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Research Article

Diversity and abundance of zoophagous insects in and around Islamia University campus, Bahawalpur, Punjab, Pakistan

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Abstract

Zoophagous insects constitute a major part of predatory fauna. Predators either generalist or specialist plays an important role in maintaining the natural balance of an ecosystem. Insects belonging to different orders viz. (Odonata, Coleoptera, Diptera and Hymenoptera) either present on the ground or on leaves were collected from Baghdad-ul-Jadeed campus. The insects were collected from different habitats as (desert area, vegetation, landscapes, crop fields and grassy lawns). Specimens were captured by direct hand picking, with the help of hand nets and automatic sifters. Later they were preserved in solution (Alcohol + few drops of Glycerin). Statically the taxonomic status was determined with the help of available literature in keys and online web sites. These findings seemed to be helpful in ecological management of the ecosystem.

Keywords: Insects, zoophagous, diversity, abundance.

INTRODUCTION

Insects are a class of living creatures within the arthropods that have a chitinous exoskeleton, a three-part body (head, thorax, and abdomen), three pairs of jointed legs, two compound eyes, and two antennae (Wilson, 2009). In a world of increasingly fragmented landscapes where species diversity is additionally threatened by climate change, the effects of diversity on ecosystem processes become more and more relevant.

Species richness and abundance patterns of interacting insect groups are important factors influencing ecosystem processes. Agricultural intensification often reduces biodiversity and associated ecosystem functions, while trophic guilds can be differentially affected and contradictory effects have been found in different regions (Rothenwohrer et al., 2011).

Insects can be found in every environment on our planet. Insects have adapted to a broad range of habitats, successfully finding their own niche, because they will consume almost any substance that has nutritional value. Insects perform a vast number of important functions in our ecosystem. They aerate the soil, pollinate blossoms, and control insect and plant pests; they also decompose dead materials, thereby reintroducing nutrients into the soil. Burrowing bugs such as ants and beetles dig tunnels that provide channels for water, benefiting plants. All insects fertilize the soil with the nutrients from their droppings (Wilson, 2002).

Insects play significant roles in the ecology of the world due to their vast diversity of form, function and life-style; their considerable biomass; and their interaction with plant life, other organisms and the environment. Since they are the

major contributor to biodiversity in the majority of habitats, except in the sea, they accordingly play a variety of extremely important ecological roles in the many functions of an eco-system (Gullan and Cranston, 2005).

MATERIAL AND METHODS

A preliminary survey was carried out to select the different habitats. At each locality two blocks of one acre each was selected for sampling of fauna. Field tour was initiated as per schedule from November 2011 to April 2012. Sweep net was used to sweep all types of adult and large arthropod present above the canopy of plants. Heavy duty muslin nets were used to sweep through vegetation forming a figure of eight. Direct hand picking and automated sifters were also employed to collect the fauna. All the specimens were preserved in laboratory grade Alcohol with few drops of Glycerin. The identification up to species level was done with the help of available, related taxonomic information and online electronic keys available on different websites and by the other zoological keys (Pocock, 1900). The trophic level of each species was confirmed from recent available online literature.

RESULTS

A total of six months were spent in the field for sampling and thirty three (33) species of arthropods were recorded. Overall six (6) species were captured from habitat one which belonged to order Coleoptera and Hymenoptera (Table 1). Among Coleoptera; *Calleida punctata, Coccinella septempanctuata, Coccinella larvae, Tenebrio* species and *Oxyporus occipitalis* were present. While order Hymenoptera consisted of only a single species *Camponotus pennsylvanicus*. From habitat two overall six (6) species were captured which belonged to order Coleoptera and Hymenoptera (Table 1). Among Coleoptera*; Carabidae species, Calleida punctata, Coccinella septempanctuata, Coccinella larvae and Oxyporus occipitalis*. While order Hymenoptera consisted of *Camponotus pennsylvanicus.* Overall eight (8) species were captured from habitat three which belonged to order Coleoptera, Hymenoptera and Odonata (Table 2). Among Coleoptera; *Calosoma species, Calleida punctata, Coccinella septempanctuata, Coccinella larvae, Tenebrio species, Oxyporus occipitalis*. Among Hymenoptera; *Camponotus pennsylvanicus;* while order Odonata consisted of only *Crocothemis erythraea*. Overall seventeen (17) species were captured from habitat four which belonged to order Coleoptera, Hymenoptera, Diptera and Odonata (Table 1). Among Coleoptera; *Calosoma species, Paranaemia vittigera, Calleida punctata, Coccinella septempanctuata, Coccinella larvae, Digitonthophagus gazelle, Eleodes armatus, Tenebrio molitor, Platydema rufficolle , Penthe pimelia, Hydrobius fuscipes.* Among Hymenoptera; *Camponotus pennsylvanicus* and *Polistes olivaceus*. Among Diptera; *Syrphus species, Syrphus baltetus* and *Musca domestica* while order Odonata consisted of only one species *Coenagrion puella*. Overall seventeen (17) species were captured from habitat five which belonged to order Coleoptera, Hymenoptera and Diptera (Table 1). Among Coleoptera; *Hippodamia variegata, Calleida punctata, Coccinella septempanctuata, Coccinella larvae, Cheilomenes sexmaculata, Scarabaeidae species, Tenebrio species, Oxyporus occipitalis, Eleodes osculans, Tenebrio molitor, Eutrophopsis bicolor and Sphaerius acaroides.* Among Hymenoptera; *Camponotus pennsylvanicus, Polistes olivaceus and Andrena pilipis*. While Diptera consisted of *Syrphus baltetus* and *Musca domestica.* Overall eighteen (18) species were captured from habitat six which belonged to three orders Coleoptera, Hymenoptera and Odonata. (Table 2). Among Coleoptera; *Anthia sexguttata, Paranaemia vittigera, Hippodamia convergens, Hippodamia variegata, Calleida punctata, Coccinella septempanctuata, Coccinella larvae, Tenebrio species, Oxyporus occipitalis, Melanocanthon bispinatus, Eleodes armatus, Penthe pimelia, Hydrobius fuscipes.* While Hymenoptera consisted of only one specie *Camponotus pennsylvanicus.*

Table 1. Distribution of insect fauna in different habitats of university campus

Class	Order	Family	Taxa	H 1	H 2	H 3	H 4	H 5	H 6	Total no.
nsecta	Coleoptera	Carabidae	*Anthia sexguttata*	0	0	0	0	0	22	22
			*Calosoma spp. **	0	0	23	25	0	0	48
			*Carabidae spp. **	0	21	0	0	0	0	21
			Calleida punctata	21	21	22	25	23	38	150
		Coccinellidae	*Coccinella septempanctuata*	26	25	31	35	48	95	260
			Coccinella larvae	22	31	24	32	47	33	189
			Paranaemia vittigera	0	0	0	44	0	21	65
			Hippodamia convrgens	0	0	0	0	0	32	32
			Hippodamia variegata	0	0	0	0	25	22	47
			Cheilomenes sexmaculata	0	0	0	0	18	0	18
		Scarabaeidae	*Scarabaeidae spp.**	0	0	0	0	21	0	21
			Digitonthophagus gazelle	0	0	0	24	0	0	24
			Melanocanthon bispinatus	13	11	22	31	30	24	131
		Tenebrionidae	*Eleodes armatus*	0	0	0	22	0	21	43
			Eleodes osculans	0	0	0	0	41	0	41
			Tenebrio molitor	0	0	0	31	21	0	52
			Platydema ruficolle	0	0	0	23	0	0	23
			*Tenebrio spp. **	22	0	21	0	21	23	87
		Tetratomidae	*Penthe pimelia*	0	0	0	21	0	32	53
			Eustrophopsis bicolor	0	0	0	0	42	0	42
		Hydrophilidae	*Hydrobius fuscipes*	0	0	0	13	0	21	34
		Staphylinidae	*Oxyporus occipitalis*	19	21	21	0	22	33	116
		Sphaeriusidae	*Sphaerius acaroides*	0	0	0	0	26	0	26
	Hymenoptera	Formicidae	*Camponotus pennsylvanicus*	35	46	21	41	56	73	272
			Camponotus discolor	0	0	0	0	0	21	21
		Andrenidae	*Andrena pilipes*	0	0	0	0	21	0	21
		Vespidae	*Polistes olivaceus*	0	0	0	22	24	26	72
	Diptera	Syrphidae	*Syrphus spp. **	0	0	0	21	0	0	21
			Syrphus balteatus	0	0	0	24	21	0	45
		Muscidae	*Musca domestica*	0	0	0	21	30	44	95
	Odonata	Libellulidae	*Crocothemis erythraea*	0	0	21	0	0	0	21
		Ceonagrionidae	*Odonata nymph*	0	0	0	0	0	19	19
			Ceonagrion puella	0	0	0	23	0	0	23
No. of individuals						2155				
No. of species						33				

Table 2. Shannon diversity index among different orders of class insecta sampled from university campus

Order	N0	H'	N1	N2	E5
Coleoptera	25	2.12	22.82	20.24	0.84
Hymenoptera	4	1.03	2.1	2.9	0.89
Diptera	3	1.02	2.02	2.87	0.81
Odonata	2	1	2.12	2.92	0.8

(N0=Number of species;N1= Lowest value;N2=Highest value;H'=Diversity; E5=Evenness)

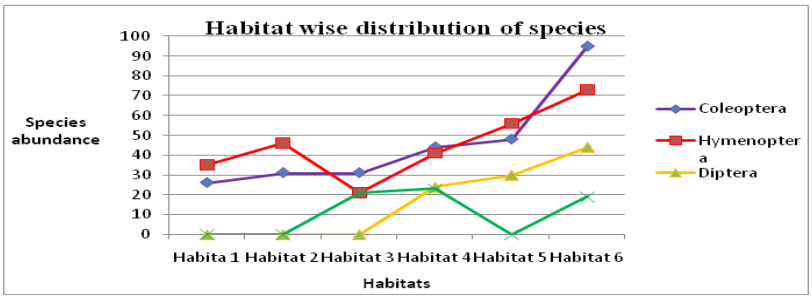

Figure 1. Habitat wise distribution of different faunal order in university campus

DISSCUSION

Biodiversity is generally a measure of the relative number and types of organisms present. When considering the effects of biodiversity on a system, two concepts are especially important to consider: stability and productivity (Schowalter, 2006). Most ecosystems tend to be highly disturbed. Common practices like tillage, planting, application of fertilizers and pesticides, irrigation, and harvest can cause temporary or longer-lasting changes in average environmental conditions that change the functioning of the ecosystem (Altieri et al., 2005).

No insect population exists as an isolated entity. Rather, at any location many populations of organisms interact to varying degrees in a community. Different species within an ecological community interact in a number of ways. In agro ecosystems, the study of trophic interactions is important with regard to pest management. Individuals of a population feed on, and in turn are fed upon other species (Tscharntke and Hawkins, 2004).

Trophic relations play a major role in structuring the natural communities and probably determine local species abundance (Arditi and Ginzburg, 1989). Coccinellids, the most widespread and abundant predators in many regions, are known for their strongest impact on aphid and/or jassid species(Hodeck and Honek, 1996). *Coccinella septempunctata*, *Cheilomenes sexmaculata* and *Hippodamia variegata* populations comprise major part of coccinellid predator species present in and around the croplands. Hymenopterans as ants and other wasp species are often viewed as the most devastating predators (Jeanne, 1975). Predation by ants and wasps seems to be highest in tropical regions, with ants together with birds being among the most important predators in the new world tropics and predatory wasps (especially hornets of the genus *Vespa*) becoming as important as ants in the old world tropics (Paine, 1992; Papazian, 1997; Garbutt, 1998).

CONCLUSION

Among different species, thirty three (33) zoophagous species were reported from different habitats of University campus from Nov 2011 to Apr 2012. Eighteen (18) species were reported in the month of November, 29 in December, 21 in January, 27 in February, 21 in March while twenty four (24) species were reported in April. Seven (7) species were reported in habitat 1, six (6) from habitat 2, nine (9) from habitat 3, eighteen (18) from habitat 4, eighteen (18) from habitat 5 and eighteen (18) from habitat 6. Twenty three (23) species belonged to order Coleoptera, four (4) species belonged to order Hymenoptera, three (3) belonged to order Odonata and remaining three (3) species belonged to order Diptera. Order Coleoptera was the dominant one in all habitats but Hymenoptera, Diptera and Odonata were also present. The value of Shannon diversity index (H') for different faunal order sampled from various habitats of university campus showed that Coleoptera Shannon Diversity Index (H') value was 2.12 while Evenness (E5) was 0.84. In case of order Hymenoptera Shannon Diversity Index (H') value was recorded as 1.03 while Evenness (E5) was 0.89. For order Diptera Shannon Diversity Index (H') value was recorded as 1.02 while Evenness (E5) was 0.81. For order Odonata Shannon Diversity Index (H') value was recorded as 1 while Evenness (E5) was 0.8. These evenness values were in agreement with (Magurran, 1988).

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