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Contributions to the taxonomy and faunistics of the spongillafly genus *Sisyra* Burmeister, 1839 (Neuroptera: Sisyridae)

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Abstract – A new faunistic record and the description of a new species of *Sisyra* Burmeister, 1839 (Neuroptera: Sisyridae) are presented in this paper: *Sisyra bureschi* Rausch et Weißmair, 2007 is reported for the first time from Sweden, and *Sisyra mononoke* sp. nov. is described from India, Kashmir. Additionally, *Sisyra flavicornis* Comstock, 1918, a species described from India, is proposed to be removed from *Sisyra*.

Key words – taxonomy, new species, new record, distribution, Oriental Region, Palaearctic Region, aquatic insect

INTRODUCTION

Sisyra Burmeister, 1839, occurring in all major biogeographic realms and containing nearly 50 valid species, is the most species-rich genus of Sisyridae (Neuroptera) (Oswald 2023). The genus can be readily distinguished from the other genera of the family by the presence of an epicranial sulcus on vertex, the enlarged base of the last segment of the maxillary palp, and by the lack of the series of outer gradate crossveins in the fore wing (Monserrat 1981, Assmar *et al*. 2022). Selected Palaearctic and Oriental *Sisyra* species are treated in this paper. Prior to this work, 10 Palaearctic and 12 Oriental species were known in the genus (*Sisyra aurorae* Navás, 1933 is counted for both regions, as its known locality (China: Zhejiang: Zhoushan) lies at the border of the two regions) (Navás 1933, Oswald 2023).

The identification of the spongillafly material of the Biological Museum of Lund University, Lund (MZLU) resulted in a new faunistic record of *Sisyra* from the Western Palaearctic Region (Sweden), and a newly described species from the Oriental Region (India), which are presented in this paper. *Sisyra bureschi* Rausch et Weißmair, 2007 is reported from Sweden for the first time.

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Its identification was based on Aspöck *et al.* (1980), Rausch & Weissmair (2007), Canard *et al.* (2015*a*), Tillier & Coppa (2019), Thierry *et al.* (2020), and Szőke (2022).

Furthermore, the *Sisyra* material of the MZLU included specimens of a new species from India. Its identification was based on Monserrat (1981), and on the original descriptions and subsequent redescriptions of the known spongillafly species, especially those from the Oriental Region (Needham 1909, Banks 1913, Navás 1930, 1933, 1935, Monserrat 1981, Yang 1986, Yang & Gao 2002). The type material of the new species was also compared with the type specimens of *Sisyra yunana* C. Yang, 1986, *Sisyra curvata* C. Yang et Gao, 2002, *Sisyra hainana* C. Yang et Gao, 2002, *Sisyra nervata* C. Yang et Gao, 2002 (deposited in the China Agricultural University, Beijing) and *Sisyra mierae* Monserrat, 1981 (deposited in the Complutense University of Madrid) by photos of scientific quality.

Morphological terminology in the description of the new species follows Aspöck *et al.* (1980), Aspöck (2002), Aspöck & Aspöck (2008), Randolf *et al.* (2013), and Breitkreuz *et al.* (2017). Label data of the specimens are given verbatim with explanatory information in square brackets. All specimens were identified by the author, using a Nikon SMZ800 stereomicroscope. Taxa are listed in alphabetical order.

RESULTS

Sisyra bureschi Rausch et Weißmair, 2007 (Figs 1–2)

Material examined – One male (Fig. 1), "Sk. Rörum, Själsbäcken, Bo Tjeder, 1/7-48 [date on the back side of first label], Registrerad 1998 ArtDatabanken Ragnar Hall", specimen pinned, Id. No. MZLU 00185885, deposited in MZLU; one female (Fig. 2), "Sk. Rörum, Själsbäcken, Bo Tjeder, 1/7-48 [date on the back side of first label], Sisyra terminalis Curtis female A. Popov det. 1995", specimen pinned, Id. No. MZLU 00185886, deposited in MZLU.

Remarks – First record for Sweden. The distribution of this recently described species is imperfectly known. So far it has been reported from Bulgaria, Croatia, Turkey (Rausch & Weissmair 2007), Germany (Weissmair 2010), France (Canard *et al.* 2015*b*), and Bosnia and Herzegovina (Szőke 2022). The first record for Sweden represents the northernmost known occurrence of this species.

Figs 1–2. *Sisyra bureschi* Rausch et Weißmair, 2007 voucher specimens with their labels, 1 = male, 2 = female (photos by Viktória Szőke)

Sisyra mononoke sp. nov.
(Figs 3–10)

Type material – Holotype: female, "India, Kashmir, Srinagar, 4.7.1979, I. Säveland", specimen pinned, Id. No. MZLU 00185867 (Figs 3–5). Paratypes: one male, "India, Kashmir, Srinagar, 23.6.1979, I. Säveland", specimen pinned, Id. No. MZLU 00185868; one male, "India, Kashmir, Srinagar, 4.7.1979, I. Säveland", specimen pinned, Id. No. MZLU 00185865. The holotype and one paratype (MZLU 00185868) are deposited in the MZLU, one paratype (MZLU 00185865) is deposited in the Hungarian Natural History Museum, Budapest (HNHM).

Diagnosis – The new species can be identified by the combination of the following character states: body extensively yellowish to yellowish brown; scape, pedicel and flagellomeres brown, apical half of flagellum paler; pronotum, mesonotum and metanotum mostly yellowish; abdominal segments predominantly brownish with a pale violet tone, tergites and sternites yellowish; wing membranes pale yellow, translucent, without maculae, pterostigma not pigmented, venation yellow (Figs 3–7); in fore wing subcostal veinlets sometimes forked (in number varying from 13 to 15 proximad to pterostigma) and with three ra-rp crossveins (the distal one distad to pterostigma) (Fig. 6); hind wing with two ra-rp crossveins (the distal one distad to pterostigma) (Fig. 7); legs yellowish; male and female genitalia diagnostic (Figs 8–10).

Fig. 3. *Sisyra mononoke* sp. nov., holotype, lateral view (photos by Viktória Szőke)

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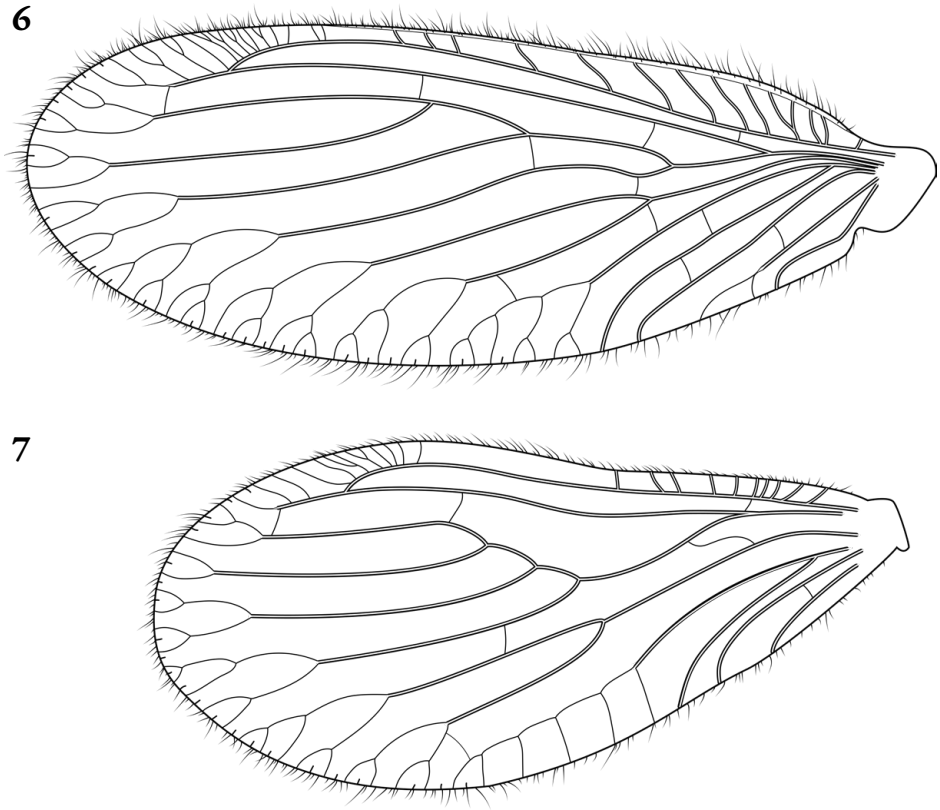
Figs 4–5. *Sisyra mononoke* sp. nov., holotype, 4 = frontal view, 5 = dorsal view. Scale bar = 1 mm (photos by Viktória Szőke)



Figs 6–7. *Sisyra mononoke* sp. nov., 6 = fore wing, 7 = hind wing (drawings by Viktória Szőke)

Description – Female and male (Figs 3–10).

Adult: Body length 2.3–2.5 mm. Body extensively yellowish to yellowish brown. Head with sparse, pale and long setae. Vertex yellowish (Figs 3, 5), epicranial suture brown. Frons brown, antennal sockets yellowish brown (Fig. 4). Clypeus brown with lighter apical margin, labrum and palpi yellowish. Scape, pedicel and flagellomeres brown, apical half of flagellum paler (Figs 3–5). Scape and pedicel longer than wide, flagellomeres quadrate. Pronotum yellowish, medially darker, its lateral edges rounded, and with sparse, pale and long setae (Fig. 5). Mesonotum and metanotum yellowish, sparsely setose (Fig. 5). Abdominal segments weakly sclerotized, predominantly brownish with a pale violet tone, tergites and sternites yellowish, female genital segments yellowish to yellowish brown (Fig. 5).

Fore wing (Figs 3–6): Length 4.8–5.5 mm, width 1.8–2.0 mm at pterostigma. Wing membrane pale yellow, translucent, without maculae, pterostigma not pigmented, venation yellow (Figs 3–5). Subcostal veinlets sometimes forked, in number varying from 13 to 15 proximad to pterostigma. Sc ends at pterostigma, fuses with RA. RA forked at wing margin. RP with 4 branches, and with bifurcations towards wing margin. MA and MP both with 2 branches, forked at wing margin. CuA with 3–4 thin branches at wing margin. CuP weakly curved, not branched. Fore wing with three anal veins, A2 forked at wing margin, A3 bent. Crossveins: one proximal sc-ra; three ra-rp (the distal one distad to pterostigma); one rp-rp (at second bifurcation of RP); one rp4-ma (proximal to rp-rp); crossvein between MP and MA absent; two mp-cua; one cua-cup; one cup-a1; one a1-a2 (Fig. 6).

Hind wing (Figs 3–5, 7): Length 3.5–4.0 mm, width 1.4–1.7 mm at pterostigma. Colouration same as fore wing, not paler (Figs 3–5). Ten subcostal veinlets proximad to pterostigma. Sc ends at pterostigma, fuses with RA. RA with 3 thin branches at wing margin. RP with 4 branches, and with bifurcations towards wing margin. MA and MP both with 2 branches, forked at wing margin. CuA with ca. 6 thin branches at wing margin. CuP weakly curved, not branched. Hind wing with two, not forked anal veins. Crossveins: one proximal sc-ra; two ra-rp (the distal one distad to pterostigma); rp-rp absent; two rp-ma (proximal one sinuous, distal one between RP4 and MA); crossvein between MP and MA absent; one mp-cua (distal to the bifurcation of MP); cua-cup and cup-a absent; one a1-a2 (Fig. 7).

Legs (Figs 3–4): Yellowish, except apices of last tarsomeres and claws darker, brownish.

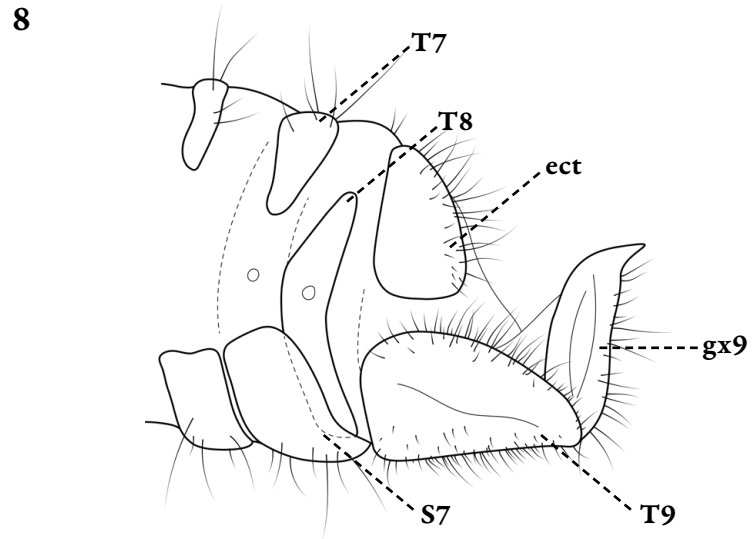
Female genitalia (Fig. 8): Sternite 7 yellowish, slightly brownish at dorsolateral corner. Tergites 7 and 8 yellowish, tergite 8 elongated, somewhat crescent-shaped. Sternite 7 and tergite 7 with a few pale setae. Ectoproct yellowish with denser pale setae, relatively large and in profile rounded triangular. Tergite 9 yellowish brown, elongated, ca. 1.7× longer than wide, dorsally evenly curved, slightly depressed ventrally, and with thin, pale setae. Gonocoxite 9 yellowish brown, longer than width of tergite 9, its apex bent posteriorly, and with pale setae.

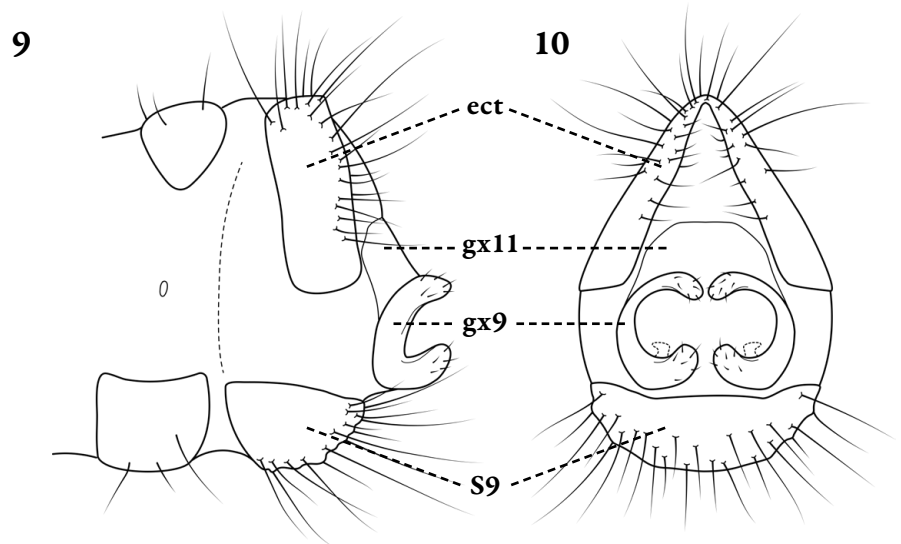
Male genitalia (Figs 9–10): Gonocoxite 9 yellowish with sparse, short, pale setae, somewhat horseshoe-shaped, positioned rather close to sternite 9. Sternite 9 yellowish with long, pale setae. Ectoproct yellowish with pale setae, narrow in profile, rooftop-shaped in caudal view.

Larva: Unknown.

Distribution – India, Kashmir.

Etymology – The new species is named after Mononoke hime (= Princess Mononoke), main character of Miyazaki Hayao's animated movie entitled Mononoke hime (1997), with respect to Miyazaki Hayao. Noun in apposition, ending not to be changed.





Figs 8–10. *Sisyra mononoke* sp. nov., 8 = female genitalia in lateral view, 9 = male genitalia in lateral view, 10 = male genitalia in caudal view. Abbreviations: T7 = tergite 7, T8 = tergite 8, T9 = tergite 9, S7 = sternite 7, S9 = sternite 9, ect = ectoproct, gx9 = gonocoxite 9, gx11 = gonocoxite 11 (drawings by Viktória Szőke)

Remarks on identification – The new species differs from all known congeners in respect of the shape of gonocoxite 9 and other sclerites of the male genitalia (Figs 9–10). The shape of gonocoxite 9 is somewhat similar to that of the Western Palaearctic *Sisyra corona* Rausch et Weißmair, 2007 and the Eastern Palaearctic *Sisyra nikkoana* (Navás, 1910); however, both of these species can easily be distinguished from the new species by their colouration and by the otherwise different male genital sclerites as discussed below. In *Sisyra corona*, the vertex is provided with a characteristic dark brown, arrowhead-shaped patch extending to the hind margin of the head; the antennae are blackish, only slightly paler at apex; the thorax is dark brown; the coxae are dark brown; the membranes and veins of the fore and hind wings are uniformly brown or blackish brown; female genitalia: tergite 9 is stouter, wider, the size of ectoproct in relation to tergite 9 is distinctly smaller; male genitalia: sternite 9 narrower, apices of gonocoxite 9 in profile less rounded, and ectoproct is distinctly smaller with shorter setae (Rausch & Weissmair 2007, Thierry *et al*. 2020, Tillier *et al*. 2018). In *Sisyra nikkoana* the body is much darker, the head and thorax are dark brown; the antennae are blackish, only slightly paler at apex; female genitalia: gonocoxite 9 more elongate, narrower; male genitalia: sternite 9 in profile is wider than long, gonocoxite 9 in profile is differently shaped, distinctly less excavated (Navás 1910, Zakharenko 1988, Makarkin 1995, Hayashi 2005).

Prior to this paper, 12 valid *Sisyra* species were known from the Oriental Region; six of which were keyed by Monserrat (1981). The new species keys out in couplet 3 together with *Sisyra mierae*. However, the latter species can be readily distinguished from the new species by the almost uniformly brownish grey body and wings, the rather different (not horseshoe-shaped) gonocoxite 9 of the male, and the distinctly stouter, wider tergite 9 of the female (Monserrat 1981). Four species were subsequently described from the Oriental part of China, namely *Sisyra yunana*, *Sisyra curvata*, *Sisyra hainana*, and *Sisyra nervata* (Yang 1986, Yang & Gao 2002). By using the identification key to the Oriental *Sisyra* species (Monserrat 1981), three of these species (*Sisyra curvata*, *Sisyra hainana*, and *Sisyra nervata*) key out with *Sisyra mierae* and the new species; all of them, however, can readily be distinguished from the new species by their genitalia. In *Sisyra hainana* the gonocoxite 9 of the male is rather different (not horseshoe-shaped), tergite 9 and gonocoxite 9 of the female are distinctly more elongate, and the ectoproct of the female is much smaller (Yang & Gao 2002). In *Sisyra nervata* the gonocoxite 9 of the male is rather different (not horseshoe-shaped) (Yang & Gao 2002); the female of this species is unknown. In the female of *Sisyra curvata* the anterior margin of tergite 9 is strongly convex in profile, the apex of gonocoxite 9 is much stronger bent posteriorly, hook-shaped, and the ectoproct is smaller (Yang & Gao 2002); the male of this species is unknown. The fourth Chinese species, *Sisyra yunana*,

cannot be confused with the new species, as its distal ra-rp crossvein of the hind wing is absent, and the antennae are decorated with a conspicuous dark-light-dark colour pattern (Yang 1986).

Monserrat (1981) did not include *Sisyra aurorae* and *Sisyra flavicornis* Comstock, 1918 in his work. *Sisyra aurorae* was described and so far it is only known from China (Zhejiang: Zhoushan), from around the border of the Eastern Palaearctic and Oriental Regions (Navás 1933). This species cannot be confused with the new species due to its conspicuously short, rounded wings with darker membrane and veins, and black head (Navás 1933, 1935). The name *Sisyra flavicornis* was introduced for a species from "British India" without explicitly indicating that it was a newly described species; no type material was listed and no depository of specimens was mentioned (Comstock 1918). Oswald (2023) suspected that the type material was deposited in the Cornell University Insect Collection, Ithaca, USA (CUIC); however, neither type nor any specimens of this species could be located at this institution (Corrie Moreau and Emily Jernigan, personal communication). In this species, a series of outer gradate crossveins in the fore wing is present (Comstock 1918: figs 139, 152, 172, Breitkreuz *et al*. 2017: fig. 10A), clearly indicating that it is not a member of *Sisyra*; it is therefore to be removed from the genus. Based on the presence of a series of outer gradate crossveins in the fore wing and the fact that Sc is not fused with RA (Banks 1939, Yang & Liu 2021) this species most probably belongs to the genus *Sisyrina* Banks, 1939, but its taxonomic identity cannot be unambiguously established based on the original description and accompanying illustrations.

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