Diversity of ant species (Hymenoptera:Formicidae) Nesting beneath different trees in Periyanaickenpalyam, Coimbatore District, TamilNadu

ABSTRACT

Ants (Formicidae: Hymenoptera) are one of the most successful organisms of the tropics and have survived many geological changes in the past and play crucial roles in ecosystem functioning. The present study ~~deals with~~examined the kinds of ants nesting beneath different trees ~~were carried out~~ in Periyanaickenpalyam village, from November 2017 to February 2018. The study observed that 384 ants nests associated with 27 floral species at different locations in Periyanaickenpalyam were recorded. Based on floral ants nest association maximum of 18% ants nest in the *Prosopis juliflora* species followed by 15% of *Azadirachta indica,Ficusreligiosa* contain 12%, *Mangiferaindica* cover 9%, S*horearobusta* (6%) and *Toona* equally contain (6%) and rest of floral species *Cocosnucifera, Ficusbenghalensis, Santalum album, Gmelinaarborea, Bambuseae, carica papaya, Thespepsiapopulnea, Delonix, Tamarinds indica, Cassia fistula, Musa acuminate* each contain (3%) were observed. According to nest wise, fifty four nest below the *Prosopis juliflora* followed by fifty two nests in A*zadirachta indica,* (49) nests engaged in *ficusreligiosa,* fourty nests in*Mangiferaindica* and twenty three nests beneath the S*horearobusta, Ficusbenghalensis each* and in *Toona*, *Bambuseae* both contain twenty two nests, *reset of species contain less than 15 ants in Gmelinaarborea,Carica papaya, Delonix*,*Cocosnucifera*, S*antalum album*, *Musa acuminate*,*Tamarinds indica,Cassia fistula* and*Thespepsiapopulnea tree*s were observed from the study.It can be concluded that this study provides clue information on ants nesting association with floral species.

Key words: [Ants diversity, Nests, Mutualism, Azradicaindica]].

1. INTRODUCTION

Ants are ubiquitous in distribution and occupy almost all terrestrial ecosystems. Ants are one of the ideal model organisms for measuring and monitoring biodiversity for many reasons. Ant belongs to a single large family Formicidae, largest of order Hymenoptera. It is represented by 26 extant subfamilies with 14,711 valid species and 428 valid genera [1] out of these, 152 species are listed by IUCN and ~~from India,~~ 10 subfamilies were reported in India, which are represented by 100 genera with 828 species. Abundance and diversity of ants species is also greater neighbouring areas, for example, In India, Himalaya and the Western Ghats harbor a large number of ant species, 656 species from 88 genera were recorded from Himalaya, and 455 species from 75 genera were recorded from the Western Ghats, especially in Tamil Nadu, 184 species from 51 genera were recorded [2 and 3]. Ants in India, occupy a variety of habitats such as leaf litter, trees, soil and dead logs, while tramp species prefer human-modified habitats. Some species even form symbiotic association with particular group of plants, which produce suitable preformed nest sites~~d~~ to attract the ants to take up residence [4]. The design and architecture of nest is distinctly purposeful and constructed with patience. They construct nests in various types of habitats, some nest in plant cavities ~~in plants~~, but majority of ants make nests in the ground. Same colony of ants may adopt very different methods of nest building at different periods during the growth and development [5].The ability of ants to build its nests ~~nesting habits~~ ranges from subterranean ~~(i.e. in either~~ terrestrial and/orintertidal habitats) [6], to lignicolous, lithophilic, and arboreal [7 and 8], with nests constructed of various combinations [9]. Ants play an important role in terrestrial ecosystems such as pollinators, seed dispersal, predators of harmful insects, good soil turners and as a food source for other animals. The plants and produce make suitable preformed nest sites to attract the ants to take up residence.

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Despite the importance of ants in different ecosystems, there is little information on abundance and diversity of ants nesting beneath different trees in Periyanaickenpalyam, TamilNadu.The present study therefore investigated the abundance and diversity of ant species nesting beneath different trees in Periyanaickenpalyam.

2. MATERIALS AND METHODS

2.1 Study area

The field work was conducted in the Periyanaickenpalyam village, Coimbatore district, TamilNadu. Coimbatore, which is located between Latitude ~~lies at~~ 11°1′6″N and Longitude~~,~~ 76°58′21″E, in south India at 411 m.a.s.l~~meters (1349 ft.) above sea level~~ on the banks of the Noyyal River, in southwestern Tamil Nadu . The average annual rainfall is around 700 mm (27.6 in) with the northeast and the southwest monsoons contributing to 47% and 28%, respectively, to the total rainfall. Periyanaickenpalayam is a neighborhood in Coimbatore in the Indian state of Tami Nadu. It is located along National Highway NH 67, Mettupalayam road, an arterial road in Coimbatore.

2.1.1 All out search method

The village was divided into 8 equal size zones. Ants were collected twice a day, each of two hours duration. (6-8 ~~am~~ and 16~~4-6~~18h Indian Standard Time (IST)~~pm~~). One day was devoted to each zone from November 2017 to February 2018. Ants were collected using a brush and forceps during day time in between 11~~am~~ to 16 h IST~~4 pm~~ twice in every month. Collected ants were transferred into 70% ethanol in plastic vials at the Department of Zoology, PSG College of arts and science and same time maintained for all zones while ants collection. The stored ant specimens were then counted and identified up to genus level (some to species level) using microscope. Species identification was carried out under the help of the keys of “Ants identification guide” [10] collected ants were identified up to the genus level by using based on literature [11, 4, 12, 13 and 14]. Identified specimens will be kept in the air tight insect wooden box. Ant species were listed and each species was counted to calculate and compared composition, richness, species diversity, trees association, habitat type and identification of ants.

3. RESULTS

Table 1 showing the ant nests with floral association on Periyanaichenpalayam village.

Common name	Scientific Name	Number of nests	Subfamily	Genera	Species
Neem tree	*Azadirachta indica*	10	Formicinae	Camponotus	radiatus
sacred fig	*Ficusreligiosa*	20	Formicinae	Camponotus	compressus
Sal	*Shorearobusta*	16	Formicinae	Camponotus	irritans
Coconut	*Cocosnucifera*	11	Formicinae	Camponotus	parius
Banyan	*Ficusbenghalensis*	23	Formicinae	Camponotus	sericeus
Sacred fig	*Ficusreligiosa*	19	Formicinae	Camponotus	fabricus
Sandal wood	*Santalum album*	11	Formicinae	Camponotus	maculatus
Mango	*Mangifera indica*	23	Formicinae	Oecophylla	smaragidina
Toona	*Toona*	12	Formicinae	Anoplolepsis	gracillipes
White teak	*Gmelinaarborea*	19	Formicinae	Paratrechina	Longicorns
Neem tree	*Azadirachta indica*	18	Myrmicinae	Monomorium	Minimum
Bamboo	*Bambuseae*	22	Myrmicinae	Monomorium	Destructor

Papaya	*carica papaya*	15	Myrmicinae	Monomorium	Pharaonis
Karuva	*Prosopis juliflora*	11	Myrmicinae	Crematogaster	Species
Porita tree	*Thespepsiapopulnea*	6	Myrmicinae	Crematogaster	Subnuda
Gulmohar	*Delonix*	13	Myrmicinae	Solenopsis	Invicta
Mango	*Mangifera indica*	10	Myrmicinae	Solenopsis	Germinata
Neem tree	*Azadirachta indica*	11	Myrmicinae	Solenopsis	Diplorhoptom
Sacred fig	*Ficusreligiosa*	4	Myrmicinae	Phediole	Spp
Tamarind	*Tamarinds indica*	7	Myrmicinae	Phediole	Megacephala
Indian laburnum	*Cassia fistula*	7	Ponerinae	Lepitogenys	Processionalis
Banana tree	*Musa acuminate*	10	Dolichoderinae	Tapinoma	Indicum
Karuva	*Cinnamoumverum*	5	Dolichoderinae	Tapinoma	Sessile
Karuva	*Cinnamoumverum*	13	Pseudomyrmicinae	Tetraponera	Species
Neem tree	*Azadirachta indica*	7	Pseudomyrmicinae	Tetraponera	Nigra
Toona	*Toona*	10	Pseudomyrmicinae	Tetraponera	Rufonigra
Karuva	*Cinnamoumverum*	9	Pseudomyrmicinae	Tetraponera	Allaborans
Sal	*Shorearobusta*	7	Formicinae	Camponotus	flying ants
Karuva	*Cinnamoumverum*	9	Myrmicinae	Solenopsis	Germinata
Neem tree	*Azadirachta indica*	6	Pseudomyrmicinae	Tetraponera	nigra(flying)
Mango	*Mangifera indica*	7	Formicinae	Camponotus	Species
Sacred fig	*Ficusreligiosa*	6	Myrmicinae	Tetramorium	Species
Karuva	*Prosopis juliflora*	7	Myrmicinae	Crematogaster	Species

The study observed that 384 ants nests associated with 27 floral species at different locations in Periyanaickenpalyam Village, TamilNadu state were recorded (Table 1). The study recorded the approximate height (H) of tree, diameter (D) of tree and ants nest entrance size (NES). Based on floral ants nest association, eighteen percentage of ants species associated with *Prosopis juliflora*treewith the height of (14-16ft), diameter (14-21cm) and nest entrance size ranges in between (0.8-1.2 cm) followed by fifteen percentage of ants species allied in *Azadirachta indica* with (9-16ft) in height, diameter of (60-70cm) and nest size of (1-1.5 cm),*Ficusreligiosa* species contain twelve percentage of ants species with the distinctive features of trees height (40-66 ft) with diameter (40-50cm) and nest size (0.9-1.5 cm), *Mangiferaindica* species contain nine percentage of ants species with the height of (19-22 ft) and the diameter of (23-28cm) with the nest size (0.9-1.5 cm),S*horearobusta* contain six percentage of ants species with (H: 19-23 ft, D:40- 55 cm and NES: 1-12 cm) and six percentage of species associated with T*oona trees* with the height of (9-12 ft), including the diameter of (20-30cm) and nest size of (1-1.5 cm) were recorded. The rest of floral species of *Cocosnucifera species* with the height of (20ft) and the diameter of (30cm) and nest sizeof *(*0-7-1.2 cm), *Ficusbenghalensis with* height (9-16 ft) and diameter of (60cm) with nest size of (1-1.7 cm),*Santalum album* with the height of twenty five feet with the diameter of sixteen centimeter and the nest size of (1-2 cm)*, Gmelinaarborea*withheight and diameter of (H: 13 ft, D:12cm, NS: 0.5-1 cm)*, Bambuseae with* height and diameter of (5 ft, 5 cm), and nest size of opening of (1-1.5 cm)*, Carica papaya* approximate height of five feet with the diameter of (10 cm) and Nest size of (1.3-1.5 cm),*Thespepsiapopulnea with* height of sixteen feet and diameter of (44cm) with the nest size of (1-1.2 cm)*, Delonix with* height of eight feet and diameter of (41 cm) with the nest size of (0.8-1.4 cm)*, Tamarinds indica* height of thirty two feet and the (26cm) diameter with the nest size of (1-1.6 cm), *Cassia fistula with* height of sixteen feet and diameter of (54 cm) with nest size of (1-1.5 cm)*, Musa acuminate* floral species with height of fifteen feet with the diameter of (10 cm) and the nest

size(0.4-.7 cm), *Prosopisjuli flora* tree species with height of sixteen feet and diameter of (20-33cm) along with the nest size(0.7-1.1 cm) were observed from the study.

According to nest wise, out of 384 ant's nests, fifty four nests (14%) in *Prosopis juliflora* floral species under three subfamilies of ants were observed. Twenty seven nests (50%) in Myrmicinae, twenty two nests (41%) in Pseudomyrmicinae and five nests (9%) in Dolichodeni species were recorded. In A*zadirachta indica (*13.5%) species which contain fifty two nests. Out of 52 nests, subfamily Myrmicinae have twenty nine nests (56%), thirteen nest in Pseudomyrmicinae (25%) and ten Formicinae nests consist of (19%) were observed.

Forty nine ants' nests species present in *Ficusreligiosa* trees which restrain (12.7%) and further undergoes into thirty nine nests (80%) in subfamily Formicinae and ten nests (20%) in Myrmicinae subfamilies were recorded. Forty nests occupied in M*angiferaindica* contain (10.5%) nests which was further undergoes into thirty (75%) nest in subfamily Formicinae and ten nest (25%) in Myrmicinae nest were recorded.

twenty three nests present in S*horearobusta* species which comprise of 6% ants nests further undergoes twenty three ants nests (100%) in subfamily Formicinae nests. Twenty two nests present in *Toona*species enclose (5.8%) nests under subfamily Formicinae contain twelve nests (55%) and ten nest (45%) in Pseudomyrmicinae species were observed. The other faunal varieties like twenty three nests in *Ficusbenghalensis species* contain 5.8%, *twenty two Bambuseae* nestcomprise of 5.7%,*ninenteen nest in gmelinaarborea* contain 4.9%, *fifteen nests in Carica papaya* enclose 3.9%, *thirteen nests in Delonix* contain 3.4%, *eleven nests in Cocosnucifera species* contain 2.8% nests, eleven nests in S*antalum album* includes 2.8%, *ten nests in Musa acuminate* include 2.6%, seven nests in *Tamarinds indica* contain1.9% ,seven nests in *cassia fistulaspecies* enclose 9% and six nests in *Thespepsiapopulnea* comprise of 1.6% of nests were observed from the study.

4. DISCUSSION

Domatia are internal plant structures that appear to be specifically adapted for habitation by ants [15]. These cavities are found primarily in the stems, leaves, and spines of plants. Many different genera of plants offer domatia. The study observed that 384 ants nests associated with 27 floral species at different locations in periyanayakenpalayamwere recorded.

Based on floral -ants nest association maximum 18% of *Prosopis juliflora* followed by 15% of *azadirachta indica,*Plants of the *Acacia* genus have some of the most widely recognized forms of domatia and offer some of the best examples of ant-plant obligate mutualism [15]. Different species of Acacia provide a variety of resources needed for their codependent counterparts. One of these resources is the need for shelter. Acacia have enlarged thorns on their stems that are excavated by ants for use as housing structures.

Fficusreligiosa contain 12%, *Mmangiferaindica* contain 9%, *Sshorearobusta* (6%) and*toona* both contain (6%). The Shorearobusta, Mangifera indica are formed building up leaf domatia. The rolling pattern of leaf domatia in Pterospermum sp and the complete leaf domatiaon a hemi parasitic angiosperm (Lorenthuslongifolia) in Manikara plant species. In the interesting, hanging like leaf domatia found in Swetenia mahogany. Some plants produce food bodies for use by other organisms [16].

Floral species *Cocosnucifera, Ficusbenghalensis, Santalum album, Gmelinaarborea, Bambuseae, carica papaya, Thespepsiapopulnea, Delonix, Tamarinds indica, Cassia fistula, Musa acuminate* each contain(3%) were observed. Mutualism between plants and ants is widespread. Two of these mutualisms involving ants in protecting plants from herbivores, and in seed dispersal (myrmecochory), are well known and intensively studied [17, 18, 19 and 20].

Colony structure can be highly variable, with some species establishing nests through either single or multiple queens [21 and 22] or obligatory parasitic relationships with other species of ants [23]. Individual nests can contain numerous dimorphic queens, each of which has a full set of thoracicsclerites and seemingly functional wings. Both queen morphs appear capable of reproduction, possessing apparently functional ovaries, and together present a typical bimodal but continuous size frequency distribution [24].

According to nest wise showed that, out of 384 ants nests associated with 27 floral species at different locations in periyanayakenpalayam were recorded. Ants nests maximum in (n=54) nest with the *Prosopis juliflora* species which undergoes three subfamily; 27(50%) nest of myrmicinae,22(41%) nests in pseudomyrmicinae and 5(9%) dolichodeni nests followed by (n=52) nests in *azadirachta indica* which under goes 29 (56%) in Mmyrmicinae, Ppseudomyrmicinae 13(25%) and Fformicinae consist of 10(19%) nests, (n=49) nests in *Fficusreligiosa* contain 39(80%) Fformicinae nests and

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10(20%) myrmicinae nest,(n=40) nests in*Mm**angiferaindica* contain 30(75%) Fformicinae nests and 10(25%) myrmicinae nest and (n=23)*Sshorearobusta* contain nests under 23(100%) Fformicinae nests and (n=22) *toona* contain nests under formicinae 12 (55%) nests and 10 (45%) Ppseudomyrmicinae. Worker size is strongly bimodal [25]: Smaller (minor) workers perform tasks within the nest while larger (major) workers carry out a range of tasks both within and outside the nest [26] reported that ant species richness generally increased with increase in vegetation. Tree hollow, tree holes and dead limbs are the most common nesting site for this species [27 and 28]. Many myrmecophytes are defended from both herbivores and other competing plants by their ant counterparts (Acacia cornigera, for example, is thoroughly guarded by its obligate ant partner, Pseudomyrmexferruginea. A single colony of P. ferruginea may contain more than 30,000 ants, and can tend multiple Acacia trees. The soldier ants are extremely aggressive, patrolling the trees twenty-four hours a day. Any disturbance to the tree alerts ants, who then recruit more workers from inside the horn domatia. These ants defend the Acacia by biting, violently stinging, and pruning any trespassers. The ants keep the plant free from other insects and vertebrate herbivores, but also from invading fungi and other plants [19].

Faunal varieties like *ficusbenghalensis*(n=23) contain 5.8%,*bambuseae* (n=22)contain 5.7%,*gmelinaarborea* (n=19)contain 4.9%,*carica papaya* (n=15)contain 3.9%,*delonix* (n=13)contain 3.4%,*cocosnucifera*(n=11) contain 2.8% nests, *santalum album* (n=11) contain 2.8%,*musa acuminate* (n=10)contain 2.6%,*tamarinds indica* (n=7)contain1.9% ,*cassia fistula* (n=7)contain1.9% and*thespepsiapopulnea* (n=6)contain 1.6%, nests were observed from the study. Nesting location within Polyrhachis species for example can vary from intertidal and subterranean to arboreal, the presence of silk nests and/or larval cocoons is highly variable and disjunct, and even the source of silk within nests can vary from their own larvae to spiders silk.

Since the tree contains their nest, these aggressive ants react strongly to any disturbance of the tree, providing the myrmecophyte with defense from grazing herbivores and encroaching vines. The ants continuously patrol the surface of their host plant and protected it from depend on this protection and grow poorly in the absence of their ant partner.

Plants of the Acacia genus have some of the most widely recognized forms of domatia and offer some of the best examples of ant-plant obligate mutualism [15]. Different species of Acacia provide a variety of resources needed for their codependent counterparts. One of these resources is the need for shelter. Acacia have enlarged thorns on their stems that are excavated by ants for use as housing structures. Since the tree contains their nest, these aggressive ants react strongly to any disturbance of the tree, providing the myrmecophyte with defense from grazing herbivores and encroaching vines.

Recent work involving principally taxonomic and ecological studies indicates that nesting habits and ecology in the taxonomically extensive ant genus Polyrhachis are almost as diverse as that of all ants in general [29], offering the unique potential to explore the evolution of nest weaving within a single genus.

CONCLUSION

A total of 33 floral species associated with ants nesting habitat have been recorded from Periyanakenpalayamvillage, Coimbatore district. During this study, out of thirty three floral species, Karuva tree followed by Neem tree, Sacred fig, Mango tree, Sal and toona species accounted for contain 63% of ants nests was occupied. The present study will yield valuable information on ant species availability in this region. Finally, to sum up, this study provides a little information about ants nesting association with floral species.

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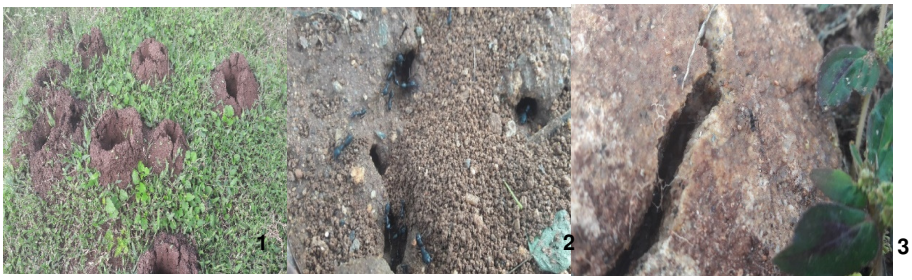
PLATE 1



1 *Camponotus spp,*2 *Componotus compressus,* 3 *Camponotus sericeus,* 4 *Camponotus fabricus,* 5 *Monomorium destructor, 6 Crematogaster subnuda*, 7 *Componotus spp, 8 Camponotus compressus, 9 componotus spp,10 Monomorium pharaonis, 11 Oecophylla smaragidina, 12 Paratrechinalongicornis*

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