

A Comparative Study On The Hymenopteran Diversity With Special Reference To Ants In Thommankuth Forest And Adjacent Areas Of Idukki District In Western Ghats.

Bany Joy¹ Gigi K Joseph²

Department of zoology, Nirmala College, muvattupuzha, kerala, india.

Abstract: A comparative study on the hymenopteran diversity with special reference to ants in Thommankuth forest and adjacent areas was carried out for a period of six months from December 2014 to May 2015. The study held in Thommankuth forest and adjacent areas resulted in identifying 19 ant species. They belonged to one family named Formicidae and four subfamilies such as Formicinae, Myrmicinae, Ponerinae and Dolichoridinae. Out of the total 19 species observed, three species found only in forested areas, whereas four species found only in agricultural area. However 11 species were observed from both the habitats. According to Shannon Weiner diversity index agricultural ecosystem is more diverse (1.04412) than forest ecosystem (1.02115). The study reveals that Thommankuth forest and adjacent areas in the Western Ghats is an excellent habitat for Hymenopteran especially ants.

Keywords: Ants, thommankuth forest, agricultural area. western ghats.

I. Introduction

Insects are virtually everywhere on the Earth's surface; excluded only the extremes of climate at the poles and on the peaks of highest mountains; just a few species live in the sea. (Cheng, 1976). They have a strong hold in most ecosystem processes as they are pollinators and nutrient cyclers. A large number of them act on insect predators, and mutualists of all of which require conservation. Using insects how to study how creation of mosaics, fragmentation of land, deforestation and creation of monocultures have an impact on diversity and stability of an ecosystem is a challenging and interesting task as it not only involves the taxonomy of concerned group but is also related to the behavioural aspects of the taxa under study. They have lived on Earth about 300 million years compared with less than 1 million for man and during this time they have evolved in many direction to become adapted for life in almost every type of habitat. (Borror, 1964). Hymenoptera is a large order comprising of great many insects which are beneficial to man. Ants shows tremendous diversity, numerical and biomass dominance in almost every habitat throughout the world (Fittkau and Klinge, 1973). It has been estimated by E.O. Wilson (1971) that the total number of individual ants alive in the world at any one time is between one and ten quadrillion (short scale). According to this estimate, the total biomass of all the ants in the world is approximately equal to the total biomass of the entire human race (Wilson, 1971). Most of the ants have either a direct or indirect relationship with vegetation. Some of these are highly specific to the habitat in which they occur, depending on the maximum benefits they attain for the nesting, mating and food availability. Their preference of microhabitat due to the above mentioned criteria were investigated by sampling ant fauna in various habitats (Viswanathan et al., 2000).

The objectives of the study are, to investigate the diversity of Hymenopterans (Formicidae) in the Thommankuth forest in Kaliyar Range, to assess the habitat preference of ant species in different vegetation types of agricultural and forest ecosystems, to assess to distribution and abundance of ants in forest and agricultural ecosystems. Thommankuth forest area belongs to Kothamangalam Forest division and located in Thodupuzha Taluk in Idukki district is one of the major ecotourism centers in Kerala. The forest area is at 360 hectare and the vegetations are semievergreen forest, reverine ecosystem and Rock ecosystem. Thommankuth is a scenic waterfall in the Southern State of Kerala and an important low altitude forest of Western Ghats. It is situated between 9°57.243' North latitude and 76°50.150' East longitude and at an elevation of 65m. The Western Ghats, one of the 34-biodiversity hotspots of the world (Myers et al, 2000) covering 5% of India's land area. Landscape heterogeneity is abundant in the Ghats (Subhashchandra 1997, Ramachandra et al., 2007).

The Ghats support a variety of endemic flora and fauna because of the diverse habitats, which have got created due to the varying topography and climate (Menon and Bawa 1997). High species diversity and endemism is associated with the Western Ghats. (Daniels (1997)). The major flora in Thommankuth forest are *Tectona grandis*, *Terminalia tomentosa*, *Bambusa arundinaria*, *Terminalia myriocarpa*, *Polialthiyas* etc. Agricultural area considered for the study was in Karimanoor Panchayat in Idukki district. Thommankuth forest area is 14km away from the agricultural vegetations under study. The agricultural area is situated in an elevation of 60m and 9°54'0"N latitude and 76°47'0"E longitude. The agricultural vegetations are banana

plantation, rubber plantation and pineapple plantation. The major type of cultivation in Karimanoor Panchayath is rubber. A notable feature of Karimanoor Panchayath is that one side of the area is of forest and the other side is of agricultural area.

II. Materials And Methods

During study ants were collected from different habitats such as semi evergreen areas, rocky area and riverine areas in Thommankuth forest. Specimens were also collected from different type of agricultural plantation in Karimanoor namely: pineapple, rubber, and banana plantation. The specimens were collected from the following three methods.

Pitfall trap

Pitfall trap is for trapping ants. The effectiveness of sampling ants may vary from species to species depending on their activities, and properties of the ground layer. Dung baited pitfall traps were used. The trap consisted of plastic cups placed at ground level (diameter 14cm and height 10cm) each jar contains 4% formalin. They were placed at randomly selected areas. Insects trapped in the jars were sorted and preserved in labeled containers of 70% alcohol. The insects were then mounted after the technique of Bolton (1994).

Quadrat method

Formicidans belonging to different families were collected by using quadrat method. 28 quadrates of 10 x 10m size were selected from four different vegetations. Vegetations selected were Rubber plantation (13 Quadrates), Banana plantation (5 Quadrates), pineapple plantation (5 Quadrates) and Coffee plantation (5 Quadrates). 30 minutes were spent in each quadrat. Hymenopterans were caught using insect collecting net. Specimens were put into labelled bottles containing benzene.

Opportunistic method

Opportunistic method was also used for the study. Irrespective of the scheduled time, ant specimen were collected from whenever and wherever possible during the study period from different habitats of the study area. Specimens collected from all traps were sorted, cleaned and preserved in 70% ethyl alcohol. The vials were labeled with the place, date of collection. Collected species were identified using standard identification manuals by using identification keys in Bingham (1975) Bolton (1994) and also some specimens were sent to specialist to confirm their identity. A reference collection is maintained in the Museum of St. Xaviers College for Women, Aluva. From the data obtained, The rank abundance of the species were described using graphical method and statistical analysis was carried out using diversity index. The species diversity was calculated using Shannon – Weiner index for both agricultural and forest ecosystem. Shannon-Weiner index is based on the weighted geometric mean of the proportional abundance of the different species. Shannon-Weiner index $H' = -\sum P_i \ln P_i$



Fig 1: Map showing Thommankuthu forest



Fig 2: Map showing Karimannoor

Different Vegetations Selected For The Study

Forest ecosystem



Fig 3: Semi evergreen forest



Fig 4: Rock ecosystem



Fig 5: Riverine

Agricultural ecosystem



Fig 6: Banana plantation



Fig 7: Rubber plantation



Fig 8: Pineapple plantation

III. Result And Discussion

Overall ant diversity

Through the study of ant fauna of Thommankuth forest and the agricultural area, a total of 19 type specimen were observed from thommankuth forest and adjacent areas. All of them belongs to the family Formicidae (table 1) .

Table 1: Checklist of Ants(Hymenoptera: Formicidae) collected form Thommankuth forest and agricultural ecosystem.

Sl.No	Family	Subfamily	Genus	Species
1	Formicidae	Formicinae	Componotus	Angusticollis, Jerdon
2	Formicidae	Formicinae	Componotus	carin carin, Emery
3	Formicidae	Formicinae	Componotus	Compressus, Fabricius
4	Formicidae	Formicinae	Componotus	mitis ,Smith
5	Formicidae	Formicinae	Componotus	parius, Emery
6	Formicidae	Formicinae	Componotus	Rufoglaucus, Jerdon
7	Formicidae	Formicinae	Leptogenys	dentilobis ,Forel
8	Formicidae	Formicinae	Oecophylla	Smaragaina, Fabricius
9	Formicidae	Formicinae	Paratrechina	longicornis, Latreille
10	Formicidae	Formicinae	Polyrhachis	rastellata, Emery
11	Formicidae	Formicinae	Polyrhachis	tibialis, Smith
12	Formicidae	Myrmicinae	Monomorium	phanaonis, Linnaeus
13	Formicidae	Myrmicinae	Meranoplus	bicolor, Guerin
14	Formicidae	Myrmicinae	Myrmecaria	brunnea, Saunders
15	Formicidae	Myrmicinae	Solenopsis	Geminate, Fabricius
16	Formicidae	Ponerinae	Diacamma	assamense, Forel
17	Formicidae	Ponerinae	Diacamma	sculptum, Jerdon
18	Formicidae	Ponerinae	Odontomachus	haematodus, Linnaeus
19	Formicidae	Dolichoderinae	Technomyrmex	albipes, Smith

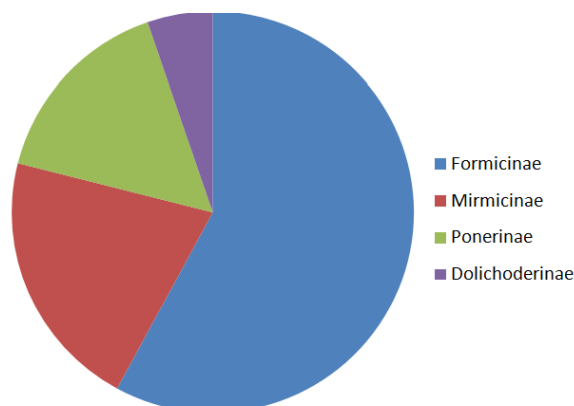


Fig 9: Subfamily wise distribution of ants collected during the study.

Ant species richness increases with increase in vegetation and vice versa (Sunil et.al 1997). Similar findings have been reported in this study which took place in forest ecosystem too with semievergreen forest type with high richness and the rock ecosystem with low richness. And in agricultural ecosystem plantain vegetation shows high species richness. These results concordant with several studies in other parts of Western Ghats. (Anu and Sabu, 2007).

Habitat preferences of ants in forest ecosystem

Table 7: Checklist of ants in different habitats of forest ecosystem.

Sl.No	Species name	Semievergreen forest	Reverine	Rock
1.	Paratrachena longicornis	26	-	-
2.	Diacemma assamense	18	-	-
3.	Componatus parius	32	-	16
4.	Meraroplus bicolor	21	-	-
5.	Componotus augusticolis	31	-	21
6.	Technomyrmex albipes	-	68	-
7.	Polyrhachis tibialis	148	-	-
8.	Myrmicaria brunnae	63	-	-
9.	Polyrhachis rastellata	28	-	-
10.	Diacamma sculptum	31	-	-
11.	Odontomachus haematodus	38	-	16
12.	Solenopsis geminata	64	-	-
13.	Oecophylla smaragdina	176	-	118
14.	Componotus rufoglaucus	39	-	-
15.	Leptogenys dentilobis	39	-	-

Distribution and abundance of Formicidae in forest ecosystem is mentioned in the table 7.

Status of ants in thommankuth forest and adjacent areas

Table 9: Checklist of ants in different vegetation types of Thommankuth forest and agricultural ecosystem

Sl.No	Species name	Rubber	Pineapple	Plantain	Semi evergreen	Reverine	Rock
1.	Paratrachena longicornis	-	-	9	26	-	-
2.	Diacemma assamense	13	-	11	18	-	-
3.	Monomorium pharaonis	48	-	63	-	-	-
4.	Componotus parius	9	-	21	32	-	16
5.	Meranoplus bicolor	-	-	13	21	-	-
6.	Componotus augusticolis	-	-	-	31	-	21
7.	Technomyrmex albipes	42	-	83	-	68	-
8.	Polyrhachis tibialis	-	-	-	148	-	-
9.	Myrmicaria brunnae	-	-	36	63	-	-
10.	Componotus carin	21	-	28	-	-	-
11.	Polyrhachis rastellata	-	-	-	28	-	-
12.	Diacamma sculptum	11	21	-	31	-	-
13.	Odontomachus haematodus	28	-	19	38	-	16
14.	Solenopsis geminata	46	26	73	64	-	-
15.	Oecophylla smaragdina	86	64	93	176	-	118
16.	Componotus rufoglaucus	-	-	28	39	-	-
17.	Componotus compressus	-	-	28	-	-	-
18.	Leptogenys dentilobis	-	-	34	39	-	-
19.	Componotus mitis	28	-	26	-	-	-

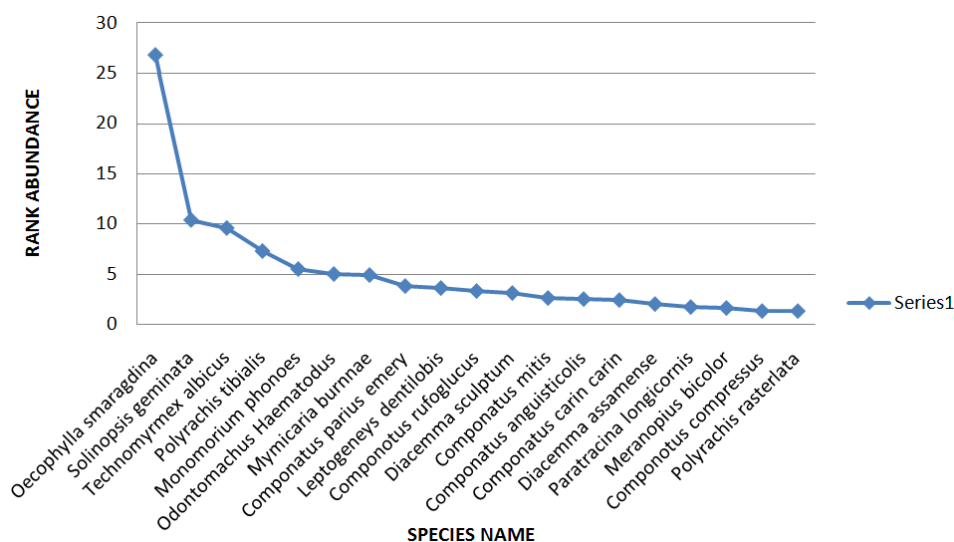


Fig 10: Rank abundance plot of ants collected from Thommankuth forest and agricultural ecosystem. Subfamily wise distribution of ants in different vegetation types

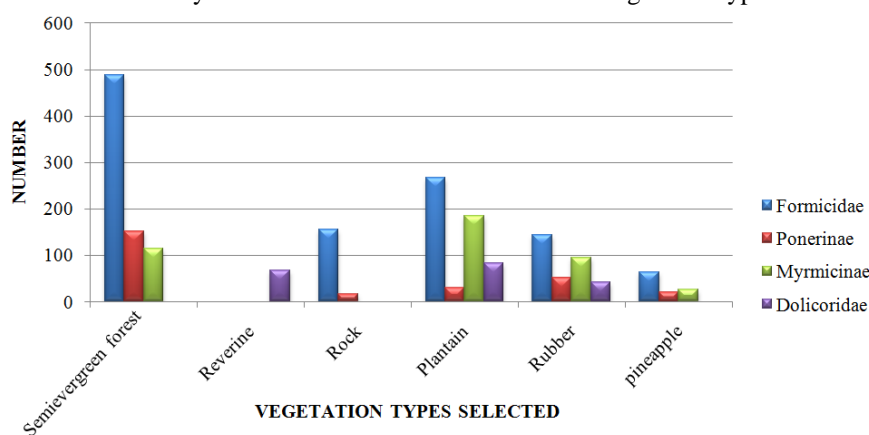


Fig 11: Graph showing the subfamily wise distribution of ants in different vegetation types

Subfamily Dolichoridae was considered to be highly dominant all over the world. But in this study it is only observed in the agricultural as well as forest ecosystem. Members of this subfamily acts as an excellent indicator species which determine human interference (Viswanathan & Ajay, 2000.) presence of this species in the forest ecosystem indicates the human interference into the forest ecosystem.

Diversity index

According to Shannon weiner diversity index in forest ecosystem Solenopsis geminate with high diversity index and Diacemma assamense with least diversity index (table 10).The Shannon diversity index value of the 15 species collected from forest ecosystem are different. Paratrachena longicornis with -0.04142, Componatus parius with -0.0636, Myrmecaria brunnae with -0.07598 ect.. While analyzing the relative abundance Solenopsis geminate with high relative abundance and Diacemma assamense with least abundance.Variation is maximum between the different species for example Diacemma assamense with relative abundance 0.018126888 while in the case of Solenopsis geminate with 0.296072508.Therefore the number of species also plays an important role in calculating Shannon Weiner diversity index,which is commonly used statistical method in calculating the diversity index of a particular region.

Table 10: Shannon – Weiner index of forest ecosystem

Species	Species identification code	Number of individuals (n)	Relative abundance (Pi)	lnPi	Pi(lnPi)
Paratrachena longicornis	1	26	0.026183283	-1.581975901	-0.04142
Diacemma assamense	2	18	0.018126888	-1.741676743	-0.03157
Componatus parius	3	48	0.048338369	-1.315708011	-0.0636
Meranoplus bicolor	4	21	0.021148036	-1.674729954	-0.03542
Componotus augusticolis	5	52	0.052366566	-1.280945905	-0.06708
Technomyrmex albipus	6	68	0.06847936	-1.164639643	-0.07972

Polirhachis tibialis	7	148	0.149043303	-0.826687533	-0.12321
Myrmicaria brunnae	8	63	0.063444109	-1.197608699	-0.07598
Componotus rufoglocus	9	28	0.028197382	-1.549791217	-0.0437
Polyrhachis rastellata	10	31	0.03121853	-1.505587555	-0.047
Diacemma sculptum	11	54	0.054380665	-1.264555489	-0.06877
Odontomachus haematodus	12	64	0.064451158	-1.190769275	-0.07675
Solenopsis geminata	13	294	0.296072508	-0.528601918	-0.1565
Oecophylla smaragdina	14	39	0.039274924	-1.405884641	-0.05522
Leptogenys dentilobis	15	39	0.039274924	-1.405884641	-0.05522
Total number of capture	993				
Shannon Weiner index	1.02115				

According to Shannon weiner diversity index in forest ecosystem Oecophylla smaragdina with high diversity index and Paratrachena longicornis with least diversity index (table 11).The Shannon diversity index value of the 16 species collected from forest ecosystem are different. Paratrachena longicornis with -0.0183, Componatus parius with , -0.04543 Myrmicaria brunnae with -0.05168 ect..While analyzing the relative abundance Oecophylla smaragdina with high relative abundance and Paratrachena longicornis with least abundance

Table 11: Shannon – Weiner index of agricultural ecosystem

Species	Species identification code	number of individuals (n)	relative abundance (Pi)	lnPi	Pi(lnPi)
Paratrachena longicornis	1	9	0.008928571	-2.049218023	-0.0183
Diacemma assamense	2	24	0.023809524	-1.62324929	-0.03865
Monomorium phoenois	3	111	0.110119048	-0.958137553	-0.10551
Componatus parius emery	4	30	0.029761905	-1.526339277	-0.04543
Meranoplus bicolor	5	13	0.012896825	-1.88951718	-0.02437
Technomyrmex albipes	6	125	0.124007937	-0.906550519	-0.11242
Myrmicarea brunnae	7	36	0.035714286	-1.447158031	-0.05168
Componatus carin carin	8	49	0.048611111	-1.313264452	-0.06384
Diacamma sculptum	9	32	0.031746032	-1.498310554	-0.04757
Odontomachus haematodus	10	47	0.046626984	-1.331362674	-0.06208
Solenopsis geminata	11	145	0.143849206	-0.84209253	-0.12113
Oecophylla smaragdina	12	243	0.241071429	-0.617854259	-0.14895
Componatus rufoglocus	13	28	0.027777778	-1.556302501	-0.04323
Componatus compresses	14	28	0.027777778	-1.556302501	-0.04323
leptogenys dentilobis	15	34	0.033730159	-1.471981615	-0.04965
Componatus mitis	16	54	0.053571429	-1.271066772	-0.06809
Total number of captures	1008				
Shannon Weiner index	1.04412				

The data obtained by analyzing the Shannon weiner index of the given data, the following conclusions are obtained.the shannon weiner diversity index of agricultural ecosystem is 1.04412 and that of forest ecosystem is 1.02115.This values shows that the more diversity and abundance and distribution of species is observed in the agricultural ecosystem than that of forest ecosystem. The number of individuals also plays an important role in calculating Shannon weiner diversity index.

IV. Conclusion

Species composition and diversity patterns in forest and agricultural ecosystems have been analyzed in this study. This study revealed that the dominancy exhibited by the Formicinae subfamily in agricultural as well as in forest ecosystem is due to their ability to adapt with different niches with a variety of feeding habits. The study held in Thommankuth forest and adjacent areas resulted in identifying 19 ant species.They belonged to one family named Formicidae and four subfamily such as Formicinae,Myrmicinae,Ponerinae and Dolichoridinae.Out of the total 19 species observed,three species found only in forested areas,whereas four species found only in agricultural area.However 11 species were observed in both the habitats. Technomyrmex albipes commonly found in human dominated,disturbed habitats,found also in thommankuth forest indicating growing disturbance happening to prestine forests. It may be due to the over interference of tourist into the forest as part of ecotourism without proper screening.Oeocophylla smaragdina was found as the most dominant

ant species distributed in all habitats except the riverine area. According to Shannon Weiner diversity index agricultural ecosystem more diverse (1.04412) than forest ecosystem (1.02115).

V. Recommendation

The authorities should take proper measures to maintain the quality of forest. The study reveals that Thommankuth forest and adjacent areas is an excellent habitat for Hymenopteran especially ants. But long term studies strongly suggested to reveal a clear picture of ant diversity of Thommankuth forest in Western Ghats..

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