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Article

The main results of monitoring of protected invertebrates of Chelyabinsk Oblast after publication of the second edition of the regional Red Data Book

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Abstract. The new data on the distribution and bioecological features of 42 species included in the regional Red Data Book have been obtained. These are 37 species of insects, three species of arachnids and two species of gastropods. For 17 species, the data on their distribution in the region turned out to be fundamentally new. Seven studied species are represented in the Red Data Book of the Russian Federation and 36 species in the Red Data Books of other subjects of the Russian Federation. The driving factors of negative impact on the populations of many species are the following: a) intensive, sometimes continuous logging and forest fires, b) large-scale and intensive use of pesticides by farmlands and on the adjacent territories, c) significant recreational load on typical habitats of rare species, d) death of many invertebrates on dirt roads caused by motor vehicles of tenants, hunters, producers of biological products, etc. e) unregulated grazing of livestock, running of horses' herds, organization of new farmlands and their further active exploitation, as well as fires in the steppe zone. The most vulnerable and sensitive to anthropogenic influence species include *Carabus hungaricus*, *Argyronom laodice*, *Clossiana thore*, *Crebeta deidamia*, *Neolysandra coelestinus*, *Bombus armeniacus*, *B. fragrans*, *B. pratorum* and *B. veteranus*. The state of populations of *Parnassius apollo*, *Bombus terrestris*, *B. serrisquama*, *Bombyllus major*, *Laphria gibbosa* and *Allohogna singoriensis* is not particularly alarming. In our opinion, *Anax parthenope*, *Dendroxena quadrinaculata*, *Mycetina cruciata*, *Chelis dahurica*, *Eresus kollari* and *Hirudo medicinalis* deserve to be listed in the third edition of the Red Data Book of Chelyabinsk Oblast in category III or IV.

Keywords: biodiversity, spiders, mollusks, distribution, protected areas, threats

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Научная статья

Главные итоги мониторинга охраняемых беспозвоночных животных Челябинской области после выхода второго издания региональной Красной книги

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Аннотация. Получены новые данные о распространении и экологических особенностях 42 видов, внесенных в региональную Красную книгу; это 37 видов насекомых, три вида паукообразных и два вида брюхоногих моллюсков. Для 17 видов данные об их распространении на территории региона оказались принципиально новыми. Семь из изученных нами видов представлены в Красной книге Российской Федерации, 36 видов – в Красных книгах других субъектов РФ. Установлено, что

главными факторами негативного влияния на популяции многих видов являются: а) интенсивные, местами сплошные рубки леса и лесные пожары, б) широкомасштабное и интенсивное применение пестицидов на сельхозугодиях и прилегающих к ним территориях, в) значительная рекреационная нагрузка в типичных местообитаниях редких видов, г) гибель многих беспозвоночных на грунтовых дорогах с активным движением автотранспортных средств арендаторов, охотников, заготовителей биопродукции, д) нерегулируемый выпас скота, прогон табунов лошадей, организация новых и, впоследствии, активная эксплуатация сельхозугодий, а также пожары в степной зоне. Наиболее уязвимы такие чувствительные к антропогенному влиянию виды, как *Carabus hungaricus*, *Argyronom laodice*, *Clossiana thore*, *Crebeta deidamia*, *Neolysandra coelestinus*, *Bombus armeniacus*, *B. fragrans*, *B. pratorum* и *B. veteranus*. Не вызывает особой тревоги состояние популяций *Parnassius apollo*, *Bombus terrestris*, *B. serrisquama*, *Bombyllus major*, *Laphria gibbosa* и *Allohogna singoriensis*. Заслуживают, на наш взгляд, внесения в третье издание Красной книги Челябинской области в категории III или IV *Anax parthenope*, *Dendroxena quadrinaculata*, *Mycetina cruciata*, *Chelis daturica*, *Eresus kollari* и *Hirudo medicinalis*.

Ключевые слова: биоразнообразие, насекомые, пауки, моллюски, распространение, ООПТ, угрозы

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Introduction

Conservation of biological diversity is becoming every year an increasingly urgent task, which is solved by the scientists all over the world. Animals with a reduced number are especially vulnerable; they primarily require the closest attention. Many of them have been already included in the Red Data Books of various levels, both federal and regional.

Annual monitoring and operational assessment of the state of populations of protected, rare and poorly studied species is an important part of maintaining the Red Data Book and serves as a reliable basis for developing timely measures for their protection and recommendations for changing (clarifying) the status.

The second edition of the Red Data Book of Chelyabinsk Oblast (Krasnaya kniga..., 2017) includes 95 species of insects from 34 families and 9 orders, 4 species of arachnids (spiders) from 3 families, 4 species of gastropods from 2 orders and 3 families and 1 species of annelids. Appendix 3 ("List of objects of the flora and fauna that call for special attention") contains 4 species of insects from 4 families and 2 orders (Table 1).

Among insects included in the Red Data Book, the largest number of species fall on Hymenoptera – 41 species from 8 families, as well as Coleoptera and Lepidoptera – 21 species from 7 families in

Table 1. Conservation status of invertebrates of the Red Data Book of Chelyabinsk Oblast and Appendix 3.

Orders and families	Red Data Book				Appendix 3 (Species that call for special attention in nature)
	Category of rarity status				
	I	II	III	IV	
Number of species in the category					
Insecta					
Odonata					
Coenagrionidae	—	—	1	—	
Aeshnidae	—	1	—	—	
Libellulidae	—	—	1	—	
Gomphidae	—	—	1	—	
Mantiptera					
Mantidae	—	—	—	1	
Orthoptera					
Tettigoniidae	—	—	2	—	
Hemiptera					
Nepidae	—	—	1	—	
Gerridae	1	—	—	—	
Homoptera					
Cicadidae	—	—	—	—	1
Coleoptera					
Carabidae	1	6	2	1	
Dytiscidae	—	1	—	—	
Lucanidae	—	1	—	—	
Coccinellidae	—	2	1	—	
Cerambycidae	3	—	—	—	
Curculionidae	—	—	2	—	
Lampyridae	—	—	1	—	
Neuroptera					
Ascalaphidae	—	—	1	—	
Lepidoptera					
Papilionidae	1	—	1	—	1
Nymphalidae	1	2	1	1	1
Satyridae	—	1	5	—	1
Lycaenidae	—	2	1	—	
Saturniidae	—	1	—	—	
Sphingidae	—	—	1	—	
Arctiidae	—	2	1	—	

Orders and families	Red Data Book				Appendix 3 (Species that call for special attention in nature)
	Category of rarity status				
	I	II	III	IV	
Number of species in the category					
Hymenoptera					
Anthophoridae	–	–	1	–	
Megachilidae	–	–	1	–	
Halictidae	–	–	1	–	
Apidae	1	6	16	–	
Chrysididae	–	1	–	–	
Formicidae	1	3	8	–	
Scoliidae	–	–	1	–	
Cephidae	–	1	–	–	
Diptera	–	–	1	1	
Asilidae	–	–	–	1	
Bombyliidae	–	–	1	–	
Total	9	30	52	4	4
Arachnida					
Aranei					
Araneidae	–	1	1	–	
Pisauridae	–	–	1	–	
Lycosidae	–	–	–	1	
Total	–	1	2	1	
Mollusca					
Geophila					
Vertiginidae	–	–	1	–	
Gastrocoptidae	–	–	1	–	
Lymnaeiformes					
Planorbidae	–	–	1	–	
Lymnaeidae	–	–	1	–	
Total	–	–	4	–	
Annelida					
Haplitaxida					
Lumbricidae	–	–	1	–	
Total	–	–	1	–	
Total invertebrate species	9	31	59	5	

each order. Species with category III of rarity status prevail – 52 species from 8 orders; 9 species from 4 orders have the highest conservation status (category I). Of the order of spiders (Aranei), one species has category II, two species – category III, and one species – category IV. All 4 species of mollusks and the small-lobed worm *Eisenia intermedia* (Michaelsen, 1899) are referred to category III.

Of 104 species of invertebrates in the Red Data Book of Chelyabinsk Oblast (2017), 71 species (68%) are protected in the Reserves (Ilmensky and its branches Arkaim, Yuzhno-Uralsky) and National Parks (Zigalga, Zyuratkul, Taganai), in the territories of nature reserves and natural monuments – 50 (48%) (Table 2). Fifteen species (14.4%), including those with category I (*Prionus coriarius* (L., 1758), *Rosalia alpina* (L., 1758), *Purpuricenus kaehlerii* (L., 1758), *Boloria freja* (Becklin, 1791), *Formica gagatoides* Ruzsky, 1904)) and II (*Anax imperator* (Leach, 1815), *Lucanus cervus* (L., 1758), *Hyperaspis reppensis* (Herbst, 1784), *Oxylichus erythrocephalus* (Fabricius, 1787), *Plebejidea cyane* (Eversmann, 1837), *Neolysandra* (= *Polyommatus*) *coelestinus* (Eversmann, 1837), *Apis mellifera mellifera* L., 1758, *Bombus pomorum* (Panzer, 1805) are not protected.

The purpose of the work is to study the current state of populations of the protected invertebrate species, to clarify their distribution both in the special protected areas and beyond, as well as to specify some bioecological features and major threatening factors for most vulnerable species.

Table 2. Features of the invertebrate protection system of the Red Data Book of Chelyabinsk Oblast. Categories of the species' rarity status are indicated in parentheses.

Order	The number of species		
	Protected in federal protected areas (reserves, national parks)	Protected in regional protected areas (nature reserves, natural monuments)	Special protection measures have not been undertaken
Insecta			
Odonata	3 (III)	3 (III)	1 (II)
Mantoptera	1 (I)	–	–
Orthoptera	2 (III)	2 (III)	–
Hemiptera	2 (I, III)	1 (I)	–
Coleoptera	13 (I, II, III)	5 (III)	7 (I, II, III)
Neuroptera	1 (III)	1 (III)	–
Lepidoptera	12 (II, III)	12 (I, II, III)	3 (I, II)
Hymenoptera	30 (II, III)	22 (III)	4 (I, II, III)
Diptera	1 (III)	1 (IV)	–
Arachnida			
Aranei	1 (III)	3 (II, III, IV)	–
Mollusca			
Geophila	2 (III)	–	–
Lymnaeiformes	2 (III)	–	–
Annelida			
Haplitaaxida	1 (III)	–	–
Total	71	50	15

Materials and methods

Study site

The research was conducted from May to September 2017–2022 in the territories of 26 (out of 27) municipal districts, 9 (out of 16) urban districts, 14 (out of 20) nature reserves and 37 (out of 158) natural monuments (Figs. 1, 2, Table 3). The Federal Protected Area Ilmen Reserve with its branch “Arkaim” were examined earlier (1990–2016). The processing of collection materials and photographs of insects was mainly completed for 2004–2021.

The works were carried out within regular (daily) routes and key sites, including water bodies (streams, rivers, old trees, ponds, lakes, temporary reservoirs) and coastal biotopes. Depending on weather conditions and specific tasks, the route length ranged from 3 to 15 km. They covered almost all the most characteristic types of terrestrial communities, including those partially transformed by man. Some materials were obtained from the settlements or their surroundings.

Methods of collecting materials

To obtain the research materials, manual harvesting, trapping with a mowing net, air and water entomological nets, soil traps (continuously), Malaise traps (continuously) and light traps (in the evening and at night) were used. During the daytime, visual observations, registration and photographing of specific biotopes and related animals were made.

Some captured invertebrates in the field were selectively (for the purpose of subsequent identification of species) killed with ethyl acetate; then stored on cotton mattresses, in paper envelopes, or fixed in 70% ethyl alcohol with added glycerin and placed in test tubes.

In laboratory conditions, imagos of Odonata, Orthoptera, Homoptera, Lepidoptera, Neuroptera, Diptera and Hymenoptera were straightened on standard straighteners, beetles and bedbugs (after light soaking) were glued to triangular plates made of transparent plastic film, which were impaled on entomological pins. After identification, individual spiders were also fixed in 70% alcohol with the addition of glycerin, while the rest were released into nature. Mollusk shells were stored in containers on moss pads. In total, 103 specimens of 33 species of insects, 2 specimens of two species of spiders and 2 specimens of two species of mollusks were placed in the collection.

In this presentation, for taxa with a rank higher than the family we used the system adopted in the Red Data Book of Chelyabinsk Oblast (2017).

Results

In the course of our investigations, new findings, i.e. 42 species of invertebrates from three classes and 10 orders were made. They include 37 species of insects from 20 families and 7 orders (Odonata, Orthoptera, Hemiptera, Coleoptera, Lepidoptera, Hymenoptera, Diptera), 3 species of arachnids from three families and one order (Aranei) and species of gastropods from two families and two orders (Geophila, Lymnaeiformis). It should be noted that the information about the geographical coordinates of our findings of many protected species is deliberately given with the reference to the nearest settlements, not to specific places (biotopes) of their discovery, in order to protect the populations of species (primarily attractive insects) from ruthless prey and collectors who pursue solely their own commercial interests. We provide some additional information on the presence of specific species in the Red Data Book of the Russian Federation, the Red Data Books of the regions adjacent to Chelyabinsk Oblast (Republic of Bashkortostan, Kurgan Oblast, Orenburg Oblast, Sverdlovsk Oblast), as well as in the Red Data Books of other subjects of the Russian Federation (Republics, Autonomous Okrugs, Territories and Regions). Photos of some species are provided in Appendix.

Type **Arthropoda**

Class **Insecta**

Order **Odonata**

Family **Aeschnidae**

Anax imperator Leach, 1815 (Figs. 3A, S1). Category II (here and further the categories are given in accordance with the Red Data Book of Chelyabinsk Oblast, 2017). A species with a decreased number. It was found in the city of Chelyabinsk (Krasnaya..., 2017).

In late June – early July 2020, nine years after our first findings (Krasnaya..., 2017), the habitat of the species (imago) within the city of Chelyabinsk (“Nikolskaya Grove” Park, beach at the Shershnevsky reservoir) was confirmed.

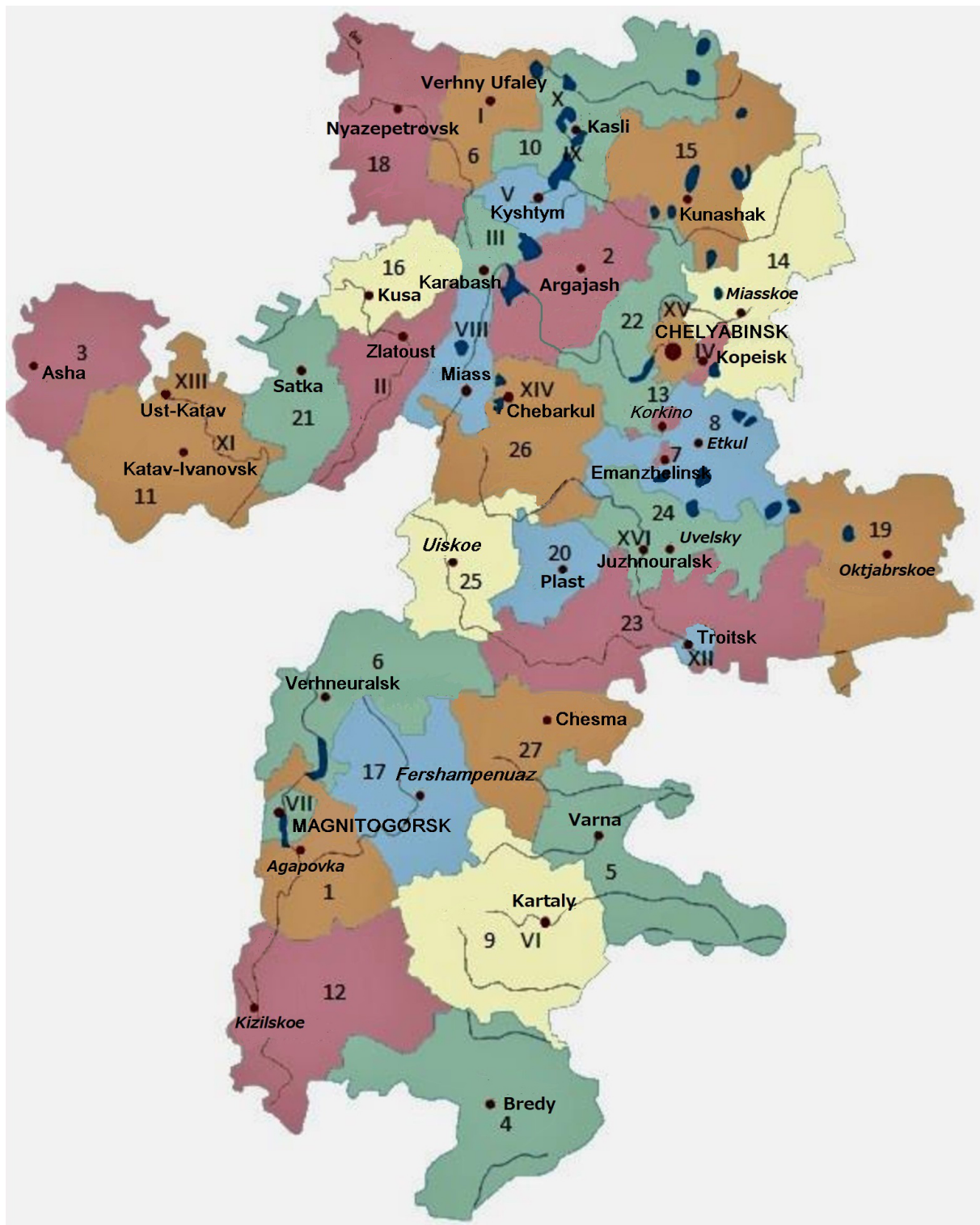


Fig. 1. Administrative division of Chelyabinsk Oblast. Regions: 1 – Agapovsky, 2 – Argayashsky, 3 – Ashinsky, 4 – Bredinsky, 5 – Varna, 6 – Verkhneuralsky, 7 – Yemanzhelinsky, 8 – Etkulsky, 9 – Kartalinsky, 10 – Kaslinsky, 11 – Katav-Ivanovsky, 12 – Kizilsky, 13 – Korkinsky, 14 – Krasnoarmeysky, 15 – Kunashaksky, 16 – Kusinsky, 17 – Nagaibaksky, 18 – Nyazepetrovsky, 19 – Oktyabrsky, 20 – Plastovsky, 21 – Satkinsky, 22 – Sosnovsky, 23 – Troitsky, 24 – Uvelsky, 25 – Uysky, 26 – Chebarkulsky, 27 – Chesmensky. Roman numerals indicate urban districts (UD).

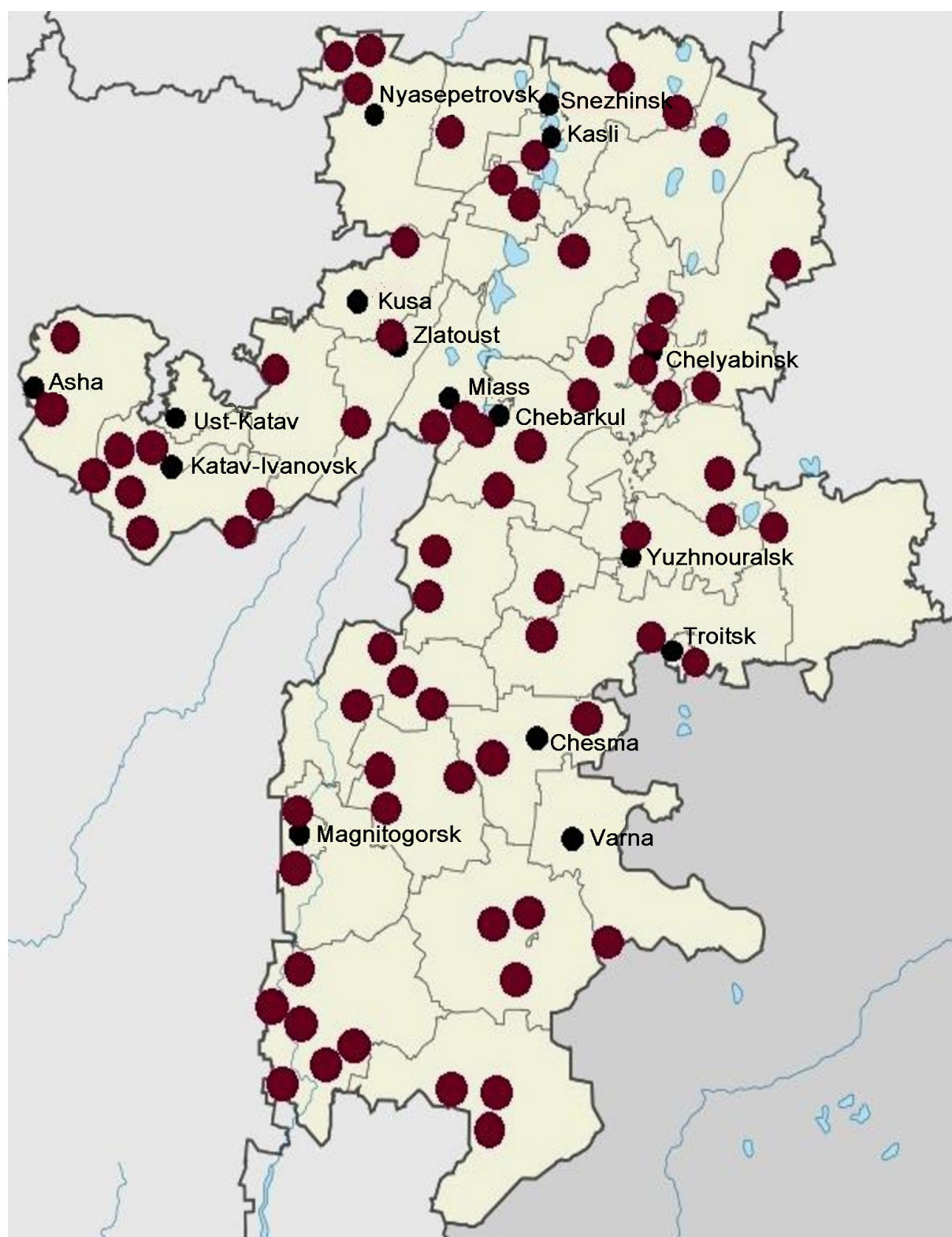


Fig. 2. Study sites of Chelyabinsk Oblast (indicated by maroon circles).

Table 3. Dates of observation, study sites and involved protected areas of Chelyabinsk Oblast.

Year	Month	Regions, urban districts (UD), protected areas, nature monuments (NM)
2017	May	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”)
	June	Nyazepetrovsky region (Nyazepetrovsky State Nature Biological Reserve)
	July	Bredinsky region (Bredinsky State Natural Biological Reserve, NM “Borovskoy Forest”)
	August	Bredinsky region (Bredinsky State Natural Biological Reserve, NM “Bredinsky Forest”, NM “Mountain Razbortnaya”)
	September	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”, NM “Lake Smolino”)
2018	April	Troitsky region (Troitsky State Complex Reserve), Troitsky UD (NM “Zolotaya Sopka”), Chesmensky region (Buskulsky State Natural Biological Reserve)
	May	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”, NM “Lake Smolino”), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”), Bredinsky region (NM “Mountain Mayachnaya”, neighbourhood of Bredy settlement, villages Rymniksky, Svetlye Oзера, Berezovka), Varna region (NM “Toguzak River Valley”, neighbourhood of Varna settlement), Kizilsky region (neighbourhoods of villages Yerlygas, Yershovsky, Zhdanovsky, Izmailovsky, Novy Kondurovsky, Bogdanovskoye)
	June	Verkhneuralsky region (Karagay State Natural Biological Reserve, Lake “Pustoye”, Khlebinka farm), Nagaibaksky region (NM “Lake Karachura”, Shiroky Log tract), Uysky region (Uysky State Natural Biological Reserve)
	July	Kaslinsky region (NM “Section of the Bagaryak River from “Berezka” tourist base to its mouth”), Kunashaksky region (neighbourhood of villages Large Kuyash, Sinarsky and Usmanova), Chesmensky region (Chernobortsky State Natural Biological Reserve, NM “Cherny Forest”, Tugunsky forest, Lake Zingeyka), Chebarkulsky region (Varlamovsky State Natural Biological Reserve, NM “Travnikovsky Forest”)
	August	Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”), Troitsky UD (NM “Geological section of volcanogenic sedimentary rocks with the fossil fauna in the Uvelka River bend”, NM “Pugachevskaya Cave”, NM “Steppe Dawns” Park), Bredinsky region (NM “Geological outcrop of the Mountain Mayachnaya with the ancient fauna”, neighbourhood of villages Bredy, Rymniksky, Svetlye Oзера and Berezovka), Varna region (UM “Toguzak River Valley”, NM “Rocky Outcrops of graptolites in the valley of the Nizhny Toguzak River”, NM “Rocky outcrops of shales with fossil remains”), Kizilsky region (NM “Volcanic Porphyry Weathering Site”, NM “Birch Log On The Ural River”, NM “Blue Shikhan”), Nagaibaksky region (NM “Alder Grove”, the neighbourhoods of villages Paris and Mica), Uysky region (NM “Section Of Mountain Carbonaceous Phthanites With Graptolites”, NM “Bulatovsky Forest”)
	September	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”), Bredinsky region (Mountain Mayachnaya, Berezovka village, neighbourhood of settlements Bredy, Rymniksky, Svetlye Oзера), Krasnoarmeysky region (Donguzlovsky State Natural Biological Reserve)

Year	Month	Regions, urban districts (UD), protected areas, nature monuments (NM)
2019	May	Verkhneufaleysky region (UM “Bolshoy Kamen”), Kaslinsky region (Shaburovsky State Natural Biological Reserve, NM “Lake Arakul”, NM “Lake Itkul”, NM “100-year-old Pine Crops Site”, Lake Bol. Allaki), Nyazepetrovsky region (Nyazepetrovsky State Nature Biological Reserve, NM “Oak grove at Shemakha village”, NM “Shemakhin Karst Field”)
	June	Ashinsky region (Ashinsky State Natural Biological Reserve, NM “Lipovaya Gora”), Katav-Ivanovsky region (Serpievsky State Natural Complex Reserve), Krasnoarmeysky region (Donguzlovsky State Natural Biological Reserve), Nyazepetrovsky region (Nyazepetrovsky State Reserve, NM “Section of the Ufa River between Timofeev and Zaikin Stones”)
	July	Katav-Ivanovsky region (NM “Top of the Ridge Bakty”, NM “Tyulyuk River”), Ust-Katavsky UD (NM “Yuryuzan River From Smirnovsky Bridge to the Nasi River mouth”), Miassky UD (NM “Mountain meadow of the Ridge Chashkovsky”), Kusinsky region (Arshinsky State Natural Biological Reserve, neighbourhood of Medvedevka village)
	August	Kaslinsky region (Shaburovsky State Natural Biological Reserve), Chebarkulsky region (NM “Travnikovsky Forest”, neighbourhood of Kambulat village)
	September	Chelyabinsk, Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”), Chelyabinsk (NM “Chelyabinsk (Urban) Forest”)
2020	May	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”), Miassky UD (NM “Lake Turgoyak”)
	June	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”, “Nikolskaya Grove” Park), Miassky UD (NM “Lake Turgoyak”), Sosnovsky region (NM “Kashtaksky Forest”)
	July	Chelyabinsk (“Nikolskaya Grove” Park, Gagarin Park), Miassky UD (NM “Lake Turgoyak”), Nyazepetrovsky region (NM “Section of the Ufa River Between Timofeev and Zaikin Stones”, NM “Ufa Healing Spring”, neighbourhoods of Araslanovo village, Araslanovo station, Shemakha village, Skaz settlement), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”)
	August	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”, “Nikolskaya Grove” Park), Miassky UD (NM “Lake Turgoyak”), Yuzhnouralsky UD, Sosnovsky region (NM “Kashtaksky Forest”, neighbourhoods of village Birgilda)
	September	Argayashsky region (neighbourhoods of Argayash settlement, Ishalino village), Verkhneuralsky region (neighbourhood of Gorbunovsky village), Yemanzhelinsky region (neighbourhoods of villages Borisovka, Klyuchi), Etkulsky region (neighbourhoods of villages Pechenkino, Pogudino, Shelomentsevo), Korkinsky region (neighbourhoods of Pervomaisky village), Krasnoarmeysky region (Donguzlovsky State Natural Biological Reserve, neighbourhoods of villages Lazurny, Popovo), Oktyabrsky region (neighbourhoods of Bolshenikolskoye village), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”, neighbourhoods of villages Bol. Balandino, Prokhorovo, Dolgoderevenskoye), Chebarkulsky region (Chebarkulsky UD, NM “Travnikovsky Forest”, neighbourhoods of Travniki settlement, Kambulat village), Kopeysky UD, Yuzhnouralsky UD, Miassky UD (NM “Lake Turgoyak”)

Year	Month	Regions, urban districts (UD), protected areas, nature monuments (NM)
2021	May	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”), Agapovsky region (neighbourhoods of villages Buranny, Novoyangelsky, Pervomaisky, Subutak, Yangelsky), Verkhneuralsky region (the neighbourhoods of villages Vyatsky, Gorbunovsky, Linevka, Krasninsky, Krutoy log, Kidyshevsky, Petropavlovsk, Surmenevsky, Sukhtelinsky, Etovna), Kizilsky region (neighbourhoods of villages Alexandrovsky, Amambayka, Yerdygash, Yershovsky, Zingeysky, Izmailovsky, Katsbakhsky, Musin, “The Path of October”, Polotsk village), Magnitogorsk UD (neighbourhoods of Magnitogorsk), Nagaibaksky region (neighbourhoods of villages Kasselsky, Kopalovsky), Kopeisky UD, Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”)
	June	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”), Varna region (neighbourhoods of Varna settlement, villages Borodinovka, Kazanovka, Novopokrovka), Verkhneuralsky region (neighbourhoods of villages Vyatsky, Bolshaya), Kartalinsky region (neighbourhoods of Kartaly settlement, villages Vishnevsky, Michurinsky, Elizavetpolskoye, Novonikolaevka, Tatishchevo, Velikopetrovka), Nagaibaksky region (neighbourhoods of villages Kasselsky, Kopalovsky), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”)
	July	Ashinsky region (Ashinsky State Natural Biological Reserve), Katav-Ivanovsky region (Ridge Zagalga, neighbourhoods of Tyulyuk village), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”),
	August	(NM “Chelyabinsk (Urban) Forest”), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”)
2022	September	(NM “Chelyabinsk (Urban) Forest”), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”)
	May	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”), Varna region (neighbourhoods of Varna settlement, villages Borodinovka, Zarechye, Novy Mir, Solntse, Toguzak river mouth), Verkhneuralsky region (neighbourhoods of villages Linevka, Mezhozerny, right bank of the Kurosan river), Troitsky region (neighbourhood of village Osipovka), Plastovsky region (NM “Andrew’s Stone Quarry”, NM “Borisov Hills”, neighbourhoods of Stepninskoye village)
	June	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”), Argayashsky region (the neighbourhood of Urazbaeva village, Lake Small Miassovo), Varna region (the left bank of the Upper Toguzak River), Nagaibaksky region (neighbourhoods of Kuropatkinsky village, Ostrolensky, Dawn, Mica, Lake Islambekovskoye), Plastovsky region (neighbourhoods of Chuksa settlement), Troitsky region (neighbourhoods of villages Kamenka, Osipovka, Stepnoye, Chernorechye), Cheshmensky region (the neighbourhoods of the Novy Mir, Novoetkulsky, Novoukrainsky, Kovylny, Redutovo, Uglitsky, Chernoborsky villages, the left bank of the Chernaya river)
	July	Verkhneuralsky region (Karagai State Natural Biological Reserve, neighbourhoods of Karagaysky settlement, Lake Karagayskoye), Plastovsky region (NM “Borisov Hills”, neighbourhoods of town Plast, settlements Kochkar and Stepninskoye)
	August	Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”), town Zlatoust
	September	Chelyabinsk (NM “Chelyabinsk (Urban) Forest”, “Nikolskaya Grove” Park), Chelyabinsk UD, Sosnovsky region (NM “Kashtaksky Forest”)

In early August 2020, one specimen (imago) was detected near Kashtak settlement on the shore of the water canal of the Chelyabinsk Metallurgical Plant (N 55°17'47" E 61°22'17").

The species is listed in the Red Data Books of the Russian Federation (Krasnaya..., 2021) (category V), the Republic of Bashkortostan (Krasnaya..., 2014) (category III), Kurgan Oblast (Krasnaya..., 2012) (category II) and Orenburg Oblast (Krasnaya..., 2019) (category II); it is also represented in the Red Data Books of 30 other subjects of the Russian Federation.

Family Gomphidae

***Ophiogomphus cecilia* (Fourcroy, 1785)** (Figs. 3B, S2). Category III. A rare species. It inhabits the territories of forest, forest-steppe and partly steppe zones. It lives in the Ilmen and Kharlushevsky Nature Reserves, Karabashsky and Magnitogorsk urban districts, on the coast of Lake Uvildy, rivers Atia, Bol. Kizil, Gumbeika, Zingeika, Miass, Yuryuzan (Krasnaya..., 2017).

In 2018–2020, the species was repeatedly noted on forest edges, clearings and forest roads in the Arshinsky (N 55°33'27" E 59°44'33"), Karagaisky (N 54°06'31" E 59°34'16"), Serpievsky (N 54°45'18" E 57°41'21"), Shaburovsky (N 56°11'43" E 61°11'26") Nature Reserves, on the territories of Natural Monuments "Travnikovskiy Forest" (N 54°52'21" E 60°34'11") and "Cherny Forest" (N 53°53'51" E 60°27'58"), on floodplain meadows near the Bagaryak river (N 56°10'53" E 61°35'35") and forest roads in the vicinity of villages Kolpakova (N 56°10'53" E 61°44'40"), Zhukova (N 56°10'53" E 61°33'18") and Pldnevo (N 56°10'46" E 61°37'41") (Kaslinsky region), in the neighbourhoods of Izranda (N 55°29'18" E 59°49'66") and Alexandrovka (N 55°31'00" E 59°49'66") villages (Kusinsky region) (Krasutsky and Gashek, 2019, 2020a, b).

In June – early July 2020, it was registered in open sites of forest and dirt roads in Kashtak forest near Kashtak settlement (N 55°18'08" E 61°21'08") (Sosnovsky region) and at the Chelyabinsk airport (N 55°13'44" E 61°21'08"). In July, it was found in Nyazepetrovsky region on the forest roads and near power lines, including the Ridge Bardym at the Araslanovo railway station (N 56°13'06" E 59°22'55") and Araslanovo village (N 56°12'19" E 59°18'08") (Krasutsky and Gashek, 2021a).

In mid-June 2021, it was recorded in a grass meadow at the foot of Mountain Bolshaya, 4 km northeast of Vyatka village (N 53°54'13" E 58°59'15") (Verkhneuralsky region).

The species is included in the Red Data Books of three more subjects of the Russian Federation.

Family Libellulidae

***Leucorrhinia caudalis* (Charpentier, 1840)** (Fig. 3C). Category III. A rare species. It was registered on Lake Akakul, near Atlyan village, on the Miass River and on lakes Bol. Miassovo and Uvildy (Krasnaya..., 2017).

In 2020, it was discovered on the shore of a small heavily overgrown pond in the Nature Monument "Kashtakskiy Forest" (Sosnovsky region) (N 55°20'36" E 61°23'32"). One individual flew along the coast together with males of the *Libellula depressa* L., 1758 (Krasutsky and Gashek, 2021a).

Order Orthoptera

Family Tettigoniidae

***Sago pedo* (Pallas, 1771)** (Figs. 3D, S3). Category III. A rare species. It is rare and locally found in Chelyabinsk Oblast, i.e. in the Troitsky region (Troitsky and Sanarsky Nature Reserves), Kizilsky, Kartalinsky regions and in the vicinity of Magnitogorsk. There is an information about finds in Sosnovsky and Oktyabrsky regions, the Karagai and Chernoborsky Nature Reserves, Varna and Verkhneuralsky regions, in Bredinsky Forest, the Uy river valley near Osipovka village, the Kurasan river near Kopalovsky village, in the vicinity of villages Alekseevka and Polotsk, the Chelyabinsk city forest (Krasnaya..., 2017).

In August 2017, one specimen was found in a grass meadow in the southwestern part of the Bredinsky Nature Reserve (N 52°13'16" E 60°35'06") (Bredinsky region) (Krasutsky and Gashek, 2019).

At the end of September 2020, a single representative was also recorded in the steppe area within the boundaries of the Kurosan gold deposit, to the southwest of Gorbunovsky village (N 53°59'46" E 59°45'00") (Verkhneuralsky region), and in mid-June 2021, one specimen was found in the grass-grass steppe northeast of Linevka village (N 53°58'50" E 60°16'35") (Verkhneuralsky region) and in the petrophytic steppe near Mountain Mayak Etovny, 5 km northwest of Etovna village (N 54°01'43" E 60°03'44") (Uysky region).

It is listed in the Red Data Books of the Russian Federation (2021) (category II), the Red Data Books of the Republic of Bashkortostan (2014) (category III), Kurgan Oblast (2012) (category II) and Orenburg Oblast (2019) (category II), including the Red Data Books of 22 other subjects of the Russian Federation.

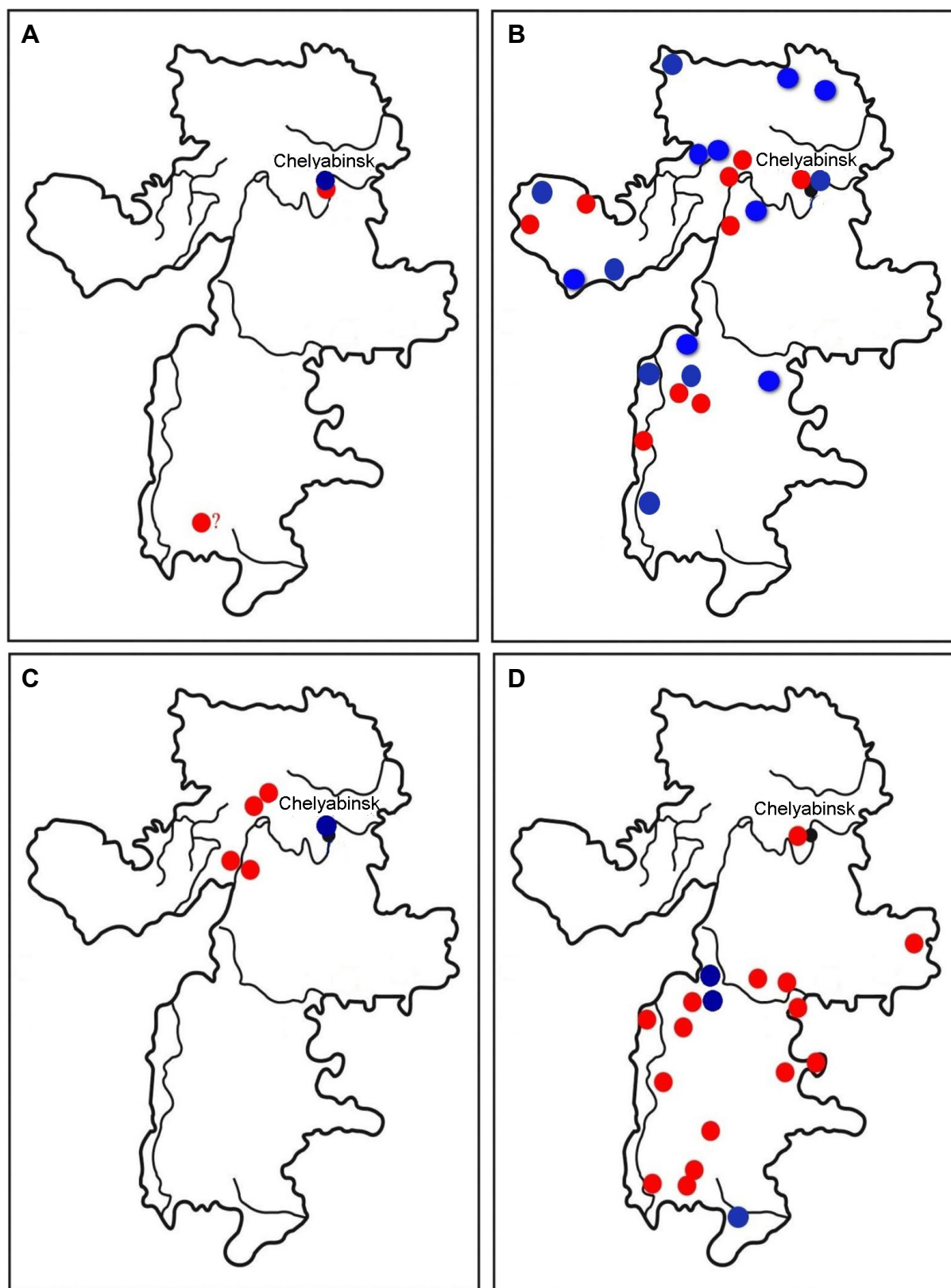


Fig. 3. Locations of *Anax imperator* (A), *Ophiogomphus cecilia* (B), *Leucorrhinia caudalis* (C) and *Sago pedo* (D) in Chelyabinsk Oblast. Here and further (in Figures) the locations known from the Red Data Book of Chelyabinsk Oblast (2017) are indicated in red and identified by the authors – in blue.

***Onconotus servillei* Fischer-Waldheim, 1846** (Fig. 4A). Category III. A rare species. It is endemic to the steppe zone of Eurasia, noted in the Arkaim Reserve, in the Troitsky and Sanarsky Nature Reserves, as well as in the Bredinsky and Oktyabrsky regions (Krasnaya..., 2017).

In August 2017, it was discovered in a grass meadow of the Bredinsky Nature Reserve (N 52°11'59" E 60°42'45") (Krasutsky and Gashek, 2019).

In July 2019, it was recorded nearby Chernovskoye village (N 54°52'59" E 60°03'26") (Miassky UD) in a dry meadow, which is the northernmost finding of this species (Krasutsky and Gashek, 2020a, b).

The species is listed in the Red Data Book of Orenburg Oblast (2019) (category III) and in the Red Data Books of 5 other subjects of the Russian Federation.

Order Hemiptera

Family Nepidae

***Ranatra linearis* (Linnaeus, 1758)** (Fig. 4B). Category III. A rare species. In Chelyabinsk Oblast, it was found in lakes of the Ilmensky, East Uralsky and Arkaim Reserves, in ponds of the Chernoborsky Nature Reserve, lakes Bol. Akakul and Alakul, the Asha river near Tochilny settlement, Toguzak river near Alekseevka village, pond Kommunar in Chelyabinsk, pond Minyar and Lake Chebarkul (Krasnaya..., 2017).

In early June 2020, two individuals were noted in the shallow waters of the western shore of the NM "Lake Turgoyak" (N 55°09'00" E 60°04'00") (Miassky UD) (Krasutsky and Gashek, 2021a).

At the end of June 2022, one specimen was recorded in the abundant (in aquatic plants) shallows on the western shore of Lake Mal. Miassovo near Urazbaeva village (N 55°10'47" E 60°21'09") (Argayashsky region).

The species is listed in the Red Data Book of Kurgan Oblast (2012) (category IV) and is represented in the Red Data Books of 10 more subjects of the Russian Federation.

Order Coleoptera

Family Carabidae

***Carabus hungaricus cribellatus* Adams, 1812** (Fig. 4C). Category II. A species with a decreased number. In the region, it was previously discovered in the Arkaim Reserve, the Troitsky Nature Reserve, and in the vicinity of Yershovsky and Granitny villages of Kizilsky region (Krasnaya..., 2017).

In July 2022, one (dead) individual was found in the Karagai Nature Reserve (N 54°06'31" E 59°34'16") (Verkhneuralsky region) in a dry meadow with thickets of *Spiraea hypericifolia* L. and *Cotoneaster melanocarpus* Fisch. ex A. Blytt.

The species is listed in the Red Data Books of the Russian Federation (2021) (category II), Orenburg Oblast (2019) (category II) and represented in the Red Data Books of 16 other subjects of the Russian Federation.

***Calosoma sycophanta* (Linnaeus, 1758)** (Figs. 4D, S4). Category III. A rare species. It was found in the Ilmen Reserve, Troitsky and Chebarkulsky Natutal Reserves, NM "Cherny Forests", Sanarsky at Chebarkul town, Tomino village, in "Nikolskaya Grove" Park in Chelyabinsk (Krasnaya..., 2017).

We detected this species on birch trees at Urazbaev village (N 55°10'47" E 60°21'09") (Krasutsky and Gashek, 2019) (Argayashsky region). In 2018, it was found in birch plantations in the northeastern part of the Karagai Nature Reserve (N 54°06'35" E 59°34'16") (Krasutsky and Gashek, 2019).

The species is listed in the Red Data Books of the Russian Federation (category II), the Red Data Book of the Republic of Bashkortostan (category III), Kurgan Oblast (category II) and Orenburg Oblast (category II). It is also represented in the Red Data Books of another 30 subjects of the Russian Federation.

Family Lampyridae

***Lampyris noctulica* (Linnaeus, 1758)** (Fig. 5A). Category III. A rare species. In Chelyabinsk Oblast, it is noted in the Ilmen and Arshinsky Nature Reserves, in the vicinity of Kisegach village and on Lake Yelovoye (Krasnaya..., 2017).

In 2019, it was discovered in the Serpievsky Nature Reserve, in the meadow communities of the Kuryak River floodplain (N 54°45'34" E 57°45'21") (Katav-Ivanovsky region), in the meadows of the Ufa River floodplain, in the vicinity of Araslanovo village (N 56°18'91" E 59°46'51") (Nyazepetrovsky region) (Krasutsky and Gashek, 2020a, b).

O.P. Malykh, the employee of the Ashinsky Nature Reserve, states that in some years the species is common in the meadows of the Asha river floodplain near Grindstone settlement (N 55°05'50" E 57°10'56") (Ashinsky region) (Krasutsky et al., 2021).

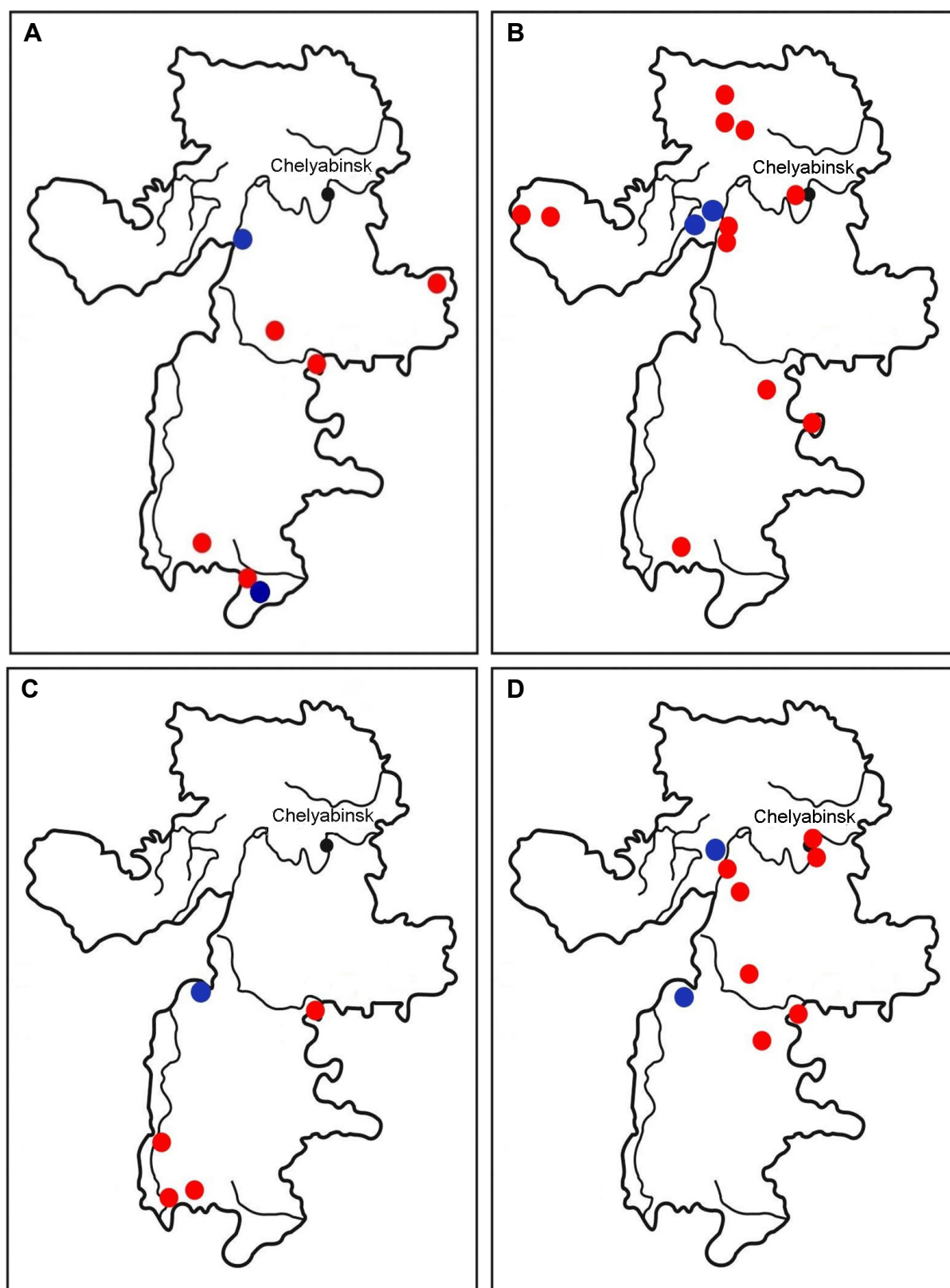


Fig. 4. Locations of *Onconotus servillei* (A), *Ranatra linearis* (B), *Carabus hungaricus cribellatus* (C) and *Calosoma sycophanta* (D) in Chelyabinsk Oblast.

At the end of June 2022, several individuals were registered at the edge of a birch forest near Lake Mal. Miassovo at Urazbaeva village (N 55°10'47" E 60°21'09") (Argayashsky region). In July, several representatives of this species were also noted on an island in the northern part of Lake Uvildy at Saimaa village (N 55°31'26" E 60°29'43") (Argayash region).

The species is represented in the Red Data Books of two more subjects of the Russian Federation.

Order **Lepidoptera**

Family **Papilionidae**

***Parnassius apollo* (Linnaeus, 1758)** (Figs. 5B, S5). Category III. A rare species. It is widely spread in the territory of Chelyabinsk Oblast and found in steppe, forest-steppe and forest zones, where forage plants of caterpillars grow – species of the genus *Sedum*, mainly acrid *S. acre* L. and purple *S. telephium* L. (Krasnaya..., 2017).

In 2017–2020, the species was recorded in the Bredinsky (N 52°13'16" E 60°35'06") and Karagaisky (N 54°06'35" E 59°34'16"), Uysky (N 54°13'41" E 59°51'86") Natural Reserves, on the territory of Natural Monuments "Cherny Forest" (N 53°53'51" E 60°27'58") (Chesmensky region) and "Travnikovskiy Forest" (N 54°53'29" E 60°27'30") (Chebarkulsky region), in the Tugunsky forest tract (N 53°54'21" E 60°45'22") (Chesmensky region), on the meadows of the Bagaryak floodplain (N 56°10'53" E 61°35'45") (Kaslinsky region), near villages Chernovskoye (N 54°52'59" E 60°03'22") (MiasskyUD) and Araslanovo (N 56°18'91" E 59°46'51") (Nyazepetrovsky region) (Krasutsky and Gashek, 2019, 2021a).

At the beginning of May 2021, the caterpillars were found on the purple ridge in the Kurasan river floodplain near Sukhtelinsky settlement (N 53°56'49" E 60°04'48") (Verkhneuralsky region), at the end of June, several butterflies were observed on Mountain Bolshaya near Vyatsky settlement (N 53°54'13" 58°59'15") (Verkhneuralsky region), and in July – on grass meadows of the Ashinsky Nature Reserve (N 55°05'52" E 57°10'57") (Krasutsky and Gashek, 2021b; Krasutsky et al., 2021).

At the end of June 2022, imago was recorded in the petrophytic steppe on Mountain Kamennaya Sopka, to the east of Verkhneuralsk (N 53°53'00" E 59°13'14"), while in early July – in the meadows of the Miass River floodplain at Prokhorovo village (N 55°21'11" E 61°28'04") (Sosnovsky region), in mid-July – on grass meadows of the Karagai Nature Reserve (N 54°06'35" E 59°34'16") and on rocky steppe hills near Mezhozerny settlement (N 54°08'53" E 59°22'28") (Verkhneuralsky region).

The species is listed in the Red Data Book of the Russian Federation (2021) (category II), the Republic of Bashkortostan (2014) (Category III); Kurgan Oblast (2012) (category II), Orenburg Oblast (2019) (category II) and Sverdlovsk Oblast (2018) (category III). It is represented in the Red Data Books of 48 other subjects of the Russian Federation.

Family **Nymphalidae**

***Argynnis* (=Argyronome) laodice (Pallas, 1771)** (Figs. 5C, S6). Category IV. A species with an undefined status. In Chelyabinsk Oblast, sporadic findings of this butterfly were made in the vicinity of cities Nyazepetrovsk, Kyshtym, Miass, Snezhinsk and Chelyabinsk; at the railway station Kisegach and on Lake Uvildy (Krasnaya..., 2017).

In mid-July of 2022, one specimen (imago) was discovered in the Karagai Nature Reserve in a small clearing of a pine forest at the foot of Mountain Leshachya (N 54°06'35" E 59°34'17") (Verkhneuralsky region). Thus, this is the southernmost site of species discovery in Chelyabinsk Oblast (Krasutsky and Gashek, 2022b).

The species is listed in the Red Data Books of the Republic of Bashkortostan (IV category), Sverdlovsk Oblast (IV category) and Kurgan Oblast (III category) regions; it is also represented in the Red Data Books of 7 other subjects of the Russian Federation.

***Clossiana* (=Boloria) selenis (Eversmann, 1837)** (Fig. 5D). Category III. A rare species. In Chelyabinsk Oblast, it is found in the vicinity of cities Chelyabinsk and Kyshtym, the NM Sanarsky Forest, at Nepryakhino village (Chebarkulsky region), Tyulyuk settlement (Katav-Ivanovsky region) and the Yuryuzan River (Krasnaya..., 2017).

In July 2022, several butterflies were recorded on the edges and clearings of pine forests in the northeastern part of the Karagai Nature Reserve (N 54°06'35" E 59°34'17") (Verkhneuralsky region).

The species is listed in the Red Data Books of the Republic of Bashkortostan (2014) (IV category), Sverdlovsk Oblast (2018) (IV category), as well as in the Red Data Books of 4 more subjects of the Russian Federation.

***Clossiana* (=Boloria) thore (Hubner, 1804)** (Fig. 6A). Category II. A species with a decreased number. In the Region, it is confined to the forest zone and the northern forest-steppe (Krasnaya..., 2017) and found at Tyulyuk settlement (Katav-Ivanovsky region), lives on the ranges of Nurgush, Taganai, in

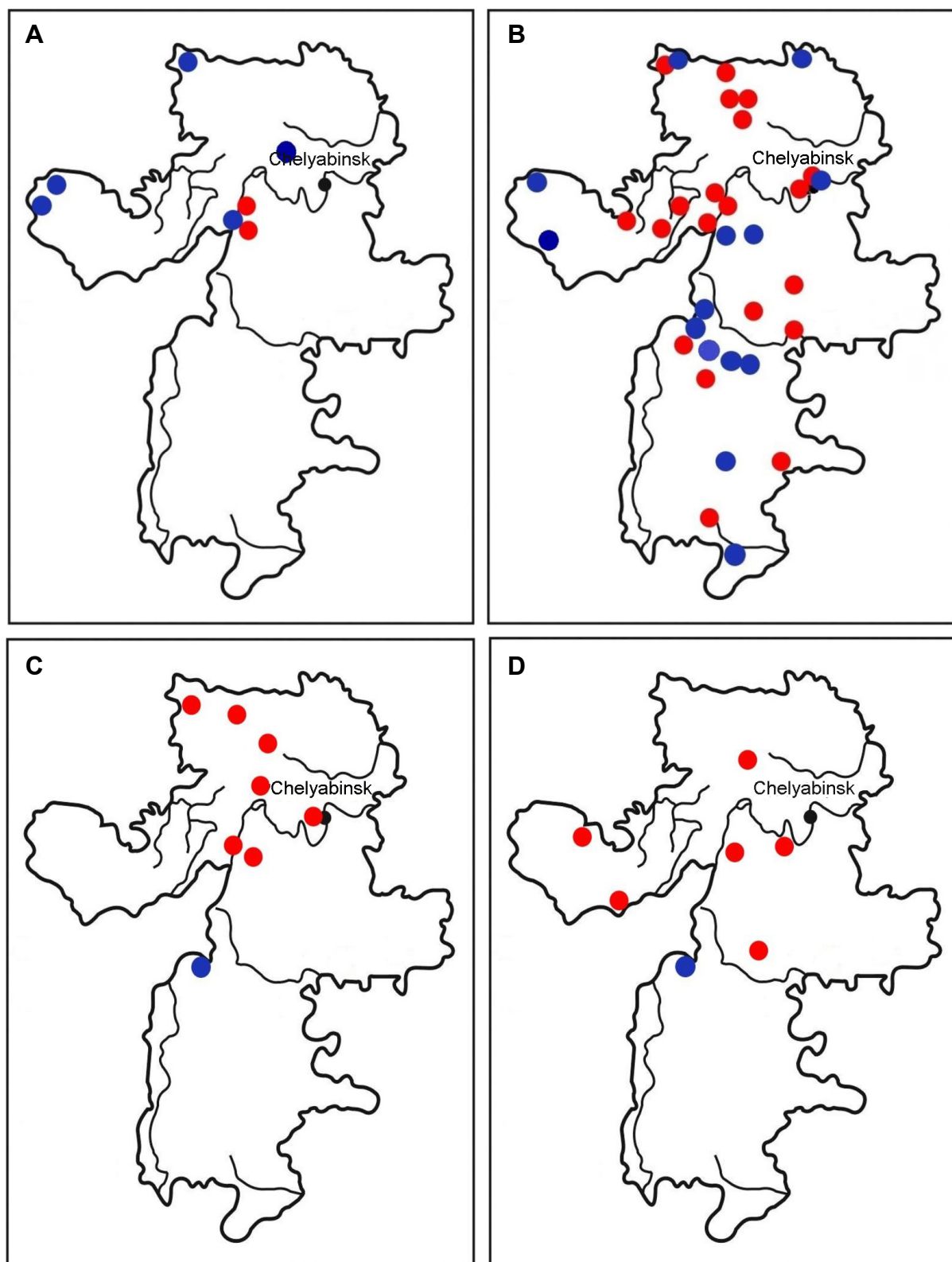


Fig. 5. Locations of *Lampyrus noctulica* (A), *Parnassius apollo* (B), *Argynnis laodice* (C) and *Clossiana selenis* (D) in Chelyabinsk Oblast.

cities Kasli and Nyazepetrovsk, on Sopka Alexandrovskaya (Zlatoustovsky UD) and near Kisegach settlement (Chebarkulsky region) (Krasnaya..., 2017).

In June 2019, this species was found in the forest edges of the Ashinsky (N 55°12'22" E 57°21'41") and Serpievsky (N 54°45'18" E 57°41'21") Nature Reserves, while in July – at the NM Ridge Bakty (N 58°35'56" E 58°47'53") (Katav-Ivanovsky region). The existence of a micropopulation in the vicinity of settlement of Tyulyuk (N 58°35'56" E 58°47'52") (Katav-Ivanovsky region) has been confirmed. Butterflies were recorded along forest roads and on forest edges overgrown with compound and umbelliferous plants (Krasutsky and Gashek, 2020a, b).

During studies (July 2020), we expected to find this species in the Nyazepetrovsky region. However, a large-scale logging of coniferous and mixed forests throughout this territory resulted in the loss of suitable biotopes for this butterfly.

The species is listed in the Red Data Book of the Republic of Bashkortostan (category III) and in the Red Data Books of three other subjects of the Russian Federation.

Family **Satyridae**

Lopinga (=Crebeta) deidamia Eversmann, 1851 (Fig. 6B). Category II. A species with a reduced number, found in the Ridge Taganai and Tyulyuk settlement of Katav-Ivanovsky region (Krasnaya..., 2017).

In July 2019, we confirmed the existence of a micropopulation in the vicinity of the settlement of Tyulyuk and noted several individuals 3 km to the southwest at the foot of the Ridge Bakty (N 58°35'55" E 58°47'53") (Katav-Ivanovsky region) (Krasutsky and Gashek, 2020a, b).

The species is listed in the Red Data Books of the Republic of Bashkortostan (category III), Sverdlovsk Oblast (category III) and in the Red Data Book of another subject of the Russian Federation.

Coenonympha amaryllis (Stoll, 1782) (Fig. 6C). Category III. A rare species. In Chelyabinsk Oblast, it was discovered on the Leonov Mountains, on the territory of the NM "Mountain Cheka" and "Zolotaya Sopka", as well as at Kizil'skoye village (Krasnaya..., 2017).

In June 2021, it was noted in a grass meadow nearby Petropavlovsk village (N 54°00'50" E 60°06'11") (Verkhneural'sky region) (Krasutsky and Gashek, 2021a).

At the end of June 2022, several butterflies were recorded in the feather-grass steppe on Mountain Golaya in the vicinity of Stepninskoye village (N 54°04'21" E 60°24'37") (Plastovsky region), whereas in early July – in the grass meadows of the Karagai Nature Reserve (N 54°06'35" E 59°34'16").

The species is listed in the Red Data Book of the Republic of Bashkortostan (2014) (category IV) and in the Red Data Book of another subject of the Russian Federation.

Family **Lycaenidae**

Neolysandra (=Polyommatus) coelestinus (Eversmann, 1837) (Fig. 6D). Category II. A species with a decreased number. It was previously noted at town Troitsk and village Bredy (Krasnaya..., 2017).

At the end of June 2018, two male butterflies were found in a small grass meadow with a predominance of mountain clover *Trifolium montanum* L. near Smirnovsky village (N 53°37'56" E 59°38'31") (Verkhneural'sky region). This is the westernmost finding of the species in the region (Krasutsky and Gashek, 2019).

Additional long-term investigations are needed to study the state of the found species population in all these territories (sites).

Family **Sphingidae**

Hemaris (=Haemorrhagia) tityus Linnaeus, 1758 (Fig. 7A). Category III. A rare species. In Chelyabinsk Oblast, it was noted in the Troitsky Nature Reserve, in the vicinity of the Arkaim Reserve, on Mountain Cheka and in the Ilmen Reserve (Krasnaya..., 2017).

In July 2020, a single specimen was marked on clover flowers *Trifolium* sp. at a power line clearing at Araslanovo village (N 56°12'28" E 59°20'07").

The species is represented in the Red Data Books of 20 other subjects of the Russian Federation.

Family **Arctiidae**

Callimorpha dominula (Linnaeus, 1758) (Figs. 7B, S7). Category II. A species with a decreased number. In Chelyabinsk Oblast, it was noted in the vicinity of Troitsk, near Lake Chebarkul and in the Chernoborsky Nature Reserve (Krasnaya..., 2017).

In July 2018, one specimen was found in a mixed forest near a stream on the territory of the Nature Monument "Cherny Forest" (N 53°53'51" E 60°27'34") (Chesmensky region) (Krasutsky and Gashek, 2019, 2020a, b).

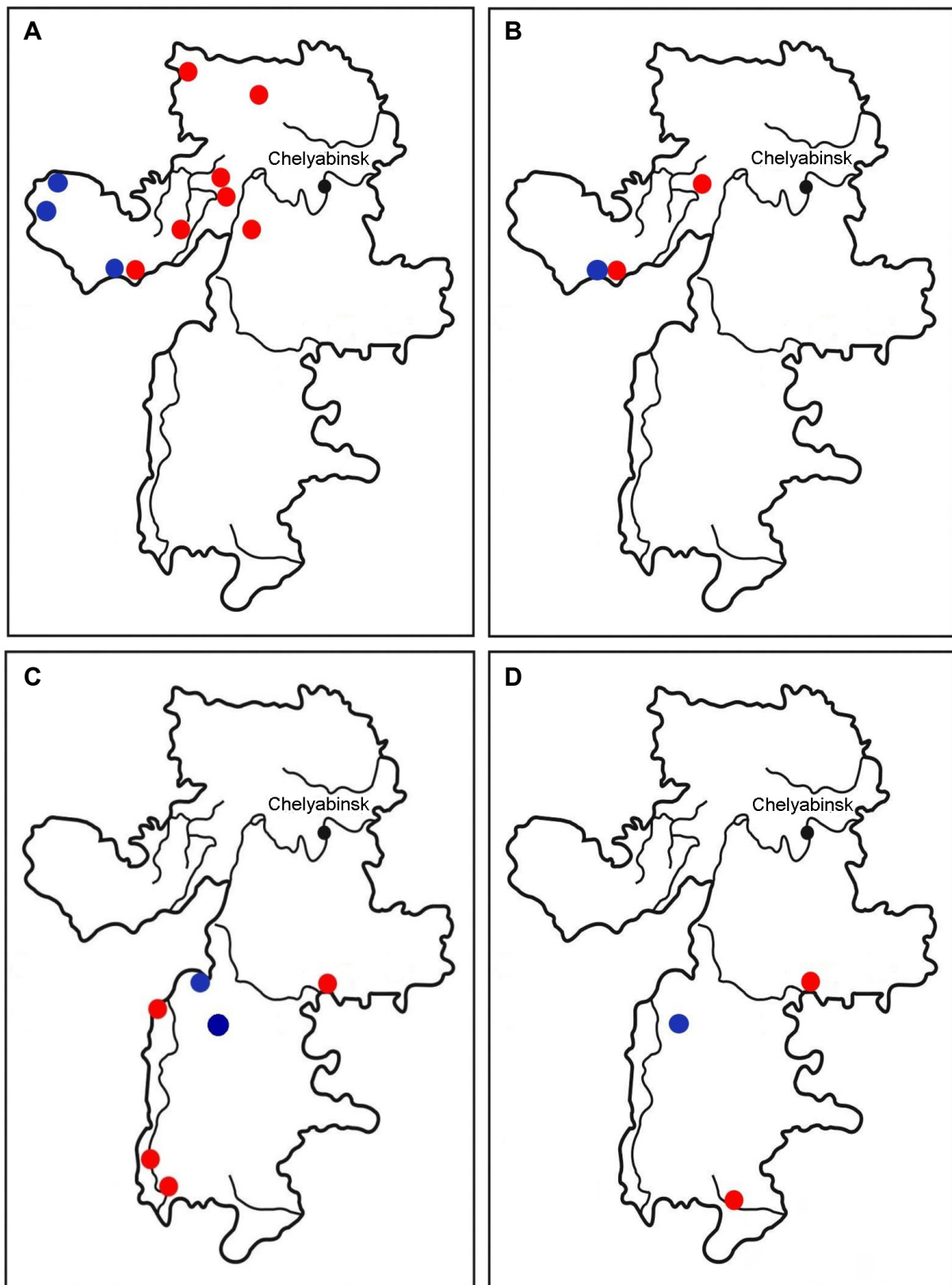


Fig. 6. Locations of *Clossiana thore* (A), *Lopinga deidamia* (B), *Coenonympha amaryllis* (C) and *Neolysandra coelestinus* (D) in Chelyabinsk Oblast.

In mid-July 2022, imago was occasionally detected on the edges of mixed (pine-birch) forests in the Karagai Nature Reserve (N 54°06'35" E 59°34'16"). It is worth noting that during two days (July 14 and 15), butterflies willingly flew into the light of the light trap.

The species is represented in the Red Data Books of 29 other subjects of the Russian Federation.

Order **Hymenoptera**

Family **Anthophoridae**

***Xylocopa valga* Gerstaecker, 1872** (Figs. 7C, S8). Category III. A rare species. In Chelyabinsk Oblast, it is found in the steppe and forest-steppe areas, i.e. in the Arkaim Reserve, Buskul'sky and Chernoborsky Nature Reserves, on the territory of the NM "Sanarsky Forest", in "Nikolskaya Grove" Park of Chelyabinsk (Krasnaya..., 2017).

At the end of July 2017, it was registered in the meadows of the NM "Borovskoy Forest" near Borovoye village (N 52°39'45" E 60°25'50") (Bredinsky region) (Krasutsky and Gashek, 2019).

At the end of May 2018, it was noted on rock outcrops 3 km north of the settlement Gryaznushinsky (N 52°32'57" E 58°57'52") (Kizil'sky region), and at the end of June – in meadow communities with dead birches on the hills of the Karagai Nature Reserve (N 54°06'35" E 59°34'16") (Krasutsky and Gashek, 2019, 2020a, b).

In May–June 2021, it turned out to be common on the steppe slopes of hills and in birch logs of the left-bank tributaries of the Ural River in the site surrounded by villages of Obruchevka (N 52°45'53" E 59°12'56"), Izmailovka (N 52°39'41" E 59°18'34"), Bogdanovskoye (N 52°25'43" E 59°03'30") (Kizil'sky region) and on Mountain Kamennaya Sopka near Verkhneuralsk (N 53°53'00" E 59°13'14") (Verkhneuralsky region).

According to E.A. Popov report, the species was not rare in May 2022 on the territory adjacent to the Donguzlovsky Nature Reserve (N 55°04'42" E 61°41'54"), and in June–July – in the Kharlushevsky Nature Reserve (N 55°20'40" E 61°20'31"), near villages Bol. Kharlushi (N 55°12'53" E 60°58'47") and Mamaev (N 55°11'55" E 60°53'52") (Sosnovsky region).

It is indicated in the Red Data Books of the Republic of Bashkortostan (2014) (IV category), Kurgan Oblast (2012) (II category), Orenburg Oblast (2019) (VII category), as well as in the Red Data Books of 36 other subjects of the Russian Federation.

Family **Megachilidae**

***Megachila rotundata* (Fabricius, 1787)** (Fig. 7D). Category III. A rare species. In Chelyabinsk Oblast, it was noted in the Troitsky Nature Reserve, in the Chelyabinsk (urban) forest and in the "Nikolskaya Grove" Park of Chelyabinsk (Krasnaya..., 2017).

In July 2018, one individual was found in a meadow in the floodplain of the Bagaryak river near Sinarsky village (N 56°10'53" E 61°35'35"), which is the northernmost find of this species in the region.

In mid-July 2021, one representative of this species was recorded in a grass meadow of the floodplain of the Mal. Asha river in the Ashinsky Natural Reserve (N 55°12'22" E 57°21'41"), and one – in mid July of 2022 – on the flowers *Psephellus carbonatus* (Klokov) in the meadow community of the Karagai Nature Reserve (N 54°06'35" E 59°34'16").

In the collection materials of B.V. Krasutsky there is one specimen caught in July 2008 in a grass meadow with *Trifolium pretense* L. at the Kisegach railway station (N 54°59'09" E 60°17'43") (Chebarkul'sky UD) (Krasutsky and Gashek, 2020b, 2021a).

The species is represented in the Red Data Books of 14 other subjects of the Russian Federation.

Family **Apidae**

***Bombus armeniacus* Radoszkowski, 1877** (Figs. 8A, S9). Category III. A rare species. In Chelyabinsk Oblast, it was recorded in the Troitsky Nature Reserve, the valleys of rivers Uy and Uvelka and on Mountain Vorovskaya (Agapovsky region) (Krasnaya..., 2017).

In July 2018, the species was discovered in the Chernoborsky Nature Reserve (Krasutsky and Gashek, 2021a).

In early May 2021, two individuals were recorded on a flowering *Prunus tenella* Batsch in the bed of an unnamed tributary of the Yangelka River 5 km north of the village Novoyangelka (N 53°11'54" E 58°55'14") (Agapovsky region), in mid May – on the banks of the Bol. Karaganka river near Nov. Kondurovsky settlement (N 52°36'00" E 59°24'58") and 6 km northeast of Zingeysky settlement (N 52°59'35" E 59°32'35") (Kizil'sky region). In June 2021, the species was often found in the meadows next to Linevka village (N 53°58'50" E 60°16'35") (Verkhneuralsky region), and in mid-July – on dry meadows in the Karagai Nature Reserve (N 54°06'35" E 59°34'16").

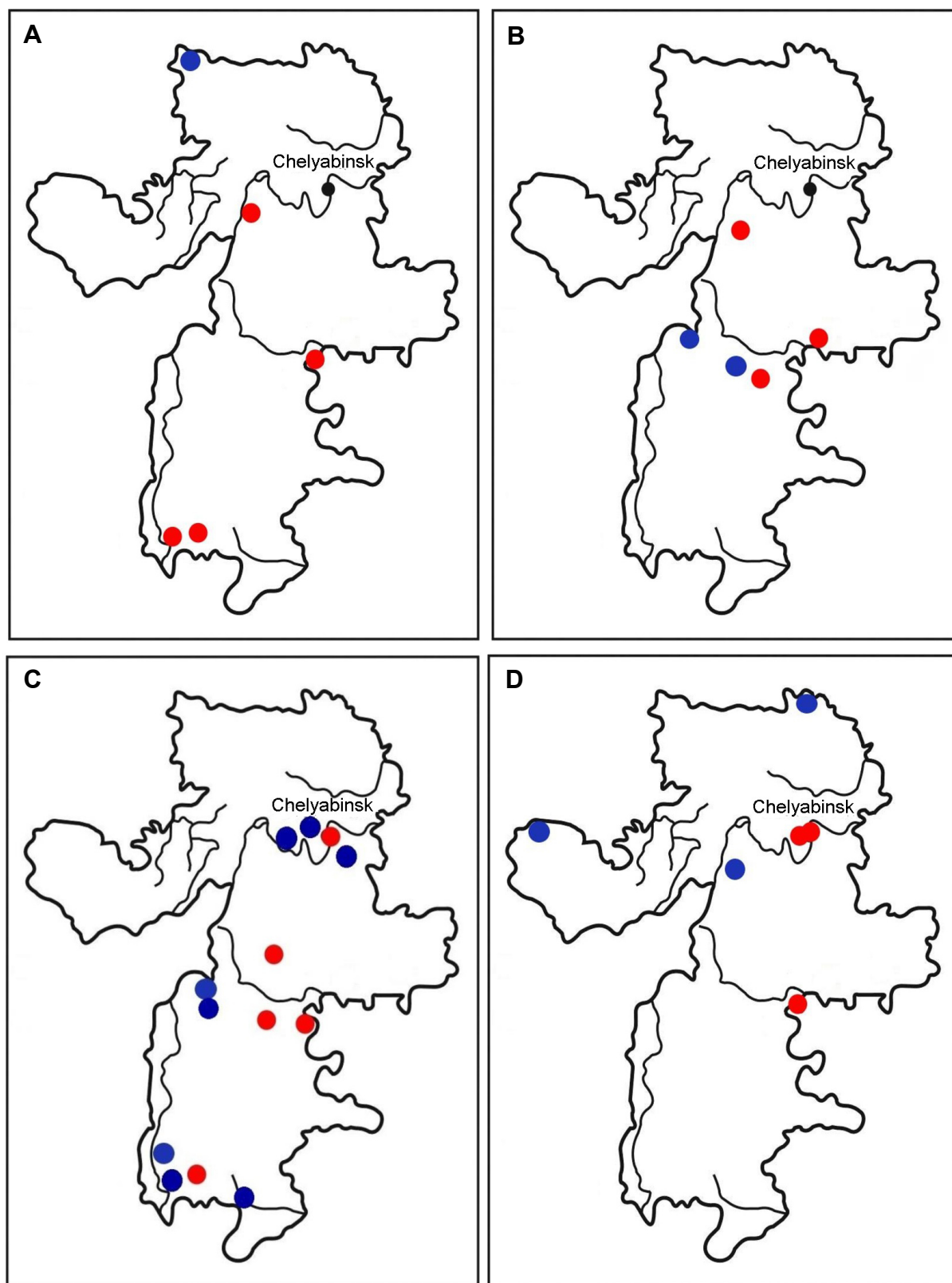


Fig. 7. Locations of *Hemaris tityus* (A), *Callimorpha dominula* (B), *Xylocopa valga* (C) and *Megachila rotundata* (D) in Chelyabinsk Oblast.

In early May of 2022, several individuals were registered in the meadows at the Nizhniy Toguzak river mouth (N 53°26'28" E 60°59'04") (Varna region) and near the Gumbeika river in the vicinity of the settlement of Rassvet (N 53°26'56" E 59°48'45") (Nagaibak region), at the end of June two individuals were marked on a steppe meadow near Kovylny settlement (N 53°52'42" E 60°58'23") (Chesmensky region).

The species is listed in the Red Data Book of the Russian Federation (2021) (category II), the Red Data Books of the Republic of Bashkortostan (2014) (category IV), Kurgan Oblast (2012) (category II) and Orenburg Oblast (2019) (category III), as well as in the Red Data Books of 24 other subjects of the Russian Federation.

***Bombus hypnorum* (Linnaeus, 1758)** (Figs. 8B, S10). Category III. A rare species. In Chelyabinsk Oblast, it was found in the Ilmen Reserve, near Lake Turgoyak and in the Troitsky Nature Reserve (Krasnaya..., 2017).

In mid-July 2021, two individuals were recorded in the Ashinsky Nature Reserve near the road along the Mal. Asha river on the flowers of the *Cirsium* sp. and *Arctium lappa* L. (N 55°33'27" E 59°44'33").

In July 2022, N.A. Baldin discovered this species in Alabuga village (N 55°32'19" E 62°20'22") (Krasnoarmeysky region).

The species is represented in the Red Data Books of two other subjects of the Russian Federation.

***Bombus terrestris* Linnaeus, 1758.** Category III (Figs. 8C, S11). A rare species. Perhaps, it is spread in the forest-steppe and steppe zones of Chelyabinsk Oblast. This species was found in the Ilmen and East Ural Reserves, Agapovsky region (Mountain Vorovskaya) (Krasnaya..., 2017).

In early May 2018, it was quite common on Mountain Mayachnaya, to the northeast from Rymniksky settlement (N 52°30'06" E 60°08'50") (Bredinsky region). In July–August, it was noted in the meadows and forest edges in the Uysky (N 54°13'41" E 59°51'86"), Karagai (N 54°06'35" E 59°34'16"), Chernoborsky Nature Reserves (N 53°50'14" E 60°08'38"), including Natural Monuments "Travnikovsky Forest" (N 54°54'20" E 60°33'33") and "Kashtaksky Forest" (N 54°32'31" E 61°49'33").

In June–July 2019, it turned out to be rare in the Ashinsky (55°33'27" E 59°44'33") and Serpievsky Nature Reserves (N 54°45'18" E 57°41'21"), as well as at Medvedevka village (N 55°13'44" E 57°27'06") (Kusinsky region) (Krasutsky and Gashek, 2020a, b, 2021a).

In August 2020, it was discovered in the "Nikolskaya Grove" Park in Chelyabinsk nearby Travniki settlement (N 54°54'30" E 60°33'33") (Chebarkulsky region) (Krasutsky and Gashek, 2021a).

In early May 2021, several individuals were observed on the flowering *Prunus tenella* Batsch in the unnamed stream channel (tributary of the Yangelka river), 5 km north of Novoyangelka village (N 53°11'55" E 58°55'14") (Agapovsky region).

At the end of June 2022, it was noted at the edge of a birch forest in the vicinity of Urazbaeva village (N 55°10'47" E 60°21'09") (Argayashsky region), and in mid-July – on grass meadows of the Karagai Nature Reserve.

The species is represented in the Red Data Book of one more subject of the Russian Federation.

***Bombus pratorum* (Linnaeus, 1761)** (Fig. 8D). Category II. A species with a decreased number. In Chelyabinsk Oblast, it is recorded only in the Ilmen Nature Reserve (Krasnaya..., 2017).

The inventory of collections (for 1994–2007) revealed that the species was also found in June 2006 at the Kisegach railway station (N 54°59'09" E 60°17'43") (Chebarkulsky UD), and in July 2007 – on the edge of the birch forest near Mirny settlement (N 55°19'07" E 61°04'44") (Sosnovsky region) (Krasutsky and Gashek, 2019).

In July 2017, it was discovered in the NM "Chelyabinsk (urban) Forest" (N 55°09'44" E 61°24'11"), and in July 2018 – on the territory of the Nature Monument "Cherny Forest" near Chernoborskoye village (N 53°55'41" E 60°30'06") (Chesmensky region) (Krasutsky and Gashek, 2020a, b, 2021a).

In early September of 2020, it was marked on the flowers of the *Rosa rugosa* Thunb. in the Botanical Garden of Chelyabinsk State University (Chelyabinsk).

In July 2021, the species was encountered in the meadows of the Ashinsky Nature Reserve (N 55°12'22" E 57°21'41") (Krasutsky et al., 2021) and in the mountain meadow of the Ridge Zigalga (N 54°36'41" E 58°36'13") (Katav-Ivanovsky region).

The species is represented in the Red Data Books of three more subjects of the Russian Federation.

***Bombus muscorum* (Fabricius, 1775)** (Figs. 9A, S12). Category III. A rare species. It is probably spread throughout Chelyabinsk Oblast, but reliably known only from the Ilmen Reserve, the Taganai and Zyuratkul National Parks, including the Troitsky Nature Reserve (Krasnaya..., 2017).

During the inventory of collections for 1994–2007, it was revealed that this species was also found in

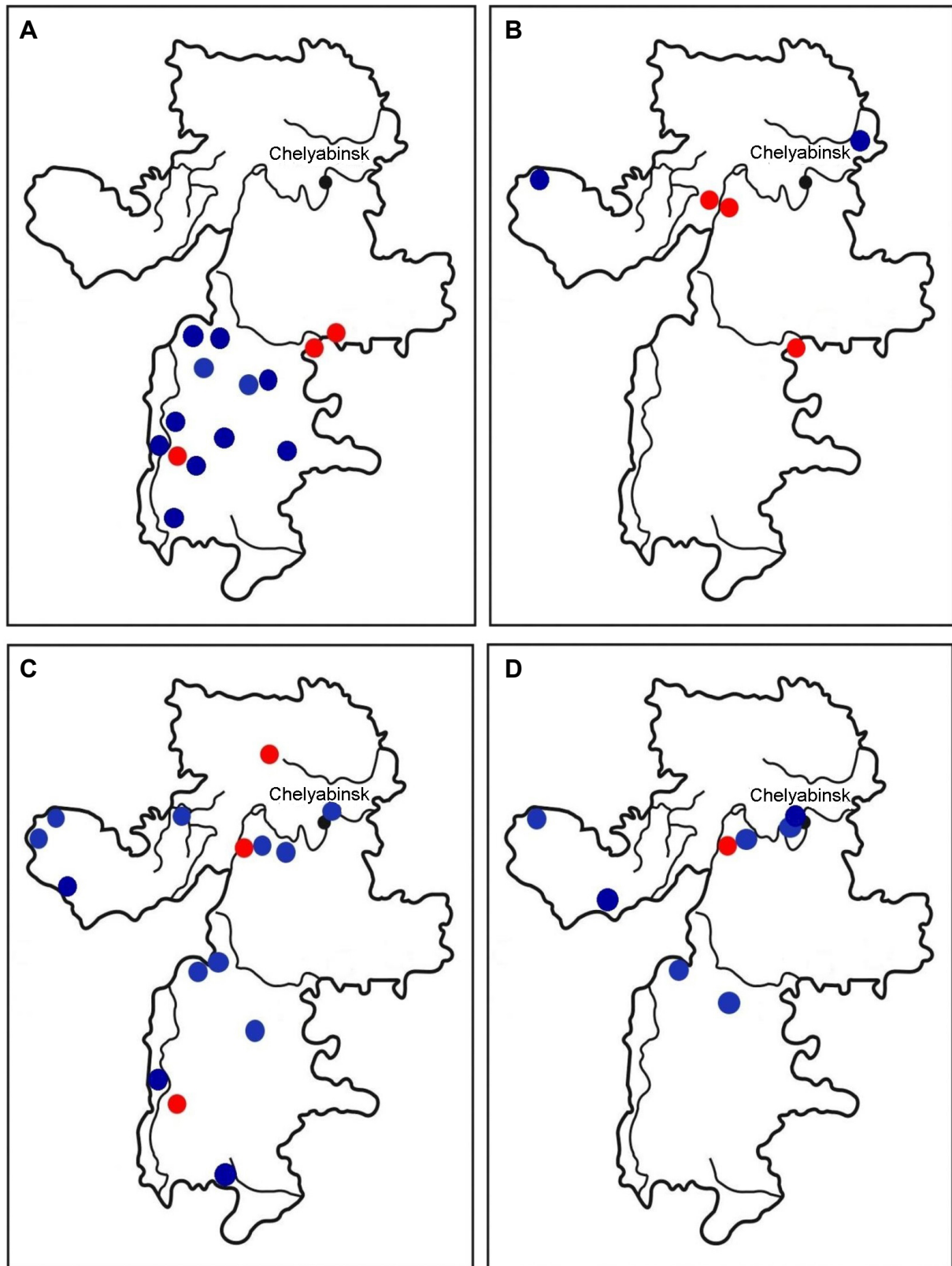


Fig. 8. Locations of *Bombus armeniacus* (A), *Bombus hypnorum* (B), *Bombus terrestris* (C) and *Bombus pratorum* (D) in Chelyabinsk Oblast.

July 2007 in a grass meadow in the vicinity of Mirny settlement (N 55°19'07" E 61°04'44") (Sosnovsky region) (Krasutsky and Gashek, 2019).

In August 2017, the species was discovered on the territory of the NM "Chelyabinsk (urban) Forest" (N 55°08'14" E 61°21'31"), and in July 2018 – on the meadows of the NM "Cherny Forest" (N 53°55'41" E 60°30'06") (Krasutsky and Gashek, 2020a, b).

In July 2019 and 2021, it was not uncommon in places of the mixed grass meadows at the Ashinsky Nature Reserve (N 55°12'22" E 57°21'41") (Krasutsky and Gashek, 2021a), and at the end of June 2021 – in the steppe meadows near Kovylny settlement (N 53°52'42" E 60°58'23") (Chesmensky region).

In mid-July 2022, one individual was noted at the edge of a pine forest in the Karagai Nature Reserve (N 54°06'35" E 59°34'16").

The species is listed in the Red Data Books of Sverdlovsk (2018) (category III) and Kurgan regions (2012) (category III), as well as in the Red Data Books of 32 other subjects of the Russian Federation.

***Bombus confusus* Schrenck, 1859** (Fig. 9B). Category III. A rare species. In Chelyabinsk Oblast, it tends to live in the forest-steppe areas. The species was found in the Ilmen Reserve and in the Troitsky Nature Reserve (Krasnaya..., 2017).

In mid-July 2022, one individual was detected on the flowers of big burdock in a grass meadow of the Karagai Nature Reserve (N 54°06'35" E 59°34'16").

The species was included in the Red Data Book of the Republic of Bashkortostan (2014) (category IV) and the Red Data Books of 10 other subjects of the Russian Federation.

***Bombus lucorum* (Linnaeus, 1761)** (Fig. 9C). Category III. A rare species. It is probably spread throughout Chelyabinsk Oblast, found in the Ilmen and East Ural Reserves, the Troitsky Nature Reserve, and the Ablyazovsky meadows in the Agapovsky region. Its finds are probable in the Arkaim Reserve (Krasnaya..., 2017).

After inventory of B.V. Krasutsky collections, we revealed that this species was discovered in June 2008 in a grass meadow at the Kisegach station (N 54°59'04" E 60°18'13") (Chebarkulsky UD).

In June 2020, it was singly marked on the flowers of *Veronica* sp. and *Vicia cracca* L. nearby Kashtak settlement (N 55°18'31" E 61°22'22").

The species is listed in the Red Data Book of the Kurgan region (category III) and the Red Data Book of another subject of the Russian Federation.

***Bombus soroeensis* Fabricius, 1777** (Fig. 9D). Category III. A rare species. In Chelyabinsk Oblast, it is known from the Ilmen Reserve and the Troitsky Nature Reserve (Krasnaya..., 2017).

In mid-July 2022, one individual was registered in a grass meadow in the northeastern part of the Karagai Nature Reserve (N 54°06'35" E 59°34'16").

Through clarifying the species of bumblebees collected in 2017–2022, it was found out that at the end of July 2017 this species was recorded in the meadow communities of the Kortubai (Karatubai) forest near the settlement of Rymniksky (N 52°30'06" E 60°08'50") (Bredinsky region), in June and in July 2018 – in the meadows near villages Surmenevsky (N 54°02'39" E 59°41'06") (Verkhneuralsky region) and Usmanova (N 56°10'43" E 61°49'41") (Kunashaksky region), and in early May 2021 – in the meadow steppe of the unnamed stream valley, 4 km northeast of Vyatka village (N 53°54'13" E 58°59'15") (Verkhneuralsky region).

The species is listed in the Red Data Books of 6 more subjects of the Russian Federation.

***Bombus serratissimus* Morawitz, 1888** (Figs. 10A, S13). Category III. A rare species. It is found throughout the region, being repeatedly registered in the Ilmen Reserve, the Troitsky Nature Reserve and near Troitsk (Krasnaya..., 2017).

In August 2017, the species was discovered in the Bredinsky Nature Reserve (N 52°13'16" E 60°35'06"), in July 2018 it was quite common in the meadows of the Chernoborsky Nature Reserve (N 53°50'14" E 60°08'38") and on the territory of the NMs "Cherny Forest" (N 53°53'51" E 60°27'58") (Chesmensky region) at settlements of Surmenevsky (N 54°02'39" E 59°41'06") (Verkhneuralsky region) and Kopalovsky (N 53°52'09" E 59°52'42") (Nagaibak region).

Processing of photographic materials suggest that in May 2018, this bumblebee was observed in the steppe on the banks of the Upper River Gusikha, 4 km south-east of Musin village (N 52°23'53" E 59°02'49") (Kizilsky region).

In June–July 2019, this species was found in mixed grass meadows in Ashinsky (N 55°33'27" E 59°44'33") and Serpievsky Nature Reserves (N 54°45'18" E 57°41'21") (Krasutsky and Gashek, 2020a, b, 2021a), and in June 2020 – at the Chelyabinsk airport (N 55°18'18" E 61°30'18") (Krasutsky and Gashek, 2021a).

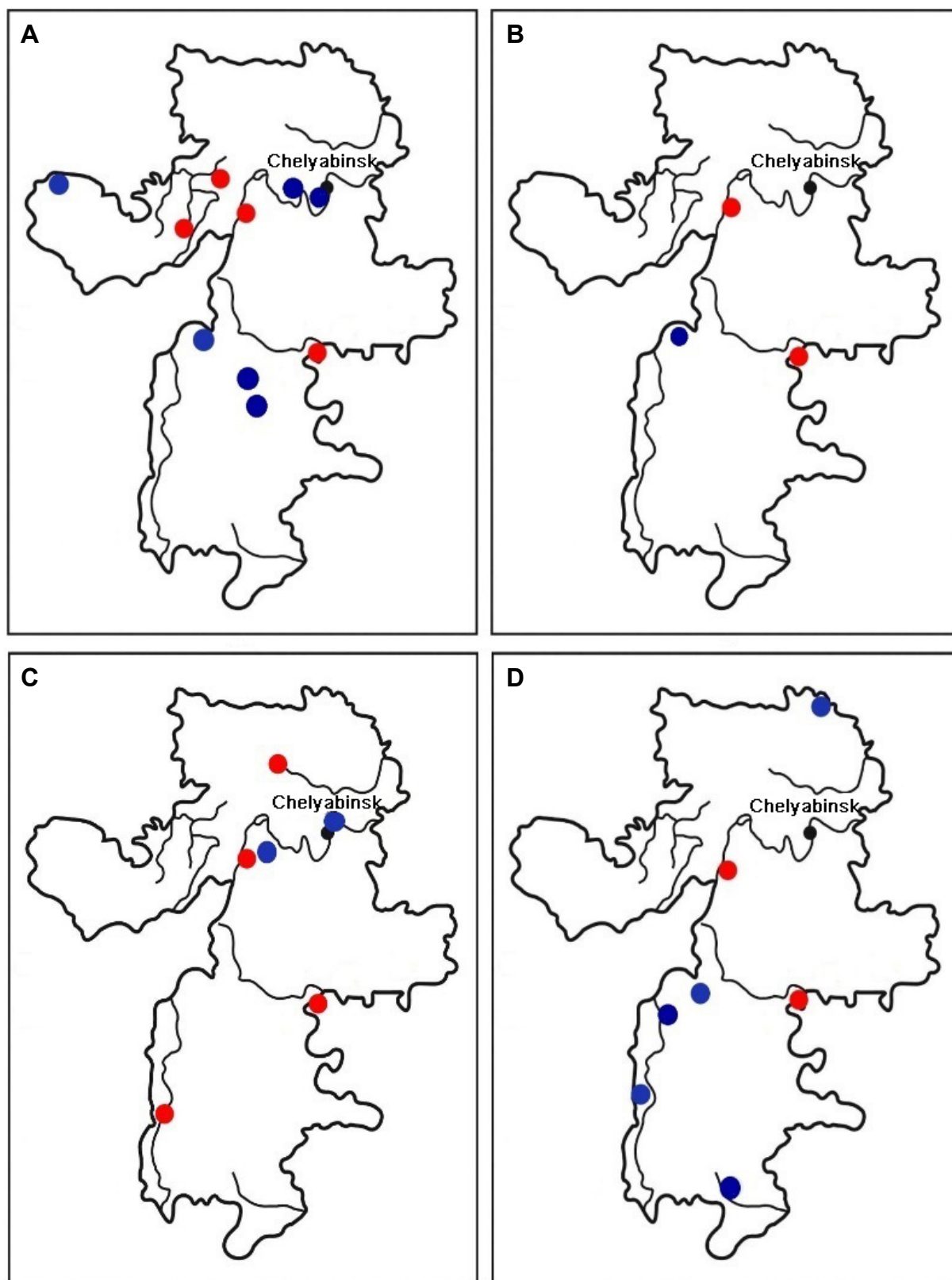


Fig. 9. Locations of *Bombus muscorum* (A), *Bombus confusus* (B), *Bombus lucorum* (C) and *Bombus soroensis* (D) in Chelyabinsk Oblast.

In June–July 2021, it was marked in the mountain meadows of the Zigalga National Park (Mountain Transversal) (N 54°35'31" E 58°31'24"), in the mountain steppe nearby Vyatka village (N 53°54'13" E 58°59'15") (Verkhneuralsky region) and on grass meadows near Zingeysky settlement (N 52°59'35" E 59°32'35") (Kizilsky region) (Krasutsky et al., 2021).

In early May 2022, single individuals were observed in the petrophytic steppe on Mount Ivanova to the west of Linevka village (N 53°58'50" E 60°16'35") (Verkhneuralsky region), at the Toguzak river mouth (N 53°26'28" E 60°59'04") (Varna region), at the end of June – in the vicinity of Kovylny settlement (N 53°52'42" E 60°58'23") (Chesmensky region) and on Golaya Mountain at Stepninskoye settlement (N 54°04'21" E 60°24'37") (Plastovsky region), in July – on grass meadows of the Karagai Nature Reserve (N 54°06'35" E 59°34'16").

The species is listed in the Red Data Book of the Sverdlovsk region (2018) (category III) and the Red Data Books of 19 other subjects of the Russian Federation.

***Bombus maculidorsis* Scorikov, 1922** (Fig. 10B). Category II. A species with a decreased number. In Chelyabinsk Oblast, it was discovered in the Ilmen Nature Reserve and may be found in the vicinity of lake Turgoyak (Krasnaya..., 2017).

At the end of May 2018, one individual was captured on the left bank of the river Bol. Karaganka between the settlements of Yerlygas and Ershovsky (N 52°29'08" E 59°08'11") (Kizilsky region).

At the end of May 2021, it was marked near the road at Izmailovsky settlement (N 52°39'41" E 59°18'34") (Kizilsky region).

In mid-July 2022, one individual was found in a steppe to the south of Kovylny settlement (N 53°52'42" E 60°58'23") (Chesmensky region).

The species is represented in the Red Data Books of 7 more subjects of the Russian Federation.

***Bombus consobrinus* Dahlbom, 1832** (Fig. 10C). Category III. A rare species, detected in the Ilmen and East Ural Nature Reserves (Krasnaya..., 2017).

In June 2019, it was found in the meadow communities on the territory of the Ashinsky (N 55°33'27" E 59°44'33"), Serpievsky (N 54°45'18" E 57°41'21") Nature Reserves and in nearby Medvedevka village (N 55°13'44" E 57°27'06") (Kusinsky region) (Krasutsky and Gashek, 2020a, b, 2021a).

From processing the collections (2017–2021), it follows that this species was discovered in July 2018 in a grass meadow in the Chernoborsky Nature Reserve (N 53°50'14" E 60°08'38") (Chesmensky region), in September 2020 – in a power line site at Travniki settlement (N 54°54'30" E 60°33'33") (Chebarkulsky region), and in July 2021 – on a grass meadow in the Ashinsky Nature Reserve (N 55°33'27" E 59°44'33").

The species is represented in the Red Data Books of 5 more subjects of the Russian Federation.

***Bombus fragrans* (Pallas, 1771)** (Fig. 10D). Category I. An endangered species. It was recorded in the Arkaim Reserve (Krasnaya..., 2017).

In August 2017, this species was noted twice in the mixed grass meadows of the Bredinsky Nature Reserve (N 52°13'16" E 60°35'06"), and in June 2018 – in the territories adjacent to the NM "Lake Karachura" (N 53°47'22" E 60°01'29") (Nagaibaksky region) and at the Khlebinka farm (N 53°51'15" E 59°45'03") (Verkhneuralsky region). Thus, this species in Chelyabinsk Oblast penetrates into the southern forest-steppe regions (Krasutsky and Gashek, 2019, 2020a, b).

The species is included in the Red Data Books of the Russian Federation (category II), Kurgan Oblast (II) and Orenburg Oblast (II), as well as in the Red Data Books of 19 other subjects of the Russian Federation.

***Bombus distinguendus* Morawitz, 1869** (Fig. 11A). Category III. A rare species. In Chelyabinsk Oblast, it is known from the Ilmen and East Ural Reserves, the Troitsky Nature Reserve, surroundings of cities Chelyabinsk and Kopeysk, the Ablyazovsky meadows in the Agapovsky region (Krasnaya..., 2017).

Processing the collections (2017–2021), prove species finding in May 2018. It was captured at the edge of a pine forest on the territory of the NM "Chelyabinsk (urban) Forest" (N 55°08'14" E 61°21'31"), in June – on a dry meadow near Surmenevsky settlement (N 54°02'39" E 59°41'06") (Verkhneuralsky region), in July – on the territory of the Chernoborsky Nature Reserve (N 53°50'14" E 60°08'38").

In mid-June 2021, it was noted at Linevka village (N 53°58'50" E 60°16'35") (Verkhneuralsky region), and in July 2021 – on the grass meadows of the Ashinsky Nature Reserve near the Mal. Asha river (N 55°33'27" E 59°44'33").

The species is listed in the Red Data Book of one more subject of the Russian Federation.

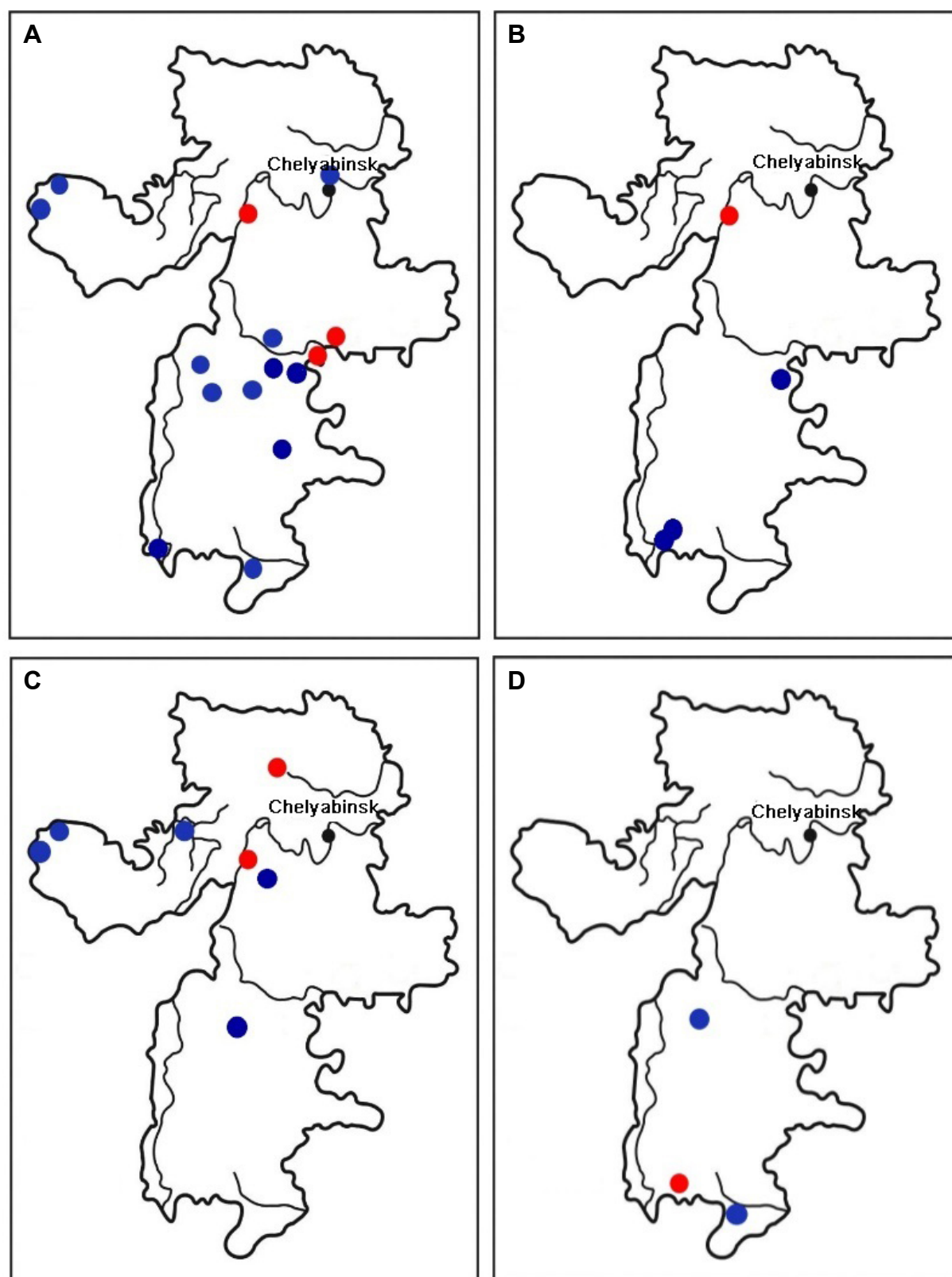


Fig. 10. Locations of *Bombus serratissimus* (A), *Bombus maculidorsis* (B), *Bombus consobrinus* (C) and *Bombus fragrans* (D) in Chelyabinsk Oblast.

Family **Scoliidae**

***Scolia hirta* Schrenck, 1781** (Fig. 11B). Category III. A rare species. In Chelyabinsk Oblast, it lives in the steppe zone (Krasnaya..., 2017).

In July 2022, we found one individual on umbelliferae plant growing along a dirt road in the Karagai Nature Reserve (N 54°06'35" E 59°34'16"). This is the northernmost find of the species in the region.

The species is listed in the Red Data Book of Kurgan Oblast (2012) (category II) and the Red Data Books of 21 other subjects of the Russian Federation.

Family **Formicidae**

***Formica pressilabris* Nylander, 1846** (Fig. 11C). Category II. A species with a decreased number. Highly likely, it is spread throughout the Chelyabinsk Region, but is rare everywhere. It was found in the vicinity of cities Magnitogorsk and Verkhneural'sk, Ilmen and Arkaim Reserves, the Karagaysky, Sanarsky, Troitsky, Uysky Natural Reserves, Travnikovskiy, Jabyk-Karagaisky Forests, Mountain Cheka, as well as Verkhneural'sky (Leonov Mountains, Lake Bol. Bugodak), Troitsky (Mountain Golaya near settlements Stepninskoye and Varvarinka) and Uvel'sky (near the settlement Podgorniy) regions (Krasnaya..., 2017).

In early May 2022, this species was discovered in the meadow communities on Mount Berkut, 5 km southwest of Kuropatkinsky settlement (N 53°43'48" E 59°36'20") (Nagaibak'sky region), and at the end of July – 3.5 km northeast of the settlement Novoetkul'sky (N 53°53'10" E 60°55'30") (Chesmensky region).

The species is listed in the Red Data Books of two more subjects of the Russian Federation.

Order **Diptera**Family **Asilidae**

***Laphria gibbosa* (Linnaeus, 1758)** (Figs. 11D, S14). Category IV. Its status is undefined. It is found throughout the Chelyabinsk region, more often in the forest-steppe zone. The species was recorded in the Sanarsky, Cherny and Chelyabinsk (urban) forests (Krasnaya..., 2017).

In 2018, the species was repeatedly found in the Karagai (N 54°06'35" E 59°34'16") and Chernoborsky (N 53°50'14" E 60°08'38") Nature Reserves, on the territory of Natural Monuments "Travnikovskiy Forest" (N 54°54'20" E 60°33'33") and "Kashtak'sky Forest" (N 55°17'47" E 61°22'17"). At the end of June 2019, it was noted in the Serpievskiy Nature Reserve (N 54°45'18" E 57°41'21") (Krasutsky and Gashek, 2020a, b), while in 2020 at Araslanovo village (N 56°12'19" E 59°18'08") (Nyazepetrovskiy region) and in the southern part of Kashtak settlement (N 55°17'46" E 61°22'17") (Chelyabinsk UD) (Krasutsky and Gashek, 2021a).

In 2022, the species was again not rare on the forest edges of the Karagai Nature Reserve.

It is listed in the Red Data Books of 8 other subjects of the Russian Federation.

Family **Bombyliidae**

***Bombylius major* Linnaeus, 1758** (Figs. 12A, S15). Category III. A rare species. In Chelyabinsk Oblast, this species was noted in the Ilmen Nature Reserve, in the Etkul'sky forest, on the Ablyazovskiy meadows, on Mountain Vorovskaya, in the Kizil'sky region near the settlement "October Way", in the Nagaibak region near the settlement of Kopalovskiy and in the Salt Log tract near Arsinsky settlement, as well as in the vicinity of Varlamovo village (Krasnaya..., 2017).

In June–August 2018, it was found in the Uysky (N 54°13'41" E 59°51'86") Nature Reserve, in the vicinity of Zhukovo village (N 56°10'53" E 61°33'18") (Kaslinsky region), Smirnovskiy village (N 53°49'46" E 59°19'23") (Verkhneural'sky region), on the territories of Natural Monuments "Travnikovskiy Forest" (N 54°53'29" E 60°27'31") and "Kashtak'sky Forest" (N 55°18'18" E 61°22'57") (Krasutsky and Gashek, 2020b).

In 2019, it was registered in the meadow communities of the Asha River floodplain in the Ashinsky Nature Reserve (N 55°12'22" E 57°21'41") and in a dry meadow in the vicinity of Chernovskoye village (N 54°52'59" E 60°03'26") (Miassky UD) (Krasutsky and Gashek, 2020a, b, 2021a), and in 2021 it was marked on a dirt road at the Chelyabinsk airport (N 55°18'18" E 61°30'18") (Krasutsky et al., 2021).

After processing the collections for 2021, it was revealed that in late May 2021, this species was captured on a dirt road near the settlement of Izmailovskiy (N 52°39'41" E 59°18'34") (Kizil'sky region).

In early May 2022, the species was discovered in the petrophytic steppe near Linevka village (N 53°58'50" E 60°16'35") (Verkhneural'sky region), on the banks of the Uy river, southwest of the village Osipovka (N 54°07'17" E 61°03'58") (Troitsky region), on dirt roads at the Nizh. Toguzak mouth (N 53°26'28" E 60°59'04") (Varna region), and in mid-July – on dirt roads in the northeastern part of the Karagai Nature Reserve (N 54°06'35" E 59°34'16").

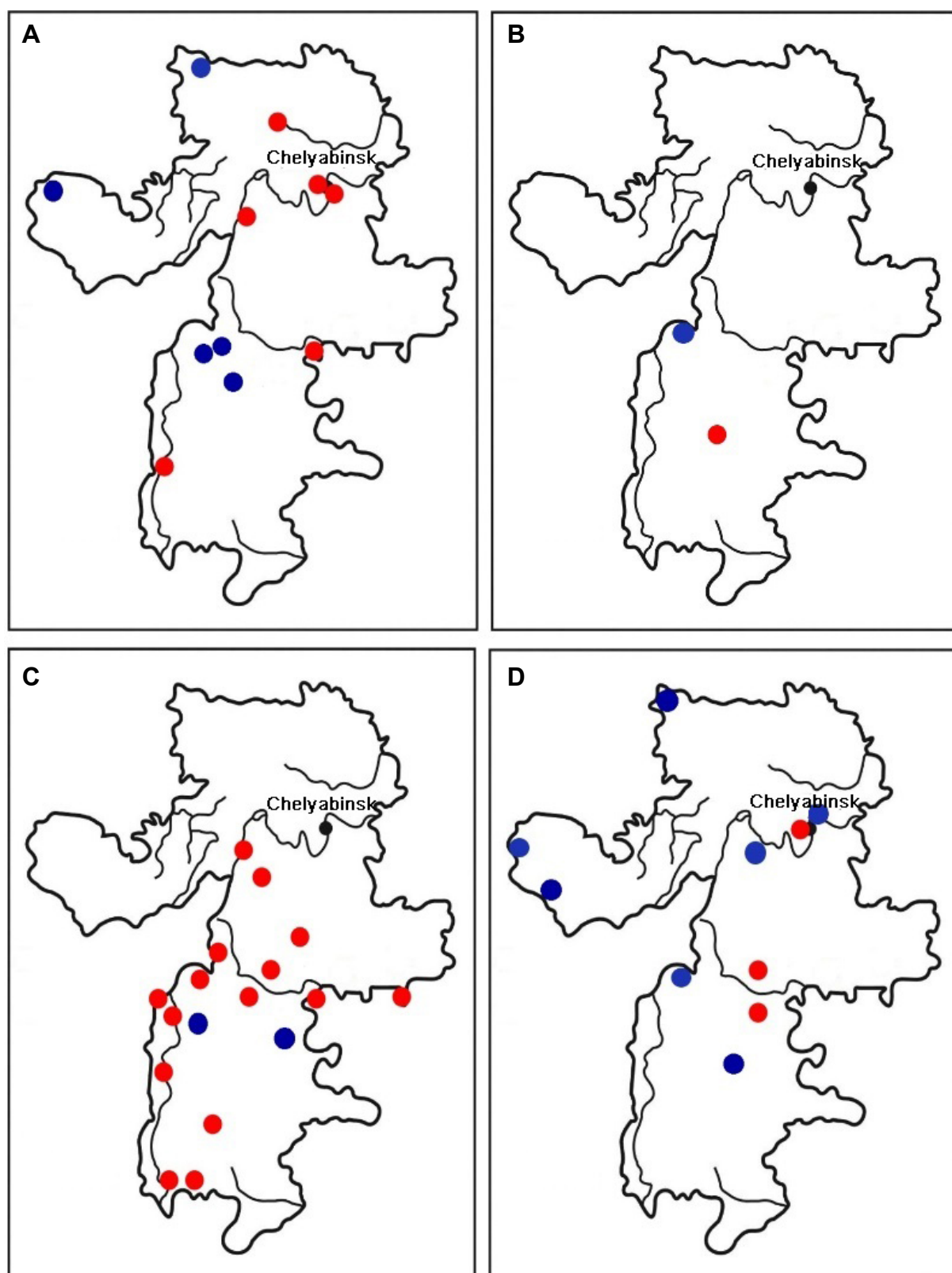


Fig. 11. Locations of *Bombus distinguendus* (A), *Scolia hirta* (B), *Formica pressilabris* (C) and *Laphria gibbosa* (D) in Chelyabinsk Oblast.

Class **Arachnida**

Order **Aranei**

Family **Araneidae**

***Argiope bruennichi* (Scopoli, 1772)** (Figs. 12B, S16). Category III. A rare species found in the Troitsky Nature Reserve and the NM "Bredinsky Forest" (Krasnaya..., 2017).

In 1996–2014, this species was regularly observed in high-grass areas along the edges of small forest and grooves on the territory of the Arkaim Reserve (N 52°38'57" E 59°34'16").

Later, in 2018, we discovered it on a dirt road nearby Kambulat village (N 54°51'00" E 60°34'06") (Chebarkulsky region) (Krasutsky and Gashek, 2019).

Family **Lycosidae**

***Allohogna singoriensis* (Laxman, 1770)** (Figs. 12C, S17). Category IV. Its status is undefined. The species was recorded in the Troitsky Nature Reserve and Lake Karatabyz in Oktyabrsky region (Krasnaya..., 2017).

In 1996–2014, it was common on solonchaks and field roads near the Bol. Karaganka river in the Arkaim Reserve (N 52°38'57" E 59°34'16") and its surroundings. In 2009–2014, it was repeatedly marked in the downed pastures and saline steppe areas in the vicinity of Nizh Sanarka village (N 54°07'42" E 61°12'09") (Troitsky region). In August 2010, several individuals were detected on solonchaks along the northern shore of Lake Tulak near Komsomolsky settlement (N 53°16'48" E 61°00'50") (Varna region) (Krasutsky and Gashek, 2019, 2021a). In July and September, a spider was discovered in the forest-meadow communities of the Ural river floodplain at Ershovsky settlement (N 52°29'08" E 59°08'11") (Kizilsky region) (Krasutsky et al., 2021).

In August 2018, it was registered in a grass meadow near the Kamenka river near Gryaznushinsky settlement (N 52°32'57" E 58°57'52") (Kizilsky region) (Krasutsky and Gashek, 2019, 2020a, 2021a), in 2019 – on the Ufa river near the Yuldashevo village (N 56°00'36" E 52°22'35") (Nyazepetrovsky region).

In 2020, a large tarantula habitat was found in the vicinity of Bolshenikolskoye settlement (N 54°33'03" E 62°11'01") on the southern shore of the Gorky lake (Oktyabrsky region) (Krasutsky and Gashek, 2020a; Krasutsky et al., 2021b).

In July 2022, a tarantula hole was discovered on the northern shore of the Nature Monument "Bitter-Salty Lake" (N 53°47'52" E 61°01'34") (Chesmensky region). In August 2022, N.A. Baldin, an employee of the State Historical Museum of the Southern Urals, found it under the house porch in Alabuga village (N 55°32'09" E 62°21'13") (Krasnoarmeysky region).

The species is listed in the Red Data Books of 16 more subjects of the Russian Federation.

Family **Pisauridae**

***Dolomedes plantarius* (Clerck, 1757)** (Figs. 12D, S18). Category III. A rare species recorded in the reservoirs of the Troitsky Nature Reserve and the Ilmen Reserve (Krasnaya..., 2017).

We found it in the coastal zone of Lake Chebarkul (N 54°57'36" E 60°19'46") and on temporary reservoirs nearby Kisegach settlement (N 54°59'09" E 60°17'43") (Chebarkul region), in a spring near the settlement of Travniki (N 54°54'30" E 60°33'33") (Chebarkulsky region), at Kamennaya Sanarka village (N 54°07'57" E 60°44'35") (Troitsky region), as well as in the Karagai Nature Reserve (N 54°06'35" E 59°34'16"), where it was found sporadically in puddles on a forest road and on adjacent marshy meadow sites (Krasutsky and Gashek, 2019).

In June 2018, one young individual was found in a small swamp in aspen-birch grooves at Arsinsky settlement (N 53°45'02" E 59°53'08") (Nagaibaksky region) (Krasutsky and Gashek, 2019, 2020a).

The species is represented in 5 Red Data Books of other subjects of the Russian Federation.

Type **Mollusca**

Class **Gastropoda**

Order **Geophila**

Family **Gastrocoptidae**

***Gastrocopta theeli* (Westerlund, 1877)** (Fig. 13A). Category III. A rare species. In Chelyabinsk Oblast, it was noted in the vicinity of villages Kamennaya Sanarka (Troitsky region), Sychevo (Krasnoarmeysky region), Krasnogorsky (subordinated to the city of Yemanzhelinsk), Zlatoust (southern slope of Mountain Maly Taganai), on the rocks along the banks of the Miass River (Miassky UD), 1 km north of the Ustinovo railway junction (Uchalinsky region of the Republic of Bashkortostan) (Krasnaya..., 2017).

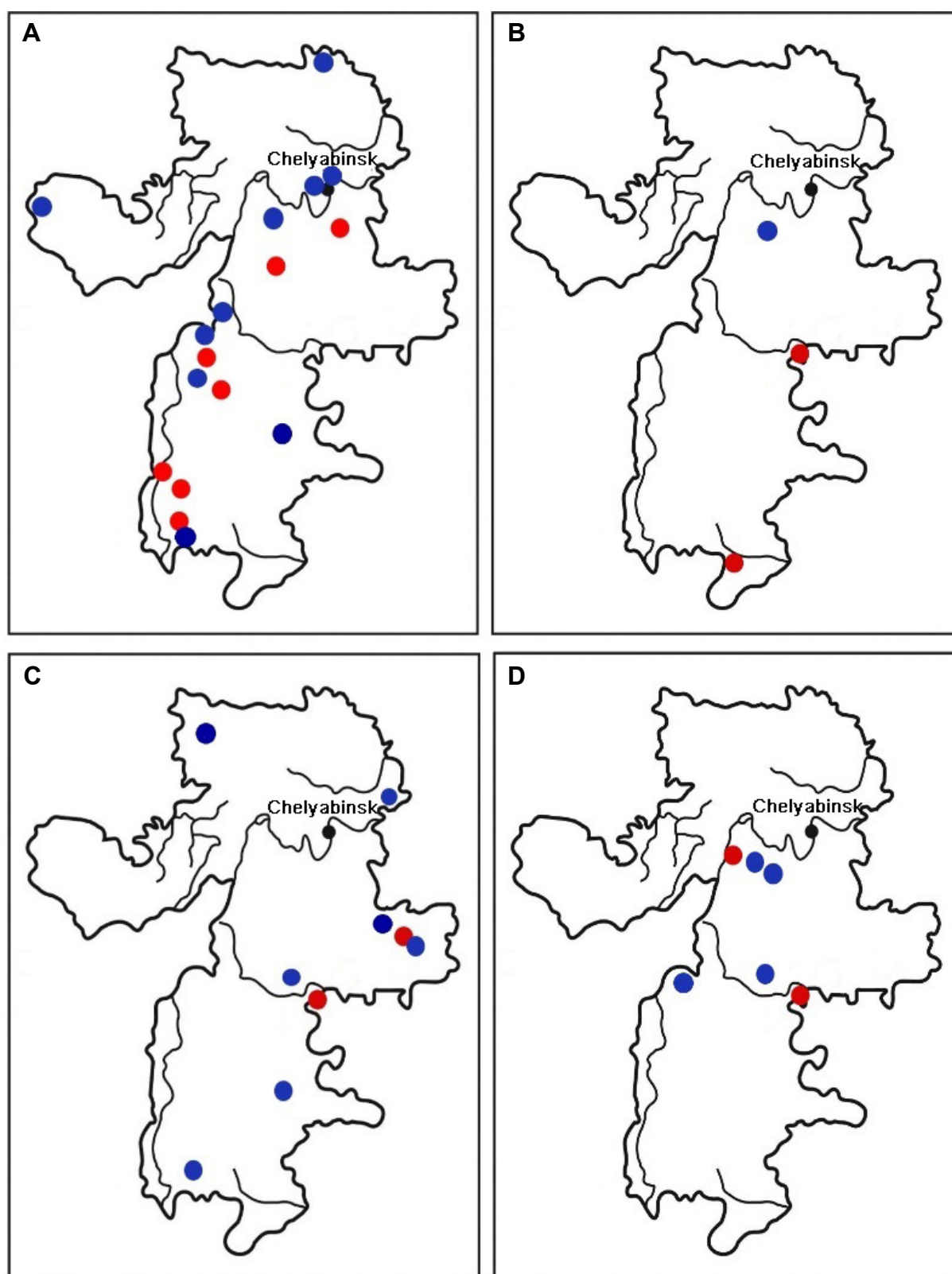


Fig. 12. Locations of *Bombylius major* (A), *Argiope bruennichi* (B), *Allohogna singoriensis* (C) and *Dolomedes plantarius* (D) in Chelyabinsk Oblast.

In July 2021, one clam shell was found on an embankment rocky road near the shore of the Mal. Asha river, near its confluence with the Asha River in the Ashinsky Nature Reserve (N 55°12'22" E 57°21'41").

Order **Lymnaeiformis**

Family **Lymnaeidae**

***Lymnaea (Myxas) glutinosa* (O.F. Müll., 1774)** (Figs. 13B, S19). Category III. A rare species. In Chelyabinsk Oblast, it was found in the following lakes: Bol. Akulya, Argayash, Bol. Miassovo, Mal. Miassovo, Savelkul (Ilmen Nature Reserve), Midiak (Argayashsky region), Chebarkul, as well as in the Miass river, in Chelyabinsk. It is rare everywhere (Krasnaya..., 2017).

We registered it near the water surface in the coastal zone of the western part of the lake, densely overgrown with aquatic plants Zingeyka (N 55°42'19" E 60°10'57") (Chesmensky region). The number did not exceed 1 individual/m² (Krasutsky and Gashek, 2019, 2020a).

Discussion

Seven of the studied species are represented in the Red Data Book of the Russian Federation (2021). These are six species of category II (decreasing in number and/or distribution): *Sago pedo*, *Carabus hungaricus*, *Calosoma sycophanta*, *Parnassius apollo*, *Bombus armeniacus*, *Bombus fragrans* – and one species of category V (recoverable and recovering) – *Anax imperator*.

Six species are included only in the Red Data Book of Chelyabinsk Oblast (2017). These are *Neolysandra coelestinus* (category II), *Leucorrhinia caudalis* (III), *Bombylius major* (III), *Argiope bruennichi* (III), *Gastrocopta theeli* (III) and *Lymnaea glutinosa* (III).

At the same time, 36 species (categories I–IV) listed in the Red Data Book of Chelyabinsk Oblast (2017) are also represented in the Red Data Books of other subjects of the Russian Federation (Figs. 14–16). For example, *Parnassius apollo* is included in 53 other Data Books, *Xylocopa valga* – in 40, *Bombus muscorum* – in 35, *Calosoma sycophanta* – in 34, *Anax imperator* – in 33, *Callimorpha dominula* – in 30 (Figs. 14, 15). The number of Red Data Books containing *Bombus armeniacus* (28), *Sago pedo* (26), *Scolia hirta* (23), *Bombus fragrans* (22), *B. serrisquama* (21), *Hemaris tityus* (21), *Carabus hungaricus* (18) and *Allohogna singoriensis* (17) is somewhat smaller (Figs. 14–16). Less than 10 Red Data Books

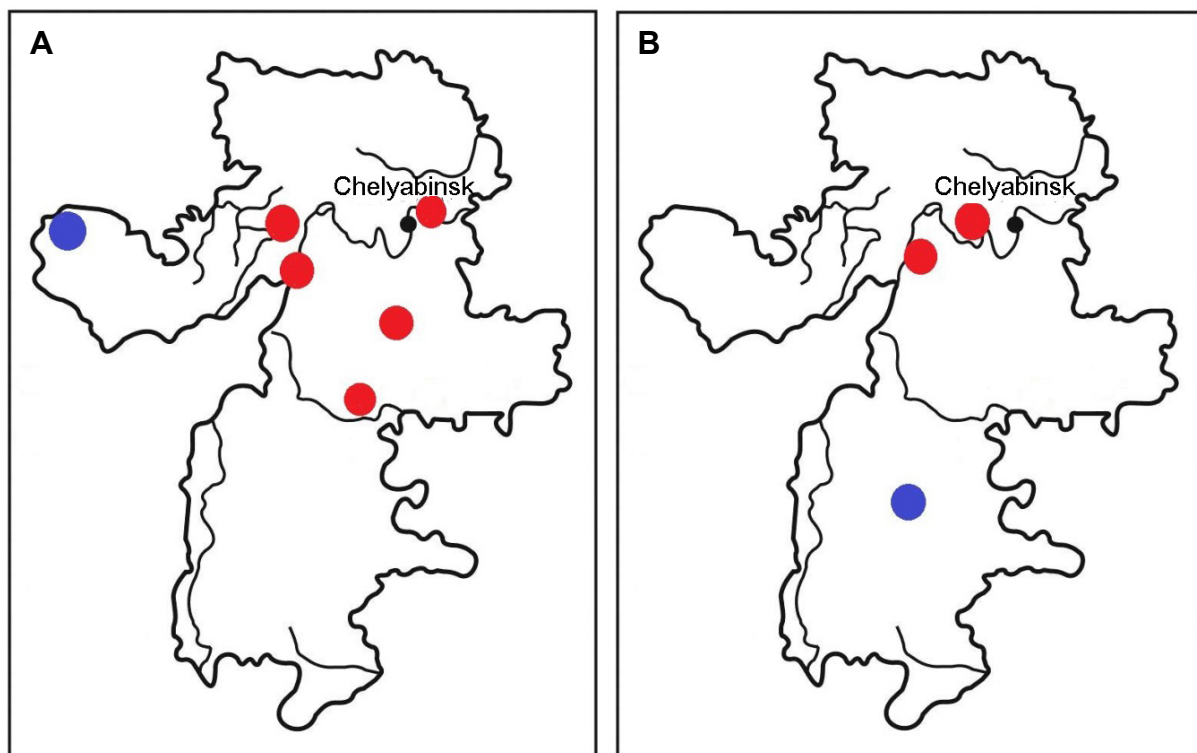


Fig. 13. Locations of *Gastrocopta theeli* (A) and *Lymnaea (Myxas) glutinosa* (B) in Chelyabinsk Oblast.

mention 18 species of invertebrates, five of which have category II in the Red Data Book of Chelyabinsk Oblast (2017) (Figs. 14–16).

Even such a simple analysis of the specific species representation in the Red Data Books of the RF subjects allows to conclude that a number of invertebrates (insects and spiders) require their protection in most regions of Russia (in the European part of the Urals, Western and Central Siberia) where similar threat factors probably exist.

For 17 species, we have received fundamentally new data on their distribution in the region. These are the northernmost finds of *Onconotus servillei* (in the village of Chernovskoye, Miassky UD), *Hemaris tityus* (Araslanovo settlement, Nyazepetrovsky region), *Megachila rotundata* (the neighbourhood of Sinarsky settlement, Kunashaksky region), *Argiope bruennichi* (surroundings of Kambulat village, Chebarkulsky region). On the contrary, the southernmost locations of *Argynnis laodice* (Karagai Nature Reserve), *Bombus maculidorsis* (the neighbourhood of Izmailovsky settlement, Kizilsky region), *Lymnaea glutinosa* (Lake Zingeyka, Chesmensky region) were discovered. Much to the west of the known sites of finds, we recorded *Neolysandra coelestinus* (the neighbourhood of Smirnovsky settlement, Verkhneuralsky region), *Bombus consobrinus* (Ashinsky Nature Reserve), *Bombus distinguendus* (Ashinsky Nature Reserve), *Laphria gibbosa* (Ashinsky and Nyazepetrovsky Natural Reserves) and *Gastrocopta theeli* (Ashinsky Natiral Reserve). New finds of *Bombus hypnorum* occurred in the far west (Ashinsky Natural Reserve) and almost in the far east of the region (Alabuga village, Krasnoarmeysky region). Many new places of discovery (mainly in the west, north and south of the region) for *Bombus serrisquama* (13), *B. terrestris* (12), *B. pomorum* (7) and *B. soroeensis* (5) were revealed.

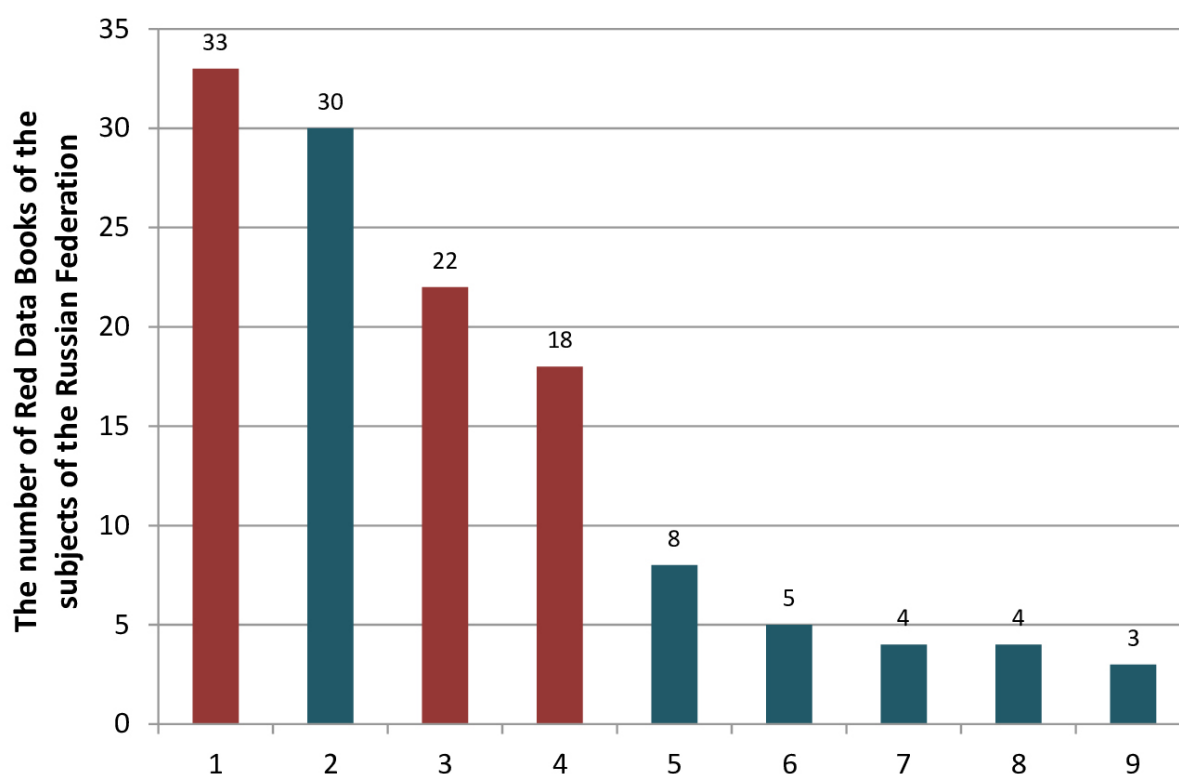


Fig. 14. Invertebrates (categories I and II) of Chelyabinsk Oblast represented in Red Data Books of other subjects of the Russian Federation (species included in the Red Data Book of the Russian Federation are marked in red). 1 – *Anax imperator*, 2 – *Callimorpha dominula*, 3 – *Bombus fragrans*, 4 – *Carabus hungaricus*, 5 – *Bombus maculidorsis*, 6 – *Clossiana thore*, 7 – *Lopinga deidamia*, 8 – *Bombus pratorum*, 9 – *Formica pressilabris*.

Finally, the undisputed “record holder” in the number of new finds (14) was *Parnassius apollo*, noted almost throughout the territory of our region.

Of 42 species represented in the Red Data Book of Chelyabinsk Oblast, with the significantly supplemented information on their distribution, 40 species are found both in the special protected areas and beyond. Among them, 23 species were recorded in the federal protected areas. There is a hope that, with strict observance of the protection regime regulated by the relevant provisions on Reserves, National Parks, Nature Reserves and Natural Monuments, populations (micropopulations) of such species will be protected from many negative influences, primarily from humans. Today, the state of some populations is already alarming, and this is especially true for species that, due to their biological characteristics, are confined to certain habitats (biotopes) and highly specialized in terms of food resources. Any, even minor changes in these components, can lead to irreversible consequences, up to the complete disappearance of entire species complexes. Thus, deforestation in the Nyazepetrovsky region, including in the Nyazepetrovsky Natural Reserve, negatively affected *Clossiana thore*, not found in this territory for more than 5 years.

Argynnis laodice is recorded sporadically and irregularly at the sites of detection. One of the largest groups of this species existed in the vicinity of Kisegach settlement at the southeastern boundary of the Ilmen Reserve more than 30 years ago. Here, large-scale logging was implemented, which caused the destruction of habitats most preferred by this butterfly. A new discovery of the species occurred in 2022 in the Karagai Nature Reserve. However it is hardly possible to assess its current state.

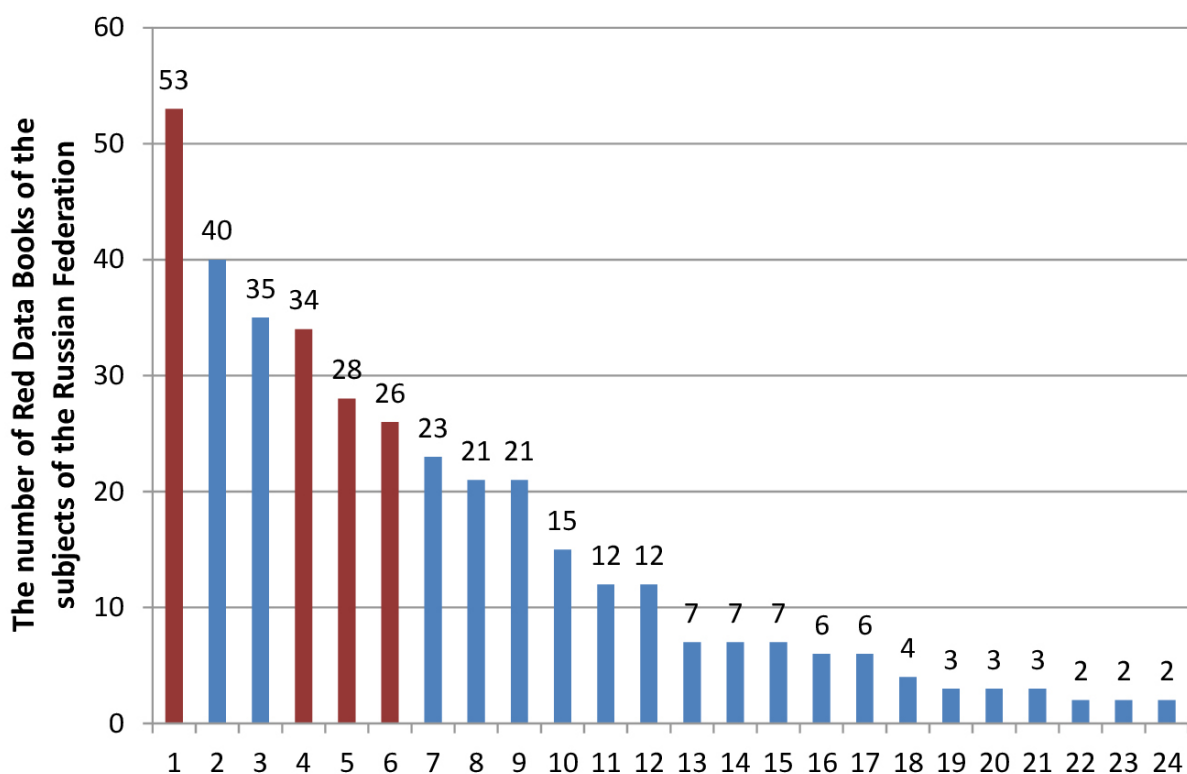


Fig. 15. Invertebrates (category III) of Chelyabinsk Oblast represented in Red Data Books of other subjects of the Russian Federation (species included in the Red Data Book of the Russian Federation are marked in red). 1 – *Parnassius apollo*, 2 – *Xylocopa valga*, 3 – *Bombus muscorum*, 4 – *Calosoma sycophanta*, 5 – *Bombus armeniacus*, 6 – *Sago pedo*, 7 – *Scolia hirta*, 8 – *Hemaris tityus*, 9 – *Bombus serratissima*, 10 – *Megachila rotundata*, 11 – *Ranatra linearis*, 12 – *Bombus confusus*, 13 – *Onconotus servillei*, 14 – *Clossiana selenis*, 15 – *Bombus soroensis*, 16 – *Bombus consobrinus*, 17 – *Dolomedes plantarius*, 18 – *Ophiogomphus cecilia*, 19 – *Coenonympha amaryllis*, 20 – *Bombus hypnorum*, 21 – *Lampyrus noctulica*, 22 – *Bombus lucorum*, 23 – *Bombus terrestris*, 24 – *Bombus distinguendus*.

The local population of *Lopinga deidamia* is vulnerable in certain areas of the forest adjacent to the settlement of Tyulyuk (Katav-Ivanovsky region). Butterflies die on unpaved roads with active traffic of vehicles transporting large groups of recreants. The micropopulation on the nearby NM “Ridge Bakty” is in a slightly more advantageous position, but it is very small.

Bombus armeniacus and especially *Bombus fragrans* are most sensitive to steppe fires, steppe plowing and overgrazing. At the same time, the toxic effect of pesticides is applied in huge quantities almost everywhere, not only in the steppe zone, but also in the forest-steppe. In contrast to compact populations of the *Bombus armeniacus* well preserved in the foothill and mountain steppes, local groupings of *Bombus fragrans* in flat steppes in the south of Chelyabinsk Oblast are very fragmented, extremely small and vulnerable. As for other bumblebee species, the indicators of their species richness and abundance are the highest on the territory of the Ashinsky Nature Reserve, where we found 7 protected species. Among them is quite common *Bombus pratorum* (a species with a decreasing number). But in other territories, some species are rare and irregular; these are, in particular, *Bombus confusus*, *Bombus muscorum*, *Bombus lucorum*, *Bombus maculidorsis*, *Bombus consobrinus* and *Bombus distinguendus*.

It is difficult to assess the current state of populations of the hairy (steppe) scolia *Scolia hirta*, the data on their distribution is very scarce, and the information on their number is missing. In 2022, a single individual was discovered in the forest-steppe, i.e. beyond the steppe zone, thus, being a northernmost finding.

The populations of *Parnassius apollo* are most prosperous and widespread in Chelyabinsk Oblast. They are found almost everywhere in sites with food plants of caterpillars (species of the genus *Sedum*). In some habitats, the number of species is quite high from year to year.

The state of populations of such species as *Bombylius major* and *Laphria gibbosa* is also not alarming. In some areas and suitable biotopes, they are quite common and occur regularly.

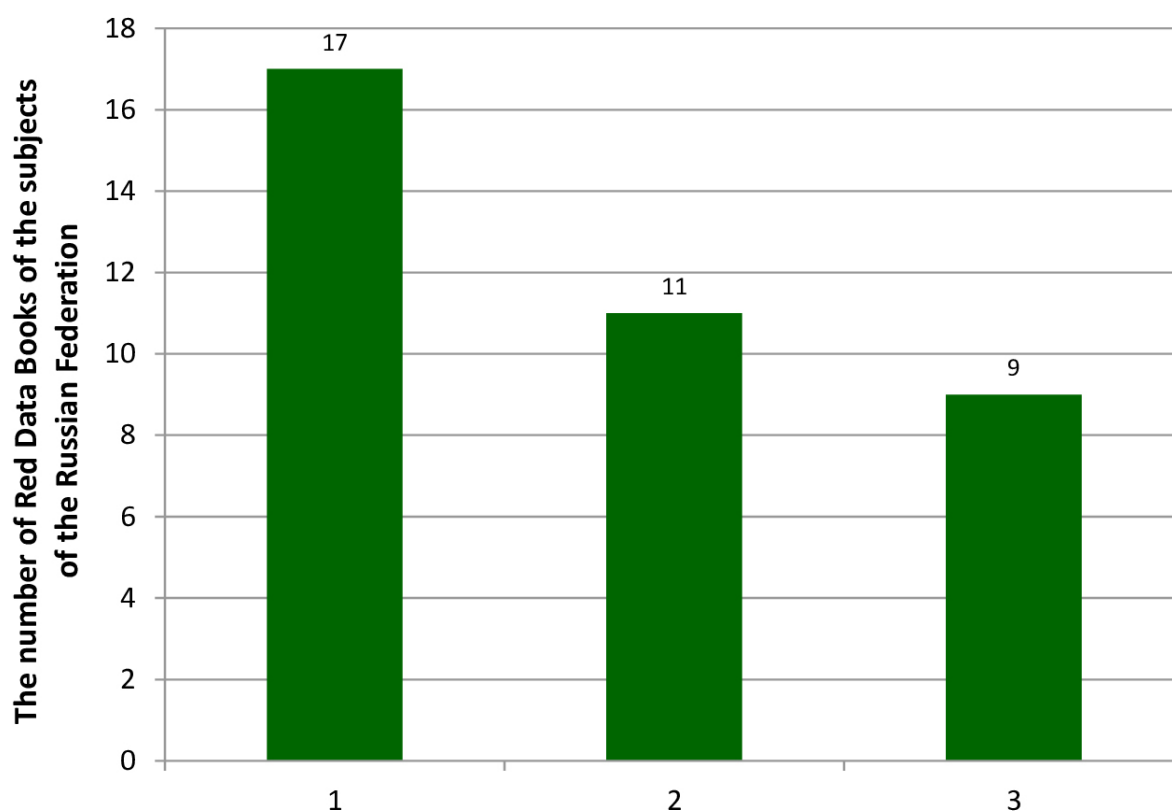


Fig. 16. Invertebrates (category IV) of Chelyabinsk Oblast represented in Red Data Books of other subjects of the Russian Federation 1 – *Allohogna singoriensis*, 2 – *Argynnis laodice*, 3 – *Laphria gibbosa*.

In recent years, we have discovered 10 new colonies of the Russian tarantula *Allohogna singoriensis*, one of them – in the extreme northwest of the region (Nyazepetrovsky region). Some habitats were quite large. It is premature to talk about the trend towards a decrease in the number of this species (Krasnaya kniga..., 2017). On the contrary, we are witnessing an increase in number and distribution of the species in the region, that, apparently, can be explained by climate aridization and deforestation.

Two species of category II, *Anax imperator* and *Neolysandra coelestinus*, were found outside the protected areas. The first species was noted in the city of Chelyabinsk and its surroundings. Interestingly, one of the groups, including only imago dragonflies (with insufficiently strong and poorly flying individuals), until recently existed at a considerable distance from the supposed reservoir of the larval habitat. We cannot explain this fact yet. A local and small population of the second species today lives in the west of the region (Verkhneuralsky region). However, its survival is open to question since this territory is reserved for intensive farming. We consider both of these species to be very vulnerable. In the absence of proper protection measures, they can quickly disappear.

During our research, such species as the medical leech *Hirudo medicinalis* L., 1758 (Hirudinea, Arhynchlobdella), the four-spotted deadweed *Dendroxena quadrimaculata* Scopoli, 1771 (Coleoptera, Silphidae) and the Daurian dipper *Chelis daturica* (Boisduval, 1832) (Lepidoptera, Arctiidae) were discovered for the first time in Chelyabinsk Oblast. We reported on these findings in a number of publications (Krasutsky and Gashek, 2020a, b). Let us remind again that these species (marginal for Chelyabinsk Oblast) are candidates for inclusion in the next (third) edition of the Red Data Book of Chelyabinsk Oblast, at least in category IV (species with undefined status). In June 2022, we also discovered for the first time in our region a mycetophilic species – *Mycetina cruciata* (Schaller, 1783) (Coleoptera, Endomychidae), the distribution and ecology of which have been poorly studied in Russia. This interesting and obviously rare species is already represented, for example, in the Red Data Book of Ulyanovsk Oblast (2015) in category III.

As potential candidates for inclusion in the regional Red Data Book, we can name some more insects, the number of which has sharply declined in recent years. Among them, a previously common and numerous species *Pieris brassicae* L., 1758 (Lepidoptera, Pieridae) has completely disappeared. Common on very few lakes *Anax parthenope* (Selys, 1839) (Odonata, Aeschnidae) (Fig. S20); *Colias chrysotheme* (Esper, 1781), *Colias croceus* (Geoffroy, 1785), *Pontia chloridice* (Hubner, 1813), *Euchloe ausonia* (Hubner, 1803) (Lepidoptera, Pieridae), as well as increasingly rare *Rhyssa persuasoria* (L., 1758) and *Megarhyssa macrurus* (L., 1771) (Hymenoptera, Ichneumonidae) were found irregularly and singly on some territories of the steppe zone and the forest-steppe subzone (Fig. S21). Clearly, special studies are needed to make a final decision on these species.

Among the rare species of spiders, we recommend to include in category III, first of all, the spider *Eresus kollari* Rossi, 1846, found in Chelyabinsk Oblast (six finds) (Fig. S22). Today, this species is represented in the Red Books of 10 more subjects of the Russian Federation (Krasutsky and Gashek, 2022a).

Conclusion

As a result of our research, the new data were obtained on the distribution and some bioecological features of 42 species of invertebrates listed in the Red Data Book of Chelyabinsk Oblast. They include 37 species of insects:

Category I – 1 species (*Bombus fragrans*);

Category II – 9 species (*Anax imperator*, *Carabus hungaricus*, *Clossiana thore*, *Lopinga deidamia*, *Neolysandra coelestinus*, *Callimorpha dominula*, *Bombus pratorum*, *B. maculidorsis*, *Formica pressilabris*);

Category III – 25 species (*Ophiogomphus cecilia*, *Leucorrhinia caudalis*, *Sago pedo*, *Onconotus servillei*, *Ranatra linearis*, *Calosoma sycophanta*, *Lampyrus noctulica*, *Parnassius apollo*, *Clossiana selenis*, *Coenonympha amaryllis*, *Hemaris tityus*, *Megachila rotundata*, *Xylocopa valga*, *Bombus confusus*, *B. muscorum*, *B. armeniacus*, *B. soroeensis*, *B. hypnorum*, *B. terrestris*, *B. lucorum*, *B. serratissima*, *B. consobrinus*, *B. distinguendus*, *Scolia hirta*, *Bombylius major*);

Category IV – 2 species (*Argyronome laodice*, *Laphria gibbosa*).

Data on three species of spiders have also been obtained:

Category III – 2 species (*Argiope bruennichi*, *Dolomedes plantarius*);

Category IV – 1 species (*Allohogna singoriensis*);

Two species of mollusks of category III (*Gastrocopta theeli*, *Lymnaea glutinosa*).

The most vulnerable species, the population state (micropopulations) of which causes the greatest concern – *Anax imperator*, *Argynnis laodice*, *Clossiana thore*, *Lopinga deidamia*, *Neolysandra coelestinus*, *Bombus fragrans*, *Scolia hirta*, have been identified. Most of these species are not (or properly) protected.

The main factors of negative impact on many species are the following:

1) Intensive, sometimes continuous logging, including on the territories of some Natural Reserves of the forest zone and the forest-steppe subzone (Ashinsky, Arshinsky, Varlamovsky, Karagai, Nyazepetrovsky, Serpievsky, Uysky, Shaburovsky) and forest fires (Vlasova et al., 2019). The most affected species are those that closely related to forests – a place of their food resources and reproduction (*Argynnis laodice*, *Clossiana thore*, *Lopinga deidamia*).

2) Large-scale (over large areas within the entire region) and reusable (during the full growing season) use of pesticides on farmlands and adjacent territories, which has an extremely negative impact on food supply and directly on invertebrates themselves (many Orthoptera, Lepidoptera, Hymenoptera).

3) Significant recreational load, primarily intensive flows of tourists traveling both on foot and by vehicles along paths and roads leading to sightseeing places and passing through typical habitats of rare species. *Lampyrus noctulica*, *Lopinga deidamia* and some species of the genus *Bombus* are particularly affected.

4) Death of imago and larvae of many invertebrates on dirt roads caused by transport of tenants, hunters, harvesters of biological products, etc. *Ophiogomphus cecilia*, *Carabus hungaricus*, *Clossiana selenis*, *C. thore*, *Argiope bruennichi* are vulnerable.

5) Unregulated grazing, running of horses' herds, organization of new and further active exploitation of farmlands, fires in the steppe zone. The most sensitive are *Sago pedo*, *Neolysandra coelestinus*, *Bombus armeniacus*, *B. fragrans*, *B. lucorum*, *B. pratorum*, *Megachila rotundata*, *Scolia hirta* and *Allohogna singoriensis*.

Modern systems of invertebrate protection should be aimed at preserving their preferred biogeocenoses and even entire landscapes with a characteristic set of key components providing optimal conditions for long-term habitat and successful reproduction of specific species.

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APPENDIX. Photographs of some species of invertebrates in the Chelyabinsk region.



Fig. S1. *Anax imperator* (photo by B.V. Krasutsky).



Fig. S2. *Ophiogomphus cecilia* (photo by V.A. Gashek).



Fig. S3. *Sago pedo* (photo by V.A. Gashek).



Fig. S4. *Calosoma sycophanta* (photo by V.A. Gashek).



Fig. S5. *Parnassius apollo* (photo by V.A. Gashek).



Fig. S6. *Argynnis laodice* (photo by B.V. Krasutsky).

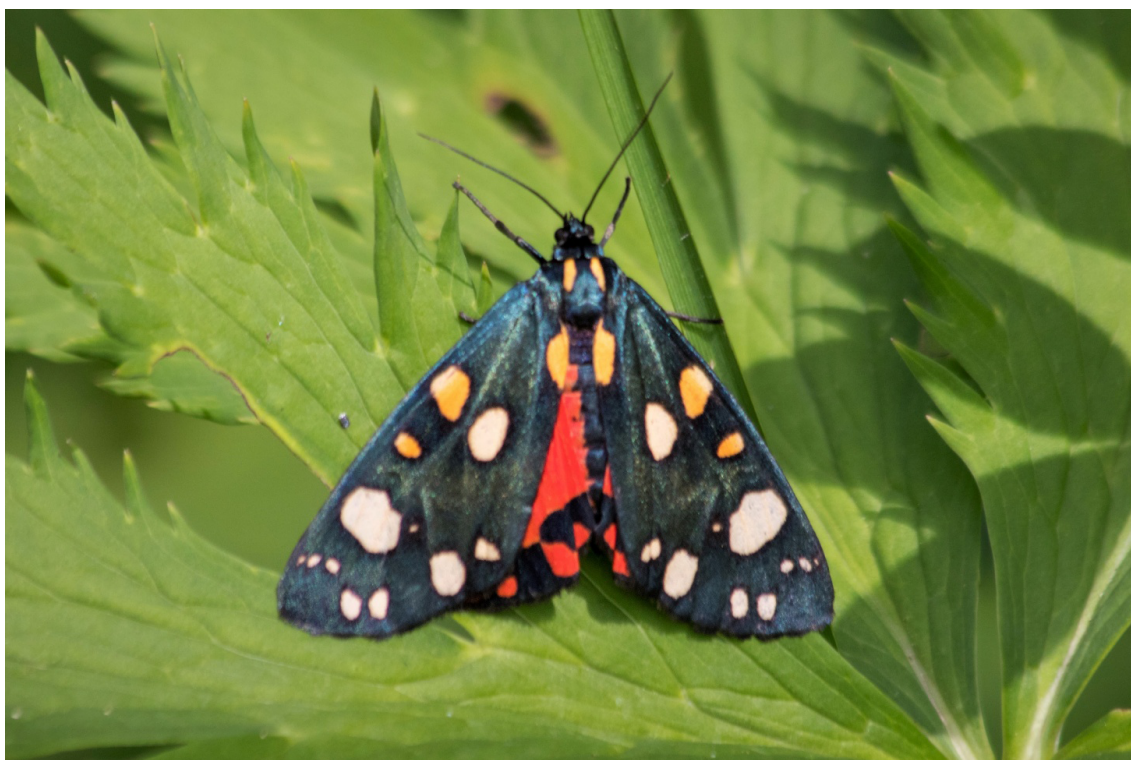


Fig. S7. *Callimorpha dominula* (photo by V.A. Gashek).



Fig. S8. *Xylocopa valga* (photo by V.A. Gashek).



Fig. S9. *Bombus armeniacus* (photo by V.A. Gashek).



Fig. S10. *Bombus hypnorum* (photo by V.A. Gashek).



Fig. S11. *Bombus terrestris* (photo by S.M. Ovchinnikov).



Fig. S12. *Bombus muscorum* (photo by V.A. Gashek).



Fig. S13. *Bombus serrisquama* (photo by V.A. Gashek).



Fig. S14. *Laphria gibbosa* (photo by V.A. Gashek).



Fig. S15. *Bombylius major* (photo by V.A. Gashek).



Fig. S16. *Argiope bruennichi* (photo by B.V. Krasutsky).



Fig. S17. *Allohogna singoriensis* (photo by V.A. Gashek).



Fig. S18. *Dolomedes plantarius* (photo by V.A. Gashek).



Fig. S19. *Lymnaea glutinosa* (photo by B.V. Krasutsky).



Fig. S20. *Anax parthenope* (photo by S.M. Ovchinnikov).



Fig. S21. *Megarhyssa macrurus* (photo by B.V. Krasutsky).



Fig. S22. *Eresus collari* (photo by V.A. Gashek).