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Title	Description of some morphs on the primary host of Micromyzodium kuwakusae (Uye) (Hemiptera: Aphididae)
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Citation	Insecta matsumurana. New series : journal of the Faculty of Agriculture Hokkaido University, series entomology., 73, 65-74
Issue Date	2017-10
Doc URL	https://hdl.handle.net/2115/67685
Type	departmental bulletin paper
File Information	3 Sugimoto2.pdf

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INSECTA MATSUMURANA

NEW SERIES 73: 65–74 OCTOBER 2017

DESCRIPTION OF SOME MORPHS ON THE PRIMARY HOST OF MICROMYZODIUM KUWAKUSAE (UYE) (HEMIPTERA: APHIDIDAE)

By SHUN'ICHIRO SUGIMOTO

Abstract

SUGIMOTO, S., 2017. Description of some morphs on the primary host of *Micromyzodium kuwakusae* (Uye) (Hemiptera: Aphididae). *Ins. matsum. n. s.* 73: 65–74, 6 figs.

Field observation, morphological study, and transfer experiments showed that yellow aphids on *Loropetalum chinense* (Hamamelidaceae) are the primary host generations of *Micromyzodium kuwakusae* (Uye) that has been reported to be associated with *Fatoua villosa* (Moraceae). The present study showed that *M. kuwakusae* alternates host plants between *L. chinense* as a primary host and *F. villosa* as a secondary host. Some morphs on the primary host of *M. kuwakusae* are described for the first time, and the life cycle is summarized.

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Introduction

Micromyzodium kuwakusae (Uye) was originally described as a member of the genus *Macrosiphoniella* based on apterous and alate viviparous females on *Fatoua villosa* (Moraceae) (Uye, 1924). After that this species has not been referred at all in the taxonomic revisions of aphids from Japan (cf. Shinji, 1941; Miyazaki, 1971). However, the apterous and alate viviparous females have been briefly described with some figures and photographs under the name *Eomyzus kuwakusae* by Moritsu (1983). *M. kuwakusae* has been recorded also from China (Su *et al*., 2012) and Korea (Lee *et al*., 2013). Su *et al*. (2012) described the morphology of apterous and alate viviparous females with the collection data of specimen examined. Although they included four apterous viviparous females from " 櫪木 ?" in the specimens examined (" 櫪木 " means *Loropetalum chinense* in a Chinese character), they did not include *L. chinense* in the host records in their paper. Lee *et al*. (2013) recorded the morphology of apterous viviparous female found on *F. villosa*. Thus, only the morphology of viviparous females is known for this species, but its life cycle and association with other plants have not been reported.

In the course of recent aphid survey, a yellow aphid species belonging to the tribe Macrosiphini was found on *L. chinense* (including var. *rubra*) at the several sites of Tôkyô Metropolis and Kanagawa Prefecture, central Japan in early April 2015. The yellow aphid was morphologically similar to *Micromyzodium kuwakusae* on *F. villosa*, but it was different from the latter in having black tibiae, reduced dorsal pigmentation and short dorsal setae on the body. Colonies of the yellow aphid on *L. chinense* disappeared from the plant before late April after the appearance of the alate form; however, in late June one apterous viviparous female was accidentally found on *L. chinense* at Sagamihara, Kanagawa Prefecture. Its morphology accorded well with the apterous morph of *M. kuwakusae* on *F. villosa* in having pale yellow tibiae, developed dorsal patch and long dorsal setae on the body. Moreover, transfer experiments using alate viviparous females of *M. kuwakusae* from *F. villosa* confirmed that the alate females transferred on *L. chinense* in October produced yellow-colored oviparous females on the leaves. Field observations also confirmed that alate viviparous females and oviparous females appeared on *L. chinense* and that they were not distinguished from the morphs observed in the transfer experiment. These facts led to the conclusion that *M. kuwakusae* on *F. villosa* and the yellow aphids on *L. chinense* are one and the same species. In the present study, some morphs on the primary host of *M. kuwakusae* are described for the first time, and the life cycle is summarized.

Materials and Methods

All the specimens examined were collected or reared by the author, and were mounted on microscope slides by Martin's (1983) methods. They are deposited in the Laboratory of Systematic Entomology, Hokkaido University and the Tokyo Substation of Yokohama Plant Protection Station.

Description

Micromyzodium kuwakusae (Uye)

Macrosiphoniella kuwakusae Uye, 1924: 408.

Eomyzus kuwakusae: Moritsu, 1983: 115 & 330.

Micromyzodium kuwakusae: Eastop & Blackman, 2005: 28; Su *et al*., 2012: 663; Lee *et al*., 2013: 130.

Fundatrix (Fig. 1). Color in life: body pale yellow; head grayish yellow; antennae black; legs black, but coxae, trochanter and base of femora brownish yellow; siphunculi black; cauda pale yellow.

Body oval, 1.73–1.85 mm long. Head smooth on dorsum, sparsely spinulated near antennal sockets and on venter; dorsal setae blunt at apices, arranged in one anterior, one middle and two posterior pairs; anterior pair longer than other ones, of which the longest one is 1.0–2.0 times as long as the basal width of antennal segment III; antennal tubercles diverging at inner side, each with 2 setae. Antennae 6-segmented, 0.9–1.2 times as long as body; segments I and II smooth, III and IV weakly imbricated, V and VI imbricated; segment III with 5–11 setae, all of which are blunt at apices and about 1/3 of the basal width of antennal segment III; processus terminalis of segment VI 2.8–3.3 times as long as base of the segment. Rostrum reaching hind coxae: ultimate segment 1.5–1.7 times as long as segment II of hind tarsus, with 2 secondary setae. Legs with many short setae; longest seta on hind femora and middle part of hind tibiae 0.27–0.45 times and 0.67–1.0 times as long as the trochantro-femoral suture and middle width of the tibiae, respectively; hind tibiae rather short than those of fundatrigenia, 2.1–2.6 times as long as siphunculi. Abdomen membranous, weakly imbricated on ante- and postsiphuncular sclerites and a dorsal band on segment VIII; tergites I–VII with short and blunt setae, of which longest one on tergite III is about 1/3 as long as the basal width of antennal segment III; tergite VIII with 5 or 6 long hair-like setae, of which longest one is 1.7–3.0 times as long as the basal width of antennal segment III. Genital plate with 5–11 setae along posterior margin and a pair of setae anteriorly. Siphunculi cylindrical or slightly swollen at middle, weakly imbricated, 2.8–3.0 times as long as caudal length, with a flange. Cauda shortly conical, constricted at extreme base, with 5 setae.

Measurements of one specimen (mm): body 1.76; antenna 1.88, segments III–VI 0.46+0.31+0.30+0.64 (0.15+0.49); ultimate rostral segment 0.17; hind femur 0.60, hind tibia 1.12; segment II of hind tarsus 0.10; siphunculus 0.48; cauda 0.16; longest seta 0.03 on head, 0.01 on antennal segment II, 0.015 on hind femur, 0.025 on middle part of hind tibia, 0.01 on abdominal tergite III, 0.05 on abdominal tergite VIII.

Apterous fundatrigenia (Figs 2, 3, 6a). Differs from the fundatrix in the following characters [based on 11 specimens collected in April (Fig. 2)]: body 1.67–2.05 mm long; anterior and middle pairs of dorsal setae on head almost same in length, of which the longest one is 1.2–2.6 times as long as the basal width of antennal segment III; antennae 1.1–1.4 times as long as body, segment III with 10–17 setae, processus terminalis of segment VI 3.6–4.5 times as long as base of the segment; ultimate rostral segment 1.3–1.5 times as long as segment II of hind tarsus; hind tibiae longer, 2.6–3.2 times as long as siphunculi; abdomen with small black spots and bands on tergites II to V, sometimes these spots and bands connected to each other and forming irregularly shaped dorsal

Fig. 1. Fundatrix: (a) general aspect, (b) head, (c) abdomen.

patch; tergite VIII with 4 setae; siphunculi 2.3–2.7 times as long as caudal length.

Measurements of one specimen (mm): body 1.88; antenna 2.30, segments III–VI 0.53+0.37+0.38+0.82 (0.15+0.67); ultimate rostral segment 0.165; hind femur 0.80, hind tibia 1.46; segment II of hind tarsus 0.12; siphunculus 0.495; cauda 0.195; longest seta 0.055 on head, 0.015 on antennal segment III, 0.02 on hind femur, 0.055 on middle part of hind tibia, 0.015 on abdominal tergite III, 0.075 on abdominal tergite VIII.

One specimen collected in June (Fig. 3) closely resembles the apterous alienicola on *Fatoua villosa* in having pale yellow tibiae, developed dorsal patch, and long hair-like setae on the body. The relative length of the longest seta on each part to the basal width of antennal segment III is as follows: on dorsal head 3.2 times (3.5–4.0 in the apterous alienicola), on antennal segment III 1.5 times (1.8–2.0), on abdominal tergite III 3.0 times (4.6–5.0). Moreover the longest seta on hind femora and middle part of hind tibiae is 1.3 times (1.2–1.3) and 1.83 times (1.8–2.2) as long as the trochantro-femoral suture and middle width of the tibiae, respectively.

Measurements of one specimen (mm): body 1.60; antenna 1.89, segments III–VI 0.45+0.31+0.28+0.68 (0.13+0.55); ultimate rostral segment 0.145; hind femur 0.62, hind tibia 1.15; segment II of hind tarsus 0.10; siphunculus 0.39; cauda (unmeasured); longest seta 0.08 on head, 0.038 on antennal segment III, 0.065 on hind femur, 0.50 on middle part of hind tibia, 0.075 on abdominal tergite III, (unmeasured) on abdominal tergite VIII.

Emigrant (Fig. 4a) and *Immigrant* (Fig. 4c). Both morphs closely resemble the alae alienicola (Fig. 4b) in general aspect, but differ in having shorter setae than the

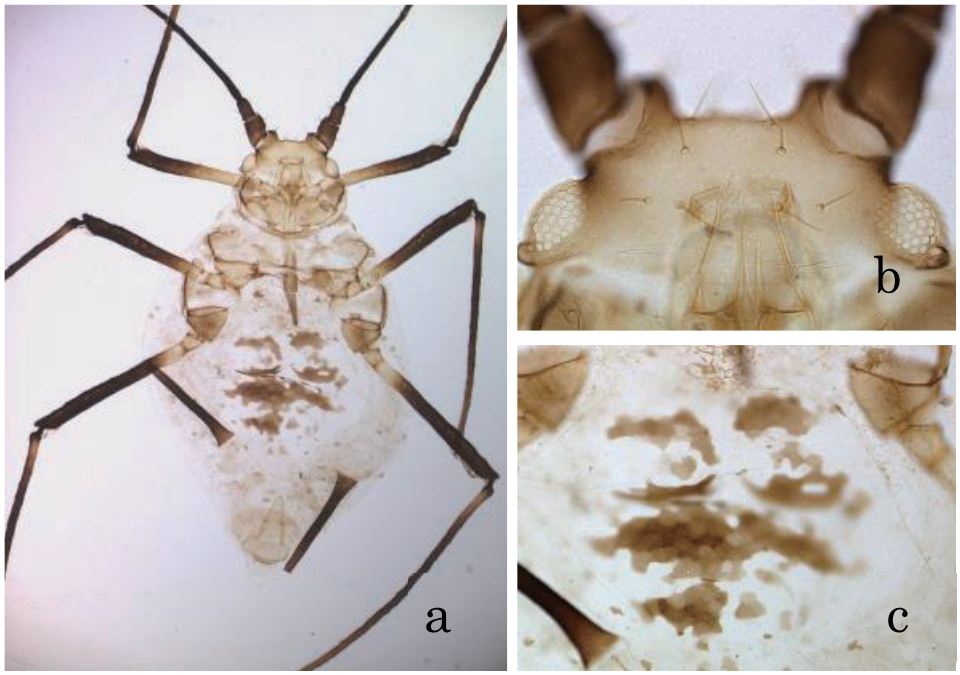

Fig. 2. Fundatrigenia collected in April: symbols as in Fig. 1.

alienicola, and the emigrant differs from the immigrant in having more short setae. These differences are mentioned in the parenthesis of the following description.

Color in life: head, antennae, thorax, legs and siphunculi black; abdomen dusky yellow with a large central patch dorsally and rounded sclerites marginally.

Body 1.73–1.85 mm long. Antennae 1.1–1.3 times as long as body; segment III with 25–45 secondary rhinaria and with 5–11 setae, of which the longest one is 0.33–0.90 times (0.33–0.70 in emigrant, 0.60–0.90 in immigrant; 1.4 in alienicola) as long as the basal width of the segment; segment IV with 14–31 rhinaria; segment V with 3–13 rhinaria; processus terminalis of segment VI 3.7–5.7 times as long as base of the segment. Legs with many short setae; longest seta on hind femora 0.39–0.82 times (0.39–0.63 in emigrant, 0.56–0.82 in immigrant; 1.0 in alienicola) as long as the trochantro-femoral suture; longest seta on middle part of hind tibiae 0.83–1.2 times (0.83–1.2 in emigrant, 1.0–1.2 in immigrant; 1.4 in alienicola) as long as middle width of the tibiae. Abdomen with shorter setae especially in emigrant; longest seta on tergites III 0.4–2.2 times (0.4–0.9 in emigrant, 1.2–2.2 in immigrant; 3.0 in alienicola) as long as basal width of antennal segment III; that on VIII 0.8–2.4 times (0.8–1.8 in emigrant, 1.4–2.4 in immigrant; 2.6 in alienicola) as long as basal width of antennal segment III. Siphunculi 1.9–2.4 times as long as caudal length.

Measurements of one emigrant (mm): body 1.70; antenna 2.01, segments III–VI 0.45+0.29+0.32+0.80 (0.15+0.65); ultimate rostral segment 0.14; hind femur 0.65, hind tibia 1.37; segment II of hind tarsus 0.10; siphunculus 0.31; cauda 0.13; longest seta 0.02 on head, 0.015 on antennal segment III, 0.025 on hind femur, 0.25 on middle part of hind

Fig. 3. Fundatrigenia collected in June: symbols as in Fig. 1.

tibia, 0.013 on abdominal tergite III, 0.02 on abdominal tergite VIII.

Measurements of one immigrant (mm): body 1.65; antenna 2.08, segments III–VI 0.47+0.33+0.295+0.835 (0.13+0.705); ultimate rostral segment 0.13; hind femur 0.62, hind tibia 1.24; segment II of hind tarsus 0.09; siphunculus 0.28; cauda 0.12; longest seta 0.04 on head, 0.02 on antennal segment III, 0.03 on hind femur, 0.03 on middle part of hind tibia, 0.05 on abdominal tergite III, 0.055 on abdominal tergite VIII.

Oviparous female (Figs 5, 6b). Resembles the fundatrix in general aspects, but differs from therefrom in the following characters: body small, 1.15–1.57 mm long; legs pale brown except on apical half of femora; dorsum with long hair-like setae, longest seta on head, abdominal tergites III and VIII 2.6–5.0, 2.7–6.0 and 3.9–5.7 times as long as basal width of antennal segment III, respectively; ultimate rostral segment 1.1–1.2 times as long as segment II of hind tarsus, with 2–4 setae; hind tibiae 2.4–3.2 times as long as siphunculi, with numerous scent plaques except on basal and apical small areas; tergite VIII with 6–13 setae; genital plate totally with 24–45 setae including 12–24 ones along posterior margin; siphunculi 2.4–3.7 times as long as caudal length; cauda shorter, with 5–10 setae.

Measurements of one specimen (mm): body 1.38; antenna 1.73, segments III–VI 0.32+0.29+0.26+0.66 (0.15+0.51); ultimate rostral segment 0.115; hind femur 0.525, hind tibia 0.98; segment II of hind tarsus 0.105; siphunculus 0.36; cauda 0.13; longest seta 0.07 on head, 0.035 on antennal segment III, 0.055 on hind femur, 0.40 on middle part of hind tibia, 0.07 on abdominal tergite III, 0.085 on abdominal tergite VIII.

Male (Figs 4d, 6b*)*. Differs from the immigrant in the following characters: body 1.48–1.86 mm long; antennae 1.3–1.4 times as long as body, with 37–47 secondary

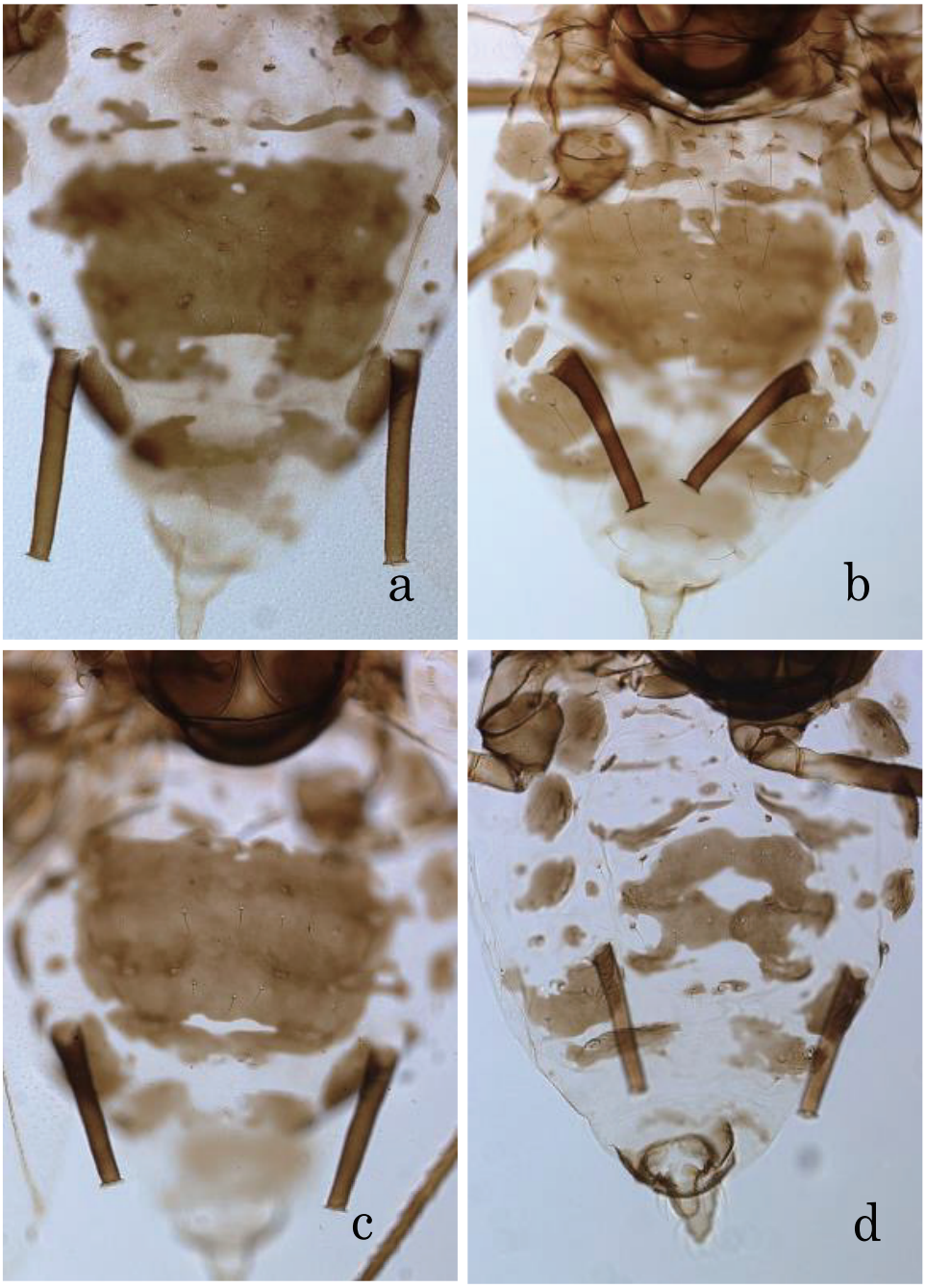

Fig. 4. Abdomen of alate morphs: (a) emigrant, (b) alienicola, (c) immigrant, (d) male.

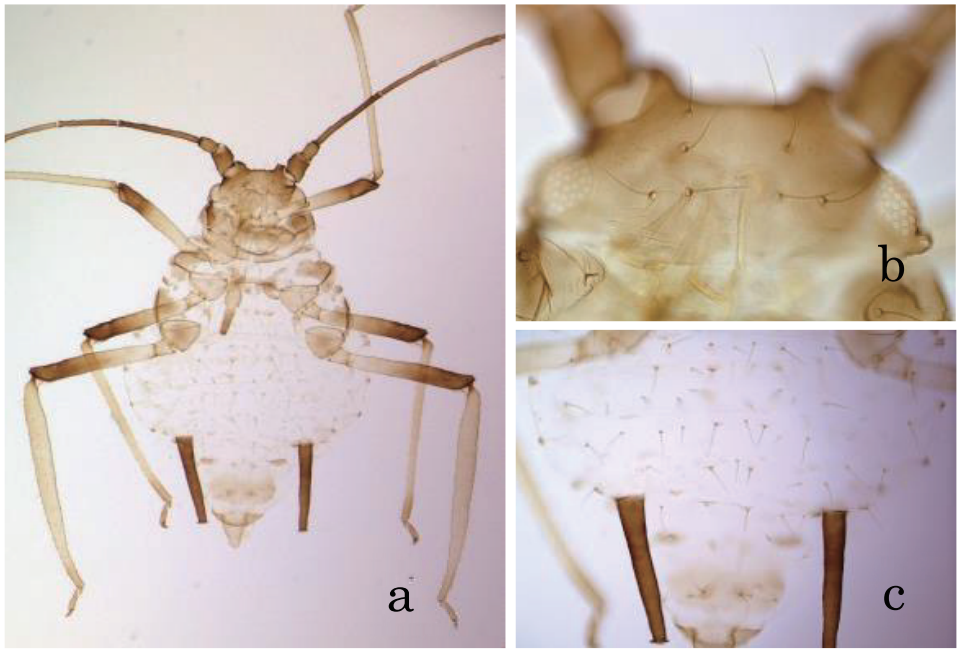

Fig. 5. Oviparous female: symbols as in Fig. 1.

rhinaria on segment III, 16–25 on IV, 8–16 on V and 1 or 2 (rarely 0) on base of VI; abdomen with transvers bands on tergites III–VII, which are often broken at middle or partly connected each other .

Measurements of one emigrant (mm): body 1.70; antenna 2.36, segments III–VI 0.56+0.41+0.375+0.85 (0.135+0.715); ultimate rostral segment 0.12; hind femur 0.685, hind tibia 1.44; segment II of hind tarsus 0.10; siphunculus 0.27; cauda 0.115; longest seta 0.03 on head, 0.02 on antennal segment III, 0.03 on hind femur, 0.25 on middle part of hind tibia, 0.045 on abdominal tergite III, 0.05 on abdominal tergite VIII.

Specimens examined. *Fundatrix*: Aomi, Kôtô-ku, Tôkyô (1ex., 2.iv.2015, on *Loropetalum chinense* var. *rubra* (LCR); 1ex., 9.iv.2015, on LCR, 2exs., 15.iii.2016, on LCR); Honmoku, Yokohama, Kanagawa Pref. (1ex., 4.iv.2015, on LCR). *Apterous fundatrigenia*: Aomi, (2exs., 2.iv.2015, on LCR; 6exs, 9.iv.2015, on LCR); Honmoku (3exs, 4.iv.2015, on *Loropetalum chinense* (LC); 1exs., 4.iv.2015, on LCR); Shimomizo, Sagamihara, Kanagawa Pref. (1ex., 20.vi.2015, on LCR). *Emigrant*: Aomi (6exs., 22.iv.2015, on LCR); Honmoku (5exs., 15.iv.2015, on LC). *Apterous alienicola*: Tonomachi, Matsue, Shimane Pref. (2exs., 13.ix.2015, on *Fatoua villosa*); Ishihara-machi, Kokuraminami-ku, Kita-Kyûshû, Fukuoka Pref. (9ex., 30.x.2016, on *F. villosa*). *Alate alienicola*: Tonomachi (1ex. 13.ix.2015, on *F. villosa*). *Immigrant*: Aomi (2exs., 16.xi.2015, on LCR); Shimomizo (2exs., 7.xi.2015, on LCR); Reared specimens (5 alates produced by the clone collected at Tonomachi in Shimane and emerged on *F. villosa* from 15 to 18 October 2015, mounted at 28.x.2015). *Oviparous female*: Aomi (7exs., 16.xi.2015, on LCR); Shimomizo (16exs., 7.xi.2015, on LCR); Reared specimens (7exs. produced on LCR by above 5 alate forms which are emerged on *F. villosa* and artificially transferred to LCR, 9.xi.2015). *Male*: Aomi (1ex., 16.xi.2015,

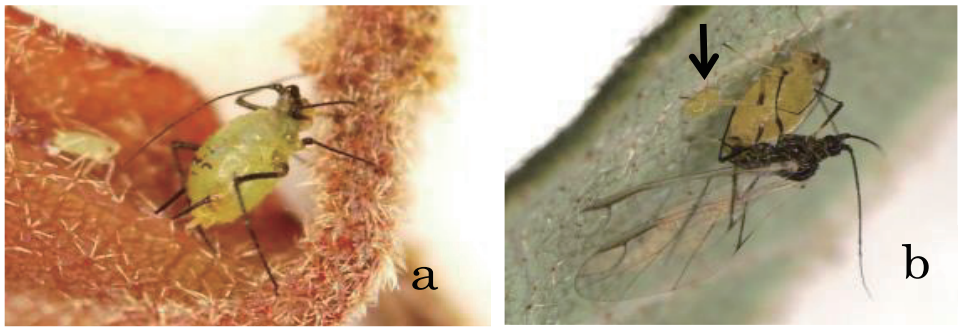

Fig. 6. General aspect in life of some morphs on *Loropetalum chinense* var. *rubra*: (a) fundatrigenia, (b) oviparous female, males and egg (arrow).

on LCR), Shimomizo (5exs., 7.xi.2015, on LCR).

Host plant. Primary host: *Loropetalum chinense* (including var. *rubra*) (Hamamelidaceae). Secondary host: *Fatoua villosa* (Moraceae).

Outline of the life cycle. In my field observation at Aomi and Honmoku, which are located on the cost area of the Tokyo Bay, the adult fundatrices of this species were found on the underside of leaves of *Loropetalum chinense* (including var. *rubra*) from middle March to early April. Their progeny (apterous fundatrigeniae) were found from early to middle April (Fig. 6a), and the emigrants (spring migrants) emerged on *L. chinense* from middle April and migrated to *Fatoua villosa* by late April. The immigrants (autumn migrants) emerged on *F. villosa* from middle to late October, migrated to *L. chinense*, and produced oviparous females. From early to middle November when the oviparous females became adults, alate males were also found on the leaves of *L. chinense*. After mating (Fig. 6b), the oviparous females laid overwintering eggs on the underside of the leaves. Thus, *M. kuwakusae* is a species host-alternating between *L. chinense* as a primary host and *F. villosa* as a secondary host. In June a small colony consisting of one apterous fundatrigenia and some larvae was found on *L. chinense* at Shimomizo, Sagamihara City, which is located inward approximately 30 km away from the Tokyo Bay. This situation is probably an accidental event, because there were no findings of *M. kuwakusae* on *L. chinense* in any of the observation sites during May to September 2015. The alienicolae feed mainly on the underside of the leaves and cause a little curling of the leaves of *F. villosa*; however, the fundatrices, fundatrigeniae and oviparous females on *L. chinensis* cause no deformation in the host leaves.

Discussion

Blackman & Eastop (2006, 2016) and Holman (2009) do not include the plant name *Loropetalum chinense* in their publications, probably because no aphids have been recorded with exact data from *L. chinense*. As mentioned in the introduction, however, *L. chinense* has been recorded with a question mark in the collection data of *M. kuwakuae* by Su *et al*. (2012). This study showed that *M. kuwakuae* is a surely *L. chinese*-infesting aphid and uses the plant as a primary host. According to Su *et al*. (2012), *Pilea notata*

and *Urtica fissa* (Urticaceae) are recorded as a host plant of *M. kuwakuae*. Since plants belonging to the genera *Pilea* and *Urtica* were not included in the survey of this study, it is not clear whether *M. kuwakuae* uses these plants in Japan or not. In the field observation, I confirmed *Aphis aurantii* Boyer de Fonscolombe infesting *L. chinense*, which is known as a polyphagous aphid mainly on various shrubs.

Acknowledgments

I thank Miss A. Katô (Tokyo Metropolitan Agriculture and Forestry Research Center), who first found a yellow aphid on *L. chinense* in Tokyo and has requested the Yokohama Plant Protection Station to identify the aphid. I also thank Mr. Y. Yokoi (Director of Research Division, Yokohama Plant Protection Station) for comments on early draft of the manuscript and my colleague Mr. G. Takahashi for his taking a photograph in figure 6a.

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