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INHIBITORY EFFECT OF SOME PLANT MATERIALS ON THE EGG-LAYING ABILITY AND ADULT EMERGENCE OF COWPEA BRUCHIDS, *CALLOSOBRUCHUS MACULATUS*

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ABSTRACT: Four plant materials were evaluated in the laboratory for their inhibitory action on the egg-laying ability and adult emergence of cowpea bruchids, *C. maculatus*, with the hope of utilising them as storage protectants against the said insect pest. The plant materials were *Piper guineense* (seed and leaf), *Xylopia aethiopica* fruit and citrus peel. Actellic dust, a known synthetic storage insecticide, was used alongside the four plant materials while there was an untreated control which acted as standard check.

The results from the study show that *Piper guineense* (seed and leaf), citrus peel as well as *Xylopia aethiopica* significantly reduced the number of eggs laid as well as the number of emerged adults at some of the tested dosages. Actellic dust outperformed all other treatments with respect to the parameters tested.

1. INTRODUCTION: Cowpea is a warm-weather drought-tolerant crop, and it is grown throughout the tropics particularly on semi-arid and low-rainfall regions. It provides food and fodder, and improves soil fertility. It is cultivated in about 7.7 million ha worldwide of which about 6 million ha is in Africa. However, the average yield of cowpea is low (100 to 300kg ha^{-1}) because of numerous constraints, particularly insect pests, and diseases. In addition to yied loss in the field, cowpea also suffers considerable loss in storage due to bruchids (F.A.O. 1981).

New and relatively uninfected cowpea appears in the market between the months of September and November. Within three months, infestation by weavils, mainly *Callosobruchus maculatus*, becomes a storage problem. A conservative estimate put grain losses during storage at between 15 and 20% annually (Agboola, 1980). Caswell (1973) estimated that 4.5% of the annual reduction, valued at $30 million, is lost annually in Nigeria alone due to bruchids and some consider this to be a conservative estimate.

Repellants, antifeedants, and inhibitory and insecticidal substances have been identified in a large variety of plant species long before the industrial revolution of the late 1930s and 40s when compounds such as nicotine, derris and pyrenthrum were the only effective insecticides. (Olaifa and Akingboungbe, 1986).

The insect pest under study is a field-to-store pest. Infestation starts on the field and is carried over to the store in form of eggs. Inhibitors are present in plants which can prevent this insect from laying eggs and when eggs are laid, development into adults is also inhibited. This should help in reducing the

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menace of the insect pest under study. It is against this background that some plant parts were tested for the parameters under consideration with the objective of recommending the part(s) which are effective as storage protectants against the cowpea bruchids, *Callosobruchus maculatus*. The plants considered are *Piper guneense* (seed and leaf), *Xylopia aethiopica* (fruit) and citrus peel while actellic dust, a known synthetic storage protectant, was used alongside the plant materials. These materials were applied at various concentrations.

2.0 MATERIALS AND METHODS

2.1 Insect Culture- *Callosobruchus maculatus* was cultured in brown cowpea variety IT-124 at 12% moisture content and room temperature. Six Kilner jars each containing 300g of cowpea were used. Ten bruchids made of six females and four males were introduced into each of the jars. After six days, the insects were removed and the emergence of adults awaited.

2.2 Preparation of Test Plant Materials: *Xylopia aethiopica* fruit, *Piper guineense* seed and leaf, as well as citrus peel were washed, sun-dried and ground in a high-speed blender into fine particles. They were then sieved separately, and preserved in solid powder form.

2.3 Cold Treatment of Cowpea Seeds: Cowpea used for this experiment was first frozen in the deep freezer for seven days so as to kill any bruchids present in the seeds irrespective of the stage of development.

2.4 Application of Plant Powder: *Xylopia aethiopica* fruit, *Piper guineense* seed and leaf, and citrus peel powder was applied to 100g of cowpea in specimen bottles at various concentrations i.e. 1g/100g, 1.5g/100g and 2g/100g of cowpea. The control was not treated with any plant powder. Cowpea seeds were also treated with actellic dust at the rate of 0.03, 0.05 and 0.07/100g of cowpea seeds. The following observations were then made and recorded.

2.5 Egg-laying Record: The record of number of eggs laid by the surviving bruchids in each of the treated cowpea bottles was recorded daily for a period of two weeks.

2.6 Emergence of Adults: The number of adults that emerged from each of the treatments was recorded.

3.0 RESULTS

3.1 Effect of Powdered Plant Materials and Actellic Dust on the Egg-laying Ability of Bruchids: Egg-laying was observed on day three of data collection and it was discovered that the various treatments brought about significant differences in the number of eggs laid by the bruchids, with the exception of *Xylopia* treatment at 1.0g per 100g of seeds. All the treatments significantly reduced egg-laying in the bruchids (*C. maculatus*) compared with the control. The *Piper* seed treatments compared favourably with actellic dust at various doses tested (Table 1).

3.2 Effect of Powdered Plant Materials and Actellic Dust on Adult Emergence: The effects of powdered plant materials and actellic dust on adult emergence of *C. maculatus* are shown in Table 2. Significant differences were observed in the number of adult insects that emerged from the cowpea seeds as from day two of data collection. The various treatments, with the exception of *Xylopia aethiopica* on days 1 to 4, significantly reduced the number of insects that emerged from the seeds when compared with the control. The actellic dust treatment, particularly from day four onward, was superior to the other forms of treatments.

4. DISCUSION: All the treatments at various concentrations significantly reduced the number of eggs laid compared with the control except *Xylopia aethiopica.*

The reduction by *P. guineense* seed and leaf might be due to the presence of a toxic substance known as piperine in the plant material. Citrus peel was found to significantly reduce the number of eggs laid at all the dosage levels compared with the control. This might be due to the presence of active components present in the peel which are capable of inhibiting egg production (Helen, 1972; SU, 1976).

Very few adults emerged from the seeds treated with citrus peel at all the dosage levels. This might also be due to the presence of active components in the peel acting as toxicant to the bruchids at both the developmental and adult stages (Helen *et al,* 1972; SU, 1976). Actellic dust inhibited emergence of adults at 0.05g/100g and 0.07g/100g of seeds but few emerging adults were observed in the seeds treated with 0.03g/100g. Adesuyi (1979) and Conghurn (1973) reported that actellic dust inhibited adult emergence at all dosage levels they tested throughout their period of study.

5. CONCLUSION: Both *Piper guineense* (seed and leaf) and citrus peel were found to be toxic to bruchids by reducing their population through inhibition of egg laying and reduction in the number of

TABLE 1: Egg record of Callosobruchus maculatus adults After powdered materials of plant application

NO OF EGGS LAID (CUMULATIVE)

DAYS		3	4	5	6	7	8
TREATMENT (g)							
Piper guineense							
Seed	1.0	4.1bc	7.3b	9.3cd	13.1c	15.0bc	15.1bc
	1.5	3.2cd	6.3bc	8.1de	10.2cd	13cd	13.2c
	2.0	3.1cd	6,3bc	8.2cde	8.3d	8.3e	8.3d
Piper guineense							
Leaf	1.0	5.2ab	9.1ab	14.1ab	18.2ab	23.1ab	27.2a
	1.5	4.0bc	8.2ab	11.2bc	15.3bc	20.0b	24.3ab
	2.0	4.0bc	7.0b	11.0bc	13.1c	16.2b	18.4bc
Citrus peel							
	1.0	5.2ab	10.0a	14.0ab	17.2b	20.0b	24.1ab
	1.5	4.0bc	9.3ab	13.1b	17.1b	19.3b	20.3b
	2.0	4.bc	4.1c	9.1de	11.2c	13.2cd	15.2bc
Xylopia aethopica							
Fruit	1.0	6.2a	1.0a	16.1a	20.0ab	20.1b	28.1a
	1.5	5.1ab	9.0ab	13.2b	17.0b	20.0b	20.2b
	2.0	4.2bc	8.1ab	11.3bc	14.3b	16.2b	18.1bc
Actellic dust							
	0.03	3.3cd	8.0ab	12.0bc	14.1b	17.0b	17.0bc
	0.05	3.2cd	7.0ab	10.0c	10.0de	1.0de	10.4cd
	0.07	2.0d	4.2c	6.3c	8.0d	10.0de	10.4cd
Control	0	6a	10a	10c	21a	27a	33.3a

Same letters after figure in a column between means denote lack of significant difference according to turkey test at P = 0.05.

TABLE 2: Number of emerged adults after powdered Materials of plant application.

		ADULT EMERGENCE (CUMMULATIVE)							
DAYS		1	2	3	4	5	6	7	8
TREATMENT (g)									
Piper guineense									
Seed	1.0	1.0a	1.0cd	2.0cd	3.0de	5.0ef	5.0	5.1ef	5.5f
	1.5	1.0a	1.1cd	2.0cd	3.0de	3.0gf	4.0f	4.0f	4.0f
	2.0	1.0a	2.1cd	2.0cd	2.0e	2.1g	2.1g	2.1g	2.1g
Piper guineense									
Leaf	1.0	1.0a	2.0c	4.0bc	6.0b	7.0cd	7.0d	7.0d	7.0d
	1.5	1.0a	1.0cd	4.0bc	5.0bc	5.0c	7.0d	7.0d	7.1d
	2.0	1.0a	1.0cd	3.0bc	5.0bc	6.2de	6.0d	6.0de	6.2de
Citrus peel									
	1.0	0a	2.1c	3.2c	4.0cd	6.0de	6.0de	6.0de	7.1d
	1.5	0a	1.2cd	3.0c	3.3de	4.0ef	4.2e	4.0f	4.2f
	2.0	0a	0d	1.0d	1.0fg	2.0g	2.0g	2.0g	2.0g
Xylopia aethopica									
	1.0	2.1a	4.0ab	4.2bc	5.0bc	8.2bc	14.2b	14.3b	17.3b
	1.5	2.2a	5.0a	5.1ab	8.0a	9.3b	12.1c	15.0b	16.2b
	2.0	1.0a	3.1bc	6.1a	6.0b	9.3b	11.2c	12.3c	13.0c
Actellic dust									
	0.03	0a	1.0cd	1.0d	1.0fg	1.0gh	1.1gh	2.0g	2.0g
	0.05	0a	0d	0d	0 0g	0d	0.0h	0h	0h
	0.07	0a	0d	0d	0g	0i	0.0h	0h	0h
Control	0	3.0a	4.0ab	6.3a	8.2a	13.4a	16.2a	24.3a	24.3a

N.S = Not significant

Same letter after figure in a column donotes lack of significant difference between means according to tukey test at P = 0.05.

emerged adults from egg. The test plants, however, should be further investigated so as to establish the constituents responsible for this inhibition. This will make it possible to recommend the plant materials for grain storage purposes against the cowpea bruchid, *Callosobruchus maculatus*.

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