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Efficacy of aqueous extracts of *Jatropha curcas* in the control of some field insect pests of Okra, *Abelmoschus esculentus* (L.) Moench

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ABSTRACT

A field research was carried out to determine the efficacy of aqueous extracts of *Jatropha curcas* on some field insect pests of okra plant. The experiment was carried out at the Teaching and Research Farm of the University of Ilorin. The experiment was done using a Randomized Complete Block Design with three treatments, each replicated three times. The treatments used were aqueous extracts of*Jatropha curcas* leaves, *J. curcas* seeds and control. The total land used was 8 m x 5.3 m and this was divided into 9 plots with each plot measuring 2 m x 1.1 m with a 0.5 m alley. The okra variety used was NH47-4. There were 4 rows per plot and 16 okra stands per plot. The initial application was applied to the crop at 16 days after planting, while the second and third application occurred at 26 days and 36 days after planting respectively. Data were collected on the number of insects on the crop, weight of damaged pods and weight of undamaged pods. The result shows that there was no significant difference (P > 0.05) between the aqueous extracts and the control. However, the aqueous extracts of *J. curcas* seeds had the highest pod weight (8.33g) and this was significantly different from the pod weight of the control (1.33g).

Keywords: Okra, pests, aqueous extracts, *Jatropha curcas*, bio pesticide

INTRODUCTION

Okra(*Abelmoschus esculentus* (L) Moench) belongs to the family Malvaceae (Siemonsma, 1982). It probably originated from East Africa and today is widely distributed in the tropics, sub-tropics and warmer portions of the temperate region (ECHO, 2003). Okra is available almost throughout the year and could be cultivated in poor soil or dry areas (Burkil, 1997). The worldwide production of okra as a fruit vegetable is estimated at six million tonnes per year, while in West Africa, it is estimated at 500,000 – 600,000 tonnes per year (Burkil, 1997). The West and Central African region accounts for more than 75% of okra produced in Africa but the average productivity in the region is very low (2.5t/ha) compared to East Africa (6.2t/ha) and North Africa (8.8t/ha) (FAOSTAT, 2006). Nigeria is the largest producer (1,039,000t) followed by Cote d'Ivoire, Ghana and others (FAOSTAT, 2008).

In Nigeria, there are two distinct seasons for okra, the wet and the dry seasons (Bamire and Oke, 2003). Okra cultivation and production has been widely practiced because of its importance to the economic development and can be found in almost every market in Africa (Babatunde *et al*., 2007). It is among the most economically important vegetable crops in the world (Javed *etal*., 2009).

One of the major constraints to the high yield of okra in Nigeria is high insect pest infestation (Echezona *et al*., 2010). There are many insect pests of okra, which include *Podagrica* spp., *Oxycarenus hyalinipennis*, *Dysdercus superstitiosus*, aphids,white fly and leafhoppers (Uddin II and Odebiyi, 2010).Insect pest infestation is one of the most limiting factors in increasing the yield potential of okra (Adesina, 2013). In Nigeria, chemical insecticides are used for the control of insect pests of okra (Belanger *et al*., 2001). Exclusive reliance on insecticides as a control strategy against insect pests has resulted in several undesirable side effects like pesticide pollution, resurgence of secondary pests, insecticide resistance, elimination of beneficial fauna and human health problems(Scott *et al*., 2004).There is therefore a need to explore alternative approaches to reduce the sole dependence on insecticides (Dudu and Williams, 1991). Musa *et al* (2011)and Murdoch *et al*. (1997) reported that in response to the high cost of pesticides and their negative side effects is the need for a paradigm shift to the development of other types of control methods which may eliminate the use of insecticides and could have economic and health benefits to the applicators, consumers and the environment.

The use of plant derived insecticides is in recent times being investigated by researchers as a possible replacement for synthetic insecticides because they are supposedly safer and may be more readily available and affordable (Dudu and Williams, 1991). Several natural products such as *Eucalyptus globulus*, *Zanthoxylum zanthoxyloides* and *Moringa oleifera* have been used to control insect pests as an alternative to chemicals (Saravan *et al*., 2010). Furthermore, Muhammad *et al* (2010) posited that awareness regarding food safety has increased the demand for organically produced food, which necessitates evaluating the performance of bio pesticides as safer alternatives to conventional insecticides.This study examined the efficacy of aqueous extracts of*J. curcas* as a bio pesticide in the control of some field insect pests of okra.

MATERIALS AND METHODS

The experiment was carried out at the Teaching and Research Farm, University of Ilorin. Okra variety NH47-4 was used for the experiment. The okra seeds were sourced from the Kwara State Agricultural Development Programme, Ilorin, Nigeria. The plant derived insecticides used for the study were extracted from the leaves and seeds of *Jatropha curcas*. The leaves and seeds of *J. curcas* were collected from Oke-odo area of Tanke, Ilorin.

An 8 m x 5.3 m land area was cleared, ploughed, harrowed, mapped out and divided into three blocks of three plots each measuring 2 m x 1.1 m with an alley of 0.5 m between the plots. There were three treatment applications.The treatments were allocated randomly in each block in a randomized complete block design (RCBD) in three replicates

The plots were prepared into flat beds. Planting of okra seeds was done using an intra row spacing of 60 cm and inter row spacing of 30 cm. There were 4 rows per plot and 16 stands per plot.Four (4) seeds were sown per hole and this was later thinned to 2 seedlings per stand after emergence. There was no fertilizer application and all the plots were bounded on all sides to prevent erosion.The treatments used were aqueous extracts of *Jatropha curcas*leaves, *J. curcas* seeds and control.Two kilograms (2 kg) each of freshly harvested *J. curcas* leaves and seeds were pulverized using a mortar and pestle to obtain a marshy substrate. Two (2) litres of water was then added separately to the marshy substrate of *J. curcas* leaves and seeds. This was then stirred and allowed to stand for 24 hours in the laboratory. Thereafter it was stirred and sieved using muslin cloth to obtain a homogenous solution. The aqueous extracts obtained were used for the study.

There were a total of 3 spraying regimes.Spraying of the treatments commenced at 4 weeks after emergence and subsequently repeated onthe 26th and 36th day respectively. Sampling for insects started at 2 weeks after planting and this was done by visual counting of the insects encountered. Two middle rows selected per plot were sampled for insects and all insects found were counted and recorded. Sampling was done 2 times a week and this continued until all the crop was harvested from the field.

Data collected to assess the efficacy of the plant derived insecticides include: number of insect pests, weight of damaged pods and weight of undamaged pods. The data were subjected to Analysis of Variance using SPSS version 21 and where there was significant differences ($P<0.05$) the means were separated using the New Duncan’s Multiple Range Test.

RESULTS

The aqueous extracts of *J. curcas* leaves and seeds were not able to reduce the population of *Podagrica uniformis* on okra. There was no significant difference ($P > 0.05$) between the extracts and the control (Table 1).

Table 1: Effects of aqueous leaf and seed extractsof *J. curcas*on mean number of *Podagrica uniformis* on okra

Treatments	Weeks After Planting								
	1	2	3	4	5	6	7	8	9
Jatropha leaf extract	0.71	0.71	0.71	0.88	1.00	1.05	0.88	1.00	0.71
Jatropha seed extract	0.71	0.71	0.71	1.05	0.71	0.88	1.17	0.71	0.71
Control	0.71	0.71	0.71	1.05	0.88	1.29	0.88	0.88	1.00
S.E.M	0.00	0.00	0.00	0.26	0.31	0.37	0.33	0.31	0.29
	ns	ns	ns	ns	ns	ns	ns	ns	ns

S.E.M: Standard Error of Mean

ns: Not significant

The trend was similar for the population of *Podagrica sjostedti* (Table 2).

Table 2: Effects of aqueous leaf and seed extracts of *J. curcas* on mean number of *Podagrica sjostedti* on okra

Treatments	Weeks After Planting								
	1	2	3	4	5	6	7	8	9
Jatropha leaf extract	0.71	0.71	0.71	0.88	0.71	1.17	0.88	0.71	0.88
Jatropha seed extract	0.71	0.71	0.71	0.71	0.71	0.88	0.71	0.71	0.88
Control	0.71	0.71	0.71	0.88	0.88	0.88	0.71	1.17	0.88
S.E.M	0.00	0.00	0.00	0.07	0.05	0.11	0.05	0.10	0.08
	ns	ns	ns	ns	ns	ns	ns	ns	ns

S.E.M: Standard Error of Mean

ns: Not significant

There was also no significant difference (P > 0.05) between the treatments and controlfor *Dysdercus superstitiosus* (Table 3).

Table 3: Effects of aqueous leaf and seed extracts of *J. curcas* on mean number of *Dysdercus superstitiosus* on okra

Treatments	Weeks After Planting								
	1	2	3	4	5	6	7	8	9
Jatropha leaf extract	0.71	0.71	0.71	0.71	1.00	1.05	0.71	0.71	0.71
Jatropha seed extract	0.71	0.71	0.71	0.71	0.88	0.71	0.88	0.88	0.71
Control	0.71	0.71	0.71	0.71	1.05	0.88	1.17	0.71	0.71
S.E.M	0.00	0.00	0.00	0.00	0.11	0.08	0.11	0.05	0.00
	ns	ns	ns	ns	ns	ns	ns	ns	ns

S.E.M: Standard Error of Mean

ns: Not significant

The trend was also similar for the population of *Cosmophila flava* (Table 4) and *Oxycarenus hyalinipennis* (Table 5).

Table 4: Effects of aqueous leaf and seed extracts of *J. curcas* on mean number of *Cosmophila flava* on okra

Treatments	Weeks After Planting								
	1	2	3	4	5	6	7	8	9
Jatropha leaf extract	0.71	0.71	0.71	0.88	0.71	1.17	0.88	0.71	0.88
Jatropha seed extract	0.71	0.71	0.71	0.71	0.71	0.88	0.71	0.71	0.88
Control	0.71	0.71	0.71	0.88	0.88	0.88	0.71	1.17	0.88
S.E.M	0.00	0.00	0.00	0.07	0.05	0.11	0.05	0.10	0.08
	ns	ns	ns	ns	ns	ns	ns	ns	ns

S.E.M: Standard Error of Mean

ns: Not significant

Table 5: Effects of aqueous leaf and seed extracts of *J. curcas* on mean number of *Oxycarenus hyalinipennis* on okra

Treatments	Weeks After Planting								
	1	2	3	4	5	6	7	8	9
Jatropha leaf extract	0.71	0.71	0.71	0.71	0.71	0.88	1.17	0.88	0.71
Jatropha seed extract	0.71	0.71	0.71	0.88	0.71	0.88	0.71	0.71	0.71
Control	0.71	0.71	0.71	0.71	1.05	0.88	0.88	0.88	0.88
S.E.M	0.00	0.00	0.00	0.05	0.07	0.08	0.11	0.07	0.05
	ns	ns	ns	ns	ns	ns	ns	ns	ns

S.E.M: Standard Error of Mean

ns: Not significant

The aqueous extracts of *J. curcas* seed had the lowest weight of damaged pods among the treatments (Table 6) and this was significantly different from the control(P< 0.05) 2 weeks after harvesting. The trend was similar for the weight of undamaged pods. Aqueous extracts of *J. curcas* seed had the highest weight of undamaged pods and this was significantly different from the control at 2 weeks after harvest (Table 7).

Table 6: Effect of aqueous leaf and seed extracts of *J. curcas* on mean weight of damaged pods (g)

Treatments	Weeks after harvest	
	1	2
Jatropha leaf extract	4.00	4.00^{ab}
Jatropha seed extract	2.33	1.00^{b}
Control	5.00	6.00^{a}
S.E.M.	0.77	0.88
	ns	

Data are presented as means. Means in the same column followed by the same letter are not significantly different at P< 0.05 using New Duncan's Multiple Range Test

S.E.M: Standard Error of Mean

ns: Not significant

Table 7: Effect of aqueous leaf and seed extracts of *J. curcas* on mean weight of undamaged pods (g)

Treatments	Weeks after harvest	
	1	2
Jatropha leaf extract	3.67	3.00^{ab}
Jatropha seed extract	4.33	8.33^{a}
Control	1.67	1.33^{b}
S.E.M.	1.10 ns	1.50

Data are presented as means. Means in the same column followed by the same letter are not significantly different at P< 0.05 using New Duncan's Multiple Range Test

S.E.M: Standard Error of Mean

ns: Not significant

DISCUSSION

All the treatments evaluated did not reduce the population of*Podagrica uniformis*, *P. sjostedti*, *Dysdercus superstitiosus*, *Cosmophila flava* and *Oxycarenus hyalinipennis* on okra, but they seem to have protected the okra leading to increased weights of pods of the treated plants. This study confirms earlier reports by Misra and Misra (2010) that *J. curcas* possess insecticidal properties but may have a slow effect on some insect pests due to lack of persistence and wide spectrum activity. It also corroborates the work of Adesina and Afolabi (2014), they reported the slow action of *J. curcas* extracts in the control of flea beetles of okra.

Koul *et al* (2008) reported that *J. curcas* has a high concentration of tannins, saponins and cardiac glycosides. This also supports the report of Chaieb (2010) that phytochemical properties such as tannins, saponins and cardiac glycosides possess strong activities against several plant pathogens and insect pests. Karamanoli *et al* (2011) reported that tannin exerts its actions by a combination of mechanisms that include iron chelation and enzyme inhibition, which act as insecticidal, antifeedant and reproduction inhibitor against insect pests and their effects may be delayed.

This is in line with the work of Ojo *et al* (2011) who reported that antifeedant properties inhibits the normal feeding behaviour of insect pests.Ogunleye *et al* (2010) reported that *J. curcas* possess antifeedant properties as a result of the presence of tannin and saponin. These properties of *J. curcas* could explain the reason for the good yield obtained from the okra plant though insect pests were present in high numbers. It is likely that the aqueous extracts of *J. curcas* seeds suppressed the feeding activity of the selected insect pests of okra in this study which resulted in increased yield. This treatment could be used by resource poor farmers to ensure a good harvest while growing okra.

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