

Report on Heteroceran Lepidoptera diversity of Harmu, Ranchi, Jharkhand



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Abstract : Heteroceran lepidoptera (moth) are common pests over plants and damage leaves, stems, flowers and fruits. A study was carried in Harmu, Ranchi between January 2010 and December 2010. A total 11 species belonging to 4 families (Tortricidae, Pyralididae, Noctuidae and Sphingidae) were collected. The statistical interpretations were carried out by using Shannon-Wiener diversity index and Shannon's equitability. Biodiversity of moth with host plants was observed and species richness was observed 2.37. The species richness and abundance are indicative of that the Harmu area has good representation of moth diversity.

Key Words : Heteroceran lepidoptera, Shannon-Wiener diversity index, Harmu, Ranchi

Introduction

The Ranchi district is known for its rich biodiversity and remains as merely explored especially in the area of the study of Heteroceran lepidoptera. Insects of this class are mainly pests (Metcalf and Flint, 1973; Mathur and Singh, 1961) high economic importance. Scientific work has enriched the field of biodiversity as commercial exploitation of silk moth belonging to the family Saturniidae and Bombycidae (Grimaldi, 2005) have been done since the establishment of the Central Tasar Research Institute (CTRI) at Ranchi. On the other hand, other families of heteroceran lepidoptera have not been studied properly till date in the newly carved out State of Jharkhand or in undivided Bihar. Due to the continuous change in the landscape of Ranchi district by urbanization the species requires immediate attention. Many of the species may be endangered or may be on the verge of extinction.

In view of this, a survey work was carried out to map the biodiversity of the heteroceran lepidoptera profile from January 2010 to December 2010. The moth diversity index (Shannon, 1948) of this report was 2.37 which is lower to the Peshawar town of Pakistan was 3.14 (Aslam, 2009) and higher to the Karaikal region of Pondicherry, India was about 1.71 (Adiroubane and Kappummal, 2010).

Materials And Methods

The present study was conducted in Harmu, Ranchi located at 23°22'52'' N latitude to 85°18'05'' E longitude covering an area of nine km². The Harmu municipal area is dotted with several man made constructions, Harmu filed, Harmu River. The area is divided into localities by a network of roads. The annual mean temperature value of Harmu area was maximum 29.24 °C and minimum 18.08 °C. The maximum monthly mean temperature was 36.9 °C (May) and

minimum monthly mean temperature was 9.9° C (January). The annual mean rain fall was 121.05 mm. The annual mean value of average relative humidity was 68.17%. The annual mean speed of wind was 7.76 km/h. Regular visits during year January 2010 to December 2010 were made to different areas of Harmu municipal area especially around the Harmu field, residential area, and Harmu River. The collection work was made monthly by photophilic trap method between 6pm to 9pm by quadrat method (With a caution not to disturb the dispersal and movement of species in order to observe the ethics and movement of species) and a comparative data sheet were prepared (Table 2). The specimens were identified up to species level with the help of keys from the Richard and Davies (1934), Bell and Scott (1937), Metcalf and Flint (1939) and Pradhan (1994).

Vegetation profile of Harmu, Ranchi

Harmu field is outlined by rich plantation of Sesum (*Delbergia latifolia*), Amaltas (*Cassia fistula*), Potato (*Solanum tuberosum*), Tomato (*Lycopersicon esculentum*), *Nerium oleander* and man made flower gardens, Grasses (family poaceae), and bushy shrubs (Graph 1). Harmu housing colony is planned with good number of exotic and endogenous trees and shrubs around the fields and roads. Citizens also planted fruit trees like mango (*Mangifera indica*), litchi (*Litchi chinensis*), Guava (*Pasidium guajava*), Citrus (*C. limon*), Papaya (*Carica papaya*) along with herbs and shrubs.

Specimens have been deposited in the Department of Zoology, Ranchi Women's College, Ranchi.

Following statistical tools were applied for the biodiversity measurement of the area :

Shannon-Weiner (1948) diversity index was used to calculate Diversity Index:

$$H' = -\sum p_i \ln p_i$$

Here, $p_i = n_i/N$

n_i = number of individuals of a species

N = total number of individuals of all species

\ln = natural logarithm (to base)

H' = diversity index

The maximum possible diversity consisting X categories (no. of species here) was calculated by using the formula

$$H'_{\max} = \ln X$$

Another parameter evenness (J) was calculated by

$$J' = H' / H'_{\max}$$

Richness Index:

This was a measure of number of species in a community.

$$D = (S-1) / \ln(N)$$

Here, D = Margalef index (1948-51)

S = No. of species

N = Total number of species.

Results And Discussion

Species richness is the simplest diversity measure to count the number of species in an area. Species diversity, on the other hand takes into account the relative abundance of a species and not just its occurrence. The first index used in the present study is Shannon-Weiner diversity index (1948), which comes from information-statistics. Information statistics

TABLE 1 : Heteroceran lepidoptera (moth) diversity of Harmu, Ranchi collected between January 2010 and December 2011 by photophilic trap method.

Sl. No.	Sample No.	Name of moth species	Common Name	Family	Host Plant
1	SPH001	<i>Acherontia atropos</i> , Linn.	Death's head Hawk moth	Sphingidae	Solanaceae, Lantana
2	SPH002	<i>Acherontia styx</i> , Westwood	Death's head Hawk moth	Sphingidae	Sesamum indicum, Solnaceae (Potato)
3	SPH003	<i>Deilephila nerii</i> , Linn.	Sphinx moth or oleander hawk worm moth	Sphingidae	Nerium oleander
4	SPH004	<i>Deilephila lineate</i> , Linn.	Melonworm moth	Sphingidae	Poaceae family
5	PYR001	<i>Diaphania nitidalis</i> , Stoll	Pickleworm moth	Pyralididae	Cucumber & melon
6	PYR002	<i>Diaphania hyalinata</i> , Linn.	Melonworm moth	Pyralididae	Poaceae family
7	PYR003	<i>Chilo partellus</i> , Swinhoe	spotted stem borer moth	Pyralididae	Sorghum
8	NOC001	<i>Alabama argillacea</i> , Hubner	Cotton bollworm moth	Noctuidae	Cotton
9	NOC002	<i>Heliothis zea</i> , Boddie	Cotton bollworm moth	Noctuidae	Cotton, corn, tomato
10	NOC003	<i>Catocala fraxini</i> , Schrank	cutworm moth	Noctuidae	Leaves of herbs & shrubs
11	TOR001	<i>Cydia pomonella</i> , Linn.	Codling moth	Tortricidae & Olethturidae (Metcalf & Flint)	Tree fruits

indices are based on the rationale that diversity in a natural system can be measured in a way that is similar to the way information contained in a code or message is measured.

All the observations of field survey have been recorded in a Table number 1, 2 and 3 along with graph 1 and 2 have been plotted. In the Table 1, taxonomy of collected moths is listed indicating scientific name, common name, family and host plants. In the table 2, the monthly collection record from January 2010 to December 2010 is arranged and on this basis a comparative line graph 2 was sketched out. It clearly outlines the species richness of collected samples during the above mentioned time period. In the Table 3, diversity index (Shannon-Weiner, 1948) of collected species and Dominance of all the 11 species of Heteroceran lepidoptera has been calculated. From the present study it is concluded that *Diaphania nitidalis* belongs to class Pyralididae is the most abundant species (0.2554) belonging to this area. Next to *Diaphania nitidalis* is *Cydia pomonella* or Codling moth (0.2502), *Alabama argillacea* or cotton leaf moth (0.2332), *Catocala fraxini* or cutworm moth (0.2332), *Deilephila nerii* or sphinx moth (0.2076) and *Heliothis zea* or bollworm moth (0.2209) are evenly distributed over this region. The number of the above mentioned

species varies between 10-15 individuals per species. However, the species richness value of *Diaphania hyalinata* or Melon worm moth (0.1610) is lowest but *Acherontia atropos* or Death's head hawk moth (0.1778), *Acherontia styx* or Death's head hawk moth (0.1857) ranked low.

The result of Table 3 indicates the value of $Pi \ln Pi$ is 2.373. The Shannon diversity index for real communities are often found to fall between 1.5 and 3.5. It indicates that the diversity richness of collected moths is still good in the Harmu area of Ranchi. But due to the lack of sufficient data of the diversity of moths (except silk moth) in Ranchi the comparison and analysis of the mode of loss or gain in diversity of them is little difficult. The moth diversity index (Shannon, 1948) of Peshawar town of Pakistan was 3.14 (Aslam, 2009) which is certainly much higher than the value obtained from Ranchi in this report while the Shannon index of Karaikal region of Pondicherry, India was about 1.71 (Adiroubane and Kappummal, 2010), which is much lower than obtained data in this report (2.37).

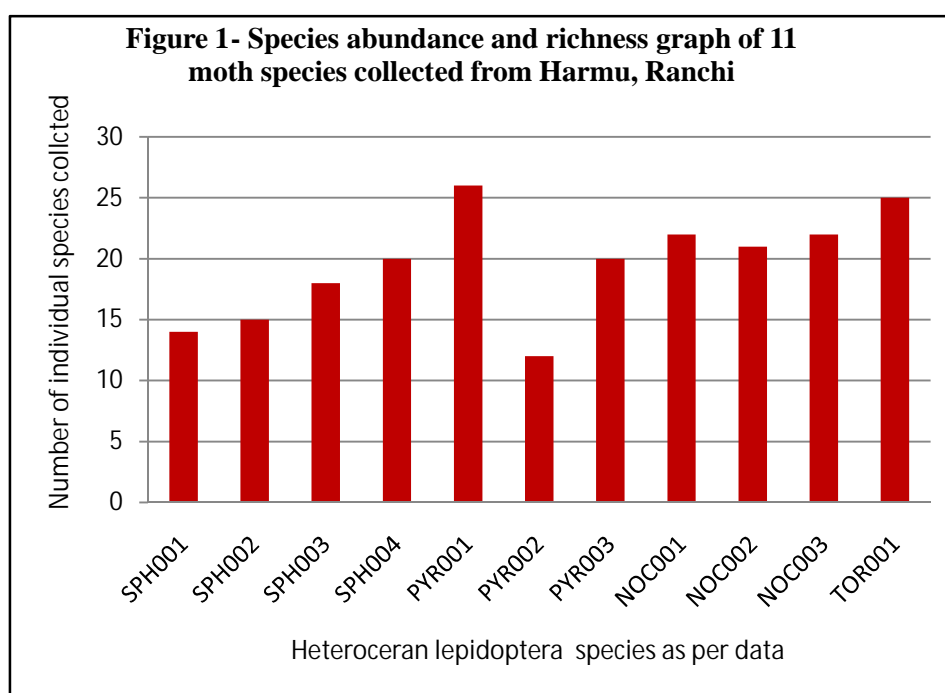
The author reports that the present study is probably the median study of this type of this region. Therefore, we suggest that the area requires taxonomic further rigorous morpho-taxonomic study of heteroceran lepidoptera.

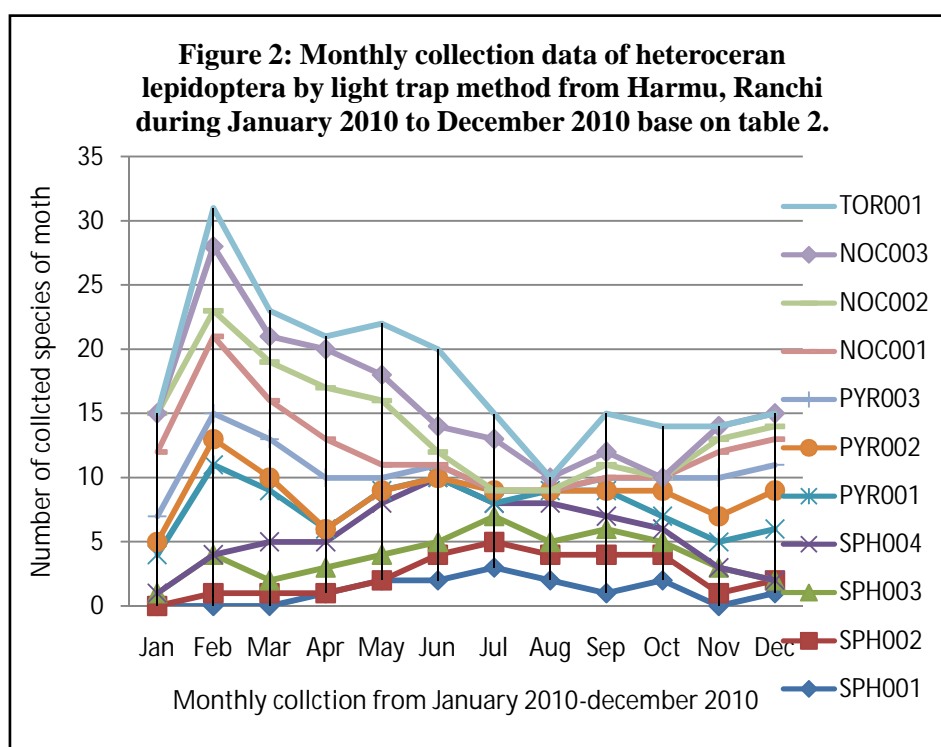
TABLE 2 : Monthly collection data of heteroceran lepidoptera by light trap method from Harmu, Ranchi during January 2010 to December 2010 of one year.

Sl. No.	Sam.No.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot
1	SPH001	0	0	0	1	2	2	3	2	1	2	0	1	14
2	SPH002	0	1	1	0	0	2	2	2	3	2	1	1	15
3	SPH003	1	3	1	2	2	1	2	1	2	1	2	0	18
4	SPH004	0	0	3	2	4	5	1	3	1	1	0	0	20
5	PYR001	3	7	4	1	1	0	0	1	2	1	2	4	26
6	PYR002	1	2	1	0	0	0	1	0	0	2	2	3	12
7	PYR003	2	2	3	4	1	1	0	0	1	1	3	2	20
8	NOC001	5	6	3	3	1	0	0	0	0	0	2	2	22
9	NOC002	3	2	3	4	5	1	0	0	1	0	1	1	21
10	NOC003	0	5	2	3	2	2	4	1	1	0	1	1	22
11	TOR001	0	3	2	1	4	6	2	0	3	4	0	0	25
	TOT	15	31	23	21	22	20	15	10	15	14	14	15	215

TABLE 3 : Heteroceran lepidoptera (moth) diversity of the collected samples with species richness index (Shannon-Weiner diversity index, 1948) of Harmu, Ranchi.

Sl. No.	Codes number	No. of individuals sampled	Relative abundance R.A. = ni/100	Pi = ni/N	Pi Log Pi
1	SPH001	14	0.065	-2.732	-0.177870371
2	SPH002	15	0.070	-2.663	-0.185761941
3	SPH003	18	0.084	-2.480	-0.207650199
4	SPH004	20	0.093	-2.375	-0.220921466
5	PYR001	26	0.121	-2.113	-0.255470134
6	PYR002	12	0.056	-2.886	-0.161064077
7	PYR003	20	0.093	-2.375	-0.220921466
8	NOC001	22	0.102	-2.280	-0.233260943
9	NOC002	21	0.098	-2.326	-0.227201988
10	NOC003	22	0.102	-2.280	-0.233260943
11	TOR001	25	0.116	-2.152	-0.250204907
		N = 215	1.000	-26.660	2.373588434





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Limitation:

The filed studies were not done during mid summer days. The following data is a rough sketch.

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