Int. J. Pure Appl. Sci. Technol., 23(1) (2014), pp. 34-39

International Journal of Pure and Applied Sciences and Technology

ISSN 2229 - 6107

Available online at ***www.ijopaasat.in***

Research Paper

Efficacy of Garlic (*Allium sativum*), Red Pepper (*Capsicum frutescens*), Yellow Pepper (*Capsicum annum*) on Cowpea Weevils (C*allosobruchus maculatus*) and their Potentials in Seed Protection

J.A. Wahedi[1,*], L.D. David[2], B.P. Mshelmbula[1] and R. Zakariya[1]

[1] Department of Biological Sciences, Adamawa State University, Mubi, P.M.B 25, Mubi, Nigeria

[2] Department of Biological Sciences, Taraba State University, P.M.B 1167, Jalingo, Nigeria

* Corresponding author, e-mail: (wajasini@yahoo.com)

(Received: 10-9-13; Accepted: 15-6-14)

Abstract: *The efficacy of garlic (Allium sativum), red pepper (Capsicum frutescens), and yellow pepper (Capsicum annum) alongside a synthetic insecticides (Rambo) was evaluated for their toxicity against cowpea weevils (Callosobruchus maculatus) and their ability on seed protection. The study was conducted at the Botanical garden of the Department of Biological Sciences, Adamawa State University, Mubi. Data collected was subjects to one way analysis of variance (ANOVA), and the treatment means were compared using the Duncan New' Multiple Range Test (DNRMT) at 5% probability level $P<0.05$. The results showed that the treatments were effective in controlling adult C. maculatus on stored cowpea, and the treatments had no effect on seed protection as treated seeds performed significantly equal to the control (untreated). Therefore, it is recommended that the yellow pepper, red pepper and garlic could be used to control weevils on stored cowpea.*

Keywords: *Allium sativum*, Biopesticide, *Callosobruchus maculatus*, *Capsicum annum*, *Capsicum frutescens*.

Introduction

Cowpea (*Vigna unguiculata* (L.) Walp) is a food and animal feed crop cultivated in a range of ecologies especially in the savannah region and in the tropics and sub tropics.[1] Cowpea can also be grown in poor soils with more than 0.2% organic matter and low levels of phosphorus.[2] It is a grain

crop Cowpea is known by different names around the world. In Africa the land of its primary origin, cowpea is known as '*wake'* and '*ewa'* in much of West Africa and '*kunde'* in East Africa.[3] This grain legume is the most economically important African indigenous legume crop.[4] Cowpea is a major source of dietary protein in tropical and subtropical regions of the world especially where availability and consumption of animal protein is low.[5] It is the most important source of food and fodder in West Africa with 23-25% protein in its grains, and an important source of vitamin B with 62% soluble carbohydrate and small amount of other nutrients.[6] Its green peas and dry grains are consumed as food, because of its superior nutritional attributes, adaptability and productivity.[7] Cowpeas are of economic value to humans and livestock but insects such as the bean weevil (*Callosobruchus maculatus*) causes considerable damage to these grains both in the field and storage. Postharvest losses of cowpea due to the bruchid *Callosobruchus maculatus* (F.) constitute a major setback in the storage of this crop.[1]

Cowpea weevils (*Callosobruchus maculatus* (Fab.)) infest seeds of wild and cultivated legumes to stored beans in the northern part of Nigeria.[8] The weevils prefer dried cowpeas but will attack other beans and peas in storage.[9]

Enhancing cowpea productivity on the field therefore requires the control of the cowpea weevil's activities. Various control tactics have been employed. The most popular being the chemical method which relies heavily on the use of synthetic insecticide and fumigants. Chemical insecticides have been used with great success. This unfortunately is costly, toxic to its users, presents undesirable effects on non-target organisms, aids development of resistant strains and are generally not environmentally friendly,[10,11] which has necessitated the exploration of a more sustainable alternative, especially the use of biopesticide which are environmentally safe, specific with broad spectrum bioactivity in the control of stored product pests.[12] Therefore, this study was carried out to determine the effects of garlic, red pepper and yellow pepper in the control of weevils in cowpea as well as cowpea seed viability.

Materials and Methods

Samples Collection

Garlic (*Allium sativum*), Yellow pepper (*Capsicum annum*) and Red Pepper (*Capsicum frutescens*) were bought from Mubi main market and were subsequently ground into fine powder using electric blender. These were stored separately in clean bottles with screw cap tops. A synthetic chemical (Rambo) (Transfluthrin 0.2%) was obtained from an Agro-chemical store in Mubi main market, and was used as control standard. Clean cowpea seeds were also procured from Mubi main market. They were dried to a constant weight in an oven between the temperatures of 45-50^{0}C for about seven days. They were subsequently air dried for about an hour and then wrapped tightly in a polythene bag.

Insect Culture

The initial stock of adult *Callosobruchus maculatus* was obtained from bins around Mubi main market on infested cowpeas and was maintained on beans in about 500cm^3 jar under laboratory conditions for about twenty four (24) hours before they were removed. It was subsequently maintained under laboratory conditions for F! adult *C. maculatus* emergence. This helped in raising adult weevils of uniform size and age.

Method of Application

Four replicates each of the treatment concentrations (1g, 2g, and 3g), including the synthetic chemical (Rambo), were constituted as follows: 1g, 2g, 3g of the powder treatments, were added to 20g of cowpea seeds in about 300ml rearing plastic jars and was stirred vigorously, to ensure a uniform coating of the grain by the powder treatment samples. Thereafter, 10 newly emerged adult *C*

maculatus were introduced into the plastic jars. The jar tops were covered with muslin clothes with the help of rubber-ring to allow proper ventilation. The control jar (also replicated four times) contained 10 newly emerged adult insects and 20g of cowpea but no treatment was added. The jar tops were also covered with Muslin cloth using rubber-ring.

Data Collection

Mortality count for adult *C. maculatus* was noted daily for about four days post exposure. This was done by first of all emptying the contents of the jars and the dead insects removed and subsequently the remaining contents of the jar were put back after retrieving the dead insects. Seed viability test was carried out two weeks after the mortality investigation on adult *C. maculatus*. Ten (10) cowpea seeds were picked from each plastic jar and were planted in well prepared and labeled plots in the botanical garden of Adamawa State University Mubi. Seed germination were noted and counted, 10 days after planting.

Data Analysis

Data collected was subjected to one way Analysis of Variance (ANOVA), and the treatment means were compared using the Duncan New' Multiple Range Test (DNRMT) at 5% probability level $P<0.05$.

Results and Discussions

Table 1 shows the effect of yellow pepper, red pepper, garlic bulb powder and a synthetic chemical (Rambo) on adult *Callosobruchus maculatus*.

Table 1: Effect of Garlic Bulb Powder, Red Pepper, Yellow Pepper and Synthetic chemical (Rambo) on the mortality of adult *C. maculates*

Treatment	Conc. (g)	Days (Mean±SD)			
		1	2	3	4
Control	0.00	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}
YP	1.00	4.00 ± 0.82^{b}	4.50 ± 1.29^{b}	1.50 ± 1.00^{b}	0.00 ± 0.00^{a}
	2.00	4.25 ± 0.50^{b}	4.75 ± 0.50^{b}	1.00 ± 0.00^{b}	0.00 ± 0.00^{a}
	3.00	4.25 ± 1.50^{b}	5.75 ± 1.50^{b}	0.00 ± 0.00^{a}	0.00 ± 0.00^{a}
RP	1.00	2.75 ± 0.50^{b}	4.25 ± 0.50^{bc}	3.00 ± 0.82^{b}	0.00 ± 0.00^{a}
	2.00	4.25 ± 1.26^{c}	3.75 ± 0.96^{b}	2.00 ± 1.16^{b}	0.00 ± 0.00^{a}
	3.00	3.50 ± 0.58^{bc}	4.75 ± 0.50^{c}	1.75 ± 0.96^{b}	0.00 ± 0.00^{a}
GBP	1.00	2.25 ± 0.50^{b}	5.00 ± 0.82^{b}	2.25 ± 0.96^{b}	0.75 ± 0.96^{a}
	2.00	2.75 ± 0.96^{b}	4.25 ± 0.50^{b}	1.75 ± 0.50^{b}	1.25 ± 0.96^{a}
	3.00	2.25 ± 0.50^{b}	4.75 ± 0.96^{b}	2.00 ± 0.82^{b}	1.00 ± 1.16^{a}
Rambo	1.00	2.50 ± 1.41^{b}	4.25 ± 0.96^{b}	3.25 ± 1.26^{b}	0.00 ± 0.00^{a}
	2.00	2.75 ± 0.96^{b}	5.00 ± 0.82^{b}	2.25 ± 0.50^{b}	0.00 ± 0.00^{a}
	3.00	3.00 ± 0.82^{b}	4.50 ± 0.58^{b}	2.50 ± 1.29^{b}	0.00 ± 0.00^{a}

Values are means of 4 replicates. Where YP= Yellow Pepper, RP= Red Pepper, GBP= Garlic Bulb Powder.

Means carrying the same superscript along the columns are not significantly different at P<0.05 (DNRMT).

All the treatments were toxic against *C. maculatus* when compared with the control untreated. Yellow Pepper recorded the highest mortality count of 4.25±0.50 and 4.25±1.50 at 2.0g and 3.0g respectively, and was quick in recording 100% mortality (0.00±0.00) at 3g treatment concentration. At the end of the experiment on toxicity effect of the treatment samples on adult *C. maculatus*, the biopesticide performed equal or better than the control standard, which further proves their effectiveness as biopesticide on cowpea weevils. The order of activity of the biopesticide in the mortality of *C. maculatus* is YP>RP>GP. All the treatments caused significant (P<0.05) mortality on adult *C. maculatus.* This corroborate with the findings of Ofuya,[13] who reported that dry chill-pepper were found very toxic and significantly caused higher mortality in cowpea weevils (*C. maculatus*); Ivbijaro and Agbaje,[14] who reported that red pepper significantly caused higher mortality on adult *C. maculatus*; Oparaeke and Dike,[15] who reported 75% mortality of adult *C. maculatus* exposed to garlic bulb powder (*A. sativum*).

Table 2 shows the effect of Yellow Pepper, Red Pepper, Garlic bulb powder and a synthetic chemical (Rambo) on seed viability.

Table 2: Effect of Garlic bulb powder, Red Pepper, Yellow Pepper and Synthetic Chemical (Rambo) on Cowpea Seed Viability

Treatment	Conc. (g)	Seed Viability (Mean±SD)
Control	0.00	7.25±0.50[a]
YP	1.00	6.00±2.71[a]
	2.00	7.25±2.87[a]
	3.00	7.25±1.26[a]
RP	1.00	5.50±0.58[a]
	2.00	6.00±2.45[a]
	3.00	6.75±0.50[a]
GBP	1.00	7.75±1.89[a]
	2.00	8.75±0.50[a]
	3.00	8.50±0.58[a]
Rambo	1.00	7.25±1.71[a]
	2.00	6.75±0.50[a]
	3.00	6.25±1.71[a]

Values are means of 4 replicates. Where YP= Yellow Pepper, RP= Red Pepper, GBP= Garlic Bulb Powder.

Means carrying the same superscript along the columns are not significantly different at P<0.05 (DNRMT).

All the treatments (biopesticide) including the control standard, did not differ significantly (P<0.05) from the control untreated. This indicates that the seed germination/quality was not affected by the

treatments. This coincides with the findings of Keita, *et al.*[16] and Sathyaseelan *et al.* [17] who reported that though various plant products were effective in reducing damage of *C. maculatus*, seed quality and germination were not affected. This also goes with the findings of Oparaeke and Dike,[15] where cowpea seeds treated with garlic bulb powder did not cause any effect on the seed germination.

Conclusion

The overall results confirmed that yellow pepper, garlic powder and synthetic chemical (Rambo) were effective against *C. maculatus*. Though all the treatments showed some activities on *C. maculatus*, 2.0g and 3.0g of all the treatments were found to be more effective especially in suppressing adult *C. maculatus* survival (mortality).

Acknowledgement

The authors wish to acknowledge the contribution of Professor Saquib Mohammad, Head of Department, Biological Sciences, Adamawa State University, Mubi for the statistical analysis.

References

[1] S.R. Singh, L.E.N. Jackai, J.H.R.D. Santos and C.B. Adalla, Insect of pests of cowpea, In: S.R. Singh (ed.), Insect Pests of Food Legumes, IITA/John Wiley and Sons, (1990), 43-89.

[2] B. Singh, Improving the production and utilization of cowpea as food and fodder, *Field Crops Research*, Scharum Publishers, India, 84(2003), 169-180.

[3] D. Gibbon and A. Pain, Crops of the Drier Regions of the Tropics, ELBSI Longman, (1988), 157.

[4] A.S. Langyintua, J. Lowenberg-Deboerji, M. Faye, G. Ibro, B. Moussa, A. Kengna, S. Kushwaha and G. Ntoukam, Cowpea supply and demand in west and central Africa, *Field Crops Research*, 82(2) (2003), 215-231.

[5] A.M. Oparaeke, M.C. Dike and I. Onu, Evaluation of seed and leaf powders of neem (*Azadirachta indica* A. Juss) and pirimiphos-methyl for control of *Callosobruchus maculatus* (F.) in stored cowpea, *Entomological Society of Nigeria (ESN)*, 31(1998), 237-242.

[6] B. Singh, Potential and constraint of unproved cowpea varieties on increasing the productivity of cowpea-cereal systems in the dry savannah of West African, in P. Majiwa, M.J. Odera, N. Muchiri, G. Omanya and P. Werehore (eds), A plan to apply technology in the improvement of cowpea productivity and utilization for the benefit of farmers and consumers in Africa, *Proceeding of Cowpea Stakeholders Workshop, Nairobi Kenya: African Agricultural Technology Foundation*, (2007), 14-26.

[7] J.E. Onyibe, A.Y. Kamara and L.O. Omoigui, Guide to cowpea production in Borno state, Nigerian, Promoting Sustainable Agriculture in Borno State (PROSAB), Ibadan, Nigeria, (2006), 36.

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

[9] C.C. Ohiagu, Storage of food grains in the savannah zones of northern Nigeria, In J.M. Menyonga, T. Benzumar and A. Youdeowie (Eds), Food Grain Production in Semi Arid Africa, SAFGRAD, Ouagadougou, Burkina Faso, (1987), 361-368.

[10] B. Jembere, D. Obeng-Ofori, A. Hassanali and G.N.N. Nyamasoyo, Products derived from the leaves of *Ocimum kilimandscharicum* (Labiatae) as post-harvest grain protectants against the infestation of three major stored product insect pests, *Bulletin of Entomological Research*, 85(1995), 361-367.

[11] E.U. Okonkwo and W.I. Okoye, The efficacy of four seed powders and the essential oils as protectants of cowpea and maize grains against infestation by *Callosobruchus maculatus* (Fabricius) (Coleoptera: Bruchidae) and *Sitophilus zeamais* (Motschulsky) (Coleoptera: Curculionidae) in Nigeria, *International Journal of Pest Management*, 42(3) (1996), 143-146.

[12] L.J. Bamaiyi, I.S. Ndams, W.A. Toro and S. Odokina, Laboratory evaluation of mahogany (*Khaya senegalensis* Desv.) seed oil and seed powder for the control of *callosobruchus maculates* (Fab.) (Coleoptera: Bruchidae) on stored cowpea, *Journal of Entomology*, 4(3) (2007), 237-242.

[13] T.I. Ofuya, Use of wood ash, dry chill-pepper fruits and onion scale leaves for reducing *Callosobruchus maculatus* (F.) damage in cowpea seeds during storage, *J. Agric. Sci. Cam*., 107(1986), 467-468.

[14] M.F. Ivbijaro and M. Agbaje, Insecticidal activities of *piper guineense* schum and thonn and *capsicum* species on the cowpea bruchid, *Callosobruchus maculatus* (F.), *Insect Science and its Application*, 7(1986), 521-524.

[15] A.M. Oparaeke and M.C. Dike, Comparison of garlic and lemon grass products at the control of *Callosobruchus maculatus* F. (Coleoptera: Bruchidae) on stored cowpea grains, *Nigerian Journal of Entomology*, 13(1996), 73-80.

[16] S.M. Keita, C. Vincent, J.P. Schmit, J.T. Arnason and A. Belanger, Efficacy of essential oil of *Ocimum basilicum* L. and *O. gratissimum* (L). applied as on insecticidal fumigant and powder to control *Callosobruchus maculatus* (Fab.) (Coleoptera: Bruchidae), *Journal of Stored Products Research*, 37(4) (2001), 339-349.

[17] V. Sathyaseelan, B. Baskaran and S. Mohan, Efficacy of some indigenous pesticidal plants against pulse beetle, *Callosobruchus maculatus* (L.) on green gram, *Journal of Entomology*, 5(2) (2008), 128-132.