

Studies on the Pupal Mosquitoes of Japan (9) ¹⁾

Genus *Lutzia*, with Establishment of Two New Subgenera, *Metalutzia* and *Insulalutzia* (Diptera, Culicidae)

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Abstract The pupae of three Japanese species of the genus *Lutzia* are described and their taxonomic characters are discussed. A key and chaetotaxy tables for all species are prepared. *Lutzia* is treated here as a genus rather than as a subgenus of *Culex*. A new subgenus *Metalutzia* is established for *Lutzia fuscana*, *Lt. halifaxii*, *Lt. tigripes* and *Lt. vorax*, and another new subgenus *Insulalutzia* for *Lt. shinonagai*. A key to the three subgenera of *Lutzia* is given. *Lt. vorax* is resurrected from synonymy with *Lt. halifaxii*.

Lutzia was established by THEOBALD, 1903, as a distinct genus (originally spelled as *Lützia*) for a Mexican species, *Culex bigotii*. EDWARDS followed him in 1921 and 1922, but in 1932 he sank it to a subgenus of *Culex*. All later authors apparently have adopted EDWARDS' treatment of 1932. BELKIN, 1962, stated that *Lutzia* might be a very ancient derivative of *Culex*. TANAKA *et al.*, 1979, expressed their view that its morphological modifications were more distinct than in the other subgenera of *Culex*, and it was more reasonable to consider *Lutzia* as a genus. In this paper, following the suggestion of TANAKA *et al.*, 1979, I treat *Lutzia* as an independent genus. KNIGHT and STONE, 1977, listed 21 subgenera and 718 species under the genus *Culex*. Many of these subgenera are morphologically very well defined. Not only *Lutzia* but also other subgenera of the genus *Culex* should have their status reevaluated.

The genus *Lutzia* consists of two species from Central and South America (*Lt. allostigma* and *Lt. bigotii*), three species from Asia and Australasia, and one species from Africa. As stated by EDWARDS, 1932, they are distinctly divided into American and Africa-Asia-Australasian groups. Though not so thought by EDWARDS, 1932, these two groups are no doubt of different stock and may deserve to be ranked as subgenera. CHRISTOPHERS, 1906, proposed *Jamesia* for the Africa-Asia-Australasian group (type-species: *Culex concolor* = *Culex fuscans*), but the name appears to have been preoccupied by JECKEL, 1861 (after KNIGHT and STONE, 1977). Thus, a new name is necessary for the Africa-Asia-Australasian group and I here propose *Metalutzia*.

TANAKA *et al.*, 1979, described *Cx. (Lut.) shinonagai* from Ogasawara-guntô (the Bonin Islands). The taxonomic peculiarity of the adult and larva of this species was fully discussed by them. In this study, the pupa of this species was found to be quite distinct from that of *Lt. fuscana* and *Lt. vorax*, while those of these two species as well as African *Lt. tigripes* (after EDWARDS, 1941) are difficult to distinguish from each other. Therefore, a separate treatment for *Lt. shinonagai* is reasonable, and a new subgenus *Insulalutzia* is presented in this paper.

According to REINERT's principle (1975), I propose the abbreviation, "Lt.," for the genus *Lutzia*, "Mlt." for the subgenus *Metalutzia*, and "Ilt." for *Insulalutzia*.

The principles and methods of this study follow TANAKA, 1999 and TANAKA, 2001. I am indebted to Mr. Edward S. SAUGSTAD for reviewing the manuscript.

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Metalutzia*, a new subgenus of *Lutzia

Type species: *Lutzia vorax* EDWARDS, 1921, from Japan. *Lt. fuscana* (WIEDEMANN, 1820), *Lt. halifaxii* (THEOBALD, 1903), and *Lt. tigripes* (GRANDPRE et CHARMOY, 1901) belong to this subgenus.

Insulalutzia*, a new subgenus of *Lutzia

Type species: *Culex (Lutzia) shinonagai* TANAKA, MIZUSAWA et SAUGSTAD, 1979, from Ogasawara-guntō (the Bonin Islands). Monotypic.

The subgenera *Lutzia*, *Metalutzia* and *Insulalutzia* can be distinguished from each other by the following key.

Key to Subgenera of the Genus *Lutzia*

1. **Adult:** wing pale marked; tarsi pale banded. **Larva:** seta 6-C far anterior of 5-C and at level of 4- and 7-C; 11- and 13-C approximated; dorsomentum with median tooth bifid, the total number of teeth 14-18; siphon longer than saddle, with 1-S of smooth, multibranching subventral setae.
 Subg. *Lutzia* (Central and South American species)
- **Adult:** wing entirely dark scaled; tarsi without pale band. **Larva:** seta 6-C posterior of 5-C; 11- and 13-C widely separated; dorsomentum with median tooth unicuspid, the total number of teeth 9-11 (usually 9); siphon shorter than or at most as long as saddle, 1-S of barbed, 1-3 branched midventral setae. 2
2. **Adult:** prealar area with a scale patch below knob; ♂ palpus with numerous, conspicuous, long apical bristles. **Pupa:** seta 5-II mesad of 4-II; 9-II-VI blunt-tipped; segment VIII with posterolateral corner rather sharply produced. **Larva:** pecten extending nearly whole length of siphon, with teeth rather broadly spaced.
 Subg. *Metalutzia* nov. (Asian, Australasian and African species)
- **Adult:** prealar area without scale patch; ♂ palpus without conspicuous, long apical bristles. **Pupa:** seta 5-II laterad of 4-II; 9-II-VI pointed-tipped as 9-I; segment VIII with posterolateral corner not produced. **Larva:** pecten restricted to middle one third, with teeth closely spaced.
 Subg. *Insulalutzia* nov. (A species endemic to Ogasawara-guntō)

Genus *Lutzia* THEOBALD

THEOBALD, 1903, Monogr. Culicid. 3: 155. Type species: *Culex bigotii* BELLARDI from Mexico.

Dorsal apotome with each lobe more or less squarely semicircular; lateralia usually with feeble trace of facets of compound eye. Trumpet with tracheoid ventrally near base; pinna 1/3-1/2 as long as trumpet. All cephalothoracic setae weak and shorter than trumpet; 2- and 3-C approximated; 6-C shortest of all cephalothoracic setae; 8-C slightly caudad of level of trumpet base. Abdominal terga and sterna covered with minute spicules; seta 1-I (float hair) with thick primary branches which are subdivided into many secondary branches; 4-I at middle between 3-I and 6-I; 5-III mesad of 4-III; 4-IV anterolaterad of 5-IV; 2-IV-VI anteromesad of respective setae 1 and fairly close to posterior margin of respective terga; 11-VI laterad of 10-VI; no conspicuous setae on segment VII except for 9-VII; 6-VII posteromesad of 9-VII; 11-VII close to and cephalad of 10-VII; 9-VIII differentiated, located cephalad of posterolateral corner; 14-VIII longer than 14-III-VII, shorter than 2-VII. Median caudal lobe (segment IX) very

short, with a short stout seta (1-IX) on each side. Paddle rounded, with midrib curved inwards, with 2 apical setae (1- and 2-Pd), 2-Pd longer than 1-Pd.

Key to Japanese Species of the Pupa of *Lutzia*

1. Seta 1-I with less than ten primary and about 20 secondary branches; 2- and 3-I separated; 1-II with divergent branches; 1-III and -IV single; 5-II laterad of 4-II; 9-II~VI pointed-tipped as 9-I; 9-VII very weakly and sparsely barbed, single or two branched; 9-VIII with only 2-3 branches; segment VIII with posterolateral corner not produced. *Lt. (Mlt.) shinonagai*
- Seta 1-I with about 10 primary and numerous secondary branches; 2- and 3-I approximated; 1-II with branches not very divergent; 1-III and -IV multibranched and never single; 5-II mesad of 4-II; 9-II~VI blunt-tipped; 9-VII and -VIII strongly barbed and with more (2-14) branches; segment VIII with posterolateral corner rather sharply produced. 2
2. Longest setae of segments IV-VI sometimes longer than next tergum. *Lt. (Mlt.) vorax*
- Longest setae of segments IV-VI never longer than next tergum. *Lt. (Mlt.) fuscana*

Lutzia (Metalutzia) vorax EDWARDS

(Fig. 1; Table 1)

EDWARDS, 1921, Bull. ent. Res. 12: 327 (♂). Type-loc.: Tokio (*sic*), Japan.

Trumpet length: 0.74-1.05 mm. Paddle length: 1.07-1.32 mm.

Trumpet index 3.69-4.41 (\bar{x} 3.93; 8 ex.); pinna 0.36-0.51 (\bar{x} 0.40) length of trumpet. Seta 1-C \geq 2-C > 3-C in length; 10-C often barbed. Abdominal terga covered with microsculpture of short ridges bearing a single caudally directed minute spicule; on the sterna, these ridges tend to form an imbricate pattern especially in posterior segments; dorsal intersegmental membrane reticulate, more distinctly in anterior intersegments. Setae 2- and 3-I approximated; 3-, 6- or 7-I longest of setae of the segment, and 1-I subequal to them in length; the longest seta 0.72-1.15 (\bar{x} 0.96) length of tergum I, 14 setae of 35 examined as long as or longer than tergum I; 7-I usually as long as or longer than 6-I; 9-I pointed-tipped as usual. Seta 1-II relatively short, with thick stem and fine branches, which are not very divergent; 2-II more often (62%) anterolaterad of 3-II; 5-II always mesad of 4-II, and more often (65%) caudad of it, most often longest of setae of the segment; 7-II sometimes longest, and usually longer than 6-II; 3-II nearly as long as them; the longest seta 0.56-0.83 (\bar{x} 0.68) length of tergum III; 9-II~VI short, blunt-tipped, at or slightly cephalad of level of respective setae 6. Seta 1-, 3- or 5-III longest of setae of the segment, and 6-III nearly as long as them; the longest seta 0.51-0.81 (\bar{x} 0.63) length of tergum IV; 2-III always cephalad of 1-III but transverse position variable; asetose sensillum usually posterolaterad of 4-III. Seta 1- or 5-IV longest of setae of the segment, the longest seta 0.63-1.03 (\bar{x} 0.83) length of tergum V, 2 setae of 39 examined as long as or longer than tergum V; 2-IV almost always anteromesad of 1-IV; 3-IV often (45%) anterolaterad of 5-IV; 4-IV anterolaterad of 5-IV; asetose sensillum variable in position relative to 4-IV, but always caudad of its level. Usually seta 5-V or sometimes 1-V longest of setae of the segment, the longest seta 0.71-1.16 (\bar{x} 0.94) length of tergum VI, 14 setae of 39 examined as long as or longer than tergum VI; 4-V almost always anteromesad of or tandem with 5-V; asetose sensillum more often (72%) posterolaterad of 4-V. Seta 3-VI sometimes (33%)

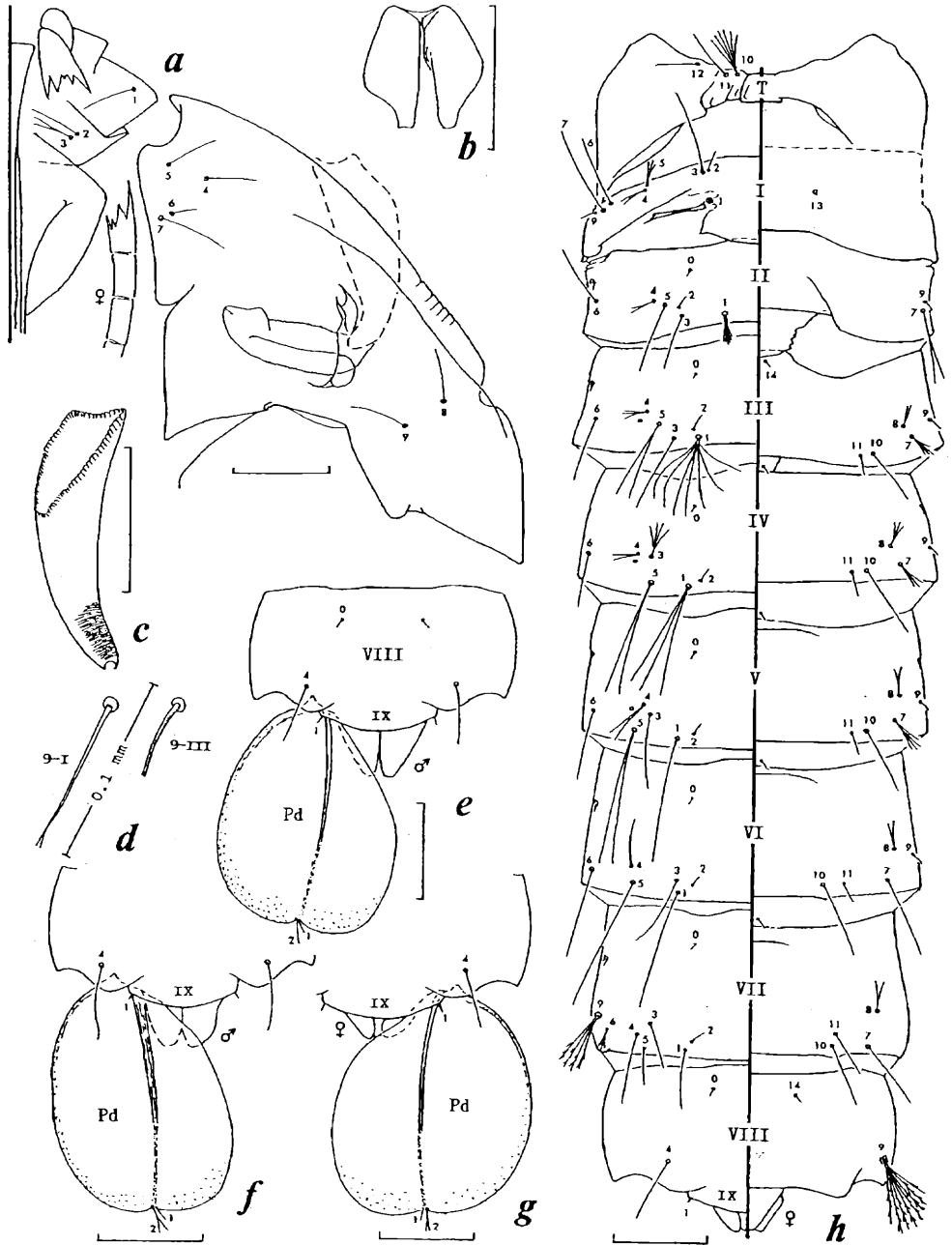


Fig. 1. Pupa of *Lutzia (Metalutzia) vorax*. — a, Cephalothorax (part); b, dorsal apotome; c, trumpet; d, setae 9-I and 9-III; e, segment VIII and left paddle (typical); f, left paddle (narrowest); g, right paddle (broadest); h, metathorax and abdomen. (Scales represent 0.5 mm unless otherwise indicated.)

anteromesad of 1-VI; 4-VI usually anterolaterad of or tandem with 5-VI; 5-VI longest of setae of the segment, 0.73-1.06 (\bar{x} 0.90) length of tergum VII, 5 setae of 34 examined as long as or longer than tergum VII. Seta 2-VII almost always anteromesad of or rarely tandem with 1-VII; 4-VII anterolaterad of 5-VII; 9-VII barbed, 0.44-0.70 (\bar{x} 0.53) length of side of segment VIII, 0.66-0.93 (\bar{x} 0.80) length of 9-VIII. Posterolateral corner of segment VIII rather sharply produced; seta 9-VIII strongly barbed, located at posterior 0.23-0.29 (\bar{x} 0.26) of and 0.56-0.78 (\bar{x} 0.66) length of side of the segment, 0.24-0.35 (\bar{x} 0.29) length of paddle. Median caudal lobe 0.38-0.44 (\bar{x} 0.41) width of segment VIII; ♂ genital lobe 0.27-0.33 (\bar{x} 0.30) length of paddle. Paddle with apex emarginate, covered with minute spicules densely on marginal area and sparsely on disk; index 1.10-1.39 (\bar{x} 1.24); seta 1-Pd very short, 0.21-0.55 (\bar{x} 0.36) length of 2-Pd, which is slightly laterad of 1-Pd, 0.07-0.13 (\bar{x} 0.10) length of paddle.

Supernumerary setae. Seta 11-I was found in 13 specimens (17 setae) of 20 examined, single to eight branched, about as long as 9-I but thicker than it. Seta 10-II was found in nine specimens (12 setae), single, usually about the size of 10-III, but without alveolus, a short remnant of the associated nerve usually is visible. Seta 11-II was found on the left side of a single ♂ specimen (C-1898-5), three branched, shorter than associated 10-II, with neither alveolus nor associated nerve. Seta 13-II was found on the right side of a single ♀ specimen (C-1899-27), five branched, similar to larval seta 13-II in appearance, about as long as 2-II, placed far from the posterior margin of the sternum, without alveolus but with a remnant of the associated nerve. Seta 13-IV was found on both sides of a single ♂ specimen (H-2006-8), located anteromesad of 11-IV, two branched, about as long as 8-IV, with a normal alveolus and a distinct remnant of the associated nerve. Seta 13-V was found on both sides of the same specimen as above, single, otherwise similar to 13-IV. Seta 10-VIII was found in three specimens (five setae), single, about as long as 10-VII, without alveolus, the associated nerve indistinct. A pair of very thick and apparently abnormal setae was found on the posterior wall of sternum VIII near 10-VIII; the left one has two primary branches, five secondary branches and numerous fine tertiary branches, and the right one two primaries, three secondaries and numerous tertiaries. This seta may possibly be interpreted as 13-VIII.

Table 1. Range of the branching of the pupal setae of *Lutzia (Metalutzia) vorax* EDWARDS, 1921

Seta No.	Cephalo-thorax	I	II	III	Abdomen		VI	VII	VIII
					IV	V			
0	—	—	1-2(1†)	1	1-2(1†)	1-2(1†)	1-2(1†)	1-2(1†)	1-2(1†)
1	1-4(1†)	m	3-11(6)	4-14(7)	2-9(3)	1-4(1)	1-2(1*)	1	—
2	1-2(1†)	1-2(1†)	1	1	1	1	1	1	—
3	1-4(2)	1-3(1)	1-2(1*)	1-2(1*)	2-7(4)	1-2(1†)	1-2(1†)	1	—
4	1	1-5(2)	1-4(2)	2-6(3)	1-3(2)	1-4(2)	1-2(1†)	1-3(1†)	1
5	1-2(1†)	1-8(3)	1-4(1†)	1-5(2)	1-7(2)	1-4(2)	1-3(1*)	1-2(1†)	—
6	1-2(1†)	1-4(1*)	1-3(1†)	1-2(1†)	1-2(1†)	1-3(1†)	1-2(1†)	1-5(3)	1-Pd 1-3(1†)
7	1	1-2(1)	1-5(2)	2-6(4)	1-5(3)	1-5(4)	1-2(1†)	1	—
8	1	—	—	1-5(2)	1-6(3)	1-4(2)	1-5(2)	1-5(2)	—
9	1	1-4(1)	1	1	1	1	1	2-8(4)	5-14(8)
10	2-9(6)	—	—	1	1	1	1-2(1†)	1	—
11	1-2(1†)	—	—	1-2(1†)	1	1-3(1*)	1-2(1†)	1-2(1†)	2-Pd 1-3(1*)
12	1-2(1†)	—	1-X 1	—	—	—	—	—	—
13	—	1	—	—	—	—	—	—	—
14	—	—	—	1	1	1	1	1	1-2(1†)

Modes in parenthesis, * the case occurring in 80-89%, † in 90-99%.

Specimens examined: 10♂, 10♀: Honshū and Kyūshū; 7♂, 5♀: Ryūkyū Arch.; 2♂, 5♀: Ogasawara-guntō; 1♀: Taiwan.

Specimens examined. 33♂, 22♀ in total. **Honshū** — Sagami-hara, Kanagawa Pref., 16♂, 5♀, VIII. 13 and 15, 1974, catch basin, col. E. S. SAUGSTAD; Zama, Kanagawa Pref., 2♂, 2♀, VIII. 3, 1973, barrel, col. E. S. SAUGSTAD; Misakubo (Nakagoya), Shizuoka Pref., 1♂, 1♀, VIII. 16, 1969, iron drum, col. M. SAWADA and A. YOSHII; Misakubo (Mukai-ichi), Shizuoka Pref., 1♂, VIII. 18, 1969, stone mill, col. M. SAWADA and A. YOSHII. **Tsushima (Is.)**, **Kyūshū** — Izuhara, 1♂, 2♀, X. 8, 1970, grave stone, col. M. Nishikawa; Mt. Ariake, 2♂, IX. 26, 1974, rock hole, col. K. MIZUSAWA; Mt. Ariake, 1♂, 1♀, IX. 26, 1974, cement tank, col. K. MIZUSAWA. **Amami-guntō**, **Ryūkyū Arch.** — Mt. Yuwan, Amami-Ōshima, 2♂, 2♀, VII. 4, 1970, tire, col. K. MIZUSAWA and M. NISHIKAWA. **Okinawa-guntō**, **Ryūkyū Arch.** — Yona, Okinawa-hontō, 1♂, X. 25, 1971, ground pool, col. K. MIZUSAWA, S. SHINONAGA and T. KIKUCHI; Gajanokobanta, Okinawa-hontō, 1♂, 1♀, XII. 9, 1971 and IX. 30, 1972, rock hole, col. K. MIZUSAWA; Yona, Okinawa-hontō, 2♂, 1♀, X. 1, 1972, rock hole, col. K. MIZUSAWA. **Yaeyama-guntō**, **Ryūkyū Arch.** — nr. Ōhara, Iriomote-jima, 1♂, XI. 11, 1971, stream, col. K. TANAKA and K. MIZUSAWA; Funaura, Iriomote-jima, 1♀, XII. 1, 1971, ground pool, col. K. MIZUSAWA. **Ogasawara-guntō (Bonin Islands)** — Haha-jima, 2♀, VI., 1973, ground pool, col. S. HAYASHIDA; nr. Mt. Chūō, Chichi-jima, 1♂, IX. 28, 1973, ground pool, col. K. MIZUSAWA; Ohmura, Chichi-jima, 1♂, 3♀, IX. 29, 1973, man-made container, col. K. MIZUSAWA. **Taiwan** — 1♀ (without precise information).

Distribution. Japanese Archipelago; Ryūkyū Archipelago; Ogasawara-guntō; Mariana Islands; Prymorye; Korea; Cheju-do; China; Taiwan; Hong Kong; Malay Peninsula; Burma; Nepal; India; Ceylon..

Taxonomic discussion. BRAM, 1967, synonymized *Lutzia vorax* with *L. halifaxii* (as *Culex*). Shirivanakarn, 1976 (pers. comm.), had a view that both species were distinct, because the abdominal pale banding is constant in *Lutzia vorax*. In fact, all specimens from Japan, Korea, the Ryūkyū Archipelago and the Ogasawara-guntō that I examined had the abdominal banding typical of *Lutzia vorax*, with none typical of *L. halifaxii* or of any form intermediate between the two. Although I here follow Shirivanakarn's view and treat *Lutzia vorax* as a distinct species, I still feel some hesitation, because both species are difficult to separate in the male genitalia, pupa and larva. Methods other than morphology definitely are necessary for differentiating such doubtfully distinct species. EDWARDS, 1941, described and discussed pupal characters common to all Asian and African species of *Lutzia*, and stated that setae 1- and 5-IV-VII were in "no case longer than the segments." In the case of Japanese *Lt. vorax*, the longest seta (usually 1 or 5) of segments IV-VI is sometimes as long as or longer than the next tergum, 5% of the longest setae in segment IV, 36% in segment V, and 15% in segment VI; terga II-VII are always longer than the preceding tergum. The 40% of the longest seta of tergum I examined also was longer than the tergum. ISHIHARA, 1942, gave a short (six lines) description and an illustration of the apex of the abdomen of the pupa of this species. ASANUMA, 1948, discussed the variation of branching of the cephalothoracic setae, and presented a short (eight lines) description and a simplified illustration of the apex of abdomen. La Casse and YAMAGUTI, 1948 and 1950, illustrated the trumpet and paddle. KAMIMURA, 1976, treated the pupa very briefly. TOMA and MIYAGI, 1986, presented a short description, a full illustration and a chaetotaxy table on 12 specimens from Okinawa-hontō as *Culex (Lutzia) halifaxii*. They gave the length of the paddle as 0.46-0.54 mm and the width as 0.41-0.45 mm, but these may be erroneous. Their seta 3-III is my 5-III and their 5-III is my 3-III, and their 1-P may be my 2-Pd and their 2-P may be my 1-Pd. There were no marked differences in morphological characters among the populations from Palearctic Japan, the Ryūkyū Archipelago, the Ogasawara-guntō and Taiwan.

Lutzia (Metalutzia) fuscana (WIEDEMANN)
(Table 2)

WIEDEMANN, 1820, Dipt. Exot.: 9 (♂ ♀; *Culex*). Type-loc.: India.

Trumpet length: 0.75–0.94 mm. Paddle length: 0.99–1.20 mm.

Trumpet index 3.52–4.05 (2 ex.); pinna 0.44–0.58 (\bar{x} 0.51) length of trumpet. Seta 1–C \geq 2–C > 3–C in length; 10–C sometimes barbed. Abdominal terga covered with microsculpture of short transverse ridges bearing a single minute spicule, these ridges tending to form imbrication on sterna especially in posterior segments; dorsal intersegmental membrane reticulate, more distinctly in anterior intersegments. Setae 1–, 3–, 6– and 7–I subequal in length, and one of them longest of setae of the segment, longest seta 0.69–0.99 (\bar{x} 0.82) length of tergum I; 2– and 3–I approximated; branches of 9–I often unequal, pointed as usual. Seta 1–II relatively short, with thick stem and fine branches, which are not very divergent; 2–II more often (70%) anteromesad of 3–II; 3–, 5–, 6– and 7–II subequal in length and one of them longest of setae of the segment, the longest seta 0.54–0.78 (\bar{x} 0.64) length of tergum III; 5–II mesad of and usually caudad of 4–II; 9–II–VI blunt-tipped, located about at level of respective setae 6. Setae 1–, 3– and 5–III subequal in length and one of them longest of setae of the segment, the longest seta 0.52–0.75 (\bar{x} 0.62) length of tergum IV; 2–III anteromesad of 1–III; aetose sensillum usually posteromesad of 4–III. Setae 1– and 5–IV subequal in length and one of them longest of setae of the segment, the longest seta 0.57–0.80 (\bar{x} 0.71) length of tergum V; 2–IV anteromesad of 1–IV; 3–IV variable in position relative to 5–IV; 4–IV anterolaterad of 5–IV; aetose sensillum usually posteromesad of 4–IV. Setae 1– and 5–V subequal in length and one of them longest of setae of the segment, the longest seta 0.72–0.95 (\bar{x} 0.87) length of tergum VI; 4–V anteromesad of or tandem with 5–V; aetose sensillum posterolaterad of 4–V. Seta 3–VI usually anteromesad of or tandem with 1–VI but always laterad of 2–VI; 4–VI variable in position relative to 5–VI; 5–VI longest of setae of the segment, 0.61–0.94 (\bar{x} 0.80) length of tergum VII. Seta 2–VII anteromesad of 1–VII; 4–VII anterolaterad of 5–VII; 9–VII strongly barbed, 0.46–0.65 (\bar{x} 0.57) length of side of segment VIII, 0.73–1.15 (\bar{x} 0.90) length of 9–VIII. Posterolateral corner of segment VIII rather sharply produced; seta 9–VIII strongly barbed,

Table 2. Range of the branching of the pupal setae of *Lutzia (Metalutzia) fuscana* (WIEDEMANN, 1820)

Seta No.	Cephalo-thorax	I	II	III	Abdomen IV	V	VI	VII	VIII
0	—	—	1	1	1	1	1	1	1
1	1–2(2)	m	2–7(4)	6–11(9)	2–6(5,6)	1–3(2)	1–2(2*)	1–2(1*)	—
2	1	1	1	1	1	1	1	1	—
3	1–3(2)	1–3(1*)	1	1–3(1)	2–6(4,5)	1–3(2)	1	1	—
4	1	3–7(4,5)	1–4(3)	2–5(3,4)	1–2(2)	1–4(3,4)	2–3(2)	1–2(1*)	1
5	1	2–9(–)	1–2(1)	1–7(5)	1–7(6)	1–3(3)	1–3(2)	1–2(1*)	—
6	1	1	1	1–2(1*)	1–2(1)	1–2(1*)	1–2(1*)	2–4(2)	1–Pd 1
7	1	1–3(2)	1–3(1)	2–6(5)	1–3(2)	2–5(3)	1	1–2(1*)	
8	1–2(1*)	—	—	2–6(2)	2–7(3)	2–3(3)	2–4(3)	2–4(2)	—
9	1–3(1)	1–3(2)	1	1	1	1	1	4–5(5)	5–10(–)
10	2–9(–)	—	—	1	1	1	1	1	—
11	1–2(1*)	—	—	1	1	1–3(1*)	1	1	—
12	1–2(1*)	—	1–X 1	—	—	—	—	—	2–Pd 1–2(1)
13	—	1	—	—	—	—	—	—	—
14	—	—	—	1	1	1	1	1	1

Modes in parenthesis, * the case occurring in 80% or more.

Specimens examined: 1 ♀: Okinawa-hontō, Ryukyu Arch.; 2 ♂, 2 ♀: Cheju-do, Korea.

located posterior 0.23–0.31 (\bar{x} 0.28) of and 0.57–0.70 (\bar{x} 0.63) length of side of the segment, 0.23–0.33 (\bar{x} 0.30) length of paddle. Median caudal lobe 0.37–0.41 (\bar{x} 0.40) width of segment VIII; ♂ genital lobe 0.32–0.34 (2 ex.) length of paddle. Paddle emarginate at apex, with minute spicules dense on marginal area and sparse on disk; index 1.05–1.36 (\bar{x} 1.15); seta 1–Pd 0.31–0.52 (\bar{x} 0.43) length of 2–Pd, which is 0.06–0.09 (\bar{x} 0.08) length of paddle.

Supernumerary setae. Seta 11–I was found in all 5 specimens examined (9 setae), 1–3 branched.

Specimens examined. 2♂, 3♀ in total. **Okinawa-guntô, Ryukyu Arch.** — Yona, Okinawa-hontô: 1♀, X. 24, 1971, blocked stream, col. K. MIZUSAWA, S. SHINONAGA and T. KIKUCHI. **Cheju-do, Korea** — Namcheju-kun: 2♂, 2♀, VIII. 7, 1993, col. 5th Prev. Med., U. S. Army.

Distribution. India; Oriental Region; Prymorye; southern Korea; Micronesian Is.; Timor.

Taxonomic discussion. Above description and table 2 are based on only 5 specimens from two localities, therefore more variations are expected to occur. TOMA and MIYAGI, 1986, gave a short description, a full illustration and a chaetotaxy table on 12 specimens from Minna-jima, Miyako-guntô, the Ryukyu Archipelago. Their seta 3–III is my 5–III, and their 5–III is my 3–III. Body setae on the whole are shorter in *Lt. fuscana* than in *Lt. vorax*, and setae of segments II–VII in *Lt. fuscana* never are longer than the next tergum. However, no definitely distinct difference has been found in the pupal characteristics of these two species. Difference in lengths of the longest setae of segments IV–VI shown in the foregoing key provides a limited means for separating these species. As both species have very wide range of distribution, other populations also should be studied at least at the level of my present study.

Lutzia (Insulalutzia) shinonagai (TANAKA, MIZUSAWA et SAUGSTAD)

(Fig. 2; Table 3)

TANAKA, MIZUSAWA and SAUGSTAD, 1979, Contrib. Am. Entomol. Inst. (Ann Arbor) 16: 245 (♂, ♀, larva). Type-loc.: Kitahukurozawa, Chichi-jima (Is.), Ogasawara-guntô.

Description based on a single ♀ specimen.

Trumpet length: 0.48 mm. Paddle length: 0.73–0.74 mm.

Pinna 0.37 length of trumpet. Seta 1–C ≅ 2–C > 3–C in length. Abdominal terga covered with very short ridges bearing usually a few minute spicules in anterior segments, with poorly developed ridges bearing a single spicule in posterior segments, these short ridges less developed than in *Lt. vorax* and *Lt. fuscana*, and never forming imbrication; reticulation on intersegmental membrane less developed than in *Lt. varax* and *Lt. fuscana*, visible on posterior part of both sides of tergum I and at middle of intersegments II–IV. Seta 1–I with 5–6 primary branches and 19–21 secondary branches, which are much fewer than in *Lt. varax* and *Lt. fuscana*; 1–I longest of setae of the segment, ca 0.85 as long as tergum I; 3–I far laterad of 2–I, but still closer to it than to 4–I; 9–I–VI fine and pointed-tipped. Seta 1–II with branches divergent; 2–II anteromesad of 3–II, which is longest of setae of the segment, and 0.58–0.62 length of tergum III; 5–II anterolaterad of 4–II; 7–II about as long as 6–II. Seta 1–III longest of setae of the segment, 0.75–0.84 length of tergum IV; 2–III mesad of 1–III; 5–III about as long as 3–III and shorter than 1–III; aetose sensillum posteromesad of 4–III on left side, and caudad and slightly laterad of it on right side. Seta 1–IV longest of setae of the segment, 0.80–0.84 length of tergum V; 2–IV mesad of 1–IV; 3–IV tandem with 5–IV on left side and anteromesad of it on right side; 5–IV nearly as long as or shorter than 1–IV; aetose sensillum postero-

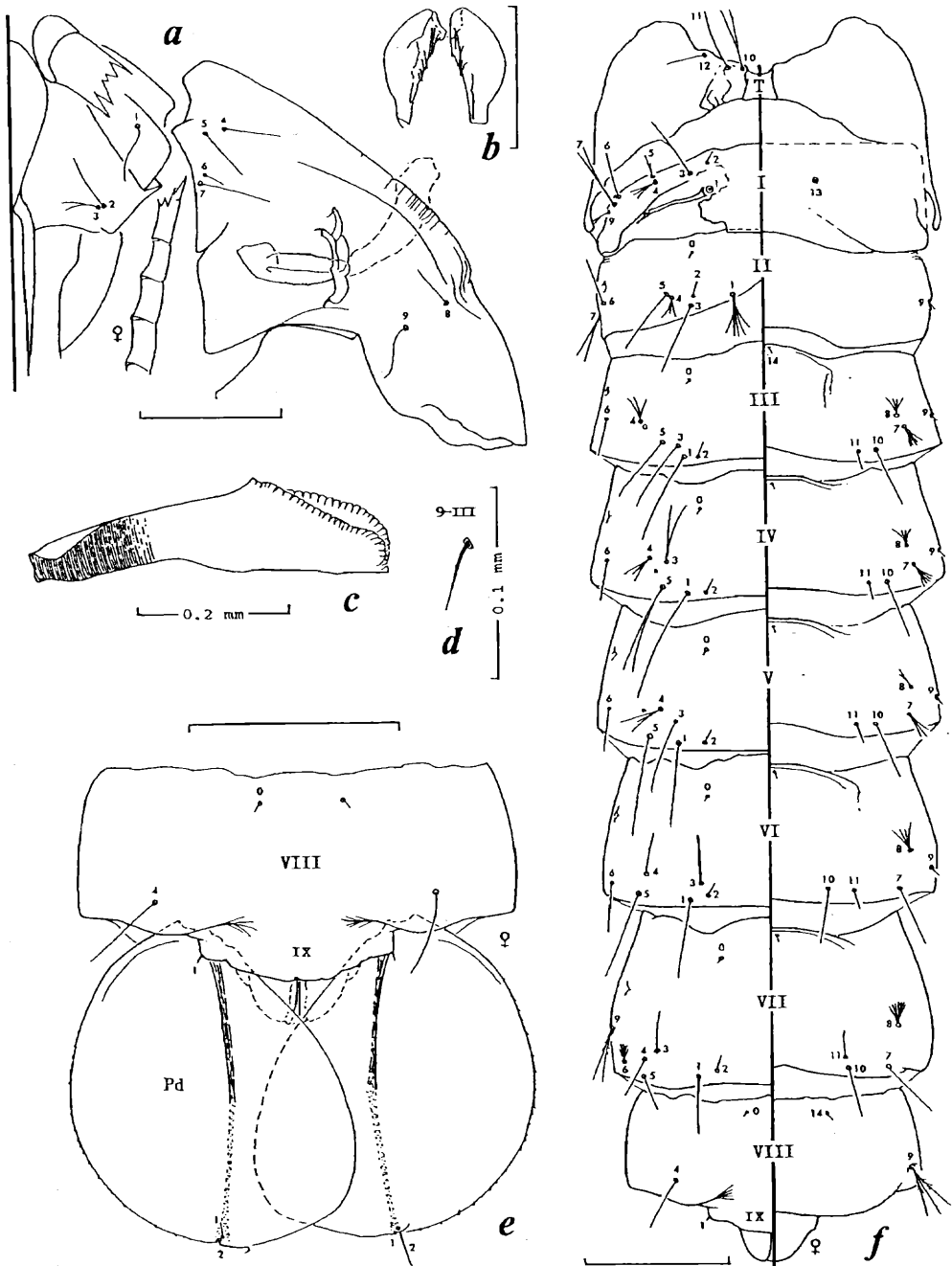


Fig. 2. Pupa of *Lutzia (Insulalutzia) shinonagai*. — a, Cephalothorax (part); b, dorsal apotome; c, trumpet (somewhat deformed); d, seta 9-III; e, segment VIII and paddles; f, metathorax and abdomen. (Scales represent 0.5 mm unless otherwise indicated.)

mesad of 4-IV on left side and caudad and slightly laterad of it on right side. Seta 4-V anteromesad of 5-V; 5-V longest of setae of the segment, 0.70-0.72 length of tergum VI; aetose sensillum posterolaterad of 4-V. Seta 3-VI anteromesad of 1-VI but laterad of 2-VI; 4-VI anteromesad of 5-VI; 5-VI longest of setae of the segment, 0.53 length of tergum VII. Seta 2-VII anteromesad of 1-VII; 4-VII tandem with and cephalad of 5-VII; 9-VII single or two branched, poorly barbed, 0.58-0.63 length of side of segment VIII, 1.00-1.13 length of 9-VIII. Posterolateral corner of segment VIII not produced; seta 9-VIII located at posterior 0.23-0.27 of and 0.56-0.58 length of side of the segment, barbed, 0.27 length of paddle; 14-VIII very short, about as long as 0-VIII. Median caudal lobe 0.45 width of segment VIII.⁶ Paddle very slightly emarginate or subtruncate at apex, fringed with tiny spicules on margins except basal half of inner margin; disk scattered with minute spicules rather densely on marginal area and very sparsely in median area; index 1.14-1.15; seta 1-Pd 0.34 length of 2-Pd; 2-Pd 0.12 length of paddle.

Supernumerary setae. Seta 11-I was found on the right side, single. Seta 8-II was found on the left side, two branched, about as long as 9-II; the alveolus and the remnant of the associated nerve are normal. Seta 10-II was found on both sides, two branched, about as long as 6-II; the alveolus is absent, and the remnant of the associated nerve is barely visible.

Table 3. Range of the branching of the pupal setae of *Lutzia (Insulalutzia) shinonagai* (TANAKA, MIZUSAWA et SAUGSTAD, 1979)

Seta No.	Cephalo-thorax	Abdomen							
		I	II	III	IV	V	VI	VII	VIII
0	—	—	1	1	1	1	1	1	1
1	1-2	19-21	4-5	1	1	1	1	1	—
2	1	1	1	1	1	1	1	1	—
3	2	1	1	1	2-4	1	1	1	—
4	1	3-5	3	3	3	2	1	1	1
5	1	1-2	1	1	1-2	1	1	1	—
6	1	1	1	1	1	1	1	4-5	1-Pd 1
7	1	2	2	5-7	3-5	3	1	1	—
8	1	—	—	4	4	2-3	4	6-7	—
9	1	2	1	1	1	1	1	1-2	2-3
10	2	—	—	1	1	1	1	1	—
11	1	—	—	1	1	1-2	1-2	1	2-Pd 1
12	1	—	1-X 1	—	—	—	—	—	—
13	—	1	—	—	—	—	—	—	—
14	—	—	—	1	1	1	1	1	1

Specimen examined: 1 ♀: Chichijima (Is.), Ogasawara-guntō.

Specimens examined. 1 ♀ (paratype): nr. Chûôzan (Mt.), Chichi-jima (Is.), Ogasawara-guntō, IX. 28, 1973, tree hole, col. K. MIZUSAWA.

Distribution. Ogasawara-guntō (the Bonin Islands).

Taxonomic discussion. The pupa of this species is described here for the first time. This pupa can be distinctly separated from *Lt. fuscana* and *Lt. vorax* by the characters shown in the foregoing key. In addition to the subgeneric characters of the adult and larva, these pupal characters may become good basis for subgeneric separation of this species from the other species of *Lutzia*. Because only one specimen was studied, character variation should be studied with more material.

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