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Evaluation of insecticidal properties of *Momordica charantia* in reducing oviposition and seed damaged by *Callosobruchus maculatus* (Fab.) Walp

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The efficacy of leaf powder of *Momordica charantia* against the storage pest, *Callosobruchus maculatus* on stored cowpea was investigated. Leaf powder was added as admixtures to 20 g of grains at the following rates of 0.5g, 1.0g, 1.5g and 2.0g to assess contact toxicity, damage assessment, progeny production. Results indicated that the plant material was toxic to the insect. The leaf powder of *M. charantia* applied at 2.0g greatly caused reduction in the number of eggs laid, eggs hatched and significantly inhibited adult emergence and seed damaged by the weevils compared to other concentrations. The result revealed that *M. charantia* powder can be used as guarding against storage pest infestation in storing cowpea seed.

Key words: Admixtures, Concentrations, Efficacy, Inhibit, Leaf powder

Introduction

Agricultural produce cannot all be consumed at once; there is needed for proper storage. One major problem encountered by farmers during storage of farm produce is insect pest infestation. This often leads to loss in both quality and quantity of the produce (Ogunleye, 2000). Synthetic insecticides are still being employed for the control of storage insect pests. However, the short comings associated with the use of conventional method elucidate the need for alternative pest management strategies that would protect the farmers and their produce, in addition to being affordable and available when needed. In Nigeria, nature has bestowed an array of insecticidal or medicinal plants across the various ecological zones, which could play a fundamental role in pest management strategies. Various natural plant products have been used with a

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good degree of success as protectants against a number of stored products' insect pests (Ewete and Alamu, 1999).

Momordica charantia is native to Africa but has been used in Chinese folk medicine for centuries as a 'bitter cold' herb, and has recently been brought into mainstream Chinese medicine as well as natural medical traditions around the world. Recent research has shown that the immature fruit might have some antibiotic, anticancer, and antiviral properties, particularly well suited for use in treatment of malaria, HIV, and diabetic conditions (Wikkipedia, 2001) but the insecticidal properties are not yet to the exploited. This research work aimed to evaluate the effectiveness of *M. charantia* in controlling of the storage pest, *C. maculatus*. Therefore, the objective of this study was to evaluate the insecticidal properties of *M. charantia* in reducing oviposition and seed damage by *C. maculatus* in stored cowpea.

Materials and Methods

The study was carried out in the Department of Agricultural Technology, Rufus Giwa Polytechnic, Owo, Ondo State, Nigeria (7^0 11' 43" N 5^0 33' 57" E), in March 2011.

The adult of *Callosobruchus maculatus* used for the experiment was obtained from infested cowpea bought from Oja–Oba market, Akure, Ondo State. The cowpea seeds were put in a kilner jar covered with muslin which prevent the insects from escaping and allow for aeration. The jar was kept at room temperature for the insects to breed and multiply and emerged insects were used for the experiment.

The seeds of cowpea drum variety used as bioassay were obtained from Erekesan market (Oja-Oba), Akure, Ondo state. These were properly hand-picked and sieved, thus ensured that only wholly and uninfested seeds were used. These were nevertheless then kept in a deep freezer for 4 weeks to kill any immature stage of the insect (if any); followed by air drying in the laboratory for 24 hours to prevent mouldiness according to the work of Olotuah *et al.* (2007). Disinfected cowpea seeds were then weighed using digital weighing balance model TS 400D (precision standard) into 20g in triplicate for each concentration and then stored in cool dry place as stated by Iloba and Ekrakene (2006).

Leaves of *M. charantia* were obtained from the polytechnic community and air dried under a room temperature for about 15days. Thereafter, the dried leaves were grounded into powder using hammer mill as stated by Epidi *et al.* (2008).

Toxicity Effects of M. charantia on C. maculatus

The plant powder was tested at 0.5g, 1.0g, 1.5g, and 2.0g per 20g of uninfested cowpea seeds in separate glass petri-dish (9.0cm). There was also a control treatment involving no addition of plant powder on the seeds. Each petri-dish was tumbled several times to ensure homogenous mixing of powder with grains as the method of Adesina (2010). Ten unsexed insects of *C. maculatus* were introduced into each petri-dish. Adult mortality was monitored and counted 48 hours after infestation. Percentage adult mortality was calculated using the method by Omotosho and Oso (2004) as follows: - Percentage mortality = number of dead insects/ total number of insect x 100.

Insects were considered as dead on failure to respond to three probings using a blunt dissecting probe as stated by Obeng-oforie *et al.* (1997). The numbers of eggs laid by the female beetles on the seeds were counted at 14 days after infestation, this used to calculate the percentage egg hatching according to Abdullah *et al.* (2011) as follows:- egg hatching (%) = total eggs hatched/total eggs in each petri-dish x 100.

At the end of the experiment of 35days, the number of adult emergence were recorded, damaged seeds and undamaged seeds were counted and used to determine the percentage punctured grains as stated by Law- Ogbomo and Enobakhare (2007) as follows:- Percentage punctured grains = number of punctured grain per treatment / total number of grain per treatment x 100.

The experiment was designed as Completely Randomized Design (CRD) with three replications. The egg counts, damaged and undamaged seeds were transformed to square root. The percentages were arcsine transformed before analysis. Data were subjected to analysis of variance (ANOVA) using Microsoft Excel 2003 software package, and treatment means were compared using Least Significant Difference (LSD) at $p< 0.05$.

Results and discussions

Effect of leaf powder of M. charantia on survival of C. maculatus

Survival of *C. maculates* in 48 hr post treatment was highest (30.99 %) in cowpea treated with 0.5 and 2.0 g concentrations (Table 1). Survival rate among the different concentrations did not differ within the treatment means, but significantly different compared to control treatment. This result supported by Epidi *et al.* (2008) findings that leaf powders of *Vitex grandifolia* and *Dracaena arborea* did not significantly suppress the survival of *C. maculatus.*

Table 1. Percentage means mortality of *C. maculatus* at 48 hours after treatment of infested grains with different concentration of *M. charantia*

g powder/20g of grain	*C. maculatus* mortality
0.0g	0.00
0.5g	30.99
1.0g	28.78
1.5g	30.78
2.0g	30.99
LSD (0.05%)	2.23

Effect of leaf powder of M. charantia on number of eggs laid by C. maculatus

The mean number of eggs laid by *C. maculatus* is presented in Table 2. The leaf powder applied at 2.0g greatly caused reduction in the number of eggs laid by the weevils and this was significantly different ($P< 0.05$) compared with 0.5g and control treatments. The reduction in the rate of oviposition by *C. maculatus* is consistent with Adesina (2010) who reported that storing cowpea seeds by admixture with plant powders would fill the intergranular air space and prevent free movement of adults for mating and oviposition.

Table 2. Mean number of eggs laid by *C. maculatus* at 14 days after treatment of infested grains with different concentration of *M. charantia*

g powder/20g of grain	mean no of egg laid
0.0g	12.40
0.5g	6.40
1.0g	3.48
1.5g	3.32
2.0g	2.07
LSD (0.05%)	2.41

Effect of leaf powder of M. charantia on percentage egg hatching laid by C. maculates

Egg hatching was lowest in cowpea seeds treated with 2.0g concentration of the leaf powder and highest in the control as shown in Table 3. The control was significantly higher than in all levels of *M. charantia* treatment concentrations. From the result, it can be deduced that the plant powder contains ovicidal properties that inhibit percentage egg hatching. This confirms earlier finding of Maurya (2009) that *M. charantia* act as ovicidal on mosquitoes.

Table 3. Percentage mean egg hatching of *C. maculatus* treated with different concentration of *M. charantia*

g powder/20g of grain	% mean egg hatching
0.0g	30.9
0.5g	27.53
1.0g	26.15
1.5g	24.97
2.0g	21.27
LSD (0.05%)	2.41

Effect of leaf powder of M. charantia on adult emergence of C. maculates

Adult emergence was highest in control (27.93) and at 2.0g dosage, adult weevil did not emerge (Table 4). This finding confirms earlier report of Maurya (2009) that *M. charantia* fruit wall act as an effective biolarvicide against mosquitoes. This effectiveness is due to the fact that *C. maculatus* lay their eggs on the seed coat thus bringing the eggs and larvae in close contact with the plant powder as reported by Adedire and Lajide (2001).

Table 4. Means adult emergence of *C. maculatus* in grains treated with different concentration of *M. charantia*

g powder/20g of grain	mean no of emerging adults
0.0g	27.93
0.5g	24.83
1.0g	21.43
1.5g	17.35
2.0g	0.00
LSD (0.05%)	5.99

Effect of leaf powder of M. charantia on punctured seeds by C. maculates

M. charantia exhibited significantly different at 2.0g, 1.5g and 1.0 g treatments compared to control (Table 5). This showed that the plant possesses insecticidal properties. The result was in consistent with Adesina (2010) that the higher the rate of adult emergence, the higher the percentage seed punctured.

Table 5. Percentage means of punctured seed treated with different concentration of *M. charantia*

g powder/20g of grain	% punctured seeds
0.0g	31.55
0.5g	15.65
1.0g	16.38
1.5g	7.04
2.0g	6.15
LSD (0.05%)	19.02

Conclusion

The finding showed that leaf powder of *M. charantia* has a great potential for use as admixture with cowpea seeds in storage at small holding farmers' level to reduce insect pest infestation damage. Furthermore, there is needed to determine the chemical constituents of the plant, so as to evaluate the mammalian toxicity of the plant.

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