Ant Diversity in an urban garden at Mumbai, Maharashtra

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Abstract : Ants are considered as one of the most diverse, abundant and ecologically significant organisms on earth. The parks, gardens and small patches of natural vegetation provide suitable environment for ecological communities in urban habitats, like Mumbai. The diversity of ants (Hymenoptera) was studied in 2010-2012, at Maharashtra Nature Park Society (MNPS), Mumbai. During the present study, 28 species of ants representing six subfamilies- Aenictinae, Dolichoderinae, Formicinae, Myrmicinae, Ponerinae and Pseudomyrmicinae were recorded. The highest diversity was exhibited by the subfamily Myrmicinae with eleven ant species represented by seven genera. The ants belonging to *Crematogaster spp.* exhibited the highest diversity, represented by four species. This was followed by Formicinae with 28% contribution and represented by six genera and eight species including the invasive ants, Black crazy ants, Red Fire Ants and Yellow crazy ants. Ten ant species were commonly observed at Maharashtra Nature Park, four species of Myrmicinae, four of Formicinae and one each from Dolichoderinae and Pseudomyrmicinae.

Common occurrence of *Tetraponera rufonigra* (Family: Pseudomyrmicinae), an arboreal species, at Maharashtra Nature Park indicated availability of suitable trees providing microhabitats for the species at this site. Two species of *Diacamma* and two species of *Leptogenys* (Family: Ponerinae) were occasionally recorded at Maharashtra Nature Park. These are predator species indicating availability of prey organisms at this site.

Key words **:** Ant species, distribution, classification, urbanization, disturbance gradient, indicator species.

Introduction

Biodiversity deals with the life of different living organisms on the planet earth, their homes or habitats, and the systems that support them. It also deals with the complex interaction and interdependence on each other. Under the current scenario of biodiversity loss, and in order to preserve it, it is essential to achieve a deep understanding on all the aspects related to the biological interactions, including their functioning and significance.

According to Quadros *et al.,* (2009), the studies of biodiversity have now assumed greater significance as ecologists try desperately to document global biodiversity in the face of unprecedented perturbations, habitat loss and extinction rates. Biodiversity is intrinsically valuable as a means of improving our understanding of the structure and functioning of ecological communities (McArthur and Kitchen, 2007).

The fauna forms an important aspect in biodiversity studies and mainly comprises of invertebrates and vertebrates. Invertebrates are the most successful and prolific animals on the planet. Among invertebrates, insects are the most numerous and diverse organisms on Earth. Moreover, because many insects are highly mobile, their presence in an ecosystem may be temporary, thus reducing the ability of biological monitoring to detect changes. Being less transient, many researchers have turned using ants (Hymenoptera: Formicidae) and ant functional groups as bioindicators (Andersen, 1997; Stephens and Wagner, 2006; Underwood and Fisher, 2006; Majer *et al.,* 2007, Fagan *et al.,* 2010, Gomez and Abril, 2011).

Overall literature survey indicates that, there exists extensive research on several aspects of insect diversity with more emphasis on the Lepidopterans, beetles of household compost vegetation of Maharashtra. There is a neglect to Myrmecology i.e. the study of ants in and around Mumbai. Hence the present study to document the diversity of ants is undertaken. The sampling area selected was Maharashtra Nature Park Society, Sion, Mumbai

Material and Methods

Maharashtra Nature Park Society **(Latitude 19° 02'N; longitude 72° 48'E) is 15 hectare (37 acres) manmade park on garbage dump** resembling a mini forest. This vegetated area provides suitable environment for ecological communities in urban habitats, like Mumbai. Insects can be effectively used to assess biodiversity status of these ecosystems.

The study transect approximately measured about 1023 feet. This area is characterized with number of trees and human influence due to the park visitors. Hand picking method was employed for the collection of specimens because it is less labour intensive, does not involve time consuming placement of pitfall traps and can be safely used in too wet or with heavy disturbance activities. Ellison *et al.,* (2007), has discussed comparisons of sampling efficiency by hand collecting accumulates species more efficiently than other commonly used pitfall traps or baits. Sampling was done in premonsoon, monsoon and post monsoon periods

from December 2010 to January 2012 of morning as well as later afternoons. 5 samples of each ant were collected using gloves and were transferred to vials with 70% ethyl alcohol and glycerol for preservation. Forceps and brush were used for collection. These specimens were mounted using standard procedure for identification using light microscope as well as compound microscope in the laboratory. The individuals were identified up to species level, using Narendra and Kumar, (2006) and Tiwari, (1998). Ant Web was used for confirmation of species.

The ant nests in the study transect were recorded by observing nest entries and movements. Nests were categorized as suggested by Amarasinghe (2010). The flora of the study site was identified with help of botanists, and using keys, Cook (1967) and Randhawa (2004).

Observation

During the study, twenty eight ant species were recorded in Maharashtra Nature Park represented in the following Table 1.

Table 1. List of ant species recorded

Sr No	Common name	*Scientific name*	Occurrence	Premonsoon	Monsoon	Postmonsoon
1	Lesser Army ants (Aenictinae)	*Aenictus ceylonicus*	Occasional	+	-	-
2	Odour ant (Dolichoderinae)	*Tapinoma melanocephalum*	Common	+	+	+
3	White footed ghost ant (Dolichoderinae)	*Technomyrmex albipes*	Occasional	+	-	-
4	Common. Godzilla ant (Formicinae)	*Camponotus compressus*	Common	+	+	+
5	Golden backed ant (Formicinae)	*Camponotus sericeus*	Seasonal	+	-	+
6	Pentagonal ant (Formicinae)	*Lepisiota frauenfeldi*	Occasional	+	-	-
7	Red antler ant (Formicinae)	*Lepisiota opaca*	Occasional	-	-	+
8	Common. Bullhorn ant (Formicinae)	*Polyrhachis lacteipennis*	Seasonal	+	-	+
9	Black crazy ant (Formicinae)	*Paratrechina longicornis*	Common	+	+	+
10	Yellow crazy ant (Formicinae)	*Anoplolepis gracilipes*	Common	+	+	+
11	Weaver ants (Formicinae)	*Oecophylla smaragdina*	Common	+	+	+
12	Tetramorium species (Myrmicinae)	*Tetramorium bicarinatum*	Occasional	+	-	-
13	Miniscule house ant (Myrmicinae)	*Tetramorium smithi*	Occasional	+	-	-
14	Red fire ant (Myrmicinae)	*Solenopsis geminata*	Common	+	+	+
15	Glossy slender acrobat ant (Myrmicinae)	*Crematogaster ransonneti*	Seasonal	-	+	+
16	*Crematogaster sp* (Myrmicinae)	*Crematogaster sp 1*	Occasional	+	-	-
17	Common. Broad acrobat ant (Myrmicinae)	*Crematogaster subnuda*	Common	+	+	+
18	Crematogaster species (Myrmicinae)	*Crematogaster rothneyi*	Occasional	+	-	-
19	Silky shield ant (Myrmicinae)	*Meranoplus bicolor*	Seasonal	+	-	+

19	Silky shield ant (Myrmicinae)	*Meranoplus bicolor*	Seasonal	+	-	+
20	Pharaoh ant (Myrmicinae)	*Monomorium pharaonis*	Seasonal	+	+	-
21	Spiny harvester ant (Myrmicinae)	*Pheidole watsoni*	Common	+	+	+
22	Deceptive. Serrated ant (Myrmicinae)	*Cataulacus taprobanae*	Common	+	+	+
23	Diacamma species (Ponerinae)	*Diacamma ceylonense*	Seasonal	+	-	+
24	Lesser striated bispinous ant (Ponerinae)	*Diacamma rugosum*	Seasonal	+	-	+
25	Procession ant (Ponerinae)	*Leptogenys processionalis*	Seasonal	+	+	-
26	Slender jawed sail ant (Ponerinae)	*Leptogenys chinensis*	Seasonal	+	-	+
27	Shy spineless bark ant (Ponerinae)	*Platythyrei sagei*	Occasional	+	-	-
28	Arboreal bicoloured ant (Pseudomyrmicinae)	*Tetraponera rufonigra*	Common	+	+	+
				26	13	18

Table 1. The above table indicates seasonal data, where (+) indicates presence of ants while (-) indicates absence of ants.

Table 2. Percentage contribution of various subfamilies

Subfamily	Species	Percentage (%)
Myrmicinae	11	39.28
Formicinae	8	28.57
Ponerinae	5	17.85
Dolichoderinae	2	7.14
Aenictinae	1	3.58
Pseudomyrmicinae	1	3.58

The nests observed were classified based on the location using the key described by Amarasinghe (2010).

1] Subterranean nests (S) – Cone or mound,

2] Arboreal nests (A) – Made with leaves among living tree

3] Lignicolous (LG) – Constructed in or outside stems of living plants and among dead decaying leaf litter.

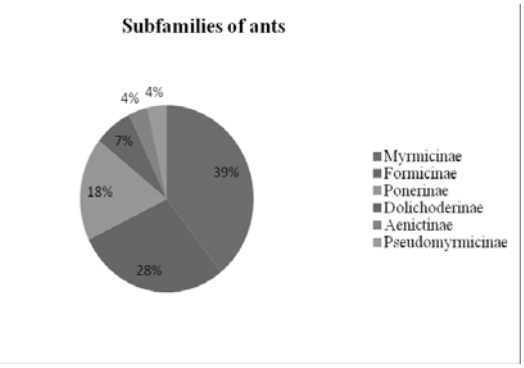
Paratrechina longicornis, Tapinoma melanocephalum, Cataulacus taprobanae, Crematogaster subnuda species were observed with arboreal nesting. *Solenopsis geminata, Pheidole watsoni* followed Subterranean nesting, while lignicolous nesting was seen in *Tetraponera rufonigra, Meranoplus bicolour, Camponotus compressus*. These were found in association with different plants, the plants diversity in MNPS is found to be varied and rich with 59 species of trees in the study area.

Result And Discussion

During the present study, we recorded 28 species of ants representing six subfamilies- Aenictinae, Dolichoderinae, Formicinae, Myrmicinae, Ponerinae and Pseudomyrmicinae.

The highest diversity was by the subfamily Myrmicinae with eleven ant species represented by seven genera. The ants belonging to *Crematogaster spp*. exhibited the highest diversity, represented by four species. This was followed by Formicinae with 28% contribution and represented by six genera and eight species including the Invasive ants, Black crazy ants, Red Fire Ants and Yellow crazy ants.

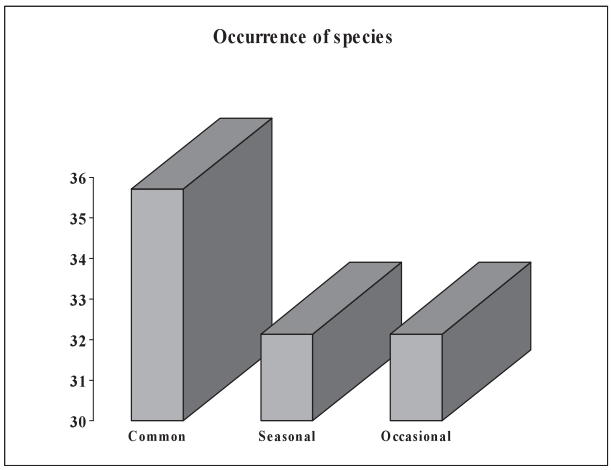
Fig 1.1– Maharashtra Nature Park Society



Dominance of Myrmicinae in terms of diversity was common at Maharashtra Nature Park. Dominance of Myrmicinae at urban sites was also recorded by, Kumar and Mishra (2008) at Vadodara, Barve and Davidar (2008) at Bangalore, Chavhan and Pawar (2011) at Amravati and Bhagat *et al.,* (2008) at IIT Campus, Mumbai.

Occurrence of species: The ant species that were recorded in almost all visits in all the three season, were designated as "common" species, whereas, the species which were recorded in 1 or 2 seasons were considered as "Seasonal" species. The species which were recorded only during one or visits, were considered as "occasional"

Fig 1.2- Occurrence of species (percentage contribution)



Ten ant species were commonly observed at Maharashtra Nature Park, four species of Myrmicinae, four of Formicinae and one each from Dolichoderinae and Pseudomyrmicinae.

It is noteworthy that *Camponotus compressus* (Family: Formicinae) and *Anoplolepis gracilipes* (Family: Formicinae) were the common species. *Camponotus compressus*, is a general predator and is common in variety of habitats including gardens. *Anoplolepis gracilipes* is an invasive species, indicating disturbance in the habitat.

Common occurrence of *Tetraponera rufonigra* (Family: Pseudomyrmicinae), an arboreal species, at Maharashtra Nature Park indicates availability of suitable trees providing microhabitats for the species at these sites. *Lepisiota opaca* rarely occurs in urban region. It can be present only in undisturbed environment. (Narendra and Kumar, 2006). Occassional presence of this species in MNPS is significant.

Two species of *Diacamma* and two species of *Leptogenys* (Family: Ponerinae) were occasionally recorded at Maharashtra Nature Park. These are predator species indicating availability of prey organisms at this site. Three species of *Crematogaster* ants were common in this area. *Crematogaster* species have been reported as being able to tap the high productivity of canopy foliage by feeding on plant and insect exudates (Davidson, 1997) this can be the reason for their common occurrence during the present study.

Nesting: In Maharashtra Nature Park area, nests of nine species were observed. *Tetraponera rufonigra,* the arboreal bicoloured ant is reported to nest in dead wood of trees and posts (Narendra and Kumar, 2006). During this study, it showed lignicolous nests in Maharashtra Nature Park, especially on *Ficus tsiela* species. Similar observations were recorded by Amarasinghe, (2006). Kumar and Mishra (2008), observed its nesting on *Caesalpinia crista* at Vadodara. Few other ant species also showed arboreal nesting. This included *Cataulacus taprobanae* and *Crematogaster species*. *Cataulacus taprobanae* selected *Ficus arnotiana* for its colony at Maharashtra Nature Park, while nesting of *Crematogaster subnuda* was recorded on *Barringtonia.* Narendra and Kumar, (2006) stated that feathers are taken for nests decoration. We observed *Crematogaster sp* as one of the species taking feathers in arboreal nest on *Barringtonia* tree. However, these feathers contrary to the observation of Narendra and Kumar (2006) were not being used for decoration of the nest entrance to act as visual signal; but the feathers were taken inside the nest, the reason is unknown and needs further study.

At Maharashtra Nature Park, various ant species were recorded in association with plants, either in search of food or nesting. This included true arboreal species like *Tetraponera rufonigra* and *Cataulacus taprobanae*, nesting in tree hollows. In addition to this various species of *Crematogaster* ants and generalist species like *Paratrechina longicornis* were also recorded to associate with plants for shelter or feeding purpose. It is noticed that these four species are highly adaptable and are found associated with maximum number of trees.

The study reveals the following salient features of the ants and the study area are noted-

- Higher ant diversity in the urban garden areas with diverse vegetation.
- Better association of ant species with native trees like *Ficus* species.
- Higher ant diversity recorded in premonsoon season.
- Dominance of subfamily Myrmicinae in urban garden area.

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