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THE POTENCY OF OIL PALM BUNCH ASH AND SEED POWDER OF AFRICAN ETHIOPIAN PEPPER (*XYLOPIA AETHIOPICA*) AGAINST COWPEA WEEVIL (*CALLOSOBRUCHUS MACULATUS* F) IN STORAGE

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ABSTRACT

A study of the potency of local plant products (oil palm bunch ash and seed powder of the African Ethiopian pepper (*Xylopia aethiopica)* was investigated against the cowpea weevil (*Callosobruchus maculatus* F). it was apparent that Actellic dust (which was used as a "standard" control and *X aethiopica* at the two concentrations (15 and 10g per 100g seeds) proved very potent in the control of the bruchid weevil with 97.50; 93.75 and 92.50 percent mortality respectively. *X, aethiopica* treatments and Actellic dust remarkably inhibited oviposition and almost completely halted postembryonic development. The palm bunch ash at the two dosage rates significantly reduced oviposition and progeny emergence compared to the control. The *X aethiopica* seed powder at 15g and Actellic dust offered complete protection against *C. maculatus* while mere 1% damage was inflicted on cowpea grains treated with 10g of *X aethiopica*. Oil palm bunch ash at all concentrations considerably reduced damage in contrast to the untreated control. Actellic dust and the oil palm bunch ash did not adversely affect seed viability. However, *X. aethiopica* treated grains were 72.50% viable.

INTRODUCTION

The cowpea (*Vigna unguiculata* L. (Walp) popularly known as beans is a tropical herbaceous, short stem annual grain legume, which is cultivated in many tropical and subtropical countries. In Nigeria, cowpea is the most important indigenous grain legume. Anon (1990) stated that a total of 1,412,550 tonnes of cowpea was produced in the country for the1989/90 cropping season.

The problems associated with chemical control of insects have stimulated a search for materials to replace arsenics, lead, organochlorine, and silica fluoride insecticides etc which though very effective for their particular purposes, possess a serious disadvantage of being toxic to man, other animals and the environment (Van Schoubroeck *et al*, 1992). Plants traditionally used in the tropics to protect stored products against various insect pests have been reviewed by Golob and Webley (1980). Several plant species have been tried including pepper, wood ash, tobacco dust, vegetable oil, lemon grass, neem, *Ocimum* leaves etc (Olaifa and Erhun, 1989; *Golob et al*, 1982, Su, 1977; Dike and Mbah, 1992; Ivbijaro, 1983; Fuglie, 1998) and more are still being tried for their insecticidal properties as an alternative to the increasingly problematic synthetic pesticides. In the present study, two of such plant materials oil palm (*Elaeis guineensis*) bunch ash and African Ethiopian pepper (*X. aethiopica*) powder were examined for their insecticidal properties.

MATERIALS AND METHODS

Source of cowpea, insect pest and plant materials

The cowpea varieties used were two, local variety (For the insect culture) and IITA 60 for the experiment. *C. maculatus* (F) was the insect pest employed in this study. The oil palm bunch ash and the seed powder of African Ethiopian pepper (*X. aethiopica*) were the natural plant product insecticides. The insect pest under investigation *C. maculatus* was reared in the laboratory for 5 weeks under normal room temperature of 25°C and 70% relative humidity (Caswell, 1980). In a Kilnar jar containing 400g cowpea grains, 100 adult weevils were introduced. Five weeks after oviposition, the adult weevils were sieved out to obtain F1 generation. Dried oil palm bunch was burnt into ash in a metal tray. Similarly, dried seeds of *X. aethiopica* were ground with an electric motor to a fine powder.

Treatment and data collection

The oil palm bunch ash and *X. aethiopica* powder were each applied at two different levels 15g and l0g into the Kilnar jars containing 100g cowpea grains. Using a highly sensitive balance, .04g of Actellic dust (formulated product based on the manufacturers recommended rate of 30g to 50g of the product per 100kg grains) was weighed and added into a jar containing 100g cowpea grains. There was also an untreated control. All the treated jars were vigorously shaken to allow adequate mixture of the grains and powder. All the treatments were replicated four times and the jars arranged in a completely randomised design. Both the treated and untreated jars were inoculated with 10 pairs of freshly emerged adult *C. maculatus*. The jars were examined for adult longevity and oviposition four weeks after treatment. After 8 weeks, progeny emergence and the level of damage done to cowpea seeds from a random sample of 50 seeds whose emergent holes were counted, seed quality was assessed visually i.e. for changes in seed texture and colour.

Viability test

Ten seeds were randomly selected from each treated jar with the highest (15g) doses of the oil palm bunch ash, *X. aethiopica* and Actellic dust and the control, plated in petri-dishes and the germination count taken after 5 days.

Data analysis

Data obtained were subjected to analysis of variance at 5% level of probability (P<0.05) and the means separated by the least significant difference test.

RESULTS AND DISCUSSION

Result in Table 1 revealed that *X. aethiopica* was more effective at all the dosage levels than the oil palm bunch ash with mortality rates of 93.75% and 92.50% at dosage levels of 15 and 10g/100g seed respectively after four weeks, whereas the oil palm bunch ash offered 72.50% and 63.75% adult mortality at 15g and 10g levels respectively. However, the oil palm bunch ash and *X. aethiopica* seed powder produced significantly higher control of the weevil than the untreated control, which only recorded 6.25% mortality. This could be attributed to natural mortality resulting from senescence. There was no significant difference between *X. aethiopica* and the synthetic chemical insecticide (Actellic dust) with 97.50% mortality on the mean number of dead insects

Table 1: Percentage mortality of *Callosobruchus maculatus* on cowpea 4 weeks after treatment.

Treatment	No. of insects inoculated	Mean no of dead insects*	mortality of the insects (%)
Oil palm bunch ash 15g	20	14.50^{b}	72.50
Oil palm bunch ash 10g	20	12.75^{c}	63.75
Xylopia aethiopica seed 15g	20	18.75^{a}	93.75
Xylopia aethiopica seed 10g	20	18.50^{a}	92.50
Actellic (0.04g)	20	19.50^{a}	97.50
Control	20	1.25^{d}	6.25
LSD P<0.05)		1. 69	

*Means followed by the same letters are not significant at P<0.05 level of significance.

The efficacy of *X. aethiopica* seem to be consistent with the previous findings of Orji (1994) in which cowpea and maize grains inoculated with the respective weevils and treated with the ground seeds of *X. aethiopica* were free from infestations after 3 months. According to Ojimelukwe and Kalu (2003) two plant products (*Capsicum annum* and *X. aethiopica*) were able to protect cowpea flour from infestation by *C. maculatus* within 60 days.

Table 2: Effect of Xylopia aethiopica and oil palm bunch ash on oviposition and progeny emergence of *Callosobruchus maculatus* after 4 and 8 weeks

Treatment	Mean no. of egg plugs on 20 grain samples*	Mean F1 generations*	F1 generations (%)
Oil palm bunch ash 15g	6.50^{b}	2^{b}	30.77
Oil palm bunch ash 10g	7.25^{b}	2.75^{b}	37.93
Xylopia aethiopica seed 15g	1.75^{c}	0^{c}	0
Xylopia aethiopica seed 10g	2.50^{c}	0.50^{c}	20
Actellic (0.04g)	2.50^{c}	0^{c}	0
Control	32.75^{a}	16.25^{a}	49.62
LSD (P<0.05)	4.35^{a}	1.83	

*Means followed by the same letters are not significant at P<0.05 level of significance.

Also, the *X. aethiopica* seed powder treatments were more effective in suppressing oviposition than the oil palm bunch ash with mean egg plugs of 1.75 and 2.50 for the 15g and 10g concentrations respectively, which were not significantly different with the result obtained in Actellic dust treatment with observed mean egg plug of 2.25. Grains treated with 15g and 10g oil palm bunch ash, however, recorded mean egg plugs of 6.50 and 7.25 respectively for the same period, which proved significantly more effective in reducing oviposition than the control (Table 2).

Table 3: Effect of the plant products on percentage damage for cowpea grains caused by the bruchid weevil after 8 weeks of storage.

Treatment	No. of grains Randomly selected	Mean no of grains with adult emergent holes*	Grain damage (%)
Oil palm bunch ash 15g	5	5.75[b]	11.50
Oil palm bunch ash 10g	50	4.50[b]	9
Xylopia aethiopica seed 15g	50	0[c]	0
Xylopia aethiopica seed 10g	50	0.50[c]	1
Actellic (0.04g)	50	0[c]	0
Control	50	24.75[a]	49.50
LSD (P<0.05)		3.98	

*Means followed by the same letters are not significant at P<0.05 level of significance.

Olaifa and Erhun (1989) reported similar observations at low and high concentrations of *Piper guineense*. Similarly, Pereira (1983) discovered that 5ml of palm oil per kilogram of cowpea reduced percentage hatch of *C. maculatus*. When cowpea grains were treated with seed dust of *X. aethiopica* less number of eggs of *C. maculatus* was observed (Ojimelukwe and Kalu, 2003). The cowpea grains treated with 15g *X. aethiopica* seed powder were similarly observed to have completely retarded adult emergence. This complete prevention of progeny emergence was similar to the result obtained from Actellic dust treated jars. *X. aethiopica* seed powder at 10g per 100g seeds recorded 20% FI generation, which was in contrast to the higher percentage F1 post embryonic emergence found in seeds treated with 15 and 10g levels of the oil palm bunch ash that had percentage progeny development of 30.77% and 37.93% respectively (Table 2), which was significantly better than the control in which 49.62% F1

In Table 3, the result of the effect of the treatments on grain damage revealed that the two doses of *X. aethiopica* were significantly more effective in preventing grain damage by *C. maculatus*. Thus, 15 and 10g *X aethiopica* treatments that recorded zero and 1% damage respectively offered almost complete protection against weevil infestation. The oil palm bunch ash at 15g and 10g dosage rates provided 11.50% and 9.00% damage respectively, which were significantly better than 49.50% damage recorded in the untreated control. The zero damage recorded by the higher level of *X. aethiopica* seed powder (15g) compared favourably with the performance of the Actellic treatment used as a check. Dike and Mbah (1992) similarly used lemon grass products to protect cowpea grains in storage. Golob *et al* (1982) also reported that wood ash, tobacco dust and sand, protected maize grains against *Sitophilus zea mais Kotsch* and *Sitotriga cerealella* (Oliv). Ojimelukwe (200) found that seed damage for cowpea seeds stored with *X. aethiopica* against *C. maculatus* for six months was significantly less than seed damage in the control.

The effect of these plant products on seed viability after storage (Table 4) showed a significant difference between *X. aethiopica* and oil palm bunch ash treatment at 15g and the rest seed treatments (untreated seed (control) and Actellic dust) on percentage germination of cowpea seeds. The seeds treated with *X. aethiopica* seed powder were the least viable (72.50%) at 15g / 100g seeds. Ivbijaro (1983) previously reported that seeds treated with 1g and 3g dry ground neem seeds were 82% viable. Ojimelukwe (2000) also stated that seeds stored with *X. aethiopica* were significantly more viable than the infested control and comparable to the uninfested control. From the result, it is apparent that *X. aethiopica* in addition to the protection of stored grains reduced the viability of the treated seeds and may thus not be used for the storage of grains reserved for planting.

Table 4: Effect of plant materials on seed viability 8 weeks after storage

Treatment	No. of seeds planted	Mean no of seeds that germinated*	Seed germination (%)
Oil palm bunch ash 15g	10	9.25[a]	92.50
Xylopia aethiopica seed 15g	10	7.25[b]	72.50
Actellic (0.04g)	10	8.25[ab]	82.50
Control	10	8.75[ab]	87.50
LSD P<0.05)		1.59	

*Means followed by the same letters are not significant at P< 0.05 level of significance.

Physical examination of grains after treatment, revealed that notwithstanding the fact that the overall attractiveness of oil palm bunch ash there was neither a distortion in texture nor deterioration of the testa of stored grains. The insecticides of plant origin did not impart any unpleasant flavour on stored cowpea grains although, the peculiar sweet aroma of *X. aethiopica* (the African Ethiopian pepper a popular spice plant) could be perceived and tasted and the over-all attractiveness of the ash stored seeds were affected by the black colour of the oil palm bunch ash.

CONCLUSION

The efficacy of these plant extracts (*X. aethiopica* seed powder and oil palm bunch ash) in offering protection to cowpea grains against the weevil has revealed their potential as a reliable source of insecticides of plant origin. They have considerable potential as stored product insecticides. The approach is sustainable and offers a cheap control agent compared to the high cost of synthetic insecticides. Besides, these natural plant extracts are safe to handle, readily available and environment friendly.

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