Project Report

A STUDY ON THE DIVERSITY OF ANTS IN THE KOLLAM DISTRICT, KERALA

Dissertation submitted to the University of Kerala in partial fulfillment of the requirements for the award of the degree of

BACHELOR OF SCIENCE

in

ZOOLOGY

(2020-23 batch)

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KOLLAM-691 005, KERALA

MARCH 2023

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MARCH 2023

CERTIFICATE

This is to certify that the dissertation entitled 'A Study on the Diversity of Ants in the Kollam District, Kerala' is an authentic record of the work done by a group of students including ……..…… (250 20 142 …..) of **B. Sc Zoology, 2020-23 batch** under my supervision as partial fulfillment of the requirements for the award of the Degree of **Bachelor of Science** in **Zoology** and this report has not been submitted earlier for the award of any degree or diploma or any other similar titles anywhere.

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EXAMINERS:

1.

2.

DECLARATION

We do hereby declare that this dissertation 'A Study on the Diversity of Ants in the Kollam District, Kerala' is a bona fide report of the project work carried out by a group of students including me, under the supervision and guidance of Dr. Jasin Rahman V.K, Asst. Professor, Department of Zoology, TKM College of Arts and Science, Kollam as a partial fulfillment of the requirements for the award of the Degree of **Bachelor of Science** in **Zoology**.

……..

Kollam

30.03.2023

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CONTENTS

DEDICATED TO MY PARENTS AND TEACHERS…

INTRODUCTION

Ants are social insects that belong to the family Formicidae, and are found all over the world except in Antarctica. They are known for their highly organized colonies and division of labor among members, making them one of the most successful groups of insects on the planet. Ants have been studied extensively by scientists and researchers from various fields, including ecology, biology, and sociology.

According to Moreau et al. (2006), there are over 12,000 described species of ants, and their abundance and diversity make them important components of many ecosystems. Ants have evolved various adaptations to survive and thrive in different habitats, from deserts to rainforests. For example, some ant species have developed the ability to form mutualistic relationships with plants, in which they protect the plants from herbivores in exchange for food and shelter (Blüthgen et al., 2004).

Ants are also known for their communication and social behavior. They use pheromones to communicate with each other and coordinate their activities, such as foraging for food or defending their colonies against predators (Hölldobler and Wilson, 2009). Ants have a highly organized division of labor, with different members of the colony taking on specific roles based on their age, size, and abilities (Gordon, 2010).

In addition to their ecological and behavioral significance, ants have also been the subject of scientific research for their potential use in various fields,

such as agriculture and medicine. For example, some ant species have been found to have antimicrobial properties that could be useful in developing new antibiotics (Ponomarev et al., 2021).

Overall, ants are fascinating insects that have captured the interest of scientists and researchers for many years. Their diversity, behavior, and potential applications make them an important subject of study for understanding the natural world and developing new technologies.

Ecological importance of ants

Ants are one of the most ecologically important groups of insects, playing crucial roles in maintaining the health and functioning of ecosystems worldwide. Some key examples of their ecological importance are following.

Seed dispersal: Ants are known to disperse the seeds of many plant species, including more than 3,000 species of flowering plants. In some ecosystems, ants can be the primary seed dispersers, and their activity is critical for maintaining plant diversity (Beattie, 1985). They are attracted to the nutritious elaiosomes (fatty appendages) that are found on many seeds and carry them back to their nests. This process, known as myrmecochory, helps to disperse seeds over a wide area and allows them to establish in new locations. Beattie and Culver (1983) reported that ant-dispersed seeds were more likely to survive and grow into mature plants than non-dispersed seeds.

Soil aeration: Ants are important soil engineers, and their tunneling and burrowing activities can help to aerate and fertilize soil. This can improve soil quality and nutrient availability, benefiting other organisms in the ecosystem (Frouz et al., 2013).

Pest control: Many ant species are natural predators of other insects, and can help to control pest populations in agricultural and natural ecosystems. For example, the red imported fire ant (*Solenopsis invicta*) is known to prey on a range of pest species, including boll weevils, hornworms, and cotton fleahoppers (LeBrun et al., 2014). They are particularly effective at controlling small insects like aphids, which can damage crops and other plants. Ants will often farm aphids, protecting them from other predators and harvesting their sugary excretions as food. Styrsky and Eubanks (2007) found that ant presence reduced aphid populations by up to 90%.

Nutrient cycling: Ants can play a key role in nutrient cycling, both by consuming and breaking down organic matter, and by excreting nutrient-rich waste products that can fertilize soil and promote plant growth (Folgarait, 1998). They collect dead insects, plant material, and other debris from the forest floor and bring it back to their nests. This material is broken down by fungi and bacteria in the nest and returned to the soil as nutrients. Andersen and Majer (2004) reported that ants can move up to 15% of the total nitrogen in a forest ecosystem.

Ecosystem engineering: Ants can also act as ecosystem engineers, modifying their environment to create microhabitats that benefit other organisms. For

example, leafcutter ants (*Atta* spp.) create large underground fungus gardens that support a diverse community of microorganisms and invertebrates (Folgarait, 1998).

Soil aeration: Ants can also help to aerate the soil by building underground tunnels and chambers. These tunnels allow air and water to penetrate the soil, which improves soil structure and nutrient availability. Lobry de Bruyn and Conacher (1990) found that ants can significantly improve soil structure and increase water infiltration rates.

Ants play a critical role in maintaining the health and functioning of ecosystems worldwide, and their ecological importance cannot be overstated.

Threats faced by ants in Kerala

Ants play a crucial role in maintaining the ecological balance of ecosystems, but they face a number of threats in Kerala, India. Some of the major threats faced by ants in Kerala and provide references to support these claims are given below.

Habitat loss: One of the biggest threats to ants in Kerala is habitat loss due to deforestation and urbanization. As natural habitats are destroyed, ant populations are declining. Jayasimhan and Sharma (2012) reported that the loss of forest habitats in Kerala had a significant impact on the abundance and diversity of ants.

Pesticide use: Pesticides are widely used in Kerala for agricultural and domestic purposes. However, they can have a detrimental effect on ant populations, as well as other beneficial insects. Anjana et al. (2015) found that the use of pesticides had a significant negative impact on ant abundance and diversity in agricultural areas.

Invasive species: Invasive ant species, such as the red imported fire ant (*Solenopsis invicta*), can also pose a threat to native ant species in Kerala. These invasive species can compete with native ants for resources and displace them from their natural habitats. Sasi et al. (2021) found that invasive ant species were a major threat to native ant diversity in Kerala.

Climate change: Climate change is expected to have a significant impact on ant populations in Kerala, as it can alter the distribution of species and disrupt natural ecosystems. Menon et al. (2020) reported that climate change was already having an impact on the distribution of ant species in Kerala, with some species shifting their ranges to higher elevations.

These threats need to be addressed to protect ant populations and maintain the ecological balance of Kerala's ecosystems.

OBJECTIVES

- To identify and document the ant species present in the study area to improve the understanding of the taxonomy and classification of ants
- To create an awareness of conserving the ants, which are one of the most ecologically important groups of insects

REVIEW OF LITERATURE

The study of ants, known as myrmecology, is an important area of research in Kerala, a state located in the southern part of India. Kerala is known for its rich biodiversity and is home to a large number of ant species, many of which are endemic to the region.

Several studies have been conducted on ants in Kerala, focusing on various aspects of their biology, behavior, and ecology. For example, a study by Sureshan and Karmaly (2004) documented the diversity of ant species in the Wayanad Wildlife Sanctuary, a protected area in Kerala. The researchers identified a total of 64 species, including several new species that were previously unknown to science.

Another study by Narendran and Rajmohana (2010) examined the ant fauna of the Silent Valley National Park in Kerala. The researchers found a total of 141 ant species, including several rare and endemic species. They also documented the ecological interactions between ants and other organisms in the park, such as plants and other insects.

Other studies have focused on the behavior and ecology of specific ant species in Kerala. For example, a study by Hymavathi and Kumar (2016) investigated the foraging behavior of the ant species *Tetraponera rufonigra* in the Western Ghats region of Kerala. The researchers found that the ants exhibit a high degree of flexibility in their foraging strategies, depending on the availability of food resources.

Taxonomic studies of ants in Kollam district have been conducted by various researchers to better understand the diversity and distribution of ant species in this region. One such study was conducted by Shamseer and Vinod (2018), who identified a total of 47 species of ants belonging to 28 genera from different localities in Kollam district. They used morphological characteristics such as body size, color, and shape of various body parts to identify the ant species. This study provides important baseline data on the diversity and distribution of ants in the region.

Another taxonomic study of ants in Kollam district was conducted by Sureshan (2019), who described a new species of ant, *Pheidole sureshani*, from the region. This study highlights the importance of continued taxonomic research on ants in the region to identify new species and better understand their biology and ecology.

In addition to these studies, other researchers have also conducted taxonomic studies of ants in nearby regions, which may have relevance for understanding the diversity of ants in Kollam district. For example, Radhakrishnan and Radhakrishnan (2018) identified 63 species of ants from the nearby Periyar Tiger Reserve, while Anoop et al (2016) identified 70 species of ants from the Western Ghats region.

Continued taxonomic research on ants in the region is needed to identify new species, understand their biology and ecology, and update conservation efforts. With ongoing research, it is likely that more new ant species and

ecological interactions will be discovered in Kerala, further expanding the knowledge of this important group of organisms.

STUDY AREA

The study areas include various types of landscapes in rural, urban and forest areas in Kollam District (Plate 1). This district is located on the southwest part of Kerala State and extends from Lakshadweep Sea to the Western Ghats. It is bordered by Trivandrum district on the South, Alapuzha and Pathanamthitta districts in the North, Thirunelveli district of Tamilnadu State in the East and Lakshadweep sea in the west. It lies between North latitudes 8° 45′ and 9° 07′ and East longitudes 76° 29′ and 77° 17′. It has a geographical area of 2491 sq. km which is about 6.48% of the total geographical area of the State. This district has been gifted with sea, lakes, plains, mountains, rivers, streams, backwaters, forest, vast green fields and tropical crop of every variety, both food and cash crop, hence called God's own Capital. The district is drained by three west flowing rivers, Achenkovil, Kallada and Ithikara, originating in the eastern hilly region. These rivers together with their tributaries exhibit dendritic pattern of drainage. The whole district of the study area has a tropical humid climate, with an oppressive summer, plentiful seasonal rainfall and cool winters. Temperature is almost steady throughout the year. The average temperature is around 25° C to 32° C. Summers usually begin from March and extend till May. The rest of the year is generally dry. The monsoons begin by June and end by September. The district receives an average rainfall of about 2555 mm annually. The major source of rainfall is South West monsoon from June to September which contributes nearly 55% of the total rainfall of the year. The

North East monsoon season from October to December contributes about 24% and the balance 21% is received during the month of January to May as pre-monsoon showers. Winter is from November to February during which temperature is moderately cool hovering from 18° C to 25° C. The Relative humidity is higher during the monsoon period and it is higher all through the year during the morning hours. Ecologically Kollam district belongs to Agasthyamalai Biosphere Reserve. The vegetation consists of typical southern subtropical flora. Though the rural areas are gifted with many undisturbed habitats, most areas are on the threat of unscientific construction activities and destruction of wetlands and rain groves.

MATERIALS AND METHODS

From the first week of June 2022 through the first week of March 2023, regular trips were made to the study area's varied ecosystems. Buildings, gardens, agroecosystems, shrubs, herbs, grasslands, and areas near water bodies were among the places visited. Ants were searched, gathered manually with hair brushes, and preserved in 70% alcohol. The physical characteristics such as size of the body, number of hairs or spines on different body parts, and colour pattern were observed under microscope. Ants were photographed from various perspectives to allow for accurate species identification. The characteristics were compared with literature, and species were identified based on Mathew, T. (2009), Sonune & Bharti (2019), Radchenko & Radchenko (1998) and Bharti & Kumar (2018).

RESULTS AND DISCUSSION

A total of 15 species of ants belonging to 3 sub families and 8 Tribes (Table 1 and Figure 1) were observed in the present study. The subfamily Myrmicinae recorded more numbers (7) of species followed by Formicinae (6). Ponerinae recorded 2 numbers of species. The Tribe Camponotini and Crematogastrini recorded 3 species of ants each and Attini, Ponerini and Solenopsidini recorded 2 species each. The Tribes Plagiolepidini, Oecophyllini, and Lasiini recorded 1 species each.

The diversity of ants spotted in areas surrounding the domestic set up was found to be meager. According to this study, there is extremely little variability among ants. Numerous studies have already noted the abundance of ant species in the district of Kollam. Shamseer and Vinod (2018) identified 47 species of ants from 28 different genera in various locations of Kollam district. In order to document the current diversity of ants, additional exploration must be conducted with the appropriate tools. The study also reminds us of the need of conservation of the local habitats for the protection of this invertebrate biodiversity.

We learned through this study that ants are important and helpful organisms in the ecology, so their diversity should be preserved. Ants are vital members of ecosystems because they spread seeds, improve soil quality, and eat other insect species. Therefore, protecting ants is essential to keeping ecosystems healthy.

Table 1. Ants recorded from the study area		
Sl. No.	**Scientific name**	**Tribe**
Sub family: **Formicinae**		
1.	*Anoplolepis gracilipes* Smith, F., 1857	Plagiolepidini
2.	*Camponotus compressus* Fabricius, 1787	Camponotini
3.	*Camponotus mitis* Smith, F., 1858	Camponotini
4.	*Camponotus parius* Emery, 1889	Camponotini
5.	*Oecophylla smaragdina* Fabricius, 1775	Oecophyllini
6.	*Paratrechina longicornis* Latreille, 1802	Lasiini
Sub family: Myrmicinae		
7.	*Carebara affinis* Jerdon, 1851	Crematogastrini
8.	*Meranoplus bicolor* Guérin-Méneville, 1844	Crematogastrini
9.	*Monomorium pharaonis* Linnaeus, 1758	Solenopsidini
10.	*Pheidole megacephala*	Attini
11.	*Pheidole* sp.	Attini
12.	*Solenopsis geminata*	Solenopsidini
13.	*Tetramorium* sp.	Crematogastrini
Sub family: Ponerinae		
14.	*Diacamma scalpratum* Smith, F., 1858	Ponerini
15.	*Odontomachus haematodus* Linnaeus, 1758	Ponerini

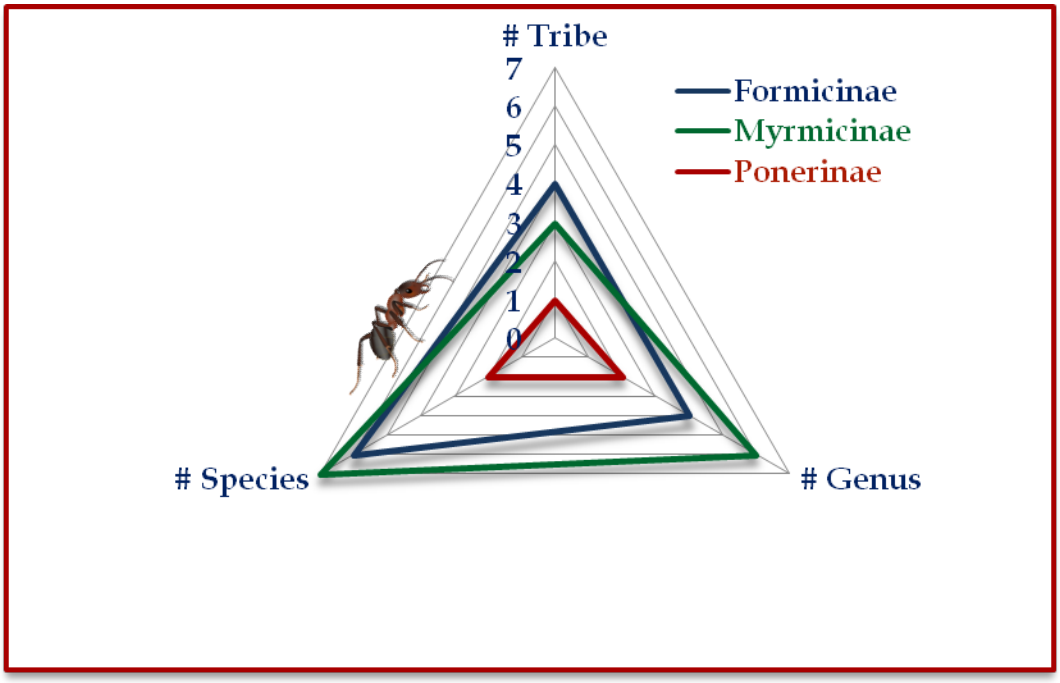

Fig. 1. Number of Tribe, Genus and Species under each subfamily of ants

ANTS RECORDED FROM THE STUDY AREA

1

Anoplolepis gracilipes **Smith, F., 1857**

2

Camponotus compressus **Fabricius, 1787**

3

Camponotus mitis **Smith, F., 1858**

4

Camponotus parius **Emery, 1889**

5

Oecophylla smaragdina **Fabricius, 1775**

Oecophylla smaragdina **Queen**

6

***Paratrechina longicornis* Latreille, 1802**

7

***Carebara affinis* Jerdon, 1851**

8

***Meranoplus bicolor* Guérin-Méneville, 1844**

9

***Monomorium pharaonis* Linnaeus, 1758**

10

***Pheidole* sp.**

11

***Pheidole megacephala* Fabricius, 1793**

12 	13 
***Solenopsis geminata* Fabricius, 1804**	***Tetramorium* sp.**
14 	15 
***Diacamma scalpratum* Smith, F., 1858**	***Odontomachus haematodus* Linnaeus, 1758**

SUMMARY AND CONCLUSION

In the current study, a total of 15 species of ants were found, with 3 subfamilies and 8 Tribes represented. More species were identified in the subfamily Myrmicinae (7), followed by Formicinae (6). Ponerinae listed two different species. Attini, Ponerini, and Solenopsidini recorded 2 species each, while Camponotini and Crematogastrini each recorded 3 species. A single species was recorded by each of the tribes Plagiolepidini, Oecophyllini, and Lasiini.

There was little variety among the ants detected in the vicinity of the household setup. From this study we understood that the diversity of ants deserves conservation as they are vital and beneficial organisms in the environment. Ants play important roles in ecosystems, including acting as seed dispersers, soil engineers, and predators of other insect species. Therefore, conserving ants is crucial to maintaining healthy ecosystems. Ants can be conserved by adopting following strategies:

Protecting habitats: Conserving natural habitats, including forests, grasslands, and wetlands, is crucial to maintaining ant populations. Protecting habitats from destruction and degradation due to human activities such as deforestation, urbanization, and pollution is key to preserving ant diversity.

Controlling invasive species: Invasive ant species, such as the red imported fire ant (*Solenopsis invicta*), can have negative impacts on native ant

populations and other organisms in ecosystems. Controlling the spread of invasive ant species is important for conserving native ant diversity.

Educating the public: Raising awareness about the importance of ants and their role in ecosystems can help people understand the value of conserving these insects. Education can also promote responsible behaviors, such as reducing pesticide use and avoiding destruction of ant habitats.

Citizen science: Citizen science projects can engage the public in ant conservation efforts, such as monitoring ant populations and recording observations of ant behavior. This can help researchers and conservationists better understand the distribution and diversity of ant species and identify areas that need conservation attention.

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