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RESEARCH ARTICLE

Fauna of Curculionoidea of the Khopersky State Nature Reserve (Russia)

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Abstract

For the first time, a detailed inventory and zoogeographical characterization of the Curculionoidea fauna of the Khopersky State Nature Reserve have been conducted, along with an analysis of the landscape and habitat distribution of weevils. In total, 361 species of Curculionoidea belonging to 5 families have been recorded within the reserve. Of these, 169 species are reported from the Khopersky Reserve for the first time, and 76 of them are new to the fauna of the Voronezh Region, including several rare species. The main features of the zoogeographical structure of the fauna are a very high proportion of species belonging to the Western Palaearctic arealogical complex (100 species, almost 28%), as well as considerable species richness of the nemoral (66 species), Mediterranean (64 species), and, to a lesser extent, Scythian (steppe) (59 species) faunal complexes, with a minor participation of weevils of Kazakh–Turanian origin (9 species).

Keywords

Curculionoidea, Khopersky State Nature Reserve, Oka–Don Lowlands, fauna, species composition, zoogeographical structure, habitat distribution

Introduction

The Khopersky State Nature Reserve (hereafter KhSNR) is located in the Voronezh Region, in the southeastern part of the Oka–Don Lowlands, within the valley of the Khoper River. Botanically and geographically, KhSNR lies on the border between the Central Russian subprovince of the East European forest-steppe province and the Middle Don subprovince of the Pontic steppe province (Isachenko & Lavrenko 1980), but in terms of landscape structure it is much closer to the former (Tsvelev 1988). Most of its territory is covered by broad-leaved forests and pine plantations of artificial origin. The reserve extends for approximately 50 km from north to south, with a width ranging from 1.5 to 9 km. Coordinates: latitude 51.1055–51.3096° N, longitude 41.5780–41.9382° E.

The Khoper River divides the reserve into two geomorphological parts: a low-lying left bank and a high right bank. The forests of the right bank are represented by upland ash–oak forests, typical of the southern broad-leaved forests of central and western European Russia (Isachenko & Lavrenko 1980; Zaitsev 2024). On south-facing slopes and, in some places, in ravines (the Osiyan and Lisya Balka tracts), forb steppes, steppe meadows and glades, as well as scree-slope vegetation along steep ravines are developed.

The extensive left-bank floodplain is occupied by numerous oxbow lakes and floodplain forests (including blackberry–lily-of-the-valley oak forests, poplar forests, willow stands, and swampy black alder forests). On the natural levees, rich forb steppe meadows and, in places, oak woodlands are widespread (Tsvelev 1988).

The above floodplain terrace of the left bank is mainly occupied by pine forests (plantations on the site of former sandy steppes, with some areas actively expanding through natural regeneration) and post-fire wastelands. Along forest edges and in open areas, particularly on the slope from the floodplain to the terrace, psammophytic meadows and small patches of sandy steppes are present. The largest remnant of secondary sandy steppe developed on the site of a former watermelon field near the reserve boundary and in the buffer zone (Yellow Yar tract). Small areas on the elevated parts of the terrace are occupied by sparse oak woodlands (Tsvelev, 1988).

The flora of KhSNR and its immediate surroundings is forest-steppe in character, with high species richness (approximately 1,150 species of vascular plants, excluding cultivated species) (Tsvelev 1988).

Comprehensive biodiversity studies in protected areas are feasible only with a large team of specialists and/or dedicated ecosystem monitoring programs (Senkevich et al. 2024; Afonina et al. 2025; Vdovina et al. 2025). Consequently, most studies of invertebrates, and insects in particular, are limited to detailed investigations of selected taxonomic or ecological groups (Figueiredo et al. 2024; Aleksanov 2025; Sushko 2025).

One suitable model group is Curculionoidea, the largest superfamily of trophically specialized phytophagous beetles. Although the collections of weevil beetles within KhSNR have been made repeatedly, until recently, data on the faunal com-

position of these groups in the reserve were fragmentary. Notably, in the invertebrate registry of the Voronezh Region (Negrobov, 2005), records of Curculionoidea species from KhSNR and the surrounding settlements (Novokhoperk, Varvarino, Alfyorovka, etc.) are practically absent.

The first dedicated publication on the weevils of the reserve appeared a few years ago (Ryaskin 2019). It reported 106 species of Curculionoidea, including several species mentioned in earlier records (Vorontsov 1961; Vorontsov et al. 1961; Guryanova 1961; Tsurikov 2013). Previously, Volodchenko (2016) recorded 17 species from KhSNR, of which 10 species were not listed by Ryaskin (2019). Subsequently, several additional studies (Ryaskin et al. 2024, 2025) mentioned individual weevil species from the reserve and adjacent areas.

Recently, 50 species for KhSNR were included in the Central European Russia beetle database, published on the GBIF platform (Ruchin et al. 2024). Most of the weevil specimens were identified by the present author. Small but notable collections by K.P. Tomkovich, including specimens of species rare for KhSNR such as *Otiorhynchus brunneus*, *Pseudomyllocerus sinuatus*, and *Metadonus distinguendus*, were identified by I.A. Zabaluev (Zoological Museum, Moscow State University).

The first comprehensive insect checklist of KhSNR, which included 119 species of Curculionoidea (excluding Scolytinae), was published by Davydenko et al. (2024). Among these, 12 species of Curculionoidea had not been reported in previous studies. Unfortunately, the article does not provide species-level annotations or references to literature sources for individual species. The records of two species listed with uncertainty (*Orchestes alni* Linnaeus, 1758 and *O. subfasciatus* Gyllenhal, 1835) require confirmation, as they were likely confused with similar taxa, although their presence in the reserve is possible.

Two studies by the author of the present article (Dedyukhin 2023, 2025) provide further data. In the first, materials on six weevil species were reported as new for KhSNR and the region as a whole. In the second, preliminary results of the Curculionoidea inventory of KhSNR were summarized, listing 77 species, including 37 species new to the reserve. Detailed examination revealed that previous records of *Charagmus griseus* (Fabricius, 1775) and *Thamiocolus sahlbergi* (C.R. Sahlberg, 1845) were based on misidentifications of *Charagmus gressorius* (Fabricius, 1792) and *Thamiocolus sinapis* (Desbrochers des Loges, 1893), respectively.

Overall, the cited publications report a total of 194 Curculionoidea species for KhSNR. However, a complete, verified species list for the reserve has not been previously published, and no study has provided a detailed analysis of the Curculionoidea fauna of KhSNR.

The aim of the present study is, based on original materials and a critical analysis of the literature, to 1) summarize the current knowledge of the species composition of Curculionoidea in Khopersky State Nature Reserve; 2) conduct a zoogeographical analysis of the fauna; and 3) present an overview of the landscape- and habitat-level distribution of weevil beetles in the reserve.

Materials and methods

The study is based on original data obtained during field surveys in KhSNR (including the buffer zone) in June 2023 and May and August 2024, using standard collection methods (entomological sweep netting, collecting beetles from host plants, etc.). These surveys covered most of the reserve, including all forestry units: the surroundings of Varvarino village (left-bank floodplain of the Khoper River, Otrog, Kuchugury, and Yellow Yar tracts on the upper floodplain terrace), Kalinovka village (Kalinovsky Forest), Alfyorovka village (scree slopes, slope meadows, and steppes of the right bank within the reserve and buffer zones, including the Shpil and Lisya Balka cordons), and Vasilyevka village (broad-leaved forests and slopes to the Khoper River). This approach allowed coverage of all landscape units of the reserve, a wide range of habitats, and different seasonal aspects of the entomofauna. In addition, a critical analysis of all available publications by other authors was conducted.

Species identification was performed using a range of keys (Identification… 1965; Smreczyński 1972, 1974, 1976; Dieckmann 1974, 1977, 1983, 1988; Freude et al. 1981, 1983; Lohse & Lucht 1994; Isaev 2007). Identification of certain species was confirmed by B.A. Korotyaev (Zoological Institute, Russian Academy of Sciences) or verified against the collections of the Zoological Institute, RAS (St. Petersburg). Nomenclature follows the latest version of the Palaearctic Curculionoidea catalogue (Alonso-Zarazaga et al. 2023).

The total material collected exceeded 2,000 beetle specimens. All specimens are currently housed in the author's collection, with the most notable finds deposited in the fund collection of the Zoological Institute, RAS (St. Petersburg).

Results

To date, a total of 361 species of Curculionoidea belonging to five families have been recorded in KhSNR and adjacent areas: Nemonychidae (1), Anthribidae (7), Attelabidae (12), Brentidae (53), and Curculionidae (288) (excluding Scolytinae) (Table 1). During the present study, 339 species were collected directly, while an additional 22 species are known only from literature records. 168 species are reported from KhSNR for the first time, of which 76 are new to the fauna of the Voronezh Region.

Although most of the Curculionoidea fauna of KhSNR has now been established, allowing a first comprehensive analysis of the fauna and a description of the distribution of weevil species across the study area, it is likely that up to 100 additional species may yet be discovered in the reserve.

The list of species with their distribution across the main habitat types of KhSNR is presented in Suppl. material 1: Table S1. Species reported for the first time from KhSNR are marked with a single asterisk (*), and species new to the Voronezh Region are marked with a double asterisk (**).

Table 1. Species richness of phytophagous beetle families in the fauna of Khopersky State Nature Reserve

№	Families	Total	Number of species	
			New for Khopersky State Nature Reserve	New for the Voronezh Region
1	Nemonychidae	1	–	–
2	Anthribidae	7	3	2
3	Attelabidae	12	2	–
4	Brentidae	53	31	15
5	Curculionidae	288	132	59
	Total	361	168	76

Discussion

Zoogeographical analysis. The main feature of the zoogeographical structure of the KhSNR fauna is the very high proportion of Western Palaearctic species (100 species; nearly 28%). For comparison, the Zhigulevsky Nature Reserve (Middle Volga region) and the Shaitan-Tau Reserve (Southern Urals), also located in the southern forest-steppe, harbor 60 and 58 Western Palaearctic species, respectively (Dedyukhin 2022, 2023).

Most species of this complex have Euro-Mediterranean ranges (including Euro–Near Eastern ranges), while the ranges of 39 species are restricted to Europe. Some Western Palaearctic species in the Don region occur at the eastern limits of their ranges (*Squamapion atomarium*, *Perapion affine*, *Lixus tibialis*, *Ceutorhynchus constrictus*, *Oprohinus suturalis*, *Thamiocolus sinapis*, *Anthonomus rubripes*, *Cionus olens*, *C. clairvillei*, *Orchestes quedenfeldtii*, *Mecinus janthiniformis*, *Gymnetron hoferi*, *Philopedon plagiatum*, *Pseudomyllocerus sinuatus*, *Sciaphobus squalidus*). Some are distributed slightly further east, up to the Volga Upland (*Melanobaris atramentaria*, *Tychius pumilus*, *Curculio pellitus*, *Otiorhynchus brunneus*, *O. pilosus*, *Charagmus gressorius*), and just over half of these species occur in the Trans-Volga region and the Urals, while a few are known from the Trans-Urals and the Altai.

Although KhSNR is located in the center of European Russia, the fauna also includes species of the Central Palaearctic and Central–East Palaearctic complexes (a total of 21 species; 9.1%). For example, immigrants from the inland regions of Eurasia include *Squamapion lukjanovitshi*, *Pleurocleonus sollicitus*, *Bothynoderes declivis*, *Asproparthenis punctiventris*, *Larinus idoneus*, *L. iaceae volgensis*, *Lixus linnei*, *Pseudorchestes exiguus*, *Sibinia beckeri*, *Metadonus anceps*, *M. curtus*, and *Ptochus porcellus*.

As expected, the studied fauna is dominated by species with southern range types (subboreal and south-boreal–subboreal), comprising a total of 214 species, or 60% of the fauna. Within this heterogeneous group, three main faunal complexes are distinguished: nemoral, mediterranean, and steppe complexes.

A characteristic feature of the KhSNR fauna is, on the one hand, the high proportion of nemoral weevils closely associated with the humid territories of Europe (66 species), and on the other hand, a large number of Mediterranean species (64 species) and, to a lesser extent, steppe species (59 species).

Within the nemoral complex, species are predominantly ecologically associated with trees and shrubs of broad-leaved forests (*Quercus robur*, *Fraxinus excelsior*, *Corylus avellana*, *Ulmus minor*), for example: *Neocoenorhinus pauxillus*, *Magdalis armigera*, *Attelabus nitens*, *Polydrusus picus*, *Lignyodes enucleator*, *Curculio pellitus*, *C. venosus*, *C. nucum*, *C. glandium*, *Archarius pyrrhoceras*, *Orchestes quercus*, *O. hortorum*, *O. quedenfeldtii*, *Otiorhynchus pilosus*, *O. fullo*, *Pseudomyllocerus sinuatus*, *Phyllobius glaucus*, *Polydrusus pterygomalis*, *Sciaphilus asperatus*, and others. Other species are associated with herbaceous undergrowth plants of these forests (*Ceutorhynchus roberti*, *C. constrictus*, *Datonychus urticae*, *Thamiocolus sinapis*, *Liophloeus tessulatus*, *Sciaphobus squalidus*).

Some nemoral species inhabit steppe-like forest edges, while others occur in meadow steppes and wet meadows (*Exapion difficile*, *Pseudostenapion simum*, *Liparus coronatus*, *Baris analis*, *Mogulones abbreviatulus*, *M. raphani*, *Oprohinus suturalis*, *Prisistus suturalba*, *Cionus clairvillei*, *Sitona languidus*), and some are associated with aquatic and riparian vegetation (*Squamapion vicinum*, *Nanophyes globulus*, *N. globiformis*, *Nanomimus hemisphaericus*, *Sphenophorus striatopunctatus*, *Gymnetron villosulum*, *Bagous brevis*, *B. petro*).

We also provisionally include in the nemoral complex species associated with *Chamaecytisus ruthenicus* (Fisch. ex Wolosz.) Klask., which mainly grows along edges of pine forests (*Exapion formaneki*, *E. elongatulum*, *Philopedon plagiatum*, *Polydrusus confluens*, *Sitona striatellus*).

A significant portion of the Mediterranean and East Mediterranean species (e.g., *Cyphocleonus achates*, *Ceutorhynchus nanus*, *C. niyazii*, *Cionus olens*, *C. clairvillei*, *Anthonomus rubripes*, *Otiorhynchus brunneus*, *Trachyphloeus alternans*, *Psallidium maxillosum*, *Charagmus gressorius*) occur in the Khopyor Nature Reserve near the northern or northeastern limits of their distribution ranges. The relative proximity of the Black Sea region is reflected in the presence of Pontic and Pannonian – Pontic species in the fauna (*Melanobaris atramentaria*, *Mecinus janthiniformis*, *M. laeviceps*, *Gymnetron hoferi*, *Attactagenus albinus*). A distinct group is formed by desert-steppe and southern steppe species of Turanian and Kazakh (Sarmatian) origin, such as *Pleurocleonus sollicitus*, *Bothynoderes declivis*, *Larinus idoneus*, *L. minutus*, *Lixus linnei*, *Pseudorchestes exiguus*, *Tychius affinis*, *Sibinia beckeri*, *Metadonus anceps*, *M. curtus*, *M. distinguendus*, *Ptochus porcellus*.

Species belonging to the groups discussed above are not typical of the East European oak forest–steppe zone and within the reserve occur almost exclusively on

sandy soils of the above-floodplain terrace; some were found on sandy slopes of the right bank of the Khopyor River or on steppe solonets areas.

Landscape and Habitat Distribution of the Curculionoidea. Analysis of the distribution of *Curculionoidea* species across the studied territory revealed that 219 species (61%) are currently known from the right-bank part of the reserve, while 283 species (79%) have been recorded from the floodplain and the above-floodplain terrace of the left bank. The pronounced differences observed between these partial faunas are expected, as these two parts of the reserve differ markedly in their natural conditions. Therefore, the right and left banks of the Khopyor River belong to different botanical–geographical regions.

The considerably higher known species richness of the left bank is determined by both objective factors – the presence of extensive floodplain and near-water complexes, as well as sandy terraces absent on the right bank – and methodological factors, since most of the field studies, for logistical reasons, were conducted on the left bank. Consequently, the upland right bank remains much less studied.

Nevertheless, the differences between these territories are of an objective nature, as evidenced by the fact that a significant number of species in the Khopyor Nature Reserve are known exclusively from the right bank. Only 144 species are common to both banks, and the Jaccard similarity coefficient between the two samples is only 40%.

Below, there is a brief characterization of the main habitat complexes of phytophagous beetles in the reserve (Table 2).

The broadleaf forest complexes of the reserve are rather distinctive. In total, 89 species of *Curculionoidea* have been recorded in the oakwoods (*Quercus robur*), lime forests (*Tilia cordata*), and black alder forests (*Alnus glutinosa*) of the reserve, including both the right- and left-bank areas. Many of these species are associated with meadow edges, whereas only about two-thirds of them (59 species) permanently inhabit tree vegetation or the forest undergrowth.

The specific character of these complexes is largely defined by the group of West Palaearctic nemoral weevils (see above). Some of these species occur only in the upland forests of the right bank, such as *Otiorhynchus pilosus* (locally causing noticeable damage to ash leaves in the undergrowth), *Orchestes quedenfeldtii* (a specialized leaf miner on Ulmus minor), *Datonychus urticae* (a monophagous species on Stachys sylvatica), and *Curculio pellitus* (on Quercus robur).

At the lower slope of the right-bank escarpment of the Khopyor River, in a moist poplar–elm grove, several specimens of *Thamiocolus sinapis* were collected from *Lamium maculatum* and *Stachys palustris* – representing the easternmost record of this European nemoral species.

Conversely, some species have so far been found only in the broadleaf forests of the left bank, including *Orchestes quercus*, *Pseudomyllocerus sinuatus*, *Ceutorhynchus constrictus*, and *C. roberti*. On a psammophytic edge of a sparse oakwood on the above floodplain terrace of the left bank, *Prisistus suturalba* was recorded.

Table 2. Species Richness and Share of Zoogeographical Complexes in the Curculionoidea Fauna of the Khopersky State Nature Reserve

Complexes	Number of species	Share in the fauna (%)
Longitudinal Complexes		
Cosmopolitan	1	0.3
Holarctic	12	3.3
Transpalaearctic	72	20.1
Western-Central Palaearctic	140	38.8
Western Palaearctic	100	27.7
Central Palaearctic	19	5.2
Central-Eastern Palaearctic and Subtrans-Eurasian	14	3.9
Amphipalaearctic	3	0.8
Latitudinal Complexes		
Boreal and Arctic-Boreal	8	2.2
Polyzonal (including temperate)	139	38.5
South-Boreal-Subboreal	73	20.2
Subboreal	141	39.1
Total number of species	361	100

Note: The percentage in parentheses represents the share (%) of each group in the local fauna.

It is also noteworthy that throughout the reserve, in forests containing *Acer tataricum*, the species *Exechesops foliatus* occurs. It is an East Asian nemoral species that has widely expanded its range in recent decades across the European part of Russia (up to and including Donbass) and into eastern Ukraine (Martynov & Nikulina 2016; Ryaskin et al. 2025; Dedyukhin 2025).

On the edge of an upland oakwood, the narrow oligophage *Rhynchaenus xylostei* was recorded on the alien honeysuckle species *Lonicera tatarica*. Interestingly, within the same upland oak forest, the native honeysuckle *Lonicera xylosteum* L., a boreal relict occurring here beyond its southern range limit (Zaitsev 2024), also grows. It is probable that *R. xylostei* shifted from the native *L. xylosteum* to the introduced *L. tatarica*.

The most distinctive and, at the same time, the most diverse assemblage is concentrated in the sandy steppes and psammophytic edges of pine forests on the above floodplain terrace of the left bank (136 species). Among them, many species are of steppe or Mediterranean origin: *Squamapion atomarium* and *S. oblivium* (on *Thymus pallasianus* H. Braun), *Squamapion lukjanovitshi* (collected in the Yellow Yar tract on *T. marschallianus* Willd.), *Exapion formaneki*, *E. elongatulum*, *Pachytychius sparsutus*, *Attactagenus albinus*, and *Polydrusus confluens* (on *Chamaecytisus ruthenicus*), *Pleurocleonus sollicitus* (probably on *Artemisia marschalliana* Spreng.),

Cyphocleonus achates, *Larinus obtusus*, and *Ceratapion penetrans* (on *Centaurea stoebe* L.), *Larinus idoneus* and *L. iaceae volgensis* (on *Jurinea* spp.), *L. minutus* and *Pseudorchestes exiguus* (on *Centaurea majorovii* Dumbadze), *Lixus subtilis* and *Asproparthenis punctiventris* (broad oligophages on *Chenopodiaceae*), *Bothynoderes declivis* (monophage on *Bassia laniflora* (S.G. Gmel.) A.J. Scott), *Lixus punctirostris*, *Ceutorhynchus canaliculatus*, *C. ignitus* (on *Berteroa incana* (L.) DC.), *Lixus tibialis* (on *Hieracium umbellatum* L.), *Oprohinus suturalis* (on *Allium sphaerocephalon*), *Anthonomus rubripes* (on *Potentilla argentea* s.l.), *Gymnetron hoferi* (host plants unknown, probably on *Veronica* spp.), *Tychius pumilus* and *Protapion dissimile* (on *Trifolium arvense*), *Pseudoprotapion ergenense* and *Tychius affinis* (on *Astragalus varius*), *Sibinia vittata* and *S. subelliptica* (both on *Dianthus* L.), *S. hopffgarteni* (on *Eremogone* spp.), *S. tibialis* (on *Otites* spp.), *S. unicolor* (on *Gypsophila paniculata* L.), and *Thamiocolus signatus* (common on *Stachys recta* in sandy steppe; it has not been found in other habitats where this plant grows). In addition, many polyphagous species occur here: *Otiorhynchus brunneus*, *Attactagenus albinus*, *Strophosoma albosignatum*, *Omias globulus*, *Ptochus porcellus*, and others.

The sandy habitats are especially rich in species associated with plantains (*Plantago* L.) – *Mecinus pyraster*, *M. ictericus*, *M. labilis*, *M. pascuorum*, *M. pirazzollii*; mulleins (*Verbascum* L.) – *Cionus thapsus*, *C. clairvillei*, *C. rossicus*; wallflowers (*Erysimum* L.) – *Bruchela schusteri*, *Lixus linnei*, *L. albomarginatus*, *Melanobaris hochhuthi*, *M. atramentaria*, *Ceutorhynchus plumbeus*, *C. talickyi*, *C. rhenanus*, *C. viridanus*; and toadflaxes (*Linaria* Mill.). On various *Linaria* species, *Rhinusa neta* and *Rh. antirrhini* are common, while *Mecinus janthinus* and *M. heydenii* are confined to *Linaria vulgaris* Mill. The monophagous *M. laeviceps* and *M. janthiniformis* feed on *L. genistifolia* (L.) Mill., on which a single specimen of *Rhinusa* sp. (possibly an undescribed species) was also collected. Many of these are rare and locally distributed species, characteristic or even specific to sandy steppe ecosystems.

A distinct biotopic group is formed by forest and meadow species inhabiting pine forests and their shaded glades (47 species in total). Most of them are associated with pine (*Pissodes castaneus*, *P. pini*, *Hylobius abietis*, *H. pinastri*, *Magdalis duplicata*, *M. frontalis*), stonecrop (*Hylotelephium maximum* (L.) Holub) (*Aizobius sedi*, *Pericartiellus telephii*), and sorrels (*Rumex acetosella* L. or *R. thyrsiflorus* Fingerh.) (four *Apion* species, *Perapion affine*, *Perapion oblongum*, *Rhinoncus pericarpius*, and *Marmaropus besseri*).

It is likely that Coniocleonus turbatus, which is very common on psammophytic edges, develops on the roots of *Rumex acetosella*. On a sandy road within a pine forest, *Charagmus gressorius* was also collected; although this species is usually associated with lupines (*Lupinus* L.), only *Lotus corniculatus* L. and *Chamaecytisus ruthenicus* were present at the collection site.

Several other species are linked to narrow-leaved willows growing in moist hollows, for example *Temnocerus nanus* and *Acalyptus sericeus*.

A large and diverse group of species inhabits the forb–feather grass steppes, meadow steppes, and saline steppes of the high right bank of the Khoper River (125

species). Most of them are meadow-steppe species (*Squamapion flavimanum*, *Pseudoprotapion elegantulum*, *Stenopterapion intermedium*, *Hemitrichapion reflexum*, *Protapion ruficrus*, *Tychius sharpi*, *Ischnopterapion loti*, *Sitona waterhousei*, *Tychius squamulatus* – all on *Lotus corniculatus*), as well as *Hemitrichapion pavidum*, *Hypera plantaginis*, *Sitona languidus*, *Malvaevora timida*, *Thamiocolus virgatus*, *Pseudorchestes ermischi*, and *C. montanus* (on *Verbascum thapsus* L.).

However, a significant proportion of typical steppe and southern-steppe species are also represented: *Squamapion elongatum*, *Lixus subtilis*, *L. cylindrus*, *L. cardui*, *Ceutorhynchus nanus*, *Cionus olivieri*, *C. leonhardi* (on *Verbascum lychnitis* L.), *Mecinus plantaginis*, *Metadonus curtus*, and others.

In the northwestern part of KhSNR, steppe solonets occur locally. The weevil assemblages of these habitats remain poorly studied, but several specialized species have already been recorded. Thus, in the Lisya Balka tract, *Sibinia beckeri* (a species considered monophagous on *L. gmelini* (Willd.) Kuntze) in saline steppe patches was collected on *Limonium bungei* (Claus) Gamajun. *Pseudorchestes kostali* was also found, a species associated with *Galatella* Cass.

Steep, sandy slopes of the right bank of the Khoper River serve as microrefugia for southern species. This group includes *Melanobaris carbonaria*, *Aulacobaris caerulescens*, *Ceutorhynchus pallidactylus* (all collected on *Sisymbrium altissimum* L.), *C. sisymbrii* and *C. niyazii* (on *Sisymbrium loeselii*), *C. nanus* (probably on *Alyssum turkestanicum*), *Psallidium maxillosum*, *Asproparthenis punctiventris*, *Lixus rubicundus*, *L. subtilis* (on *Chenopodiaceae*), *Nemonyx lepturoides* and *Ranunculiphilus faeculentus* (on *Consolida regalis* Gray), *Tychius crassirostris* (a series collected in the Krutoy Yar tract on *Melilotus albus* Medik.), *Pachycerus segnis*, and *Ptochus porcellus*.

A total of 111 species of Curculionoidea were recorded in the meadows of the left-bank floodplain of the Khoper River. The core of this assemblage is formed by meadow and meadow-steppe species such as *Auletobius sanguisorbae*, *Involvulus pubescens*, *Exapion difficile*, *Mononychus punctumalbum*, *Baris analis*, *Ceutorhynchus barbareae*, *Microplontus millefolii*, *Pseudorchestes circumvistulanus*, and *Thamiocolus virgatus*. They are characteristic of well-developed floodplains of large rivers, from the southern forest zone to the steppe zone. On elevated short-term flooded areas, a number of predominantly steppe species were recorded, including *Mesotrichapion punctirostre*, *Lixus abdominalis*, *Gymnetron hoferi*, *Cionus olens*, *C. clairvillei*, and *Trachyphloeus alternans*.

On near-water and aquatic vegetation along the banks of the Khoper River and in its floodplain lakes, 71 species of Curculionoidea were recorded. In shaded sites and among willow thickets, the following species occur: *Temnocerus coeruleus* (on *Alnus glutinosa* (L.) Gaertn.), *Lepyrus palustris* and *Phyllobius jacobsoni* (on *Salix* spp. along the Khoper bank), *Cryptorhynchus lapathi*, *Tachyerges pseudostigma*, *T. stigma*, *T. salicis*, and *Polydrusus corruscus* (on *Salix* spp. in various habitats).

The tall-herb banks of water bodies and waterlogged meadows in floodplain depressions are characterized by *Thamiocolus kraatzi* and *T. viduatus* (on *Stachys*

palustris L.), *Nanophyes globulus*, *N. globiformis*, *N. marmoratus*, *Nanomimus hemisphaericus*, and *Hylobius transversovittatus* (on *Lythrum* spp.), *Tapinotus sellatus* (on *Lysimachia vulgaris* L.), *Mogulones raphani* and *M. abbreviatulus* (on *Symphytum officinale* L.), *Datonychus arquata* (on *Lycopus* spp. and *Mentha arvensis*), *Squamapion vicinum* (on *Mentha arvensis* L.), *Phyllobius dahli* (on *Artemisia abrotanum* L.), and *Phyllobius thalassinus*.

The complex of weevils associated with aquatic and amphibious plants includes *Sphenophorus abbreviatus*, *Arthrostenus fullo*, *Notaris scirpi*, and *N. acridulus* (on *Phragmites australis* (Cav.) Trin. ex Steud.), *Tanysphyrus lemnae* (on *Lemnaceae*), *Rhinoncus inconspectus* (on *Persicaria amphibia* (L.) Delarbre), *Poophagus hopffgarteni* (on *Rorippa amphibia* (L.) Bess.), three species of the genus *Thryogenes* and *Limnobaris dolorosa* (on *Cyperaceae*), *Bagous nodulosus* and *B. validus* (both common on *Butomus umbellatus* L.), *B. petro* (on *Utricularia vulgaris* L.), *B. subcarinatus* (on *Ceratophyllum demersum* L.), *Bagous robustus*, *B. brevis*, *Hydronomus alismatis*, and several other species.

Conclusions

Thus, a comprehensive inventory of the weevil fauna (Curculionoidea) of the Khopersky Nature Reserve has been carried out for the first time. The study revealed a high level of species richness and faunal originality, with a considerable number of range-margin and rare species, which further emphasizes the great conservation value of this protected area. The composition of Curculionoidea in the reserve is still incompletely known, indicating the promising potential for further research on this group both within the reserve itself and throughout the Khoper Region as a whole.

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Supplementary material 1

Table S1. List of Curculionoidea species of Khopersky State Nature Reserve and their distribution across habitat types

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Data type: table

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