Evaluation Of Jatropha Curcas Lam. Extracts In The Control Of Some Field Insect Pests Of Cowpea (Vigna Unguiculata L. Walp).

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ABSTRACT: This study was conducted at the Department of Crop Science and Technology Research farm, Federal University of Technology, Owerri, during 2010 cropping season. The experiment was laid out in Randomized Complete Block Design. The plant extracts were tested at four rates (0.00, 1.00, 2.00 and 3.00 ml/ plot), and Pirimiphos-methyl (Actellic 25 E. C) at the rates of 1.25, 2.50 and 3.75 ml/ plot. The plant extracts were mixed with 300 ml of water, and Actellic 25 E. C was mixed with 1 litre of water. Result of the experiment indicated that *J. curcas* seed oil together with Actellic 25 .E. C. reduced the number of tested insect pests (*Aphids crassivora, Maruca testulalis* and *Megalurothrips sjostedti*). Number of pods produced were increased significantly together with total grain yield/ plot compared with the untreated plots. Result on germination test showed that the treatment materials had no significant effect on the viability of cowpea seeds after three months of storage. Generally, the results indicated that the seed oil of *Jatropha curcas* gave significant protection of cowpea seeds against field insect pests of cowpea. They also increased pod number and total grain yield more than the root extracts.

Key words: Actellic 25. E. C., Application rates, Cowpea, Field pests, *Jatropha curcas*, Plant extracts, Seed viability.

1. INTRODUCTION.

Cowpea, (*Vigna unguiculata* (L.) Walp) is one of the most important grain legumes cultivated in the tropics and sub-tropics [16]. The seeds serve as a major source of plant protein, vitamins for man and feeds for animals [28]. Cowpea plays an important role in providing soil nitrogen to cereal crops (maize, millet, and sorghum) when grown in rotation [9]. The young leaves and immature pods are eaten as vegetables [6]. It also serves as source of income to the poor farmers in most parts of the continent [22]. Several investigators reports revealed that 78 % of the farmers in the far North, 48 % in the North and a very small proportion in the Adamawa region intensively cultivate this crop [14]. Insect pests are the major constraints to cowpea production in West Africa. Damage by insect pests of cowpea can be as high as 80-100 % if not controlled [5]. The crop is severely attacked at every stage of its growth by a myriad of insects that make the use of tolerant varieties and insecticide sprays imperative. In West Africa, *Callosobruchus maculatus* F., which is a field -to-store pest, each year, causes losses in cowpea *(V. unguiculata*) and bambara groundnuts (*Vigna subterraca*). Up to 100 % seed damage and 65 % weight loss have been recorded in cowpea within 18 weeks of storage in Northern Ghana [31].

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Also, aphids damage young cowpea seedlings by sucking sap from the undersurface of young leaves and stem tissues, and on the pods of mature plants [27]. Several measures have been adopted to curb the problems of cowpea insect pest infestation. These include the use of chemical agents such as DDT and Lindane, [29] and fumigants. These measures, however, are becoming more and more expensive and less available to the peasant farmers. Though, synthetic insecticides have proved very effective in controlling these beetles, the problems associated with its usage such as; insect resistance, pest resurgence, health hazards, residual toxicity, increasing costs of application and widespread environmental hazards have directed the need for effective, biodegradable pesticides [30], [7]. Plant materials have been used over the years for the protection of field crops and stored commodities against insect attack [10]. Some of these plant species possess one or more useful properties such as repellency, antifeedant biodegradability, and ability to reduce insect resistance [23]. They have also been reported to possess insecticidal properties against a wide range of insect pests [13], [15], [18]. For instance, petroleum ether extract of Neem [26] dichloromethane and methanol extracts of *Acorus calamus* and *Cassia siamia* [17], *Jatropha curcas* seed oil [1], powdered leaves and extracts of *Vitex negundo* [24], plant lectins derived from *Cicer arietinum* [25] and powder of *Terminalia chebula* and *Cassia auriculata* [11] were reported to have significant oviposition deterrent and other biological activity against *C. maculatus.* Due to paucity of documented information on the efficacy of *J. curcas* in insect pest control, this study was aimed at evaluating the efficacy of *J. curcas* extracts in the control of some field insect pests of cowpea (*V. unguiculata*).

2 Materials and Methods

The field trials were conducted from August –November of 2010 cropping season. The site is geographically located between latitude 05^0 27^l N and longitude 07^0 0 0^lE [2]. The meteorological data showed that the mean annual rainfall was between 2334.40 mm and 2397.01 mm with a mean temperature of 31^0C and relative humidity of 89 %. The experimental site was cleared using cutlass and mapped out using measuring tape (50.00 m), pegs and garden lines to get a total land area

of 384.00 m^2 (32 m x 12m) used for the trial. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three (3) replications. Each plot measured 1.95 m^2 (1.50 m x 1.30 m) and 1m alleys between plots and blocks were maintained, giving a total of 54 plots. One (1.00) kg of cowpea seeds (Ife brown variety) from the International Institute of Tropical Agriculture (IITA) in June, 2010, was sorted to remove holed/wrinkled seeds from the wholesome ones. The graded seeds in a mouth-tied transparent polythene bag containing 3 tablets of phostoxine in an envelope were placed in an air-tight plastic bucket for 2 weeks. Fifty untreated cowpea seeds were plated at 10 seeds per petri-dish lined with Whatman's filter paper moistened with water as aid when necessary. Seven days later, the percentage germination was calculated according to [4]:

$$\text{Percent germination} = \frac{\text{No. of un-germinated seeds}}{\text{No. of seeds plated}} \times \frac{100}{1}$$

The second germination test was done three months after storage with the plant materials and the synthetic insecticide so as to determine the effect of the extracts on seed viability. The same procedure was used as in the previous test. The percentage germination loss was also calculated. Seeds and roots of *J. curcas* were obtained from Ilorin in Kwara State. The mature dried fruits were dehisced and the seeds cracked to remove the kernel. Similarly, the roots were chopped into small bits and air-dried. The kernel and the dried root parts were pulverized with an electric blender and weighed. 100 gm of the plant materials were individually dissolved in 500 cm^3 of acetone and the solution filtered through a muslin cloth. The filtrate was subjected to low pressure distillation and the solvent recovered for further use. Each of the plants extracts was placed in a 200 ml bottle, covered and labelled accordingly. Actellic 25 E. C. was obtained from one of the agro-chemical stores in Owerri. The synthetic chemical was dissolved in water at the rate of 1litre to 20 litres of water and kept safe for later use. The stored root and seed extracts (*J. curcas*) obtained from the extraction were used at the rates of 1.00, 2.00 and 3.00 ml dissolved in 300 ml of water. These were clearly labelled and kept. Similarly, 1.25, 2.5 and 3.75 ml of the synthetic insecticide (Actellic 25 E. C) were also dissolved in 1 litre of water and labelled. These mixtures were used in the field for spraying. Fresh mixtures were compounded each time when needed. Spraying started from 10.00 am to 12.00 pm each spraying day after insects sampling. A 5-litre knapsack sprayer was used for the application. All the insecticides were sprayed once every week for four weeks. Ten plants were randomly inspected visually per plot for signs of phytotoxicity two days after each spray. Sampling of insect pests was done from 6.30 am-9.30 am every Tuesday (weekly). Flower bud thrips (*Megalurothrips sjostedti* Trybom), cowpea aphids (*Aphids crassivora)* and legume pod borers (*Maruca vistrata* Fab.) were sampled by randomly picking ten flowers from plants in each plot. The flowers were placed in a vial containing 30 % alcohol and taken to the laboratory where they were dissected and the number of pests found was recorded. All the data collected was subjected to Analysis of Variance (ANOVA) for Randomized Complete Block Design (RCBD) procedures as described by [32] and means separated using Least Significant Difference (LSD) at appropriate level of significance.

3 RESULT

Pre-spray at 4 weeks after planting gave the mean number of aphids sampled was lowest (0.67) on plots to be sprayed with Actellic 25 E. C and *J. curcas* seed oil at highest rates (3.75 and 3.00 ml), respectively. These results differ significantly from *J. curcas* root extracts which recorded the highest (4.08) mean number of sampled aphids (Table 1). Mean number of sampled thrips was highest (2.00) on plots designated for *J. curcas* seed oil at lowest and highest rates (1.00 & 3.00 ml) together with Actellic 25 E. C at highest rate (3.75 ml). However, there was no statistical difference on mean number of sampled thrips and maruca across the treatment materials. Results of treatment materials on the target insect pests after first spray (5 WAP) shows no obvious differences (P=0.05) on the infestation levels of aphids, thrips and maruca spp on all the treatment materials. However, *J. curcas* root extract and the untreated plots, recorded the highest (4.00) and second highest (3.00) number of aphids, respectively. Furthermore, the results shows that the untreated plots (control) and *J. curcas* root extracts at lowest rate (1.00 ml), each, recorded the highest mean number of aphids (4.00) at 6 weeks after planting (6 WAP). While, *J. curcas* seed oil and Actellic 25 .E. C, each recorded the lowest (1.00) number of aphids. The highest mean number of thrips and maruca was recorded by the control followed by plots sprayed with *J. curcas* root extracts as against *J. curcas* seed oil and Actellic 25 E. C. which were the least infested. It is also observed that the effect of the treatment materials on the target insect pests at 7 WAP in the untreated plots recorded the highest (4.00) mean number of aphids, followed by plots spread with *J. curcas* root extract which recorded 3.00, across rates. The lowest (1.00) infestation of aphids was recorded by plots spread with *J. curcas* seed oil and Actellic 25 E. C. These results are significantly different from each other (P=0.05). Similarly, the untreated plots recorded the highest number of thrips and maruca, while plots spread with Actellic 25 .E. C was the least infested.

TABLE

Table 1: Effect of Plant Materials on Cowpea Field Pests

		Pests											
Materials	**Rate**	**Aphids Initial 4 WAP**	**Aphids 1st 5 WAP**	**Aphids 2nd 6 WAP**	**Aphids 3rd 7 WAP**	**Thrips Initial 4 WAP**	**Thrips 1st 5 WAP**	**Thrips 2nd 6 WAP**	**Thrips 3rd 7 WAP**	***Maruca* spp Initial 4 WAP**	***Maruca* spp 1st 5 WAP**	***Maruca* spp 2nd 6 WAP**	***Maruca* spp 3rd 7 WAP**
JSE	1.00ml	2.33	1.00	1.00	1.00	2.00	2.00	1.00	2.00	1.67	1.00	1.00	2.00
	2.00ml	1.00	1.00	1.00	1.00	2.00	1.00	1.00	2.00	1.33	1.00	1.00	2.00
	3.00ml	0.67	1.00	1.00	1.00	0..33	1.00	1.00	1.00	0.33	1.00	1.00	1.00
JRE	1.00ml	4.00	4.00	4.00	3.00	2.00	2.00	3.00	1.00	1.00	1.00	3.33	2.00
	2.00ml	1.00	2.00	2.00	3.00	1.33	2.00	1.00	2.00	0.67	1.00	3.00	2.00
	3.00ml	1.00	2.00	2.00	3.00	1.33	1.00	1.00	2.00	1.00	1.00	1.00	1.00
ACT	1.25ml	4.33	1.00	1.00	1.00	1.33	1.00	1.00	1.00	1.67	1.00	1.00	1.00
	2.50ml	3.67	1.00	1.00	1.00	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	3.75ml	0.67	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.33	1.00	1.00	1.00
C	0.00ml	2.67	3.00	4.00	4.00	1.67	2.00	3.00	4.00	1.33	1.00	2.00	3.00
LSD $_{0.05}$		**1.110**	**NS**	**NS**	**1.817**	**NS**	**NS**	**NS**	**1.480**	**NS**	**NS**	**1.607**	**NS**

Key: JSE= *Jatropha curcas* seed extract; JRE= *J. curcas* root extract; ACT= Actellic 25 E. C; C: Control.

The highest (42.40 %) percentage pod damage was recorded by the untreated plots followed by *J. curcas* roots extracts at highest rate (3.00 ml). Actellic 25 .E. C at moderate rate (2.50 ml) recorded the lowest (3.80) percentage pod damage (Table 2). The results differ significantly from each other (P=0.05). The result of 100 seed weight shows that there was no significance difference (P=0.05) among the treatment materials. Grain yields were higher in treated plots than untreated plots (control). Yields obtained from plots sprayed with Actellic 25 .E. C were higher than all other treated plots, followed by *J. curcas* seed oil, while plots sprayed with *J. curcas* root extracts were the lowest (Table 2). The results differ statistically from each other (P=0.05). The target insect pests were significantly reduced by the *J. curcas* seed oil and Actellic 25. E. C., they also offered different levels of protection to the flowers and pods against thrips, aphids and maruca pod borers. These insect pests were better controlled in plots sprayed with Actellic 25 E. C than plots sprayed with plant extracts. Also, there were higher pod density, drastic reduction of damaged pods and higher grain yield on plots sprayed with Actellic 25 E. C and *J. curcas* seed oil.

Table 2: Table 2: Effects of treatment materials on Percentage Pod Damage, 100 Seed Weight and yield.

Materials	Rate	percentage pod damage	100 seeds wgt (g)	Yield (g)
JSE	1.00ml	9.80	14.23	112.70
	2.00ml	9.20	14.58	130.00
	3.00ml	7.20	15.51	146.00
JRE	1.00ml	20.70	14.93	59.33
	2.00ml	18.30	14.43	61.33
	3.00ml	19.1	14.21	66.67
ACT	1.25ml	3.90	14.03	131.00
	2.50ml	3.80	14.12	183.33
	3.75ml	4.90	15.14	291.33
C	0.00ml	42.40	13.22	45.33
LSD		**14.80**	**Ns**	**29.29**

Key: JSE= *Jatropha curcas* seed extract; JRE= *J. curcas* root extract; ACT= Actellic 25 E. C; C: Control.

The plant materials and Actellic 25 .E. C used in storing the cowpea seeds had no significant (P=0.05) effect on the viability of the seeds (Table 3). However, the highest germination percentage (86.67 %) was recorded by Actellic 25 .E .C, at moderate and highest rates (0.30 and 0.40 ml) and *J. curcas* seed oil at lowest rate (1.00 ml), respectively which did not differ statistically (P=0.05) from the untreated control with 86.44 % germination percentage.

Table 3: Effect of Plant Extracts and Actellic 25 EC on Germination Percentage

Treatment Material	Rate	Germination (%)
JSE	**1.00ml/100g**	**86.67**
	2.00ml/100g	**86.56**
	3.00ml/100g	**83.33**
JRE	**1.00ml/100g**	**83.44**
	2.00ml/100g	**84.22**
	3.00ml/100g	**86.56**
ACT	**0.20ml/100g**	**86.56**
	0.30ml/100g	**86.67**
	0.40ml/100g	**86.67**
C	**0.00ml/100g**	**86.44**
LSD0.05		**NS**
Germination Test before treatment application.		**86.67**

Key: JSE= *Jatropha curcas* seed extract; JRE= *J. curcas* root extract; ACT= Actellic 25 E. C; C: Control.

4 DISCUSSION

The performance of *J. curcas* seed oil in the control of the target insect pests was better than that of the root extracts. This could be due to presence of several steroids and diterpenes (phorbol esters) which are the most toxic molecules in the plant [13]. This result is in agreement with the findings of [19] who reported that *J. curcas* seed oil contains phorbol esters which exerted potential insecticidal effects against *Busseola fusca* and *Sesamia calamistis.* However, the inefficacy of the root extracts could be due to the absence of curcin toxalbumin in the root as reported by [20]. [8] had earlier reported that the root contains a smaller amount of phorbol ester (0.55 mg / g dry matter) when compared with the seed which contains 2.00-6.00 mg/ g dry matter. Germination percentage showed there were no significant differences (P=0.05) among the treatment materials used and when compared with the control. All cowpea seeds treated recorded up to 83 % germination as against 86.67 % before the commencement of the experiment. This result agrees with the work of [21] which reported that *J. curcas* extracts had no effects on germination of treated seeds.[3], had reported that plant extracts generally do not affect the germinability of seeds treated with them.

5 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In summary, this study shows that the plant extracts were able to control the target field insect pests of cowpea. However, the seed oil of *J.curcas* was more effective and comparable with Actellic 25 E. C than the root extract. The treatment materials did not affect the viability of the stored seeds as the germination percentages were statistically the same. This plant is available in Nigeria for famers to use in protecting their crops; it is very cheap, accessible, easily bio-degradable and friendly to the environment. It could be used as alternative to the use of synthetic insecticide in controlling insect pests of cowpea. It is recommended that the insecticidal efficacy of this plant products as protectants of field crops, be further explored. Agricultural Institutes and

Faculties of Agriculture in our tertiary institutions in Nigeria should research into probable agronomic practices aimed at the domestication and/ or cultivation of *J. curcas* plants.

6 REFERENCES

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