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Title	On the aphid genus <i>Periphyllus</i> van der Hoeven (Hemiptera: Aphididae) from Acer in Japan
Author(s)	Sugimoto, Shun'ichiro
Citation	Insecta matsumurana. New series : Journal of the Research Faculty of Agriculture Hokkaido University, series entomology, 80, 23-72
Issue Date	2024-10
Doc URL	https://hdl.handle.net/2115/93440
Type	departmental bulletin paper
File Information	02_Sugimoto1.pdf



**ON THE APHID GENUS PERIPHYLLUS VAN DER HOEVEN
(HEMIPTERA: APHIDIDAE) FROM ACER IN JAPAN**

By SHUN'ICHIRO SUGIMOTO

Abstract

SUGIMOTO, S., 2024. On the aphid genus *Periphyllus* van der Hoeven (Hemiptera: Aphididae) from *Acer* in Japan. *Ins. matsum. n. s.* 80: 23–72.

The genus *Periphyllus* from *Acer* in Japan was investigated. As a result, *P. acerijaponicus* sp. nov. from *Acer japonicum*, *P. amamiensis* sp. nov. from *A. insulare*, *P. chidoricola* sp. nov. from *A. carpinifolium*, and *P. kajicola* sp. nov. from *A. diabolicum* are described here. *P. allogenens* Szelegiewicz, which was collected on *A. maximowiczianum*, is recorded for the first time from Japan. And some hitherto unknown morphs in *P. acerihabitans*, *P. allogenens*, *P. hokkaidensis* and *P. viridis* are described, and the synonymy of *P. kuwanaii* (Takahashi) and *P. tokyoensis* Sorin is proposed. Moreover, keys to the species and subspecies based on the apterous morphs (fundatrix, viviparous female and mature dimorph) are provided.

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INTRODUCTION

The aphid genus *Periphyllus* in Japan have been studied by Essig & Kuwana (1918), Matsumura (1919), Takahashi (1919a, b), Shinji (1941), Higuchi (1972), Sorin (1990) and Wieczorek *et al.* (2016). Up to now, the following nine species (one with two subspecies) are recorded from Japan: *P. acerihabitans* Zhang, 1982; *P. brevisetosus* Sorin, 1990; *P. californiensis* (Shinji, 1917); *P. hokkaidensis* Sorin, 1990; *P. koelreuteriae* (Takahashi, 1919b); *P. kuwanaii* (Takahashi, 1919b); *P. loricatus* Pashtshenko; 1987, *P. tokyoensis* Sorin, 1990; *P. viridis viridis* Matsumura, 1919; *P. viridis osugiensis* Sorin, 1990. Except for one species *P. koelreuteriae*, which is associated with *Aesculus turbinata* and *Koelreuteria paniculata* (Higuchi, 1972), all are *Acer*-infesting species (Higuchi, 1972; Sorin, 1990; Wieczorek *et al.*, 2016). On the other hand, it is known that the genus *Periphyllus* shows a complex seasonal polymorphism to cope with physiological changes in the host (Blackman & Eastop, 1994). Among the *Acer*-infesting species mentioned above, many different morphs in *P. californiensis*, *P. kuwanaii*, *P. loricatus* and *P. viridis* have been reported by Takahashi (1919a), Essig & Abernathy (1952) and Pashtshenko (1986, 1987). Recently, the dimorph and oviparous female of *P. acerihabitans* were reported by Wieczorek *et al.* (2016). However, only one or two morphs have been reported in the remaining species and subspecies, *P. brevisetosus*, *P. hokkaidensis*, *P. tokyoensis* and *P. viridis osugiensis*.

In the recent survey of *Acer*-infesting *Periphyllus* species in Japan, I found four new species and one newly recorded species from Japan, and described all of them with some photographs including color in life and pigmentation on slides of the apterous morphs. Moreover, the synonymy of *P. kuwanaii* (Takahashi, 1919) and *P. tokyoensis* Sorin, 1990 is proposed, and keys to the species and subspecies based on the apterous morphs (fundatrix, viviparous female and mature dimorph) are provided.

MATERIALS AND METHODS

All the specimens examined in this study were collected by the author unless otherwise stated. They were preserved in 70% ethanol and were mounted on microscope slides in balsam by Martin's (1983) methods. Among the specimens, part of the apterous viviparous females showing pale green or yellow in life and all of the dimorphs were stained by acid fuchsin before the dehydration by glacial acid. The identification of *Acer* plants on which a *Periphyllus* species was collected followed Igari's (2010) handbook based on the systems of Ogata (1965, 1967) and Ohashi (1993, 1999).

Regarding morphs recognized in the life cycle of a *Periphyllus* species, for example, Essig & Abernathy (1952) recorded 16 morphs for *P. californiensis*, which are including some intermediates such as "apterous + alate viviparous female" and "apterous viviparous + oviparous female". In this paper, the following seven morphs are described: fundatrix, apterous viviparous female, alate viviparous female, dimorph (aestivating larva), mature dimorph, oviparous female, and male. If necessary, intermediate characters between morphs are referred to in the description of each morph. Moreover, in some species examined in this study, the apterous and alate viviparous females showed different color in life and different sclerotization depending on the season when they appear. In such case, they are described separately as follows: 'spring generation' collected by late May, 'summer generation' collected from June to September in southern

Honshû and to August in Hokkaidô, northern Japan, and ‘autumn generation’ collected after October in southern Honshû and after September in Hokkaidô.

The holotype and paratypes of four new species and all the specimens examined in this study are deposited in the collection of the Laboratory of Systematic Entomology, Hokkaido University (SEHU).

Periphyllus acerihabitans Zhang

[Japanese name: Tôkaede-nitai-ke-aburamushi]

Periphyllus acerihabitans Zhang, 1982 in Zhang & Zhong 1982: 73.

Periphyllus acerihabitans: Park & Park, 1995: 148; Wieczorek *et al.*, 2016: 584; Ko *et al.*, 2022: 475.

Zhang & Zhong (1982) gave brief original descriptions of the apterous and alate viviparous females. After that, Wieczorek *et al.* (2016) redescribed these morphs and described the oviparous female and aestivating dimorph in details. Based on the present specimens, some additional characters of the apterous and alate viviparous females and the hitherto unknown morphs (fundatrix, mature dimorph, male) are described below:

Fundatrix (Fig. 1A). Color in life: anterior half of body bark brown to black, posterior half yellowish green with a broad spinal blackish longitudinal stripe. Color in mounted specimen: head pale yellow; antennae pale yellow, but distal 1/2 of segment IV and whole of V–VI brown; legs pale yellow, but hind femora with a brown band on sub-distal part; abdomen pale with pale brownish sclerites dorsally and marginally; siphunculi pale brown.

Body oval, 2.68–2.94 mm long, 1.7–2.0 times as long as its maximum width. Head smooth dorsally and ventrally; dorsum with many setae of different length, of which 8–10 setae are somewhat long and stout, the longest one 7.7–9.0 times as long as basal width of antennal segment III. Antennae 6-segmented, 0.36–0.39 times as long as body; basal two segments smooth, flagella imbricated except basal half of segment III; segment I with 12 or 13 setae; segment III with 9–12 setae, of which the longest one is 4.7–5.7 times as long as basal width of the segment; segment IV with 2 setae; segment V with one seta; segment VI with 2 setae on base; processus terminalis 0.47–0.64 times as long as base of segment VI. Ultimate rostral segment 2.3–2.7 times as long as its basal width, 0.88–1.0 times as long as segment II of hind tarsus. Tibiae with many setae, of which the longest one on hind tibiae is 2.6–2.9 times as long as the width at the middle of the tibia; hind tibiae with spinules on distal part and on distal 1/3 along the inner side. First tarsal chaetotaxy 5:5:5. Abdomen membranous with a pair of spinal sclerites and marginal sclerites on each of tergites I–VII, and with an oval-shaped spinal sclerite on tergite VIII; dorsum with numerous setae of different length, of which 2 setae on spinal sclerites are stouter and longer than the others; marginal sclerites with 2–4 setae on tergites I and VII and 6–14 setae on II–VI; among setae on each marginal sclerite, one seta is longer than the others; tergites VIII totally with 20–25 setae, of which 13–18 arise from the spinal sclerite; the longest seta on tergites I–V 6.7–7.3 times as long as basal width of antennal segment III, on marginal sclerites 8.3–9.0 times and on tergite VIII 8.7–9.0 times as long as the above mentioned width. Siphunculi truncated, 1.2–1.3 times as long as the top width, with reticulation weakly in 1–3 rows at apex, with a flange. Cauda broadly rounded, with 37–40 setae.

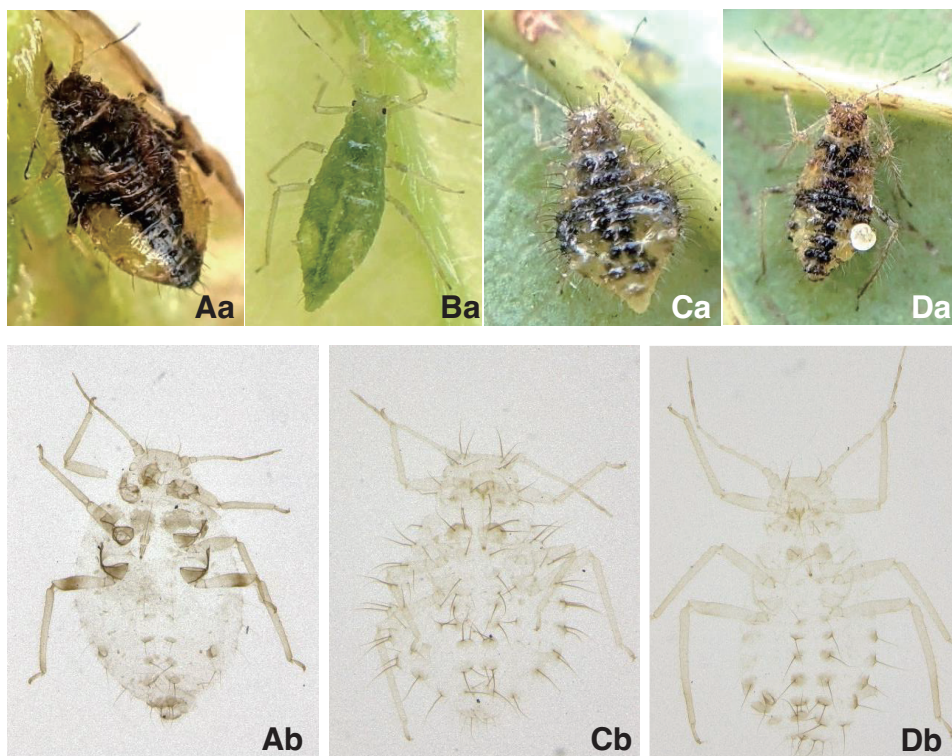


Fig. 1. *Periphyllus acerihabitans*. A: fundatrix, B: apterous viviparous female (spring generation), C: mature dimorph, D: apterous viviparous female (autumn generation), a: general aspect in life, b: general aspect in mounted specimen.

Apterous viviparous female (spring generation) (Fig. 1B). Slightly differs from the descriptions by Zhang & Zhong (1982) and Wieczorek *et al.* (2016) in the following characters: Abdomen with a short spinal band on each of tergites I–VII, a transvers band on tergite VIII, and marginal sclerites on each of tergites I–VI; these bands and sclerites are distinct in stained specimens. Cauda with 14–18 setae.

Alate viviparous female (spring generation). Slightly differs from the descriptions by Zhang & Zhong (1982) and Wieczorek *et al.* (2016) in the cauda bearing more (14–21) setae.

Mature dimorph (Fig. 1C). Similar to the fundatrix, but differs from it in the following characters:

Color in life: body yellowish green with a broad blackish cross-shaped pattern on the dorsum. Color in mounted specimen: head, antennae, legs and siphunculi pale yellow; body with many dark brownish setae (see below); abdomen with pale brownish sclerites dorsally and marginally.

Body rounded, 1.58–2.10 mm long, 1.5–1.8 times as long as its maximum width. Head dorsally with 35–50 setae, of which 4–5 pairs are long, stout and dark brown; the longest seta on dorsum 10.0–12.5 times as long as basal width of antennal segment III.

Antennae 5-segmented, 0.43–0.51 times as long as body; segment I with 8–11 setae; segment III with 5–8 setae, of which the longest one is 7.0–8.0 times as long as basal width of the segment; segment IV with 1 or 2 setae; segment V with 1 or 2 setae on base; processus terminalis 0.67–1.1 times as long as base of segment V. Ultimate rostral segment 1.3–1.5 times as long as its basal width, 0.71–0.80 times as long as segment II of hind tarsus. Tibiae with longer setae, of which the longest one on hind tibiae is 3.4–4.3 times as long as the width at the middle of the tibia. Abdomen with long, stout and dark brownish setae; 2 setae arising from each of spinal sclerites on tergites I–VIII, 1 seta arising from each of pleural sclerites on tergites III and IV, 2–4 setae arising from each of marginal sclerites on tergites I–V, and 1 seta arising from each of marginal sclerites on tergites VI and VII; tergites VIII totally with 17–23 setae, of which 6–9 arise from the spinal sclerite; the longest seta on tergites I–V 10.5–12.5 times as long as basal width of antennal segment III, on the marginal sclerites 13.5–15.0 times and on tergite VIII 11.0–15.0 times as long as the above mentioned width. Siphunculi 1.3–2.1 times as long as the top width. Cauda with 14–17 setae.

Apterous viviparous female (autumn generation) (Fig. 1D). Differs from the mature dimorph in the following characters:

Color in mounted specimen: dorsal and marginal sclerite brown; siphunculi brown; dark brownish setae fewer than the mature dimorph (see below).

Body oval, 2.00–2.74 mm long, 1.8–2.1 times as long as its maximum width. Head with one or two pairs of dark brownish setae on the anterior half; the longest one 6.7–9.3 times as long as basal width of antennal segment III. Antennae 6-segmented, 0.52–0.66 times as long as body; segment III with 8–15 setae, of which the longest one is 5.0–6.7 times as long as basal width of the segment; segment IV with 3–5 setae; segment V with 2 setae; processus terminalis 1.5–1.8 times as long as base of segment VI. Ultimate rostral segment 1.7–2.0 times as long as its basal width, 0.64–0.77 times as long as segment II of hind tarsus. Abdomen with long, stout and dark brownish setae; 1 seta arising from each of spinal sclerites on tergites II–V, 2 seta arising from each of spinal sclerites on tergites VI–VIII, and 1 seta arising from each of marginal sclerites on tergites III–VI; tergites VIII totally with 10–16 setae, of which 4–9 arise from the sclerite; the longest seta on tergites I–V 8.0–11.3 times as long as basal width of antennal segment III, on marginal sclerites 9.3–10.7 times and on tergites VIII 8.3–10.0 times as long as the above mentioned width. Cauda with 20–23 setae.

Alate viviparous female (autumn generation). Slightly differs from the spring generation in the following characters:

Antennae with more (23 or 24) secondary rhinaria on the segment III. Abdomen with a pair of spinal sclerites on each of tergites I–VII, a transvers band on VIII and marginal sclerites on II–IV, these sclerites and band are pale brown in mounted specimen.

Oviparous female. Slightly differs from a description given by Wieczorek *et al.* (2016) in having longer setae on the antennal segment III (the longest one 5.2–7.0 times as long as basal width of the segment) and in having 24–29 setae on the cauda.

Male. Differs from the alate viviparous female in having more secondary rhinaria numbering 53–80 on antennal segment III, 21–36 on IV and 6–10 on V, and in having short spinal bands on abdominal tergites I–VII.

Specimens examined. All specimens were collected from *Acer buergerianum*. *Fundatrix*: 3exs., 28.iii.2010, Kasuganomichi, Chûô-ku, Kôbe, Hyôgo Pref. *Apterous viviparous female (spring generation)*: 4exs., 30.v.2014, Ôta-chô, Naka-ku, Yokohama, Kanagawa Pref.; 5exs.,

24.v.2020, Nishitomioka, Isehara, Kanagawa Pref. *Alate viviparous female (spring generation)*: 3exs., 18.iv.2010 & 4exs., 25.iv.2010, Kasuganomichi; 1ex., 30.v.2014, Ôta-chô; 2exs., 24.v.2020, Nishitomioka. *Dimorph*: 6exs., 25.iv.2010, Wakinohama, Chûô-ku, Kôbe; 10exs., 30.v.2014, Ôta-chô; 2exs., 27.v.2019, Aomi, Kôtô-ku, Tôkyô. *Mature dimorph*: 3exs., 7.xi.2010 & 2exs., 14.xi.2010, Wakinohama; 1ex., 22.xi.2013, Ôta-chô. *Apterous viviparous female (autumn generation)*: 2exs., 7.xi.2010; 1ex., 14.xi.2010 & 1ex., 23.xi.2010, Wakinohama; 1ex., 22.xi.2013, Ôta-chô; 1ex., 27.xi.2020, Aomi. *Alate viviparous female (autumn generation)*: 1ex., 23.xi.2010, Wakinohama. *Oviparous female*: 8exs., 23.xi.2010, Wakinohama; 1ex., Akamatsu-chô, Nada-ku, Kôbe; 3exs., 27.xi.2020, Aomi. *Male*: 2exs., 23.xi.2010, Wakinohama; 4exs., 27.xi.2010, Akamatsu-chô; 1ex., 22.xi.2013, Ôta-chô; 3exs., 27.xi.2020, Aomi.

Host plant. Acer buergerianum.

Distribution. Japan (Honshû, Shikoku, Kyûshû); China; South Korea.

Remark. The apterous viviparous female (spring generation) shows pale green in life, whereas the other apterous morphs have a broad T-shaped or a cross-shaped dark brownish mark on the abdomen in life (Figs 1Aa, 1Ca, 1Da). The alate viviparous female (spring generation) of this species closely resembles the corresponding morph of *P. viridis* s. lat. in having pale green body in life, but differs from the latter by first tarsal chaetotaxy (5:5:5 in this species vs. 7:7:7 in *P. viridis* s. lat.).

Periphyllus acerijaponicus sp. nov.

[Japanese name: Hauchiwakaede-nitai-ke-aburamushi]

The apterous and alate viviparous females (spring generation) of this new species are characterized by yellow or yellowish green body in life, which distinguishes this species from other *Periphyllus* species.

Fundatrix (Fig. 2A). Color in life: body moss green with black spots dorsally. Color in mounted specimen: head dark brown; antennae dark brown except basal 2/3 of segment III pale brown; legs dark brown except trochanter and basal 1/5 of femora pale yellow; pronotum dark brown; meso- and metanotum and abdomen pale with dark brownish sclerites dorsally and marginally; siphunculi dark brown.

Body rounded, 2.15–2.75 mm long, 1.5–1.7 times as long as its maximum width, with long and stout setae. Head smooth dorsally and ventrally; dorsum with 8 setae, their basal width wider than diameter of an ommatidium in compound eyes, the longest seta 5.8–8.0 times as long as basal width of antennal segment III. Antennae 5-segmented, 0.34–0.46 times as long as body; basal two segments smooth, flagella imbricated except basal half of segment III; segment I with 2–4 setae; segment III with 4–6 setae, of which the longest one is 2.7–4.3 times as long as basal width of the segment; segment IV with 1 seta; segment V with 2 setae, rarely 1 on base; processus terminalis 1.4–1.7 times as long as base of segment V. Rostrum reaching middle coxae; ultimate segment 2.0–2.5 times as long as its basal width, 0.83–0.93 times as long as the segment II of hind tarsus. Tibiae with many long setae, of which the longest one on hind tibiae is 2.1–3.6 times as long as the width at the middle of the tibia; hind tibiae with a few spinules on distal part. First tarsal chaetotaxy 5:5:5. Abdomen membranous with a pair of spinal sclerites and marginal sclerites on each of tergites I–VII, with 1 or 2 pair of seta-bearing pleural sclerites on each of tergites I–VI, and with a transverse band on tergite VIII; each spinal sclerite usually with 2 setae, of which outer one is longer and stouter than inner one and its basal width is wider than diameter of an ommatidium in compound eyes; marginal

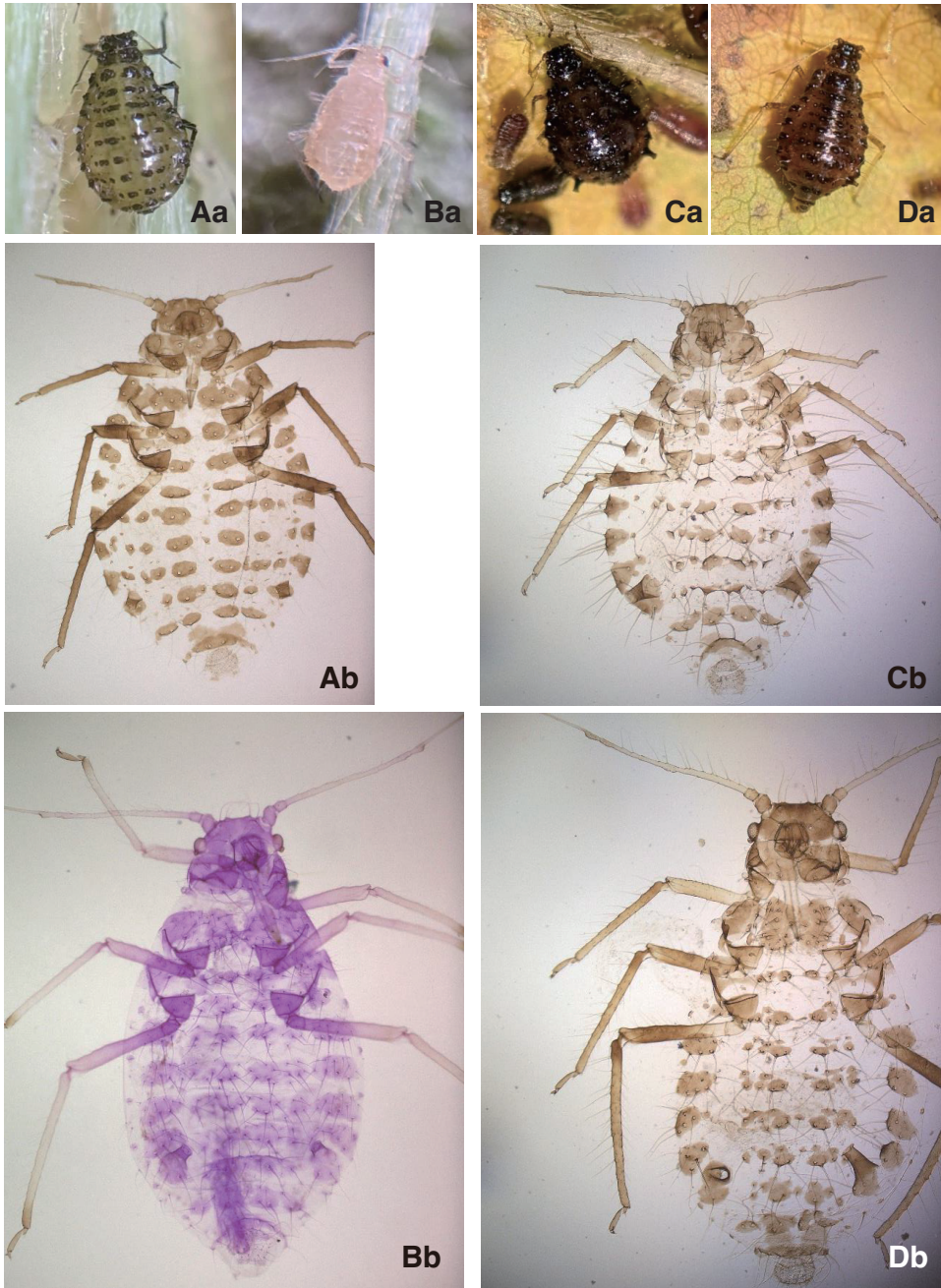


Fig. 2. *Periphyllus acerijaponicus* sp. nov. A: fundatrix, B: apterous viviparous female (spring generation), C: mature dimorph, D: apterous viviparous female (autumn generation), a: general aspect in life, b: general aspect in mounted specimen.

sclerites with 2–4 setae on tergites I and VII and 3–5 setae on II–VI; tergite VIII with 8–10 setae on the band; the longest seta on tergites I–V 6.0–9.2 times as long as basal width of antennal segment III, on marginal sclerites 7.0–10.0 times and on tergite VIII 6.0–10.0 times as long as the above mentioned width. Siphunculi truncated, 1.3–1.4 times as long as the top width, reticulated at most on 2 rows at apex, with a flange. Cauda rounded, with 13–17 setae.

Apterous viviparous female (spring generation) (Fig. 2B). Differs from the fundatrix in the following characters:

Color in life: body pale yellow. Color in mounted specimen: head, antennae, legs and siphunculi pale yellow, only distal part of tibiae and tarsi brown; dorsal and marginal sclerites on abdomen inconspicuous, but distinct in the specimen stained by acid fuchsin.

Body oval, 1.57–2.60 mm long, 1.8–2.2 times as long as its maximum width. Head: dorsal setae slender, their basal width as wide as diameter of an ommatidium in compound eyes. Antennae 6-segmented, 0.52–0.69 times as long as body; segment III with 6–10 setae; segment IV with 3 or 4 setae; segment V with 2–4 setae; segment VI with 1 or 2 setae on base; processus terminalis 3.4–3.9 times as long as base of segment VI. Ultimate rostral segment 1.8–2.2 times as long as its basal width, 0.67–0.81 times as long as segment II of hind tarsus. Abdominal sclerotization as in the fundatrix, sometimes tergites I–V each with a pair of oval-shaped sclerites made by the fusion of spinal sclerites and pleural sclerites, and tergites VI and VII each with a spinal band; each spinal sclerite with 6–8 setae on tergite I–V, the basal width of the stoutest seta on each sclerite as wide as diameter of an ommatidium in compound eyes; marginal sclerites with 4–7 setae on tergites I and VI, 7–14 setae on II–V and 2 setae on VII. Siphunculi with reticulation in 3–5 rows at apex.

Alate viviparous female (spring generation). Color in life specimen: abdomen pale yellowish green with black bands dorsally. Color in mounted specimen, the following parts dark brown: head, antennae except for basal half of segment III, thorax, legs except coxae, trochanter and basal 1/3 of femora (sometimes fore femora wholly pale brown), dorsal bands and marginal sclerites on abdomen, and siphunculi.

Body 2.22–3.00 mm long. Antennae 6-segmented, 0.61–0.81 times as long as body; segment III with 9–20 round to oval-shaped secondary rhinaria along whole length, with 10–14 setae, of which the longest one is 4.3–5.7 times as long as basal width of the segment; segment IV usually with no rhinarium, with 4–7 setae; segment V with a large primary rhinarium occupying whole breadth of the segment, with a distinct rim, with 2–5 setae; segment VI with 1 or 2 setae on base; processus terminalis 3.4–4.4 times as long as base of segment VI. Ultimate rostral segment 0.72–0.82 times as long as segment II of hind tarsus. Tibiae with spinules on distal 1/5 of all tibiae, with many long setae, of which the longest one on hind tibiae is 3.1–4.4 times as long as the width at the middle of the tibia. Abdomen with a broad band and marginal sclerites on each of tergites I–VII, and with a transverse band on tergite VIII; tergite VII often with a transverse band made by the fusion of broad band and marginal sclerites; tergite VIII with 11–14 setae on the band. Siphunculi truncated, 1.7–2.3 times as long as the top width; reticulated on distal 2/3, imbricated on basal 1/3, with a flange. Cauda rounded, with 14–16 setae.

Aestivating dimorph. Color in life: body whitish green.

Body 0.62–0.68 mm long, 0.34–0.38 mm wide. Head with spinal suture stretching to abdomen, with 4 rounded lamellae near anterior margin. Antennae 4-segmented, 0.50–0.57 times as long as body; segment I strongly protruded anteriorly, with 2 lamellae

which are curved outward and smaller than those on head; segment II with 1 sickle-like seta, of which length is as long as basal width of segment III; processus terminalis 1.3–1.6 times as long as base of segment IV. Meso- and metanotum each with a pair of lamellae marginally, of which ones on mesonotum are slenderer than those on metanotum. Rostrum passing middle coxae. Fore tibiae with 5 or 6 and middle tibiae with 7 small leaf-like lamellae, of which the basal and apical ones are sometimes slender or sickle-like in shape. Hind tibiae with normal setae, the longest seta 1.7–2.0 times as long as the width at the middle of the tibia. Metanotum and abdominal tergites I–VI each with spinal and lateral plates; each spinal plate with one spinule. Abdominal tergites I–VII each with a pair of rounded lamellae marginally; VII also with a pair of leaf-like lamellae dorso-posteriorly; VIII with a pair of leaf-like lamellae posteriorly, which are as wide as or little slenderer than dorso-posterior ones on VII.

Mature dimorph (Fig. 2C). Similar to the fundatrix, but differs from it in the following characters:

Color in life: body dark brown. Color in mounted specimen: legs pale brown, sometimes basal part of tibiae brown to dark brown.

Body somewhat small, 1.60–2.40 mm long. Head: dorsal setae slender, their basal width as wide as diameter of an ommatidium in compound eyes, the longest seta 6.8–10.4 times as long as basal width of antennal segment III. Antennae: segment III with 3 or 4 setae, of which the longest one is 5.3–6.8 times as long as basal width of the segment; processus terminalis 1.8–2.2 times as long as base of segment VI. Ultimate rostral segment 1.3–1.5 times as long as its basal width, 0.67–0.75 times as long as segment II of hind tarsus. Abdomen: marginal sclerites with 7–10 setae on tergites II–V; tergite VIII with 10–13 setae on a transvers band. Siphunculi 1.6–1.8 times as long as the top width. Cauda broadly rounded, with 10–12 setae.

Apterous viviparous female (autumn generation) (Fig. 2D). Similar to the mature dimorph in the color of life and mounted specimens, but differs from it in the following characters:

Color in mounted specimen: middle and hind femora dark brown on distal 1/2–2/3. Body oval, 2.67–3.00 mm long, 1.7–2.2 times as long as its maximum width. Antennae 6-segmented, 0.54–0.72 times as long as body; segment I with 4–7 setae; segment III with 6–14 setae, of which the longest one is 4.5–5.7 times as long as basal width of the segment; segment IV with 3–7 setae; segment V with 2–5 setae; segment VI with 2 setae, rarely 1 on base; processus terminalis 2.9–3.8 times as long as base of segment VI. Ultimate rostral segment 1.5–1.8 times as long as its basal width. Siphunculi 1.8–2.2 times as long as the top width, with reticulation at most on distal 1/4.

The specimens examined were intermediates between oviparae and alatae, having both 1–44 scent plaques on the hind tibiae and rudimentary ocelli near the anterior part of compound eyes.

Alate viviparous female (autumn generation). Differs from the spring generation in the following characters:

Color in life: abdomen dark brown. Body 2.55–3.64 mm long. Setae longer, the longest seta on antennal segment III 5.7–7.1 times as long as basal width of antennal segment III and on hind tibiae 3.6–5.0 times as long as middle width of the tibia. Antennal segment IV sometimes with 1–3 secondary rhinaria.

Oviparous female. Similar to the apterous viviparous female (autumn generation) in the color of life and mounted specimens, but differs from it in the following characters:

Body 3.03–3.25 mm long. Hind tibiae swollen, with numerous scent plaques. Abdomen prolonged on posterior part; tergite VII without a pair of sclerites but with about 10 seta-bearing scleroites arranged transversely, and with 2 or 3 setae lacking scleroites near spiracles; tergite VIII without a transvers band, with 14 or 15 long setae transversely and 4–8 additional short setae each marginally. Siphunculi reticulated on distal 3/8. Cauda broadly rounded, with 21–23 setae.

Male. Similar to the alate viviparous female, but differs from it in having more secondary rhinaria numbering 73–104 on antennal segment III, 47–55 on IV and 16–27 on V, and in having short spinal bands on abdominal tergites I–VII.

Specimens examined. All specimens were collected from *Acer japonicum* at Nikkô in Tochigi Prefecture, central Japan. Holotype: one apterous viviparous female, 17.v.2015, Nikkô Botanical Garden (NBG). Paratypes: one fundatrix, 3.v.2015, NBG; four apterous viviparous females and three alate viviparous females, the same data as the holotype. Other specimens examined: *Fundatrix*: 1ex., 3.v.2015, NBG; 2exs., 19.v.2019 & 2exs., 1.v.2021, Tamozawa. *Apterous viviparous female (spring generation)*: 1ex., 19.v.2019, Tamozawa. *Alate viviparous female (spring generation)*: 4exs., 3.v.2015, NBG, 8exs., 1.v.2021, Tamozawa. *Aestivating dimorph*: 5exs., 17.v.2015, NBG; 2exs., 19.v.2019, Tamozawa. *Mature dimorph*: 7exs., 24.x.2020 & 1ex., 3.xi.2020, Tamozawa. *Apterous viviparous female (autumn generation)*: 8exs., 24.x.2020, Tamozawa. *Alate viviparous female (autumn generation)*: Tamozawa; 12exs., 24.x.2020, Tamozawa. *Oviparous female*: 2exs., 24.x.2020, Tamozawa. *Male*: 2exs., 24.x.2020, Tamozawa.

Host plant. *Acer japonicum*.

Distribution. Japan (Honshû).

Remark. This species differs from *P. californiensis*, which also lives on *A. japonicum*, in having longer processus terminalis in all morphs [the ratio of the length of processus terminalis to that of the base in the ultimate antennal segment: fundatrix 1.4–1.7 in this species vs. 0.7–1.0 in *P. californiensis* examined in this study; apterous viviparous female (spring generation) 3.4–3.9 vs. 1.7–2.4; alate viviparous female (spring and autumn generations) 3.1–4.5 vs. 1.8–3.2; aestivating dimorph 1.3–1.6 vs. 0.7–1.0; mature dimorph 1.8–2.2 vs. 1.2–1.7; apterous viviparous female (autumn generation) 2.9–3.8 vs. 2.0–3.0; oviparous female 4.0–4.2 vs. 1.8–2.9; male 3.9–4.0 vs. 1.8–3.0].

Etymology. The species name is derived from the botanical name of the host plant.

Periphyllus allogenes Szelegiewicz

[Japanese name: Megusurinoki-nitai-ke-aburamushi]

Periphyllus allogenes Szelegiewicz, nom. nud., 1974: 463.

Periphyllus allogenes Szelegiewicz, 1981: 37; Park & Park, 1995: 148; Ko & Lee, 2023: 207.

Periphyllus triflorumi Lee & Seo, 1992: 254.

This species has hitherto been known only from the Korean Peninsula and is recorded for the first time from Japan. In this study, the apterous and alate viviparous females and the first instar larvae were collected on *Acer maximoxicizianum* naturally grown in Honshû and Kyûshû, central and western Japan. Based on the present specimens, the differences with the Korean population and a brief description of the first instar larva are given below:

Apterous viviparous female (Fig. 3A). Slightly differs from the original description of *allogenes* Szelegiewicz in having large body size (1.32–1.95 mm in the present

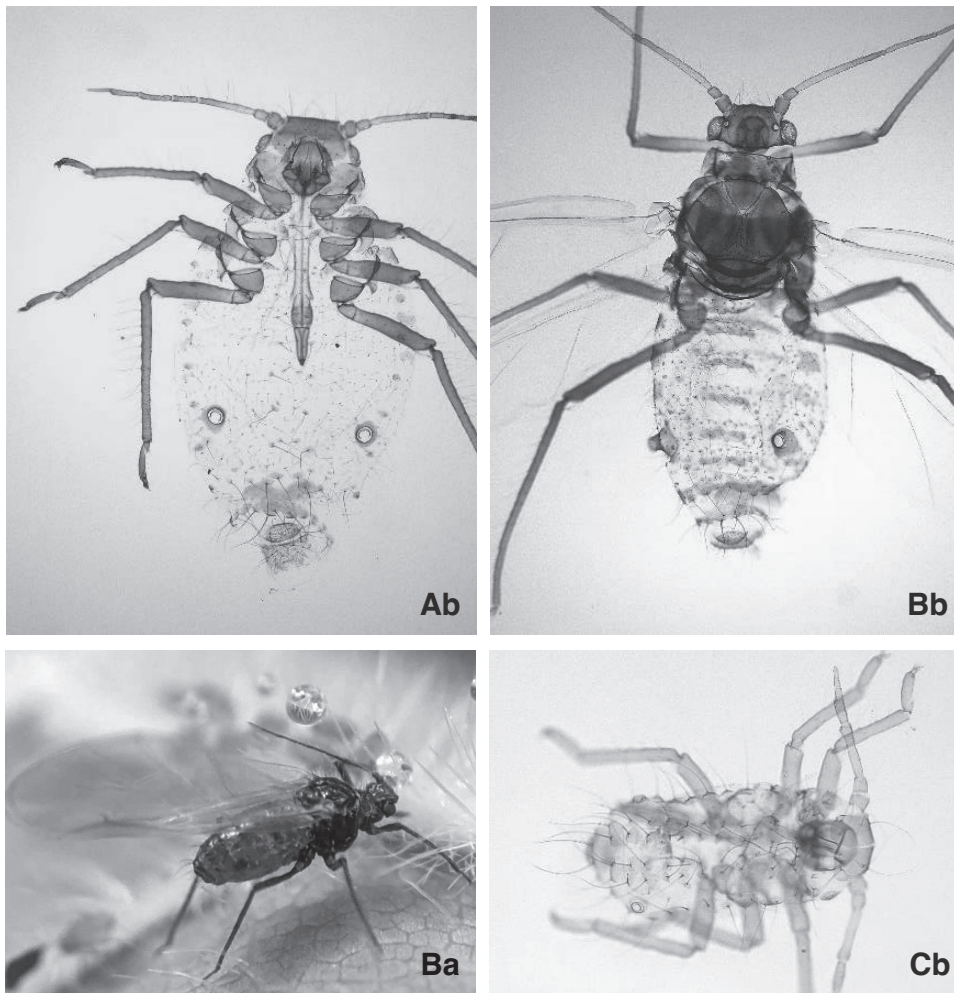


Fig. 3. *Periphyllus allogenes*. A: apterous viviparous female, B: alate viviparous female, C: first instar larva, a: general aspect in life, b: general aspect in mounted specimen.

specimens vs. 1.06–1.15 mm in the original description) and having more setae on the antennal segment III (6–14 setae vs. 3–5 setae).

Alate viviparous female (Fig. 3B). Differs from the description of alate viviparous female given by Ko & Lee (2023) in having more setae on the antennal segments III and IV (16–27 on III, 10–13 on IV in the present specimens vs. 8–18 on III, 4–8 on IV in the Korean specimens), fewer secondary rhinaria on the antennal segment IV (1–5, sometimes no rhinarium vs. 6–10 rhinaria) and longer ultimate rostral segment which is 0.75–0.85 times as long as segment II of hind tarsus (0.641–0.718 times in the Korean specimens).

First instar larva (produced by the alate viviparous females occurring on May) (Fig. 3C). Color in life: body bright brown.

Body 0.63–0.70 mm long, 0.24–0.26 mm wide. Setae on body including antennae

and legs, long and pointed. Head with 1 pair of setae on anterior margin and 3 pairs of setae on dorsum (2 pairs posteriorly, 1 pair anteriorly), of which the longest one on dorsum is 3.6–4.3 times as long as basal width of segment III. Antennae 4-segmented, 0.44–0.50 times as long as body; segment I with 3 setae; segment II with 2 setae, of which the longer one is 2.2–3.3 times as long as basal width of segment III; segment III with 1 seta which is nearly as long as longer seta on segment II; segment IV with 1 seta on base; processus terminalis 1.0–1.3 times as long as base of segment IV. Rostrum reaching abdominal segment VII; ultimate segment 2.6–2.8 times as long as its basal width, about 1.1 times as long as segment II of hind tarsus. Tibiae with normal setae, the longest one on hind tibiae 2.7–3.6 times as long as the width at the middle of the tibia. Abdominal tergites I–VII each with 2 pairs of spinal setae and a pair of marginal setae, these setae with sclerites at their bases; VIII with 4 setae on a transverse band; the longest seta on tergites I–V 4.7–6.2 times as long as basal width of segment III.

Specimens examined. All specimens were collected from *Acer maximowiczianum*. *Alate viviparous female*: 10exs., 17.v.2015, Nikkô Botanical Garden, Nikkô (NBG), Tochigi Pref.; 6exs., 19.v.2019, Tamozawa, Nikkô, Tochigi Pref.; 1ex., 18.v.2022, Tamozawa. *First instar larva*: 2exs. 17.v.2015, NBG, Nikkô; 3exs., 19.v.2019, Tamozawa. *Apterous viviparous female*: 1ex., 10.vii.2019 [reared specimen: generation produced by one alate viviparous female (coll., 19.v.2019, Tamozawa) at laboratory kept in 25 degrees centigrade]; 7exs., 19.x.2019, Mt. Hikosan, Soeda-machi, Fukuoka Pref.

Host plant. *Acer maximowiczianum*. *A. triflorum* (Szelegiewicz, 1974; Lee & Seo, 1992; Ko & Lee, 2023). Both *A. maximowiczianum* and *A. triflorum* belong to the section *Trifoliata* by Ogata's (1967) system.

Distribution. Japan (Honshû, Kyûshû); the Korean Peninsula.

Remark. As mentioned above, the Japanese population of this species slightly differs from the Korean population. Among eight apterous viviparous females examined, one reared specimen, which became an adult in July in the laboratory, had the body 1.32 mm long and 6 setae on the antennal segment III. This specimen is close to the original description of *allogenes* Szelegiewicz, of which the holotype and paratypes are collected in August (Szelegiewicz, 1981). On the other hand, the remaining seven specimens, which are collected in October, had the body 1.62–1.95 mm long and 8–14 setae on the antennal segment III. Probably these differences are included within the range of seasonal variation. Therefore, I adopt the name *allogenes* Szelegiewicz for the present Japanese specimens, although there are some differences between the Japanese and Korean specimens of the alate viviparous females.

The alate viviparous females and their offspring (first instar larvae) were found on the leaf undersurface and petiole of *A. maximowiczianum* at Nikkô in Tochigi Prefecture, central Japan in May of 2015, 2019 and 2022. Subsequent investigations in these years failed to find any specimens of this species at the same observation sites. On the other hand, the rearing experiment of some first instar larvae produced by one alate viviparous female (coll., 19.v.2019) showed that approximately two months are needed for larvae to reach adulthood. This suggests that the first instar larvae may be dimorph with long normal setae as shown in *Periphyllus aceris* (Linnaeus) (cf. Fig. 3 in Hille Ris Lambers, 1947).

Periphyllus amamiensis sp. nov.

[Japanese name: Shimaurikaede-nitai-ke-aburamushi]

Fundatrix (Fig. 4A). Color in life: body pale green. Color in mounted specimen: head and antennae pale yellow; legs pale yellow except tarsi brown; siphunculi brown.

Body rounded, 2.10–2.25 mm long, 1.6–1.9 times as long as its maximum width. Head smooth dorsally and ventrally; dorsum with 8–11 setae, of which the longest one is 4.3–5.8 times as long as basal width of antennal segment III. Antennae 6-segmented,

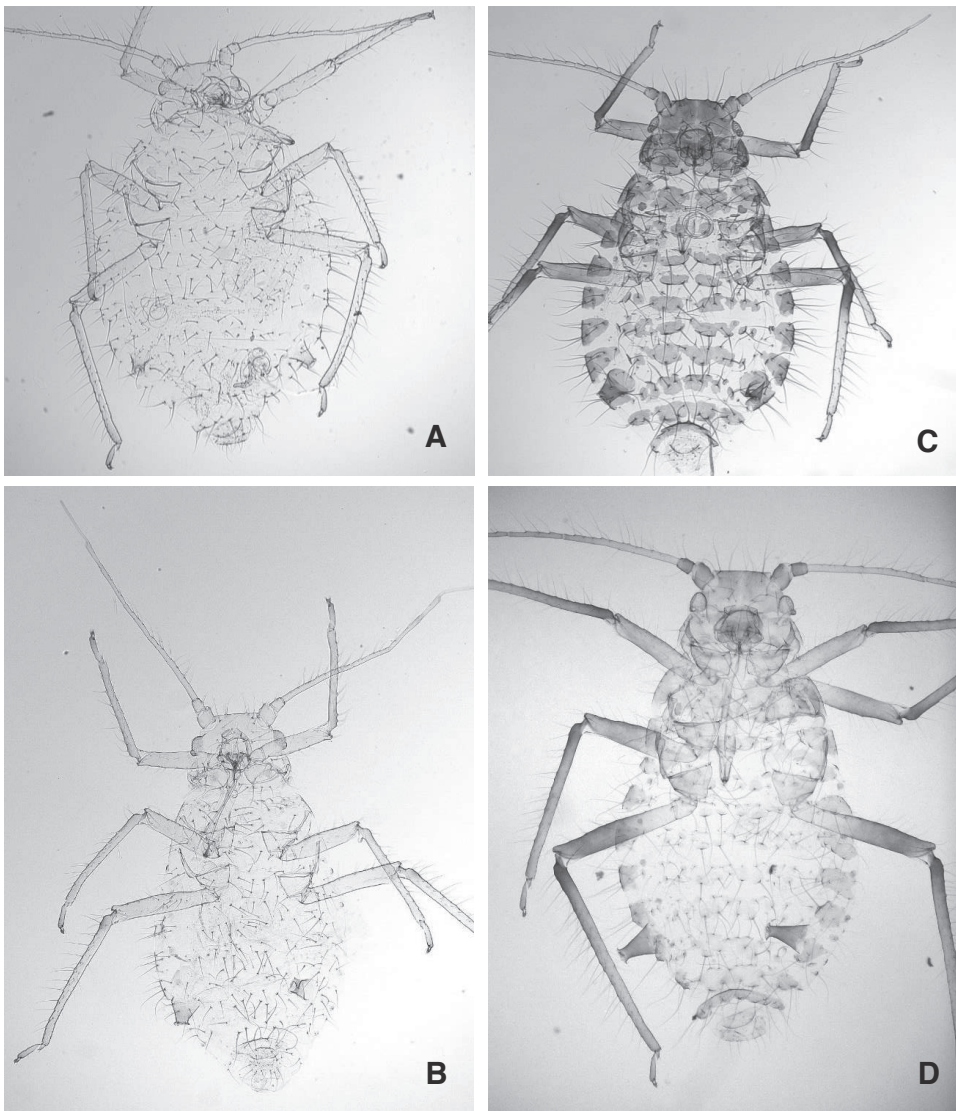


Fig. 4. *Periphyllus amamiensis* sp. nov. A: fundatrix, B: apterous viviparous female (spring generation), C: mature dimorph, D: apterous viviparous female (autumn generation).

0.55–0.59 times as long as body; basal two segments smooth, flagella imbricated except basal half of segment III; segment I with 5 or 6 setae; segment III with 10–12 setae, of which the longest one is 3.7–4.7 times as long as basal width of the segment; segment IV with 1 or 2 setae; segment V with 1 or 2 setae; segment VI with 2 or 3 setae on base; processus terminalis 1.1–1.2 times as long as base of segment VI. Rostrum reaching middle coxae; ultimate segment 1.7–2.0 times as long as its basal width, 0.79–0.86 times as long as segment II of hind tarsus. Tibiae smooth, with spinules on distal part of all tibiae and on distal 3/8 along inner side of hind tibiae, sometimes these spinules on fore and middle tibiae inconspicuous, with many long setae, of which the longest one on hind tibiae is 3.4–4.2 times as long as the width at the middle of the tibia. First tarsal chaetotaxy 5:5:5. Abdomen membranous with seta-bearing scleroites arranged irregularly in double transverse rows and marginal sclerites on each of tergites I–VII, and with a transverse band on tergite VIII, these scleroites, sclerites and band are distinct in the specimens stained by acid fuchsin; marginal sclerites with 3–6 setae on tergites I and VI, 5–9 setae on II–V and 2 or 3 setae on VII; tergite VIII with 11–14 setae on the band; the longest seta on tergites I–V 3.3–4.3 times as long as basal width of antennal segment III, on marginal sclerites 5.0–6.3 times and on tergite VIII 5.3–6.0 times as long as the above mentioned width. Siphunculi truncated, 1.4–1.9 times as long as the top width, with reticulation in 2 rows at apex, with a flange. Cauda broadly rounded, with 11–13 setae.

Apterous viviparous female (spring generation) (Fig. 4B). Similar to the fundatrix in the color of life and mounted specimens, but differs from it morphologically in the following characters:

Body oval, 1.88–2.62 mm long, 1.8–2.3 times as long as its maximum width. Head dorsally with 9–16 setae, of which the longest one is 4.2–6.8 times as long as basal width of antennal segment III. Antennae 0.63–0.84 times as long as body; segment I with 5–9 setae; segment III with 11–18 setae; segment IV with 3–7 setae; segment V with 3–6 setae; segment VI with 2 setae on base; processus terminalis 1.7–2.4 times as long as base of segment VI. Abdomen with a pair of spinal sclerites or a spinal short band, the longest seta on tergites I–V 4.3–6.8 times as long as basal width of antennal segment III, on marginal sclerites 4.6–7.2 times and on tergite VIII 4.3–6.8 times as long as the above mentioned width. Siphunculi with reticulation on apical 2/5.

Alate viviparous female. Color in life: abdomen pale green with black bands dorsally. Color in mounted specimen, the following parts brown to dark brown: head, antennae, thorax, femora except basal 1/3–1/4, tibiae, dorsal and marginal sclerites, and siphunculi.

Body 2.64–3.25 mm long. Head smooth dorsally; dorsum with 10–13 setae, of which the longest one is 5.3–6.4 times as long as basal width of antennal segment III. Antennae 6-segmented, 0.75–0.90 times as long as body; segment III with 13–24 round to oval-shaped secondary rhinaria along whole length, with 16–20 setae, of which the longest one is 4.4–5.7 times as long as basal width of the segment; segment IV with 0–3 rhinaria, with 5–7 setae; segment V with 4–6 setae; segment VI with 2 setae on base; processus terminalis 2.4–3.1 times as long as base of segment VI. Ultimate rostral segment 0.76–0.82 times as long as segment II of hind tarsus. Tibiae smooth, with spinules on distal 1/3 of all tibiae; the longest seta on hind tibiae 3.8–4.7 times as long as the width at the middle of the tibia. Abdomen with seta-bearing scleroites and marginal sclerites on each of tergites I–VII, and with a transverse band on tergite VIII, sometimes

with a pair of spinal sclerites or a spinal band made by the fusion of several sclerites on each tergite III–VII; marginal sclerites on tergites I and V–VII small or sometimes disappearing; tergites I–VII with many long setae arranged roughly in double rows; marginal sclerites with 5 or 6 setae on tergite I, 10–12 setae on II–V, 6–9 on VI and 3 or 4 setae on VII; tergites VIII with 9–12 setae on the band. Siphunculi truncated, 2.2–2.5 times as long as the top width, reticulated except on basal 2/5, with a flange. Cauda rounded, with 14–18 setae.

Aestivating dimorph. Color in life: body whitish green.

Body 0.72–0.78 mm long, 0.43–0.47 mm wide. Head with spinal suture stretching to abdomen, with 4 rounded lamellae near anterior margin. Antennae 4-segmented, 0.45–0.49 times as long as body; segment I strongly protruded anteriorly, with 2 lamellae which are curved outward and smaller than those on head; segment II with 1 stout and blunt seta, of which length is little shorter than basal width of segment III; processus terminalis 0.67–0.71 times as long as base of segment IV. Meso- and metanotum each with a pair of lamellae marginally, of which ones on mesonotum are slenderer than those on metanotum. Rostrum passing middle coxae. Fore tibiae with 6 and middle tibiae with 7 or 8 small leaf-like lamellae, of which the basal and apical ones are sometimes slender or sickle-like in shape. Hind tibiae with normal setae, the longest seta 1.8–2.2 times as long as the width at the middle of the tibia. Metanotum and abdominal tergites I–VI each with spinal and lateral plates; each spinal plate with one spinule. Abdominal tergites I–VII each with a pair of rounded lamellae marginally; VII also with a pair of leaf-like lamellae dorso-posteriorly; VIII with a pair of leaf-like lamellae posteriorly, which are little wider than dorso-posterior ones on VII.

Mature dimorph (Fig. 4C). Similar to the fundatrix in the body size and shape, but differs from it in the following characters:

Color in life: body dark green to dark brown. Color in mounted specimen: head dark brown; antennae dark brown except segments III to basal 1/2 of V pale brown; coxae, trochanter, basal 1/5 of femora, distal 3/4–1/2 of tibiae and tarsi pale yellow; femora brown on distal 4/5; tibiae dark brown on basal 1/4–1/2; pronotum dark brown; meso- and metanotum and abdomen pale with dark brownish sclerites dorsally and marginally; siphunculi dark brown.

Antennae: segment I with 3 or 4 setae; segment III with 7–10 setae, of which the longest one is 5.0–6.3 times as long as basal width of the segment; segment V with 2 setae; segment VI with 1 or 2 setae on base; processus terminalis 0.8–1.2 times as long as base of segment VI. Rostrum passing middle coxae; ultimate segment 1.4–1.7 times as long as its basal width, 0.84–0.96 times as long as segment II of hind tarsus. Abdomen with a pair of spinal sclerites and marginal sclerites on each of tergites I–VII, with 2–4 seta-bearing pleural sclerites on each tergite I–VI, and with a transverse band on tergite VIII; the longest seta on tergites I–V 6.0–7.0 times as long as basal width of antennal segment III, on marginal sclerites 6.7–8.3 times and on tergite VIII 6.0–8.0 times as long as the above mentioned width. Siphunculi 1.7–2.1 times as long as the top width, with reticulation on apical 2/5.

Apterous viviparous female (autumn generation) (Fig. 4D). Similar to the mature dimorph in the color of life and mounted specimens, but differs from it in the following characters:

Body oval, 2.40–3.25 mm long, 1.9–2.2 times as long as its maximum width. Head dorsally with 12–19 setae, of which the longest one is 4.4–6.3 times as long as basal

width of antennal segment III. Antennae 0.63–0.77 times as long as body; segment I with 5–8 setae; segment III with 12–18 setae, of which the longest one is 3.8–5.5 times as long as basal width of the segment; segment IV with 4–9 setae; segment V with 3–6 setae; processus terminalis 1.8–2.6 times as long as base of segment VI. Ultimate rostral segment 1.9–2.1 times as long as its basal width, 0.80–0.94 times as long as segment II of hind tarsus. The longest seta on hind tibiae 2.6–3.7 times as long as the width at the middle of the tibia. Abdominal tergite VIII with 13–17 setae on a transvers band; the longest seta on tergites I–V 4.8–7.3 times as long as basal width of antennal segment III, on marginal sclerites 5.0–7.3 times and on tergite VIII 5.2–7.5 times as long as the above mentioned width. Siphunculi 1.7–2.8 times as long as the top width. Cauda broadly rounded, with 12–17 setae.

Oviparous female. Similar to the apterous viviparous female (autumn generation), but differs from it in the following characters:

Body 2.67–3.60 mm long. Hind tibiae not swollen, with 19–73 scent plaques. Abdominal tergite VIII with 13–17 setae arising from scleroites arranged in transversely and 2–5 additional setae without scleroites each marginally. Siphunculi with reticulation in 2 rows at apex.

Male. Similar to the alate viviparous female, but differs from it in the following characters:

Antennae with 104–107 secondary rhinaria on segment III, 40–43 on IV and 18–29 on V. Ultimate rostral segment as long as segment II of hind tarsus. Abdomen with 4 seta-bearing spinal scleroites on tergite I, an oval-shaped spinal sclerite bearing 4–6 setae on each of tergites II–VI, and a short band bearing 6 setae on tergite VIII. Cauda rounded, with 13 setae.

Specimens examined. The following specimens were collected from *Acer insulare* at the Amami-Ōshima Island, Kagoshima Prefecture, south-western Japan. Except for specimens collected on 16 March 2019 at Asani by the author (SS), all were collected by T. Nakagawa. Holotype: one apterous viviparous female, 10.v.2014, Asani, Naze. Paratypes: two fundatrices, 20.ii.2019, Asani; fifteen apterous viviparous females, the same data as the holotype; nine apterous viviparous females, 16.iii.2019, SS, Asani; one alate viviparous female, 26.iii.2018, Asani; two alate viviparous females, 16.iii.2019, SS. Other specimens examined: *Fundatrix*: 2exs., 2.ii.2019, Asato, Naze. *Apterous viviparous female (spring generation)*: 4exs., 8.iv.2018, & 3exs., 22.iv.2018, Asani; 1ex, 22.iv.2018, Ôdana, Yamato-son. *Alate viviparous female*: 1ex, 17.iii.2018, & 1ex, 8.iv.2018, Asani; 3exs, 8.iv.2019, Asato. *Aestivating dimorph*: 12exs., 8.iv.2018 & 5exs. 16.iii.2019, SS, Asani. *Mature dimorph*: 4exs., 2.xii.2018 & 1ex., 24.xii.2018, Asani; 4exs., 2.xii.2018; 1ex., 22.xii.2018 & 2exs., 24.xii.2018, Asato. *Apterous viviparous female (autumn generation)*: 4exs., 24.xii.2018, Asani; 11exs., 24.xii.2018, Asato. *Oviparous female*: 1ex., 24.xii.2018, Asani; 5exs., 24.xii.2018, Asato. *Male*: 1ex., 24.xii.2018, Asato.

Host plant. *Acer insulare*.

Distribution. Japan (Amami-Ōshima Is.).

Remark. The apterous viviparous female (spring generation) of this species resembles the equivalent morph of *Periphyllus acerihabitans* in showing pale green body in life but differs from the latter in having less than 20 setae on the head dorsally. On the other hand, *P. acerihabitans* has more than 30 setae on the same part.

Etymology. The species name refers to the type locality.

Periphyllus californiensis (Shinji)
[Japanese name: Momiji-nitai-ke-aburamushi]

Thomasia californiensis Shinji, 1917: 61.

Chaitophorus aceris Linnaeus: Matsumura, 1917: 354 (partim), nec *Aphis aceris* Linnaeus, 1761.

Chaitophorus japonicus Baker, 1918: 86.

Chaitophorinella acerifoliae Takahashi, 1919a: 273 & 324.

Periphyllus californiensis: Shinji, 1941: 422; Essig & Abernathy, 1952: 39; Higuchi, 1972: 95; Pashtshenko, 1987: 105; Park & Park 1995: 148; Junkiert *et al.*, 2011: 4.

Shinji (1917) originally described this species based on the apterous and alate viviparous females collected from *Acer macrophylla* (!) in April 1915 at Berkeley in California, USA. Comparison of the present equivalent morphs collected in the same season in Japan with his original description showed that the Japanese and American specimens accord in the following characters: (1) body color in life salmon-red to orange in the both morphs (Fig 5B as an example of the present apterous morph), (2) presence of transverse bands on the dorsal abdomen in the both morphs (Figs 5Ba, 5Bb as examples of the present apterous morph), (3) processus terminalis twice as long as base of antennal segment VI in the both morphs (1.7–2.4 times in the present apterous morph, 1.8–3.2 times in the present alate morph), and antennal segment III with about 18 secondary rhinaria in the alate morph (6–27 in the present alate morph). Although the host plants of the Japanese specimens differ from the host plant in the original description, morphological similarity mentioned above supports the opinion that the present specimens collected from *Acer* species belonging to the section Palmata should be identified as *Periphyllus californiensis* (Shinji). So far as I have examined color in life of the apterous morphs, fundatrix and mature dimorph showed brown (Figs 5Aa, 5Ca), and apterous viviparous female including its larva showed pinkish or purplish brown (Figs 5Ba, 5Da). Essig & Abernathy (1952) gave detailed descriptions of all morphs appearing in the life cycle of this species. The present specimens accord with their descriptions, and some diagnostic characters are added below:

Fundatrix (Fig. 5A). Body 1.90–2.66 mm long, 1.3–1.8 times as long as its maximum width. Antennae 5- or 6-segmented, 0.35–0.47 times as long as body; processus terminalis 0.67–1.0 times as long as base of ultimate segment. Ultimate rostral segment 1.8–2.4 times as long as its basal width, 0.75–0.93 times as long as segment II of hind tarsus. Hind tibiae entirely dark brown (Fig. 5Ab).

Apterous viviparous female (spring generation) (Fig. 5B). Body 1.95–3.20 mm long, 1.7–2.4 times as long as its maximum width. Antennae 6-segmented, 0.74–0.85 times as long as body; processus terminalis 1.7–2.4 times as long as base of segment VI. Ultimate rostral segment 1.7–1.8 times as long as its basal width, 0.67–0.75 times as long as segment II of hind tarsus. Hind tibiae entirely dark brown (Fig. 5Bb).

Apterous viviparous female (summer generation). Body 1.55–1.65 mm long, 1.9–2.5 times as long as its maximum width. Antennae 0.53–0.80 times as long as body; processus terminalis 2.5–2.9 times as long as base of segment VI. Ultimate rostral segment 1.8–2.2 times as long as its basal width, 0.63–0.80 times as long as segment II of hind tarsus. Hind tibiae pale brown.

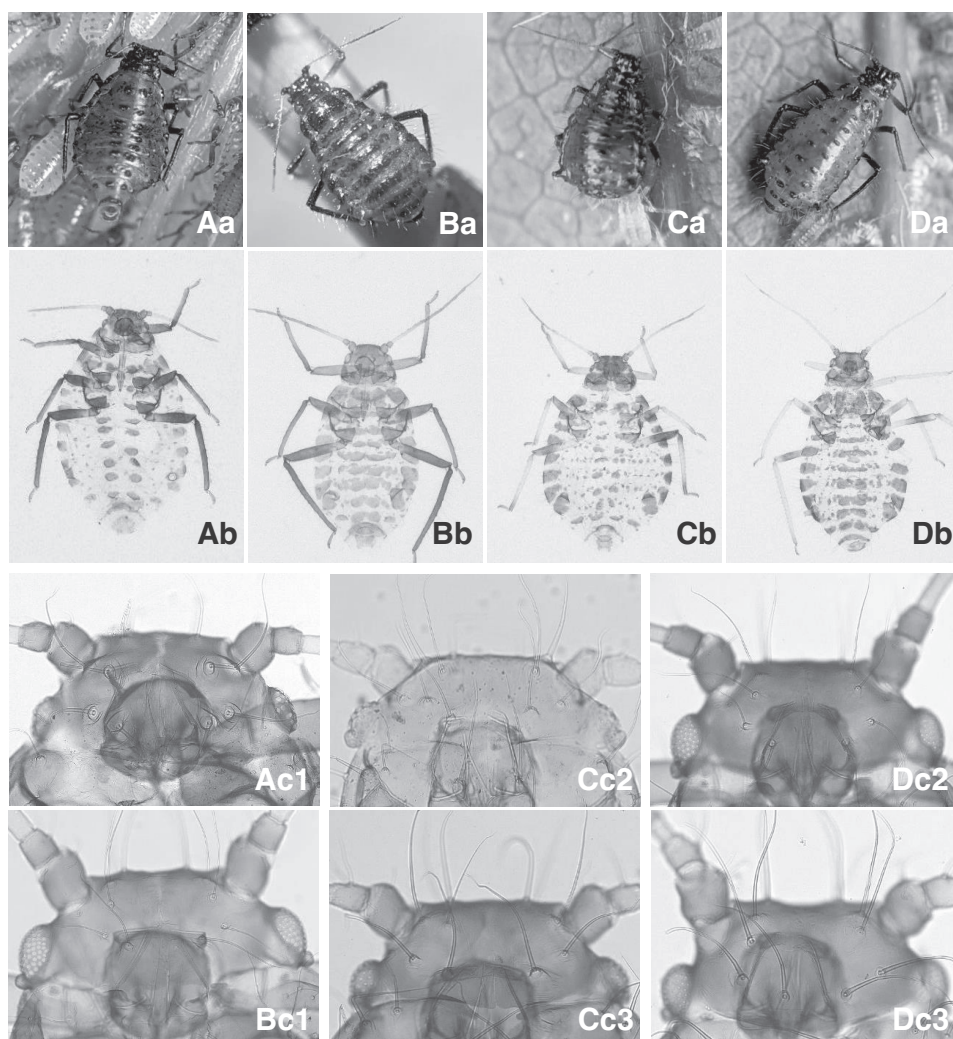


Fig. 5. *Periphyllus californiensis*. A: fundatrix, B: apterous viviparous female (spring generation), C: mature dimorph, D: apterous viviparous female (autumn generation), a: general aspect in life, b: general aspect in mounted specimen; c: head, 1: specimen collected at Kôbe in Honshû, western Japan, 2: specimen collected at Nikkô in Honshû, central Japan, 3: specimen collected at Hakodate in Hokkaidô, norther Japan.

Alate viviparous female. Body 2.00–3.45 mm long. Antennae 0.62–0.86 times as long as body; segment III with 6–27 secondary rhinaria (25 or less in 91 % of the specimens examined); processus terminalis 1.8–3.2 times as long as base of segment VI. Ultimate rostral segment 0.59–0.80 times as long as segment II of hind tarsus.

Aestivating dimorph. Body 0.61–0.67 mm long, 0.34–0.40 mm wide. Antennae 4-segmented, 0.46–0.54 times as long as body; processus terminalis 0.67–1.0 times as long as base of segment IV.

Mature dimorph (Fig. 5C). Body 1.22–2.55 mm long, 1.4–1.9 times as long as its maximum width. Antennae 6-segmented, 0.45–0.70 times as long as body; processus terminalis 1.2–1.7 times as long as base of segment VI. Ultimate rostral segment 1.1–1.6 times as long as its basal width, 0.62–0.75 times as long as segment II of hind tarsus. Hind tibiae pale brown (Fig. 5Cb).

Apterous viviparous female (autumn generation) (Fig. 5D). Body 2.20–3.21 mm long, 1.5–2.1 times as long as its maximum width. Antennae 0.50–0.69 times as long as body; processus terminalis 2.0–3.0 times as long as base of segment VI. Ultimate rostral segment 1.5–1.7 times as long as its basal width, 0.62–0.75 times as long as segment II of hind tarsus. Hind tibiae entirely dark brown, pale brown at middle or entirely pale (Fig. 5Db).

In the population of Hokkaidô, northern Japan, the dorsal setae on head are as thick as those of the mature dimorph (Fig. 5Dc3 vs. Fig. 5Cc3) and stouter than those on head of the equivalent morph from Honshû (Fig. 5Dc3 vs. Fig. 5Dc2). To understand this difference, the further morphological study based on the specimens collected throughout the year in Hokkaidô is needed.

Oviparous female. Body 2.40–3.55 mm long. Hind tibiae swollen, with numerous scent plaques. Antennae 0.43–0.61 times as long as body; processus terminalis 1.8–2.9 times as long as base of segment VI. Ultimate rostral segment 0.63–0.80 times as long as segment II of hind tarsus.

Male. Antennae with 59–95 secondary rhinaria on segment III, 18–44 on IV and 9–23 on V. Antennae 0.68–0.87 times as long as body; processus terminalis 1.8–3.0 times as long as base of segment VI. Ultimate rostral segment 0.69–0.80 times as long as segment II of hind tarsus.

Specimens examined. Abbreviations of the *Acer* species on which each morph was collected are as follows: AA: *A. amoenum*, AC: *A. carpiniifolium*, AJ: *A. japonicum*, AP: *A. palmatum*, AR: *A. rufinerve*, ASI: *A. sieboldianum*, ASH: *A. shirasawanum*, AT: *A. tenuifolium*.

Fundatrix: 1ex., 3.v.2015, on AT & 1ex., 3.v.2015, on ASH, Nikkô Botanical Garden (NBG), Nikkô, Tochigi Pref.; 2exs., 19.iv.2015, on AT, Mt. Takako, Hachioji, Tôkyô; 3exs., 30.iii.2014, on AP, Honmoku, Naka-ku, Yokohama, Kanagawa Pref.; 3exs., 6.iv.2014, on AP, 1ex., 13.iv.2014, on AA, 4exs., 13.iv.2013, on ASI & 2exs., 27.iv.2014, on AA, Nanasawa, Atsugi, Kanagawa Pref.; 2exs., 29.iv.2014, on AR & 3exs., 29.iv.2015, on AA, Moto-Hakone, Hakone, Kanagawa Pref.; 1ex., 28.iii.2010, on AP, Kasuganomichi, Chûô-ku, Kôbe, Hyôgo Pref. *Apterous viviparous female (spring generation)*: 3exs., 3.v.2015, on AT, NBG; 2exs., 2.v.2019, on AC, Tamozawa, Nikkô, Tochigi Pref.; 8exs., 27.v.2019, on AP, Aomi, Kôtô-ku, Tôkyô; 2exs., 19.iv.2014, on AP, 2exs., 19.iv.2014, on AA, & 3exs., 19.iv.2019, on ASI, Mitsuike, Kawasaki, Kanagawa Pref.; 2exs., 29.iv.2015, on AP, Moto-Hakone; 2exs., 18.iv.2010, on AP, Kasuganomichi; 6exs., 4.v.2014, on AP, Mt. Futatabi, Chûô-ku, Kôbe, Hyôgo Pref.; 6exs., 12.v.2018, on AP, Mt. Hikosan, Soedamachi, Fukuoka Pref. *Apterous viviparous female (summer generation)*: 4exs., 21.ix.2014, on ASH, Tamozawa. *Alate viviparous female*: 1ex., 8.x.2020, on AA & 1ex., 8.x.2020, on AJ, Goryôkaku, Hakodate, Hokkaidô; 3exs., 3.v.2015, on ASH, NBG; 1ex., 2.v.2019, on AC, Tamozawa; 5exs., 27.v.2019, on AP, Aomi; 4exs., 19.iv.2014, on AP, 3exs., 19.iv.2014 on ASI & 4exs., 19.iv.2014, on AA, Mitsuike; 8exs., 5.iv.2014 & 1ex., 15.xii.2013, on AP, Honmoku; 3exs., 24.xi.2013, on AA, 1ex., 30.xi.2013, on AP & 1ex., 7.xii.2014, on AP, Nanasawa; 2exs., 18.iv.2010, on AP, Kasuganomichi. *Aestivatind dimorph*: 5exs., 27.v.2019, on AP, Aomi; 5exs., 8.iv.2014, on AA, Mitsuike; 5exs., 12.iv.2012, on AP, Honmoku; 3exs., 27.iv.2014, on ASI, Nanasawa. *Mature dimorph*: 2exs., 8.x.2020, on AA & 9exs., 8.x.2020, on AJ, Goryôkaku; 4exs., 9.x.2020, on AJ,

Kamiyunokawa, Hakodate, Hokkaidô; 8exs., 21.ix.2014, on *ASI*, Tamozawa: 1ex., 16.xi.14, on *AP*, Mt. Takao. *Apterous viviparous female (autumn generation)*: 5exs., 8.x.2020, on *AA* & 6exs., 8.x.2020, on *AJ*, Goryôkaku.; 5exs., 3.xi.2020, on *AA*, Tamozawa; 1ex., 16.x.2014, on *AP*, Mt. Takao; 1ex., 26.x.2014, on *AA*, Mt. Kôbôyama, Hadano, Kanagawa Pref. *Oviparous female*: 1ex., 23.x.2015, on *AA*, Gojyôdôri, Asahikawa, Hokkaidô, T. Matsuzawa leg; 8exs., 8.xi.2014 & 1ex., 9.xi.2019, on *ASH*, Tamozawa; 7exs., 15.xii.13, on *AP*, Honmoku; 2exs., 30.xi.2013 & 2exs., 7.xii.2013, on *AP*, Nanasawa; 8exs., 30.xi.2013 & 4exs., 23.xi.2014, on *AA*, Nanasawa; 1ex., 8.xii.2014, on *AP*, Funako, Atsugi, Kanagawa Pref.: 8exs. 7.xii.2014 & 8exs., 12.xii.2020, on *ASI*, Nanasawa. *Male*: 1ex., 8.xi.2014 & 1ex., 9.xi.2019, on *ASH*, Tamozawa; 2exs., 30.xi.2013 & 2exs., 7.xii.2014, on *AP*, Nanasawa; 3exs., 6.xii.2014, on *AP*, Funako: 1ex., 30.xi.2013 & 1ex., 23.xi.2014, on *AA*, Nanasawa; 3exs., 7.xii.2014, on *ASI*, Nanasawa.

Host plant. *Acer amoenum*, *A. carpinifolium*, *A. japonicum*, *A. palmatum*, *A. rufinerve*, *A. sieboldianum*, *A. shirasawanum* & *A. tenuifolium*. Besides the plants mentioned above, the followings are recorded as a host from Japan: *Aesculus turbinata* (as *Chaitophorinella acerifoliae*: Takahashi, 1919a) and from the foreign countries: *Acer pseudosieboldianum*, *A. mono*, *A. negundo* & *A. platanoides* (the Russian Far East: Pashtshenko, 1987); *Acer campestre*, *A. circinatum*, *A. macrophyllum*, *A. negundo*, & *Aesculus californica* (USA: Essig & Abernathy, 1952), *Acer miyabei* (as an interception record at USA from England: Essig & Abernathy, 1952); *Acer oblongum* (India: Ghosh, 1980).

Distribution. Japan (Hokkaidô, Honshû, Shikoku, Kyûshû). Other Asian region (China, Korea, Taiwan, Thailand, India, the Russian Far East); Europe (England, Netherlands, Italy, Denmark, Croatia, Germany, Switzerland, Poland); North America (USA, Canada); Pacific Ocean (Australia, New Zealand) (after Junkiert *et al.*, 2011).

Remark. Among the *Acer* species mentioned above as the host plant, *A. amoenum*, *A. circinatum*, *A. japonicum*, *A. palmatum*, *A. pseudosieboldianum*, *A. sieboldianum*, *A. shirasawanum* and *A. tenuifolium* belong to the section Palmata of the genus *Acer* (Ogata, 1967). Most specimens of *P. californiensis* examined in this study were collected from *Acer* species belonging to the section Palmata. Moreover, morphs collected from these *Acer* species included not only viviparous generation but also the fundatrix, oviparous female, and male. Pashtshenko (1987) has already mentioned that *A. pseudosieboldianum* is the main host plant for this aphid in the Russian Far East and *A. mono*, *A. negundo* and *A. platanoides* are rare hosts. In Japan, Takahashi (1919a) referred to *Acer carpinifolium* and *Aesculus turbinata* as rare hosts of *Chaitophorinella acerifoliae* (= *P. californiensis*). In this study, this species was collected only once from *A. rufinerve* belonging to the section Macrantha at Moto-Hakone in Kanagawa Prefecture, although I have observed other aphids on *A. rufinerve* at many sites (cf. Sugimoto, 2013, 2020). These suggest that *P. californiensis* is strongly associated with *Acer* species belonging to the section Palmata. *Acer japonicum* belonging to the section Palmata is infested by *P. acerijaponicus* sp. nov. as well as *P. californiensis*. The differences between the two aphid species are stated in the remark of *P. acerijaponicus* sp. nov.

Essig & Abernathy (1952) documented the following collection records from *Acer* species other than the section Palmata and from plants other than the genus *Acer* in the United States: *A. macrophyllum* (in 1915, the specimen used in the original description of this aphid), *A. campestre* (in 1925), *A. negundo* (in 1932) & *Aesculus californica* (in 1935). They also showed some quarantine records of *P. californiensis* (including the possibility of this aphid) in association with the importation of *A. palmata* and

Acer sp. from Japan, England and Holland into the United States from 1925 to 1948. Regarding the international trade of maples produced in Japan, Kondo (2021) notes that the Yokohama Nursery Company has been exporting maples, mainly the Japanese maple *A. palmatum* and its horticultural varieties since 1891, and that large quantities of the maples were exported to England and the United States from 1912 to 1921. Based on the collection and quarantine records in the United States, Essig & Abernathy (1952) mentioned that “this species (= *P. californiensis*) was also probably introduced into England and elsewhere in America on Japanese ornamental maples and spread to our native maples, *A. macrophyllum* Pursh and *A. circinatum* Pursh”. The fact that *P. californiensis* was found on some *Acer* species native to the United States seems to occur only in an early stage of invasion of this aphid. Similar cases have been reported in the *Solidago altissima*-infesting aphid *Uroleucon nigrotuberculatum* in Japan (Sugimoto & Matsumoto, 2000).

The characters of “*P. californiensis*” from India in the descriptions by Ghosh (1980) and Chakrabarti *et al.* (1987) do not accord with those of Japanese population in the following points: body light yellow in life, first tarsal chaetotaxy 7:7:7, and number of secondary rhinaria (30–34) on the antennal segment III in the alate viviparous female. These differences indicate the possibility that the population identified as *P. californiensis* from India is an unknown *Periphyllus* species.

Periphyllus chidoricola sp. nov.

[Japanese name: Chidorinoki-nitai-ke-aburamushi]

Fundatrix (Fig. 6A). Color in life: body yellowish brown to brown. Color in mounted specimen: head dark brown; antennae dark brown except basal 1/3 of segment III pale brown; legs dark brown except trochanter and basal 1/5 of femora pale brown; pronotum brown; meso- and metanotum and abdomen pale with brownish scleroites dorsally and sclerites marginally; siphunculi dark brown.

Body rounded, 2.32–2.65 mm long, 1.5–1.7 times as long as its maximum width. Head smooth dorsally and ventrally; dorsum with 8 setae, of which 4 setae on the anterior half are longer, 4.3–6.3 times as long as basal width of antennal segment III, setae on the posterior half shorter, 2.0–4.0 times as long as the above-mentioned width. Antennae 6-segmented, 0.36–0.50 times as long as body; basal two segments smooth, flagella imbricated except basal half of segment III; segment I with 3–5 setae; segment III with 5–7 setae, of which the longest one is 1.3–3.1 times as long as basal width of the segment; segment IV with 1 or 2 setae; segment V with 1 or 2 setae; segment VI with 1 or 2 setae on base; processus terminalis 0.75–1.0 times as long as base of segment VI. Ultimate rostral segment 1.6–1.9 times as long as its basal width, 0.77–0.87 times as long as segment II of hind tarsus. Tibiae smooth, with spinules on distal part and on distal 3/8 of inner side of hind tibiae; the longest seta on hind tibiae 2.2–3.2 times as long as the wide at the middle of the tibia. First tarsal chaetotaxy 5:5:5. Abdomen membranous with 2 pairs of seta-bearing spinal scleroites and small marginal sclerites on each of tergites I–VII, with a pair of seta-bearing pleural scleroites and a transverse band on tergite VIII, sometimes inner spinal and pleural scleroites and marginal sclerites on tergites VI and VII inconspicuous; marginal sclerites with 1 or 2 setae on tergite I, 2–5 setae on II–V and 2 or 3 on V–VII; tergite VIII with 8–14 setae on the band; the longest seta on tergites I–V 1.6–3.3 times as long as basal width of antennal segment III, on marginal sclerites 3.0–5.4

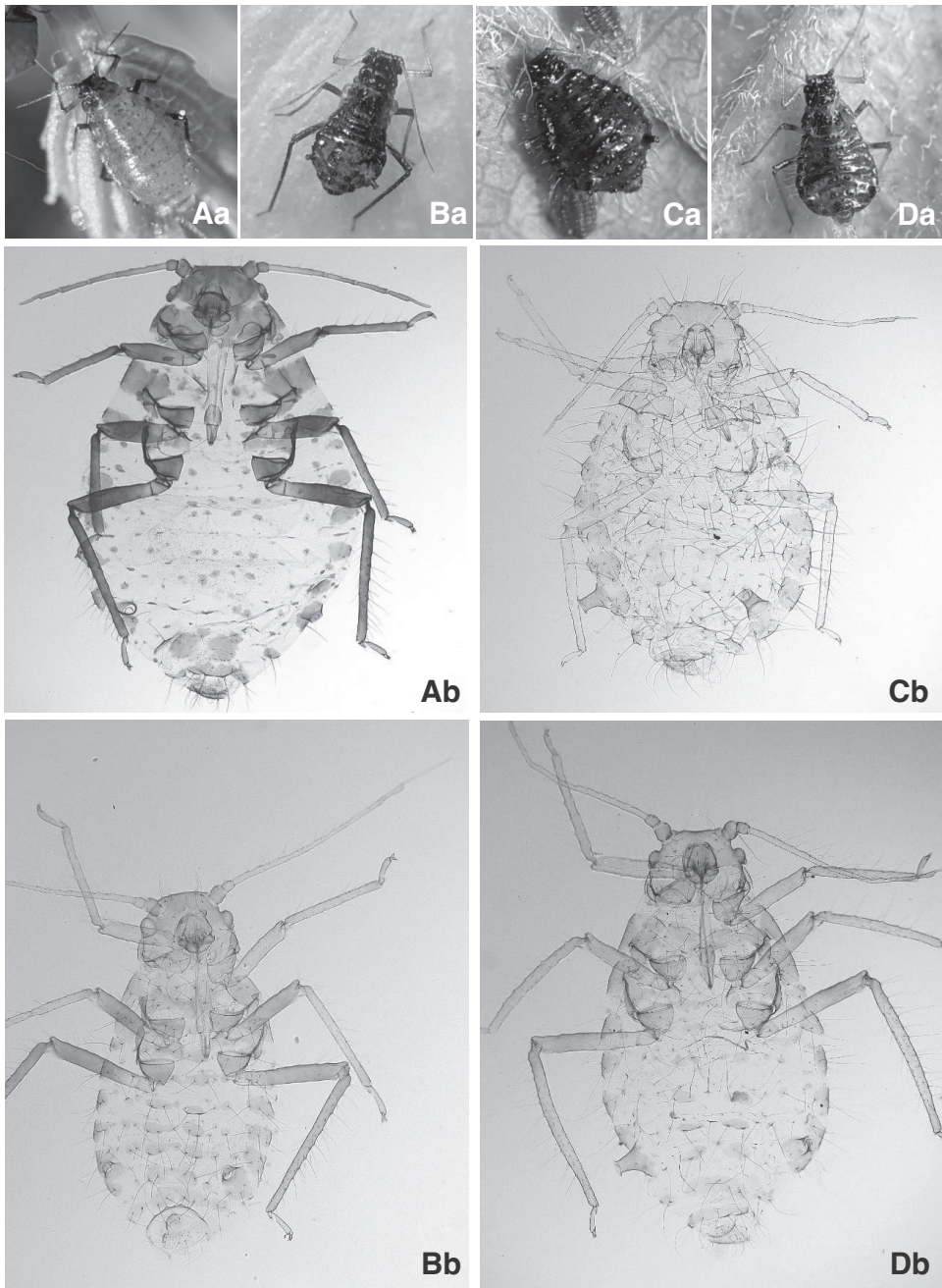


Fig. 6. *Periphyllus chidoricola* sp. nov. A: fundatrix, B: altiform apterous viviparous female (spring generation), C: mature dimorph, D: apterous viviparous female (autumn generation), a: general aspect in life, b: general aspect in mounted specimen.

times and on tergite VIII 6.3–7.7 times as long as the above mentioned width. Siphunculi truncated, 0.6–0.9 times as long as the top width, with reticulation in 2 or 3 rows at apex, with a flange. Cauda broadly rounded, with 10–15 setae.

Apterous viviparous female (spring generation) (Fig. 6B). Differs from the fundatrix in the following characters:

Color in life: body greenish black, but larvae pale green. Color in mounted specimen: the pigmentation is weaker than that of the fundatrix, especially in the antennal segments III–V and the fore legs.

Body oval, 1.30–1.78 mm long, 2.0–2.4 times as long as its maximum width. Head dorsally with 8 setae, all of which are almost same length, 5.3–7.2 times as long as basal width of antennal segment III. Antennae 0.77–0.86 times as long as body; segment I with 4–6 setae; segment III with 8–14 setae, of which the longest one is 4.3–5.2 times as long as basal width of the segment; segment IV with 2–5 setae; segment V with 2–4 setae; segment VI with 1 or 2 setae on base; processus terminalis 2.1–2.8 times as long as base of segment VI. Ultimate rostral segment 2.4–2.8 times as long as its basal width, 0.80–0.86 times as long as segment II of hind tarsus. Abdomen with a pair of spinal sclerites bearing 2 (in some specimens 3 or 4) long setae on each of tergites I–VII, with 2 pairs of seta-bearing pleural sclerites on each of tergites I–V and a pair of seta-bearing pleural sclerites on tergite VI; marginal sclerites with 2–5 setae on tergites I and VI, 6–10 setae on II–V and 2 setae on VII; the longest seta on tergites I–V 5.3–7.2 times as long as basal width of antennal segment III, on marginal sclerites 5.0–7.2 times and on tergite VIII 5.7–8.4 times as long as the above mentioned width. Siphunculi 1.0–1.3 times as long as the top width.

Seven of the 10 specimens examined were alatform apterae. Of them, five had rudimentary ocelli, undeveloped wings and 5–12 secondary rhinaria on antennal segment III, while two had only rudimentary ocelli.

Alate viviparous female. Color in life: abdomen pale green to green with black bands dorsally. Color in mounted specimen, the following parts dark brown: head, antennal segments I and II, thorax, middle and hind femora except basal parts, hind tibiae, dorsal bands and marginal sclerites, and siphunculi.

Body 1.85–3.36 mm long. Head dorsally with 8 setae, of which the longest one is 6.7–9.5 times as long as basal width of antennal segment III. Antennae 6-segmented, 0.68–0.95 times as long as body; segment III with 13–30 (20 or more in 74% of the specimens examined) round-shaped secondary rhinaria along the whole segment, with 10–17 setae, of which the longest one is 5.0–7.8 times as long as basal width of the segment; segment IV usually with no rhinarium (rarely 1), with 3–8 setae; segment V with 2–6 setae; segment VI with 1 or 2 setae on base; processus terminalis 2.1–3.2 times as long as base of segment VI. Ultimate rostral segment 1.8–2.0 times as long as its basal width, 0.71–0.90 times as long as segment II of hind tarsus. Tibiae smooth, with spinules on distal 1/3 of all tibiae, with many long setae, the longest seta on hind tibiae 3.4–5.0 times as long as the width at the middle of the tibia. Abdomen with a broad band on each of tergites I–VII, with 3 or 4 pairs of setae arranged roughly in single row on each band; tergites VIII with 10–14 setae on a transverse band; marginal sclerites developed on tergites II–V, each sclerite with 10–14 setae. Siphunculi truncated, 1.4–2.2 times as long as the top width, reticulated on distal 3/5 and imbricated on basal 2/5, with a flange. Cauda rounded, with 12–21 setae.

Aestivating dimorph. Color in life: body whitish green.

Body 0.55–0.70 mm long, 0.26–0.37 mm wide. Head with spinal suture stretching to abdomen, with 4 rounded lamellae near anterior margin. Antennae 4-segmented, 0.47–0.51 times as long as body; segment I strongly protruded anteriorly, with 2 lamellae which are curved outward and smaller than those on head; segment II with 1 stout and blunt seta, of which length is as half as basal width of segment III; processus terminalis 0.71–1.11 times as long as base of segment IV. Meso- and metanotum each with a pair of lamellae marginally, of which ones on mesonotum are slenderer than those on metanotum. Rostrum passing middle coxae. Fore tibiae with 5 or 6 and middle tibiae with 6 or 7 small leaf-like lamellae, of which the basal and apical ones are sometimes slender or sickle-like in shape. Hind tibiae with normal setae, the longest one 1.5–1.7 times as long as the width at the middle of the tibia. Metanotum and abdominal tergites I–VI each with spinal and lateral plates. Metanotum and abdominal tergites I–VI each with spinal and lateral plates; each spinal plate with one spinule. Abdominal tergites I–VII each with a pair of rounded lamellae marginally; VII also with a pair of leaf-like lamellae dorso-posteriorly; VIII with a pair of leaf-like lamellae posteriorly, which are little wider than dorso-posterior ones on VII.

Mature dimorph (Fig. 6C). Similar to the fundatrix in the body shape, but differs from it in the following characters:

Color in life: body dark brown. Color in mounted specimen: all legs and antennal segments pale yellow.

Body somewhat small, 1.25–2.12 mm long. Head: the longest seta on dorsum 6.0–8.4 times as long as basal width of antennal segment III. Antennae 0.46–0.64 times as long as body; segment III with 4–8 setae, of which the longest one is 5.0–6.2 times as long as basal width of the segment; processus terminalis 1.2–1.5 times as long as base of segment VI. Ultimate rostral segment 1.6–2.0 times as long as its basal width, 0.86–1.0 times as long as segment II of hind tarsus. Tibiae smooth, with spinules on distal 1/3 of inner side of hind tibiae, with many long setae, of which the longest one on hind tibiae is 3.0–4.3 times as long as the width at the middle of the tibia. Abdomen: marginal sclerites with 3–5 setae on tergites I and VI, 5–9 setae on II–V and 2 setae on VII; the longest seta on tergites I–V 7.5–8.7 times as long as basal width of antennal segment III, on marginal sclerites 7.5–9.1 times and on tergite VIII 7.5–10.7 times as long as the above mentioned width. Siphunculi 1.0–1.4 times as long as the top width. Cauda broadly rounded, with 7–12 setae.

Apterous viviparous female (autumn generation) (Fig. 6D). Similar to the mature dimorph, but differs from it in the following characters:

Color in mounted specimen: hind femora and base of hind tibiae brownish. Body oval, 1.9–3.1 mm long, 1.7–2.1 times as long as its maximum width. Antennae 0.57–0.71 times as long as body; segment I with 5–7 setae; segment III with 8–16 setae; segment IV with 3–6 setae; segment V with 3 or 4 setae; segment VI with 1 or 2 setae on base; processus terminalis 2.3–2.8 times as long as base of segment VI. Ultimate rostral segment 1.8–2.2 times as long as its basal width, 0.77–0.90 times as long as segment II of hind tarsus. Siphunculi 1.3–1.9 times as long as the top width, with reticulation on distal 1/3. Cauda broadly rounded, with 8–15 setae.

Some specimens examined are alatform with rudimentary ocelli near antennal segment I on the head.

Oviparous female. Similar to the apterous viviparous female (autumn generation), but differs from it in the following characters:

Body 2.80–3.13 mm long. Ultimate rostral segment 0.81–0.84 times as long as segment II of hind tarsus. Hind tibiae swollen, with numerous scent plaques. Abdominal tergite VII without a spinal band, with 4 pairs of setae-bearing scleroites; tergite VIII without a transvers band, with 18–26 setae transversely including short marginal ones.

Male. Similar to the alate viviparous female, but differs from it in the following characters:

Antennae with 76–110 secondary rhinaria on segment III, 28–45 on IV and 8–24 on V. Ultimate rostral segment 0.79–1.0 times as long as segment II of hind tarsus. Abdomen with a sclerotic short band bearing 4 setae on each of tergites I–VII; these bands on tergites III–V more or less rounded. Cauda rounded, with 10–13 setae.

Specimens examined. All specimens were collected from *Acer carpinifolium*. Holotype: one fundatrix, 2.v.2019, Tamozaawa, Nikkō, Tochigi Pref. Paratypes: three fundatrices, the same data as the holotype; two apterous viviparous females, 5.v.2014, Mt. Takao, Hachiōji, Tōkyō; three apterous viviparous females, 18.v.2014, Mt. Takao; four apterous viviparous females, 27.x.2018, Shimotanigami, Kōbe; one apterous viviparous female, 24.x.2020, Tamozaawa. Other specimens examined: *Fundatrix*: 1ex., 19.iv.2015, Mt. Takao, Hachiōji, Tōkyō; 1ex., 29.iv.2015 & 3exs., 10.iv.2021, Motohakone, Hakone-machi, Kanagawa Pref. *Apterous viviparous female (spring generation)*: 4exs., 5.v.2014, Mt. Takao; 1ex., 29.iv.2015, Motohakone. *Alate viviparous female*: 2exs, 17.v.2015, 5exs, 2.v.2019 & 10exs, 19.v.2019, Tamozaawa; 1ex., 19.iv.2013, 15exs, 5.v.2014 & 7exs., 18.v.2014, Mt. Takao; 5exs., 29.v.2015 & 7exs., 10.iv.2021, Motohakone; 5exs., 4.xi.2013, Kamitanigami, Kōbe, Hyōgo Pref.; 2exs., 27.x.2018, Shimotanigami, Kōbe; 4exs., 29.iv.2018, Mt. Hikosan, Soeda-machi, Fukuoka Pref. *Aestivating dimorph*: 2exs., 17.v.2015 & 3exs., 17.v.2019, Tamozaawa; 5exs., 18.v.2014, Mt. Takao. *Mature dimorph*: 2exs., 8.ix.2014, 5exs., 21.ix.2014 & 1ex., 18.x.2015, Tamozaawa. *Apterous viviparous female (autumn generation)*: 3exs., 8.xi.2014, 3exs., 18.x.2015 & 7exs., 3.xi.2020, Tamozaawa. *Oviparous female*: 1ex., 8.xi.2014, Tamozaawa. *Male*: 1ex., 8.xi.2014 & 2exs., 9.xi.2019, Tamozaawa; 1ex., 4.xi.2013, Kamitanigami.

Host plant. *Acer carpinifolium*.

Distribution. Japan (Honshū, Kyūshū).

Remark. This species resembles *P. californiensis*, but the fundatrix of *P. chidoricola* differs from that of *P. californiensis* in having reduced sclerotization on the dorsal abdomen (Fig. 6A vs. Fig. 5A), and in having shorter setae on the dorsum of head and on the anterior half of the abdominal tergum. In life, the apterous viviparous female (spring generation) of *P. chidoricola* shows greenish black (Fig. 6Ba), and its larvae pale green, while that of *P. californiensis* (Fig. 5Ba) and its larvae show purplish brown. In mounted specimens, the ratio of the length of ultimate rostral segment to the length of segment II of hind tarsus may be useful as a diagnostic character between the equivalent morph of both species: apterous viviparous female (spring generation) 0.80–0.86 in this species vs. 0.63–0.80 in *P. californiensis* examined in this study, mature dimorph 0.86–1.0 vs. 0.62–0.75, apterous viviparous female (autumn generation) 0.77–0.90 vs. 0.62–0.75, alate viviparous female 0.71–0.90 vs. 0.59–0.80, oviparous female 0.81–0.84 vs. 0.63–0.80, male 0.79–1.0 vs. 0.69–0.80.

Etymology. The species name refers to the Japanese name “Chidori-no-ki” of the host plant.

Periphyllus hokkaidensis Sorin
[Japanese name: Ezoitaya-nitai-ke-aburamushi]

Chaitophorus aceris Linnaeus: Matsumura, 1919: 115 (partim); nec *Aphis aceris* Linnaeus, 1761.

Periphyllus hokkaidensis Sorin, 1990: 802.

Sorin (1990) gave detailed descriptions of the apterous and alate viviparous females. Based on the present specimens, descriptions of the oviparous female and male, and some additional characters of the apterous viviparous female are given below:

Apterous viviparous female (autumn generation) (Figs 7A, 7B). Body 1.45–1.86 mm long, 1.6–2.1 times as long as its maximum width. Head dorsally with 12–17 setae, of which the longest one is 3.3–4.4 times (3.3–4.0 in the specimens collected on September, 4.0–4.4 in those collected on October) as long as basal width of antennal segment III. Antennae 0.54–0.66 times as long as body; segment I with 4–6 setae; segment III with 8–12 setae, of which the longest one is 2.7–4.7 (2.7–4.0 in the specimens collected on September, 4.0–4.7 in those collected on October) times as long as basal width of the segment; segment IV with 4–8 setae; segment V with 3–6 setae; segment VI with 2 setae on base; processus terminalis 1.5–2.0 times as long as base of segment VI. Ultimate rostral segment 1.7–2.1 times as long as its basal width, 0.75–0.86 times as long as segment II of hind tarsus. Tibiae with many long setae, of which the longest one on hind tibiae is 2.2–3.8 times as long as the width at the middle of the tibia. Abdomen with a broad band and marginal sclerites on each of tergites I–VII, and with a transverse band on tergite VIII (Fig. 7A), in some specimens, these bands on tergites I–VI are broken at the middle and formed pairs of large sclerites (Fig. 7B); marginal sclerites with 2 or 3 setae on tergites I, VI and VII and 4–8 setae on II–V; tergites VIII with 10–15 setae on the band; the longest seta on tergites I–V 3.0–4.0 times as long as basal width of antennal segment III, on marginal sclerites 3.1–4.4 times and on tergite VIII 4.6–6.0 times as long as the above mentioned width. Siphunculi truncated, 0.68–1.0 times as long as the top width. Cauda with 16–20 setae.

Oviparous female (Fig. 7C). Differs from the apterous viviparous female in the following characters:

Color in life: body reddish brown with dark brownish dorsal bands. Body 2.00–2.90 mm long, 2.0–2.5 times as long as its maximum width. Hind tibiae not swollen with 4–66 scent plaques (4–40 scent plaques in 80% of 56 tibiae examined). Abdomen elongated on the posterior segments; tergite VI with 8–10 setae, of which all setae or some spinal ones are arising from scleroites or from sclerites made by the fusion of several scleroites; tergite VII with 11–14 setae between spiracles, these setae usually lacking scleroites at their bases, but sometimes spinal 4–6 ones with small scleroites; tergites VIII without a dorsal band nor scleroites, totally with 34–49 setae, of which 11–14 setae are long and arranged transversely, and 10–15 setae on each side are short and thin. Siphunculi weakly imbricated, with reticulation in 1 or 2 rows at apex. Cauda with 27–39 setae.

Male (Fig. 7D). Apterous. Differs from the apterous viviparous female in the following characters:

Color in life: body black. Body 1.55–1.95 mm long, 2.3–2.6 times as long as its maximum width. Head with rudimentary ocelli near antennal segment I; the longest setae on dorsum 5.2–6.0 times as long as basal width of antennal segment III. Antennae

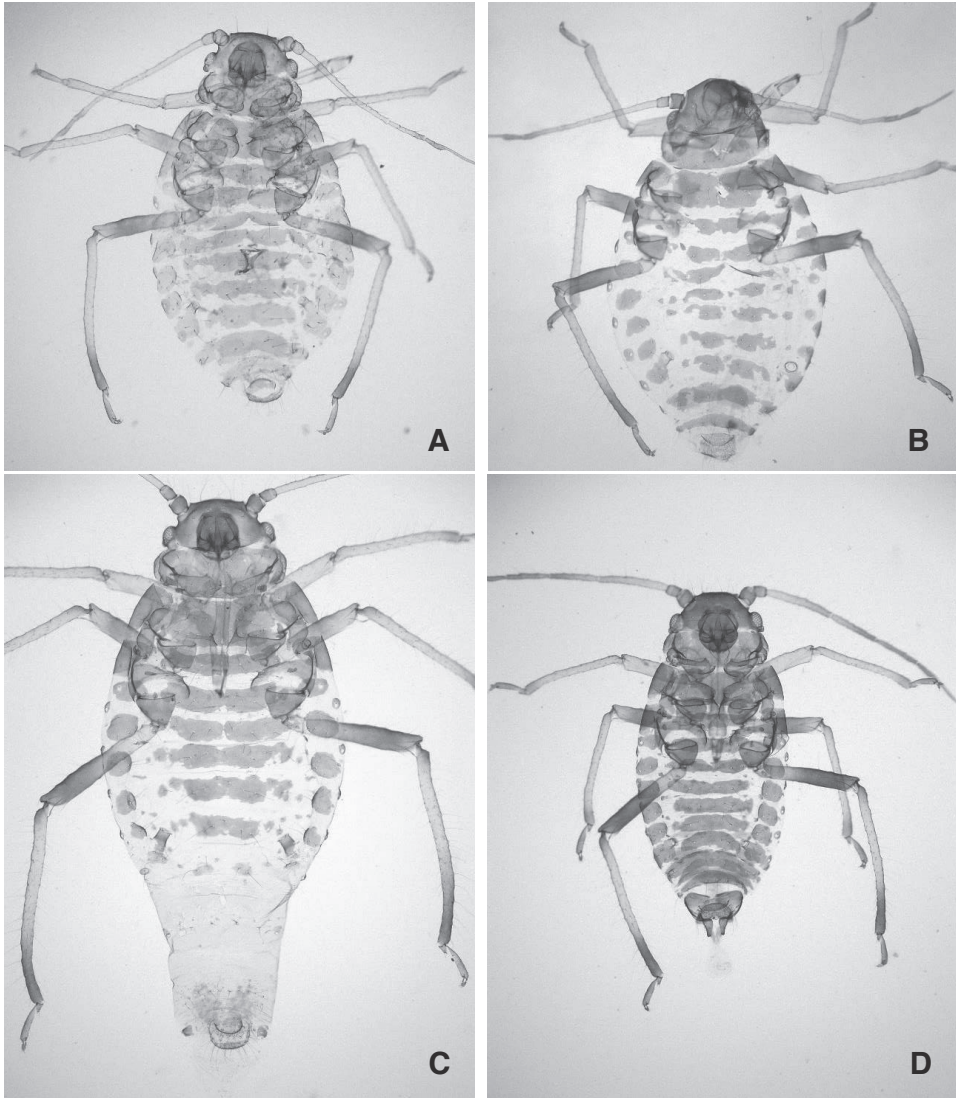


Fig. 7. *Periphyllus hokkaidensis*. A: apterous viviparous female (with a dorsal band on each of abdominal tergites I–VII), B: ditto (with a pair of large sclerites on each of abdominal tergites I–VI), C: oviparous female, D: male.

0.72–0.74 times as long as body, with 20–29 secondary rhinaria on segment III, 9–17 on IV and 4–11 on V. Hind tibiae with spinules on distal 1/8. Abdominal tergites I–VI each with 6–8 setae, VII with 7–11 setae. Siphunculi reticulated on distal 1/3, more or less smooth on basal 1/3. Cauda with 15 or 16 setae.

Specimens examined. All specimens were collected in Hokkaidô. *Apterous viviparous female*: 10exs., 28.ix.2013, on *Acer pictum* subsp. *mono*, Higashiyama-chô, Iwamizawa; 5exs., 10.x.2020, on *A. pictum* subsp. *mayrii*, Ônuma Park., Nanae-cho. *Oviparous female*: 28exs., 10.x.2020, on *A.*

pictum subsp. *mayrii*, Ônuma Park. Male: 5exs., 10.x.2020, on *A. pictum* subsp. *mayrii*, Ônuma Park.

Host plant. *Acer pictum* subsp. *mayrii* & *A. pictum* subsp. *mono*. *A. miyabei* & *A. mono* forma *subtrifidus* (after Sorin, 1990).

Distribution. Japan (Hokkaidô).

Remark. Sorin (1990) mentioned that this species differs from *P. kuwanaii* in having shorter processus terminalis in the apterous and alate viviparous females and fewer secondary rhinaria on the antennae of the alate viviparous female. These characters are also applicable to sexual morphs of both species: the ratio of the length of processus terminalis to the base of antennal segment VI 1.5–1.9 in oviparous female and 1.5–1.7 in male of *P. hokkaidensis* (2.1–3.0 in oviparous female and 2.4–2.9 in male of *P. kuwanaii* examined in this study); number of secondary rhinaria 20–29, 9–17, 4–11 on each of segments III–V in male of *P. hokkaidensis* (53–91, 29–50, 12–18 on each of III–V in male of *P. kuwanaii* examined in this study).

In the apterous viviparous females examined, some specimens had a pair of large sclerites on each of abdominal tergites I–VI as referred to in the above description (Fig. 7B). This character accords with *Periphyllus brevisetosus* which was described by Sorin (1990) based on the specimens collected on early August in Hokkaido. On the other hand, the present specimens of the apterous viviparous females, which were collected on late September and middle October, differ from the original description of *P. brevisetosus* in having larger body size (1.45–1.86 mm long in the present specimens vs. 1.25 mm long in *P. brevisetosus*) and longer setae (the longest seta on head dorsally 3.3–4.4 times and on antennal segment III 2.7–4.7 times as long as basal width of antennal segment III, respectively, in the present specimens vs. 2.71 times and 2.43 times as long as the above mentioned width, respectively, in *P. brevisetosus*). Generally speaking, the body size of *Periphyllus* species becomes small in summer. Therefore, to discuss the identity of *P. brevisetosus* and *P. hokkaidensis*, the further morphological study based on the specimens collected throughout the year is needed.

Periphyllus kajicola sp. nov.

[Japanese name: Kajikaede-nitai-ke-aburamushi]

Fundatrix (Fig. 8A). Color in life: body brown with pairs of black spots dorsally. Color in mounted specimen: head dark brown; antennae pale yellow except segments I, II, distal 1/2 of V & VI dark brown; coxae, distal 4/5 of femora, extremely base and distal 1/2 of hind tibiae dark brown; pronotum dark brown; meso- and metanotum and abdomen pale with dark brownish sclerites dorsally and marginally; siphunculi dark brown.

Body rounded, 2.60–3.05 mm long, 1.5–1.7 times as long as its maximum width. Head smooth dorsally and ventrally; dorsum with 8 stout setae, their basal width as wide as diameter of an ommatidium in compound eyes, the longest one is 4.8–7.5 times as long as basal width of antennal segment III. Antennae 6-segmented, 0.36–0.48 times as long as body; basal two segments smooth, flagella imbricated except basal half of segment III; segment I with 2–4 setae; segment III with 3–9 setae, of which the longest one is 2.5–4.4 times as long as basal width of the segment; segment IV with 1 or 2 setae; segment V with 1 seta; segment VI with 1 or 2 setae on base; processus terminalis 0.8–1.1

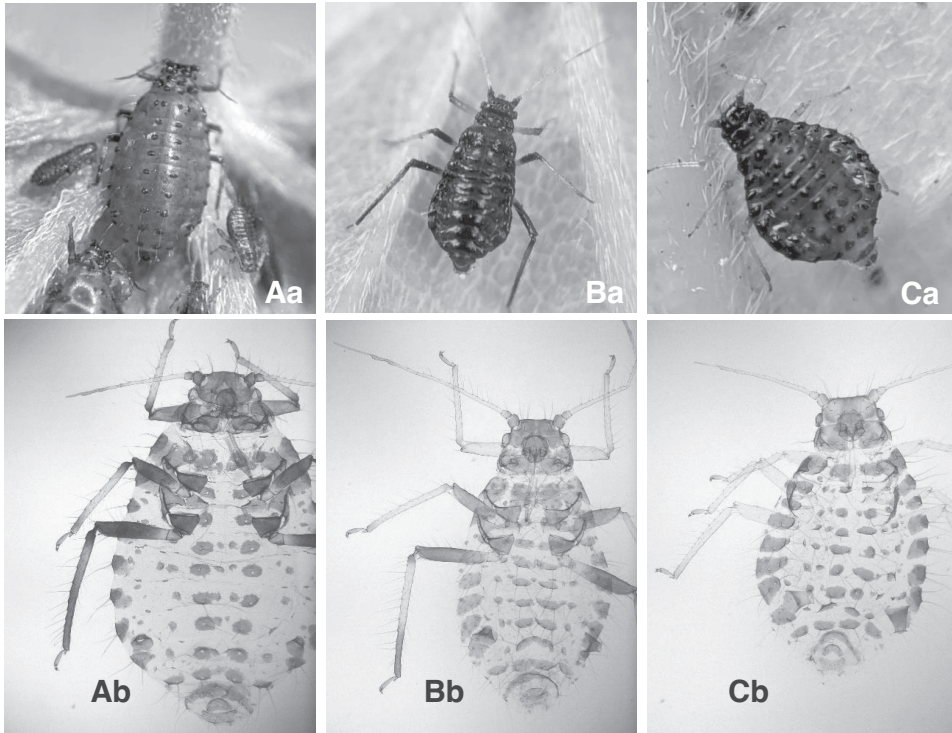


Fig. 8. *Periphyllus kajicola* sp. nov. A: fundatrix, B: apterous viviparous female (spring generation), C: mature dimorph, a: general aspect in life, b: general aspect in mounted specimen.

times as long as base of segment VI. Ultimate rostral segment 1.9–2.2 times as long as its basal width, 0.75–0.90 times as long as segment II of hind tarsus. Tibiae smooth, with spinules on distal 1/4 along inner side of hind tibiae, with many long setae, of which the longest one on hind tibiae is 2.9–3.7 times as long as the width at the middle of the tibia. First tarsal chaetotaxy 5:5:5. Abdomen membranous with a pair of spinal and marginal sclerites on each of tergites I–VII, with 1 or 2 pair of seta-bearing pleural sclerites on each side of tergites I–VI, and with a transverse band in tergite VIII; spinal sclerites usually with 2 setae, of which the outer seta is longer and stouter than inner one; marginals sclerite with 2–5 setae on tergites I and VI, 4–7 setae on II–V and 2 setae on VII; marginal setae variable in length and thickness; tergites VIII with 10–14 setae on the band; basal width of long and stout setae on spinal and marginal sclerites as wide as or slightly wider than the diameter of an ommatidium in compound eyes; the longest seta on tergites I–V 6.3–8.0 times as long as the basal width of antennal segment III, on marginal sclerites 6.3–6.3 times and on tergite VIII 5.0–8.9 times as long as the above mentioned width. Siphunculi truncated, 0.8–1.2 times as long as the top width, with reticulation in 2 rows at apex, with a flange. Cauda broadly rounded, with 13–17 setae.

Apterous viviparous female (spring generation) (Fig. 8B). Similar to the fundatrix, but differs from it in the following characters:

Color in life: body shining black. Color in mounted specimen: fore femora wholly pale brown.

Body oval, 1.80–3.38 mm long, 1.8–2.3 times as long as its maximum width; dorsal and marginal setae slenderer than those of fundatrix, their basal width narrower than diameter of an ommatidium in compound eyes. Antennae 0.59–0.82 times as long as body; segment I with 4–7 setae; segment III with 10–20 setae, of which the longest one is 2.8–5.3 times as long as basal width of the segment; segment IV with 3–10 setae; segment V with 2–6 setae; processus terminalis 2.3–3.3 times as long as the base of segment VI. Ultimate rostral segment 1.7–2.1 times as long as its basal width, 0.64–0.77 times as long as segment II of hind tarsus. Hind tibiae with spinules on distal 2/9 and on distal 1/3–1/2 along inner side. Abdominal sclerotization as in the fundatrix, sometimes tergites V–VII each with a spinal band made by the fusion of spinal sclerites; spinal sclerites usually with 2 setae, sometimes with 3 or 4 setae in the case of large sclerites; marginal sclerites with 3–7 setae on tergites I and VI, 7–15 setae on II–V and 2 setae on VII. Siphunculi 1.0–2.3 times as long as the top width, with reticulation on distal 1/4–1/3.

Thirteen of the 41 specimens examined were alatiform with 2–17 secondary rhinaria on antennal segment III and/or rudimentary ocelli near the anterior part of each compound eye.

Alate viviparous female. Color in life: abdomen dark brown with black bands dorsally. In mounted specimen, the following parts dark brown: head, antennae except segments III & IV, thorax, middle and hind femora except each basal part, hind tibiae, dorsal bands and marginal sclerites, and siphunculi.

Body 2.26–3.57 mm long. Head smooth dorsally; dorsum with 8 setae, of which the longest one is 5.7–8.3 times as long as basal width of antennal segment III. Antennae 6-segmented, 0.70–0.94 times as long as body; segment III with 21–42 secondary rhinaria, usually more than 25, along the whole segment, with 12–20 setae, of which the longest one is 4.3–6.0 times as long as basal width of the segment; segment IV usually with no rhinarium (rarely 1), with 5–11 setae; segment V with 3–7 setae; segment VI with 1 or 2 setae on base; processus terminalis 2.7–3.7 times as long as base of segment VI. Ultimate rostral segment 0.67–0.76 times as long as segment II of hind tarsus. Tibiae smooth, with spinules on distal 1/10–1/5 of fore tibiae, on distal 1/6–1/4 of middle ones, and on distal 3/10–2/5 of hind ones, with many long setae, of which the longest seta on hind tibiae is 2.9–4.3 times as long as the width at the middle of the tibia. Abdomen with a spinal band and marginal sclerites on each of tergites I–VII, and with a transverse band on tergite VIII; a spinal band with 8–12 setae transversely on each of tergites I–V, 6–9 setae between siphunculi on VI and 4–6 setae on VII, sometimes the spinal band on VII fused with marginal sclerites of the tergite; tergites VIII with 11–17 setae on the band; marginal sclerites with 7–10 setae on tergites I and VI, 9–14 setae on II–V and 2 or 3 setae on VII. Siphunculi truncated, 1.9–2.9 times as long as the top width, reticulated on basal 3/5 and imbricated on distal 2/5, with a flange. Cauda rounded, with 13–23 setae.

Aestivating dimorph. Color in life: body whitish green.

Body 0.56–0.71 mm long, 0.25–0.42 mm wide. Head with spinal suture stretching to abdomen, with 4 rounded lamellae near anterior margin. Antennae 4-segmented, 0.51–0.58 times as long as body; segment I strongly protruded anteriorly, with 2 lamellae which are curved outward and smaller than those on head; segment II with 1 stout and blunt seta, which is half of the basal width of segment III; processus terminalis 0.93–1.29

times as long as base of segment IV. Meso- and metanotum each with a pair of lamellae marginally, of which ones on mesonotum are slenderer than those on metanotum. Rostrum passing middle coxae. Fore tibiae with 5 or 6 and middle tibiae with 7 or 8 small leaf-like lamellae, of which the basal and apical ones are sometimes slender or sickle-like in shape. Hind tibiae with normal setae, the longest one 1.6–2.2 times as long as the width at the middle of the tibia. Metanotum and abdominal tergites I–VI each with spinal and lateral plates; each spinal plate with one spinule. Abdominal tergites I–VII each with a pair of rounded lamellae marginally; VII also with a pair of leaf-like lamellae dorso-posteriorly; VIII with a pair of leaf-like lamellae posteriorly, which are little wider than dorso-posterior ones on VII.

Mature dimorph (Fig. 8C). Differs from the fundatrix in the following characters:

Color in life: body shining black. Color in mounted specimen: legs wholly pale yellow.

Body 1.59–2.00 mm long. Head: the longest seta on dorsum 6.7–9.6 times as long as basal width of antennal segment III. Antennae 0.48–0.72 times as long as body; segment III with 5–9 setae, of which the longest one is 5.2–8.4 times as long as basal width of the segment; processus terminalis 1.2–1.8 times as long as base of segment VI. Ultimate rostral segment 1.4–1.6 times as long as its basal width, 0.73–0.82 times as long as segment II of hind tarsus. Tibiae smooth, with spinules on distal 1/8–1/7 and on distal 2/7–3/8 along inner side of hind tibiae, with many long setae, of which the longest one on hind tibiae is 2.8–4.8 times as long as the width of the middle of the tibia. Abdomen: marginal sclerites with 4–7 setae on tergite I and VI, 5–10 setae on II–V and 2 or 3 setae on VII; the longest seta on tergites I–V 7.3–9.2 times as long as basal width of antennal segment III, on marginal sclerites 9.2–10.8 times and on tergite VIII 5.3–6.5 times as long as the above mentioned width. Siphunculi 1.2–1.6 times as long as the top width, with reticulation in 2–4 rows at apex. Cauda broadly rounded, with 7–13 setae.

Oviparous female. Similar to the mature dimorph, but differs from it in the following characters:

Color in mounted specimen: distal half of middle and hind femora brown. Body 2.95–3.30 mm long. Hind tibiae swollen, with numerous scent plaques. Abdomen prolonged on posterior part; tergite VII with 8 seta-bearing scleroites arranged transversely and one or 2 setae without scleroites near spiracles; tergite VIII lacking a transverse band, with 8–11 long setae transversely and 4–6 additional short setae on each margin. Siphunculi 1.7–2.7 times as long as the top width, with reticulation on distal 1/4–1/3. Cauda with 17–23 setae.

Male. Similar to the alate viviparous female, but differs from it in having more secondary rhinaria numbering 58–87 on antennal segment III, 27–43 on IV and 11–20 on V and in having short spinal bands on abdominal tergites I–VII.

Specimens examined. All specimens were collected from *Acer diabolicum*. Holotype: one apterous viviparous female, 19.v.2019, Tamozaawa, Nikkō, Tochigi Pref. Paratypes: one fundatrix, 10.v.2014, Moto-Hakone, Hakone-machi, Kanagawa Pref.; three apterous viviparous females, 10.v. 2014, Sengokubara, Hakone-machi, Kanagawa Pref.; nine apterous viviparous females, 12.v.2018, Mt. Hikosan, Soeda-machi, Fukuoka Pref.; three fundatrices and eight apterous viviparous females, the same data as the holotype. Other specimens examined: *Fundatrix*: 3exs., 20.iv.2014, Mt. Takao, Hachioji, Tōkyō; 1ex., 29.iv.2014 & 6exs., 2.v.2015, Moto-Hakone; 4exs., 10.v.2014, Sengokubara; 2exs., 29.iv.2017, Mt. Hikosan. *Apterous viviparous female (spring generation)*: 7exs, 3.v.2015, Tamozaawa; 5exs., 5.v.2014, Mt. Takao; 1ex., 1.v.2014, Moto-Hakone;

6exs, 12.v.2018, Mt. Hikosan. *Alate viviparous female (spring generation)*: 12exs, 3.v.2015; 2exs, 17.v.2015 & 5exs, 19.v.2019, Tamozawa; 2exs, 26.iv.2014, 6exs., 5.v.2014 & 5exs., 18.v.2014, Mt. Takao; 1ex., 10.v.2014 & 3exs., 2.v.2015, Motohakone; 2exs., 10.v.2014, Sengokubara; 8exs., 29.iv.2017, Mt. Hikosan. *Aestivating dimorph*: 3exs., 19.v.2019, Tamozawa; 12exs., 18.v.2014, Mt. Takao; 5exs., 12.v.2018, Mt. Hikosan. *Mature dimorph*: 4exs., 2.xi.2014, Sengokubara; 7exs., 19.x.2019, Mt. Hikosan. *Oviparous female*: 8exs., 2.xi.2014, Sengokubara. *Male*: 2exs., 8.xi.2014, Tamozawa; 2exs., 2.xi.2014, Sengokubara.

Host plant. Acer diabolicum.

Distribution. Japan (Honshû, Kyûshû).

Remark. This species may be closely related to *Periphyllus californiensis* in dark brownish body, but differs from it in having hind tibiae with pale area on the basal 1/3–2/3 in the fundatrix and apterous viviparous female (spring generation) (Figs 8Ab, 8Bb vs. Figs 5Ab, 5Bb) and in having more secondary rhinaria on the antennal segment III of the alate viviparous female (30 or more in 91% of the specimens examined in this species vs. 6–27 in *P. californiensis* examined in this study). My field survey in Sengokubara, Hakone failed to find apterous viviparous females (autumn generation) of this species even when mature dimorphs and oviparous females were collected. This suggests that this species has a life cycle in which mature dimorphs directly produce oviparous females.

Etymology. The species name refers to the Japanese name “Kaji-kaede” of *Acer diabolicum*.

Periphyllus kuwanaii (Takahashi)

[Japanese name: Kuwana-nitai-ke-aburamushi]

Chaitophorus aceris Linnaeus: Matsumura, 1917: 354 (partim); 1919: 115 (partim); nec *Aphis aceris* Linnaeus, 1761.

Chaitophorus japonica Essig & Kuawana, 1918: 82, nec *Chaitophorus japonicus* Baker, 1918.

Chaitophorus japonicus (sic!) Essig & Kuawana: Matsumura, 1919: 115.

Chaitophoriniella japonica Essig & Kuawana: Takahashi, 1919a: 277 & 326.

Chaitophorinella kuwanaii Takahashi, 1919b: 176, pro *Chaitophorus japonica* Essig & Kuawana, 1918.

Periphyllus testudinatus Thornton: Shinji, 1941: 430, nec *Phillophrus testudinatus* Thornton, 1852.

Periphyllus kuwanaii: Essig & Abernathy, 1952: 81; Higuchi, 1972: 96; Pashtshenko, 1986: 1164; Park & Park 1995: 150.

Periphyllus tokyoensis Sorin, 1990: 806. syn. nov.

Periphyllus tokyoensis: Park & Park, 1995: 151.

Pashtshenko (1986) provided descriptions and illustrations of 13 adult morphs and the aestivating dimorph of this species, and mentioned that the apterous viviparous female, mature dimorph and sexupara appearing in summer and autumn differ from spring apterous viviparous female in having small body and light-colored narrow dorsal bands or pairs of sclerites instead of dark dorsal bands. These characters are applied to the Japanese population (Fig. 9B vs. Figs 9C, 9D, 9E, 9F).

Specimens examined. Abbreviations of the *Acer* plants on which each morph was collected are as follows: *APD*: *A. pictum* subsp. *dissectum*, *APM*: *A. pictum* subsp. *mono*, *APP*: *A. pictum*

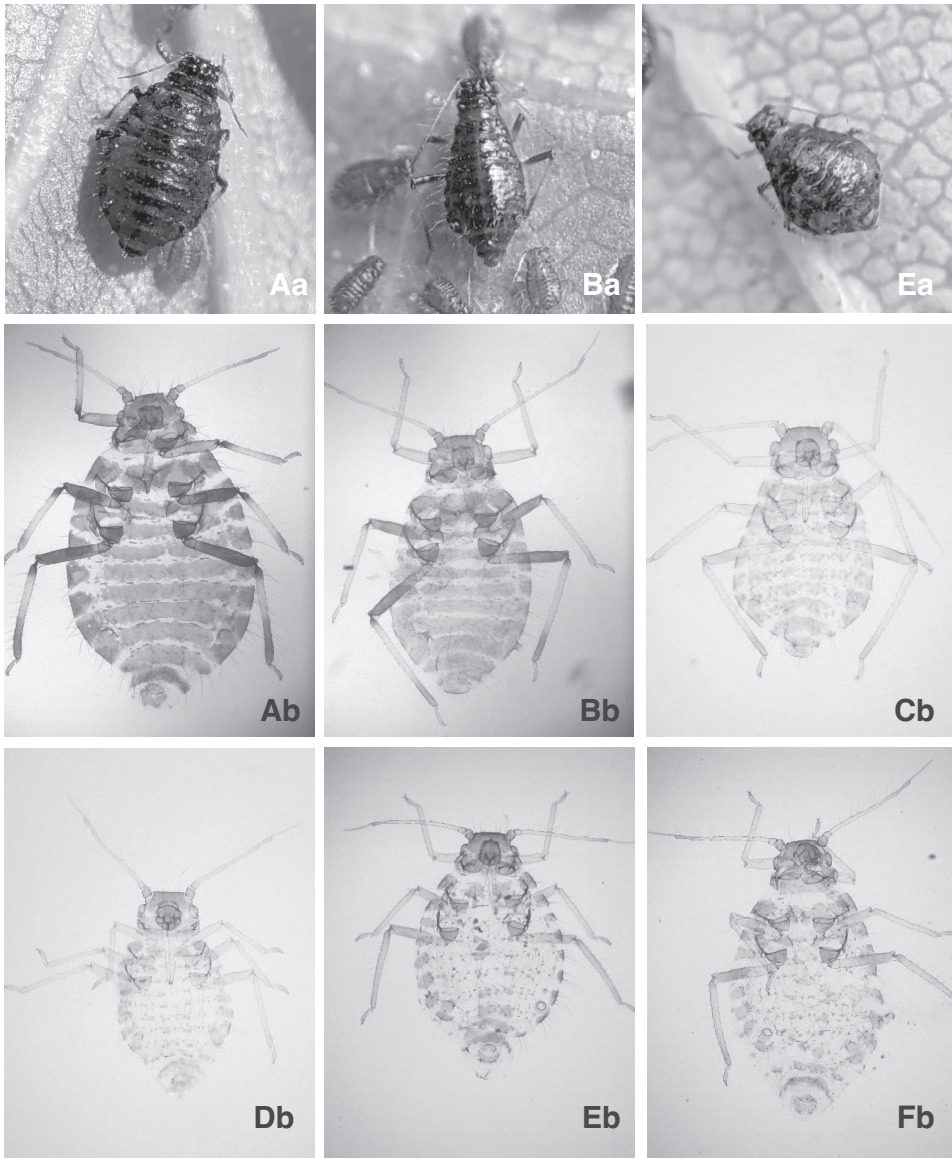


Fig. 9. *Periphyllus kuwanaii*. A: fundatrix, B: apterous viviparous female (spring generation), C: apterous viviparous female (summer generation collected on 20.vii.2014 at Mt. Takao, Tokyo), D: ditto (summer generation collected on 18.vii.2013 at Mt. Kôbôyama, Kanagawa Pref.), E: mature dimorph, F: apterous viviparous female (autumn generation), a: general aspect in life, b: general aspect in mounted specimen.

subsp. *pictum*.

Fundatrix (Fig. 9A): 3exs., 3.v.2019, on *APP*, Tamozawa, Nikkô, Tochigi Pref.; 7exs., 20.iv.2014 & 2exs., 19.iv.2015, on *APP*, Mt. Takako, Hachiôji, Tôkyô; 9exs., 6.iv.2014 & 6exs., 13.iv.2014, on *APD*, Nanasawa, Atsugi, Kanagawa Pref.; 5exs., 13.iv.2014, on *APD*, Mt. Kôbôyama, Hadano, Kanagawa Pref.; 2exs., 29.iv.2014, on *AR* & 3exs., 29.iv.2015, on *APD*, Moto-Hakone, Hakone, Kanagawa Pref. *Apterous viviparous female* (spring generation) (Fig. 9B): 5exs., 2.v.2019, on *APP*, Tamozawa; 4exs., 5.v.2014 & 8exs., 18.v.2014, on *APP*, Mt. Takao; 3exs., 13.iv.2013, on *APD*, Nanasawa; 4exs., 27.iv.2014, on *APD*, Mt. Kôbôyama. *Apterous viviparous female* (summer generation) (Figs 9C, 9D): 4exs., 20.vii.2013, on *APD*, Mt. Takao; 6exs., 7.vii.2013, 5exs., 18.viii.2013 & 2exs., 1.vi.2014, on *APD*, Mt. Kôbôyama; 1ex., 1.vi.2014 & 2exs., 6.vii.2014, on *APP*, Moto-Hakone; 2exs., 8.vii.2019, on *APP*, Hara-mura, Suwa-gun, Nagano Pref. *Alate viviparous female*: 6exs., 2.v.2019, on *APP*, Tamozawa; 3exs., 3.v.2015 & 1ex., 17.v.2015, on *APP*, Nikkô Botanical Garden (NBG), Nikkô, Tochigi Pref.; 7exs., 5.v.2014 & 1ex., 18.v.2014, on *APP*, Mt. Takao; 2exs., 13.iv.2014, on *APD*, Nanasawa; 7exs., 27.iv.2014 & 4exs., 1.vi.2014, on *APD*, Mt. Kôbôyama; 2exs., 1.vi.2014, on *APP*, Moto-Hakone; 4exs., 8.vii.2019, on *APP*, Hara-mura. *Aestivating dimorph*: 5exs., 5.v.2014 & 8exs., 18.v.2014, on *APP*, Mt. Takao, 8exs., 6.vii.2014, on *APD*, Moto-Hakone. *Mature dimorph* (Fig. 9E): 4exs., 26.ix.2013, on *APM*, Lake Shikotsu, Hokkaidô; 8ex., 24.x.2020, on *APP*, Tamozawa. *Apterous viviparous female* (autumn generation) (Fig. 9F): 2exs., 26.ix.2013, on *APM*, Lake Shikotsu; 3exs., 24.x.2020, on *APP*, Tamozawa; 2exs., 17.xi.2013, on *APP*, Mt. Takao; 1ex., 7.xii.2014, on *APP*, Nanasawa; 8exs., 4.x.2013 & 1ex., 24.xi.2013, on *APD*, Mt. Kôbôyama; 6exs., 1.ix.2013, on *APD*, Moto-Hakone. *Oviparous female*: 9exs., 9.xi.2019, on *APP*, Tamozawa; 8exs., 17.xi.2013 & 8exs., 16.xi.2014, on *APP*, Mt. Takao; 2exs., 7.xii.14, on *APD*, Nanasawa; 7exs., 24.xi.2013, on *APD*, Mt. Kôbôyama. *Male*: 1ex., 9.xi.2019, on *APP*, Tamozawa; 1ex., 17.xi.2013 & 1ex., 16.xi.2014, on *APP*, Mt. Takao; 2exs., 24.xii.2013, on *APD*, Mt. Kôbôyama.

Host plant. *Acer pictum* subsp. *dessectum*, *A. p.* subsp. *mono* & *A. p.* subsp. *pictum*. *A. ginnala* & *A. okamotoanum* (Korea: Lee & Seo, 1992); *A. negundo*, *A. platanoides* & *A. ukurunduense* (the Russian Far East: Pashtshenko, 1987)

Distribution. Japan (Hokkaidô, Honshû, Shikoku). China; Korea; the Russian Far East (after Blackman & Eastop, 1994).

Remark. Sorin (1990) gave a detail description of the apterous viviparous female of *Periphyllus tokyoensis* using samples collected on 24th July 1959 at Asakawa, Tokyo, and separated it from *P. kuwanaii* mainly in terms of the body length (about 1.06 mm in *P. tokyoensis* vs. 1.7–2.2 mm in *P. kuwanaii*) and the ratio of the length of ultimate rostral segment to that of segment II of hind tarsus (about 0.9 in *P. tokyoensis* vs. about 0.8 in *P. kuwanaii*). My surveys at the site where the specimens identified as *P. kuwanaii* was collected in the spring found many apterous viviparous females with the body length of about 1.0 mm on young plant parts such as the top of lammas shoots through late May to early November. Of these small apterous viviparous females, four specimens collected on 20th July 2014 at Mt. Takao, near Asakawa (Fig. 9C), showed 0.85–1.27 mm in the body length and 0.89–0.95 in the ratio of the length of ultimate rostral segment to that of segment II of hind tarsus, and had a dorsal band and a few small sclerites on each of abdominal tergites I–VI. These characters accord well with the description of *P. tokyoensis*. Therefore, I concluded that *P. tokyoensis* corresponds to small individuals of *P. kuwanaii* and should be treated as a junior synonym of *P. kuwanaii*.

Periphyllus loricatus Pashtshenko
[Japanese name: Karakogikaede-nitai-ke-aburamushi]

Periphyllus sp., Paik, 1972: 178 (partim).

Periphyllus ginnalae Paik in Szelegiewicz, nom. nud., 1974: 463.

Periphyllus loricatus Pashtshenko, 1987: 112.

Periphyllus loricatus: Park & Park, 1995: 150.

Periphyllus takahashii Sorin, 1990: 804.

Pashtshenko (1987) described this species from Russia based on the fundatrix, apterous and alate viviparous females, alatform aptera, aestivating dimorph, mature dimorph, sexupara, unusual autumn viviparous female, oviparous female, and male. After that Sorin (1990) gave a detailed description of the apterous viviparous female under the name *P. takahashii*, which was proposed as a synonym of *P. loricatus* by Blackman & Eastop (1994). Based on the present specimens, a brief redescription is given below:

Fundatrix (Fig. 10A). Apterous. Color in life: head, thorax, and spinal area of abdomen shiny black, the rest of abdomen dark brown. Color in mounted specimen: head dark brown; antennae dark brown except segments III–V pale yellow; legs dark brown except trochanter, basal 1/5 of femora and middle part of tibiae pale yellow; pronotum brown; meso- and metanotum and abdomen with brownish sclerites dorsally and marginally; siphunculi dark brown.

Body 2.60–2.80 mm long, 1.6–1.8 times as long as its maximum width. Head dorsally with 27–35 setae, of which the longest one is 5.7–6.9 times as long as basal width of antennal segment III. Antennae 6-segmented, 0.33–0.39 times as long as body length; segment I with 6–9 setae; segment III with 12–19 setae, of which the longest one is 3.7–4.3 times as long as basal width of the segment; segment IV with 4–7 setae; segment V with 3–4 setae; segment VI with 2 setae on base; processus terminalis 0.54–0.9 times as long as base of segment VI. Ultimate rostral segment 1.7–1.9 times as long as its basal width, 0.74–0.81 times as long as segment II of hind tarsus. Tibiae with spinules on distal 1/3 along inner side of hind tibiae; the longest seta on hind tibiae 2.7–3.4 times as long as the width at the middle of the tibia. First tarsal chaetotaxy 6:6:6. Abdomen with many small dorsal and marginal sclerites on each of tergites I–VII, and with a transverse band on tergite VIII, but tergites IV–VI often with broad band made by the fusion of many sclerites; tergites I–V each with 34–44 setae, VI with 23–30 setae and VII with 12–16 setae of different length, among these setae, a pair of spinal setae on each tergite are longer and stouter than the others; marginal sclerites with 2–4 setae on tergites I, VI and VII and 3–5 setae on II–V; tergites VIII with 14–18 setae on the transverse band; the longest seta on tergites I–V 5.7–7.1 times as long as basal width of antennal segment III, on marginal sclerites 6.3–7.4 times and on tergite VIII 6.3–8.6 times as long as the above mentioned width. Siphunculi truncated, 0.75–1.0 times as long as the top width. Cauda with 10–14 setae.

Apterous viviparous female (spring generation) (Fig. 10B). Differs from the fundatrix in the following characters:

Body 2.41–2.55 mm long. Head dorsally with 15–18 setae, of which the longest one is 5.0–5.5 times as long as basal width of antennal segment III. Antennae 0.57–0.63 times as long as body; segment III with 20–23 setae; segment IV with 7–8 setae; segment V with 4–6 setae; processus terminalis 1.4–1.8 times as long as base of segment VI. Ultimate rostral segment 2.2–2.4 times as long as its basal width, 0.69–0.71 times as long

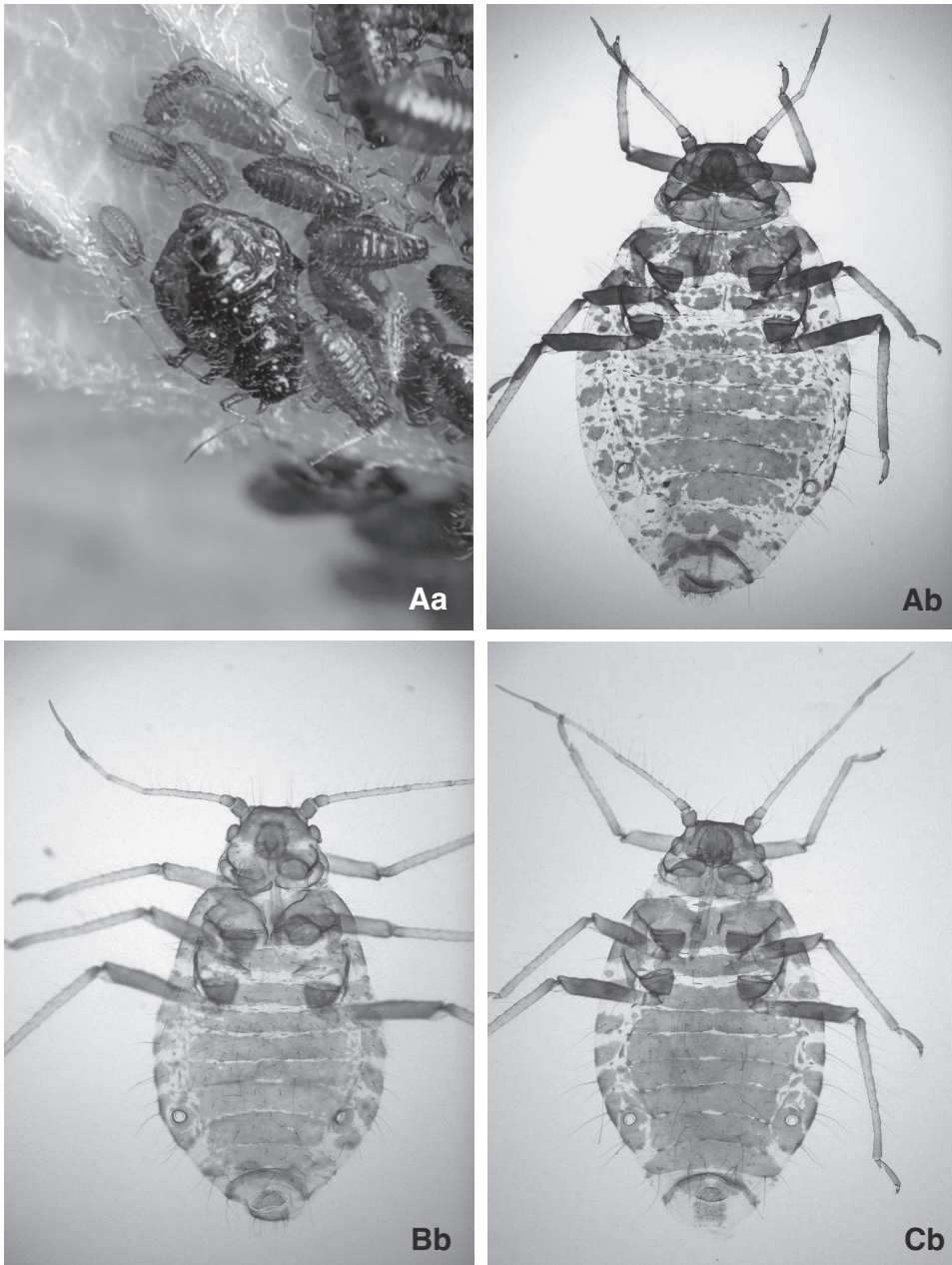


Fig. 10. *Periphyllus loricatus*. A: fundatrix, B: apterous viviparous female (spring generation), C: ditto (summer generation), a: general aspect in life, b: general aspect in mounted specimen.

as segment II of hind tarsus. Tibiae with spinules on distal part of all tibiae and on distal 1/3 along inner side of hind tibiae. Abdomen sclerotized dorsally with faint traces of the boundaries between tergites; tergites I–VI each with 22–33 setae; marginal sclerites with 4–7 setae on tergite I, 6–10 setae on II–V, 3–5 setae on VI and 2 setae on VII; marginal sclerites on tergites I–VI sometimes fused with dorsal sclerites; the longest seta on tergites I–V 5.0–6.6 times as long as basal width of antennal segment III, on marginal sclerites 5.5–7.4 times and on tergite VIII 6.3–7.1 times as long as the above mentioned width.

Apterous viviparous female (summer generation) (Fig. 10C). Differs from the spring generation in having smaller sized body and longer setae:

Body 1.69–1.90 mm long. Head: the longest seta on dorsum 6.7–8.8 times as long as basal width of antennal segment III. Antennae: segment III with 12–18 setae, of which the longest one is 4.5–6.0 times as long as basal width of the segment. Ultimate rostral segment 1.8–2.1 times as long as its basal width. Tibiae with longer setae, the longest one on hind tibiae 3.6–4.3 times as long as the width at the middle of the tibia. First tarsal chaetotaxy 5–6:5–6:5–6. Abdominal tergites I–VI each with 18–28 setae, and VII with 8–10 setae; tergites VIII with 10–13 setae; the longest seta on tergites I–V 8.0–10.4 times as long as basal width of antennal segment III, on marginal sclerites 8.3–10.4 times and on tergite VIII 7.7–9.2 times as long as the above mentioned width.

Alate viviparous female. Color in life specimen: body almost black.

Body 2.18–2.30 mm long. Antennae 6-segmented, 0.66–0.70 times as long as body; segment III with 14–22 secondary rhinaria; segment IV with rarely one rhinarium; processus terminalis 1.4–1.8 times as long as base of segment VI.

Specimens examined. All specimens were collected from *Acer ginnala* var. *aidzuense* at Haramura, Suwa-gun, Nagano Pref. *Fundatrix*: 15exs., 11.v.2022. *Apterous viviparous female*: 28exs., 8.vii.2019; 3exs., 11.v.2022. *Alate viviparous female*: 6exs., 11.v.2022.

Host plant. *Acer ginnala* var. *aidzuense*. *A. ginnala* (Szelegiewicz, 1974; Pashtshenko, 1987; Park & Park, 1995).

Distribution. Japan (Honshū); the Korean Peninsula; the Russian Far East.

Remarks. *Periphyllus* species described by Paik (1972) may include more than one species since they are based on species collected from *Acer formosum*, *A. ginnala* (!) and *A. mono*. In his accounts, the illustration of fig 28b in the plate 7 corresponds to the body color in life of fundatrix described in this paper. Pashtshenko (1987) mentioned that apterous viviparous females with a few shortened setae appear in middle summer and unusual apterous viviparous females with heavy sclerotized abdomen appear in autumn. These apterous viviparous females accord partly with the description of *Trichaitophorus ginnalarus* which is described by Qiao *et al.* (2004) based on the apterous viviparous female collected from *Acer ginnala* on late July in Harbin, China. In this study, there was no chance to examine *Trichaitophorus*-like specimens on *A. ginnala* var. *aidzuense*. Therefore, the further morphological study of morphs appearing especially in summer to autumn is needed.

Periphyllus viridis viridis (Matsumura)
[Japanese name: Itaya-midori-ke-aburamushi]

Chaitophorus viridis: Matsumura, 1919: 111.

Periphyllus viridis: Takahashi, 1939: 124; Shinji, 1941: 434; Higuchi, 1972: 96; Pashtshenko, 1987: 108; Park & Park: 1995: 151.

Matsumura (1919) originally described the alate viviparous female and nymph. After that, Takahashi (1939), Shinji (1941) and Higuchi (1972) have given brief descriptions of the apterous and alate viviparous females. Pashtshenko (1987) described the fundatrix, alate viviparous female, aestivating dimorph, oviparous female, and male in detail. Based on the present specimens, brief descriptions of these morphs and the mature dimorph are given below:

Fundatrix (Fig. 11A). Color in life: body reddish brown. Color in mounted specimen: head pale brown; antennae brown; legs pale brown except distal 1/4 of femora and both tips of tibiae brown; siphunculi pale brown; abdomen pale with pale brownish scleroites at the base of dorsal setae.

Body somewhat rounded, 2.75–3.83 mm long, 1.6–1.9 times as long as its maximum width; dorsal and marginal setae stout, their basal width as wide as or little narrower than diameter of an ommatidium in compound eyes. Head smooth dorsally and ventrally; dorsum with 15 or 16 setae, of which the longest one is 4.4–5.3 times as long as basal width of antennal segment III. Antennae 6-segmented, 0.68–0.83 times as long as body; basal two segments smooth, flagella imbricated except on basal 2/3 of segment III; segment I with 8–10 setae; segment III with 16–20 setae, of which the longest one is 3.6–4.5 times as long as basal width of the segment; segment IV with 6–11 setae; segment V with 3–6 setae; segment VI with 2 setae on base; processus terminalis 1.5–1.9 times as long as base of VI. Ultimate rostral segment 1.6–1.8 times as long as its basal width, 0.64–0.73 times as long as segment II of hind tarsus. Tibiae with many long setae along outer side, of which the longest one on hind tibiae is 2.6–3.1 times as long as the width at the middle of the tibia; hind tibiae with a few spinules on distal 1/10. First tarsal chaetotaxy 7:7:7. Abdomen membranous with seta-bearing scleroites arranged in a single transverse row and marginal sclerites on each of tergites I–VII, and with a transverse band on tergite VIII; marginal sclerites with 3–6 setae on tergites I–V and 2 or 3 setae on VI and VII; tergites VIII with 10–15 setae on the band; the longest seta on tergites I–V 4.2–4.9 times as long as basal width of antennal segment III, on marginal sclerites 4.5–7.0 times and on tergite VIII 4.7–5.5 times as long as the above mentioned width. Siphunculi 1.3–1.6 times as long as the top width, imbricated on basal 2/3, reticulated on distal 1/3, with a flange. Cauda thumbnail-like in shape, with 14–18 setae.

Apterous viviparous female (spring generation). Differs from the fundatrix in the following characters:

Color in life: body pale green. Color in mounted specimen: head, antennae, legs and siphunculi pale yellow. Body oval, 2.84 mm long, 2.2 times as long as its maximum width; dorsal and marginal setae slenderer than those of fundatrix, their basal width half as wide as the diameter of an ommatidium in compound eyes. Head dorsally with 10 setae. Antennae 0.98 times as long as body; processus terminalis 3.3 times as long as base of VI. Ultimate rostral segment 1.9 times as long as its basal width, 0.62 times as long as segment II of hind tarsus. The longest seta on hind tibiae 3.4 times as long

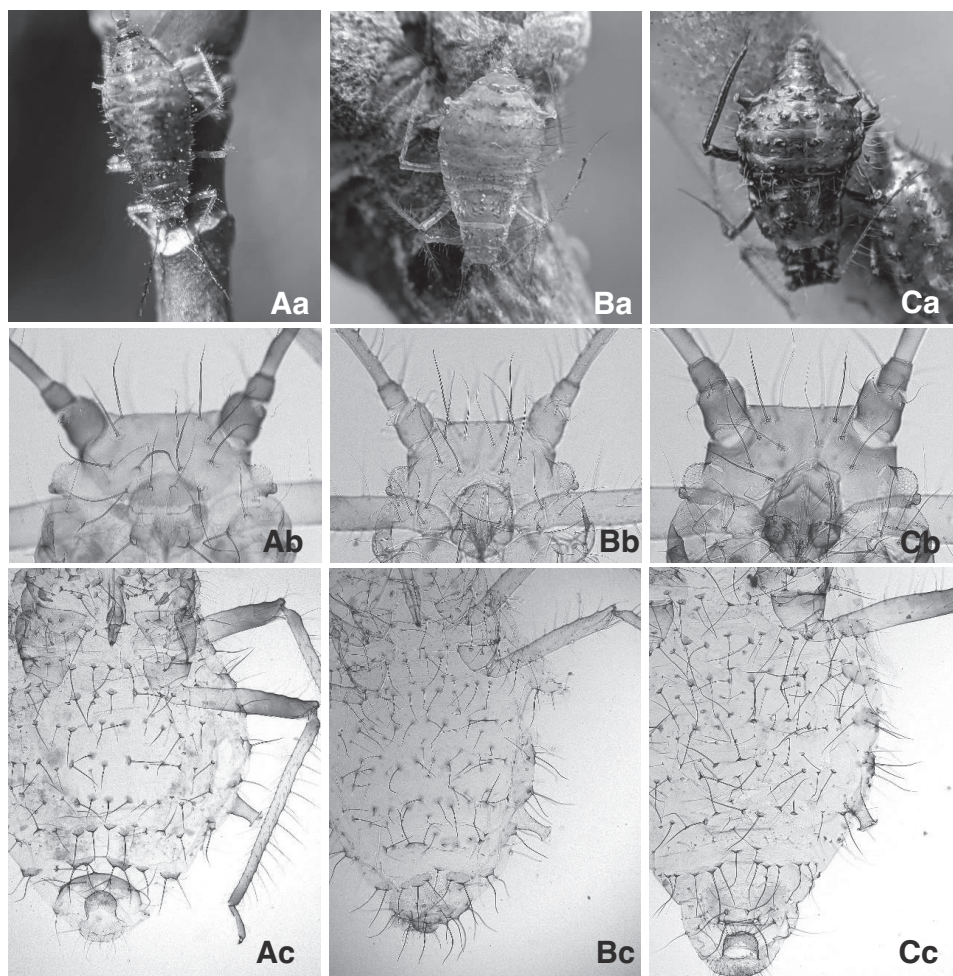


Fig. 11. *Periphyllus viridis viridis*. A: fundatrix, B: apterous viviparous female (autumn generation), C: oviparous female; a: general aspect in life, b: head, c: abdomen.

as the width at the middle of the tibia. Abdominal tergite VII with a pair of sclerites made by the fusion of some scleroites; scleroites and marginal sclerites on tergites I–VI inconspicuous. Cauda with 12 setae.

Alate viviparous female (spring generation). Color in life: abdomen pale green. Color in mounted specimen, the following parts brown: antennal segments III–VI, distal part of tibiae, and tarsi.

Body 2.20–3.30 mm long. Head dorsally with 9–13 setae, of which the longest one is 4.5–6.8 times as long as basal width of antennal segment III. Antennae 6-segmented, 0.94–1.3 times as long as body; segment I with 7–13 setae; segment III with 10–26 rounded secondary rhinaria on basal 1/2–2/3, with 13–22 setae, of which the longest one is 3.4–5.3 times as long as basal width of the segment; segment IV with 8–15 setae;

segment V with 6–9 setae; segment VI with 2 setae on base; processus terminalis 3.3–4.4 times as long as base of segment VI. Ultimate rostral segment 1.7–2.2 times as long as its basal width, 0.57–0.68 times as long as segment II of hind tarsus. Tibiae with many long setae along outer side, of which the longest one on hind tibiae is 3.3–4.8 times as long as the width at the middle of the tibia, with spinules on distal 1/10–3/20 of fore and middle tibiae and on distal 1/8–1/5 on hind ones. Abdomen with long setae arranged almost in a single transverse row on each of tergites I–VII; tergite VIII with 9–15 setae on a transverse band. Siphunculi truncated, 1.7–2.8 times as long as the top width, imbricated on basal 1/5, reticulated on distal 4/5, with a flange. Cauda with 10–16 setae.

Aestivating dimorph. Body 0.70–0.77 mm long, 0.41–0.49 mm wide. Head with spinal suture stretching to abdomen, with 4 rounded lamellae near anterior margin. Antennae 0.61–0.67 times as long as body; segment I strongly protruded anteriorly, with 2 lamellae which are curved outward and smaller than those on head; segment II with 1 stickle-like seta, of which length is 2.5–3.5 times as long as its maximum width and little longer than basal width of segment III; processus terminalis 1.9–2.3 times as long as base of segment IV. Meso- and metanotum each with a pair of lamellae marginally, which are slenderer on mesonotum than on metanotum. Rostrum passing middle coxae. Fore tibiae with 6 and middle tibiae with 8 or 9 small leaf-like lamellae, of which the basal and apical ones are sometimes slender or sickle-like in shape. Hind tibiae with normal setae, the longest seta 1.4–1.7 times as long as the width at the middle of the tibia. Metanotum and abdominal tergites I–VI each with spinal and lateral plates; each spinal plate with one spinule. Abdominal tergites I–VII each with a pair of rounded lamellae marginally; VII also with a pair of rounded but more or less slender lamellae dorso-posteriorly; VIII with a pair of small, rounded lamellae posteriorly,

Mature dimorph: Differs from the fundatrix in the following characters:

Body rounded, 2.08–2.60 mm long; dorsal and marginal setae slender as in the apterous viviparous female (spring generation). Head: the longest setae on dorsum 6.3–7.4 times as long as basal width of antennal segment III. Antennae: segment III with 16 or 17 setae, of which the longest one is 5.9–6.9 times as long as basal width of the segment; processus terminalis 2.1–2.3 times as long as base of segment VI. Ultimate rostral segment 1.5–1.7 times as long as its basal width, 0.67–0.86 times as long as segment II of hind tarsus. Hind tibiae with a few spinules on distal 1/10; the longest seta on hind tibiae 3.7–4.7 times as long as the width at the middle of the tibia. Abdomen membranous with seta-bearing scleroites and marginal sclerites on each of tergites I–VII, and with a transverse band on tergite VIII, sometimes tergite VII with a pair of spinal sclerites made by the fusion of several scleroites; scleroites on tergites I–VII almost same in size; marginal sclerite with 5–10 setae on tergites I–V and 2–5 setae on VI and VII; tergite VIII with 18–27 setae on the band; the longest seta on tergites I–V 5.5–7.0 times as long as basal width of antennal segment III, on marginal sclerites 6.5–8.0 times and on tergite VIII 6.3–8.3 times as long as the above mentioned width. Siphunculi truncated, 1.6–1.9 times as long as the top width. Cauda with 12–14 setae.

Apterous viviparous female (autumn generation) (Fig. 11B). Slightly differs from the mature dimorph in the following characters:

Color in life: body pale green or brown. Color in the mounted specimen as in the mature dimorph.

Body oval, 3.14–3.32 mm long, 1.8–2.0 times as long as its maximum width. Head dorsally with 10–14 setae, of which the longest one is 5.2–6.0 times as long as basal

width of antennal segment III. Antennae 0.83–0.90 times as long as body; segment III with 20–27 setae, of which the longest one is 5.0–5.4 times as long as basal width of the segment; segment IV with 7–13 setae; segment V with 7–10 setae; processus terminalis 3.1–4.3 times as long as base of VI. Ultimate rostral segment 1.8–1.9 times as long as its basal width, 0.70–0.71 times as long as segment II of hind tarsus. Abdomen with seta-bearing scleroites, of which large ones are located mainly in spinal area, the largest scleroite 0.06–0.07 mm in diameter; scleroites on pleural areas little smaller than those on spinal area; tergite VIII with 12–14 setae on a transverse band; the longest seta on tergites I–V 5.2–6.0 times as long as basal width of antennal segment III, on marginal sclerites 5.6–6.4 times and on tergite VIII 6.0–6.4 times as long as the above mentioned width. Cauda with 17 or 18 setae.

All three specimens examined were ovipariform with 2–23 scent plaques on the hind tibiae while their body contain embryos.

Oviparous female (Fig. 11C). Slightly differs from the apterous viviparous female (autumn generation) in the following characters:

Color in the mounted specimen is more similar to the fundatrix than the apterous viviparous female (autumn generation).

Body oval, 3.05–3.60 mm long. Hind tibiae swollen with numerous scent plaques. Abdomen with scleroites as in the apterous viviparous female, but the largest scleroite is at most 0.05 mm in diameter; scleroites on pleural areas much smaller or sometime disappearing; tergite VIII totally with 16–20 setae, of which 12–15 setae are long and arising from scleroites, and 2–4 setae on each side are shorter than setae on the scleroites; the longest seta on tergite VIII 5.5–7.0 times as long as basal width of antennal segment III. Siphunculi reticulated on distal 1/3–1/2. Cauda with 33–42 setae.

Male. Alate. Color in life: abdomen pale green with black dorsal bands and marginal sclerites. In mounted specimen, the following part dark brown: head, antennae, thorax, femora except basal 1/4–1/2, tibiae, tarsi, siphunculi, cauda, and dorsal and marginal sclerites on abdomen.

Antennae with 155–189 secondary rhinaria on segment III, 76–117 on IV and 23–48 on V. Ultimate rostral segment 0.70–0.74 times as long as segment II of hind tarsus. Abdominal tergites I–VII each with a short band, which is rounded on tergites III–V; tergite VIII totally with 12 or 13 setae, of which about 10 setae on a spinal area arise from scleroites, some scleroites sometime fused together. Siphunculi imbricated on basal 1/5, reticulated on distal 4/5. Cauda with 13–15 setae.

Specimens examined. The following specimens are collected from *Acer pictum* subsp. *dissectum* unless otherwise stated. *Fundatrix*: Nanasawa, 1ex., 6.iv.2014 & 6exs., 28.iii.2015, Atsugi, Kanagawa Pref. *Apterous viviparous female (spring generation)*: 1ex., 10.v.2014, Moto-Hakone, Hakone, Kanagawa Pref. *Alate viviparous female*: 1ex., 10.iv.2012 & 8exs., 13.iv.2014, Nanasawa; 1ex., 27.iv.2014 & 7exs. 11.iv.2015, Mt Kôbôyama, Hadano, Kanagawa Pref.; 8exs., 10.v.2014 & 9exs., 29.v.2015, Moto-Hakone; 1ex., 1.vi.2014, on *A. pictum* subsp. *pictum*, Moto-Hakone. *Aestivating dimorph*: 7exs., 10.v.2014, Moto-Hakone. *Mature dimorph*: 5exs., 26.ix.2013, on *A. pictum* subsp. *mono*, Lake Shikotsu, Hokkaidô. *Apterous viviparous female (autumn generation)*: 2exs., 30.x.2013 & 1ex., 12.xii.2020, Nanasawa. *Oviparous female*: 4exs., 7.xii.2014 & 1ex., 12.xii.2020, Nanasawa. *Male*: 2exs., 30.xi.2013, Nanasawa.

Host plant. *Acer pictum* subsp. *mono*, *A. pictum* subsp. *dissectum* & *A. pictum* subsp. *pictum*.

Distribution. Japan (Hokkaidô, Honshû, Shikoku); Korea; the Russian Far East.

Periphyllus viridis osugiensis Sorin
[Japanese name: Ôsugi-itaya-midori-ke-aburamushi]

Periphyllus viridis osugiensis Sorin, 1990: 807.

Sorin (1990) gave detailed descriptions of the alate viviparous female and aestivating dimorph. In this study, the fundatrix, apterous viviparous females, oviparous female, and male of this subspecies were newly discovered. Based on the specimens, diagnostic characters between the equivalent morphs of the nominotypical and this subspecies are given below:

Fundatrix (Fig. 12A). Color in life: body moss green, sometimes abdomen reddish brown to dark brown. Color in mounted specimen: antennae darkened at the tips of each segment III to V; legs pale brown except distal 1/3 of femora and distal part of tibiae brown.

Body 4.05–4.35 mm long. Dorsum of head with 8–14 setae, of which two pairs on latero-frontal areas are longer than the others, longest one on the latero-frontal areas 3.5–4.5 times and on the posterior area 2.8–3.5 times as long as basal width of antennal segment III, respectively. Antennae 0.62–0.68 times as long as body; segment I with 6–8 setae. Abdomen with somewhat shorter setae, the longest seta on tergites I–V 2.7–3.7 times as long as basal width of antennal segment III, on marginal areas 3.0–4.0 times and on tergite VIII 4.0–5.0 times as long as the above mentioned width. Cauda with 18–22 setae.

Alate viviparous female (spring generation). Body 2.90–3.75 mm long. Antennal segment III with 28–45 secondary rhinaria along whole length except distal 1/7–1/5. Ultimate rostral segment 0.68–0.77 times as long as segment II of hind tarsus. Cauda with 12–18 setae.

Aestivating dimorph. Body 0.78–0.83 mm long, 0.50–0.54 mm wide. Antennae 0.60–0.68 times as long as body; processus terminalis 1.8–2.6 times as long as base of segment IV.

Apterous viviparous female (autumn generation) (Fig. 12B). Color in life: body reddish brown. In mounted specimen, pigmentation as in the fundatrix.

Ultimate rostral segment 2.0 times as long as its basal width, 0.77 times as long as segment II of hind tarsus. Abdomen with somewhat shorter setae, the longest seta on tergites I–V 5.2 times as long as basal width of antennal segment III, on marginal areas 5.2 times and on tergite VIII 5.6 times as long as the above mentioned width.

One specimen examined was ovipariform with 4–7 scent plaques on the hind tibiae.

Oviparous female (Fig. 12C). Ultimate rostral segment 2.0–2.1 (1.7–2.0 in the nominotypical subspecies) times as long as its basal width, 0.77–0.85 (0.67–0.76 in the nominotypical subspecies) times as long as segment II of hind tarsus. Cauda with 22–26 setae.

Male. Antennal segment IV with 47 secondary rhinaria (76–117 in the nominotypical subspecies); ultimate rostral segment 0.78–0.88 (0.70–0.74 in the nominotypical subspecies) times as long as segment II of hind tarsus. Cauda with 12 or 13 setae.

Specimens examined. All specimens were collected from *Acer pictum* subsp. *pictum* at Kamihatsuishi-machi and Tamozawa in Nikkô, Tochigi Prefecture. *Fundatrix*: 8exs., 1.v.2021,

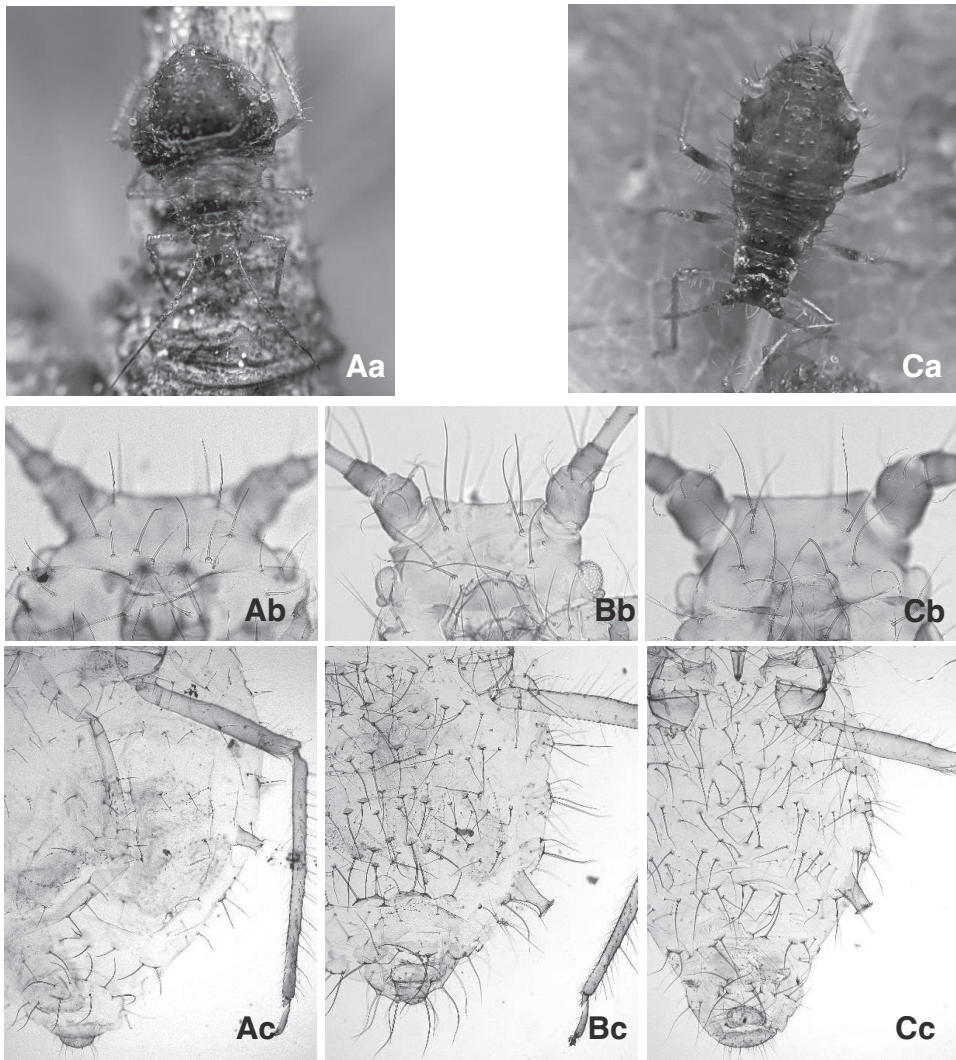


Fig. 12. *Periphyllus viridis osugiensis*. A: fundatrix, B: apterous viviparous female (autumn generation), C: oviparous female; a: general aspect in life, b: head, c: abdomen.

Tamozawa. *Alate viviparous female (spring generation)*: 2exs., 17.v.2015, 2exs., 2.v.2019 & 5exs., 19.v.2019, Tamozawa; 4exs., 1.v.2001, Kamihatsuishi-machi. *Aestivating dimorph*: 17exs., 19.v.2019, Tamozawa. *Apterous viviparous female (autumn generation)*: 1ex., 3.xi.2020, Tamozawa. *Oviparous female*: 7exs., 3.xi.2020, Tamzaowa. *Male*: 4exs., 3.xi.2020, Tamozawa.

Host plant. *Acer pictum* subsp. *pictum*. *A. mono* (= *A. pictum*) (after Sorin, 1990).

Distribution. Japan (Honshū).

Remark. In addition to characters given by Sorin (1990), this subspecies differs from the nominotypical subspecies in having larger body size in the fundatrix and

dimorph and having shorter dorsal setae on the head and abdomen in the fundatrix, apterous viviparous female (autumn generation) and oviparous female. Finally, I would like to point out that the taxonomic status of *P. viridis osugiensis* should be revised in the progress of further biogeographical and molecular phylogenetic studies.

DISCUSSION

This study revealed the morphological characteristics of several morphs (fundatrix, apterous viviparous female and mature dimorph) in *Periphyllus* species. The result showed that in *P. acerihabitans*, *P. acerijaponicus* sp. nov., *P. chidoricola* sp. nov., *P. kajicola* sp. nov., and *P. viridis viridis*, the fundatrices differed from their next generation (apterous viviparous females) not only in morphology but also in body

Table 1. Host plant of the *Periphyllus* examined in this study.

Section	Host Plant	Species and subspecies of <i>Periphyllus</i>											
		group with 8 setae on the dorsum of head					group with more than 10 setae on the dorsum of head						
	Species and subspecies	<i>P. acerijaponicus</i> sp. nov.	<i>P. californiensis</i>	<i>P. chidoricola</i> sp. nov.	<i>P. kajicola</i> sp. nov.	<i>P. acerihabitans</i>	<i>P. amamiensis</i> sp. nov.	<i>P. allogenens</i>	<i>P. hokkaidensis</i>	<i>P. kuwanai</i>	<i>P. loricatus</i>	<i>P. viridis viridis</i>	<i>P. viridis osugiensis</i>
Macrantha	<i>Acer rufinerve</i>		△										
	<i>A. insulare</i>						○						
Palmata	<i>A. amoenum</i>		○										
	<i>A. japonicum</i>	○	○										
	<i>A. palmatum</i>		○										
	<i>A. shirasawanum</i>		○										
	<i>A. sieboldianum</i>		○										
	<i>A. tenuifolium</i>		○										
Platanoidea	<i>A. pictum dissectum</i>									○		○	
	<i>A. pictum mayrii</i>								○				
	<i>A. pictum mono</i>								○	○		○	
	<i>A. pictum pictum</i>									○		○	○
Trifoliata	<i>A. maximowiczianum</i>							○					
Integrifolia	<i>A. buergerianum</i>					○							
Trilobata	<i>A. ginnala</i>										○		
Lithocarpa	<i>A. diabolicum</i>				○								
Indivisa	<i>A. carpinifolium</i>		△	○									

○: true host; △: accidental or rare host.

color in life. Moreover, even in the apterous viviparous female of the same species, the spring and autumn generations differed in the following points: (1) color in life (ex., *P. acerihabitans*, *P. acerijaponicus* sp. nov., *P. amamiensis* sp. nov.), (2) sclerotization on the dorsum of abdomen (ex., *P. kuwanaii*), and (3) pigmentation of hind tibiae (ex., *P. californiensis*, *P. chidoricola* sp. nov., *P. kuwanaii*). Fundatrix and apterous viviparous female (spring generation), and mature dimorph and apterous viviparous female (autumn generation) can be found simultaneously in spring and autumn, respectively, but the keys of Higuchi (1972) and Sorin (1990), which deal with the genus *Periphyllus* in Japan, do not include the fundatrix and the mature dimorph or seasonal variation in the apterous viviparous female. Therefore, it is needed for preparing a practical key containing these morphs found at the same season, the new species and newly recorded species described in this study.

Each *Periphyllus* species examined in this study is collected from a specific species or a species group within the genus *Acer* as shown in Table 1. This suggests that *Acer*-infesting *Periphyllus* species in Japan are easily distinguishable by the combination of the morphology, body color in life, time of appearance, and host plant. In this study, some species were not collected throughout the year, and *P. brevisetosus* was not examined. Therefore, the following key is provisional for the identification of apterous morphs (fundatrix, apterous viviparous female, mature dimorph) appearing in spring and autumn.

KEY TO THE SPECIES AND SUBSPECIES OF *PERIPHYLLUS* FROM *ACER* IN JAPAN

Fundatrix and apterous viviparous female (spring generation)

Periphyllus allogenes and *P. hokkaidensis* are excluded in the below key because of no specimens collected in spring.

1. First tarsal chaetotaxy 7:7:7. Cauda thumbnail-like in shape. On *Acer pictum* s. lat. 2 (*P. viridis* s. lat.)
- First tarsal chaetotaxy 5-6:5-6:5-6. Cauda broadly rounded..... 4
2. Processus terminalis 1.5-1.9 times as long as base of ultimate antennal segment. Body reddish brown, dark brown or moss green in life..... 3 (Fundatrix)
- Processus terminalis more than 3.0 times as long as base of ultimate antennal segment. Body pale green in life..... *P. v. viridis* (Viviparous female)
3. Body 2.8-3.8 mm long. Head with 15 or 16 setae dorsally, the longest one on the posterior area 4.0-5.1 times as long as basal width of antennal segment III..... *P. v. viridis*
- Body 4.1-4.4 mm long. Head with 10-14 setae dorsally, the longest one on the posterior area 2.8-3.5 times as long as basal width of antennal segment III..... *P. v. osugiensis*
4. Processus terminalis less than 1.3 times as long as base of ultimate antennal segment, if more than 1.3 then antennae 0.33-0.46 times as long as body length..... 5 (Fundatrix)
- Processus terminalis more than 1.4 times as long as base of ultimate antennal segment. Antennae 0.52-0.86 times as long as body length..... 12 (Viviparous female)
5. Head with more than 25 setae dorsally..... 6
- Head with less than 20 setae dorsally..... 7
6. Abdominal tergites with dark brownish sclerites and bands. Siphunculi shorter than the top width. Body almost black in life. On *Acer ginnala*..... *P. loricatus*
- Abdominal tergites with pale brownish sclerites. Siphunculi longer than the top width. Body dark brown on anterior half and yellowish green on posterior half in life, with a broad spinal blackish longitudinal stripe on the dorsum of abdomen. On *Acer buergerianum*

.....	<i>P. acerihabitans</i>	
7. Head with more than 10 setae dorsally.....		8
- Head with 8 setae dorsally.....		9
8. Abdomen with a broad dark brownish band on each tergite. Siphunculi 0.62–1.2 times as long as the top width. Body black in life. On <i>Acer pictum</i> s. lat.....	<i>P. kuwanaii</i>	
- Abdomen with seta-bearing scleroites or a pair of sclerites bearing some setae on each tergite, these scleroites and sclerites pale brown. Siphunculi 1.4–1.9 times as long as the top width. Body pale green in life. On <i>Acer insulare</i>	<i>P. amamiensis</i> sp. nov.	
9. Antennae 5-segmented; processus terminalis 1.4–1.7 times as long as base of ultimate segment. Body moss green with black spots dorsally in life. On <i>Acer japonicum</i>		
.....	<i>P. acerijaponicus</i> sp. nov.	
- Antennae 5- or 6-segmented; processus terminalis less than 1.1 times as long as base of ultimate segment.....		10
10. Abdomen with two pairs of seta-bearing spinal scleroites on each of tergites I–VII. Body yellowish brown to brown in life. On <i>Acer carpinifolium</i>	<i>P. chidoricola</i> sp. nov.	
- Abdomen with a pair of spinal sclerites bearing two setae on each of tergites I–VIII.....		11
11. All tibiae entirely dark brown to black. Body reddish or purplish brown in life. On <i>Acer</i> species belonging to the section Palmata.....	<i>P. californiensis</i>	
- Fore and middle tibiae pale at middle, and hind tibiae pale brown on basal half. Body brown in life. On <i>Acer diabolicum</i>	<i>P. kajicola</i> sp. nov.	
12. Head with more than 10 setae dorsally.....		13
- Head with 8 setae dorsally.....		16
13. Head with 26–37 setae dorsally. Body pale green in life. On <i>Acer buergeria</i>		
.....	<i>P. acerihabitans</i>	
- Head with 10–18 setae dorsally.....		14
14. Abdomen with pale brownish seta-bearing scleroties. Siphunculi 1.3–1.8 times as long as the top width. Body pale green in life. On <i>Acer insulare</i>	<i>P. amamiensis</i> sp. nov.	
- Abdomen with a dark brownish band on each tergite. Siphunculi as long as or little shorter than the top width. Body black in life.....		15
15. Processus terminalis 1.8–2.6 times as long as base of antennal segment VI. On <i>Acer pictum</i> s. lat	<i>P. kuwanaii</i>	
- Processus terminalis 1.4–1.8 times as long as base of antennal segment VI. On <i>Acer ginnala</i>		
.....	<i>P. loricatus</i>	
16. Processus terminalis 3.4–3.9 times as long as base of antennal segment VI. Body pale yellow in life. On <i>Acer japonicum</i>	<i>P. acerijaponicus</i> sp. nov.	
- Processus terminalis 1.7–3.3 times as long as base of antennal segment VI. Body dark color in life		17
17. Hind tibiae pale brown except at base and on distal half. Body shining black in life. On <i>Acer diabolicum</i>	<i>P. kajicola</i> sp. nov.	
- Hind tibiae entirely dark brown to black.....		18
18. Abdomen with a dark brownish band on each of tergites I–V. Body reddish or purplish brown in life. On <i>Acer</i> species belonging to the section Palmata	<i>P. californiensis</i> (part., see 19)	
- Abdomen with a pair of dark brownish spinal sclerites on each of tergites I–VII.....		19
19. Ultimate rostral segment 1.8–2.2 time as long as its basal width, 0.63–0.80 times as long as segment II of hind tarsus. Body reddish or purplish brown in life. On <i>Acer</i> species belonging to the section Palmata.....	<i>P. californiensis</i> (part., see 18)	
- Ultimate rostral segment 2.4–2.8 times as long as its basal width, 0.80–0.86 times as long as segment II of hind tarsus. Body greenish black in life. On <i>Acer carpinifolium</i>		
.....	<i>P. chidoricola</i> sp. nov.	

Mature dimorph and apterous viviparous female (autumn generation)

Periphyllus loricatus is excluded in the key because of no specimens collected in autumn.

1. First tarsal chaetotaxy 7:7:7. Cauda thumbnail-like in shape. On *Acer pictum* s. lat. 2 (*P. viridis* s. lat.)
- First tarsal chaetotaxy 5-6:5-6:5-6. Cauda broadly rounded. 4
2. Processus terminalis 2.1-2.3 times as long as base of ultimate antennal segment *P. v. viridis* (Mature dimorph)
- Processus terminalis more than 3.0 times as long as base of ultimate antennal segment 3 (Viviparous female)
3. Longest dorsal seta on head 5.2-6.0 times as long as basal width of antennal segment III. Ultimate rostral segment 1.8-1.9 times as long as its basal width, 0.70-0.71 times as long as segment II of hind tarsus. *P. v. viridis*
- Longest dorsal seta on head 4.7 times as long as basal width of antennal segment III. Ultimate rostral segment twice as long as its basal width, 0.77 times as long as segment II of hind tarsus *P. v. osugiensis*
4. Head with more than 30 setae dorsally. Body yellowish green in life with a broad blackish cross-shaped pattern on the dorsum. On *Acer buergerianum* 5
- Head with less than 25 setae dorsally 6
5. Body rounded, 1.5-1.8 times as long as its maximum width. Antennae 5-segmented; processus terminalis 0.67-1.1 times as long as base of ultimate segment *P. acerihabitans* (Mature dimorph)
- Body oval, 1.8-2.1 times as long as its maximum width. Antennae 6-segmented; processus terminalis 1.5-1.8 times as long as base of ultimate segment *P. acerihabitans* (Viviparous female)
6. Head with more than 10 setae dorsally 7
- Head with 8 setae dorsally 12
7. Processus terminalis more than 1.5 times as long as base of ultimate antennal segment. Body reddish brown to dark brown in life. On *Acer pictum* s. lat. 8
- Processus terminalis less than 1.2 times as long as base of ultimate antennal segment, if more than 1.5 then not on *Acer pictum* s. lat. 10
8. Processus terminalis 1.5-2.0 times as long as base of ultimate antennal segment. Abdomen with a broad band on each of tergites I-VII, in some specimens with a pair of large sclerites on each of tergites I-VI. *P. hokkaidensis* (Viviparous female)
- Processus terminalis 1.8-3.1 times as long as base of ultimate antennal segment. Abdomen with a pair of small sclerites on spinal area and some seta-bearing sclerites on pleural area on each of tergites I-VII. 9
9. Body rounded, 1.4-1.6 times as long as its maximum width. *P. kuwanaii* (Mature dimorph)
- Body oval, 1.7-2.0 times as long as its maximum width. *P. kuwanaii* (Viviparous female)
10. Antennae 0.40-0.48 time as long as body; processus terminalis as long as base of segment VI. Rostrum passing hind coxae; ultimate segment 0.97-1.0 times as long as segment II of hind tarsus. Body brownish orange in life. On *Acer maximowiczianum* *P. allegenes* (Viviparous female)
- Antennae more than 1/2 as long as body. Body dark green to dark brown in life. On *Acer insulare* 11
11. Body rounded, 1.6-1.9 times as long as its maximum width. Processus terminalis 0.85-1.2 times as long as base of ultimate antennal segment. Ultimate rostral segment 1.4-1.7 times as long as its basal width. *P. amamiensis* sp. nov. (Mature dimorph)
- Body oval, 1.9-2.2 times as long as its maximum width. Processus terminalis 1.8-2.6 times as long as base of ultimate antennal segment. Ultimate rostral segment 1.9-2.1 times as long as its basal width. *P. amamiensis* sp. nov. (Viviparous female)

12. Antennae 5-segmented; processus terminalis 1.8–2.2 times as long as base of ultimate segment. On *Acer japonicum*..... *P. acerijaponicus* sp. nov. (Mature dimorph)
- Antennae 6-segmented..... 13
13. Processus terminalis 1.1–1.8 times as long as base of ultimate antennal segment 14 (Mature dimorph)
- Processus terminalis 2.0–3.8 times as long as base of ultimate antennal segment 16 (Viviparous female)
14. Ultimate rostral segment 1.6–2.0 times as long as basal width of the segment, 0.86–1.0 times as long as segment II of hind tarsus. On *Acer carpinifolium* *P. chidoricola* sp. nov.
- Ultimate rostral segment 1.1–1.6 times as long as basal width of the segment, 0.62–0.75 times as long as segment II of hind tarsus..... 15
15. Hind tibiae pale at middle. On *Acer* species belonging to the section Palmata *P. californiensis*
- Hind tibiae entirely pale brown. On *Acer diabolicum*..... *P. kajicola* sp. nov.
16. Ultimate rostral segment 1.8–2.2 times as long as its basal width. On *Acer carpinifolium* *P. chidoricola* sp. nov.
- Ultimate rostral segment 1.5–1.8 times as long as its basal width. On *Acer* species belonging to the section Palmata..... 17
17. Processus terminalis 2.9–3.8 times as long as base of ultimate antennal segment. Hind tibiae pale brown except at base. Only on *Acer japonicum* *P. acerijaponicus* sp. nov.
- Processus terminalis 2.0–3.0 times as long as base of ultimate antennal segment. Hind tibiae entirely dark brown to black, entirely pale brown, or pale brown at middle. On many species belonging to the section Palmata..... *P. californiensis*

ACKNOWLEDGMENTS

I thank Dr. I. Yao (SEHU) for sending literatures, Mr. T. Matsuzawa (Yokohama Plant Protection Station) and Mr. T. Nakagawa (Moji Plant Protection Station) for offering valuable specimens, Dr. J. Shimizu (Nikkô Botanical Garden of the Tokyo University) for permission to collect *Acer*-infesting aphids in the garden, and Dr. S. Akimoto (SEHU) for comments on the manuscript.

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