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Research Article

Nests and Habitats of Ants Observation in Aurangabad Maharashtra, India

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Abstract

Background and Objective: Ants are a highly social and diverse group of insects. Ants show symbiotic association with particular plants and group of insects which produce suitable nest sites for ants. The study showed the nature of nest and habitat of ant species *Meranoplus bicolor*, *Leptogenys processionalis*, *Solenopsis geminata*, *Camponotus compressus*, *Oecophylla smaragdina*, *Crematogaster brunnea contemta* etc., in Aurangabad, M.S. **Materials and Methods:** The study was done in Aurangabad city in which the study site is divided in urban and periurban area during two successive years June, 2015 to May, 2017. In urban and peri-urban habitats monthly visits have been arranged, some ant's specimen was collected from ants nest. Photos have been taken for the observation and study of nest by all out-search methods from study sites. **Results:** The two ant species *Crematogaster brunnea contemta* and *Oecophylla smaragdina* make their nest on trees only. Ant species *Solenopsis geminata*, *Meranoplus bicolor*, *Camponotus compressus*, *Leptogenys processionalis* prefer to make their nest on ground. Both trees and ground forager ants species are found in urban and periurban habitats. **Conclusion:** According to preferable habitats ants make their nest, they also modified their internal structure according to their needs in different seasons. Six ant's species nests are observed in urban and peri-urban habitats of Aurangabad city.

Key words: Ants nest, physico-chemical parameter of soil, habitat, biomass, indicator species

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Ants are eusocial insects belonging to a single-family Formicidae of order Hymenoptera from class Insect. Ants found everywhere except few large islands. They occur in all types of terrestrial habitats like rain forests, swamps, harsh desert, sea coast to and deep in the soil and tips of highest trees. There are 26 extent subfamilies with 428 valid genera and 14,711 valid species reported¹. The ants are ecologically important due to their nesting and foraging behaviour in providing several ecosystem services and functions, from increasing soil aeration and water drainage with their tunnel, seed dispersal, nutrient aggregation at their nesting sites, to scavenging and predation of dead and live animals respectively ants play important role in ecological processes because they directly or indirectly affect floral and faunal groups by predation, protecting certain plant, scavenging, tending homopterans, dispersing seeds and they also aid in nutrient and soil turnover². Animal and plants wastage are bringing by ants into their nest and this material mix into the soil, it helps to enrichment of carbon, nitrogen, phosphorus and other nutrients present in the soil³. Ant show mutualistic interrelation with plant and other organisms. Thus, ants play important role in terrestrial ecosystem, in community interactions, in development of soil quality, in underground ecological process such as alter chemical, physical and biological environment leading to effect on soil macro and microorganisms and plants⁴.

It has been indicated that the composition of ant species is unique to each habitat and most likely governed by the vegetation and the other biota around it⁵. The diverse array of nesting and foraging strategies form below ground to arboreal these arrays shows spatial distribution and diversity form ground to canopy. In crevices of rocks, leaf nest, in soil ant builds the nest each colony has its own nest⁶. Due to the nesting habits ants are agents of bioturbation, creates avenues for water, mixed soil horizon and exchange of gas through the chambers and tunnels make up their nest. These activities are responsible for altering soil, soil production and biotic profiles. Nest is the place where most interaction between members of colonies of social insect occurs and their important function is to provide food storage and to protect microhabitat for immature development⁷. Ant nests showed higher nutrient and cation content than adjacent non-nest soil samples but similar pH. Nutrient content was higher in ant refuse materials than in nest soils. The fertilizer effect of ant nests was also higher in dry habitats than in grasslands or savannas. Cation content was higher in nests of plant-feeding

ants than in nests of omnivorous species and lower in nests from agro-ecosystems than in nests from any other habitat⁸.

Hence to understand the role of ants in soil ecosystem it is essential to understand the effects of ant nests on soil physiognomies. This study is innovative and quantitative approach to understand the effects of ant nests as key soil modifiers. This study highlighted the role of ants as ecological engineers and to understand the nature, design and size of nests and habitats of ants, diversity of ants according to the habitat from Aurangabad city.

MATERIALS AND METHODS

Study area: The study was done in Aurangabad city in which the study site is divided in urban and peri-urban area during two successive years June, 2015 to May, 2017.

Sample collection: Ants sampled were collected from urban habitat includes sites such as residential, urban garden, urban industry and peri-urban habitat includes sites such as periurban industry, grassland and agriculture field (Fig. 1). The ant sampling was carried by handpick, pitfall trap, scented trap, all out search method was in morning 6-8 am.

Research methodology: Collected ants were sorted and preserved in 70% alcohol and identification was made with the help of stereoscope trinocular microscope based on standard taxonomic keys suggested by Bolton⁹, Mathew *et al.*¹⁰ and Sheela¹¹ etc. The nest of different ants species were observed and studied for their appearance, structure and method of nest construction. The surrounding soils near ant nest were collected from each site. Soil sample were air dried over night and sieved through 2 mm screen. The nest ecology is studied with the help of analysis of various physico-chemical parameters such as nitrogen, phosphorus, potassium, water holding capacity, organic carbon and pH as per standard protocol described¹².

RESULTS

During the study the nests of ant's species such as *Crematogaster brunnea contemta*, *Solenopsis geminata*, *Meranoplus bicolor*, *Camponotus compressus*, *Oecophylla smaragdina* and *Leptogenys processionalis* were under investigations (Fig. 2). The two ant species *Crematogaster brunnea contemta* and *Oecophylla smaragdina* make their nest on trees only. Ant species *Solenopsis geminata*, *Meranoplus bicolor*, *Camponotus compressus*, *Leptogenys*



Fig. 1: Satellite image of collection sites of urban and peri-urban habitats

<https://earth.google.com/web>

Table 1: Physico-chemical parameters of soil from urban and peri-urban habitats

Sites	pH (1 :2.5)	OC (%)	N (kg ha ⁻¹)	P (kg ha ⁻¹)	K (kg ha ⁻¹)	WHC (%)
Urban sites	8.52	3.52	676	83.8	812	93.7
Peri-urban sites	8.72	4.67	877	71.8	906	88.0

WHC: Water holding capacity

Table 2: Distribution of ants nests at urban and peri-urban habitats

Subfamily	Species	Nesting habitat	Urban habitat			Periurban habitat		
			Residential	Urban garden	Urban industry	Peri-urban industry	Grassland	Agriculture
Myrmicinae	<i>Crematogaster brunnea contemta</i>	Carton type	+	+	+	+	+	+
	<i>Solenopsis geminata</i>	Soil	+	+	+	+	+	+
	<i>Meranoplus bicolor</i>	Soil	-	+	-	+	+	+
Formicinae	<i>Camponotus compressus</i>	Mound	+	+	+	+	+	+
	<i>Oecophylla smaragdina</i>	Hanging on leaves	+	+	+	+	+	+
Ponerinae	<i>Leptogenys processionalis</i>	Soil	-	+	-	+	+	+

processionalis prefer to make their nest on ground. Peri-urban region which is at the fringe of urban and rural habitats and includes the sites like peri-urban industry, grassland and agriculture fields, two ant species as *Leptogenys processionalis*, *Meranoplus bicolor* were observed to make their nest. Urban habitat includes sites such as residential area, urban garden, urban industry were four ant species such as *Solenopsis geminata*, *Oecophylla smaragdina*, *Camponotus compressus*, *Crematogaster brunnea contemta* were observe to make their nests. The properties of soil in urban habitat are as follows. pH was 8.52, organic carbon was 3.52%, Nitrogen was 676 kg ha⁻¹, phosphorus was 83.8 kg ha⁻¹, potassium was 812 kg ha⁻¹ and water holding capacity (WHC) was 93.7%. etc.

In peri-urban habitat pH was 8.72, organic carbon was 4.67%, Nitrogen was 877 kg ha⁻¹, phosphorus was 71.8 kg ha⁻¹, potassium was 906 kg ha⁻¹ and water holding capacity was 88.0%. The soil fertility is more in periurban habitat as compared to urban habitat (Table1). Distribution of ants in all habitats shows in Table 2. The nesting habitats of different ant species are as follows:

Meranoplus bicolor: These species belong to Genus *Meranoplus* Smith. Head, alitrunk, petiole and legs are ferruginous red in color, abdomen is brownish black. It is sluggish with hairy body. Nest of these ant are present on ground surrounding with a small crater. These ant forage on

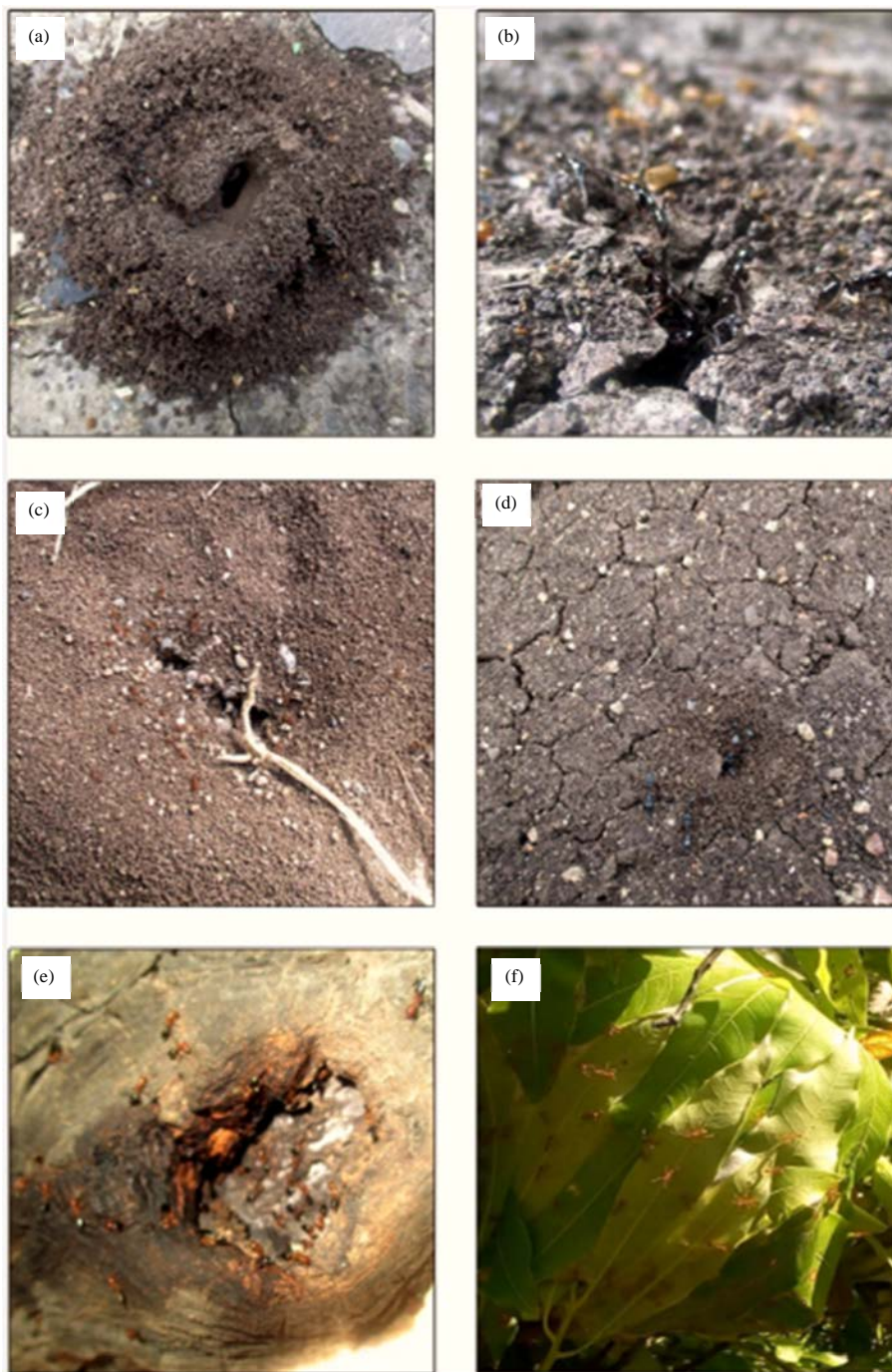


Fig. 2(a-f): Nest of ants in urban and peri-urban habitat

(a) Nest of *Meranoplus bicolor* at periurban habitat, (b) Nest of *Leptogenys processionalis* at periurban habitat, (c) Nest of *Solenopsis geminata* at urban habitat, (d) Nest of *Camponotus compressus* at urban habitat, (e) Nest of *Crematogaster brunnea* at urban habitat and (f) Nest of *Oecophylla smaragdina* at urban habitat

ground and move slowly. These ants nest on bare land, grassland, sparse forest and in less disturbed area. The nest opening is simple hole. It feeds on harvest grass seed and floral nectar.

***Solenopsis geminata*:** This species ant is members of the *Solenopsis* Westwood genus. These ants are widespread in disturbed urban habitats. They are commonly known as fire ants. It is reddish yellow, shining and smooth, mandibles

marked dark reddish brown. They feed on seeds, crickets. Colonies of these ants are polygynous. Nest of these ants are concrete structure like seen in soil, open areas and more and less disturbed areas. They can survive in adverse environmental conditions including human habitations to disturbed habitats. They have painful stings. These ants tend homoptera to get honeydew and feeds on sweets, meat and fat. They are carnivorous usually feeding on other insects and small invertebrates. These ants reduce the population of butterfly eggs and larvae.

Crematogaster brunnea contemta: This species ant is members of the *Crematogaster* Lund genus. These are commonly called acrobat ants. This species distinguished from others by elevating their heart shaped gaster up to over their heads when disturbed. They make nest in soil, crack and crevices of stones, decaying logs or stumps of fallen trees. These ant species are 3-4 mm small in size. These ants forage on ground, trees and low vegetation. These ants are found in both urban and peri-urban habitat. This ant makes carton nest on tree.

Leptogenys processionalis: These species belong to Genus *Leptogenys* Roger. These ants have painful sting. These ants are slender and shiny. Ants of these species construct nest on tree trunk like hollow tunnels, loose soil and under object on ground. Nest of these species generally seen temporary in loose soil. These ants are ground dwelling. They feed on the cockroach, termites and other insects. These ants are predatory and nomadic. These species are found in less disturbed habitat.

Camponotus compressus: This species ant is members of *Camponotus* Mayr, Genus the scientific name of this genus in Greek term is campo means bent or flexible notum means back this is in reference to the distinctively concave shape of the mesosoma of these ants. The whole body is black and opaque. They are commonly known as Carpenter ants. These are black colored and big size ant. Nest of these ants are monodomous terrestrial. They build nest in the dead or decaying logs at the base of trees, soil with or without coverings, in between rocks, in twigs on trees and shrubs. Nest of these ant are mound like. These ants are predators and scavengers and will collect nectar of plants. They show mutuality association with Hemiptera for collection of honeydew produced by aphids, mealybugs, coccids etc.

Oecophylla smaragdina: These species belong to Genus *Oecophylla* Smith. These ants commonly called as 'weaver

ants or red ants. This ant also called as arboreal ant. These ants always make their nest on trees. They make their nest on trees like mango by sticking with an adhesive thread like sticky substance produced by larvae. Nest of these ant are hanging type. These ants are predacious and forage on ground and vegetation. These ants are aggressive and attack intruders they come across.

DISCUSSION

Studies on ant prefer to build their nest, they provide safety, shelter and microenvironment to ants. Nest size is strongly proportional to population of worker within it as reported¹³. Ants use pheromones to mark trails connecting the nest, food source². Foraging strategy and food preference in different habitat was suggested¹⁴. In eastern Florida native and exotic ants nest was in red Mangroves habitat¹⁵. The nest and habitat of ants is in Thrissur district of Kerala¹⁶. The interaction between ants with aphids is for their honey dew secretion¹⁷. Ant colony comprises multiple nests on multiple trees and examined nest structure and process involved in construction of nest¹⁸. Many factors driven on ant community assembled and ants and habitat filtering on nest colonization and community composition of arboreal twig nesting ants was arranged¹⁹. Change in soil chemistry causing distance from the nest²⁰. The soil parameter studied such as pH, organic matter, Ca, Mg, Na, K, humic and fulvic acids. The decrease in pH corresponded with increase in organic matter content with distance from the nest, Organic matter positively correlated with available Ca and K²¹. Species composition reflects the functional changes on the structure of ant communities than species richness and could be more useful in environmental monitoring that use ant communities to evaluate the effect of agriculture activity on biodiversity. Ants greatly affected chemical, physical and biological properties of soil. The effects on physical soil properties are connected with the building of galleries and corridors, which increase the porosity of soil and because of that, may cause separation of soil particles according to their size. Chemical change of soil represents pH towards neutral and increase in nutrient content such as nitrogen and phosphorus in ant nest affected soil²². The nesting activity of ants changes the physical properties of the soil. It involves the penetration resistance of ant nest, their temperature regime and particle size distribution for the nests of three soil dwelling ant species²³. Nesting of ants beneath different trees has variability. Almost 384 ant nests associated with 27 floral species at different location in Periyanaickenpalayam was recorded²⁴. The study site includes urban and peri-urban region of Aurangabad city. Nest building

of ants and foraging activities positively modified the quality of impacted soil. In ants impacted soil nutrients level were increased as compared to surrounding soil. In urban habitats anthropogenic activity is seen more it affects ant's species richness, abundance and nesting site compared to peri-urban habitats.

CONCLUSION

The present study concluded that in Aurangabad city six species of ants nest are observed in urban and periurban habitats according to their nesting habitats. Ants act as an indicator because ants respond quickly to the surrounding environment. The process of construction of the nest, foraging activity increases the fertility of the soil. The contribution of active ants mounds to the surrounding soil ecosystems involves long-term nutrient release into the system.

SIGNIFICANCE STATEMENT

This study discovered six ants species nest in urban and periurban habitats. This study will help researchers to uncover more species of ants nest based on their seasonality, soil habitat.

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