BIODIVERSITY OF LEPIDOPTEROUS INSECTS IN AGRO-FOREST AREA OF BAHAWALPUR

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ABSTRACT

The present research was conducted to see the biodiversity of lepidopterous insects in cropped and forest areas from August to October, 2004 at the Lal Sohanra National Park, Bahawalpur. A total number of 4397 specimens, which were identified into 19 families and 70 species. In cropped area, a total number of 3050 specimens with a mean value of 53.509 and in the forest area a total of 1347 with a mean value of 23.632 were collected, which differed significantly from each other. The mean values in the months of August, September and October were 28.000, 39.632 and 48.079 respectively and they differed significantly. The maximum mean value of 206.80 specimens was obtained for the family Noctuidae which had no significant difference with Pyralidae. The minimum mean value of 0.6667 was achieved in the family Bombycidae, which was statistically similar to most of other families.

INTRODUCTION

Study on biodiversity of insects is of great importance because more than half of the world's known animal species are insects (Wilson, 1992) in which Lepidoptera is the 2nd largest and the most diverse order in class Insecta (Benton, 1995). Uptil now, more than 100,000 species of lepidopteous insects have been studied (Richards and Davies, 1977). Economically lepidopterans are of great importance in larval stage. These are phytophagous and act as serious pests, defoliators, pollinators and parasites. Majority of, the species devour foliage and shoots of trees and crops. A smaller number also bore into stems or attack underground parts. The saturniids and bombycids yield silk of commercial value. Adults of many species are beautiful butterflies and may serve as basis for art and design. The presence or absence of this order serves to monitor ecological changes in the particular habitat. It has exact feeding requirements to survive and reproduce and worst suffer by environmental degradation and insecticidal effects.

The butterflies and moths from the Indo-Pak subcontinent were collected and identified from various localities by Puri (1931), Peile (1937), Bell and Scet (1937), and Ahsan and Iqbal (1975). The sphingid moths of Iran and Afghanistan were worked out by Daniel (1965) and Elbert (1969). The biodiversity of lepidopterans in different parts of world, was studied by Benton (1995), Basset (1996) and Thomas (2001).

As previously no work has been done on the biodiversity of insects in agro-forest area of Pakistan, it is the need to estimate to what extent man's exploitation of natural resources has imparted adverse impacts on the habitat and behavior of insect pests. The agro-forest area of Bahawalpur comprises natural and man-made forests alongwith some crops like cotton, maize and sugarcane, which also act as habitat for insects.

The present research studies were focused to collect, identify and compare the insect biodiversity (species richness and evenness) of lepidopterous insects in the agro-forest area of Bahawalpur, Pakistan.

MATERIALS AND METHODS

The Agro-forest area of Bahawalpur consisted of 127480 acres and located in southern part of province Punjab (Pakistan). For biodiversity studies, this area was classified into two parts on the basis of vegetation i.e. crop area and forest area. In cropped area, the main crops were cotton (*Gossypium hirsutum),* sugarcane (*Saccharum officinarium)* and maize *(Zea mays).* In the forest area, the main vegetations were shisham (*Delbergi sisso),* sufaida (*Eucalyptus citriodora),* phulai (*Acacia modesta),* mulberry, ornamentals and grasses of different types.

Collection was made by netting, hand picking and light traps. Sampling was done for five consecutive days in each month. All the specimens were

identified in laboratory side by side with the help of available descriptions. Identified material was deposited in insectarium of the Department of Agriculture Entomology, University of Agriculture, Faisalabad. Count total population per month was also made from August, 2004 to October, 2004.

The data collected was analysed statistically through computer Using MSTATC programme to calculate the diversity i.e., species richness and evenness. The significance in the population of different species under various families on both crop and forest areas, was obtained with the help of randomized complete Block Design with three parameters.

Parameter-1:

Replication
R1 = August
R2 = September
R3 = October

Parameter- 2:

Locality
L1 = Crop area.
L2 = Forest area.

Parameter-3:

Species.
S1, 2, 3, …….. species

The means thus obtained were compared by Duncan's multiple range test at 5% level of probability.

RESULTS AND DISCUSSION

A total of 4397 individuals were collected in which October was more populated month (48.097) than September (39.632) and August (28.000). These differed significantly from one another.

Cropped area is the most susceptible host for these insects (53.509) but forest area is less susceptible for lepidopterous insects (23.632). So, insect population significantly differs in both habitats.

Family Noctudidae had more population in cropped area (271.000) than forest area (142.667) and differed significantly. Family pyralidae had more population in cropped (359.667) than forest area (25.000) and differed significantly. Family Gelechiidae and Epipyropidae had mean population of 127.000 and 116.667 respectively in cropped area and significantly differed from their population in forest area with mean values of 11.00 and 10.333 respectively. Similarly, many families like Geometridae Arctiidae and Saturniidae with mean values (4.333), (6.333) and 4.333) respectively, had more population in cropped area than forest area with mean values 3.333, 1.000 and 1.333 respectively but not significantly differed.

Many families like Pieridae, Lycaenidae, Hesperiidae, Papilionidae, Danaidae, Lymentriidae, Nymphalidae and Tineidae with mean values 87.667, 26.000, 34.333, 25.000, 17,333, 15.333, 18.000 and 6.333, respectively, had more population in forest area and significantly differed from cropped area with mean values of 53.000, 16.333, 7.667, 8.000, 8.000, 10.000, 6.667 and 2.667 respectively. Similarly, families like Plutellidae, Sphingidae, Styridae and Bombycidae with mean values 14.333, 7.333, 1.333 and 1.333, respectively, had more population in forest than cropped area with mean values of 11.667, 2.667, 0.667 and 0.000, respectively but the difference was not significant.

Above results suggest that both cropped and forest areas act as alternate hosts for lepidopterous insects, but the most serious insect pests of major crops were present in cropped area but they also used the forest area as alternate habitat.

Comparison of means for locality

Locality	Means
L1	53.509a
L2	23.632 b

Comparison of means for months

Months	Means
August	28.000 c
September	39.632 b
October	48.079 a

Comparison of means for families

Families	Crop Area	Forest Area	Means
Noctuidae	271.00	142.667	206.80 a
Pyralidae	359.667	25.000	192.3 a
Pieridae	53.00	87.667	70.33 b
Gelechiidae	127.00	11.000	69.00 b
Epipyropidae	116.667	10.333	63.50 b
Lycaenidae	16.333	26.000	21.17 c
Hesperiidae	7.667	34.333	21.00 c
Papilionidae	8.00	25.000	16.50 c
Plutellidae	11.667	14.333	13.00 c
Danaidae	8.00	17.333	12.67 c
Lymentriidae	10.00	15.333	12.67 c
Nymphalidae	6.667	18.000	12.33 c
Sphingidae	2.667	7.333	5.000 c
Tineidae	2.667	6.333	4.500 c
Geometridae	4.333	3.333	3.833 c
Arctiidae	6.333	1.000	3.667 c
Saturniidae	4.333	1.333	2.833 c
Styridae	0.667	1.333	1.000 c
Bombycidae	0.00	1.333	0.667 c

Overall population of various species belonging to different families in cropped and forest areas

Sr. #.	Family	Cropped Area				Forest Area			
		Aug.	Sep.	Oct.	Total	Aug.	Sep.	Oct.	Total
1	**Nymphalidae**								
	a. *Argyreous hyperbius*	0	1	2	3	2	2	5	9
	b.*Nymphalis xanthomolus*	2	0	1	3	4	1	5	10
	c. *Junonia hierta*	4	3	1	8	6	5	5	16
	d. *Vanessa indica*	1	0	5	6	4	6	9	19
2	**Papilionidae**								
	a. *Papilio polyctor*	0	2	1	3	0	3	5	8
	b. *Papilio demoleus*	3	8	6	17	13	18	20	51
	c. *Papilio polytes*	0	0	1	1	0	3	4	54
	d. *Papilio macham*	0	1	0	1	1	0	4	5
	e.*Atrophaneura philoxenus*	0	1	1	2	0	1	3	4
3	**Hesperiidae**								
	a. *Parnara guttata*	1	0	2	3	2	9	13	24
	b.*Badamia excelamatonis*	0	1	5	6	7	10	13	30
	c. *Gomalia albofasciata*	2	4	2	8	3	6	12	21
	d. *Hasora alexis*	0	2	3	5	8	7	13	28
4	**Pieridae**								
	a. *Pieris canidia*	3	7	5	15	8	11	16	35
	b *Catopsilia femora*	4	2	5	11	3	5	10	18
	c. *Pieris brassicae*	10	15	26	51	15	22	45	82
	d. *Pieris napi*	10	13	16	39	15	10	16	41
	e. *Colias crocea*	1	4	5	10	5	4	9	18
	f. *Colias erate*	5	7	11	23	15	12	17	44
	g. *Catopsilia crocale*	1	0	2	3	3	5	4	12
	h. *Pieris rapae*	1	3	3	7	3	3	6	12
5	**Gelechiidae**								
	a. *Anarsia melanoplecta*	0	1	3	4	0	1	1	2
	b. *Pectinophora gossypiella*	110	125	129	364	2	4	9	15
	c. *Anarsia melanochropa*	0	2	3	5	1	0	6	7
	d. *Anarsia idioptela*	0	3	5	8	1	3	5	9
6	**Lymentriidae**								
	a. *Pericallia ricini*	0	2	4	6	2	6	9	17

	b. *Cosmophila erosa*	2	6	8	16	2	4	9	15
	c. *Euproctis fraternae*	3	1	4	8	2	3	9	14
7	**Sphingidae**								
	a. *Acherontia atropos*	0	2	2	4	0	3	8	11
	b. *Acherontia sytx*	2	1	0	3	0	4	1	5
	c. *Agrius convolvuli*	0	0	1	1	0	2	4	6
8	**Tineidae**								
	a. *Tinea pellionella*	1	1	3	5	2	1	5	8
	b. *Tineola bisselliella*	2	0	1	3	2	3	6	11
9	**Noctudiae**								
	a. *Agrotis flammatra*	4	4	6	14	6	10	19	35
	b. *Agrotis ipsilon*	3	5	9	17	8	13	23	44
	c. *Agrotis segetum*	2	3	4	9	7	9	15	31
	d. *Helicoverpa armigera*	39	57	78	174	8	11	16	35
	e. *Sopdoptera litura*	8	14	17	39	11	14	19	44
	f. *Autographa nigrisigna*	2	4	6	12	4	5	11	20
	g. *Plusia orichalcea*	4	5	9	18	9	7	11	27
	h. *Sylepta dercogata*	1	3	5	9	3	3	7	13
	i. *Earis insulana*	80	121	137	338	21	34	40	95
	j. *Sesmia inferens*	0	4	2	6	0	5	4	9
	k. *Euproctis lunata*	1	2	5	8	3	5	6	14
	l. *Trache notabilis*	2	5	8	15	1	4	11	16
	m. *Earis vitella*	43	54	57	154	12	14	19	45
10	**Pyralidae**								
	a. *Ostrinia nubilalis*	4	5	8	17	1	1	2	4
	b. *Cnaphalocrosis medinlis*	5	4	11	20	0	2	1	3
	c. *Syleptra derogate*	3	5	6	14	0	0	2	2
	d. *Scirpophaga novella*	12	24	30	66	1	2	4	7
	e. *Chilo partellus*	163	186	161	510	1	5	3	9
	f. *Chilo infuscatellus*	61	103	49	213	5	8	11	24
	g. *Emmalocera depressella*	22	26	45	93	0	3	5	8
	h. *Acigona steniella*	25	56	65	146	1	7	10	18
11	**Lycaenidae**								
	a. *Virachola isocrates*	4	5	8	17	13	20	48	81
	b. *Zizeerea knysna*	1	6	3	10	0	1	3	4
	c. *Zizeerea maha*	0	1	1	2	0	0	2	2
	d. *Azanus ubaldus*	2	4	6	12	1	2	4	7
	e. *Heliophous bakeri*	0	1	2	3	0	2	4	6
	f. *Aphnaeus ictis*	0	1	4	5	0	4	6	10
12	**Danaidae**								
	a. *Danaus chrysippus*	4	6	11	21	10	18	18	46
	b. *Danaus genutia*	2	1	0	3	3	2	1	6
13	**Epipyropidae**								
	a. *Epipyrope melanoleuca*	103	136	111	350	7	15	9	31
14	**Arctiidae**								
	a.Amsacta moorei	2	4	13	19	0	1	2	3
15	**Plutellidae**								
	a. *Plutella xylostella*	8	9	18	35	8	13	23	44
16	**Bombycidae**								
	a. *Bombyx mori*	0	0	0	0	0	1	2	3
	b. *Eupterote fabia*	0	0	0	0	0	1	0	1
17	**Saturniidae**								
	a. *Attacus atlas*	2	4	7	13	1	0	3	4
18	**Geometridae**								
	a. *Acontia groelsi*	4	2	7	13	2	3	5	10
19	**Styridae**								
	a. *Aulocera padma*	0	0	2	2	0	1	3	4

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