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Seasonal Variation and Ant Species Diversity ("Hymenoptera: Formicidae") in the Serampore Area, Hoogly, West Bengal

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ABSTRACT

Ants (Hymenoptera: Formicidae) play an important role in ecosystems, as they are both abundant and ecologically important. They are among the most diverse and important organisms worldwide. This research aims to investigate the seasonal patterns of ant species in and around Serampore, Hooghly, West Bengal, India, with a focus on species composition and distribution in different months. A total of sixteen ant species from 12 different genera were identified in different habitats (including fields, roadsides, urban areas, and gardens), during the period from October 2015 to March 2016. The study identified 5 species in 4 genera in both the Formicinae and Myrmicinae subfamilies, 4 species from 2 genera within the Ponerinae subfamily, and 1 species each from the Dolichoderinae and Pseudomyrmicinae subfamilies. The number of recorded species was significantly low in January and December.

Keywords: Seasonal pattern, Species composition, Ants, West Bengal

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Introduction

Ants (Hymenoptera: Formicidae) are a key ecological group in most terrestrial habitats, holding a dominant position among arthropods. They are integral to ecosystems, contributing significantly to animal biomass and functioning as ecosystem engineers. Present at nearly every trophic level of the food chain, ants are essential to the smooth operation of terrestrial ecosystems and the ecosystem services they provide. As a dominant faunal group, they are highly sensitive to disturbances such as mining and agriculture. They also play vital roles in diverse ecological processes, including nutrient cycling, seed dispersal, and regulating insect populations. Ants are significant organisms globally, influencing community dynamics, serving as ecological indicators, and performing essential functions such as pollination, soil turnover, and predation. Additionally, they are responsible for the dispersal of numerous plant species. Several studies have explored ant activity and seasonal patterns in various regions, though few have focused specifically on the seasonal dynamics of ants in India. This research aims to examine the seasonal patterns of ant species in and around Serampore, Hooghly, West Bengal, India, focusing on species composition and distribution over different months. The findings will provide valuable insights into the distribution and diversity of ant species in the area.

Materials and Methods

Study area and sampling

In India, ants can be found in a wide range of habitats, including dead logs, leaf litter, trees, and soil, while tramp species tend to favor human-altered environments. They occupy nearly every trophic level in the food web. The

ants for this study were collected from diverse ecological settings, such as field sides, roadsides, town areas, and gardens, around Serampore (22.7505° N, 88.3406° E) in Hooghly district, West Bengal. Sampling was conducted from October 2015 to March 2016, with surveys carried out twice a month at fifteen-day intervals, during morning (8 AM to 10 AM) and afternoon (3 PM to 5 PM) hours, on days with favorable weather (free of strong winds or heavy rain). Ants are generally easy to collect, and in this study, they were captured using nets, forceps, and bush-beating methods. The specimens were placed in plastic vials, each labeled with details of the collection site, date, and information about whether the species was ground-dwelling or arboreal. After collecting, we brought the samples to the laboratory for identification. Specimens were also photographed using a Nikon S6800 camera. The list of ant species found is presented in **Figure 1**, and all identifications were verified through the Zoological Survey of India, Kolkata.

Figure 1. The list of ant species identified in the study: 1. *Paratrechina longicornis*, 2. *Camponotus compressus*, 3. *Camponotus crassisquamis*, 4. *Anoplolepis gracilipes*, 5. *Oecophylla smaragdina*, 6. *Phidologiton affinis*, 7. *Crematogaster mogdiliani*, 8. *Crematogaster rogenhoferi*, 9. *Solenopsis geminata*, 10. *Pheidole smythiesi*, 11. *Diacamma rugosum*, 12. *Pachycondyla sulcata*, 13. *Pachycondyla rufipes*, 14. *Pachycondyla melaneria*, 15. *Tapinoma melanocephalum*, and 16. *Tetraponera rufonigra*.

Results and Discussion

The latest list of ant species from India involves eight hundred twenty-eight species and subspecies, representing 100 genera [1]. Mathew and Tiwari [2] documented 163 species from 52 genera in Meghalaya. Ants play a crucial role in ecosystems by breaking down plant, animal, and organic matter, contributing to decomposition processes, and promoting the activity of decomposers in their nests. They also support microbial functions. Urban ecosystems

are intricate socio-ecological systems with key functions. As urbanization increases, commercial, residential, and industrial areas expand, leading to the reduction of natural environments. Urbanization is a major factor in habitat degradation, loss, and fragmentation. The month-wise distribution of ant species during the research period is presented in **Table 1** (+: indicates presence, -: indicates absence). A total of sixteen ant species were identified during the study, including: *Camponotus compressus* Fab., *Camponotus crassisquamis* Forel, *Anoplolepis gracilipes* Smith, *Oecophylla smaragdina* Fabricius, *Phidologiton affinis* Jerdon, *Paratrechina longicornis* Latreille, *Crematogaster mogdiliani* Emery, *Solenopsis geminata* Fabricius, *Crematogaster rogenhoferi* Mayr, *Pheidole smythiesii* Forel, *Diacamma rugosum* Le Guillou, *Pachycondyla sulcata* Frane, *Pachycondyla melaneria* Emery, *Pachycondyla rufipes* Jerdon, *Tapinoma melanocephalum* Fabricius, and *Tetraponera rufonigra* Jerdon. Among these, 5 species from 4 genera belong to the subfamilies Formicinae and Myrmicinae, four species from 2 genera are part of the subfamily Ponerinae, and one species each is from the subfamilies Dolichoderinae and Pseudomyrmicinae.

Table 1. Monthly presence and absence of ant species (+: observed, -: not observed) in Serampore, Hooghly, throughout the study duration

Sub-Family	Species name	Month					
		Oct	Nov	Dec	Jan	Feb	Mar
Formicinae	***A. gracilipes***	+	+	-	-	+	+
	C. compressus	+	+	-	-	+	+
	C. crassisquamis	+	+	-	-	+	+
	O. smaragdina	+	+	-	-	+	+
	P. longicornis	+	+	+	+	+	+
Myrmicinae	***C. mogdiliani***	+	+	-	-	+	+
	C. rogenhoferi	+	+	-	-	+	+
	P. affinis	+	+	-	-	+	+
	P. smythiesi	+	+	-	-	+	+
	S. geminata	+	+	+	+	+	+
Ponerinae	***D. rugosum***	+	+	-	-	+	+
	P. sulcata	+	+	+	-	+	+
	P. rufipes	+	+	-	-	+	+
	P. melaneria	+	+	-	-	+	+
Dolichoderinae	***T. melanocephalum***	+	+	+	-	+	+
Pseudomyrmecinae	***T. rufonigra***	+	+	-	-	+	+

Ants are among the most ecologically vital and diverse organisms globally, representing a significant group within the vast array of biodiversity. Research by Kumar *et al*. [3] highlights that ant species richness tends to rise with increased vegetation cover. Palanichamy *et al*. [4] further emphasized the role of black ants (*Camponotus* spp.) in pollinating certain flowering plants. Numerous ant species are highly sensitive to habitat structure and microclimatic changes, making them responsive indicators of environmental shifts [5, 6]. The findings of this study revealed a clear seasonal variation in ant activity. Species numbers were at their lowest during December and January. While all species were observed in October, February, November, and March, only four species were found in December and two in January. Notably, *S. geminata* and *P. longicornis* were present throughout the research period, whereas *T. melanocephalum* and *P. sulcata* were absent solely in January.

Species abundance and richness were found to be greater during the warmer months compared to winter, aligning with the observations of researchers [7, 8]. In this study, ant species numbers reached their lowest point in January, consistent with findings by researchers [9], who also noted the absence of Pheidole smythiesii and Pachycondyla javana during the winter season. Our results confirmed that ant populations and their fluctuations are heavily influenced by environmental factors, with even minor changes in these conditions potentially causing significant impacts on the biological behavior of the species studied. Ants serve as critical environmental indicators and play

essential ecological roles, particularly through their relationships with other organisms across various trophic levels [10, 11].

Conclusion

The population of ants, acknowledged as among the world's ecologically vital and diverse organisms, exhibited variations throughout the study and across different months of the year. As key elements of terrestrial ecosystems, ants make up a significant portion of animal biomass and display remarkable sensitivity to changes in habitat structure and microclimatic conditions, responding strongly to environmental shifts. Their exceptional adaptability to a wide range of habitats highlights their distinctive evolutionary importance.

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