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Insect Biodiversity in Karkheh Wild Life Refuge, SW Iran

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ABSTRACT

A study of the insect biodiversity was performed in Karkheh Wild Life Refuge, SW Iran. Insects were collected during May to October in 2010 to determine their diversity, species richness and evenness. Species were sorted into morphospecies and classified to the lowest taxonomic level possible. A total of 2207 specimens were captured using different sampling methods e.g., netting, beating, hand picking, and trapping. Specimens belong to 100 species, 47 families and 13 orders of insects. Based on the data collected, Coleoptera, with 32 species and highest diversity index of H' = 0.318, were the most diverse and abundant order among collected insects. The staphylinid beetle *Achenium debile* (Erichson) was dominant species, with relative abundance of 23.9%. The bug *Pyrrhocoris apterus* Linnaeus was ranked as second dominant species, with relative abundance of 8.4%. Dermaptera and Ephemeroptera, each of them with 1 species, had the least species number compare to other orders. The overall insect biodiversity indices of Shanon-Wiener and Simpson were 3.286 and 0.91, respectively. Evenness was 0.7, using Pielou's index. Overall biodiversity indices show relatively high biodiversity in the area. These data provide a baseline for other studies on wild life refuges of SW Iran.

Key words: Insect biodiversity, dominant species, Karkheh wild life refuge, Iran

INTRODUCTION

Threats to biodiversity are global and are usually a direct result of human impact that contributes to reduction of genetic diversity through habitat loss and fragmentation as a result of increased human development. Biodiversity studies are needed to monitor such impacts.

More than half of the world's known animal species are insects (Wilson, 1992). Insects play a vital and often central role in ecosystem functioning and define the complex nature of biodiversity and their condition is indicative of ecosystem health (Jana *et al*., 2006). Biological diversity is now recognized increasingly as a vital parameter to assess global and local environmental changes and sustainability of developmental activities (Lovejoy, 1995). There is a contemporary trend to use arthropod species, especially insects, as more appropriate indicator taxa (Samways, 1990).

There are few studies on insect biodiversity in SW Iran: e.g., Soleimannezhadian (2009) showed that planting strips of alfalfa around sugarcane fields could increase biodiversity indices and resulted in reduction of the damages caused by *Sesamia* spp. (Lep.: Noctuidae) in Khuzestan. In

the other research studies on Thysanoptera in wheat fields of Khuzestan revealed that due to high diversity of this order and interspecific competition, thrips species can not outbreak in the mentioned wheat fields (Ramazani, 2010).

Karkheh Wild Life Refuge (KWLR) is located in the west of Khuzestan Province (SW Iran) along Karkheh River and encompasses over 13000 ha. This area is excessively hot and dry in the summer and the annual average rainfall does not exceed 300 mm. KWLR possesses green and thick plantations which contain *Populus* spp., *Tamarix* spp. and *Lycium* sp. Such dense forests have suitable habitat condition by which conserve the diversity of wild life. KWLR has an important role in the ecology and biodiversity of the region. It is the habitat of Persian Fallow Deer, *Dama mesopotamica* (Brooke) which is nearly extinct today (Shalbaf, 2011). At present, 30 Persian Fallow Deer are keeping in a 70 ha protected site. The aim of this survey was to calculate diversity, species richness and evenness of insect fauna at the habitat of Persian Fallow Deer. There was no data on insects of KWLR before our study.

MATERIALS AND METHODS

Study area: This study was carried out at the protected site of Persian Fallow Deer (70 ha), which is located at Karkheh Wild Life Refuge (KWLR), at approximate coordinates of 31° 55' N 48° 15' E. The main vegetations of the area are *Populus* sp., *Tamarix* sp., *Lycium* sp., dewberries and grasses of different types.

Sampling plan: Sampling was conducted during April to September 2010, twice a month: a two hours a day sampling and one hour a night sampling. Sampling methods were non-specific according to Southwood (1978): netting, beating, hand picking and trapping (pitfall and light traps). Netting was carried out with a 30 cm net swept over the topmost 20-30 cm of vegetation (grasses, low shrubs, etc.).

Material identification: Specimens were sorted and identified to the lowest taxonomic level possible, based on available resources and keys but at least to family level. Samples were sorted to recognizable taxonomic units, RTUs according to Oliver and Beattie (1993). A total of 100 morphospecies belonging to 13 orders and 47 families were separated.

Data analysis: All the metrics were calculated using the Species Diversity and Richness software (SDR), version 3.0 (Pisces Conservation) (Henderson and Seaby, 2002). The following diversity indices were used to describe the insect diversity at the study area according to Magurran (2004), one is the Shannon-Wiener index:

$$H = \Sigma(pi - \ln(pi))$$

where, pi is the proportion of individuals of ith species and the other is Simpson's:

$$1\text{-}D = 1\text{-}\Sigma[ni\ (ni\text{-}1)/N\ (N\text{-}1)]$$

where ni is number of the individuals of the ith species and N is the total number of individuals in the sample. Evenness was calculated by Pielou's index:

$$E = H'/\ln S$$

where H' is the Shannon-Wiener function and S is the total number of species observed. Simpson's dominance index:

$$C = \Sigma (ni/N)^2$$

was used to determine the dominant species.

RESULTS

The research studies were conducted from May-October in 2010. A total of 2207 specimens were captured, belonging to 100 species, 47 families and 13 orders of insects (Table 1). It's worth mentioning that the absolute numbers provided are an underestimate of the total diversity as many microhabitats were not sampled. Insects such as borers in plants, detrivores living in nests, soil-dwelling orders like Collembola were not sampled. Results (Table 1) indicated that 76% of the RTUs belonged to just five orders: Coleoptera, Lepidoptera, Hemiptera, Homoptera and Hymenoptera.

Based on the results, Coleoptera, with 32 species and highest diversity index of H' = 0.318, were the most diverse and abundant order among collected insects. Hemiptera and Lepidoptera were ranked as second and third after Coleoptera, respectively. Staphylinidae and Scarabaeidae were the most abundant as well as diverse families among Coleoptera families based on H' value. The staphylinid beetle *Achenium debile* (Erichson) was dominant species, with relative abundance of 23.9%. Diurnal firebug *Pyrrhocoris apterus* Linnaeus was ranked as second dominant species, with relative abundance of 8.4%. Dermaptera and Ephemeroptera, each of them with 1 species, had the least species number compare to other orders.

The overall insect biodiversity indices of Shanon-Wiener and Simpson were 3.286 and 0.91, respectively in this study. Evenness was 0.7, using Pielou's index. Overall biodiversity indices show relatively high biodiversity in the area, but existence of dominant species

Table 1: Number of families, RTUs and H' values for each insect order collected at KWLR in 2010

Orders	No. of families	No. of RTU	H' value
Ephemeroptera	1	1	0.009
Odonata	2	2	0.006
Orthoptera	3	6	0.129
Dictyoptera	2	2	0.012
Dermaptera	1	1	0.012
Hemiptera	8	14	0.310
Homoptera	6	6	0.050
Neuroptera	4	8	0.078
Coleoptera	8	32	0.318
Diptera	1	2	0.003
Trichoptera	1	2	0.115
Lepidoptera	7	18	0.202
Hymenoptera	3	6	0.150

Table 2: Diversity indices of Shanon-Wiener and Simpson, evenness and abundance of insects in KWLR in 2010

Sampling dates	Abundance	Species diversity (H')	Species diversity (1-D)	Evenness (E)
May	0.64	2.34	405	0.66
June	0.72	1.97	999	0.56
July	0.91	2.75	422	0.78
August	0.83	2.13	148	0.75
September	0.81	2.05	108	0.76
October	0.91	2.70	125	0.86
Total	0.91	3.28	2207	0.71

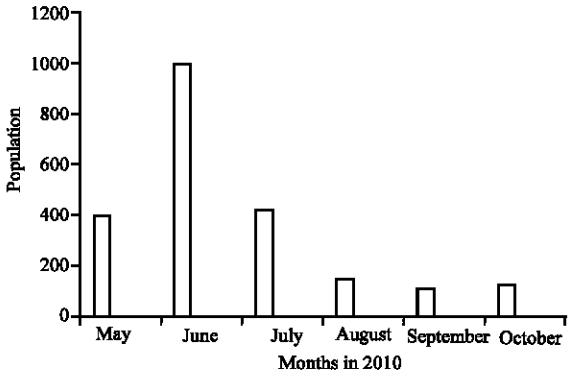

Fig. 1: Monthly changes in the population of insects at KWLR in 2010 (6 months)

(*Achenium debile* and *Pyrrhocoris apterus*) decreases biodiversity and evenness indices in some monthly samples. Diversity, species richness and evenness were calculated and shown in Table 2.

DISCUSSION

It's difficult to compare our results to regional biodiversity data since most of the previous studies deal with a single taxon and data on similar habitats are unavailable. However, the fauna of Noctuidae (Lepidoptera) of sugarcane field's area (Esfandiari *et al*., 2010), 30 kms to KWLR, shows the similarity to the collected noctuids at KWLR, e.g., *Clytie* spp., which feed on *Tamarix* spp. were common in night samples. Consequently, the biodiversity (diversity index, species richness and evenness) of insects in KWLR is mainly due to the vegetation in this area as vegetation plays an important role for the existence of insect fauna in a community as it provides the main source of food etc. for insects in the absence of human disturbance in the area.

Generally based on this practical example, it seems that excessive warm weather in mid-summer decreased diversity and abundant of insects due to its effect on development and reproduction of insects. Suitable ecological conditions and climatic factors such as optimum temperature should increase the insects' abundance gradually after summer (Fig. 1).

This study was an attempt to describe some aspects of biodiversity of insect fauna of KWLR. A lot of further research is necessary in this regard and further collections are essential for getting a detailed periodic estimate of the faunal diversity of insects and development of standard monitoring procedures for assessing the environmental stability in this area.

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