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Utilization of different habitat types by ant species (Hymenoptera) in a selected study area; an experiment designed for a short study.

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ABSTRACT:

Ant diversity is influenced by a variety of environmental factors, including sunlight exposure and anthropogenic activities. Hence, the present study was undertaken to know about the availability of different ant species at different lighted conditions and anthropological influences in the West Bengal State University (WBSU) campus, Barasat. Total twenty-seven (27) ant species were recorded from different study sites. The research highlights the interplay between light conditions and human-induced changes in habitat, providing insights into how anthropogenic factors alter ecological dynamics and species distribution.

Key words: Ants, West Bengal State University, Lighted conditions, Anthropological influences, Pitfall methods, Habitat generalists, Habitat specialists, Indicator species.

1. INTRODUCTION:

Ants (Hymenoptera: Formicidae) have numerous advantages over other arthropods in studies of species diversity. They occur throughout the world, are easily collected, taxonomically well-known and constitute an important fraction of the animal biomass in terrestrial ecosystems (E. J. Fittkau, 1973; Bert Hölldobler, 1990). They also respond to stress on a much finer scale than do vertebrates (Alan N. Andersen, 2008). The availability and distribution of ant species are profoundly influenced by their environmental conditions and human activities. Light influences many aspects of ant life, including foraging behavior, colony activity, and predation risk (Š. Kadochová, 2019).

Shaded environments provide a variety of microhabitats including leaf litter, decaying wood, and varied soil types. More stable temperature and humidity in shaded areas can be more favorable for a wider range of ant species (Yi-Huei Chen, 2014). The complex structure of shaded environments can create niches that are less accessible to dominant ant species, allowing a greater number of species to coexist (Torres, 1984). Studies have shown that habitat complexity can enhance species richness by offering more ecological niches (Agosti, 2000). Shadow areas might offer less prey-predator interactions compared to open, sunlit areas which lead to a greater diversity of ants being able to establish themselves in these environments (Agosti, 2000).

Disturbance often leads to an increase in resources such as food and nesting sites (microhabitats and ecological niches) (Lessard, 2019). Disturbances might lower the competitive abilities of dominant species, allowing less competitive or specialist species to thrive (Robert D. Holt, 1994). Disturbances can also introduce non-native or opportunistic ant species that can thrive in disturbed conditions. These species can increase overall ant diversity, even though they might be outcompeting or displacing native species (Stacy M. Philpott, 2009; Sze Huei Yek, 2023).

2. OBJECTIVE:

The present study has been designed to find out the availability of different ant species at different lighted conditions and anthropological influences.

3. STUDY AREAS:

The study was conducted in the West Bengal State University campus. In the present experimental study, four study sites were selected on the basis of presence and absence of sunlight and anthropological influences - shaded disturbed area, lighted disturbed area, shaded undisturbed area and lighted undisturbed area.

4. STUDY DESIGN:

The experiment had been conducted by pitfall method (Rhianna R. Hohbein, 2018). For the collection of ants species pitfall traps were placed with baits in the selected 4 locations inside the campus. In this present study, total 1080 pitfalls were laid.

5. COLLECTION AND PRESERVATION:

Ant specimens were collected and preserved in 70% ethanol inside 1.5 ml microcentrifuge tubes separately for each location. The collected samples were labeled by study area, date and time, repetition and replication number.

6. IDENTIFICATION:

The collected ant species were identified by the help of light microscope and Nikon stereo microscope and identified ant species were verified using the Ant-wiki database. (https://www.antwiki.org/wiki/India) and Hymenoptera section of Zoological Survey of India, Prani Vigyan Bhawan, M- block, New Alipore, Kolkata- 700053.

7. RESULTS:

Table 1: Availability of ants' species at different conditions.

No.	SHADED AREA	LIGHTED AREA	DISTURBED AREA	UNDISTURBED AREA
1	*Anoplolepis gracilipes*			*Anoplolepis gracilipes*
2	*Aphaenogaster feae*	*Aphaenogaster feae*	*Aphaenogaster feae*	*Aphaenogaster feae*
3	*Brachyponera chinensis*	*Brachyponera chinensis*	*Brachyponera chinensis*	*Brachyponera chinensis*
4	*Camponotus compressus*	*Camponotus compressus*	*Camponotus compressus*	*Camponotus compressus*
5	*Camponotus irritans*		*Camponotus irritans*	
6	*Camponotus mitis*	*Camponotus mitis*	*Camponotus mitis*	*Camponotus mitis*
7	*Camponotus parius*	*Camponotus parius*	*Camponotus parius*	*Camponotus parius*
8		*Camponotus sericeus*	*Camponotus sericeus*	
9	*Carebara diversa*	*Carebara diversa*	*Carebara diversa*	*Carebara diversa*
10	*Crematogaster rothneyi*	*Crematogaster rothneyi*	*Crematogaster rothneyi*	*Crematogaster rothneyi*
11	*Crematogaster subnuda*	*Crematogaster subnuda*	*Crematogaster subnuda*	*Crematogaster subnuda*
12	*Diacamma indicum*	*Diacamma indicum*	*Diacamma indicum*	*Diacamma indicum*
13	*Leptogenys chinensis*		*Leptogenys chinensis*	
14	*Meranoplus bicolor*	*Meranoplus bicolor*	*Meranoplus bicolor*	*Meranoplus bicolor*
15	*Monomorium pharaonis*	*Monomorium pharaonis*	*Monomorium pharaonis*	*Monomorium pharaonis*
16	*Paratrechina longicornis*	*Paratrechina longicornis*	*Paratrechina longicornis*	*Paratrechina longicornis*
17	*Pheidole indica*	*Pheidole indica*	*Pheidole indica*	*Pheidole indica*
18		*Pheidole sharpi*	*Pheidole sharpi*	
19		*Polyrhachis dives*		*Polyrhachis dives*
20	*Solenopsis geminata*	*Solenopsis geminata*	*Solenopsis geminata*	*Solenopsis geminata*

21	*Tapinoma melanocephalum*	*Tapinoma melanocephalum*	*Tapinoma melanocephalum*	*Tapinoma melanocephalum*
22	*Technomyrmex albipes*	*Technomyrmex albipes*	*Technomyrmex albipes*	*Technomyrmex albipes*
23	*Tetramorium smithi*		*Tetramorium smithi*	
24	*Tetraponera rufonigra*			*Tetraponera rufonigra*
25	*Trichomyrmex destructor*	*Trichomyrmex destructor*	*Trichomyrmex destructor*	*Trichomyrmex destructor*

Table 2: Availability of ants' species at different habitats.

No.	SHADED DISTURBED AREA	LIGHTED DISTURBED AREA	SHADED UNDISTURBED AREA	LIGHTED UNDISTURBED AREA
1			*Anoplolepis gracilipes*	
2	*Aphaenogaster feae*	*Aphaenogaster feae*	*Aphaenogaster feae*	*Aphaenogaster feae*
3	*Brachyponera chinensis*	*Brachyponera chinensis*	*Brachyponera chinensis*	*Brachyponera chinensis*
4	*Camponotus compressus*	*Camponotus compressus*	*Camponotus compressus*	*Camponotus compressus*
5	*Camponotus irritans*			
6	*Camponotus mitis*	*Camponotus mitis*	*Camponotus mitis*	*Camponotus mitis*
7	*Camponotus parius*	*Camponotus parius*	*Camponotus parius*	*Camponotus parius*
8		*Camponotus sericeus*		
9	*Carebara diversa*	*Carebara diversa*		*Carebara diversa*
10	*Crematogaster rothneyi*	*Crematogaster rothneyi*		*Crematogaster rothneyi*
11	*Crematogaster subnuda*	*Crematogaster subnuda*		*Crematogaster subnuda*
12	*Diacamma indicum*	*Diacamma indicum*	*Diacamma indicum*	*Diacamma indicum*
13	*Leptogenys chinensis*			
14	*Meranoplus bicolor*	*Meranoplus bicolor*	*Meranoplus bicolor*	*Meranoplus bicolor*
15	*Monomorium pharaonis*	*Monomorium pharaonis*	*Monomorium pharaonis*	
16	*Paratrechina longicornis*	*Paratrechina longicornis*	*Paratrechina longicornis*	*Paratrechina longicornis*
17	*Pheidole indica*	*Pheidole indica*	*Pheidole indica*	*Pheidole indica*
18	*Pheidole sharpi*	*Pheidole sharpi*		*Pheidole sharpi*
19				*Polyrhachis dives*
20	*Solenopsis geminata*	*Solenopsis geminata*	*Solenopsis geminata*	*Solenopsis geminata*
21	*Tapinoma melanocephalum*	*Tapinoma melanocephalum*	*Tapinoma melanocephalum*	*Tapinoma melanocephalum*
22	*Technomyrmex albipes*	*Technomyrmex albipes*	*Technomyrmex albipes*	*Technomyrmex albipes*
23	*Tetramorium smithi*			
24			*Tetraponera rufonigra*	
25	*Trichomyrmex destructor*	*Trichomyrmex destructor*	*Trichomyrmex destructor*	*Trichomyrmex destructor*

In **Table 1**, the availability of ants' species were higher in shaded (22) and disturbed (22) areas compared to lighted (20) and undisturbed areas (20) respectively.

In **Table 2**, the availability of ants' species was higher in shaded disturbed areas (21) than lighted disturbed areas (19) but in lighted undisturbed areas the ants availability were higher (18) than shaded undisturbed areas (16).

8. DISCUSSION:

Based on the food availability, predator interaction, environmental factors, and competition among co-species, animals choose a suitable habitat (Anna Åkesson, 2021). There were some ant species which were exclusively found in shaded areas like *Anoplolepis gracilipes, Camponotus irritans, Leptogenys chinensis, Tetramorium smithi, Tetraponera rufonigra.* Also, *Camponotus sericeus, Pheidole sharpi, Polyrhachis dives* were exclusively found in lighted areas. (Table 1)

Camponotus irritans, Camponotus sericeus, Leptogenys chinensis, Pheidole sharpi, Tetramorium smithi were exclusively found in the disturbed areas and *Anoplolepis gracilipes, Polyrhachis dives, Tetraponera rufonigra* these three ant species were exclusively found in undisturbed areas. (Table 1)

Camponotus irritans, Leptogenys chinensis, Tetramorium smithi these three ant species were exclusively found in shaded disturbed areas and *Camponotus sericeus* was exclusively found in lighted disturbed areas. (Table 2)

Anoplolepis gracilipes, Monomorium pharaonis, Tetraponera rufonigra these three ant species were exclusively found in shaded undisturbed area, whereas *Carebara diversa, Crematogaster rothneyi, Crematogaster subnuda, Pheidole sharpi, Polyrhachis dives* these five ant species were exclusively found in lighted undisturbed area. (Table 2)

Species can be exclusive to a niche restriction because it allows them to minimize competition with other species by specializing in a specific set of environmental conditions or resource usage within their habitat, maximizing their chances of survival and reproduction in that particular niche (Lessard, 2019).

Aphaenogaster feae, Brachyponera chinensis, Camponotus compressus, Camponotus mitis, Camponotus parius, Diacamma indicum, Meranoplus bicolor, Paratrechina longicornis, Pheidole indica, Solenopsis geminata, Tapinoma melanocephalum, Technomyrmex albipes, Trichomyrmex destructor, these thirteen (13) ants species were the most common ants, found in every location and these ants are the **habitat generalists** (Bert Hölldobler, 1990). They can tolerate a wide range of environmental fluctuations. *Anoplolepis gracilipes, Camponotus irritans, Camponotus sericeus, Leptogenys chinensis, Polyrhachis dives, Tetramorium smithi, Tetraponera rufonigra* these seven (7) ants' species are the **habitat specialist** (Bert Hölldobler, 1990).

Species' exclusiveness and generalness significantly influence their distribution patterns. Specialist ants, adapted to specific environments or resources, tend to have a narrow distribution, restricted to areas where their specific needs are met. In contrast, generalist ants can thrive in a wide variety of habitats, giving them a broader geographic range and making them more resilient to environmental changes (Bert Hölldobler, 1990).

Oecophylla smaragdina, Polyrhachis laevissima these two ant species were significantly present in the study area but these ants were not found in the pitfall traps.
According to Kremen et al. (1993), an indicator species of disturbance is defined on the basis of its presence/absence in sites with different levels of disturbance and/or on differences in its abundance when comparing sites experiencing different levels of disturbance (C. Kremen,

1993). The ant species *Anoplolepis gracilipes* was significantly abundant in the shaded undisturbed site so, *Anoplolepis gracilipes* can be considered as an **indicator species**.
This study concludes that a single habitat type does not allow all species even if the habitat is full of resources.

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