

A study on ants (Hymenoptera: Formicidae) of Medinipur, West Bengal, India

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Abstract

Ants are the most successful arthropod fauna to study ecology of a particular region as because it can withstand even harsh environmental situation. Ants are the largest section of the insects belonging to the endopterygota group. Present study reveals the distribution of ant fauna in forest, grassland and human habitats located around Midnapore town. The study area represents thirty four species of ants under twenty different genera has been identified. The recorded ants belonging to five subfamilies: Formicinae, Myrmicinae, Ponerinae, Dolichoderinae and Pseudomyrmicinae. The most dominant genus was *Crematogaster* followed by *Pheidole*. Present study shows that the similarity index of ant species between human habitat and forest is highest. Dominant index of ant fauna in human habitat and forest ecosystem depicts that genus *Crematogaster* is the most adapted genus in both human habitat and forest ecosystem.

Keywords: recorded, species, diversity, ecology, Midnapur

1. Introduction

Ants are regarded as a most important fauna of terrestrial ecosystem. These are most adaptive in harsh environmental condition. All the known species of ants are regarded as eusocial group of animal [1]. Ants are such an important invertebrate which plays an important role in the alteration of soil ecosystem diversity. They also participate actively in the community interaction that develop quality soil ecosystem. It take part in underground ecological processes and alter the physical, chemical and biological environment leading to effect on plants, soil micro and macro organisms. The abundance and varied role ecological roles of ant make them influential in agro-ecosystem [1]. The role of ants in ecosystem with special emphasis on ground-dwelling ants in soil processing and function as ecosystem engineers was discussed by Folgarait [2]. Therefore, the study of ant ecology, diversity and function in soil ecosystem is a vital task to the researchers in rapidly growing urbanization throughout the globe. So, the study of ant diversity in three contrasting ecosystems of Midnapur district of West Bengal shows some ecological significance of the region. Present study is a documentation of ant faunal diversity of study area.

Global record of ant species is about 13,255 [3]. Recently ants are grouped into 21 sub families [4]. Subfamily Martialinae has been merged with family Formicidae [5]. All species of ant fall into family Formicidae. Family Formicidae is included in the superfamily Vespidae under order Hymenoptera of class Insecta. Subfamily Myrmicinae is the largest subfamily under family Formicidae, having 138 genera followed by subfamily Formicinae which have 39 genera and Ponerinae with 25 genera.

Indian ant faunal diversity includes 12 subfamilies namely Aenictinae, Amblyoponinae, Cerapachyinae, Dolichoderinae, Dorylinae, Ectatomminae, Formicinae, Leptanillinae, Myrmicinae, Ponerinae, Proceratiinae and Pseudomyrmecinae [4]. World record depicts 21 known subfamilies of ants [4]. In India, ants occupy diversified habitat like leaf litters, trees, soil and dead wood logs, whereas tramp species prefer man made

habitats. Myrmicinae represents maximum ant diversity (45%) having genera *Pheidole* and *Crematogaster*. Formicinae is the second largest subfamily with 25% species diversity under genera *Camponotus* and *Polyrhachis*. Subfamily Ponerinae comprises 14% of species diversity having maximum diversity in genus *Leptogenys* [4]. In India, the work on ant ecology and diversity is very poor and scattered. Gunawardene *et al.* [6] have published their work on ants of the Western Ghat – Sri Lanka hotspot. Sunil Kumar *et al.* [7] reported ant fauna of Bangalore City. Recently, Tiwary *et al.* [8] published a list of 591 species of ant from India. Very recently Bharati *et al.* [9, 10] listed 828 species of ant in India and the state of West Bengal has the highest number of ant species (382) under 65 genera among the 30 Indian States. Despite these studies, there is still a lot about ant diversity that deserves further research in this region, and therefore more studies are needed.

The objective of this study was to find out ant diversity and distribution in three different habitats such as forest, grassland and human habitats around Midnapore town of Paschim Medinipur District of West Bengal. Till date no research on ant diversity has been done in this area. This study will generate some valuable information about distribution and richness of ant species in and around Midnapur Town and the present study will certainly be the base line for further study on the group from the study area for future researchers.

2. Materials and Methods

2.1 Study Site

Ant samples were collected from different localities in and around Midnapur Town within 20 km from Vidyasagar University. Midnapur is located at Longitude 86°34' - 87°54'E; Latitude 22°23' - 22°56' N. Three different ecological habitats, forest, grassland and human habitat has been chosen for specimen sampling. The forest included Gope Ghar Forest, Kalaikunda Forest Range and Salbani Forest. The grasslands were the region of Police Line and Fallowing land behind Birla Mill with some tree plantations. The human habitats cover general civil area with sufficient human influence such as Bus

Stand, Locality around Railway Station and Rabindra Nagar of Midnapur Town.

2.2 Experiment

Author has employed all out search method for the collection of ants sample from January 2015 to December 2015. Ants were hand collected using a forcep and brush during day time (8am to 4pm), twice in every month and preserved in alcohol (70%) in the Department of Zoology, Raja N. L. Khan Women’s College, with careful note on their habitat and relative visual abundance. Ant species were listed and each species were counted to calculate diversity index and similarity index among the three contrasting habitat.

2.3 Ants Identification

The collected samples were identified up to the genus and species level by using Olympus stereo binocular microscope and based on the literature available [11-15]. Validity of species name, authority and spelling has been followed to Bolton’s Synopsis [12] and Catalogue of Ants of the world for the Formicidae [16].

2.4 Data Analyses

List of ant species and the complete count of number of individuals for each habitat has been done for species richness and species diversity computation. The results were analysed by indices to indicate the ant species diversity in forest, grassland and human habitats. Shannon- wiener function [17] was also used to compute the species diversity indices of ant living in each habitat as follow:

$$H' = - \sum_{i=1}^R pi \ln pi$$

Where

$$Pi = \frac{ni}{N}$$

H' = Species diversity index

N = Total no. of species

ni = ith no. of species

Pi= Proportion of the totalsample belonging to ith species.

To measure the similarity between sample of two community for Sorensen coefficient [18], following equation has been used.

$$QS = \frac{2c}{a+b}$$

Where,

QS = Sorensen coefficient of similarity.

a = No of species in sample A

b = No. of species in sample B

c = No. of common species in sample A and sample B

Scale for inference:

- >.71 strongly similar.
- .61 –.70 moderately similar.
- .51 –.61 slightly similar.
- .41 – 50 moderately dissimilar.
- <.40 strongly dissimilar.

3. Results

A total of thirty four species of ants have been identified from the three different study sites of Paschim Midnapur district. Collected samples were identified into five subfamilies. Among these subfamily Myrmicinae was the highest recorded group included 21 species under 11 genera, subfamily Formicinae has 7 species under 4 genera, subfamily Ponerinae has 3 species under 2 genera, subfamily Dolichoderinae has 2 species under 2 genera and subfamily Pseudomyrmicinae has single species. The total 34 species has been listed in Table-1. Of these 34 ant species 30 were found from forest, 22 from human habitat and 16 from grassland habitat (Fig. 1). Out of these 34 species, 9 were common in all the three habitats (Table-1). Species diversity index among three different habitat (Table-2) indicate that forest is the best preferable habitat for ant fauna as because species diversity index is higher in forest habitat (F>H>G). The study of Sorensen similarity index reveals that highest similarity (0.77) has been found between forest habitat (F) and human habitat (H), whereas lowest similarity (0.42) has been found between human habitat (H) and grassland habitat (G), (Table-3).

Table 1: Ant species found in and around Midnapore town.

Family	Subfamily	Species	Habitat		
			Forest(F)	Grass land(G)	Human habitat(H)
Formicidae	Dolichoderinae	<i>Iridomyrmex anceps</i> (Roger, 1863)	+	-	+
		<i>Tapinoma indicum</i> (Forel, 1895)	-	-	+
	Formicinae	<i>Camponotus irritans</i> (Smith, 1857)	+	+	+
		<i>C. wasmanni</i> (Emery, 1893)	+	-	-
		<i>C. parius</i> Emery, 1889	+	-	+
		<i>Oecophylla smaragdina</i> (Fabricius, 1775)	+	-	-
		<i>Paratrechina longicornis</i> (Latreille, 1802)	+	-	+
		<i>Polyrhachis exercita</i> (Walker, 1859)	+	+	+
		<i>P. rastella</i> (Latreille, 1802)	+	+	+
	Myrmicinae	<i>Rhopalomastix rothneyi</i> Forel, 1900.	+	-	-
		<i>Triglyphothrix obese</i> (Andre, 1887)	+	+	-
		<i>Aphaenogaster rotheyi</i> (Forel, 1902)	+	-	+
		<i>A. schurri</i> (Forel, 1902)	+	+	+
		<i>Cardiocondyla nuda</i> (Mayr, 1866)	-	+	-
		<i>Monomorium pharohnis</i> (Forel, 1902)	+	+	+
		<i>Myrmicaria brunnea</i> (Saunders, 1842)	+	+	+
		<i>Pheidole spathifera</i> Forel, 1902	+	+	+
		<i>P. striativentris</i> (Mayr, 1878)	+	-	-
		<i>P. lamellinoda</i> (Forel, 1902)	+	-	+

		<i>Creinatogaster diffusa</i> (Jerdon, 1851)	+	+	+
		<i>C. brunnea contenta</i> Mayer, 1879	+	+	+
		<i>C. ebenina</i> Forel, 1902	+	-	+
		<i>C. aberrans</i> Forel, 1892	+	-	+
		<i>C. rothneyi</i> Mayr, 1879	+	+	-
		<i>C. rogenhoferi</i> (Mayr, 1879)	+	-	+
		<i>C. walshi</i> Forel, 1902	+	-	-
		<i>Pheidologeton diversus</i> (Jerdon, 1851)	+	-	+
		<i>Solenopsis geminata</i> (Fabricius, 1804)	+	+	-
		<i>S. nitens</i> Bingham, 1903	+	-	-
		<i>Tetramorium guineese</i> (Fabricius, 1793)	-	+	-
	Ponerinae	<i>Leptogenys (labopelta) dentilobis</i> (Forel, 1895)	+	-	+
		<i>L. (labopelta) diminuta</i> (Fred. Smith, 1858)	+	+	+
		<i>Pachycondyla</i> sp.	+	+	-
	Pseudomyrmicinae	<i>Tetraponera nigra</i> (Jerdon, 1851)	-	-	+
Total	5	34	30	16	22

Table 2: Shannon Index value on species structure of three ecological habitat: forest (F), grassland (G) and human habitat (H) in the study area around Midnapur town.

Ecological Index for species structure	Forest (F)	Grassland (G)	Human habitat (H)
Shannon Index or General Species Diversity Index	1.75	1.23	1.58

Table 3: Sorensen’s Quotient of Similarity

Similarity between F & G	0.61	Moderately similar
Similarity Index between F & H	0.77	Strongly similar
Similarity Index between G & H	0.42	Moderately dissimilar

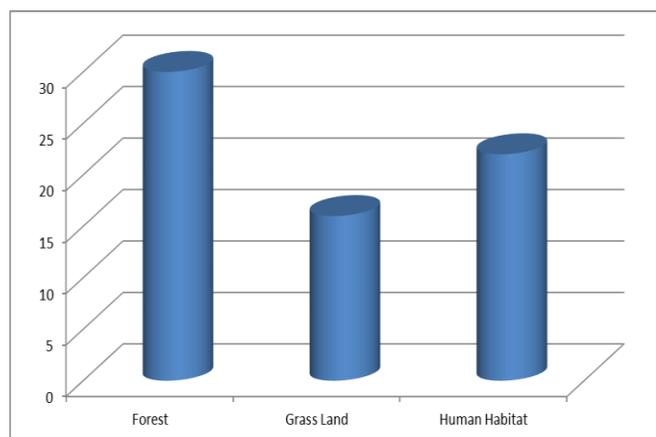


Fig 1: Ant faunal richness in three different habitats

4. Discussion

Present study reveals the record of 34 species of ant of 20 genera under five subfamilies from the study area (Table-1). Genus *Creinatogaster* is the most abundant and records seven species and genera *Aphaenogaster*, *Myrmecaria* and *Monomorium* of Myrmicinae; *Camponotus* and *Polyrchis* of Formicinae and *Leptogenys* of Ponerinae are widely distributed genera found in all the habitat of the study area. Some genera are restricted in their distribution and with very few numbers of species found during the study, such as *Rhopalomastix* having only one species and *Oecophylla smaragdina* (Weaver ant) records only from Salboni Forest but not in grassland or human habitat. Weaver ants build their nest by green leaves and stems with the larval silk [16]. During the present study a number of weaver ant’s nest of *Oecophylla smaragdina* have been found in Salbani forest in summer months. The subfamily

Myrmicinae, having six species is widely distributed in all three habitat territory of the study site. This data correlate with the studies of different workers [1,7] but contradict with the studies of workers like Chavan and Pawar [19] & Kundu [20]. Subfamily Formicinae having three species namely *Camponotus irritans* (Smith, 1857), *Polyrhachis exercita* (Walker, 1859) and *P. rastella* (Latreille, 1802) are common to all three study site. Subfamily Ponerinae having common species of *Leptogenys (labopelta) diminuta* (Fred. Smith, 1858) which has been recorded from all the present study area. The genus *Camponotus* recorded of two species from all three study sites. Due to their nesting behaviour these ants are known as “Carpenter Ant”. They live in tree trunk but do not feed on wood. These important insect pests cause damage to the buildings [21]. In addition to this genus *Pachycondyla* has been identified form the collection of specimens from Police Line and Kalaikunda forest shows interesting behaviour when feel disturbed, secrete acid foam from the end of abdomen for defence [22].

The study of species diversity indices of three study site, forest (1.75), grassland (1.23) and human habitat (1.58) indicates that species richness of ant species is influenced by type of habitat. The study of similarity index to show the similarity between two community reveals that similarity between (F) and (H) is strong and between (F) and (G) is moderate but between (G) and (H) is moderately dissimilar. Similarity measurement depicts that forest habitat and human habitat showed maximum similar ant species diversity. It also depicts that highest number of ant species are present in both habitat and also indicate that both habitats consist of similar microclimatic condition. As such lower similarity index value indicates more different microclimatic condition between two habitats. Sunil Kumar *et al.* [7] reported that the ant diversity is directly proportional to the diversity of vegetation. Lowest index value of grassland ecosystem of implies that there is on dominant ant species in the grassland ecosystem of the study site. Ants perform much ecological function which is beneficial for mankind such as control of pest population, plant pollination and soil erosion. Present study reveals important information on and ant diversity of the study region will certainly be helpful for future researchers to study on the group.

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5. References

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