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Diversity of Ant species in Karnatak University campus, Dharwad

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Abstract
Ants are eusocial insects of the family Formicidae belonging to the order Hymenoptera. Ants may be evolved from wasp like ancestors in the mid-crestaceous period and were diversified after the rise of flowering plants. So far more than 12,500 species of ants have been identified and classified. With such a vast diversity, occupying almost all ecosystems except Antartica and few islands, they forms about 15-25% of the total terrestrial animal biomass. They are known to be bio-indicators of the prevailing habitat w.r.t. the vegetation and soil fertility. Hence, the present study was undertaken to know the ant diversity and to create a base line data of Karnatak University (KU) campus, Dharwad, which is of prime importance to carry out further research on ants. During the present study, 24 different species of ants belonging to 15 genera divided into 6 sub-families such as, Formicinae (10), Myrmicinae (10), Ponerinae (1), Dorylinae (1), Dolichoderinae (1) and Pseudomyrmicinae (1) under the family Formicidae were collected and identified. Of the total recorded sub-families from the study area only the Eastern part of KU campus has individuals belonging to 4 sub-families and each of the other parts such as Northern, Southern, Western and Central has individuals belonging to 3 sub-families. Presence of different groups of ants in the demarcated zones may be due to the selective needs such as food, shelter and adaptive capabilities of particular ant species to the prevailing vegetation and soil type.
Keywords: *Ants; Diversity; Karnatak University Dharwad*

1. Introduction

Earth is blessed with amazing variety of living organisms consisting of both micro and macro organisms such as bacteria, fungi, plants and animals. The variability among all these organisms from all sources such as terrestrial and aquatic ecosystems helps to maintain the genetic variations among them.

As India falls in the tropical belt, it is blessed with rich biodiversity due to its varied climatic and altitudinal conditions coupled with variety of ecological habitats. On the basis of species richness, India ranks sixth among twelve mega diversity regions of the world.

Karnataka has various types of forests such as, scrub, moist deciduous, semi-evergreen, evergreen and dry deciduous accounting for about 20% of the total geographical area.

As all the living organisms play an important role in one or the other way in nature, ants also have most important role in soil formation and fertility. The study of these interesting and diverse group of insects is known as ‘‘Myrmecology’’. All ants are eusocial and they are considered as useful organisms for monitoring the soil fertility as they are abundant of ubiquitous in both intact and disturbed areas (Andersen, 1990; Pearson, 1994; Andersen, 1997; Folgarait, 1998; Hoffman, 2000).

Ant distribution is seen on almost every landmass except Antarctica and few Islands contributing about 15 to 25% of the total terrestrial animal biomass. Currently, about 12,500 ant species from 21 sub-families are recorded worldwide (Bolton, 2003). The family Formicidae is included in the super family Vespoidea of the order Hymenoptera, class-Insecta, Phylum-Arthropoda. Among the family Formicidae, sub-family Myrmicinae is the largest with 138 genera followed by Formicinae with 39 genera and Ponerinae with 25 genera. Recently, one more sub-family ‘Martialinae’ has been included to family Formicidae (Rabeling et al., 2008).

According to the Bolton (2003) Oriental region has rich ant diversity with 101 genera belonging to 13 sub families of which 5 sub families are endemic to this region. Likewise, India also

harbors about 631ant species falling under 82 genera belonging to 13 sub- families.

The estimated total number of species living on the earth is around 50 millions, out of which the known and recorded number of species is just around 1.8 million. This clearly indicates that there is a need for studying the unknown biodiversity. Hence, the present study was undertaken to know the ant diversity and to create a base line data for further research on ants of Karnatak University, campus Dharwad.

2. Materials and Methods:

2.1 Study site:

Karnatak University, Dharwad (150 26`N and 740 49`E) is a well known University present in the Northern part of Karnataka, India. The campus has dry deciduous vegetation with temperature ranging from 16 to 38 0C. It receives an average annual rain fall of 800-900 mm. The survey of ants was carried out in the whole campus which was divided into 5 different sites as follows,

Site 1:- Northern area of KUD campus includes nearby Boys hostel, Post office, Banks and surrounding areas.

Site 2:- Southern area of KUD campus includes nearby Girls hostel, Railway track, Hanuman temple, Karnatak Regional Science Centre Dharwad.

Site 3:- Eastern part of KUD campus includes Library, Canteen, Botanical garden and surrounding areas.

Site 4:-Western part of KUD campus includes Stadium (ground) M. P. Ed department and surrounding areas.

Site 5:- Central part of KUD Campus which includes Main and Administrative buildings, along with green garden and surrounding areas.

2.2 Survey Time:

A regular survey was carried out every week between 6 to 10 am and 4 to 6 pm in the study sites from August to February. Observations were made randomly on the basis of habitat, structure and availability of ant species.

2.3 Collection:

Ants were collected from different sites using various methods suitable for respective habitats. Morning and evening collections gave best results.

Ant colonies will be deeper in the soil during winter season, although a few foragers at the surface, hence, we could collect individuals by digging to a depth of 1-3 meters. In spring season, the colonies moved nearer the soil surface. The observed species were collected, photographed and preserved for further studies.

2.4 Killing and Preservation:

Ethyl acetate coated blotting papers were used for killing the ants by placing them in the poison bottle in order to avoid direct contact with chemical.

Pinning was made by using ordinary pins in a insect box for preservation.

2.5 Identification:

Several types of keys were used for taxonomic studies, to identify the collected ant specimens.

1. The collected specimens were identified based on the morphological characters such as, number of segments in antenna, position of antenna, type of eyes, number of nodes, spines present in the petiole region, presence or absence of sting, body coloration, size, and hair etc.
2. The collected specimens were photographed and identified by using effective available keys and field guides from the net or books of ants (http://antkey.org/en; http://www.ipm.ucdavis.edu/TOOLS/ANTKEY/; Bolton, 1994).

3. Results:

In the present study, a total of twenty four ant species belonging to 15 genera and 6 sub-families under the family Formicidae were collected from the KUD campus (Table 1; Plates 1-4). This includes ten species each from sub-family Formicinae and Myrmicinae, followed by one species each under Ponerinae, Dorylinae, Dolichoderinae, and Pseudomyrimicinae.

Sub-family Formicinae and Myrmicinae represents the highest percentage of species (42%) followed by Ponerinae, Dorylinae, Dorichoderinae, Pseudomyrimicinae with least percentage (4%) each (Table 2; Graph 1).

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Table 1: Different ant species observed within KU campus Dharwad and their classification

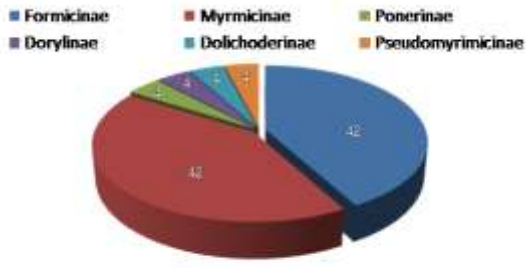
Order	Family	Sub-family	Scientific name	Common name
Hymenoptera	Formicidae	Formicinae	*Camponotus compressus*	Carpenter ant
			Camponotus vicinus	Carpenter ant
			Camponotus modoc	Western carpenter ant
			Camponotus americanus	Carpenter ant
			Camponotus pennsylvanicus	Black carpenter ant
			Camponotus vicinus	Carpenter ant
			Camponotus species	Carpenter ant
			Brachymermex species	Rover ant
			Oecophylla smargdana	Weaver ant
			Oecophylla species	Weaver ant
		Myrimicinae	*Pheidole species*	Big headed ant
			Tetramorium caespium	Pavement ant
			Crematogaster species	Acrobat ant
			Harpegnathos saltator	Jumping ant
			Solenopsis invicta	Red imported fire ant
			Solenopsis germinate	Fire ant
			Pheidole species	Big headed ant
			Monomorium minimum	Little black ant
			Crematogaster species	Acrobat ant
			Macromischa Isabella	Unknown
		Ponerinae	*Leptogenous species*	Termite eater ant
		Dorylinae	*Doylus orientalus*	Red big ant
		Dolichoderinae	*Tapinoma sessile*	Odorous house ant
		Pseudomyrimicinae	*Tetraponera rufonigra*	Arborial bicoloured ant

Table 2: Percentage occurrence of ant species under different sub-families

Sl. No.	Sub-family	Species observed (Number)	Percentage occurrence (%)
1	Formicinae	10	42
2	Myrmicinae	10	42
3	Ponerinae	1	4
4	Dorylinae	1	4
5	Dolichoderinae	1	4
6	Pseudomyrimicinae	1	4

Off the total number of sub-families recorded in the study area, four sub-families are represented in the site 3 and three sub-families in each of the remaining sites.

The occurrence of number of species under each genus was also calculated. The genus Camponotus represents maximum number of species (6) followed by Pheidole, Oecophylla, Crematogaster and Solenopsis with two species each and Brachymermex, Tetramorium, Herpegnathos and Macromischa, Tetraponera, Monomorium, Tapinoma, Dorylus with only one species each in the study area.



Graph 1: Percent occurrence of collected ant species under different sub-families

Of the total species recorded, only seven species were observed indoor where as seventeen species were observed from outdoor habitats (Table 3; Graph 2).

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PLATE 1

PLATE 2

PLATE 3

PLATE 4

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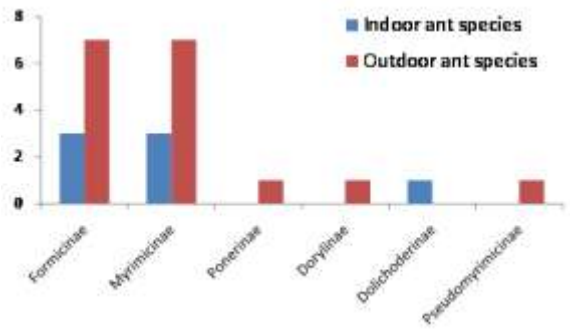
Plate.1:
1: Carpenter ant (Camponotus compressus) 2: Carpenter ant (Camponotus vicinus) 3: Western carpenter ant (Camponotus modoc) 4: Carpenter ant (Camponotus americanus) 5: Black carpenter ant (Camponotus pennsylvanicus) 6: Carpenter ant (Camponotus vicinus)
Plate.2:
7: Rover ant (Brachymyrmex spp.) 8: Weaver ant (Oecophylla smargdana) 9: Weaver ant (Oecophylla spp.)
10: Big headed ant (Pheidole spp) 11: Pavement ant (Tetramorium caespitum) 12: Acrobat ant (Crematogaster spp.)
Plate 3:
13: Jumping ant (Harpegnathos saltator) 14: Red imported fire ant (Solenopsis invicta) 15: Fire ant (Solenopsis germinate) 16: Big headed ant (Pheiodole spp.) 17: Little black ant (Monomorium minimum) 18: Acrobat ant (Crematogaster spp.)
Plate 4:
19: Macromischa Isabella 20: Termite eater ant (Leptogenous spp) 21: Red big ant (Dorylus orientalius)
22: Odorous house ant (Tapinoma sessile) 23: Arboreal bicoloured ant (Tetraponera rufonigra) 24: Velvet ant

Table 3: Distribution of Indoor and Outdoor ant species

Sub-family	Genus (Number)	Species (Number)		
		Indoor	Outdoor	Total
Formicinae	3	3	7	10
Myrimicinae	7	3	7	10
Ponerinae	1	0	1	1
Dolichoderinae	1	1	0	1
Dorylinae	1	0	1	1
Pseudomyrimicinae	1	0	1	1



Graph 2: Comparative account of Indoor and Outdoor ant species among different sub-families.

The species wise distribution of ants in the demarcated study sites indicates that Camponotus compressus and Leptogenous individuals were observed in all the five sites. Further, association of ant species with plant taxa was also observed and this suggests that they were confined to a specific plant taxa. However, nine species were encountered on more than one plant taxa.

4. Discussion:

The Karnatak University campus contains rich ant diversity with variety of other insects. The results obtained from the present study showed twenty five species of ants belonging to six sub-families under the family Formicidae, which speculates that the ant diversity is influenced by topography, flora, fauna and climatic conditions of particular area. It can be assumed that the undulating topography, rich plant community and favorable climatic conditions (16-36 0C temperature, 800-900 mm rain fall) of KUD campus provides comfortable shelter and foraging grounds, protection from hostile atmospheric conditions for ants and other group of insects like Honey bees, Wasps, Stick insects etc.

Ants show various interesting behaviours such as tending with species of coccids, pseudo coccids and aphids etc. Another interesting observation is that many species of ants built their nest and sophisticate their nests especially during rainy seasons.

The success of ants in different environments has been attributed to their social organisation and their ability to modify habitats and defend themselves may be due to their long co-evolution with other species.

The present results are corroborate with the earlier reports that vegetation pattern influences the richness and distribution of ant species (Bonte et al., 2003; Palomo et al., 2003; Cardoso et al., 2010). In addition to this other factors such as levels of CaCO3, total organic matter, moisture content, temperature of air and soil, pH and salinity also play an important

role in distribution pattern of ants (Boomsma and Isaaks, 1982).

The pattern of distribution of ground nest probably relates to the availability of food resources and vegetation complexity which in turn may play an important role in soil turnover and nutrient recycling (Lal, 1988). Some of the ant species occupy the nest constructed by other organisms. Crematogaster group are exclusively arboreal nest building ants suggesting that the tidal influx may limit the activity of ants to the crown of the trees (Lopes and Aguiar dos Santos, 1996; De Baar and Hockey, 1993).

Ant species observed in demarcated sites in present study probably points to the selective needs (in terms of food and shelter) and adaptive capabilities of particular species to harsh prevailing environmental conditions compared to inland properties such as soil temperature, levels of CaCO3 and the type of plant species found in particular habitat that selectively associate between flora and fauna. Thus, contributing to their successful survival and reproductive fitness even in the harsh conditions (Andersen, 1990).

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