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Review on ecological aspects of ants

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Abstract

Ants are very important and major component of terrestrial ecosystems. Ants are also called ecosystem engineers due to their specific activities like altering vegetation and soil properties through their nesting and foraging behaviors. Biodiversity of ants was very high and it was dynamically interacting with biotic and abiotic factors. The review summarizes the ant biodiversity pattern according to season, vegetation and disturbance level in particular habitats. The study reported that ant diversity was observed more in summer and rainy season but lower in winter season. Vegetation habitat influenced by climatic change, soil pattern, human impact such as land use, pollution hence ant diversity can change accordingly. According to disturbance habitat the diversity of ant was seen to be more in less and partially disturbed habitat as compared to disturbed habitat.

Keywords: Ants, Ecology, Disturbed/ undisturbed habitat, Seasonality

Introduction

Order Hymenoptera is an important group in class Insecta and it contain agriculturally, ecologically, and economically important species. Ants, Honeybees and bumble bees are very good pollinators (Anbalagan. *et al.*, 2015) [4]. In terms of numbers dominance and ecological importance, Hymenoptera are fundamentally significant (Lasalle and Gauld, 1993) [23]. Ants are classified as a single family- Formicidae in order Hymenoptera. One family alone within this order can be used to exemplify the importance of insect and biodiversity (Holldobler and Wilson 1990, Agosti *et.al.*, 2000) [16, 2]. Ants are significant part of ecosystem not only because they represent a great part of the animal biomass but also they acts as ecosystem engineers. They are important below ground process through the fluctuation of physical and chemical environment and through their effect on plants, microorganisms and other soil organisms (Folgarait, 1998) [13]. The known living ants involve 16 families, 296 genera and 15000 species around 10,000 of which are described (Bolten, 1994). Ants are used as indicators of environmental change in disturbed landscapes often without adequate understanding of their response to disturbance (John H. Graham. *et al.*, 2009).

Seasonal Pattern

Habitat wise diversity was reported in Semiarid Karoo. Diversity and abundance of epigaeic ant determined various habitat semiarid Karoo in summer and winter season. The result shows that ant diversity and abundance was higher in summer as compared to winter (Lindsey and Skinner, 2000). Variation in ant community can be analysed in different habitat of dry and wet season such as early stage, moderate stage, and intermediate stage. The result shows that in early stage 48% species were sampled both dry and wet season followed by 38% in intermediate stage followed by 28% in late stage (Neves *et al.*,2010) [26]. In Tanzania effect of seasonality on abundance of African weaver ant *Oecophylla longinoda* studied in cashew agro ecosystem habitat. The study reported that effect of onseason and offseason on abundance of ant was determined in the cashew field of Kibaha and Bagamoyo district. During study period of 2011 and 2012 the mean percentage of African weaver ant colonization trails is varied in Bagamoyo and Kibaha thus variation seen more in Bagamoya 74.3 and 57.0% as compared to 72.6 and 54.9 in Kibaha respectively (Olotu, 2016) [28]. Spatial and temporal distribution of dominance group along adjacent communities was studied in Mediterranean ground ant communities. Ground ant communities in open area regulated by temperature variation, while in shrub lands and forest, dominant species are more abundant. Seasonal pattern in community structure shows temperature fluctuation varied between habitat types (Retana. J and Cerda. X, 2000) [32]. In Maryland Forest spatial and temporal variation in soil and litter layers abundance of ants was studied. In monthly samples litter and soil layers during March and October total 22 ant species was reported. In Soil layer the most single ant species *Brachymyrmex depilis* was reported and it was rare in litter layer. In litter layer during May, July, August species richness of ants was high (Lynch *et al.*, 1988) [22]. In Southeastern New Mexico seasonal and diurnal activity of ant community can be studied. In three different habitat such as Shinnery-Oak mesquite dunes, grassland, creostebush shrubland active ant colonies were reported. 12 species were reported in the mesquite grassland habitat, 10 species in the oak mesquite dune habitat and 8 species in the creostebush habitat. In these three habitat very large seasonal difference was seen. Species *conomyrma insane* colonies was active in Oak-mesquite habitat in early summer and in mesquite- grassland habitat in late summer (Whitford. W.G 1999) [38]. In South Eastern Brazil in Parque Estadual do Rio Doce was studied the ant assemblages in rainy and dry season. In dry season 3075 individuals six subfamilies, 24 genera and 65 species were found whereas, in rainy season 6216 individuals, six subfamilies 30 genera and 78 species. It shows that rainy season has greater number of ant species as compared to dry season (Coelho and Ribeiro, 2006) [9]. In Western Australia ant composition and activity can be studied in naturally vegetated and farmland environments, seasonal fluctuations of foraging ant and nest building activity as well as various land use soil

type combination are described. The result shows that in winter ant activity and species richness was lower as compared to spring and summer (Bruyn. De. 1993) [5]. In India habitat wise ant diversity can be studied such as, Bharti (2009) [8] studied the various species of ants in Punjab Shivalic region of various season. In summer season species richness of ants is maximum during this period out of 40 species representing 24 genera and 8 subfamilies were observed followed by in winter season only 5 species belonging to 3 subfamilies were reported. In west Khasi Hills Meghalaya India studied seasonal variation in ant. Number of species recorded was highest during spring and summer and lowest during winter. During the study period the number of species sampled was highest in spring (23 species), summer (22 species) and autumn (21 species) and lower in winter (16 species). Ecological factors such as soil, temperature, relative humidity, air temperature, soil moisture was positively correlated with species richness, Shannon-Wiener index and seasonal change in ant individual numbers but not significantly correlated with p^H. Number of individuals and species diversity per sample was lower during winter and higher during summer (Kharbani and Hajong, 2013) [20]. In Costal Odisha diversity and seasonality of ant was assessed in Urban and Suburban habitat. In outdoor and indoor habitat five subfamilies were reported such as Myrmicinae, Formicinae, Dolichoderine, Ponerinae, and Pseudomyrmicinae. On the basis of seasonal study Myrmicinae ant were found in both outdoor (63.4%) and indoor (52.0%) habitats followed by subfamily Formicinae indoor habitats (34.4%) and outdoor habitat (12.3%), Ponerinae outdoor (2.7%) and indoor (3.4%) and Pseudomyrmicinae ants (0.1%) in outdoor habitat only (Dash and Patnaik, 2015) [12]. In Rainforest of Western Ghats of ground foraging ants seasonal and spatial patterns can be studied. Dominant species *Pheidole* was lower in abundance during wet season. Total 31 species representing 24 genera was reported. Number of ant species was highest in dry season 29 species and lower in early wet season 27 species, wet season 19 species and late wet season 13 species (Basu 1997) [7].

Disturbed and Undisturbed Pattern

In the Southeastern Fall line Sandhills the diversity and abundance of ants can be measured or accountable in three different habitat such as high, medium and low disturbances. In these three habitat total 48 species in 23 genera were sampled. 41 species in lightly disturbed and moderately disturbed site was recorded. 31 species in the highly disturbed site was reported. The result shows that species richness, equitability and abundance of ants in Southeastern Fall line Sandhills are all influenced by disturbance (Graham *et al.*,2004) [14]

In Sky Island investigation on effect of fire ant community reported ant community genera richness and total abundance are significantly higher in burned areas as compared to unburned areas (Wilkinson *et al.*, 2005) [39]. The highly disturbed and less disturbed areas in and around Bangalore city. Total 51 species of ants belonging to seven subfamilies was reported in five different habitat type. Species diversity was high in Cubbon Park (2.37) and less in Bangalore University (1.73). The study reported that ant species abundance and richness was higher in disturbed site because in disturbed site common species are increased (Savitha. *et al.*, 2008) [35].

The study reported ant community variation in Urban and agricultural ecosystem as urban habitat is highly disturbed site as compared to less disturbed agricultural site. In Urban ecosystem ants of 9 genera and 15 species were reported. In agriculture ecosystem ants of 10 genera and 16 species were reported. The species diversity index was higher in agricultural ecosystem (2.69) and less in Urban ecosystem (2.65) (Kumar and Mishra, 2008) [19]. The study deals with ant diversity of disturbed and undisturbed habitat of Great Indian Bustard wildlife sanctuary. Total 19 and 16 ant species were collected from disturbed and undisturbed habitat respectively. Shannon-wiener diversity index value ($H^`$) for undisturbed forest site (2.76) was slightly higher than disturbed forest site (2.46) (Patkar and Chavan, 2014) [29].

Vegetation Pattern

In different country diversity of ant can be studied according to different vegetation, habitat, altitudinal, forest, Park and some on flora and fauna pattern are as follow, ant diversity in temperate climate by using four sampling method such as Winkler extractors, Pitfall trap, Baiting and manual collection etc. Ants can be sampled in three different vegetation such as Causs, Oak grove and pine forest. It shows that Causs habitat has 29 species of ant was reported followed by Oak Grove 22 species of ant reported and in Pine forest 17 species of ant was reported (Groc *et al.*, 2007) [15]. Species diversity of ants of three land use type habitat such as mixed deciduous forest, teak plantation and durian orchard reported the Shannon wiener species diversity index was highest in the mixed deciduous forest 2.387 followed by durian orchard 1.997 followed by teak plantation 1.463. Seasonal diversity of ants was reported more in wet season (April to October) in all three habitat and lower in dry season (November to March) (Torchote *et al.*,2010) [37]. Ants can be sampled in seven different habitats in New Guinea such as primary forest, rubber plantation, coffee plantation, oilpalm plantation, Kumai grassland, eucalypt savannah and urban grassland. Out of these seven different habitat greatest diversity was found in rubber plantation (Room, 1975) [31]. In Mediterranean and Oro Mediterranean parts of Montenegro the species number of ant fauna can be recorded. It reported that ant species belong to 15 zoogeographical elements within three main zone as Mixed Deciduous forest zone Mediterranean zone and Coniferous high mountainous forest zone. Species richness of ant in Mixed and Deciduous forest zone was the highest at 700-1100 m altitude (Karaman, 2011) [21]. In Acadia National park Maine ants can be sampled in twelve different habitat and result shows that greatest species richness (S) was observed in habitats designated rocky outcrop (S= 26), Old field /meadow (S= 24) and Wetlands (S= 25). Moderate species richness of ants was reported in Deciduous forest (S =16), Coniferous forest (S = 11), Scrub/ Shrub (S = 14), Shoreline (S = 12), Jack Pine high elevation (S= 9) and high elevation scrub/shrub (S = 10). Lowest species richness was reported in parking lot/ roadside areas (S= 3), on rocky peninsulas (S = 4) and heath and bog habitats (S = 4) (Ouellette, 2010) [27]. In Southern Cape ant species richness was compared between Fynbos and Forest ecosystem. Two species are seen to be common in both habitats as *Acantholepis capensis* and *Camponotus maculates*. Total 27 species are found in Fynbos and 18 in the Forest (Koen and Breytenbach 1988) [18]. In Tanzania at Mlingano Mango Orchard habitat diversity of ant species was studied.

The study reported that arboreal ant such as *Crematogaster* and weaver ants *Oecophylla longinoda* was most dominant while *Pheidole* was least dominant in ground dwelling (Matcru. *et al.*, 2014) [25]. In Imback Canyon, Sabah Malaysia litter dwelling ant communities can be sampled in elevational gradient. Total 1002 ants from 10 subfamilies were sampled. Subfamily Myrmicinae represented 51.7% of the total species followed by Ponerinae 18.1%, Dolichoderinae 12.9% and Formicinae 8.6% are reported (Yusah. *et al.,* 2012) [40]. The study deals with overview of ant fauna of Cape Arid National Park, Western Australia. The ant Fauna can be compares with Wyperfeld National park. In both National Park *Camponotus* 28 species, *Iridomyrmex* 24 species, and *Melanophorus* 15 species were recorded (Andersen and Burbidge 1992) [1]. In Sungai Lalang Forest Reserve, Malaysia sampling of ant can be done by using two methods such as pitfall trap and Yellow pan trap. The result shows that by using pitfall trap higher number of ant species 31501 were collected as compared to yellow pan trap 1963 individuals. It shows that pitfall trap is more effective (Haneda. *et al.*, 2005) [17]. In Central Amazonia forest reserve terra-firme ant species distribution was analysed. Soil texture was correlated with moisture content and vegetation structure. Total 26,814 ant species were sampled belongs to 11 subfamilies, 54 genera, 85 species were sampled (Deoliveira P.Y 2009) [11].

In India, Wayanad region of Western Ghats diversity of forest litter inhabiting ants according to different elevation was studied. Abundance of ant species was influenced by physical factors such as rainfall, humidity, temperature, moisture, slope of terrain etc. In between 300 to 1650 m of AMSL five primary forest site was lying. In 1000 m AMSL (25 species) greatest species richness was reported and at 1650 m AMSL (5 species) lowest species richness was reported. Similarly at 1000 m AMSL highest Shannon diversity was reported and at 300 m AMSL lowest Shannon diversity was reported (Sabu. *et al.*, 2008) [34]. The study of diversity and species richness of ants around Gautala-Autrumghat in Aurangabad district of Maharashtra. Ants can be sampled in four different habitat such as forest, grassland, agriculture and residential areas. Diversity of ant species was higher in forest and agriculture habitat followed by grassland habitat (Sonune and Chavan, 2011) [36]. The study deals with the distribution and diversity of ant species in and around Amravati city of Maharashtra. Ant can be sampled in three different habitat as forest, grassland and human habitat. The result shows that the similarity index of ant was highest in forest and human habitat followed by grassland habitat. In myrmicinae sub family 11 genera, 21 species in formicinae subfamily 4 genera 7 species, in ponerinae subfamily 2 genera 3 species, dolichoderinae subfamily 2 genera 2 species and pseudomyrmicinae subfamily 1 genus of single species was reported. Species diversity index was highest in forest (1.75) followed by human habitat (1.58) and in grassland (1.2) was reported (Chavhan and Pawar, 2011) [10]. Ant diversity and species richness from three different vegetation type that is forest area, agricultural field and urban habitat were studied and documented that diversity and species richness of ants were more in the protected areas as compared to the disturbed or unprotected area (Patkar *et al.*, 2013) [30]. In Wayanad region of Western Ghats analysis of forest litter ant assemblages was done by using taxonomic and conventional diversity measures. In Wayanad region three vegetation type as evergreen, deciduous and shoal evergreen forest are involved. Out of these three habitat eveness in taxonomic spread was high in ant assemblages in deciduous forest and low in evergreen forest (Anu and Sabu, 2006) [3]. Department of atomic energy (DAE) campus Kalpakkam, South India studied the ant diversity in five different landscape such as riparian wood area, scrub jungle, building area, monoculture and sandy area. Shannon diversity index in riparian wood (2.62) followed by scrub jungle (2.53) followed by monoculture (2.36), sandy area (2.35) and building area (2.24) (Ramesh.*et al.,* 2010) [33].

References

1. Andersen AN, Burbidge AH. An overview of the ant fauna of Cape Arid National Park, Western Australia, Journal of the Royal Society of Western Australia. 1992, 41-46.
2. Agosti D, Alonso LE. The ALL protocol: A standard protocol for the collection of ground-dwelling ants. In Agosti, D., Majer, J.D., Alonso L.E. & Schultz, T.R. (Eds.): Ants: standard methods for measuring and monitoring biodiversity. – Smithsonian Institution Press, Washington, D.C, 2000, 204-206.
3. Anu A, Sabu T K. Biodiversity analysis of Forest litter ant assemblages in the Wayanad region of Western Ghats using taxonomic and conventional diversity measures. Journal of Insect Science: Article 6 Ants World. 2006; 7:417.
4. Anbalaga NV, Paulraj MJ, Ignacimuthu S. Diversity and abundance of Hymenoptera families in vegetable crops in North-eastern district of Tamil Nadu, India. IJFBS 2015; 2(3):100-104.
5. Bruyn de LAL. Ant Composition and activity in naturally-vegetated and farmland environments on contrasting soil at Kellerberrin, Western Australia, Soil Biol. Biochem. 1993; 25(8):1043-1056.
6. Bolton B. Identification guide to the ant genera of the world, 1994, 222.
7. Basu P. Seasonal and Spatial Patterns in Ground Foraging Ants in a Rain Forest in the Western Ghats, India, Biotropica, 1997; 29:489-500.
8. Bharti H, Sharma YP, Kaur A. Seasonal Patterns of Ants (Hymenoptera: Formicidae) in Punjab Shivalik. Halteres, 2009; 1(1):36-47.
9. Coelho IR, Ribeiro SP. Environment Heterogeneity and Seasonal Effects in Ground- Dwelling Ant (Hymenoptera: Formicidae) Assemblages in the Parque Estadual do Rio Doce, MG, Brazil. Neotropical Entomology 2006; 35(1):19-29.
10. Chavhan A, Pawar SS. Distribution and Diversity of Ant species (Hymenoptera: Formicidae) in and Around Amravati City of Maharashtra, India. World Journal of Zoology. 2011; 6(4):395-400.
11. Deoliveira PY, Desouza JLP, Baccaro FB. Ant species distribution along a topographic gradient in a terra- firme forest reserve in Central Amazonia, Pesq. agropec. bras, Brasilia, 2009, 852- 860.
12. Dash S, Patnaik HP. Diversity and Seasonality of ants associated with outdoor and indoor habitats of costal Odisha. Journal of Eco-friendly Agriculture. 2015, 184-188.

13. Folgarait PJ. Ant biodiversity and its relationship to ecosystem functioning: Is view Biodiversity and conservation, 1998, 1221-1244.
14. Graham JH, Hughie HH, Jones S, Wrinn K, Krzysik AJ, Duda JJ *et al*. Habitat disturbance and the diversity and abundance of ants (Formicidae) in the southeastern Fall line sandhills. Journal of Insect science, 2004, 1-15.
15. Groc S, Delabie JHC, Cereghino R, Orivel J, Jaladeau F, Grangier J, *et al*. Ant species diversity in the grand Causses (Aveyron, France): In search of sampling methods adapted to temperate climates. Elsevier, 2007, 913-922.
16. Hölldobler B, Wilson EO. The Ants. 733 pp. Belknap Press of Harvard University, Cambridge, MA, 1990.
17. Haneda NF, Sajap AS, Hussin MZ. A Study of Two Ant (Hymenoptera: Formicidae) Sampling Methods in Tropical Rain Forest, Journal of Applied Sciences, 2005, 1732-1734.
18. Koen JH, Breytenbach W. Ant species richness of Fynbos and Forest ecosystem in the Southern Cape, South African Journal of Zoology. 1988, 184-188.
19. Kumar D, Mishra A. Ant community variation in urban and agricultural ecosystems in Vadodara District (Gujarat State), Western India, Asian myrmecology, 2008, 2:85-93.
20. Kharbani H, Hajong SR. Seasonal patterns in ant (Hymenoptera: Formicidae) activity in a forest habitat of the West Khasi Hills, Meghalaya, India. Asian Myrmecology. 2013; 5:103-112.
21. Karaman MG. Zoogeography, diversity and altitudinal distribution of ants (Hymenoptera: Formicidae) in the Mediterranean and the oro-Mediterranean parts of Montenegro, NWJZ, 2011, 26-34.
22. 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, American Midland Naturalist, 1988; 119:31-44.
23. Lasalle J, Gauld ID. Hymenoptera: their diversity and their impact on the diversity of other organisms, 1993, 1-27.
24. Lindsey PA, Skinner JD. Ant composition and activity patterns as determined by pitfall trapping and other methods in three habitats in the semi-arid Karoo. Journal of Arid Environments. 2000; 48:551-568.
25. Matcru LC, Kombo ZS, Masumbuko L. Ant Species Diversity and Composition at Mlingano Mango Orchard in Tanzania, Research Journal of Agricultural and Environmental Sciences. 2014; 1:29-33.
26. Neves FS, Braga RF, Espiritosanto MM, do Delabie JHC, Fernandes GW, Sanchez-Azofeifa GA. Diversity of Arboreal Ants In a Brazilian Tropical Dry Forest Effects of Seasonality and Successional Stage. Sociobiology. 2010; 56(1):1-18.
27. Ouellette GD, Drummond FA, Choate B, Groden E. Ant Diversity and Distribution in Acadia National Park, Maine. Environ Entomol. 2010; 39(5):1447-1456.
28. Olotu M I. Effect of Seasonality on abundance of African Weaver ant Oecophyllalonginoda (Hymenoptera: Formicidae) in cashew agro-ecosystems in Tanzania, Academic Journals. 2016, 1439-1444.
29. Patkar NB, Chavan RJ. Diversity of Ants (Hymenoptera: Formicidae) From Undisturbed and Disturbed Habitats of Great Indian Bustard Wildlife Sanctuary, (M.S.) India, IJSR, 2014; 3:398-401.
30. Patkar NB, Sonune BV, Chavan RJ. Studies On (Hymenoptera:Formicidae) In And Around Solapur City, (M.S.), India. Indian Stream Research Journal. 2013; 3:1-4.
31. Room PM. Diversity and Organization of the Ground Foraging Ant Faunas of Forest, Grassland and Tree Crops in Papua New Guinea, Aust. J Zool. 1975, 71-89.
32. Retana R, Cerda X. Patterns of diversity and composition of Mediterranean ground ant communities tracking spatial and temporal variability in the thermal environment, Online //: digital. CSIC, 2000, 436-444.
33. Ramesh T, Hussain KJ, Satpathy KK, Selvanayagam M, Prasad MVR. Diversity, Distribution and Species composition of ant's fauna at department of atomic energy (DAE) campus Kalpakkam, South India. World Journal of Zoology. 2010, 56-65.
34. Sabu TK, Vineesh PJ, Vinod KV. Diversity of forest litter – inhabiting ants along elevations in the Western Ghats. Journal of Insect Science. 2008; 8:1-12.
35. Savitha S, Barve N, Davidar P. Response of ants to disturbance gradients in and around Bangalore, India. Tropical Ecology, 2008, 235-243.
36. Sonune BV, Chavan RJ. Studies on Diversity and Species Richness of Ants (Hymenoptera: Formicidae) Around Autramghat in Aurangabad District of Maharashtra, India, 2011, 344-347.
37. Torchote P, Sitthicharoenchai D, Chaisuekul C. Ant Species Diversity and Community Composition in Three Different Habitats: Mixed Deciduous forest, Teak Plantation and Fruit Orchard. Tropical Natural History 2010, 37-51.
38. Whitford WG. Seasonal and Diurnal Activity Patterns in Ant Communities IN a Vegetation Transition Region of Southeastern New Mexico (Hymenoptera: Formicidae), Sociobiology, 1999, 34:477-490.
39. Wilkinson EB, Lebrum EG, Spencer ML, Whitby C, Kleine C. Short Term Effect Of Fire on Sky Island Ant Communities, USDA Forest service proceeding RMRS, 2005, 550-552.
40. Yusah KM, Turner EC, Yahya BE, Fayle TM. An elevational gradient in litter- dwelling ant communities in Imbak Canyon Sabah, Malaysia, Journal of Tropical Biology and Conservation. 2012, 192-199.