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A review of the *Syndiamesa* Kieffer , 1918 (Diptera: Chironomidae: Diamesinae), with DNA barcoding of known species

Обзор рода *Syndiamesa* Kieffer , 1918 (Diptera: Chironomidae: Diamesinae), с ДНК-баркодингом известных видов

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Key words: Diptera, Chironomidae, Diamesinae, *Syndiamesa*, review, DNA barcoding.

Ключевые слова: Diptera, Chironomidae, *Syndiamesa,* обзор, ДНК-баркодинг.

Abstract. This article provides a review on chironomids of the genus *Syndiamesa* Kieffer , 1918 in the Palaearctic Region. Using an integrative method the little-known species *S. edwardsi* Pagast, 1947, *S. mira* (Makarchenko, 1980), *S. nigra* Rossaro, 1980 and *S. yosiii* Tokunaga, 1964 are redescribed. A cryptic species *Syndiamesa* sp. from South Korea is identified, the male of which is morphologically indistinguishable from *S. yosiii.* However, ASAP analysis placed these two species into different mOTUs, and the minimum K2P distance between them was 6.51%. An unidentified specimen to the genus level (BOLD ID: GBDTA6975-21) from Germany belonged to *Syndiamesa edwardsi*, and a larva of *Syndiamesa* sp. (BOLD ID: ECIPY162-10) from Canada belonged to *Diamesa gregsoni* Edwards, 1933. Therefore, to date there is no molecular evidence for *Syndiamesa* to live in the Nearctic. A key to adult males of known species is given.

Резюме. Приведён обзор хирономид рода *Syndiamesa* Kieffer, 1918 Палеарктики. С использованием интегративного метода переописаны малоизвестные и редкие виды: *S. edwardsi* Pagast, 1947, *S. mira* (Makarchenko, 1980), *S. nigra* Rossaro, 1980 и *S. yosiii* Tokunaga, 1964. Выявлен криптический вид *Syndiamesa* sp. из Южной Кореи, самец которого по морфологическим признакам не отличается от вида *S. yosiii*. Анализ ASAP распределил эти два вида в разные мОТУ, а минимальная K2P-дистанция между ними составила 6,51 %. Неопределённый до родового уровня экземпляр из Германии (BOLD ID: GBDTA6975-21) принадлежал к виду *Syndiamesa edwardsi*, а личинка *Syndiamesa* sp. (BOLD ID: ECIPY162-10) из Канады оказалась *Diamesa gregsoni* Edwards, 1933. Следовательно, молекулярные доказательства обитания рода *Syndiamesa* в Неарктике к настоящему времени отсутствуют. Для имаго самцов известных видов рода дана определительная таблица.

Introduction

The genus *Syndiamesa* Kieffer, 1918 is not well developed in the subfamily Diamesinae, and after its establishment by Kieffer [1918], due to the lack of a type species, it was considered controversial for long time. The type species *Diamesa hygropetrica* Kieffer, 1908 of the genus was identified only eleven years later by Edwards [1929]. Later Serra-Tosio [1968] described *Parapotthastia* Serra-Tosio, 1969 as a new genus and named *Sympotthastia edwardsi* Pagast, 1947 as the type-species including also in this genus *Diamesa hygropetrica* Kieffer, considering these two species to be congeneric [Serra-Tosio, 1973]. After reviewing the history and essence of this issue, Cranston [1975] synonymized *Parapotthastia* Serra-Tosio with *Syndiamesa* Kieffer.

Currently the genus *Syndiamesa* includes 12 species, of which six are distributed in East Palaearctic, namely: *S. kashimae* Tokunaga, 1936, *S. kyogokusecunda* Sasa et Suzuki, 1998, *S. longipilosa* Endo, 2007, *S. mira* (Makarchenko, 1980), *S. montana* Tokunaga, 1936, *S. yosiii* Tokunaga, 1964 [Ashe, O'Connor, 2009; Yamamoto, Yamamoto, 2014; Wang et al., 2020]. Five species are known from West Palaearctic — *S. edwardsi* (Pagast, 1947), *S. hygropetrica* (Kieffer, 1908), *S. nigra* Rossaro, 1980, *S. serratosioi* Kownacki, 1981 and *S. vaillanti* Kownacki, 1981 [Ashe, O'Connor, 2009]. And one species, *S. fanduangularis* Fu, 2025 recorded for Oriental Region [Fu et al., 2025]. For North America, only a mention of unnamed species of *Syndiamesa* from Canada (Northwest Territories) is known [Oliver at al., 1990; Ashe, O'Connor, 2009; Langton, 2023]. It should be noted that a number of the listed above species are still known from original descriptions based on a single male and for which no modern redescriptions has yet been made.

Considering this, in our article we provide an overview of the chironomids of the genus *Syndiamesa* Kieffer in the Palaearctic. Using an integrative method, the little-known species *S. edwardsi* Pagast, *S. mira* (Makarchenko), *S. nigra* Rossaro, and *S. yosiii* Tokunaga are redescribed. A cryptic species *Syndiamesa* sp. is identified, the male of which is morphologically indistinguishable from *S. yosiii*. A key to adult males of known species is given.

To date, DNA barcoding studies on chironomids of the genus *Syndiamesa* remain critically sparse. Recently, a description of a new species, *S. fanduangularis* Fu was published, utilizing an unrooted Neighbor-joining tree to demonstrate its minimal genetic distance to *S. yosiii* Tokunaga [Fu et al., 2025].

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Historically, phylogenies based on morphological characters suggested that *Syndiamesa* is sister to the *Diamesa* + *Lappodiamesa* clade [Serra-Tosio, 1973; Rossaro, 1995]. In contrast, multilocus molecular phylogenies have demonstrated a direct sister-group relationship between the genera *Syndiamesa* and *Diamesa* Meigen, 1835 [Semenchenko et al., 2024]. Given that DNA barcoding has been successfully applied to resolve taxonomic issues within the genus *Diamesa* [e.g., Montagna et al., 2016; Lencioni et al., 2021; Makarchenko et al., 2022a–b, 2023; Lencioni et al., 2024], there is no doubt regarding its utility and efficacy for the genus *Syndiamesa.*

Materials and methods

The adult males were preserved in 70% ethanol for further study of morphology and n 96 % ethanol for DNA barcoding. The material was slide-mounted in polyvinyl lactophenol. The morphological terminology and abbreviations used below generally follow Sæther [1980]. For some structures of the hypopygium, however, the terminology of Hansen, Cook [1976] and Oliver [1989] is used. The photographs were taken using an Axio Lab.A1 (Carl Zeiss) microscope with an AxioCam ERc5s 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 Bioresource Collection (reg. number 2797657) of the Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far East Branch of the Russian Academy of Sciences, Vladivostok, Russia (FSCEATB FEB RAS).

Total genomic DNA was isolated using the DNeasy Blood & Tissue Kit (Qiagen, Hilden, Germany) in accordance with the manufacturer's protocol, with the final DNA eluted in a volume of 100 µl. The mitochondrial cytochrome *c* oxidase subunit I (*COI*) gene fragment was amplified utilizing the universal primer pair LCO1490 and HCO2198 [Folmer et al., 1994]. The resulting PCR products were purified using Exonuclease I (ExoI) and Thermosensitive Alkaline Phosphatase (FastAP) (Thermo Fisher Scientific Inc., USA). Bidirectional sequencing was subsequently performed on an ABI 3130xl Genetic Analyzer (Applied Biosystems) using the BigDye Terminator v3.1 Cycle Sequencing Kit. Further specifics regarding the PCR thermal profile and sequencing procedures are detailed in Makarchenko et al. [2022a], Semenchenko, Makarchenko [2025] and Makarchenko, Semenchenko, [2026].

To reconstruct the phylogenetic tree and perform species delimitation, we retrieved all publicly available sequence data for the genus *Syndiamesa* from BOLD and GenBank, supplemented by an exhaustive audit of unidentified diamesines barcodes from the BOLD repository. The type specimen of *Pseudokiefferiella parva* (Edwards, 1932) was selected as the outgroup. To partition the dataset into molecular operational taxonomic units (mOTUs), the Assemble Species by Automatic Partitioning (ASAP) framework [Puillandre et al., 2021] was implemented utilizing Kimura 2-parameter (K2P) distances under default computational settings.

Phylogenetic reconstruction was executed via Bayesian inference (BI) in MrBayes 3.2.7a [Ronquist et al., 2012] employing Markov Chain Monte Carlo (MCMC) randomization. The analysis was run for 1 million generations across four parallel Markov chains (one cold and three heated), with the initial 25 % of the sampled topologies discarded as burn-in. To generate an ultrametric tree structure, a strict clock model (brlenspr = clock:uniform) was applied. The optimal partitioning scheme and evolutionary nucleotide substitution models were evaluated using PartitionFinder 2.1.1 [Lanfear et al., 2012] independently for each codon position of the *COI* gene. The newly generated sequences have been deposited in GenBank under accession numbers PZ381782–PZ381788.

The present work is registered in ZooBank (www.zoobank.org) under urn:lsid:zoobank.org:pub:42D42458-EDA3-4462-B9A9-6089D2838D24

Taxonomy

Syndiamesa Kieffer, 1918

Syndiamesa Kieffer, 1918: 103, Type species: *Diamesa hygropetrica* Kieffer, 1909, by subsequent designation of Edwards [1929: 303].

= ***Parapotthastia*** Serra-Tosio, 1968: 145, Type species *Sympotthastia edwardsi* Pagast, 1947 by original designation; Cranston, 1975.

Syndiamesa edwardsi (Pagast, 1947)

Figs 1–3.

Sympotthastia edwardsi Pagast, 1947;

Parapotthastia edwardsi (Pagast): Serra-Tosio, 1968: 146, 1971: 88;

Syndiamesa edwardsi (Pagast): Pinder, 1978: 44; Kownacki, 1981: 387; Langton, Wisser, 2003: 76; Ashe, O'Connor, 2009: 312.

Material. **Russia,** ***Republic of Severnaya Ossetia-Alania:*** 1 adult ♂ — Irafsky District, Anhuidong River, h~1829 m a.s.l., 42.900183°N, 43.585233°E, 3.I.2018, leg. D. Palatov; ***Kabardino-Balkarskaya Republic:*** 1 adult ♂ — Elbrus Region, Baksan River valley near the village of Azau Polyana and the ski lifts to Elbrus, h~ 2370 m a.s.l., 43.2652 °N, 42.4767861 °E, light trap, 26.VII.2023, leg. D. Palatov.

Description. *Adult male* (n = 2, except when otherwise stated). Total length 5.4–5.8 mm. Total length/wing length 1.13.

Coloration. Head, thorax, legs and abdomen dark brown; wings grayish, with brown venation.

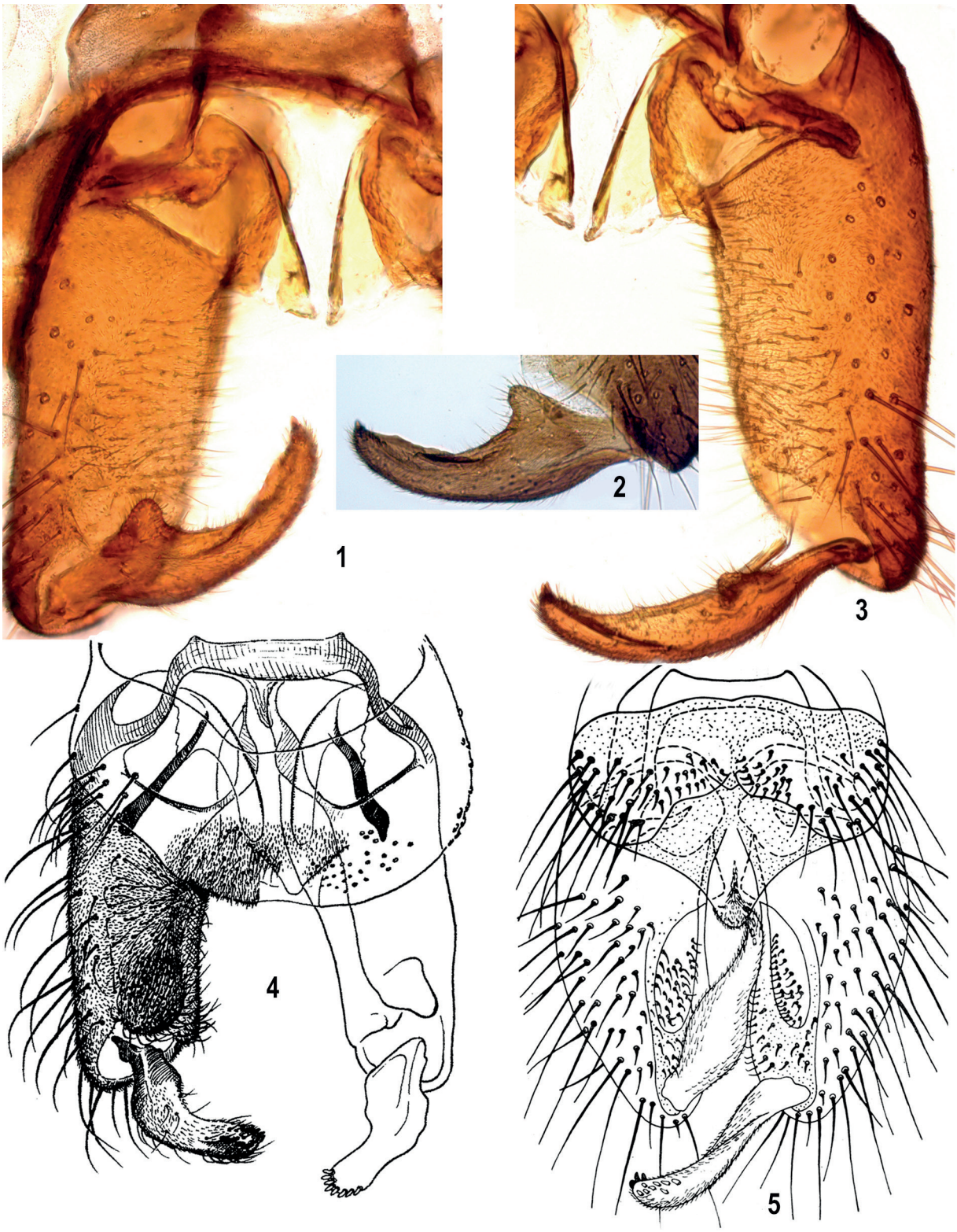
Head. Eyes pubescent, with short dorsomedial extension. Temporal setae including 13 orbitals, 20–21 verticals and 8–10 postorbitals. Clypeus with 18–21 setae. Antenna with 13 flagellomeres and developed plume; terminal flagellomere with subapical setae 32–40 µm long; pedicel with 3 setae; AR 2.14–2.30. Palpomere lengths (in µm): 48–56; 128–144; 212–236; 248–252; 304. Palpomere 3 distally with sensilla capitata (diameter 20 µm). Head width/palp length 0.90–0.94.

Thorax. Antepronotum with 13–14 lateral setae. Acrostichals 5, 56–60 µm long; dorsocentrals 30–31, 148–236 µm long (in posterior third of scutum in 2–3 rows); prealars 4–9; scutellars 45–46.

Wing. Length 4.7–4.8 mm, width 1.36 mm. R and R_1 with 23–31 setae, R_{4+5} with 7 setae. Costa extension 131 µm long. RM length/MCu length 3.0. Anal lobe developed, outline rounded and slightly protrude. Squama with 43–46 setae, 92–248 µm long, in 2 rows.

Legs. Spur of fore tibia 112 µm long; spurs of mid tibia 96–100 µm and 100–104 µm; of hind tibia 88–108 µm and 132 µm long. Hind tibial comb with 14 setae. Length (µm) and proportions of leg segments are as in Table 1.

Hypopygium (Figs 1–3). Tergite IX with 24–26 setae, without anal point. Laterosternite IX with 8–9 setae. Transverse sternopodeme as in Fig. 1, 176–196 µm length, 52–60 µm wide. Aedeagal lobe 128 µm long, weakly chitinized; phallapodeme sclerotized, 160 µm long. Gonocoxite 525 µm long, with small basal lobe. Gonostylus 284–295 µm long, curved like a scythe blade, pubescent and bearing short setae, with distinct dark inner lobe in basal part covered with short setae and microtrichiae; in subapical part with 1–2 megasetae, 12–16 µm long (Figs 1–3).



Figs 1–5. Details of morphology of adult male of *Syndiamesa* species: *S. edwardsi* (Pagast) (1–3), *S. hygropetrica* (Kieffer) (4) and *S. koshimae* Tokunaga (5). 1, 3–5 — hypopygium in dorsal view; 2 — gonostylus. Fig. 4 after Serra-Tosio, [1971], Fig. 5 after Tokunaga [1936].

Рис. 1–5. Детали строения имаго самцов видов рода *Syndiamesa: S. edwardsi* (Pagast) (1–3), *S. hygropetrica* (Kieffer) (4) и *S. kashimae* Tokunaga (5). 1, 3–5 — гипопигий, вид сверху; 2 — гоностиль. Рис. 4 по Serra-Tosio [1971]; рис. 5 по Tokunaga [1936].

Table 1. Lengths (in μm) and proportions of leg segments of *Syndiamesa edwardsi* (Pagast), male (n = 2)
Таблица 1. Длина (в мкм) члеников ног самца и их индексы *Syndiamesa edwardsi* (Pagast) (n = 2)

	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	BV	SV	BR
P_1	1880–1920	2120–2240	1520–1640	771–804	525–574	230–246	230–246	0.72–0.73	3.03–3.21	2.54–2.63	2.5–2.7
P_2	2120–2160	2120–2160	1240	640–689	410–426	164–180	213	0.57–0.58	3.67–3.85	3.42–3.48	1.7–2.0
P_3	2520–2560	2680–2920	1720–1840	902–918	508–525	213	246–246	0.63–0.64	3.72–3.86	2.96–3.05	2.5–3.0

Pupa described by Serra-Tosio [1971] and Langton, Wisser [2003]. Larva unknown.

Remarks. Prior to our research [Makarchenko et al., 2023], this species had not been recorded in the Caucasus. Therefore, we decided to redescribe the male from our material and compare it with known populations in the Western Palaearctic. Most complete information is available only for males from the French Alps [Serra-Tosio, 1968, 1971]. In general, the *D. edwardsi* males from the Caucasus match the description of the species from the French Alps, with the exception of the number of prealar setae on the scutum, which in specimens from the Caucasus are 4–9, in males from the French Alps 15–25.

Distribution. France, Germany, Great Britain, Ireland, Italy, Spain and Russia (Republics of Severnaya Ossetia-Alania and Kabardino-Balkaria).

Syndiamesa fanduangularis Fu, 2025

Fig. 28.

Syndiamesa fanduangularis Fu in Fu, Shangguan, Yang, 2025: 350.

Diagnosis of adult male. After Fu et al. [2025]: Eyes pubescent. Scutum with 13 acrostichals. AR 3.14. Posterior margin of tergite IX rounded; anal point triangular; superior volsella right-angled. Gonostylus lacking a sclerotized tooth.

Pupa and larva unknown.

Remarks. This is the first indication of the genus *Syndiamesa* for the Oriental Region. The species was described from a single male with using DNA barcoding and need additional morphological study.

Distribution. China (Hubei).

Syndiamesa hygropetrica (Kieffer, 1909)

Fig. 4.

Diamesa hygropetrica Kieffer, 1909: 40; Potthast, 1915: 353; Pagast, 1947: 468; Pankratova, 1970: 87;

Syndiamesa hygropetrica (Kieffer): Kieffer, 1918: 103; Edwards, 1929: 303; Goetghebuer, 1932: 159, 1939: 6; Tshernovskij, 1949: 99; Ashe, O'Connor, 2009: 312;

Parapotthastia hygropetrica (Kieffer): Serra-Tosio, 1968: 146, 1971: 83.

Diagnosis of adult male. After Serra-Tosio [1968, 1971]: *Eyes pubescent.* AR 2.0–2.5. Acrostichals of scutum absent. Prealars setae slightly extended anteriorly. Anal lobe of wing approximately at a right angle. Hypopygium with short triangular anal point and pubescent only in basal part. Gonostylus with 8–10 macrosetae arranged in semicircle on apex, without basal wart (Fig. 4).

Pupa described by Serra-Tosio [1971], Pankratova [1970], Potthast [1915]. Larva described by Potthast [1915], Tshernovskij [1949], Pankratova [1970].

Distribution. Widely distributed in the Western Palaearctic [Ashe O'Connor, 2009]. Before our research it was unknown for the Caucasus.

Syndiamesa kashimae Tokunaga, 1936

Fig. 5.

Syndiamesa kashimae Tokunaga, 1936: 534; Kownacki, 1981: 386; Ashe, O'Connor, 2009: 312; Yamamoto, Yamamoto, 2014: 251.

Diagnosis of adult male. After Tokunaga [1936] and Endo [2007]: Eyes pubescent; AR 2.87; antepronotum without setae; legs with long setae on all femora, hind tibiae and fore tarsi. Medial field of gonocoxite without any distinct protuberance; tergite IX with 'with broad, pubescent anal point'; gonostylus comparatively slender, with three tiny megasetae on distal margin.

Pupa and larva unknown.

Remarks. This species was described based on only one male from Kashima, 1600 m a.s.l., Nagano Prefecture, Japan [Tokunaga, 1936] and need additional morphological study. According to Endo [2007], the holotype is missing except for the slide-mounted legs.

Syndiamesa kyogokusecunda Sasa et Suzuki, 1998

Figs 6–8.

Syndiamesa kyogokusecunda Sasa et Suzuki, 1998: 25; Endo, 2007: 297; Ashe, O'Connor, 2009: 312; Yamamoto, Yamamoto, 2014: 251.

Diagnosis of adult male. After Sasa, Suzuki [1998] and Endo [2007]: Eyes pubescent, AR 1.0–1.4. Medial field of gonocoxite with small protuberance in distal part only (Fig. 6); posterior margin of tergite IX weakly concave, with small tubercle-like 'anal point' (Fig. 7); gonostylus broad and rounded, widest at the middle, with a triangular or broadened tooth in the subapical part (Fig. 8).

Pupa and larva unknown.

Distribution. Japan (Hokkaido).

Syndiamesa longipilosa Endo, 2007

Figs 9–10.

Syndiamesa longipilosa Endo, 2007: 292; Ashe, O'Connor, 2009: 312; Yamamoto, Yamamoto, 2014: 251.

Diagnosis of adult male. After Endo [2007]: Eyes hairy. AR 0.8–1.1. Hypopygium: tergite IX without anal point (Fig. 9); medial field of gonocoxite without distinct protuberance; gonostylus slightly arcuate, without sclerotized lamella or tooth (Fig. 10).

Distribution. Japan (Honshu).

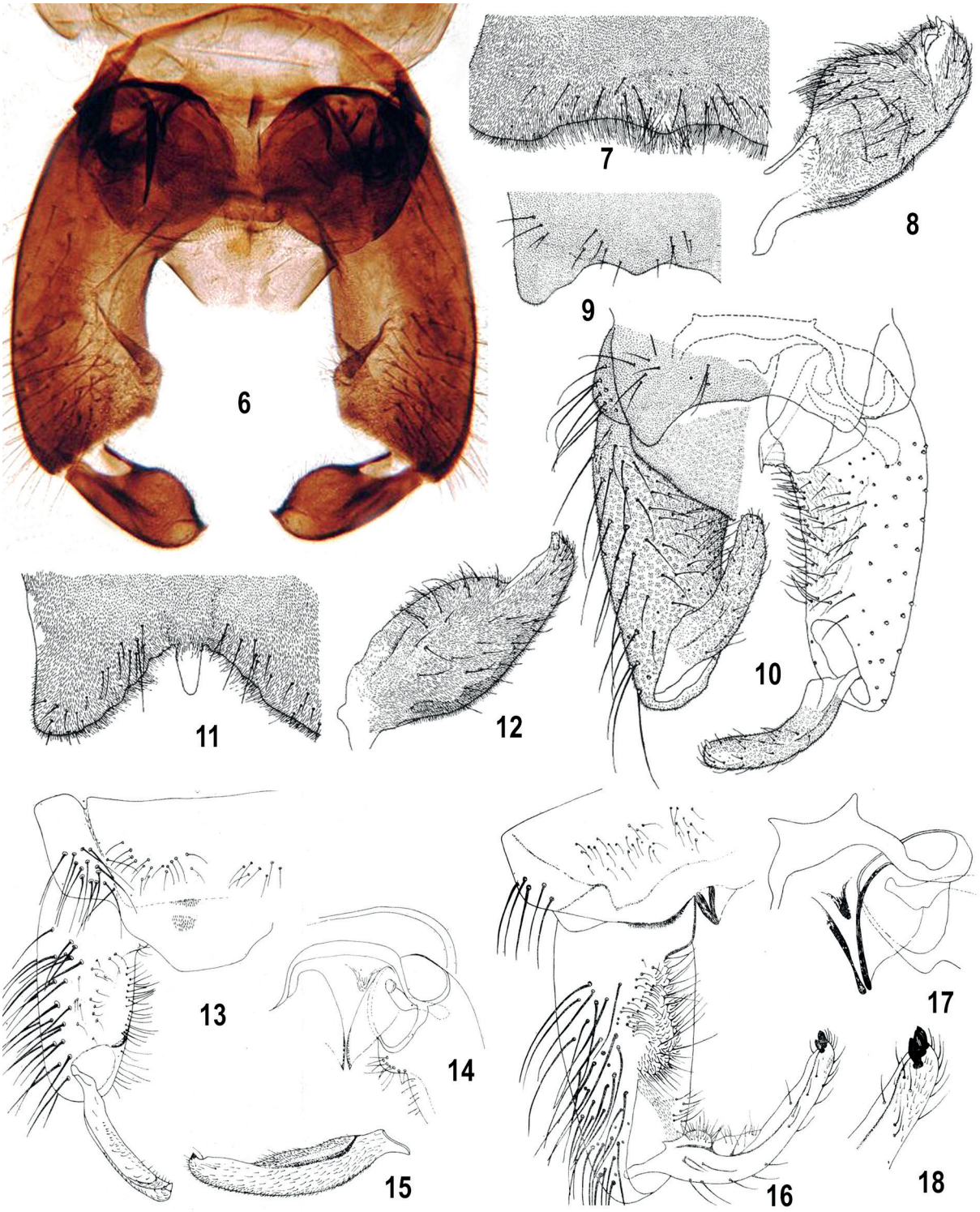
Syndiamesa mira (Makarchenko, 1980)

Figs 19–24.

Parapotthastia mira Makarchenko, 1980: 466;

Syndiamesa mira (Makarchenko, 1980): Makarchenko, 1985: 62, 2006: 276; Endo, 2007: 295; Ashe, O'Connor, 2009: 313; Yamamoto, Yamamoto, 2014: 251.

Material. **Russia,** ***Sakhalinskaya Oblast:*** 1 adult ♂ (holotype), 28 adult ♂♂ (paratypes) — Kurile Islands, Kunashir Island, surroundings of Sernovodsk Village, Tyurino River, 24.IV.1978, leg. E. Makarchenko;



Figs 6–18. Details of morphology of adult male of *Syndiamesa* species: *S. kyogokusecunda* Sasa et Suzuki (6–8), *S. longipilosa* Endo (9–10), *S. montana* Tokunaga (11–12), *S. serratosioi* Kownacki (13–15) and *S. vaillanti* Kownacki (16–18). 6, 10, 13, 16 — hypopygium in dorsal view; 7, 9, 11 — tergite IX; 8, 12, 15 — gonostylus; 14, 17 — part of hypopygium without tergite IX; 18 — distal part of gonostylus. Scale bars: 50 μm. Fig. 6 from https://type.kahaku.go.jp/TypeDB/detail?cls=diptera&pkey=diptera-000625; Figs 7–12 after Endo [2007]; Figs 13–18 after Kownacki [1981].

Рис. 6–18. Детали строения имаго самцов видов рода *Syndiamesa: S. kyogokusecunda* Sasa et Suzuki (6–8), *S. longipilosa* Endo (9–10), *S. montana* Tokunaga (11–12), *S. serratosioi* Kownacki (13–15) и *S. vaillanti* Kownacki (16–18). 6, 10, 13, 16 — гипопигий, вид сверху; 7, 9, 11 — тергит IX; 8, 12, 15 — гоностиль; 14, 17 — часть гипопигия без тергита IX; 18 — дистальная часть гоностиля. Рис. 6 по: https://type.kahaku.go.jp/TypeDB/detail?cls=diptera&pkey=diptera-000625; Рис. 7–12 по Endo [2007]; Рис. 13–18 по Kownacki [1981].

1 adult ♂ — Moneron Island, Chuprova Bay, unnamed stream, 19.VII.2004, leg. E. Makarchenko. **Japan, *Hokkaido Island:*** 2 adult ♂♂ — Shintoku, Yutomuraushi River, 31.V.–11.06.1999, leg. K. Endo.

Description. Adult male (n = 4, except when otherwise stated). Total length 5.3–5.5 mm. Total length/wing length 1.25–1.42.

Coloration. Head, legs and abdomen dark brown, thorax dark brown to black, wings grayish, with brown venation.

Head. Eyes pubescent, with moderate dorsomedial extension. Temporal setae including 8–15 orbitals, 18–33 verticals and 8–9 postorbitals. Clypeus with 18–26 setae. Antenna with 13 flagellomeres and developed plume; terminal flagellomere with 1–2 subapical setae 40–48 μm long; pedicel with 4 setae; AR 1.09–1.43. Palpomere lengths (in μm): 50–60; 113–120; 113–204; 210–256; 240–288. Palpomere 3 distally with sensilla capitata (diameter 20 μm). Head width/palp length 0.89–1.14.

Thorax. Antepronotum with 15 lateral setae. Acrostichals 3–5; dorsocentrals 18–23; prealars 11; scutellars 21–28.

Wing. Length 3.8–4.2 mm, width 0.94–1.1 mm. R and R_1 with 30–44 setae, R_{4+5} with 7–22 setae. Costa extension 66–82 μm long. RM length/MCu length 3.8–4.0. Anal lobe developed, outline rounded and slightly protrude. Squama with 30–40 setae, 60–152 μm long in 2 rows.

Legs. Spur of fore tibia 92–112 μm long; spurs of mid tibia 84–92 μm and 80–84 μm; of hind tibia 100–140 μm and 144–148 μm long. Hind tibial comb with 16 setae. Length (μm) and proportions of leg segments are as in Table 2.

Hypopygium (Figs 19–24). Tergite IX with 13–27 short setae on each side. Laterosternite IX with 18–20. Posterior margine of tergite IX strongly concave, with small tubercle like of 'anal point' (Fig. 19). Transverse sternopodeme as in Fig. 21, 140–208 μm length, 48–52 μm wide, with short anterolateral projections. Aedeagal lobe 160 μm long, weakly chitinized; phallapodeme sclerotized, 152 μm long. Gonocoxite 440 μm long, medial field with proximal and distal protuberances with some short setae (Figs 19–20). Gonostylus 256 μm long, relatively narrow, in bent boomerang shape (Fig. 22), with apical short megaseta 8–12 μm long and with sclerotized triangular or semicircular tooth subapically (Figs 23–24). HR 1.83–2.1.

Pupa and larva described by Makarchenko [1980, 1985].

Remarks. During the revision of the genus *Syndiamesa* it turned out that the description of *S. mira*, made in the 80s of the last century are not detailed enough, are published In Russian [Makarchenko, 1980]. Also the several important morphological features were missing in the original description of this species. Therefore, it was decided to redescribe *S. mira* more thoroughly in accordance with the requirements of modern taxonomy.

When comparing males from three populations, it is noticeable that specimens from Hokkaido Island longer (6.53–6.90 mm) than those from Kunashir and Moneron Islands (5.3–5.5 mm) as well as wing length which accordingly 4.16–4.43 mm and 3.8–4.2 mm. The shortest legs are found in males from Moneron Island. The remaining features are similar or overlap.

Distribution. Moneron and Kunashir Islands (Kurile Islands) in Russia and Hokkaido Island in Japan.

Syndiamesa montana Tokunaga, 1936

Figs 11–12.

Syndiamesa montana Tokunaga, 1936: 532; Endo, 2007: 297; Ashe, O'Connor, 2009: 313; Yamamoto, Yamamoto, 2014: 251.

Diagnosis of adult male. After Tokunaga [1936] and Endo [2007]: Eyes pubescent, AR 1.3–1.7. Acrostichals on scutum absent. Medial field of gonocoxite with small protuberances in proximal and distal parts; posterior margin of tergite IX strongly concave, with short cylindrical anal point without microtrichia (Fig. 11); gonostylus broad, with proximal three-equarters much wider than distal one-quarter, with sclerotized lamella in subapical part (Fig. 12).

Pupa. Described by Tokunaga [1936]. Larva unknown.

Remarks. Species described by single male and pupa, need in additional morphological study. According to Endo [2007] the holotype of *S. montana*, except for the slide-mounted legs of one side, is missing.

Distribution. Japan (Honshu).

Syndiamesa nigra Rossaro, 1980

Figs 25–27.

Syndiamesa nigra Rossaro, 1980:192; Ashe, O'Connor, 2009: 313.

Material. **Russia, *Republic of Severnaya Ossetia-Alania:*** 1 adult ♂ — Irafsky District, Kumaldon River, h~1228 m a.s.l., 42.967900 °N, 43.786733 °E, 29.XII.2017, leg. D. Palatov; 1 larva — the same data except Galausidon River, h~1353 m a.s.l., 42.952067°N, 43.797733°E, 31.XII.2017, leg. D. Palatov; ***Krasnodarskii Krai:*** 1 adult ♂ — Sochi urban district, Adler District, Stream above the Krasnaya Polyana resort, h~950 m a.s.l., 42.952067 °N, 43.797733 °E, from snow, 10.I.2025, leg. D. Palatov.

Description. *Adult male* (n = 2, except when otherwise stated). Total length 5.0–5.9 mm. Total length/wing length 1.09–1.24.

Coloration. Head, thorax, legs and abdomen dark brown; wings grayish, with brown venation.

Head. Eyes pubescent, with short dorsomedial extension. Temporal setae including 15–17 orbitals and 13–14 verticals. Clypeus with 19–20 setae. Antenna with 13 flagellomeres and developed plume; terminal flagellomere with subapical setae 56 μm long; pedicel with 2–3 setae; AR 0.54–1.60. Palpomere lengths (in μm): 60; 124; 172; 184; 192. Palpomere 3 distally with sensilla capitata (diameter 20 μm). Head width/palp length 1.05.

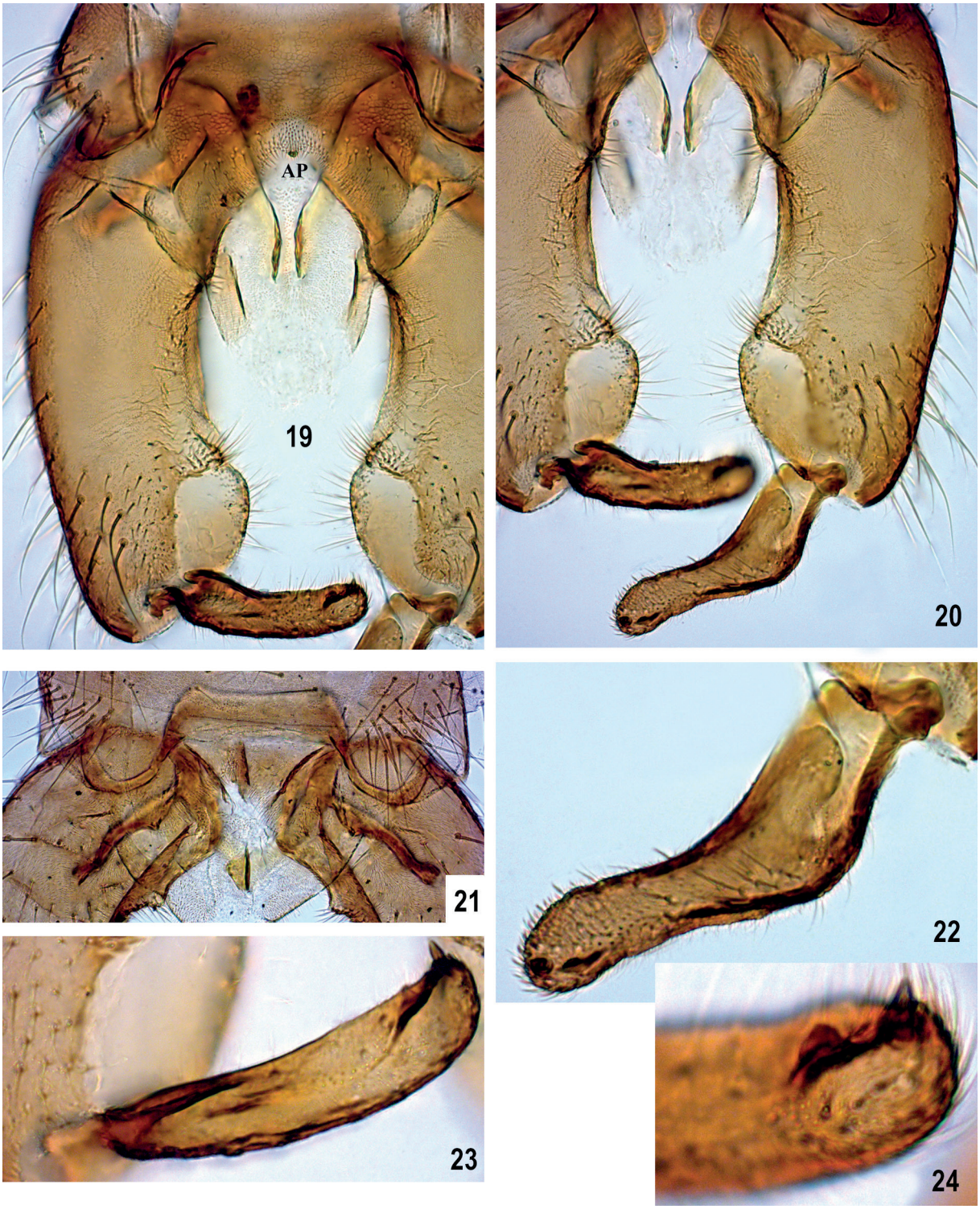
Thorax. Antepronotum with 8 lateral setae. Acrostichals absent; dorsocentrals 21–30 (in posterior third of scutum in 2–3 rows); prealars 6–11; scutellars 10–12.

Wing. Length 4.3–4.8 mm, width 1.2–1.24 mm. R and R_1 with 31–32 setae, R_{4+5} with 7–10 setae. Costa extension 140 μm long. RM length/MCu length 2.6–3.0. Anal lobe developed, outline rounded and slightly protrude. Squama with 31–45 setae, 80–192 μm long in 2 rows.

Legs. Spur of fore tibia 116 μm long; spurs of mid tibia 72 μm and 120 μm; of hind tibia 76 μm and 120 μm long. Hind tibial comb with 10 setae. Length (μm) and proportions of leg segments are as in Table 3.

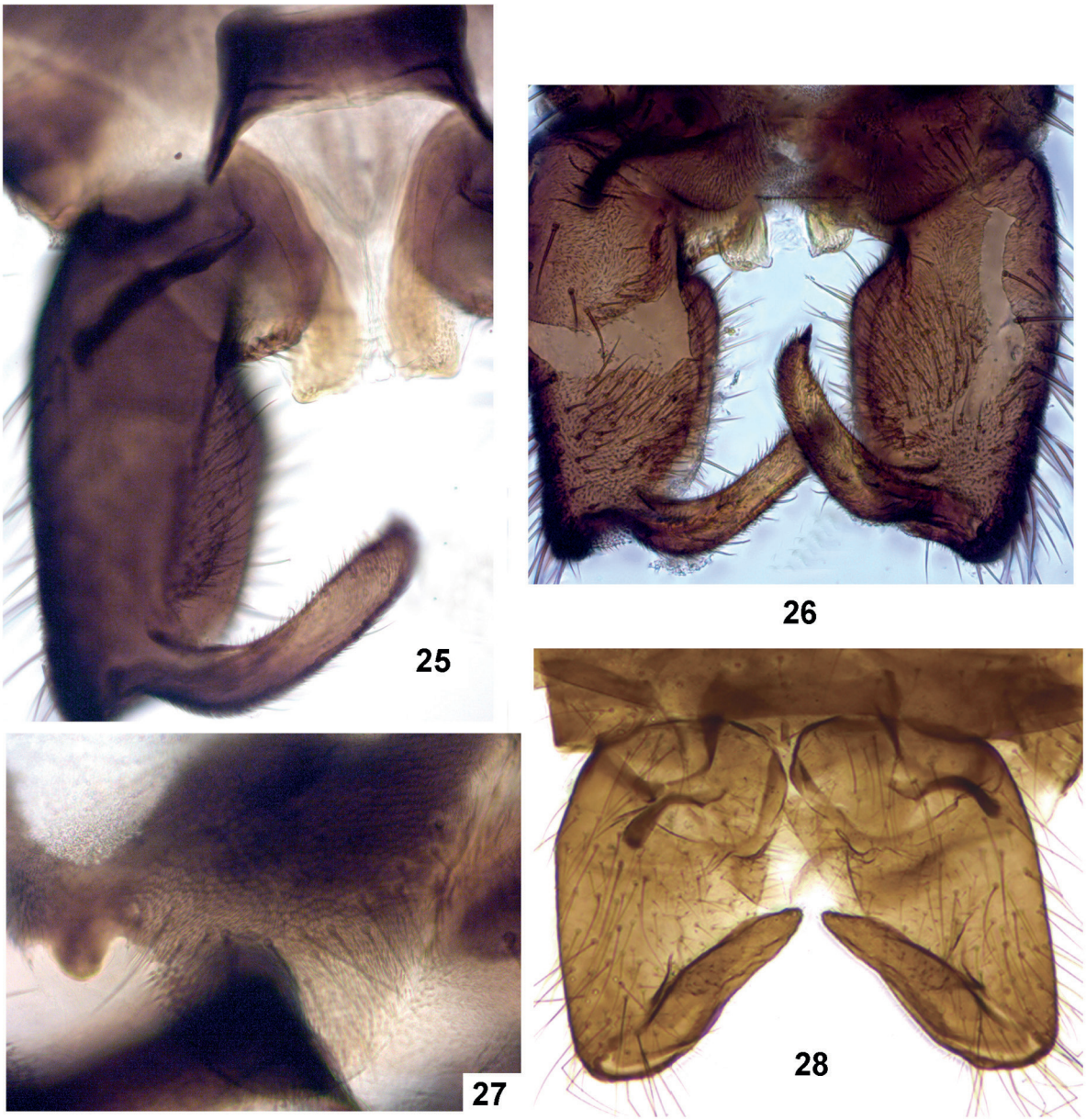
Table 2. Lengths (in μm) and proportions of leg segments of *Syndiamesa mira* (Makarchenko), male (n = 4)
Таблица 2. Длина (в мкм) члеников ног самца и их индексы *Syndiamesa mira* (Makarchenko) (n = 4)

	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	BV	SV	BR
P_1	1520–2080	1880–2240	1160–1480	656–787	459–541	213–246	213–246	0.59–0.66	2.96–3.33	2.92–3.13	2.9–3.0
P_2	1800–2360	1600–2200	920–1120	446–590	328–377	164–197	197–246	0.47–0.58	3.81–4.29	3.70–4.28	2.5–2.7
P_3	2080–2560	2120–2560	1280–1640	804–869	426–512	197–246	213–246	0.60–0.64	3.34–3.72	3.12–3.28	3.2–3.6



Figs 19–24. Details of morphology of adult male of *Syndiamesa mira* (Makarchenko). 19–20 — hypopygium in dorsal view; 21 — endoskeleton; 22–23 — gonostylus in varies positions; 24 — subapical part of gonostylus. Designations: AP — 'anal point'.

Рис. 19–24. Детали строения имаго самца *Syndiamesa mira* (Makarchenko). 19–20 — гипопигий, вид сверху; 21 — эндоскелет; 22–23 — гоностиль в различных положениях; 24 — субапикальная часть гоностиля. Обозначения: AP — «анальный отросток».



Figs 25–28. Details of morphology of adult male of *Syndiamesa* species: *S. nigra* Rossaro (25–27) and *S. fanduangularis* Fu (28). 25–26, 28 — hypopygium in dorsal view; 27 — part of tergite IX with anal point. Fig. 28 after Fu et al. [2025].

Рис. 25–28. Детали строения имаго самцов видов рода *Syndiamesa: S. nigra* Rossaro (25–27) и *S. fanduangularis* Fu (28). 25–26, 28 — гипопигий, вид сверху; 27 — часть тергита IX с анальным отростком. Рис. 28 по: Fu et al. [2025].

Hypopygium (Figs 25–27). Tergite IX with 13–14 setae (40–64 μm long) from one side of anal point and bare anal point in the form of small rounded protrusion, 24 μm (Fig. 27). Laterosternite IX with 8 setae, 92–128 μm long. Transverse sternopodeme as in Fig. 25, 188–200 μm length, 64–68 μm wide. Aedeagal lobe 128 μm long, weakly chitinized; phallapodeme sclerotized, 140–148 μm long. Gonocoxite 408–416 μm long; medial field wide, with numerous short setae. Gonostylus 220–228 μm long, relatively narrow, without tooth in subapical part, with megaseta 16 μm long (Figs 25–26).

Pupa and larva described by Rossaro [1980].

Remarks. The original description of the male of this species was made on a fragile, newly emerged individual and, as a result, the anal point of tergite IX was not visible or poorly defined which affected the diagnosis. Before our discovery in the Caucasus, the species was known only from the Italian Alps.

Distribution. Italian Alps and Caucasus.

Syndiamesa serratosioi Kownacki, 1981

Figs 13–15.

Syndiamesa serratosioi Kownacki, 1981: 388; Ashe, O'Connor, 2009: 313.

Diagnosis of adult male. After Kownacki [1981]: Eyes pubescent. AR 2.29. Acrostichals of scutum present. Hypopygium without anal point; gonocoxite very long, slender with small volsella on the basal part covered with dark setae and with numerous long dark brown setae dorsolaterally, medial region of the gonocoxite with a distinct field of setae without

Table 3. Lengths (in μm) and proportions of leg segments of *Syndiamesa nigra* Rossaro, male (n = 2)
Таблица 3. Длина (в мкм) члеников ног самца и их индексы *Syndiamesa nigra* Rossaro (n = 2)

	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	BV	SV	BR
P_1	1800–1960	2120–2360	1440–1480	804–820	558–574	230–262	246–262	0.61–0.70	2.91–3.03	2.65–3.0	2.5–3.4
P_2	1960–2240	2000–2400	1120–1280	590–677	394–459	230	230–246	0.53–0.56	3.48–3.71	3.54–3.63	1.7–3.1
P_3	2360–2680	2640–2920	1560–1800	771–1017	476–607	230–246	246–262	0.59–0.62	3.48–3.81	3.11–3.21	2.5–4.4

inferior volsella (Fig. 13); gonostylus long and slender nearly straight, ending with 1 short, black subterminal spur, without a lobe on the basal part (Fig. 15); transverse sternopodeme arched, relatively thin (Fig. 14).

Pupa and larva unknown.

Distribution. Poland (Tatra Mountains).

Syndiamesa vaillanti Kownacki, 1981

Figs 16–18.

Syndiamesa vaillanti Kownacki, 1981: 390; Ashe, O'Connor, 2009: 313.

Diagnosis of adult male. After Kownacki [1981]: Eyes pubescent. AR 2.16. Acrostichals of scutum present. Hypopygium without anal point; gonocoxite with a naked small volsella on the basal part (Fig. 16), gonostylus very long and slender, sickle-shaped bent, with a distinct lobe, the basal part covered with setae, ending with 2 or 3 short, black subterminal megasetae (Figs 16, 18); transverse sternopodeme very broad medially with distinct antero-lateral projections (Fig. 17).

Pupa and larva unknown.

Distribution. Morocco.

Syndiamesa yosiii Tokunaga, 1964

Figs 29–31.

Syndiamesa yosiii Tokunaga, 1964: 22; Makarchenko, 1985: 63, 2006: 276; Ashe, O'Connor, 2009: 313; Yamamoto, Yamamoto, 2014: 251;

= *Parapotthastia rara* Makarchenko, 1980: 468;

= *Syndiamesa chuzemagna* Sasa, 1989: 93.

Material. **Russia, *Primorskiii Krai:*** 4 adult ♂♂ — Khasanskiy District, Kedrovaya Pad' Nature Reserve, Kedrovaya River basin, Kabanyi Stream, 14.II.1978, leg. E. Makarchenko; 2 adult ♂♂ — the same data except, Kedrovaya River, 3.0956 °N, 131.5577 °E, 24.II.2017, leg. A. Semenchenko; 1 adult ♂ — Terneisky District, Ternei Village, Mashinukovsky Stream, 12.III.1986, leg. E. Potikha; ***Evreiskaya Avtonomnaya Oblast:*** 2 adult ♂♂ — Obluchensky District, Fedotkin Stream, Bidzhan River basin (Amur River basin), 48.638835 °N, 131.620967 °E, 7.IV.2014, leg. E. Makarchenko; 1 adult ♂ — the same data except 17.IX.2015, leg. E. Makarchenko; 1 adult ♂ — the same data except, Lopatinsky Stream, 48.63016 °N 131.651900 °E, 7.IV.2014, leg. E. Makarchenko.

Description. *Adult male* (n = 4, except when otherwise stated). Total length 5.1–6.8 mm. Total length/wing length 1.1–1.6.

Coloration. Head, thorax, legs and abdomen from dark brown to black; wings grayish, with brown venation.

Head. Eyes pubescent, with moderate dorsomedial extension. Temporal setae including 6–8 orbitals and 22 verticals. Clypeus with 16–20 setae. Antenna with 13 flagellomeres and developed plume; terminal flagellomere with subapical setae 29–40 μm long; pedicel with 2 setae; AR 1.93–2.60. Palpomere lengths (in μm): 68; 136–139; 200–214; 280–298; 294–304. Palpomere 3 distally with sensilla capitata (diameter 16 μm). Head width/palp length 0.91–1.0.

Thorax. Antepronotum with 7–13 lateral setae. Acrostichals 3; dorsocentrals 19–25; prealars 5–9; scutellars 32–38.

Wing. Length 4.1–5.1 mm, width 1.0–1.16 mm. R and R_1 with 27–41 setae, R_{4+5} with 3–11 setae. Costa extension 213 μm long. RM length/MCu length 3.0–3.6. Anal lobe developed, outline rounded and slightly protrude. Squama with 28–29 setae in 1–2 rows.

Legs. Spur of fore tibia 112–120 μm long; spurs of mid tibia 88–100 μm and 88 μm; of hind tibia 88–108 μm and 112–132 μm long. Hind tibial comb with 13–15 setae. Length (μm) and proportions of leg segments are as in Table 4.

Hypopygium (Figs 29–31). Tergite IX quite strongly concave, with 31 setae, without anal point. Laterosternite IX with 8–12 setae. Transverse sternopodeme as in Fig. 25, 192 μm length, 28 μm wide. Gonocoxite 384 μm long, without appendages, inner edge is evenly pubescent with short and thin setae, the outer edge is covered with longer and stronger setae. Gonostylus 236 μm long, approximately the same width along the entire length, with small ridge distally; subapical with megaseta, 12 μm long and 3 setae, 16 μm long.

Pupa and larva described by Makarchenko [1985].

Distribution. Japan (Hokkaido, Honshu); Russia (Far East); China.

Syndiamesa sp.

Fig. 32.

Material. **Republic of Korea:** 1 adult ♂ — Gyeonggi-do, Gapyeonggun, Bukhan River, Han River basin, 37.9768 °N, 127.443 °E, 26.IV.2014, leg. H.J. Kang.

Remarks. This species was identified based on DNA barcoding results from a single male adult (see the "DNA barcoding results" section) and was found to be cryptic, as it was morphologically indistinguishable from *S. yosiii*, with the exception of a slight difference in the structure of the gonosty-

Table 4. Lengths (in μm) and proportions of leg segments of *Syndiamesa yosiii* Tokunaga, male (n = 4)
Таблица 4. Длина (в мкм) члеников ног самца и их индексы *Syndiamesa yosiii* Tokunaga, самец (n = 4)

	fe	ti	ta_1	ta_2	ta_3	ta_4	ta_5	LR	BV	SV	BR
P_1	1564–1720	1802–2200	1190–1460	595–689	425–476	204–246	204–246	0.58–0.66	3.19–3.25	2.82–3.25	2.9–5.0
P_2	1751–2040	1734–2240	850–1160	442–590	323–377	153–180	170–213	0.49–0.52	3.98–4.56	3.69–4.40	2.8–3.4
P_3	1924–2480	1976–2800	1292–1920	646–902	408–541	187246	204–246	0.58–0.69	3.59–3.72	2.75–3.02	3.0–5.0

lus. The male *Syndiamesa* sp. gonostylus has a wider, rounded protrusion along the inner edge than that of *S. yosiii* (Fig. 32). It is possible that additional material will reveal further differences between the species in the future, and a new species could then be described.

Distribution. South Korea.

Key to adult males of the genus *Syndiamesa* Kieffer

1. Acrostichals of scutum absent 2
— Acrostichals present 5
2. AR 2.87–3.0. Anal point rounded-triangular, covered with microtrichiae (Fig. 5) ..... *S. kashimae* (Tokunaga)
— AR 1.0–1.7. Anal point different 3
3. Anal point short and pubescent only in basal part. Gonostylus with 8–10 macrosetae arranged in semicircle on apex (Fig. 4) ..... *S. hygropetrica* Kieffer
— Anal point tubercle-like or short cylindrical. Gonostylus without subterninal macrosetae 4
4. Gonostylus broad, with sclerotized lamella subapical. Anal point short cylindrical, bare (Figs 11–12) ..... *S. montana* (Tokunaga)
— Gonostylus broad in subapical part but without sclerotized lamella. Anal point small tubercle-like (Figs 6–8) ..... *S. kyogokusecunda* Sasa et Suzuki
5. Eyes hairy. Gonostylus without sclerotized tooth or lamella (Figs 9–10). AR 0.8–1.1 ..... *S. longipilosa* Endo
— Eyes pubescent. Gonostylus with sclerotized tooth or lamella in subapical part. AR 1.34–2.7 6
6. Gonostylus with distinct inner lobe in basal part 7
— Gonostylus without inner lobe in basal part 8
7. Gonostylus ending with 1 macroseta (Figs 1–3) .... *S. edwardsi* (Pagast)
— Gonostylus ending 2–3 subterminal macrosetae (Figs 16–18) ..... *S. vaillanti* Kownacki
8. Anal point present or not clearly expressed 9
— Anal point absent 11
9. Anal point small tubercle-like. Gonostylus relatively narrow, with sclerotized triangular or semicircular tooth in subapical part (Figs 19–24) ... *S. mira* (Makarchenko)
— Anal point different. Gonostylus without tooth in subapical part 10
10. Anal point in the form of a small rounded protrusion. Gonostylus is curved at the basal part and is approximately the same width along its entire length. (Fig. 27) .... *S. nigra* Rossaro
— nal point triangular. Gonostylus is almost straight, slightly widened basally, narrowing slightly towards the rounded apex (Fig. 28; Fu et al. 2005, Fig. 2 C) .... *S. fanduangularis* Fu
11. Acrostichals 14. LR_1 0.75 ..... *S. serratosioi* Kownacki
— Acrostichals 3. LR_1 0.58–0.66 ..... *S. yosiii* Tokunaga

DNA barcoding results

In the present study, we generated 6 new DNA barcodes for the genus *Syndiamesa*, which represented two species: 5 sequences for *S. yosiii* and one sequence for an undetermined *Syndiamesa* sp. (accession number PZ381787). The maximum intraspecific K2P genetic divergence within *S. yosiii* was remarkably low at 0.61 %, despite the specimens being collected from geographically distant localities across the Primorskii Krai and the Evreiskaya Avtonomnaya Oblast (Fig. 33), spanning a geographic distance of approximately 616 km. Another prominent example of low intraspecific divergence (1.10 %) was documented within *S. nigra*. The analyzed specimens of *S. nigra* originated from highly remote populations in the Republic of North Ossetia-Alania (Caucasus), the Krasnodarskii Krai, and Montenegro (Balkans), where the maximum geographic isolation between the Montenegro and Caucasian sites reached up to 1,986 km.

The minimum interspecific distance between the morphologically distinct, cryptic *Syndiamesa* sp. (PZ381787) from South Korea and *S. yosiii* was 6.51 %, which noticeably exceeds the standard baseline threshold traditionally established for the closely related genus *Diamesa* (~5.0 %, according to Montagna et al. [2016]). The second closely related species pair was *S. nigra* and *S. edwardsi*, showing a minimum interspecific divergence of 6.69 %. The average interspecific distance among all other remaining species of the genus was 10.04 %.

The primary partitioning results obtained via the ASAP algorithm completely coincided with our morphological species identifications and the calculated interspecific threshold baselines. However, our thorough molecular audit of unverified database records revealed two major taxonomic anomalies.

The first case involved an adult midge from Germany (Bavaria), which was registered in BOLD as an unidentified diamesine (BOLD ID: GBDTA6975-21). Our comparative analysis conclusively demonstrated that this specimen belongs to *S. edwardsi* (Fig. 33). The genetic distance between the Bavarian specimen and the identified *S. edwardsi* (EAM364) was 4.45 %, falling within the accepted 5.0 % intraspecific genus boundary, and their conspecificity was fully supported by the ASAP partition.

The second case involved an Arctic larva from Eastern Canada erroneously assigned to the genus *Syndiamesa* (BOLD ID: ECIPY162-10). Our analysis revealed that this specimen belongs to the *Diamesa gregsoni* Edwards, with an average pairwise K2P distance of only 1.83%. This finding officially eliminates the last available molecular evidence for the presence of the genus *Syndiamesa* in the Nearctic Region.

The Bayesian consensus tree resolved a stable evolutionary framework for the genus, though featuring a localized polytomy (Bayesian posterior probability, BPP = 0.74) at the more recent nodes (Fig. 33). This polytomy contains three distinct clades: 1) the sister East-Palearctic species pair of *S. yosiii* and *Syndiamesa* sp. from South Korea, 2) the sister West-Palearctic species pair of *S. nigra* and *S. edwardsi*, and 3) the recently described Oriental species *S. fanduangularis*. The earliest branched lineage was undescribed species from China.

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Figs 29–32. Details of morphology of adult male of *Syndiamesa* species: *S. yosiii* Tokunaga (29–31) and *Syndiamesa* sp. (32). 28–32 — hypopygium in dorsal view.

Рис. 29–32. Детали строения имаго самцов видов рода *Syndiamesa: S. yosiii* Tokunaga (29–31) и *Syndiamesa* sp. (32). 28–32 — гипопигий, вид сверху.

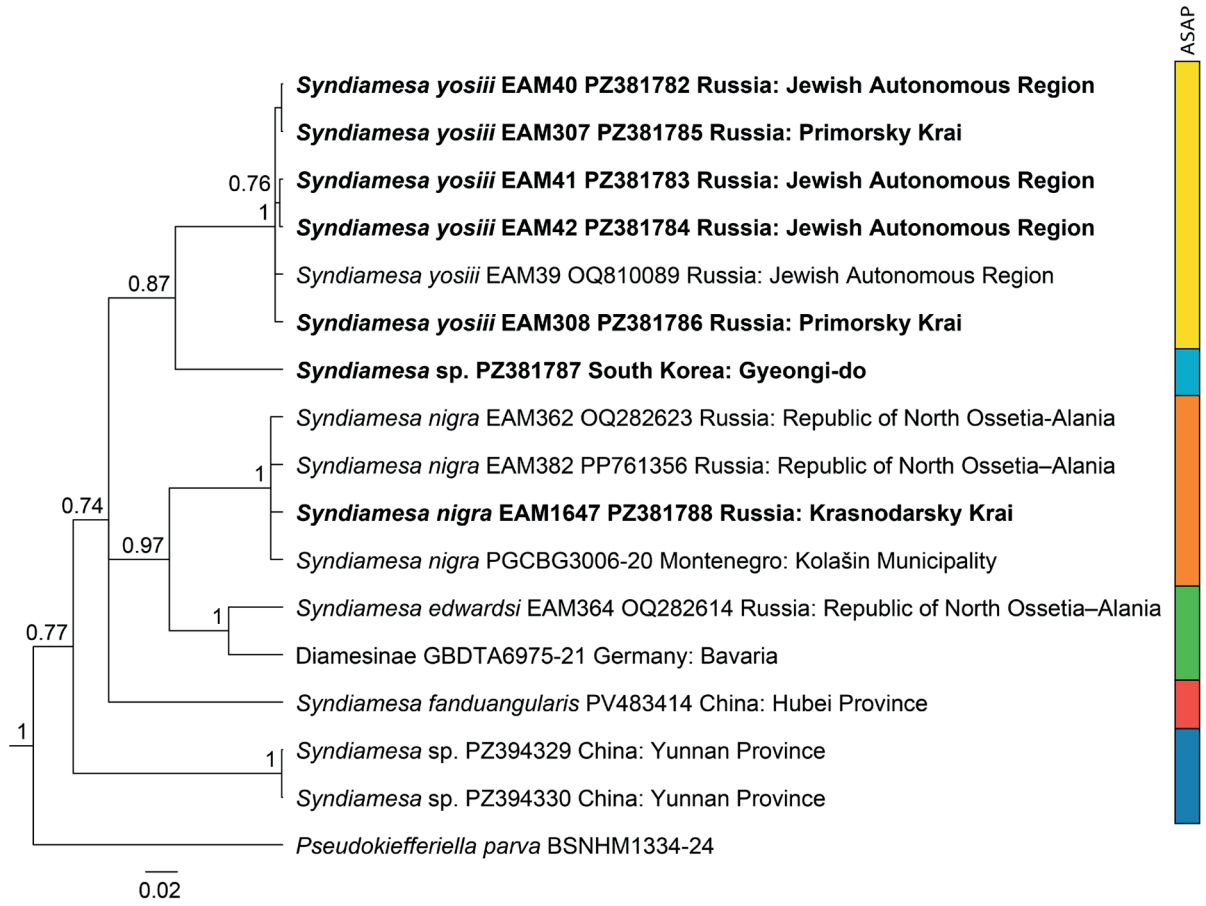


Fig. 33. Ultrametric Bayesian inference (BI) tree based on the cytochrome *c* oxidase subunit I (*COI*) nucleotide sequence data of the genus *Syndiamesa* Kieffer, utilizing *Pseudokiefferiella parva* as the outgroup. Bayesian posterior probabilities (higher than 0.70) are given above the tree nodes. Vertical bars on the right indicate the molecular operational taxonomic units (mOTUs) resolved by the ASAP analysis. Reference specimens obtained in the present study are highlighted in bold.

Рис. 33. Ультраметрическое дерево, построенное методом байесовского моделирования на основе нуклеотидных последовательностей гена субъединицы I цитохромоксидазы (*COI*) хирономид рода *Syndiamesa* Kieffer, с использованием *Pseudokiefferiella parva* (Edwards) в качестве внешней группы. Значения байесовской апостериорной вероятности (выше 0,70) указаны над узлами дерева. Вертикальные полосы справа показывают молекулярные операционные таксономические единицы (мОТУ), выделенные в результате анализа ASAP. Особи, полученные в настоящем исследовании, выделены жирным шрифтом.

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