

## Population dynamics of hymenoptera formicidae in relation of edaphological factor of Hazaribag sanctuary, Jharkhand, India

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**Received** : 28.03.2024; **Accepted** : 08.05.2024

### ABSTRACT

In a sanctuary insects have great role in the nutrient cycling and they play significant role in the food structure of terrestrial bird community. Research contributions on forest fauna of India comparison to that of other parts of the world are inadequate. Besides, this insect community plays an important role in the feeding behaviour of bird's sanctuary. This paper deals with hymenopteran insect population fluctuation in Hazaribag sanctuary in relation to certain edaphological factors. At the same time certain environment factors were studied for twelve months to see their effects on hymenopteran population.

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KEY WORDS : Hazaribagh, Hymenoptera, Sanctuary

### Introduction

Soil organisms collectively bring about decay and cycling of nutrients, nitrogen-fixation, mechanical weathering, mixing of soil, help in the production of growth stimulating substances, improve soil aeration and of course also cause some harm to plants. Research contribution on forest soil fauna of India, compared to that of other parts of world are inadequate. Besides these insect communities play an important role in the feeding structure of terrestrial particularly ground niche of sanctuary.

Present paper deals with synecological investigation on hymenopteran population variations and diversity in the sanctuary with certain atmospheric and edaphic factors. Hazaribag sanctuary is located in Jharkhand state covering an area of about 75 sq. miles. Sanctuary is at about 1700' above sea level at latitude 24°6 N and longitude 85°23' E It is a dry deciduous type of forest having Sal (*Shorea robusta*), as common tree species.

### Materials and Methods

The soil surface hymenopteran fauna, their relative abundance were studied for twelve months

(August 2022 to July 2023). Study area of 200 m<sup>2</sup> was selected covering most undisturbed area of sanctuary. A quadrat of 1 m<sup>2</sup> was placed at 10 random plots. After

**TABLE - 1 : Species of Hymenoptera recorded from Hazaribag Sanctuary**

1.	<i>Monomorium inaicum</i>
2.	<i>Campanotus compressus</i>
3.	<i>Campanotus paria</i>
4.	<i>Campanotus taylora</i>
5.	<i>Monomorium gracillinum</i>
6.	<i>Solenopsis geminate</i>
7.	<i>Anoplolepis longipes</i>
8.	<i>Formica sanguinea</i>

placing quadrat insects were handpicked within shortest possible time and kept in polythene bags for identification and counting. For identification different references were used. Population density was expressed as no./m<sup>2</sup>. Soil analysis was made<sup>9</sup>.

## Results

Hymenopterans sampled from the soil surface of sanctuary from ten sampling plots belong to eight species given in Table - 1.

Data on monthly variations in the total number of individuals/m<sup>2</sup>, show the maximum abundance occurred during September and minimum in the months of March, April and May. During September maximum population was represented by six species.

In March, April and May given species were found in each month- In March, two species were *Campanotus taylori* and *Formica sanguinea*, In April species were *Campanotus taylori* and *Anoplolepis longipes*, and two species *Monomorium indicum* and *Formica sanguinea* were found in the month of May.

In the soil surface samples, average physical characteristics were:

Coarse sand	20.40%
Fine sand	31.85%
Silt	15.40%
Clay	32.15%

**TABLE - 2 : Correlation matrix of physico-edaphic factors**

<b>ST</b>	8						
<b>H</b>	4	3					
<b>pH</b>	-1	-2	-5				
<b>org C</b>	4	7	4	-3			
<b>phos</b>	2	6	3	-6	7		
<b>org N</b>	0.5	3	0.4	-6	6	7	
<b>Moist</b>	4	6	5	-6	8	7	6
	<b>AT</b>	<b>ST</b>	<b>H</b>	<b>Ph</b>	<b>OrC</b>	<b>Phos</b>	<b>OrgN</b>

AT= Atmospheric temp. ST=Soil temp.H= Relative humidity OrC= % Organic carbon Phos= Inorganic phosphate OrgN=Organic nitrogen Moist= % Moisture content of soil.

## Discussion

From the correlation matrix we can say that atmospheric temperature shows significant relationship with soil temperature, but it does not show significant relationship with any other parameter. Organic carbon shows significant relationship with soil temperature. This agrees with the earlier view<sup>11</sup>.

Since there are several factors at work simultaneously in ecological situations, it was thought desirable to evaluate the multiple liner regression between edaphic factors -atmospheric temp. ( $x_1$ ), soil temp. ( $x_2$ ), relative humidity ( $x_3$ ), pH ( $x_4$ ), organic carbon ( $x_5$ ), inorganic phosphate ( $x_6$ ), organic nitrogen ( $x_7$ ), moisture content ( $x_8$ ), rainfall ( $x_9$ ) and total population variations of hymenoptera. Multiple linear regression equation between hymenoptera on to environmental factors is expressed by :-

$$Y = 54.31 + (-0.084 x_1) + (-0.347 x_2) + (0.006 x_3) \\ + (-5.137 x_4) + (5.822 x_5) + (-10.212 x_6) \\ + (-10.776 x_7) + (0.411 x_8) + (0.005 x_9)$$

From the multiple linear regression equation we may say that variation of population of hymenoptera is positively influenced by - relative humidity, organic carbon, soil moisture and rainfall. But regulative influence may be seen by atmospheric temp., soil temp., p, phosphorus and organic nitrogen.

Nitrogen acts as an attractant for arthropods but

**TABLE-3 : Showing values of %age contribution to multiple determination (R<sup>2</sup>)**

Co-efficient of multiple determination R <sup>2</sup>		0.969
F ration ( df = 9,2)		7.019
Percent contribution of each environmental factor to R		%
1	Atmospheric temp.	1.3
2	Soil temp.	22.7
3	Relative humidity	1.4
4	pH	25.2
5	Organic carbon	20.8
6	Inorganic phosphate	6.9
7	Organic nitrogen	2
8	Soil moisture	16.6
9	Rainfall	3.1

present study does not show the same (Table - III). It will be quite reasonable to believe that conditions which are beneficial to bacteria and fungi are also beneficial to soil fauna. Food chains of most of the meiofauna depend ultimately on microbiological population. At the same time population density varies according to change in vegetation largely affects food chains of soil organisms as reported earlier<sup>4</sup>.

Correlation co-efficient 'r' matrix between certain physico-chemical parameters of surface soil of Hazaribag Sanctuary. 'r' has been multiplied by 10.

Although a few studies<sup>6</sup>, have demonstrated the predominance of particular taxa in local assemblages and their responses to changes in land management, the richness of assemblages is unpredictable because of lack of knowledge of habitat requirement.

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