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A report of the impact of some ecological factors on the diversity of Creatonotus transiens Walker (Lepidoptera: Noctuidae) at Ranchi, Jharkhand.

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ABSTRACT

Moths (Lepidoptera : Heteroceran) are one of the largest group of horticulture and agro-forestry pests. They are also important part of the food chain. Present study was conducted at two sites in Ranchi during the. Total 291 individuals of *Creatonotus transiens* Walker were collected by using light traps and net traps fortnightly during the study period (year 2010 to 2013). Diversity index was calculated by Shannon-Weiner method. While of Correlation (Karl Pearson's Coefficient) between the diversity of moth and some ecological factors (Mean temperature, relative humidity, wind speed, sunlight and rain) was computed by the help of SPSS software version 11.0. *Creatonotus transiens* Walker (Lepidoptera: Noctuidae) belongs to family Erabidae was the one of the most common noctuid moths at the study area. The results establish the positive correlation with temperature and negative correlation with sunlight. The effect of wind speed, relative humidity and rain could not be established by the statistical method. The Shannon-Weiner diversity index indicates weak appearance of the moth in study area.

Key words : Heteroceran Lepidoptera, Ranchi, Shannon-Weiner, Correlation, Light trap, *Creatonotus transiens* Walker.

INTRODUCTION

Insects comprise more than half of the world's known animal species (Wilson, 1992). 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. A regular work by Holloway (1980, 1984 and 1985) demonstrated their abundance, species richness, response to vegetation and climate.

Ranchi was selected as the study area for this project work. Two sites were selected for the collection of *Creatonotus transiens*, Walker and they were Morhabadi and Bariyatu. Total 291 individuals of *Creatonotus transiens* Walker were found from the study area during study period 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 and also to know the impact of rapid urbanization of the city and changing climate on the diversity of non-silk moths. After the correlation of ecological factors with diversity index, it is concluded that, it shows correlation with sunlight as found abundant during the winter season. Similar kind of work based on the diversity of moths was done in the Peshawar city, Pakistan (Aslam, 2009) and Karaikal region of Pondicherry. Moanaro and Choudhary (2016) also reported the influence of weather parameters on population dynamics of insect pests in Eastern Platue of India. The relationship between biodiversity and seasonality of insect pests in the agro-ecosystem of Jharkhand is

also reported by Choudhary et al, (2014) on mango and reported the seasonal synchrony.

MATERIALS AND METHODS

Study Area

Ranchi is located at geo-coordinate 23°22´52´´ N latitude to 85°18´05´´ E longitude. The geo-coordinate of the two sites at Ranchi were Bariyatu (Geo-Coordinate: 23.39505 (Latitude); 85.36308 (Longitude)) and Morhabadi (Geo-coordinate: 23.39733 (Latitude); 85.33493(Longitude).

Collection and Identification

The light trap was used to collect the moth. Ecological factor taken for the project were mean temperature, relative humidity, wind speed, sunlight and rain. All specimens were counted and a few of them were preserved and among them *Creatonotus transiens* Walker 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).

Methodology

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. A correlation between the ecological factors and diversity of *Creatonotus transiens* Walker at different study areas accomplished by applying Karl Pearson's Coefficient of Correlation (r) and computed through SPSS ver. 11.0.

Vegetation profile of study areas of Ranchi

This study areas were rich in various 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 agro-ecosystem based plants like Potato (*Solanum tuberosum*), Tomato (*Lycopersicum esculantum*), Rice (*Oryza sativa*), wheat (*Triticum aestivum*), Maize (*Zea*) Brinjal (*Solanum melongena*), Sugarcane (*Saccharum officinarum*), Banana (*Musa acuminata*) and other shrubs.

Species Diversity Index (H´)

Shannon-Weiner diversity index (1948) was applied to calculate the diversity of the moth.

Diversity index was calculated by

$$H' = -pi\ ln\ pi$$

Karl Pearson's Coefficient of Correlation (r)

$$r = (X-X)(Y-Y)/ nS_xS_y$$

RESULTS AND DISCUSSION

The indentified species *Creatonotus transiens* Walker is a Heteroceran Lepidoptera belonging to super family Noctuidae and family Erabidae. Its larva is a pest on different plants including *Musa, Zea, Vigna* etc. According to table 1.1, total 291 moths of the above said were collected and counted at the study areas (Bariyatu: 166 and Morhabadi: 125). During the rainy season it availability in the agro-horticulture areas was dominant. Author reported that it was found in consonant with the results of Rajkumar *et al.* (2010) that noctuid moths were collected maximum at the end of rains. It was also found that the moth was distributed mainly in summer and rainy seasons at the study area. Author's result shown consonance with the earlier work reported by Zahoor *et al.* (2003) where they found weak availability of *Creatonotus transiens* Walker during the mid monsoon season. On the basis of table 1.2 authors reported that the species diversity index of the moth was maximum in the year 2011 at Morhabady site (H´= 0.1892) and minimum in the year 2013 (H´=0.1236) and at Bariyatu site, the maximum value in year 2010 (H´=0.2304) and minimum in the year 2013 (H´=0.1356) The overall species diversity value at Ranchi was 1.374. Author's result does not consonant with the results of Aslam, 2009 that Peshawer town of Pakistan was having good diversity of moth even the rapid urbanization was taking place there, but shows similar kind of results of Adiroubane, 2010 that Karaikal region of Pondicherry was low diversity of moths. Table 1.3 reports that a positive correlation was found between the mean temperature and diversity of moth at both sites Bariyatu (r=0.668, p=0.025) and Morhabadi (r=0.580, p=0.061). Here, correlation was significant at 0.05 levels at Bariyatu. Author's result found consonant with the conclusion

Table 1.1: Seasonal collection table of *Creatonotus transiens* Walker (Lepidoptera: Noctuidae) from the study area.

Year	2010	2010	2010	2010-11	2011	2011	2011-12	2012	2012	2012-13	2013			
Seasons	Winter	Summer	Rains	Winter	Summer	Rains	Winter	Summer	Rains	Winter	Summer			
Months	Nov-Feb	Mar-Jun	Jul-Oct	Nov-Feb	Mar-Jun	Jul-Oct	Nov-Feb	Mar-Jun	Jul-Oct	Nov-Feb	Mar-Jun	Total	AM	SD
Bariyatu	0	23	40	2	19	23	4	14	31	4	6	166	15.09091	13.20193
Morhabadi	0	14	23	3	7	32	3	14	23	2	4	125	11.36364	10.67963
Total	0	37	63	5	26	55	7	28	54	6	10	291	26.45455	22.91447

Table 1.2: Shannon diversity index of *Creatonotus transiens* Walker at two sites in Ranchi during study period

	Year	ni	Pi=ni/N	Log Pi	Pi. Log Pi
Bariyatu	2010	65	0.10015	-2.30105	0.230459097
	2011	46	0.06543	-2.72672	0.178419506
	2012	49	0.06148	-2.78903	0.171471373
	2013	6	0.04317	-3.14271	0.135656739
Morhabadi	2010	39	0.06842	-2.68207	0.183510375
	2011	43	0.07191	-2.63239	0.189285614
	2012	39	0.05612	-2.88035	0.161631162
	2013	4	0.03774	-3.27714	0.123665839
		291			1.374099707

Table 1.3 : Correlation between the ecological factors with the diversity of *Creatonotus transiens* Walker.

	Bariyatu		Morhabadi	
Ecological factors	r	p	r	p
Temperature	0.668*	0.025	0.58	0.061
R.H.	0.111	0.746	-0.034	0.921
Wind speed	0.317	0.343	0.222	0.511
Sun light	-0.411	0.209	-0.4	0.223
Rain	0.268	0.426	0.677*	0.022

*=Sign. at 0.05 level (2-tailed); **=sign. at 0.01 level

of Ngmpongsai *et al.* (2005); Jaroensutasinee *et al.* (2011) reported that temperature has usually positive correlation with the diversity of moths. The positive correlation was reported with wind speed and rain at Bariyatu where r=0.317, p=0.343 and r=0.268, p=0.426 respectively and a negative with sunlight r= -0.411, p=0.209. It is suggested that the correlation of wind speed, relative humidity and rain was not significant at Bariyatu site. Author's result was consonant with the outcomes of Yela and Holyoak (1997) that relative humidity has positive correlation with the diversity of moths ans Zahoor *et al.*, 2004 that *Creatonotus transiens Walker* was less populated during strong sunny days. It is reported that correlation with rain at Morhabadi site (r= 0.667, p=0.022) found much significant at 0.05 level. Author's result consonant with Choi and Chun, 2009 that mean temperature and rainfall show positive correlation with diversity of moth.

CONCLUSION

It can be concluded that climatic or ecological or weather factors have regulatory effect for *Creatonotus transiens* Walker in Ranchi. These data suggests that the diversity of the moth is not much effective Change in climate, loss of habitat and host plants also affects its diversity and abundance in the work area. Bariyatu site could not show the significant correlation of ecological factors with the diversity of moth. Meanwhile, it was noticed by author that relative humidity and wind speed were not significant ecological factors to affect the diversity of *Creatonotus transiens* Walker at all two sites. Further, intense research work is needed in Ranchi related to the moth diversity to strengthen the trends of species richness, evenness and diversity of moths.

Limitation

The street and house lights and lack of good inventory of moths in the study area also may affect the accuracy of result.

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