EVALUATION OF THE EFFICACY OF SOME SELECTED PLANT MATERIALS (BOTANICALS) IN THE CONTROL OF COWPEA WEEVIL (*Callosobruchus maculatus* F.) ON STORED COWPEA

Ilodibia, C.V[1]., Chukwuma, M.U[2]., Achebe, U[2]., Emeka, A[1]., Egboka, T[1] and Ezeabara, C.A[1]

[1]Department of Botany, Nnamdi Azikiwe University, Awka. Anambra State
[2]Nwafor Orizu College of Education Nsugbe. Anambra State
Email: chinyereokafor206@yahoo.com

ABSTRACT

Laboratory experiments were conducted to assess the efficacy of three botanicals on cowpea weevil, (*Callosobruchus maculatus).* Treatments consisted of *Citrus* peel power (CPP) *Occimum* spp. Leaf powder (OLP) hot pepper power (HPP) at dosage rate of 1g /20g cowpea seeds, a synthetic insecticide, Pirimiphos-methyl dust (PMD) at 0.1g /20g cowpea seeds as check and a control. The experiments were laid out in a completely randomized design (CRD) replicated three times. Results revealed that HPP was most effective in increasing adult mortality, in reducing progeny emergence and cowpea seeds damage. The maximum shelf life of the botanicals was attained at 12weeks after treatment (WAT), except that the effectiveness of HPP persisted for up to 16 WAT and was more effective than other botanicals at this period. HPP is hereby recommended in the control of *C. maculatus* on stored cowpea seeds.

Keywords: Botanicals, Cowpea Weevil and Stored Cowpea

INTRODUCTION

Cowpea is an important leguminous crop. It serves as a source of plant protein in both the tropical and sub-tropical regions of the world. Cowpea grains like other agricultural produce in the tropics are beset with storage problems. Ihiedioha, (1992) noted that, the longer cowpea seeds remain in storage, the more susceptible they are to infestation by rodents, insects etc.Infestation of stored cowpea is of great concern to famers because it results not only in food shortage for human consumption but also in scarcity of planting materials. Insect pests are by far the greatest threat to stored cowpea seeds. The Nigerian Institute of Food Science and Technology (NIFEST) estimated that about 4% of cowpea seeds harvested annually is lost as a result of weevil attack during storage. In Nigeria and other developing countries of the world, ignorance and lack of adequate storage methods have compounded the situation.

In a situation where a high percentage of the world population especially the third world countries depend on plant produce for their existence, the need to preserve food to tide over the period of want becomes imperative. Plant and plant produce may be reduced not only in quantity but also in quality by pests and diseases in the field or at storage. In Nigeria it is estimated that between 45 to 55% of annual produce is lost during storage as a result of the activities of micro-organism and poor storage facilities (NRCRT, 1980). Similarly, Caswell, (1981) reported that cowpea weevil alone accounts for over 90% of the damage done to cowpea seeds by insects. Singh (1977) reported 100% loss of cowpea within 3-6 months of storage. There is therefore an urgent need for the development of an efficient control measures for these diseases and pests both in the field and at storage. In agriculturally developed countries, control of pest damage

during storage has been achieved through purposeful breeding technology and chemical treatments of seeds before and during storage. Research efforts in Nigeria are still in their niche and the country had insufficient funds to import modern chemicals and other technologies that have helped advanced countries to succeed. Furthermore, these chemicals have been reported to have short comings. Consequently, Nigerian Scientists are exploring ways and means of achieving control of storage pests and disease using locally available plants materials, otherwise called botanicals as an alternative to the use of synthetic chemicals in stored products protection. The present study therefore evaluates the efficacy of *Citrus* peel powder, *Occimum* leaf powder and hot *Capsicum* powder as botanicals in the control of cowpea weevil *Callosobruchus maculatus on* stored cowpea.)

MATERIALS AND METHODS

The study was conducted in the Botany laboratory, Nnamdi Azikiwe University Awka from July 2012 to September 2012. Insects used for the experiment were collected from infested stock of cowpea seeds from Ose market in Onitsha, Anambra State. The cowpea seeds were also collected from the same market. The plant materials were collected from different locations in Onitsha.

Plant materials

Citrus fruits were peeled using a sharp knife. *Citrus* peels, *Occimum* leaves and fruits of chilli (hot pepper) were air-dried and ground to fine powder in a laboratory mill. The powders were bagged in black polyethylene bags to prevent possible volatilization of active ingredients and stored for the different bioassays.

The cowpea seeds (Mgbanani) black variety was first sterilized by freezing for 48 hours in order to kill any insect pest present. The seeds were later sieved with a 2mm sieve to remove dead insects, exuviate and frass. These seeds were then packed into polythene bags and later used for the experiment.

Insect Culture

The test insect s *C. maculatus* were cultured in black cowpea variety *Mgbanani* at ambient laboratory conditions (Abulude *et al.* 2007). Ten pairs of *C. maculatus* were introduced to glass jars each containing 500g of cowpea seeds previously sterilized by freezing for 48 hours. The glass jars were covered and tightened to present the contamination and escape of insects. Seven days were allowed for mating and Oviposition. The parent insects were sieved out and the cowpea seeds containing eggs were left undisturbed until the new adults emerged. Progenies of the insects, which emerged from the cultures, were used for the experiment.

Experimental Design

Citrus peel, powder, *Occimum* leaf powder, and hot pepper powder were separately added as direct admixtures with cowpea seeds in 70cm-wide Petri- dishes at the rate of 1g/20g of cowpea. Pirimiphos-methyl (*acetellic* dust 2%) was used as a standard insecticide and was admixed at 0.1g /20g cowpea seed. There was an untreated one which did not contain any botanical and serve as control. The whole treatments were labeled and kept in the laboratory cup board and were used for the experiment. Two Petri-dishes were randomly selected from each of these batches of treated or control seeds and were infested with three *C. maculatus* pairs for oviposition. The rest were stored for 4, 8, 12 and 16 weeks after treatment (WAT), before they were infested with *C. maculatus* as previously stated. The experiment was laid out in a completely randomized design with three replications each. In each case, adult *C. maculatus* were removed after three days. During the first two days, dead C. maculatus were replaced and

on day three, all *C. maculatus* were removed. The treated cowpea seeds and the control, each containing *C. maculatus* eggs, were monitored daily until the F1 progenies emerged.

Data Collection

The data were collected on daily replacement of dead insects or mortality, daily progeny emergency and extent of seed damage, done by counting the number of seeds with holes per treatment.

Data Analysis

Frequency of replacement data, progeny *C. maculatus* counts having low counts and zero values were transformed to square roof of (x + 0.5) before analysis of variance while perforation or exit hole counts expressed as percentages were arcsine transformed prior to the analysis of variance. Mean separation was carried out using SNK test at 0.05. LSD

RESULTS AND DISCUSSION

The effect of treatment of cowpea seeds with botanicals on mean daily replacement of dead adult insects is presented in Table 1. The result showed that PMD recorded the highest adult insect mortality at (0 -16 WATs) these were followed by HPP. PMD was more effective and recorded the highest mortality in adult insect compared to botanicals, although these were at par with HPP. Among the botanicals, HPP is most effective. CPP had the lowest number of dead adult insects and least effective but better than the control.

Table 2 shows the effects of treatment of cowpea seeds with botanicals on mean daily progeny emergence. Treatments containing botanicals or P M D recorded significantly lower progeny emergence than the control. PMD was most effective treatment in reducing the number of emerged progeny followed by HPP. While PMD had the lowest emerged progeny and was most effective compared to other treatments, HPP was significantly more effective among treatments containing botanicals.

The results in Table 3 show the effect of treatment of cowpea seeds with botanicals on mean percentage cowpea seeds with holes. The result revealed that the control seeds recorded significantly higher percentage cowpea seeds with holes compared to other treatments. PMD was most effective and recorded the lowest percentage cowpea seeds with holes and HPP was the most effective treatment in reducing percentage cowpea seeds with holes compared to other botanicals.

The study showed that mean daily mortality of *C. maculatus* was significantly higher in PMD and HPP treatments throughout the period of the experiment. HPP was more toxic to *C. maculatus* than other botanicals. But they are all better than the untreated control. Similarly, the plant materials lost their potency and effectiveness with time. The present work is in conformity with the work of Raja *et al.* (2000) which reported that when pulses were stored in gunny bags treated with aqueous extracts from leaves of *Melia azadirachta Hyptis suaveolens* and tubers of *Cyperus rotundus,* they effectively protected them without insect infestation for up to 6 months.

Treating cowpea seeds with botanicals at the dosage of 1g/20g cowpea seeds gave protection against progeny emergency and reduced severe damage on cowpea seeds compare with untreated control irrespective of period after treatment. From 0- 16WATs, all plant materials and PMD protected cowpea seeds against *C. maculatus* except that PMD recorded lower mean daily

progeny emergency and percentage cowpea seeds. This confirms with the findings of Dike and Mbah (1992) who reported that lemongrass powdery products were effective, at 20. 0g per 100g cowpea seeds in protecting cowpea seeds from bruchid attack up to eight weeks post-treatment.

However, data on percentage cowpea seeds with holes shows significantly higher weight loss in the control treatment than in the botanicals. This agrees with Kossau and Bosque-perez (1995) that damage to maize seeds is actually done to embryo. The present study shows that all the botanicals used had insecticidal action against *C. maculatus*, and HPP was more effective in reducing cowpea seed damage and number of emerged progeny and increasing their mortality. The use of those botanicals would eliminate the possibilities of food contamination when synthetic insecticidal are mixed with grain in storage. Also the use of botanicals in storage pest control could become an important Supplement to synthetic pesticides because of their broad spectrum of bioactivity and relative safety to the environment, man and other animals. Botanicals are even more affordable than synthetic insecticides.

CONCLUSION

The results of the study showed that HPP, at lg per 20g could be effective against infestation by *C. maculatus* in cowpea grains and could be considered for integration with other effective control options in the management of *C. maculatus*.

Table 1: The effect of treatment of cowpea seeds with botanicals on mean daily replacement of dead adult insects

Mean number of dead *C. maculatus* per weeks after Treatment (WAT)					
Treatment	0	4	8	12	16
CPP	3.33^{bc}	2.33^{c}	2.33^{b}	2.00^{b}	1.33^{b}
OLP	2.60^{c}	1.67^{c}	2.33^{b}	2.00^{b}	1.67^{b}
HPP	4.67^{bc}	2.67^{c}	4.00^{b}	3.00^{b}	2.50^{b}
PMD	6.33^{a}	4.67^{a}	4.33^{a}	4.00^{a}	3.67^{a}
CNTL	2.33^{bc}	2.00^{c}	1.67^{b}	1.33^{b}	1.00^{b}
SE±	0.84	0.58	0.70	0.73	0.84

1 Means in column followed by the same letter (s) are not significantly different at ($P < 0.05$) using student Newman –Keul's Test (SNK).

2 CPP = *Citrus* peel powder, OLP = *Occimum* leaf powder, HPP = hot pepper powder, PMD = Pirimiphos-methyl dust, CNTL = control

Table 2: Effect of treatment of cowpea seeds with botanicals against mean daily progeny emergency in *C. maculatus*

Mean progeny development per weeks after treatment (WAT)					
Treatments	0	4	8	12	16
CPP	24.33^{d}	13.33^{c}	17.33^{c}	17.00^{c}	15.00^{c}
OLP	54.00^{b}	24.67^{b}	25.67^{b}	21.00^{b}	24.67^{b}
HPP	37.00^{bc}	8.00^{e}	8.00^{e}	6.67^{e}	6.33^{e}
PMD	13.33^{e}	2.67^{f}	2.00^{f}	2.00^{f}	1.00^{f}
CNTL	57.33^{a}	83.00^{a}	54.67^{a}	54.67^{a}	53.33^{a}
SE±	4.89	0.93	0.68	1.18	0.80

Means in column followed by the same letter (s) are not significantly different ($P < 0.05$) using student Newman Keul's Test (SNK)

Table 3: Effect of treatment of cowpea seeds with botanicals on mean percentage cowpea seeds with holes

Mean % cowpea seeds with holes per weeks after treatment (WAT)					
Treatments	0	4	8	12	16
CPP	19.50[b]	7.09[c]	6.01[cd]	5.68[c]	5.68[c]
OLP	21.56[ab]	9.03[b]	8.02[b]	7.69[b]	9.04[b]
HPP	20.87[b]	5.68[c]	5.01[cd]	4.67[c]	3.67[d]
PMD	11.38[c]	1.13[e]	1.67[e]	1.33[e]	1.33[e]
CNTL	19.60[a]	21.52[a]	21.53[a]	22.57[a]	23.63[a]
S E	0.01	0.03	0.01	0.00	0.01
CNTL	57.33[a]	83.00[a]	54.67[a]	54.67[a]	53.33[a]
SE±	4.89	0.93	0.68	1.18	0.80

REFERENCES

Caswell, G.H. (1981). Damage to stored cowpea in the Northern part of Nigeria. *Samaru Journal of Agricultural Research 1:* 1-11

Dike, M.C and Mbah, O.I. (1992). Evaluation of the lemon-grass *Cymbopogon citratus* staph.) products in the control of Callosbruchus maculatus F. (coleopteran: Bruchidae) on stored cowpea. *Nigerian journal of plant protection* 14: 88-91.

Ihedioha, K. (1992). Rodent control will reduce food losses in Africa. *African science monitor Nigeria* 15:115.

Kossau, D.K. and Bosque- perez, N. A. (1995). *Insect pests of maize in storage: Biology and Control.* IITA Research Guide 32, Training Program, International Institute of Tropical Agriculture (IITA), second edition Ibadan, Nigeria. 28pp

Raja, N., Albert, S., Babu, A and Ignacimuthu, S. (2000). Role of botanical protectants and larval parasitoid *Dinarmus vagabundus.*

Singh, S. R. (1977). Cowpea cultivars resistant to insect pests in world germplasm collection. *Tropical Grain Legume Bulletin* 9:3-7.