

To robber flies fauna (Diptera: Asilidae) of Mordovia, Russia

DMITRY M. ASTAKHOV^{1,*}, ALEXANDER B. RUCHIN^{2,**}, OLGA D. ROMADINA¹, IVAN M. PRISTREM¹

¹Volgograd State University, Universitetskii pr., 100, Volgograd 400062, Russia. *email: dmitriy_astachov@mail.ru, astakhov@volsu.ru

²Joint Directorate of Mordovia State Nature Reserve and Smolny National Park, Saransk, Russia; **email: ruchin.alexander@gmail.com

Manuscript received: 25 February 2019. Revision accepted: 14 March 2019.

Abstract. Astakhov DM, Ruchin AB, Romadina OD, Pristrem IM. 2019. To robber flies fauna (Diptera: Asilidae) of Mordovia, Russia. *Biodiversitas* 20: 994–1005. On the basis of long-term data (2007–2018), the fauna of robber flies (Asilidae) of the Republic of Mordovia was studied. Taking into account our own and literary data, 35 species of robber flies from 18 genera were noted. Of them, 19 species were noticed in the Republic of Mordovia for the first time. We presented the photos of morphological traits of *Choerades fuliginosa* (Panzer 1798), *Choerades gilva* (Linnaeus 1758), *Choerades ignea* (Meigen 1820), *Laphria gibbosa* (Linnaeus 1758), *Andrenosoma albibarbe* (Meigen 1820), *Andrenosoma atra* (Linnaeus 1758), *Didysmachus picipes* (Meigen 1820), *Dysmachus stylifer* (Loew 1854), *Pamponerus germanicus* (Linnaeus 1758), *Philonicus albiceps* (Meigen 1820), *Machimus gonatistes* (Zeller 1840), *Neoitamus cothurnatus* (Meigen 1820), *Neoitamus cyanurus* (Loew 1849), *Dioctria atricapilla* (Meigen 1804), *Leptogaster cylindrica* (De Geer 1776).

Keywords: Asilidae, new records, robber flies, Russia

INTRODUCTION

Diptera, along with Coleoptera, Hymenoptera, and Hemiptera, is one of the largest orders in the world fauna. The same applies to regional faunas. During the last decade, we studied the biological diversity of various insect groups of the Republic of Mordovia. This allowed us to identify many rare species and make species lists of some families (Ruchin and Kurmaeva 2010; Ruchin and Artaev 2016; Semenov 2016; Ruchin and Egorov 2017a, 2017b, 2018a, 2018b, 2018c, 2018d; Ruchin and Makarkin 2017; Ruchin 2018; Ruchin and Grishutkin 2018; Ruchin and Mikhailenko 2018; Ruchin et al. 2018, 2019a, 2019b; Tomaszewska et al. 2018; Ruchin and Antropov 2019). However, Diptera representatives are still underexplored group. There is only some limited information about the Mordovian fauna of the Tipulidae and Limoniidae (Ruchin and Pilipenko 2015), Simuliidae (Budaeva and Ruchin 2014), Bibionidae (Kornev et al. 2016), Syrphidae (Chursina and Ruchin 2018b), Bombyliidae (Chursina and Ruchin 2018a) and Tabanidae (Budaeva and Ruchin 2016). However, many groups are still unexplored.

Robber flies (Diptera, Asilidae) are one of the largest families in the Diptera order. It contains more than 7,500 species (Dikow et al. 2017). The size of robber flies may vary from 5 to 60 mm (Dikow 2009). Robber flies are characterized by a different body shape (as a rule, with a cylindrically elongated abdomen) and a very diverse coloring of sclerites, which are often covered with thick hairs. Representatives of the family are known from various habitats. But the greatest species diversity is typical for arid and semi-arid areas, as well as for tropical forests. Being active predators, adult flies and their larvae play a prominent role in ecosystems (Astakhov 2015). Robber flies can inhabit different types of terrestrial ecosystems.

Some of them (stenotopic species) occur only in one plant community type, others (eurytopic species) can inhabit two or more types of plant communities (Dennis and Lavigne 1975; Londt 2006; Dennis et al. 2012; Astakhov 2013; Dennis 2018; Moreira and Maia 2018).

Until now, the fauna of robber flies of the Mordovia remained poorly studied. And the species composition of the robber flies of this territory is of considerable interest for understanding the structure of the robber flies fauna of the entire Middle Volga region. There are some publications covering the data on the robber flies of the Mordovia. Redikortsev (1938) for the first time indicated only one species of *Laphria gibbosa* for the fauna of the Mordovia State Nature Reserve. Plavilshchikov (1964) noted 13 species of Asilidae family found in the Mordovia State Nature Reserve (*Leptogaster cylindrica*, *Dioctria cothurnata*, *Lasiopogon cinctus*, *Laphria marginata*, *Laphria gibbosa*, *Choerades gilva*, *Choerades fuliginosa*, *Andrenosoma atra*, *Asilus crabroniformis*, *Machimus rusticus*, *Neoitamus cyanurus*, *Tolmerus atricapillus* and *Echthistus rufineris*). Antsiferova and Dobromyslov (1966) indicated two species - *Leptogaster cylindrica* and *Didysmachus picipes* in the study of crops of *Vicia* - *Avena* - *Phacelia* and *Vicia* - *Avena* mixtures in Mordovia. Antsiferova (1979) noted two species *Leptogaster cylindrica* and *Asilus crabroniformis* in the study of insect communities of *Medicago* spp. Ruchin (2008) indicated several Asilidae species: *Dioctria oelandica*, *Didysmachus picipes*, *Tolmerus atricapillus* and *Pamponerus germanicus* in the Smolny National Park (Mordovia). Thus, 16 species of robber flies were revealed in the Republic of Mordovia. During the current study, we found 13 species known earlier for Mordovia. The species of *Dioctria cothurnata*, *Dioctria oelandica* and *Asilus crabroniformis* have not been found in the extensive material studied during our

study. And we don't include them in the list presented below. Thus, taking into account the new data, the fauna of the robber flies of Mordovia currently includes 35 species from 18 genera. Of them, 19 species are listed for the fauna of the region for the first time. In the fauna of Mordovia, the family Asilidae is represented by 6 subfamilies: Laphriinae, Asilinae, Diocriinae, Leptogastrinae, Stichopogoninae and Brachyrhopalinae.

All species are widely distributed in the European Russia. And for all species we provided a detailed annotated list, distribution data and, if necessary, notes.

MATERIALS AND METHODS

The studied material had been collected by A. B. Ruchin, G. B. Semishin, M. K. Ryzhov, A. A. Zvonov and E. A. Lobachev during more than 10 years. We provided information on the species distribution according to the literature data by indicating the source for each species. Systematics and nomenclature is given according to Dikow (2009) and Lehr (1988). The asterisk «*» indicates the species noted in the Republic of Mordovia for the first time.

The material was determined according to the recent identification keys relevant for the study area (Richter 1969; Lehr 1989, 1991, 1996; Astakhov 2015). The specimens included in this study were also compared with those from the collection of the Zoological Institute of RAS with reliable definitions by V. A. Richter and P. A. Lehr. To reliably determine some species, we studied the male genital structures. The top of the male abdomen was cut off, maintained with a warm KOH solution and washed with water. Genital structures were examined in glycerol and stored in microtubes attached to the corresponding flies. For some rare species, we provided detailed photographs of the morphological trait details, which can also help in the future to identify these species. The photos were taken using the Canon EOS 1200D camera with a Canon macro f/4.5 100mm IS USM lens. To achieve sufficient focal depth, several individual images were stitched together using the Helicon Focus 6 software. The subsequent processing of photographs was made in Gimp 2.

RESULTS AND DISCUSSION

Order Diptera

Family Asilidae

Subfamily Laphriinae

Subfamily Laphriinae

Choerades amurensis (Hermann 1914) *

Materials. Saransk, village Dobrovolny, near the pond, 16.VI.2011, 1 ♂ (G. B. Semishin).

Distribution. Russia: the center of the European part; Samara province; Orenburg province; Western and Eastern Siberia; The Far East (Lehr 1988; 1991).

Choerades fuliginosa (Panzer 1798)

(Figs 1-2) Literature. Plavilshchikov (1964)

Materials. Temnikov district, Mordovia State Nature Reserve, square 276, 20.VII.2014, 1 ♂ (A.B. Ruchin); Temnikov district, Mordovia State Nature Reserve, square 398, 24.VII.2016, 1 ♂ (A.B. Ruchin); Temnikov district, Mordovia State Nature Reserve, square 420, 07.VI.2015, 1 ♂ (A.B. Ruchin); Krasnoslobodsk district, settlement Sivin, 20.VIII.2017, 1 ♂ (A.B. Ruchin); National park "Smolny", Lvovskoe forestry, 05.VII.2008, 1 ♂ (A.B. Ruchin); Staroe Shaygovo district, village Staroye Shaygovo, 01.VII.2018, 1 ♀ (A.B. Ruchin); Ruzaevka district, village Boldovo, 04.VI.2016, 1 ♀ (A.B. Ruchin); Chamzinka district, village Mokshalei, 28.VII.2018, 1 ♂ (A.B. Ruchin); Dubenki district, 8 km SE village Engalychevo, 01.VII.2009, 1 ♂ (A.B. Ruchin).

Distribution. Forests from Spain to the Baikal Lake; in the north up to 65 ° N; the whole Europe, Turkey, the Caucasus and the Transcaucasus (Lehr 1991).

Choerades gilva (Linnaeus 1758)

(Figs 3-4)

Literature. Plavilshchikov (1964)

Materials. Temnikov district, Mordovia State Nature Reserve, settlement Pushta, 10.VIII.2013, 1 ♂ (A.B. Ruchin); Temnikov district, Mordovia State Nature Reserve, cordon Steklyannyi, square 86, 07.VIII.2015, 1 ♀ (G. B. Semishin); Temnikov district, Mordovia State Nature Reserve, cordon Pavlovsky, 28.VII.2018, 1 ♂ (G. B. Semishin); Temnikov district, Mordovia State Nature Reserve, cordon Pavlovsky, 06.VII.2013, 1 ♀ (G. B. Semishin).

Distribution. European part of the former USSR, Western and Eastern Siberia, the Far East; most part of Europe, Mongolia,? Japan; Nearctic (Canada, the USA) (Lehr 1988, 1991).

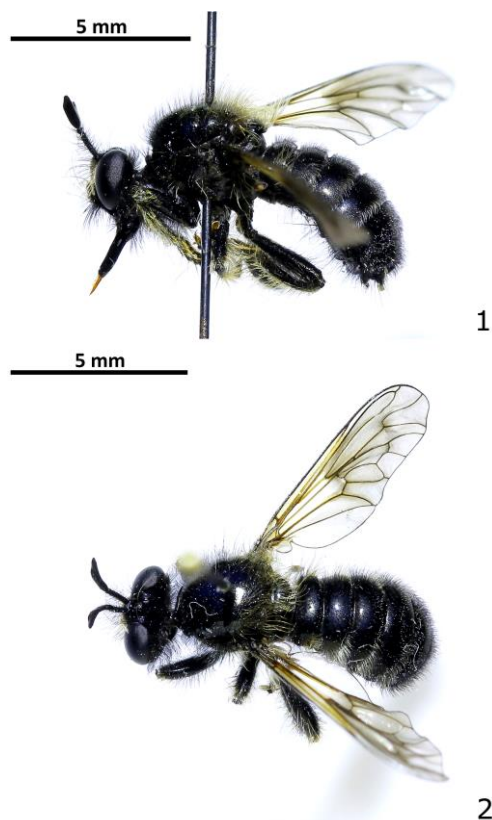
Note. Lehr (1991) considered *Choerades ignea* as a synonym of *Choerades gilva*, explaining this by the similarity of the male genital structures of these species. But according to our opinion, external characters (coloring of the hairs and macrosetae of the mystax and scutellum, coloring of the abdomen tergites, etc.) are convincing evidence of the independence of these two species. Recent molecular genetic data showed that these are closely related but completely independent species (Van den Broek 2014).

Choerades ignea (Meigen 1820)*

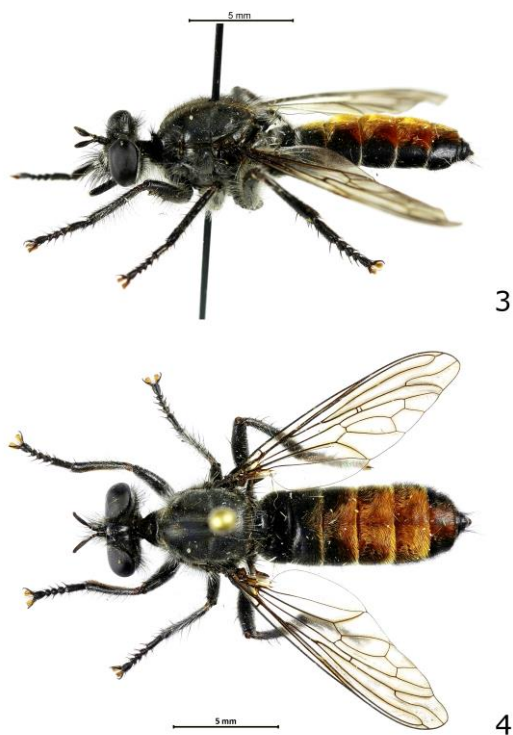
(Figs 5-6)

Materials. Temnikov district, Mordovia State Nature Reserve, settlement Pushta, 12.IX.2017, 1 ♂ (A.B. Ruchin); Temnikov district, Mordovia State Nature Reserve, square 330, 17.VI.2016, 1 ♀ (A.B. Ruchin); square 360, 23.VIII.2015, 1 ♀ (A.B. Ruchin); square 368, 24.VIII.2017, 1 ♀ (A.B. Ruchin).

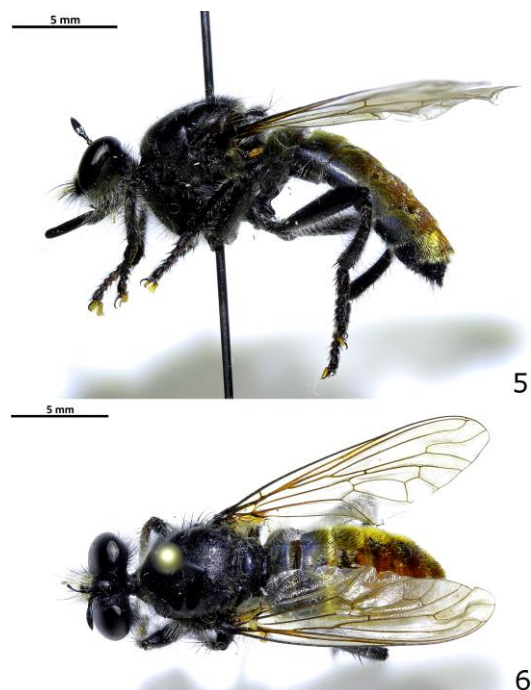
Distribution. European part of the former USSR to the north up to the south of the Leningrad province; Western Siberia; most part of Western Europe, Kazakhstan (Richter 1968; Lehr 1988).



Figures 1-2. *Choerades fuliginosa* (Panzer 1798), female: (1) general lateral view, (2) general dorsal view



Figures 3-4. *Choerades gilva* (Linnaeus 1758), female: (3) general lateral view, (4) general dorsal view.



Figures 5-6. *Choerades ignea* (Meigen 1820), female: (5) general lateral view, (6) general dorsal view

Choerades marginata (Linnaeus 1758)

Literature. Plavilshchikov (1964)

Materials. Temnikov district, Mordovia State Nature Reserve, square 360, 21.VI.2015, 2 ♂ (A.B. Ruchin); Atyurevo district, village Mordovskaya Kozlovka, 08.VI.2013, 1 ♂ (A.B. Ruchin).

Distribution. Russia: Lower Volga region, the center of the European part (forest) to the Leningrad province. England, Netherlands, Norway, Sweden, Finland, Germany, Poland, Italy, Albania, Romania, Armenia, Iran (Lehr 1988, 1991; Astakhov 2015).

Laphria gibbosa (Linnaeus 1758)

(Figs 7-8)

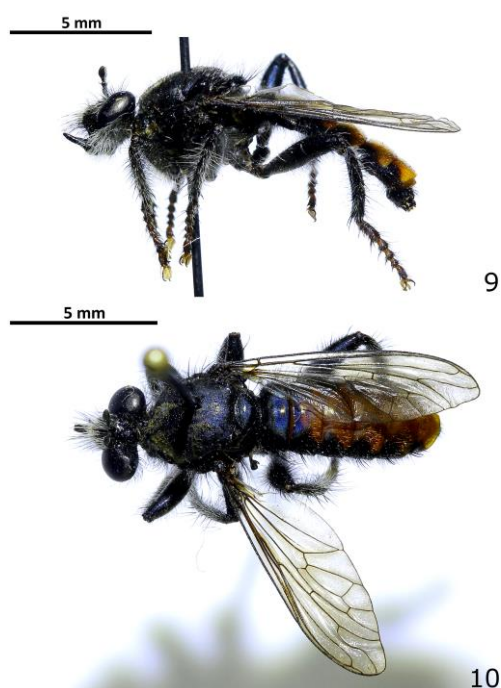
Literature. Redikortsev (1938); Plavilshchikov (1964)

Materials. Temnikov district, Mordovia State Nature Reserve, settlement Pushta, 15.VII.2012, 1 ♂ (A.B. Ruchin); Temnikov district, Mordovia State Nature Reserve, square 368, 24.VIII.2017, 1 ♂ (A.B. Ruchin); square 413, 04.VIII.2017, 1 ♂ (A.B. Ruchin); Atyurevo district, village Mordovskaya Kozlovka, 08.VI.2013, 2 ♂ (A.B. Ruchin); Zubova Polyana district, settlement Vadovo-Sosnovka, 30.VII.2009, 1 ♀ (A.B. Ruchin); Zubova Polyana district, settlement Vadovo-Sosnovka, 31.VII.2018, 1 ♀ (A.B. Ruchin); Saransk, 15.VII.2006, 1 ♀ (A.B. Ruchin); Bolshie Berezniki district, settlement Simkinskoe forestry, 12.VIII.2017, 1 ♀ (A.B. Ruchin).

Distribution. Russia: the European part: Lower Volga region, Western and Eastern Siberia, the Far East. England, France, Belgium, Denmark, Germany, Sweden, Finland, Austria, Switzerland, Spain, Italy, Romania. Transcaucasus (forests of the Caucasus Minor), Kazakhstan (Richter 1968; Lehr 1988, 1989, 1999; Astakhov 2015).



Figures 7-8. *Laphria gibbosa* (Linnaeus 1758), male: (7) general lateral view, (8) general dorsal view



Figures 9-10. *Andrenosoma albibarbe* (Meigen 1820), male: (9) general lateral view, (10) general dorsal view

Laphria ephippium (Fabricius 1781)*

Materials. Saransk, a green grove, on a bush by the road, 20.VI.2011, 1 ♀ (G. B. Semishin); Saransk, Dobrovolny, near the pond, 20.VI.2011, 1 ♀ (G. B. Semishin); Lyambir district, village Ekaterinovka, 02.VI.2009, 1 ♂ (A.B. Ruchin).

Distribution. Russia: the center and south of the European part (Richter 1969), Lower Volga region. England, France, Spain, Denmark, Sweden, Germany, Austria, Italy, Poland, Hungary, Romania, Albania, Bulgaria (Lehr 1989; Astakhov 2015). Forest european species, spread to 60-61 °N in the north.

Laphria flava (Linnaeus 1761)*

Materials. Temnikov district, Mordovia State Nature Reserve, 5 km N settlement Pushta, square 408, 19.V.2013, 1 ♀ (A.B. Ruchin); settlement Pushta, 23.VI.2013, 1 ♀ (A.B. Ruchin); square 338, 27.V.2018, 1 ♂ (A.B. Ruchin); cordon Inorsky, 08.VI.2015, 09.VI.2015, 2 ♀ (G. B. Semishin); square 308, 11.VI.2016, 1 ♀ (A.B. Ruchin); square 347, 13.VII.2017, 2 ♂ (A.B. Ruchin); cordon Pavlovsky, 28.VII.2018, 2 ♀ (G. B. Semishin); square 404, 26.V.2016, 1 ♂ (A.B. Ruchin); square 360, 21.VI.2015, 1 ♀ (A.B. Ruchin); cordon Hugalovsky, 07.VIII.2017, 1 ♀ (G. B. Semishin); square 338, 03.VII.2016, 1 ♀ (A.B. Ruchin); cordon Dolgiy Most, 11.VI.2015, 1 ♀ (G. B. Semishin).

Distribution. Russia: the European part, Lower Volga region, Western and Eastern Siberia, the Far East. Western Europe, Kazakhstan. Mongolia (Lehr 1988, 1989; Astakhov 2015). The species inhabit the forests of the temperate zone of the Palaearctic.

Andrenosoma albibarbe (Meigen 1820)*

(Figs 9-10)

Materials. Temnikov district, Mordovia State Nature Reserve, square 360, 21.VI.2015, 1 ♂ (A.B. Ruchin); square 384, 14.VI.2016, 1 ♂ (A.B. Ruchin); Ardatov district, settlement Oktyabrsky, 26.V.2017, 1 ♂ (A.B. Ruchin).

Distribution. Transpalearctic species (Lehr 1988, 1989).

Andrenosoma atra (Linnaeus 1758)

(Figs 11-12)

Literature. Plavilshchikov (1964)

Materials. National park "Smolny", Barakhmanovskoe forestry, square 74, 13.IX.2017, 1 ♂ (G. B. Semishin).

Distribution. Russia: the European part of the former USSR to the north up to the Leningrad region, the Caucasus; most part of Western Europe, Algeria, the Canary Islands (Richter 1968, 1969; Lehr 1988).

Subfamily Asilinae

Didysmachus picipes (Meigen 1820)

(Figs 13-14)

Literature. Antsiferova and Dobrosmyslov (1966); Ruchin (2008).

Materials. Temnikov district, Mordovia State Nature Reserve, square 368, 06.VI.2012, 1 ♂ (A.B. Ruchin); square 399, 07.VI.2015, 1 ♂ (A.B. Ruchin); square 434, 05.VI.2015, 1 ♂ (A.B. Ruchin); cordon Drozhdenovskiy, 18.VI.2017, 1 ♂ (A.B. Ruchin); Temnikov district, settlement Vesely, 06.VI.2015, 1 ♂ (A.B. Ruchin); Atyurevo district, village Chudinka, 07.VI.2008, 1 ♀ (A.B. Ruchin).

Ruchin); Kovylkino district, village Chepurinovka, 29.VI.2017, 1 ♀ (A.B. Ruchin); Ichalki district, National park "Smolny", Lvovskoe forestry, 20.VI.2008, 1 ♂, 1 ♀ (A.B. Ruchin); Lvovskoe forestry, 24.VI.2008, 1 ♀ (A.B. Ruchin); Lvovskoe forestry, square 53, 18.VII.2017, 1 ♂ (G. B. Semishin); Kemlyanskoe forestry, square 81, 27.VII.2017, 1 ♀ (A.B. Ruchin); Kemlyanskoe forestry, square 66, 27. VII.2017, 1 ♀ (A.B. Ruchin); Lyambir district, village Atemar, 24.VI.2017, 1 ♀ (A.B. Ruchin); Bolshie Berezniki district, 9 km S village Simkino, biological station of Mordovian university, 10.VII.2009, 1 ♀ (A.B. Ruchin).

Distribution. Russia: the northwest and the center of the European part; Lower Volga region; Western Siberia. Western Europe, Georgia, Azerbaijan, Armenia, Northern Kazakhstan; Iran (Stackelberg 1954; Richter 1968; Lehr 1996, 1988; Astakhov 2015; Mohhamadi et al. 2017).

Dysmachus fuscipennis (Meigen 1820)*

Materials. Temnikov district, Mordovia State Nature Reserve, square 115, 18.VI.2016, 1 ♂ (A.B. Ruchin); Atyashevo district, village Kamenka, 24.VI.2016, 1 ♀ (A.B. Ruchin).

Distribution. Russia: the European part, Lower Volga region; Western Siberia (Lehr 1988). France, Germany, Italy, Poland. Czech Republic, Slovakia, Hungary, Romania, Albania, Bulgaria, Greece, Georgia, Armenia,

Azerbaijan, Asia Minor, Kazakhstan (Richter 1968; 1969; Astakhov 2015; Lehr 1988).

Dysmachus stylifer (Loew 1854)*

(Figs 15-16)

Materials. Temnikov district, Mordovia State Nature Reserve, cordon Novenkovsky, 29.VI.2016, 1 ♂ (A. A. Zvonov); Atyurevo district, village Pichopolonga, 02.VII.2016, 1 ♂ (A.B. Ruchin); Bolshie Berezniki district, village Permissi, 06.VII.2017, 1 ♂ (A.B. Ruchin).

Distribution. Russia: Lower Volga region. Germany, Austria, Italy, Poland, Czech Republic, Hungary, Romania, Albania, Bulgaria, Greece, Ukraine, Azerbaijan, Turkey (Richter 1968; Lehr 1988, 1996; Astakhov 2015).

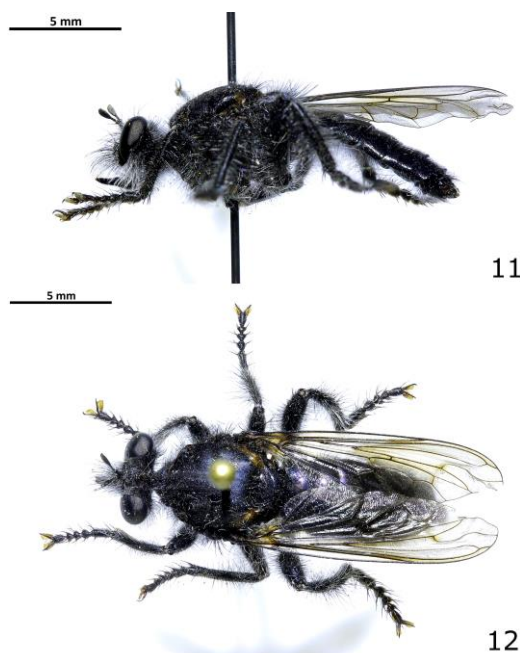
Note. Apparently, the find is close to the northern border of the range.

Echthistus rufinervis (Meigen 1820)

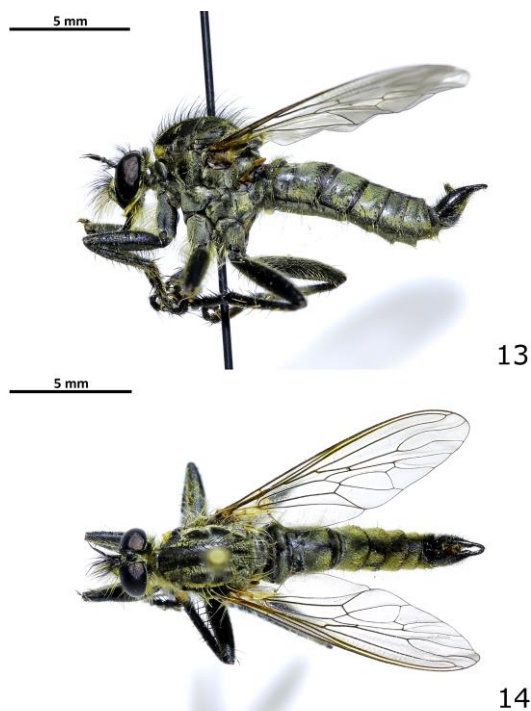
Literature. Plavilshchikov (1964)

Materials. Temnikov district, village Nizhnie Borki, 30.V.2015, 1 ♀ (A.B. Ruchin); Atyurevo district, village Mordovskaya Kozlovka, 08.VI.2013, 1 ♀ (A.B. Ruchin).

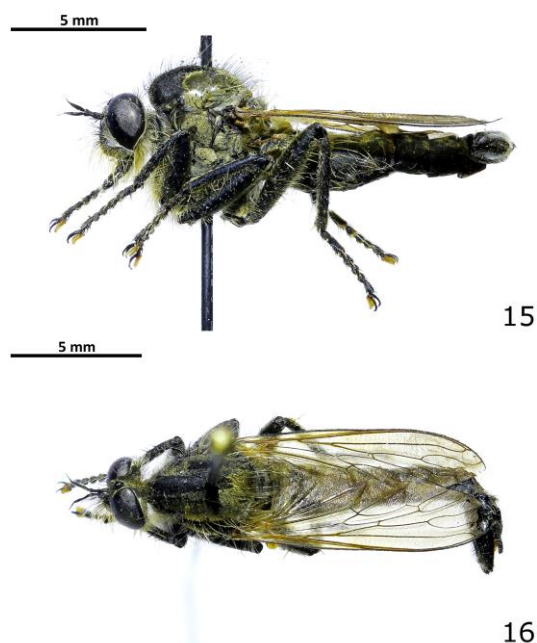
Distribution. Russia: the centre of the European part; Lower Volga region; Western Siberia. England, France, Germany, Poland, Bulgaria, Greece, Turkey, Israel, Kazakhstan; Egypt (Richter 1969; Lehr 1992, 1996; Astakhov 2015; Lehr 1988).



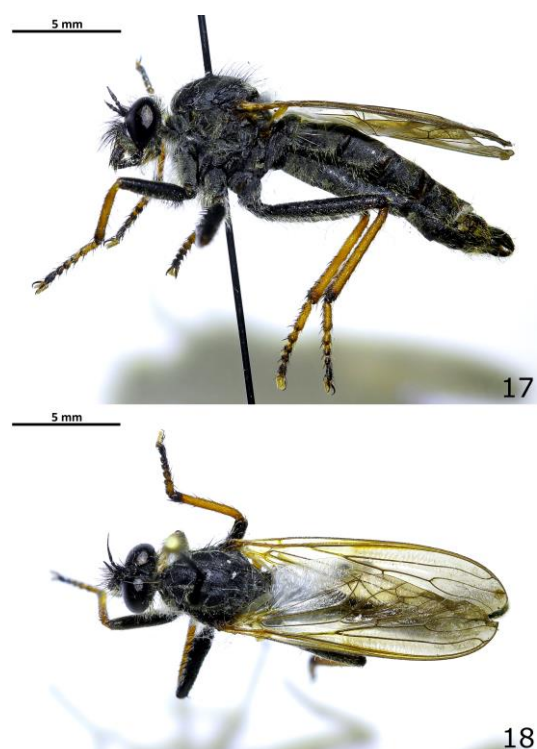
Figures 11-12. *Andrenosoma atra* (Linnaeus 1758), male: (11) general lateral view, (12) general dorsal view.



Figures 13-14. *Didysmachus picipes* (Meigen 1820), male: (13) general lateral view, (14) general dorsal view



Figures 15-16. *Dismachus stylifer* (Loew 1854), male: (15) general lateral view, (16) general dorsal view.



Figures 17-18. *Pamponerus germanicus* (Linnaeus 1758), male: (17) general lateral view, (18) general dorsal view.

Pamponerus germanicus (Linnaeus 1758)
(Figs 17-20)

Literature. Ruchin (2008).

Materials. Temnikov district, Mordovia State Nature Reserve, settlement Pusta, 30.V.2008, 1 ♀ (A.B. Ruchin); 6

km NW village Pushta, 09.VI.2013, 1 ♀ (A.B. Ruchin); cordon Inorsky, 10.VI.2015, 1 ♀ (G. B. Semishin); cordon Inorsky, 07.VI.2015, 02.VI.2017, 2 ♀ (G. B. Semishin); square 431, 23.VI. 2013, 1 ♀ (A.B. Ruchin); square 431, 01.VI.2014, 1 ♀ (A.B. Ruchin); Elniki district, village Malye Mordovskie Poshaty, 31.V. 2014, 1 ♂ (A.B. Ruchin); Atyurevo district, village Pichepolonga, 02.VII.2016, 1 ♀ (A.B. Ruchin).

Distribution. Russia: northwest (Stackelberg 1954) and south of the European part; Lower Volga region; Yakutia; Buryatia; Irkutsk region. Austria, Czech Republic, England, France, Germany, Denmark, Poland, Norway, Sweden, Finland, Hungary, Romania, Italy (Lehr 1999; Astakhov 2015; Lehr 1988).

Philonicus albiceps (Meigen 1820)*

(Figs 21-22)

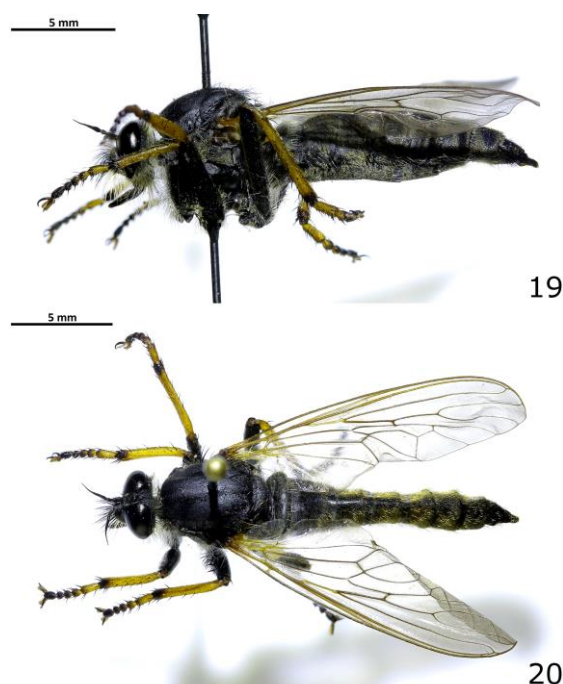
Materials. Temnikov district, Mordovia State Nature Reserve, cordon Inorsky, 02.VII.2017, 1 ♀ (A.B. Ruchin); Elniki district, village Novye Shaly, 22.VII.2017, 1 ♂, 1 ♀ (A.B. Ruchin); Krasnoslobodsk district, village Staroe Sindrovo, 01.VIII.2008, 1 ♀ (A.B. Ruchin); 539 km river Moksha, near the road, 07.VII.2011, 1 ♀ (G. B. Semishin).

Distribution. Transpalearctic species (Lehr 1988; Astakhov 2015; Mohammadi et al. 2017).

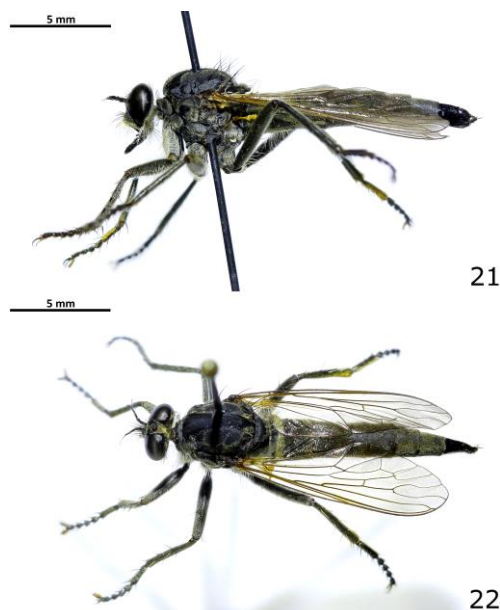
Rhadiurgus variabilis (Zetterstedt 1838)*

Materials. Temnikov district, Mordovia State Nature Reserve, square 381, 28.V.2018, 1 ♂ (A.B. Ruchin).

Distribution. Russia: north and center of the European part of the former USSR, Western and Eastern Siberia, the Far East; Northern and middle zone of Western Europe (Lehr 1981, 1988; Richter 1969).



Figures 19-20. *Pamponerus germanicus* (Linnaeus 1758), female: (19) general lateral view, (20) general dorsal view.



Figures 21-22. *Philonicus albiceps* (Meigen 1820), female: (21) general lateral view, (22) general dorsal view.



Figures 23-24. *Machimus gonatistes* (Zeller 1840), male: (23) general lateral view, (24) general dorsal view.

Machimus gonatistes (Zeller 1840)*
(Figs 23-24)

Materials. Temnikov district, Mordovia State Nature Reserve, square 413, 09.VIII.2014, 04.VIII.2017, 1 ♂, 1 ♀ (A.B. Ruchin); cordon Steklyannyi, 17.VIII.2018, 1 ♀ (G. B. Semishin); square 379, 01.VII.2016, 1 ♂ (A.B. Ruchin); Atyurevo district, village Pichopolonga, 02.VII. 2016, 1 ♂ (A.B. Ruchin); Zubova Polyana district, settlement Shkola Traktornyh Brigadirov, 28.VI.2016, 1 ♂ (A.B. Ruchin); Krasnoslobodsk district, village Sinyakovo, 19.VII.2014, 1 ♀ (A.B. Ruchin); Krasnoslobodsk district, village Penkovo, 31.VII.2008, 1 ♂ (A.B. Ruchin); Ichalki district, National park "Smolny", Barakhmanovskoe forestry, square 74, sandy slope, 31.VIII.2017, 1 ♀ (G. B. Semishin); Barakhmanovskoe forestry, square 101, 09.VIII.2018, 2 ♂ (G. B. Semishin); 539 km river Moksha, near the road, 07.VII.2011, 1 ♂ (G. B. Semishin).

Distribution. Russia: Lower Volga region; Western Siberia (Astakhov 2015; Lehr 1988). Denmark, Germany, Poland, Finland, Austria, Hungary, Romania, Italy, Greece, Bulgaria. Ukraine, the Caucasus, Morocco, Tunisia, Kazakhstan (common), but not found in Central Asia (Richter 1964, 1969; Lehr 1971, Lehr 1988).

Machimus rusticus (Meigen 1820)

Literature. Plavilshchikov (1964)

Materials. Bolshie Berezniki district, village Elizavetinka, 28.VII.2018, 2 ♂, 1 ♀ (A.B. Ruchin); Bolshie Berezniki district, village Simkino, 26.VIII.2017, 1 ♂ (A.B. Ruchin).

Distribution. Russia: the European part; Lower Volga region; Caucasus. England, Netherlands, France, Spain, Germany, Austria, Italy, Poland, Romania, Albania, Bulgaria. Ukraine, Transcaucasus, Kazakhstan, Kyrgyzstan (Richter 1968, 1969; Astakhov 2015; Lehr 1988).

Neoepitriptus setosulus (Zeller 1840)*

Materials. Temnikov district, village Purdoshki, 15.VIII.2015, 1 ♂ (A.B. Ruchin).

Distribution. Russia: the middle zone of the European part, Lower Volga region (Richter 1969; Astakhov 2015). France, the Netherlands, Germany, Poland, Austria, Romania, Italy, Bulgaria, Ukraine, Caucasus (forests of the Main Caucasian Ridge), Kazakhstan (Richter 1964; Lehr 1988).

Note. This record allowed to clarify the northern boundaries of the species range.

Neoitamus cothurnatus (Meigen 1820)*

(Figs 25-26)

Materials. Temnikov district, Mordovia State Nature Reserve, square 319, 13.VII.2017, 1 ♂ (A.B. Ruchin).

Distribution. Russia: the north and center of the European part. Austria, former Czechoslovakia, Denmark, France, England, Italy, Netherlands, Romania, Sweden, Finland, former Yugoslavia (Lehr 1988).

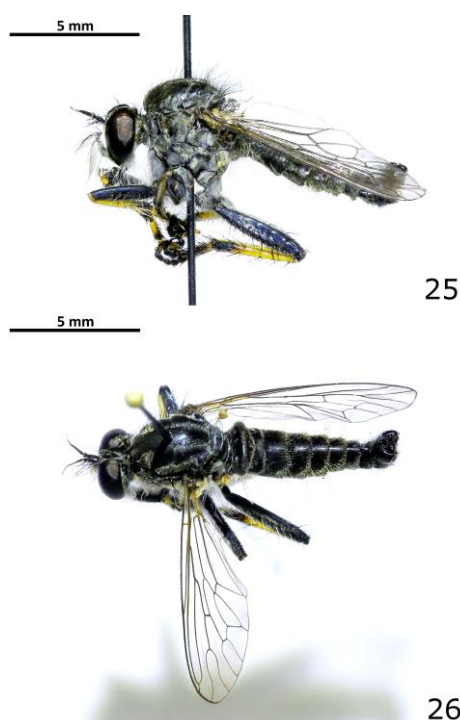
Note. The subspecies *Neoitamus cothurnatus univittatus* (Loew 1871) is known from Western and Eastern Siberia, the Far East, and also from Kazakhstan, Mongolia, and Japan (Lehr 1988).

Neoitamus cyanurus (Loew 1849)

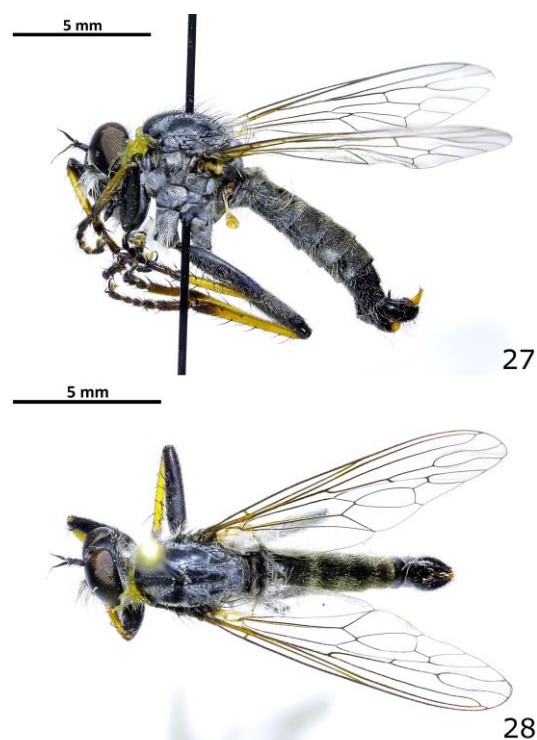
(Figs 27-28)

Literature. Plavilshchikov 1964

Materials. Temnikov district, Mordovia State Nature Reserve, square 342, 20.VI. 2015, 1 ♂ (A.B. Ruchin); square 360, 21.VI.2015, 1 ♂, 1 ♀ (A.B. Ruchin); square 308, 11.VI.2016, 1 ♂ (A.B. Ruchin); cordon Pavlovsky, 07.VII.2013, 1 ♀ (G. B. Semishin); Atyurevo district, village Mordovskaya Kozlovka, 08.VI.2013, 1 ♂ (A.B. Ruchin).



Figures 25-26. *Neoitamus cothurnatus* (Meigen 1820), male: (25) general lateral view, (26) general dorsal view.



Figures 27-28. *Neoitamus cyanurus* (Loew 1849), male: (27) general lateral view, (28) general dorsal view.

Distribution. Russia: the northwest and the middle zone of the European part; Lower Volga region, Western and Eastern Siberia, Far East (Astakhov 2015; Lehr 1988). England, Netherlands, Denmark, France, Germany, Austria, Italy, Sweden, Finland, Poland, Hungary, Romania, Bulgaria, Greece (Stakelberg 1954; Richter 1969; Lehr 1988).

Neoitamus socius (Loew 1871)*

Materials. Temnikov district, Mordovia State Nature Reserve, square 368, 19.VI.2012, 1 ♂ (A.B. Ruchin); square 330, 17.VI.2016, 1 ♀ (A.B. Ruchin); square 360, 15.VI.2018, 1 ♀ (A.B. Ruchin); square 361, 07.VII.2016, 1 ♀ (A.B. Ruchin); Atyurevo district, village Klopinka, 29.VI.2013, 1 ♀ (A.B. Ruchin); Ichalki district, National park "Smolny", Lvovskoe forestry, square 53, 07.VII.2017, 1 ♂ (G. B. Semishin); Bolshie Berezniki district, 9 km S village Simkino, biological station of Mordovian University, 20.VII.2009, 1 ♀ (E.A. Lobachev).

Distribution. Russia: the northwest and the middle zone of the European part, Western and Eastern Siberia, (?) The Far East. Belgium, France, Spain, Germany, former Czechoslovakia, Austria, Hungary, Sweden, Finland, Poland, Romania, Albania, Bulgaria, (Stakelberg 1954; Richter 1969; Lehr 1999; Astakhov 2015; Lehr 1988).

Tolmerus atricapillus (Fallén 1814)

Literature. Plavilshchikov (1964); Ruchin (2008).

Materials. Temnikov district, Mordovia State Nature Reserve, settlement Pushta, 20.VIII.2013, 1 ♀ (A.B. Ruchin); cordon Steklyannyi, 17.VIII.2018, 1 ♀ (G. B. Semishin); cordon Steklyannyi, 31.VIII.2018, 1 ♂, 1 ♀ (G. B. Semishin); cordon Plotomoyka, 12.IX.2017, 1 ♂ (A.B. Ruchin); square 397, 17.VIII.2014, 1 ♂ (A.B. Ruchin); square 421, 03.IX.2016, 1 ♂ (A.B. Ruchin); square 409, 10.VIII.2016, 1 ♂ (A.B. Ruchin); cordon Inorsky, 04.VIII.2017, 1 ♀ (G. B. Semishin); cordon Inorsky, 24.VIII.2017, 1 ♀ (G. B. Semishin); cordon Dolgiy Most, 14.VI.2015, 1 ♂ (G. B. Semishin); Zubova Polyana district, settlement Vysha, 31.VII.2018, 1 ♂, 1 ♀ (A.B. Ruchin); Krasnoslobodsk district, settlement Sivin, 20.VIII.2017, 1 ♀ (A.B. Ruchin); Kovylkino district, settlement Silikatny, 08.VIII.2013, 1 ♂ (A.B. Ruchin); Bolshoe Ignatovo district, National park "Smolny", Aleksandrovskoe forestry, square 39, 11.VIII.2018, 1 ♂ (A.B. Ruchin); Ichalki district, National park "Smolny", Barakhmanovskoe forestry, 2 km NE of the village Tashkino, 06.IX.2009, 1 specimen with without abdomen (A.B. Ruchin); Ichalki district, National park "Smolny", Lvovskoe forestry, square 63, 19.IX.2018, 1 ♂, 1 ♀ (G. B. Semishin); Kemlyanskoe forestry, square 81, 27.VII.2017, 1 ♀ (A.B. Ruchin); Kemlyanskoe forestry, square 93, 07.VIII.2018, 3 ♂ (G. B. Semishin); Ichalki district, village Lobaski, 17.VIII.2017, 1 ♂ (A.B. Ruchin); Staroe Shaygovo district, village Govorovo, 10.VII.2016, 1 ♂ (A.B. Ruchin); Romodanovo district, village Pushkino, 17.VIII.2017, 1 ♂, 1 ♀ (A.B. Ruchin).

Ruchin); Romodanovo district, settlement Zarechnyi, 03.VIII.2018, 1 ♀ (A.B. Ruchin); Lyambir district, village Surkino, 27.VIII.2017, 1 ♂ (A.B. Ruchin); Lyambir district, village Novaya Uda, 29.VII.2016, 1 ♀ (A.B. Ruchin); Atyashevo district, village Kamenka, 25.VIII.2017, 3 ♀ (A.B. Ruchin); Atyashevo district, village Selishchi, 03.VIII.2018, 1 ♀ (A.B. Ruchin); Atyashevo district, village Selishchi, 10.VIII.2017, 1 ♂, 6 ♀ (A.B. Ruchin); Atyashevo district, village Kapasovo, 26.VIII.2017, 2 ♂ (A.B. Ruchin); Ruzaevka district, village Palaevka, 19.VIII.2017, 1 ♂, 1 ♀ (A.B. Ruchin); Chamzinka district, village Gorbunovka, 03.VIII.2018, 1 ♂ (A.B. Ruchin); Chamzinka district, settlement Komsomolsky, VII.2009, 1 specimen without abdomen (M. K. Ryzhov); Chamzinka district, village Alekseevka, 03.VIII.2018, 2 ♀ (A.B. Ruchin); Ardatov district, village Pyksyasy, 10.VIII.2017, 2 ♂, 3 ♀ (A.B. Ruchin); Kochkurovo district, village Podlesnaya Tavla, 04.VIII.2018, 1 ♂, 1 ♀ (G. B. Semishin); Kochkurovo district, village Kochkurovo, 11.VIII.2017, 1 ♂ (A.B. Ruchin); Kochkurovo district, village Novaya Pymra, 11.VIII.2017, 3 ♂ (A.B. Ruchin); Bolshie Berezniki district, village Simkino, 12.VIII.2017, 2 ♂ (A.B. Ruchin); Bolshie Berezniki district, village Simkino, 05.VIII.2018, 1 ♂, 1 ♀ (A.B. Ruchin); Dubenki district, village Yavleyka, 10.VIII.2017, 1 ♂, 8 ♀ (A.B. Ruchin); Zubova Polyana district, settlement Yavas, 05. VIII.2013, 1 ♂ (A.B. Ruchin);

Distribution. The species range covers most of the forest and forest-steppe zones of the Palearctic; in Europe, the northern boundary of the range is located at approximately 64 degrees north latitude, passing along the slopes of the Alps in France. This species is known in England. The indication for the Canary Islands is doubtful (Engel 1930). In Russia it is common throughout Siberia. In the Far East it reaches the Sakhalin island. The southern boundary of the range apparently coincides with the northern boundary of the steppes, but along the slopes of the mountains it reaches Tarbagatay (Republic of Buryatia, Russia); the species is also known in the Crimea and the Caucasus (Lehr 1981; Astakhov 2015).

Note. Apparently, it is the most widespread species in the study area.

Tolmerus cingulatus (Fabricius 1781)*

Materials. Krasnoslobodsk district, village Selishchi, 19.VII.2014, 1 ♂ (A.B. Ruchin); Kovylkino district, village Tokmovo, 02.IX.2017, 2 ♂ (A.B. Ruchin); Atyashevo district, village Selishchi, 30.VI.2018, 2 ♀ (A.B. Ruchin).

Distribution. Russia: the middle zone of the European part; Lower Volga region; Caucasus. England, Norway, the Netherlands, France, Denmark, Sweden, Germany, Austria, Finland, Poland, Hungary, Romania, Albania, Bulgaria, Ukraine, Transcaucasus (Azerbaijan); Turkey, Iran (Lehr 1981, 1988; Richter 1968, 1969; Astakhov 2015).

Subfamily Dioctriinae

Dioctria atricapilla (Meigen 1804)*

(Figs 29-30)

Materials. Temnikov district, Mordovia State Nature Reserve, 5 km N settlement Pushta, square 408, 23.VI.2012, 1 ♂ (A.B. Ruchin); 6 km NW settlement Pushta, 22.V.2012, 1 ♀ (A.B. Ruchin); 6 km NW settlement Pushta, 01.VII.2012, 1 ♀ (A.B. Ruchin); square 115, 18.VI.2016, 1 ♂ (A.B. Ruchin); square 368, 06.VI.2012, 1 ♀ (A.B. Ruchin); square 368, 13.VI.2012, 1 ♀ (A.B. Ruchin); cordon Podrubny, 12.VI.2013, 2 ♀ (A.B. Ruchin); square 37, 18.VI.2016, 1 ♂ (A.B. Ruchin); Ichalki district, National park "Smolny", Lvovskoe forestry, 21.VI.2008, 1 ♂ (A.B. Ruchin); Bolshie Berezniki district, 9 km S village Simkino, biological station of Mordovian university, 30.VI.2009, 1 ♀ (A.B. Ruchin); Temnikov district, village Tatarskoe Karaevo, 17.VI.2017, 1 ♂ (A.B. Ruchin); Tengushevo district, settlement Barashevo, 30.VI.2013, 1 ♀ (A.B. Ruchin);

Distribution. Russia: northwest, middle belt of the European part, Lower Volga region; Western and Eastern Siberia, Primorsky Krai. Western Europe, the Caucasus, Kazakhstan, Mongolia, China (Stakelberg 1954; Richter 1969; Lehr 2001; Astakhov 2015; Lehr 1988).

Dioctria flavipennis (Meigen 1820)*

(Figs 31-32)

Materials. Atyashevo district, village Kamenka, 24.VI.2016, 1 ♂, 1 ♀ (A.B. Ruchin); Ruzaevka district, settlement Levzhensky, 13.VI.2015, 1 ♂ (A.B. Ruchin).

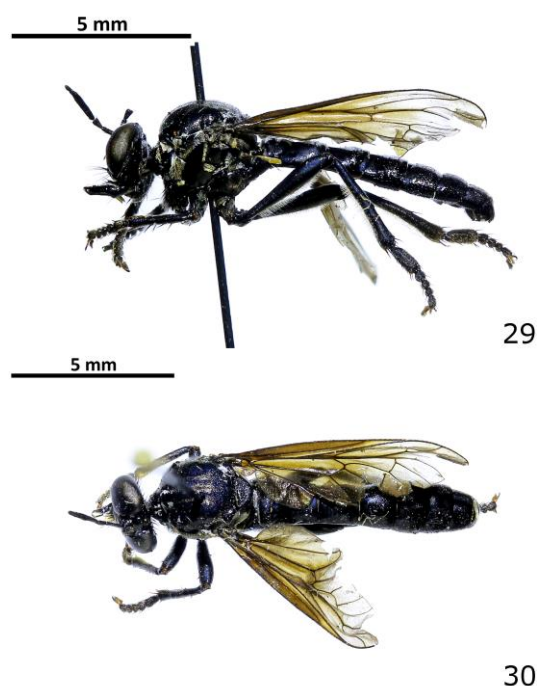
Distribution. Russia: the middle zone of the European part, Lower Volga region, Siberia. France, Germany, Austria, Poland, Hungary, Romania, Bulgaria, Ukraine, Kazakhstan, Kyrgyzstan (Lehr 1965, 2001; Richter 1969; Astakhov 2015; Lehr 1988).

Note. This finding allowed to clarify the northern boundaries of the species range.

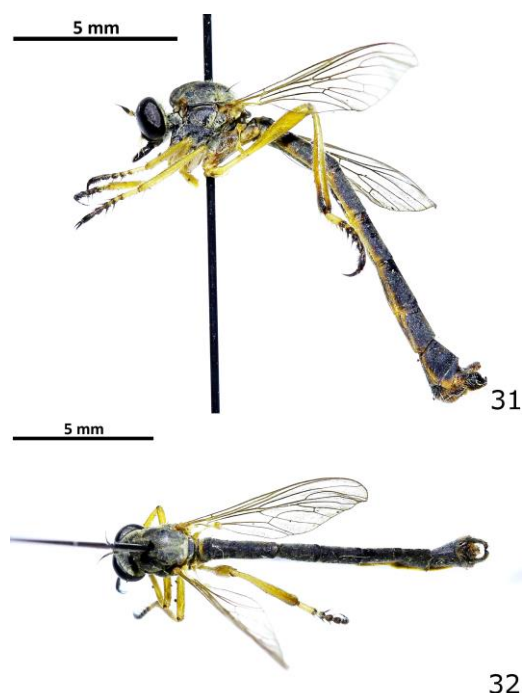
Dioctria hyalipennis (Fabricius 1794)*

Materials. Temnikov district, Mordovia State Nature Reserve, 6 km NW settlement Pushta, 28.VI.2015, 1 ♀ (A.B. Ruchin); square 360, 21.VI.2015, 1 ♂ (A.B. Ruchin); square 364, 11.VI.2016, 1 ♂ (A.B. Ruchin); square 381, 21.VI.2015, 1 ♀ (A.B. Ruchin); square 405, 05.VII.2015, 1 ♂ (A.B. Ruchin); square 413, 12.VI.2016, 1 ♀ (A.B. Ruchin); square 430, 12.VI.2016, 1 ♂ (A.B. Ruchin); square 431, 23.VI.2013, 1 ♀ (A.B. Ruchin); Temnikov district, Temnikov, 01.VI.2008, 1 specimen with damaged abdomen (A.B. Ruchin); Ichalki district, National park "Smolny", Barakhmanovskoe forestry, 20.VII.2007, 1 ♀ (A.B. Ruchin).

Distribution. Russia: the northwest and the middle zone of the European part, Lower Volga region. Netherlands, Denmark, Sweden, Germany, Austria, Italy, Finland, Poland, Czech Republic, Romania, Bulgaria, Belarus, Ukraine, Kazakhstan; Tunisia (Stakelberg 1954; Lehr 1965; Richter 1969; Astakhov 2015; Lehr 1988).



Figures 29-30. *Dioctria atricapilla* Meigen 1804, male: (29) general lateral view, (30) general dorsal view.



Figures 31-32. *Leptogaster cylindrica* (De Geer 1776), male: (31) general lateral view, (32) general dorsal view.

Dioctria rufipes (De Geer 1776)*

Materials. Saransk, 03.VI.2009, 1 ♂ (A.B. Ruchin); Ruzaevka district, settlement Levzhensky, 09.VI.2009, 1 specimen with damaged abdomen (A.B. Ruchin); Ruzaevka district, settlement Levzhensky, 21.VI.2009, 1 ♀ (A.B. Ruchin); Bolshie Berezniki district, village Degilevka, 12.VI.2015, 1 ♀ (A.B. Ruchin).

Distribution. Russia: northwest, middle zone and south of the European part, Western Siberia. England, France, the Netherlands, Denmark, Germany, Austria, Italy, Sweden, Finland, Poland, Hungary, Romania; Ukraine, Bulgaria, the Caucasus, Kazakhstan, Kyrgyzstan, Mongolia (Stakelberg 1954; Richter 1964, 1969; Lehr 1965; 1999; Astakhov 2015; Lehr 1988).

Subfamily Leptogastrinae

Leptogaster cylindrica (De Geer 1776)

Literature. Plavilshchikov (1964); Antsiferova and Dobrosmyslov (1966); Antsiferova (1979).

Materials. Tengushevo district, village Khlebino, 18.VI.2015, 1 ♂ (A.B. Ruchin); Temnikov district, Mordovia State Nature Reserve, cordon Inorsky, 05.VII.2016, 1 ♀ (A. A. Zvonov); square 421, 13.VI.2016, 1 ♀ (A.B. Ruchin); Tengushevo district, settlement Barashevo, 30.VI.2013, 1 ♀ (A.B. Ruchin); Atyashevo district, village Selishchi, 24.VI.2016, 1 ♀ (A.B. Ruchin); Bolshie Berezniki district, 6 km SE village Permisi, 12.VI.2015, 1 ♀ (A.B. Ruchin).

Distribution. Transpalearctic species (Richter 1969; Lehr 1999; Astakhov 2015).

Subfamily Stichopogoninae

Lasiopogon cinctus (Fabricius 1781)

Literature. Plavilshchikov (1964)

Materials. Tengushevo district, settlement Barashevo, V.2008, 1 ♀ (A.B. Ruchin).

Distribution. Russia: the European part; Caucasus. Northern and Middle zone of Western Europe, Eastern Europe (Richter 1968; Lehr 1988).

Subfamily Brachyrhopalinae

Cyrtopogon luteicornis (Zetterstedt 1842)*

Materials. Temnikov district, Mordovia State Nature Reserve, cordon Steklyannyi, 18.V.2018, 1 ♀ (G. B. Semishin).

Distribution. Russia: the north of the European part; Finland (Lehr 1988, 1998).

Note. This record allowed to clarify the southern boundaries of the species range.

RESULTS AND DISCUSSION

Thus, we have indicated for the first time 19 new species for the Republic of Mordovia. Some species were found on the northern limits of their ranges (*Dysmachus stylifer* Loew, *Neoepitriptus setosulus* Zeller, *Dioctria flavipennis* Meigen, *Cyrtopogon luteicornis* Zetterstedt). The boundaries of the ranges of several species are clarified. We found that two species (*Neoepitriptus*

setosulus, *Dioctria flavipennis*) are located to the north of the main part of the ranges. Locations of one more species (*Cyrtopogon luteicornis*) are to the south of the main part of the range.

The most numerous species in the study area were *Tolmerus atricapillus* Fallén, *Choerades fuliginosa* Panzer, *Laphria flava* Linnaeus, *Didymachus picipes* Meigen, *Machimus gonatistes* Zeller and *Dioctria atricapilla* Meigen. Less abundant, but fairly common were *Choerades gilva* Linnaeus, *Choerades ignea* Meigen, *Choerades marginata* Linnaeus, *Laphria gibbosa* Linnaeus, *Andrenosoma albibarbe* Meigen, *Dysmachus fuscipennis* Meigen, *Dysmachus styliifer* Loew, *Pamponerus germanicus* Linnaeus, *Philonicus albiceps* Meigen, *Neoitamus cyanurus* Loew, *Neoitamus socius* Loew, *Tolmerus cingulatus* Fabricius, *Dioctria hyalipennis* Fabricius and *Leptogaster cylindrica* De Geer. The group of rare and non-numerous species included *Laphria ephippium* Fabricius, *Andrenosoma atra* Linnaeus, *Echthistus rufinervis* Meigen, *Rhadiurgus variabilis* Zetterstedt, *Machimus rusticus* Meigen, *Neoepitriptus setosulus* Zeller, *Neoitamus cothurnatus* Meigen, *Dioctria flavipennis* Fabricius, *Dioctria rufipes* De Geer, *Lasiopogon cinctus* Fabricius and *Cyrtopogon luteicornis* Zetterstedt.

To nowadays, there are a number of studies conducted in regions adjacent to the Republic of Mordovia. In the Chuvash Republic, Volkova (1934) noted 12 species of robber flies (*Leptogaster cylindrica*, *Dioctria oelandica*, *D. hyalipennis*, *Laphria gibbosa*, *Choerades ignea*, *Asilus crabroniformis*, *Didymachus picipes*, *Pamponerus germanicus*, *Neoitamus cyanurus*, *Neoitamus socius*, *Tolmerus atricapillus*, *Epitriptus cingulatus*). Currently, 36 species from 17 genera are known from the Ulyanovsk region (Maslennikov 2016). Long-term (1980-2008) studies in the Samara Region allowed to identify 62 species from 23 genera for this area (Lyubvina 2011). The fauna of robber flies of the Lower Volga region is represented by 111 species from 50 genera (Astakhov 2015; Lehr 1960). These data from different areas of the European Russia and the landscape diversity in Mordovia located at the border of forest and steppe zones indicate that the robber flies fauna of the region is still not completely understood. And additional research is needed to clarify the biodiversity of the group.

ACKNOWLEDGEMENTS

The authors are grateful to A.A. Khapugin (Tyumen State University, Tyumen, Russia) for valuable comments. The reported research was funded by Russian Foundation for Basic Research and the government of Volgograd region, grant № 18-44-343001.

REFERENCES

Antsiferova TA. 1979. Insect community of Alfalfa and its seed productivity. In: Ecological-faunistic investigations in Non-

- chernozem zone of the European part of the USSR. Vol. 2. Saransk. [Russian]
- Antsiferova TA, Dobrosmyslov PA. 1966. Entomofauna of oats-vetch-phacelium and oats-vetch mixtures in the Mordovian ASSR. In: Ecological-faunistic relationships of selected groups of invertebrates and vertebrates. Mordovia Book Publishing House, Saransk. [Russian]
- Astakhov DM. 2011. Robber fly species (Diptera: Asilidae) new to the lower Volga area. *Zoosystematica Rossica* 20 (2): 338-339.
- Astakhov DM. 2013. Landscape and stational distribution of the robber flies (Diptera, Asilidae) in the Lower Volga area. *Entomol Rev* 93 (8): 1005-1023. DOI: 10.1134/S0013873813080083
- Astakhov DM. 2015. Predatory Robber Flies (Diptera, Asilidae) of the Lower Volga Area. *Trudy Russkogo Entomologicheskogo Obshchestva* 86 (1): 410 p. [Russian]
- Budaeva IA, Ruchin AB. 2014. To the fauna of blackflies (Diptera: Simuliidae) of the Republic of Mordovia (Russia). *Caucasian Entomological Bull.* 10 (1): 155-159. [Russian]
- Budaeva IA, Ruchin AB. 2016. To the fauna of horseflies (Diptera: Tabanidae) of the Republic Mordovia (Russia). *Belgorod State University Scientific Bulletin. Nat Sci* 35 (11): 85-93. [Russian]
- Chursina MA, Ruchin AB. 2018a. A checklist of Bombyliidae (Diptera) from Mordovia, Russia and variation of wing shape in *Bombylius* species. *Biodiversitas* 19 (6): 2147-2156. DOI: 10.13057/biodiv/d190622
- Chursina MA, Ruchin AB. 2018b. A checklist of Syrphidae (Diptera) from Mordovia, Russia. *Halteres* 9: 57-73. DOI: 10.5281/zenodo.1255874
- Dikow RB, Frandsen PB, Turcatel M, Dikow T. 2017. Genomic and transcriptomic resources for assassin flies including the complete genome sequence of *Proctacanthus coquillettii* (Insecta: Diptera: Asilidae) and 16 representative transcriptomes. *PeerJ* 5: e2951.
- De Bree E, Van den Broek R, Smit JT. 2014. De gouden stamjager *Choerades igneus* nieuw voor Nederland (Diptera: Asilidae) 43: 47-54. [Dutch]
- Dennis DS. 2018. Ethology of *Holopogon snowi* Back, 1909 (Diptera: Asilidae) in Northeastern Florida, USA. *J Entomol Res Soc* 20: 95-112.
- Dennis DS, Lavigne RJ. 1975. Comparative behavior of Wyoming robber flies II (Diptera: Asilidae). *University of Wyoming Agric Exp Stn Sci Monogr* 30: 1-68.
- Dennis DS, Lavigne RJ, Dennis JG. 2012. Spiders (Araneae) as prey of robber flies (Diptera: Asilidae). *J Entomol Res Soc* 14: 65-76.
- Engel EO. 1930. Asilidae. In: E. Lindner (ed.). *Die Fliegen der palaearktischen Region*. Stuttgart: Schweizerbart 24. 491 p.
- Kornev II, Akseenko EV, Ruchin AB. 2016 New data of the fauna and distribution of the genus *Bibio* Geoffroy, 1762 (Diptera: Bibionidae) of the Republic of Mordovia (Russia). *Ukrainska Entomofaunistyka* 7 (4): 55-56. [Russian]
- Lehr PA. 1960. Robber flies of the genus *Habropogon* (Asilidae, Diptera) of the Kazakhstan and of Middle Asia. *Akademiia Nauk KSSR, Trudy Instituta Zoologii* 11: 180-192. [Russian]
- Lehr PA. 1965. Robber flies of the tribe Dioctriini of Kazakhstan and Central Asia. *Trudy nauchno-issledovatel'skogo instituta zashchity rasteniy* 9: 184-199. [Russian]
- Lehr PA. 1971. Mode of life and significance of *Machimus rusticus* Meig., (Diptera, Asilidae) and related species of robber flies. *Biologicheskoe nauki. Alma-Ata* 3: 203-213. [Russian]
- Lehr PA. 1981. Robber flies of the subtribe of Machimini Lehr. *Notice 1. Pauki i nasekomye Dal'nego Vostoka. Vladivostok. Trudy Biologopochvenno instituta* 85 (188): 90-128.
- Lehr PA. 1988. Family Asilidae. In: Á. Soós (ed.). *Catalogue of Palaearctic Diptera. Athericidae-Asilidae*, 5. Budapest: Akademiai Kiadó. 197-326.
- Lehr PA. 1989. Robber-flies of the subfamily Laphriinae (Diptera, Asilidae) of the fauna of the USSR. *Entomologicheskoye obozrenie* 68 (2): 406-421. [Russian]
- Lehr PA. 1991. Revision of robber flies of the genus *Choerades* Walker, 1851, and notes on the structure of the subfamily Laphriinae (Diptera, Asilidae). *Entomologicheskoye obozrenie* 70 (3): 694-715. [Russian]
- Lehr PA. 1992. «Small» genera of robber flies of the subfamily Asilinae (Diptera, Asilidae). I. Taxonomy and ecology. *Zoologicheskii Zhurnal* 71 (5): 91-105. [Russian]
- Lehr PA. 1996. Robber Flies of the Subfamily Asilinae (Diptera, Asilidae) of the Palaearctic Region. *Ecological-Morphological Analysis, Systematics, and Evolution. Dal'nauka, Vladivostok*. 184 p. [Russian]

- Lehr PA. 1998. Robber-flies of the genus *Cyrtopogon* Loew, 1847 (Diptera, Asilidae) of the Palaearctic. *Entomologicheskoye obozrenie* 77 (4): 860-887. [Russian]
- Lehr PA. 1999. Fam. Asilidae - Robber flies. In: Sidorenko V.S. (Ed.), Key to the insects of Russia Far East. Vol. VI. Diptera and Siphonaptera. Pt. 1. Dalnauka, Vladivostok, pp. 591-640. [Russian]
- Lehr PA. 2001. Robber flies of the subfamily Dioctriinae, stat. n. (Diptera, Asilidae) of Asia. I. Taxonomy, ecology and phylogeny. *Entomologicheskoye obozrenie* 80 (1): 194-208. [Russian]
- Londt JGH. 2006. Predation by Afrotropical Asilidae (Diptera): an analysis of 2000 prey records. *Afr Entomol* 14 (2): 317-328.
- Lyubvina IV. 2011. On the fauna of robber-flies (Diptera, Asilidae) of Samara region. *Izvestiya of Samara Scientific Center of the Russian Academy of Sciences* 13 (1), 135-138. [Russian] <https://doi.org/10.5962/bhl.part.20540>
- Maslennikov VA. 2016. Ecological and faunistic review robber flies (Diptera: Asilidae) of the Ulyanovsk province. *XXX Luybitshevskie chtenija* 404-413. [Russian]
- Mohammadi R, Khaghaninia S, Astakhov DM. 2017. Study of the robber flies (Diptera: Asilidae) in East and West Azerbaijan provinces of Iran, with two new species record for the country. *J Biodivers Syst* 3 (3): 247-255.
- Moreira DP, Maia VC. 2018. Asilidae (Diptera) of two Atlantic Forest protected areas of Rio de Janeiro, Southeastern Brazil. *Anais Da Academia Brasileira De Ciencias* 90 (2): 1579-1589. DOI: 10.1590/0001-3765201720170695
- Plavilshchikov NN. 1964. A list of insect species found in the Mordovian State Nature Reserve. *Proceedings of the Mordovia State Nature Reserve* 2: 105-134. [Russian]
- Redikortsev VV. 1938. Materials to the entomofauna of the Mordovia State Nature Reserve. In: Fauna of the Mordovia State Nature Reserve: Scientific results of the zoological expedition under the guidance of Prof. S.S. Turov in 1936. Moscow. [Russian]
- Richter VA. 1964. Zoogeographical characteristics of the robber flies fauna (Diptera, Asilidae) of the Caucasus. *Entomologicheskoe Obozrenie* 43 (2): 335-346. [Russian]
- Richter VA. 1968. "Predacious Robber Flies (Diptera, Asilidae) of the Caucasus," in Keys to the Fauna of the USSR, Published by the Zoological Institute, Academies of Sciences of the USSR (Nauka, Leningrad, 1968), 97: 1-285 [Russian].
- Richter VA. 1969. Family Asilidae, In: Key to the Insects of the European Part of the USSR. Diptera and Siphonaptera, Ed. by Stackelberg AA, Nartshuk EP. (Nauka, Leningrad), 5 (1): 504-531. [Russian]
- Ruchin AB. 2008. List of insect species of National Park «Smolny». *Proc Natl Park «Smolny»* 1: 151-180. [Russian]
- Ruchin AB. 2018. Biology and distribution of the Clouded Apollo *Parnassius mnemosyne* (Linnaeus, 1758) (Lepidoptera: Papilionidae), a rare butterfly in the Republic of Mordovia, Russia. *J Threatened Taxa* 10 (7): 11980-11983. <http://doi.org/10.11609/jot.3709.10.7.11980-11983>
- Ruchin AB, Antropov AV. 2019. Wasp fauna (Hymenoptera: Bethyridae, Chrysididae, Dryinidae, Tiphidae, Mutillidae, Scoliididae, Pompilidae, Vespidae, Sphecidae, Crabronidae & Trigonalidae) of Mordovia State Nature Reserve and its surroundings in Russia. *J Threatened Taxa* 11 (2): 13195-13250. DOI: 10.11609/jot.4216.11.2.13195-13250
- Ruchin AB, Antropov AV, Khapugin AA. 2019a. Distribution, abundance, and habitats of rare species *Parnopes grandior* (Pallas 1771) (Hymenoptera, Chrysididae) in Mordovia and adjacent regions, Russia. *Biodiversitas* 20 (2): 303-310. DOI: 10.13057/biodiv/d200201
- Ruchin AB, Artaev ON. 2016. On expansion of the distribution range of some scoliid wasps (Scoliidae, Hymenoptera, Insecta) in the Middle Volga region. *Res J Pharm, Biol Chem Sci* 7 (3): 2110-2115.
- Ruchin AB, Egorov LV. 2017a. New and interesting species of Coleoptera in the Republic of Mordovia. *Eversmannia* 51-52: 21-26. [Russian]
- Ruchin AB, Egorov LV. 2017b. Overview of insect species included in the Red Data Book of Russian Federation in the Mordovia State Nature Reserve. *Nat Conserv Res* 2 (1): 2-9. doi: 10.24189/ncr.2017.016 [Russian]
- Ruchin AB, Egorov LV. 2018a. Discovery of *Allonyx quadrimaculatus* (Schaller, 1783) (Coleoptera Cleridae Clerinae) in Russia. *Redia* 101: 143-146. <http://dx.doi.org/10.19263/REDIA-101.18.19>
- Ruchin AB, Egorov LV. 2018b. Fauna of longicorn beetles (Coleoptera: Cerambycidae) of Mordovia. *Russ Entomol J* 27 (2): 161-177. doi: 10.15298/rusentj.27.2.07
- Ruchin AB, Egorov LV. 2018c. *Leptura aurulenta* (Coleoptera, Cerambycidae), a new record of a very rare species in Russia. *Nat Conserv Res* 3 (1): 88-91. DOI: 10.24189/ncr.2018.003
- Ruchin AB, Egorov LV. 2018d. On distribution of *Mimela holosericea* (Fabricius, 1787) (Insecta, Scarabaeoidea, Scarabaeidae, Rutelinae) in Russia and adjacent territories. *J Entomol Acarological Res* 50: 7390. doi:10.4081/jea.2018.7390
- Ruchin AB, Egorov LV, Semishin GB. 2018. Fauna of click beetles (Coleoptera: Elateridae) in the interfluvium of Rivers Moksha and Sura, Republic of Mordovia, Russia. *Biodiversitas* 19 (4): 1352-1365. DOI: 10.13057/biodiv/d190423
- Ruchin AB, Egorov LV, Semishin GB. 2019b. Ladybird beetles fauna (Coleoptera: Coccinellidae) of the Republic of Mordovia, Russia. *Biodiversitas* 20 (2): 316-327. DOI: 10.13057/biodiv/d200203
- Ruchin AB, Grishutkin GF. 2018. Biology and distribution of *Parnassius apollo* (Linnaeus, 1758) a rare species in Mordovia Republic, Russia. *Biodiversitas* 19 (2): 431-436. DOI: 10.13057/biodiv/d190210
- Ruchin AB, Kurmaeva DK. 2010. On rare insects of Mordovia included in the Red Book of the Russian Federation. *Entomol Rev* 90 (6): 712-717. DOI: 10.1134/S0013873810060060
- Ruchin AB, Makarkin NV. 2017. Neuroptera and Raphidioptera in the Mordovia State Nature Reserve. *Nat Conserv Res* 2 (2): 38-46. doi: 10.24189/ncr.2017.001 [in Russian]
- Ruchin AB, Mikhailenko AP. 2018. Fauna of mantids and orthopterans (Insecta: Mantodea, Orthoptera) of the Mordovia State Nature Reserve, Russia. *Biodiversitas* 19 (4): 1194-1206. DOI: 10.13057/biodiv/d190403
- Ruchin AB, Pilipenko VE. 2015. Preliminary checklist of the Tipuloidea (Diptera: Limoniidae, Tipulidae) of the Mordovia Republic. *Eversmannia* 41: 57-60. [in Russian with English abstract]
- Semenov VB. 2016. New data on the fauna of Staphylinidae (Coleoptera) of Mordovia. *Proceedings of the Mordovian State Nature Reserve* 16: 431-434. [Russian]
- Stackelberg AA. 1954. Materials on the fauna of Diptera of the Leningrad province II. *Trudy Zoologicheskogo instituta Akademii nauk SSSR* 15: 199-228. [Russian]
- Tomaszewska W, Egorov LV, Ruchin AB, Vlasov DV. 2018. First record of *Clemmus troglodytes* (Coleoptera: Coccinelloidea, Anamorphidae) for the fauna of Russia. *Nat Conserv Res* 3 (3): 103-105. DOI: 10.24189/ncr.2018.016
- Volkova MI. 1934. Diptera of the Chuvash Republic according to the data of the zoological expedition for 1926-29. *Trudy Obshchestva Estestvoispytateley pri Kazanskom Universitete* 53 (2): 70-103. [Russian]