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Diversity and abundance of the myrmicofauna in Chalisgaon, North Maharashtra region, India

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Abstract
During a survey on 2015 to 2017, 27 species of ants were collected from five subfamilies (Myrmicinae, Formicinae, Ponerinae, Pseudomyrmecinae and Dolichoderinae) and 18 genera in and around the Chalisgaon city, Jalgaon. Among them, *Myrmicaria brunnea, Pheidole woodmasoni, Monomorium sp., Crematogaster rothneyi, Solenopsis sp.* and *Camponotus compressus,* species were the most dominant species in terms of number of individuals. The subfamily Myrmicinae, represented by 12 species was the most dominant followed by Formicinae (8 species), Ponerinae (3 species), Dolichoderinae and Pseudomyrmecinae (each 2 species).
As mediator in many ecosystems their species composition gives an indication of ecosystem health and functioning; while some are purists reliant on undisturbed ecosystems, others are weeds or even invasive. Their abundance and varied ecological roles make them influential in agricultural ecosystems around the Chalisgoan city, Jalgaon.

Keywords: ants, diversity, abundance, Chalisgaon. Jalgaon

1. Introduction
Ants represent up to 80% of animal biomass became an essential component of various ecosystems in the biosphere. They are a conspicuous and diverse, component of terrestrial biodiversity distributed worldwide including India [1, 2, 3]. Ants are virtually everywhere, populating all forest strata and display a remarkable range of social behavior and foraging habits. In nature, they are living in different habitats and effectively involved in the food chain, soil aeration, seed dispersal, mutualism with other animals, plant protection and parasitism. As a predator, they also often used as biological control agents of insect pests and fungal pathogens [4, 5].
Urbanization is the progressive increase of the population in towns and cities. Globally, increasing urbanization widely affects the natural habitats of many endemic species including ants. It is caused by many urbanizing factors i.e. industrialization, roads construction, habitat degradation and fragmentation, urbanizing landscapes, deforestation [6, 7, 8, 9, 10, 11]. Even though huge urban disturbances, ants respond quickly and are able to tolerate to urban habitats [12, 13]. As the loss of natural habitat of ant species in urban ecosystem, it is necessary to recognized their multiple habitats and conserve them effectively.
Chalisgaon ($20^0$47' N, $75^0$02' E) is situated at the North-West of Maharashtra state in India. It has an average elevation of 344 meters (1128 feet). The surrounding vegetation is tropical dry deciduous type which spreads through the biologically diverse and productive habitat for native flora and fauna. The myrmicofauna of this region is till unexplored and very rich, both in species numbers and endemism. But day by day its diversity is particularly endangered by anthropogenic disturbances.
The objective of this research was to conduct a survey of ant fauna and to analyse ant species richness at different habitat levels in Chalisgaon region. This study may provide a platform for further myrmecological research. Hopefully, it will also help to conserve this most interesting fauna, to which researchers have dedicated many of their studies.

2. Material and Methods
2.1 Ant Collection
In the present study ants were collected from five different habitats of vegetation i.e. agriculture field, trees, grasslands, houses and roads and pavements. Ants were collected between 13:00 and 17:00h from each study sites during March, 2015 to April, 2017. For the present study, no any nest was disturbed or dug to collect the samples. They were collected by using standard methods a sieve, tray and forceps and kept in small plastic vials containing 80% alcohol for identification. The ants were identified by using standard taxonomic keys [1, 14, 15] and taxonomic specialists.

2.2 Data Analyses
The total number of ant species and individuals were counted from each sample of different habitats. Ant species from each habitat was then analyzed by the Shannon-Wiener Diversity Index and the Simpson Dominance Index. The Shannon-Wiener Diversity Index was calculated as a measure of relative diversity. The strength of species numerical abundance was calculated by Simpson Dominance Index. The results were used to indicate the ant species structure in forest, grasslands, agriculture field, houses and roads and pavements.

3. Result and Discussion
Chalisgaon region along with urban landscape is covered with agriculture field, industries and forest. It was noted that the ant species observed in five different habitats within same geographical region varied considerably.

During the study, 27 ant species belonging to 18 genera and 5 subfamilies were recorded from the selected habitats of Chalisgaon region. Among the 5 subfamilies, there were 08 species in 5 genera of subfamily Formicinae, 12 species in 7 genera of subfamily Myrmicinae, 3 species in 3 genera of subfamily Ponerinae, 2 species in 2 genera of subfamily Dolichoderinae, 2 species in 1 genus of subfamily Pseudomyrmecinae (Table 1).

3.1 Agriculture field

In the agriculture field total 21 species of ants was recorded which showed that the ants seem to tolerate and recover the same areas after disturbance due to agriculture practices. About 78% of ant fauna was observed in the agriculture field which has been shown that ants are well adapted to impoverished habitats (Table 2). In the agriculture field, various practices such as irrigation, drainage, tillage, ploughing and use of pesticides have been applied for the production of crop. It was noted that such practices decreases the ant diversity and colony densities [5, 9, 16]. According to Philpott and Armbrecht (2006), ants are important predators and may aid pest prevention and management if well understood and studied. It is essential to understand and maintain the agro-ecosystem by using eco-friendly agricultural practices.

3.2 Grassslands

In grasslands and open spaces of Chalisgaon area, total 19 ant species were recorded. Due to the grazing intensity, it became the highly disturbed area which affects ant species richness. Even though a reduction in ant species richness, some ant species as *Myrmica brunnea*, *Monomorium distructor*, *Camponotus compressus* dominated significantly and cover upto 80% dominancy in grasslands. The species richness of some invasive ant species and reduction of some native ant species in urban green area is caused by increasing soil temperature and decreasing soil moisture was noted by earlier workers [8, 12, 13, 17, 18].

3.3 Roads and pavements

Certain ant species has been documented on roads and pavements due to nesting and/or ground-foraging behavior. Owing to urbanization and road construction, only 10 ant species was observed. Among the collected ant species, *Camponotus compressus*, *Solenopsis geminate and Tetramorium smithi* were the most dominating and well adapted ant species located on this habitat. Roads and pavements is the heavily disturbed habitat showed low species richness and diversity of ground-foraging ants [11, 19, 20, 21].

3.4 Houses

Total 8 ant species (29.63%) was recorded from indoor, outdoor, in the soil and even though in relatively open areas of houses. Among the ant species, *Tapinoma melanocephalum (52%) Paratrechina longicornis (22%), Tetramorium caespitum (35%)* and *Camponotus compressus (14%)* were the most common and dominant household ants. They were formed their nests in the electric boards, woodwork, the masonry of buildings and also in the soil. A higher frequency of ant existence in houses expected due to the favorable climatic conditions and the characteristics of human habitation in the tropics [22]. It was noted that they mostly feeds on sweets, meats, breads, fruits, dead animals and plant secretion. As the species richness of household ants, they considered as harmful to human health, food products, wood furniture, electrical and electronic equipment [23].

3.5 Trees

Around 16 ant species were collected from 189 trees. During collection, ants were observed in different behavior as nesting, foraging and even both. It was also observed that more than 60% ant species collected from the tree were the foraging individuals. Among these foraging ants, *Camponotus sp.*, *Solenopsis geminata*, *Tetraponera sp.*, *Crematogaster sp.*, *Myrmicaria brunnea* were showed their high abundance and diversity. The variation in reported species richness may be influenced by several factors. The most likely ecological effects of such disturbance on arboreal ants are increased due to forest conversion, forest fragmentation and temperature fluctuation [6, 23, 24].

Many arboreal ants was noticed to form mutualistic relationship with the homopteran bugs, which place a greater relative importance on defending bugs from bug-predators or from competing ant colonies. In this relationship, ants harvest honeydew, a sugary exudate of bugs and protect them from predators and parasitism [25, 26]. Weaver ant, *Oecophylla smaragdina* colonies were observed generally on Mango and peepal trees. They construct their nests by drawing together leaves and fixing them with the help of larval silk. Weaver ants are predatory in nature which able to protect a variety of crops against many insect pests [1, 23].

The species diversity indices compared among the five different habitats such as agriculture field, trees, grassland, roads and pavements and houses were slightly different (Table 3). It indicates that the different habitats influence the variation in ant species located in these habitats. The Shannon diversity index was relatively diverse in the agriculture field (2.72), following by grassland (2.57), trees (2.46), roads and pavements (2.14) and lastly the houses (1.92). The Simpson and Shannon J indices of each habitat while comparing, noted that the agriculture field was more diverse while the house was less diverse during the survey period.

Houses have the lowest dominance index value which indicates that there is no dominant ant species exist. Even though the regular cleanliness, the habitat has been slightly changed time to time but no any dominance alteration observed in the household ants. Grasslands and roads and pavements are the open spaces which affect severely by anthropogenic disturbances, grazing animals and certain climatic changes where dominance of ants is slightly higher. In the agriculture field, due to huge application of agro-practices by the farmers, the ant species richness and their dominance alter frequently, hence dominance value is higher than other habitats (Table 3).

4. Conclusions

It is concluding that 27 ant species belonging to 19 genera and 5 subfamilies recorded from the five different habitats i.e. agriculture field, trees, grasslands, houses and roads and pavements. The studied ant species in five different habitats is

varied significantly which shows that they act as reliable indicators of ecosystem. During living in different habitat in urban environment, they acts as parasites, predators, bioindicators, destructor and even though observed to maintain mutualistic relationship with other animals. As the variable and huge ecological importance in various fields, it is necessary to interpret and conserve them carefully.

We believe that the results of this preliminary study justify the launching of more detailed investigations on the role of ants in different ecological habitat. It is also possible that use of ants as indicators of ecological disturbances and of on the causes of variations in ant species diversity richness. In addition to this, further study will be focus on the ant fauna and their relationship with other organisms in the form of mutualism, parasitism, commensalism as well as predator in the ecosystem.

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Table 1: Ants collected from different localities of Chalisgaon city

Subfamily	Sr. No.	Species	Agri. field	Trees	Houses	Roadsides	Grasslands
Formicinae	1	*Camponotus compressus* (Fabricius, 1787)	+	+	+	+	+
	2	*Camponotus sericeus* (Fabricius, 1798)	+	+	-	+	+
	3	*Camponotus parius* (Emery, 1889)	+	+	-	-	+
	4	*Oecophylla smaragdina* (Fabricius, 1775)	-	+	-	-	-
	5	*Paratrechina longicornis* (Latreille, 1802)	-	+	+	-	+
	6	*Plagiolepis jerdonii* (Forel, 1894)	+	+	-	-	+
	7	*Lepisiota capensis* (Mayr,1862)	+	+	-	-	-
	8	*Lepisiota opaca pulchella* (Forel, 1892)	+	+	-	-	+
Myrmicinae	9	*Crematogaster brunnea contemta* (Mayr, 1879)	+	+	-	-	-
	10	*Crematogaster artifex* (Forel, 1902)	+	+	-	-	-
	11	*Crematogaster subnuda*	+	+	-	-	-
	12	*Aphaenogaster beccarii* (Emery, 1887)	+	-	-	+	-
	13	*Monomorium pharaonis* (Linnaeus, 1857)	+	-	+	-	+
	14	*Monomorium destructor* (Jerdon,1851)	+	+	+	-	+
	15	*Solenopsis geminata* (Fabricius, 1804)	+	+	-	+	+
	16	*Tetramorium caespitum* (André, 1887)	+	-	+	-	+
	17	*Tetramorium simillimum* (Smith, 1851)	-	-	-	+	+
	18	*Tetramorium smithi* (Mayr, 1879)	+	-	+	+	+
	19	*Pheidole woodmasoni* (Forel,1885)	+	+	-	-	+
	20	*Myrmicaria brunnea* (Saunders, 1842)	+	+	-	+	+
Ponerinae	21	*Anochetus sp.*(1)	-	-	-	+	+
	22	*Pachycondyla* (1)	+	-	-	+	+
	23	*Leptogenys chinensis* (Mayr, 1870)	+	-	-	+	+
Dolichoderinae	24	*Tapinoma melanocephalum* (Fabricius, 1793)	+	+	+	-	+
	25	*Iridomyrmex anceps* (Roger, 1863)	+	-	+	-	-
Pseudomyrmecinae	26	*Tetraponera nigra* (Jerdon, 1851)	-	+	-	-	-
	27	*Tetraponera rufonigra* (Jerdon, 1851)	-	+	-	-	-
		Total species richness	21	18	08	11	19
		%age of species richness	77.77	62.96	29.63	40.74	70.37

Table 2: Subfamily-wise distribution of ant fauna at Genus, species and individual level

Subfamily	Genera		Species		Individuals	
	No.	%age	No.	%age	No.	%age
Formicinae	05	27.78	08	29.63	321	28.69
Myrmicinae	07	38.89	12	44.44	526	47.01
Ponerinae	03	16.67	03	11.11	125	11.17
Dolichoderinae	02	11.11	02	7.41	89	7.95
Pseudomyrmecinae	01	5.55	02	7.41	58	5.18
Total (5)	18	100	27	100	1119	100

Table 3: Alpha diversity indices from different habitats

Habitats	Shannon H	Simpson D	Shannon equitability J	Dominance index
Trees	2.462	0.077	0.86	0.93
Grasslands	2.578	0.090	0.87	0.89
Agriculture field	2.716	0.075	0.91	0.92
Houses	1.925	0.134	0.82	0.83
Roads and pavements	2.144	0.116	0.89	0.87

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