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NEW RECORDS OF STYLOPIDS (STREPSIPTERA: STYLOPIDAE) FROM THE EUROPEAN PART OF RUSSIA

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Summary. An annotated list of eight species of the strepsipterans family Stylopidae collected from bees in the Lipetsk and Kursk oblast of Russia is given. Five species, *Kinzelbachus friesei*, *Stylops andrenaphilus, S. spreta, S.* cf. *aino* and *Stylops* sp., are new for the fauna of the Russia. Brief information on distribution and ecology of these species is given.

Key words: insects, stylopids, bees, fauna, new records, Europe.

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Резюме. Приведен аннотированный список восьми видов веерокрылых семейства Stylopidae, собранных с пчел на территории Липецкой и Курской областей. Пять видов (*Kinzelbachus friesei*, *Stylops andrenaphilus, S. spreta, S.* cf. *aino* и *Stylops* sp.) являются новыми для фауны России. Приведены данные по распространению и биологии каждого вида.

INTRODUCTION

Strepsiptera, also known as twisted-winged parasites, is a small insect order with around 600 described species (Kathirithamby, 2018). They are obligate parasites of other insects and parasitize insects from seven orders (Kathirithamby, 1989; Cook, 2014). All strepsipterans have three endoparasitic larval stages and for the majority of the species females remain as endoparasites in their adulthood (Pohl & Beutel, 2008). In contrast, the males live their short adult life, only lasting hours, as free-living (Kathirithamby, 1989; Cook, 2014).

The Strepsiptera fauna of Russian Federation is still poorly known. Until recently, there was no comprehensive account specifically dedicated to the strepsipteran fauna of Russia within its present borders, although in keys to the insects of the European part of the USSR (Medvedev, 1965) and the Russian Far East (Lelej, 1996) mention specimens from territories currently located both within individual subjects and outside the country. Furthermore, in the

Amur Region, Ignatenko (2004, 2012) discovered several imago of *Hylaeus* species stylopized by a females *Hylecthrus* sp. By far, a total of ten species have been recorded in the country (Cook, 2019; Ogol', 2020).

Present paper aims to provide new data on distribution of the strepsipterans family Stylopidae (endoparasites of bees) in the European part of Russia.

Collections of bees collected by V.T. Kuznetsova from 1969 to 1987 were processed. Own fees were held from 2019 to 2022. All bees stylopized by strepsipterans were dissected to examine the twisted-winged parasites. Extracted parasites were dehydrated in absolute alcohol, mounted in Faure's liquid on celluloid micro-slides, and pinned with the specimen from whom they originated. The illustrations of the female cephalothoraxes were taken with a Xiaomi Redmi Note 8 Pro smartphone camera through the eyepiece of a binocular stereoscopic microscope MBS-10. The examined material was deposited in the collection of Voronezh State University.

LIST OF THE SPECIES

Family Stylopidae Kirby, 1813

Subfamily Stylopinae Kirby, 1813

Genus *Halictoxenos* Pierce, 1909

***Halictoxenos tumulorum* Perkins, 1918**
Fig. 1

MATERIAL EXAMINED. **Russia:** Kursk Oblast, 18.7 km SW of Kursk, near vill. Berezka, Central Chernozem Nature biosphere reserve named after V.V. Alekhin, Streleckaya step, Dedov Vesely, 51.566494°N, 36.107151°E, the edge of the forest, 12.VIII 2022, K.S. Ivlev leg. – 1♂ of *Halictus* (*Monilapis*) *simplex* Blüthgen, 1923 (K.S. Ivlev det. (rechecked by Yu.V. Astafurova)) stylopized by 1♀ of *Halictoxenos*. *tumulorum* (between IV and V sternites) (A.M. Ostrovsky det.).

DISTRIBUTION. Widely distributed in central and southern Europe, also extending to the Near East and North Africa, currently known from Italy (type locality), Austria, Canary Islands, Czech Republic, Great Britain, Finland, France, Germany, Hungary, Ireland, Italy, Netherlands, Portugal, Slovakia, Turkey, Ukraine, Belgium, Estonia and the North-western part of European Russia (Pohl 2010; Soon *et al.*, 2011; Cook, 2019).

REMARKS. Three known European *Halictoxenos* species are highly specialized parasites of bees from the genus *Halictus* (Hymenoptera: Halictidae). *Halictoxenos tumulorum* is the only known Stepsiptera parasite of the *Halictus* subgenus *Seladonia*, including *H*. (*S*.) *kessleri* Bramson 1879 and *H*. (*S*.) *tumulorum* (Linnaeus, 1758), as well as *H*. (*Monilapis*) *simplex* Blüthgen, 1923 (Cook, 2019), which is a common and widespread species in European Russia (Kinzelbach, 1978).

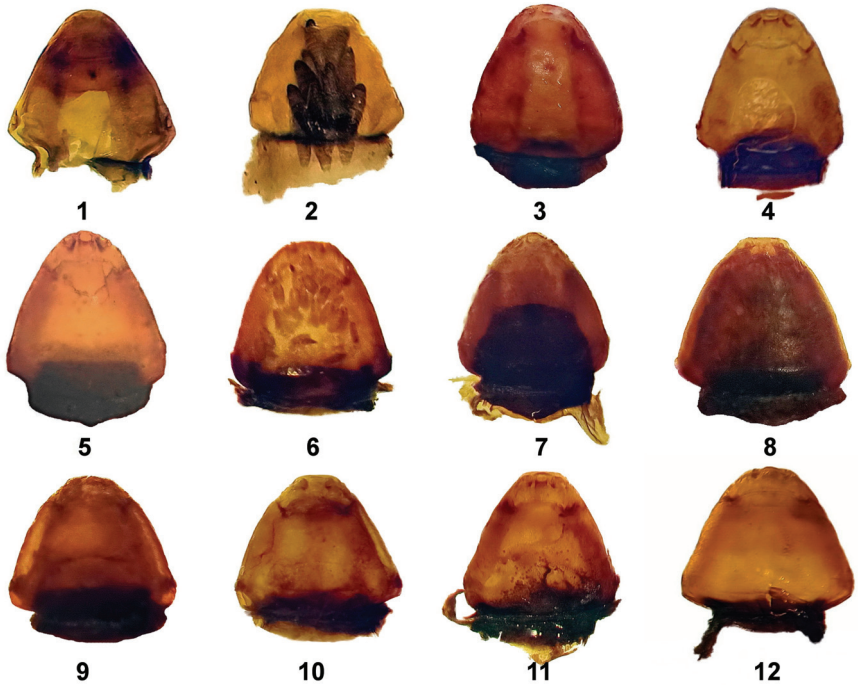
Genus *Hylecthrus* Saunders, 1850

***Hylecthrus rubi* Saunders, 1850**
Fig 2

MATERIAL EXAMINED. **Russia:** Lipetsk Oblast, Zadonsk Dist., 40 km E of the vill. Donskoye, Galichya Gora Nature Reserve, Morozova Gora, 52.600240°N, 38.925229°E, 28.VIII 2019, O.N. Berezhnova leg. – 1♂ of *Hylaeus* (*Lambdopsis*) *annularis* (Kirby, 1802) (K.S. Ivlev det. (it was compared by copies, rechecked by A. Z. Osychnyuk)) stylopized by 1♀ of *Hylecthrus rubi* (between IV and V tergites) (A.M. Ostrovsky det.).

DISTRIBUTION. Widely distributed in Europe and extending to the Middle East, currently known from Albania, Austria, Bulgaria, Croatia, France, Germany, Great Britain, Greece, Hungary, Israel, Italy, Romania, Sicily, Slovakia, Slovenia, Spain, Switzerland, Turkey, Ukraine, Russia, Belarus (Pohl, 2010; Cook, 2019; Ostrovsky, 2019).

REMARKS. *Hylecthrus rubi* is a typical parasite of many *Hylaeus* (Hymenoptera: Colletidae) species (Medvedev, 1965; Kinzelbach, 1971b). However, from Russia only *Hylaeus annularis* has been recorded as its host. In European Russia *H. annularis* is a widespread and common species.



Figs 1–12. Ventral view of adult female cephalothoraxes of stylopids: 1 – *Halictoxenos tumulorum* Perkins, 1918; 2 – *Hylecthrus rubi* Saunders, 1850; 3 – *Kinzelbachus friesei* (Hofeneder, 1949); 4, 5 – *Stylops andrenaphilus* Luna de Carvalho, 1974; 6 – *S. spreta* Perkins, 1918; 7 – *S. thwaitesi* Perkins, 1918; 8, 9, 10 – *S.* cf. *aino* Kifune et Maeta, 1990; 11, 12 – *Stylops* sp.

Genus *Kinzelbachus* Özdikmen, 2009

Kinzelbachus friesei (Hofeneder, 1949)

Fig. 3

MATERIAL EXAMINED. **Russia Russia:** Lipetsk Oblast, Zadonsk Dist., 40 km E of the vill. Donskoye, Galichya Gora Nature Reserve, Morozova Gora, 52.583295°N, 38.914447°E, floodplain of the Don river, 24.VI 1967, V.T. Kuznetsova leg. – 1♀ of *Melitturga clavicornis* (Latrielle, 1808) (V.T. Kuznetsova det.) stylopized by 1♀ of *Kinzelbachus friesei* (between IV and V tergites) (A.M. Ostrovsky det.).

DISTRIBUTION. Russia (first record). The species is currently known from Hungary, France, Azerbaijan, Georgia, Turkey (Cook, 2019).

REMARKS. *Kinzelbachus* is a monytypic genus only known by its female and larva. Characters that define *Kinzelbachus* include a brood opening that is much further towards the apex than in *Stylops*, giving it a short labium and metathoracic spiracles that are clearly visible (Cook, 2019). Only *Melitturga clavicornis* (Latrielle, 1808) has been recorded as *Kinzelbachus friesei* host. In European Russia *Melitturga clavicornis* is a rare species.

Genus *Stylops* Kirby, 1802

Stylops andrenaphilus Luna de Carvalho, 1974

Figs 4–5

MATERIAL EXAMINED. **Russia:** Lipetsk Oblast, Zadonsk Dist., 40 km E of the vill. Donskoye, Galichya Gora Nature Reserve, Morozova Gora, 52.5902°N, 38.9204°E, steppe, 04.VII 1969, V.T. Kuznetsova leg. – 1♀ of *A*. (*S*.) *dorsata* (Kirby 1802) (K.S. Ivlev det. (it was compared by copies, rechecked by A. Z. Osychnyuk)) stylopized by 1♀ of *Stylops andrenaphilus* (between IV and V tergites) (A.M. Ostrovsky det.); Lipetsk Oblast, Zadonsk Dist., 40 km E of the vill. Donskoye, Galichya Gora Nature Reserve, Morozova Gora, 52.604214°N, 38.928212°E, the edge of the forest, 10.V 1987, V.T. Kuznetsova leg. – 1♀ of *Andrena* (*Simandrena*) *lepida* Schenck, 1859 (V.T. Kuznetsova det.) stylopized by 1♀ of *Stylops andrenaphilus* (between IV and V tergites) (A.M. Ostrovsky det.).

DISTRIBUTION. Russia (first record). The species is currently known from Spain (type locality), France, Germany, Great Britain, Hungary, Netherlands, former Yugoslavia (Cook, 2019; Smit *et al.*, 2020).

REMARKS. *Stylops andrenaphilus* is a typical parasite of solitary bees *Andrena* (*Simandrena*) *dorsata* (Kirby 1802) and *A*. (*S*.) *propinqua* Schenk, 1853 (Hymenoptera: Andrenidae) (Straka *et al.*, 2015; Cook, 2019; Smit *et al.*, 2020). In European Russia *A*. (*S*.) *dorsata* and *A*. (*S*.) *lepida* are a common species. However, *A*. (*S*.) *lepida* is new host of *S. andrenaphilus*.

Stylops spreta Perkins, 1918

Fig. 6

MATERIAL EXAMINED. **Russia:** Lipetsk Oblast, Zadonsk Dist., 40 km E of the vill. Donskoye, Galichya Gora Nature Reserve, Morozova Gora, 52.585555°N, 38.917225°E, steppe, 28.VI 1979, V.T. Kuznetsova leg. – 1♀ of *Andrena* (*Micrandrena*) *nanaeformis* Noskiewicz, 1924 (V.T. Kuznetsova det.) stylopized by 1♀ of *Stylops spreta* (between IV and V tergites) (A.M. Ostrovsky det.).

DISTRIBUTION. Russia (first record). Currently known from Great Britain (type locality), Spain, Germany, Austria, Netherlands (Mandery, 2016; Cook, 2019; Smit *et al.*, 2020).

REMARKS. *Stylops spreta* is a typical parasite of many *Andrena* (*Micrandrena*) species (Hymenoptera: Andrenidae) (Straka *et al.*, 2015; Mandery, 2016; Cook, 2019; Smit *et al.*, 2020). However, *A*. (*M*.) *nanaeformis* is a new host of *Stylops spreta*. In European Russia *A*. (*M*.) *nanaeformis* is a common species.

Stylops thwaitesi Perkins, 1918

Fig. 7

MATERIAL EXAMINED. **Russia:** Lipetsk Oblast, Volovsky Dist., 70 km SE of Livny, vill. Naberezhnoye, 51.985368°N, 38.117629°E, roadside, 10.VI 1981, V.T. Kuznetsova leg. – 1♀ of *Andrena* (*Taeniandrena*) *gelriae* van der Vecht, 1927 (V.T. Kuznetsova det.) stylopized by 1♀ of *Stylops thwaitesi* (between IV and V tergites) (A.M. Ostrovsky det.).

DISTRIBUTION. Currently known from Great Britain (type locality), Austria, Finland, France, Germany, Hungary, Italy, Netherlands, Portugal, Ukraine, Russia, Belarus, Spain, Switzerland, former Yugoslavia (Cook, 2019; Smit *et al.*, 2020; Ostrovsky, 2021a, b).

REMARKS. *Stylops thwaitesi* is a typical parasite of many *Andrena* (*Taeniandrena*) species (Hymenoptera: Andrenidae) (Straka *et al.*, 2015; Cook, 2019; Smit *et al.*, 2020). However, *A*. (*T*.) *gelriae* is new host of *S. thwaitesi.* In European Russia *A*. (*T*.) *gelriae* is a common species.

***Stylops* cf. *aino* Kifune et Maeta, 1990**
Figs 8–10

MATERIAL EXAMINED. Lipetsk Oblast, Zadonsk Dist., 40 km E of the vill. Donskoye, Galichya Gora Nature Reserve, Morozova Gora, 52.585555°N, 38.917225°E, steppe, 24.VII 1984, V.T. Kuznetsova leg. – 1♀ of *Andrena* (*Hoplandrena*) *rosae* Panzer, 1801 (K.S. Ivlev det. (it was compared by copies, rechecked by A. Z. Osychnyuk)) stylopized by 1♀ of *Stylops* cf. *aino* (between IV and V tergites) (A.M. Ostrovsky det.); Lipetsk Oblast, Zadonsk Dist., 40 km E of the vill. Donskoye, Galichya Gora Nature Reserve, Morozova Gora, 52.604168°N, 38.916552°E, *Stipa capillata* steppe, 15.VII 1985, V.T. Kuznetsova leg. – 1♀ of *Andrena* (*Hoplandrena*) *rosae* Panzer, 1801 (K.S. Ivlev det. (it was compared by copies, rechecked by A. Z. Osychnyuk)) stylopized by 2♀ of *Stylops* cf. *aino* (between IV and V tergites) (A.M. Ostrovsky det.).

DISTRIBUTION. Russia (first record). Japan (type locality), Korea (Kifune & Maeta, 1990; Cook, 2019).

REMARKS. This species was described from Japan, where its host *Andrena* (*Hoplandrena*) *rosae* also occurs (Kifune & Maeta, 1990). Whether or not the *Stylops* species parasitizing the European *A*. (*H*.) *rosae* is the same as the one in Japan and Korea needs to be verified, unfortunately no DNA barcodes are available for *Stylops aino* nor for the European parasite of *A*. (*H*.) *rosae.* In European Russia *A*. (*H*.) *rosae* is a common species.

***Stylops* sp.**
Figs 11–12

MATERIAL EXAMINED. **Russia:** Lipetsk Oblast, 6 km NE of Yelets, near vill. Golikovo, 52.698653°N, 38.827870°E, left bank of the Sosna river, stone slope, 10.VI 1980, V.T. Kuznetsova leg. – 1♂ of *Andrena* (*Truncandrena*) *truncatilabris* Morawitz, 1878 (V.T. Kuznetsova det.) stylopized by 1♀ of *Stylops* sp. (between IV and V tergites) (A.M. Ostrovsky det.); Lipetsk Oblast, Zadonsk Dist., 40 km E of the vill. Donskoye, Galichya Gora Nature Reserve, Morozova Gora, 52.583295°N, 38.914447°E, floodplain of the Don river, 24.V 1982, V.T. Kuznetsova leg. – 1♀ of *Andrena* (*Truncandrena*) *truncatilabris* Morawitz, 1878 (V.T. Kuznetsova det.) stylopized by 1♀ of *Stylops* sp. (between IV and V tergites) (A.M. Ostrovsky det.).

REMARKS. Examined Examined *Stylops* specimens from *Andrena* (*Truncandrena*) *truncatilabris* Morawitz, 1878 is probably a new species. It belongs to a clade D of undescribed *Stylops* species associated with *Andrena* hosts from subgenus *Truncandrena*. Interestingly, *Stylops* from *Andrena* (*Truncandrena*) *varia* Pérez, 1895 was in a different clade, suggesting that two different *Stylops* species may utilize *Andrena* hosts from subgenus *Truncandrena* (Lähteenaro *et al.*, 2023). Therefore, until additional data is provided, it should remain a separate taxon. In European Russia *A*. (*Tr*.) *truncatilabris* is a rare species.

CONCLUSION

As the result of this study, eight species of strepsipterans are recorded from the European part of Russia, of them *Kinzelbachus friesei*, *Stylops andrenaphilus, S. spreta, S.* cf. *aino* and *Stylops* sp. are new for the fauna of Russia. Whether or not the *Stylops* species parasitizing the European *Andrena* (*Hoplandrena*) *rosae* is the same as the one in Japan and Korea needs to be verified, unfortunately no DNA barcodes are available for *S. aino* nor for the European parasite of *A.* (*H.*) *rosae.* Furthermore, the identity of the parasite of *Andrena* (*Truncandrena*) *truncatilabris* remains unresolved, no DNA barcodes are available, and it has not previously been recorded as a host of a *Stylops* species.

Many species recorded here are widely distributed in Europe and their presence in European Russia is unsurprising. However, despite the records and material listed above, the order Strepsiptera remains quite poorly studied in Russia, and new country records and further details relating to host species and distributions can still be expected.

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