International Journal of Zoology Studies
ISSN: 2455-7269; Impact Factor: RJIF 5.14
www.zoologyjournals.com
Volume 2; Issue 3; May 2017; Page No. 15-18

A study on the hymenopteran diversity with special reference to ants in agricultural ecosystem of Idukki district in Western Ghats of India

Bany Joy, Gigi K Joseph

Department Of Zoology, Nirmala College, Muvattupuzha, Kerala, India

Abstract
A comparative study on the hymenopteran diversity with special reference to ants in Agricultural ecosystem of Idukki district of Western Ghats was carried out for a period of six months from December 2014 to May 2015. The study held in the different habitats of study area resulted in identifying 19 ant species. They belonged to one family named Formicidae and four subfamilies such as Formicinae, Myrmicinae, Ponerinae and Dolichoridinae. This study reveals the dominancy of subfamily Formicinae in all vegetations of agricultural ecosystem. It is due to their ability to adapt to different environmental niche. Out of the total 19 species observed, 15 species were found in plantain vegetation and therefore it is the most species rich habitat in the agricultural ecosystem of idukki district in Western Ghats. The study reveals that the agricultural ecosystem of idukki district in Western Ghats is an excellent habitat for Hymenopteran especially ants.

Keywords: ants, agricultural ecosystem. idukki, western ghats

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) [14].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) [12]. 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) [24].It has been estimated by E.O. Wilson (1971) [52] 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) [52].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) [51].
The objectives of the study are,to investigate the diversity of *Hymenopterans* (*Formicidae*) in the agricultural ecosystem of Idukki district in Western Ghats. 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) [37]. High species diversity and endemism is associated with the Western Ghats. (Daniels (1997)) [18]. 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.

Materials and Methods
During study ants were collected from different habitats such as 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).

Quadrate method
Formicidans belonging to different families were collected by using quadrate 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 quadrate. 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'= -∑Pi ln Pi

Agricultural ecosystem

Fig 1: Banana plantation

Fig 2: Rubber plantation

Fig 3: Pineapple plantation

Result and Discussion

Table 1: 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 rufoglucus	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.

Conclusion

Species composition and diversity patterns in agricultural ecosystems have been analyzed in this study. This study revealed that the dominancy exhibited by the Formicinae subfamily 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 16 ant species. They belonged to one family named Formicidae and four subfamily such as Formicinae, Myrmicinae, Ponerinae and Dolichoridinae.

Reference

1. Agosti DLE, Schuts TR. *Ants-standard method for measuring and monitoring Biodiversity*. Smithsonian Institution Press. Washington DC, 2000.
2. Ali TM. *Ant fauna of Karnataka – 1*. Newsletter of IUSSI Indian Chapter. 1991; 5:2-8.

3. Ali TM. *Ant fauna of Karnataka – 1*. Newsletter of IUSSI Indian Chapter. 1992; 6:1-9.
4. Anderson AN. *Ants as indicators of ecosystem restoration following mining: a functional group approach*. Centre for conservation biology, The University of Queensland. Hymenoptera: Formicidae) at Forest Research Institute (FRI) Dehradun (India), 1997.
5. Anu A, Sabu TK. Biodiversity analysis of forest litter ant assemblage in the Wayanad region of Western ghats using taxonomic and conventional diversity measures. 13pp. *Journal of Insect Science.* 2006.
6. Beattie AJ, Culver DC. Directed dispersal: demographic analysis of an ant-seed mutualism. *American Naturalist.* 1988, 131.
7. Bestelmeyer BT, Wiens JA. The effects of land use on the structure of ground-foraging ant communities in the Argentine chaco. *Ecological Applications*. 1996; 6:1225-1240.
8. Bharti H. List of Formicids *research.* 2002; 26(4):337-342.
9. Bingham CT. Ants and Cockoo Wasps, The fauna of British India, including Ceylon and Burma: *Hymenoptera London.* 1903, 2.
10. Bio indicators in relation to fire management of spotted gum Eucalyptus macualata.
11. Bolton B. *A new general catalogue of ants of the world*. Harward University Press: London, 1995.
12. Borror DJ, Delong DM. *An introduction to study of insects*. Holt, Rinehart and Winston, inc: London, 1964.
13. Chapman JW, Capco SR. Check List of the Ants Hymenoptera: Formicidae) of Asia. *Monogr. Inst. Sci. Tech. Manila*. 1951; 1:1-327.
14. Cheng L (ed). *Marine Insects*, North Holland, Amsterdam, 1976.
15. Chhotani OB, Marti PK. *Contribution to the Knowledge of Formicidae of the Andaman Islands. Newsletter of Zoological suevey of India.* 1977; 3(1):17-20
16. Collingwood CA.*Formicidae (Hymenoptera: Aculeata) from Nepal*. Khumbu HimaL, Universitatsverlag Wagner, Innsbruck-Munchen, 1970.
17. Creighton WS. *The ants of North America*. Bulletin of the museum of comparative zoology, Harward, 1950.
18. Daniels RJ. Taxonomic uncertainities and conservation assessment. *Current Science*. 1997; 73(2):169-172
19. Deyrup ML, Davis L, Cover S. *Exotic ants of Florida*. Transactions of the American entomological society, 1989.
20. Dumpert K. *The Social Biology of Ants*, 1978.
21. Evans WC, Leston D. *Bull. Entomol. Res.* 61: 357-362.
22. Fellers, J.H. 1987. Interference and exploitation in a guild of woodland ants. *Ecology.* 1971; 68:1466-1478.
23. Fisher BL, Robertson H. Comparison and origin of forest and grassland ant assemblages in the high plateau of Madagascar biotropica. *Current Science.* 2002; 73:134-136
24. Fittkau EJ, Klinge H. On biomass and trophic structure of the Central Amazonian rain forest ecosystem. Biotropica *Current Science.* 1973; 5:2-14.
25. Greenslade PJM. *Ants (Hymenoptera;Formicidae) of Tasmania rain forest*,Report to department of parks and wildlife heritage. Tasmania, Australia, 1980.
26. Hickman JC. Pollination by ants;a low energy system.*Science.* 1974, 184.
27. Holldobler B, and Wilson EO. *The Ants*. The Belknap Press of Harward University, Cambridge, 1990.
28. Massachusetts Hook. *Forests in South East Queensland*. Memoirs of the museum of Victoria, 1997.
29. Janzen DH. Coevolution and mutualism between ants and acacias in central America. *Evolution*. 1966, 20.
30. Karmaly KA, Narendran TC. *Indian Ants Genus Camponotus Mayr*. Terresian Karmal Publication. Kerala, 2006.
31. Lubbock, J. Observations on ants, bees, and wasps, color of flowers as an attraction to bees; experiments and considerations thereon. J. Linn. Lond. (Zool), 1881.
32. Lyford WH. Importence of ants to brown podzolic soil genesis in New England. Harward forest paper no.7.Petersham, 1963.
33. Lynch JF, Johnson AK, Balinsky EC. Spatial and temporal variation in the abundance and diversity of ants (Hymenoptera: Formicidae) in the soil and litter layers of a Maryland forest. *Am. Mid. Nat.* 1988; 119:31-44.
34. Macmohan JA, Mull JF, Crist TO. Harvester ants *(Pogonomyrmex* species.) their community and ecosystem influences. *Annual review of ecology and systematic.* 2000, 31.
35. Major JD. Recolonization by ants of rehabilitated mineral sand mines on North Stradbroke Is. Queensland, with particular reference to seed removal. Aust. J. Ecol. 1985; 10:31-48
36. McKenzie DH, Hyatt DE, McDonald VJ. Editors. *Ecological indicators.* Chapman and Hall, London, England, 1995.
37. Menon S, Bawa KS. Applications of geographic information systems, remote methods for rapid assessment of biodiversity. *Ecological Applications.* 1997; 6:594-607.
38. Michener CD. *The bees of the world*. Baltimore Johns Hopkins University Press, 2000.
39. Myers N, Mittermrir CG, Kent J. Biodiversity hotspots for conservation priorities. *Nature.* 2000; 403:820-828
40. Noss RF. Indicators for monitoring biodiversity: a hierarchical approach. *Conserv. BioI*. 1990; 4:355-364
41. Oliver I, Beattie AJ. Designing a cost effective invertebrate survey, 1996.
42. Ramachandran TV, Subhash Chandra MD, Joshy NV, Narendra AT, Ali M.Energy and Wetland research group centre for ecological science, 2012.
43. Rastogi NP, Nair, Kolatkar M, William H, Gdagkar R. Indian institute of science campus survey and some preliminary observations. J. Indian institute of science. 1997, 77.
44. Spellerberg. *Evaluation and Assessment for Conservation*. Chapman and Hall, 1992.
45. Stacy M. Nest-site Limitation and Nesting Resources of Ants (Hymenoptera: Formicidae) in Urban Green Spaces (PDF). *Environmental Entomology*, 2009.
46. Subhaschandran MD. On the Ecological history of Western Ghats. *Current Science,* 1997.
47. Tiwari RN, Jonathan JK. A New species of *Lyomyrmex* Mayr from Andaman Nicobar islands (Hymenoptera:Formicidae)Records of Zoological survey of India, 1986.
48. Vanderwoude C, Anderson AN, Alan PN. Ant communities, 1997.
49. Varghese T. Ant fauna of Indian Institute Campus, 2009.
50. Veeresh GK, Ali TM. The present status of our knowledge of Indian ants. 1991, 77.

51. Viswanathan, Narendra. The effect of urbanization on the biodiversity of ants in Banglore. J. Ecobio. 2000, 12.
52. Wilson EO. *Insect Societies.* Belknap Press, Cambridge, Massachusetts, 1971.
53. Wood JG. Study of Insect Life volume 2.Arihant publishing house, Jaipur, 1994.
54. Yeatman EM, Greenslade PJM. Ants as indicators of habitat in three conservation parks in South Australia. South Aust. Nat. 1980; 55:20-26.
55. Web references
56. www.wikipedia.com accessed on 24 February, 2015.
57. http://ces.iisc.ernet.in/Ant Taxonomi/index.htm accessed on 15 February, 2015.