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Evaluation of Some Plant Products for the Control of the Cowpea Weevil (*Callosobruchus maculatus)*

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Abstract: A laboratory experiment was conducted for fourteen weeks to determine the efficacy of some selected plant product extracts (Azadiracta indica seeds, Aloe vera, flame seeds and Trema orientalis) for the control of cowpea weevil (Callosobruchus. maculatus). The treatments consisted of a local variety of cowpea (kanannado) and four plants extracts (Trema orientalis, Aloe vera gel, flame tree seeds powder, Neem oil and the control. The treatments were laid out in a completely randomized design, replicated four times. Data were collected on Mortality rate, moisture content, Weight loss and Germination percentage. Data obtained were subjected to analysis of variance and treatment means separated using the LSD differences between means were compared at the five percent level of significance. Neem plant extract was used as standard to check the performance of the other plant extracts. The results revealed that by the first few weeks Neem oil being of proven potency showed initial superior performances as compared to the other plant extracts. At the end of the experiment the control treatment and flame tree seeds showed the same degree of control, neem was significantly different from the other treatment while Aloe vera and the control showed the same degree of control.

Key words: Cowpea · Different plant extracts · *C. maculatus*

INTRODUCTION

Like other crops, cowpea is attacked by a wide range of diseases and pests [1]. Almost all parts of the crops are susceptible to insect infestation and more than Eighty five insect species have been found to cause damage to cowpea [2]. *Callosobruchus maculatus* is reported as the most important bruchid that attacks cowpea if unchecked, *C. maculatus* is a field to storage pest. The infestation which starts in the field causes damage that ranges from rendering cowpea unsuitable for consumption to reduced viability and as populations builds up, great losses can be recorded [3]. The seeds lose 30% of their weight [4]. In Nigeria, cowpea losses by beetles have been estimated at 2.44 million tonnes for 1981/82 and 3.67 million tonnes in 1984/85 [5].

In the past control measures adopted by various governments and research institutes were concentrated on storage structures such as barns, granaries (Rumbus) and silos. Thereafter, insecticides were introduced but these sooner than later created such problems as pest resistance, pest resurgence as well as environmental degradation [6] resulting in world-wide call to minimize their usage and to develop less hazardous pest control measures [7]. The persistence nature of most of the chemical insecticide on our environment, coupled with high cost and unavailability at critical periods of requirement, high level of toxicity which bring about deleterious effect on human being, animals and the general environment necessitate the investigate of alternative formulation and dosage rate of some plant (Neem, Aloe vera, flame tree seeds and *Trema orientalis*) as insecticides required for optimum storage of cowpea. The central challenge to increasing cowpea yield is most probably insect pest infestation aside other factors such as lack of capital, poor production technology, poor marketing and inadequate extension services. Fortunately, nature has offered us a profusion of plants for use in crop protection. These plant materials have been used by small holder farmers in Nigeria to protect stored product from insect pest damage for a long time. Although, some of these plant species (Neem, Aloe vera, Flame tree seeds

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and *Trema orientalis*) many have given some measure of control against *C. maculatus* based on individual material used, yet, no attempt has so far been made to specifically screen and coordinate their efficacies in a single experiment.

The objective of this study is to evaluate the comparative efficacy of plant products and to determine which has the best bioactivity against *C. maculatus* on stored cowpea and to ascertain appropriate levels of plant product required for effective control of the beetle on stored cowpea. Problems in the tropics appear to be greater than are obtained in the temperate climate presumably because of optimal conditions of temperature and humidity for pest development found in the former [7]. In Nigeria, *C. maculatus* is a major primary pest of stored cowpea grains although infestation begins in the field and is carried over into the store where it becomes the predominant pest problem [8].

MATERIALS AND METHODS

The experiment was carried out in the laboratory at Samaru College of Agriculture, Division of Agricultural Colleges, Ahmadu Bello University Samaru Zaria-Kaduna Nigeria (11° 11'N,07° 38'686 m above sea level). The experimental materials used for this research were obtained from Samaru market and the materials include a local variety of cowpea (Kananndo). *Trema orientalis (Pigeon wood), Aloe vera, Flame tree seeds* and the neem oil was obtained from NARICT Zaria were used as the treatments. The cowpea seeds used in this experiment were sterilized / fumigated with ½ tablets of Aluminum phosphates in air tight containers for 72 hours to kill any residual infestation or eggs on the grains. The fumigated pulses were spread on a sack at room temperature in the laboratory for 48 hours to neutralize the effect of force toxin on the seed, for subsequent use in the trails. In constituting the treatment dry flame tree seed*s* and *Trema orientalis* (whole plant) were ground to powder and sieved. And the *Aloe vera* gel was extracted from *Aloe vera plant*.

The *Bruchid, C.maculatus,* stocks which are of uniform size and age (between 0-24 hours old) were collected from infested cowpea at cowpea production unit IAR ABU Zaria. The Bruchids were reared in a kilner jar for four [8] weeks for new generation and population build up. Fourty eight (48) Glass jars were used to conduct this trial. Each glass jar contained 200 grames of clean cowpea and five [9] pairs of newly emerged adult bruchids. The experiment was set up in a completely randomized design and there were four replications. 1.00g, 2.00g and 3.00g of the plant products (powders of flame tree seeds, *Trema orientalis* and Aloe vera gel)1.00m,2.00m and 3.00m of Neem oil constituted the treatment, except for the control experiment that was untreated. The 48 treatments were labeled, covered and kept under room temperature in the laboratory for 14 weeks on a table top.

Data were collected on the following parameters:

- Mortality rate
- Moisture content.
- Weight loss
- Germination percentage

However, the variable/ parameters were derived base on the above criteria.

After one week, each treatment was observed for mortality by counting the number of dead and active *C. maculatus* and recorded.

$$\text{Using the formula Mortality rate} = \frac{\text{Number of dead } C.\ maculatus}{\text{Total number of } C.\ maculatus}$$

Data collected were subjected to analysis of variance and treatment means separated using LSD.

The moisture content of the cowpea was determined using electric oven dryer at department of soil science laboratory/ABU, Zaria. The randomly selected samples were placed on petrict dishes and placed into the oven for four hours to dry. The dried sample was removed from the oven at 100 °C and the container was covered to avoid reabsorbtion of moisture from the environment, furthermore, the sample was allowed to cool down for about 2 hour before the reading was taken. The formula below was used in determining the moisture content of the sample.

$$\%\text{Moisture Content} = \frac{\text{Initial weight of dish + Sample-final weight of dish + Sample}}{\text{Initial weight of sample + dish-Weight of dish}} \text{X } 100$$

At the end of the experiment that is the 14th week each treatment was weighted to assess the final weight loss due to feeding of the insect and the data collected were used to find the percentage weight loss.

$$\%\text{ weight loss} = \frac{\text{Initial weight-Final weight}}{\text{Initial weight}} \text{x}100$$

At the end of the 14th week of the experiment the grains were tested for viability and germination. 20 seeds were randomly picked from each jar for all the treatment and placed in a Petri dishes lined with moistened filter paper. These were left on the laboratory bench at a temperature of 27°C for 7 days after which germination percentage was calculated.

$$\text{Using the formula \% Germination} = \frac{\text{Number of germinated seed X100}}{\text{Total number of seed planted}}$$

RESULTS

Mortality rate was decreasing as the weeks after application of treatments increase. At 14th week the mortality was highest for neem followed by aleovera, trema, flame seed. The control had the lowest mortality rate. As shown in figure 1.

At the end of 14th week cowpea treated with Neem oil was the only one that lost moisture while those treated with Flame gain 3.25%, Aloe vera 1%, Trema 0.5% and the control 3.25%.This shows a significantly higher performance of neem over the other treatments at 5% level of significance (Table 2).

Table 1: Moisture Content of Cowpea Samples Treated with Plant Extracts at the Beginning and at 14 Weeks after Treatment

	% of Moisture Content		
	----------		Moisture
Plant Extracts	Initial	Final	Gain or Loss
Neem Oil	2.0	1.0	1[a]
FLAME SEEDS	1.75	5	-3.25[b]
ALOE VERA	2.5	3.5	-1[b]
TREMA	2	2.5	-0.5[b]
CONTROL	2	3.5	-1.5[b]

Means with the same letters in the column are not significantly different at 0.05 level of significance

Table 2: Weight Loss of Cowpea at 14 Weeks after Treatment

	Weight Loss		Change in Weight	
	----------		----------	
Plant Extracts	Initial	Final	%	G
NEEM OIL	200	195	5	2.5[a]
FLAME SEEDS	200	80	120	60[c]
ALOE VERA	200	135	65	32.5[b]
TREMA	200	75	125	62.5[c]
CONTROL	200	60	140	70[c]

Means with the same letters in the column are not significantly different at 0.05 level of significance

Table 3: Germination Percentage of Cowpea at 14 Weeks after Treatment

Plant Extracts	Planted	Germinated	Germination Percentage
NEEM OIL	20	0	0
FLAME SEEDS	20	0	0
ALOE VERA	20	0	0
TREMA	20	0	0
CONTROL	20	0	0

Means with the same letters in the column are not significantly different at 0.05 level of significance

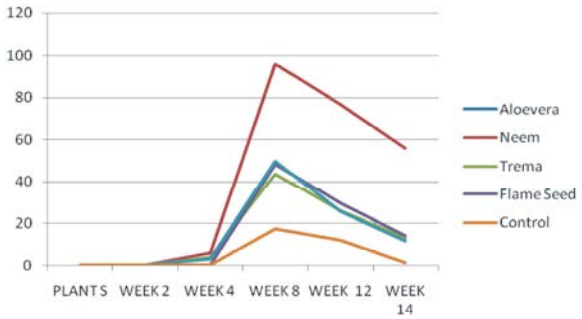

Fig. 1: Mortality rate of *C. maculatus (%)* at different week under different control strategies

At 14th week, cowpea treated with neem has the lowest weight lost (2.5%) as compared to other treatments followed by that treated with *Aloe* vera (32.5%), which was significantly lower to other treatments; Flame powder (60 %), trema (6.52%) and the control (70%) as shown in Tables 2 and 3.There was no significant difference between cowpea treated with Flame powderd, Trema Aloe vera and the control This clearly indicates that Neem oil offer better protection of cowpea against feeding and development of the bruchid. There was no significant difference among the treatment in term of germination percentage (Table 3) at the 14th week. None of the seeds germinated.

DISCUSSION

All the treatments gave varying degree of control over a short period but soon worn out including Neem which is of proven efficacy. The use of *Zanthoxylum xanthoxyloids* bark and root was found to increase high mortality rate of insect as reported by [9]. [3] also found that *Oleoresin* was very effective against legume flower bud thrips and that the toxicity was both time and dose dependent. [9] found garlic to be effective in the control of maize weevil. [4] also found the use of aqueous extract of neem to be effective against cowpea defoliator. All these shows that various plant extracts are effective against insects in different crops

The toxic action could be attributed to the presence of highly pungent secondary metabolites with phenolic properties in the plant reputed for insecticidal activity [10]. Dead insects were observed having their metathoracic wings outstretched from the elytra suggesting that mortality was actually caused by the treatments. In this work, the activities of insects affected the quality of seeds in such a way that none of them germinated which showed that none of the treatment at the level under investigation should be used as a seed protectant for more than 14 weeks. Though the inability of seed treated with neem to germinate was as a result of the neem oil that cover the seed coat and prevent it from germination. The implication of this is that neem may be used for grains preservation but they are not appropriate for seed preservation

CONCLUSION

In conclusion, all the treatments under investigation showed some degree of control but did not suppress progeny emergence over a long period which mean that their ovicidal property was time and dose dependent. The treatment should be used for short term small scale food preservation. It is therefore recommended that higher doses than that used in this research should be investigated for use as grain and seed protect ants. This plant extract could be a promising source of naturally occurring insecticides in storage pest management systems. Resource poor farmers could prepare the plant extract and use them locally, thus becoming economical and safe to farmers and their environment.

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