**International Journal of Entomology Research**
**www.entomologyjournals.com**
**ISSN: 2455-4758**
**Received: 15-02-2022, Accepted: 01-03-2022, Published: 16-03-2022**
**Volume 7, Issue 3, 2022, Page No. 97-106**

# Diversity of ants in Tumkur University, Tumakuru, Karnataka, India

**Latha V[1], Shobha P N[2], Vanitha N[2], Kokilamani A L[2*]**
[1] Department of Zoology, Maharani's Science College for Women, Bengaluru, Karnataka, India
[2] Department of Research and Studies in Zoology, Tumkur University, Tumakuru, Karnataka, India
* Corresponding Author: alkokilamani@yahoo.co.in

**Abstract**
Ants are ubiquitous in distribution and being one of the important detritivores, they play a significant role in balancing the ecosystem. Some of them are ground dwellers and few are arboreal in habitat. Tumakuru one of the districts in Karnataka is rich in floral and faunal diversity. However, there is lacuna in the documentation of biological and ecological aspects of ant fauna. This study aims at recording diversity ofant species by adapting all-out-search method from January 2019 to April-2019 at Tumkur University Campus, Tumakuru. During survey five different subfamilies namely Formicinae, Myrmicinae, Ponerinae, Dolichoderinae and Pseudomyrmicinae with 28 ant species belonging to 17 Genera were recorded from our study area. The subfamily Myrmecinae was shown to be more dominant and diversified with 6 genera and 13 species (46%). The second most diversified subfamily was Formicinae which includes 6 genera and 10 (36%) species.Least diversified subfamily is Pseudomyrmecinae with 1 generic species. The study area has recorded high species diversity richness value. From the present study it is evident that different types of habitats and ecological factors of the campus are favourable for the wide diversity of ant species. The present data forms base line information for conducting future research in the ant biology exclusive to Tumakuru district.

**Keywords:** diversity, ants

## Introduction
Ants are most dominant components of terrestrial ecosystem because of universal distribution. Thus constitute greater part of biomass. Their morphology varies as per habitat. Ants perform various ecological functions such as carnivorous, omnivorous, predators, pests on economically important crop plants, decomposers by feeding on organic waste, insects or other dead animals and pollinators of many species of plants (Lach *et al*. 2010, Del Toro *et al*. 2012, Guénard 2013) [9, 4, 5]. Antsact as ecosystem engineers. They play very important role in the ecosystem by improving the soil and assisting the decomposition process and are considered as good biological indicators due to mutualistic behaviour with flora and fauna (Watanasit *et al*. 2000) [13]. Thus the study of diversity and distribution of ant species is of more significant in understanding their ecological functions and biogeographic patterns.
Ants are omnipresent and occupy almost all terrestrial ecosystems. There are about 15000 species of ants (Andrade, 2007) [3], Only 11,769 species have been described (Agosti, 2000) [1]. The family Formicidae contains 21 subfamilies, 283 genera and about 15000 living ant species. A total of 828 valid species and subspecies names belonging to 100 genera are listed from India. About 257 species of ants belonging to 61 genera were estimated from Karnataka state (Bharati *et al*. 2016) [6]. However, much work remains yet to document the ant species in different parts of the state in particular, Tumakuru district. Tumakuru district is known for its rich floral and faunal diversity. It is one of the districts of Karnataka having suitable ecological habitat for various rare and endangered flora and fauna. Hence, to fill the lacuna the present study was conducted to document the diversity of ant species of Tumakuru District.

## Materials and Method
### Study area
The study was conducted in the campus of Tumkur University, Tumakuru, Karnataka. Tumkur University campus is situated at a distance of 70 km Northwest of Bangalore at 30˚20" 16' N and 77° 7" 13' E in the plain of Deccan plateau of peninsular India. The campus is free from major anthropogenic activities like construction of buildings, cutting of trees and animal grazing and it includes minor anthropogenic activities that too academic oriented and constrained to various buildings of the campus.
To know the diversity and abundance of ant's fauna the study area has been divided in to 4 sites. Site-1 UCS (University College of Science) includes infrastructure buildings, and gardens;Site-2 UCA (University College of Arts) includes infrastructure buildings, gardens with thick vegetation;Site-3 play grounds include 2 big play

grounds, a tennis court with sparsely distributed vegetation and Site-4 includes academic buildings, and each building is provided with thick vegetative gardens in their quadrangle.

**Methods**

Field survey was conducted from January 2019 to April 2019. Study area was divided into different slots each slot measuring 25M×25M area to follow the Quadrate method. During field work the photography of individual ant species and their colony and nests were done by using camera Nikon 5000D. Ants were collected by hand picking using sharp forceps, needle and camel brush by adapting all-out-search method. And also by offering them baits like sugar, jaggery and rice grains. The ants were collected in vials containing 70% alcohol and were brought in to the laboratory for further identification.

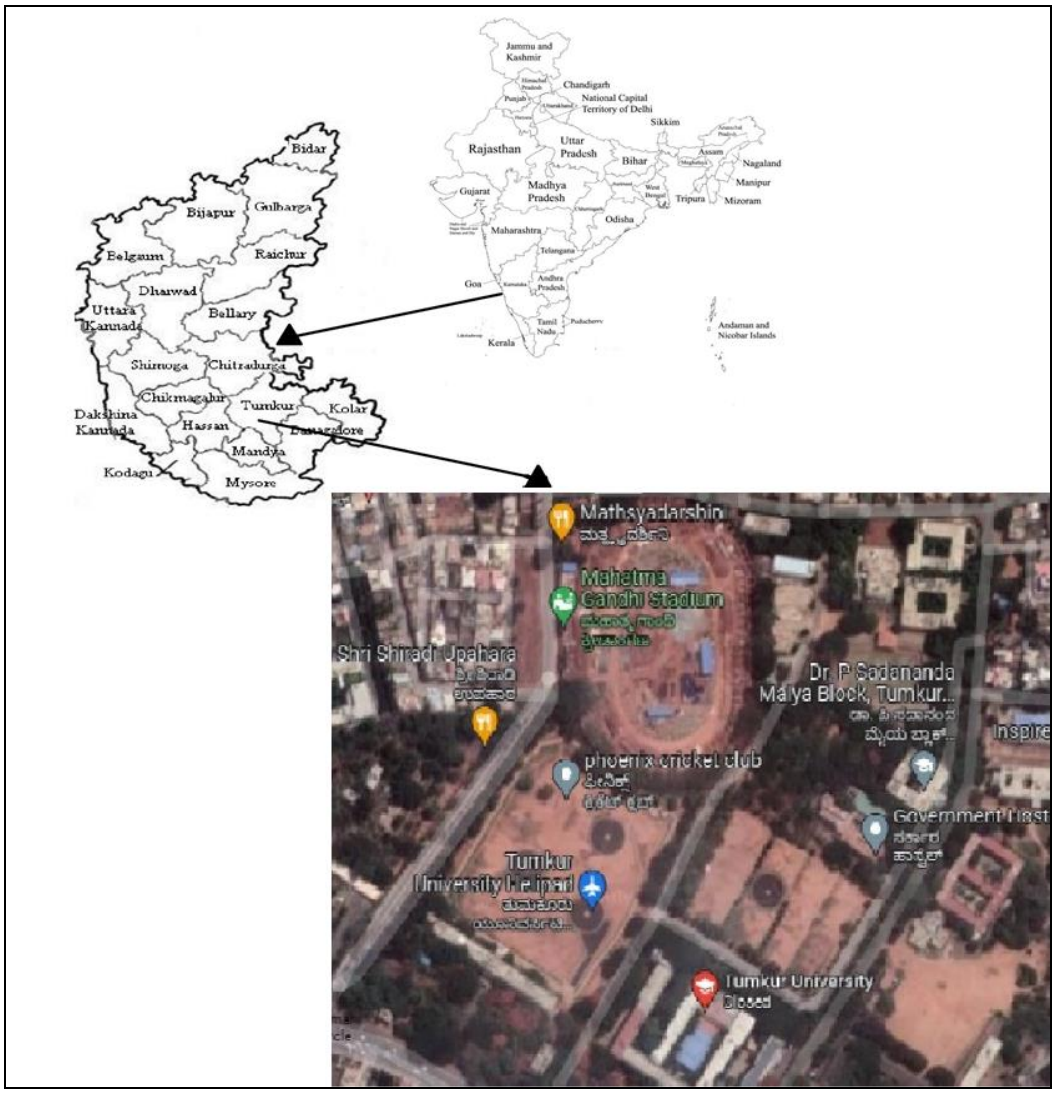


**Fig 1:** Study area

The collected ants were separated as different castes and were identified upto genus level with the help of available literature (Holldobler and Wilson,1990; Sheela, 2008) [7, 12] and hand book of the ants for peninsular India (Ajay Narendra and Sunil Kumar, 2006) [2]. The species level identification was done by seeking the help of experts from Department of Entomology, University of Agricultural Science, GKVK, Bangalore. The collected ants were observed under the LAFCO Dissection microscope, UNILAB Binocular microscope for key morphological features, and the same were photographed under Lawrence and Maya stereoisomer microscope.

**Methods for measuring species diversity**

**Shannon diversity indexby by using formula**

$$H = -\sum_{i=1}^{s} \text{pi} \ln pi$$

H= Shannon's diversity index

S = total number of species in the community (richness)

pi = proportion of S made up of the i species for natural community, the Shannon index usually falls between 1.5 and 3.5, and rarely exceeds 4.5.

**Evenness (Equitability) by using formula**

$$J = \frac{H'}{H'max}$$

J = Evenness or Equitability index
H′= Shannon diversity index
H′ max = ln s

**Simpson's diversity index (SDI) by using formula**

$$D=1-\frac{\sum n(n-1)}{N(N-1)}$$

Where: n= number of individuals of each species
N= total number of individuals of all species

**Results and Discussion**

From the present survey we have noticed five different subfamilies of Family Formicidae namely Formicinae, Myrmicinae, Ponerinae, Dolichoderinae and Pseudomyrmicinae. A total of 28 ant species belonging to 17 Genera of 5 sub families and 1245 individuals were recorded from our study area (Table 1). Representative species of the reported sub families were photographed for identification (Plate 1, 2, 3 & 4).

Among which the subfamily Myrmicinae was found to be most diversified with 6 genera and 13 species. These represents 46% of the total ant species collected from the study area. The second most diversified subfamily was Formicinae which includes 6 genera and 10 (36%) species. The subfamily Ponerinae and Dolichoderinae were found to be with 2 genera each (7%). The subfamily Pseudomyrmicinae was found to be least diversified with 1 genus only i.e. *Tetraponera* (4%) (Table1, Fig.2 and Fig. 4).

Genera *Crematogaster* and *Camponotus* were recorded to be most diversified genera with 5 species each. Genera like M*onomorium* and *Pheidole* were observed to be having 3 and 2 species each respectively. The remaining recorded genera have 1 species each (Table 1 and Fig 3).

During our study period the species like *Camponotus sericeus*, *Pheidole pilifera*, *Tapinoma melanocephalon* and *Leptogenys chinensis* were found to be the most abundant species. The least abundant species was T*etraponera rufonigra*. Our results are in support with Bharati *et al*., (2016) [6], the subfamily Myrmicinae is found to be a dominant in the Indian subcontinent conditions.

The ant species *C. sericeus, C. irritans, T. destructor* of sub family Formicinae, *M. minimum,* and *S. geminate* of subfamily Myrmicinae and *T. melanocephalum* of subfamily Dolichoderinae were found to be distributed in all the four localities of the study area (Table 2).

It has shown that the Site-4 was harbouring more diversified ant species than the remaining three Sites of the study area with 21 ant species in which *P. pilifera* was noticed to be more abundant and *C. compressus* with less frequent. It was followed by Site-1 with 20 species, in which *O. smaragdina* distributed more frequently and *D. rugosum* was less noticed. Site-2 and Site-3 were recorded with 12 and 7 ant species respectively. From this it has been revealed that the Sites- 4 and -1 were more ecologically diversified habitats that serve as essential sites for the survival of most of the number of ant species (Fig.5). Our observation has shown that the density of ant population was declined as the vegetation of the study area decreases i.e (S4>S1>S2>S3). Less diversity of ant species was recorded from playground (S3) which includes the ground dwelling ant species like *Solenopsis*sp, *T. destructor, Camponotus* sp, *Tapinoma melanocephalum* and S-3 was moderately interrupted by human activities. *S. geminata and T. melanocephalum* were high in this Site. This is due presence of micro habitats which are ideal for these ant species. Similar results were drawn by Savitha *et al*. (2008) [11]. *T. melonocephalum* prefer hot and open habitats and from dominant functional group. The number of species in each Site was computed and species diversity was calculated using the Shannon-Wiener-Index. The value of Shannon-Wiener Index (H) for species richness of our study area was 2.92, the value of species evenness distribution was 0.876 and Simpson's value (D) = 0.94 (Table 3). The Shannon index increases as both the richness and the evidences of the community increase. The values of (H) and (D) have shown that the study area hashigh species diversity and species richness. Our results are in congruence with Kumar *et al*. (1997) [8] and Pachpor & Ghodke (2000-2001) [10], habitats with abundant trees support high diversity of ants. Thus, habitat variables such as canopy cover and litter content in the soil can provide an appropriate habitat for ants. Habitat complexity provides hiding, nesting and foraging grounds to the many ant species, but the human interrupted habitats are does not. The study includes 4 IUCN Red list ant species *viz*., *Monomorium pharaonis* (pest species) (Plate 1, img 9), *Paratrechina longicornis* (Plate 3, img 19) *Anoplolepis gracilipes* and *Tapinoma melanocephalum* (Tramp/invasive species) (Plate 4, img 23 & 24) (Bharati *et al*. 2016) [6].

**Conclusion**

From the present study it is evident that diverse habitats and ecological factors of the campus supported the wide diversity of ant species. From the values of H and D it is concluded that species richness, diversity and abundance were high in undisturbed ecological habitat. The study area has no major anthropogenic activity that disturbs the habitat of ant species. Further, additional studies are required to record the whole ecological niche of ants and their ecological significance. To conclude the study area is ecologically favourable for harbouring the wide biodiversity of ant species and the data generated forms significant base line information for conducting future research on ant's biology, exclusively of Tumakuru district.


**Plate 1**

Genus: *Pheidole*

Img.10: *Pheidole rhea*

Img.11: *P.pilifera*

Img.11a: Minor worker of *P.pilifera*

Genus: *Solenopsis*

Img.12: *Solenopsis geminata*

Genus: *Trichomyrmex*

Img.13: *Trichomyrmex destructor*

Img.13a: Polymorphic of *T.destructor*

## Subfamily: Formicinae

Genus: *Camponotus*

Img.14: *Camponotus compressus*

Img.14a: Polymorphic of *C.compressus*

Img.15: *C.irritans*

**Plate 2**

Img.15a: Polymorphic of *C.irritans*

Img.16: *C.japonicus*

Img.17: *C.pennsylvanicus*

Genus: *Paratrechina*

Img.18: *C.sericeus*

Genus: *Plagiolepis*

Img.18a: Polymorphic of *C.sericeus*

Genus: *Polyrhachis*

Img.19: *Paratrechina longicornis*

Genus: *Oecophylla*

Img.20: *Plagiolepis jerdonii*

Img.21: *Polyrhachis rastellata*

Img.22: *Oecophylla smaragdina*

**Plate 3**


**Plate 4**

**Table 1:** List of Ants fauna recorded from tumkur university campus, Tumakuru

| Sl. No. | Subfamilies | Genus | Species |
|---|---|---|---|
| 1 | Myrmicinae | *Crematogaster* | *biroi* |
| | | | *cerasi* |
| | | | *pilosa* |
| | | | *rothneyi* |
| | | | *subnuda* |
| | | *Meranoplus* | *bicolor* |
| | | *Monomorium* | *criniceps* |
| | | | *minimum* |
| | | | *pharaonic* |
| | | *Pheidole* | *rhea* |
| | | | *pilifera* |
| | | *Solenopsis* | *geminate* |
| | | *Trychomyrmex* | *destructor* |

| | | | |
|---|---|---|---|
| 2 | Formicinae | *Anoplolepis* | *gracilipes* |
| | | *Camponotus* | *compressus* |
| | | | *irritans* |
| | | | *japonicus* |
| | | | *pennsylvanicus* |
| | | | *serices* |
| | | *Oecophylla* | *smaragdina* |
| | | *Paratrechina* | *longicornis* |
| | | *Plagiolepis* | *jerdonii* |
| | | *Polyrhachis* | *rastellata* |
| 3 | Dolichoderinae | *Tapinoma* | *melanocephalum* |
| | | *Technomyrmex* | *albipes* |
| 4 | Pseudomyrmicinae | *Tetraponera* | *rufonigra* |
| 5 | Ponerinae | *Diacamma* | *rugosum* |
| | | *Leptogenys* | *chinensis* |
| Total | 5 | 17 | 28 |

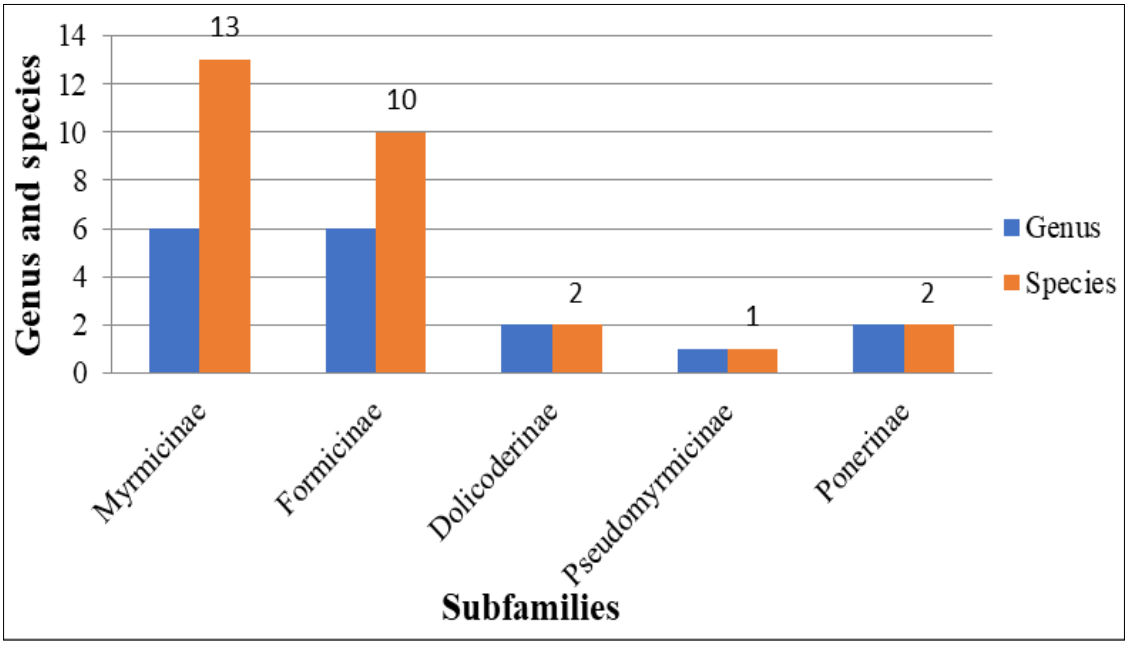


**Fig 2:** Graphical representation of Subfamilies vs Genera & Species

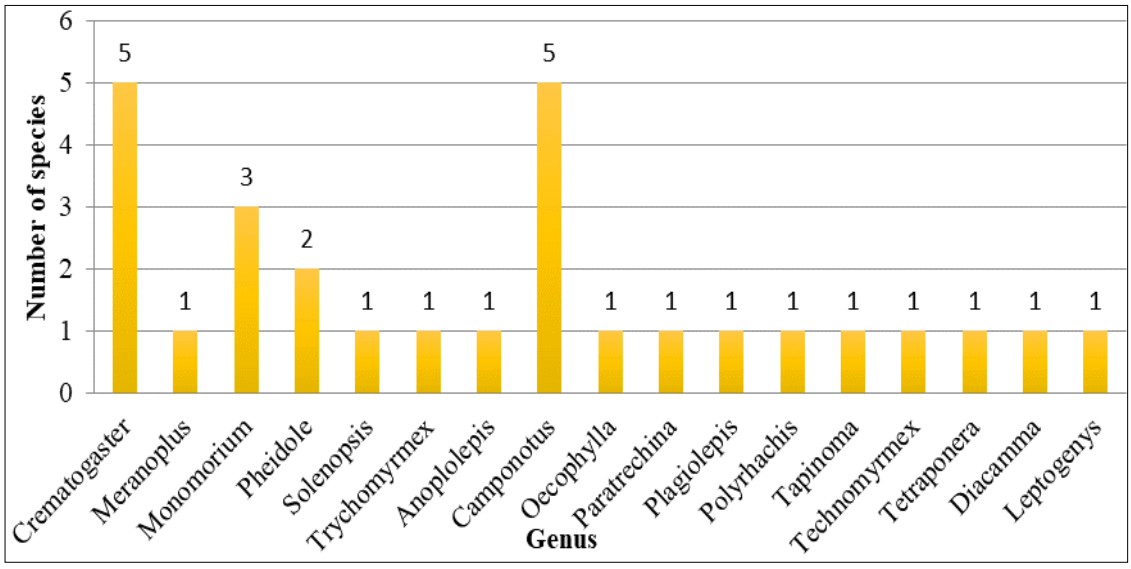


**Fig 3:** Graphical representation of Genus vs Species

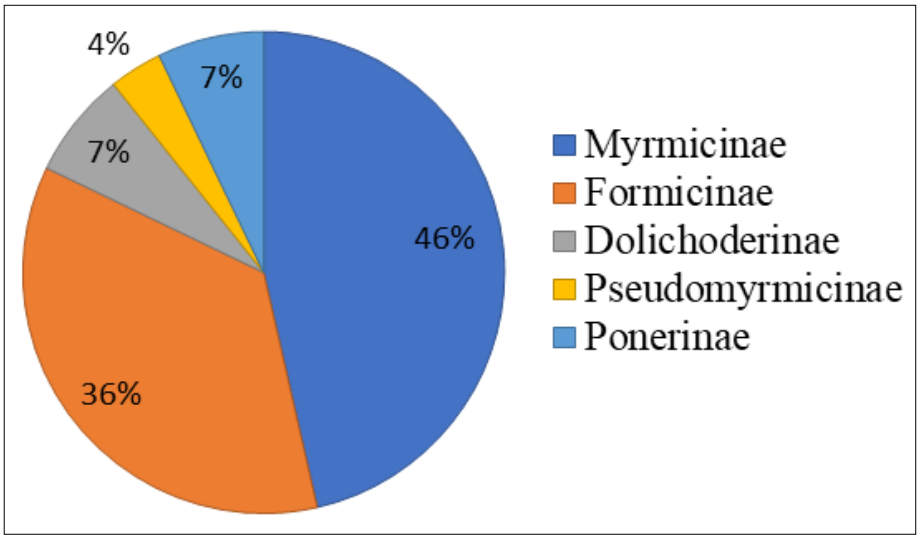


**Fig 4:** Subfamily wise distribution of Ant fauna found in study area

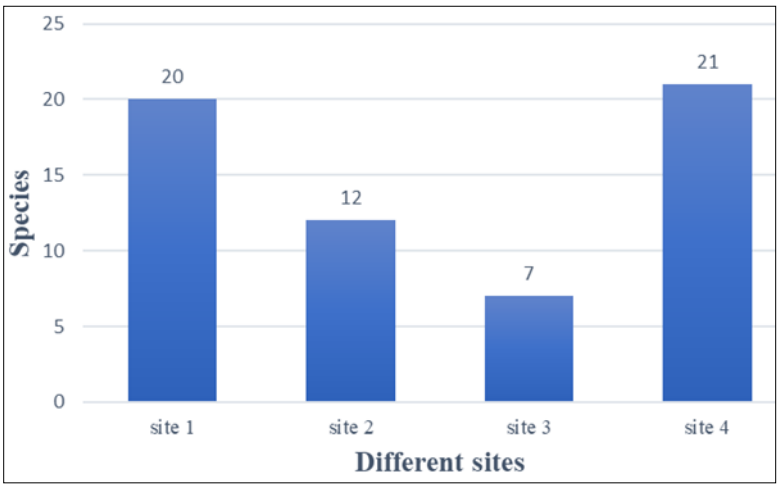


**Fig 5:** Graphical representation of number of ant species distributed in different Sites of study area

**Table 2:** Distribution of ants in different sites of study area

| Sl. No. | Species | Site-1 | Site-2 | Site-3 | Site-4 |
|---|---|---|---|---|---|
| 1 | *Crematogaster biroi* | - | - | - | + |
| 2 | *Crematogaster cerasi* | + | - | - | + |
| 3 | *Crematogaster pilosa* | + | - | - | - |
| 4 | *Crematogaster rothneyi* | - | - | - | + |
| 5 | *Crematogaster subnuda* | + | + | - | - |
| 6 | *Meranoplus bicolor* | - | - | - | + |
| 7 | *Monomorium criniceps* | + | - | - | - |
| 8 | *Monomorium minimum* | + | + | + | + |
| 9 | *Monomorium pharaonic* | + | - | - | + |
| 10 | *Pheidole rhea* | - | + | - | + |
| 11 | *Pheidole pilifera* | - | - | + | + |
| 12 | *Solenopsis geminate* | + | + | + | + |
| 13 | *Trichomyrmex destructor* | + | + | + | + |
| 14 | *Anoplolepis gracilipes* | + | - | - | - |
| 15 | *Camponotus compressus* | + | + | - | + |
| 16 | *Camponotus irritans* | + | + | + | + |
| 17 | *Camponotus japonicus* | + | - | - | - |
| 18 | *Camponotus pennsylvanicus* | + | - | - | - |
| 19 | *Camponotus sericeus* | + | + | + | + |
| 20 | *Oecophylla smaragdina* | + | + | - | + |
| 21 | *Paratrechina longicornis* | - | - | - | + |
| 22 | *Plagiolepis jardonii* | - | - | - | + |

| | | | | | |
|---|---|---|---|---|---|
| 23 | *Polyrhachis rastellata* | + | + | - | + |
| 24 | *Tapinoma melanocephalum* | + | + | + | + |
| 25 | *Technomyrmex albipes* | + | - | - | + |
| 26 | *Tetraponera rufonigra* | + | + | - | - |
| 27 | *Diacamma rugosum* | + | - | - | + |
| 28 | *Leptogenys chinensis* | - | - | - | + |
| Total | 28 | 20 | 12 | 7 | 21 |

**Table 3:** Values of species diversity and richness in our study area

| Indices | Values |
|---|---|
| Shannon- Wiener Index (H) | 2.92 |
| Evenness | 0.876 |
| Simpson's (D) | 0.94 |

**References**


1. Agosti D, Majer J, Alonso L, Schultz T. Litter ant communities of the Brazilian Atlantic Rain forest region, 2000.
2. Ajay Narendra, Sunilkumar M. On a Trail with Ants: A hand book of the Ants of Peninsular, India, 2006, 1-193.
3. Andrade T. Diversity of ground dwelling ants in Cerrado: An Analysis of temporal variations and distinctive Physiognomies of vegetation Formicidae: Hymenoptera, 2007, 50.
4. Del Toro I, Ribbons RR, Pelini SL. The little things that run the world revisited a review of ant mediated ecosystem services and disservices (Hymenoptera:Formicidae). Myrmecological News,201217:136-146.
5. Guenard B. An overview of the species and ecological diversity of ants. In els, John Wiley and Sons, Ltd, Chichestes, 2013. doi, 10,1002| 9780470015908, a0023598.
6. Himender Bharti, Benoit Guenard, Meenakshi Bharti, Evan P. Economo. An updated checklist of the ants of India with their specific distribution in Indian States (Hymenoptera, Formicidae), Zoo keys,2016:551:1-83.
7. Holldobler B, Wilson EO. The ants. Springer-Harvard University Press, 1990, 732.
8. Kumar SK, Shrihari T, Nair P, Varghese T, Gadagkar R. Ant species richness at selected localities of Bangalore.Insect Environment,1997:3:3-5.
9. Lach L, Parr CL. Abbott KL(Ed). Ant Ecology, I edition, Oxford University Press, Oxford, 2010, 402.
10. Pachpor T, Ghodke Y. Ant genera distribution across Pune city. Journal of Ecological Society,2000-2001:13(14)18-22.
11. Savitha S, Narayani Barue, and Priya Davidor. Response of ants to disturbance gradients in and around Bangalore, India. Tropical Ecology,2008:49(2):235-243.
12. Sheela S. Hand book on Hymenoptera: Formicide, Z.S.I, 2008, 1-55.
13. Watanasit S, Bickel TO. Diversity of Ants from Ton Ngacnang wildlife Sanctuary, Songkhla, Thailand. 2000, 187-194.