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# Distribution and Diversity of Ant Species (Hymenoptera: Formicidae) in and Around Amravati City of Maharashtra, India

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**Abstract:** The study tried to explore the distribution ants in forest, grassland and human habitats located around Amravati city. In this area, thirty four species of ants in twenty genera were identified. These ant species belong to five subfamily; Formicinae, Myrmicinae, Ponerinae, Dolichoderinae and Pseudomyrmicinae. The dominant genus was *Crematogaster* followed by the genera *Pheidole* and *Camponotus*. Among these three habitats, the similarity index of ant species between forest and human habitat was the highest. The indices of dominance in forest and human habitat indicate that the genera *Crematogaster* is most adapted genera in forest and human habitat. The ant, *Oecophylla smaragdina* is firstly recorded in the Amravati region.

**Key words:** Formicidae % Ants % Genera % Habitat % Diversity % Vidarbha

## INTRODUCTION

Ants are important components of ecosystems not only because they constitute a great part of the animal biomass but also because they act as ecosystem engineers. All the known species of ants are eusocial [1].

Amravati is a city in the state of Maharashtra, India and it is the seventh most populated metropolitan city in Maharashtra. Amravati is located at 20°56'N 77°45'E 20.93°N 77.75°E. It has an average elevation of 343 meters (1125 feet). It lies 156 km (97 miles) west of Nagpur and serves as the administrative center of Amravati District and of Amravati Revenue Division. Amravati has a tropical wet and dry climate with hot and dry summers from March to June.

Globally, there are about 12,571 extant ant species. As per the recent classification, all ants are grouped into 21 subfamilies [2]. Recently, the subfamily Martialinae has been added to the family Formicidae [3]. All the ants species fall into the single family Formicidae. This family is included in the superfamily Vesipedae of the order Hymenoptera, which is placed in the class Insecta. The Myrmicinae is the largest subfamily of the Formicidae, with 138 genera, followed by Formicinae that have 39 genera and Ponerinae which have 25 genera.

Indian Ant Fauna, represent diversity, includes 12 known subfamilies like; Aenictinae, Amblyoponinae, Cerapachyinae, Dolichoderinae, Dorylinae, Ectatomminae, Formicinae, Leptanillinae, Myrmicinae, Ponerinae, Proceratiinae and Pseudomyrmecinae. All over the world there are 22 known subfamilies of ants. The current species list includes approximately 600 species from 81 genera and will continue to increase in number as researchers begin to explore systematically the diverse habitats of ants across the region. Ants in India, occupy a variety of habitats such as leaf litter, trees, soil and dead logs, while tramp species prefer human-modified habitats. Myrmicinae forms the bulk of Indian ant diversity (45%) with genera *Pheidole* and *Crematogaster* having the most species. The subfamily, Formicinae is the second largest ant group (25% of species), with genera *Camponotus* and Polyrhachis constituting the majority of the diversity. The subfamily Ponerinae contributes about 14% of species of which genera *Leptogenys* the most diverse [4].

In India, a few reports on ants ecology and diversity exist. (Gunawardene *et al.* [5] published work on ants of the Western Ghats - SriLanka hotspot. Kumar *et al.* [6] reported the ant fauna from some areas of Bangalore City. Recently a list of 591 species of ants in India was released [7].

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The objective of this study was to find out ant diversity and distribution of ant in three different habitats such as forest, grassland and human habitats. Till research on ant diversity has not been done in this area. This study will generate some valuable information about distribution and richness of ants species in and around Amravati city.

## MATERIALS AND METHODS

**Study Site and Habitat:** The ant samples were collected from various localities in and around Amravati city, within 15 km of the city centre. Three ecological habitats, forest, grassland and human were chosen for sampling. The forest included Pohara Forest, Agriculture field of Janta Agricultural College, Nagpur road and Agricultural Field nearby Kathora village. The grasslands included region of Wadali Lake and Chhatri Lake in the wilderness zone with tree plantations. The human habitats cover civil area with pronounced human influence such as Pote Town Ship, Hollywood Colony and Govt. Vidarbha Institute Campus.

**Experiment:** We employed all out search method for the collection of ants form August 2009 to July 2010. Ants were hand collected using a brush and forceps during day time from 11 AM to 4 PM twice in every month and preserved in 70 % ethyl alcohol at the Department of Zoology, Govt. Vidarbha Institute of Sciences and Humanities, Amravati, with careful notes of their locality, habitat and relative visual abundance. Ant species were listed and each species was counted to calculate and compared the composition, richness, species diversity indices, indices of dominance, including similarity indices among the three different habitat types.

**Ants Identification:** The collected ants were identified up to the genus level by using Stemi DV4 stereo microscope based on literature [8-12].

**Data Analyses:** Ant species listed and the complete count of the number of species presented in each habitat were done for species composition and species structure indices. The results were used to indicate the ant species diversity in forest, grassland and human habitats. Shannon- wiener function [13] was also used to calculate the species diversity indices of the ants living in each type of habitats as follow:

$$H = \sum_{i=1}^{s} (pi)(\mathrm{In}pi)$$

Where

$H$ = Species diversity index
$S$ = no. of species
$Pi$ = proportion of the total sample belonging to $i^{th}$ species.

To measure the similarity between two community samples, coefficient of Sorensen [13] was used as the following equation.

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

Where

QC = Sorensen similarity coefficient
a = No. of species in sample A and sample B (joint occurrences)
b = No. of species in sample B but not in sample A
c = No. of species in sample A but not in sample B

## RESULTS

Thirty four species of ants were identified in the study area of the Amravati city and allied region. All the collected ants were identified into five subfamilies. There were 21 species in 11 genera of subfamily Myrmicinae, 7 species in 4 genera of subfamily Formicinae, 3 species in two genera of Ponerinae, 2 species in two genera of subfamily Dolichoderinae and a single species with a 1 genus of subfamily Pseudomyrmicinae. These 34 species of ants where identified upto the genus level. The details are listed in Table 1.

Of these thirty four ants species, 30 species were collected from the forest, 22 from human habitats and 15 species from grassland. Of these thirty four species of ants 10 species where common in all the three habitats, (Table 2). The species diversity indices among the three habitats were slightly different. The index was the highest in forest (1.75), following by human habitats (1.58) and grassland (1.2). The highest similarity index was in between forest (F) and human habitation (0.77), while the lowest similarity index is between the human habitats and grassland (0.53), (Table 3).

Table1: Subfamily wise distribution of ant genera and identified species in and around Amravati city.

| Subfamily | Genus | Species found |
|---|---|---|
| Formicinae | Camponotus | Taylori (Forel) |
| | | Wasmanni (Emery, 1893) |
| | | Paria (Emery, 1889) |
| | Oecophylla | Smaragdina(Fabricius,1775) |
| | Paratrechina | Longicornis (Latreille,1802) |
| | Polyrchis | Rastella (Latreille,1802 |
| | | sp.1 |
| Myrmicinae | Rhoptromyrmex | Sp.1 |
| | Triglyphothtrix | obese (Andre, 1887) |
| | Aphaenogaster | rotheyi (Forel,1902) |
| | | schurri (Forel,1902) |
| | Monomorium | nigrum (Forel 1902) |
| | Myrmicaria | brunnea (Saunders 1841) |
| | Cardiocondyla | nuda(Mayr, 1866) |
| | Pheidole | hoogwerfi (Forel,1902) |
| | | striativentris (Mayr,1878) |
| | | lamellinoda (Forel,1902) |
| | Crematogaster | diffusa (Jerdon,1851) |
| | | brunnea.contemta.(Forel, 1902) |
| | | ebenina (Forel, 1902) |
| | | aberrans (Forel, 1892) |
| | | rothneyi (Mayr, 1878) |
| | | rogenhoferi (Mayr, 1878) |
| | | sp.1 |
| | Pheidologeton | diversus (Jerdon, 1851) |
| | Solenopsis | sp.1 |
| | | sp.2 |
| | Tetramorium | Guineese (Fabricus,1793) |
| Ponerinae | Leptogenys | (labopelta)dentilobis (Forel,1895) |
| | | (labopelta) diminuta (Fred. Smith 1858) |
| | Pachycondyla | sp. |
| Dolichoderinae | Iridomyrmex | anceps (Roger,1863) |
| | Tapinoma | indicum(Forel,1895) |
| Pseudomyrmicinae | Tetraponera | nigra (Jerdon,) |
| Total | 20 | 34 |

Table 2: Distribution of ant Species in three different habitats in and around Amravati city.

| | Habitat | | |
|---|---|---|---|
| Ant Species Found | Forest (F) | Grassland (G) | Human Habitat (H) |
| Camponotus taylori (Forel) | + | + | + |
| Camponotus wasmanni (Emery, 1893) | + | - | _ |
| Camponotus paria (Emery, 1889) | + | - | + |
| Oecophylla smaragdina(Fabricius,1775) | + | - | - |
| Paratrechina longicornis (Latreille,1802) | + | - | + |
| Polyrchis rastella (Latreille,1802) | + | + | + |
| Polyrchis sp.1 | + | + | + |
| Rhoptromyrmex Sp.1 | + | - | - |
| Triglyphothtrix obese (Andre, 1887) | + | + | - |
| Aphaenogaster rotheyi (Forel,1902) | + | - | + |
| Aphaenogaster schurri (Forel,1902) | + | + | + |

Table 2: Continue

| Ant Species Found | Habitat | | |
|---|---|---|---|
| | Forest (F) | Grassland (G) | Human Habitat (H) |
| Monomorium nigrum (Forel 1902) | + | + | + |
| Myrmicaria brunnea (Saunders 1841) | + | + | + |
| Cardiocondyla nuda(Mayr, 1866) | - | + | - |
| Pheidole hoogwerfi (Forel,1902) | + | + | + |
| Pheidole striativentris (Mayr,1878) | + | - | - |
| Pheidole lamellinoda (Forel,1902) | + | - | + |
| Crematogaster diffusa (Jerdon,1851) | + | + | + |
| Crematogaster brunnea.contemta.(Forel, 1902) | + | + | + |
| Crematogaster ebenina (Forel, 1902) | + | - | + |
| Crematogaster aberrans (Forel, 1892) | + | - | + |
| Crematogaster rothneyi (Mayr, 1878) | + | + | - |
| Crematogaster rogenhoferi (Mayr, 1878) | + | - | + |
| Crematogaster sp.1 | + | - | - |
| Pheidologeton diversus (Jerdon, 1851) | + | - | + |
| Solenopsis sp.1 | + | + | - |
| Solenopsis sp.2 | + | - | - |
| Tetramorium Guineese (Fabricus,1793) | - | + | - |
| Leptogenys (labopelta)dentilobis (Forel,1895) | + | - | + |
| Leptogenys (labopelta) diminuta (Fred. Smith 1858) | + | + | + |
| Pachycondyla sp.1 | + | + | - |
| Iridomyrmex anceps (Roger,1863) | + | - | + |
| Tapinoma indicum(Forel,1895) | - | - | + |
| Tetraponera nigra (Jerdon,) | - | - | + |
| Ant Species Richness | 30 | 15 | 22 |

+ - Present, - -Absent

Table 3: Ecological indices of ant species structure in the three different habitats: forest (F), grassland (G) and Human habitat (H) in the study area around Amravati city, Maharashtra.

| Ecological Indices of Species Structure | Forest (F) | Grassland (G) | Human Habitats (h) |
|---|---|---|---|
| Species Diversity Index (Shannon) | 1.75 | 1.23 | 1.58 |
| Similarity Index between F and G = 0.61 | | | |
| Similarity Index between F and H = 0.77 | | | |
| Similarity Index between G and H = 0.53 | | | |

## DISCUSSION

In the present study, we recorded 34 species of ants in 20 genera representing five subfamilies namely Myrmicinae, Formicinae, Ponerinae, Dolichoderinae and Pseudomyrmicinae. Out of these five subfamily, Myrmicinae is the most abundant having 21species in 11 genera including *Rhoptromyrmex sp*. that firstly recorded. This subfamily is widely distributed in all geographic regions. This correlate with the present study, because, we also collected the highest number of ant species from Myrmicinae subfamily.

Thirty ants species were collected from the forest, 22 from human habitats and 15 species from grassland (Table 2). The species diversity indices among the three habitats were slightly different. The index was the highest in forest (1.75), following by human habitats (1.58) and lowest index (1.23) was recorded in grassland.

The subfamily Formicinae, having seven species in four genera, Subfamily Ponerinae and Dolichoderinae were recorded only the two genera each with three and two species respectively; while the subfamily Pseudomyrmicinae were recorded very poorly with only

one genera from G.V.I.S.H campus. That indicate the human inhibiting in this region disturb the ant habitats and ecology.

Few ant genera as *Crematogaster* with most abundant record of seven species and genera *Aphaenogaster*, *Myrmicaria* and *Monomorium* of Myrmicinae, *Camponotus* and *Polyrchis* of Formicinae and *Leptogenys* of Ponerinae are mostly found everywhere, commonly found in all the habitats and most localities. Few genera are confined to few localities or habitat types, such as *Rhoptromyrmex* with record of only one species and *Oecophylla smaragdina* the (Weaver ant) recorded only from Pohara Forests but not in grassland and in the human habitation area. Weaver ants nest are formed basically of living leaves and stems bound together with larval silk [12]. In this study, it was found a least of Weaver ants nests hanging on the trees in Pohara Forest in summer season, because of being an aggressive predator and territory defense, they sometimes drop down from their nests and tree branches onto the ground for foraging and defense.

The genus *Camponotus* were record of three species in all the study area. These ants are called as Carpenter ants because of their “Nesting Behaviors”. They dwell in the tree trunks, living and making space inside, but do not feed on the wood. Tree hollow, tree holes and dead limbs are the most common nesting site. The Carpenter ants are important insect pests causing damages in building [14].

Some of the ants which are reported as an important urban pest related to with human communities are Pharaoh ant *Monomorium pharaonis* and Ghost ant *Tapinoma melanocephalum* are found in the study in the most of locality. The Pharaoh ants are omnivores feeding on wide varieties of food. They are found living outdoor sometimes, locating near rotten blogs or in piles of lumber. These ants may bit but rarely sting. Ghost ants are predator. They feed on small insect eggs. They do not bite or sting. Usually, they outdoors, are nesting in the soil at the base of trees, rotten wood, decayed tree parts or beneath leaf litter. Both the Ghost ant and the Pharaoh ants infest into buildings and create nuisances [14,15].

In addition there were two genera of ant found only nearby Wadali Lake and Chhatri Lake. They were *Pachycondyla* and *Polyrchis* belonging to the subfamily Ponerinae and Formicinae, respectively. The first genus has an interesting behavior, when they get disturb, secrete acid foam from the tip of abdomen to defense them.

The study of species diversity indices compared among the three types of habitats such as forest (1.73), grassland (1.23) and human habitation (1.58) indicates that the difference in habitat influence the kinds of ant species inhibiting in these habitats. The similarity indices, tools for comparing the similarity between two community samples, vary from 40% to 60% among those habitats sites. By the similarity measurement, forest and human habitat showed the most similar ant species diversity. The highest similarity index between them indicated the highest number of ant species coexistence in both sites. It is possible that the places of human habitations may consist of some similar microhabitat types occurring in forest. Although forest and human habits site have nearly same number of ant species, the lower index value indicate the microhabitats between the two areas are more different. Sunil Kumar *et al.* [6] reported the ant species richness generally increases with increase in vegetation.

The genus *Crematogaster*, *Pheidole* and *Camponotus* are dominant in the forest site and human habitats. Grassland has lowest dominance index the lowest index value implies that there is no dominant ant species exist in the grassland site for the Amravati city. Some of the ant genera are recorded consistently with record single species each from one or two sites. These are *Triglyphothtrix* from Wadali Lake, *Aphaenogaster* with two species from Janta Agriculture College, *Cardiocondyla* and *Tetramorium* from Chhatri Lake. *Pheidologeton* is a genus of ants also called Marauder ants, due to their raids similar to those of Army ants. One of the specie was collected from the Pohara forest. Their nests are more permanent but almost as large as those of Army ant. One of the species *Tetraponera nigra* of Pseudomyrmicinae collected from the tree trunk of *Azadirakhta indica* in the G.V.I.S.H campus only.

Ants perform many ecological roles which are beneficial to humans being, including the suppression of pest populations and an erosion of the soil. Present study will yield valuable information of ant availability in the region. The environs of Amravati City is rich in Ant species deserve further study.

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