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CORRELATION BETWEEN ECOLOGICAL FACTORS AND DIVERSITY OF *AGYLLA REMELANA*, MOORE (LEPIDOPTERA: NOCTUIDAE) AT BARIYATU, RANCHI, JHARKHAND, INDIA.

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ABSTRACT

Present study was conducted at Bariyatu in the Ranchi district during the year 2011 to 2013. Heteroceran Lepidoptera is one of the largest order of agricultural and agro-forestry pests. Thus, it shows impact on the economy. *Agylla remelana,* Moore belongs to family Noctuidae was collected by light net traps between 17:00 hrs to 21:00 hrs fortnightly in the study area. Identification was accomplished by different keys. Total 142 individuals of *Agylla remelana,* Moore were recorded during the study period from the three sites at study area. Diversity index was calculated by Shannon-Weiner method. While statistical correlation with ecological factors (Mean temperature, relative humidity, wind speed, sunlight and rain) was computed by the help of SPSS software. *Agylla remelana,* Moore (Lepidoptera: Noctuidae) was the most common noctuid moths at study area. Correlation with mean temperature, rain, relative humidity, wind speed and sunlight was positive. The correlation with rain was very significant with the species richness of the moth. Although anthropogenic disturbances were causing the habitat loss in the study area and therefore impact on the species richness of *Agylla remelana,* Moore was observed.

Key words : Heteroceran Lepidoptera, Ranchi, Bariyatu, Morhabadi, Bariyatu, Shannon-Weiner, Correlation, SPSS, Light trap, *Agylla remelana,* Moore.

INTRODUCTION

Lepidoptera is the second largest and more diverse order of class Insecta (Benton, 1995). It includes both butterfly and moths (Hutchins, 1972; Gunathilagaraj *et al.*, 1998; Nair, 2001; Nair, 2002) but the number of moth species is much higher than that of butterflies. It is one of the most suitable groups for most quantitative comparisons between insect faunas to be valid, for many reasons explained by Holloway (1980, 1984 and 1985) especially their abundance, species richness, response to vegetation and climate. The term 'diversity' encompasses different ecosystems, species, genes and their relative abundance at a given area. Insects comprise more than half of the world's known animal species (Wilson, 1992; Krishna, 2013).

Bariyatu area at Ranchi district was selected for the collection of *A. remelana,* Moore. The landscape of this area is covered by green lands, Plateau Mountains, agricultural areas, man made residential colonies. Total 142 individuals of *A. remelana,* Moore were recorded from the study area during study period (2011 to 2013) by the help of light net trap. The ecological factors considered for this project were mean

temperature, relative humidity, wind speed, sunlight and rain. Objective of this work was to study the influence of different ecological factors on the diversity of moths in the study area. Bariyatu was selected for this project because to know the impact of rapid urbanization of the city and changing climate on the diversity of non-silk moths in the newly formed state capital Ranchi. After the correlation of ecological factors with *Agylla remelana,* Moore it was found that rainfall was directly affecting the distribution of the moth. Similar kind of work was done on the moth diversity in the Peshawar city, Pakistan (Aslam, 2009), Karaikal region of Pondicherry and Sengupta *et al.* (2014), Qureshi *et al.* (2014) on the butterflies diversity with seasonal parameters in Himalayan regions.

MATERIALS AND METHODS

The geo-coordinate of the Bariyatu at Ranchi is 23.36001 (Latitude) and 85.31002(Longitude). Field collection method was done by the light trap. Ecological factor taken for the project were mean temperature, relative humidity, wind speed, sunlight and rain. *A. remelana,* Moore was identified by the help of keys of Hampson (1892, 1893, 1894), Druce (1881-1900), Bell and Scott (1937), Matcalf and Flint (1939), Pradhan (1994), Richard and Davies (1934).

The study period was divided into three seasons as summer (March to June), rains (July to October) and winter (November to February). Collected data were computed by the help of SPSS software to get both richness of moth and correlation between the ecological factors and diversity.

Vegetation profile of Bariyatu, Ranchi:
The area selected was measured about four hundred square meter. This area has also a good number of both exotic and endogenous plants including Mango (*Mangifera indica*), Litchi (*Litchi chinensis*), Amaltas (*Cassia fistula*), Citrus (*C. limon), Fig*, Guava (*Pasidium guajava*), Papaya (*Carica papaya*), Rose (*Rosa damascena*), Sesum (*Delbergia latifolia*), China rose (*Hibiscus rosa-sinensis*) *Nerium oleander* and other crop land plants like Potato (*Solanum tuberosum*), tomato (*Lycopersicum esculantum*), Rice (*Oryza sativa*), wheat (*Triticum aestivum*), Brinjal (*Solanum melongena*), Sugarcane (*Saccharum officinarum*), Banana (*Musa acuminata*) and other shrubs.

Diversity Index:
To calculate the diversity of the moth, Shannon-Weiner diversity index (1948) was used.
Diversity index was calculated by

$H' = -pi\ ln\ pi$
Here. $pi = ni/N$
ni = 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

$$J' = H' / H'max$$

Karl Pearson's Coefficient of Correlation:
$r = \sum(X-X)(Y-Y)/ nS_xS_y$
Here, r= Coefficient of correlation,
X =Variable X; X= Mean of variable X,
Y=Variable Y; Y= Mean of variable Y,
N= number of pairs of variables,
S_x=Standard deviation of variable X, and
Y_x=Standard devotion of variable Y.

RESULTS AND DISCUSSION

According to table-1, *Agylla remelana,* Moore was dominantly distributed at the study area during the rainy season as 45 and 39 in numbers during the year 2011 and 2012 respectively. Author reported that it was consonant with the results of Rajkumar *et al.* (2010) that noctuid moths were collected maximum at the end of rains. Author's result shown consonance with the earlier work reported by Zahoor *et al.* (2003) where they found weak availability of *A. remelana,* Moore during the mid monsoon season. It was also found that *A. remelana,*

Moore was distributed through the year but mainly found in summer and rainy seasons at the study area. On the basis of table-2 authors reported that the Shannon Diversity value of the moth was maximum (0.3544) in the year 2012 and minimum (0.1005) in the year 2013. Author's result did not consonant with the results of Aslam, 2009 that Peshawer town of Pakistan that good diversity of moth was found there even the rapid urbanization was taking place there, but consonant with the results of Adiroubane, 2010 that Karaikal region of Pondicherry was low diversity of moths. The Pearson product-moment correlation coefficient was completed to assess the relationship between ecological factors i.e., mean temperature, relative humidity, wind speed, sunlight and rain and moths was computed. Table-3 reported that a positive correlation was found between the mean temperature and diversity of moth (mean temperature: r=0.325, p=0.288). Author's result consonant with the conclusion of Ngmpongsai *et al.* (2005) and Jaroensutasinee *et al.* (2011) that temperature has positive effect on the growth and diversity of moth. A positive correlation with relative humidity was found (relative humidity: r=0.207, p=0.541). Author's result was consonant with the outcomes of Yela and Holyoak (1997) that relative humidity has positive correlation with the diversity of moths but wind speed shown less effect.. A positive correlation was obtained with wind speed (wind speed: r=0.446, p=0.169). While, with sunlight positive correlation found (sun light: r=0.084, p=0.805). Author's result consonant with the report of Zahoor *et al.,* 2004 that *A. remelana,* Moore was less populated during strong sunny days and Riberio and Freitas, 2010 that moth doesn't depend on solar radiation. A positive correlation found with rain at the site was (rain: r=0.757, p=0.007). Author's result consonant with Choi and Chun, 2009 and Brehm *et al.*, 2006 that mean temperature and rainfall show positive correlation with diversity of moth.

Table-1: Seasonal collection table of *Agylla remelana,* Moore (Lepidoptera: Noctuidae) from the study area (Bariyatu, Ranchi).

Year	2011	2011	2011	2011-12	2012	2012	2012-13	2013			
Seasons	Winter	Summer	Rains	Winter	Summer	Rains	Winter	Summer			
Months	Jan-Feb	Mar-Jun	Jul-Oct	Nov-Feb	Mar-Jun	Jul-Oct	Nov-Feb	Mar-Jun	Total	AM	SD
	0	22	45	4	20	39	8	4	142	17.75	16.9263

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Table-2: Shannon diversity index of *Agylla remelana,* Moore at three sites in Ranchi during study period

Year	ni	Pi=ni/N	Log Pi	Pi. Log Pi
2011	71	0.5	-0.693147181	-0.34657359
2012	67	0.471830986	-0.751134438	-0.3544085
2013	4	0.028169014	-3.569532696	-0.10055022
Total	142			-0.80153231

Table-3: Correlation between the ecological factors with the diversity of *Agylla remelana,* Moore.

Factors	**r**	**p**	**N**
Temperature	0.352	0.288	11
R.H.	0.207	0.541	11
Wind speed	0.446	0.169	11
Sun light	0.084	0.805	11
Rain	0.757**	0.007	11

****=sign. at 0.01 level**

CONCLUSION

On the basis of results and discussion author reported that *Agylla remelana*, Moore was found throughout the year at Ranchi. But it was dominant during the post monsoon and pre-monsoon seasons. In winter it was negligible. Habitat destruction may cause the loss of both habitat and host plants in some extent in the study area. The correlation with the ecological factors was found significant only with the rainfall. Although solar radiation show negative correlation but in this case it was positive but very weak. While the relative humidity and wind speed was not so significant on its diversity. *A. remelana*, Moore is one the important part of the food web so its loss may affect the ecosystem of study area in future. Further, detailed study is needed to be done on a large scale to come on a concrete conclusion.

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