Journal of Agriculture and Sustainability
ISSN 2201-4357
Volume 8, Number 2, 2015, 61-68

The Efficacy of *Atemisia annua* and *Occimum grastissimum* Leaf Powders against *Callosobruchus maculatus* (F) (Coleoptera: Bruchidae) on Stored *Vigna unguiculata*

Okore, Oghale. O. and Okoro, Chinwendu N.

Zoology and Environmental Biology Department, Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State, Nigeria

Corresponding author: Okore, Oghale. O., Zoology and Environmental Biology Department, Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State, Nigeria

Abstract: Labouratory trials were carried out to test the efficacy of *Atemisia annua* and *Occimum grastissimum* leaf powders against the cowpea bruchid (*Callosobruchus maculatus)* on stored *Vigna unguiculata* seeds. The efficacy of the plant powders on the adult emergence rate was investigated in two separate sets A and B. From the results obtained, it was observed that both plant powders posses' insecticidal properties. 100% mortality was observed after eight days of subjecting the adult bruchid to the plant powders. They were effective against the insect evidenced from the reduced rate of emergence and percentage number of seeds with perforations. Significant differences were obtained between the control and treatments. The highest numbers of emerging adults recorded in the control experiment were 397.00 ±147.08 and 605.00 ±121.62. The highest number recorded for *A. annua* and *O. grastissimum* in the four weeks were 85.50 ±21.92 and 60.00 ±4.24. A reduction in the population of an insect in most instances makes for reduced pest impact on stored products. This was evidenced in this research as percentages of perforated seeds in the control, *A. annua* and *O. grastissimum* treated seeds were 80%, 57% and 27.5% respectively. These results show that *A. annua* and *O. grastissimum* have potential as botanicals for preventing the loss accrued to this insect.

Key words: *A. annua*, *Callosobruchus maculates*, efficacy, emergence rate, insecticidal, *Occimum grastissimum.*

Introduction

The storage bruchid *Callosobruchus maculatus* (F.) (Coleopetera: Bruchidae) is a major pest of stored cowpea *Vigna unguiculata* (Walp.) seeds in the tropics and sub tropics (Jackai and Daoust, 1986 and Murdock *et al.*, 1997). Ngamo *et al.,* (2007) reported it as a major pest of stored cowpea in Africa and particularly in northern Cameroon. Cowpea seeds are very important and cheap source of dietary protein for many countries (Ofuya, 2001). Damages due to insects affect especially the quality, the quantity, and the commercial and agronomic values of the product (Bell, 1998). In general, stored grain insect larvae usually bore into the grain feeding preferentially on the germ with large amount of the protein and vitamins (Dal Bello *et al*., 2001). The protection of agricultural products from diseases and pests are achieved in industrialized countries today almost entirely through the application of synthetic chemical products (Amatobi, 1995 and Boeke, 2002). Their improper usage has led to high mammalian toxicity, environmental pollution and insect resistance problem. Target insects are able to develop resistance against single insecticide (Boeke, 2002). This has made for search for alternative insecticides worldwide. Numerous authors have reported on the use of natural products which are cheap, less toxic to mammals, easy to adopt and environmentally friendly (Lale, 2002, Oparaeke and Amodu, 2000 and Lale and Adulrahman, 1999). Opaeraeke and Daria (2005) used *Trecularia africana* (African bread fruit) seeds to control *C. maculatus.* Also, Ogunwolu and Idowu (1994) reported that the powder of the seeds of *Azadirachta indica* (neem seeds) lowered the oviposition and adult emergence of *C. maculatus.* Thus, this present study was carried out to ascertain the efficacy of *Atemisia annua* and *Occimum grastissimum* leaf powders against the cowpea bruchid (*Callosobruchus maculatus)* on stored *Vigna unguiculata* seeds.

Materials and Method

This research was carried out in the Biology labouratory of the Michael Okpara University of Agriculture, Umudike, in Abia state, Nigeria. The cowpea seeds and

Occimum grastissimum leaves were purchased from the Umuahia (Abia state capital) main market while the leaves of *Atemisia annua* were obtained from the Ministry of Agriculture Enugu State, Nigeria. Whole cowpea seeds were selected and sterilized using the Uniscope labouratory oven at 60^{o}C to kill any egg on the seeds.

The plant leaves were washed, oven dried at 45^{o}C and ground into fine powder. The powders were stored in sterilized bottles prior to use.

Mortality test

The effect of the plant powders on *C. maculatus* , measured with rate of death was carried out. 10 of the bruchid were introduced into Petri-dishes containing 0.5g of the powders and adequately covered and monitored. Daily monitoring at every 6 hours interval was done for 10 days. Death records were taken; dead weevils showed no visible sign of movement after 3 minutes observation. There was a control in which 10 *C. maculatus* were kept in a Petri-dish without the plant powders. This experiment lasted until 100% death was recorded with the plant powders. Percentage mortality was obtained using the formula below

$$\% \text{ Mortality} = \frac{\text{number of dead bruchid}}{\text{Total number of bruchid}} \times 100$$

Investigating the effect of the plant powders on *C. maculates* in bean seeds.

To ascertain the insecticidal activity of the plant powders (treatment) in stored bean seeds, 15.0g of the carefully selected and sterilized seeds were weighed into appropriate containers. 2.0g of the treatments were mixed with the bean seeds and 10 golden brown adults of the bean bruchid were introduced into each of the mixtures. Golden brown adults were selected to ensure young adults were used. A control experiment in which there was no treatment was similarly set up. There were 5 replicates for each of the treatments and the control. The experiment was carried out in two sets, A and B. The cultures were allowed to stand for a month after which new adult bruchids began to

emerge. The numbers of emerging adults was after then counted on weekly basis for 4 weeks. The percentage number of bean seeds with perforations was also calculated.

Data collected from the replicates were analysed using the Analysis of Variance. Mean separation was achieved using Duncan's multiple Range Test.

Results and Discussion

The results indicated that the leaf powders of *A. annua* and *O. gratissimum* have insecticidal properties on *C. maculatus.*

Mortality rate

100% mortality was recorded from the Petri-dishes containing the *O. gratissimum* plant powder at day 8 and on this same day, mortality on *A. annua* treatment was 90% (90.00 ± 10.00) while for the control, it was 30% (30.00 ± 10.00) . Death of the insect started occurring on the control from day 3 with the record of 3.33 ±5.77 while in the treatments, it was after the first day. The values obtained are shown in table 1.

Table 1: **Mortality rate of** *A. annua* and *O. gratissimum* plant powders on *C. maculatus.*

Days	Control	*A. annua*	*O. gratissimum*
1	0.00^{c} ±0.00	3.33^{b} ± 5.77	20.00^{a} ±10.00
2	0.00^{b} ±0.00	26.67^{a} ±11.55	30.00^{a}± 17.32
3	3.33^{b} ±5.77	30.00^{a} ± 10.00	40.00^{a} ± 17.32
4	10.00^{b} ± 10.00	50.00^{a} ±17.32	60.00^{a} ± 10.00
5	20.00^{b} ± 10.00	60.00^{a} ± 26.46	76.67^{a} ± 5.77
6	23.33^{b} ± 15.28	66.67^{a} ± 20.82	76.67^{a} ± 5.77
7	26.67^{b} ± 11.55	80.00^{a} ± 10.00	90.00^{a} ± 10.00
8	30.00^{b} ± 10.00	90.00^{a} ± 10.00	100.00^{a} ± 0.00

Means in the same row with different superscripts are significantly different ($P<0.05$)

Emergence Rate

Adult emergence was observed a month after commencement of the experiment. The figures obtained are shown in table 2a. The numbers of adult bruchids emerging from *A. annua* in the first week after the one month period were 10.00 ±0.00, 17.00 ±2.83 while for *O. gratissimum*, the following figures were obtained 10.00 ±0.00 and 11.00 ±0.00. By the fourth week, the number increased to 60.00 ±4.24 and 85.50 ±21.92 for *A. annua* and 26.00 ±5.66 and 44.50 ±14.85 for *O. gratissimum*. The control experiment recorded 67.00 ±21.21/45.50 ±12.02, 190.00 ±125.87/76.00 ±8.49, 397.00 ±147.08/128.50 ±23.34 and 605.00 ±121.62/151.50 ±43.13 in the four weeks of count. Significant differences were obtained in the numbers of *C. maculatus* recorded in all the preceding weeks except for the first week.

The percentage number of seeds perforated by the activities of the bean bruchid is shown in Table 2b. It was highest (80%) in the control. This was followed by the *A. annua* treatment and then the *O. gratissimum* with 45% and 19.5% in Set A experiments while in the Set B, the percentages were 70%, 57% and 27.5% respectively.

Table 2a: Numbers of Emerging *S. oryzae* in Rice cultures in the labouratory

	SETS A			SET B		
Weeks	Control	*A. annua*	*O. gratissimum*	Control	*A. annua*	*O. gratissimum*
1	67.00^{a} ±21.21	10.00^{b} ±0.00	10.00^{b} ±0.00	45.50^{a} ±12.02	17.00^{b} ±2.83	11.00^{b} ±0.00
2	190.00^{a} ±125.87	29.50^{b} ±2.12	60.00^{b} ±12.16	76.00^{a} ±8.49	44.50^{b} ±4.95	17.50^{c} ±4.95
3	397.00^{a} ±147.08	49.50^{b} ±3.54	60.00^{b} ±4.24	128.50^{a} ±23.34	79.50^{ab} ±20.51	29.50^{c} ±6.36
4	605.00^{a} ±121.62	60.00^{b} ±4.24	26.00^{b} ±5.66	151.50^{a} ±43.13	85.50^{b} ±21.92	44.50^{b} ±14.85

Means in the same row with different superscripts are significantly different

Table 2b. Percentage number of bean seeds with perforations

Treatments	Percentage seed perforation in SETS A	Percentage seed perforation in SET B
Control	80	70
A. annua	45	57
O. gratissimum	19.5	27.5

Discussion

From the result obtained in this study, it is very interesting to note that *O. gratissimum* was more potent in killing the adult bean bruchid. The potency of *O. gratissimum* was further buttressed by the result obtained in the number of emerging adult *C. maculatus* as more of the adult insect were obtained from the *A. annua* cultures in both Sets A and B experiments. Also the significant differences obtained in the second and third week after the one month period in the Set B experiment indicate that the two plant powders acted differently in affecting the adult insect. More seeds were perforated in the *A. annua* experimental sets than in the *O. gratissimum*. This latter plant material is more accessible to local farmers and individuals than *A. annua.* Its use to protect beans is thus advocated for and encouraged.

References

[1] Amatobi, C. I. 1995. Insecticide application for economic production of cowpea grains in the northern Sudan savanna of Nigeria. Int. J. of Pest Manage. 41: 14–18. 172

[2] Bell, A. P. H. 1998. Les pertes dues aux insectes sur les stocks paysans de céréales en Côte d'Ivoire. Céréales en région chaude AUPELF-UREF, Eds John Libbey Eurotext, Paris pp. 47-56.

[3] Boeke, S. J. 2002. Traditional African plant products to protect stored cowpeas against insect damage; the battle against the beetle. Ph D thesis, Wageningen University, p. 151.

[4] Dal Bello G, Pandin S, Lopez L, and Fabrizio M 2001. Laboratory evaluation of chemical biological control of rice weevil (Sitophilus oryzae L.) in stored grains. J. Stored Prod. Res. 37: 77-84.

[5] Jackai, L. E. N., Singh, S. R., Raheja, A. K. And Wiedijic, F. 1985. Recent trends in the control of cowpea, V. unguiculata (L.) Walp., pests in Africa. In: Cowpea Research, Production and Utilization (Singh, S. R. and Rachie K. C. eds.), pp. 233-243. John Wiley and Sons, Chichester, U. K.

[6] Lales, N. E. S. and Abdurrahman, H. J. 1999. Evaluation of neem (*Azadirachta indica* Juss.) seed oil obtained by different methods and neem powder for the management of Callosobruchus *maculatus* (F.)

[7] Lale N. E. S. (2002). Stored-Product Entomology and Acarology in Tropical Africa. Mole Publications, Port-Harcourt, Nigeria.

[8] Murdock, L. L., Chambliss, O. L., Endondo, C., and Wolfson, J. L. 1997. Post harvest storage of cowpea in sub-Saharan Africa. In: Advances in Cowpea Research (Singh, B. B., Mohan raj, D. R., Dashiel, K. E., and Jackai, L. E. N.) NTA/JJ VSD Publication,IITA, Ibadan, Nigeria.

[9] Ngamo, T. S. L., Kouninki, H. Ladang, Y. D. Ngassoum, M. B., Mapongmestsem, P. M.and Hance T. 2007. Potential of Anisopteromalus calandrae (Hymenoptera: Pteromalidae) as biocontrol agent of Callosobruchus maculatus (F.) (Coleopetera: Bruchidae). African Journal of Agricultural Research 2(4): 168-172.

[10] Ofuya, T. T. 2001. Biology, Ecology and control of Insect pests of stored food legumes in Nigeria. In: Pest of stored cereals and pulses in Nigeria: Biology, Ecology and VControl. Dave Collins Publications, Akure, Nigeria.

[11] Ogunwolu, O. and Idowu, O. 1994. Potential of powdered *Zanthoxylum zanthoxyloides* (Rutaceae) root bark and *Azadirachta indica* (Meliceae) seed for control of the cowpea bruchid, *Callosobruchus maculatus* (Bruchidae) in Nigeria. Journal of African Zoology, 108: 521-528

[12] Oparaeke, A. M. and Amodu, M. E. 2000. Insecticidal efficacy of cashew products against *Callosobruchus maculatus* on stored cowpea. Journal of Agricultural Research 11: 135 – 140

[13] Oparaeke, A. M. and Daria, V. S. 2005. Toxicity of some plant powders to *Callosobruchus maculatus* on stored cowpea. Nigerian journal of Entomology 22: 76 - 83