Original Article

Basic Science

Evaluation of *Vernonia amygdalina* for the Control of *Tribolium confusum* on Stored Pearl Millet

Livinus Y BAWA [1], Lucius J BAMAIYI [1], Oparaeke A AMADI [2], Joseph N AINIKA [2,*]

ABSTRACT [ENGLISH/ANGLAIS]

The efficacy of Bitter leaf products was evaluated for the control of *Tribolium confusum* infesting pearl millet seeds. The plant products were used at 2.5 g, 5.0 g, 10.0 g and 1.0 ml, 2.0 ml, 4.0 ml /100 g pearl millet seeds while Actellic EC was applied at recommended by manufacturer. All the treatments were replicated three times. The parameters assessed include, mortality, emergence, damage and germinability of seeds. The results showed that Actellic EC (2%) caused significantly higher ($p < 0.05$) mortality of adult *T. confusum* at 24 hrs than bitter leaf treated grains and the control. The extract at 4.0 ml had significantly ($p < 0.05$) higher mortality of *T. confusum* than other formulations and the untreated control. The powder at all levels and extract at 1.0 ml and 2.0 ml are not significantly different compared to the control. At 48 hrs and 72 hrs Actellic EC caused significant ($p < 0.05$) mortality (100%) of adult *T. confusum* compared to others while the extract at 4.0 ml had higher mortality compared to the control. No significant mortality was recorded among plant products and the control at 72 hrs. No emergence of *T. confusum* at all levels of bitter leaf treatments at 4 weeks except at 2.0 ml of extract and the control which was not significant. At 8 weeks the emergence was significantly higher ($p < 0.05$) on the control than on different concentrations of powder, extract and Actellic EC. No significant difference was observed among the treated grains. Grain damage and grain germination showed no significant difference in all the treatments.

Keywords: Bitter leaf, pearl millet, Actellic EC *Tribolium confusum*

RÉSUMÉ [FRANÇAIS/FRENCH]

L'efficacité des produits feuille amère a été évaluée pour le contrôle de Tribolium confusum infestant des graines de millet perle. Les produits végétaux ont été utilisées à raison de 2,5 g, 5,0 g, 10,0 g et 1,0 ml, 2,0 ml, 4,0 ml / 100 g de graines de mil tandisActellic CE a été appliqué à recommandé par le fabricant. Tous les traitements ont été répétés trois fois. Les paramètres évalués sont, la mortalité, l'émergence, les dommages et la faculté germinative des semences. Les résultats ont montré que Actellic CE (2%) a provoqué significativement plus élevée ($p < 0,05$) la mortalité des adultes T. confusum à 24 heures que la feuille amère grains traités et le contrôle. L'extrait à 4,0 ml était significativement ($p < 0,05$) plus élevé de mortalité de T. confusum que d'autres formulations et le témoin non traité. La poudre à tous les niveaux et l'extrait de 1,0 ml à 2,0 ml et ne sont pas significativement différente par rapport au témoin. À 48 heures et 72 heures Actellic CE causé significative ($p < 0,05$) de la mortalité (100%) des adultes T. confusum par rapport aux autres alors que l'extrait à 4,0 ml ont eu une mortalité plus élevée par rapport au témoin. Aucune mortalité significative n'a été enregistrée parmi lesproduits végétaux et le contrôle à 72 heures. Aucune levée de T. confusum à tous les niveaux de traitements foliaires amères à 4 semaines, sauf à 2,0 ml d'extrait et le contrôlequi n'était pas significative. À 8 semaines à l'émergence était significativement plus élevée ($p < 0,05$) sur le contrôle que sur différentes concentrations de poudre, extrait etActellic CE. Aucune différence significative n'a été observée entre les grains traités.Dommages de céréales et de la germination du grain n'a pas montré de différence significative dans tous les traitements.

Mots-clés: Feuille amère, le millet perlé, Actellic CE Tribolium confusum

Affiliations:

[1] Department of Crop protection, Faculty of Agriculture, Institute for Agricultural Research, Ahmadu Bello University, Zaria, NIGERIA

[2] Agronomy Department, Institute for Agricultural Research, Faculty of Agriculture, Ahmadu Bello University Zaria, NIGERIA

Address for Correspondence/ Adresse pour la Correspondance: ainikajoseph@yahoo.com

Accepted/Accepté: February, 2012

Citation: Bawa LY, Bamaiyi LJ, Amadi OA, Ainika JN. Evaluation of *Vernonia amygdalina* for the Control of *Tribolium confusum* on Stored Pearl Millet World Journal of Engineering and Pure and Applied Sciences 2012;2(2):69-73.

INTRODUCTION

Pearl millet (*Pennisetum glaucum*) probably originated in the West African savanna region. It is grown on more than 43 million hectares world-wide and ranks sixth among the important cereal crops in the world. In 2003, world-wide pearl millet production was estimated at 29.8

million metric tons, harvested on 36.3 million hectare, an area larger than that used for wheat production in the USA [1].

Nigeria is an important millet producing country. With an average annual production of 3.4 million metric tons it ranks second after India in global millet production [2]. Pearl millet is very hardy crop which thrives in conditions which most other crops would not survive. Africa and Asia together account for 98 percent of world output [3]. The pearl millet seed beetle, *Tribolium confusum* is a secondary pest of stored produce. Damage may be up to 5% in grain weight [4].

A large number of plant-derived substances exert various physiological and behavioral activities on stored product insects and notable among these plants are various spices and medicinal plants used traditionally for protecting foodstuffs against insects [5].

Bitter leaf (*V. amygdalina*) is a shrub or small tree that grows up to 23 feet tall with gray or brown bark that is rough and flaked. The pith, leaf, and root have medicinal qualities. The root and the twigs are chewed as appetizers. The herb is believed to have tonic, anti-parasitic, anti-tumor, and anti-bacterial properties [6].

This study examines the insecticidal activities of bitter leaf plant, the leaf powder and the extract of the plant using beetle adult mortality, emergence, damage, and germinability as indices.

MATERIALS AND METHODS

Insect Culture

The target pest *Tribolium confusum* was reared in the Laboratory under room temperature in the Department of Crop Protection, Ahmadu Bello University, Zaria.

The *T. confusum* for culturing was obtained from already infested millet seeds from the Storage Laboratory. Two weeks after oviposition, the adult weevils were sieved out in order to eliminate mixing with F_1 generation. The main objective of this procedure is to obtain and use 24 hrs old adults for the experiment.

Preparation of Materials

Bitter leaf was obtained from Samaru environs. The fresh leaves were shade- dried for five days and pounded into powder using mortar and pestle. Similarly, the fresh leaves were pounded and 100 g was weighed and 1000 ml of water was added to it which was left to stand for 48 hours after which the mixture was sieved using a muslin cloth. The filtrate is the crude extract. The crude extract was used at three different rates of 1.0 ml, 2.0 ml, and 4.0 ml. Actellic EC was used as check. For the powder it was used also at three rates of 2.5 g, 5.0 g, and 10 g.

Statistical Analysis

The analysis of variance (ANOVA) was carried out to verify the existence of significant differences between treatments. Student's Newman Keul test (SNK) was used to separate the means.

RESULTS and DISCUSSION

The Effect of Bitter Leaf Powder and Leaf Extract on Mortality of Adult *T. Confusum*

The results (Table 1.) showed that Actellic EC (2%) caused significantly higher ($p < 0.05$) mortality of adult *T. confusum* at 24 hrs compared to bitter leaf treated grains and the control. Bitter leaf extract at 4 ml /100 g seeds had significantly ($p < 0.05$) higher mortality of *T. confusum* compared to the other formulations at different treatment levels and the untreated control. But bitter leaf powder at all levels and bitter leaf extract at 1.0 ml and 2.0 ml are not significantly different compared to the control.

At 48 hrs Actellic EC caused significantly higher ($p < 0.05$) mortality of adult *T. confusum* than the other treated grains and the control. Bitter leaf extract at 4.0 ml /100 g seed had significantly ($p < 0.05$) higher mortality of *T. confusum* than the control but there was no significant difference among bitter leaf treatments on one hand and the control on the other. Actellic EC recorded a 100% mortality of *T. confusum* at this point. At 72 hrs all the bitter leaf treatments did not caused any significant mortality compared to the untreated.

Effect of Bitter Leaf Powder and Leaf Extract on Progeny Emergence of *T. Confusum*

Results showed that at 4 weeks there was no emergence of *T. confusum* at all levels of treatment except at 2.0 ml of bitter leaf extract and the control which was not significant. At 8 weeks post-treatment the progeny emergence was significantly higher ($p < 0.05$) on the control than on bitter leaf powder, bitter leaf extract at different concentrations and Actellic EC, but there was no significant difference among the treated grains.

Effect of Bitter Leaf Powder and Leaf Extract on Percentage Damage of Millet Seeds at 8 Weeks Post-Treatment

The percentage grain damage showed no significant difference in all the treatments although, the control had more grain damage than the treated grains.

Table 1: This table shows effect of bitter leaf powder and leaf extract on mortality of Adult *Tconfusum* at 24, 48, and 72 hours post-treatment

Treatment	Conc.(g or ml /100 g seed	24 Hours	48 Hours	72 Hours
Bitterleaf powder	2.5g	0.00c	0.33bc	1.00b
	5.0g	0.00c	1.00bc	1.33b
	10.0g	0.67c	1.33bc	1.67b
Bitter leaf extract	1.0ml	0.33c	1.00bc	0.33b
	2.0ml	0.00c	1.67bc	1.00b
	4.0ml	2.67b	3.67b	1.67b
Actellic EC	2.0ml	9.67a	0.00a	0.00a
Control	0.00	0.00c	0.00c	0.00b
SE±		0.34	0.58	0.35

Means with the same letter(s) in a column are not significantly different at 5% using SNK.

Table 2: This table shows effect of bitter leaf powder and leaf extract on progeny emergence of *T. Confusum* after exposure to treatments

Treatment	Concs g or ml/100 g seed	Progeny emergence at 4, and 8 weeks respectively.	
		F_1	F_2
leaf powder	2.5g	0.00a	1.67b
	5.0g	0.00a	1.00b
	10.0g	0.00a	0.67b
leaf extract	1.0ml	0.33a	0.00b
	2.0ml	0.00a	0.00b
	4.0ml	0.00a	0.00b
Actellic EC	2.0ml	0.00a	0.00b
Control	0.00	0.67a	12.00a
SE±		0.18	1.57

Means with the same letter (s) in a column are not significantly different at 5% using SNK.

Table 3: This table shows effect of bitter leaf powder and leaf extract on percentage damage of millet seeds at 8 weeks.

Treatment	Concs g or ml/100 g seed	Mean damage
leaf powder	2.5g	1.67a
	5.0g	1.33a
	10.0g	1.00a
leaf extract	1.0ml	0.33a
	2.0ml	0.33a
	4.0ml	0.00a
Actellic EC	2.0ml	0.00a
Control	0.00	4.00a
SE±		4.62

Means with the same letter(s) in a column are not significantly different at 5% using SNK

Table 4: This table shows effect of bitter leaf powder and leaf extract on percentage germinability of millet seeds at 12 week

Treatment	Concs g or ml/100 g seed	Percentage germination
leaf powder	2.5g	51.7
	5.0g	52.7
	10.0g	64.3
leaf extract	1.0ml	51.7
	2.0ml	57.7
	4.0ml	62.7
Actellic EC	2.0ml	60.3
Control	0.00	43.7
		NS
SE±		5.05

Means with the same letter(s) in a column are not significantly different at 5% using SNK

Effect of Bitter Leaf Powder and Leaf Extract on Percentage Germinability of Millet Seeds at 12 Weeks Post-Treatment

Results of the effect of bitter leaf powder and leaf extract on millet seeds germinability showed that there was no significant difference among all the treatments, although bitter leaf powder at 10.0 g /100 g seed had higher germination compared to bitter leaf extract at 4.0 ml/100 g seed and Actellic EC in that order.

In the present study, the leaf powder and leaf extract were evaluated, along with Actellic EC used as a check. Actellic EC (2%) caused significantly higher ($p < 0.005$) mortality of adult *T. confusum* during the periods on pearl millet compared with plant products.

Enobakhare and Law-Ogbomo [7] showed that *O. gratissimum* and *V. amygdalina* as grains Protestants have been observed to be effective in the management of *Sitophilus oryzae.*

In terms of adult emergence the plant products significantly ($p < 0.005$) suppressed emergence of adult *T. confusum* when compared with the control (Table 2). Adult emergence of *T. confusum* was least in millet seeds treated with bitter leaf extract while the control significantly ($p < 0.005$) had the highest adult emergence. The efficacy of the plant products in significantly suppressing emergence has largely been attributed to ovicidal properties, which prevent eggs from hatching into adults [8]. The damage inflicted on millet grains by *T. confusum* after two months of storage as presented in Table 3, shows that damage was more in the control treatment but not significantly different compared to bitter leaf extract and Actellic treatments. The effectiveness of the plant products which reduced damage to millet seeds stored for two months may be due to the suppression of progeny development [9, 10, and 11].

Treatment of millet seeds with the plant products has no effect on the germinability of the treated seeds. Oparaeke *et al.* [12] reported that some plant products may not hinder seed after a three months storage period.

CONCLUSION

Results obtained from this study demonstrate the potentials of these plant derived insecticides against millet weevil in Nigeria. These multiple effects of the powder, and extract, and their availability locally make them attractive candidates in upgrading traditional postharvest protection practices.

Further investigations are required to determine the efficacy and methods of formulation of their active principles.

REFERENCES

[1] Faostat and Agricultural Organization of the United Nations Rome, Italy (2004). Accessed from http://apps.fao.org.food . Last accessed: December 2011.

[2] Anonymous. Federal Ministry of Agriculture and National Resource, Abuja, Nigeria 1998. p. vii.

[3] Mahendral P, Jayanta D, Rai RK. Fundamentals of Cereal Crop production. Tata McGraw-Hill publishing Company Limited New Dehli. 1996. p. 95-108.

[4] Amatobi CI. Arthropods pests of Crops in Nigeria: General Biology. Natural Enemies and Control. P.A Ndahi Printing No. 45 club street S/Gari, Zaria. 2007. p.190-2.

[5] Ho SH, Koh L, MA Y and Sim KY. The oil of garlic Allium sativum L. (Liliaceae), as a Potential grain protectant against Tribolium castaneum (Herbst) and Sitophilus zaemais Motsh. Postharvest Biology Technology 1996;9:41-8.

[6] Anonymous. Bitter Leaf general information. 2007. Accesed from: http://www.Herbalremedies.com/bitter leaf-information.html . Last Accessed April 2008.

[7] Enobakhare DA, Law-Ogbomo KE. Efficacy of leaf powders Ocimum gratissimum and Vernonia amygdalina as grain protectants against Sitophilus zeamais Mots. In three varieties of maize. J. Agric for fish 2002;33:22-7.

[8] Jadhav KD, Jadhav LD. Use of vegetable oils, plant extracts and synthetic products as Protestants from pulse beetle Callosobruchus maculatus in stored grain. Journal of food Science Technology 1984;14:100-13.

[9] Ivbijaro MF. Toxicity of neem seed Azadirachta indica A. Juss to Sitophilus oryzae (L.) in store Maize. Protection Ecology 1983.5:353-7.

[10] Oparaeke AM, Dike MC and Onu I. Control of Callosobruchus maculatus F. on stored Cowpea with African curry, Ocimum gratissimum L. and African bush tea, Hyptis suaveolens Poit leaf powders. Nigerian Journal of Entomology 2002;19:99-108.

[11] Oparaeke AM, Amodu YE.The insecticidal efficacy of cashew products against Callosobruchus

maculatus F. on stored cowpea. Samaru Journal of Agricultural Research 2003.19: 135-40.

[12] Oparaeke AM, Dike MC.Comparison of garlic and lemon grass products in the control of Callosobruchus maculatus Fab. (Coleoptera: Bruchidae) on stored cowpea grains. Nigerian Journal of Entomology 1996;13: 73- 80.

ACKNOWLEDGEMENT / SOURCE OF SUPPORT

I wish to acknowledge Bawa's family for their financial supports during this study.

CONFLICT OF INTEREST

No conflicts of interests were declared by authors.