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Rediscovery of "*Astegopteryx*" *takenouchii* (Homoptera, Aphidoidea), with Notes on its Soldiers and Hornless Exules

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Abstract The broccoli's-head-like gall of "*Astegopteryx*" *takenouchii* was rediscovered from *Styrax japonica* in Japan. Second-instar soldiers were found among aphids in the gall. First-instar larvae deposited by alates (emigrants) have well-developed marginal wax plates on their tergites, but, unlike 1st-instar exules of other gall-forming cerataphidines, they lack frontal horns and have a long rostrum. These characters strongly suggest that this species belongs to the genus *Aleurodaphis*.

The original description of *Astegopteryx takenouchii* was given by TAKAHASHI (1934). He left a description of its alates taken from a gall and a good figure of the gall in a dried condition. The gall was collected from a tree at Nishishiiya, Usagun, Ōita Pref., Japan, on November 3rd, 1933; he inferred, from the host range of its allies, that the tree was a species of *Styrax*. Although the large gall of *A. takenouchii* should be noticeable, it has not been rediscovered up to now.

On October 5th, 1986, Mr. T. TABE found a gall of this species on the snowbell *Styrax japonica* at Tsutsumi, Chigasaki, Kanagawa Pref., Japan. Through the courtesy of Mr. T. HAMAGUCHI, we had an opportunity of examining the material. The gall and the aphid inhabitants had already been dried up, but we got some well-mounted specimens of alates, apterae and immatures, by boiling them in 10% KOH solution. Morphological characters of the alates accorded well with those in the original description except that the 6th antennal segment sometimes has one secondary rhinarium or two.

In this paper, we describe the gall, report the occurrence of 2nd-instar soldiers, and transfer this species to *Aleurodaphis* for the reason mentioned later.

Gall

The following description is based on color photos taken by Mr. F. HIRANO



Fig. 1. Gall of *Aleurodaphis takenouchii*: upperside (A) and underside (B).

and on fragments of the gall.

The gall (Fig. 1) is globular, and looks like a broccoli's head. The diameter is about 10 cm. The main parts are made of ramified twig-like projections as in the gall of *Ceratoglyphina bambusae* (= *Astegopteryx styracicola*) (cf. fig. 1 in AOKI *et al.*, 1977). The "twigs" themselves are solid, and aphids live on their surfaces. The surface of the whole gall is not coated with wax as in *C. bambusae* (cf. fig. 1 in AOKI, 1979), and looks green.

According to TABE (pers. comm.), the gall stemmed from a rather thick twig, which was undoubtedly of more than one year (see also fig. 1 A in TAKAHASHI, 1934).

Occurrence of Soldiers

Among the mounted specimens we found eight aphids (Fig. 2) which are similar to the sterile 2nd-instar soldiers of *Ceratoglyphina bambusae* (AOKI *et al.*, 1977), *Astegopteryx styraci* (AOKI & KUROSU, 1989) and *Pseudoregma shitosanensis* (AOKI, 1982) in having sclerotized tergites and thick frontal setae. These aphids are probably sterile 2nd-instar soldiers of *Aleurodaphis takenouchii*. (None of them had the next instar skin inside.) We also found two and four aphids which are presumed to be 1st-instar and normal 2nd-instar larvae, respectively. They are described below to support our presumption.

1. *First-instar larva*

The following description is based on the two mounted specimens.

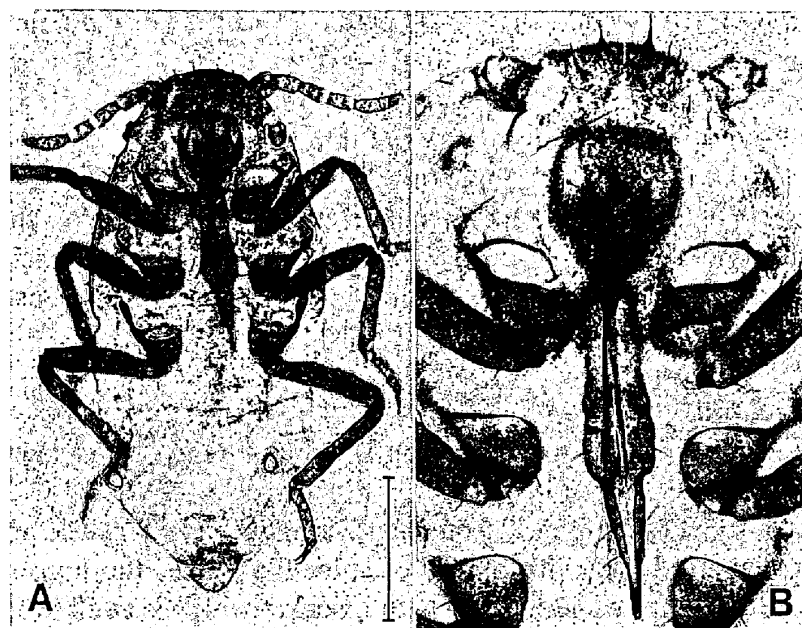


Fig. 2. Second-instar soldier of *Aleurodaphis takenouchii*: dorsal (A) and ventral (B) views.
Scale: 0.02 mm for A and 0.01 mm for B.

Body 0.52–0.56 mm long. Antenna 5-segmented. Tergites membranous, without wax plates. Head with a pair of spine-like setae; the longer one 0.020–0.022 mm, ca. 0.003 mm wide at base, with a socket which is ca. 0.008 mm wide at base. Ultimate rostral segment 0.110–0.112 mm long, without secondary setae. Abdominal tergites I–IV each with 3 pairs of setae; longest seta on tergite I 0.038 mm; abdominal tergites V–VII each with spinal and marginal pairs of setae (tergite V sometimes also with a pleural seta); tergite VIII and cauda each with a pair of setae. Anal plate with 4 setae. Cornicle absent. Tarsi 2-segmented; 1st segment with a pair of setae; 2nd segment 0.088–0.090 mm on hind tarsus.

The 1st-instar larvae are thought to molt into 2nd-instar aphids of two forms, soldiers and normal 2nd-instar larvae (reproductives-to-be), as in the aforementioned cerataphidines.

2. Soldier (Fig. 2)

The following description is based on the eight mounted specimens unless the sample size is mentioned in parentheses.

Body 0.64–0.77 mm long. Antenna 5-segmented. Tergites sclerotized weakly but more strongly than in the 1st-instar and normal 2nd-instar larvae, without wax plates. Head with a pair of thick spine-like setae; the longer one 0.020–0.024 mm, ca. 0.004 mm wide at base, with a socket which is ca. 0.010 mm wide at base. Ultimate rostral segment 0.096–0.106 mm long ($n=7$), without secondary setae. Abdominal tergites with a number of long pointed setae; tergite I with 10–13 setae, of which the longest one is 0.050–0.070 mm ($n=7$); tergites VII and VIII with 6–7 and

4–6 setae, respectively; cauda with 4–7 setae. Cornicle on abdominal tergite V, ring-like, somewhat elevated around, 0.016–0.022 mm in inner diameter, encircled by 4–6 setae. First tarsal segment with 1 (on hind tarsus) or 2 (on fore and mid tarsi) spine-like setae in addition to a pair of longer, pointed setae. Second segment of hind tarsus 0.082–0.086 mm long ($n=7$).

The presence of thick spine-like setae on the frons suggests that the soldiers of this species not only defend their colony (by stinging predators with their stylets) but also push honey globules and exuviae out of the gall with their heads, as those of *Astegopteryx styraci* do (AOKI & KUROSU, 1989).

3. *Normal 2nd-instar larva*

The following description is based on the four mounted specimens unless the sample size is shown in parentheses.

Body 0.68–0.79 mm long. Antenna 5-segmented. Tergites membranous, without wax plates. Head with a pair of spine-like setae; the longer one 0.014–0.018 mm, ca. 0.002 mm wide at base, with a socket which is ca. 0.008 mm wide at base. Ultimate rostral segment 0.090–0.100 mm long ($n=3$), without secondary setae. Abdominal tergites with a number of short setae; tergite I with 9–12 setae, of which the longest one is 0.024–0.032 mm; tergites VII and VIII with 6–7 and 4–5 setae, respectively; cauda with 6 setae. Cornicle ring-like, 0.018–0.022 mm in inner diameter, encircled by 4 or 5 setae. First tarsal segment with 3 or 4 setae as in the soldier. Second segment of hind tarsus 0.084–0.090 mm long.

The normal 2nd-instar larvae are thought to grow into apterae and alate emigrants.

Heteroecy and Taxonomic Position

Among the mounted specimens we also found three aphids with a long rostrum (Fig. 3). They are 1st-instar larvae undoubtedly laid by alates, because larvae of the same type are contained as embryos in alates. They are not sexuales, because the embryos in alates are not dimorphic in size, and because they have well-developed marginal wax plates (Fig. 3 B); such wax plates are unknown in cerataphidine sexuales. (For figures of the 1st-instar sexuales of some cerataphidines, see AOKI *et al.*, 1981; KUROSU & AOKI, 1986; AOKI & KUROSU, 1989.) They are therefore 1st-instar exules which are normally to be laid on the (unknown) secondary host, and their mothers are emigrants.

The following description of the 1st-instar exule is based on the three specimens.

Body 0.48–0.54 mm long. Head, prothorax, abdominal tergite VIII and cauda sclerotized. Tergites surrounded by a number of marginal wax plates. Each wax plate composed of round cells arranged in a row; the number of cells in a plate 2–3 on abdominal tergite I, 9–10 on abdominal tergite VIII; total number of marginal cells excluding those on head 79–91. Non-marginal small plates appearing just

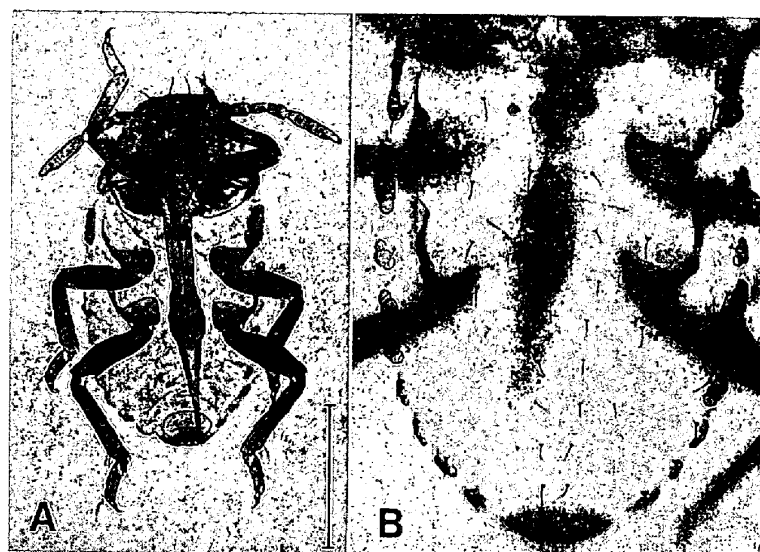


Fig. 3. First-instar larva deposited by the emigrant of *Aleurodaphis takenouchii*: ventral view (A) and abdominal tergites (B). Scale: 0.02 mm for A and 0.01 mm for B.

posterior to spinal setae on prothorax and mesothorax, and sometimes also on metathorax. Head with 2 pairs of long setae near the frontal margin, of which the longest one is 0.024–0.030 mm, without frontal horns. Antenna 5-segmented; segments III and IV weakly, V distinctly imbricated; number of setae on each segment as follows: I: 2, II: 2, III: 0, IV: 2, V: 1+5; the basal seta on V 0.020–0.022 mm long; length of each segment in mm as follows: I: 0.030–0.032, II: 0.030–0.034, III: 0.026–0.028, IV: 0.026–0.030, V: 0.082–0.088; primary rhinaria ciliated, on IV 0.006–0.008 mm and on V 0.014–0.016 mm in axial length. Rostrum reaching near the end of body; ultimate segment slender, 0.154–0.156 mm long, a little longer than hind tibia, without secondary setae. Tarsi 2-segmented, with some spinules; 1st segment with a pair of setae, of which the longer one is 0.046–0.050 mm on hind tarsus; 2nd segment 0.056–0.060 mm long on hind tarsus, with 3 pairs of setae apically, a pair of setae mid-dorsally, and a pair of setae on empodium, the dorsoapical setae long and capitate, the empodial setae extending beyond the apices of claws and spatulate (though not clearly), the lateroapical setae also long and indistinctly spatulate, the others pointed. Abdominal tergites I–III each with 3 pairs of setae, the longest one on tergite I 0.014–0.016 mm; abdominal tergites IV–VII each with only spinal and marginal pairs of setae, but on IV and V a pleural seta sometimes appearing; tergite VIII with a pair of setae, the longer one 0.022–0.024 mm; cauda with a pair of setae. Anal plate with 2 pairs of setae. Cornicle absent.

The 1st-instar larvae have well-developed marginal wax plates on their tergites, but, unlike 1st-instar exules of other gall-forming cerataphidines (*Astegopteryx styracophila*, *Cerataphis fransseni*: HILLE RIS LAMBERS, 1953; *Ceratovacuna nekoashi*: TAKAHASHI, 1958; *Pseudoregma shitosanensis*: AOKI, 1982; *Ceratoglyphina bambusae*,

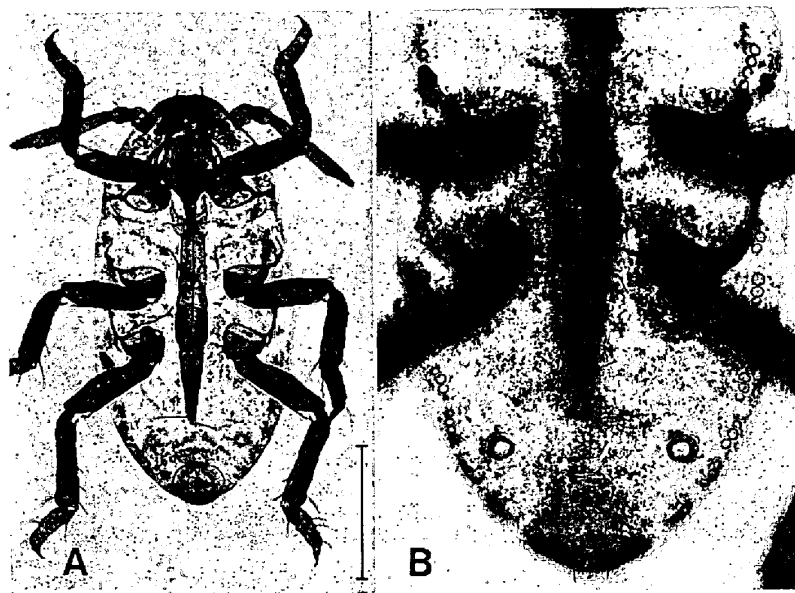


Fig. 4. First-instar larva of *Aleurodaphis blumeae* collected from *Carpesium abrotanoides* at Tateyama, Chiba Pref., Japan, on May 21st, 1986: ventral view (A) and abdominal tergites (B). Scale: 0.02 mm for A and 0.01 mm for B.

Astegopteryx bambucifoliae: AOKI & KUROSU, in prep.), they lack frontal horns and have a very long rostrum. These characters strongly suggest that *takenouchii* is closely related to *Aleurodaphis* species. We accordingly transfer this species from *Astegopteryx* to *Aleurodaphis*. The taxonomic position of the genus *Aleurodaphis* has not been clear up to now. If *takenouchii* really belongs to *Aleurodaphis*, this genus will certainly belong to the tribe Cerataphidini because of its association with *Styrax*.

Three species of *Aleurodaphis* have hitherto been known in Japan from secondary hosts: *Aleurodaphis blumeae* from *Carpesium abrotanoides* (TAKAHASHI & SORIN, 1958), *A. asteris* from *Gymnaster savatieri* (TAKAHASHI & SORIN, 1958) and *A. sp.* from *Impatiens textori* (MORITSU, 1983). We examined 1st-instar larvae of *A. blumeae* (Fig. 4) and *A. sp.* and found that both of them have 4-segmented antennae and distinct ring-like cornicles (see Fig. 4 B for *A. blumeae*). According to SORIN (pers. comm.), 1st-instar larvae of *A. asteris* also have distinct cornicles. Therefore, the generations of *A. takenouchii* on the secondary host probably have not been reported under other names.

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