

On the Diversity of Beetles in the Baghdad Campus, Islamia University of Bahawalpur, Pakistan

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ABSTRACT

Coleoptera fauna in Baghdad Campus was investigated from July 2020 to April 2021. Three habitats included inter dunal sandy area, core desert area, and area in and around the hostel which have been named as H-1, H-2 and H-3 respectively. Techniques like hand picking, plant jerking and pitfall trapping were adopted for sampling in order to explore distribution and diversity of Coleoptera fauna. 1037 samples were collected and preserved in 70% alcohol. Samples were identified on the basis of morphological characters by using bug guide. 7 families and 16 genera were sorted out. The family Tenebrionidae include the genera *Blaps*, *Eleodes*, *Pimelia*, *Gonocephallu*, and *Eusattus* was present. The family Coccinellidae includes genera *Coccinella* was also found. The family Carabidae includes *Anthia*, *Scarites* and *Calosoma*. The family Elateridae, Carculionidae, and Chrysomelidae contains genera *Agriotes*, *Rhynchophorus*, and *Altica* respectively. The Family Scarabaeidae contains the *Thyce*, *Heteronychus*, *Tomarus*, *Phyllophagaa* genera. In total count, maximum diversity and abundance of *Altica* was reported. Genus *Anthia*, *Scarites*, *Agriotes*, *Rhynchophorus*, *Heteronychus*, and *Tomarus* were found in minimum but equal number. In habitat-3, maximum diversity was observed as compared to other habitats. It is concluded that these findings seemed to be helpful in ecological management of the beetles.

KEY WORDS: OLEOPTERA, MORPHOLOGY, DIVERSITY, ABUNDANCE, ECOLOGICAL MANAGEMENT.

INTRODUCTION

Coleoptera is an order of insects commonly called beetles. The word “coleoptera” is derived from two Greek words; *kelos*, meaning “sheath” and *pteron*, meaning “wing” so called “sheathed wing”. The reason for naming is that most beetles have two pairs of wings. The front pair is known as “elytra” which is hard and thick like a sheath. It is for protection of rear pair and for the rear part of body (Hunt et al. 2007; Wagner et al. 2021). In animal kingdom, Coleoptera is the largest order (Nieto and Alexander 2010). This order has more species than any other order, consisting of almost 25% of all known life forms (Ruchin et al. 2021). Identified and described species of beetles are about 40% (about 400,000 species) and new species are also being discovered. According to some estimates, the total number of species are as high as 100 million (Ruchin et al. 2021).

Beetles are adorned with bright metallic coloration. Though, they may also be dull black or brownish. Some are gorgeously coloured like ladybugs (García et al. 2021). In size, they range from the smallest (10.25 mm) to the largest

(cerambycids 150 mm long). The beetles have variations in their habitats. They have wide range of distribution and adaptations. They exist in soil, stored grains, humus, rotten wood, flowers, decaying organic matter, furniture, bark of trees and museum specimens; some are also present in water and near water (Rossa and Goczał 2021).

Approximately, $\frac{3}{4}$ of beetle species feed on plants in both immature and mature stages. Beetles are important as they play vital role in the ecosystem. Some beetles act as decomposers in ecosystem. They feed on dead plants and fungi (Bug guide). Most of them destroy crops, forests, and other economically important plants. Thus, the beetles are known as pest (Souza et al. 2021). However, members of subfamily Epilachninae feed on plants and are considered as serious pests of important agricultural crops like pea and sunflower (Ćurčić et al. 2021). Some beetle species are invasive. They have capacity to destroy 30.3% of the urban trees (Nowak et al. 2001). The beetle’s capability to attack multiple genera of healthy hardwood trees could intensely change urban and forest ecosystems. Initially, precise recognition of this invasive pest is important to determine swarms before they become unmanageable (Biffi et al. 2021).

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Beetles are not only pest but also beneficial. They have a role in controlling the populations of pests. One of the well-known examples is the ladybug (family: Coccinellidae). Both the larvae and adults eat aphids and soft bodied insects to assist in regulating pest population. Some feed on mealybugs and insects (Biffi et al. 2021).

If food is less available, they may feed on other sources like nectar (Brown et al. 2010; Ćurčić et al. 2021). Beetles have ability to mimic for their protection. Mimicry provides one of the clearest examples of significance of natural selection (Banerjee 2014). The mimetic system is being investigated on different levels. It includes the hereditaries and evolution of warning coloration and the factors causing distastefulness. Discrepancy in chemical defense as a result of individual differences in physiology, rather than differences in the host plant, has been less investigated. It was due to the trouble normally experienced in precise quantifying toxic components (Wang et al. 2021).

MATERIAL AND METHODS

Abundance and species richness of beetles were studied in three different habitats of Baghdad-ul-Jadeed Campus, The Islamia University of Bahawalpur. The experimental sites were named as Site H-1, interdunal sandy area near human

habitation, Site H-2, core desert area and Site H-3, area in and around hostel. The field survey was carried out on weekly basis from July 2020 to April 2021. In experimental habitats, beetles were collected by hand picking, trapping through pitfall and plant jerking techniques. Hand picking was done for random picking of beetles in selected sites and plant jerking was used to capture beetles from flowers. After collection, the experimental samples were preserved by using 10% formalin solution or 70% ethanol. The specimens were identified on basis of morphometric characters. It was done by using online keys, diagrams, and the bug guide. Shannen's weiner and Simpson's diversity index is calculated for the available research data in MS. Excel.

RESULTS AND DISCUSSION

Mean temperature and rainfall were observed during study period. Highest temperature was noticed in July i.e., 92°F and minimum temperature was in January i.e., 54.5°F (Accweather). The sites showed maximum diversity in June and July (monsoon season). This season is resourceful and fortunate for growth and survival of Coleoptera fauna. It is true that insects avoid harsh winter through diapause, thus diversity of beetles in all sites are least in winter months. (Banerjee 2014). Similar results were found in the present research.

Table 1. Distribution of Coleoptera in different habitats of Baghdad Campus, Bahawalpu

Class	Order	Family	Genera	H-1	H-2	H-3	Total
Insecta	Coleoptera	Tenebrionidae	<i>Blaps</i>	33	17	4	54
			<i>Eleodes</i>	1	1	0	2
			<i>Pimelia</i>	30	15	4	49
			<i>Gonocephallum</i>	1	0	3	4
			<i>Eusattus</i>	128	65	36	229
		Coccinellidae	<i>Coccinella</i>	4	1	60	65
		Carabidae	<i>Anthia</i>	1	0	0	1
	<i>Scarites</i>		0	0	1	1	
	<i>Calosoma</i>		0	0	30	30	
		Elateridae	<i>Agriotes</i>	0	0	1	1
		Carculionidae	<i>Rhynchophorus</i>	0	0	1	1
		Chrysomelidae	<i>Altica</i>	363	154	67	584
		Scarabaeidae	<i>Thyce</i>	0	0	10	10
			<i>Heteronychus</i>	1	0	0	1
			<i>Tomarus</i>	0	0	1	1
			<i>Phyllophagaa</i>	0	0	4	4
Shannon's Weiner Diversity Index				1.07	1.00	1.75	
Simpson's diversity index				0.45	0.46	0.21	
Dominance Index				0.54	0.53	0.78	
Number of individuals							1037
Number of genera							16

The field survey was carried out from July 2020 to April 2021. During this period, 1037 samples of Coleoptera fauna were collected from three habitats like H-1, H-2, and H-3. After identification, 1037 samples were comprised of 1 order,

7 families and 16 genera. In total count, maximum diversity of genus *Altica* was found and *Anthia*, *Scarites*, *Agriotes*, *Rhynchophorus*, *Heteronychus* and *Tomarus* showed minimum but almost equal diversity. Genus *Blaps* is present

in different habitats of Baghdad Campus, Bahawalpur. From July 2020 to April 2021, 33 individuals from habitat-1, 17 from habitat-2 and 4 from habitat-3 were collected. Total number of collected beetles was 54. Maximum number was seen in habitat-1 and minimum in habitat-3. Genus *Eleodes* samples during collection period were 1 in habitat-1, 1 in habitat-2 and none in habitat-3. Total number of sampled beetles in all habitats was 2. Maximum number was reported in habitat-1 and habitat-2. 30 individuals of genus *Pimelia* were captured from habitat-1, 15 individuals from habitat-2. Its 4 individuals were present in habitat-3. Total samples were 49. Its maximum number was found in habitat-1. Minimum distribution was observed in habitat-3 (Biffi et al. 2021).

Genus *Gonocephallum* belongs to family Tenebrionidae and its collected individual was only 1 in habitat-1. None was found in habitat-2. 3 samples were collected from habitat-3. Total number of reported beetles was 4. Its maximum number was found in habitat-3. Genus *Eusattus* is from the family Tenebrionidae and total number of reported specimens was 129. 128 beetles were present in habitat-1, 65 in habitats-2 and 36 in habitat-3. Maximum number was observed in habitat-1 and minimum number was in habitat-3.

It was the second largest genus reported during research conduction. Genus *Coccinella* belongs to the family Coccinellidae. 4 samples were found in habitat-1, 1 ladybird was seen in habitat-2 and 60 samples were collected from habitat-3. Total 65 ladybirds were collected in selected sites. Maximum number was seen in habitat-3 and minimum number in habitat-2. Genus *Anthia* is carabid beetle in the family Carabidae. Only one sample was sorted out from habitat-1. No beetle was captured from habitat-2 and habitat-3 during research period. Genus *Scarites* belongs to the family Carabidae. No beetle was found in habitat-1 and habitat-2. Only one beetle was collected from habitat-3. Its reported individuals were minimum during research conduction. Beetles of the genus *Calosoma* were found in only habitat-3. Total numbers of samples reported were 30 from habitat-3. No beetle was seen in habitat-1 and habitat-2. It was in minimum number during the study period.

Genus *Agriotes* is from the family Eleteridae. It was only observed in habitat-3. Only 1 sample was present in habitat-3. No beetle of this genus was found in habitat 1 and habitat-2. Genus *Rhynchophorus* belongs to the family Carculicidae. Only one weevil was sorted out in habitat-3 during research period. It was absent in both habitat-1 and habitat-2. Genus *Altica* belongs to the family Chrysomelidae. 363 individuals were collected from habitat-1 during the field observations. 154 individuals in habitat-2 and 67 individuals in habitat-3 were found. Maximum individuals were reported in habitat-1. Minimum number was reported in habitat-3. It is the largest genus sorted out during research conduction in Baghdad Campus, Bahawalpur. Genus *Thyce* is placed in the family Scarabaeidae. It was absent in habitat-1 and habitat-2. 10 individuals were reported in habitat-3. Total samples of this genus were 10 during collection period (Biffi et al. 2021; Souza et al. 2021).

Genus *Heteronychus* belongs to family Scarabaeidae. It was found in habitat-1 only. Sample collected from habitat-1 was 1. It was absent in habitat-2 and habitat-3. The family scarabaeidae also includes genus *Tomarus*. Only one beetle was observed in habitat-3. None was found in habitat-1 and habitat-2. Genus *Phyllophaga* is also included in the family Scarabaeidae. It was absent in habitat-1 and habitat-2. Its samples sorted out from habitat-3 were 4.

CONCLUSION

The present research has been conducted for taxonomic understanding of Coleoptera fauna in Baghdad Campus, Bahawalpur. After identification, 1037 samples were comprised of 1 order, 7 families and 16 genera. In total count, maximum diversity of genus *Altica* was found and *Anthia*, *Scarites*, *Agriotes*, *Rhynchophorus*, *Heteronychus* and *Tomarus* showed minimum but almost equal diversity. All identified genera are affected by type of vegetation, temperature and rainfall.

Conflict of Interest: There is no conflict of interest

Data Availability Statement: The database generated and/or analysed during the current study are not publicly available due to privacy, but are available from the corresponding author on reasonable request.

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