



## Biodiversity of ant fauna in the campus of government degree college, Kalaburagi

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### Abstract

Taxonomically ants are the most neglected group of insects to be studied in Kalaburagi. The current study was conducted to collect ants from the Campus of Government First Grade Degree College, Kalaburagi which has undergone with several changes in natural habitat because of urbanization. The pre objective of the study was to prepare preliminary checklist of the campus. The study was carried out during January 2019 to May 2019. Ants were collected randomly from indoor (Class rooms, Laboratory, Rest rooms & washrooms) and outdoor (streets, botanical Garden, barren ground and Parking site) by Using aspirator, pitfall traps, Bait traps and hand pick method. A total of twelve species representing nine genera and three subfamilies namely Formicinae, Myrmicinae and Dolichoderinae were identified during the study. Formicinae was the most diverse subfamily with 3 genera (*Camponotus*, *Lepisiota* and *Paratrechina*) and 6 species (*Camponotus compressus*, *C. irritans*, *C. parius*, *C. sericeus*, *Lepisiota frauenfeldi*, and *Paratrechina longicornis*). Myrmicinae was represented by five genera and one species of each genus. (*Crematogaster sp.1*, *Monomorium subopacum*, *Pheidole sulcaticeps*, *Solenopsis geminate* and *Tetramorium walshi*). While only a single species i.e. *Tapinoma melanocephalum* was reported from subfamily Dolichoderinae. Considering the relatively small area surveyed, this region of Kalaburagi district appears to support the most diverse ant fauna yet recorded.

**Keywords:** formicidae, taxonomy, diversity, Karnataka, habitat

### Introduction

The systematic position of ants makes its position to the order Hymenoptera which is separated from rest of the members of order via node which may be one or two segmented and connects mesosoma with gaster, geniculate antennae, and distinctly present meta-pleural gland (Wilson 1971) [22] under the family Formicidae belonging to super family Vespoidea. More than 13,800 of an estimated total of 22,000 species have been classified. They are easily identified by their elbowed antennae and the distinctive node-like structure that forms their slender waists. The family Formicidae includes 16 subfamilies, 296 genera and presently there are about 15000 species of ants all over the world (Bolton, 1994) [7], of these the number of described species is more than 12000 (Bolton *et al.*, 2006) [8] while many waiting for description but still there are large number of undiscovered species (Holldobler and Wilson 1990) [13]. Bingham 1903 [6] was the first to comprehensively study the Indian Ant fauna and documented all of his finding in a book. He identified a total of 498 ant species belonging to 79 genera and 5 subfamilies. Presently ant species recorded from the Indian subcontinent are 847. Rasheed *et al.*, (2020) [20].

Ants constitute an important fraction of the animal biomass in terrestrial ecosystems and respond to stress on a much finer scale compared to vertebrates (Hölldobler and Wilson 1990; Andersen 1997) [13, 2]. Ants of southern India was catalogue by Jerdon (1851, 1854) [14] followed by Forel (1900a, b, 1901a) who extended the list by adding 267 new species from the region. Bingham (1903) [6] made Comprehensive documentation of Indian ants including all the previous works. Few independent studies working on ant

genera have reported species of ants from Karnataka but the comprehensive study on the ants of area comprising of northern Karnataka was very least, since then only a single published study by Begum, R., (2021a) [3] attempted to investigate habitat association of ant species (Subfamily: Myrmicinae) in heterogeneous landscape of Kalaburagi district, Karnataka. Begum, R., (2021b) [4] analyzed the taxonomic position and species diversity of ants in four different habitats and reported 40 species from selected localities of the semi-arid region of Karnataka. The current study was designed to document the ant diversity of GFGDC campus with the aim to improve the knowledge regarding the overall ant diversity.

### Materials and Methods

#### Study site

Government Degree College, Kalaburagi (76°51'10" N and 17°19'12" E) with 11.03 acres land occupied with multistoried buildings spread across 85000 sq. feet. The campus has stretch of both vegetative terrain and dry land.

#### Collection of ants

Surveys were carried out in GFGDC campus during Jan – May 2019. Ants were collected randomly from various habitats i.e., Class rooms, washroom, laboratory, rest rooms, parking sites botanical garden, barren ground and streets in different localities of the study area. Collection was done both during the early morning and late evenings. Many studies have reported that the use of different sampling techniques enhance the diversity of ant species captured (Longino and Collwell, 1997) [18]. As one goal of the current study was to find the diversity of ants in the study area, four

main sampling methods were used to sample ants randomly from various areas buccal aspirator, opportunistic hand collection, bait traps (Sugar solution, Honey Syrup and cookies) and pitfall traps. The collected ants were later

preserved in 70% ethyl alcohol. Later, preserved ants were card mounted carefully, labeled with the all the necessary collection data processed and preserved in air tight insect boxes for further identification.

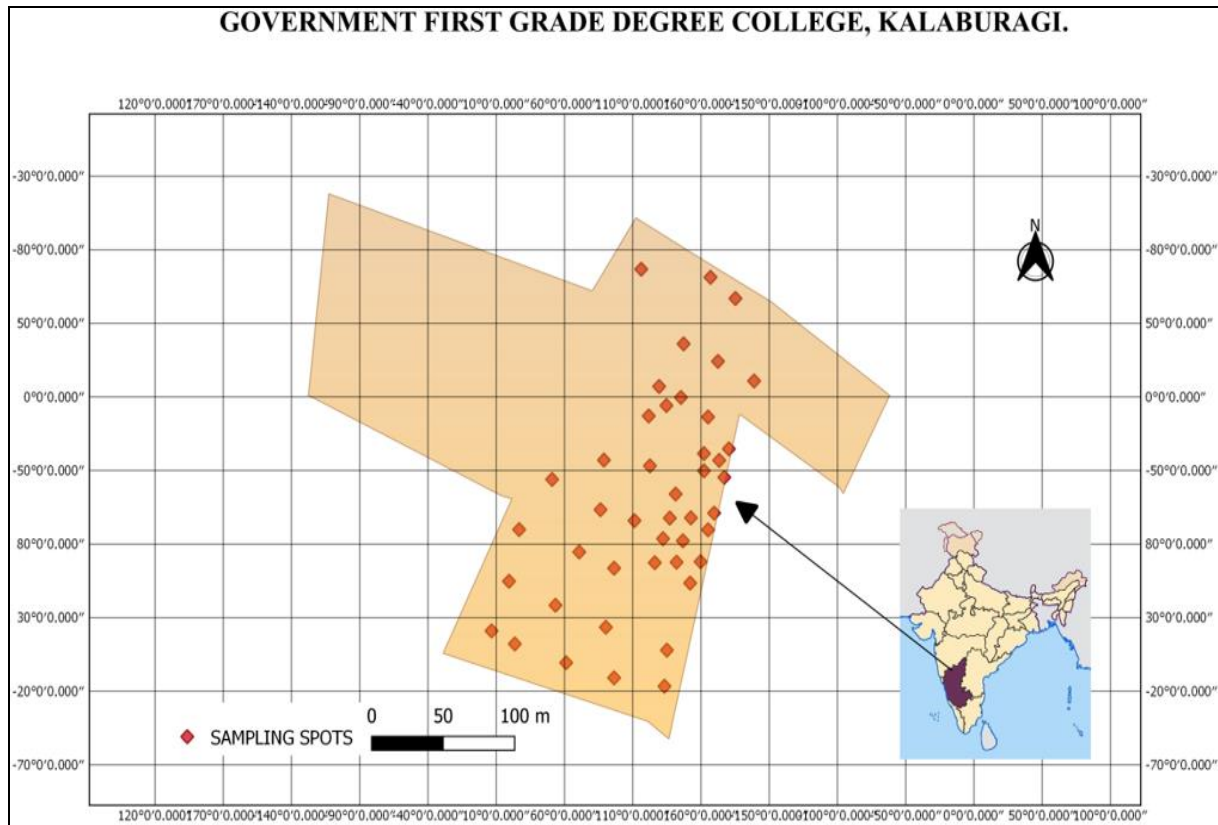


Fig 1

**Identification**

Ants were identified using the stereo zoom microscope with the reference of identification keys scripted in by Bingham (1903) [6] and Bolton (1994) [7]. The identification keys were as follow:

**Key to sub-family**

1. Body with two reduced or isolated segments (the petiole and post petiole) between alitrunk and gaster. (2)
2. Body with one reduced or isolated segments (the petiole and post petiole) between alitrunk and gaster. (3)
3. Frontal lobes almost always present and expanded towards the sides; bases of antennae partially visible. (4)
4. Sting vestigial or absent. (5)
5. Posterior margin of clypeus projecting back between antennal sockets; eyes usually medium to small in size; ocelli absent. Myrmicinae.
6. Apex of gaster with semicircular acidopore formed from hypopygium of projecting as a nozzle with fringed setae (sometimes the acidopore concealed by a projection of pygidium, but if so the antennal insertions are located well behind the posterior clypeal margin eg; *Polyrachis*) Formicinae.
7. Apex of gaster with hypopygium lacking acidopore; the antennal sockets posterior margin of clypeus. (6)
8. Petiole usually reduced and over hung by first gastral segment; apex of gaster with a transverse slit. Dolichoderinae.

**Key to genera**

Subfamily: formicinae

1. Antennae with 8 segments (including the scape).
2. Antennae with 9-12 segments (including the scape). (2)
3. Antennae with 9-11 segments (including the scape). (3)
4. Antennae with 12 segments (including the scape). (5)
5. Palps long, with a formula of 6:4 (maxillary;labialpalps). Maxillary palps reaching almost to or further than the back of the head when straight. (4)
6. Propodeum armed with a pair of spines, teeth, or tubercles. Lepisiota.
7. Mandibles triangular. (6)
8. Antennal sockets very close to the rear margin of the clypeus. (7)
9. Antennal sockets away from the rear margin of the clypeus. (11)
10. Palps long, extending along the underside of the head, with formula of 6:4 (maxillary;labialpalps). (8)
11. Mesothorax not constricted immediately behind pronotum. (9)
12. Mandibles with 5 teeth; always lacing erect setae. (10)
13. Erect setae absent on propodeum; erect setae on head scattered across surface; dorsal face of propodeum broad and gently rounded; femora and tibiae with large erect setae. Paratrechina
14. Petiole with an erect node or scale. (12)
15. Tergite of first gastral segments slightly longer than the second. (13)
16. Mesosoma without deep metanotal furrow,

metathoracic tubercular spiracles do not surpass the dorsal face of the propodeum in minor workers, propodeum without transverse ridge. *Camponotus*

**Subfamily: myrmicinae**

1. Postpetiole attached to the front of the gaster. Gaster not particularly heart shaped when viewed from above. (2)
2. Antennae (including the scape) with:  
10 segments (3)  
12 segments (8)
3. Antennal scrobes absent. (4)
4. Antennae with the apical segments forming a distinct 3-segmented club. (5)  
Antennae with the apical segments forming a distinct 2-segmented club. (6)
5. Eyes present. *Monomorium*.
6. Frontal lobes separated. (7)
7. Front margin of the clypeus with a single central elongate seta. Rear face of the propodeum rounded, without teeth, spines or propodeum rounded, without teeth, spines or flanges. *Solenopsis*.
8. Front margin of the clypeus broadly convex or with short teeth. (9)
9. Mandibles triangular to elongate-triangular. ( 10)
10. Basal margin of mandible without 2 lobes. Front margin of the clypeus without a pair of teeth. (11)
11. Area of the clypeus immediately below the antennal sockets without sharp-edged hole. (12)
12. Lateral portions of the clypeus not flattened, not projecting as a shelf over the mandibles. (13)
13. Frontal lobes present, at lest partially covering antennal articulations. (14)
14. Front margin of the clypeus without a single central elongate seta. Other setae may be present. (15)
15. Occipital region of head with 3 pairs of similar prominences. (16)
16. Antennal scrobes absent. (17)
17. Head with an elongate ridge or groove passing below the eye. (18)
18. Pronotum forming a high, dome-like arc, propodeum depresssed below the pronotum. (19)
19. Palp formula 2:2 or 3:2 (maxillary: labial). Mandible apically with two large teeth, followed by one or two very small teeth and then another larger tooth. *Pheidole*.

**Subfamily: dolichoderinae**

1. Petiole in profile usually a simple, transversely flattened strip. Petiole overhung by first gastral segment. (2)
2. Gaster with 4 plates on its upper surface (fifth tergite reflexed below the fourth). Pronotum generally lacking erect hairs. *Tapinoma*.

**Results**

The current study was designed to investigate the ant fauna of GFGDC campus as no work has been previously done on the diversity of this important group in the study area. A random collection was carried out from the study area by using three different collection techniques. Twelve species of ants belonging to nine genera of three sub-families were reported during the study period (Table 1). Sub-family Formicinae represents the highest percentage of species (60%) followed by Myrmicinae (30%) and Dolichoderinae

with least percentage (10%). Genus *Camponotus* was represented by the highest number of species (4 species). The remaining genera were represented by one species each. (Table 2). Among the twelve species of ants three were introduced species (I) i.e., *Paratrechina longicornis*, *Monomorium subopacum* and *Solenopsis germinate*.

**Table 1:** Different ant species observed within the campus of Government First Grade Degree College, Kalaburagi, Karnataka.

Sub-family	Genus	Species
Dolichoderinae	<i>Tapinoma</i>	<i>Tapinoma melanocephalum</i>
Formicinae	<i>Camponotus</i>	<i>Camponotus compressus</i>
		<i>Camponotus irritans</i>
		<i>Camponotus parius</i>
		<i>Camponotus sericeus</i>
	<i>Lepisiota</i>	<i>Lepisiota frauenfeldi</i>
<i>Paratrechina</i>	<i>Paratrechina longicornis</i>	
Myrmicinae	<i>Crematogaster</i>	<i>Crematogaster sp.1</i>
	<i>Monomorium</i>	<i>Monomorium subopacum</i>
	<i>Pheidole</i>	<i>Pheidole sulcaticeps</i>
	<i>Solenopsis</i>	<i>Solenopsis geminate</i>
	<i>Tetramorium</i>	<i>Tetramorium walshi</i>

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

Sub-family	Species observed (Number)	Percentage occurrence (%)
Formicinae	6	60
Myrmicinae	3	30
Dolichoderinae	1	10

**Discussion**

Present study recorded total 12 species belonging to nine genera and three subfamilies from GFGDC Kalaburagi. Future studies should include more unexplored areas and diversity in habitats which should be surveyed for the ant fauna of Kalaburagi. Along with ant diversity ecological studies should also be conducted to know the effect of presence or absence of these important bioengineers and ecological indicators on the ecology of a particular area. All of the species that are recognized in this study are also reported by different studies from India and present in the list of Indian ants species enlisted by Bharti (2016)<sup>[5]</sup>, a total of 828 valid species known to occur in India. Tropical habitats have a rich store of ant diversity. Unfortunately, data on the ants of both natural and manmade habitats are poor, especially for the Indian region (Gadagkar et. al. 1993)<sup>[12]</sup>. Begum, R., (2021a)<sup>[3]</sup> carried out detailed and comprehensive study on the diversity of ant fauna (Sub family: Myrmicinae) in GUK, Kalaburagi and reported eleven species belonging to six genera of subfamily myrmicinae. The genus *Crematogaster* represented four species however; single species is reported in our study area. This could be due to difference in ecological and habitat condition from which the collections were made. Ants representing sub family Formicinae with highest occurrence during the study period are represented in all the study sites, whereas, only species *Tapinoma melanocephalum* belonging to sub family Dolichoderinae was encountered during the study period. The occurrence of number of species under each genus was also determined. The maximum number of species reported from genus *Camponotus* followed by *Lepisiota*, *Monomorium*, *Paratrechina*, *Pheidole*, *Solenopsis*, and *Tapinoma* with

only one species each from the study area. Ants are known for creating annoyance in the households and other human dwelling habitats, they can cause the inconvenience with their presence. In the following study we found only two species of ants *i.e.*, *Solenopsis germinate* and *Camponotus compressus* made its presence indoor whereas, remaining all eight species observed from outdoor habitats.

This is the first attempt of a study on ant diversity in the campus of government degree college, Kalaburagi. The region has the altitude 300-750m above mean sea level. Species richness is very low in the study area compares to other regions of Karnataka. Ant biodiversity is incredibly high and highly responsive to human impact. Diversity of the species of ants from the present study shows that ants with stand human interferences. The government degree college campus is about 87 year old; the campus has undergone many modifications in the form of floral cultivations extension of permanent structures, which has become more rapid in the past few years. The campus is located on the edge busy road with high rate of vehicular traffic which has also increased air pollution in surrounding compared to past years along with noise of vehicles and vibration of vehicular movement has risen to a disturbing level. On the campus gardening is carried out as a part of NCC, NSS and other extracurricular activities which leads to digging, change of soil, replacement of soil, additional minoring, burning of litter, change of plants and grass that usually results in the change of topological profile of ants ecosystem. Ants exhibit a greater resistance to pollutants in comparison to other invertebrates (Torossian and Causse 1968; Le Masne and Cougourdan, 1972)<sup>[21, 17]</sup> even to industrial pollutants (Petal *et al.*, 1975)<sup>[19]</sup>. We conclude that while ant species richness generally increases with increase in vegetation and declines with increase in disturbances, the environs of Kalaburagi city harbor a rich ant fauna which deserves further study.

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### Reference

- Andersen A. Ants as indicators of ecosystem restoration following mining: a functional group approach. Pp:319-325 in: Hale, P.; Lamb, D. (eds.) 1997. *Conservation outside nature reserves*. Brisbane: Centre for Conservation Biology, University of Queensland, 1997, 540 pp.
- Andersen AN. Functional groups and patterns of organization in North American ant communities: a comparison with Australia. *J. Biogeogr*,1997a:24:433-460.
- Begum R, Majagi SH, Vijaykumar K. Habitat associations of ant species (subfamily: myrmicinae) in a heterogeneous landscape of Kalaburagi district, Karnataka. *Uttar pradesh journal of Zoology*,2021a:41(23):27-32.
- Begum R, Majagi SH, Vijay Kumar K. Ants species richness and diversity in relation to different ecological habitat in selected localities of the semi-arid region of Karnataka, India. *Environ Monit Assess*,2021b:193(3):145. doi: 10.1007/s10661-021-08941-2. PMID: 33629184.
- Bharti H, Guénard B, Bharti M, Economo EP. An updated checklist of the ants of India with their specific distributions in Indian states (Hymenoptera, Formicidae). *ZooKeys*,2016:551:1-83.
- Bingham CT. The fauna of British India, including Ceylon and Burma. Hymenoptera. Ants and Cuckoo-wasps. London: Taylor and Francis,1903:2:506.
- Bolton B. Identification guide to the ant genera of the world. Cambridge, Mass.: Harvard University Press, 1994, 222.
- Bolton B, Alpert G, Ward PS, Nasrecki P. Bolton's Catalogue of ants of the World. Harvard University Press, Massachusetts, U.S, 2006.
- Forel A. Les Formicides de l'Empire des Indes et de Ceylan. Part VI. *Journal of the Bombay Natural History Society*,1900a:13:52-65.
- Forel A. Les Formicides de l'Empire des Indes et de Ceylan. Part VII. *Journal of the Bombay Natural History Society*,1900b:13:303-332.
- Forel A. Les Formicides de l'Empire des Indes et de Ceylan. Part VIII. *Journal of the Bombay Natural History Society*,1901a:13:462-477.
- Gadagkar R, Nair P, Chandrashekar K, Bhat DM. Ant species richness and diversity in some selected localities in Western Ghats, India. *Hexapoda (Insecta Indica)*,1993:5:79-94.
- Hölldobler B, Wilson EO. The Ants. Cambridge, Harvard University Press, 1990, 732.
- Jerdon TC. A catalogue of the species of ants found in Southern India. *Madras Journal of Literature and Science*,1851:17:103-127.
- Jerdon TC. A catalogue of the species of ants found in Southern India. [part]. *Annals and Magazine of Natural History*,1854a:(2)13:45-56.
- Jerdon TC. A catalogue of the species of ants found in Southern India. [concl.] *Annals and Magazine of Natural History*,1854b:(2)13:100.
- Le Masne G, BONAVITA-COUGOURDAN A. Premiers résultats d'une irradiation prolongée au césium sur les populations de fourmis en Haute-Provence. *Ekologia Polska*,1972:20:129-144.
- Longino JT, Colwell RK. Biodiversity assessment using structured inventory: capturing the ant fauna of a tropical rain forest. *Ecological Applications*,1997:7:1263-1277.
- Petal J, Jakubczyk H, Chmielewski K, Tatur A. Response of ants to environmental pollution. In *Progress in Soil Zoology* J. Vabek, ed, 1975, 363-373.
- Rasheed, Syed, Basit, Yar, Ahmad, Zaidi *et al.* The Diversity of Ants (Hymenoptera: Formicidae) in District Charsadda, Khyber Pakhtunkhwa: New Reports from Pakistan. *Pakistan Journal of Zoology*,2020:52(10):17582/journal.pjz/20180916170913.
- Torossian C, Causse R. Effets des radiations gamma sur la fertilité et la longévité des colonies de *Dolichoderus quadripunctatus*. *Comptes Rendus du Colloque "Isotopes and radiation in entomology"*. International Atomic Energy Agency, Vienna, 1968, 155-164.
- Wilson EO. The Insect Societies. Cambridge, Mass: Belknap Press of Harvard University Press, 1971.