Uttar Pradesh Journal of Zoology

Volume 45, Issue 13, Page 23-27, 2024; Article no.UPJOZ.3579
ISSN: 0256-971X (P)

Ant Species Richness and Diversity in Selected Habitats in Chavara Panchayath, Kollam District, Kerala, India

Arya Krishnan [a], Dhanyaraj D. [a] and Kiran P. [a*]

[a] PG Department of Zoology, BJM Government College, Chavara, Kollam 691583, Kerala, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.56557/upjoz/2024/v45i134132

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://prh.mbimph.com/review-history/3579

Original Research Article

Received: 26/03/2024
Accepted: 29/05/2024
Published: 04/06/2024

ABSTRACT

Ants are an important part of the ecosystem not only because of their huge biomass but also because of their role in the ecosystem. The aim of this study is to address the diversity and abundance of ants in Chavara panchayat, Kollam district, Kerala. The study records a total of 16 ant species belongs to 1 family, 7 tribes, and 3 subfamilies in Chavara panchayat, which provides a brief scenario and improves our knowledge the diversity and distribution of the myrmecofauna in the region. The subfamilies include Formicinae (4 genera and 7 species), Myrmicinae (5 genera and 6 species), and Ponerinae (3 genera and 3 species). Formicinae was the most diverse subfamily, Myrmicinae was the most abundant tribe, and Ponerinae was the least abundant and most diverse subfamily. Biodiversity indices show that the study area has high biodiversity and species richness.

**Corresponding author: Email: kirangprabhakaran@gmail.com;*

***Cite as:** Krishnan, Arya, Dhanyaraj D., and Kiran P. 2024. "Ant Species Richness and Diversity in Selected Habitats in Chavara Panchayath, Kollam District, Kerala, India". UTTAR PRADESH JOURNAL OF ZOOLOGY 45 (13):23-27. https://doi.org/10.56557/upjoz/2024/v45i134132.*

Keywords: Ant diversity; biodiversity; Formicidae; Myrmecofauna; sub family.

1. INTRODUCTION

"Ants appeared on Earth 140–160 million years ago, long before the arrival of humans, mostly during the Cretaceous period. They are one of the important components of the ecosystem, improving the soil and contributing to the decomposition process" [1]. They are also considered good biological indicators due to their mutual behaviour with both flora and fauna. India has 60–65% of the ant varieties in the world.

"Ants are a group of insects that are beneficial to humans. They play an important role in terrestrial ecosystems through numerous interactions with various plant species, including seed dispersers, leaf and seed predators, and, in some cases, pollinators. Ants are found everywhere except Iceland, Greenland, and Antarctica, but the number of species decreases with increasing latitude, altitude, and aridity. Most ants have either a direct or indirect association with vegetation. Some are very specific to the habitat in which they occur, depending on the maximum benefits they achieve in terms of reproduction, mating, and food availability. They are widely used to assess landscape disturbance and species diversity" [2]. Using insects to study how mosaics, land fragmentation, deforestation, and monocultures affect the diversity and stability of ecosystems is a complex and interesting task because it not only concerns the taxonomy of the group in question but also involves behavioral aspects of the taxa under study.

This study is the first overview of the taxonomic diversity of ants in this region. The purpose of the study was to find out the diversity and distribution of ants in different ecological habitats, such as a temple, a residential area, and a university campus. This study provides useful information about the diversity, distribution, and richness of ant species in and around Chavara Panchayath.

2. MATERIALS AND METHODOLOGY

2.1 Study Area

The objective of this study was to investigate the diversity and abundance of ant species at selected stations in Chavara panchayat, Kollam district, Kerala. The latitude of the study area is 8.9952900°N, and the longitude is 76.532880°W. Intensive ant samples were collected from different ecological habitats, such as (i) Residential areas, (ii) BJM campus, and (iii) Temple.

2.2 Methodology

During the study period from June 2023 to September 2023, samples were collected from morning to evening. Direct and indirect sampling techniques were used to collect ants [3]. Direct sampling involves searching (all out), where ant samples are collected randomly by hand with forceps and a brush. Collected ant samples were taken in a killing jar and then preserved in 70% alcohol, or the ant sample was taken directly into a 5 ml bottle containing 70% alcohol. Indirect sampling includes traps and baited traps. Peanut butter, sugar solution, honey solution, and cookies were used as bait. The collected ant samples were cleaned and preserved in 70% alcohol. Then the preserved samples were fixed and labelled for further identification. Ant specimens were examined under a stereozoom binocular microscope, and different taxonomic classes were identified based on the taxonomic keys of Bingham [4]; Holldobler and Wilson [5]; Bolton [6]; and Rastogi N. et al. [7].

2.3 Data Analysis

Ant species diversity of the selected habitats of chavara panchayat was analyzed using the following diversity indices with PAST software

1. **SHANNON-WIENER INDEX:**

   Shannon-Wiener Species Diversity Index, $H' = \sum pi \ln pi$

Where pi is the proportion of individuals belonging to species I and ln is the natural log.

2. **SIMPSON'S DIVERSITY INDEX:**

   Simpson's Diversity Index, $D = 1-((\sum n(n-1))/N(N-1)$

Where n is the number of individuals of each species and N is the total number of individuals of all species.

3. **EVENNESS INDEXES (PIELOU'S INDEX):**

   Pielou's evenness index, $J' = H' / H'\,Max$ or $H'/\ln(S)$

Where H′ is the Shannon-Weiner diversity index and H′ max or ln(S) is the maximum diversity possible. S is the number of species or species richness.

4. **RICHNESS INDEX (MARGALEF'S DIVERSITY INDEX):**

Margalef's diversity index,D = (S – 1)/ ln N

Where S is the number of species, and N is the total number of individuals in the Sample.

3. RESULTS

A preliminary survey of the ant fauna of Chavara panchayat succeeded in collecting 16 ant species belonging to 12 genera, 7 tribes, and 3 subtribes. Forminicae was the most diverse, with 4 genera and 7 species, followed by Myrmicinae with 5 genera and 6 species, and Ponerinae with the least diversity, with 3 genera and 3 species. The Simpson index of diversity (1-D) for temples was 0.88; however, for temples and residential areas, it was the same as 0.87, which is very close to 1, indicating greater diversity in these habitats. Similarly, Shannon Wiener indexes 0.93, 0.87, and 0.91 for campus, temple, and residential areas in confirmation of the greater diversity of ants in these respective habitats (Table 2). The highest evenness index (0.93) was on campus, while the lowest index (0.87) was temple habitats (Table 2).

4. DISCUSSION

Current study reported 16 ant species from 12 families, 7 tribes, and 3 subfamilies for the Chavara panchayat region. The greatest number of ant species reported in the Myrmicinae subfamily is similar to this study's findings. Ant diversity in Jammu and Kashmir's Himalayan

Table 1. Checklist of ants in different sites from Chavara panchayath

Sl.no	Species	Sub Family	Tribe	Genus
1	*Anoplolepis gracilipes* (Smith, 1857)	Formicinae	Lasiini	Anoplolepis
2	*Camponotus angusticollis* (Jerdon, 1851)	Formicinae	Camponotini	Camponotus
3	*Camponotus compressus* (Fabricius, 1787)	Formicinae	Camponotini	Camponotus
4	*Camponotus irritans* (Smith, F., 1857)	Formicinae	Camponotini	Camponotus
5	*Camponotus rufoglaucus* (Jerdon, 1851)	Formicinae	Camponotini	Camponotus
6	*Oecophylla smaragdina* (Fabricius, 1775)	Formicinae	Oecophyllini	Oecophylla
7	*Paratrechina longicornis* (Latreille, 1802)	Formicinae	Lasiini	Paratrechina
8	*Crematogaster rothneyi* (Mayr, 1879)	Myrmicinae	Crematogastrini	Crematogaster
9	*Meranoplus bicolor* (Guerin-Meneville, 1844)	Myrmicinae	Crematogastrini	Meranoplus
10	*Monomorium floricola* (Jerdon, 1851)	Myrmicinae	Solenopsidini	Monomorium
11	*Monomorium pharaonis* (Linnaeus, 1758)	Myrmicinae	Solenopsidini	Monomorium
12	*Myrmicaria brunnea* (Saunders, 1842)	Myrmicinae	Solenopsidini	Myrmicaria
13	*Solenopsis geminata* (Fabricius, 1804)	Myrmicinae	Solenopsidini	Solenopsis
14	*Diacamma rugosum* (Le Guillou, 1842)	Ponerinae	Ponerini	Diacamma
15	*Odontomachus simillimus* (Smith,F., 1858)	Ponerinae	Ponerini	Odontomachus
16	*Platythyrea parallela* (Smith, F., 1859)	Ponerinae	Platythyreini	Platythyrea

Table 2. Diversity indices in the different sites of Chavara panchayath

Diversity index	Campus	Temple	Residential area
Shannon-Wiener	2.14358	2.31645	2.19307
Shannon evenness	0.93094	0.87775	0.91458
Simpson index	0.87362	0.88636	0.87467
Margalef	3.90865	4.92600	4.17032

altitudinal gradient was conducted by Bharti et al. [8]. They discovered that Myrmicinae was the most prevalent subfamily, with Formicinae, Ponerinae, and Dolichoderinae following closely behind.

However, Myrmicinae (48% of extant ant species), Formicinae (23%), and Ponerinae (10%) are the three largest subfamilies worldwide [9]. The above results show similarity with this global model. The Simpson diversity index (1-D) of 0.87 was the same in the campus and human habitat, indicating greater diversity, and the Shannon index (2.14 and 2.19, respectively) indicated a similarly diverse ant population. Casseney et al. studied the diversity of ant species in open (almost swamp-free) and covered habitats. (Artificial forests) and reported similar ant diversity. Similarly, Pacheco and Vasconcelos [10] reported an ant species that was larger in wooded urban parks. These results also seek new answers about what adaptations or characteristics made these ant species adapt to their habitats.

The Shannon evenness index showed a maximum at the campus and a minimum at the temple. Simpson recorded the highest diversity in the temple (0.886). Based on the observed indices, it is clear that the community is less diverse on campus (0.873) compared to the other two positions [11]. The Margalef campus had a diversity of 3.90, the temple 4.92, and the residential area 4.17. Margalef's diversity index was highest in the temples and lowest on the campus, indicating that the temple has the highest species richness compared to the residential area and the campus. In the present study, out of 16 different ant species, 8 are tree species and 8 are soil dwellers based on their habitat. The majority of individual species belong to the habitat of trees, and the fewest are soil dwellers. Habitat selection is often influenced by resource availability and environmental conditions.

5. CONCLUSION

A total of 16 species, representing 12 families and 3 subfamilies, were recorded from Chavara panchayath. During this study, Formicinae was the most dominant subfamily in terms of species richness among the three subfamilies. Based on this study, it can be concluded that the diversity of ants in these 3 site is different in terms of species richness, abundance, and composition. Ants are good biological indicators because they react immediately to changes in the environment. Compared to other insects such as spiders and weevils, ants are better taxa as disturbance indicators. The abundance of certain ant species in the human habitat was remarkably similar to that of the vegetative habitat because they found ideal conditions for it, such as nest sites, food availability, and open feeding grounds. Detailed studies on the similarity between humans and vegetative habitats are urgently needed. The reasons why there are more species in the human habitat, according to the type of disturbance, physico-chemical properties of the soil, climatic factors, flora and fauna, etc., should be explained in the future.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Watanasit S, Bickel TO. Diversity of Ants from Ton Nga Chang Wildlife Sanctuary. Thailand: Songkhla. 2000;33-66.
2. Paknia O, Pfeiffer M. Steppe versus desert: multi-scale spatial patterns in diversity of ant communities in Iran. Insect Conservation and Diversity. 2011;4:297–306.
   DOI: 10.1111/j.1752-4598.2011.00136.x
3. Agosti D, Majer J D, Alonso L E, Schultz T R (eds). Ants: Standard methods for measuring and monitoring biodiversity. Smithsonian Institute Press, Washington D C. 2000;280.
4. Bingham C T. The fauna of British India, including Ceylon and Burma. Hymenoptera. Ant and Cuckoo- wasps. Taylor and Francis, London. 1903;2: 506.

5. Holldobler B, Wilson E O. The Ants.Harvard University Press. Cambridge, U S A; 1990.
6. Bolton B. Identification Guide to the Ant Genera of the World. Cambridge, Massachusetts, Harvard University Press. 1994;222.
7. Rastogi N, Nair P, Kolatkar M, William H, Gadagkar R. Ant fauna of the Indian Institute of Science Campus- Survey and some preliminary observations. Indian Inst. Sci. 1997;77:133-140.
8. Bharti H, Sharma YP, Kaur A. Seasonal patterns of ants (Hymenoptera: Formicidae) in Punjab Shivalik. Halteres. 2009;1(1):36–47.
9. Kasseney BD, N'Tie TB, Nuto Y, Wouter D, Yeo K, Glitho IA. Diversity of ants and termites other botanical garden of the University of Lome. Togo. Insects. 2019; 10(7):218.
10. Pacheco R, Vasconcelos HL. Invertebrate conservation in urban areas: Ants in the Brazilian Cerrado. Landsc Urban Plan. 2007;81:193–199.
11. Begum R, Majagi SH, Vijaykumar K. Ants species richness and diversity in relation to different ecological habitat in selected localities of the semi-arid region of Karnataka, India. Environmental Monitoring and Assessment. 2021 Mar; 193:1-3.

Peer-review history:
The peer review history for this paper can be accessed here:
https://prh.mbimph.com/review-history/3579