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Oribatid Species (Acari, Oribatei) as Bioindicator at a Subtropical Forest Floor

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Abstract: ***Indicator species analysis was conducted on the species of oribatid mites collected at a subtropical forest floor. Sampling was conducted at five sites of the forest. Of the thirty - one species considered, eight species had significant indicator value at least for one site while, six species exhibited significant indicator value for the entire sampling region.***

Keywords: Indicator species**,** Cryptostigmata, Soil mite

1. Introduction

Edaphic invertebrates may be used as bioindicators in view of anthropogenic disturbances and they reveal community - based ecological characteristics more conspicuously than the vertebrates (Gerlach et al., 2013; Manu et al., 2019) Oribatids - the tiny arachnids have been projected as the environmental indicator by a number of workers around the globe (Behan - Pelletier, 1999, Gulvik, 2007, Gergocs and Hufnagel, 2009, Moitra, 2013). It's almost ubiquitous presence on earth with huge diversity and abundance, exhibiting adaptive specificity to diverse habitats, have emboldened the prospect of its use as the effective bioindicator. The abundance and diversity of oribatids respond to the variabilities of several edaphic and environmental factors including temperature, moisture, soil fertility, concentration of heavy metals etc (Gergocs and Hufnagel, 2009; Moitra et al., 2020; Wehner, 2021; Moitra et al., 2022).

Though a few studies have been attempt - ted in the subtropical forest regions lying at the foothill region of Himalayas of North Bengal, there is still dearth of literature on the indicator values of oribatid mites though they most often have been found to be the most numerical abundant group among soil dwelling mesofauna in the region. The current study was therefore attempted to investigate the prospect of oribatid species available in the region as the bioindicator of the prevailing ecosystem.

2. Materials and method

Five subplots (5m x 5m) were selected at a subtropical forest - Baikunthpur, located at the foothill region of Himalayas (26.7749° N, 88.5036° E), in the district Jalpaiguri of North Bengal. Sampling was conducted at monthly intervals from 2017 to 2019. It is a humid subtropical forest with *Shorearobusta* and *Tectona grandis* as the major vegetation. Temperature during the collection period ranged from 16.5 ^{o}C to 31.6^{o}C while the relative humidity varied from 43.7% to 81.7%.

Stainless steel corers (5cm diameter) and a sampler were used for collection of soil samples. Extraction was made using apparatus following Macfadyen (1953).

Indicator values of the oribatid species collected from the sampling sites were calculated following the method suggested by Dufrêne and Legendre (1997) on the basis of the site specificity and fidelity of data of species. The formula used:

$$IV_{ij} = A_{ij} \times B_{ij} \times 100$$

Where, IV_{ij} = Indicator value, $A_{ij} = x_{ij} / \sum^{j} x_j$ and $B_{ij} = n_{ij} / n_j$

x_{ij} is the mean abundance of species i at group j and and $\sum^{j} x_j$ is the sum of the mean of species i in all groups. n_{ij} is the number of sites where species i occurs in the group j and n_j is the total number of sites sampled in group j. Software 'IndVal 2.0' was used for the analysis.

3. Results and Discussion:

A total of thirty - one species of oribatid mites were found to occur at more than one sampling site in the region. Site - wise relative occurrence during sampling revealed that eight oribatid species (*Dolicheremaeus bengalensis*, *Scheloribatesalbialatus*, *Dolicheremaeusgeminus*, *Lamellobates palustris*, *Nothrusgracilis*, *Tectocephaeusvelatus*, *Scheloribatesparvus*, *Dolicheremaeus coronarius*) have significant indicator value for at least one site (Table 1).

Of the eight oribatid species, no species was found have significant indicator value for each of the five sampling sites when calculation made separately for individual sites. *Dolicheremaeus bengalensis* was found to be significant four out of five sites which appeared to be the most common species in the region. Three species (viz., *Scheloribatesalbialatus*, *Dolicheremaeusgeminus*, *Lamellobates palustris*) appeared significant for three sampling sites.

Each of the three species (*Tectocephaeusvelatus*, *Scheloribatesparvus*, *Dolicheremaeus coronarius*) exhibited significant indicator value for one site only.

Calculation of indicator value, when done taking occurrence data from all sites together, showed that six oribatid species have over - all significant indicator value for the area sampled (*Dolicheremaeus bengalensis*,

Scheloribatesalbialatus, *Dolicheremaeusgeminus*, *Lamellobates palustris*, *Nothrusgracilis*, *Tectocephaeusvelatus*). *Dolicheremaeus bengalensis* had the highest indicator value followed by *Scheloribatesalbialatus.* Of the other oribatid species, *Xylobatesseminudus*, *Allonothrusrusseolus* and *Xylobates capucinus* were recorded from three or four of the five sampling plots, none of them however, exhibited enough frequency of occurrence to have a significant indicator value for any one site or over - all area sampled. No previous comparing data for indicator species analysis was available for the region studied. In a study conducted at the sites under anthropogenic disturbances at Kolkata, *Tectocephaeusvelatus* and *Lamellobates palustris* exhibited high indicator values (Moitra et al., 2013). Markkula et al. (2018) mentioned oribatid species like *Carabodeslabyrinthicus*, *Chamobates borealis* and *Neoribatesaurantiacus* to be promising as indicators in northern European sub - Arctic peatlands.

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Table 1: Indicator value of the species of oribatid mites collected from the sites (* = Significant)

Sl. No	Name	Site - I	Site - II	Site - III	Site - IV	Site - V	All Sites
1	*Dolicheremaeus bengalensis*	80.7*	93*	89*	76.5	82.4*	87*
2	*Scheloribatesalbialatus*	86.4*	78.6*	67.5	55.7	63.4	80.7*
3	*Dolicheremaeusgeminus*	85.2*	75.2	81.5*	58.4	48.3	86.3*
4	*Lamellobates palustris*	20.3	76.8	80.4*	82.2*	65.8	78.7*
5	*Nothrusgracilis*	75.3	67.1		65.2	84.6*	78.6*
6	*Tectocephaeusvelatus*	48.9	58.4	33.7	89.3*	32.8	82.8*
7	*Oppiayodai*		39.7	58		66.5	
8	*Scheloribatesparvus*			77.9*	67.8		
9	*Dolicheremaeus coronarius*	65.3		73*			
10	*Galumnaflabelliferaorientalis*	54			64.3		
11	*Xylobatesseminudus*	1	14.3	3.7		54.3	
12	*Platynothruspeltifer*			31.3		40.5	
13	*Allonothrusrusseolus*	33.4		21.4		16.7	
14	*Metabelbaobtusus*				23.1	41.2	
15	*Malaconothrusgeminus*			26	33.2		
16	*Scheloribatescurvialatus*				33.5	23.1	
17	*Scheloribatespraeinciscus*			21.8		26.6	
18	*Dolicheremaeus*sp.		24.1		20.3		
19	*Rostrozetesfoveolatus*		36.4	5.2			
20	*Hoplophorellascapellata*	21.4		19.6			
21	*Xylobates capucinus*	12.1		11	17.6		
22	*Setoxylobatesfoveolatus*		16.4	20.2			
23	*Lamellobates (Paralamellobates) bengalensis*			9.4		20.3	
24	*Suctobelbaquadricarina*			1		22.3	

25	*Rhysotritia*sp.	6.2				11	
26	*Cosmochthonius*sp.	6.3	9.2				
27	*Arthrodamaeus*sp.		11			2	
28	*Liacarus*sp.				7.4	3	
29	*Tectocepheussarekensis*			2.1		4.2	
30	*Paulianacarusfoliatus*			1.4		1	
31	*Unguizetes*sp.		1.1			1	