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Diversity and Species Richness of Ants in coastal Odisha

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ABSTRACT
Ant diversity associated with various habitats of coastal odisha have been studied. After periodical sampling, it has been observed that peak summer, rainy, winter & spring season coinciding with April-May 2014,July-Aug 2014 ,Oct-Nov 2014 & Jan-Feb 2015 , abundance of subfamilies arranged in an ascending order of predominancy are Pseudomyrmicinae(1.22%) < Ponerinae(4.24%) < Dolichoderinae(17.64%) < Formicinae(26.97%) < Myrmicinae(49.93%) respectively. Study with different locations & seasons a total 27 number of ant species has been documented irrespective of seasons under coastal odisha conditions..The least predominant subfamily was pseudomyrmicinae that comprised of only 2 species and subfamily formicinae consists of 6 species, ponerinae & Dolichoderinae having each of 3 species. The maximum number of species i.e.13 species was documented in subfamily myrmicinae. The myrmicinae recording the highest genera & species richness indicated a disturbed environment at Bhubaneswar .The taxonomic composition & species richness representing different subfamilies with greater prevalence during pre-monsoon & spring season,so it can be considered as the most ideal season for ant species in coastal odisha (Fermendaz,2003). Several ant species like black crazy ant Paratrechina longicornis (Formicinae), acrobat ant,Crematogaster sp (Myrmicinae); red fire ant Solenopsis geminata (Myrmicinae) and Odorus ant, Tapinoma sp (Dolichoderinae) have been identified as predominant species which needs more attention which may become problematic for future in Bhubaneswar situation .
Key words: *Ant diversity, species richness, problematic ants. coastal Odisha,*

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INTRODUCTION

Anthropogenic disturbance increased, appeared to destroy the natural vegetation in urban and sub-urban areas, which concurrently risk the natural ecosystems. Since natural vegetation serves as an important reservoirs of biodiversity and contributes to the improvement of quality of life in cities [1[, biodiversity studies have been emphasized in recent years [2-4]. Ants are increasingly used for biodiversity assessments, and comparison of habitats and ecosystems [5]. Further, the data on the ants in natural and manmade habitats are poorly documented [6] and the coastal habitats are reported to harbor rich biodiversity among the terrestrial ecosystems [7]. Therefore, the present studies documented the species composition and community structure of ants under different coastal Odisha conditions.

MATERIALS AND METHODS

The studies were made from April'14 to February'15, at three different types of habitats located near Bhubaneswar. Geographically, the city is situated in the eastern coastal plains of Odisha and south-west of the Mahanadi River between 21° 15' north latitude 85° 15'

longitudes, at an altitude of 45 meters above MSL. The selected locations were viz., (1) Forestry college campus (FC) with perennial trees like Teak, Sisoo, Neem, Bahada, and Sandal wood which mimics the urban forest garden (2) Residential premise in sub urban area (Vill: Nagapur, Block: Gope; Dist: Puri) and (3) Forest park (FP) with perennial plants and manmade landscapes. The methods employed for collection of the ant fauna include all out search (hand collection with aspirator), pitfall and bait methods. Ants sampling using pitfall traps have been reported as an efficient method of sampling ground ant communities [8] and widely used in open areas [9] as well as for environments with disturbance [10].

At each selected location, ants were collected from a 25 sq.meter quadrant by placing plastic cups (6 cm in diameter and 7cm in length) half filled with water and few drops of liquid detergent at the center and four corners of the quadrant. Plastic tubes (9cm long and 2.5cm wide) with sugar bait (candy) were also placed in the similar fashion at each selected locations. For trapping the arboreal ants plastic tubes with sugar bait were tied to the tree trunk at a height of 6ft from the ground. The ants were collected from the traps after 24 hrs of placement. Sampling of ants was complemented by manually picking them from flowers, leaves, dead leaves, under rocks and rotten tree trunks using brush dipped in 70% alcohol as well as entomological tweezers and aspirator. The collections were made during April – May'14, July - August'14, October - November 14 and January - February'15 coinciding with summer, rainy, winter and spring seasons. Most of the taxa were sorted out based upon the colour, size and some basic morphological features and preserved in 70% alcohol. The sorted ant specimens were then counted and identified up to genus level (some to species level) using Trinocular zoom stereoscopic microscope (Model: BD42-A) and the keys provided by Bolton [11] and Musthak Ali [12].

The identified ant species were listed and the number of ants in each genus / species was documented with respect to habitats so as to enumerate the species composition and species structure indices. Various ecological indices like Shannon- wiener's index, H [13] and Simpson's index of diversity, SID [14] was worked out as per the following equations;

Shannon- wiener's index (H):

$$H = \sum_{i=1}^{s} - (P_i * \ln P_i)$$

Where,

H= the Shannon species diversity index

S= no. of species encountered or species richness

Pi = proportion of the total sample belonging to i^{th} species.

$\ln P_i$=natural logarithm with base e = 2.718281828.....

$\sum$ = sum from species 1 to species S

The index values (H) can range of 0 to ~4.6. A value near 0 would indicate that every species in the sample is the same i.e there is no diversity, while higher value of H would indicate more diverse communities and the numbers of individuals are evenly distributed between all the species.

Simpson's Index of diversity (SID): The Simpson's Index (D) is a measure to assess the probability that two individuals randomly selected from a sample will belong to the same species or some category other than species. The above index was calculated using the following equation.

$$D = \frac{\Sigma\, n(n-1)}{N(N-1)}$$

Where,

n = the total number of organisms of a particular species

N = the total number of organisms of all species

With this index, 0 represents infinite diversity and 1, no diversity. That is, the bigger the value of D, the lower the diversity. In order to make the measure meaningful, D is often subtracted from 1 to give Simpson's Index of Diversity (1 - D).The value of this index also ranges between 0 and almost 1, the greater the value, the greater the sample diversity. A value approaching zero indicates low biodiversity. For a given richness (*S*), *D* increases as equitability increases, and for a given equitability *D* increases as richness increases.

RESULTS AND DISCUSSION

In coastal Odisha, ants were mostly represented by five sub-families viz., Myrmicinae, Formicinae, Dolichoderinae, Ponerinae and Pseudomyrmicinae. The sub-families in descending order of their predominance were recorded as Myrmicinae (49.93%) > Formicinae (26.97%) > Dolichoderinae (17.64%) > Ponerinae (4.24%) > Pseudomyrmicinae (1.22%) (Table 1).

Table 1: Predominance of ant sub-families in different periods under coastal Odisa conditions

Sub-family	Proportional (%) ant density , during				Overall
	April-May'14	July – Aug'14	Oct –Nov'14	Jan – Feb'15	
Myrmicinae	47.30	30.8	58.20	63.43	49.93
Formicinae	16.33	46.1	33.27	12.17	26.97
Pseudomyrmicinae	0.90	0	0.33	3.63	1.22
Ponerinae	4.43	1.3	6.37	4.87	4.24
Dolichoderinae	31.03	21.8	1.80	15.93	17.64
Data averaged over locations.					

The myrmicinae ants predominated during January – February'15 (63.43%) and October – November'14 (58.20%). The formicinae ants predominated during rainy season (46.1%) and subsequently their number receded appreciably. The Dolichoderinae ants were proportionately high during summer'14 (31.03%), while. the ponerine ants predominated in October – November'14 (6.37%). Pseudomyrmicine ants were discernible in small proportion of 3.63% during January – February'15.

A total of 27 ant species have been documented across locations and seasons at Bhubaneswar. The sub-family Myrmicinae was represented by a maximum of 13 species which was followed by Formicinae with 6 species and Ponerinae and Dolichoderinae, each with 3 species. The Pseudomyrmicinae with two species was least dominant. The data in Table 2 evidenced that ant species richness and composition represented by different sub-families varied with seasons distinctly. The species richness was maximum (22 species) during Jan – Feb'15 and April –May'14 (20 species) and in rest of the periods it ranged from 14 – 18. Relatively high diversity in species composition was also evidenced (Table 3) from the species diversity indices like Simspon's Index of diversity (SID) and Shannon-Wiener index (H) during April – May'14 (SID = 0.84; H = 2.01) and Jan – Feb'15 (SID = 0.90; H=-2.63).

Table 2: Seasonal variation in species richness of ants under different sub-families, irrespective of locations

Sub-family	Species richness during,				
	April – May'14	July - Aug'14	Oct – Nov'14	Jan – Feb'15	Overall
Myrmicinae	8	6	7	10	13
Formicinae	5	6	5	6	6
Pseudomyrmicinae	2	0	1	1	2
Ponerinae	3	1	3	3	3
Dolichoderinae	2	1	2	2	3
Total:	**20**	**14**	**18**	**22**	**27**

Myrmicinae not only predominated among the sub-families, but also predominated in all the seasons studied. However, in proportion to total ants myrmicinae ants predominated during January – February'15 (63.43%) and October – November'14 (58.20%). The formicinae ants predominated during rainy season (46.1%) and subsequently their number receded appreciably. The Dolichoderinae ants were proportionately high during summer'14 (31.03%), while. the ponerine ants were seen predominating in October – November'14 (6.37%). Pseudomyrmicine ants were discernible in small proportion of 3.63% during January – February'15.

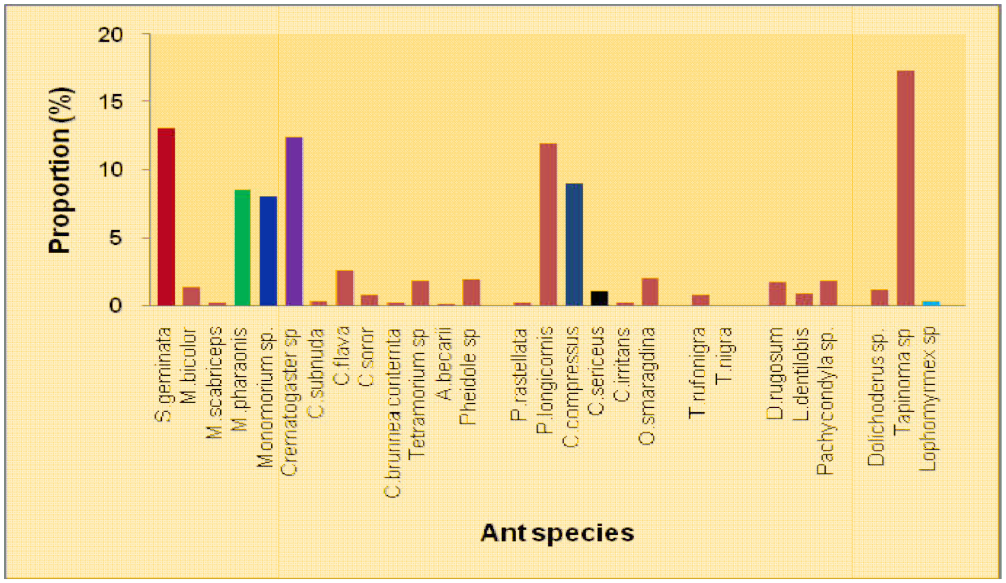
The highest representation of subfamily myrmicinae followed by Formicinae corroborates with the findings of Bharti *et al.* [15], Cunha and Nair [7] and Selvarani *et al.* [16].

Myrmicinae having the highest genera and species richness indicated disturbed environments at Bhubaneswar as myrmiciane ants were considered as an indicator of disturbed environments. In contrast with the species richness of coastal Odisha (27 species) the number of species as reported by various researchers varied with locations like 40 species from Punjab [17], 51 species from Bangalore city [2] species from Mumbai [18]; 28 species from Meghalaya [20]; 21 species from Tamil Nadu. [19]. The ant species richness generally increases with the increase in vegetation [21].

Table 3: Species richness and diversity in ant community of coastal Odisha

Periods / Habitats	Species richness	Diversity Indices	
		Simpson's Index of Diversity (SID)	Shannon Diversity Index (H)
Periods irrespective of habitats:			
April – May'14	13	0.84	-2.01
July – Aug.'14	12	0.78	-1.78
Oct. – Nov.'14	15	0.71	-1.48
Jan. – Feb.'15	23	0.90	-2.63
Locations irrespective of seasons:			
Loc. 1 (FC)	21	0.87	-2.38
Loc. 2 (Res.)	23	0.85	-2.24
Loc.3 (FP)	18	0.82	-2.07
FC: Forest College; Res: Residential premise; FP: Forest Park			

Similarly, irrespective of seasons the diversity indices showed similar trends at different locations and the SID varied from 0.82 – 0.87. The Shannon Diversity Index (H) values ranged from -2.07 to -2.37 with respect to the locations. Thus, under the coastal Odisha conditions pre-monsoon and spring seasons were found ideal for the prevalence of most ant species. The predominating ant species in proportion to the total population were recorded as Odorus ants, *Tapinoma* sp. (17.36%), Red fire ant, *S.geminata* (13.08%), Acrobat ant, *Crematogaster* sp.(12.45%) and Crazy ants, *Paratrechina longicornis* (11.97%)(Fig.1). Thus, under Bhubaneswar situations the Odorus ants, *Tapinoma* sp. (Dolichoderinae); red fire ant, *Solenopsis geminata* (Myrmicinae), acrobat ant, *Crematogaster* sp.(Myrmicinae) and black crazy ants, *Paratrechina longicornis* (Formicinae) have been identified as predominant species. Currently, four ant species namely *Monomorium pharaonis, M. indicum, P. longicornis* and *T. melanocephalum* have emerged as weedy species in India with few more turning to be notorious as well [17] and these ant species are difficult to control with recently launched management practices.



REFERENCES

1. Balram, S. and D. Suzana. (2005). Attitudes toward urban green spaces: integrating questionnaire survey and collaborative GIS techniques to improve attitude measurements. *Landscape and Urban Planning* 71: 147-162.
2. Savitha, S., Barve, N. and Davidar, P. (2008). Response of ants to disturbance gradients in and around Bangalore, India. *Tropical Ecology*, **49** (2): 235-243.
3. Quadros Goldin, Gauri Gurav, Kaustubh Bhagat, Alok Chorghe, Aniruddha Dhamorikar, Kashmira Khot and Manoj Nagarkar (2009). *In*: Report of the "Study of the Biodiversity of Indian Institute of Technology Bombay Campus". World Wide Fund – India, MSO for IIT Bombay. Pp 1-158.Savitha, S., Barve, N. and Davidar, P. (2008). Response of ants to disturbance gradients in and around Bangalore, India. *Tropical Ecology*, **49** (2): 235-243.
4. Narendra A, Gibb H and Ali TM, (2011). Structure of ant assemblages in Western Ghats, India: role of habitat, disturbance and introduced species. *Insect Conservation and Diversity* **4**: 132-141.
5. Andersen, A.N. and Majer, J.D. (2004). Ants show the way down under: Invertebrates as bioindicators in land management. *Frontiers in Ecology and the Environment*,**2**: 291-298.
6. Gadagkar, R., Nair, P.,Chandrashekara, K. and Bhat, D.M.(1993). Ant species richness and diversity in some selected localities in western ghats, India. *Hexapoda,* **5**(2):79-94.
7. Cunha, Pradeep D. and Nair, V. M. G. (2013). Diversity and Distribution of Ant Fauna in Hejamadi Kodi Sandspit, Udupi District, Karnataka, India. *HALTERES*, Volume **4**, 33-47.
8. Read, J.L. and Andersen, A.N.(2000).The value of ants as early warning bioindicators: responses to pulsed cattle grazing at an Australian arid zone locality. **Journal of Environments**, v.45, p.231-251.
9. Retana, J. and Cerda, X. 2000.Patterns of diversity and composition of Mediterranean ground ant communities tracking spatial and temporal variability in the termal environment. **Oecologia**, v.123, p.436-444.
10. Graham, J.H.; Krzysik, A.J.; Kovacic, D.A.; Duda, J.J.; Freeman, D.C.; Emlen, J.M.; Zak, J.C.; Long, R.W.; Wallace, M.P.; Chamberlin-Graham, C.; Nutter, J.P. and Balbach, H.E. (2009). Species richness, equitability, and abundance of ants in disturbed landscapes. *Ecological Indicators*, v.9, p.866-877.
11. Bolton B. (1994). Identification guide to the ant genera of the world. Harvard University Press, Cambridge, USA, pp. 1-5.
12. Musthak Ali, T.M. (2013).*Taxonomy of Ants: Training Manual* (Compiled by T.M.Musthak Ali), ICAR Supported Niche Area of Excellence for capacity Building in Taxonomy of Insects & Mites, Dept. of Entomology, UAS, 7th to 11th January13, Bangalore. Pp: 201.
13. Shannon, C.E. and Wiener, W. (1963).The Mathematical Theory of Communities. University of Illinois Press, Urbana. pp. 117.
14. Simpson, E.M. (1949). *In:* Measurement of diversity. ***Nature***.Pp: 163.
15. Bharti, H., Sharma, Y. P. and Kaur, A. (2009). Seasonal Patterns of Ants (Hymenoptera: Formicidae) in Punjab Shivalik. *Halteres*, **1** (1): 36-47.
16. Selvarani, S., Amutha, C. and Moorthi, P.V. 2014. Seasonal assemblage of leaf litter ants in Mehamalai, Western Ghats, India. *International Journal of Environmental Biology*, **4**(2):196 – 200.
17. Bharti, H. 2012. Ants as Pest. Clean India Journal, January, 2012 (retrieved on 24.11.14from the website: http://www.cleanindiajournal.com/ants_as_pest/)
18. Khot, K., Quadros, G. and Somani, V. (2013).Ant Diversity in an urban garden at Mumbai, Maharashtra. National Conference on Biodiversity: Status and Challenges in Conservation-FAVEO'2013: 121- 125.
19. Gokulakrishnan, S., Ramakrishnan, N. And Roopavathy, J. (2014). Ant Diversity In Three Selected Localities of Thanjavur and Cuddalore Districts of Tamilnadu. *Indian Journal of Applied Research*, **4**(9): 561 – 565.
20. Kharbani, H. and Hajong, S.R. (2013). Seasonal patterns in ant (Hymenoptera: Formicidae) activity in a forest habitat of the West Khasi Hills, Meghalaya, *India. Asian Myrmecology*, **5**: 103 – 112.
21. Kumar, D. and Mishra, A. (2008). Ant community variation in urban and agricultural ecosystems in Vadodara District (Gujarat State), western India. *Asian Myrmecology,* Volume **2**: 85 – 93