Taxonomic analysis of the fauna of coleoptera (beetles) in Bukhara region

Avaz Rayimov[1,2*], *M.A.* Rustamova[1,2], *Marhabo* Ashurova[1,2], *Mashhura* Yuldasheva[1], *Zilola* Abulova[1,2], and *M.* Saidova[2]

[1]Bukhara State Pedagogical Institute, Bukhara City, Piridastgir, 2, 200100, Uzbekistan
[2]Bukhara State University, Bukhara city, M.Ikbol 11, 200100, Uzbekistan

Abstract: This article presents the diversity, seasonal changes in species composition, ecological features, forage specialization, and systematic analysis of beetles found in Bukhara region. The assessment of the negative impact of beetles on cultivated plants, the determination of population density, as well as the development of certain steps to protect rare species of aesthetic importance in the conditions of Bukhara were studied.

1 Introduction

The order Coleoptera includes 300,000 species around the world [1-8], according to recent data - 400,000 species (Bouchard, 2014) [2]. The order Coleoptera includes 4 suborders, 179 families, 498 subfamilies [4]. The families Histeridae and Tenebrionidae were studied in the Kyzylkum region [5], and the family Tenebrionidae was studied in the Ustyurt region [2]. The genus of Coccinella, Propyela, Hippodamia, and Oenopia belonging to the Coccinellidae family have been studied throughout the Earth to a certain degree. 30 Paleoarctic species of the genus Coccinella are listed in several catalogues of the early 20 th century [6-7].

2 Literature analysis

With a comprehensive study of Beetles that are important in nature and human life, we can achieve control of their numbers, preserve environmental sustainability and diversity of beetles. In Bukhara, less attention is paid to research work on the species composition, abundance, reproduction, bioecological features, distribution and importance of Beetles in natural ecosystems and agrocenoses. Updates in the composition of agricultural crops in the country, specialization in new varieties and types of crops, in turn, contribute to an increase in the number of beetle species, especially invasive species [9-23].

* Corresponding author: maxbuba013@gmail.com

3 Material and methodology

To study the importance of Beetles of various groups in various natural biotopes of Bukhara region (Jandor, Romitan, Bukhara, Peshku, Gijduvan, Shafirkan, Karaulbazar) - semi-deserts, natural reservoirs, developed territories, agricultural landscapes and developed urban zones samples were collected by stationary and route observations at different times of the year (spring, summer, autumn)[17;18;19].

Beetles were caught using an entomological mattress [9]. Beetles living in the soil and damaging the underground organs of plants were studied prior to planting crops with the techniques recommended by V.P. Vasilyeva et al. (1975). At the same time, ground beetles on each field were also taken into consideration, 8-16 holes with a size of 50x50 cm were dug out like chess board and samples were taken. Beetles in them were placed in pure ether, contained in a mixture of 4% formalin or 70% alcohol with 1% glycerin in order to determine the species [10;11;20;21].

Soil traps were used to study ground beetles during the growing season. That is, glass jars with a capacity of 0.5 liters were placed in arable land to a depth of 1-2 cm from the soil level. A moist soil 3-4 cm thick is poured into the jar and mouth of jar was covered with polyethylene with a hole. 10 of them were placed on each rack along the diagonals of the field. They were monitored every 5-7 days [12].

The frequency of insect encounters, the quantitative population density and the dominance were found out with the method of of K.K. Fasulati [13]. Quantitative indicators of the density of individuals were determined by the formula: $V=R/n$

Here V is the quantitative density of the population; R is a total number of insects of one species in the entire sample; n is the number of collected samples.

During the collection of beetles, the lifestyle and behavior of particularly important species were studied. A glass or plastic container with a wide neck was used for temporary storage of collected Beetles. A number of industry determinants and scientific sources were used to identify the systematic position of Beetles [14;15]. Online detectors were also used when necessary. Night route calculations were carried out using conventiona l LED lights.

4 Result and discussion

Our observations to determine the species composition of the Beetle fauna in Bukhara region were conducted between the years of 2015 and 2023. Planting a variety of cultivated plants attracts representatives of Coleoptera genus offering food supply and a place to reproduce. Accordingly, the study of the emergence of various types of entamofauna into agrocenoses, the patterns of their adaptation, the role and influence of Coleoptera on agricultural crops, the involvement of “useful” species in agrocenoses, the assessment of the place of the agricultural landscape in protection, as well as the development of measures for the conservation and protection of rare and endangered species are of great scientific and practical importance. Based on the analysis of the field materials collected, 14 beetle families and 70 species were identified in Bukhara region (Scarabaeidae, Coccinellidae, tenebrionodae, meloidae, chrysomelidae, carabidae, elateridae, curculionidae, cerambycidae, dutisidae, cyrinidae, silphidae, Ipidae, buprestidae). (Table 1).

Table 1. Systematic analysis of coleoptera found in the Bukhara region.

Coleoptera species.	Phytophage	Predator	Necrophage	Caprophage
Kingdom. Metazoa				
Sub-kingdom . Eumetazoa.				
Phylum . Arthropoda.				
Sub-phylum . Tracheata.				
Class . Insecta.				

Sub-class . Ectognata.				
Order. Coleoptera.				
Family. Scarabaeidae.				
Lethus rosmarus.	+			
Polyphylla adspersa	+			
Oxythyrea cinctella	+			
Epicometis turanica	+			
Protaetia marginicollis	+			
Oxythyrea cinctella	+			
Protaetia turkestanica	+			
Stalagmosoma allbellum	+			
Protaetia agglomerata	+			
Scarabaeus sacer				+
Synapsis tmolus				+
Copris lunaris				+
Copris hispahus				+
Cetonia aurata	+			
Melolontha hippocostani	+			
Melonotha afflicta	+			
Rpicometis hirta	+			
Family. Coccinellidae				
Ephilachna chrysomelina	+			
Coccinella septempunctata		+		
Adalia bipunctata		+		
Coleomegilla maculata		+		
Hippodamia undecimnotata		+		
Propylea quatuordecimpunctata		+		
Family. Tenebrionidae				
Blaps halophile	+			
Pisterotarsa gigantea	+			
Opatroides punctulatus	+			
Dailognatha nasute	+			
Family. Meloidae				
Mulabris guad ripunctata	+			
Mulabris turkestanica	+			
Mulabris sedecimpimctata	+			
Mylabris frolove		+		
Family. Chrysomelidae				
Leptinotarsa desemlineata	+			
Chrysomela populi	+			
Galeruceia tenella	+			
Galierusella luteola	+			
Chrysomela menthastri	+			
Lema melonopus	+			
Family. -Carabidae				
Calosoma sycophanta	+			
Cicindela deserticola		+		
Calosoma auropunctatum		+		

Scarites bucida		+		
Cicindela decempustulata		+		
Carabus campestris	+			
Amara aenea		+		
Amara ovata		+		
Cicindela turkestanica		+		
Anthia mannerheimi		+		
Zabrus morio	+			
Machozetus lehmann	+			
Family.*Elateridae*				
Agriotes meticulosus	+			
Cion cerambycinus	+			
Family. Curculionidae				
Anthonomus pomorum	+			
Sitobhilus granarius	+			
Sitona longula	+			
Phytonomus variabilis.	+			
Sitona cylindricollis	+			
Family.Cerambycidae				
Agapanthia dahi	+			
Prionus turkestanicus	+			
Dorkadion turkestanicum	+			
Aeolesthes sarta	+			
Family. Dutisidae				
Dytiscum marginais		+		
Family. Cyrinidae				
Gyrinus marinus		+		
Family. Silphidae				
Necrophorus investigator			+	
Necrophorus satanas			+	
Necrophorus humator			+	
Thanatophilus terminatus			+	
Family. Ipidae.				
Scolytus scolytus	+			
Scolytus rugolosus	+			
Family. Buprestidae				
Iulodes bucharica	+			
Iulodes variolaris	+			
Total	46	16	4	4

According to the nutritional preferences of Coleoptera genus found in Bukhara region, there are the phytophagus comprising 46 species (65%), predators - 16 species (23%), Necrophage-4 species (6%), Caprophage-4 species (6%). (Fig. 1).

During the favorable spring, summer and autumn seasons, they multiply many times, as a result, the number of individuals in the population increases.

According to the results, of the 70 species of beetles found in the Bukhara region, the largest number by species composition belongs to the family of Scarabaeidae-17 species (24.2%), the family of Carabidae consists of 12 species (17.1%), the family of Coccinellidae - 8 species (8.5%), the family of Tenebrionodae - 4 species (5.7%), Meloidae family - 4 species (5.7), there are 6 species in the family of Chrysomelidae (8.5%), 2 species in the family of Elateridae (2.8%), 5 species in the family of Curculionidae (7.1%), 4 species in the family of Cerambycidae (5.7%), 1 species in the family of Dutisidae

(1.4%), 1 species in the family of Cyrinidae (1.4%), %), and the family Silphidae includes 4 species (5.7%), the family Ipidae - 2 species (2.8%), the family Buprestidae -2 species (2.8%) (Table 2).

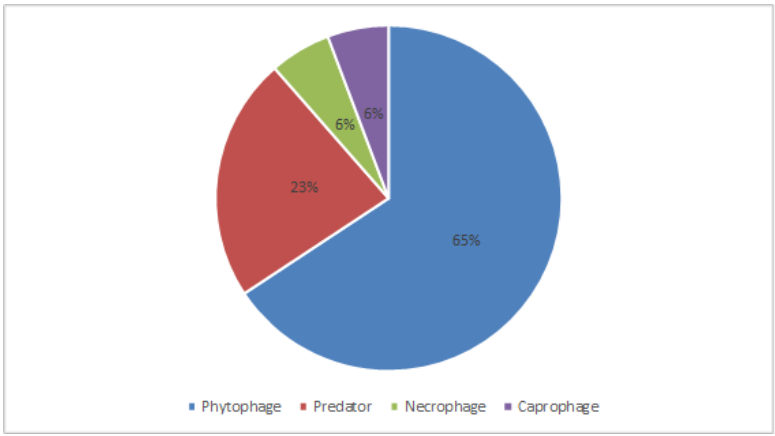

Fig. 1. Coleoptera living in Bukhara region in the context of ecological groups, depending on the type of feed

Table 2. The spectrum of the leading families of Coleoptera found in Bukhara region.

	Families	Number of species	%
1	Scarabaeidae	17	24,2
2	Coccinellidae	6	8,5
3	Tenebrionodae	4	5,7
4	Meloidae	4	5,7
5	Chrysomelidae	6	8,5
6	Carabidae	12	17,1
7	*Elateridae*	2	2,8
8	Curculionidae	5	7,1
9	Cerambycidae	4	5,7
10	Dutisidae	1	1,4
11	Cyrinidae	1	1,4
12	Silphidae	4	5,7
13	Ipidae.	2	2,8
14	Buprestidae	2	2,8
	Total	70	100

In the Bukhara region, there are 2 leading families of Coleoptera with 12 or more species. The leading families of Coleoptera comprised 29 species (41.42%), the remaining 12 families comprised 41 species (58.58%). In the remaining families, the species are distributed as follows there are 2 families consisting of 6 species (Coccinellidae, Chrysomelidae), 1 family consisting of 5 species (Curculionidae), 3 families consisting of 4 species (Meloidae, Silphidae, Cerambycidae), 3 families consisting of 2 species (Ipidae, Buprestidae, Elateridae), 2 families consisting of 1 species (Dutisidae, Cyrinidae) (Table 3)

Table 3. Taxonomic composition of Coleoptera found in Bukhara region

Phylum	Class	Order	Family	Species
Arthropoda.	Insecta.	Coleoptera.	Scarabaeidae.	*Lethus rosmarus.*
				Polyphylla adspersa
				Oxythyrea cinctella
				Epicometis turanica
				Protaetia marginicollis
				Oxythyrea cinctella
				Protaetia turkestanica
				Stalagmosoma allbellum
				Protaetia agglomerata
				Scarabaeus sacer
				Synapsis tmolus
				Copris lunaris
				Copris hispahus
				Cetonia aurata
				Melolontha hippocostani
				Melonotha afflicta
				Rpicometis hirta
			Coccinellidae	*Ephilachna chrysomelina*
				Coccinella septempunctata
				Adalia bipunctata
				Coleomegilla maculata
				Hippodamia undecimnotata
				Propylea quatuordecimpunctata
			Tenebrionidae	Blaps halophile
				Pisterotarsa gigantea
				Opatroides punctulatus
				Dailognatha nasute
			Meloidae	Mulabris guad ripunctata
				Mulabris turkestanica
				Mulabris sedecimpimctata
				Mylabris frolove
			Chrysomelidae	Leptinotarsa desemlineata
				Chrysomela populi
				Galeruceia tenella
				Galierusella luteola
				Chrysomela menthastri
				Lema melonopus
			Carabidae	Calosoma sycophanta
				Cicindela deserticola

				Calosoma auropunctatum
				Scarites bucida
				Cicindela decempustulata
				Carabus campestris
				Amara aenea
				Amara ovata
				Cicindela turkestanica
				Anthia mannerheimi
				Zabrus morio
				Machozetus lehmann
			Elateridae	*Agriotes meticulosus*
				Cion cerambycinus
			Curculionidae	Anthonomus pomorum
				Sitobhilus granarius
				Sitona longula
				Phytonomus variabilis.
				Sitona cylindricollis
			Cerambycidae	Agapanthia dahi
				Prionus turkestanicus
				Dorkadion turkestanicum
				Aeolesthes sarta
			Dutisidae	Dytiscum marginais
			Cyrinidae	Gyrinus marinus
			Silphidae	Necrophorus investigator
				Necrophorus satanas
				Necrophorus humator
				Thanatophilus terminatus
			Ipidae.	Scolytus scolytus
				Scolytus rugolosus
			Buprestidae	Iulodes bucharica
				Iulodes variolaris

Beetles play a crucial role in the food chain in nature. Beetles are divided into diurnal and nocturnal, depending on what time of day they lead an active lifestyle. Flight, nutrition, and reproduction of diurnal beetles occur during the light period of the day. They differ from each other in that they find shelter and hide at dusk. Today, the data of the state cadastre of wildlife objects do not allow us to obtain accurate data on the total number of beetle species found in Bukhara region. Therefore, it is advisable to carry out practical work in this direction.

Periodic changes in the number of Beetle populations are associated with the change of seasons. Unusual changes in beetle populations are observed as a result of a reduction in food sources due to natural adverse environmental conditions, namely drought, severe winter frosts and high temperatures in the summer season. In recent decades, related to human economic activity in the territories where our observations were conducted, the formation of settlements in the desert zone of the region, the laying of automobile and railway networks, excessive grazing of livestock around reservoirs in the desert, on pastures are the reason for the reduction in the number of beetles in the region[1;22].

5 Conclusion

The study of Hymenoptera beetles in Bukhara region, the creation of their cadastre, and constant monitoring are important for the protection of species of practical importance. Activities to study the diversity, systematic analysis, and dynamics of the beetle population are being carried out in order to preserve the beetle world. The study of Hymenoptera beetles in Bukhara region is important for assessing the state of their populations and identifying trends in their changes, developing recommendations on ways to preserve rare and endangered species. The development of territories where rare and rare beetles are common in nature, the use of vegetation there for livestock, the development of industry make such resources of nature non-renewable. The preservation and protection of them, as well as the reproduction of their species, is our duty for future generations.

References

1. Rayimov A.R. Turaev.M, Azizova.N, Turayeva.N., Taxonomic analysis of the species composition and fauna of fish caught in the watery areas of Bukhara region Ural Environmental Science Forum “Sustainable Development of Industrial Region” Chelyabinsk, Russia, April 25-28, 2023 P.1-6
2. A.R. Rayimov , Sh.B. Bakayeva, D.S. Kalandarova, Ecological groups of mammals found in Bukhara region and adjacent areas E3S Web of Conferences 538, 03008 (2024) https://doi.org/10.1051/e3sconf/202453803008 IPFA 2024
3. A.R. Rayimov, M.D. Normurodov, Systematic analysis of butterflies in Bukhara region BIO Web of Conferences 93, 01027 (2024) https://doi.org/10.1051/bioconf/20249301027Forestry Forum 2023
4. A.R. Rayimov, M.D. Qoilova, J.R. Raximov, Species composition of non-hunting fish in Bukhara region E3S Web of Conferences 538, 03011 (2024) https://doi.org/10.1051/e3sconf/202453803011 IPFA 2024
5. A.R. Rayimov, M.M. To‘raev, U.I.Ismoilova, Ecological Groups Of Mammals In Bukhara Region And Adjacent Territories European Journal of Molecular Clinical Medicine ISSN 2515-8260 Volume 09, Issue 07, 2022.P.9506-9515
6. A.R. Rayimov, M.M. Turaev, B.F. Aripov, Ecological groups of reptiles found in Bukhara region, BIO Web of Conferences 93, 01026 (2024) https://doi.org/10.1051/bioconf/20249301026 Forestry Forum 2023
7. A.R. Rayimov, R.R. Raxmonov, B.O. Komilova, Ecological and ethological features of Acridotheres tristis during reproductive phase E3S Web of Conferences 538, 03007 (2024) https://doi.org/10.1051/e3sconf/202453803007
8. A.R. Rayimov1, M.D. Normurodov . Systematic analysis of butterflies in Bukhara region BIO Web of Conferences 93, 01027 (2024) https://doi.org/10.1051/bioconf/20249301027
9. A.V. Ivanov, “New Data on the Beetle Fauna of the Families Hister idae and Tenebrionidae and the Superfamily Scarabaeoidea of Ustyurt State Natural Reserve, Kazakhstan,” Euroasian Entomological Journal 11, 223–235 (2012)
10. Bouchard, P., Bousquet, Y., Davies, A., Alonso-Zarazaga, M., Lawrence, J., Lyal, C., Newton, A., Reid, C., Schmitt, M., Slipinski, A. and Smith, A., Family-Group Names In Coleoptera (Insecta). ZooKeys, 2011. 88, pp.1-972.
11. Bouchard, P., The Book Of Beetles. Chicago: The University of Chicago Press. 2014.

12. Davletshina, A.G., “Species Composition and Distribution of Tenebrionidae in Biotopes of South-West KyzylKumy,” Zoologicheskii Zhurnal 46, 524–533 (1967).
13. G.G. Jacobson Die Käfer Russlands und West Europas. Ein Handbuch zum Bestimmen der Käfer. A. F. Devriena, S.-Peterburg’, 1915: pp. 865-1024.
14. https://insects.space/ru/
15. https://play.google.com/store/apps/detailsid=ua.agrosoftex.determinant2&hl=ru
16. https://www.insectidentification.org/bugfinder-start.asp
17. R. Kuldoshev et al., E3S Web of Conferences 371. 05069 (2023)
18. R. Qo’ldoshev et al., E3S Web of Conferences 538. 05017 (2024)
19. R. Qo’ldoshev et al., E3S Web of Conferences 538. 05042 (2024)
20. Hamroyev, H. Jumayeva, E3S Web of Conferences 420. 10007 (2023)
21. Kuldoshev R., Rahimova M. Region important directions for developing students’ ecological education and thinking //E3S Web of Conferences. – EDP Sciences, 2024. – T. 549. – C. 09028.
22. Qo’ldoshev R., Dilova N., Hakimova N. Guiding left-handed students to a healthy lifestyle during the period of adaptation to school education //BIO Web of Conferences. – EDP Sciences, 2024. – T. 120. – C. 01049.
23. Dilova N. et al. The methodological principles for developing environmental education in the republic of Uzbekistan //E3S Web of Conferences. – EDP Sciences, 2024. – T. 538. – C. 05001.