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Ecological Impact on Biodiversity of Apterygota And Pterygota Insects of Undisturbed Areas Of The Chotanagpur Plateau

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ABSTRACT
Present paper deals with comparative study of Apterygota and Pterygota study of fluctuation in Hazaribag sanctuary in relations to certain physiochemical factor of soil. In the present study insect population density showed bimodal peak. One in January and other in September. Total insect population was comparatively low in April, May and June.
Keywords: Shorea robusta, Pterygota and Apterygota, Richness Indices

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INTRODUCTION

In India total of 639182 km² under forest cover. In Jharkhand forest area is 23253.4 km² which is about 29.3% of total Jharkhand geographical areas. It is dry deciduous type of forest having sal tree (*Shorea robusta*). This work has been taken up for the purpose of enclosing our horizon of understanding of the forest ecological principle. The forest so far studied by various investigator in India have revealed that each forest has a characteristic feature of its own with regard to physical, chemical and biological condition**.** Soil surface insects have great role in the nutrient cycling of the ecosystem. Present paper deals with comparative study of Apterygota and Pterygota study of fluctuation in Hazaribag sanctuary in relations to certain physiochemical factor of soil. Species diversity index(H),species evenness(E) and species richness(D) has been estimated for twelve months .Correlation matrix and multiple analysis have been made to see edaphological effect of sanctuary on both Apterygota and Pterygota insect population dynamics. Besides these, insect community play an important role in the feeding behaviour of birds of the sanctuary.

MATERIAL AND METHODS

The soil fauna Pterygota and Apterygota insect, their relative abundance where study for twelve month (August 2017-July2018.Ten intensive area 200 sq.m where selected covering most undisturbed area of sanctuary. From each study area a quadrate of 1 sq.m was placed at 10 random plots. All insect were collected in polythene bags. Population density was expressed as no./sq.m in the field standard data and soil analysis was made according to Goel and Trivedy,[1].Standard data sheet was used [2]. For identification different references where used.Diversity indices were calculated following formula:

$$\textbf{Shannon's index} = H' = -\sum_{i=1}^{S}[\frac{ni}{n} ln \frac{ni}{n}]$$

Where, ni= No individual belonging to **i**th of **s**-species in the sample
n=Total number of individuals in the sample.

$$\textbf{\textit{Simpson's index}} = \lambda = \sum_{i=1}^{s} P_i^{\,2}$$

Where, Pi=$\frac{ni}{N}$, ni=No of individuals of the species
N=Total no of individual for all s species in the population
Hill's diversity number(1973) $\mathbf{N1}=e^{H1}$
H'is Shannon's index $\mathbf{N2}=\frac{1}{\lambda}$ where,λ is Simpson's index

RICHNESS INDICES

Margalef(1958)$\boldsymbol{R1} = \frac{s-1}{\ln(n)}$
Menchinick(1964), $\mathbf{R2}=\frac{s}{\sqrt{n}}$
Where, s=Total no ofspecies n= total no of individuals

EVENNES INDICES

E1=$\frac{H'}{\ln(s)}$ similar to of Pielou E2=$\frac{e^{H'}}{\ln(s)}$ sheldon E3=$\frac{e^{H'}-1}{s-1}$, Heip
E4=$\frac{\frac{1}{\lambda}}{e^{H'}}$,Hill (1973) E5=$\frac{\frac{1}{\lambda}-1}{e^{H'}-1}$, alatalo(1981)

RESULTS

Monthly variations in physio-chemical characteristics of soil determined of fixed location have been presented in the table below:

Table1: Mean value of soil –factors in different months at Hazaribag sanctuary.

MONTH	Air temp ˚C	Soil temp.	humidity	pH	organic C %	Phosphate mg/100gm	total nitrogen %	Moisture % content
August	20.6	22.2	93	6.4	1.77	0.47	1.7	13.24
	19	23.1	82	6.5	1.62	0.29	1.28	12.8
	32.4	24.3	91	7.1	1.25	0.25	0.86	9.21
	18.6	20.2	94	7.1	1.02	0.05	0.85	3.61
	8.6	12.5	80	7.3	0.97	0.12	0.92	0.92
	9.4	10.4	81	6.5	0.24	0.07	0.99	0.6
	11.6	12.5	61	7	0.21	0.06	1.02	1.2
	17.8	17.6	39	7.2	0.89	0.01	1.23	1.36
	16.4	21.3	45	7.1	0.92	0.22	1.05	2.52
	15.2	22.2	48	70.1	1.01	0.26	1.22	5.32
	38.2	3.4	96	6.8	1.21	0.31	1.1	5.81
	20.1	28.6	98	6.5	1.67	0.52	1.36	11.26

Soil Surface Insects:

During the study period (Aug, 2017 to July, 2018, six most abundant orders of Apterygota and Pterygota insects where collected from the sanctuary. Orders are as follows:

Apterygota: i)THYSANURA II) DIPLURA iii) COLLUMBOLA
Pterygota: i) ORTHOPTERA ii) COLEOPTERA iii) HYMENOPTERA

Table 2:Monthly average variation of individual /m² of different order. Each average is from samples of 10 different locations

Months	OR	HY	DIP	COLLU	THY	COL
AUG'17	20	6	2	1	2	20
SEP	30	12	4	2	5	25
OCT	23	8	6	0	1	12
NOV	25	8	3	0	1	8
DEC	13	7	2	0	1	7
JAN'18	11	7	0	0	0	23
FEB	10	3	0	0	0	7
MAR	7	2	0	1	1	7
APR	4	2	0	1	1	3
MAY	3	2	0	0	0	1
JUN	2	3	2	1	1	1
JULY	3	6	3	1	0	5

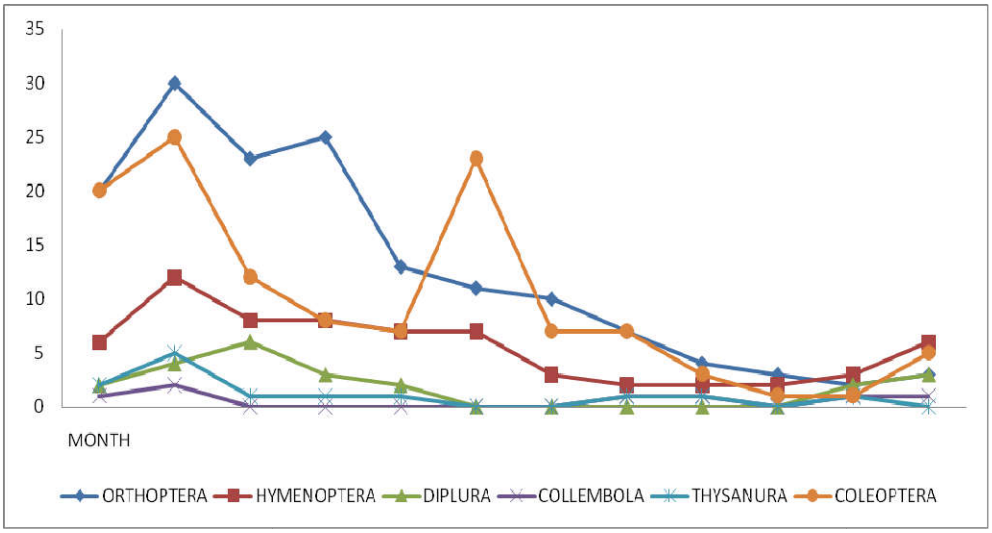

Figure1: Monthly variation of different order in sanctuary

PHYSIO-CHEMICAL FACTORS OF SOIL

Correlation coefficient 'r' matrix between certain physiochemical factor of surface soil of Hazaribag sanctuary's' has been multiplied by 10.

Table 3:percentage variation data is given below shows that most dominating orders of the insect orders of soil surface are orthoptera and coleoptera.

ST	8						
RH	4	3					
Ph	-1	-2	-5				
OrC	4	4	4	-3			
PhoS	2	6	3	-6	7		
OrgN	5	3	4	-6	6	7	
Moist	4	6	5	-6	8	7	6
	AT	ST	RH	PH	OrC	PhoS	OrgN

AT=Atmospheric temp. ST= Soil temp
RH=relative Humidity OrC=%organic Carbon
PhoS=Inorganic phosphate Moist=%moisture content
OrgN=% total nitrogen

Table 4:Data showing percentage contribution of different orders in the monthly mean value of Insect

MONTHS	OR	HY	DIP	COLM	THY	COL
Aug,2017	39.2	11.76	3.9	1.9	3.9	39.2
Sep	38	15.4	5.12	2.5	6.4	32.05
Oct	46	16	12	-	2	24
Nov	55.5	17.7	6.6	-	2.2	17.7
Dec	43.3	23.3	6.6	-	3.3	23.3
Jan,2018	26.8	17	-	-	-	56
Feb	50	15	-	-	-	35
Mar	38.8	11.1	-	5.5	5.5	38.8
Apr	36.3	18.1	-	9	9	27.2
May	50	33.3	-	-	-	16.6
Jun	20	30	20	10	10	10
July,2018	16.6	33.3	16.6	5.5	-	27.7

OR= ORTHOPTERA HY=HYMENOPTERA DIP=DIPLURA
COLM=COLLEMBOLA THY=THYSANURA COL=COLEOPTERA

DISCUSSION

Diversity indices inorthoptera, data involving orthoptera population density were subjected to different diversity indices. A number of indices have been computed to measure species richness. species evenness and species diversity indices that are independent to sample size. Margalef index (RI) was maximum in the month of august (3.3 bits/individual) andminimum value was April (0.72bits/individual). Diversity indices in both species richness and evenness into a single value.Maximum value of Shannon's index (H')was recorded from the data of August (2.31 bits/individual) and minimum value was April (0.56 bits/individuals).

Data involving coleopteran density were subjected to different diversity indices. A number of indices have been propose to measure species richness ,species evenness and diversity indices that are independent of the sample size.

Diversity indices incorporate both species and evenness into a single value.maximmum value of Shannon's index (H'0 was recorded from the data of September and January (2.1bits/individual). Evenness values were maximum in May and June months. Correlation coefficient data table indicate that of eight variable, it is only temperature which since to have no association with insect group. In respect to each of other variable correlation coefficient is found to be significant. Humidity shows significant positive correlation with Diplura and Hymenoptera. pH is found negatively correlated with coleopteran .Organic carbon shows significant positive correlation with Diplura and Collembola

When coefficient correlation data in between monthly variation of different order considered we find many significant results.

Orthoptera shows significant positive relationship with all other order and with total insect population density but it does not show's any rationalizing with Collembola.

Hymenoptera shows significant relationship with Diplura ,Thysanura ,Coleoptera and total insect population density.

Hymenoptera shows significant positive relationship with total insect population density.

Collembola shows significant relationship with Thysanura.Total insect population density shows significant relationship with Thysanura and Coleoptera.

A positive correlation between Collembola and Phosphate content of soil has been observed [3,4,5].

Hence ,we concluded that biodiversity of insect in undisturbed areas from Margalef diversity indices shows that Pterygota insect are more biodiversity than Apterygota insect but we are not getting the desire result in other diversity indices due to same geographical area .

Some species of insects have already been reported to have preference for low temperature [6].But coleopteran population was considerably high. According to Block (1966b) seasonal abundance of insects is influenced by temperature partly by impositing restriction on their breeding season and partly by previously limiting developmental period of eggs [7].

From above account we must be concluded that soil in this part of chotanagpurplateau is a very complex habitat having its various physiochemical and biotic factor intermingle with each other. Results of different workers reviewed have showed closed similarity as well as striking differences. Differences may be due to prevalence local micro climate conditions which according to Wallwork [8] exert profound influence on pattern of population growth of soil organism.

CONCLUSION

In the present study we have taken diversity indices of two major order. In Orthoptera margalef index was maximum in the month of August and minimum in the month of April. The Shannon's index was maximum in the month of August and minimum in April.

In the present study insect population density showed bimodal peak. One in January and other in September. Total insect population was comparatively low in April, May and June.

Habitat utilization in terms of food is not equal for all insect species .orthoptera show significant correlation with Hymenoptera ,Diplura ,Thysanura , Coleoptera and total insect density. It has been shown from the present study that the total surface insect population exhibited bimodal fluctuation .Results of different worker reviewed have showed close similarity as well as striking differences. In our future plan of action ,I will considered the coal field areas where previously used for coal mining activity and now have been left.Base line data for aquatic areas and aerial insect ,social insects are also a matter of urgent

consideration to make a final conclusion. I will calculate the biodiversity of those areas in my future plan.

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