

# Fauna of mantids and orthopterans (Insecta: Mantodea, Orthoptera) of the Mordovia State Nature Reserve, Russia

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**Abstract.** Ruchin A, Mikhailenko AP. 2018. Fauna of mantids and orthopterans (Insecta: Mantodea, Orthoptera) of the Mordovia State Nature Reserve, Russia. *Biodiversitas* 19: 1194-1206. The data on the distribution and habitat confinement of one Mantodea species and 44 Orthoptera species in the Mordovia State Nature Reserve are given. Of these, one species of Orthoptera (*Calliptamus italicus*) is recorded for the first time for the Mordovia State Nature Reserve, four species (*Mantis religiosa*, *Phaneroptera falcata*, *Conocephalus fuscus*, *Tettigonia caudata*) are recently penetrated, one species (*Conocephalus fuscus*) is reported in the Republic of Mordovia for the first time. In the fauna of mantids and orthopterans of the Mordovia Reserve, three ecological groups were identified: polytopic, not confined to certain biotopes (14 species), hygrophilous representatives of intrazonal habitats (5 species) and xerophiles. Among the latter, there are species of extrazonal habitats (13 species) and confined to dry pine forests (7 species). The steppe group was not represented. For the three key habitats with the largest number of identified species, brief botanical descriptions are given. Factors influencing the species composition and current state of fauna of mantises and orthopterans of the Mordovia Reserve are discussed, and measures are proposed for the conservation of vulnerable species.

**Keywords:** Mantodea, Orthoptera, fauna, Mordovia State Nature Reserve, Republic of Mordovia

## INTRODUCTION

Mantises and orthopterans (Insecta: Mantodea, Orthoptera) are characteristic components of natural communities of diverse landscapes and form an integral part of the fauna of consumers in a significant proportion of phytocenoses (Latchininsky et al. 2011). Possessing good abilities to fly, and, accordingly, to resettle, many orthopterans actively explore new territories. For example, in recent years and in Europe and Russia, there has been a tendency to move to the north and northeast in species such as *Phaneroptera falcata* (Poda, 1761) (Böhme et al. 2011; Ivinskis and Rimšaitė 2008; Kočárek et al. 2008; Samietz et al. 2014), *Conocephalus fuscus* (Fabricius, 1793) (Kleukers et al. 1996; Ozersky 2012), *Mantis religiosa* (Linnaeus, 1758) (Cannings 2007; Bolshakov et al. 2010; Linn and Griebeler 2016), *Oecanthus pellucens* (Scopoli, 1763) (Sackl and Zechner, 1999), *Metrioptera roeselii* (Hagenbach, 1822) (Hochkirch and Damerau 2009; Kaňuch et al. 2013) and others. The thermophily of the majority of orthopteran species leads to a significant reduction of their species number and biomorphological spectrum in the forest zone. In this connection, the main habitats of the orthopteran species are various open biotopes, which in these conditions of management often turn out to be transformed. The distribution and phytocenotic characteristics of these biotopes are in many ways the product of the historical relationship between man and nature in each particular region. On the contrary, orthopterans with limited dispersal capacity can serve as

indicators of undisturbed, primary landscapes, fragments of which are still preserved in sparsely populated areas of the forest zone.

A significant role in the conservation of biodiversity of geographic zones is assigned to Protected Areas (Grebennikov 2016). The compilation of faunistic lists of insects for individual territories is the first important step in the study of biodiversity, since knowledge of the fauna of the region is an essential foundation for all further biological research. In a number of Russian nature reserves and national parks, studies were conducted on the fauna of Mantodea and Orthoptera. For example, the fauna of these detachments was studied in the Prioksko-Terrasny State Nature Reserve (Kritskaya and Labetskaia 1972), the Central Chernozem State Nature Reserve (Kritskaya and Litvinova 1984), the Bashkir State Nature Reserve (Kopaneva 1985), the Voronezh State Nature Reserve (Emets 2016), the National Park "Sebezhsy" (Saveliev 1999), the «Kaluga Zaseki» State Nature Reserve (Alexanova and Alekseev 2003), the Ilmen State Nature Reserve (Lagunov 2006), the Volga-Kama Reserve (Karmazina and Shulaev 2009), the Kabardino-Balkarian State Nature Reserve (Mokaeva 2010), the National Park «Nizhnyaya Kama» (Zhukov 2015), the National Park «Samarskaya Luka» (Benediktov 2017).

However, in the territory of the Mordovia State Nature Reserve extensive studies have not been conducted so far. Some fragmentary information about the fauna of this group was obtained in the late 1930s and mid-1940s. N.N. Plavilshchikov (1964) published a list of integrated

material on the entomofauna of the Mordovia Reserve, where 37 species of orthopterans were indicated. Later, in the presence of new material and to refine the results of past studies, a report was published on the orthopterans of the Mordovia State Nature Reserve, which included 40 species (Ruchin et al. 2013). At the same time from the previously mentioned species 9 species were excluded (*Meconema thalassinum* (DeGeer, 1771), *Pholidoptera fallax* (Fischer, 1854), *Euprepocnemis plorans* (Charpentier, 1825), *Stenobothrus fischeri* (Eversmann, 1848), *Omocestus petraeus* (Brisout, 1856), *Eremippus simplex* (Eversmann, 1859), *Ochrilidia hebetata* (Uvarov, 1927), *Duroniella kalmyka* (Adelung, 1906), *Bryodemis gebleri* (Fischer von Waldheim, 1836) by different authors (Redikortsev 1938; Plavilshchikov 1964). In this paper we

present updated information on the fauna of mantids and orthopterans of the Mordovia State Nature Reserve, identify the distribution of representatives of these orders in the biotopes within the studied territory, identify several ecological groups of local orthopterofauna, describe the characteristic habitats of species and discuss conservation of rare and vulnerable species in recent conditions.

### MATERIALS AND METHODS

The Mordovia State Nature Reserve is located in the Temnikov district of the Republic of Mordovia on the forested right bank of the Moksha river and covers an area of 321.62 km<sup>2</sup> (Figure 1).



Figure 1. Mordovia State Nature Reserve, Russia location and study sites (red dots)



**Figure 2.** Typical biotopes of the Mordovia State Nature Reserve, Russia. A. Floodplain meadow (cord. Plotomoyka, author: G.B. Semishin); B. Meadow (cord. Inorskiy, author: G.B. Semishin); C. Glades in a mixed forest (quar. 420, author: G.B. Semishin); D. Floodplain meadows with adjacent oak forest (quar. 376, author: O.N. Artaev)

From the north the border runs along the Satis river—the right tributary of the Moksha, further to the east along the Arga river, which flows into the Satis river. The western border runs along the rivers Chernaya, Satis and Moksha. From the south the forest-steppe approaches naturally delineating the boundary of the reserve massif. By natural zoning the forest tract of the Mordovia State Nature Reserve belongs to the zone of coniferous-deciduous forests on the border with the forest-steppe. Forest communities occupy 89.3% of the total territory. In general, the vegetation cover of the Mordovia State Nature Reserve has a taiga character with a definite gravitation towards a nemoral complex during successions. The participation of forest-steppe elements is typical for this territory. Pine (*Pinus sylvestris* L.) is the main forest tree in the Mordovia State Nature Reserve. It forms pure or mixed plant communities in the southern, central and western parts of the Mordovia Reserve. Birch (*Betula pendula* Roth) forests occupy the second place in the forest area of the Mordovia Reserve. These are predominantly secondary communities at the sites of cut and burnt pine forests. Especially a lot of young birch forests are at places damaged by wildfire in 2010. Lime (*Tilia cordata* Mill.) forests are located mainly in the northern part of the Mordovia State Nature Reserve. These are secondary plant

communities that arose on the site of pine forests and lime-spruce forests. Oak (*Quercus robur* L.) forests occupy a relatively small area of the Mordovia Reserve. They are common in the Moksha river floodplain in the western part of the reserve. Spruce (*Picea abies* L.) and alder (*Alnus glutinosa* (L.) Gaertn.) forests are located mainly in floodplains of rivers and streams (Pushta, Vyaz-Pushta, Vorsklaia, Arga, etc.) and occupy small areas. Plant communities of small-leaved tree species (birch, aspen, alder) are formed on burnt forest areas (Khapugin et al. 2016). The main areas of floodplain meadows are located along the Moksha river in the south-west of the Mordovia State Nature Reserve. The territory of the reserve is conditionally divided into quarters. Their numbering begins from the north and continues from west to east (Figure 1, 2).

Material was collected in the seasons 2011-2017 using generally accepted entomological methods of field research (Fasulati, 1971). In 2017, in addition, the method of bioacoustic monitoring was used (Benediktov and Mikhailenko 2017), in particular to detect species of the morphologically difficult group *Chorthippus* (*Glyptobothrus*) *biguttulus* gr. In total, over 60 habitats were surveyed during the survey. More than 2,000 specimens were collected and processed.



In the annotated list below, references are given for each species to the literature with indications for the territory of the Mordovia Reserve. In the section „Results" new collection points (previously unpublished data, quarters are listed in increasing numbering order), date of collection, number of collected specimens, surname of the collector are listed. In the absence of the surname of the collector, the material was compiled by the first author of the article. For the species, we have found, original information about their biotopic confinedness in the Mordovia Reserve and characteristics of some key habitats are given. The name of the first recorded species for the Republic of Mordovia is marked with an asterisk (\*), species first recorded in the Mordovia Reserve-with two asterisks (\*\*). The "?" sign indicates species whose status requires confirmation by new collected material.

A systematic list is given according to Bei-Bienko and Mishenko (1964) and Sergeev (1986). The nomenclature is used according to Cigliano et al. (2018). The genera *Bicolorana*, *Roeseliana* and *Pseudochorthippus* are considered as subgenera in the genera *Metrioptera* and *Chorthippus*, respectively. The common Latin synonyms are given for some species. All the collection material is stored in the funds of the Museum of the Mordovia State Nature Reserve (Pushta), in the Biological Museum of the Mordovia State University (Saransk) and in the personal collections of the authors.

Abbreviations used in the work: exemplar-ex, quarter-quar., cordon-cord.

## RESULTS AND DISCUSSION

### MANTODEA

#### Mantidae

*Mantis religiosa* (Linnaeus, 1758)

**Literature.** Ruchin 2014, 2016.

**Material.** quar. 86, cord. Steklyannyi, 8.VIII.2016, 1 ex., Khapugin A.A.; quar. 330/358, 10.VIII.2016, 1 ex., Sharikov M.V.; Pushta, 20.VIII.2015, 13.VIII.2016, 2 ex.; quar. 420, 22.VIII.2016, 1 ex.; quar. 436, 19.VIII.2016, 1 ex.; quar. 377, 03.IX.2016, 1 ex.; quar. 59, 23.VIII.2016, 1 ex.

**Biotopes.** In meadows, roadsides, kitchen gardens, clearings, in sparse forest shelterbelts, can come across in the depths of the forest and fly to the light.

### ORTHOPTERA

#### Tettigoniidae

*Phaneroptera falcata* (Poda, 1761)

**Literature.** Ruchin et al. 2013.

**Material.** cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 3.VIII.2014, 1 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 82, 28.VII.2015, 1 ex.; quar. 85, 23.VIII.2016, 1 ex.; quar. 115, 3.VIII.2014, 1 ex.; quar. 330, 4.VIII.2013, 2 ex.; quar. 368,

21.VII.2013, 1 ex.; quar. 408, cord. Dolgy most, 15.VII.2013, 1 ex.; quar. 427, 20.VII.2013, 1 ex.; cord. Drozhdenovsky, quar. 434, 18.VIII.2013, 1 ex.;

**Biotopes.** On floodplain and elevated meadows, clearings, glades, roadsides.

\* *Conocephalus (Anisoptera) fuscus* (Fabricius, 1793) (= *discolor* Thunberg, 1815)

**Material.** quar. 85, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 79, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 377, 03.IX.2016, 1 ex.; quar. 401, cord. Taratinsky, 16.VIII.2015, 1 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 12.IX.2017, 3 ex.

**Biotopes.** In meadows with varying degrees of moisture, near water and roads on ruderal vegetation.

*Conocephalus (Anisoptera) dorsalis* (Latreille, 1804)

**Literature.** Redikortsev 1938; Ruchin et al. 2013.

**Material.** quar. 368, 24.VIII.2017, 1 ex., Mikhailenko A.P.

**Biotopes.** Near the water on the coastal grassy vegetation. It is locally rare, known only in the Mordovia State Nature Reserve.

*Tettigonia viridissima* (Linnaeus, 1758)

**Literature.** Ruchin et al. 2013.

**Material.** cord. Dolgy most, 15.VII.2013, 1 ex.; quar. 427, 20.VII.2013, 1 ex.; quar. 431, 23.VI.2013, glade, 1 ex.; quar. 398, 24.VII.2016, 1 ex.; cord. Inorsky, quar. 436, 28.VI.2015, 1 ex.; quar. 419, 22.VIII.2016, 2 ex.; quar. 420, 6.VIII.2017, 1 ex.; quar. 448, 19.VIII.2016, 1 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 03.IX.2015, 06.IX.2014, 5.VIII.2016, 4 ex.

**Biotopes.** In meadows of various types, usually dry, on glades and fringes, often on trees, can fly to the light.

*Tettigonia caudata* (Charpentier, 1845)

**Literature.** Ruchin et al. 2013.

**Material.** quar. 85, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 276, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 448, 19.VIII.2016, 1 ex.

**Biotopes.** On dry and steppe meadows, near roads on ruderal vegetation.

*Tettigonia cantans* (Fuessly, 1775)

**Literature.** Plavilshchikov 1964; Ruchin et al. 2013.

**Material.** cord. Novenky, 26.VI.2016, 1 ex., Zvonov A.A.; cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 276, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 324, 15.VII.2017, 1 ex.; quar. 376, 19.VI.2016, 1 ex.; quar. 386, 7.VII.2016, 2 nymphs; cord. Polyansky, 3.VII.2016, 1 ex., Zvonov A.A.; quar. 401, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Dolgy most, 15.VII.2013, 1 ex.; quar. 411, 7.VII.2016, 1 ex.; quar. 421, 8.VI.2014, 1 ex.; cord. Inorsky, quar. 436, 15.VIII.2014,

23.VIII.2016, 2 ex.; quar. 448, 19.VIII.2016, 1 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 12.VI.2016, 13.VIII.2016, 2 ex.

**Biotopes.** In meadows of various types, in sparse forests of various composition, in forest glades and fringes, near water, on bush and trees.

*Decticus verrucivorus* (Linnaeus, 1758)

**Literature.** Redikortsev 1938; Ruchin et al. 2013.

**Material.** cord. Plotomoyka, 3.VIII.2014, 1 ex.; quar. 86, cord. Steklyannyi, 4.VIII.2015, 1 ex.; ibid, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 114, 24.VIII.2017, 1 ex.; quar. 249, 13.VIII.2015, 1 ex.; quar. 283, 4.VII.2015, 1 ex.; quar. 324, 15.VII.2017, 1 ex.; quar. 330, 4.VIII.2013, 1 ex.; quar. 358/389, 14.VI.2013, 1 ex.; quar. 368, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 384, 20.VII.2013, 23.VIII.2015, 3 ex.; quar. 397, 17.VIII.2014, 1 ex.; cord. Dolgy most, 15.VII.2013, 1 ex.; quar. 417, 20.VIII.2016, 1 ex.; quar. 420, 24.VIII.2016, 1 ex.; quar. 424, 4.VIII.2013, 1 ex.; quar. 427, 20.VII.2013, 1 ex.; cord. Inorsky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Drozhdenovskiy, quar. 434, 18.VIII.2013, 1 ex.; quar. 448, 10.VIII.2016, 1 ex.; Pushta, 24.VII.2014, 1.VIII.2015, 15.VIII.2016, 30.VIII.2017, 7 ex.

**Biotopes.** In meadows, mainly dry, on forest glades, near roads, on glades and other areas with disturbed vegetation.

*Metrioptera (Metrioptera) brachyptera* (Linnaeus, 1761)

**Literature.** Redikortsev 1938; Ruchin et al. 2013.

**Material.** quar. 59, 23.VIII.2016, 1 ex.; quar. 80, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 368, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 398, 24.VII.2016, 1 ex.

**Biotopes.** In steppe meadows, glades and fringes of pine forests. It is locally rare, known only in the Mordovia State Nature Reserve.

*Metrioptera (Bicolorana) bicolor* (Philippi, 1830)

**Literature.** Plavilshchikov 1964; Ruchin et al. 2013.

**Material.** cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 330, 4.VIII.2013, 1 ex.; quar. 338, 21.VII.2013, 3.VII.2016, 7 ex.; quar. 368, 21.VII.2013, 1 ex.; quar. 384, 20.VII.2013, 1 ex.; quar. 408, 23.VIII.2016, 1 ex.; quar. 413, 4.VIII.2017, 1 ex.; quar. 417, 20.VIII.2016, 1 ex.; quar. 419, 6.VIII.2017, 1 ex.; quar. 420, 6.VIII.2017, 1 ex.; quar. 434, 22.VIII.2015, 1 ex.; cord. Inorsky, quar. 436, 15.VIII.2014, 28.VI.2015, 1.VIII.2015, 23.VIII.2016, 23.VIII.2017, 28 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 27.VII.2013, 2 ex.

**Biotopes.** In meadows of different composition and degree of moisture, except wet, on forest glades in thin dry pine forests.

*Metrioptera (Roeseliana) roeselii* (Hagenbach, 1822)

**Literature.** Feoktistov 2011; Ruchin et al. 2013.

**Material.** cord. Novenkovskiy, 13.VII.2014, 1 ex.; ibid, 26.VI.2016, 2 ex., Zvonov A.A.; cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 59, 23.VIII.2016, 1 ex.; quar. 80, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 249, 13.VIII.2015, 1 ex.; quar. 324, 16.VIII.2015, 15.VII.2017, 2 ex.; quar. 351, 16.VIII.2015, 2 ex.; quar. 368, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 377, 03.IX.2016, 1 ex.; quar. 384, 20.VII.2013, 6 ex.; quar. 393, 20.VIII.2016, 2 ex.; quar. 399, 17.VIII.2014, 2 ex.; quar. 400, 13.VIII.2015, 1 ex.; cord. Taratinskiy, 16.VIII.2015, 4 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 402, 03.IX.2016, 3 ex.; cord. Dolgy most, quar. 408, 15.VII.2013, 2 ex.; quar. 413, 4.VIII.2017, 1 ex.; quar. 434, 22.VIII.2015, 1 ex.; quar. 421, 03.IX.2016, 6 ex.; cord. Inorsky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 448, 3.VIII.2013, 1 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.

**Biotopes.** In meadows, mainly wet, in relief depressions, near water, on forest glades, on roadsides and other disturbed places with ruderal vegetation.

*Pholidoptera griseoaptera* (De Geer, 1773) (= *cinerea* (Gmelin in Linnaeus, 1789))

**Literature.** Feoktistov 2011; Ruchin et al. 2013.

**Material.** cord. Srednyaya Melnitsa, 31.IX.2013, 2 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Steklyannyi, 12.VIII.2013, 2 ex.; quar. 338, 3.VII.2016, 1 nymph; 358/389 quar., 20.V.2013, 1 ex.; quar. 403, 5.VII.2015, 1 ex.; quar. 408, 19.V.2013, 4.IX.2013, 08.IX.2014, 7 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 22.VII.2013, 1 ex.

**Biotopes.** On the fringes and glades in deciduous and mixed forests.

## Gryllidae

*Gryllus campestris* Linnaeus, 1758

**Literature.** Ruchin et al. 2013.

**Biotopes.** Floodplain meadows, on elevated dry plots with a dilute grass cover, in mink. Position is highly local.

*Modicogryllus frontalis* (Fieber, 1844)

**Literature.** Feoktistov 2011; Ruchin et al. 2013.

**Material.** Pushta, 1.IV.2012, 12.V.2014, 2 ex.; cord. Inorsky, 21.V.2016, 1 ex.

**Biotopes.** In the meadows, near the dwelling, it is attracted to the light and falls into the premises. It is locally rare, known only in the Mordovia State Nature Reserve.

## Gryllotalpidae

*Gryllotalpa gryllotalpa* (Linnaeus, 1758)

**Literature.** Plavilshchikov 1964; Ruchin et al. 2013.

**Material.** quar. 85, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 401, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Novenkovskiy, 26.VI.2016, 1 ex., Zvonov A.A.; Pushta, 12.V.2013, 25.V.2015, 19.VIII.2016, 27.VIII.2017, 8 ex.

**Biotores.** Floodplain meadows, as a rule, near water, in wet peaty or sandy-silty soil.

### Tetrigidae

*Tetrix subulata* (Linnaeus, 1758)

**Literature.** Feoktistov 2011; Ruchin et al. 2013.

**Material.** cord. Srednyaya Melnitsa, 29.V.2013, 27.VI.2013, 1.VIII.2013, 5 ex.; quar. 59, 23.VIII.2016, 1 ex.; cord. Steklyannyi, 28.V.2013, 1 ex.; cord. Podrubny, 9.VI.2013, 1 ex.; quar. 278, 14.V.2016, 4 ex.; quar. 358/389, 20.V.2013, 14.VI.2013, 7 ex.; quar. 368, 10.V.2015, 1 ex.; quar. 377, 03.IX.2016, 2 ex.; quar. 402, 03.IX.2016, 1 ex.; quar. 404, 26.V.2016, 1 ex.; quar. 408, 19.V.2013, 31.VII.2013, 4.IX.2013, 5.V.2015, 23.VIII.2016, 20.V.2017, 54 ex.; quar. 421, 11.V.2014, 03.IX.2016, 10 ex.; quar. 424, 23.VIII.2016, 2 ex.; quar. 430, 12.VI.2016, 1 ex.; quar. 431, 9.V.2013, 2 ex.; cord. Drozhdenovskiy, quar. 434, 18.VIII.2013, 1 ex.; quar. 435, 13.VI.2016, 1 ex.; cord. Inorsky, 9.VI.2013, 10.V.2013, 19.IV.2014, 23.VIII.2016, 14.V.2017, 8 ex.; quar. 448, 3.VIII.2013, 1 ex.; Pushta, 30.IV.2013, 1.V.2013, 27.V.2013, 12.IX.2017, 8 ex.

**Biotores.** In various habitats with low vegetation, except dry: near water, in meadows, glades.

*Tetrix tenuicornis* (Sahlberg, 1893)

**Literature.** Ruchin et al. 2013.

**Material.** quar. 408, 31.VII.2013, 4.IX.2013, 32 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.

**Biotores.** In humid and moderately humid habitats with rare vegetation: in meadows, near roads and housing. It is locally rare, known only in the Mordovia State Nature Reserve.

*Tetrix bipunctata* (Linnaeus, 1758)

**Literature.** Feoktistov 2011; Ruchin et al. 2013.

**Material.** cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 308, 11.VI.2016, 2 ex.; quar. 338, 21.VII.2013, 3.VII.2016, 2 ex.; quar. 345, 22.VIII.2015, 1 ex.; quar. 384, 20.VII.2013, 10.V.2016, 2 ex.; quar. 368, 21.VII.2013, 10.V.2015, 2 ex.; quar. 386, 27.V.2016, 1 ex.; quar. 387, 23.VIII.2015, 1 ex.; quar. 407, 21.V.2016, 3 ex.; 408 quar., 27.VI.2013, 4.IX.2013, 4 ex.; quar. 417, 3.VI.2016, 1 ex.; 420, 31.V.2015, 1 ex.; quar. 427, 30.VI.2014, 10.VIII.2016, 3 ex.; quar. 424, 23.VIII.2016, 1 ex.; quar. 431, 2.VI.2016, 2 ex.; quar. 434, 22.VIII.2015, 1 ex.; cord. Inorsky, quar. 436, 17.VIII.2013, 1 ex.; quar. 442, 2.VI.2016, 2 ex.

**Biotores.** In all points where there are pines: light forests, forest glades, edges.

### Acrididae

*Podisma pedestris* (Linnaeus, 1758)

**Literature.** Redikortsev 1938; Ruchin and Mikhailenko 2013; Mikhailenko and Ruchin 2015.

**Material.** cord. Novenkovskiy, 13.VII.2014, 2 ex.; quar. 86, cord. Steklyannyi, 12.VII.2014, 1 larva.

**Biotores.** Sites with a rare grass cover and bald patches of sand in sparse old-growth pine forests. It is locally rare, known only in the Mordovia State Nature Reserve.

\*\* *Calliptamus italicus* (Linnaeus, 1758)

**Material.** quar. 86, 24.VIII.2017, 1 ex.; quar. 368, 21.VII.2013, 24.VIII.2014, 35 ex.; Pushta, 20.VIII.2017, 2 ex.

**Biotores.** Dry and warmed glades in pine forests, areas with low and rare vegetation. It is locally rare, known only in the Mordovia State Nature Reserve.

? *Stenobothrus nigromaculatus* (Herrich-Schaffer, 1840)

**Literature.** Plavilshchikov 1964; Ruchin et al. 2013; Mikhailenko and Ruchin 2015.

**Note.** From the Mordovia Reserve it is known only from the literature.

*Stenobothrus lineatus* (Panzer, 1796)

**Literature.** Plavilshchikov 1964.

**Material.** quar. 368, 21.VII.2013, 24.VIII.2014, 4 ex.; ibid, 24.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Inorsky, 23.VIII.2017, 1 ex., Mikhailenko A.P.

**Biotores.** In dry herbaceous associations with a dilute grass cover: in steppe meadows and glades in pine forests.

*Omocestus viridulus* (Linnaeus, 1758)

**Literature.** Plavilshchikov 1964.

**Material.** quar. 79, 28.VII.2015, 1 ♀.; quar. 376, 19.VI.2016, 1 ♀.

**Biotores.** In wet habitats on floodplain meadows.

? *Omocestus rufipes* (Zetterstedt, 1821) (=ventralis (Zetterstedt, 1821))

**Literature.** Plavilshchikov 1964.

**Note.** Known only from the literature.

*Omocestus haemorrhoidalis* (Charpentier, 1825)

**Literature.** Redikortsev 1938.

**Material.** quar. 142, 11.VII.2015, 4 ex.; quar. 368, 21.VII.2013, 4.VII.2015, 5 ex.; ibid, 24.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Dolgy most, 14.VII.2013, 15.VII.2013, 3 ex.; quar. 427, 10.VIII.2016, 1 ex.; cord. Inorsky, quar. 436, 1.VIII.2015, 2 ex.; Pushta, 27.VII.2013, 1 ex.

**Biotores.** In a variety of dry habitats, on forest glades, where it prefers sites with a rare grass cover.

*Myrmeleotettix maculatus* (Thunberg, 1815)

**Literature.** Redikortsev 1938; Ruchin et al. 2013; Mikhailenko and Ruchin 2015.

**Material.** quar. 86, cord. Steklyannyi, 12.VII.2014, 4.VIII.2015, 4.VIII.2015, 54 ex.; ibid, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 368, 21.VII.2013, 24.VIII.2014, 24.VIII.2017, 9 ex.; ibid, 24.VIII.2017, 1 ex., Mikhailenko A.P.

**Biotores.** On glades in dry sandy pines. It is locally rare, known only in the Mordovia State Nature Reserve.

? *Chorthippus (Chorthippus) albomarginatus* (De Geer, 1773)

**Literature.** Redikortsev 1938; Plavilshchikov 1964.

**Note.** It is known only from literature data so far. In the republic, as a whole, it populates meadows of various

types, mostly wet. It is locally rare, known only in the Mordovia State Nature Reserve.

*Chorthippus (Chorthippus) dorsatus* (Zetterstedt, 1821)

**Literature.** Plavilshchikov 1964; Ruchin et al. 2013.

**Material.** cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 3.VIII.2014, 1 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 59, 23.VIII.2016, 3 ex.; quar. 80, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 249, 13.VIII.2015, 1 ex.; quar. 324, 16.VIII.2015, 2 ex.; quar. 342, 22.VIII.2015, 2 ex.; quar. 368, 21.VII.2013, 24.VIII.2014, 4 ex.; ibid, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 377, 03.IX.2016, 1 ex.; quar. 384, 23.VIII.2015, 2 ex.; cord. Taratinsky, 16.VIII.2015, 1 ex.; quar. 417, 20.VIII.2016, 2 ex.; quar. 420, 6.VIII.2017, 1 ex.; quar. 421, 03.IX.2016, 1 ex.; cord. Drozhdenovskiy, quar. 434, 18.VIII.2013, 2 ex.; cord. Inorsky, quar. 436, 1.VIII.2015, 3 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 448, 3.VIII.2013, 1 ex.; cord. Novenkiy, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 27.VII.2013, 12.IX.2017, 4 ex.

**Biotope.** In meadows of different degrees of moistening, forest glades.

*Chorthippus (Glyptobothrus) brunneus* (Thunberg, 1815)

**Literature.** Plavilshchikov 1964; Ruchin et al. 2013.

**Material.** quar. 80, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 85, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 303, 18.VII.2016, 1 ex.; quar. 330, 4.VIII.2013, 6 ex.; quar. 368, 21.VII.2013, 21.VII.2013, 4 ex.; ibid, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 408, 14.VII.2013, 1 ex.; quar. 409, 10.VIII.2016, 1 ex.; cord. Inorsky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 27.VII.2013, 2 ex.

**Biotope.** In meadows of various types, except wet, on forest glades, clearings and other disturbed places.

*Chorthippus (Glyptobothrus) biguttulus* (Linnaeus, 1758)

**Literature.** Ruchin et al. 2013.

**Material.** cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 80, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 85, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 330, 4.VIII.2013, 3 ex.; quar. 368, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 401, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 408, 23.VIII.2016, 1 ex.; quar. 417, 20.VIII.2016, 1 ex.; cord. Drozhdenovskiy, quar. 434, 18.VIII.2013, 8 ex.; cord. Inorsky, quar. 436, 17.VIII.2013, 5 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 448, 3.VIII.2013, 5 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 27.VII.2013, 11.IX.2017, 12.IX.2017, 5 ex.

**Biotope.** In meadows, forest clearings and glades, areas with disturbed grass cover, near housing.

*Chorthippus (Glyptobothrus) mollis* (Charpentier, 1825)

**Literature.** Feoktistov 2011.

**Material.** quar. 79, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 324, 15.VII.2017, 1 ex.; quar. 368, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 384, 20.VII.2013, 1 ex.; cord. Taratinsky, 16.VIII.2015, 1 ex.; cord. Inorsky, quar. 436, 17.VIII.2013, 5 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 11.IX.2017, 2 ex.

**Biotope.** In dry and steppe meadows, on clearings, glades and fires in dry pine forests.

*Chorthippus (Glyptobothrus) apricarius* (Linnaeus, 1758)

**Literature.** Redikortsev 1938; Plavilshchikov 1964; Ruchin et al. 2013.

**Material.** cord. Novenkovskiy, 13.VII.2014, 2 ex.; ibid, 26.VI.2016, 1 ex., Zvonov A.A.; cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 3.VIII.2014, 1 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 59, 23.VIII.2016, 2 ex.; quar. 79, 28.VII.2015, 2 ex.; quar. 80, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 85, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 249, 13.VIII.2015, 8 ex.; quar. 274, 13.VIII.2015, 1 ex.; quar. 276, 20.VII.2014, 3 ex.; quar. 283, 4.VII.2015, 3 ex.; quar. 288, 4.VII.2015, 1 ex.; cord. Podrubny, 19.VII.2016, 1 ex.; quar. 322, 13.VIII.2015, 3 ex.; quar. 324, 16.VIII.2015, 4 ex.; quar. 330, 4.VIII.2013, 3 ex.; quar. 331, 18.VII.2016, 1 ex.; quar. 338, 21.VII.2013, 1 ex.; quar. 342, 22.VIII.2015, 6 ex.; quar. 351, 16.VIII.2015, 3 ex.; quar. 357, 4.VIII.2013, 1 ex.; quar. 360, 27.VII.2014, 23.VIII.2015, 9 ex.; quar. 368, 21.VII.2013, 24.VIII.2014, 4.VII.2015, 12 ex.; ibid, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 384, 20.VII.2013, 27.VII.2014, 15 ex.; quar. 387, 23.VIII.2015, 2 ex.; quar. 393, 20.VIII.2016, 1 ex.; quar. 397, 6.VIII.2017, 1 ex.; quar. 398, 24.VII.2016, 4 ex.; quar. 399, 17.VIII.2014, 24.VII.2016, 4 ex.; quar. 401, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 405, 5.VII.2015, 1 ex.; cord. Dolgy most, 15.VII.2013, 23.VIII.2016, 9 ex.; quar. 409, 10.VIII.2016, 1 ex.; quar. 411, 7.VII.2016, 1 ex.; quar. 419, 6.VIII.2017, 1 ex.; quar. 420, 6.VIII.2017, 1 ex.; quar. 421, 03.IX.2016, 2 ex.; quar. 424, 23.VIII.2016, 4 ex.; quar. 427, 23.VIII.2015, 10.VIII.2016, 11 ex.; quar. 434, 22.VIII.2015, 3 ex.; cord. Inorsky, quar. 436, 17.VIII.2013, 1.VIII.2015, 28.VI.2015, 8 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 440, 10.VIII.2016, 6 ex.; quar. 446, 13.VIII.2016, 2 ex.; quar. 448, 3.VIII.2013, 2 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 27.VII.2013, 9 ex.

**Biotope.** In meadows and forest glades, in sparse pine forests, near roadsides and in various secondary herbaceous associations.

*Chorthippus (Glyptobothrus) pullus* (Philippi, 1830)

**Literature.** Plavilshchikov 1964.

**Material.** quar. 338, 3.VII.2016, 1 ♀.

**Biotope.** On glades in dry sandy pines. It is locally rare, known only in the Mordovia State Nature Reserve.

*Chorthippus (Pseudochorthippus) parallelus* (Zetterstedt, 1821)

**Literature.** Ruchin et al. 2013.

**Material.** cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 249, 13.VIII.2015, 2 ex.; cord. Podrubny, 19.VII.2016, 1 ex.; quar. 322, 13.VIII.2015, 2 ex.; quar. 324, 16.VIII.2015, 4 ex.; quar. 330, 4.VIII.2013, 2 ex.; quar. 331, 18.VII.2016, 1 ex.; quar. 338, 21.VII.2013, 24.VIII.2014, 12 ex.; quar. 368, 24.VIII.2017, 1 ex.; quar. 384, 20.VII.2013, 7 ex.; quar. 393, 20.VIII.2016, 1 ex.; quar. 397, 17.VIII.2014, 6.VIII.2017, 3 ex.; quar. 398, 24.VII.2016, 2 ex.; quar. 399, 17.VIII.2014, 24.VII.2016, 4 ex.; cord. Polyansky, 17.VIII.2014, 1 ex.; cord. Dolgy most, 14.VII.2013, 15.VII.2013, 23.VIII.2016, 6 ex.; quar. 413, 4.VIII.2017, 2 ex.; quar. 419, 6.VIII.2017, 1 ex.; quar. 421, 03.IX.2016, 1 ex.; cord. Drozhdenovsky, quar. 434, 18.VIII.2013, 22.VIII.2015, 5 ex.; cord. Inorsky, quar. 436, 17.VIII.2013, 1.VIII.2015, 28.VI.2015, 23.VIII.2016, 15 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 417, 20.VIII.2016, 1 ex.; quar. 420, 6.VIII.2017, 4 ex.; quar. 440, 10.VIII.2016, 3 ex.; quar. 448, 3.VIII.2013, 4 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 27.VII.2013, 12.IX.2017, 5 ex.

**Biotopes.** In meadows of different degree of moistening, mainly on wet, on forest glades and in woodlands, near roads and other disturbed places.

?*Stauroderus scalaris* (Fischer von Waldheim, 1846)

**Literature.** Plavilshchikov 1964.

**Note.** Known only from the literature.

*Gomphocerippus rufus* (Linnaeus, 1758) (= *Gomphocerus rufus* (Linnaeus, 1758))

**Literature.** Redikortsev 1938.

**Material.** quar. 330, 4.VIII.2013, 1 ex.; quar. 338, 21.VII.2013, 1 ex.; quar. 342, 22.VIII.2015, 1 ex.; quar. 360, 23.VIII.2015, 2 ex.; quar. 368, 24.VIII.2014, 1 ex.; ibid, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 386, 7.VII.2016, 1 nymph; . 387, 23.VIII.2015, 8 ex.; quar. 393, 20.VIII.2016, 2 ex.; quar. 399, 17.VIII.2014, 1 ex.; quar. 409, 10.VIII.2016, 1 ex.; quar. 413, 9.VIII.2014, 4 ex.; quar. 424, 23.VIII.2016, 1 ex.; quar. 427, 20.VII.2013, 23.VIII.2015, 10.VIII.2016, 5 ex.; cord. Inorsky, quar. 436, 28.VI.2015, 1 ex.

**Biotopes.** On forest glades and in dry sparse forests, including in artificial ecotones (clearings, roadsides of forest roads).

*Dociostaurus brevicollis* (Eversmann, 1848)

**Literature.** Plavilshchikov 1964.

**Material.** cord. Novenkovsky, 13.VII.2014, 2 ex.; cord. Steklyannyi, 12.VII.2014, 4.VIII.2015, 3 ex.; quar. 142, 11.VII.2015, 3 ex.; quar. 303, 18.VII.2016, 2 ex.; quar. 368, 24.VIII.2014, 1 ex.

**Biotopes.** In steppe meadows, forest clearings with a dilute grass cover in dry sandy pines, on sites with disturbed vegetation. It is locally rare, known only in the Mordovia State Nature Reserve.

*Chrysochraon dispar* (Germar, 1835)

**Literature.** Redikortsev 1938; Ruchin et al. 2013.

**Material.** cord. Novenkovsky, 13.VII.2014, 1 ex.; cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 80, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 85, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 324, 15.VII.2017, 1 ex.; quar. 402, 03.IX.2016, 1 ex.; cord. Inorsky, quar. 436, 28.VI.2015, 1 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.

**Biotopes.** In wet meadows in river floodplains and in relief depressions, on forest glades with similar conditions.

*Euthystira brachyptera* (Ocskay, 1828)

**Literature.** Plavilshchikov 1964; Ruchin et al. 2013.

**Material.** cord. Novenkovsky, 13.VII.2014, 1 ex.; ibid, 26.VI.2016, 2 ex., Zvonov A.A.; cord. Srednyaya Melnitsa, 23.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Plotomoyka, 3.VIII.2014, 1 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 59, 23.VIII.2016, 1 ex.; quar. 82, 28.VII.2015, 1 ex.; quar. 80, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 86, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 142, 11.VII.2015, 1 ex.; quar. 249, 13.VIII.2015, 3 ex.; quar. 274, 13.VIII.2015, 1 ex.; quar. 288, 4.VII.2015, 1 ex.; quar. 322, 13.VIII.2015, 1 ex.; quar. 324, 16.VIII.2015, 15.VII.2017, 5 ex.; quar. 330, 4.VIII.2013, 1 ex.; quar. 331, 18.VII.2016, 2 ex.; quar. 338, 21.VII.2013, 3.VII.2016, 2 ex.; quar. 342, 22.VIII.2015, 2 ex.; quar. 345, 22.VIII.2015, 3 ex.; quar. 347, 23.VIII.2016, 2 ex.; quar. 360, 23.VIII.2015, 27.VII.2014, 3 ex.; quar. 368, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 370, 4.VII.2015, 1 ex.; quar. 384, 23.VIII.2015, 27.VII.2014, 3 ex.; quar. 386, 7.VII.2016, 1 ex.; quar. 397, 17.VIII.2014, 6.VIII.2017, 3 ex.; quar. 398, 24.VII.2016, 4 ex.; quar. 399, 17.VIII.2014, 24.VII.2016, 5 ex.; cord. Polyansky, 3.VII.2016, 1 ex., Zvonov A.A.; cord. Taratinsky, 16.VIII.2015, 1 ex.; quar. 402, 03.IX.2016, 1 ex.; cord. Dolgy most, 14.VII.2013, 15.VII.2013, 23.VIII.2016, 5 ex.; quar. 411, 7.VII.2016, 3 ex.; quar. 413, 4.VIII.2017, 1 ex.; quar. 417, 20.VIII.2016, 3 ex.; quar. 419, 6.VIII.2017, 2 ex.; quar. 420, 6.VIII.2017, 1 ex.; quar. 421, 8.VI.2014, 03.IX.2016, 4 ex.; quar. 427, 10.VIII.2016, 1 ex.; quar. 434, 22.VIII.2015, 1 ex.; cord. Inorsky, quar. 436, 28.VI.2015, 1.VIII.2015, 23.VIII.2016, 5 ex.; ibid, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 440, 10.VIII.2016, 3 ex.; quar. 448, 3.VIII.2013, 2 ex.; cord. Novenky, 23.VIII.2017, 1 ex., Mikhailenko A.P.; Pushta, 27.VII.2013, 30.VII.2013, 6 5 ex.

**Biotopes.** In meadows of various types and degree of moistening, except wet, on glades and in thin pine forests.

*Stethophyma grossum* (Linnaeus, 1758) (= *Mecostethus grossus* (Linnaeus, 1758))

**Literature.** Redikortsev 1938; Plavilshchikov 1964; Ruchin et al. 2013.

**Material.** quar. 402, 03.IX.2016, 1 ex.; quar. 420, 22.VIII.2015, 1 ex.; quar. 421, 03.IX.2016, 3 ex.; cord. Inorsky, 8.VII.2013, 1 ex., Stoyko T.G.; Pushta, 29.IX.2017, 1 ex.

**Biotopes.** In the flood meadows, along the banks of reservoirs, in swamps and damp meadows in relief



depressions. It is locally rare, known only in the Mordovia State Nature Reserve.

? *Locusta migratoria* Linnaeus, 1758

**Literature.** Plavilshchikov 1964.

**Note.** Known only from the literature.

*Psophus stridulus* (Linnaeus, 1758)

**Literature.** Redikortsev 1938; Plavilshchikov 1964; Ruchin et al. 2013; Mikhailenko and Ruchin 2015.

**Material.** quar. 413, 9.VIII.2014, 2 ex.

**Biotopes.** On clearings and glades in dry pine forests. It is locally rare, known only in the Mordovia State Nature Reserve.

*Oedipoda caerulea* (Linnaeus, 1758)

**Literature.** Redikortsev 1938; Ruchin et al. 2013.

**Material.** cord. Novenkovsky, 13.VII.2014, 4 ex.; quar. 79, 24.VIII.2017, 4 ex.; quar. 80, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 85, 23.VIII.2016, 24.VIII.2017, 15 ex.; cord. Steklyannyi, 12.VII.2014, 24.VIII.2017, 12 ex.; quar. 276, 23.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 303, 18.VII.2016, 4 ex.; quar. 330, 4.VIII.2013, 4 ex.; quar. 338, 21.VII.2013, 1 ex.; quar. 368, 21.VII.2013, 7 ex.; *ibid*, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 384, 20.VII.2013, 1 ex.; quar. 424, 4.VIII.2013, 3 ex.; cord. Drozhdenovsky, quar. 434, 18.VIII.2013, 4 ex.; cord. Inorsky, quar. 436, 17.VIII.2013, 1.VIII.2015, 8 ex.; *ibid*, 23.VIII.2017, 1 ex., Mikhailenko A.P.;

**Biotopes.** In dry steppe meadows with a rare or disturbed grass cover, on clearings in dry and sparse sandy pines, roadsides, on glades and old fires, free of woody vegetation. It is locally rare, known only in the Mordovia State Nature Reserve.

? *Bryodemella tuberculata* (Fabricius, 1775) (= *Bryodemella tuberculatum* (Fabricius, 1775))

**Literature.** Redikortsev 1938; Plavilshchikov 1964.

**Note.** Known only from the literary data.

*Sphingonotus caeruleus* (Linnaeus, 1767)

**Literature.** Mikhailenko and Ruchin 2015.

**Material.** quar. 79, 24.VIII.2017, 2 ex., Mikhailenko A.P.; quar. 80, 24.VIII.2017, 1 ex.; quar. 85, 24.VIII.2017, 1 ex., Mikhailenko A.P.; cord. Steklyannyi, quar. 86, 12.VII.2014, 4.VIII.2015, 5 ex.; *ibid*, 24.VIII.2017, 1 ex., Mikhailenko A.P.; quar. 278, 18.VII.2016, 1 ex.; quar. 303, 18.VII.2016, 3 ex.

**Biotopes.** On glades in dry sandy pine forests, on slopes of railways with rare vegetation. It is locally rare, known only in the Mordovia State Nature Reserve.

## Discussion

The fauna of mantids and orthopterans of the Mordovia Reserve covers recently 1 species and 44 species, respectively. The most numerous family are Acrididae-27 species, followed by Tettigoniidae-11 species, Gryllidae-2 species, Gryllotalpidae-1 species, Tetrigidae-3 species of the same genus.

*Conocephalus fuscus* was first noted for the fauna of the Republic of Mordovia. This widespread species in the forest-steppe has penetrated the meadow biotopes deeper into the forest zone in recent years (Kleukers et al. 1996; Karmazina and Shulaev 2009; Ozersky 2012 missing in ref). Another species actively dispersed in the northern and north-eastern directions is *Mantis religiosa*. For the first time in the territory of Mordovia, it was registered in the very hot year 2010 (Bolshakov et al. 2010). Later mantises began to be found everywhere in the republic. However, in general, the findings were made in open biotopes, i.e. on meadows, roadsides, kitchen gardens, clearings, in sparse forest shelter belts (Ruchin 2014). For the first time, 2 findings of mantids were recorded in the territory of Pushta in the Mordovia Reserve in 2015 (Ruchin 2016). Then it began to be found in the depths of the forest in 2016. Thus, the mantis was active in all kinds of natural biotopes, not limited to open ones. *Calliptamus italicus* was first recorded for the fauna of the Mordovia Reserve. This thermophilic species, which is characteristic of the more southern subzones, chooses the most warmed biotopes here. All the individuals caught in the Mordovia State Nature Reserve are closer to the solitary phase by wing proportions, so we do not consider it is a recent invader.

Six species (*Stenobothrus nigromaculatus*, *Omocestus rufipes*, *Chorthippus albomarginatus*, *Stauroderus scalaris*, *Locusta migratoria*, *Bryodemella tuberculata*) were noted in studies of the first half of the 20th century, but have not been found yet.

*Stenobothrus nigromaculatus* in the main part of the range, including in Mordovia (Bei-Bienko and Mishenko 1964; Krištín et al. 2013; Ruchin et al. 2017), is confined to steppe grassy associations with open grass and limestone outcrops. In the Mordovia State Nature Reserve there are possible findings of this species on dry warmed edges of pine forests with similar conditions. On the main part of the range, including in Mordovia, it is confined to steppe grassy associations with open grass and limestone outcrops. Findings are possible on dry warmed edges of pine forests with similar conditions.

*Omocestus rufipes* is a highly local species with late phenology, usually confined to riverine dunes, fringes and glades in pine forests. It is rare even in the southern regions of Russia (Savitsky 2005), it was previously also quoted from the Vladimir region (Derevyanko 2002) without specifying the material. We have not confirmed it yet. *Ch. albomarginatus* was found twice on the fringes of the forests in the republic (our unpublished data). *S. scalaris* is widely distributed in the Palearctic from Europe to Transbaikalia. It enters the south of the taiga zone, it is quite common in the forest-steppe and in the north of the steppe zone, it is found southward locally (Carlsson and Kindvall 2011; Sergeev 2014). It cannot be excluded that this grasshopper is present in the fauna of the Mordovia State Nature Reserve, because the species was found 30 km west of its territory, in the Tengushevo district of the Republic of Mordovia (our unpublished data). It was also noted in the Vladimir region (Derevyanko 2002), but without specifying the material.

Also, in the fauna list, *L. migratoria* is omitted. This species is indicated earlier (Predchetenskiy 1925; Zolotarev 1936; Plavilshchikov 1964; Oliger 1971) for the territory of Temnikov district, and its flights and temporary habitat in suitable biotopes are not ruled out in the Mordovia Reserve.

We omit *B. tuberculata* in the list of fauna of the Mordovia State Nature Reserve, because not so long ago this species was observed both north and south of the Republic of Mordovia, for example, in Vladimir (Derevyanko 2002; Eremkin 2014) and Penza (Polumordvinov 2013) areas. This species is very local and confined to undisturbed psammophytic biotopes. It was also mentioned by Predtechensky (1925) for the Anaevsky volost of the Spassky district of the Penza province (now Zubova Polyana district of Republic of Mordovia).

Considering the representation in the collections of certain species of Mantodea and Orthoptera of the Mordovia State Nature Reserve, we point out that these data, in a first approximation, reflect the relative abundance of species in biotopes, as a result of the use of standardized accounting methods.

Species found in many studied sites of the Mordovia State Nature Reserve are the following: *Phaneroptera falcata*, *Conocephalus fuscus*, *Tettigonia viridissima*, *Tettigonia cantans*, *Decticus verrucivorus*, *Metrioptera bicolor*, *Metrioptera roeselii*, *Pholidoptera griseoptera*, *Tetrix subulata*, *Tetrix bipunctata*, *Omocestus haemorrhoidalis*, *Chorthippus dorsatus*, *Chorthippus brunneus*, *Chorthippus biguttulus*, *Chorthippus mollis*, *Chorthippus apricarius*, *Chorthippus parallelus*, *Gomphocerippus rufus*, *Chrysochraon dispar*, *Euthystira brachyptera*, *Oedipoda caerulescens*.

Species from a few sites are *Mantis religiosa*, *Tettigonia caudata*, *Metrioptera brachyptera*, *Gryllotalpa gryllotalpa*, *Stenobothrus lineatus*, *Myrmeleotettix maculatus*, *Dociostaurus brevicollis*, *Stethophyma grossum*, *Sphingonotus caerulans*. Species marked only in selected sites are as follows: *Conocephalus dorsalis*, *Gryllus campestris*, *Tetrix tenuicornis*, *Podisma pedestris*, *Calliptamus italicus*, *Modicogryllus frontalis*, *Omocestus viridulus*, *Chorthippus pullus*, *Psophus stridulus*.

Polytopic species which inhabit a variety of biotopes (meadows of different types and degree of moisture, sparse forests of various composition, forest glades and fringes, clearings, near water, roadsides and other disturbed places with ruderal vegetation, near housing, some of them come across on a bush and trees and sometimes fly to light): *Tettigonia viridissima*, *Tettigonia cantans*, *Decticus verrucivorus*, *Metrioptera bicolor*, *Metrioptera roeselii*, *Pholidoptera griseoptera*, *Tetrix subulata*, *Tetrix tenuicornis*, *Chorthippus dorsatus*, *Chorthippus brunneus*, *Chorthippus biguttulus*, *Chorthippus apricarius*, *Chorthippus parallelus*, *Euthystira brachyptera*. Local species, confined to clearly restricted biotopes, we divided into three groups.

Types of intrazonal habitats (these are usually marshes, river floodplains, wet meadows, more rarely their fragments in relief depressions and forest glades with similar conditions, some species are found directly near

water on coastal grassy vegetation or in the ground): *Conocephalus dorsalis*, *Gryllotalpa gryllotalpa*, *Omocestus viridulus*, *Chrysochraon dispar*, *Stethophyma grossum*.

Species confined to extrazonal ? habitats, occurring in more or less significant separation from their continuous range or steppe species inhabiting biotopes which are uncharacteristic but suitable for temperature and water regime. Most of these species fly well, and we cannot unequivocally interpret the origin of all the locations of these species, that is, assert the relictness of these locations or the periodic irradiation of such species from their refugia in the main part of the range: *Mantis religiosa*, *Phaneroptera falcata*, *Conocephalus fuscus*, *Tettigonia caudata*, *Gryllus campestris*, *Modicogryllus frontalis*, *Calliptamus italicus*, *Stenobothrus lineatus*, *Omocestus haemorrhoidalis*, *Chorthippus mollis*, *Dociostaurus brevicollis*, *Oedipoda caerulescens*, *Sphingonotus caerulans*.

Species, confined in our subzone to certain phytocenoses or vegetation formations (in this case, mainly pine forests). These are mostly wingless or non-flying species, whose habitats can be considered to be relict, that is, the age of which is equal to or greater than the age of the given formation: *Tetrix bipunctata*, *Metrioptera brachyptera*, *Podisma pedestris*, *Chorthippus pullus*, *Gomphocerippus rufus*, *Myrmeleotettix maculatus*, *Psophus stridulus*.

We consider the last two groups of species, confined to the driest and warmest biotopes, as xerophilic. The greatest number of species occurs in points that satisfy the conditions of existence (suitability) for habitat species from different ecological groups. Such conditions are the result of heterogeneity, mosaic biotopes, which are often located in ecotones (for example, on the border of forest and meadow, meadow and water body).

Special mention should be made of several habitats in which the maximum number of species occurs. So, in the meadows of the central floodplain of the Moksha (quar. 401, 402, 421) we encountered 14 species of orthopterans. These meadows are surrounded by floodplain oak forests. The cereals which are predominant in the herb layer composition are the following: *Bromus inermis* Leyss., *Alopecurus pratensis* L., *Dactylis glomerata* L., *Elymus repens* (L.) Gould and others, *Filipendula ulmaria* (L.) Maxim., *Cirsium arvense* (L.) Scop. s.l. Also *Rumex confertus* Willd., *Tanacetum vulgare* L., *Centaurea jacea* L., *Geranium pratense* L., *Trifolium pratense* L., *Galium boreale* L., *G. verum* L., *Alchemilla* spp. (Vargot et al. 2016) were noted.

A large meadow in the forest (quar. 368) in the vicinity of the cordon Zhegalovsky represents a series of adjacent biotopes: from the edge of a dry pine tree through sand dunes to a small standing water basin in a lowering of the relief. Young pine trees grow here (*Pinus sylvestris* L.), settled by self-seeding. The soil cover near them is represented by green mosses and lichens, among which there are individual shoots of *Pilosella officinarum* Vaill., *Potentilla argentea* L., *Helichrysum arenarium* (L.) Moench. Closer to the forest boundary a herb layer is developed that contains *Calamagrostis epigejos* (L.) Roth.,

*Elymus repens*, *Poa pratensis* L. s.l, *Agrostis capillaris* L., *Hypericum perforatum* L., *Vicia cracca* L., *Rumex acetosa* L., *Veronica officinalis* L., *V. chamaedrys* L. and some other species (Vargot et al. 2016; Lisovenko et al 2017). There are 22 species of orthopterans with different biology.

The outskirts of the cordon Steklyannyi (quar. 86) represent a wide (up to 60 m) clearing in the pine forest, where water is accumulated between these roads, there are sandy areas which are devoid of vegetation, heathers, cranberries and sand-gravel mound. On the slopes of the railway there is no continuous vegetation cover. Among the gravel, the following forest and meadow species are found here: *Rubus nessensis* Hall, *Pteridium aquilinum* (L.) Kuhn, *Trifolium pratense* L., *Fragaria vesca* L., *Galium mollugo* L., *Elymus repens*, *Leucanthemum vulgare* (Vaill.) Lam., *Silene tatarica* (L.) Pers., *S. vulgaris* (Moench) Garcke, *Medicago sativa* L., as well as weeds: *Artemisia absinthium* L., *Chenopodium* spp., *Atriplex* spp., *Oenothera biennis* L., *Erigeron canadensis* L., *Lepidium densiflorum* Schrad., *Setaria viridis* (L.) P. Beauv., *Sambucus racemosa* L. and other species. Some areas are covered with small clumps of green mosses (Khapugin et al. 2013; Vargot et al. 2016). 16 species of Mantodea and Orthoptera were caught here.

Also, we would like to note a point with such a southern view as *Sphingonotus caerulans* near the Nizhny Novgorod region (on the territory of the Nizhny Novgorod region we marked it in Pervomaisk on the side of the railway embankment). This species is found in the Mordovia State Nature Reserve far beyond the northern boundary of its continuous distribution, roughly corresponding to the July 24 ° C isotherm (Prisny 2014) and on our meridian its findings are by far the most northern in the center of European Russia. From the Mordovia Reserve *S. caerulans* has light-colored front wings, does not have a dark sling on the hind wings, only a few individuals have a slight darkening along their outer edge, which suggests that all collected specimens belong to the nominative subspecies. Populations of this species in the Mordovia State Nature Reserve are occupied by two areas divided by a continuous forest area: the northeastern quarters and the central part. In the first case, the population inhabits the roadside of the railway embankment and adjacent territories. Approximately this thermophilic species prefer such conditions within its range, populating firstly place stone placers, gravel deposits (Budrys and Pakalniškis 2007; Jaun-Holderegger and Zettel 2008; Kuravova 2014). The second population occurs in the areas burnt in 2010. The habitats are sand dunes with a minimal projective covering of grassy vegetation here.

Most of the species of orthopterans living in the Mordovia State Nature Reserve are widespread in the forest zone and subzone of the forest-steppe of the center of European Russia and were noted in the Mordovia Reserve earlier. The species, which were not observed by former explorers in the reserve, we consider to be recently penetrated: *Mantis religiosa*, *Phaneroptera falcata*, *Conocephalus fuscus*, *Tettigonia caudata*.

Species on the northern border of a continuous area or beyond its borders, which were not observed in the Center of European Russia until the north of the Mordovia State Nature Reserve or were marked locally: *Gryllus campestris*, *Modicogryllus frontalis*, *Calliptamus italicus*, *Sphingonotus caerulans* (nominative subspecies). Rare species with reduced numbers or disappearing in different parts of their ranges are important as indicators of the preservation of relic biotopes and fragments of the landscape. Their list was proposed by us for inclusion in the regional Red Data Book (Mikhailenko and Ruchin 2015). Such species were more widely distributed in the past, and now their preserved habitats are protected: *Podisma pedestris*, *Stauroderus scalaris*, *Stenobothrus nigromaculatus*, *Chorthippus pullus*, *Myrmeleotettix maculatus*, *Psophus stridulus*, *Sphingonotus caerulans*, *Bryodemella tuberculata*.

Species diversity of orthopterans in Protected Areas is determined mainly by geographical breadth, nature of the relief and the variety of their vegetation, and does not depend on their area directly (Storozhenko and Sergeeva 2015).

Territorial protection, organized since the Mordovia State Nature Reserve has been created, provides protection of natural landscapes from human transformation. Unfortunately, it does not include parts of the northern meadow steppe, and meadow areas occupy a relatively small area, so the fauna of orthopterans of Mordovia is represented in it only partially. List of species of the Mordovia Reserve is depleted mainly due to a small representation of steppe elements of the fauna of orthopterans in it. A number of habitats of steppe vulnerable species, also proposed by us for inclusion in the Red Data Book of the Republic of Mordovia, is in the protected areas below (with a weak protection regime) or has no protection at all.

Factors affecting the species composition and abundance of Orthoptera in the Mordovia State Nature Reserve are very diverse. For example, forest fires temporarily make it possible for xerophilous species with good potential for dispersal to settle (*Chorthippus* spp., *Oe. caerulescens*, *S. caerulans*). Then, as far as the overgrowth of such places is concerned, fires can permanently make an area completely unsuitable for the life of orthopterans due to the very high density of young birch, aspen, some shrubs. Solid fellings under power lines and other anthropogenically created xerophytic habitats (railroad embankments, curbs cleared of vegetation) allow steppe and semidesert elements of the fauna of the region to penetrate deep into the forest zone along such «corridors».

The anthropogenic factor is only one of many causes of species dispersal and extinction (Bei-Bienko 1970; Kritskaya 1982; Prisny 2007; Hochkirch et al. 2016). The climatic changes of recent years exert a powerful influence, changing the temperature and water regime in the region, which leads not only to the introduction of more southern, heat-loving species, but also to changes in the composition of vegetation in existing biotopes, which can lead to unsuitability for orthopterans (Prisny 2005; Prisny and Negin 2012; Hochkirch et al. 2016). Mesophilization of

biotopes, associated with global climatic changes, leads to the overgrowth of their high grass, shrub and trees and, accordingly, to the destruction of meadow and fringe complexes of orthopterans living in them.

The main reason for the decrease in the number and disappearance of populations of xerophilous species of orthopterans in the Mordovia State Nature Reserve is the overgrowing of their stands by forest. The great cattle trampled down the trees and brushed shrubs, i.e. reduced the degree of overgrowth of biotopes-meadows and glades, which were preferable for orthopterans. Therefore, such places remained open for a long time, covered with xerophytic vegetation with patches of pure sand. Now the populations of xerophiles in such biotopes need to be maintained with the help of artificial regulatory measures, especially relevant for use in years with high amounts of precipitation. To preserve the maximum number of Orthoptera species, it is necessary to preserve the maximum mosaic structure of biotopes, as well as the development of regulations for regulatory measures (applicable specifically for the given area) aimed at increasing it. To do this, it is necessary to exclude regenerative forest plantations on the fringes, sand dunes, and carry out reclamation work on the glades exposing to afforestation. The implementation of measures for the creation and expansion of existing ecotones is advisable in the neighborhood with habitats of rare species. Frequently, for the natural settlement of such species it is sufficient to create a temporary «ecological corridor». For non-flying species it is necessary to practice artificial settlement in such newly created habitats. □

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