STUDIES ON THE ENVIRONMENTAL IMPLICATIONS OF ANTS (HYMENOPTERA: FORMICIDAE) ASSOCIATED WITH TWO SYNANTHROPIC ENVIRONMENTS IN AWKA, NIGERIA

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ABSTRACT

A study of ants associated with two synanthropic environments in Awka was carried out in 2008 using pitfall and bait traps. The study yielded a total of 561 ants with 409 obtained from the hemisynanthrophic environment while 192 ants were collected from the endophilic environment. The percentage occurrence, total distribution and average numbers of trapped individual species of Paratrechina, Acantholepis, Pheidole and Camponotus in the hemisynanthrophic environment are (16.9%, 2,6), (35.3%, 150, 12.5), (40.1%, 170, 14.2) and (7.6%, 23, 2.7) respectively. The percentage occurrence, total ant distribution and average number of trapped species of Acantholepis and Pheidole sp. using honey as bait are (47.19%, 49, 2.3) and (52.9%, 55, 13.8) respectively whereas Paratrechina, Acantholepis and Pheidole sp. shows (43.8%, 21.5, 3), (31.40%, 15, 3.8) and (25%, 12, 3) respectively when sugar was used as bait. The study further reveals different dispersion patterns and degree of variability between species in the hemisynanthrophic environment. Pheidole sp. and Acantholepis were also trapped in high numbers. The paucity in the collection of Paratrechina and Camponotus is possibly suggestive that these species are not attracted to honey baits. The attraction of more Paratrechina species to sugar bait indicated that these species are sugar loving ants.

Keywords: Environmental implications, Ants, Hymenoptera, Formicidae, Synanthropic environments

INTRODUCTION

The success of ants has been attributed to their social organization, ability to modify their habitats, tap resources and defend themselves (Holldobler and Wilson, 1990). The majority of ants are general predators or scavengers, feeding on a wide range of prey including other arthropods and seeds. Adult ants feed exclusively on liquid foods. They store food when available and distribute it to the colony in times of shortage (Agosti and Johnson, 2005). Andersen (1993) reported that while most ants will feed on a wide variety of foods, others specialize on a much narrower range.

Workers specialize in tasks according to their sizes. Workers forage in the canopy and below the canopy (Janzen and Caroll, 1983; Bennett and Breed, 1985; Harrison *et al.,* 1987; Belk *et al.*, 1989; 1989) and on the ground (Bennett and Breed, 1985)

The importance of ants and the increasing need to have adequate knowledge of them have necessitated evolving many sampling methods to help in their study. However, there is no single universal method of accurate sampling of ants. According to Upton (1991) hand collecting consists of searching for ants everywhere they are likely to occur, as foragers, while pitfall is extensively used in studying surface dwelling arthropods including ants. Trapping procedures have two basic requirements: the insect must move and the trap must hold captured insects. These traps can also be either attractive (e.g. bait trap) or passive in their mode of collection (Pedigo and Rice, 2006)

According to National Honey Board (2002), honey is farmed and used all over Nigeria, originally harvested from the wild but today agriculture is a growing industry in many parts of Nigeria, with its flavour varying mainly depending on source. They also observed that there was no significant difference in the elemental content of honey from different locations. White (1975) also noted colour and composition is also dependent on the flower that supplied the nectar with such colours including white, reddish, brown and amber colour among others.

Ebiringa and Echebiri (2004) also reported that honey contained 16.63% moisture, 30.85% dextrose, 38.33% fructose, 0.07% ash, and 0.2% total acids with pH, specific gravity and free acidity of 4.35, 1.403 and 21.75 meg/kg respectively. Omar *et al.* (2004) who noted that honey contains the sweetest of all sugars in nature with valuable potential energy (and with levulose being of greater importance) reported that honey contains 73.31% invertase sugar, 2.63% sucrose, 2.89% dextrine, 1.08% nitrogen substance, 18.96% water and 0.24% ash. In describing the distribution of ants, in the study areas the terms hemisynanthrophic and endophilic (Baumgartner and Greenberg, 1985) denote the ants degree of synanthropy. Lincoln *et al.* (1985) therefore aptly used synanthropy to refer to a situation where an organism like the ant lives close to human habitation as opposed to exanthropy when such species live far away from human dwelling.

This study is therefore aimed at identifying and assessing the populations of ants that are associated with two synanthropic environments and their implications in Awka using pitfall traps and bait traps containing liquid honey and sugar separately for the outdoor and indoor populations respectively. Attempts will be made to study the relative abundance of ants from the two environments and to determine the foraging ant species in these environments.

MATERIALS AND METHODS

Study Area: The present research concentrated on two synanthropic environments in Umugbunu of Awka capital territory. Awka is situation between latitude 5 and 6 25^0N and longitude 7^0E and 8^0E, and located in the lowland rainforest zone of Southern Nigeria (Keay, 1965; Charter, 1970). The town stretches in an East-West direction along the Enugu-Onitsha express highway and 5km in a North-South orientation. The built up area consists of 1,207,800m^2 or 12,007 hectares.

Ecologically, Awka lies in the Guinea Savannah experiencing between 1,000mm and 1,500mm of rain yearly. It experiences two seasons – the dry and the west season with a bout of harmattan from December to January. A north-south and East-west escarpment gives Awka its topographic character.

Umugbunu is located between Okpuno and Umudioka, two of the 33 villages that make up Awka. The features of this area include presence of sparsely distributed buildings consisting of student hostels with patches of herbaceous plants including *Sida acuta,* Burm, *Tridax procumbens* L.*, Axonopus compressus* Sw.

In describing the distribution of ants, in the study areas the terms hemisynanthrophic and endophilic (Baumgartner and Greenberg, 1985) denote the ants degree of synanthropy. Lincoln *et al.* (1985) therefore aptly used synanthropy to refer to a situation where an organism like the ant lives close to human habitation as opposed to exanthropy when such species live far away from human dwelling.

Sampling Techniques: A study of ants in two synanthropic environments of Umugbunu in Awka, Anambra State was carried out during the wet season between June and July 2008. Pitfall and bait traps were used for ant collection. The baits were sugar and honey. The bait trap was made up of uniform plastic jars 16cm depth and 5.00cm diameter with eight perforations (5.00mm diameter each) on their lid. In sampling for endophilic ants, the bait traps were placed indoors on the floor in inhabited and uninhabited buildings. Throughout the sampling period, the doors and windows were left ajar for inhabited buildings. At each location, six traps, each containing one of the two baits in each case were placed on the ground, at least two meters apart. The pitfall traps consisted of six containers of 3.5cm depth and 6cm diameter buried in the ground with the rim left open and flushing with surrounding surface. Each trap was filled with 5% formalin up to two-thirds the size of each container. Sampling was from 6.00am in the morning to 6.00am, the following day and ants were collected at 24 hourly intervals. The pitfall traps were used in sampling hemisynanthrophic ants. Six samples each were taken from hemisynanthrophic environments while six samples were taken from endopilic environments during the sampling period.

The collections were labeled and preserved in 5% formalin for taxonomic studies. The ants species were identified using relevant keys and with reference to Insects of Nigeria; Checklist and Bibliography (Medler, 1980). The identified ants were verified in the Department of Crop Protection and Institute of Agricultural Research, Ahmadu Bello University, Zaria.

A statistical analysis was carried out on the data. Coefficient of variation and range were also determined for the various ant species collected in both the hemisynanthrophic and endophilic environment in other to compare the relative dispersion of the two sets of data obtained from the two environments.

RESULTS

Table 1 shows the total number of ant species trapped during the weekly sampling, and their relative abundance, in the synanthropic environment using pitfall technique. A total number of 409 ants comprising four different genera were obtained. The highest numbers of ants was trapped in the first week and last week of the study. *Pheidole* and *Acantholepis* sp. occurred highest respectively among the species. *Camponotus* sp. was not trapped in the fourth and fifth week of the study respectively. There was no regularity in trend, in the trapping of these ants in the course of the study.

Table 1: Total number of ant species trapped weekly in the hemisynanthrophic environment in Awka

Month and Year	May 2008			June 2008				Total Ant	Percentage Distribution
Ant Species	I	II	III	IV	V	VI	VII	Species	
Paratrechina	8	12	7	7	9	13	15	71	17.36
Acantholepis	39	20	25	10	8	21	24	147	35.94
***Pheidole* sp.**	26	32	22	16	13	24	37	170	41.56
Camponotus	8	3	1	0	0	4	5	21	5.14
Total per week	81	67	55	33	30	62	81	409	100

Table 2 shows that the total number of ants obtained and their relative abundance in the use of either honey or sugar as bait on the sampling occasions. When honey served as bait, *Pheidole* occurred highest with a relative abundance of 52.90% followed by *Acantholepis* with a relative abundance of 47.12% while *Paratrechina* and *Camponotus* were not obtained at all. However the use of sugar as bait recorded the collection of 48 ants species with

Paratrechina, trapped highest followed by *Acantholepis,* and then *Pheidole.* In general more ant species were collected from the honey-baited traps.

Table 2: Relative abundance of the ant species obtained in the endophilic environment using honey and sugar as baits in the months of May and June 2008

Species	Honey		Sugar	
	Total Ants Collected	Percentage Distribution	Total Ants Collected	Percentage Distribution
Paratrechina	0	0	21	43.75
Acantholepis	49	47.12	15	31.25
Pheidole	55	52.88	12	25
Total	104	100	48	100

Table 3 shows measures of dispersion of the various trapped ant species in hemisynanthrophic environment. For *Paratrechina,* the measures of dispersion (MD, VAR, SD, R) obtained were not so much dispersed from the means as in other species, particularly *Acantholepis* which has a very high measure of dispersion. *Pheidole* sp. and *Camponotus* sp. occurred within the two extremes (highest and lowest) with *Camponotus* having lesser measures of dispersion than the *Pheidole* species.

Table 3: Measures of dispersion of the various trapped ant species in hemisynanthrophic environment

Measures of Dispersion of Ant Species	MD	VAR	SD	CV	R
Paratrechina	0.23	0.07	0.26	0.31	8
Acantholepis	0.59	0.83	0.91	0.52	31
***Pheidole* sp.**	0.50	0.46	0.70	0.34	24
***Camponotus* sp.**	0.23	0.16	0.40	1.08	15

MD = Mean deviation; VAR = Variance; SD = Standard deviation; CV = Coefficient of variation; R = Range.

Furthermore, the coefficient of variation (CV) obtained for each of the species showed that *Camponotus* sp. had the highest degree of variability followed by *Acantholepis, Pheidole* sp. and *Paratrechina* sp. in that order (Figure 1).

DISCUSSION

From the findings of the study, the species of ants *Paratrecina, Acantholepis, Pheidole* sp., and *Camponotus* sp., trapped were also among the nine species recorded in a study in Awka by Ewuim (1996) using pitfall technique. In this study four ant species were obtained from a synanthropic environment while three species were obtained from endopilic environment. The higher occurrence is possibly as a result of the longer period of trapping and larger surface area in the hemisynanthrophic environment and difference in the trapping techniques used. The use of pitfall trap enhanced their trapping as previously reported by Greenslade (1973). Higher pitfall capture is also a reflection of the locomotory activity of the arthropods which is in line with early report of Williams (1959). Most of the ant species were found to live in soil where they can make nests in mounds, aboreal cavities, and wood which are all found in the hemisynanthrophic environment and in accordance with works of Bennett and Breed (1985) and Breed and Harrison (1989).

Pheidole sp. and *Acantholepis* were also trapped in high numbers. The higher occurrence of *Acantholepis* is in the line with previous study by Ewuim (1997) who observed that *Acantholepis* species were very active surface dwelling forms, found in habitats where environmental factors favour their foraging. *Camponotus* sp. was the lowest in occurrence, possibly because of the paucity of their nests at the sampling sites, in addition to the open nature of the habitat, and limited food sources which affected their foraging and invariably their trapping in the endophilic environment. *Pheidole* sp. had greatest percentage of relative abundance showing that *Pheidole* species were attracted more to the honey bait than other species and possibly because of presence of more satellite nests of *Phedole* in the endophilic environment.

The paucity in the collection of *Paratrechina* and *Camponotus* is possibly suggestive that these species are not attracted to honey baits. Under natural conditions, *Camponotus* sp. (Carpenter ants) nest in live on dead trees, and in rotten logs and stumps, and also construct their nests in houses, telephone poles, and other wooden structures including window sills together with wood in contact with the soil (Day, 1996). It is therefore possible that these species failed to have many satellite nests usually traceable to their parental nests (Merchant, 2003) in the exothropic environment, hence their low trapping.

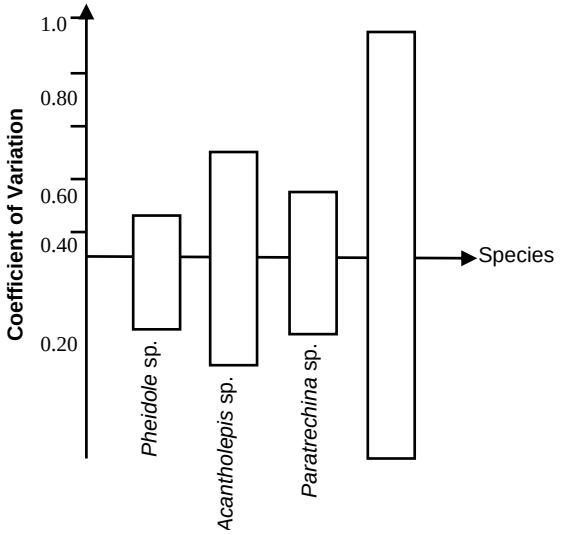

Figure 1: Coefficient of variation (CV) obtained for ants (Hymenoptera: Formicidae) associated with two synanthropic environments in Awka, Nigeria

The attraction of more *Paratrechina* species to sugar bait indicated that these species are sugar loving ants. It was also generally observed that greater numbers of ants were trapped using honey as bait

when compared to those of sugar in the endophilic environment. This result might be traced to the sweetened nature of honey and the presence of levulose in it (Omar *et al.,* 2004) and the flavour of the residues of essential oil components usually found in honey including thymol, menthol, eucalyptol, and minute camphor concentrations (Nozal *et al.,* 2002; Lazaro *et al*., 2005). The four species were found in the chosen hemisynanthrophic environment while *Camponotus* sp. and *Paratrechina* were the only species that did not occur in the endophilic environment indicating that most of the species live in the hemisynanthrophic environment.

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