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Short Communication

Assessment of the toxic potentials of some plants powders on survival and development of *Callosobuchus maculatus*

Y. M. Abdullahi[1] and S. Muhammad[2]*

[1]College of Science and Technology, Sokoto State Polytechnic, Sokoto, Nigeria.
[2]Department of Biological Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria.

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Dried leaves powders of *Guirea senegalensis*, *Piliostigma reticulatum* and dried fruit powder of *Piper guineense*, were tested along side a conventional insecticide, Actellic-2-Dust, to compare their efficacies on survival of cowpea weevil (*Callosobuchus maculates*) during storage. Both the treated and untreated cowpeas (control) were then infested with newly emerged adult bruchids of both sexes. In all the trials, 83 to 100% mortality rates were observed in the treated samples. The rates in the untreated control ranges from 33.3 to 43.6%. The effects of the powders on fecundity were more pronounced on *P. guineense* and Actellic-dust treated samples. Similar effects were observed on development of immature stages and emergence of adult weevils. *P. guineense* had the highest larvicidal effects and lower productivity result especially. *P. reticulatum* had the lowest mortality rate and higher productivity result. The effects of the different powders were found to be dose related.

Key words: Cowpea weevil, *Callosobuchus maculates*, biological insecticides, *Vigna unguiculata*.

INTRODUCTION

The use of naturally occurring plant materials to protect agricultural products against a variety of insect pests is an old-age practice in some parts of the world (Peter, 1985). Extracts from different plants have been shown to possess insecticidal properties against a wide range of insect pests (Golob et al., *1982;* Delobel and Malonga, 1987; Srivastava, 1988; Dennis, 1990; Onolemhemhen and Oigiangbe, 1991; Ruskin 1992; Liu, 1994; Hossafay and faisal, 1994; Imam, 1997; Lale, 1992, 1994; Yahaya and Magaji, 1997; Yahaya, 2002). Cowpea, a protein rich food, is a staple food in many societies. It is used not only as human food but also as a fodder for livestock feeds. It is subject to attack by a variety of insect pests. However, *Callosobuchus maculatus* is probably the most common pest of stored cowpea seeds in Nigeria.

Several measures have been adopted to curtail the problems of insect infestation. These include the use of chemical agents/insecticides such as DDT and Lindane (Srivastava 1998). Despite these efforts, insect infestation during storage still persists. In view of the economic importance of cowpea, the severity of damage caused and the problems associated with the use of synthetic insecticides (Osuji, 1985; Ruskin, 1992) we evaluated natural methods for the control of *C. maculatus* during storage.

MATERIALS AND METHODS

The materials used are dried leaves of *Guirea senegalensis*, *Piliostigma reticulatum*, dried fruits of *P. guineense* and a synthetic insecticide, Actellic-2-Dust. The dried materials were ground and sieved repeatedly to obtain the finest particles. Local variety of cowpea *Vigna unguiculata* L. (Walp) was used in this study. The Cowpea seeds with emergence holes or egg debris on the testa were considered infested and removed. The un-infested seeds were sterilized by freezing for three weeks to kill any residual insect. Adult weevils (*C. maculatus*) used in the experiment were reared in the Physiology Laboratory, Usmanu Danfodio University, Sokoto on previously sterilized *V. unguiculata* seeds. The second-generation adults that emerged were employed in all the trials.

Four sterilized petridishes (9 cm x 1 cm) containing 50 g of sterilized cowpeas were treated with 1 g of the plant powders separately. The 5th petri dish contained untreated cowpeas, serving as control. The Petri dishes were labelled accordingly and kept in the laboratory. Both dishes were then infested with 10 newly emerged adult bruchids of both sexes. Each treatment and control

*Corresponding author. E-mail: sanusi1966@yahoo.com.

was replicated three times at 24 h interval. Temperature and relative humidity ranges between 25-28^{o}C and 50-60%, respectively.

The same procedure was repeated using the same quantity of the grains treated with 2 g and 3 g of the dusts in the second and third trials. Observations were made on adult's mortality, fecundity and emergence of the adult weevils. The weevils were considered dead when there was no response after proving the abdomen with a pin. Eggs laid on 20 seeds randomly selected from each petridishes were counted on the 5th, 6th and 8th day post infestation in trials 1, 2 and 3, respectively. These set of seeds were then returned into the Petri dishes containing various dusts and, observations were made on emergence of adult weevils. The data obtained was subjected to analysis of variance.

RESULTS

Adult Mortality

Results obtained have shown clearly that the materials tested affected the longevity or survival of the cowpea weevils. Between 83-100% mortality rates were recorded in trials (Table 1). The mortality rates in the untreated control ranges between 33.3-43.6% in all the trials within the same period. Analysis of variance revealed a significant difference between the treated and untreated samples (P<0.01).

Table 1. Effects of plant materials used on mortality of *C. maculates*.

Treatment	Mean Mortality (%)		
	1st trail (1g)	2nd trail (2 g)	3rd trail(3 g)
P. reticulatum	83.3b/8	83.3b/6	86.67b/5
G. senegalensis	80b/8	90c/6	83.67b/5
P. guineense	100 c/8	100d/6	100c/5
Actellic Dust	100c/8	100d/6	100c/5
Control	43.3a/8	43.3a/6	33.3a/5

Note: Means with the same letter or not significantly different at P>0.05.

Table 2. Effects of experimental materials on ovipostion.

Treatment	Mean Fecundity (%)		
	1st trail (1g)	2nd trail (2 g)	3rd trail (3 g)
P. reticulatum	55.3c	51c	35.3c
G. senegalensis	62d	52.3c	38.3c
P. guineense	26a	20.3a	16.3a
Actellic Dust	45b	38b	26.7b
Control	71c	67d	65d

Means followed by a common letter do not differ significantly at 5% level (P<0.05).

Oviposition

Table 2 shows the mean number of eggs laid in both treated and untreated cowpeas. Oviposition was very much reduced in treated samples as compared with untreated control. Very few eggs were laid in *P. guineense* treated samples. *P. reticulatum* and *G. senegalensis* have the least ovicidal effects with highest mean fecundity of 51-62 eggs in trials 1 and 2. However, at higher concentration (3 g) all the materials used have significant effects on egg-laying capacity of the weevils (Table 2).

Adult Emergence

The effects of the powders on egg development and emergence of adults of *C. maculatus* is shown in Table 3. The table revealed that in all the trials between 49.2-59.1% of the total eggs laid in *P. guineense* treated samples died at various stages of development. Also more than 60% of the total eggs laid, developed and emerged as adults in *G.senegalensis* and *P. reticulatum* treated samples. This means that *P. guineense* powder has the highest larvicidal effects and lowest productivity result (Table 3). *G. senegalensis* is least efficacious especially at lower concentrations (1 and 2 g).

Table 3. Total number of adult that emerged.

Treatment	Mean Emergence (%)		
	1St trail (1 g)	2nd trail (2 g)	3rd trail (3 g)
P. reticulatum	76.5c	71 c	66.9c
G. senegalensis	80cd	78d	68.9c
P. guineense	50a	50.8a	40.9a
Actellic Dust	66.6b	59.7b	53.7b
Control	81.2d	83d	79.5d

Means with the same letter are not significantly different at P<0.05.

DISCUSSION

The result clearly revealed that each of the materials tested have distinct effects on survival of *C*. *maculatus.* Treatment of cowpea with various concentrations of the dusts affected the longevity/survival period of the weevils, resulting in higher mortality rates of *C*. *maculatus*). Yahaya and Magaji (1997), reported earlier that powders of *P. guinnense,* significantly affected survival and egg-laying capacity of the adult weevils. It was also observed that increased in the concentration reduces the life span of the weevils.

The higher ovicidal effects/reduced oviposition rates observed in *P. guineense* treated cowpeas agrees with the findings of Lale, 1992; Yahaya and Magaji 1997; Yahaya, 2002. The striking effects of *P. guineense* powder could be attributed to its guineensine 1 component and to its irritating smell which prevents physical contact and caused suffocation among the adult

weevils. Though reasons for the higher larvicidal effects are not clear, the significant difference observed in productivity results especially in *P. guineense* treated samples indicated the possible potentials of the dust as an alternative agent for the control of *C. maculatus.* The the effect of each powder was dependent upon its concentrations. Thus lower rates were clearly insufficient to have a pronounced effect on oviposition and larval development especially in *G.senegalensis* and *P. reticulatum.* When compared with other experimental materials, *P. guineense* seems to be more efficacious. Conculusively, *P. guineense* could provide adequate protection to cowpea against *C. maculatus* during storage. More extensive study might provide useful information on the potentials of these plants.

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