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Studies on the Heteroceran Lepidoptera diversity of Family Sphingidae from Morhabadi, Ranchi, Jharkhand

Anand Kr. Thakur^a, Nanda Ghosh^b

^aDepartment of Zoology, S. S. Memorial College, Ranchi, Jharkhand

^bDepartment of Zoology, Ranchi Women's College, 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 Morhabadi, Ranchi between January 2010 and December 2010. They are common pests of plants. A total 08 species belonging to family Sphingidae were collected. The statistical interpretations were done using Shannon-Wiener diversity index and Shannon's equitability. Biodiversity of moth with host plants was observed and species richness was observed 2.02. 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, Morhabadi, 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 so they have commercial value (Metcalf and Flint, 1939; Mathur, 1961)^{1,2}. Lots of works have been done in the field of biodiversity of silk moth belonging to families Bombycidae and Saturniidae (Grimaldi, 2005)³ because of the establishment of the Central Tasar Research Institute (CTRI) at Ranchi but other families of heteroceran lepidoptera are not listed properly till date. Due to the continuous change in the landscape of Ranchi district by rapid urbanization (development of residential colonies, removal of cropland and trees) the status of species requires immediate attention. Many of the species may be endangered or at the edge of extinction.

In view of this, a survey work was carried out to

*Corresponding author :

Phone: 09835056547

E-mail : fmruanand@yahoo.in

map the biodiversity of the heteroceran lepidoptera profile from January 2010 to December 2010 at Morhabadi municipal area in Ranchi. The moth diversity index (Shannon, 1948)⁴ of this report was 2.02 which is lower to the Peshawar town of Pakistan was 3.14 (Aslam, 2009)⁵ and higher to the Karaikal region of Pondicherry, India was about 1.71 (Adiroubane, 2010)⁶.

MATERIALS AND METHODS

The present study was conducted in Morhabadi, Ranchi located at 23°22'52" N latitude to 85°18'05" E longitude covering an area of nine km². The Morhabadi municipal area is dotted with several man made constructions, Ranchi University campus and Morhabadi field. The area is divided into localities by a network of roads. The climatic status included the annual mean temperature value of Morhabadi 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 Morhabadi especially around the Morhabadi field and residential area. 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). The specimens were identified up to species level with the help of keys from the Bell and Scott (1937)⁷; Metcalf and Flint (1939)¹; and also consulted Pradhan (1994)⁸; Richard and Davies (1934)⁹.

Diversity Index:

Diversity index is calculated as

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

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 K categories (no. of species here) was calculated by using the formula

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

Another parameter evenness (J) is calculated as

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

Richness Index:

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

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

Here, D = Margalef's index

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 (Stiling, 2002)⁴ which comes from information-statistics. Information statistics 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 and a graph has been plotted. In the table 1 the Shannon diversity value of the 08 species of family Sphingidae of Heteroceran lepidoptera was calculated. From the present study it is concluded that *Dilephila nerii* is the most abundant species (0.31903) belonging to this area and it is a pest on *Nerium oleander*. Next is *Dilephila lineata* or melonworm moth (0.31142), its host plants belongs to family poaceae. Then *Acherontia atropos* (Death's head hawk moth) and *Cephonodes hylas*, are appeared as evenly distributed (0.26147) over this region. The number of the above mentioned species varies between 06-15 individuals per species. However, the species richness value of *Herse convulvuli* (Convolvulus hawk moth) is ranked lowest (0.18442) among the produced data while *Acherontia styx* (Death's dead hawk moth) and *Chaerocampa rafflesi* (Pellucid hawk moth) are common in their species richness (0.23469).

The result of table 1 indicates the value of p_i ($\ln p_i$) is 2.02. 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 moths is good but not up to the mark in the Morhabadi area of Ranchi. The moth diversity index (Shannon, 1948) of this report was 2.02, which is lower to the Peshawar town of Pakistan was 3.14 (Aslam, 2009)⁵ and higher to the Karaikal region of Pondicherry, India was about 1.71 (Adiroubane, 2010)⁶. This may be caused due to anthropogenic destruction of natural habitat of these moths. 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 moths of family sphingidae is little difficult. As far as ecological profile of this region is concerned, the area herbs and mostly, has shrubs and trees Some of the common plant varieties are Sugarcane (*Saccharum*), Poaceae, *A. indica*, *C. limon*, Amaltas, *Jhattia siliqusa*, *Solanum tuberosum* (Potato). *Sesamum indicum*, *Nerium oleander*, Papaya (*Carica papaya*), Guava (*Pasidium guajava*).

The present study is the first study of this type in this region. Therefore, it is essential that the area understudy should be mentioned to observe any further change in the diversity of moths.

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Limitation:

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

detailed landscape survey might throw more on the available niche distribution of the species.

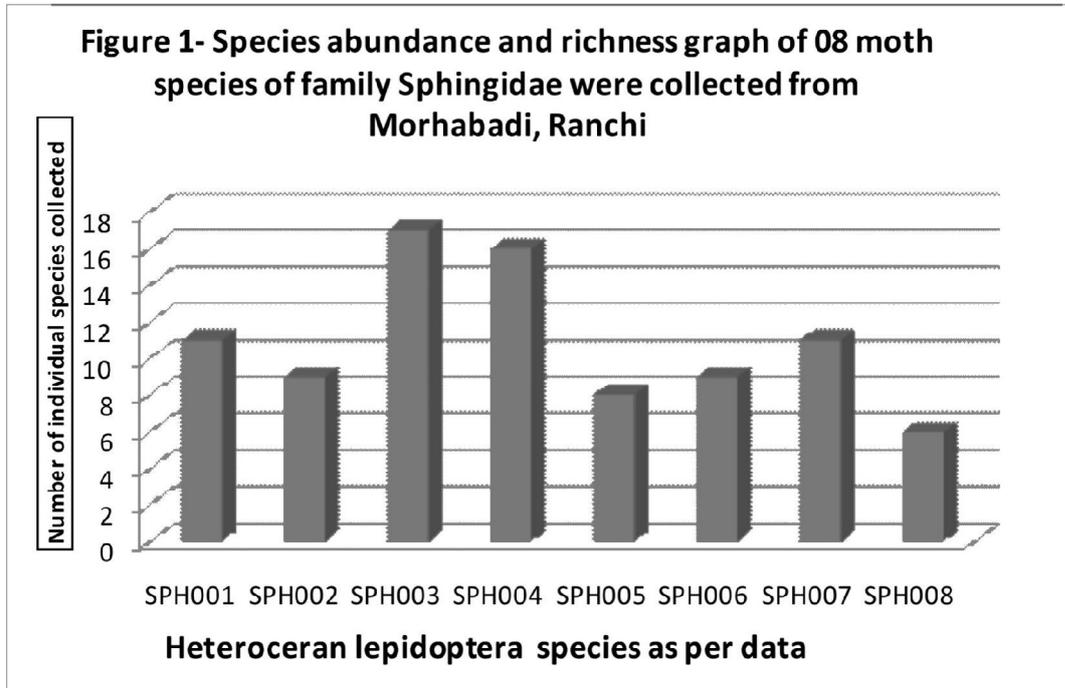


Figure 1: Heteroceran lepidoptera-family Sphingidae (moth) diversity of Morhabadi, Ranchi collected by photo trap method during January 2010 to December 2011

Table 2- The species richness index (Shannon-Weiner diversity index, 1948) of Morhabadi, Ranchi of heteroceran lepidoptera (moth) of the family Sphingidae were collected by photo trap method.

Code	Name of moth	ni	RA = ni/100	Pi=ni/N	log Pi	Pi. Log Pi
SPH001	<i>Acherontia atropa</i>	11	0.11	0.126437	-2.06801	-0.26147
SPH002	<i>Acherontia styx</i>	9	0.09	0.103448	-2.26868	-0.23469
SPH003	<i>Deilephila nerii</i>	17	0.17	0.195402	-1.63269	-0.31903
SPH004	<i>Deilephila lineate</i>	16	0.16	0.183908	-1.69332	-0.31142
SPH005	<i>Deilephila galii</i>	8	0.08	0.091954	-2.38647	-0.21945
SPH006	<i>Chaerocampa rafflesii</i>	9	0.09	0.103448	-2.26868	-0.23469
SPH007	<i>Cephonodes hylas hylas</i>	11	0.11	0.126437	-2.06801	-0.26147
SPH008	<i>Herse convolvuli convolvuli</i>	6	0.06	0.068966	-2.67415	-0.18442
	TOTAL	87	0.87	1	-17.06	2.02665

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