

# Diversity and Distribution of Ants (Hymenoptera: Formicidae) in Gauhati University Campus, Assam

#Hridisha Nandana Hazarika, \$Kamal Adhikari, \*Bulbuli Khanikor

#\$Research Scholar, \*Assistant Professor, Department of Zoology, Gauhati University, Guwahati, Assam, India.

#hnhazarika4@gmail.com, \$kamaladhikari246@gmail.com, \*khanikorbulbuli@yahoo.co.in

**ABSTRACT:** Ants are the important invertebrates play momentous role in the terrestrial ecosystem and also participated actively in the interactions that develop the quality of soil. The present study was undertaken to investigate the diversity and distribution of ants in Gauhati University campus, Assam, India. The ants were collected from four different habitats i.e. open area, hilly area, near wetland area and human habitat area from June to September 2017. A total of 21 species of ants belonging to 4 subfamilies i.e. Formicinae, Pseudomyrmicinae, Myrmicinae and Ponerinae were recorded. The Myrmicinae subfamily was more diverse with 10 species, followed by Formicinae with 8 species, Ponerinae with 2 species and Pseudomyrmicinae were found least diverse with only 1 species. The Shannon-Weiner species diversity indicated that the diversity was highest in hilly area (2.793), followed by open area (2.291), human habitat area (2.265) and lowest in near the wetland area (1.993). As Assam is a part of Eastern biodiversity hotspot area but less work has been done earlier on the ant diversity on this region so the present work will not only throw light on ant diversity in the Gauhati University campus but also in the whole region.

**KEYWORDS:** Ants, Assam, Distribution, Diversity, Gauhati University, North-East India.

## I. INTRODUCTION

Ants are imperative component of ecosystem not only because of their massive biomass but also because of the role they played in the ecosystem. The soil ants are recognized as ecosystem engineers. The ants act as bio-indicators to evaluate forest quality and environmental controls because they associated with the various cyclical processes of nature such as nitrogen cycle, carbon cycle and causative to reducing climate change. In many countries like India, Burma and Thailand etc. people feed ants. Ants also act as seed dispersers and they help in pollination. Ant also acts as bio-control agents and has an important role in IPM programme. For instance in Australia, *Oecophylla* ants are used to control the main pest of cashew and mango [1] and in many parts of the world these ants are used as the effective bio-control agent.

Ants belong to the family Formicidae, superfamily Formicoidea, and order Hymenoptera in the class Insecta. There are more than 25,000 species of ants present worldwide [2] and thus ants are numerous in numbers of species as well as numbers of individuals per colony. However their diversity and abundance are influenced by anthropogenic activities [3]. As per the recent classification, the Formicidae family is divided into 21 subfamilies and 290 genera [4], among which Myrmicinae is the largest subfamily containing 138 genera followed by Formicinae

having 39 genera and Ponerinae containing 25 genera. Recently, a new subfamily Martialinae has been added to the family Formicidae [5]. So, the Formicidae family contain 22 subfamilies in worldwide. Tropical habitats are rich in ant diversity. But the data on the ants of both natural and manmade habitats are poor especially for the Indian region [6]. The Indian ant diversity constitute 45% of Myrmicinae subfamily with genera *Pheidole* and *Crematogaster* comprising the most species, 25% of Formicinae subfamily with genera *Camponotus* and *Polyrhachis* are most diverse and 14% of Ponerinae subfamily with genera *Leptogenys* having the most species [7]. Such types of studies were also previously performed in different parts of India by targeting various insect species in some specific area. Recently, a survey listed presence of 828 species of ants in India [8]. In Assam, limited studies on ant diversity were done in comparison to other places although only one report of occurrence of six ant species was found from the Jorhat district [9].

Assam is a part of biodiversity hotspot. In the present study Gauhati University campus is chosen as ideal study site for containing different habitats like human habitat area, hilly area, open area and wetlands. Various previous works have been done on faunal diversity in Gauhati University campus, which indicates that it has a rich faunal diversity especially insect diversity. 109 species of birds belonging to 44 families [10] also reported to present in the campus. 140

species of butterflies belonging to 5 families [11], 12 species of beetles belonging to 10 genera and 6 families [12] and 14 species of Hemiptera belonging to 12 genera and 7 families (Hazarika et al 2010) were reported from Gauhati University campus. But less work was found to be reported previously on ant diversity in this particular site. In this context, present study aimed to document the diversity and distribution of ants in Gauhati University campus.

## II. MATERIALS AND METHODS:

**STUDY SITE:** Gauhati University is located at geographical location of 26.1530°N latitude and 91.6639°E longitude and 45m above the mean sea level. The climate is tropical mesothermal with high humidity and moderate temperature. The temperature ranges from 10.6°C to 32°C. The average annual precipitation ranges from 300 to 400mm. During monsoon period maximum rainfall takes place and temperature ranges between 24°C-32°C with relative humidity from 55.5% to 85.5% [11]. The vegetation types found in the area are mixed-moist deciduous forests, semi-evergreen forests and scattered deciduous forests. Degraded and Shrub type of forests are also found. The University Campus contains varied natural habitats ranging from wetlands, grasslands, forests, many small and medium size ponds [10], hilly areas. The survey of the ants are carried out in the whole campus which is divided into 4 different study sites- (a) open area, (b) near wetland area, (c) human habitats area and (d) hilly area.

**SURVEY TIME:** The survey was carried out twice in a week from 6 am to 11 am in each study sites from June to September 2017.

### SAMPLING OF ANTS:

For collection of ants the standard protocol [14] used with modifications. Various sampling techniques including sugar baits, leaf litter technique, beating vegetation, hand collection were carried out for sampling of ants. The survey was carried out from June to September 2017. In each study site five 10 m transects were selected along which the samples were collected with different sampling methods. Six sugar baits were placed in each transect with 2m spacing between the baits. Hand collection was carried out within an area of 5m on either side of the transect by searching for ants on rotten logs, stumps, dead and live branches, twigs, low vegetation, termite mounds and under stones. Ants foraging on the vegetation were sampled by beating the vegetation (to dislodge ants from plants on to sheets) and collecting ants within an area of 5m left and right of the transect.

### PRESERVATION OF ANTS:

After collection of the ants they were washed properly and preserved in 70% alcohol.

### IDENTIFICATION OF ANTS:

The collected ants were identified by using Leica stereo microscope based on identification key [4], [15]. Different

types of taxonomic keys such as body colour, pilosity, presence of petiole and post petiole, presence of spines in propodeum and petiole, number of segment of antennae, position of antennae etc. are used for identification of the collected ants.

### DATA ANALYSIS:

Diversity indices like Shannon-Weiner diversity index, Simpsons Diversity index and Evenness Index is calculated using PAST software.

## III. RESULTS

In the present study, a total of 15,471 no. of individuals belonging to 21 species, 14 genera and 4 subfamilies were recorded from the Gauhati University campus, Guwahati, Assam. The Myrmicinae was the most dominant subfamily in terms of species richness (10 species) followed by Formicinae (8 species), Ponerinae (2 species) and Pseudomyrmicinae (1 species). As presented in the Fig.1 Subfamily Myrmicinae represents highest percentage of species (47.62%) followed by Formicinae (38.09%), Ponerinae (9.52%) and lowest in Pseudomyrmicinae (4.76%). Among the 21 specimens, 12 specimens were identified upto species level.

During the present investigation highest species diversity was observed in hilly area and lowest in near the wetland area (Table.3). As presented in the Table.2 21 species were collected from hilly area, 13 species were collected from open area, 15 species were collected from human habitat area and 9 species were collected from near the wetland area. Out of these 21 species only 9 species were common in all the four habitats. The genus *Camponotus* represents maximum number of species (4) followed by *Myrmica*, *Monomorium*, *Crematogaster* and *Diacamma* with two species each and *Oecophylla*, *Paratrechina*, *Anoplolepis*, *Leptogenys*, *Carebare*, *Meranoplus*, *Solenopsis*, *Pheidole* and *Tetraponera* with only one species each in the study area.

Of these 21 species *Camponotus compressus*, *Camponotus angusticollis*, *Camponotus vicinus*, *Paratrechina longicornis*, *Myrmica* sp1, *Myrmica* sp2, *Monomorium* sp1, *Monomorium* sp2 were common in all the habitats. *Camponotus rufoglaucus*, *Leptogenys diminuta* and *Carebare* sp were found only in the open area and hilly area. While *Oecophylla smaragdina*, *Diacamma* sp2, *Tetraponera rufonigra* were found in the hilly area and human habitat area. Other species *Diacamma* sp1, *Crematogaster* sp and *Solenopsis geminata* were found only in the hilly area.

Diversity indices were computed for the ant species from different habitats. The species diversity indices were different among the four different habitats. The Shannon-wiener index was highest in hilly area (2.793) followed by open area (2.291), human habitat area (2.265) and near the

wetland area (1.993). Moreover, the highest value of evenness index of ants is in near the wetland area followed by hilly area, open area and lastly in the human habitat area. During the present investigation lowest species diversity observed in near the wetland area (9 species) and highest species diversity was observed in the hilly area (21 species).

**Table 1: Different ant species collected from Gauhati University campus.**

Subfamilies	Genus	Species
Formicinae	<i>Camponotus</i>	<i>compressus</i>
	<i>Camponotus</i>	<i>angusticolis</i>
	<i>Camponotus</i>	<i>rufoglaucus</i>
	<i>Camponotus</i>	<i>vicinus</i>
	<i>Oecophylla</i>	<i>smaragdina</i>
	<i>Paratrechina</i>	<i>longicornis</i>
	<i>Anoplolepis</i>	<i>gracilipes</i>
	<i>Leptogenys</i>	<i>diminuta</i>
Myrmicinae	<i>Myrmica</i>	sp1
	<i>Myrmica</i>	sp2
	<i>Carebare</i>	sp
	<i>Monomorium</i>	sp1
	<i>Monomorium</i>	sp2
	<i>Meranoplus</i>	<i>bicolour</i>
	<i>Solenopsis</i>	<i>geminata</i>
	<i>Pheidole</i>	sp
	<i>Crematogaster</i>	<i>subnuda</i>
	<i>Crematogaster</i>	sp
Ponerinae	<i>Diacamma</i>	sp1
	<i>Diacamma</i>	sp2
Pseudomyrmicinae	<i>Tetraoponera</i>	<i>rufonigra</i>

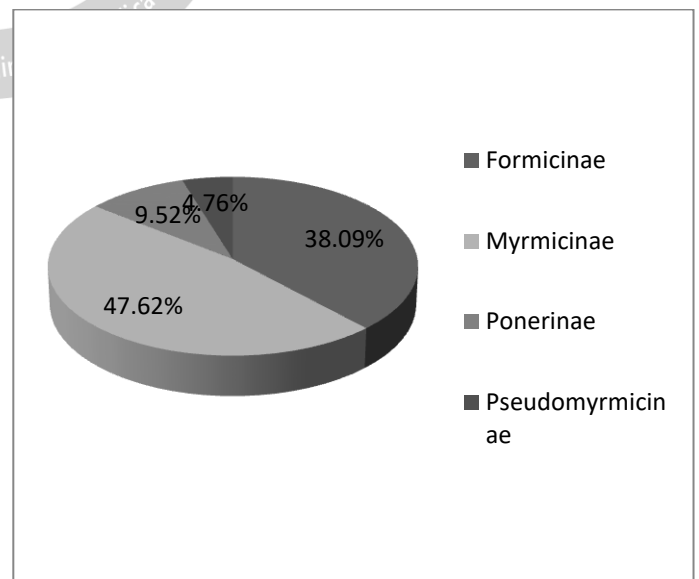
**Table 2: Habitatwise distribution of different Ant species found in Gauhati University campus.**

Name Of The Species	Site Of Collection			
	Open Area	Hilly Area	Human Habitat Area	Near Wetland Area
<i>Camponotus compressus</i>	+	+	+	+
<i>Camponotus angusticolis</i>	+	+	+	+
<i>Camponotus rufoglaucus</i>	+	+	-	-
<i>Camponotus vicinus</i>	+	+	+	+
<i>Oecophylla smaragdina</i>	-	+	+	-
<i>Paratrechina longicornis</i>	+	+	+	+
<i>Anoplolepis gracilipes</i>	-	+	+	+
<i>Leptogenys diminuta</i>	+	+	-	-
<i>Myrmica sp1</i>	+	+	+	+

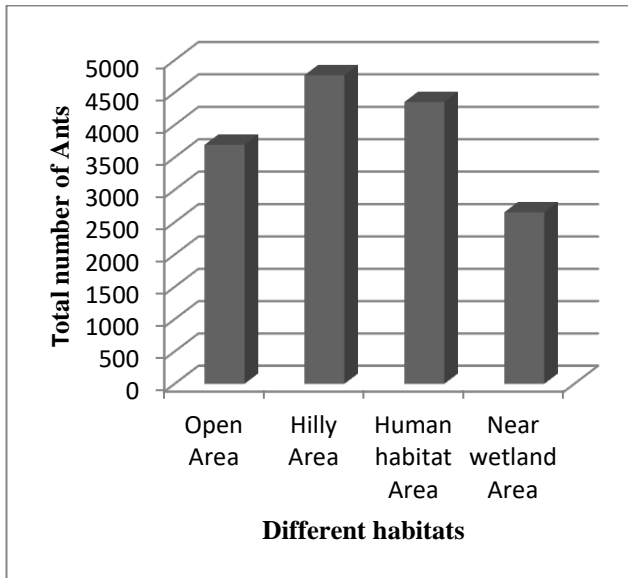
<i>Myrmica</i> sp2	+	+	+	+
<i>Carebare</i> sp	+	+	-	-
<i>Monomorium</i> sp1	+	+	+	+
<i>Monomorium</i> sp2	+	+	+	+
<i>Meranoplus bicolour</i>	-	+	+	-
<i>Solenopsis geminata</i>	-	+	-	-
<i>Pheidole</i> sp	+	+	+	-
<i>Crematogaster subnuda</i>	+	+	+	-
<i>Crematogaster</i> sp	-	+	-	-
<i>Diacamma</i> sp1	-	+	-	-
<i>Diacamma</i> sp2	-	+	+	-
<i>Tetraoponera rufonigra</i>	-	+	+	-

**Table 3: Different Diversity indices of Ant species found in Gauhati university campus.**

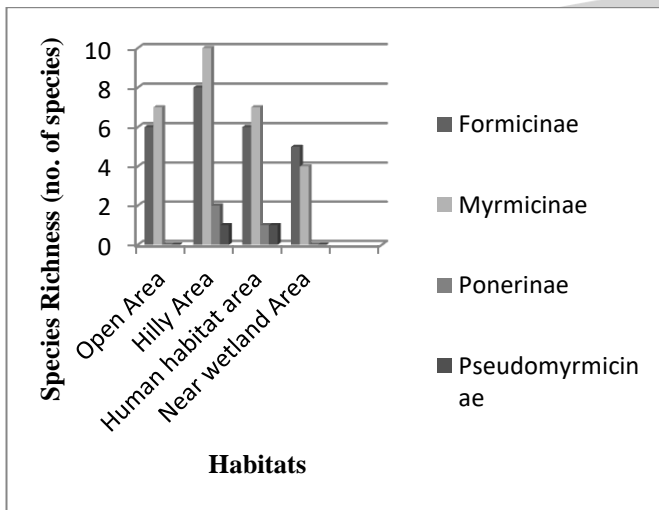
Diversity Indices	Open Area	Hilly Area	Human Habitat Area	Near Wetland Area
Shannon-Weiner Index	2.291	2.793	2.265	1.994
Simpson's Diversity Index	0.8827	0.924	0.8569	0.8491
Evenness Index	0.7601	0.772	0.6423	0.8149
Margalef Species Richness Index	1.461	2.361	1.671	1.015



**Fig1: Subfamilywise percentage occurrence of different Ant species from the Gauhati University campus.**



**Fig 2: Comparison of population of Ants in different habitats.**



**Fig 3: Representation of species richness in each subfamilies in different habitats of Gauhati University campus.**

#### IV. DISCUSSION

The Gauhati University campus contains rich ant diversity. The findings of the present study showed twenty one ant species belonging to 14 genera representing four subfamilies namely Formicinae, Myrmicinae, Ponerinae and Pseudomyrmicinae under the family Formicidae. The ant diversity is influenced by topography, flora, fauna and climatic conditions of a particular area. It is supposed that the topography, rich plant community and suitable climatic conditions of Gauhati University campus provides appropriate shelter and foraging grounds for ants. The study reveals that the relative contribution of Myrmicinae subfamily is high (47.62%) followed by Formicinae (38.09%), Ponerinae (9.52%) and Pseudomyrmicinae (4.76%) in the Gauhati University campus. Similar finding was observed by Bharti et al (2009) while studying

diversity and abundance of ants along an elevational gradient of Jammu Kashmir. They recorded subfamily Myrmicinae (66%) followed by Formicinae (26.81%), Ponerinae (4.84%) and Dolichoderinae (2.35%). Yashavantakumar et al (2016) also reported subfamily Formicinae (42%), Myrmicinae (42%), Ponerinae (4%), Dorylinae (4%), Dolichoderinae (4%) and Pseudomyrmicinae (4%) from Karnatak University campus. Dominance wise the Myrmicinae subfamily was observed as more dominant followed by Formicinae and Ponerinae while studying the diversity of ants in homogenous and heterogenous rubber plantation in Songkhla Province, Southern Thailand by Watanasit et al (2011). Sonune et al (2016) recorded Myrmicinae (6 species) was most diverse followed by Formicinae (4 species), Pseudomyrmicinae (3 species), Ponerinae (2 species), Dolichoderinae (1 species) and Aenictinae (1 species) around Gautala Autramghat Sanctuary, Aurangabad. In terms of species richness Ravi et al (2015) also reported Myrmicinae (18 species) subfamily was most dominant followed by Formicinae (8 species), Ponerinae (2 species) and Dolichoderinae (2 species) in Agro ecosystem and grasslands of Jammikunta area Karimnagar District.

The species richness and diversity indices are different in different habitats. Few ant genera as *Camponotus*, *Paratrechina*, *Myrmica* and *Monomorium* are commonly present in all habitats and few genera are confined to few habitats as *Tetraponera* recorded from hilly area and human habitat area but not in open area and near wetland area. The number of certain ant species in certain habitat were considerably increased because they get ideal condition for their nesting sites, food availability, open grounds for foraging etc [16]. Both the species richness and diversity indices were highest in the hilly area. The relatively high ant species diversity may be caused by the correspondingly high diversity in plant community. Subfamily Myrmicinae was the most diverse comprising of 7 genera and 10 species. The Myrmicinae subfamily was widely distributed in all geographic regions [5]. This correlates with the present study because highest number of ant species were recorded from Myrmicinae subfamily. The genus *Camponotus* was present in all the habitat of Gauhati University campus. In open area less number of Ant species were present as comparable to hilly area, it may be because of in hilly area the plant community was rich and human degradation were less but the open area doesn't contain numerous tree. Sonune et al (2016) reported that more number of trees and canopy cover provide foraging places as compared to others. Kumar et al (1997) reported that with the increasing rate of vegetation ant species richness is also increases and with the increasing rate of disturbances ant species richness is decrease. On the other hand, in human habitat area the diversity indices are less than hilly area and open area. Due to various human activities and exploitation the ant diversity was less around the human

habitat. The disturbed area show lower richness and diversity in their ant fauna [6]. Many of the earlier researchers suggested that due to anthropogenic activities ant population is reduce [17], [18] and in the present study Gauhati University campus was not a polluted area however ant diversity was lowest in near the wetland area in comparison to the other habitat types.

## V. CONCLUSION

From the present study it can be concluded that Gauhati University campus comprises of all the habitat type rich in ant diversity. The climate, vegetation and physiography have direct impact on the Ant diversity. So a long term study is needed to observe the species occurrence in all seasons and their interaction with the environmental changes for better results.

## VI. ACKNOWLEDGEMENT

The authors are very much thankful to the Department of Zoology, Gauhati University for providing necessary facilities and support.

## REFERENCES

- [1] L. Lach, C. L. Parr, and K. L. Abbott, *Ant Ecology*. Oxford University Press. 2010.
- [2] D. Agosti, J. D. Majer, E. L. Alonso, and T.R. Schultz (2000). *Ants: Standard Methods for Measuring and Monitoring Biodiversity*. Washington, DC: Smithsonian Institution Press.2000.
- [3] S. Philpott, I. Perfecto, I. Armbrecht, and C. L. Parr," Ant diversity and function in disturbed and changing habitats. In: Lach L, Parr CL, Abbott KL, editors. *Ant Ecology*. Oxford: Oxford University Press. pp. 137 – 156.2010.
- [4] B. Bolton, *Identification Guide to the Ant Genera of World*. Cambridge: Harvard University Press. 1994.
- [5] A. Chavhan, and S. S. Pawar," Distribution and Diversity of Ant Species (Hymenoptera: Formicidae) in and Around Amravati City of Maharashtra, India," *World Journal of Zoology*, vol. 6, no. 4, pp. 395-400.2011.
- [6] R. Gadagkar, P. Nair, K. Chandrashekhar, and D. M. Bhat," Ant species richness in some selected localities in Western Ghats, India," *Hexapoda*, vol. 5, pp. 70-94.1993.
- [7] N. R. Gunawardene, A. E. D. Daniels, G. Dulip, C. V. Springer-Verlag, I. A. U. N. Gunatilleke, C. V. S. Gunatilleke, P. V. Karunakaran, K. G. Nayak, S. Prasad, P. Puyravaud, B. R. Ramesh, K. A. Subramanian, and G. Vasanthy," A brief overview of the Western Ghats-Sri Lanka biodiversity hotspot," *Current Science* vol. 93, no. 11, pp. 1567-1572.2007.
- [8] H. Bharti, B. Guénard, M. Bharti, and E. P. Economo," An updated checklist of the ants of India with their specific distributions in Indian states (Hymenoptera, Formicidae)," *ZooKeys*, vol. 551, pp. 1–83.2016.
- [9] P. Rajkumari, D. Sharmah, A. Rahma, and P. Patgiri," Diversity and Distribution Pattern of Hymenoptera Insects in Jorhat District, Assam, India," *International Journal of Science and Research*, pp. 1938-1941.2012.
- [10] O. S. Devi, M. Islam, J. Das, and P.K. Saikia," Avian-Fauna of Gauhati University Campus, Jalukbari, Assam," *The Ecoscan*, vol. 6, no. 3&4, pp. 165-170.2012.
- [11] M. K. Saikia," Diversity of Tropical Butterflies In Urban Altered Forest at Gauhati University Campus, Jalukbari, Assam, India," *Journal of Global Biosciences* vol. 3 no. 2, pp. 452-463. 2014.
- [12] H. N. Hazarika, and J. Kalita," Diversity of Beetles (Insecta: Coleoptera) In Gauhati University Campus," *Research Journal of Social and Life Sciences*, vol. 24, no. 1, pp. 279- 284.2018.
- [13] R. Hazarika, and M. M. Goswami," Aquatic Hemiptera of Gauhati University, Guwahati, Assam, India," *Journal of Threatened Taxa*, vol. 2, no. 3, pp. 778-782.2010.
- [14] H. Bharti, M. Bharti, and M. Pfeiffer," Ants as bioindicators of ecosystem health in Shivalik Mountains of Himalayas: assessment of species diversity and invasive species," *Asian Myrmecology*, vol. 8, pp. 1–15.2016.
- [15] B. Holldobler, and E. O. Wilson, *The Ants*. Massachusetts: Harvard University Cambridge, Belknap Press. 1990.
- [16] N. Paul, P. John, B. Job, and P. L. D. Menon," Comparison of Ant (Hymenoptera: Formicidae) Diversity in Different Habitats of Machad Region of Thrissur." *Bulletin of Environment, Pharmacology and Life Sciences*, vol. 5 no. 2 pp. 28-33.2016.
- [17] R. R. Azhagu, R. Sathish, A. Prakasam, D. Krishnamoorthy, and M. Balachandar ," Diversity and distribution of Ant species (Hymenoptera: Formicidae), in Pachaiyappa's College, Kanchipuram, Tamil Nadu, India," *Journal of Entomology and Zoology Studies*, vol. 5, no. 1, pp. 459-464.2017.
- [18] B. V. Sonune, and R. J. Chavan," Distribution and diversity of ants (Hymenoptera: Formicidae) around Gautala Autramghat Sanctuary, Aurangabad Maharashtra, India," *Journal of Entomology and Zoology Studies*, vol. 4, no.2, pp. 361-364.2016.
- [19] V. Anbalagan, M.G. Paulraj, and S. Ignacimuthu," Diversity and abundance of Hymenoptera families in vegetable crops in north-eastern District of Tamil

- Nadu, India,” International Journal of Fauna and Biological Studies, vol. 2, no. 3, pp. 100-104.2015.
- [20] H. Bharti, Y. P. Sharma, M. Bharti, and M. Pfeiffer,” Ant species richness, endemism and functional groups, along an elevational gradient in the Himalayas,” Asian Myrmecology, vol. 5, no.79–101.2013.
- [21] M. M. El. Bokl, F. M. Semida, M. S. Abdel-Dayem, and El. El. Surtasi,” Ant (Hymenoptera: Formicidae) Diversity And Bioindicators In The Lands With Different Anthropogenic Activities In New Damietta, Egypt,” International Journal of Entomological Research, vol. 3, no. 2, pp. 35-46.2015.
- [22] C. A. Bruhl, M. Mohamed, and K. D. Linsemair,” Altitudinal distribution of leaf litter ants along a transect in primary forests on Mount Kinabalu, Sabah, Malaysia,” Journal of Tropical Ecology, vol. 15, pp. 265-277.1999.
- [23] S. Dash, and H. P. Patnaik, “Diversity and seasonality of ants associated with outdoor and indoor habitats of coastal Odisha,” Journal of Eco-friendly Agriculture, vol. 10, no. 2, pp. 184-188.2015.
- [24] G. S. Figueras, and O. M. Nuñez, ”Species diversity of ants in karst limestone habitats in Bukidnon and Davao Oriental, Mindanao, Philippines,” Aes Bioflux vol. 5, no. 3, pp. 306-315. 2013.
- [25] P. J. Folgarait,” Ant biodiversity and its relationship to ecosystem functioning: a review,” Biodiversity and Conservation, vol. 7, pp. 1221-1244.1998.
- [26] K. G. Kadu,” Species Richness And Diversity Of Ants In Nagpur City (MS), India,” International Journal of Researches In Biosciences, Agriculture And Technology, vol. 4, no. 3, pp. 42-44.2016.
- [26] M. S. Kumar, K. T. Shrihari, P. Nair, T. Varghese, and R. Gadagkar,” Ant Species Richness at selected localities of Bangalore,” Insect Environment, vol. 3, no. 1,pp. 3-5.1997.
- [27] S. A. Nagariya, and S.S. Pawar,” Distribution of (Hymenoptera: Formicidae) Ants Diversity in Pohara Forest Area of Amravati Region, Maharashtra State, India,” International Journal of Science and Research, vol. 3, no. 7, pp. 1310-1312. 2014.
- [28] G. D. Ouellette, F. A. Drummond, B. Choate, and E. Groden,” Ant Diversity and Distribution in Acadia National Park, Maine,” Environ. Entomol, vol. 39, no. 5,pp. 1447-1456. 2010.
- [29] N. Ravi, Ch. Sravanthy, Ch. Sammaiah, and M. Thirupathaiiah (2015). Biodiversity of Ants (Insecta-Hymenoptera) in Agro-Ecosystem and Grass Land in Jammikunta, Karimnagar District, Telangana, India. Journal of Environment vol. 4, no. 1, pp. 11-16. 2015.
- [30] S. Watanasit, and T. Nhu-eard,” Diversity of ants (Hymenoptera: Formicidae) in two rubber plantations in Songkhla Province, Southern Thailand,” Songklanakarin J. Sci. Technol. Vol. 33, no. 2, pp. 151-161.2011.
- [31] G. S. Yashavantakumar, V. N. Vidya, R. S. Vidya, D. K. Veeranagoudar, and P. M. Biradar, “Diversity of Ant species in Karnatak University campus, Dharwad,” International Journal of Advanced Scientific Research and Management, vol. 1, no. 9, pp. 64-69. 2016.