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Data Descriptor

Dataset: Coleoptera (Insecta) Collected from Beer Traps in "Smolny" National Park (Russia)

Alexander B. Ruchin [1,*], Leonid V. Egorov [2], Oleg N. Artaev [3] and Mikhail N. Esin [1]

[1] Joint Directorate of the Mordovia State Nature Reserve and National Park "Smolny", 430005 Saransk, Russia
[2] Prisursky State Nature Reserve, 428034 Cheboksary, Russia
[3] Papanin Institute for Biology of Inland Waters, Russian Academy of Sciences, 152742 Borok, Russia
* Correspondence: ruchin.alexander@gmail.com; Tel.: +7-83445-296-35

Abstract: Monitoring Coleoptera diversity in protected areas is part of the global ecological monitoring of the state of ecosystems. The purpose of this research is to describe the biodiversity of Coleoptera studied with the help of baits based on fermented substrate in the European part of Russia (Smolny National Park). The research was conducted April–August 2018–2022. Samples were collected in traps of our own design. Beer or wine with the addition of sugar, honey, or jam was used for bait. A total of 194 traps were installed. The dataset contains 1254 occurrences. A total of 9226 Coleoptera specimens have been studied. The dataset contains information about 134 species from 24 Coleoptera families. The largest number of species that have been found in traps belongs to the family Cerambycidae (30 species), Nitidulidae (14 species), Elateridae (12 species), and Curculionidae and Coccinellidae (10 species each). The number of individuals in the traps of these families was distributed as follows: Cerambycidae—1018 specimens; Nitidulidae—5359; Staphylinidae—241; Elateridae—33; Curculionidae—148; and Coccinellidae—19. The 10 dominant species accounted for 90.7% of all detected specimens in the traps. The maximum species diversity and abundance of Coleoptera was obtained in 2021. With the installation of the largest number of traps in 2022 and more diverse biotopes (64 traps), a smaller number of species was caught compared to 2021. New populations of such species have been found from rare Coleoptera: *Calosoma sycophanta*, *Elater ferrugineus*, *Osmoderma barnabita*, *Protaetia speciosissima*, and *Protaetia fieberi.*

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Keywords: dataset; Cerambycidae; Coccinellidae; Coleoptera; Curculionidae; Elateridae; Nitidulidae; occurrences; rare species; Republic of Mordovia

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1. Summary

Bait traps are relatively simple sampling methods. These methods for attracting insects are quite easy to perform and very effective in terms of the amount of data obtained compared to the time spent [1]. In recent years, the attraction of insects with baits based on the fermentation of beer, vinegar, and wine with the addition of molasses, sugar, honey, molasses, and other sweet substances, as well as fruits, has been actively used. This method is based on the attractiveness of a bait (for example, a food source simulating fermented juice) poured into a jar, plastic bottle, or plastic cylindrical container [2–6]. The fermentation used to attract and act as pheromone traps often consists of rotten fruit mixed with beer and brown sugar [7]. Many insects have receptors that perceive a variety of carbohydrates, primarily sugar [8]. Sugar plays an important role in insect life as a valuable food resource [9]. Additionally, during fermentation, many other volatile organic substances are released, which can also attract insects [10]. For example, volatile substances from yeast fermentation, such as ethanol, attract beetles because chemicals can be a signal of the presence of food sources, such as sugar and/or ethanol. During fermentation, yeast secretes metabolites that are potential food sources for insects [11].

The traps with the process of active fermentation of sugars attract a variety of insect groups; for example, Lepidoptera [12,13], Hymenoptera [14–16], Neuroptera [17], or Diptera [18–20]. At the same time, such traps are most actively used to study the biodiversity of Coleoptera, as well as to study the distribution in the space of forest ecosystems of individuals and species of this group of insects [4,5,21,22]. Since different species appear in traps in different habitats, they can be placed in open woodlands, on the edges, at different heights [22–24]. Traps with baits are convenient to place and use in protected areas, since the maintenance of such traps is easier in these areas, which people visit rarely, and the risk of vandalism is reduced. In addition, the species diversity and abundance of insects in protected areas are usually much higher than adjacent territories [25–33], which affects the effectiveness of such traps for full-scale faunal studies.

The purpose of this work is to describe a set of present data on the use of bait traps for studying Coleoptera biodiversity in "Smolny" National Park, recently published in GBIF as the Darwin Core Archive [34].

2. Data Description

2.1. Data Set Name

Each observation includes information such as the location (latitude/longitude), the date of observation, the symbol of the trap, the exposure time of the trap (the number of days that the trap was set), the species composition of Coleoptera in this trap, and the name of the observer. The coordinates were determined on the spot using a GPS device or after research using Google Maps (Table 1). A total of 9226 specimens were studied.

Table 1. Description of the data in the dataset.

Column Label	Column Description
eventID	An identifier for the set of information associated with an Event (occurs in one place in one time).
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 oftaxonomic rank with the authority
kingdom	The full scientific name of the kingdom in which the taxon is classified
taxonRank	The taxonomic rank of the most specific name in the scientificName.
decimalLatitude	The geographic latitude of location in decimal degree
decimalLongitude	The geographic longitude 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 as 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 represented 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 day of the month on 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
samplingProtocol	The names of, references to, or descriptions of the methods or protocols used during an Event.
sampleSizeValue	A numeric value for a measurement of the size (time duration, length, area, or volume) of a sample in a sampling event.
sampleSizeUnit	The unit of measurement of the size (time duration, length, area, or volume) of a sample in a sampling event.
samplingEffort	The amount of effort expended during an Event.
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

2.2. Figures, Tables and Schemes

The dataset presents data on 134 Coleoptera species from 24 families studied in the course of our research (Figure 1). The largest number of species that has been found in traps belongs to the families Cerambycidae (30 species), Nitidulidae (14 species), Elateridae (12 species) and Curculionidae and Coccinellidae (10 species each). At the same time, many families were represented in traps by only 1–2 species (Scirtidae, Buprestidae, Cleridae, Monotomidae, Laemophloeidae, Oedemeridae, Scraptiidae, Chrysomelidae and Anthribidae). Despite the significant species diversity of Cerambycidae, the number of this family in traps was insignificant (only 1018 specimens). Other families with large species diversity (Elateridae, Curculionidae, Coccinellidae, and Staphylinidae) were also represented by a small number of specimens: respectively, 33, 148, 19 and 241. At the same time, the number of individuals of the Nitidulidae family was the largest and amounted to 5359 (58.1% of the total number of individuals of all species).

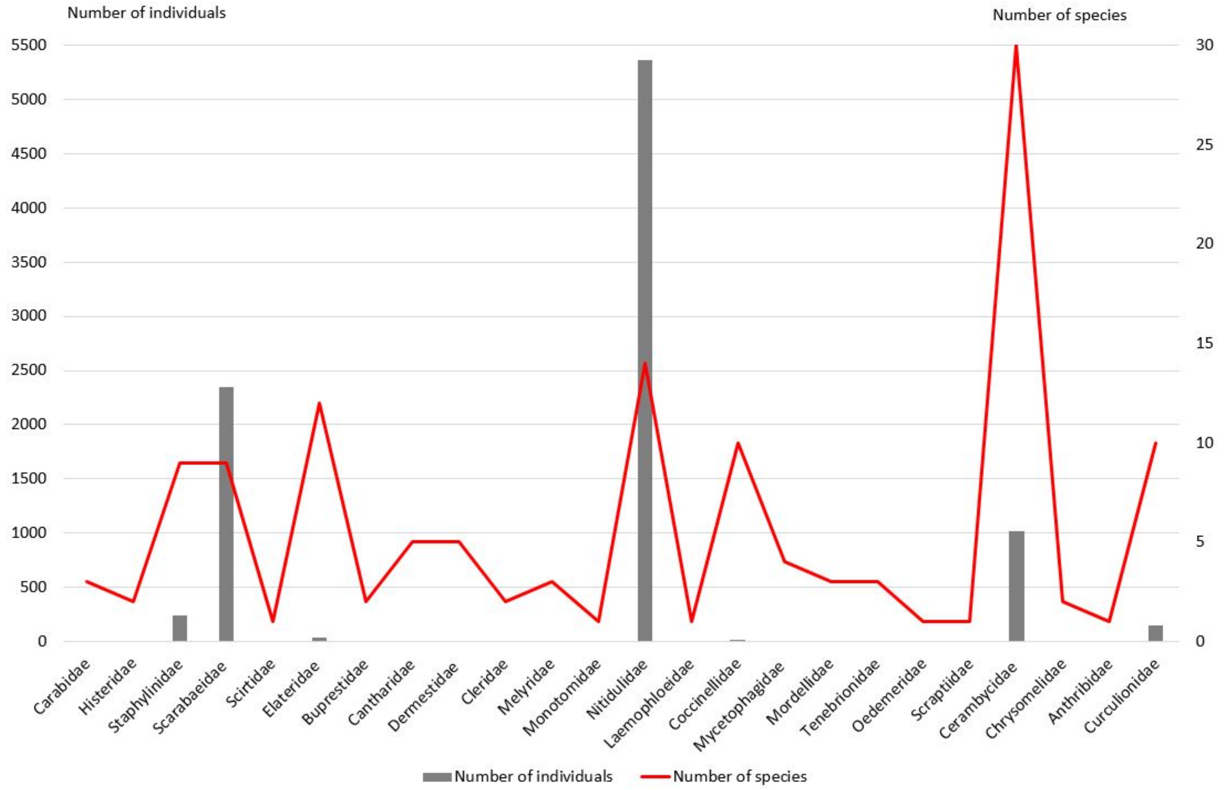

Figure 1. The number of specimens and biodiversity of Coleoptera families represented in beer traps in Smolny National Park (total data for 2018–2022).

Glischrochilus grandis (Tournier, 1872) (Nitidulidae), *Protaetia marmorata* (Fabricius, 1792) (Scarabaeidae), *Cryptarcha strigata* (Fabricius, 1787) (Nitidulidae), *Soronia grisea* (Linnaeus, 1758) (Nitidulidae), *Leptura thoracica* Creutzer, 1799 (Cerambycidae), *Leptura quadrifasciata* Linnaeus, 1758 (Cerambycidae), *Quedius dilatatus* (Fabricius, 1787) (Staphylinidae), *Rhagium mordax* (DeGeer, 1775) (Cerambycidae), *Glischrochilus hortensis* (Geoffroy, 1785) (Nitidulidae) and *Protaetia fieberi* (Kraatz, 1880) (Scarabaeidae) were the dominant species in beer traps for 2018–2022 (Figure 2). In total, they accounted for 90.7% of all collected instances. This is a conditional allocation of species whose numerical abundance and occurrence were the greatest in five-year studies. *Glischrochilus grandis* was the most numerous species (35.2% of the total) and the third most common species (52.1%). *Protaetia marmorata* in traps was second in number (23.2%) and first in occurrence (80.4%). *Cryptarcha strigata* was third in number in 5 years of research (13.2%) and was second in occurrence (69.1%). Thus, most species were rarely found in traps (no more than 8% of the number of traps) with a small number of individuals (no more than 1% of the total number of individuals).

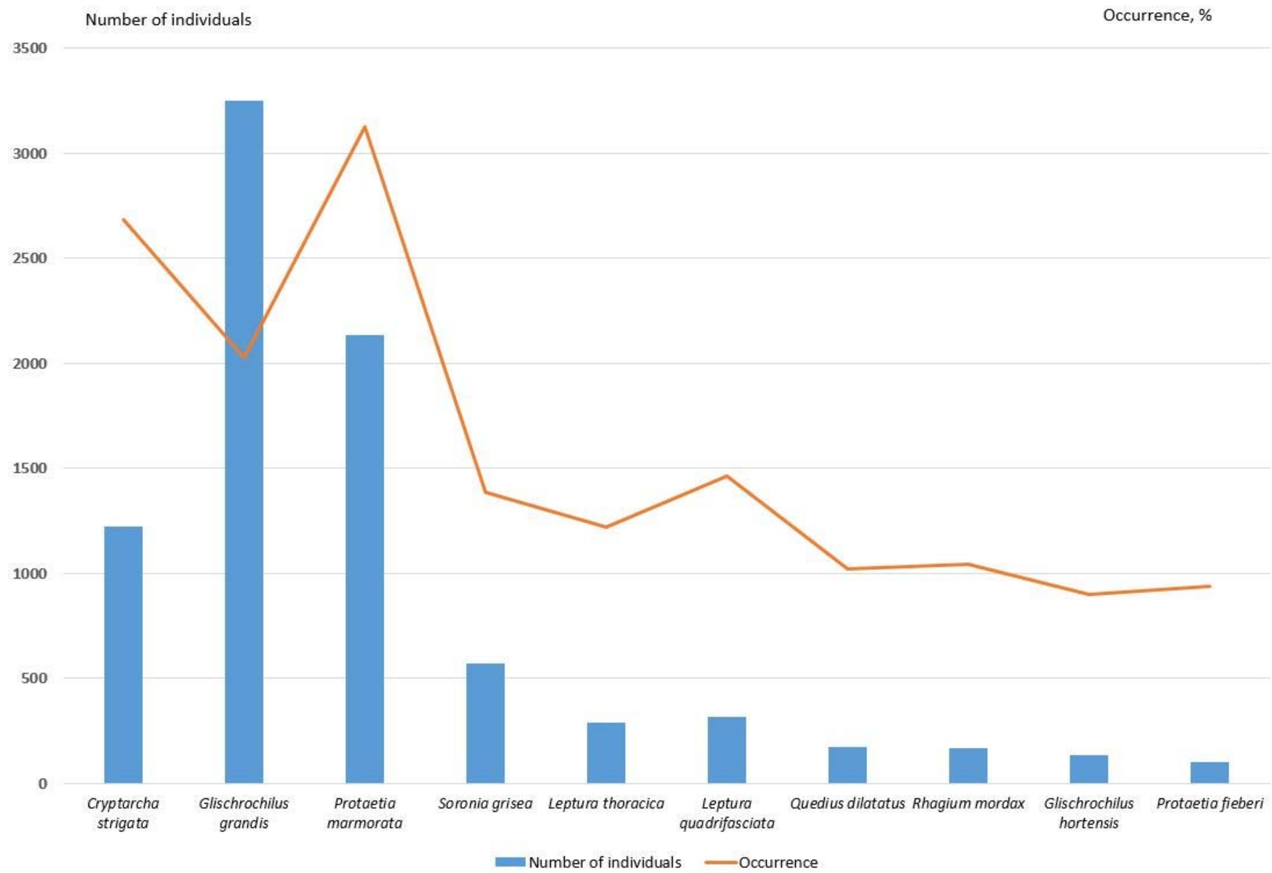

Figure 2. Coleoptera species, dominating in numbers in beer traps.

The maximum species diversity and abundance of Coleoptera was obtained in 2021. At the same time, when installing the largest number of traps in 2022 and in more diverse biotopes (64 traps), a smaller number of species was caught compared to 2021. As studies have shown (Figure 3), an increase in the number of traps in each subsequent year of the study has a certain effect on the identification of species new to the fauna, but up to a certain limit. We described a similar example above when comparing 2021 and 2022. Previously [35], it was indicated that in the fourth year of research in the Mordovia State Nature Reserve, the number of new species not previously caught decreased by five times (the number of trap exposures decreased only 2.6 times). Previously [36], it was suggested that two-year studies would be sufficient to study the biodiversity of a certain biotope, a limited forest area or a small region. For the best study of biodiversity, it is desirable not only to increase the number of traps from year to year or to place them in large numbers annually, but also to diversify the collection sites of samples.

The very rare species included in the Red Data Book of the Russian Federation [37] must be also noted. The following species were found in our studies: *Calosoma sycophanta* (Linnaeus, 1758), *Elater ferrugineus* Linnaeus, 1758, *Osmoderma barnabita* Motschulsky, 1845, *Protaetia speciosissima* (Scopoli, 1786) and *Protaetia fieberi*. If the first species is clearly a random find, then the remaining species are actively attracted with the help of beer traps. It should be noted that *Osmoderma barnabita* and *Elater ferrugineus* have not been previously recorded in "Smolny" National Park, and only with the help of beer traps was it possible to find populations of these species.

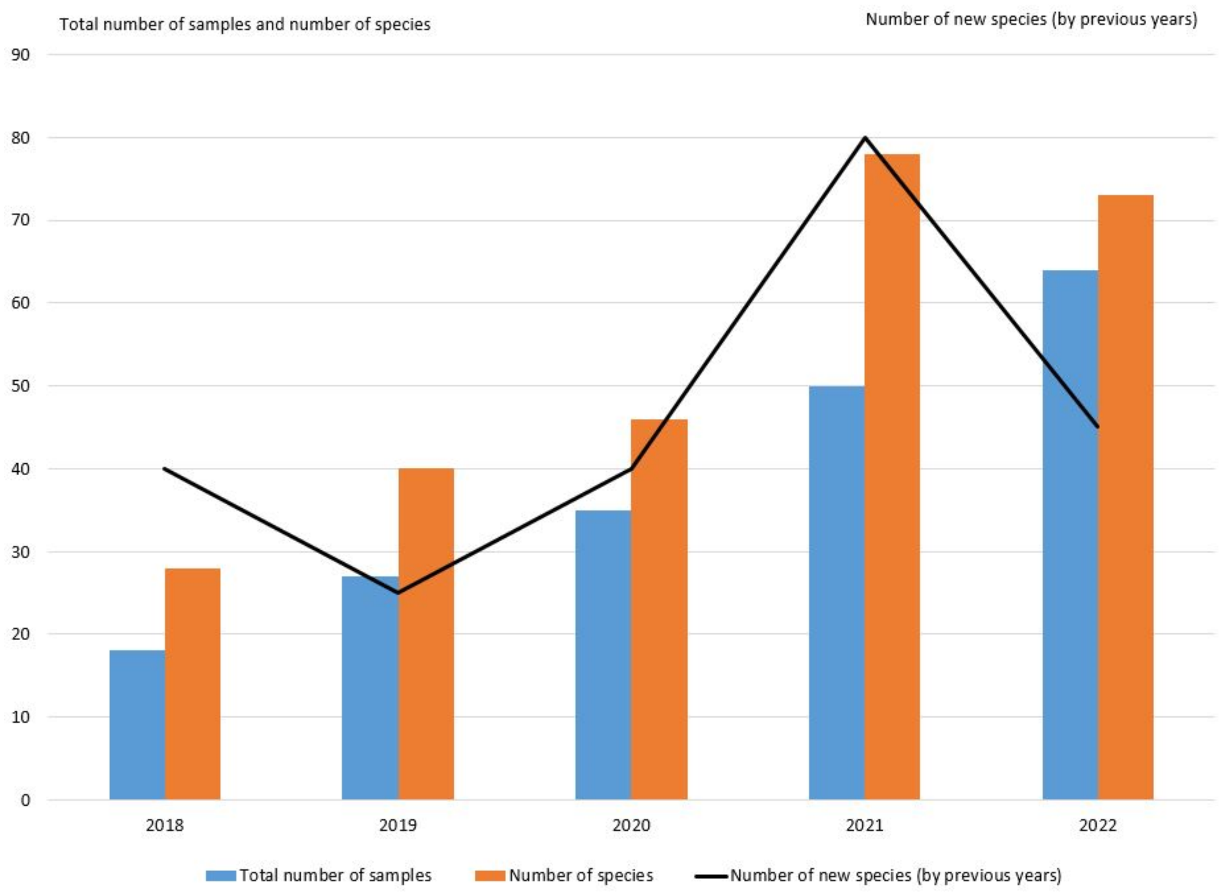

Figure 3. The dependence of the number of species caught on the number of traps by year in the "Smolny" National Park.

3. Methods

3.1. Study Area

"Smolny" National Park is located in the northeastern part of the Republic of Mordovia between 45°04′ and 45°37′ E, 54°43′ and 54°53′ N (European Russia) (Figure 4). The maximum length from west to east is 35 km; from north to south, it is 18 km. The area is 36,500 hectares. The park is located in landscapes of mixed forests on the left bank of the Alatyr River (Volga River basin). The southern part of the park is a lower and flat area, with wide watershed spaces. It occupies the hills to the north of the Alatyr River, as well as small areas of the floodplain and almost all the near-red depressions. Here, the minimum marks of the park are 95 m above sea level. The main territory has heights of 100–160 m above sea level. The northern part of the park is more elevated, with absolute marks of 214–217 m above sea level. There are a lot of ravines. The climate is moderately continental. The average annual air temperature is −4–3.5 °C; precipitation is 440–550 mm. The predominant soils are sod-podzolic. Vegetation is represented by forests dominated by pine and birch. Pine forests predominate in the southern part and were planted after continuous logging at the end of the XX century. Birch trees also grow in the southern part. The northern part of the park is dominated by linden, oak, birch and aspen. These trees grow on the site of deforestation and are secondary forests [38].

3.2. Design of Research, Identification and Taxonomic Position of Samples

Each trap was a large plastic 5-liter container with a window cut out in it on one side. The distance from the bottom was 10 cm. With the help of a load, a rope with a tied trap was thrown onto a tree branch at a height of 2 to 10 m from the soil surface. At a height of 1.5 m, the trap was tied to a tree branch without special loads. Tripods were also used in open stations (meadows, clearings in the forest, clearings under power lines). A trap there was suspended at a level of 1.5 m. Beer or dry wine with added sugar, honey or jam was used as bait. Such a mixture was fermented for a day. Traps suggested by I. Jalas [39] were also used; they were placed in the crowns of various trees at heights from 2 to 8 m. Occurrence is the ratio of the number of samples in which a species (subspecies) is present to the total number of samples, expressed in %. Exposure time is the period between the hanging of the trap and the removal of the material for analysis, expressed in days. The collected material was studied by L.V. Egorov.

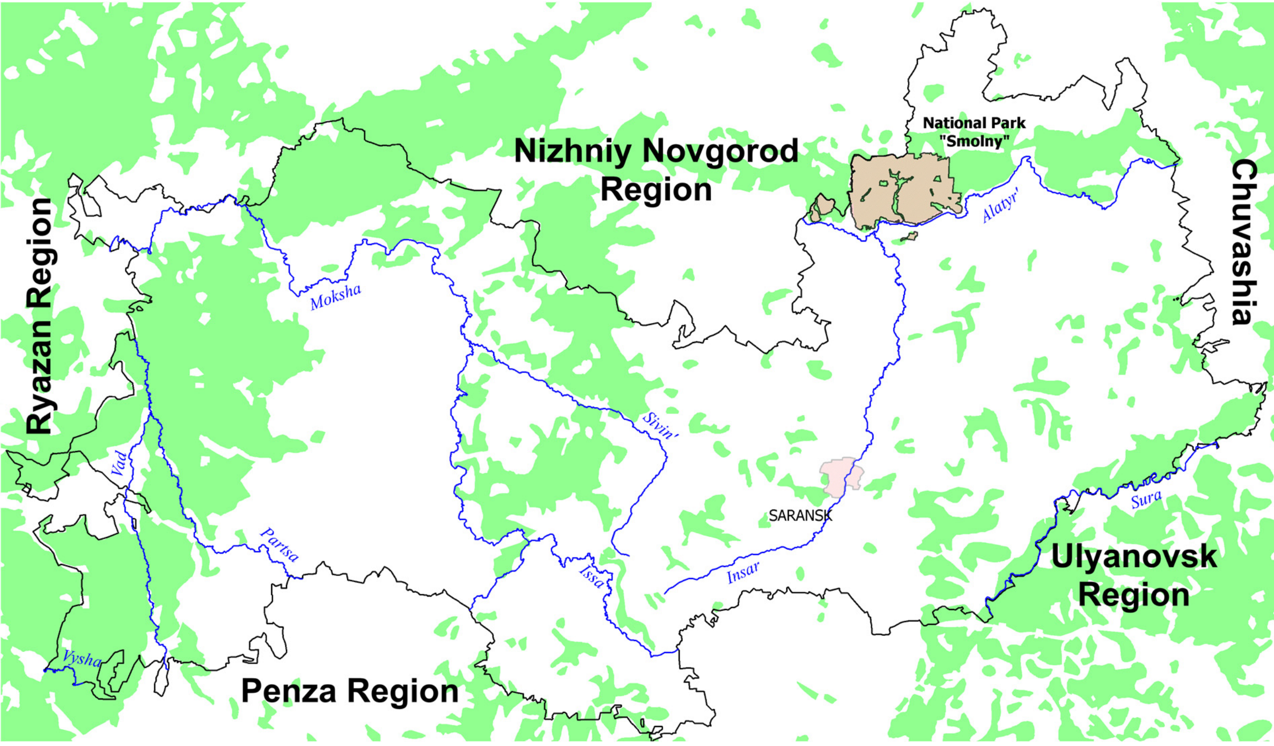

Figure 4. Study area and the area of obtaining information for the dataset.

The classification of beetle families is given according to the publications [40,41]. At the same time, we have taken into account changes in names from the Catalogue of Palaearctic Coleoptera [42–48], as well as for Cucujoidea from the publication of Robertson et al. [49], for Curculionoidea—from the publication of Alonso-Zarazaga et al. [50]. To clarify the nomenclature, the above publications were used, as well as the Catalogue of Palaearctic Coleoptera [51,52]. The years of description of some beetle species are specified according to Bousquet [53].

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