

A NEW SPECIES OF *SIMULIUM* (*NEVERMANNIA*) FROM THE OGASAWARA (BONIN) ISLANDS, JAPAN (DIPTERA: SIMULIIDAE)

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ABSTRACT: *Simulium* (*Nevermannia*) *satakei* sp. nov. is described on the basis of the pupa and mature larvae collected from the Ogasawara (Bonin) Islands in Japan. This new species, tentatively (due to lack of the adult stage) assigned to the *vernum* species-group of the subgenus *Nevermannia*, is characterized in the pupa by four gill filaments lacking transverse ridges, and in the larva by a small, M-shaped postgenal cleft, antenna without hyaline bands, and simple rectal papilla. The morphological differences among this new species and the two known species, *S. (N.) uemotoi* from Japan and *S. (N.) karzhantacum* from Uzbekistan and Turkmenistan, are noted. This is the second species of the family Simuliidae from the Islands.

Key words: *Nevermannia*, Simuliidae, *Simulium*, black fly, Ogasawara Islands, new species

Until now, *Simulium* (*Nevermannia*) *bonninense* (Shiraki), a member of the *vernum* species-group of the subgenus *Nevermannia* Enderlein, was the only species of the family Simuliidae so far recorded from the Ogasawara (Bonin) Islands located in the Pacific Ocean, ca. 1,000 km south-southeast of Tokyo (Shiraki, 1935; Stone, 1964; Saito et al., 1974; Takaoka et al., 1999). Recently, a pupa and a few larvae of an unknown species were collected together with some pupae and larvae of *S. (N.) bonninense* from a small stream in Hahajima, one of the Ogasawara Islands.

This is described here as a new species and is tentatively (due to lack of the adult stage) assigned to the *vernum* species-group within the subgenus *Nevermannia*.

The terms for morphological features used here follow those of Takaoka (2003). Holotype and paratype specimens of the new species are deposited at the Department of Infectious Disease Control, Faculty of Medicine, Oita University, Oita, Japan.

Simulium (*Nevermannia*) *satakei* sp. nov.

DESCRIPTION. Pupa. Body length 2.0 mm. **Head.** Integument (Fig. 1A) yellowish, moderately covered with small tubercles; antennal sheath (Fig. 1B) sparsely covered with small tubercles; frons with 2 medium-long slender trichomes (Fig. 1C) on each side; face with 1 long stout trichome (Fig. 1D) on each side, which is 1.3–1.7 times as long as those of frons. **Thorax.** Integument yellowish, moderately covered with small tubercles, and on each side with

3 long stout simple trichomes (Fig. 1E) mediodorsally, 2 long simple trichomes (1 somewhat shorter and more slender than the other) (Fig. 1F) anterolaterally, 1 medium-long somewhat stout simple trichome (Fig. 1G) posterolaterally, and 3 short slender simple trichomes (Fig. 1H) [though 1 additional medium-long slender trichome (Fig. 1I) was present on the right side] ventrolaterally. Gill (Fig. 1J) with 4 slender thread-like filaments arranged in dorsal and ventral pairs arising from short common basal stalk; stalk of ventral pair slightly shorter than common basal stalk but slightly longer than the stalk of dorsal pair; dorsalmost filament and ventralmost one basally diverged vertically at a right angle when viewed laterally; all filaments subequal in thickness to one another; lengths of all filaments not measurable due to loss of apical portion except dorsal filament of dorsal pair (2.7 mm long) and ventral filament of ventral pair (2.1 mm long) of right gill; all filaments light yellow, gradually tapered toward apex, furnished with annular furrows but lacking ridges (Fig. 1K), and densely covered with minute tubercles on outer surface. **Abdomen.** Dorsally, all segments weakly sclerotized and pale yellow; segments 1 and 2 sparsely or moderately covered with small tubercles (Fig. 1L); segment 1 with 1 medium-long simple slender seta (Fig. 1M) on each side; segment 2 with 1 medium-long simple slender seta and 5 short dark spinous setae (Fig. 1N) on each side; segments 3 and 4, each with 4 dark stout hooks and 1 short spinous seta on each side; segments 5–9 each with spine-combs and comb-like groups of minute spines lying transversely along anterior margin (Fig. 1O) on each

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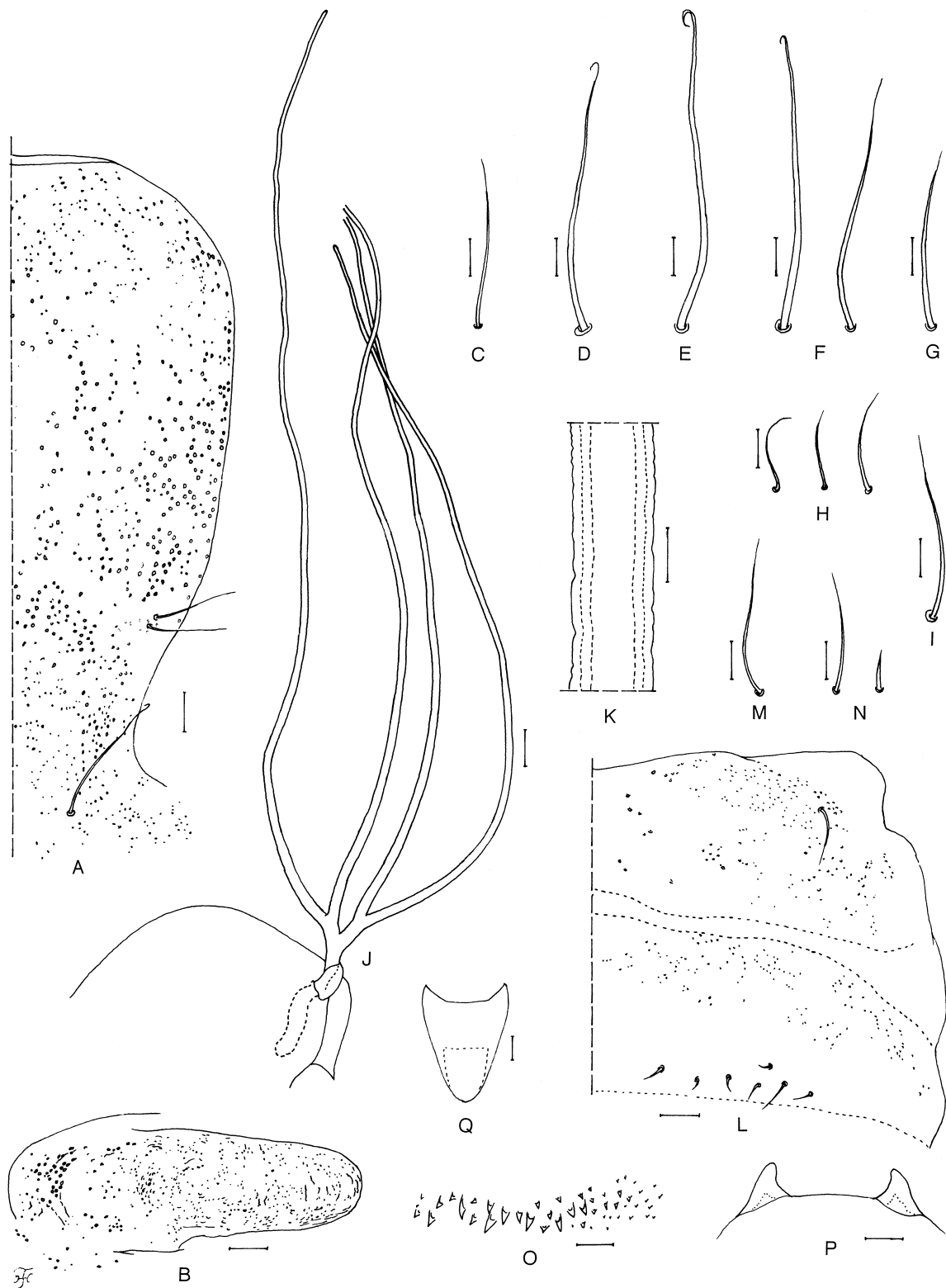


Fig.1. Pupa of *Simulium (Nevermannia) satakei* sp. nov.

A, frons and part of face (left half); B, antennal sheath; C, frontal trichome; D, facial trichome; E I, thoracic trichomes (E, mediodorsal; F, anterolateral; G, posterolateral; H and I, ventrolateral); J, gill filaments (right side; lateral view); K, basal part of gill filament showing lack of transverse ridge; L, dorsal surface of abdominal segments 1 and 2 (right half); M, medium-long simple slender seta on dorsal surface of 1st abdominal segment; N, medium-long simple slender seta and short spinous seta on dorsal surface of abdominal segment 2; O, spine-combs and comb-like groups of minute spines on abdominal segment 9 (right half); P, terminal hooks (end view); Q, cocoon (dorsal view). Scales. 0.5 mm for Q; 0.1 mm for J; 0.04 mm for A, B and L; 0.02 mm for C I, K, M, N, O and P.

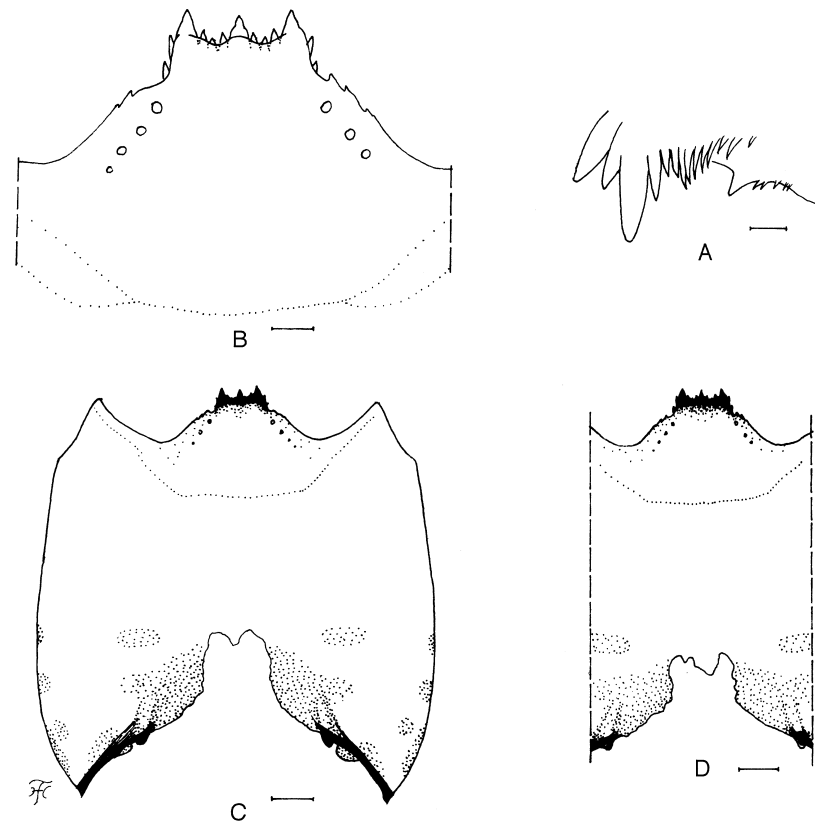


Fig. 2. Mature larva of *Simulium (Nevermannia) satakei* sp. nov. A, mandible; B, hypostoma; C and D, ventral surfaces of head capsules showing postgenal clefts of different sizes and shapes. Scales. 0.05 mm for C and D; 0.02 mm for B; 0.01 mm for A.

side; segment 9 with pair of cone-shaped terminal hooks (Fig. 1P). Ventrally, segments 3–8 nearly transparent and segment 9 weakly sclerotized and pale yellow; segment 3 with 3 short simple setae on each side; segment 4 with 1 simple dark hooklet (slightly shorter and smaller than those on segments 5–7) and 3 short simple setae on each side; segment 5 with 2 bifid dark hooks and a few short simple setae on each side; segments 6 and 7 each with 1 bifid dark inner hook and 1 simple or bifid dark outer hook, and a few short simple setae on each side; segments 4–8 with comb-like groups of minute spines. Segment 9 with short simple seta on each lateral side. **Cocoon** (Fig. 1Q). Simple, wall-pocket-shaped, moderately woven, with anterior margin somewhat thickly woven, and extending ventrolaterally; floor woven on posterior 2/5; individual threads visible; 2.5 mm long by 2.0 mm wide.

Mature larva. Body length 3.5–4.0 mm. Body color creamy yellow. Cephalic apotome yellow; head spots all positive and medium brown. Lateral surface of head capsule yellowish except eye-spot region yellowish-white, with eyebrow light brown; 2 large and 1 small spots just before posterior margin, as well as 2 small spots below eye-spot re-

gion all positive and medium brown. Ventral surface of head capsule yellow; 1 elongate spot on each side of postgenal cleft positive and medium brown. Cervical sclerites composed of 2 rod-like small pieces, not fused to occiput, widely separated from each other. Antenna composed of 3 segments and apical sensillum, much longer than stem of labral fan; proportional lengths of 1st, 2nd, and 3rd segments 1.00: 0.62–0.78: 0.83–0.93. Labral fan with about 34 rays. Mandible (Fig. 2A) with 1st comb-tooth longest; 2nd and 3rd comb-teeth subequal in length to each other; mandibular serrations composed of 2 teeth (1 large and 1 small); large tooth at a right angle to mandible on apical side; 2–4 supernumerary serrations present. Hypostoma (Fig. 2B) with a row of 9 apical teeth, the median tooth and corner teeth being most prominent, and median tooth of 3 intermediate teeth on each side smallest; lateral margins with well developed teeth; 3 or 4 hypostomal bristles in a row, subparallel to, or slightly diverging from, lateral margin on each side. Postgenal cleft (Fig. 2C,D) small, M-shaped, 0.41–0.64 times as long as postgenal bridge. Thoracic and abdominal cuticle almost bare except dorsal surface of a few posterior segments sparsely to moderately covered with col-

orless minute setae and areas on both sides of anal sclerite moderately covered with colorless short setae. Rectal scales absent. Rectal papilla simple, without secondary lobules. Anal sclerite X-shaped, anterior arms 0.8 times as long as posterior ones; accessory sclerite absent. Ventral papillae present ventrolaterally. Posterior circlet of hooks with about 64 rows of up to 15 hooks per row.

Female and Male. Unknown.

TYPE SPECIMENS. Holotype pupa with its associated cocoon, collected from a small shaded stream (width about 10 cm) slowly flowing in a forest, located on the right side of Chibusa Dam, Hahajima, Ogasawara Islands, Tokyo, Japan, 18.VI.2005, by K. Satake. Paratypes: 2 mature larvae and 1 immature larva, same locality and data as those of the holotype.

ETYMOLOGY. The species name *satakei* honors Dr. K. Satake, who collected this new species.

REMARKS. This new species is tentatively assigned to the *vernum* species-group of the subgenus *Nevermannia* by having the four gill filaments per side in the pupal stage, the antennae without any transverse hyaline bands, the mandible with supernumerary serrations, the main tooth of the mandibular serrations at a right angle on the apical side to the mandible, the hypostoma with serrated lateral margins, and the ventral papillae well developed in the larval stage.

The larva of this new species is very similar to that of *S. (N.) uemotoi* of the *vernum* species-group from Japan (Sato et al., 2004): it shares several characteristics including the small, M-shaped postgenal cleft and the simple rectal papilla. There are some differences, however, in the relative length of the three segments of the larval antennae (1.00: 0.62 0.78: 0.83 0.93 versus 1.0: 1.2 1.4: 0.8 1.0) between the two species. On the other hand, the pupa of this new species is easily distinguished from that of *S. (N.) uemotoi* by the following characteristics (those of *S. (N.) uemotoi* are shown in parentheses): frontal trichomes in two pairs (in three pairs), antennal sheath sparsely covered with small tubercles (bare), transverse ridges on the gill filaments absent (present), dorsal surface of the abdominal segments 1 and 2 sparsely covered with minute tubercles (densely and neatly covered with minute tubercles), and spine-combs on the abdominal segment 9 distinct (absent or indistinct if any).

This new species is also similar to *S. (N.) karzhantacum* (Rubtsov, 1956) from Uzbekistan and Turkmenistan, which has a similarly shaped larval postgenal cleft, but differs in the pupal stage from the latter species by lacking the transverse ridges on the surface of the gill filaments.

Simulium (Nevermannia) satakei sp. nov. represents the second species recorded from the Ogasawara Islands. It should be noted that this new species is not closely related to *S. (N.) bonninense*, which to date had been the only species prevalent in the islands, because there are distinct differences in the relative length of the first and second segments of the larval antennae and in the shape of the larval postgenal cleft as well as in the presence or absence of spine-combs on the dorsal surface of the fifth and ninth segments of the pupal abdomen between the two species.

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REFERENCES

- Rubtsov, I.A. 1956. Blackflies (fam. Simuliidae) [Moshki (sem. Simuliidae)]. Fauna of the USSR. 859pp., New Series No.64, Insects, Diptera 6 (6). Akademii Nauk SSSR, Leningrad [=St. Petersburg], Russia. In Russian. [English translation: 1990. Blackflies (Simuliidae). 1,042 pp., 2nd Ed. Fauna of the USSR. Diptera, 6 (6). E.J. Brill, Leiden].
- Saito, K., Hori, E. and Ogata, K. 1974. Simuliidae of Ogasawara Islands. *Jpn. J. Sanit. Zool.*, 24: 338 (Japanese abstract only).
- Sato, H., Takaoka, H. and Fukuda, M. 2004. A new species of *Simulium (Nevermannia)* (Diptera: Simuliidae) from Japan. *Med. Entomol. Zool.*, 55: 201–210.
- Shiraki, T. 1935. Simuliidae of the Japanese Empire. *Mem. Fac. Sci. & Agr. Taihoku Imp. Univ.*, 16: 1–90.
- Stone, A. 1964. Diptera: Simuliidae. *Insects of Micronesia*, 12: 629–635.
- Takaoka, H. 2003. The Black Flies (Diptera: Simuliidae) of Sulawesi, Maluku and Irian Jaya. xxii+581pp., Kyushu University Press, Fukuoka.
- Takaoka, H., Saito, K. and Suzuki, H. 1999. *Simulium (Nevermannia) bonninense* from the Ogasawara (Bonin) Islands, Japan (Diptera: Simuliidae): taxonomic assignment to the *vernum*-group and descriptions of male, pupa and mature larva. *Jpn. J. Trop. Med. Hyg.*, 27: 189–194.