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Coleoptera of the Penza region, Russia based on fermental crown trap

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Abstract. *Ruchin AB, Egorov LV, Polumordvinov OA. 2021. Coleoptera of the Penza region, Russia based on fermental crown trap). Biodiversitas 22: 1946-1960.* There are the results of processing the material of the 2019-2020 studies on Coleoptera from the Penza region, Russia. The surveys were carried out using fermental crown traps in various habitats on the territory of 18 districts of the region. In total, 18 traps were installed in 2019 and 96 traps – in 2020. During the research, 5,577 specimens were collected and recorded. Ninety-seven species from 19 families were found, of which 43 species are new to the Penza region. The most diverse families are Cerambycidae (24 species) and Elateridae (11 species). Species from the families Nitidulidae (3281 specimens), Scarabaeidae (1497 specimens), and Cerambycidae (453 specimens) predominated in the traps. A list of species is given, indicating references and information on biology. New data is given for 4 species included in the Red Data Book of the region (*Protaetia fieberi, Protaetia speciosissima, Gnorimus variabilis, Purpuricenus globulicollis*).

Keywords: Coleoptera, fauna, rare species, biology, fermental crown traps, Penza region

INTRODUCTION

At the beginning of the XXI century, the conservation of biological diversity is considered one of the main global challenges of humanity and as the most important condition for the stability of ecological systems (Robin 2011; Grubert 2018). Biodiversity supports society in ecological, economic, cultural and spiritual fields. Despite the fact that biodiversity has a significant impact on the daily life and development of society, the world faces permanent irretrievable losses of individual species and entire ecosystems. Species and ecosystems, as well as the threats they face, vary across and within geographic regions (Myers et al. 2000; Hooper et al. 2005; Huang et al. 2018; Ahissa et al. 2020; de Lima et al. 2020; Feng et al. 2020; King et al. 2021). It is important to maintain a high level of diversity for many reasons, including the fact that the natural world brings to human life. Therefore, in recent years, nature conservation and biodiversity conservation have been viewed as the same issue (Mathews 2016; Uwalaka et al. 2018; Kestemont 2019; Mellard et al. 2019; Cicort-Lucaciu 2020; Kroll et al. 2020; Wang et al. 2020).

Coleoptera fauna inventory and regional faunal reports are conducted in many regions of Russia in order to preserve biodiversity (Storozhenko et al. 2002; Budaev et al. 2019; Prokin et al. 2019; Ruchin et al. 2019b; Rozhnov et al. 2019; Sazhnev et al. 2019; Bondarenko et al. 2020; Egorov et al. 2020a; Sergeev 2020; Zemoglyadchuk et al. 2020). A significant part of the research is devoted to the study and conservation of rare and unique Coleoptera species, the loss of which can lead to a decrease in ecosystem biodiversity (Frolov 2013; Bardiani et al. 2017; Redolfi De Zan et al. 2017; Polevoi et al. 2018; Ruchin and Egorov 2018a,b,c; Tomaszewska et al. 2018; Ruchin and Khapugin 2019; Dedyukhin 2020).

The Penza region is located on the Russian Plain and occupies the middle and western part of the Volga Upland. Coleoptera of this region is studied intensively and in recent years a number of interesting studies have been published (Levkovich and Levkovich 2006; Pronina 2010; Bashinsky and Osipov 2019; Danilevsky et al. 2019; Ruchin et al. 2019c). However, all of them are based on standard methods of studying Coleoptera fauna, while special methods provide additional and sometimes unexpected data (Dodds 2014; Rukavina et al. 2018; Barros et al. 2020; Philips et al. 2020; Touroult and Witté 2020). This publication examines the Coleoptera biodiversity of the Penza region, which was studied in 2019-2020 using fermental crown traps.

MATERIALS AND METHODS

Study area

The Penza region is located at the junction of forest, forest-steppe and steppe natural zones. The terrain is a hilly plain. The central and eastern part of it is occupied by the western slope of the Volga upland, and the western part – by the Oka-Don lowland. The highest and most hilly surface is located in Zasurye, in the bend of Sura. Sursk-Moksha hill is situated in the Northern areas in the West region, the Oka-Don plain is in the South (150-180 m a.s.l.). The region length from East to West is 190 km (from 42°40' to 47°E), and 110 km from North to South (53°20' to 52°20'N). The terrain is elevated, slightly hilly, with deep flowing wide ancient river valleys, with many

ravines and gullies. Heights of less than 100 m a.s.l. are located in the Vysha River valley in the northwest of the region. In terms of hydrology, the region is divided into two basins of approximately equal areas: the Don Basin (the Khoper River and the Vorona River), and the Volga Basin (the Sura, Kadada, and Moksha Rivers). The watershed of the basins runs along the Kerensky-Chembar upland. The climate is temperate continental, strongly influenced by the Atlantic. The lowest temperatures were recorded on the plains in January (-43 to -45°C) and the highest ones in July (38-39°C).

There is a diverse natural vegetation cover in the south-western part of the Volga Upland, which is determined by the location of the territory at the junction of forest and steppe vegetation zones. The forest cover of the region is approximately 21.4%. Meadow (northern) steppes and broad-leaved forests are the zonal vegetation types of the research region. The border of the forest - steppe transition coincides with the border of the replacement of some geological deposits by others. Small north-western part of the region is a transition zone of mixed and broad-leaved forests. The southwestern part of the region should be attributed to the zone of steppes (Kuritsyn and Mardensky 1991).

Figure 1. The studied areas within the territory of the Penza region. The red dots indicate the collection points. The numbers indicate districts of the Penza region: 1 – Zemetchino district; 2 – Vadinsk district; 3 – Spassk district; 4 – Narovchat district; 5 – Nizhny Lomov district; 6 – Pachelma district; 7 – Bashmakovo district; 8 – Belinsky district; 9 – Tamala district; 10 – Bekovo district; 11 – Kamenka district; 12 – Serdobsk district; 13 – Kolyshlei district; 14 – Mokshan district; 15 – Issa district; 16 – Lunino district; 17 – Nikolsk district; 18 – Bessonovka district; 19 – Penza district; 20 – Gorodishche district; 21 – Sosnovoborsk district; 22 – Kondol district; 23 – Shemysheika district; 24 – Malaya Serdoba district; 25 – Lopatino district; 26 – Kuznetsk district; 27 – Russky Kameshkir district; 28 – Neverkino district. The black squares indicate the administrative centers of the districts.

MATERIALS AND METHODS

The material was collected in 2019-2020 by the first author in 18 districts of the Penza region, with the use of fermental crown traps (Figure 1). Two versions of traps were used in the crowns of trees. In the first case, the trap was a 5-liter plastic container with a window cut out on one side at a distance of 10 cm from the bottom (Ruchin et al. 2020). Fermented beer with the addition of sugar-containing components (honey, jam and sugar) was used as bait. In 2020, a different type of bait trap was additionally used (Jalas 1960). There was a mixture of white, red wine and beer with added sugar as an attractive substrate. As a fixative, 96% ethyl alcohol was added. The traps were installed in the tree crowns at a height of 7 to 10 m from the surface. The exposure (duration of installation) of the traps ranged from 7 to 15 days. Table 1 shows the geographical characteristics of each research site, with the dates of the trap installation and the coordinates of the area. During the collection, a total of 5,577 Coleoptera specimens were collected and recorded. The studied material is stored in the collection of the Mordovia State Nature Reserve (Pushta village).

Table 1. Geographical characteristics of research sites, dates of trap expositions, and coordinates of research sites in the Penza region

District	Locality	Habitat	Date	Coordinates (°N, °E)
Bashmakovo	Spirtzavod	Willow thickets	1-15.VII.2020	53.3039, 42.8993
	Ermakovsky	Deciduous forest	1-15.VII.2020	53.2646, 42.9438
	Ermakovsky	Deciduous forest	15-29.VII.2020	53.2643, 42.9415
	Troitskoe	Deciduous forest	1-15.VII.2020	53.2695, 42.8233
	Timiryazevo	Deciduous forest	1-15.VII.2020	53.2766, 42.8445
	Ermakovsky	Deciduous forest	15-29.VII.2020	53.2636, 42.9423
Belinsky	Staraya Kashtanovka	Deciduous forest	29.VII-12.VIII.2020	53.0076, 43.3022
	Belinsky	Deciduous forest	29.VII-12.VIII.2020	52.9961, 43.4096
	Volchkovo	Deciduous forest	29.VII-12.VIII.2020	52.9785, 43.4718
	Studenka	Deciduous forest	1-15.VII.2020	53.0092, 43.1431
	Poim	Aspen forest	1-15.VII.2020	53.0107, 43.2258
	Shiryaevo	Deciduous forest	15-29.VII.2020	52.9913, 43.0237
	Studenka	Deciduous forest	1-15.VII.2020	53.0092, 43.1431
	Studenka	Deciduous forest	15-29.VII.2020	53.0114, 43.1733
	Kryukovo	Deciduous forest	29.VII-12.VIII.2020	52.9738, 43.6033
Bessonovka	3 km E Grabovo	Mixed forest	25.VI.-10.VII.2020	53.3742, 45.1043
	Nikolaevka	Mixed forest	25.VI.-10.VII.2020	53.3326, 45.1850
	Kolos	Mixed forest	25.VI.-10.VII.2020	53.3219, 45.1980
	Sosnovka	Mixed forest	25.VI.-10.VII.2020	53.2957, 45.2839
	Stepanovka	Mixed forest	10-24.VII.2020	53.2432, 45.4449
	Era	Mixed forest	25.VI.-10.VII 2020	53.3683, 45.1419
	3 km SE Era	Mixed forest	25.VI.-10.VII 2020	53.3509, 45.1692
	Aleksandrovka	Mixed forest	25.VI.-10.VII 2020	53.3075, 45.2242
	4,5 km E Grabovo	Deciduous forest	25.VI.-10.VII.2020	53.3732, 45.1087
Gorodishche	Sadovka	Deciduous forest	10-24.VII.2020	53.2509, 45.4994
	5 km E Gorodishche	Deciduous forest	10-24.VII.2020	53.2755, 45.5817
	Mordovsky Ishim	Deciduous forest	10-24.VII.2020	53.1928, 45.6410
	Gorodishche	Deciduous forest	19.VIII-1.X.2020	53.2872, 45.6916
	Mozharka	Deciduous forest	10-24.VII.2020	53.2180, 45.6610
	Peschanka	Deciduous forest	19.VIII-1.X.2020	53.4761, 45.7848
	Telegino	Deciduous forest	19.VIII-1.X.2020	53.3911, 45.7274
Issa	Simanki	Deciduous forest	15–29.VI.2019	53.9228, 44.8687
Kamenka	Klychishche	Deciduous forest	29.VII-12.VIII.2020	53.1559, 43.9405
	Kamenka	Deciduous forest	29.VII-12.VIII.2020	53.2144, 44.0255
Kondol	Kondol	Deciduous forest	7-20.VIII.2020	52.8198, 44.9891
Nikolsk	Mais	Deciduous forest	6-19.VIII.2020	53.8684, 45.9690
	Pavlovka	Mixed forest	6-19.VIII.2020	53.8772, 45.8861
	Nikolsk	Mixed forest	19.VIII-1.X.2020	53.7188, 45.9846
Malaya Serdoba	Komarovka	Deciduous forest	7-20.VIII.2020	52.4693, 45.2564
Lopatino	Chardym	Deciduous forest	24.VII.-7.VIII.2020	52.6307, 45.7793
	Lopatino	Deciduous forest	24.VII.-7.VIII.2020	52.6012, 45.7774
	Kozlovka	Deciduous forest	24.VII.-7.VIII.2020	52.5670, 45.7333
Lunino	Lesnoi Viyas	Mixed forest	22.V.-12.VI 2020	53.7649, 45.4637
	Staraya Kutlya	Deciduous forest	12-25.VI.2020	53.6612, 45.3479
	Lunino	Willow thickets	12-25.VI.2020	53.5688, 45.2663
	Karaulovka	Mixed forest	12-25.VI.2020	53.5440, 45.2529
	Zasurskoe	Mixed forest	12-25.VI.2020	53.5390, 45.2426

	Ivanyrs	Mixed forest	12-25.VI.2020	53.5705, 45.3185
	Bolshoi Viyas	Birch forest	18.IV-9.V.2020	53.7985, 45.4928
	Lesnoi Viyas	Mixed forest	18.IV-9.V.2020	53.7648, 45.4636
	Kazachiya Peletma	Mixed forest	18.IV-9.V.2020	53.7548, 45.4441
	Bolshoi Viyas	Birch forest	9-22.V.2020	53.7986, 45.4927
	Lesnoi Viyas	Mixed forest	9-22.V.2020	53.7649, 45.4637
	Kazachiya Peletma	Mixed forest	22.V-12.VI.2020	53.7547, 45.4441
	Posopnaya Peletma	Mixed forest	22.V-12.VI.2020	53.7317, 45.4115
	Lomovka	Mixed forest	22.V-12.VI.2020	53.6858, 45.3678
	Ivanyrs	Mixed forest	12-25.VI.2020	53.5736, 45.3133
Mokshan	Krasnoe Poltso	Mixed forest	15–29.VI.2019	53.4629, 44.6488
	Krasnoe Poltso	Mixed forest	29.VI–12.VII.2019	53.4627, 44.6494
	Zasechnoe	Deciduous forest	15–29.VI.2019	53.5721, 44.7071
	5 km SW Sumarokovo	Deciduous forest	15–29.VI.2019	53.4890, 44.6867
	Chernozerie	Deciduous forest	29.VI–12.VII.2019	53.5884, 44.3344
	Dolgorukovo	Deciduous forest	29.VI–12.VII.2019	53.6099, 44.2715
	Gorodishche	Deciduous forest	29.VI–12.VII.2019	53.6345, 44.2534
	Alekseevka	Deciduous forest	29.VI–12.VII.2019	53.6406, 44.3468
	Solovievka	Willow thickets	29.VI–12.VII.2019	53.6175, 44.3549
	Elizino	Deciduous forest	6–24.VIII.2019	53.6018, 44.4999
	Pichuevka	Pine forest	6–24.VIII.2019	53.5816, 44.4896
Narovchat	Barabanovka	Deciduous forest	12–24.VII.2019	53.7536, 43.8806
	Kazenchik	Deciduous forest	12–24.VII.2019	53.7501, 43.8915
	Skanovo	Deciduous forest	12–24.VII.2019	53.8790, 43.7354
	Krasnyi Vostok	Mixed forest	12–24.VII.2019	53.8195, 43.7475
Nizhny Lomov	Virga	Deciduous forest	29.VII-12.VIII.2020	53.4429, 44.0567
	Sorokino	Deciduous forest	12-25.VIII.2020	53.6217, 43.3675
	Andreevka	Deciduous forest	29.VII.-12.VIII.2020	53.3920, 44.0896
	Iva	Deciduous forest	12–24.VII.2019	53.7186, 43.9433
	Svetlorechenka	Deciduous forest	12–24.VII.2019	53.6232, 43.9770
Penza	Salovka	Deciduous forest	7-20.VIII.2020	53.1155, 44.7803
Shemysheika	Russkaya Norka	Deciduous forest	24.VII.-7.VIII.2020	52.7800, 45.3981
	Verkhozim	Deciduous forest	24.VII.-7.VIII.2020	52.7467, 45.4192
	4 km S Novaya Yaksarka	Deciduous forest	10-24.VII.2020	52.9523, 45.3929
	Shemysheika	Deciduous forest	10-24.VII.2020	52.9230, 45.3937
	Azrapino	Deciduous forest	24.VII.-7.VIII.2020	52.7408, 45.6054
Vadinsk	Ovcharnye Vyselki	Deciduous forest	12-25.VIII.2020	53.6218, 42.9984
	Artamas	Deciduous forest	12-25.VIII.2020	53.5684, 42.8940
Zemetchino	Pashkovo	Mixed forest	9-19.VI.2020	53.6364, 42.4362
	Morsovo	Mixed forest	9-19.VI.2020	53.7191, 42.3516
	5 km SE Morsovo	Mixed forest	9-19.VI.2020	53.6966, 42.3866
	4 km NW Pashkovo	Mixed forest	9-19.VI.2020	53.6811, 42.4021
	Pashkovo	Mixed forest	9-19.VI.2020	53.6666, 42.4264
	3 km SE Chernoyar	Mixed forest	19.VI.-1.VII 2020	53.7795, 42.2896
	3 km S Vyazemka	Mixed forest	15-28.IV.2020	53.5839, 42.6818
	Desyatyi Oktyabr	Deciduous forest	15-28.IV.2020	53.5503, 42.6887
	Malaya Izhmora	Deciduous forest	15-28.IV.2020	53.5409, 42.7092
	3 km S Vyazemka	Deciduous forest	15-28.V.2020	53.5839, 42.6816
	Desyatyi Oktyabr	Deciduous forest	15-28.V.2020	53.5504, 42.6887
	Malaya Izhmora	Deciduous forest	15-28.V.2020	53.5410, 42.7092
	Desyatyi Oktyabr	Deciduous forest	28.V-9.VI.2020	53.5505, 42.6888
	Malaya Izhmora	Deciduous forest	28.V-9.VI.2020	53.5411, 42.7093
	Vyazemka	Deciduous forest	28.V-9.VI.2020	53.5888, 42.6852
	Sychevka	Deciduous forest	28.V-9.VI.2020	53.5916, 42.4626
	Pashkovo	Mixed forest	28.V-9.VI.2020	53.6363, 42.4362
	Saltykovo	Deciduous forest	28.V-9.VI.2020	53.6134, 42.4487
	Vyazemka	Deciduous forest	9-19.VI.2020	53.5887, 42.6852
	Morsovo	Mixed forest	19.VI.-1.VII 2020	53.7194, 42.3517
	3 km NW Morsovo	Mixed forest	19.VI.-1.VII 2020	53.7655, 42.3027
	Chernoyar	Mixed forest	19.VI.-1.VII 2020	53.7921, 42.2825
	Krasnaya Dubrava	Deciduous forest	28.IV.-15.V.2020	53.6782, 42.6334
	Vyazemka	Deciduous forest	28.IV.-15.V.2020	53.5983, 42.6764
	Desyatyi Oktyabr	Deciduous forest	28.IV.-15.V.2020	53.5505, 42.6888
	Malaya Izhmora	Deciduous forest	28.IV.-15.V.2020	53.5411, 42.7093
	Sychevka	Deciduous forest	28.V.-9.VI.2020	53.5915, 42.4625
	Vyazemka	Deciduous forest	9-19.VI.2020	53.5883, 42.6852
	Saltykovo	Deciduous forest	19.VI.-1.VII.2020	53.5914, 42.4621

Leonid Egorov identified Coleoptera. The system of Coleoptera, the volume and nomenclature of most taxa are accepted mainly according to the "Catalogue of Palaearctic Coleoptera" (Löbl and Smetana 2007, 2011, 2013; Löbl and Löbl 2015, 2016; Danilevsky 2020; Iwan and Löbl 2020). Data on the occurrence of species and species diversity were analyzed. To compare the occurrence of species, the number of species sightings was determined in relation to the total number of trap exposures. When specifying the biology of the species, we used our own data and observations in nature.

RESULTS AND DISCUSSION

Results

A total of 97 species from 20 families have been recorded. Unfortunately, the Coleoptera biodiversity of the Penza region is still very poorly studied. Scattered data (Dyukin 1912; Dmitriev 1926; Anufriev et al. 1999; Bokhovko and Stoiko 2002; Levkovich and Levkovich 2006; Polumordvinov and Glebov 2010; Pronina 2010; Lebyazhinskaya 2012; Dobrolyubova 2013) suggests that more than 1,000 species are currently known. However, this species diversity is very small and according to our objective data, the beetle fauna should number at least 3000 species. This conclusion can be made if we compare the state of the fauna of the regions bordering the Penza region. For example, in the Republic of Mordovia, about 3,300 species of Coleoptera are already known (Ruchin and Egorov 2018b, 2019a,b; Ruchin et al. 2018, 2019a; Kazantsev et al. 2019; Alekseev and Ruchin 2020; Egorov et al. 2020b; Zemoglyadchuk et al. 2020). In our research, the use of crown traps allowed us to detect 43 new species for the Penza region at once. This indicates a poor knowledge of the beetle fauna of the region and the use of new research methods in this case is very effective.

The most diverse families are Cerambycidae (24 species) and Elateridae (11 species) (Fig. 2). Most of the families were represented in our collections by single species. Species from the families Nitidulidae (3,281 specimens), Scarabaeidae (1,497 specimens), and Cerambycidae (453 specimens) predominated in the traps. The remaining families in the collections are represented by less than a hundred specimens, and some by single individuals (Fig. 3). Below, there is a list of Coleoptera species found using fermental crown traps. The list for each species contains references to literature data from the territory of the Penza region (if there is a reliable indication), the place of collection of the material, indicating the number of localities and the number of collected or recorded specimens ("Material"), original data on the biology of the species. The names of the new species for the fauna of the Penza region are marked with a single asterisk (*). In the "Material" section, the locale number is indicated (see Table 1), while the number of instances found is indicated in parentheses.

List of species

Order COLEOPTERA Linnaeus, 1758

Suborder ADEPHAGA Schellenberg, 1806

Family CARABIDAE Latreille, 1802

Harpalus xanthopus winkleri (Schauberger, 1923)

Literature data: Lebyazhinskaya (2012).

Material: 54 (1).

Biology. It is typical for broad-leaved and mixed forests, spruce forests. It falls into the crown traps accidently.

Limodromus assimilis (Paykull, 1790)

Literature data: Levkovich and Levkovich (2006); Lebyazhinskaya (2012).

Material: 11 (1).

Biology. In the region, it is a common species, found in mixed and deciduous forests. It falls into the crown traps accidently.

Suborder POLYPHAGA Emery, 1886

Family SILPHIDAE Latreille, 1806

Dendroxena quadrimaculata (Scopoli, 1771)

Literature data: Levkovich and Levkovich (2006).

Material: 46 (4); 56 (3); 102 (1); 105 (1).

Biology. An active predator. Main habitats: deciduous and mixed forests, pine forests with birch undergrowth. It is a common species. It is often found on the leaves of shrubs and undergrowth of trees, on forest roads.

**Necrodes littoralis* (Linnaeus, 1758)

Material: 6 (4); 18 (1); 32 (1); 39 (1); 41 (1); 42 (1); 61 (16); 80 (2); 83 (5).

Biology. A necrobiont. It is noted that beetles feed on Diptera larvae located on carrion. We caught them in crown traps. A single species appeares during collecting insects at night on UV light. This species is also attracted by insects that have died in traps.

Nicrophorus humator (Gleditsch, 1767)

Literature data: Bokhovko and Stoiko (2002).

Material: 42 (1).

Biology. It prefers forest habitats. The biology is similar to the previous species.

Nicrophorus interruptus (Stephens, 1830)

Literature data: Bokhovko and Stoiko (2002)

Material: 2 (2); 42 (3); 81 (1); 82 (3).

Biology. It is necrophage, was found only in forest biotopes (on the edges). A single species appeares during collecting insects at night on UV light. The biology is similar to the previous species.

**Nicrophorus sepultor* (Charpentier, 1825)

Material: 42 (1).

Biology. It was caught simultaneously with the previous three species in one trap on the edge of a deciduous forest that turns into a meadow biotope.

Nicrophorus vespillo (Linnaeus, 1758)

Literature data: Bokhovko and Stoiko (2002); Levkovich and Levkovich (2006).

Material: 82 (1).

Biology. One of the most common species of the family. It is often found in many biotopes. It rarely appears in crown traps.

Oiceoptoma thoracicum (Linnaeus, 1758)

Literature data: Levkovich and Levkovich (2006).

Material: 67 (1).

Biology. One of the most common species of the family. It is often found on the soil in many biotopes.

Family STAPHYLINIDAE Latreille, 1802

**Quedius dilatatus* (Fabricius, 1787)

Material: 4 (1); 6 (2); 8 (1); 11 (5); 12 (1); 14 (4); 15 (2); 17 (11); 18 (16); 19 (10); 20 (1); 21 (6); 22 (1); 23 (7); 27 (1); 28 (1); 33 (1); 34 (3); 37 (1); 40 (2); 41 (3); 42 (1); 63 (3); 65 (1); 71 (2); 79 (1); 81 (2); 83 (1).

Biology. It is found in mixed and deciduous forests, pine forests. The species is related to the nests of *Vespa crabro* Linnaeus, 1758, where its larvae feed on Diptera larvae in the fragments of the nests (Salnitska and Solodovnikov 2019).

Family SCARABAEIDAE Latreille, 1802

Cetonia aurata (Linnaeus, 1758)

Literature data: Dmitriev (1926); Anufriev et al. (1999); Levkovich and Levkovich (2006); Dobrolyubova (2013).

Material: 2 (1); 3 (11); 5 (25); 6 (2); 7 (1); 14 (4); 26 (1); 29 (1); 42 (1); 43 (1); 47 (1); 54 (2); 58 (2); 59 (12); 60 (2); 73 (15); 74 (3); 75 (2); 77 (3); 81 (3); 82 (5); 101 (54); 102 (1); 103 (19); 112 (2); 113 (10).

Biology. The most common type of flower chafers in the region, found in most biotopes. Beetles can often be found on flowering plants and leaking tree sap, and larvae have been found in the decaying wood of oak petiolate.

Gnorimus variabilis (Linnaeus, 1758)

Literature data: Dmitriev (1926); Levkovich and Levkovich (2006); Polumordvinov and Monakhov (2003); Red Data Book of Penza Region (2019).

Material: 64 (2); 83 (1).

Biology. A rare species. It is confined to deciduous forests, where it adheres to areas with *Quercus robur*, and is also found in pine forests. They fly from the beginning of June to the end of July, larvae are found in the rotten wood of oak and other deciduous trees, pine.

Protaetia affinis (Andersch, 1797)

Literature data: Dmitriev (1926); Levkovich and Levkovich (2006)

Material: 101 (2); 112 (4); 114 (1).

Note. These are new findings of a very rare and local species, previously known in 1910 within the modern territory of Penza. A detailed report on the distribution of the species in the European part of Russia is in press.

Protaetia fieberi (Kraatz, 1880)

Literature data: Polumordvinov and Monakhov (2003); Red Data Book of Penza Region (2019); Ruchin et al. (2019c).

Material: 1 (1); 2 (5); 3 (19); 4 (4); 5 (10); 6 (28); 8 (1); 10 (2); 14 (13); 16 (1); 19 (1); 23 (2); 26 (2); 27 (5); 29 (6); 40 (21); 41 (3); 42 (23); 47 (2); 58 (5); 59 (6); 60 (3); 61 (7); 64 (5); 66 (1); 68 (3); 69 (3); 70 (5); 71 (1); 72 (3); 73 (1); 77 (4); 79 (7); 80 (1); 81 (9); 82 (3); 83 (5); 87 (1); 89 (1); 90 (4); 91 (1); 100 (2); 101 (6); 102 (2); 103 (1); 104 (4); 113 (4); 114 (3).

Biology. This is a local species, confined to broad-leaved and mixed forests, sometimes found in floodplains of deciduous forests. Imagos are active from the end of May to August.

Protaetia marmorata (Fabricus, 1792)

Literature data: Dmitriev (1926); Levkovich and Levkovich (2006).

Material: 2 (1); 3 (26); 4 (47); 5 (13); 6 (39); 8 (1); 9 (4); 10 (8); 11 (3); 14 (26); 15 (1); 16 (4); 18 (4); 21 (3); 22 (3); 23 (4); 24 (3); 26 (2); 27 (12); 28 (5); 29 (26); 30 (1); 31 (1); 32 (27); 33 (4); 34 (2); 36 (7); 37 (3); 38 (1); 40 (9); 41 (12); 43 (5); 44 (19); 42 (8); 45 (5); 46 (19); 47 (13); 48 (4); 54 (5); 56 (6); 58 (50); 59 (18); 60 (4); 61 (13); 62 (5); 63 (1); 64 (13); 65 (1); 66 (5); 67 (7); 68 (15); 69 (6); 70 (2); 71 (4); 72 (13); 73 (11); 74 (1); 75 (6); 76 (7); 77 (38);) 78 (1); 79 (5); 80 (1); 81 (1); 82 (1); 83 (9); 84 (1); 86 (4); 87 (10); 88 (28); 89 (25); 90 (12); 91 (11); 95 (3); 98 (2); 99 (10); 100 (83); 101 (59); 102 (11); 103 (14); 104 (17); 105 (1); 106 (1); 107 (2); 111 (2); 112 (7); 113 (19); 114 (25).

Biology. It is found in deciduous and mixed forests, in parks, forest protection strips and other biotopes. Larval development takes place in the hollows of dead deciduous trees for three years. In beer traps, this is the most common species.

Protaetia cuprea volhyniensis (Gory & Percheron, 1833) (previously was indicated as *Protaetia metallica* (Herbst, 1782))

Literature data: Dmitriev (1926); Levkovich and Levkovich (2006).

Material: 2 (2); 5 (1); 14 (1); 19 (3); 32 (2); 41 (1); 42 (1); 54 (1); 55 (2); 60 (1); 61 (2); 66 (1); 68 (1); 69 (1); 82 (1); 90 (1); 101 (5); 103 (1); 107 (4); 113 (1).

Biology. It is common for deciduous and mixed forests, oak forests, and floodplains. This is a local species. Beetles usually fly in May-August. Larvae are found in decaying trunks of oak.

Protaetia speciosissima (Scopoli, 1786)

Literature data: Dmitriev (1926); Polumordvinov and Monakhov (2003); Levkovich and Levkovich (2006); Red Data Book of Penza Region (2019).

Material: 2 (1); 3 (2); 6 (12); 14 (5); 24 (1); 27 (2); 29 (1); 32 (1); 40 (4); 41 (4); 42 (2); 58 (1); 62 (1); 68 (1); 70 (1); 72 (1); 77 (1); 79 (1); 112 (4); 113 (2).

Biology. The species is confined to broad-leaved and deciduous forests with oak, and is found in floodplains of

rivers. Beetles feed on the woody sap of oak and willow trees. Imagos are caught from the end of May to the beginning of September.

Family BUPRESTIDAE Leach, 1815

Anthaxia quadripunctata (Linnaeus, 1758)

Literature data: Levkovich and Levkovich (2006).

Material: 13 (1).

Biology. It is common for pine and mixed forests, complex forests. This is a local and common species. It flies in late May-July. The larvae develop in dead trunks of pine trees.

Dicerca alni (Fischer von Waldheim, 1824)

Literature data: Levkovich and Levkovich (2006).

Material: 67 (1).

Biology. It is common in floodplain forests and blackwoods. The species is not uncommon but is local. It flies in June and July. Larvae are found in dead trunks of alder.

Family ELATERIDAE Leach, 1815

Agrypnus murinus (Linnaeus, 1758)

Literature data: Anufriev et al. (1999); Levkovich and Levkovich (2006).

Material: 44 (1); 45 (2); 47 (1); 48 (1); 55 (2); 107 (1).

Biology. This is one of the main species of agricultural pests in the region. It lives on sandy loam soils.

Ampedus cinnabarinus (Eschscholtz, 1829)

Literature data: Levkovich and Levkovich (2006).

Material: 90 (1); 107 (1).

Biology. It is found in old-growth pine forests, mixed forests with birch and spruce (Ruchin et al. 2018).

**Ampedus nigroflavus* (Goeze, 1777)

Material: 101 (1).

Biology. It is found in deciduous and mixed forests (Ruchin et al. 2018).

**Ampedus pomorum* (Herbst, 1784)

Material: 19 (2); 48 (2); 57 (1); 107 (1).

Biology. It is a common species for mixed, pine, and deciduous forests. Often it can be found in the old burned areas (Ruchin et al. 2018).

**Ampedus sanguinolentus* (Schrank, 1776)

Material: 107 (4).

Biology. It is a common species for mixed, deciduous forests with aspen (Ruchin et al. 2018).

**Limonius minutus* (Linnaeus, 1758)

Material: 32 (1).

Biology. The species is found in mixed, floodplain broad-leaved forests, pine forests with spruce, birch, aspen (Ruchin et al. 2018).

**Melanotus castanipes* (Paykull, 1800)

Material: 88 (1).

Biology. It is found in mature spruce forests with pine and birch, deciduous forests, floodplain deciduous forests with a predominance of aspen, mixed forests, pine forests with spruce (Ruchin et al. 2018).

**Melanotus villosus* (Geoffroy, 1785)

Material: 102 (1).

Biology. It is an inhabitant of deciduous forests (Ruchin et al. 2018).

Prosternon tessellatum (Linnaeus, 1758)

Literature data: Anufriev et al. (1999).

Material: 11 (2); 19 (1); 48 (13); 54 (1); 55 (12); 57 (4); 100 (2); 104 (1); 107 (6).

Biology. This is one of the main pests of agriculture in the region, it lives on forest edges and in gullies. It is often found on flowering plants. It is found in many forest ecosystems.

Selatosomus aeneus (Linnaeus, 1758)

Literature data: Anufriev et al. (1999); Levkovich and Levkovich (2006).

Material: 18 (1).

Biology. This is one of the main pests of agriculture in the region, it lives on podzolic soils. It is often found in clearings, edges of various forests.

Family CANTHARIDAE Imhoff, 1857 (1815)

**Cantharis livida* (Linnaeus, 1758)

Material: 101 (1); 107 (1).

Biology. It is found in different biotopes: on the edges and clearings of pine forests, alder forests, mixed forests, in floodplain meadows. It is rarely found in crown traps. It is confined to herbaceous plants.

**Cantharis nigricans* (O.F. Müller, 1776)

Material: 44 (2); 103 (1).

Biology. This is one of the most frequently encountered species of this family. It lives in a wide variety of biotopes of open and closed landscapes. It is rarely found in crown traps. It is confined to herbaceous plants.

**Cantharis pellucida* (Fabricius, 1792)

Material: 87 (1).

Biology. This is a common type for edges, clearings in forests, parks, and gardens. It is rarely found in crown traps. It is confined to herbaceous plants.

**Rhagonycha nigriventris* (Motschulsky, 1860)

Material: 43 (1).

Biology. This is a common species. It is found in mixed and deciduous forests, pine forests and spruce forests with pine and birch. It is rarely found in crown traps. It is confined to herbaceous plants.

Family DERMESTIDAE Latreille, 1804

**Attagenus schaefferi* (Herbst, 1792)

Material: 54 (1).

Biology. It an anthophily species. It is often caught in crown traps.

**Dermestes murinus* (Linnaeus, 1758)

Material: 102 (1).

Biology. It is found in a mixed forest at the edge of a clearing (our data).

**Globicornis emarginata* (Gyllenhal, 1808)

Material: 54 (1).

Biology. It is found in a mixed forest. According to some data, it was collected from oak firewood (Merkl 1993). Larvae were found on the dead polypore fungi (Nikitsky and Schigel 2004).

**Trogoderma glabrum* (Herbst, 1783)

Material: 98 (1); 101 (1).

Biology. It is considered a cryptogenic species for Europe. It is found near colonies of solitary bees and wasps, where its larvae feed on animal remains (Orlova-Bienkowskaja 2019).

Family PTINIDAE Latreille, 1802

**Dorcatoma robusta* (A. Strand, 1938)

Material: 95 (1).

Biology. It develops in bracket fungi in different types of forests (Nikitsky and Schigel 2004).

Family CLERIDAE Latreille, 1802

**Thanasimus femoralis* (Zetterstedt, 1828)

Material: 56 (1).

Biology. It lives in coniferous and mixed forests, is found on the bark of trunks and logs of spruce and pine trees. It's a predator (Nikitsky and Schigel 2004).

Family MELYRIDAE Leach, 1815

Cordylepherus viridis (Fabricius, 1787)

Literature data: Anufriev et al. (1999).

Material: 86 (1).

Biology. This is a common species. It is found in mixed and deciduous forests. It is rarely found in crown traps.

**Dasytes fusculus* (Illiger, 1801)

Material: 98 (1); 101 (4).

Biology. It is found in mixed and deciduous forests.

**Dasytes niger* (Linnaeus, 1760)

Material: 24 (3); 89 (1).

Biology. This is a common species. It is found in mixed and deciduous forests.

Malachius bipustulatus (Linnaeus, 1758)

Literature data: Levkovich and Levkovich (2006).

**Glischrochilus quadripunctatus* (Linnaeus, 1758)

Material: 43 (1); 53 (2); 54 (1); 102 (2).

Material: 102 (1).

Biology. This is a common species. It is found in mixed and deciduous forests.

Family MONOTOMIDAE Laporte, 1840

**Carpophilus hemipterus* (Linnaeus, 1758)

Material: 98 (1).

Biology. It is found in deciduous forests.

**Rhizophagus fenestralis* (Linnaeus, 1758)

Material: 54 (1); 73 (1); 98 (2); 99 (2); 101 (9); 111 (1).

Biology. It lives in deciduous forests. It is found under the bark. It is believed to live in association with Scolytinae (Drost and Heijerman 2017).

Family NITIDULIDAE Latreille, 1802

**Cryptarcha strigata* (Fabricius, 1787)

Material: 3 (2); 4 (3); 6 (1); 8 (2); 9 (3); 10 (4); 14 (3); 16 (11); 18 (1); 20 (2); 22 (2); 24 (2); 30 (1); 33 (4); 34 (16); 35 (7); 36 (1); 37 (3); 39 (1); 40 (2); 42 (2); 43 (2); 45 (1); 46 (1); 54 (1); 56 (3); 60 (10); 61 (4); 68 (1); 73 (2); 74 (1); 78 (5); 79 (1); 84 (3); 86 (18); 87 (7); 88 (9); 89 (13); 91 (19); 95 (1); 97 (6); 98 (14); 99 (44); 100 (2); 101 (2); 102 (2); 105 (8); 106 (24); 108 (2); 109 (4); 110 (3); 111 (18).

Biology. This is a common species, which, with a larger number, was found in oak and aspen forests. It is quite common in pine forests and mixed forests. The peak population was observed in early June (Ruchin et al. 2021).

**Cryptarcha undata* (G.-A. Olivier, 1790)

Material: 7 (2); 8 (1); 9 (1); 14 (3); 15 (1); 16 (1); 28 (1); 33 (2); 34 (1); 73 (6); 86 (1); 91 (1); 96 (1); 97 (1); 98 (1); 99 (4); 111 (7).

Biology. It is a common species with low abundance. It lives in mixed and deciduous forests.

**Glischrochilus grandis* (Tournier, 1872)

Material: 1 (9); 3 (8); 4 (4); 5 (5); 6 (11); 7 (16); 8 (47); 9 (24); 10 (103); 11 (4); 12 (13); 14 (12); 15 (10); 21 (1); 26 (1); 33 (31); 34 (21); 35 (4); 43 (20); 47 (2); 49 (3); 50 (7); 52 (2); 53 (3); 55 (30); 54 (27); 56 (12); 67 (1); 68 (1); 73 (8); 74 (4); 75 (4); 82 (1); 83 (1); 85 (10); 86 (8); 87 (3); 90 (5); 92 (2); 93 (13); 94 (3); 95 (3); 96 (68); 97 (94); 98 (775); 99 (774); 100 (48); 101 (85); 102 (44); 103 (51); 104 (1); 107 (1); 108 (21); 109 (101); 110 (108); 111 (82); 114 (9).

Biology. This is a common species, sometimes it can be numerous. It lives in deciduous and mixed forests (Ruchin et al. 2021).

**Glischrochilus hortensis* (Geoffroy, 1785)

Material: 43 (1); 48 (1); 52 (1); 55 (3); 56 (2); 57 (1); 87 (1); 98 (3); 99 (5); 101 (1); 102 (1); 109 (3); 110 (1).

Biology. This is a common species, regularly found in deciduous and mixed forests (Ruchin et al. 2021).

Biology. It is a constantly occurring species in crown traps. Its population is usually lower than the one of other Nitidulidae species.

**Glischrochilus quadrisignatus* (Say, 1835)

Material: 3 (2); 7 (1); 8 (2); 9 (2); 41 (3); 42 (1); 55 (3); 85 (3); 93 (1); 101 (1).

Biology. This is a North American dispersing species (Keszthelyi 2012). It is currently known from many regions of Russia (Orlova-Bienkowskaja 2019). It is often found on rotting fruit, on carrion and in manure, in corn, on sap-bearing trees (Price and Young 2006). In the Republic of Mordovia, this species is regularly caught in natural ecosystems, in forests of various types (Ruchin et al. 2021).

**Soronia grisea* (Linnaeus, 1758)

Material: 9 (1); 18 (1); 22 (3); 24 (3); 28 (2); 30 (1); 33 (1); 34 (1); 38 (1); 45 (1); 50 (1); 51 (1); 54 (2); 56 (1); 61 (1); 67 (1); 68 (3); 86 (2); 88 (1); 89 (1); 91 (2); 95 (1); 96 (7); 97 (14); 98 (29); 99 (33); 100 (1); 101 (1); 104 (2); 105 (3); 106 (4); 108 (2); 110 (4); 111 (2).

Biology. This is a common species, regularly found in deciduous and mixed forests (Ruchin et al. 2021).

Family COCCINELLIDAE Latreille, 1807

Adalia decempunctata (Linnaeus, 1758)

Literature data: Pronina (2010).

Material: 109 (1).

Biology. It is recorded in deciduous and mixed forests. It accidentally falls into the crown traps.

Calvia decemguttata (Linnaeus, 1767)

Literature data: Pronina (2010).

Material: 102 (2).

Biology. It is recorded in mixed forests. It accidentally falls into the crown traps.

Calvia quatuordecimguttata (Linnaeus, 1758)

Literature data: Levkovich and Levkovich (2006); Pronina (2010).

Material: 50 (1); 109 (1).

Biology. It is recorded in deciduous and mixed forests in spring. It accidentally falls into the crown traps.

**Coccinella magnifica* (L. Redtenbacher, 1843)

Material: 100 (1); 104 (1).

Biology. It is recorded in deciduous forests. It accidentally falls into the crown traps.

Halyzia sedecimguttata (Linnaeus, 1758)

Literature data: Levkovich and Levkovich (2006); Pronina (2010).

Material: 111 (1).

Biology. It was caught in the spring on the edge of a deciduous forest. It accidentally falls into the crown traps.

Harmonia quadripunctata (Pontoppidan, 1763)

Literature data: Pronina (2010).

Material: 56 (1).

Biology. It is recorded in a pine forest with birch and linden. It accidentally falls into the crown traps.

Mysia oblongoguttata (Linnaeus, 1758)

Literature data: Pronina (2010).

Material: 43 (1); 54 (1).

Biology.It was recorded in spring in mixed forests. It accidentally falls into the crown traps.

Oenopia conglobata (Linnaeus, 1758)

Literature data: Pronina (2010).

Material: 48 (1).

Biology. It was recorded in a pine forest with birch, linden and maple trees. It accidentally falls into the crown traps.

Sospita vigintiguttata (Linnaeus, 1758)

Literature data: Pronina (2010).

Material: 85 (1).

Biology. It was recorded on the edge of a deciduous forest. It accidentally falls into the crown traps.

Family MYCETOPHAGIDAE Leach, 1815

**Litargus connexus* (Geoffroy, 1785)

Material: 6 (1); 98 (1).

Biology. It inhabits deciduous and mixed forests, clearings, and edges.

Family MELANDRYIDAE Leach, 1815

**Phloiotrya subtilis* (Reitter, 1897)

Material: 87 (1).

Biology. It is found in mixed forests.

Family TENEBRIONIDAE Latreille, 1802

Lagria hirta (Linnaeus, 1758)

Literature data: Levkovich and Levkovich (2006); Dobrolyubova (2013).

Material: 65 (1); 86 (1).

Biology. his is one of the most common and numerous species. It flies in late May-July. Beetles feed on flowering plants in meadows, edges and forest clearings. It is rarely caught in crown traps, as it is usually found on the grass.

Family OEDEMERIDAE Latreille, 1810

**Chrysanthia geniculata* (W.L.E. Schmidt, 1846)

Material: 33 (1).

Biology. It is found on the edge of a deciduous forest. It is often found on flowering plants.

Chrysanthia viridissima (Linnaeus, 1758)

Literature data: Anufriev et al. (1999); Levkovich and Levkovich (2006).

Material: 57 (1).

Biology. It is found at the edge of a clearing in a mixed forest.

**Oedemera podagrariae* (Linnaeus, 1767)

Material: 40 (1).

Biology. It is found on the edge of a deciduous forest.

Family CERAMBYCIDAE Latreille, 1802

Aromia moschata (Linnaeus, 1758)

Literature data: Dyukin (1912); Levkovich and Levkovich (2006).

Material: 1 (7); 14 (1); 19 (1); 32 (1); 61 (2); 76 (1).

Biology. It is a local species of old-growth moist deciduous forest of the region. Beetles fly in June-August, they are found on flowering herbaceous plants. Larvae develop in the basal part of the trunks of different types of willows, they do not settle in withered trees.

Chlorophorus herbstii (Brahm, 1790)

Literature data: Dyukin (1912).

Material: 63 (1).

Biology. It is found in deciduous forest. In such biotopes, it is quite common.

**Chlorophorus varius* (Müller, 1766)

Material: 40 (1).

Biology. It is found on the edge of a deciduous forest.

Leptura quadrifasciata (Linnaeus, 1758)

Literature data: Dyukin (1912); Levkovich and Levkovich (2006).

Material: 5 (2); 10 (2); 11 (6); 18 (1); 19 (6); 22 (2); 23 (1); 26 (6); 29 (1); 32 (1); 40 (1); 61 (4); 63 (1); 65 (2); 66 (1); 68 (1); 79 (2); 81 (5); 107 (5); 114 (1).

Biology. It inhabits deciduous and mixed forests, clearings, and edges. Beetles fly in June and July. Thy are found on flowering plants of Umbelliferae.

Leptura thoracica (Creutzer, 1799)

Literature data: Dyukin (1912); Red Data Book of Penza Region (2019).

Material: 1 (2); 4 (2); 5 (6); 19 (11); 23 (2); 26 (13); 32 (2); 40 (1); 41 (1); 42 (3); 48 (2); 57 (1); 58 (3); 61 (2); 66 (5); 76 (1); 80 (1); 81 (2); 107 (3).

Biology. The species lives in deciduous, mixed and floodplain forests. It flies in June-July. The larvae develop in the rotten wood of deciduous trees, for example, they were found in the fallen rotten trunk of a hanging birch (*Betula pendula* Roth.).

Lepturalia nigripes (De Geer, 1775)

Literature data: Dyukin (1912).

Material: 5 (1); 91 (1).

Biology. It inhabits birch forests and light deciduous forests. Beetles fly in May-June. Single specimens were found on flowering plants of Umbelliferae.

**Mesosa myops* (Dalman, 1817)

Material: 32 (3).

Biology. It is found in mixed and deciduous forests, in pine forests with an admixture of birch (Ruchin and Egorov 2018b). In studies region, it was found in deciduous forests.

Necydalis major (Linnaeus, 1758)

Literature data: Dyukin (1912); Red Data Book of Penza Region (2019); Levkovich and Levkovich (2006).

Material: 25 (1); 27 (1); 40 (1); 58 (1); 65 (1); 66 (3); 71 (1); 76 (3).

Biology. It inhabits deciduous and mixed forests. It is rarely found on flowering plants, but it is often lured into crown traps. The larvae develop in the wood of *Salix* sp. and other deciduous trees.

**Obrium cantharinum* (Linnaeus, 1767)

Material: 1 (2); 11 (1); 18 (1); 23 (1); 27 (3); 58 (1); 63 (1); 79 (2); 84 (1).

Biology. It is a rather secretive species, its distribution is confined to old aspen forests, and it inhabits poplar stands in localities (Ruchin and Egorov 2018b). It is possible to study the distribution of this species well with the help of crown traps.

Phymatodes testaceus (Linnaeus, 1758)

Literature data: Dyukin (1912).

Material: 23 (2); 30 (1); 54 (1); 87 (3); 90 (1); 100 (1); 103 (1); 105 (1).

Biology. It inhabits oak forests and mixed forests. Beetles fly in the evening in May-June. The species is local, often found, the larvae develop in the dead oak wood.

Plagionotus detritus (Linnaeus, 1758)

Literature data: Dyukin (1912).

Material: 58 (1); 77 (1); 100 (1).

Biology. It inhabits oak forests and mixed forests. Beetles fly in June-July. The larvae develop in the dead tree-blue oak and wood logs.

Purpuricenus globulicollis (Dejean, 1839)

Literature data: Polumordvinov and Glebov (2010); Red Data Book of Penza Region (2019); Ruchin and Egorov (2019).

Material: 60 (2).

Biology. The species was recorded on the edges of deciduous and mixed forests bordering willows in floodplains. It is very rare and local in the region, active from the end of May to the end of July. The larvae develop in the branches of deciduous trees. The use of crown traps with beer gives good results for studying the distribution and abundance of this species.

Purpuricenus kaehleri (Linnaeus, 1758)

Literature data: Dyukin (1912); Polumordvinov and Glebov (2010); Red Data Book of Penza Region (2019).

Material: 2 (1); 3 (14); 6 (1); 7 (6); 10 (1); 14 (1); 25 (2); 27 (11); 32 (4); 40 (4); 42 (14); 58 (1); 59 (2); 60 (26); 61 (44); 73 (9); 76 (1); 79 (1); 81 (1); 83 (1).

Biology. Previously, it was considered a rather rare and local species, known from the floodplain oaks and willows of the Sura River. New data from crown traps show a wider distribution of the species in the region. Beetles are found from May to July. The larvae develop in the trunks and branches of dying deciduous trees.

Rhagium inquisitor (Linnaeus, 1758)

Literature data: Dyukin (1912).

Material: 43 (1).

Biology. It inhabits pine and mixed forests. Beetles fly in July-August, sometimes they can be found under the bark of pine stumps.

Rhagium mordax (De Geer, 1775)

Literature data: Dyukin (1912); Levkovich and Levkovich (2006).

Material: 22 (1); 48 (2); 55 (2); 56 (4); 57 (1); 87 (1); 90 (8); 97 (2); 98 (1); 99 (2); 101 (36); 102 (15); 103 (3); 104 (1); 109 (5); 110 (3); 111 (5).

Biology. It inhabits deciduous and mixed forests. Beetles fly in May-August. The larvae develop directly under the bark of dead trees. The species flies is well lured to the bait with beer and sugar.

Ropalopus macropus (Germar, 1823)

Literature data: Dyukin (1912).

Material: 90 (2).

Biology. It is a new find in a mixed forest. It is more typical for deciduous forests.

Rutpela maculata (Poda von Neuhaus, 1761)

Literature data: Dyukin (1912); Levkovich and Levkovich (2006).

Material: 17 (1); 19 (4); 26 (1); 27 (1); 48 (1); 76 (1); 81 (2); 107 (1).

Biology. It is a common species for mixed forest. In nature, it is more common on flowering plants of different families. It is well lured to the crown traps.

Spondylis buprestoides (Linnaeus, 1758)

Literature data: Dyukin (1912); Levkovich and Levkovich (2006).

Material: 23 (1).

Biology. It inhabits pine forests and mixed forests. It is a local species, but sometimes found in big numbers. Beetles fly in June-July. It falls accidently into crown traps.

Stenocorus meridianus (Linnaeus, 1758)

Literature data: Dyukin (1912).

Material: 21 (1); 32 (1); 58 (3); 60 (1); 61 (5); 80 (1).

Biology. It inhabits old deciduous forests, edges and adjacent meadows, forest parks. It is not uncommon, but occurs only occasionally, more often on flowering plants of Umbelliferae.

Strangalia attenuata (Linnaeus, 1758)

Literature data: Dyukin (1912); Levkovich and Levkovich (2006).

Material: 84 (1).

Biology. It inhabits deciduous and partly mixed forests. It is a common species. It flies in June-July. Larvae develop in deciduous trees.

**Trichoferus campestris* (Faldermann, 1835)

Material: 14 (1); 35 (1); 60 (1).

Biology. It is an alien species. Currently, it has spread to many regions of Russia. Over the past 20 years, it has penetrated into various countries in Western Europe, and appeared in North America (Dascãlu et al. 2013; Kadyrov et al. 2016; Pennacchio et al. 2016; Ruchin and Egorov 2018b).

**Xylotrechus antilope* (Schoenherr, 1817)

Material: 7 (1); 58 (4); 60 (1); 61 (2).

Biology. It is found in deciduous forests. It is usually found on oak trees (our data).

**Xylotrechus arvicola* (Olivier, 1795)

Material: 81 (1).

Biology. It was found on the edge of a deciduous forest. It prefers deciduous trees (our data).

**Xylotrechus pantherinus* (Savenius, 1825)

Material: 5 (1).

Biology. The species is a monophage on various species of *Salix* sp. The larvae develop in healthy or weakened trunks and branches, where they develop deep in the wood. Imagos are often found on *Salix* sp. (Laugsand et al. 2008; Karpiński et al. 2018).

Family CURCULIONIDAE Latreille, 1802

Anisandrus dispar (Fabricius, 1792)

Literature data: Sakharov (1947).

Material: 56 (8); 92 (1); 98 (20); 99 (4); 109 (25); 110 (2).

Biology. It inhabits almost all hardwoods – oak, linden, fruit trees. It has two generations per summer. Beetles of the first generation fly in May, the second one flies in the middle of summer.

Curculio glandium (Marsham, 1802)

Literature data: Dobrolyubova (2013).

Material: 7 (1); 67 (1).

Biology. It is found on the edges of mixed and deciduous forest.

Curculio nucum (Linnaeus, 1758)

Literature data: Levkovich and Levkovich (2006).

Material: 29 (5).

Biology. It is found on the edges of deciduous forest.

**Curculio villosus* (Fabricius, 1781)

Material: 98 (1).

Biology. It is found on the edges of deciduous forest.

Phyllobius argentatus (Linnaeus, 1758)

Literature data: Levkovich and Levkovich (2006).

Material: 90 (1).

Biology. It is found on the edges of mixed forest.

Phyllobius pyri (Linnaeus, 1758)

Literature data: Levkovich and Levkovich (2006).

Material: 54 (1).

Biology. It is found on the edges of mixed forest.

Discussion

The most diverse families were Cerambycidae (24 species) and Elateridae (11 species) (Figure 2). Most of the families were represented in our collections by single species. Species from the families Nitidulidae (3,281 specimens), Scarabaeidae (1,497 specimens), and Cerambycidae (453 specimens) predominated in the traps. The remaining families were represented by less than a hundred specimens, and some – by single individuals only (Figure 3).

In total, 43 of the 97 species found are new to the Penza region. Mainly, these are common species for mixed and deciduous forests and are rarely melted in other ways. Three species (*Glischrochilus quadrisignatus*, *Trogoderma glabrum*, and *Trichoferus campestris*) are alien.

Due to the fact that the fauna of Coleoptera in the Penza region is not sufficiently studied, many of the most common species have not yet been reliably found. It is known that fermental crown traps are often a good additional tool for collecting information about rare and little-known species (their abundance and distribution in the study area). For example, among the species included in the Red Data Book of Penza Region (2019), 4 species were found – *Protaetia fieberi*, *Protaetia speciosissima*, *Gnorimus variabilis*, *Purpuricenus globulicollis*. The first two species are included in the Red Book of the Russian Federation (List of Objects of the Animal World Listed in the Red Book of the Russian Federation 2020). In the Red Data Book of Penza Region (2019), 6 localities of *Protaetia fieberi* are indicated for the region, and we have made new notes concerning 48 habitats. There are also 11 localities of *Protaetia speciosissima*, while our research has proven the existence of this species in another 20 habitats.

The biodiversity of Coleoptera from crown traps differs from those caught in other ways (Barber traps, hand-picking, window traps, and others). Our trapping method allowed us to identify at once a significant number of species that are not often found in nature or lead a secretive lifestyle. Previously, such traps were recommended for use in the study of rare insect species (Ruchin et al. 2020). Different trapping methods, when used correctly, can be an effective tool, for example, in monitoring biodiversity and studying rare insect species that are difficult to detect in other ways.

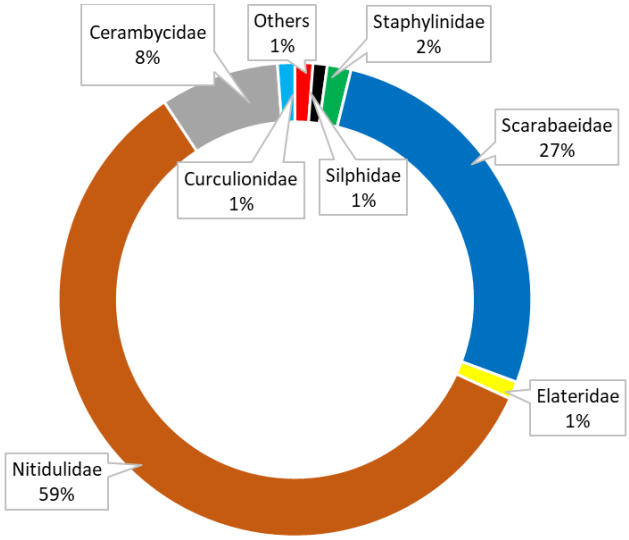

Figure 3. The number of specimens of Coleoptera in separate families registered in traps. Others – Carabidae, Buprestidae, Cantharidae, Dermestidae, Ptinidae, Cleridae, Melyridae, Monotomidae, Coccinellidae, Melandryidae, Mycetophagidae, Tenebrionidae and Oedemeridae

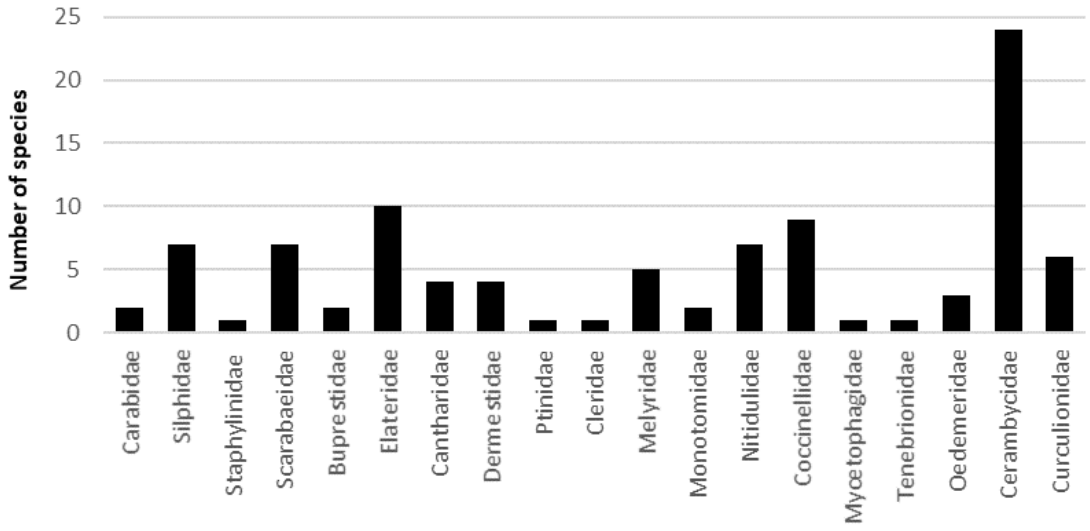

Figure 2. The number of species in the families recorded in the traps

In conclusion, the biodiversity of Coleoptera that fall into crown traps is significant. Using crown traps, 5,577 beetle specimens were collected and recorded in 2019-2020. 97 species from 19 families were found, of which 43 species are new to the Penza region. The most diverse families are Cerambycidae (24 species) and Elateridae (11 species). Numerically, species from the families Nitidulidae, Scarabaeidae, and Cerambycidae predominated in the catches. The traps used are well established for studying the diversity of species included in the Red Book of the region (Protaetia fieberi, Protaetia speciosissima, Gnorimus variabilis, Purpuricenus globulicollis). We recommend the use of crown traps with beer and wine for ecological studies of the Coleoptera fauna. This method can be used to study seasonal, biotopic features of the fauna.

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