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Comparative Study of *Azadirachta Indica* and Apronster 42WS as Seed Dressing Agents against *Messor Galla* in Borno State, Nigeria

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Abstract: **Harvester ants (*Messor galla*) are very active pest which carry away small grains from store, and they also remove planted seed from planting holes thereby causing poor seedling establishment, therefore seed are dressed by chemical pesticides before planting. The seed dressing chemicals are not available resources of poor farmers, so after seedling establishment they continue to supply missing stands leading to staggered planting. This unavailability has led to the search for alternative seed dressing agent that will be readily available and cheap for the use of the resource poor farmers. The research was conducted in university of Maiduguri. The effectiveness of the neem formulation as seed dressing agents against harvester ants (*Messor galla* forel) was investigated using field experiment. Treatment agent used are neem seed powder, neem seed oil, neem seed aqueous extract and apronstar 42 WS. Among the various treatment agent used, the result indicated that neem seed oil is the most effective treatment agent. The result in general indicated that neem seed oil formulations is better than apronstar 42 WS which is one of recommended seeds dressing chemicals. The result of the toxicity test also indicated that neem seed oil is very toxic to harvester ants, next to it is the apronstar 42 WS. Neem seed powder and neem seed aqueous extract are less effective than neem seed oil and apronstar in terms of toxicity.**

Keywords: **Messor galla, Apron star 42 WS, Neem, Seeds, seed dressing agents.**

1. INTRODUCTION

Harvester ants (*Messor* SPP) (*hymenoptera: formicidae*) are social insects and important pest of cultivated crops in the tropics and sub-tropics [**1**]. Harvester ants are among the most Ubiquitous and familiar insects occurring in vast numbers in all habitats but not extremely cold region. They have become closely associated with humans occupying their dwelling throughout the world, including Metropolitan area. Despite great variation in geographical location and habitat practically all ants are recognizable by etiolates abdomen and elbowed antennae [**2],**[**3**].

In every year ants produced a generation of winged queen and males which has the nest large swarm and nuptial flight. The males die after the flight, the queens drop to the ground, break off their wings and look for place to lay their eggs and queens continue to lay fertile eggs several years without further mating [**4**]. The queen tends her first brood of offspring during larval stage and pupa stages. These later broods consist of all these basic castes [**4**]. The above colony formation tends to increase the number of the organism forming several new colonies, hence disturbing farming practices [**5**]. In deserts, ants are major consumers of the seeds of annual plant and growth rate of rodents who depend on same food reduce in number.

Harvester ants gather and stores certain wilds grass seeds and cultivated grains in the flat granaries of its nest which consists of many tunnels and chambers [**6],**[**7**). They do not only gather the seeds that have fallen to the ground, but also plucks them directly from plants, husks them and deposits the chaff on the kitchen middens at the periphery of the mounds [**8],[9**).

The harvester ants normally keep its nest clean all the time, for this reason they cause a great damage to plant that fall within their compounds. Because of their feeding activities and colony formations harvester ants become a problem to the society particularly to farmers [**10**]. Harvester ants have become a major pest to farmers in some area, this is because the swarm into houses, farmland and store and injures seeds, seedlings, fruit and citrus tree causing great economic loss. Farming activity plays an important role in the ability of any nation to feeds its citizens therefore, if the harvester ants were not properly controlled, farming will continue facing problems at planting, harvesting, seed germination and storage period [**9]**, [**11**].

The losses associated with *Messor galla* on farm land has become too much which necessitate the application of measures such as use of chemical pesticides like dichloro diphenyl trichloroethane (DDT) and organochlorine, organophosphate compounds, and synthetic pyrethroids applied under the national program guidelines. From the beginning the insecticide method has been very successful until when the resent year's research revealed that the control of pests are becoming increasingly difficult, because the effectiveness of synthetic insecticide control methods has declined, due to various factors of human behaviour, resistance by the vectors, administrative, and prohibitive costs. It has also been observed that use of synthetic pesticide has resulted into several serious problems, some of which have been linked with human health hazards, ranging from short term impacts such headaches and nausea, to chronic impacts like cancer and endocrine disruption. Acute dangers incudes nerve, skin and eye irritation and damages. Secondly synthetic insecticide has also been linked with environmental contamination, because they are poisonous compounds and are adversely affecting other organisms besides harmful insects. National Vector Borne Disease Control Program (NVBDCP), revealed that accumulation of some insecticides in an environment can in fact pose a serious threat to both wildlife and domestic animals. Most of the deaths occurring among African children and pregnant women living in mosquito endemic countries are on increase every year. It is desirable to find compounds that effectively control *Messor galla* with minimal damage to the environment [**12]**.

2. MATERIAL AND METHOD

Materials required are 24 petri dishes, freshly prepared neem seeds oil, neem seed powder, apronstar 42 WS, sorghum and millet, wide mouth bottle, marker and water.

2.1 Collection of Materials:

24 petri dishes were collected from biological sciences laboratory, university of Maiduguri. Neem seeds were also collected, under different neem trees around sports complex area, University of Maiduguri and some were collected under neem trees around works department university of Maiduguri and some of the seeds were collected at Kala'a, Hong Local Government Area Adamawa State. Apronstar 42 WS supplied to me by my supervisor Dr. (Mrs. Anaso), while Sorghum and Millet were collected from my sister's house at Dambowa road, Maiduguri. Neem seed oil was purchased from a staff of biological Science University of Maiduguri.

2.2 Preparation of Materials:

2.2.1 Preparation of Neem Seed Powder:

The neem seeds were decorticated, winnowed and air dried. When the seeds were totally dried, they were ground into powder using electric blender. For aqueous neem seem extract, 500g of millet and *Sorghum were sucked separately with* 5g of neem seeds powder in 200ml of water in a wide mouth bottle, stirred and left for about 12 hours. Then the seeds were removed and air dried.

2.3 Site of the Experiment:

Field study were conducted in University of Maiduguri (Latitude $11^0$51'N and Longitude 13^0 16'E).12 harvester ant nest were identified between B-block, E-block and sports complex of University of Maiduguri.

2.4 Method:

Six among the twelve harvester ant nests that were located between B- block, E-block and sports complex were used as the site A, for the experiment and the remaining six nests, were used for second site B of the experiment.

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2.5 Seed Dressing:

200g of *Sorghum* seeds were mixed with 5g of newly prepared neem seed powder. Then one hundred grains of sorghum were counted into petri-dish and replicated six times. The same procedure was followed for millet. 5ml of freshly prepared neem seed oil was mixed with 200g of *Sorghum* seeds and then hundred grains of *Sorghum* were counted and placed into a petri-dish and replicated six times. The same procedure was followed for millet. In another set-up 200g of *Sorghum* was wetted with 20ml water and 5g of Apronstar 42 WS was added and mixed. The same thing was done for millet seeds. Aqueous neem seed extracted of 5g of neem seed powder was put into wide mouth bottle, then 200ml of water was added to form solution and 200g of *Sorghum* seed were added and this was allow to stand for 12 hours before the seed were removed and hundred grains of *Sorghum* were counted and place into petri-dish which replicated six times. The same procedure was followed for millet. Before placing of treated seeds each petri-dishes were labelled by marker for clear differentiation. Seeds treated with neem seed oil were marked as TA, seeds treated with apronstar were marked as TC, seeds treated with neem seed powder were marked as TB and seeds treated with aqueous neem extract were marked as TD, while control is marked TE.

2.6 Site A of the Experiment:

The Petri-dishes containing the preparations were placed around the *Messor galla* nests and these were kept under close watch for a period of five (5) hours, from 6:00am-10:00am after which observation was made. The various treatments were placed five (5) metre away from the harvester ant's entrance hole. Each harvester ant nest compound contain ten (10) petri-dishes, five petri-dishes containing *Sorghum* and remaining five petri-dishes containing millet seeds. After five hours the number of seed left on the petri-dishes were counted, and subtracted from initial seed placed, this gave the number of seed picked by *Messor galla* for each treatment. The data observed was subjected to ANOVA

3. RESULTS

3.1 Effectiveness of Various Treatments on Picking of Sorghum Seed by Harvester Ants on Site A:

Table 1: Percentage of *Sorghum* seed picked by harvester ants on site one

Treatments	Days		
	1	2	3
TA	18.67	0.50	0.17
TB	71.83	75.67	0.33
TC	66.83	50.50	1.67
TD	80.68	70.88	1.67
TE	90.16	90.00	2.50
LSD 0.05	31.43	41.74	Ns
0.01	43.47	57.69	
	**	**	

Ns= not significant
**= significant at 1% level of significance

On day one of the experiment result showed that neem seed oil is more effective than any other treatment in protection of *Sorghum* grains against harvester ants, because, less number of Sorghum seeds were picked and showed a significant difference at 1% level of significant. Neem seed powder shows no significance difference to control, that means it was not effective. Apronster 42WS was also significant (P=0.05) but neem seed oil was more effective seed dressing agent (P=0.01) than apronstar 42ws, which is the recommended synthetic seed dressing chemicals.

On day two of the experiment the result indicated that neem seed oil is the only effective seed dressing agent, for the control of seed removal by harvester ants (P=0.01). Neem seed powder and apronstar 42ws showed no significant difference, to control.

On the third day of the experiment, the general result indicated that the rate of picking was drastically reduced, because only few of the life harvester ants were seen around the nest most of them found death. The result of the experiment

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indicated that neem seed oil is the most effective treatment because it has the lowest number of seeds picked. But statistically, the result showed on significant differences among treatment.

3.2 Effectiveness of Various Treatments on Picking of Millet Seed by Harvester Ants on Site A:

TABLE 2: Percentage of millet seeds picked by harvester ants

Treatments	Days		
	1	2	3
TA	4.83	2.83	1.00
TB	57.83	31.00	1.67
TC	84.00	64.83	1.83
TD	90.23	71.32	2.00
TE	98.30	80.50	5.00
LSD 0.05	25.00	30.41	0.02
	**	**	**

NS= Not significant
** Significant at 1% level of significant.

Day one of Table 2 showed that neem seed oil, neem seed powder and apronstar 42WS are effective. Neem seed oil and need seed powder showed significant difference (P=0.01), while the Apronstar showed no significant difference that means it is not effective.

On the day two of the experiment the result indicated neem seed oil and neem seed powder showed significant difference (p=0.01) while Apronstar 42ws showed no significant difference to control. Comparing the number of seeds picked by harvester ants from the petri-dishes less seed were picked from petri-dishes containing seeds treatment with neem seed oil indicating it high effectiveness. On the contrary, the result showed that among all the treatments more seeds were picked from the petri-dishes that containing seed treated with Apronstar 42ws.

On the third day of the experiment, the result indicate that the rate of picking was reduced drastically. The result of the experiment showed significant difference (P=0.01). Comparing the number of seed picked from petri-dishes seeds treated with neem seed oil indicated high effectiveness, while seeds treated with aqueous neem seed extract, showed high number of seeds picked.

3.3 Effect of Various Treatments on Picking of Millet Seeds by Harvester Ants (Messor Galla Forel) Site A:

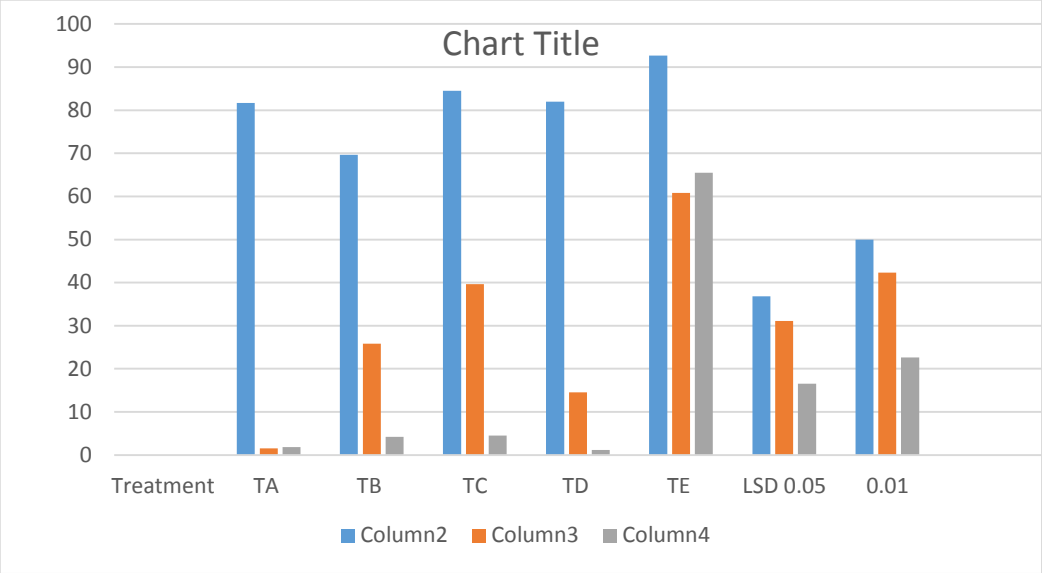

Fig 1: Percentage of millet picked by harvester ants.

NS= Not significant
**significant at 1% level of significant

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On day one of the experiment using millet seeds the result indicate that neem seed oil is the only effective seed treatment agent among the treatments used in seed dressing against harvester ants. The neem seed powder. Neem seed aqueous extract and Apronstar 42wws showed no significant to control.

On day two of the experiment the result indicate that neem seed oil and aqueous extracts, both shows significant difference at 1% level (P=0.01). Neem seed powder indicated that it is more effective than Apronstar42ws it shows significant difference at 5% level (=0.05), while Apronstar shows no significant difference to control.

Comparing the number of seed picked by harvester ants from the petri-dishes less were picked from seed oil treatment and neem seed aqueous extract indicating their high effectiveness. On the contrary, the result showed that among the treatment more seeds were picked from petri-dishes containing seeds treated with Apronstar 42ws.

3.4 Effects of Various Treatments on Picking of Sorghum Seeds by Harvester Ants on Site A:

Table 3: Percentage of *Sorghum* seed picked by harvester ants on site two

Treatment	Days		
	1	2	3
TA	17.67	0.83	0.5
TB	67.83	24.67	4.5
TC	83.33	29.00	2.50
TD	69.50	19.00	7.83
TE	100.00	57.00	66.83
LSD 0.05	25.24	31.61	13.73
0.01	34.43	43.12	18.78
	**	**	**

** Significant at 1% level of significance.

Table 3 result indicated that the neem seed oil is more effective than the rest of the treatments because less number of sorghum seed were picked and it showed significant difference at 1% level (P=0.01), next to neem seed oil is the neem powder and neem seed aqueous extract, both showed significant difference at 5%level (P=0.05) in the case of Apronstar 42ws it shows no significant difference that means it is not as effective as the neem products.

On day two of the experiment the result showed that the rate of picking has reduced drastically. All the neem seed formulations showed significant difference at 5% level of significance.

On day three off the experiment result indicated that all the treatment are effective and all showed significant difference at 5% level

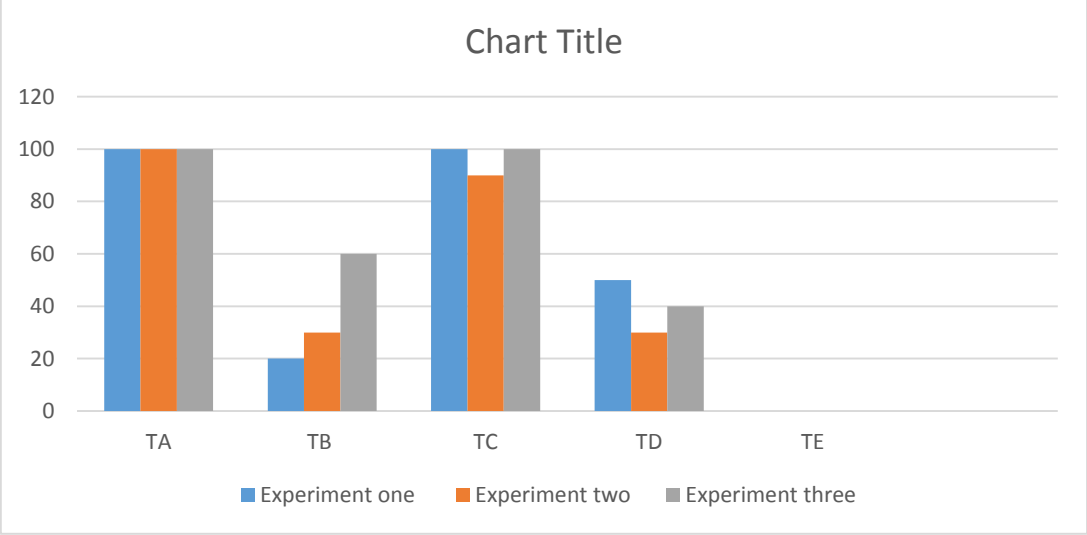

Fig 2: Toxicity of various treatments in percentage (%)

Fig 2 shows the toxic effect of various treatments on harvester ants. Neem seed oil and Apronstar 42WS showed to be the most toxic treatment. Neem seeds oil killed off all the harvester ants used for the experiment followed by Apronster 42WS. The Neem seed products all showed degree of effectiveness against Messor galla. None of the harvester ants died from the control.

4. DISCUSSION

The results of this study showed that *Messor galla* is one of the leading pest problem in the area. This is because up to 100% of the untreated seeds were picked by the ant. This is in agreement with the report by [**13**], that *Messor galla* is the major pest on broadcasted seeds, it is the most common cause of missing stand after the seedling establishment during the planting period.

The result also revealed that neem seed oil (18.67%, 0.50% and 0.17%) of day 1, 2 and 3 respectively of the treatment on *Sorghum* proved to be the most effective seed dressing agents used during the experiment. The second least of sorghum seeds picked was from the treatment of apron star 42WS (66.83%, 50.50% and 1.67%) of day 1, 2 and 3 respectively. Seed powder (0.33%) was only effective on day 2 of the experiment on sorghum. Aqueous neem extracts (1.67%) was also effective on day 3 of the experiment on sorghum. Theodor [**14**] and Abdul-Azeez [**15]** reported similar incidence of high effectiveness of seed powder in repelling insect like mosquito, and *Messor galla*.

The study also indicated high effectiveness of *seed oil* (4.83%, 2.83% and 1.00%) of day 1, 2 and 3 respectively, of the treatment on millet, followed by seed powder (57.83%, 31.00% and 1.67%) of week 1, 2 and 3 respectively. Apronster 42WS (1.83%) of day 3 was also effective.

The different treatment agents used in seed dressing were *Neem seed oil, Neem seed powder,* neem aqueous extracts, and Apronster 42WS. Among all these seed dressing agents used, *neem seed oil* (0.17%) of day 3 of treatment on Sorghum, proved to be the most effective seed dressing agents, followed by apron star 42WS (29.26%). In all the treatment on sorghum, millet, the result indicated that neem seed oil and apron star 42WS were very effective seed dressing agents, because they both showed significant difference at 0.01 significant levels. Neem aqueous extracts and neem seed powder showed significant difference at 0.05 significant levels at most level of the experiment.

4.1 Recommendation:

Previous studies have shown that *Messor galla* control intervention, adapted among farmers to regulate and control the activities of *Messor galla*, include the use of chemicals, plant materials, digging trenches, blocking the holes with sand and cultivating larger grain size. These methods have not been very effective. Farmers are faced with many problems, such as outbreak of diseases from the toxic chemical particles, emergence of pesticide resistance by the *Messor galla* and high financial involvement in buying chemicals pesticide [**16**]. It is therefore recommended that farmers adopt the use of neem seed oil as seed dressing agent, to substitute chemical pesticides which are harmful (toxic) to man and domestic animals. Neem seed oil extract is cheap to produce, and does not encounter much financial involvement when compared with the recommended seed dressing agents (apron star 42WS), which are expensive and again less effective as shown by this study.

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