Description of the larval and imaginal stages of *Montisimulium sakhalinum* (RUBTSOV) (Diptera, Simuliidae)¹⁾

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Abstract: The adult and larva of *Montisimulium sakhalinum* (RUBTSOV) are newly described and illustrated. These materials were collected from slowly running streams in the forest of Daisetsu National Park, Nukabira, Hokkaido. Some biological notes are also given.

During the summer season from June to August in 1974 and 1975, the author collected many grown larvae and characteristic pupae of a simuliid midge from slowly running streams in a forest at Nukabira, situated at the eastern part of Daisetsu National Park in Hokkaido. From these materials many adults were subsequently obtained. Through the kind offices of Dr. H. Takahasi, this species was identified by Dr. I. A. Rubtsov to be *Montisimulium sakhalinum* (RUBTSOV) (= *Eusimulium sakhalinum* RUBTSOV). This was originally described with a single pupal skin collected together with the pupae of *Eusimulium violovitshi* RUBTSOV in Sakhalin (Rubtsov, 1962). However, neither the adult nor larva of this species has been known up to the present. Therefore, the author describes the adult, together with the larva and the pupal skin of this species which is quite new to the fauna of Japan.

DESCRIPTION

Montisimulium sakhalinum (RUBTSOV, 1962)

[Karafuto-miyama-buyu (Japanese name)]

Eusimulium sakhalinum RUBZOW, Die Fliegen der Paläarktischen Region, 14, Simuliidae, 296, 1962 (Pupa).

Female. Length: body, 3.8–4.2 mm; wing, 3.4–3.6 mm. General body colour greyish brown; legs greyish black.

Head greyish brown, posterior and under-surface densely covered with short, greyish yellow hairs; a row of stout, erect, golden yellow hairs along posterior and lateral margins of eye. Frons grey, broad, diverging above, covered with short, decumbent, golden yellow hairs. Clypeus lighter than frons, tinged with whitish grey, longer than wide; lateral side densely covered with pale yellow hairs, sublateral part densely covered with golden yellow hairs, central part bare, sub-central part greyish pubescent. Antenna long, consisting of 11 segments; scape and pedicel blackish brown, sparsely covered with short yellow bristles; flagellum black, densely covered with short whitish yellow hairs; flagellum about 5.5 times as long as scape and pedicel combined; apical segment considerably longer

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than the other segments. Palpus greyish black, covered with fine, greyish white short hairs and coarser, dark long hairs; segments III, IV slightly shorter than V; sensory vesicle of segment III globular, large, dark brown, about $2/3$ as long as its segment, proximally situated. Blade of maxilla with $10+14$ retrorse teeth. Mandible with $11+16$ serrations. Median of distal margin of cibarium broadly U-shaped; dorsolateral arms slender, outwardly curved and directed posteriorly, a sclerotized ridge occurs on inner margin.

Thorax black. Prescutum and scutum covered with long, fine recumbent golden yellow hairs. Scutellum dull black, with golden yellow, somewhat longer hairs than that of scutum, a row of stout, erect, long black hairs along posterior and lateral margins of scutellum. Postscutellum dull brown, bare, shining. Pleuron and katepisternum silvery grey, bare. Pleural membrane dull brown. Wing hyaline; veins pale grey, with fine dark hairs, interspersed with the usual well-developed spinules; ventral surface of subcosta with a single row of hairs; dorsal surface of vein R with hairs and spinules and the ventral surface of radial sector with hairs only; Cu_2 S-shaped. Small basal cell present, vestigially. Fringe of calypter and alar lobe dull brown. Haltere yellow, stem dull brown with fringe of short, pale yellow hairs. Coxae dark brown, with golden yellow hairs. Trochanters with greyish black hairs, fore and mid trochanters dull brown, hind trochanters dull yellow. Femora yellow and distal end black, covered with short, pale brown hairs. Tibiae dull yellow and distal end black, covered with short, yellow hairs. Fore and mid tarsi dull brown; each segment darker towards distal end. Hind basitarsus dull yellow with distal $1/4$ black, flattened; remaining segments dull brown. Calcipala well developed with long black bristles; pedisulcus present. Claw gently curved, with a short tooth near base.

Abdomen brown, lighter and often yellowed on anterolateral and ventral surfaces, sparsely covered with short, semi-erect, yellow hairs; tergites VII and VIII with long, erect, black hairs. Basal fringe pale yellow, longer laterally. Anal lobes narrow dorsally, broadly rounded on the anteroventral margin, with a

sulcus on the posteroventral margin, moderately setose. Cercus subquadrate, about 1.5 times as broad as long in lateral view. Ovipositor lobe broad, posterior margin slightly dented; inner margins nearly parallel; inner submarginal sulcus with thick minute hairs; lobes almost bare. Stem of genital fork slender, long, heavily sclerotized; arms relatively short, broader, slightly curved, terminating distally to subquadrate plate; posteromedial corner of its plate bluntly projected, heavily sclerotized. Spermatheca normal size, rounded to subelliptical, heavily pigmented, with reticulate pattern.

Male. Length: body, 3.4–3.8 mm; wing, 3.2–3.6 mm. General body colour darker than that of female, dark greyish brown.

Head wider than thorax; posterior and undersurface of head, frons and clypeus with long, dark hairs. Upper eye facets reddish orange, lower eye facets dull brown in living examples. Antenna long, uniformly dark brown, with short, black hairs; first flagellomere and pedicel considerably longer than those of female; flagellum about five times as long as scape and pedicel combined. Palpus greyish black, covered with dense, black hairs.

Pronotum and prescutum black, with long, golden hairs. Scutum black, strongly arched; covered with long, recumbent, golden hairs, the posterior $1/4$ with a number of long, erect, dark hairs. Scutellum blackish brown, with long, erect, dark hairs. Postscutellum concolorous with scutum, bare, with shiny, velvety appearance. Pleuron blackish brown. Pleural membrane dull brown. Pleural tuft small, of pale hair. Wing as in female, excepting its size. Haltere brown; stem dull brown, fringed with short and pale hairs. Legs greyish black; with short, dark hairs; fore and mid coxae with long golden hairs. Calcipala and pedisulcus present. Hind basitarsus slightly swollen, 3.5–4.0 times as long as greatest width.

Abdomen dull brown dorsally, paler ventrally, especially on the anterior region; tergites lightly covered with short, recumbent, pale hairs; all sternites sclerotized and with long pale hairs; basal fringe pale yellow, longer laterally. Basistyle conic quadrate, its maximum width about equal to maximum

length; considerably setose. Dististyle strongly sclerotized, considerably setose, about $1/3$ as long as width; its apical lobe strongly curved to inside, horn-shaped, and provided with one long terminal spine. Ventral plate double discus-shaped, strongly sclerotized, wider than length; median part with a broad carina bluntly projecting ventrally; anterior margin slightly concave, posterior margin strongly concave in ventral view; basal arms shortly projected. Median sclerite long, slender; moderately broad at distal end, furcating in Y-shaped; arms short. Endoparameral organ with long, heavily sclerotized teeth on the anterior margin of each side.

Pupa. Length; 4.8-5.2 mm. Respiratory organ 3.2-3.5 mm, consisting of 12 filaments; base short, bottle-like, tinged with whitish yellow, covered with many spicules, and connected to stem; stem brownish violet, branched shortly into 3 trunks; filamental furcation of each trunk as shown in Fig. 22; all filaments brownish violet, slender, slightly tapering with black granules and numerous, transverse furrows. Head and thorax with numerous, ring-like granules; antenna of female reaching to hind margin of head, antenna of male extending about $2/3$ distance to hind margin of head. Thoracic lateral trichome pale yellow, dorsal trichome absent. Tergites without strong hooks, but tergite II with 2, anteriorly directed, hair-like setae along posterior margin of each side; tergites III, IV with 4, short, fine, anteriorly directed, seta-like hooks on the posterior margin of each side; tergites VI-VIII each with a row of short, fine, posteriorly directed setae near anterior margin. Terminal spines short, narrowly separated; base of spine swollen and usually pale yellow, tip slender and dark, directed anteriorly. Sternites bare except for a few scattered setae, but sternite VIII fringed with long, dark hairs near median posterior margin of each side. Cocoon yellowish brown, slipper-shaped, tightly woven, with loosely woven, deeply dented anterior margin; its dorsal projection very long.

Larva. Full-grown larva 8.0-8.5 mm in length. Body generally dark grey, but middle thorax and middle abdomen yellowish brown in living examples. Head capsule dark brown; cephalic apotome covered with dark speckles

posteromedially and anteromedially; head spots usually pigmented, distinct except with posterior spots; posterolateral spots often negative, but postero-medial spots, antero-medial spots and anterolateral spots always positive; eye spots rather large, surrounded by narrow, clear area of pale yellow and is differentiated from rest general plate; eyebrow usually distinct. Antenna longer than stalk of cephalic fan; proportional length of each segment I-IV about 14:25:10:1, segment I yellow, segment II transparent, segment III, IV grey. The form of cephalic apotome seem immediately after the moulting as shown in Fig. 29; head capsule white, cephalic fans reddish brown. Hypostomium heavily sclerotized anteriorly, hypostomial teeth as shown in Fig. 27; median tooth and outer lateral teeth prominent. Postgenal cleft narrow, spade-shaped, extending forward about $1/5$ the distance to base of hypostomium. Inner subapical ridge of mandible with 3 lightly pigmented comb-teeth, the first tooth broad and longest, the second tooth slightly longer than the third tooth; subapical inner margin with 10-11 (usually 11) almost transparent, slender, fine serrations, the apical one being the most prominent and longer than the others, and the remainder being gradually shortened; posterior margin with 2 large marginal teeth; apical tooth and 2 outer teeth of mandible strongly sclerotized. Maxillary palpus 5.0-5.5 times as long as width at base, anterior part (about $1/4$ total length) transparent. Lateral plate of proleg narrow, slightly sclerotized, extending $1/3$ length of apical segment. Each abdominal segment with dark greyish band. Rectal gill branching as shown in Fig. 33. Anal sclerite with antero-dorsal arms longer than posteroventral arms. Posterior circlet consisted of 106-108 rows of each 12-14 hooks.

Egg. Length; 0.22-0.24 mm. Width; 0.16-0.18 mm. Clam-shaped, pale yellow. Egg-mass covered with colloid substance was found on upperside of trailer at slow streams near the source of the spring in the forest.

Type series. *Holotype:* According to Rubtsov (1962) holotype is slide-mounted pupal skin, Type USSR No. 9717, Acad. Sci. Leningrad, USSR.

Materials examined. Larvae, pupae and

Figs. 1-8 *Montisimulium sakhalinum*

Adults: 1, antenna of male; 2, antenna of female; 3, maxillary palpus of male; 4, maxillary palpus of female; 5, sensory vesicle of female, dorsal view; 6, maxilla of female; 7, mandible of female; 8, distal part of cibarium of female

50 pairs of adults (reared); 24 VI-2 VII, 1974, 22 VI-20 VIII, 1975, small stream in the forest at the foot of Mt. Upepesanke; 4-VII-1974, 21-VI-1975, Fuji stream; 22-VII-1974, Kumano-sawa; 16-VII-1974, Go-no-sawa: Nukabira, Kamishihoro, Hokkaido. Larvae, pupae and 10 pairs of adults (reared); 10-VII-1974, 28-VII-1975, Shin-nosuke stream; 30-VII-1974, Niju-yon-no-sawa: Mitsumata, Kamishihoro, Hokkaido. Larvae, pupae and 5 pairs of adults (reared); 18-VII-1974, 22-VII-1975, Yamada stream; 18-VII-1974, Yanbetsu River: Shikaoi, Hokkaido. Larvae, 28-VII-1974, small stream in forest near Nupun hot spring: Shintoku, Hokkaido. Larvae and females, 1-VIII-1974, Kutchanbetsu stream: Kamikawa, Hokkaido. Larvae, pupae and 7 pairs of adults, 4-VIII-1975, small stream in col of Mt. Minami-Shokanbetsu and streams in highland swamp: Uryu, Hokkaido.

All specimens including above mentioned materials are kept in the Laboratory of Entomology, Obihiro University, Obihiro, Hok-

Figs. 9-17 *Montisimulium sakhalinum*

Adults: 9, fore legs of male; 10, mid leg of male; 11, hind leg of male; 12, fore leg of female; 13, mid leg of female; 14, hind leg of female; 15, claw of hind leg of female; 16, calcipala and pedisulcus of hind leg of female; 17, genitalia of female, ventral view; a, arm of genital fork; b, cercus and anal lobe, lateral view

kaido, Japan.

Remarks. Formerly, the present species has been treated as a member of *montium*-group among the genus *Eusimulium* ROUBAUD by Rubtsov (1962). According to his recent investigation (1974 a, b), however, this *montium*-group was treated as the new genus *Montisimulium* among the new tribe *Eusimuliini* which he erected. *Montisimulium* has some special characters, namely, female genital fork with broadened arms, male genitalia with discus-shaped ventral plate and specific larval hypostomial teeth. This species closely resembles to *M. montium* (RUBTSOV) and *M. odontostylum* (RUBTSOV) from Central Asia,

Figs. 18-21 *Montisimulium sakhalinum* Adults: 18, genitalia of male, ventral view; 19, ventral plate, lateral view; 20, ventral plate, end view; 21, dististyle, two view

Figs. 22-25 *Montisimulium sakhalinum* 22, respiratory organ; 23, pupal skin (left, dorsal and right hand ventral view); 24, cocoon, ventral view; 25, cocoon, lateral view

Figs. 26-29 *Montisimulium sakhalinum* Larvae: 26, head capsule, ventral view; 27, hypostomium; 28, head capsule, dorsal view; 29, cepalic fan in immediately after the moulting

Figs. 30-33 *Montisimulium sakhalinum* Larvae: 30, apex of mandible; 31, rectal segment of abdomen, dorsal view; 32, left lateral view of proleg; 33, rectal gill

and *M. kobayashii* (Okamoto *et al.*, 1958) of Japan, and slightly resembles to *M. shevjakovi* (RUBTSOV) of Siberia. But this species can be distinguished from *montium* and *odontostylum* by the mesonotum covering with golden yellowish pubescence, and by the structure of the style and double disc-shaped ventral plate of male, from *kobayashii* by the structure of its respiratory organs, and by the form of cocoon which has a very long dorsal projection and deeply dented anterior margin. This species is also differentiated from *shevjakovi* by the structure of genitalia of both sexes and the form and colour of the hind legs of the male; the latter having a long dorsal projection in the cocoon, and 10 filaments in the pupal respiratory organ.

Biological notes. The larvae of this species were firstly found in a small, slow, intermittent, spring-fed stream at Nukabira, Kamishihoro (altitude 800–900 m). The stream was roughly 30–50 cm in width, 10–15 cm in depth, well shaded by a mixed forest cover and consisted of incised meander and of a number of small pools and rivulets. Water grasses and mosses were abundant in or near the pools and rivulets. The water temperature varied from 8.0°C to 14.5°C in summer season. Although the larvae were commonly found in the rivulets near the source of the spring, the young ones swarm on the upper-side of grass blades, dead leaves and stones, whilst the full-grown ones on the undersides of grass blades, dead leaves and other debris. During long periods of dry weather, the rivulets often change into deep hollows or pools, the larvae survive under dead leaves. Even when the stream dried up, the larvae can remain under wet dead leaves by folding their bodies until the stream revive again after a rainfall. The stout larvae can resist about one week in nonflowing water. This was confirmed in the laboratory by rearing the larvae in a glass case. The pupae were often found in pools where no perceptible water movement. Some pupae were found on the underside of leaves and sticks buried in the silt of pools. However, a large number of pupae were usually found on the undersides of stones and trailers at the favourable points of 10–15 cm fall of water in the streams.

This species was also collected at streams fed with snow-melted water in the col of Mt. Minami-Shokanbetsu (altitude 1,400 m) and streams in the highland swamp (1,000 m). This species is univoltine and overwinters in the egg stage which hatch in late May or early June and the first adults appear about mid July. Large numbers of adults appear in early and mid August. The young larvae are found often together with full grown larvae of *Twinnia* sp., *Stegopterna* sp. and *Eusimulium uchidai*. The blood-sucking habits are unknown.

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摘 要

Montisimulium sakhalinum (カラフトミヤマブユ, 新称) に関する所見とその成虫, 幼虫の記載

1974年および1975年6～8月に大雪山国立公園の亜高山帯森林内(標高約800～900m)でブユの採集を行い未知のブユの多数の幼虫と蛹を得た。これらの室内飼育により多数の成虫も得られた。採集した蛹はRubtsov(1962)によってサハリンのユージノサハリンスク(豊原)において*E. violovitshi* RUBTSOVの蛹に混じていたただ1個の蛹の脱出殻によって記載された*Eusimulium*

sakhalinum RUBTSOV ではないかと考えた。しかし念のため高橋弘博士を通じて Dr. I. A. Rubtsov に標本の照合を求めた結果、*M. sakhalinum* (= *E. sakhalinum*) であると確認された。本種は既述のように蛹殻によって記載されたもので、その成虫および幼虫は未知であったので、本文においてそれらについて記載した。

Montisimulium では *montium*, *odontostylum* (中央アジア産), *kobayashii* (日本産) は本種に最も類似しているが, *shevjakovi* (シベリア産) も多少類似している。これらと雌雄の genitalia, 雌の sensory vesicle, 雄の後脚の色彩と形態, 繭の形態などで区別できる。特に本種の蛹の respiratory filaments に黒紫色小顆粒があ

り, その分枝法は独得であり, 繭の anterior margin が深くきれこみ, dorsal projection が極めて長い特徴がある。

幼虫期に日照りつづきで, 生息している細流がかわき上った場合, 流れの凹みの湿った落葉の間で幼虫は体を折り曲げて堪えており, 降雨後に再び細流の中の浮游植物片の下面などに見られるようになる。雌成虫の吸血性は知られていない。

本種は大雪山国立公園の亜高山帯森林内の各所の細流のほかに, 南暑寒別岳の雪溪から流れる細流 (標高 1,400 m), 高山地湿原内細流 (標高 1,000 m) にも生息していることも確認した。