *Oriental Insects* 38: 283–288.

Sorin, M. 1979. Some new species of Aphididae from Japan (Homoptera). *Kontyû* 47: 117–125.

Sorin, M. 2002. A new species of the genus *Trichaitophorus* (Hemiptera, Aphididae) from Japan. *Bulletin of the Faculty of Literature, Kogakkan University* 41: 182–193.

Sugimoto, S. 2013. Revision of three aphids described from a red-vein maple *Acer rufinerve* in Japan (Hemiptera: Aphididae). *Insecta Matsumurana* (*New Series*) 69: 27–40.

Takahashi, R. 1937. A new genus and species of Aphididae from Formosa (Homoptera). *Annotationes Zoologicae Japonenses* 6: 17–19.

Takahashi, R. 1961. Three new genera and five new and little known species of Aphididae from Japan (Homoptera). *Kontyû* 29: 247–259.

Tanai, T. 1978. Taxonomical investigation of the living species of the genus *Acer* L., based on vein architecture of leaves. *Journal of the Faculty of Science, Hokkaido University. Series 4, Geology and Mineralogy* 18: 243–282.

Tanai, T. 1983. Revisions of Tertiary *Acer* from East Asia. *Journal of the Faculty of Science, Hokkaido University. Series 4, Geology and Mineralogy* 20: 291–390.

Togashi, I. 2002. Newly insects record occurring in Mt. Hakusan, Ishikawa Prefecture (4).

Annual Report of the Hakusan Nature Conservation Center, Ishikawa Prefecture 29: 7–16. (In Japanese.)

Xu, T-Z., Cheng, Y-S., Jong, P. C., Oterdoom, H. J. & Chang, C-S. 2008. Aceraceae. In: Wu, Z-Y., Raven, P. H. & Hong, D-Y (eds) *Flora of China*. Pp. 515–553. Science Press (Beijing), Missouri Botanical Press (St. Louis). http:// foc.eflora.cn/ (Accessed on 4 March 2018.)