

Correction of mistakes. I. New synonyms of two species *Diamesa* Meigen (Diptera: Chironomidae, Diamesinae) from the Russian Far East, with redescription of *D. tsutsuii* Tokunaga and *D. nivoriunda* (Fitch)

EUGENYI A. MAKARCHENKO

Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far East Branch of the Russian Academy of Sciences, 100 let Vladivostoku 159, 690022 Vladivostok, Russia

 makarchenko@biosoil.ru;  <https://orcid.org/0000-0003-2765-8729>

During the revision of the Diamesinae from the Russian Far East it was revealed that *Diamesa coquilletti* Sublette is a synonym for *D. tsutsuii* Tokunaga as well as *D. bogatovi* Makarchenko is synonymous with *D. nivoriunda* (Fitch).

In this report, we correct the mistakes made earlier and give a redescription of investigated species from the Russian Far East.

Material and methods

The material was preserved in 70% ethanol. The adult males were slide-mounted in the polyvinyl lactophenol. The morphological terminology and abbreviations used below generally follow Sæther (1980). The photographs were taken using an Axio Lab.A1 (Karl Zeiss) microscope with an AxioCam ERc5s digital camera and an Olympus SZX16 stereomicroscope with an Olympus DP74 digital camera, and then stacked using Helicon Focus software. The final illustrations were post-processed for contrast and brightness using Adobe® Photoshop® software.

All material is deposited in the collection of the Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far East Branch of Russian Academy of Sciences, Vladivostok, Russia (FSCEATB FEB RAS).

Descriptions

Diamesa tsutsuii Tokunaga

(Figs. 1–4, 7–17)

Diamesa tsutsuii Tokunaga, 1936: 546; 1964: 22; Makarchenko 1977: 113, 1985: 82; 2006: 261, 477, 614; Linevich & Makarchenko 1989: 32; Ashe & O'Connor 2009: 287; Makarchenko & Makarchenko 2017: 130.

Diamesa coquilletti Sublette, 1966: 584; Hansen & Cook 1976: 78. **Syn. nov.**

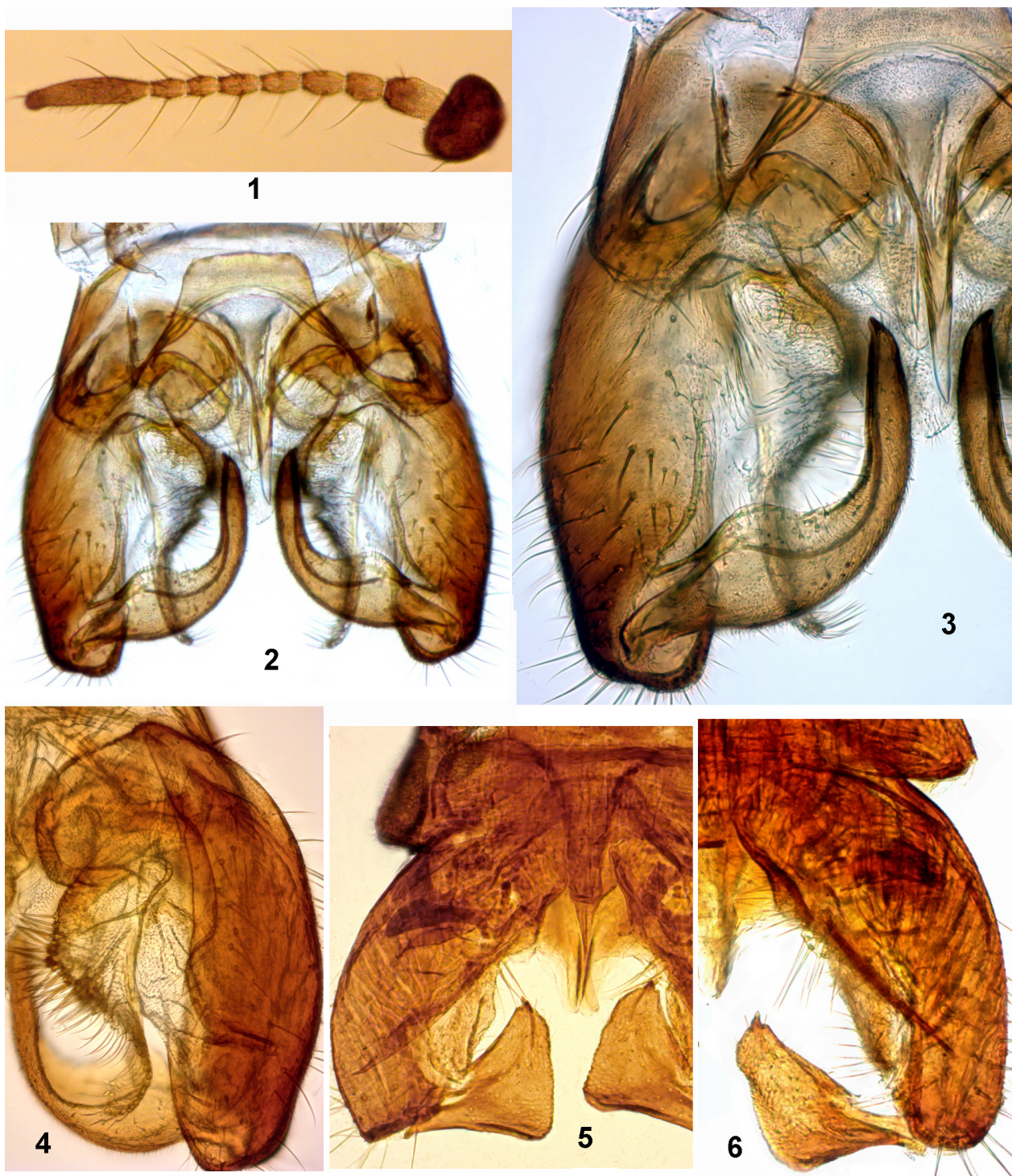
Diamesa matuimpedita Sasa, 1989: 149–150.

Material examined. Japan: 1 adult male (holotype), Nagano Prefecture, Hosono, from snow, alt. 600 m above sea level, 17.III.1935, leg. K. Tsutsui. **Russia:** 15 adult males, 5 pupae, 11 larvae, Primorye Territory, Khasansk District, Kedrovaya Pad Nature Reserve, Kedrovaya River, 15–17.II.1975, leg. E. Makarchenko; 1 adult male, Ternei District, Sikhote-Alin Nature Reserve, Spornyi Stream (Serebrianka River basin), leg. O. Zorina; 12 adult males, 6 pupae, 14 larvae, Jewish Autonomous Region, Obluchie District, Bidzhan River, (Amur River basin), from snow, N 48°38'409", E 131°37'217", 27.III.2013, leg. E. Makarchenko; 5 adult males, Khabarovsk Territory, Nanaisky District, Anyuisky National Park, Pihtsa River (tributary of Gassi Lake), Amur River basin, 25.V.2019, leg. N. Yavorskaya; 2 adult males, Magadan Region, Olskyi District, Ola River, 29.IV.2014, leg. E. Khamenkova, 2 adult males, the same data except 3.V.2019, leg. E. Khamenkova; 3 adult males, 3 pupae, Sakhalin Island, Yuzhno-Sakhalinsk City, Bereznjaki River, 17.IV.2015, leg. E. Zhivogliadova.

Adult male (n = 7, except when otherwise stated).

Total length 4.3–6.2 mm. Wing length 3.2–4.0 mm. Total length/wing length 1.33–1.35.

Coloration. Head, thorax, legs, and abdomen dark brown; scutellum brown, palp light brown, antennae brown to dark brown; wings greyish, with brownish veins.



FIGURES 1–6. Adult males of *Diamesa tsutsuii* Tokunaga (1–4) and *D. nivoriunda* (Fitch) (5–6). 1, antenna; 2, total view of hypopygium from above; 3, 5, part of hypopygium from above; 4, 6, part of hypopygium from below.

Head. Eyes hairy, reniform. Temporal setae including 7–8 preoculars, 8–11 verticals and 3–4 postorbitals. Clypeus with 11–14 setae. Antenna with 8 flagellomeres and reduced plume of setae (Fig. 1); number and length of these setae on 1–7 flagellomeres respectively (n=2): 2–3 (36–40 μ m), 1 (40–42 μ m), 3–4 (56–60 μ m), 3–4 (48–56 μ m), 3–4 (48–56 μ m), 2–3 (80–82 μ m), 2–3 (80–82 μ m); terminal flagellomere with 3–4 setae, 72–80 μ m long in basal part and with 1 subapical setae, 20–22 μ m long. Length of 1–8 flagellomeres (μ m) (n=4): 76–84, 52–56, 60–64, 48–56, 52–56, 42–44, 38–44, 156–164; AR 0.40–0.50. Palpomere length (μ m): 46–48, 55–100, 134–140, 143–152, 212–220. Palpomere 3 in distal part with sensilla capitata with diameter 20 μ m. Head width/palpal length 1.05–1.06. Antennal length/palpal length 0.80–0.84.

Thorax. Anteprenotum with 9–11 ventrolateral setae. Dorsocentrals 10–13, prealars 6–10. Scutellum with 20–42 setae.

Wing. Length 3.2–4.0 mm, width 1.0–1.2 mm. Anal lobe rounded-angular. Squama with 26–31 setae, 80–136 μm long. R and R_1 with 32–35 setae, R_{4+5} with 13–18. Costal extension 70–82 μm long. RM/MCu 2.0–2.5.

Legs. Spur of front tibia 44–56 μm long. Spurs of mid tibia 44–56 μm and 56–60 μm long. Spurs of hind tibia 67–100 μm and 64–68 μm long. Hind tibial comb with 16–18 setae. Length (μm) and proportions of leg segments are as in Table 1.

TABLE 1. Lengths (in μm) and proportions of leg segments of *Diamesa tsutsuii* Tokunaga, male (n=7).

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄	ta ₅
P ₁	1320–1800	1620–2020	100–1180	492–580	312–361	115–148	148–180
P ₂	1380–1800	1400–1660	620–700	336–620	213–262	115–148	131–164
P ₃	1560–2040	1600–2020	980–1220	533–612	295–361	115–164	148–180
continued							
	LR	BV	SV	BR			
P ₁	0.54–0.62	3.48–4.04	3.00–3.48	1.5–1.9			
P ₂	0.37–0.46	4.28–4.36	4.34–4.79	1.4–1.6			
P ₃	0.54–0.61	3.57–4.05	3.13–3.72	2.0–2.3			

Hypopygium (Figs. 2–4). Tergite IX with 12–24 setae and anal point, 124–164 μm long, ca 40 μm wide, which slender apically, broadening basally, usually does not go beyond top of proctiger or only slightly goes (Figs. 2–3). Laterosternite IX with 10–11 setae. Transverse sternopodeme trapezoidal, without antero-lateral projections, 204–280 μm long, 44–52 μm wide. Gonocoxite 400–508 μm long; inferior volsella ca 260 μm long, basal half widened, narrow distal, with setae along inner margin, which are longest in basal part. Gonostylus 280–360 μm long, curved, widened and rounded in basal third, narrow in distal two-thirds, with megaseta 32–36 μm long. HR 1.40–1.43.

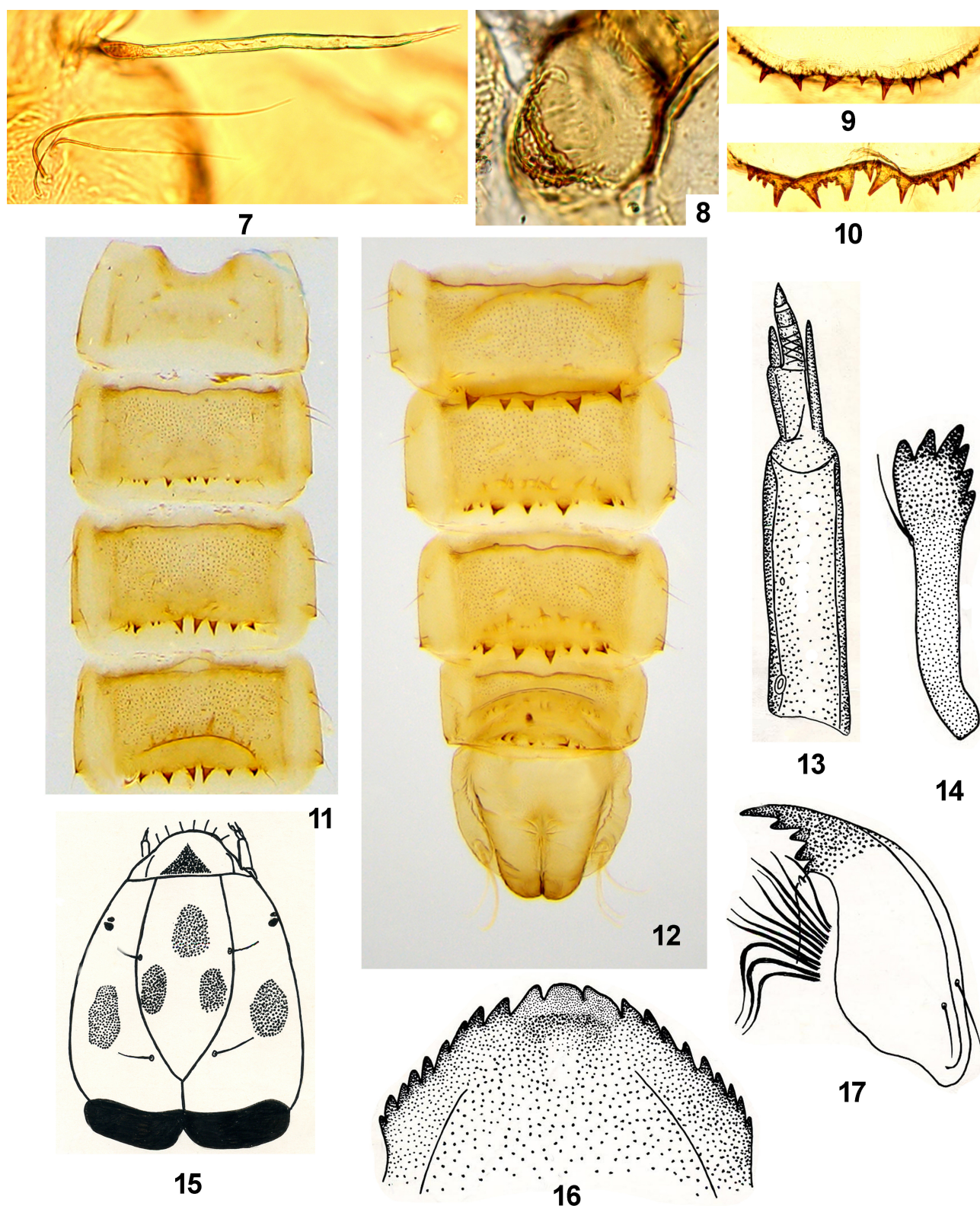
Pupa (n=5). Total length 5.7–6.0 mm. Coloration dark brown. Exuviae yellow.

Cephalothorax. Frontal apotome with 2 setae 168–180 μm long. Thorax granulated in anterodorsal part and smooth in middle and posteriodorsal parts. Anteprenotum with 2 median and 2 lateral anteprenotals; dorsocentrals 2. Thoracic horn pale, filiform, peaked, 280–359 μm long and 12–16 μm wide (Fig. 7). Precorneal setae lengths (μm): Pc₁ – 75–102, Pc₂ – 211–237, Pc₃ – 105–177. Basal part of antennal case with tubercle (Fig. 8)

Abdomen. Tergite I and sternite I without shagreen of spinules. Anterior 2/3 of tergites II–VIII with shagreen of spinules. The lateral margins of the segments are slightly serrated, with brown sharp corners protruding anally-laterally. Tergite I and sternites I–II without posterior transverse row of large thorn-like spines. Number of these spines on tergites II–VIII accordingly – 9–12 : 8–9 : 6–11 : 5–9 : 6–11 : 6–11 : 5–7 (Figs. 11–12). Number of thorn-like spines on sternites III–VIII accordingly – 10–20 : 9–13 : 7–10 : 11–13 : 8–15 : 19–18. Size of spines on tergites and sternites subequal or spines of sternites slightly narrower (Fig. 9–10). Segment I with 2 pairs of lateral setae 48–88 μm long. Segments II–VIII with 4 pairs of lateral setae; length of L₁–L₃ 92–148 μm , length of L₄ 28–68 μm . Anal lobe with 3 needle-shaped anal macrosetae 240–284 μm long, subapically recurved. Male genital sac rounded extending beyond anal lobe (Fig. 12).

Fourth instar larva (n=5). Coloration brown. Total length 6.4–10.1 mm. Head capsule brownish-yellow, with diffuse brown spots and brown or dark brown triangular spot at epistomal suture; postoccipital margin wide and black (Fig. 15). Two eye spots do not touch and there is light spot around them. Antenna yellowish brown; a large ring organ is located at base of basal segment, a small one is in middle; blade reaches base of the 4th segment, accessory blade reaches base of 3rd segment; style of 2nd segment flat, reaching base of 4th segment (Fig. 13). AR 1.8. Premandible with 6 yellow inner teeth (Fig. 14). Mandible dark brown, apical tooth long and thin, other teeth acutely triangular; seta subdentalis flat and short; seta interna with 20–22 simple pinnate branches (Fig. 17). Mentum with 1 median tooth and 10 pairs of lateral teeth; median and first pair of lateral teeth are distinguished by lighter color (Fig. 16). Maxillar palp with 8 short setae in distal part. Procercus in the form of an incompletely sclerotized ring, with 4 long and light yellow anal setae.

Remarks. Adult male of *D. tsutsuii* is closely related to European species of *cinerella* group (*D. cinerella* Meigen, *D. hamaticornis* Kieffer, *D. hyperborea* Holmgren, *D. kasymovi* Kownacki et Kownacka and *D. tonsa* (Haliday) and can be included in this group of species.



FIGURES 7–17. Pupa (7–12) and larva of fourth instar (13–17) of *Diamesa tsutsuii* Tokunaga. 7, thoracic horn and precorneals; 8, tubercle of antennal base; 9, posterior transverse row of thorn-like spines of sternite IV; 10, the same of sternite V; 11, tergites I–IV; 12, tergites V–VIII and anal segment; 13, antenna; 14, premandible; 15, head from above; 16, mentum; 17, mandible.

The synonymy of *D. tsutsuii* and *D. coquilletti* is supported by Dr. D. Hansen, who studied the type material of *D. coquilletti* from Bering Island (Hansen & Cook 1976). Here is what he wrote in his letter about it. “Comparing description

of Tokunaga (1936) and illustrations with those in my *Diamesa* revision, it appears to me that *D. coquilletti* Sublette could certainly be a synonym of Tokunaga's *D. tsutsuii*. What would be of interest to you would be those two slides of the male collected on Bering Island by Stejneger in 1897. When I received this lone male from the USNM, the male genitalia had already been slide-mounted (by Coquillett? by Sublette?), but the rest of the specimen was still on a pin. I slide-mounted this pinned portion of the male specimen. Both these slides were returned to the USNM in the mid-1970s. Coquillett (1899: 342) designated the species as type 4047 in the USNM's system. Sublette (1966) illustrated the male genitalia, as did I. I also illustrated the male antenna: Fig. 41 in my *Diamesa* revision. This looks so very close to your illustration of the antenna of *D. tsutsuii*: Fig. 13 in your 1985 Podonomidae, Diamesinae, and Prodiamesinae revision. The only specimens of *D. coquilletti* that I know of are the lone male and lone female collected by Stejneger and used by Coquillett in his description of *Eutanypus borealis*. Simply stated, that's all the material there is and only the single male is, in fact, worth dealing with. That lone male specimen was what I used in the description of the species in my 1976 revision. I feel that you could very safely regard *D. coquilletti* as a junior synonym of *D. tsutsuii*".

Biology. Apparently a bivoltine species. In Southern Primorye, the "flying" of adults occurs from the first half of December to the first half of March (maximum at the end of February) as well as in June. On Sakhalin Island adults were collected in the first half of March, on the Kunashir and Iturup Islands (Kurile Islands) from the first half of March to the end of April, in the Amur River basin in March as well as in late July, the first half of August and in November, in the Magadan Region in May and the first half of August. Adult males and females caught in winter and spring were usually found on the snow near the gullies, on the lower surface of the ice and on dry stones in the watercourse (Fig. 18). The water temperature at that time was 0.1–2°C. Copulation of chironomids, both in winter-spring time and in summer, takes place on the ground. Larvae and pupae live in foothill and mountain rivers on stones.

In Japan, *D. tsutsuii* lives in mountainous areas, at an altitude of about 600 m above sea level. Imago males were collected in the second half of March in the snow. It is also reported that adult females were caught in August (Tokunaga 1936, 1964).

Distribution. East Palaearctic species. The western border of the range is the basin of Baikal Lake. Identification by the larva and the record for Armenia of *D. tsutsuii* (Kachvoryan *et al.* 2007; Petrova *et al.* 2011) doubtful in my opinion.



FIGURES 18. Adult male of *Diamesa tsutsuii* Tokunaga in March snow, Amur River basin. Photo by E.A. Makarchenko.

***Diamesa nivoriunda* (Fitch)**

(Figs. 5–6)

Chironomus nivoriundus Fitch, 1847: 282–283.

Diamesa nivoriunda (Fitch). Johannsen, 1903: 439–441, 1934: 348, 1937: 34–35; Roback, 1957: 51–53; [non] *D. nivoriunda* (Fitch). Sublette, 1964: 130, 132 (misdetermination of a western species with hairy eyes).

Diamesa bogatovi Makarchenko, 2012: 86. **Syn. nov.**

Material examined. Russia: 1 adult male, Chukotka Peninsula, Kresta Bay, Seutakan Lake, 11.IX.1984, leg. V. Bogatov.

Adult male (n = 1).

Total length 4 mm. Wing length 3.12 mm. Total length/wing length 1.3.

Coloration. Thorax, legs, and abdomen dark brown, wings greyish.

Head destroyed.

Thorax. Antepronotum with 5 ventrolateral setae. Acrostichals absent, dorsocentrals 11, prealars 4, scutellars 17.

Wing. Length 3.12 mm; width 1.0 mm. R and R₁ with 13 setae; R₄₊₅ with 5 setae in distal part. Costal extension 80 µm long. RM length/MCu length 3.3. Anal lobe developed, rounded-angular. Squama with 33 setae.

Legs. Spur of front tibia 60 µm long. Both spurs of mid tibia 44 µm long. Spurs of hind tibia 68 µm and 52 µm long. Apex of ta₁–ta₃ of all legs with 2 pseudospurs. About 7 pseudospurs sit along the entire length of the ta₁ of the mid leg, and on the hind leg pseudospurs cover surface of ta₁ and ta₂. Hind tibial comb with 15–19 setae. Length (µm) and proportions of leg segments are as in Table 2.

TABLE 2. Lengths (in µm) and proportions of leg segments of *Diamesa nivoriunda* (Fitch), male (n=1).

	fe	ti	ta ₁	ta ₂	ta ₃	ta ₄	ta ₅	LR	BV	SV	BR
P ₁	1264	1488	976	544	320	96	112	0.66	2.82	3.15	2.0
P ₂	1360	1392	720	416	240	80	112	0.52	3.82	4.09	2.1
P ₃	1520	1680	1088	592	288	104	132	0.65	3.84	2.94	3.0

Hypopygium (Figs. 5–6). Tergite IX with 14–17 setae and anal point 156 µm long. Anal point with rod-shaped setae apically. Laterosternite IX with 9–11 setae. Gonocoxite 308 µm long, with wide and flat inferior volsella; basimedial cluster with 6–7 setae, 48–52 µm long. Gonostylus 156 µm long, greatly widens distally, with angular heel, in apical part with megaseta 8 µm long and tooth. HR 1.34–1.57.

Pupa and larva unknown.

Remark. I have synonymized *D. bogatovi* with *D. nivoriunda* with some hesitation due to the small amount of material. In the future, after getting of additional material, it will be necessary one more time to compare North American specimens with Chukotka population.

Distribution. Before finding in Chukotka Peninsula was known only from North America (Hansen & Cook 1976).

Acknowledgements

I am deeply grateful to Dr. Dean Hansen for providing photographs of male *Diamesa nivoriunda* from North America which helped me in identifying this species and comparing it with *D. bogatovi*, as well as for discussing the synonymy of *D. tsutsuii* and *D. coquillettii*.

I am also very grateful to Dr. V.M. Loktionov (Federal Scientific Center of the East Asia Terrestrial Biodiversity, Vladivostok) for help with preparing of some microphotographs.

The research was carried out within the state assignment of Ministry of Science and Higher Education of the Russian Federation (theme No. 121031000147-6).

References

- Ashe, P. & O'Connor, J.P. (2009) *A World Catalogue of Chironomidae (Diptera). Part 1. Buchonomyiinae, Chilenomyiinae, Podonominae, Aphroteniinae, Tanypodinae, Usambaromyiinae, Diamesinae, Prodiamesinae and Telmatogetoninae*. Irish Biogeographical Society & National Museum of Ireland, Dublin, 445 pp.
- Coquillett, D.W. (1899) Order Diptera. In: Jordan, D.S. (Ed.), *The fur seals and the fur seal islands of the North Pacific Ocean. Vol. 4*. Government Printing Office, Washington, D.C., pp. 341–346.
- Fitch, A. (1847) Winter insects of eastern New York. *American Journal of Agricultural and Biological Sciences*, 5 (13), 274–284.
- Hansen, D.C. & Cook, E.F. (1976) The systematics and morphology of the Nearctic species of *Diamesa* Meigen, 1835 (Diptera: Chironomidae). *Memoirs of the American Entomological Society*, 30, 1–203.
- Johannsen, O.A. (1903) Part 6. Aquatic nematocerous Diptera. In: Needham, J.G., MacGillivray, A.D., Johannsen, O.A. & Davis, K.C., Aquatic insects in New York State. *Bulletin of the University of the State of New York*, 68, pp. 197–517. <https://doi.org/10.5962/bhl.title.8531>
- Johannsen, O.A. (1934) New species of North American Ceratopogonidae and Chironomidae. *Journal of the New York Entomological Society*, 42, 343–352.
- Johannsen, O.A. (1937) Aquatic Diptera. III. Chironomidae: Subfamilies Tanypodinae, Diamesinae and Orthocladiinae. *Memoire of Cornell University Agricultural Experiment Station*, 205, 3–84.

- Kachvoryan, E.A., Oganessian, V.S., Petrova, N.A. & Zelentsov, N.I. (2007) The fauna of chironomids and blackflies (Diptera: Chironomidae, Simuliidae) and hydro-chemical characteristics of the Hrazdan River (Armenia). *Entomological Review*, 87, 73–81. <https://doi.org/10.1134/S0013873807010071>
- Linevich, A.A. & Makarchenko, E.A. (1989) New or little known species of subfamily Diamesinae (Diptera, Chironomidae) from Baikal Territory. In: *Systematics and ecology of river organisms*. DVNC AN SSSR, Vladivostok, pp. 20–37. [in Russian]
- Makarchenko, E.A. (1977) Some Diamesinae and Orthocladiinae (Diptera, Chironomidae) from the nature reserve “Kedrovaya Pad”. In: *Freshwater fauna of Kedrovaya Pad Nature Reserve*. DVNC AN SSSR, Vladivostok, pp. 109–125. [in Russian]
- Makarchenko, E.A. (1985) *Chironomids of the Soviet Far East. Subfamilies Podonominae, Diamesinae and Prodiamesinae (Diptera, Chironomidae)*. DVNC AN SSSR Press, Vladivostok, 208 pp. [in Russian]
- Makarchenko, E.A. (2006) Subfamily Diamesinae. In: *Key to the Insects of Russian Far East. Vol. 6. Diptera and Siphonaptera. Pt. 4*. Dal’nauka, Vladivostok, pp. 253–276 + 468–480 + 607–621. [in Russian]
- Makarchenko, E.A. & Makarchenko, M.A. (2012) New records of chironomids (Diptera, Chironomidae) from the Far East and bordering territories.X. Subfamilies Diamesinae and Orthocladiinae. *Euroasian Entomological Journal*, 11 (Supplement 2), 85–92. [in Russian]
- Makarchenko, E.A. & Makarchenko, M.A. (2017) Fauna and distribution of the Podonominae, Diamesinae, Prodiamesinae and Orthocladiinae (Diptera, Chironomidae) of the Russian Far East and bordering territory. Vladimir Ya. *Levanidov’s Biennial Memorial Meetings, FSCEATB FEB RAS, Vladivostok*, 7, 127–142.
- Petrova, N.A., Zhirov, S.V., Zelentsov, N.I. & Kachvoryan, E.A. (2011) On the fauna of chironomidae (Diptera) of the Hrazdan Basin (Armenia). *Entomological Review*, 91, 360–366. <https://doi.org/10.1134/S0013873811030110>
- Roback, S.S. (1957) Some Tendipedidae from Utah. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 109, 1–24.
- Sæther, O.A. (1980) Glossary of chironomid morphology terminology (Diptera: Chironomidae). *Entomologica scandinavica*, Supplement 14, 1–51.
- Sasa, M. (1989) Chironomidae of Japan: Check list of species recorded, key to males and taxonomic notes. *Research Report from the National Institute for Environmental Studies*, 125, 1–177.
- Sublette, J.E. (1964) Chironomid midges of California. II. Tanypodinae, Podonominae, and Diamesinae. *Proceedings of the United States National Museum*, 115, 85–135. <https://doi.org/10.5479/si.00963801.115-3481.85>
- Sublette, J.E. (1966) Type specimens of Chironomidae (Diptera) in the U.S. National Museum. *Journal of the Kansas Entomological Society*, 39, 580–607.
- Tokunaga, M. (1936) Chironomidae from Japan (Diptera), VI. Diamesinae. *Philippine Journal of Science*, 59, 525–552.
- Tokunaga, M. (1964) A snow midge from Japan. *Akitu*, 11, 39–40. <https://doi.org/10.1093/nq/11-1-39>