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Research Article

Studies on population diversity of beetles fauna in district Bahawalpur

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Abstract

The present studies were carried out aiming to investigate the population diversity of beetles' fauna in district Bahawalpur. Five different types of habitats namely, Interdunal sandy area, Interdunal clayey area, Sand dunes, Grassy plots and Area inside-outside residencies were sampled using 50 pit fall traps which were operated on weekly basis. A total of 507 specimens representing five families Carabidae, Tenebrionidae, Scarabaeidae, Coccinellidae, Elateridae and twelve genera *Anthia, Brachinus, Scarites, Calosoma, Blaps, Tentyria, Pimelea, Onthophagus, Tomarus, Thyce, Coccinella and Agriotes* were recorded. Overall diversity was 86% and 88% on Simpson scale and Shannon scale respectively. The highest similarity index (0.66) was found between the site Interdunal sandy area and Sand dunes.

Key words: Beetle, Simpson scale, Shannon scale, Bahawalpur.

INTRODUCTION

Coleoptera is the largest order of insects (Borer et al., 1984) with more than 350,000 known species and new species. The coleoptera is largest order in the animal kingdom (Nieto and Alexander, 2010).The beetles vairy considerably in habits, wide distribution and countless adaptation. In size they range from the minutest (10.25 mm) to the largest (cerambycids 150 mm long).They occur in soil, humus, rotten wood, decaying organic matter, in timber, furniture and museum specimens; some are aquatic, some littoral and other infest stored products. Beetles are known for their bright metallic coloration though they may also be dull black or brownish (David and Ananthakrishnan, 2006).

Order coleoptera is divided into four suborders viz. Archostemata, Myxophaga, Adephaga and Polyphaga. Suborder Archostemata include two families followed by Cupedidae (reticulated beetles) and Micromalthidae (micromalthid beetles). Suborder Myxophaga includes only super family Sphaerioidae with four families. Suborder Adephaga includes single super family Caraboidea which includes nine families. Suborder Polyphaga includes 18 super families which further divided into different number of families (David and Ananthakrishnan, 2006).

Beetles play important role in ecosystems. Prominent epigeal examples are the Tenebrionidae that play an important role as primary Decomposers (Henschell et al., 2010).Different beetles are beneficial for us. Carrion beetles feed on dead and decaying material and help in decomposition cycle. Scientific literature on beetles of Pakistan already reported by (Rafi et al., 2010) on tiger beetle, (Sultan et al., 2008) on tortoise beetle, (Darilmaz and Ahmed, 2009) On (Coleoptera :Dytiscidae).

District Bahawalpur lies from 29°23' to 30°-22' north latitudes and 71°-39' east longitudes. The climate of the area is an arid, high temperature, low relative humidity, high rate of evaporation (Farooq et al., 2010). It ranges from extreme hot in summer when the temperature may exceed 50ºc. The rainfall in the area are irregular between 100 to 250 mm occurring mostly during monsoon July to September (Akbar and Arshad, 2000). Unfortunately the area has been facing severe drought conditions for the last several years. The prolong drought has significantly affected the ecology of the area both directly (poor years of grass and herbs production following monsoon) and indirectly consumption of already limited natural resources by human – being and livestock (Sial and Arshad, 2003).Four seasonal breakups occur in the

area i.e. Winter (Nov-Feb), Spring (March-April), Summer (May-Aug), Autumn (Sep-Oct).

No work have been reported on beetle's faunal diversity from Bahawalpur region. The present was aimed to investigate beetle's population diversity from this region.

MATERIALS AND METHOD

Selected Habitat types

1. Interdunal sandy area
2. Interdunal clayey area
3. Sand dunes
4. Grassy plots, and
5. Area inside-outside residencies

A total 10 pitfall traps were set in each sampling site separated by 2 m distance. These traps were set in the ground, leaving an opening on the soil surface, and operated on weekly basis.70% alcohol with few drops of glycrine.
Identification was done on the basis of morphometric characters of various body parts of specimens, and by using identification keys (Borer et al., 1984; Andrews, 1929; Watt, 1974; Endroidi, 1985; Sasaji, 1971; Arnett et al., 2002).

Data analysis

Population diversity was determined by using diversity indices i.e., the Shannon index of diversity (SHDI, see Shannon and Weaver, 1949), Simpson index (SIDI, see Simpson, 1949), Hill's indices (1973) and Sorenson (1948). These indices were used to describe species abundance relationships in communities. Diversity is composed of two components: (1) richness (the total number of species) and (2) evenness (how the abundance data are distributed among the species). Different types of diversities described on these indices are as below:

1) α-diversity
Simpsons index: $D=\Sigma\ pi^2$
Shannon's indices of diversity and evenness: $H=-\sum (Pi\ In\ Pi)$
Equitability or evenness: H/ In S
Hill's indices
N0= It indicates no. of species
N1 = eH
N2 = 1/D
Evenness: N2-1/N1-1

2) β-diversity
Sorensen Similarity index: $\beta= 2C/ S1+S2$
Where,
S1= the total number of species recorded in the first community
S2= the total number of species in the second community
c= the number of species common to the both communities.

RESULTS AND DISCUSSION

A total of 507 specimens of beetles represented by five families, 11 subfamilies,12 genera and 12 species (Table- 3) was captured during present study from selected study sites. Five species were found most abundant and comprised 72.56% of the total sample. The abundance of *Tentyria* sp and *Pimelia* sp. was 26.03% and 15.38% respectively. Contribution of *Coccinela septempunctata, Branchinus* sp. ,and *Tomarus* sp. was 11.83%, 11.04% and 8.28% respectively. The remaining 7 species were comparatively less common and contributed approximatively 27.39% of the total sample.

The present relative abundance of the beetle families collected from the selected study sites for the one year is given in (Figure 2). Family Tenebrionidae was relatively more diverse (44.35%) followed by Carabidae (24.84%), Scarabaeidae (14.58%),Coccinellidae (11.83%) and Elateridae (3.35%).

Table 1. Diversity indices of number of individual of different Beetles species

Species	No. of individual	Percentage	Pi	Simpson's index pi2	Shannon's index Pi(In pi)
Anthia sp.	33	6.5	0.065	0.0042	0.1757
Branchinus sp.	56	11.04	0.1104	0.0122	0.2432
Scaritus sp.	5	0.98	0.0098	0	0.0453
Calosoma sp.	32	6.31	0.0631	0.0039	0.1743
Blaps sp.	20	3.94	0.0394	0.0016	0.1274
Tentyria sp.	132	26.03	0.2603	0.0677	0.35
Pimelia sp.	78	15.38	0.1538	0.0234	0.2879
Onthophagus sp.	17	3.35	0.0335	0.0011	0.1137
Tomarus sp.	42	8.28	0.0828	0.0068	0.2062
Thyce sp.	15	2.95	0.0296	0.0009	0.1042
Coccinella sp.	60	11.83	0.1183	0.014	0.2525
Agriotes sp.	17	3.35	0.0335	0.0011	0.1137
	507	100	1	D=0.1368	H=2.1941
				1-D=0.8632	

E.H/InS=2.1941/2.4849
=0.8829

Table 2. Diversity indices for Different Sites

Indices	Site A	Site B	Site C	Site D	Site E
Diversity N1	3.57	2.7	3.54	3.7	5.27
N2	1.44	1.67	1.6	1.4	1.26
Richness Nθ	4	3	5	4	6
Evenness	0.17	0.39	0.23	0.14	0.06

Table 3. Abundance of Beetles Families collected from five different sites

Family Species	Total Abundance	Percent of Total
Carabidae		
Anthia sp.	33	6.50
Branchinus sp.	56	11.04
Scaritus sp.	5	0.99
Calosoma sp.	32	6.31
		24.84
Tenebrionidae		
Blaps sp.	20	3.94
Tentyria sp.	132	26.03
Pimelia sp.	78	15.38
		44.35
Scarabaeidae		
Onthophagus sp.	17	3.35
Tomarus sp.	42	8.28
Thyce sp.	15	2.95
		14.58
Coccinellidae		
Coccinellaseptempunctata.	60	11.83
Elateridae		
Agriotess sp.	17	3.35
Total	507	

Overall diversity of beetles worked out on the basis of number of beetles from five different Sites of Baghdad-ul-jadeed campus (Table 1). Using Simpson's (1949) equation of c (index of dominance), a value 0.137 was obtained for the beetles communities in the study area. The Shannon's Index value of 2.1941 was obtained. Tentyria sp. with a value of 0.0677 (Simpson's index) and 0.350 (Shannon's Index) was the dominant sp. The overall beetles diversity (1-D=0.8632) on Simpson's scale was 86 % and on the Shannon scale (H/In S =0.8829) is 88% (Table 1).

The data of beetles collected from different five Sites was also combined to work out alpha diversity. To study the relationships between species numbers and abundance in each site samples, richness, diversity and evenness indices were used. For diversity, Hill's diversity indices viz., N1 and N2 were employed. Hill's diversity indices were calculated as a measure of diversity within the habitat .The trapping efforts being the same in all the habitats, the total number of species in the sample (Nθ) was used as a measure of richness. For measuring evenness, modified Hill's ratio (E) was

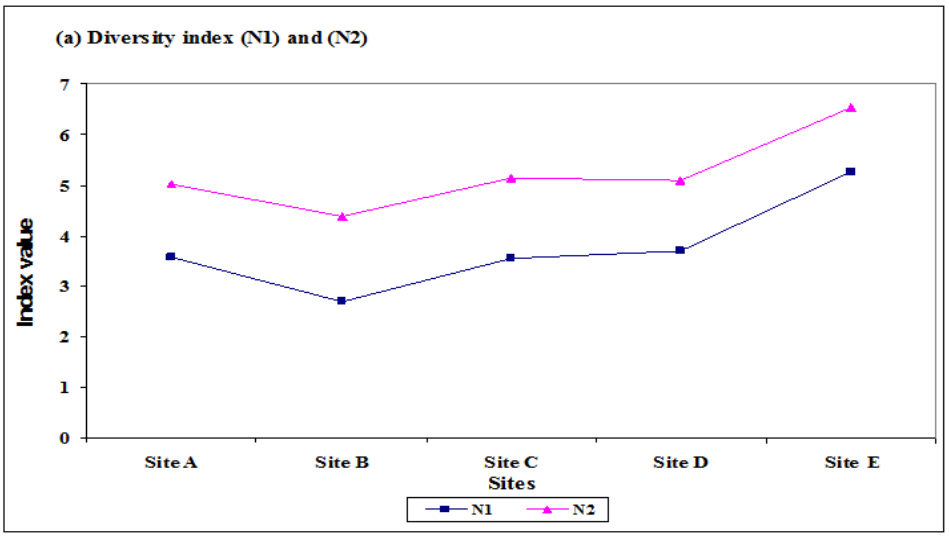

Figure 1. Changes in Diversity (N1), (N2) and evenness indices values in different sites

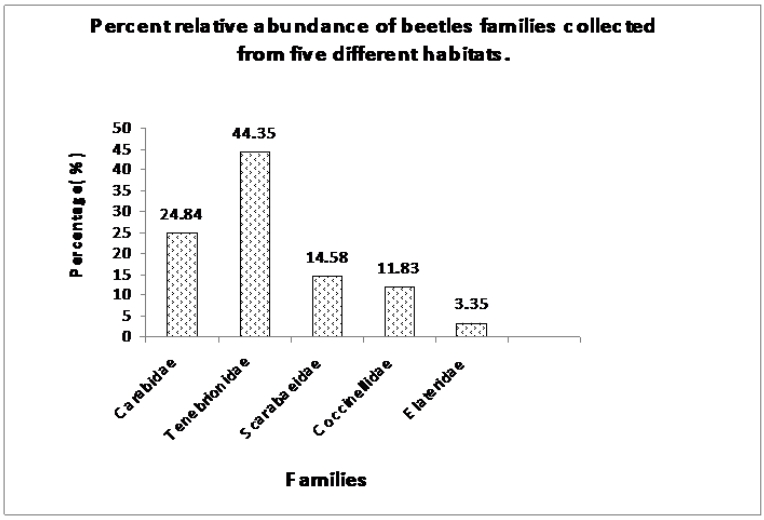

Figure 2. Abundance of Beetles Families collected from five sites

computed (Table 2).

In (Figure 1) the Hill's diversity number (N1) indicated that site "E" was relatively diverse (5.27) followed by site "D" (3.7), site "A" (3.57), site "C" (3.54) and lastly the site "B" (2.7). Modified Hill's ratio (evenness) indices also revealed almost the same order.

Beta diversity (Diversity between pair of different Sites) are given in (Table 2). For the comparison of diversity between Sites, Sorenson's Similarity Index was calculated. The index indicated 66% of similarity between the site "A" and "C". 57% similarity was observed between the site "A" and "B". Similarity between site(C-D), (D-E), (B-C) and (C-E) was at minimum. No similarity present between site (A-D), (A-E), (B-D) and (B-E).

Present results that Tenebrionidae (44.35%) was found to be the most dominant species contradict to the findings of (Tripathi et al., 2008) that tenebrionidae abundant with rate (37.23 %) due to abundant sandy and clayey patches and extensive shrub cover present in the study area. Tenebrionidae was the most dominant species in sandy and clayey patches and in most of the area uncultivated covered with shrubs. Sand component was reported to be an important factor affecting tenebrionid distribution (Thomas,1983; Ayal and Merkl, 1994). The abundance and diversity of Tenebrionidae were higher in uncultivated than in cultivated areas (Aldryhim et al., 1992).Shrub cover creates suitable microclimatological conditions (Hadley, 1970), protects (Ayal and Merkl, 1994) and provides beetles with food due to the detritus accumulation under shrubs.

No work has been done in the past on diversity indices regarding proportion of beetles in Said area. A higher value of diversity index predicts a higher diversification among the relative proportion of species population on the basis of Simpson scale, diversity was 86% and on Shannon scale was 88%.

The present result also yielded comparison between beetle species diversity in different sites. It provides useful information about diversity of beetles in the said area. The results show that different Beetles species inhabited different sites. It indicates the habitat specific occurrence of beetles, which may be due to food preferences, etc.

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