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Studies on relative abundance and Occurence of Ants species in maize cropping system

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Abstract
Studies on relative abundance and occurrence of ants species in maize cropping system was carried out at the Zonal Agriculture Research Station, University of Agricultural Sciences, GKVK, Bangalore, during *kharif* season of 2012. In the experimental plots, ants belonging to six genera and six species were collected using pit fall traps. These ants species were belong to three sub families *viz*., Formicinae, Myrmicinae and Ponerinae. Highest ant population was recorded in T1 (96.13%) and lowest in T3 (84.06%) plot. However, Ants species such as *Camponotus compressus* Fabricius, *Pheidole sp.*, *Solenopsis geminata* and *Leptogenys chinensis* were active throughout cropping season.

Keywords: Ants, maize, pit fall trap, relative abundance, species

Introduction
Ants (Hymenoptera: Formicidae) are a major structuring force in many terrestrial communities. Amongst the Planets most abundant insects; ants are one of the most important and a very diverse taxonomic group. The total ant population is estimated as one quadrillion. One out of a thousand insects is an ant. Their numbers compensate for their small size. Ants' presence in nature and their actions towards the environment are essential to the well-being of the habitats in which they thrives.

In view of their higher number, stability as populations, and feeding habits, ants have a major influence in many habitats [2, 3]. As predators of pests, they may be useful in pest management, but such positive attributes must be weighed against possible disadvantages. They play a fundamental role in agro-ecosystem functioning and provide multiple services such as biological control agents, plant pollination, soil improvement, and nutrient cycling [4]. On contrary, some feed on or disturb plants and may act as vectors of plant diseases, benefit damaging Homoptera, and attack or irritate humans, domestic animals, and other beneficial organisms [11]. Ants abundance and species richness peaked at mid-elevations influenced by the presence of favorable physical conditions and abundance of prey resources. Dominance of ants preferring termites and Collembolan as prey at sites rich in their specific prey resources indicate the influence of local prey resource availability in determining ant distribution. Ants are important components of ecosystems, not only because they constitute a significant portion of the animal biomass but also because they act as ecosystem engineers. Ant biodiversity is incredibly high, and these organisms are very responsive to human impacts, which obviously reduce their richness. However, it is not clear how such disturbances damage the maintenance of ant services to the ecosystem. Ants are important in below-ground processes by altering the physical and chemical environments and affecting plants, microorganisms, and other soil organisms. The diversity of ants is correlated with the above-ground vegetation as food resources and protects against environmental disruption [8]. The diversity and abundance of ants differed significantly according to habitat type in Jambi [13], and ant diversity shows strong negative responses to agricultural practices such as fertilization, pesticide spraying, and burning.

Many ant species are very sensitive to microclimate fluctuations and habitat structure and respond strongly to environmental changes [5]. Rizali [7] found precipitation as the main environmental factors that affected ant communities. Ants are sensitive to disturbances and rehabilitation [1], and diversity shows strong negative responses to agriculture intensification [6].

Dominant species (*Tapinoma sp*. and *Solenopsis sp*.) had wider distributions, being present at all elevations. Physical factors (slope of the terrain, rainfall, moisture, humidity and temperature) and prey resource availability (insect larvae, termites, Collembolan, etc.) influenced ant species abundance at a regional scale, whereas at local scales, site specific variations in the relationship between abundance of ants and prey-predators and physical factors were recorded. The study also highlighted the need to consider site-specific abiotic and biotic factors while examining the distribution patterns of litter ants along altitudinal gradients in other regions of the Western Ghats, which is a recognized hot spot of biodiversity with wide regional variation in vegetation types and faunal distribution patterns [9].

Material and Methods

The field experiment was laid out in a randomized complete block design with the following treatments. Each treatment was replicated thrice.

Treatments

1. Soil Test Crop Response approach (target yield of 110q/ha) fertilizer alone (251.17:113.31:114.35 kg N:P:K / ha).
2. Soil Test Crop Response approach (target yield of 110q/ha) 50% through fertilizer (123.74: 48.91: 55.59 kg N:P:K / ha) + 50% through FYM (20.76 tonnes FYM/ ha).
3. Soil Test Crop Response approach (target yield of 90q/ha) fertilizer alone (173.32: 93.66: 97.96 kg N:P:K /ha).
4. Soil Test Crop Response approach (target yield of 90q/ha) 50% through fertilizer (85.34:45.28:48.45 kg N:P:K /ha) + 50% through FYM (14.65 tonnes FYM/ ha).
5. Package of practice (150:75:40 kg N:P:K/ha) + 10 tonnes FYM/ha.
6. Low Medium High approach (150: 75: 50 kg N:P:K /ha) + 10 tonnes FYM/ha.
7. Control (absolute untreated control).

FYM was applied to the respective plots about one week before sowing. Chemical fertilizers N, P, K (Urea, SSP, MOP) were applied with recommended doses to particular treatments at the time of sowing in furrows. Seed treatment with fungicide (Bavistin @2g/kg seed) was done before sowing. The maize hybrid Hema was sown with a spacing of 60×30 cm in 10.8×3 m plot on 5th August 2012. Crop was raised under rain fed conditions.

Ant collections- Pit Fall Trap

In each treatment, one pit trap was placed for collection of ants. The trap consists of plastic cups (5cm in diameter 7cm in height) were placed in ground with their rim leveled with the soil surface to facilitate the wandering fauna to fall inside. Each cup was filed with 50 ml of 75% ethyl alcohol as killing agent or water with bit of detergent was added to break the surface tension and few drops of glycerol as an attractant. Traps were left for 48 hours and fauna were collected and later biomass and abundance of the each group were recorded. Further these fauna were separated as different taxonomic groups and preserved for further needful analysis.

Relative abundance

$$\text{Relative abundance (\%)} = \frac{\text{No. of individuals in particular group}}{\text{Total no. of individuals of all groups}} \times 100$$

Results and Discussion

Ant species *viz*., *Camponotus compressus* Fabricius, *Pheidole sp*, *Solenopsis geminata* and *Leptogenys chinensis* were active throughout cropping season. Ants belonging to six genera and six species were collected in the experiment plot during experiment. These belong to three sub families *viz*., Formicinae, Myrmicinae and Ponerinae (Table1). Among these, genera *Camponotus*, *Monomorium*, *Leptogenys*, *Pheidole*, *Pachycondyla* and *Solenopsis* possessed only 1 species each. Relative abundance of *Camponotus compressus* was highest in T3 (12.97%) and least in T1 (2.07%). Relative abundance of *Pheidole* sp. was highest in T1 (96.50%) and least in T4 (78.00%). Relative abundance of *Solenopsis geminata* was highest in T3 (6.38%) and least in T7 (0.61%). *Leptogenys chinensis* was highest in T4 (1.42%) and least in T1 (0.47%). *Pachycondyla* sp. were absent in all the treatments except T6 (0.25%) and *Monomorium indicum* were absent in T1, T3, T5, T6 and T7 treatment and was found in T2 (0.35%) and T4 (0.42%) (Table2). Highest ants population was noticed in T_1 (251.17:113.31:114.35 kg N:P:K/ha) fertilizer alone treated plot and lowest in T_3 (173.32:93.66:97.96 kg N:P:K/ha) fertilizer alone treated plot. This may be the reason due to adequate availability of required amount of food in the soil. The variation in the relative abundance of soil macro-arthropods may be due to the availability of their suitable food or host and moisture content of food and soil. Sabu [9], Virupaksha [12] and Shilpa [10] also noticed variations in macro-fauna abundance due to their site specific biotic and abiotic factors.

Table 1: Occurrence of Ants species in maize ecosystem during cropping season

Sl. No.	Ants species	Order	Family	Sub families
1	*Camponotus compressus* Fabricius	Hymenoptera	Formicidae	Formicinae
2	*Pheidole* sp.	Hymenoptera	Formicidae	Myrmicinae
3	*Solenopsis geminata* (Fabricius)	Hymenoptera	Formicidae	Myrmicinae
4	*Leptogenys chinensis* (Jerdon)	Hymenoptera	Formicidae	Ponerinae
5	*Pachycondyla* sp.	Hymenoptera	Formicidae	Myrmicinae
6	*Monomorium indicum* Forel	Hymenoptera	Formicidae	Myrmicinae

Table 2: Impact of different approaches of nutrient application on the relative abundance of Ants species during cropping season

Ants species	Relative abundance (%)						
	Treatments						
	T1	T2	T3	T4	T5	T6	T7
Ants	96.13	87.03	84.06	89.74	88.99	89.18	93.72
Camponotus compressus	2.07	10.05	12.97	9.14	6.78	10.83	5.72
Pheidole sp.	96.50	87.07	80.03	78.00	89.74	87.09	92.69
Solenopsis geminata	0.94	1.25	6.38	11.00	2.86	0.64	0.61
Leptogenys chinensis	0.47	1.25	0.59	1.42	0.60	1.16	0.96
Pachycondyla sp.	-	-	-	-	-	0.25	-
Monomorium indicum	-	0.35	-	0.42	-	-	-

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