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Comparative Effects of Aqueous Leaves Extracts of Selected Plants Material on Insect Pest of Cowpea (*Vigna Unguiculata* L. Walp)

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ABSTRACT

This study is designed to comparatively investigate the effects of aqueous extracts of some medicinal plants (Datura stramonium, Andrographis paniculata and Chromolaena odorata) on field insect pests damage to cowpea. Ife bimpe cowpea seeds are procured from IITA and planted on beds assigned to four treatment groups (including a control), in a completely randomized design. A 250g/litre of plant material is used to prepare the stock solutions. Field application of extracts is done in the mornings, two times in a week for two months. The findings of the study reveal that the different aqueous extract reduced the activities of insect pests attacking the cowpea leaves in order of D. stramonium > A. paniculata > C. odorata compared with the control thereby encouraged the cowpea plant treated with D. stramonium and A. paniculata to have more leaves, growth flowering and podding than the other groups. D. stramonium and A. paniculata are more effective in controlling insect pest damage to cowpea than C. odorata. It can be concluded that utilization of plant extracts in pest management is a cheap, environmentally friendly alternative to chemical pesticides. However, there is need to test the extracts on other crops, with similar pest problems to verify the elasticity of it effect.

Keywords: *Andrographis paniculata, Chromolaena odorata, Datura stramonium,* Cowpea *pests*

INTRODUCTION

Cowpea (*Vigna unguiculata* L. Walp) is an annual plant in the family Fabaceae. The crop is distributed throughout the tropics, and is widely cultivated in Central and West Africa, with Nigeria being a leading producer (Alghali, 1991). As a

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food crop, it is important as a cheap source of plant protein; a nutritional requirement often inadequate in the diet of many families in developing countries (IITA 1984). With the ever increasing local and global food demand, sustained interest in its increased production and preservation is justifiable. A major challenge in cowpea production however, is the abundance of pests that attack different stages of the plant and transmits diseases. However, *Aphis craccivora* attacks all stages and parts of the plant; *Maruca vitrata* feeds on tender stems, flower buds and leaves; *Megalurothrips sjostedti* attacks the flowering stage, amongst others (Jackai, 1993; Karungi, Adipala, Ogengalatigo, Kyamanywa and Oyobo, 2000; Alabi, Odebiyi and Jackai, 2003; Egho, 2010).

And where adequate control is not in place, these pests cause much yield losses (Jackai and Singh, 1985). Although many chemical insecticides can effectively control pests of cowpea, there is currently a preference for "integrated pest management" and a reduction in complete reliance on chemical pesticides (Adati *et al*., 2007). In most of the countries, due to environmental concerns and human health hazards, several chemical insecticides have been either banned or restricted (Tapondjou, Adler, Bouda and Fontem, 2002). The adverse effects of most novel chemical insecticides have led researchers to find a new avenue of insect control which has led to the discovery of products from plants, as an alternative way of controlling insects (Sutherland, Baharally and Permaul, 2002; Zibaee, 2011).

Chemical pesticides are toxic. They have high toxicity and residual value and hence are not suitable to treat the pests**.** One approach being explored in this regard is the utilization of readily available plant materials to control pests (Prates, Santos, Waquil, Oliveira and Foster, 1998). A number of plants that have shown some efficacy against pests include *Datura stramonium (*Das, Kumar and Basu, 2012), *Chromolaena odorata* (Traugott, 2014; Ellis, 2013), *Andrographis paniculata* (Meenatchisundaram, Parameswari, Subbraj, Suganya and Michael, 2009) amongst others. Many Nigerian spice plants are not widely cultivated, and so, are gradually becoming endangered (Ikpeme, Udensi, Ekaluo and Uyoh, 2012; Kayode and Ogunleye, 2008). In order to prevent the extinction of indigenous spice plants as well as ensure their continued utilization, there is need to preserve their germplasm and promote their conservation in the environment (Ibiang, Ita, Ekanem and Edu, 2012). Aside culinary and phytotherapeutic uses, finding alternative ways of utilizing these spice plants, for example as biopesticides, will make them more valuable and add impetus to efforts aimed at their conservation. Against this backdrop, and in view of the environmental and public health problems that could arise due to chemical pesticides toxicity (Asogwa

and Dongo, 2009). This study is designed to evaluate the effects of three local plants (*Datura stramonium, Chromolaena odorata and Andrographis paniculata*) on insect pest damage to leaves of cowpea.

MATERIALS AND METHODS

This experiment was carried out on a demonstration plot, Faculty of Agriculture, Food and. Natural Resources, Ondo State University of Science and Technology, Okitipupa, using viable cowpea seeds (Ife bimpe) which were procured from IITA, Ibadan, Oyo State. The site was cleared manually with cutlass, debris packed and burnt. Ridges were made and the site was divided using a Completely Randomized Design into four treatment groups; group A (control), group B (*Chromolaena odorata*), group C (*Datura stramonium)*, and group D (*Andrographis paniculata*). Each plot was made up of six (6) rows of ridges. *Andrographis paniculata leaves, Chromolaena odorata leaves and Datura stramonium leaves* were collected from the University medicinal garden and open air-dried, at room temperature after which each was grinded to a powdery form (using pestle and mortar) and kept until use. The spraying was done two (2) times in a week. Weeding was done by hand when due in the four plots. Thereafter, the viable cowpea seeds were selected and sown.

The aqueous extract was prepared by soaking 250g of different leaves material (*Andrographis paniculata, Chromolaena odorata* and *Datura stramonium)* in 1litre of distilled water for 48 hours. The extract was filtered through a Whatman no 42 (125mm) filtered paper. The filtrates were collected and kept at room temperature in the laboratory until they were needed for the study (Obadofin and Fatoba, 2014).

The treatment commenced from thirty (30) days after germination, the cowpea plants were uniformly sprayed with the respective spray solutions with quantity of 250ml using a pressure sprayer (Hogedruk plantenspuit). This was done two times in a week for two months.

Damage assessment was done through the counting of the total number and distribution of holes per leaf of cowpea. The number of holes per sub-sample of four randomly selected leaves and the number of these leaves with holes were recorded. The Insect Perforation Index (IPI) (Fatope, Mann and Takeda, 1995) was then calculated thus:

WPI = % Treated cowpea perforated X 100
% Control cowpea perforated

Weevil Perforation Index value exceeding 50 % is regarded as enhancement of

infestation by the weevil or negative ability of the plant material or insecticides tested. Two times in a week were set for assessing the repellency of the extract to the pest in the four plots**.** Any insect found was noted and recorded for every visit. After which the insect found was taking into the laboratory for identification using prepared slides, chart and literatures. Data obtained were subjected to statistical analysis using ANOVA and the means separated by DMRT (Duncan, 1955)

RESULTS AND DISCUSSION

Table 1 show the morphological parameters of cowpea treated against field pest with different aqueous plant extracts. The cowpea plant starts germinating on day 5 in respective of the plots. Also, number of damaged leaves and percentage leaf damage followed the same trends as control > *Chromolaena odorata* > *Andrograhis paniculata* > *Datura stramonium* while total number of leaves occurred in the order control < *Chromolaena odorata* < *Andrograhis paniculata* < *Datura stramonium.* It could be observed that the three botanicals are significantly different ($P > 0.05$) compared to control and occurred in the order of *Datura stramonium* > *Andrographis paniculata*>*Chromolaena odorata* and makes *Datura stramonium* the most effective whereas the *Chromolaena odorata* the least. However, the number of holes which were created by the insect pests on the cowpea leaves increased accordingly *D. stramonium* < *A. Paniculata* < *C. odorata compared to control* ($p < 0.05$) to the treated leaves. Number of damaged leaves and percentage leaf damage were also significantly lower in *D. stramonium* and *A. paniculata* in the period of the treatments than in the other groups. When viewed together, the values of all the leaf parameters in treatment of cowpea showed that aqueous extract of *D. stramonium* and *A. paniculata* as used in this study significantly reduced the activities of pre-flowering insect pests of cowpea. The feeding effect of insect pests on the treated leaves showed significant effect in *C. odorata* > *A. paniculata* > *D. stramonium* comparable to control ($p < 0.05$). All of the plant extracts were found to have effect on adult emergence of insect pests attacking cowpea (*Vigna unguiculata).*

Table 2 shows the effect of some plant extracts on insect pests of cowpea plant. The extracted leaves significantly reduced the number of insect pests attacking cowpea leaves in order of *D. stramonium* > *A. Paniculata* > *C. odorata. Datura stramonium* had the highest efficacy of dragging insect pests away. *Melanoplus differentialis, Zonocerus variegatus, Dysdercus suturellus, Aphid craccivora, Megalurothrips sjostedti trybom, Epilachna borealis, Gryllus texensis,*

Phenacoccus solenopsis were all found at the onset of the trial but some of the other insect appeared later as the plant approaches flowering such as *Polyommatus icarus, Apis mellifera, Toxomerus germinatus and Ophiomyia phaseoli.*

The results indicated that all the extracts significantly ($P < 0.05$) reduced the number of pest such as pod borer *(M. vitrata)* larvae and pod sucking bugs *C. tomentosicollis* compared with the untreated control during the experimental period. However, the botanicals extracts limiting the presence of the pest and their feeding ability on the leaves than the control. Similarly, cowpea pods were significantly ($P < 0.05$) protected from damage caused by these pests using plant extracts compared with the untreated control. The best protection was observed on plots treated with extracts of *D. stramonium* (Table 1) and plots treated by these three extracts also gave better flowering than those of the control. The untreated check gave the lowest growth throughout the experimental period. However, the treated groups had the least pod damage compared to the control. However, there were no significant ($p < 0.05$) differences among the plant extract treatments compared to the control of pest population. The result shows that plant extracts treated plots were scientifically ($p < 0.05$) better than control in terms of number of seeds/ pod. However, plots treated with extract of *D. stramonium* were found to give higher number of seeds yield compared to other plant extract.

The least performance observed in *Chromolaena odorata was* not an indication of weak potentials as it has equally been reported in some research works as being effective. Consequently, this variance in potentials may likely be dependent on the concentration levels adopted in this study. Observations made in this experiment corroborate the view of several researchers on the adoption and use of plant materials in pest control. Consequently, the high infestation of cowpea at almost every stage of its growth and concomitant damage necessitate a proactive and promising approach to its control. Although the use of synthetics had been adopted but since its use was faced with several challenges, the use of botanicals had been gaining attention in recent times. The use of plant extracts had equally been adopted and proven effective. Raja, Babu, Dorn and Ignacimuthu (2001) report that pulse stored in gunny bags and treated with aqueous extracts from leaves of *Melia azadirachta*, *Hyptis suaveolens* and tuber of *Cyperus rotundus*, were effectively protected without any infestation for up to 6 months. Kim *et al. (*2003) report the insecticidal activities of aromatic plant extracts and essential oils against *Sitophilus oryzae* and *Callosobruchus chineensis.* This result agrees with the findings of Amatobi (2000) who reports that crude extracts of cashew leaves and nuts at 10, 15 and 20% killed *A. craccivora, C. tomentosicollis,*

A. curvipes and *M. vitrata*very quickly and reduced their population by about 70% compared to untreated control treatment. Furthermore, the result obtained during the experimental period shows that the plots treated with *Datura stramonium* and *Andrographis paniculata* extracts gave significant ($p<0.05$) control of pest such as *C. tomentosicollis, M. vitrata,* and *A. curvipes*than control treatments. This result agrees with Mong and Sudderuddin (1978) who report that neem, sweetsop and tobacco leaves extracts have been found to be toxic to *M. vitrata, C. tomentosicollis* and Z. *variegatus*. Neem, West African black *Maruca vitrata, M. sjostedti, Clavigrallato mentosicollis* and *O. phaseoli* (Stoll, 1988; Ostermanni, 1976; Oparaeke, 2007). Plant extracts are known to possess toxic organic poison that is effective in reducing insect pest population (Fuglie, 1998; Gaby, 2000) including pod borer (William and Ambridge, 1996). However, several authors have shown the efficacy of different plant materials as biopesticides for the control of different pest of cowpea (Oparaeke, Dike and Amatobi, 2000; Okech, Kaposhi, Chisembun and Mundia, 1997; Oparaeke, 2004).

Panhwar (2002) also reports that good aqueous solution of garlic, ginger and neem will effectively control worms, beetles and thrips in cowpea. Tobacco, sweetsop and chilli pepper were found to be less effective than neem, ginger and garlic extract in reducing cowpea pest population at podding growth stage. This confirms the earlier work conducted by Gaby (1995) who reports that extracts of neem, garlic, ginger and chilli pepper prove to be less repellant in controlling the activities of insect pests of cowpea plant when compared to tobacco. The fruiting and flowering obtained from plant extracts treated plots were significantly ($p<0.05$) higher than untreated control plots. This was in line with Panhwar (2002) and Fuglie (1998) who report that plant extracts applied on field cowpea plants increased flower production per plant. Insect pests' infestation on the field has been identified as the major obstacle to cowpea production.

This experiment also shows that yield on plots treated with *D. stramonium and A. paniculata* were found to be significantly ($p<0.05$) higher than *C. odorata* treated plot. These results correspond positively with the earlier work conducted by previous researchers (Stoll, 1988; Fuglie (1998) which showed that plant extracts increase the yield of vegetables and pea plants by protecting them from insect pests. Stoll (1988) and Fuglie (1998) also show that a timely application of the tobacco solution especially at the onset of flowering and pod formation prevented an initial build-up of infestation pressure and consequently increases the yield of the crops. This is possible because plant extracts were most effective against post flowering insect pests of cowpea plant. There is also the need to further test the plant material to ascertain their effective dose and spraying

schedules. Research is also needed to identify, isolate and characterize the active ingredients responsible for insecticidal toxicity exhibited by plant materials (Oparaeke, 2004) and its mode of action.

Table 1: Morphological parameters of cowpea treated against field pest with different aqueous plant extracts.

Parameters	TREATMENTS				S.E
	A	B	C	D	
Germination day(s)	5	5	5	5	-
Total number of leaves	22.46^{c}	27.36^{b}	32.52^{a}	29.87^{ab}	2.4721
Number of damaged leaves	17.28^{a}	9.71^{b}	5.73^{c}	6.84^{c}	1.0632
Percentage leaf damage (%)	76.94^{a}	35.49^{b}	17.62^{c}	22.90^{c}	4.7351
Flowering period (days)	63	57	56	54	2.1966
Fruiting period (days)	72	69	68	66	1.8841
No of pods/plant	4	5	7	6	0.9083
No of damaged pods/plant	3	1	1	1	0.5090

abc - Values across the table with similar superscript are not significantly different (P>0.05). ± SEM.
A (control), B (*Chromolaena odorata*), C (*Datura stramonium)*, D (*Andrographis paniculata*)
Source: Experimentation, 2017

Table 2: Effect of plant extracts on some insect pests of cowpea plant.

	PEST STUDIED		TREATMENTS			
S/n	**Common names**	**Scientific names**	**A**	**B**	**C**	**D**
1	Grasshopper	*Zonocerus variegatus*	+	_	_	_
2	Grasshopper	*Melanoplus differentialis*	+	_	_	_
3	Butterfly	*Polyommatus icarus*	+	+	+	+
4	Honey bees	*Apis mellifera*	+	_	-	-
5	Leafhopper	*Empoas cadolichi*	+	+	-	-
6	Aphid	*Aphid craccivora*	+	-	-	-
7	Cotton stainer	*Dysdercus suturellus*	+	-	-	-
8	Squash Lady Beetles	*Epilachna borealis*	+	-	-	-
9	Bean podborer	*Maruca vitrata*	+	-	-	-
10	Bean fly	*Ophiomyi aphaseoli*	+	+	-	+
11	Bean flower thrips	*Megalurothrips sjostedti trybom*	+	+	-	+
12	Field cricket	*Gryllus texensis*	+	-	-	-
13	Solenopsis mealybug	*Phenacoccus solenopsis*	+	-	-	-
14	Hover fly	*Toxomerus germinates*	+	-	-	-
15	House fly	*Musca domesticus*	+	+	+	+
16	Brown pod sucking bug	*Clavigralla tomentosicollis*	+	_	_	_

+ present - absent
±SEM. A (control), B (*Chromolaena odorata*), C (*Datura stramonium)*, D (*Andrographis paniculata*),
Source: Experimentation, 2017

CONCLUSION

Results from this study clearly showed that *D. stramonium* and *A. paniculata* application were effective against the major post flowering insect pests of cowpea. They can offer an alternative to the synthetic insecticides because of their availability, eco-friendly to human and environment, relative cheapness and easy application by peasant farmers. This work has established that *D. stramonium* and *A. paniculata* extracts had significantly reduced post flowering insect pests of cowpea in the field. These botanical extracts should be incorporated into cowpea leaves protection practice of resource-poor farmer.

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