The Effect of Harvester Ants (*Messor* spp) Nests on Farmers' Productivity in Semi-Arid Zone of Maiduguri, Nigeria

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ABSTRACT

Field survey is carried out on cowpea, millet and groundnut farms in five villages of Maiduguri area located in the North Eastern Nigeria (Latitude 11°51'N and Longitude 13°16'E) from October to December, 2010 and 2011 to investigate the effect of harvesters' ants (Messor spp) on farmers productivity in semi-arid zone of Maiduguri, Nigeria. Five farmers' farms were randomly selected from each crop (Cowpea, groundnut and millet) being the predominant crops cultivated in the area) for the survey. The primary aim of the survey is to assess ant nest size, nest area and the number of plant loss caused by the ants activities. Data for the study were generated through physical examination and measurement using measurement tape. The readings of the measurement were recorded. Data obtained from the field survey was subjected to analysis of variance (ANOVA) and the means were separated using least significant difference (LSD) at 5% level of probability. The survey shows that all the farms had different nest sizes that were not significant from one another but their nest area and plant loss were significantly different from one another. Millet farms had the highest nest area and a corresponding plant loss than groundnut and cowpea farms. Arable crop farmers in Maiduguri area are advised to manage or avoid harvester ant nests in their farms to reduce loss of their crops during cropping seasons.

Keywords: *Harvester ants, Ant nest, nest size, nest area, Crop Loss, Messor species*

INTRODUCTION

Harvester ants (*Messor* spp) *(Hymenoptera: Formicidae)* are social insects and important pest of cultivated crops in the tropics and sub-tropics (Pretto and Forti, 2000). They are soil-dwelling ants living in perennial, complex colonies in which abound queens, alates workers, males and females, differing in size and function. Harvester ants are very common in the arid and semi-arid savanna environment characterized by patchy distribution of water and vegetation (Steinberger, Leschner and Shmida**,** 1991, Heatwole, 1996). In the West African savanna regions, *Messor galla Forel* and *Messor cretomyrmex regalis* Forel are the two main species of harvester ants identified (Deborah, 1984). Harvester ants are major graminivorous species because they devastate cultivated crops by collecting sown and fallen seeds, climb plant and harvest mature seeds and also reduce plant stand

by foraging on cultivated crops (Jago, 1993, Ireland and Andrew, 1995, Ajayi, Lale and Buahin, 1999). Many harvesters' ant species prevent infested seeds from germinating through the secretion of a herbicide on them and by exposing seed to heat (Jorgense and Porter, 1982, Fasoranti, 1997, Azarate and Peco, 2003). The consequences of the foraging activities of harvesters' ants on food crops have been reported to cause colossal crop loss and significant crop yield loss (Ajayi, Sastawa and Lale, 2001). Harvester ants are social insect which attack and destroy crop stands, in the field and also feed on the seed of these crops thereby causing or resulting in the quantitative losses on the crops produce and consequently affecting the overall output of the farms' produce in the arid and semi-arid regions of Africa (Ajayi, Lale and Buahin, 1999, Ajayi, Sastawa and Lale, 2001). Harvesters' ants are known to forage, patrol and maintain their nest by cleaning vegetation at the edge of the clip piece of vegetation of the nest yard with their mandibles thereby destroying every useful and unuseful vegetation around their nest causing crop loss (Jorgense and Porter, 1982). Losses of up to 13.8kg of groundnut pods and 54.8kg of haulms on a farmland have been reported (Ajayi, Lale and Buahin, 1999). The path-way of harvesters' ant and the vicinity of nest do not have vegetation and also crops of any type do not grow or if they grow the ant forage on them completely rendering the vicinity vegetation and crop-free as part of nest maintenance (Deborah, 1984, Jago, 1993, Heatwole, 1996 and Pirk and Lopex de Casenave, 2006). There is a dearth of information on the effect of the ant nests size, nest area and corresponding crop losses caused by harvester ants in Maiduguri area. This survey therefore is conducted to investigate the crop losses caused by the foraging activity of the harvester ant in Maiduguri area of Nigeria.

MATERIALS AND METHOD

Field survey were conducted on five farms each of cowpea, groundnut and millet around Maiduguri area (Latitude 11°51'N and Longitude 13°16'E) from October to December in 2010 and 2011. The five farms were randomly selected from the surrounding villages within Maiduguri area namely University farm, Molai, Fori, Abba Ganari and Dala Lawanti. The choice of the five villages and the three crops were because they are nearby and the crops are the predominant ones cultivated in these villages due to short rainfall duration, soil conditions and low amount of rainfall. Maiduguri has an annual rainfall of between 450 – 600mm, a relative humidity of 49% with temperature range of 28 – 46°C.

The parameters investigated during the survey were the number of harvesters' ants nest per farm, the radius of the ant nests measured using a measuring tape and the crop loss calculated. The radius of the ant nests were measured by putting the measuring tape across the nest, that is from one end of the nest to another crossing through the centre of the nest. The readings were measured carefully in metres. The ants nests area was obtained by using the formula (πr^2) whereas the total farm area was estimated by visual observation. The number of crop loss recorded was determined by dividing the occupied farm area by ants nests with the estimated plant spacing of each crop, taking into consideration that the three crops have different plant spacing.

$$\left(Mean\ Plant\ Loss = \frac{Total\ ant\ nest\ area}{\text{Re}commended\ Plant\ Spacing} \right)$$

Data obtained from the field survey was subjected to analysis of variance (ANOVA) and the means were separated using least significant difference (LSD) at 5% level of probability.

RESULTS AND DISCUSSION

Abundance of *Messor* spp nests and cowpea crop loss: Table 1 show the ant nest count taken on cowpea farms in Maiduguri. The survey showed that there was no significant difference in size of ant nests among the five cowpea farms surveyed. However, there was significant difference among the means of nests area and cowpea crop loss in the farms. Cowpea farms in Dala Lawanti had the highest mean nest areas and mean crop loss (32.58m^2 and 17.33) followed by cowpea farms in Molai village (22.89m^2 and 12.18) while cowpea farms in Abba Ganari had the lowest mean nest area and mean crop loss (14.61m^2 and 7.77). There was no significant difference between mean nest areas and crop loss of cowpea farms in University and Fori farms.

The highest mean nest areas and cowpea crop losses recorded in Dala Lawanti indicate that cowpea farms in the area were seriously occupied by *Messor* spp and had caused colossal loss to cowpea crops. This loss of crop stands will definitely affect the cowpea yield in those farms. This finding agrees with the result of Pirk and Lopex de Casenave (2006) who report that harvesters' ants nests when they are present in large number and size can cause heavy loss to crops and pasture if left uncontrolled. The survey result also implies that harvesters' ants foraged and established their nests more in Dala Lawanti cowpea farms than in other cowpea farms in the other four villages (Jago, 1993 and Heatwole, 1996). The lowest mean nest area and mean cowpea crop loss in cowpea farms located in University and Fori villages of Maiduguri indicate that ants foraging activities were lower hence the lower nest areas and lower cowpea crop loss (Fasoranti, 1997, Ajayi, Lale and Buahin, 1999).

Abundance of *Messor* spp nests and Groundnut crop loss: Table 2 show the survey results on the harvesters' ants nests count, mean nest areas and groundnut crop loss in five villages of Maiduguri area. All the five groundnut farms in each village had nest sizes that were not significantly different from one another. However, all the mean nest areas and groundnut crop loss were significantly different from one another. The survey showed that groundnut farms in Abba Ganari (28.29m^2 and 18.93) had the highest nest areas, followed closely by groundnut farms in Dala Lawanti (21.81m^2 and 14.54) and Fori (21.51m^2 and 14.34) while University farm (17.62m^2 and 11.75) had the lowest nest area and groundnut crop loss. The highest mean nest areas and plant loss in Abba Ganari groundnut farms indicate that *Messor* spp foraging activities were more hence the highest crop loss in these farms (Ajayi, Lale and Buahin, 1999, Ajayi, Sastawa and Lale, 2001, Azarale and Peco, 2003). The consequences of the foraging activities of harvesters' ants on food crops led to the expansion of their nest areas and the subsequent loss of quite a number of crop stands (Holldobler and Wilson, 1990).

Abundance of *Messor* spp Nests and Millet Crop loss: The mean nest size, nest area and millet crop loss taken on five millet farms in five villages in Maiduguri area is presented on table 3. The survey results showed that there was no significant difference in *Messor* spp mean nests size during the survey among the five millet farms, but there were significant difference among the mean nests area and millet crop loss. The mean nests area and millet crop loss recorded in University farms (27.67m^2 and 13.63) were the highest than the remaining millet farms in the four villages in Maiduguri. This result was followed by survey results of Dala Lawanti (23.73m^2 and 11.74), Fori (22.15m^2 and 10.91) and Molai (20.54m^2 and 10.12) while Abba Ganari (16.77m^2 and 8.26) had the lowest nests area and millet crop loss. The highest mean nest area and millet crop loss in the University farms indicate that there was more and serious foraging activities of the ants in those farms than in the other millet farms surveyed during those two years (Jago, 1993, Fasoranti, 1997, Ajayi, Lale and Buahin, 1999). The lowest nest area and crop loss in Abba Ganari millet farms implies lowest ants foraging activity in the area (Deborah, 1984).

Comparison of *Messor* spp nest size, nest area and Crop losses on three Crops in farmers' farms: Survey results collected on *Messor* spp nest size nest area and on three crop losses are presented on table 4. The mean nest size and mean nest area of the three crops were not significantly different from one another. However, mean crop losses of the three crops were significantly different from one another. Millet farms had significantly the highest mean nests area and crop loss (22.18m^2 and 16.93), Groundnut farms had moderate nests area and crop loss (21.77m^2 and 14.53) while cowpea farms had the lowest nest area and crop loss (20.96 and 11.50). Highest millet crop loss during the survey period could be probably due to the serious foraging activity and nest maintenance which caused quantitative loss of the crops (Jago, 1993, Ireland and Andrew, 1995, Ajayi, Sastawa and Lale, 2001). This survey result also shows that millet crops were more vulnerable to harvesters' ants attack in the field in Maiduguri, semi-arid region than the other two crops. Harvesters' ants are major pests of graminivorous crops because they devastate both the cultivated crops by collecting sown and fallen seeds, climb plant and harvest young and mature plants thereby reducing plant/crop stands (Jago, 1993, Ajayi, Lale and Buahin, 1999, Ajayi, Sastawa and Lale, 2001; Pirk and Lopex de Casenave, 2010). Harvesters' ants diet is composed almost exclusively of seed and generally limited to a restricted number of plant species due to species specific, seed selection and preference which are important mechanism in promoting species coexistence (Pirk and Lopex de Casenave, 2006, Pirk *et al*., 2009).

Table 1: Abundance of harvester ant nests and cowpea crop loss in Maiduguri area in 2010 and 2011

Cowpea farms	Mean nest size (m)	Mean nest area (m2/farm)	Mean crop loss/farm
University farm	1.18	18.25	9.71
Fori	1.40	16.49	8.77
Abba Ganari	1.17	14.61	7.77
Molai	1.27	22.89	12.18
Dala Lawanti	1.20	32.58	17.33
SE	0.67	8.55	0.82
LSD (0.05)	1.50^{NS}	7.91	1.82

Values are means of five farms NS = Not Significant

Source: Survey, 2010 - 2011

Table 2: Abundance of harvester ant nests and groundnut crop loss in the area in 2010 and 2011

Groundnut farms	Mean nest size (m)	Mean nest area (m2/farm)	Mean crop loss/farm
University farm	1.53	17.62	11.75
Fori	1.14	21.51	14.34
Abba Ganari	1.20	28.29	18.93
Molai	1.28	19.63	13.09
Dala Lawanti	1.40	21.81	14.54
SE	0.42	3.15	0.82
LSD (0.05)	0.93^{NS}	7.02	1.82

Values are means of five farms
Source: Survey, 2010 - 2011

Table 3: Abundance of harvester ant nests and millet crop loss in Maiduguri area in 2010 and 2011

Millet farms	Mean nest size (m)	Mean nest area (m^2)	Mean crop loss/farm
University farm	1.18	27.67	13.63
Fori	1.33	22.15	10.91
Abba Ganari	1.30	16.77	8.26
Molai	1.03	20.54	10.12
Dala Lawanti	1.15	23.74	11.74
SE	0.25	1.32	1.21
LSD (0.05)	0.55^{NS}	3.64	2.70

Values are means of five farms
Source: Survey, 2010 - 2011

Table 4: Comparison of Crop Losses caused by *Messor* spp. on Farms in the area in 2010 and 2011

Crops	Mean nest size (m)	Mean nest area (m^2)	Mean crop loss/farm
Cowpea	1.24	20.96	11.50
Groundnut	1.31	21.77	14.53
Millet	1.20	22.18	16.93
SE	0.19	2.10	1.06
LSD (0.05)	0.37^{NS}	4.23^{NS}	2.13

Values are means of five farms
Source: Survey, 2010 - 2011

CONCLUSION

The effect of harvesters' ants (*Messor* spp) nests on farmers' productivity in the semi-arid zone of Maiduguri, Nigeria was surveyed with the major aim of assessing ants' nests size, nest area and the number of plants loss caused by the ants' activities. The Survey shows that harvester ants (*Messor* spp) forage maintain their nest vicinity and pathways in farmers' farms. These activities result to destruction of crop stands during cropping seasons. Though their nests are of different sizes and shapes but their total area covered by the colonies had led to large areas and these large nest areas caused colossal crop losses. In this survey, it was found that large areas of millet, cowpea and groundnut farms were destroyed by the ants and consequently many crop stands were lost due to their foraging and maintenance activities. The survey showed that millet crop stands were destroyed more than groundnut and cowpea crop stands during the two years survey in Maiduguri area. Further studies should be conducted on the control and crop yield loss caused by harvester ants in Maiduguri area.

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