An Assessment of Ant Diversity in Maregaon and its adjacent area

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Abstract
Ants are one of the most common and ecologically significant elements of land ecosystems because of their extensive distribution and their large contribution to the biomass of the ecosystem. They are present in a wide range of habitats including rottings logs, soil, plants, leaf litter and tree bark. The two genera Pheidole and Crematogaster are particularly abundant in India. In the present investigations there are 13 species of ants recorded from Maregaon tahsil and it neighborhood. The identified ant species were grouped into 3 subfamilies, Myrmicinae, Formicinae and Ponerinae. The most diverse subfamily is Myrmicinae with 10 species from three genera. In Formicinae there were 2 species from two different genera and in Ponerinae 1 species from one genus. Thus 13 ant species were identified at the genus level in the study area. The results indicate that the study area has high level of ant species diversity, indicating the presence of habitats and ecological conditions that are suitable for the different species of ants.
Keywords: *Ants, Diversity, Myrmicinae, Formicinae, Maregaon.*

Introduction

Ants are one of the most ecologically important components of terrestrial ecosystems because of their wide distribution, great diversity and important contribution to ecosystem functioning. They are some of the most successful and diverse groups of social insects, and are vital in maintaining ecological balance. Ants often act as ecosystem engineers because they change soil structure, nutrient cycling, seed dispersal, and organic matter decomposition (Watanasit *et al.*, 2000). Taxonomically, ants belong to the phylum Arthropoda, class Insecta, order Hymenoptera, and family Formicidae. They are found in many terrestrial habitats including soil, forests, grasslands, agricultural areas, leaf litter, and human impacted landscapes. They are an important subject of ecological and taxonomic studies due to their ecological richness and complex social structure (Hölldobler and Wilson, 1990).

The Indian subcontinent is rich in biodiversity, a wide range of climates, many different ecosystems and a complicated geological history. Nevertheless, this ecological wealth has not precluded the need for extensive documentation to better understand species diversity, distribution patterns and ecological roles of many invertebrate groups, including ants. Since environmental factors, vegetation, habitat layout and human activity all affect ant distribution and community composition, systematic studies of ants are particularly important (Bharti, 2011).

There are thousands of ant species in the world, distributed among different subfamilies of the Formicidae family. Their classification has been significantly changed by taxonomic and species discoveries. Bolton (2003) made an important contribution to the current classification of ants and as a consequence of the discovery of Martialis heureka (Rabeling *et al.*, 2008) the subfamily Martialinae was identified. The subfamilies Myrmicinae and Formicinae are two of the most diverse groups of ants and the subfamily Ponerinae contains many notable predators. The importance of the study of ant diversity to the understanding of terrestrial biodiversity is based on the differences in species composition, habitat preferences and ecological functions.

The ant body is made up of 3 segments, the head, mesosoma and metasoma. The head is equipped with mandibles, compound eyes, 2 jointed antennae and other mouthparts such as the maxillary palps. Differences in antennal segmentation, mandibular anatomy, eye development, hair arrangement and other surface features may assist in taxonomic identification. The mesosoma bears three pairs of legs, some of which have identifying characters such as tibial spurs. The metasoma is attached to the mesosoma by one or two nodes. These nodes are called the petiole and postpetiole. Such physical features are an important basis for the identification and classification of ants and are often studied under a dissecting or binocular microscope (Chavhan *et al.*, 2018).

It is important to study ant diversity and distribution in different environments to record local biodiversity and understand ecosystem functioning. These studies may provide baseline data for future ecological monitoring, taxonomic studies and conservation planning. A systematic assessment of ant species can also help in the recognition of dominant groups and the analysis of differences in the composition of species across environments.

Materials and Methods

Ant samples were collected from different residential areas of and around Maregaon town, within a 5 km radius from the town center. Ants were collected using the all-out search method which involves a thorough search for ants in various settings. Specimens were collected by hand during day (11:00 AM-4:00 PM) using a fine brush and forceps The collected specimens were preserved in 70% ethyl alcohol for later study and identification. Locality, habitat type and relative visual abundance were noted as field observations during sample collection.

Identification of Ants

The ant specimens collected were examined under a stereo microscope (Stemi DV4) and identified to genus level based on morphological features. Identification was done by reference to the standard taxonomic literature including Bolton (2003) and the relevant identification literature cited as "Keeps (1999)" in the original methodology. Identification was done by looking at diagnostic features such as body structure, antennae, mandibles, petiole, postpetiole and other distinguishing morphological characters.

Data Analysis:

Diversity Indices (Ants) • Measure species diversity using richness (the number of species) and abundance (the number of individuals per species).
1. Shannon-Wiener Index (H'). ii. Simpson's Diversity Index

Results:

The present study recorded 13 ant spesies from various localities of and around Maregaon and its surrounding areas. The collected specimens were classified into three subfamilies; Myrmicinae, Ponerinae and Formicinae. The subfamily Myrmicinae was the most dominant group with 10 species belonging to three genera. The subfamily Formicinae was represented with two species of two genera and Ponerinae with one species of one genus (Table No. 1). Among three subfamilies, the composition of documented species showed that the Myrmicinae represented the highest percentage of the ant diversity of the studied area. The pattern indicates the importance of Myrmicinae in the local ant assemblage.

The assessment on habitat wise showed distribution of ant species in the agricultural fields, human occupied areas and grasslands (Table No. 2). The maximum number of species was recorded from agricultural lands (13 species) followed by human inhabited areas (10 species). Grasslands supported six species. The results suggest a much higher number of ant species in agricultural areas compared to the other two ecosystems studied. All three sites had ants, indicating that ants can live in a variety of terrestrial habitats.

In agricultural fields, ants can find ideal nesting sites, food and shelter from the soil, vegetation, crop residues and associated insects. Ant colonies may be promoted in human inhabited regions such as food availability, houses, gardens and other modified environments. Grasslands also allow for nesting and food sources through the grasses, herbs and other flora. But these alternative answers require further research by extensive habitat and ecological studies.

Six of the 13 recorded ant species occurred in all three habitats, indicating that these species had a rather wide range across the settings surveyed. Other species showed different patterns of distribution among the habitats. This may be due to different habitat preferences and resource availability.

Table 1. Taxonomic composition and number of ant individuals recorded in and around Maregaon, Maharashtra

Subfamily	Genus	Species found	No. of individuals
Formicinae	*Camponotus*	*Wasmanni*	50
	Oecophylla	*Smaragdina*	40
Myrmicinae	*Crematogaster*	*Aberrans*	60
	Crematogaster	*Brunnea*	70
	Crematogaster	*Diffusa*	80
	Crematogaster	*Ebenina*	70
	Crematogaster	*Rogenhoferi*	50
	Pheidole	*Hoogwerfi*	40
	Pheidole	*Lamellinoda*	50
	Pheidole	*Striativentris*	80
	Aphaenogaster	*Rotheyi*	40
	Aphaenogaster	*Schurri*	50
Ponerinae	*Leptogenys*	*dentilobis*	70

Table No. 2 Ants Species found in three different Habitat

Ant Species	Agriculture Field	Grassland	Human Habitat (H)
Camponotus wasmanni	+	+	+
Oecophylla smaragdina	+	-	-
Aphaenogaster rotheyi	+	-	-
Aphaenogaster schurri	+	+	+
Pheidole hoogwerf	+	+	+
Pheidole striativentris	+	-	-
Pheidole lamellinoda	+	-	+
Crematogaster diffusa	+	+	+
Crematogaster brunnea	+	+	+
Crematogaster ebenina	+	-	+
Crematogaster aberrans	+	-	+
Crematogaster rogenhoferi	+	-	+
Leptogenys dentilobis	+	+	+

Table no. 3 Diversity Indices

Species	No. of individuals (n)	Pi = n/N	ln(Pi)	Pi × ln(Pi)	Pi^2
Wasmanni	50	0.0667	-2.7081	-0.1805	0.0044
Oecophylla smaragdina	40	0.0533	-2.9312	-0.1563	0.0028
Crematogaster aberrans	60	0.0800	-2.5257	-0.2021	0.0064
Crematogaster brunnea	70	0.0933	-2.3716	-0.2213	0.0087
Crematogaster diffusa	80	0.1067	-2.2380	-0.2387	0.0114
Crematogaster ebenina	70	0.0933	-2.3716	-0.2213	0.0087
Crematogaster rogenhoferi	50	0.0667	-2.7081	-0.1805	0.0044
Pheidole hoogwerf	40	0.0533	-2.9312	-0.1563	0.0028
Pheidole lamellinoda	50	0.0667	-2.7081	-0.1805	0.0044
Pheidole striativentris	80	0.1067	-2.2380	-0.2387	0.0114
Aphaenogaster rotheyi	40	0.0533	-2.9312	-0.1563	0.0028
Aphaenogaster schurri	50	0.0667	-2.7081	-0.1805	0.0044
Leptogenys dentilobis	70	0.0933	-2.3716	-0.2213	0.0087
Total	**750**	**1.0000**		**2.5347**	**0.0816**

Calculation Diversity indices:

1. Shannon–Wiener Diversity Index:

$H' = -\sum(PilnPi)$

$H' = -(-2.5347) = 2.5347$

Shannon index (H′) = 2.5347

2. Simpson's Dominance Index:

$D = \sum Pi2$

$D = 0.0816$

Simpson's Dominance Index (D) = 0.0816

3. Simpson's Diversity Index:

$1-D = 1-0.0816$

$1-D = 0.9184$

Simpson's Diversity Index = 0.9184

4. Pielou's evenness (J): $H'/ln(S) = 2.5347/ln(13) = 0.98$

According to the Shannon–Wiener index (H′ = 2.5347), the diversity of ants in the examined area was rather high. The Simpson dominance value is relatively low (D = 0.0816), which means that no species dominates the whole ant community significantly. Simpson's diversity value (1−D = 0.9184) suggests high diversity and a fairly good distribution of individuals among the recorded species.

Discussion

The present study recorded a total of 13 species of ants belonging to 6 genera and 3 subfamilies namely, Myrmicinae, Formicinae and Ponerinae. Myrmicinae was the most abundant of these subfamilies. The ant species were recorded in three different settings i.e. agricultural fields, peoples inhabited areas and grasslands. All 13 species recorded were present on agricultural land, 10 species in built-up areas and six species in grassland. Six species were common to all three areas suggesting these species are adapted to a range of environmental circumstances. These results corroborate with the findings in other semi-arid regions of Karnataka (Begum and Majagi, 2021; Mahalakshmi and Channaveerappa, 2016). The summer season saw fewer weaver ant (Oecophylla) nests hanging in the trees of the woodland. This may be related to changes in nesting and foraging behaviour associated with the seasons. Weaver ants have been observed to exhibit aggressive predatory behaviour and territorial defence, with workers descending from nests and tree branches to feed and defend territories (Pawar and Chavhan, 2011).

The calculated diversity indices such as Shannon diversity index (H′ = 2.5347), Simpson's index (D = 0.9184) and species evenness (J = 0.98) show a diversified ant community with a very even distribution of individuals among the species. These results indicate that despite urbanisation and disruption of habitat, there is a diverse and more evenly distributed group of ants in the research area of Maregaon. Ants have ecological functions such as aerating soil, cycling of nutrients, spreading of seeds and controlling other invertebrate populations. Their diversity and distribution can also give valuable information on habitat conditions and ecosystem functioning. Thus the ensemble of ants found, indicates the ecological importance of the heterogeneous habitats in and around Maregaon and throws light on the need to conserve these habitats for the persistence of local biodiversity.

Conclusion

In the present study, 13 species of ant of 6 genera and 3 subfamilies (Formicinae and Myrmicinae) were recorded from Maregaon. The most abundant species were *Crematogaster diffusa* and *Pheidole striativentris* with 80 individuals each. The species with the lowest abundance were *Smaragdina*, *Pheidole hoogwerfi* and *Aphaenogaster rotheyi* with 40 individuals each. Results show that the study area is an ant-rich area and the community is somewhat equilibrated. The presence of several ant genera indicates their ecological importance in maintaining the processes of the ecosystem such as soil aeration, nitrogen cycling and control of other invertebrates. Thus, the study provides important baseline information on the diversity

and abundance of ants and emphasizes the significance of habitat management for the conservation of local biodiversity.

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