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Species diversity indices of Ant population sampled from Ranchi city, Jharkhand.

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Abstract : With respect to species diversity in different habitats of any community, there is a vivid gradient in species richness and abundance with the highest in the tropics and lowest in the poles. Use of various cardinal information statistic indices like S-W alpha diversity, abundance, evenness, similarity index and dominance for quantifying the species diversity both within and between the habitats carries significant value to depict the survival status of a particular species in a community. Ant population expected to be well diversified in terms of species richness and abundance has been sampled from northern & Southern zones of Ranchi city situated at latitude and longitude of 8802'N - 2303'E & 22055'S - 88010'E, having tropical characteristic. The results of application of these species diversity indices as information statistics tools for different ant species sampled have been discussed in this paper which can explain the causes of ant species diversity in this area in relation to other biotic and abiotic factors.

Key words: Species diversity indices: S-W diversity, Abundance, Evenness, Similarity index, Dominance, Ant population.

INTRODUCTION

Ants belonging to the order Hymenoptera constitute the largest chunk of the insect community. Hence, unprecedented ecological success and dominance in tropical ecosystems have been achieved by them. In a Brazilian tropical forest ants have been estimated to have a biomass four times that of all vertebrates[1,2]. Being such dominant and successful components of ecosystems, it is likely that ants would turn out to be good indicators of the well being of ecosystems (Daniels[3]). And yet methods reliable for sampling of ants are entirely inadequate (Romero and Jaffe[4]). More surprising is the fact that very little information exists regarding the ant fauna, and even less regarding its success and dominance in the tropical forests of Asia. (Gadagkar[5] & Wilson[6]).

Starting from agriculture field to the edible sweet material kept in our kitchens, varieties of ant populations can be easily found thriving on the wide range of both living and non-living materials. Due to having greatest power of metabolizing sugar molecules ant producing pungent formic acid the ants have also been taxonomically regarded as Formicides belonging to the family Formicidae.

Most of the tropical, warm and temperate genera of ants belong to the subfamilies, ponerinae and camponotinae in which the Indian ants as well as that of Daltonganj, Jharkhand also fall in considerable number.

Understanding the vast unexplored field of mapping of Jharkhand ants, the present investigation has been carried out as the continued step in a selected areas of Northern & Southern Zones of Daltonganj city.

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MATERIALS AND METHODS

Selection of sampling sites as follow up schedule of our study sites were located in the northern & southern sides of Ranchi city. The land vegetation of the area had been also recorded for the description of physiography of the sampling sites through quadrate method. Zigzag area lying beyond the quadrates had been ignored.

Sampling Methods :

Highly infested land quadrates showing powdered soil were sampled through specially fabricated glass aspirator with suction funnel attached to a reservoir bottle and pump in which active and tiny ants were sucked.

Quadrates with low infestation showing thick muddy soil were sampled by hand picking method.

All Out Search (AOS) method had been overall practiced to collect all the representatives of as any species of ants as possible showing visible morphological variations.

Sampling Schedule:

Two hour moring from 7.00 to 9.00 AM and two hour evening from 4.00 to 6.00 PM. sampling schedule were maintained in order to have the best samples. The mid day sampling was avoided because ants were found to disappear during this period. A full day was devoted to each quadrate and attempt was made to collect individuals of all the representatives in the population.

Taxonomic Identification :

The morphologically different individuals and representative so ants had been classified following the standard BOLTON'S KEY[7] of tropical are taxonomy and Skaife's study of ants.

Preservation and Data Collection:

All the individuals of the sample were preserved in 70% alcohol in different vials bearing appropriate tags. The quadrate wise number of sampled individuals according to their genus and species had been recorded in tabular form. (Table1)

Statistical Analysis:

Analysis of collected data had also been done by using following statistical indices within the habitat :

a) **Alpha (α) diversity Shannon Weiner index: -**

$H= \sum pi \log pi$

Where,

$\overline{H}$ = species diversity,

Pi = mean of individual species procured by the formula n/N,

logpi is the log product of pi (mean of individual species).

b **Relative abundance = ni/N x 100**

Where,

Ni = number of individuals of a species.

N = number of individuals of total number of species

c) **Evenness = H/log2S**

Where,

S = number of species, H= diversity.

d) **Simpson's dominance D = 1/Ds,**

$$Ds= \sum_{i-1}^{s} \frac{ni(n-1)}{N(N-1)}$$

Where,

s= No. of species present

i= ith no.of species (1 to ∞)

n_i = number of individuals of ith species,

N = Total number of individuals of all the species.

OBSERVATIONS

The intensive "all out search" (AOS) sampling of ant's in different sites and quadrates of the selected area – Daltonganj ponds area" locality has given exciting findings as recorded following table.

The table is record of eleven different varieties of ant's belonging to five taxonomic families as identified by Indian Institute of Science (Center of Ecological Studies) with their respective common names adopted from western literature. The large no.(3190) of sampled individuals was of medium size *Componotus maculates*, Fabr. Commonly called spotted sugar ant belonging to the family Camponotinae. The lowest no. (10) was of primitive ant of very small size belonging to the family Ponerinae, identified *Pachycondyla pumicosa, Roger*. The small black sugar ant slightly bigger than primitive ant but smaller than spotted sugar ant numbered next in the sampling record after spotted sugar ant and has been identified as *Acantholepis capensis,* Mayr. The population dens of collected sample also recorded 230 individual slender ants identified as *Sima clypeata,* Emery belonging to the family Myrmcinae and 130 of drive ants known as *Dorylus*

helvolus, Linn, of family Dorylinae. The cocktail-, brown house- and bearded ants have also figured significantly in the ant population survey of the locality. Interestingly the population counts of the black sugar ant and the brown sugar ant was almost same (39 & 40). The most debated variety was of family Dolichoderinae identified as *Iridomyrmex humilis* Mayer and commonly recognized by European Scientist as Argentine ants.

The site-specific sampling fetched exciting results as recorded in table. However, the ant hill of another (site IV) was the most populated area giving largest no. of individuals followed by sites- plain ground, plain orchid, damaged tree base and underground tunnels.

DISCUSSIONS

The present investigation has recorded significant and diversity and abundance of species in the selected locality of Daltonganj- "Pond area" and its out skirts. The results provide first hand similarities with that of Western Ghats (Karnataka) and population, assessed by Gadagkar *et.al.* The resemblance of results in these selected areas is due to the prevailing tropical conditions even on such a long stretch from Jharkhand to Western Ghat.

Although the observation is very restricted to a selected locality which prevents from drawing any form conclusion regarding the possible causes of variation in ant diversity from locality to locality of Daltonganj, Jharkhand, yet specific trends are quite evident. The first is that man disturbed sites show lower richness and diversity while the undisturbed sites encourages better population growth of any species. This is also perhaps related with monoculture plantation like specific tree around which the particular ant species, *C.maculates* grew vigorously. The cause of significant reduction in ant species richness and diversity in less vegetational shore of dam has been due to the slashing and burning the trees. The polyculture planted area like orchid and grassy land could not support much population build up of various ant varieties.[9]

Withstanding to previous discussion and also assessed by the values of alpha diversity "Shannon Weiner" index, relative abundance, evenness calculated statistically, the variety of ants species sampled in this project has clearly established the relative abundance of spotted sugar ant, *C.maculatus* amongst all the remaining species and hence make it a dominant variety in the locality.[10]

Table : Sampling data and species diversity indices of ant population of Ranchi city (sampling year2011).

Sl. No.	Name of the ant species	Sub family	No. of individuals collected	Relative Abundance RA	S-W Diversity $\overline{H}$	D=1/DS	Evenness
1.	*Pheidole indica*, Mayr	Componotinae	72	6.4748			0.006517
2.	*Formica gagattes,* Latreillie	Formicinae	60	5.3956			0.004715
3.	*Crematogaster himalayanana,* Forel	Myrmicinae	150	13.4892			0.015751
4.	*Iridomyrmex glaber*, Mayr	Myrmicinae	20	1.7985	**0.2791**	**0.17295**	0.003212
5.	*Camponotus variegatus*, Smith	Componotinae	39	3.5071			0.004589
6.	*Camponotus wasmani*, Emery	Componotinae	40	3.5971			0.006421
7.	*Pheidole minor,*Jerdon	Componotinae	319	28.6870			0.031756
8.	*Pheidole parasitica* Wilson.	Componotinae	412	37.0503			0.042517
		Total	**1112**				

Graph : Species diversity indices of ant species sampled from Ranchi city (2011).
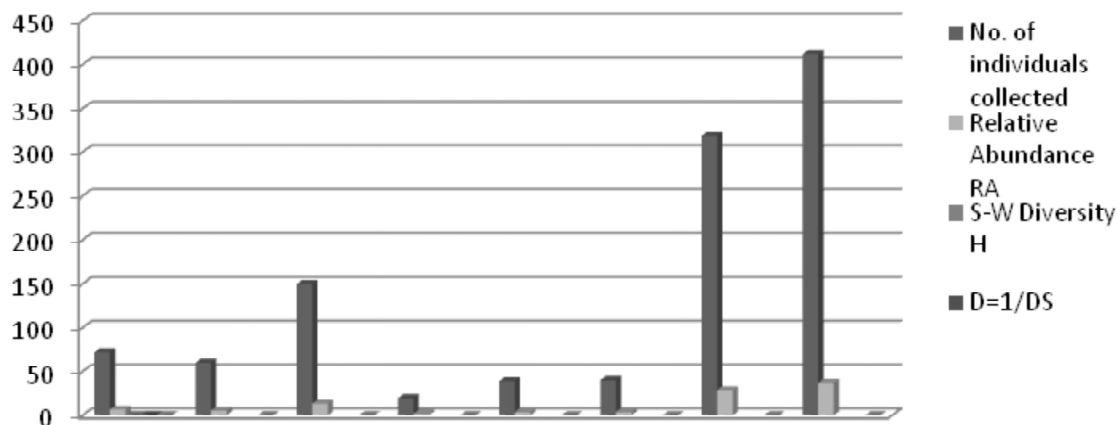
1. P.indica, Mayr, 2. F.gagates, Latreillie 3. C.himalayanana, Forel, 4.I.glaber, Mayr 5. C. variegatus, Smith 6. C. wasmani, Emery, 7. P.minor,Jerdon 8. P.parasitica Wilson.

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