ABSTRACT

of the dissertation on the topic: «Beetles (Insecta, Coleoptera) of the Katon-Karagai State National Natural Park»
for the degree of Doctor of Philosophy (PhD)
in the educational program
«8D05101 Biology»
by **Gabdullina Aliya Ulanbekovna**

General description of the work. The dissertation is devoted to the study of the ecological and faunistic characteristics of beetles (Insecta, Coleoptera) of the Katon-Karagai State National Natural Park (East Kazakhstan Region).

Relevance of the topic. Today, the system of specially protected natural areas (SPNAs) is recognized as one of the most effective means of conserving global biodiversity. Their primary function is the preservation of pristine, reference ecosystems.

In Kazakhstan, forests represent strategically important conservation areas. Although they occupy only about 1.2% of the country's territory, their ecological significance is substantial. The largest proportion of forested land in the republic (approximately 60%) is concentrated in Eastern Kazakhstan, within the Altai region. This high concentration of forest ecosystems accounts for the large number of protected areas located in this region. Overall, the national network of protected areas includes 10 state nature reserves, 7 nature sanctuaries, and 14 national parks, three of which are situated in the East Kazakhstan Region.

One of the largest protected areas in Kazakhstan is the Katon-Karagai State National Natural Park, which covers an area of 643,466 hectares, most of which is forested. One of the most important components of forest and other terrestrial ecosystems is invertebrate fauna, the majority of which consists of insects. Among insects, the order Coleoptera (beetles) is considered the largest, comprising approximately 350,000 described species; according to current estimates, the total number of beetle species on Earth may reach up to one million.

The results of entomofaunal studies provide a fundamental basis for understanding the biological diversity that is subject to protection within the world's protected areas. Monitoring of invertebrate fauna is, first and foremost, an essential task that enables the identification and assessment of conservation targets within protected territories. However, insects are closely integrated within their communities and interact with other components of natural systems; therefore, effective conservation is possible only through the preservation of entire ecosystems within protected areas and state forest lands.

The results of our research can be used not only for scientific purposes, but also for the rational use of natural resources, the promotion of environmental protection, work with local communities—especially the younger generation—and the development of ecological tourism.

Based on the recommendations developed during our research, specialists from protected areas and forestry institutions, as well as authorized bodies, can fully utilize the opportunities provided by inventory studies of entomofauna to monitor forest ecosystems. As a result of our work, this information will be accessible to specialists in protected areas and forestry across the republic.

Thus, the study of beetles in the contemporary context of specially protected areas is a prerequisite for effective environmental monitoring in SPAs and forestry institutions. Members of the order Coleoptera include predatory species that regulate populations of harmful insects, xylophagous pests that can damage forests, and various saprophagous species that participate in the mineralization of plant and animal residues and contribute to soil formation. In addition, certain groups of beetles, such as ground beetles and weevils, can serve as bioindicators of forest ecosystem health. In addition, information on representatives of beetles will be used for environmental education activities and career guidance for the younger generation.

Goals and Objectives. The goal of this research is to identify the faunistic and ecological characteristics of beetles (Insecta, Coleoptera) in the Katon-Karagai State National Natural Park. To achieve this goal, the following objectives were set:

1. Conduct an inventory of the species composition of beetles in the Katon-Karagai State National Natural Park.
2. Identify populations of rare and endangered beetle species in the Katon-Karagai State National Natural Park.
3. Determine patterns of altitudinal and biotopic distribution of beetles.
4. Investigate the trophic characteristics of beetles.
5. Develop recommendations for the conservation and sustainable use of insect fauna.

Object of Study. The fauna of Coleoptera in the Katon-Karagai State National Natural Park.

Subject of Study. The taxonomic composition, species diversity, and ecological characteristics of beetles, including endemic, rare, and endangered species of beetles in the Katon-Karagai State National Nature Park.

Research Methods. The dissertation employed traditional entomological research methods, statistical analysis, systematic ecological analysis, and multivariate mathematical analysis. For the analysis of statistical data, the free software PAST was used, which provides functions for data manipulation, graphing, univariate and multivariate statistics, and ecological analysis.

Scientific Novelty. Comprehensive studies of Coleoptera were conducted for the first time in the Katon-Karagai State National Natural Park and in the protected areas of Eastern Kazakhstan in general.

During the course of the research, the author obtained the following new results:

1. Based on original research, a synthesis of literature data, and the study of collection materials from the Institute of Zoology of the Ministry of Education and Science of the Republic of Kazakhstan (Almaty), the Institute of Systematics and Ecology of Animals of the Siberian Branch of the Russian Academy of Sciences (Novosibirsk), and the Zoological Institute of the Russian Academy of Sciences (St. Petersburg), a total of 780 species from 396 genera and 46 families of Coleoptera have been recorded in the Katon-Karagai State National Natural Park to date.
2. Six species of Coleoptera have been recorded for the first time in the fauna of Kazakhstan, and 40 species for the territory of the Katon-Karagai State National Natural Park.
3. The ecological characteristics of 17 endemic species of the Altai-Sayan mountain system, including Altai and Southwestern Altai, were studied, including two rare and endangered species.
4. Patterns of altitudinal and intra-biotope distribution of beetles, as well as characteristics of dominance, population density, and trophic relationships, were clarified.
5. Recommendations for the conservation and sustainable use of insects in national parks have been developed.
6. For the first time, a passport for a tourist entomological route was developed for the Katon-Karagai State National Natural Park, together with recommendations for the sustainable use and protection of insects in protected areas.

Main Points to Be Defended

1. The composition of the Coleoptera fauna in the Katon-Karagai State National Natural Park has been established, comprising 780 species from 396 genera and 46 families. The beetle fauna of the Katon-Karagai State National Natural Park is rich and diverse compared to the described faunas of the Markakol Reserve (18 families, 88 genera, 176 species) and the Tarbagatai National Natural Park (37 families, 257 genera, 427 species).
2. The most species-rich families were found to be Carabidae (22.6%), Curculionidae (14.5%), Staphylinidae (9%), Chrysomelidae (9%), Cerambycidae (6.6%), and Scarabaeidae (6%), which together constitute the core of the fauna (67.7%).
3. The beetle fauna of the Katon-Karagai State National Natural Park exhibits a pronounced boreal character.
4. Within the park, the largest number of beetle species were recorded in the shrub-steppe (315 species) and mixed forest (235 species) zones, while the

smallest numbers were observed in the alpine-tundra (118 species) and diverse grassland (80 species) zones.

5. A correlation has been established between the beetle faunas of different altitudinal zones in the Katon-Karagai State National Natural Park. Minimal similarity was observed between the faunas of the most distant altitudinal zones: the shrub-steppe and alpine-tundra zones share no more than 6.3% of species (27 species in common), while the shrub-steppe and subalpine meadow zones share 3.3% of species (13 species in common). In contrast, closely located altitudinal zones exhibit a higher degree of similarity: the mixed and coniferous forest faunas share 28.9% of species (124 species in common), and the subalpine meadows and alpine-tundra belt share 27.3% of species (54 species in common).

6. The trophic specialization of Coleoptera in the Katon-Karagai State National Natural Park has been determined: the majority of beetles are phytophagous (49%) and zoophagous (33%).

7. Recommendations have been developed for optimizing entomological studies in specially protected natural areas.

Theoretical Significance of the Work. The studied group of Coleoptera provides a foundation for further research on the ecology, biology, genetics, systematics, and evolution of this order. The data obtained will be useful to specialists in these fundamental areas of science.

Practical Significance of the Work. The studied group of Coleoptera serves as a potential indicator of ecosystem stability, including forest ecosystems. Therefore, long-term observations in the same areas of the park – both forested and non-forested – can provide a foundation for further monitoring of the condition of forests and non-forested areas in the Katon-Karagai district and the East Kazakhstan Region. These data can also be applied in Environmental Impact Assessments (EIA) and other environmental expertise.

The materials of the dissertation can be used by specialists—biologists, zoologists, ecologists, plant protection experts, employees of forestry institutions and protected areas, as well as teachers of higher and secondary specialized educational institutions in relevant fields.

Connection with Other Research Work. The topic of the dissertation is closely related to the research program «Nature Chronicle» (2005–2025), implemented by the Department of Science, Environmental Monitoring and Information of the Katon-Karagai State National Nature Park, as well as to the main activities of its Department of Environmental Education and Tourism.

Author's Contribution. The author personally collected and analyzed literature data, systematically conducted field and laboratory research, compiled maps, performed statistical processing of the obtained data, and summarized and presented the results. Furthermore, the reliability of the results was ensured through the use of actual material analyzed using methods of mathematical statistics.

Approval of the Dissertation Results. The main results of the dissertation have been reported and discussed at the following conferences and meetings:

1. Габдуллина, А. У. Дополнение к фауне жуков - усачей (Coleoptera, Cerambycidae) Катон - Карагайского государственного национального природного парка / А. У. Габдуллина, Р. Х. Кадырбеков // Сохранение биологического разнообразия и развитие сети особо охраняемых природных территорий : Материалы Международной научно-практической конференции, посвященной юбилею почетного профессора Костанайского государственного педагогического института, доктора биологических наук Т.М. Брагиной, Костанай, 26 февраля 2024 года. – Костанай: Костанайский региональный университет имени А. Байтурсынова, 2024. – С. 221-223.

2. Kabak I.I., Gabdullina A.U. Rare species of the ground-beetles of the genus Carabus Linné, 1758 (Coleoptera, Carabidae) of the Katon-Karagai State National Natural Park, Eastern Kazakhstan \\ The 7th International Symposium on EuroAsian Biodiversity (SEAB). Erzurum Technical University, Türkiye on 22-24 August 2024. P. 56.

3. Gabdullina A.U. Biodiversity of beetles (Insecta, Coleoptera) as an indıcator of the stability of forest ecosystems in the Katon-Karagai National Park (Kazakhstan) // International Conference on “Protection of Biodiversity and Sustainable Ecological Development in the Liberated Territories”. 29 October 2025. P. 233-234.

4. Габдуллина А.У., Воробьев В.М. К вопросу сбора герпетобионтных жуков в высокогорьях хребта Сарымсакты в Катон-Карагайском национальном парке (Казахстан) // Материалы международной научно-практической конференции «Большой Алтай. Горы и люди», посвященной Международному дню гор и 75-летию Горно-Алтайского государственного университета. БИЦ ГАГУ, 2025. С. 55-58.

Publications. On the topic of the dissertation, 16 scientific works have been published, including 5 articles in journals indexed in the Scopus database, such as «Eurasian Entomological Journal», «Entomological Review», «Baltic Journal of Coleopterology», and «Ecologica Montenegrina».

Volume and Structure of the Dissertation. The dissertation consists of an introduction, seven chapters, a conclusion, a list of findings, a bibliography, and appendices, comprising 186 pages of computer-typed text (Times New Roman, 14 pt). The text is illustrated with 11 tables and 51 figures, including 5 maps, 24 diagrams, and 22 original photographs. The bibliography contains 276 sources, of which 58 are in foreign languages.