

# Biodiversity of Coleoptera (Insecta) in Central European Russia

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**Abstract:** (1) Background: Beetles (Insecta: Coleoptera) are the most diverse order of insects. The beetle species live in many ecosystems around the globe and their roles in ecosystems are very diverse; therefore, it is important to know the local and regional biodiversity. Conservation of the entomofauna in individual macroregions requires effort to study the distribution and abundance of insects. To this end, databases are being created to record this information so that the status of a species can be objectively assessed and, if necessary, measures taken to protect it. (2) Methods: The materials were collected from the territory of eleven regions of European Russia (Ryazan, Tambov, Penza, Voronezh, Lipetsk, Moscow (including the city of Moscow), Vladimir, Kursk, Tula and Kaluga Oblasts and the Republic of Mordovia), mainly during the last approximately 20 years (2005–2024). The beetles were collected by different means (manual collection; the use of soil traps, fermental crown traps, and Malaise traps; light fishing; sweeping with an entomological net on plants and under water, etc.). (3) Results: The dataset presents data on 1310 species and subspecies of Coleoptera from 74 families found in the Eastern Part of the Eastern European Plain. In total, there are 65,100 samples and 10,771 occurrences in the dataset. (4) Conclusions: The largest families in terms of species diversity are Curculionidae (198 species), Carabidae (183 species), Staphylinidae (121 species) and Chrysomelidae (120 species).

**Keywords:** species diversity; beetles; comparison of fauna; dataset; Center of European Russia



**Citation:** Egorov, L.V.; Sazhnev, A.S.; Dedyukhin, S.V.; Ruchin, A.B.; Trushitsyna, O.S.; Nikolaeva, A.M.; Esin, M.N.; Lobachev, E.A. Biodiversity of Coleoptera (Insecta) in Central European Russia. *Diversity* **2024**, *16*, 740. <https://doi.org/10.3390/d16120740>

Academic Editor: Roberto Pizzolotto

Received: 8 November 2024

Revised: 22 November 2024

Accepted: 26 November 2024

Published: 29 November 2024



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## 1. Introduction

Beetles (Coleoptera) are the most diverse insect orders in the world, dominating many ecosystems in terms of individual abundance and occupied niches [1]. Many insect species, including Coleoptera, are at risk of extinction or significant decline due to anthropogenic factors [2]. Such local-scale population declines can be attributed to fragmented habitats [3–9]. Conservation of the entomofauna in individual macroregions requires effort to study the distribution and abundance of insects.

With its vast territory and high diversity of natural habitats, Russia faces enormous challenges in its efforts to conserve its entomofauna [10]. There is an ongoing need to document and understand changes in insect abundance and distribution data [11,12]. To this end, databases are being created to record this information so that the status of a species can be objectively assessed and, if necessary, action taken to protect it.

## 2. Data Description

### 2.1. Dataset Description

In the dataset, each observation includes basic information on the location (latitude/longitude), date of observation, name of the observer, and name of the identifier. The coordinates were determined on the spot using a GPS device or after research using Google Maps (Table 1).

**Table 1.** Description of the data in the dataset.

Column Label	Column Description
occurrenceID	An identifier for the occurrence (as opposed to a particular digital record of the occurrence).
basisOfRecord	The specific nature of the data record: HumanObservation.
scientificName	The full scientific name including the genus name and the lowest level of taxonomic rank with the authority.
kingdom	The full scientific name of the kingdom in which the taxon is classified.
decimalLatitude	The geographic latitude of location in decimal degrees.
geodeticDatum	The ellipsoid, geodetic datum, or spatial reference system (SRS) upon which the geographic coordinates given in decimalLatitude and decimalLongitude are based.
country	The name of the country in which the location occurs.
countryCode	The standard code for the country in which the location occurs.
individualCount	The number of individuals present at the time of the occurrence.
eventDate	The date when material from the trap was collected or the range of dates during which the trap collected material.
year	The integer year in which the event occurred.
month	The ordinal month in which the event occurred.
day	The integer day of the month on which the event occurred.
recordedBy	A person, group, or organization responsible for recording the original occurrence.
identifiedBy	A list of names of people who assigned the taxon to the subject.

The dataset [13] is freely available (GBIF, License: CC BY-NC 4.0) at the link: <https://doi.org/10.15468/7g3j55> (accessed on 7 November 2024).

### 2.2. Figures, Tables, and Schemes

#### 2.2.1. Taxonomic Structure

The dataset contains data on 1310 species and subspecies of Coleoptera from 74 families (alphabetically) found on the territory of eleven regions of European Russia within the eastern part (macroregion) of the Eastern European Plain (Table 2). The total number of occurrences was 10,771 and the number of specimens studied was 65,100. The largest families in terms of species (Figure 1) diversity were Curculionidae (198 species), Carabidae (183 species), Staphylinidae (121 species) and Chrysomelidae (120 species).

**Table 2.** Species diversity of beetles of the eastern part of the Eastern European Plain (Russia).

Families	Number of Species	Families	Number of Species
Aderidae	2	Hydrophilidae	30
Anamorphidae	1	Kateretidae	2
Anthicidae	2	Laemophloeidae	1
Anthribidae	9	Lampyridae	1
Attelabidae	6	Latridiidae	6
Bolboceratidae	1	Leiodidae	21
Brentidae	33	Lucanidae	4
Buprestidae	11	Lycidae	2
Byrrhidae	10	Lymexylidae	1
Byturidae	1	Melandryidae	8
Cantharidae	21	Meloidae	8

Table 2. Cont.

Families	Number of Species	Families	Number of Species
Carabidae	183	Melyridae	10
Cerambycidae	74	Monotomidae	5
Cerylonidae	2	Mordellidae	9
Chrysomelidae	120	Mycetophagidae	6
Ciidae	2	Nitidulidae	26
Cleridae	6	Noteridae	2
Coccinellidae	42	Oedemeridae	9
Cryptophagidae	1	Orsodacnidae	1
Cucujidae	1	Phalacridae	4
Curculionidae	198	Ptinidae	15
Dermestidae	16	Pyrochroidae	3
Drilidae	1	Salpingidae	2
Dryopidae	1	Scarabaeidae	51
Dytiscidae	59	Scirtidae	11
Elateridae	43	Scraptiidae	4
Endomychidae	3	Scydmaenidae	4
Erotylidae	7	Silvanidae	1
Eucinetidae	1	Spercheidae	1
Eucnemidae	5	Sphindidae	1
Geotrupidae	3	Staphylinidae	121
Gyrinidae	1	Tenebrionidae	29
Haliplidae	3	Throscidae	2
Helophoridae	4	Trogidae	3
Heteroceridae	4	Trogossitidae	2
Histeridae	17	Zopheridae	3
Hydraenidae	4		
Hydrochidae	5	Total:	1310

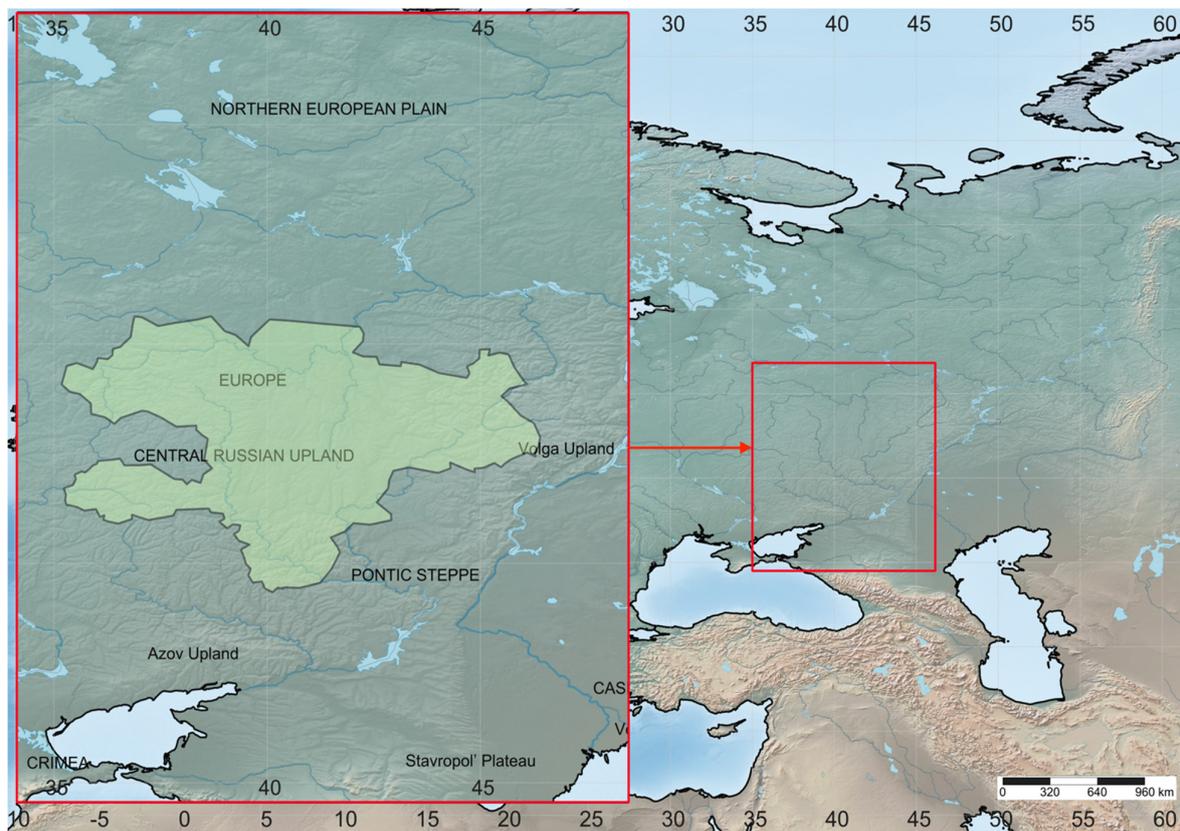


Figure 1. Map of the region studied.

The following families (15 families; 20,29%) were represented by only one species: Anamorphidae, Bolboceratidae, Byturidae, Cryptophagidae, Cucujidae, Drilidae, Dryopidae, Eucinetidae, Gyrinidae, Laemophloeidae, Lampyridae, Orsodacnidae, Silvanidae, Spercheidae and Sphindidae.

The genus structure of the macroregional fauna is very diverse—640 genera. High species diversity (>5 species) was recorded for a small number of genera (36 genera, 5.62%). The most species-rich genera are: *Amara* (Carabidae)—25 species, *Harpalus* (Carabidae)—23, *Bembidion* (Carabidae)—18, *Sitona* (Curculionidae)—15, *Hydroporus* (Dytiscidae)—14, *Cryptocephalus* (Chrysomelidae) and *Pterostichus* (Carabidae)—13 species each, and others. These genera account for 27.54% of all species in the dataset. All other genera include from one to five species.

### 2.2.2. Rare Species Records

In the dataset of the territory of the eastern part of the Eastern European Plain, there are six species (0.5% from all species) that are listed in the Red Book of Russia [14]: *Dytiscus latissimus* Linnaeus, 1758; *Calosoma sycophanta* (Linnaeus, 1758); *Lucanus cervus* (Linnaeus, 1758); *Protaetia fieberi* (Kraatz, 1880); *Protaetia speciosissima* (Scopoli, 1786); *Melandrya barbata* (Fabricius, 1787).

*Dytiscus latissimus* is a species whose abundance and/or distribution is declining; it is listed as “vulnerable” on the IUCN Red List of Threatened Species (<https://www.iucnredlist.org> (accessed on 12 August 2024)). This species has disappeared from many European countries. It prefers larger bodies of clean water. Limiting factors: habitat degradation due to desiccation of water bodies, water pollution and destruction of aquatic vegetation [14].

*Calosoma sycophanta* is a species whose abundance and/or distribution is declining; found in broadleaf and mixed forests (primarily oak); rare in most of its Russian range. Limiting factors: habitat destruction, pesticides, deforestation [14].

*Lucanus cervus* is a species whose abundance and/or distribution is declining; inhabitant of predominantly mature oak woodlands. There is a steady decline in the numbers of this species. Limiting factors: cutting down old trees and woodlots and clearing forests of rotting wood, stumps, old trees where larvae develop, insecticide applications, fires [14].

*Protaetia fieberi* and *Protaetia speciosissima* are a species whose abundance and/or distribution is declining; forest and forest–steppe stenotopic arboreal species. Limiting factors: reduction in number of large hollow trees, especially oaks, due to logging and fires; pesticide treatments [14].

*Melandrya barbata* is a species whose abundance and/or distribution is declining; xylophilous forest rare species; locally distributed. Limiting factors: rarity of large areas of permanent forest; deforestation, fires [14].

The species *Omius verruca* (Steven, 1829) (its bisexual populations are included in the Red Book of Russia [14]) was also found in the macroregion, but these common species, represented in the NPK by parthenogenetic populations, do not require protection here (protection is recommended only for local bisexual populations from the Black Sea region).

In the Ryazan region for the first time, a rare and locally widespread species *Stephanocleonus microgrammus* (Gyllenhal, 1834) (Curculionidae) was noted, which was included in the Red Data Books of the Krasnodar region (as endangered) [15] and the Rostov region (as declining) [16], and proposed for protection in the Penza region [17]. It is reasonable to recommend the species for inclusion in the next edition of the Red Data Book of the Ryazan region, especially since a whole complex of other very rare or very north-of-their-range beetle species (*Loborhynchapion amethystinum* (Miller, 1857); *Bagous aliciae* Cmoluch, 1983; *Melanobaris dalmatina* (H. Brisout, 1870); *Trachyphloeus parallelus* Seidlitz, 1868, etc.) was noted.

It should be noted that the specimen of *Glischrochilus quadripunctatus* (Linnaeus, 1758) (in the dataset) corresponds quite well to the recently described *Glischrochilus* (*Glischrochilus*)

*tremulae* Clayhills, Audisio and Cline, 2016 (so far unrecorded for Russia), whose status is not accepted by all specialists on Nitidulidae.

### 2.2.3. Alien Species Records

The dataset also contains information on alien and cryptogenic beetle species in the European part of Russia [18]; these are 22 species (1.7% from all species): *Omonadus floralis* (Linnaeus, 1758); *Trichoferus campestris* (Faldermann, 1835); *Leptinotarsa decemlineata* (Say, 1824); *Necrobia violacea* (Linnaeus, 1758); *Harmonia axyridis* (Pallas, 1773); *Exomias pellucidus* (Boheman, 1834); *Attagenus smirnovi* Zhantiev, 1973; *Dermestes ater* De Geer, 1774; *D. frischii* Kugelann, 1792; *D. lardarius* Linnaeus, 1758; *Reesa vespulae* (Milliron, 1939); *Trogoderma glabrum* (Herbst, 1783); *Sitophilus oryzae* (Linnaeus, 1763); *Cercyon laminatus* Sharp, 1873; *Typhaea stercorea* (Linnaeus, 1758); *Carpophilus hemipterus* (Linnaeus, 1758); *C. marginellus* Motschulsky, 1858; *Glischrochilus quadrisignatus* (Say, 1835); *Omosita japonica* Reitter, 1874; *Ptinus fur* (Linnaeus, 1758); *Ahasverus advena* (Waltl, 1834); *Alphitobius diaperinus* (Panzer, 1796). We consider cryptogenic species to be those that have been unintentionally introduced and have spread widely outside their natural range before their geographic distribution has been studied, so that it is not possible to determine whether a given region is part of their natural range or not [18,19].

The distribution of the native ranges of the identified alien and cryptogenic beetle species is as follows: Central Europe (*Exomias pellucidus*), Asia (*Trichoferus campestris*, *Harmonia axyridis*, *Sitophilus oryzae*, *Cercyon laminatus*, *Carpophilus marginellus*, *Omosita japonica*); North Africa (*Attagenus smirnovi*, *Alphitobius diaperinus*), North America (*Leptinotarsa decemlineata*, *Dermestes ater*, *Reesa vespulae*, *Carpophilus hemipterus*, *Glischrochilus quadrisignatus*), Central and South America (*Ahasverus advena*), and unknown (*Omonadus floralis*, *Necrobia violacea*, *Dermestes frischii*, *D. lardarius*, *Trogoderma glabrum*, *Typhaea stercorea*, *Ptinus fur*).

### 2.2.4. New Regional Records of Phytophagous Species

Due to the predominance of phytophagous beetles (by feeding type) and chortobionts with dendrobionts (by habitat preference) among all beetle species, a more detailed analysis of new species records in the macroregion is devoted to families of this ecological complex of species.

The distribution of some Coleoptera species in the European part of Russia has been clarified. The species *Pachyta lamed* (Linnaeus, 1758), found in Mordovia, is distributed here near the southern limit of its range [20]. *Pyrrhidium sanguineum* Linnaeus, 1758 and *Thammurgus caucasicus* Reitter, 1887, found in the Ryazan region, are distributed here near the northern limits of their ranges [21,22]. The eastern and northern limits of the range of *Protaetia affinis* (Andersch, 1797), which runs through the southwest of Mordovia and Penza region, were clarified. The record of the Holarctic *Byrrhus geminatus* LeConte, 1854, in the Ryazan region, is the southernmost record of this species in the European part of Russia [23].

In order to assess the novelty of the findings, we analyzed a number of literary sources containing references to beetle–phytophagous species of Central European Russia and the Eastern European Plain [24–49]. A number of species were found for the first time in the fauna of the administrative regions of Central European Russia.

For the first time for the fauna of the Ryazan region, 23 species of the family Chrysomelidae were noted: *Cryptocephalus exiguus* D.N. Schneider, 1792; *C. parvulus* O.F. Müller, 1776; *Derocrepis rufipes* (Linnaeus, 1758); *Neocrepidodera motschulskii* (Konstantinov, 1991); *Altica engstroemi* J. Sahlberg, 1893; *Phyllotreta cruciferae* (Goeze, 1777); *P. tetrastigma* (Comolli, 1837); *Aphthona nonstriata* (Goeze, 1777); *A. nigriscutis* Foudras, 1860; *A. euphorbiae* (Schrank, 1781); *Longitarsus jacobaeae* (C.R. Waterhouse, 1858); *L. parvulus* (Paykull, 1799); *L. luridus* (Scopoli, 1763); *L. minimus* Kutschera, 1864; *L. succineus* (Foudras, 1860); *L. anchusae* (Paykull, 1799); *Dibolia metallica* Motschulsky, 1845; *D. depressiuscula* Letzner, 1846; *D. cryptocephala* (Koch, 1803); *Psylliodes napi* (Fabricius, 1792); *P. picina* (Marsham, 1802); *P. chalcomera* (Illiger, 1807); *Cassida pannonica* Suffrian, 1844; one species of the family Attelabidae: *Rhynchites aura-*

*tus* (Scopoli, 1763); three species of the family Brentidae: *Aspidapion chalceus* (Marsham, 1802); *Loborhynchapion amethystinum* (Miller, 1857); *Cyanapion columbinum* (Germar, 1817), and 31 species of the family Curculionidae: *Bagous aliciae* Cmoluch, 1983; *Stephanocleonus microgrammus* (Gyllenhal, 1834); *Larinus iaceae* (Fabricius, 1775); *L. pollinis* (Laicharting, 1781); *Melanobaris dalmatina* (H. Brisout, 1870); *Mogulones geographicus* (Goeze, 1777); *Sirocalodes quercicola* (Paykull, 1792); *Curculio venosus* (Gravenhorst, 1807); *Tychius albolineatus* Motschulsky, 1859; *T. aureolus* Kiesenwetter, 1852; *Hypera interruptovittata* (Desbrochers des Loges, 1875); *H. fornicata* (Penecke, 1928); *Otiorynchus velutinus* Germar, 1823; *O. chrysostictus* Gyllenhal, 1834; *O. fullo* (Schrank, 1781); *O. pilosus* Gyllenhal, 1834; *Trachyphloeus parallelus* Seidlitz, 1868; *T. spinimanus* Germar, 1823; *Cathormiocerus aristatus* (Gyllenhal, 1827); *Omius puberulus* Boheman, 1834; *Omius verruca* Boheman, 1834; *Omiamina mollina* (Boheman, 1834); *Foucartia squamulata* (Herbst, 1795); *Urometopus nemorum* L. Arnol'di, 1969; *Exomias pellucidus* (Boheman, 1834); *Phyllobius contemptus* Schoenherr, 1832; *Polydrusus pilosus* Gredler, 1866; *P. inustus* Germar, 1823; *P. mollis* (Strøm, 1768); *Liophloeus tessulatus* (O.F. Müller, 1776) and *Sitona lateralis* Gyllenhal, 1834.

For the first time for the fauna of the Penza region, two species of the family Chrysomelidae were noted: *Galeruca dahli* (Joannis, 1866); *Longitarsus exoletus* (Linnaeus, 1758), and eight species of the family Curculionidae: *Grypus equiseti* (Fabricius, 1775); *Hylobius transversovittatus* (Goeze, 1777); *Tychius albolineatus* Motschulsky, 1859; *T. squamulatus* Gyllenhal, 1835; *Hypera plantaginis* (De Geer, 1775); *H. fornicata* (Penecke, 1928); *Otiorynchus velutinus* Germar, 1823 and *Sitona languidus* Gyllenhal, 1834.

For the first time for the fauna of the Tambov region, five species of the family Chrysomelidae were noted: *Smaragdina affinis* (Illiger, 1794); *Crepidodera nitidula* (Linnaeus, 1758); *Aphthona euphorbiae* (Schrank, 1781); *A. gracilis* Faldermann, 1837, *Longitarsus anchusae* (Paykull, 1799); two species of the family Anthribidae: *Tropideres albirostris* (Schaller, 1783) and *Dissoleucas niveirostris* (Fabricius, 1798); two species of the family Brentidae: *Omphalapion laevigatum* (Paykull, 1792) and *Loborhynchapion amethystinum* (Miller, 1857); and 28 species of the family Curculionidae: *Sitophilus granarius* (Linnaeus, 1758); *Grypus equiseti* (Fabricius, 1775); *Pseudocleonus cinereus* (Schrank, 1781); *Asproparthenis punctiventris* (Germar, 1823); *Aulacobaris picicornis* (Marsham, 1802); *Melanobaris dalmatina* (H. Brisout, 1870); *Curculio rubidus* (Gyllenhal, 1836); *Archarius crux* (Fabricius, 1776); *Liparus coronatus* (Goeze, 1777); *Hypera arator* (Linnaeus, 1758); *H. fornicata* (Penecke, 1928), *Otiorynchus chrysostictus* Gyllenhal, 1834; *O. raucus* (Fabricius, 1777); *O. fullo* (Schrank, 1781); *O. pilosus* Gyllenhal, 1834; *Trachyphloeus parallelus* Seidlitz, 1868; *T. spinimanus* Germar, 1823; *Urometopus nemorum* L. Arnol'di, 1969; *Archeophloeus inermis* (Boheman, 1842); *Phyllobius contemptus* Schoenherr, 1832; *Foucartia squamulata* (Herbst, 1795); *Polydrusus flavipes* (De Geer, 1775); *P. picus* (Fabricius, 1792); *P. inustus* Germar, 1823; *Sciaphilus asperatus* (Bonsdorff, 1785); *Brachysomus echinatus* (Bonsdorff, 1785); *Sitona cylindricollis* Fähræus, 1840 and *S. humeralis* Stephens, 1831.

For the first time for the fauna of the Lipetsk region, two species of the family Curculionidae: *Otiorynchus pilosus* Gyllenhal, 1834 and *Cycloderes pilosulus* (Herbst, 1795) were noted.

For the first time for the fauna of the Voronezh region, four species of the family Chrysomelidae were noted: *Phyllotreta ochripes* (Curtis, 1837); *Longitarsus suturellus* (Duftschmid, 1825); *L. nigrofasciatus* (Goeze, 1777) and *Chaetocnema semicoerulea* (Koch, 1803); two species of the family Brentidae: *Nanomimus hemisphaericus* (Olivier, 1807) and *Protapion ruficrus* (Germar, 1817); and 14 species of the family Curculionidae: *Sphenophorus piceus* (Pallas, 1776); *Thryogenes festucae* (Herbst, 1795); *Grypus equiseti* (Fabricius, 1775); *Hylobius transversovittatus* (Goeze, 1777); *Lepyrus capucinus* (Schaller, 1783); *Coniocleonus turbatus* (Fähræus, 1842); *Bothynoderes declivis* (Olivier, 1807); *Trichosirocalus barnevillei* (Grenier, 1866); *Metadonus curtus* (Boheman, 1842); *M. distinguendus* (Boheman, 1842); *Phyllobius jacobsoni* Smirnov, 1913; *Ph. contemptus* Schoenherr, 1832; *Pseudomylloceris sinuatus* (Fabricius, 1801) and *Urometopus nemorum* L. Arnol'di, 1969.

Of the phytophagous species represented in the database, at least 30 have been recorded at the northern limits of their range in Central European Russia: *Galeruca rufa* (Germar, 1823); *Aphthona nigriscutis* Foudras, 1860; *Longitarsus minimus* Kutschera, 1864;

*Dibolia metallica* Motschulsky, 1845; *Dibolia cryptocephala* (Koch, 1803); *Cassida pannonica* Suffrian, 1844 (Chrysomelidae); *Protapion ruficrus* (Germar, 1817) (Brentidae); *Sphenophorus piceus* (Pallas, 1776); *Bagous aliciae* Cmoluch, 1983; *Stephanocleonus microgrammus* (Gyllenhal, 1834); *Bothynoderes declivis* (Olivier, 1807); *Melanobaris dalmatina* (H. Brisout, 1870); *Minyops minutus rudis* Ménetries, 1849; *Hypera interruptovittata* (Desbrochers des Loges, 1875); *Metadonus curtus* (Boheman, 1842); *M. distinguendus* (Boheman, 1842); *Stomodes gyrosicollis* Boheman, 1842; *Otiorhynchus brunneus* Gyllenhal, 1834; *O. chrysostictus* Gyllenhal, 1834; *O. fullo* (Schrank, 1781); *O. pilosus* Gyllenhal, 1834; *Trachyphloeus parallelus* Seidlitz, 1868; *T. spinimanus* Germar, 1823; *Urometopus nemorum* L. Arnol'di, 1969; *Asproparthenis punctiventris* (Germar, 1823); *Aulacobaris picicornis* (Marsham, 1802); *Liparus coronatus* (Goeze, 1777); *Archeophloeus inermis* (Boheman, 1842); *Polydrusus picus* (Fabricius, 1792) and *Pseudomylocerus sinuatus* (Fabricius, 1801) (Curculionidae).

In contrast, in some of the southernmost localities, *Altica engstroemi* J. Sahlberg, 1893; *Grypus equiseti* (Fabricius, 1775); *Polydrusus pilosus* Gredler, 1866 and *Phyllobius jacobsoni* Smirnov, 1913, were noted.

Among the most zoogeographically interesting finds, which significantly supplement the ideas about the known ranges of the species, was the detection in the Khopersky Reserve (Voronezh region) of the weevil *Pseudomylocerus sinuatus* (Fabricius, 1801), a nemoral species widely distributed in Central, Southern and Southeastern Europe, the Caucasus (Azerbaijan, Armenia, Georgia) and the Crimea. In the east, it was known as far as the Donbass [24,37,50]. This is the first time that the species has been recorded in central European Russia. Our finding extends its known range by 400 km to the northeast.

*Bagous aliciae* Cmoluch, 1983 (Curculionidae), previously known from a few similar habitats in Poland, Ukraine, eastern European Russia (Chuvashia, Tatarstan, Ulyanovsk and Kirov oblasts), was found on limestone slopes in the Ryazan oblast; also for the first time in the central regions of European Russia [50–55]. Unlike the absolute majority of species of the genus occurring on aquatic plants, *B. aliciae* has xerophilic traits, inhabiting exclusively the tops of carbonate slopes, where it is trophically associated with *Anthemis tinctoria* L.

The discovery of *Stomodes gyrosicollis* Boheman, 1842 on a steppe slope on the left bank of the Don River in the forest–steppe of the Lipetsk region is of undoubted interest. The species was previously reported for the Lipetsk region in the work of M.N. Tsurikov [50], where it occurred in large numbers in the turf of the steppe areas of the Galichya Gora Reserve (Morozova Gora section) and in some other areas adjacent to the Don River. The site where we found it is 35–50 km north of the previously known sites. For some reason, the species is not listed for Russia in the catalog of Palearctic beetles [24]. Thus, our finding confirms its occurrence in Russia, and so far only in a very limited (and probably relict) part of its range in the forest–steppe of the Pridon region (Don basin region).

### 3. Methods

#### 3.1. Study Area

The macroregion selected for this research includes 11 regions of Russia (Figure 1): Ryazan, Penza, Tambov, Lipetsk, Voronezh, Moscow (including the city of Moscow), Vladimir, Kursk, Tula and Kaluga Regions and the Republic of Mordovia. Central European Russia is located in the center of the East European Plain. This macroregion is dominated by flat terrain, in which there are few hills and lowlands prevail. The studied regions are located within the Oka–Don Lowland, the Meshchera Lowland and the Central Russian Upland. The climate is temperate, moderately continental with relatively mild winters and warm summers (average January temperatures:  $-10$ – $-12^{\circ}$ , July— $+17$ – $18^{\circ}$  C). The amount of precipitation ranges from 400 to 600 mm. In many regions, the soils are chernozem, but sod-podzolic soils are predominant; gray forest soils are often found. These types of soils have sufficiently high fertility and, in combination with the climate, create conditions for the development of agriculture. In this regard, this macroregion is characterized by a high anthropogenic load, numerous agricultural lands and minimal forest cover of the territory. Most of the macroregion is located in the zone of mixed forests, in the south there are

broad-leaved forests and forest–steppes, and in the northeast, there is a taiga. The largest rivers are the Don River (and its numerous tributaries) and the Oka River, which flows from the northern side of the macroregion.

### 3.2. Study Material

The material for the study included Coleoptera collections from the territory of the eleven regions of European Russia mainly during the last approximately 30 years (2005–2024).

In the course of the research, traditional and diverse methods were used [56], including manual collection; the use of soil traps, fermental crown traps, and Malaise traps; light fishing; sweeping with an entomological net on plants and under water; splashing and trampling on the shores of water bodies.

The specimens are held in the collections of the Mordovia State Nature Reserve (Pushta, Republic of Mordovia), the Zoological Institute (St. Petersburg), the Zoological Museum of Moscow State University (Moscow), the Prisursky State Nature Reserve (Cheboksary, Chuvash Republic), the collections of the Papanin Institute for Biology of the Inland Waters Russian Academy of Sciences (IBIW), as well as in personal collections of the authors.

The classification of the family-group taxa used here predominantly followed Cai et al. [57] and McKenna et al. [58]. The lists of species were verified according to the Catalogue of Palearctic Coleoptera [23,58–66] according to Robertson et al. [67] and Alonso-Zarazaga et al. [24]. The exceptions were cases when the views of the authors on the rank of a taxon diverged from the opinion of the authors of the catalogs. Thus, we accepted *Aspidapion chalceus* (Marshall, 1802) and *Larinus iaceae volgensis* Becker, 1864 (in the dataset as *Larinus iaceae* (Fabricius, 1775)) as separate taxa whose independence was based on extensive regional material [51,52,68].

## 4. Conclusions

The dataset contains data on 1310 species and subspecies of Coleoptera from 74 families occurring in the territory of eleven regions of European Russia (Ryazan, Tambov, Penza, Voronezh, Lipetsk, Moscow (including the city of Moscow), Vladimir, Kursk, Tula and Kaluga oblasts and the Republic of Mordovia). In total, there are 65,100 samples and 10,771 occurrences in the dataset. The largest families in terms of species diversity are Curculionidae (198 species), Carabidae (183 species), Staphylinidae (121 species) and Chrysomelidae (120 species). Fifteen families (20.29%) were represented by only one species. The genus structure of the macroregional fauna is very diverse (640 genera). High species diversity was recorded for a 36 genera (5.62%). The most species-rich genera are *Amara*, *Harpalus* and *Bembidion* (Carabidae).

In the dataset of the territory of the eastern part of the Eastern European Plain, there are rare beetle species (six species, 0.5% from all species) that are listed in the Red Book of Russia. The dataset also contains information on alien and cryptogenic beetle species (22 species; 1.7% from all species) from the European part of Russia.

All beetle species (for imago stages) of the dataset were divided into four major groups based on what they feed on: phytophagous (plant eaters)—53.8%, zoophagous (animal eaters)—32.4%, mycetophagous (fungus eaters)—5.7%, and saprophagous (8.1%), which feed on dead organic substrate—decomposed plant and animal remains. All beetle species also form four major groups in terms of habitat preference: chorto- and dendrobionts (46.4%); herpetobionts (33.0%), which live on the surface and in the upper layers of soil; xylobionts (10.0%)—species that live under bark and in wood, including mycetophagous species closely associated with decaying wood and xylotrophic fungi; and hydrobionts (8.6%), which live in water and riparian habitats. Due to the predominance of phytophagous beetles and chortobionts with dendrobionts among all beetle species, new regional records of phytophagous species are given.

**Author Contributions:** Conceptualization, A.S.S., S.V.D., L.V.E. and A.B.R.; methodology, A.S.S., S.V.D. and A.B.R.; software, E.A.L.; validation, A.S.S., S.V.D. and L.V.E.; formal analysis, A.S.S. and S.V.D.; investigation, A.S.S., S.V.D., M.N.E., A.M.N. and O.S.T.; resources, A.S.S., S.V.D., M.N.E., A.M.N. and O.S.T.; data curation, A.S.S., A.B.R. and E.A.L.; writing—original draft preparation, A.S.S., S.V.D., L.V.E. and A.B.R.; writing—review and editing, A.S.S.; visualization, A.S.S.; supervision, L.V.E.; project administration, A.S.S.; funding acquisition, A.B.R. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by Russian Science Foundation, grant number 22-14-00026.

**Institutional Review Board Statement:** Not applicable.

**Data Availability Statement:** Creative Commons Attribution (CC BY-NC) 4.0 License <https://doi.org/10.15468/7g3j55>.

**Acknowledgments:** The authors express their gratitude to S.E. Tshernyshev (Novosibirsk, Institute of Systematics and Ecology of Animals, Russian Academy of Sciences) for assisting in the definition of some Byrrhidae, S.A. Kurbatov (Moscow, All-Russian Plant Quarantine Center, Bykovo Moscow Oblast) and to O.I. Semionenkov (Smolensk, Smolensk State University) for assisting in the definition of some Staphylinidae, N.N. Nikolaev (Brykin Bor, Oka State Nature Biosphere Reserve) for assistance in field research.

**Conflicts of Interest:** The authors declare no conflicts of interest.

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