Evaluation of Seed and Fruit Powders of *Capsicum annum* and *Capsicum frutescens* for Control of *Callosobruchus maculatus* (F.) in Stored Cowpea and *Sitophilus zeamais* (Motsch) in Stored Maize

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Abstract

Capsicum annum and Capsicum frutescens fruit and seed powders were evaluated in the laboratory for the control of Callosobruchus maculatus (F.) in stored cowpea and Sitophilus zeamais Motschulsky in stored maize. Capsicum frutescens seed powder and Capsicum annum seed powder dust were toxic to C. maculatus and S .zeamais at the rate of 5.0g, 7.5g and 5.0g, per 50g cowpea and 50g maize within 48hrs and 96hrs respectively. This paper highlights the potential of C. frutescens and C. annum seed powders as seed protectants against the test bruhids at higher rates, than their ineffective fruit powders in all parameters assessed.

Keywords: *Capsicum annum*, Capsicum frutescens, Seed powder, Fruit powder, Mortality, Callosobruchus maculatus, Sitophilus zeamais

1. Introduction

Cowpea, Vigna unguiculata (L) Walp and maize, (*Zea mays* L.) are major dietary staple foods (Ofuya, 2001:Ofuya and Adedire, 2004). Cowpea amounts to 60% daily dietary protein intake of most Nigerians (Oparaeke and Dike, 1998), while maize provide families with much needed nutrients, such as carbohydrates, proteins, fats, vitamin B and minerals (Ashamo, 2007 : Kling and Edmeades, 1997). 100% damage has been reported on unprotected cowpea after 3-5 months storage (Singh, 1997), by *Callosobruchus maculatus* (F.). Maize has also been reported in the tropics to be heavily infested by various pests, majorly *Sitophilus zeamais* Motschulsk*y*, with about 30-50% damage after 6 months in storage (Taylor, 1971). Synthetic insecticides employed in the control of insects pests proved effective, very expensive, unavailable at critical periods and they sometimes constitute health hazards to consumers (Adedire 2001: Ofuya, 2001: Oparaeke *et al*., 1998: Lale, 2002).This necessitates continous research towards substitution of harzadous synthetic insecticides for use of cheaper and eco-friendly natural plant products with active safe components, among which are use of powdered plant parts, oils and extracts.

However, the use of these synthetic chemicals is also hampered by many attendant problems such as development of insect resistant strains, their toxic residues getting into food of animals and man, workers safety and high cost of procurement (Sighamony *et al*.,1990).Literature from Nigeria and other West African countries revealed *Eugenia aromatica*, African brown pepper, *Piper guineense*, *Allium sativum*, Pepper derivatives (Su, 1994; Lale, 1992; Onu and Aliyu, 1995; Ashamo, 2007; Oni 2009; Adedire and Lajide, 2001: Ofuya *et al*,. 2000: Ogunwolu, and Odunlami 1996;Ivbijaro and Agbaje,1986) as safe, affordable and effective natural plant products with some degree of medicinal and insecticidal properties. This paper highlights the results of investigation on three application rates of *Capsicum annum* Miller and *Capsicum frutscens* L. fruit and seed powders in the control of *C. maculatus* in stored cowpea and *S. zeamais* in stored maize.

2. Materials and Methods

2.1 Rearing of insect pests

Adult cowpea storage beetles, *Callosobruchus maculatus* and maize weevils, *Sitophilus zeamais* were cultured in No.l kilner jars with meshed lids in Crop, Soil and Pest Management Department of Federal University of Technology Akure, Ondo state, Nigeria in open laboratory through-out the period of research. Standard procedure for culturing seed beetles, Ofuya and Creland, 1995: Olotuah *et al*., 2007 was followed. Ife- brown, a

susceptible variety of cowpea used for culturing *C. maculatus* while Swam-1, a susceptible maize variety used for *S. zeamais* cultures were purchased from Agricultural Development Programme (ADP) office in Akure, Ondo state, Nigeria. This same variety was used for the experiment in the laboratory at temperature 28+2 °C and 75± 5% relative humidity.

2.2 Plant Powder Preparation

Ripe fruits of *Capsicum annum* and *Capsicum frutescens* were collected from plant trees around The Federal University of Technology, Akure .The fruits were washed and sun-dried for five to ten days. Each whole dried fruits and removed seeds were pulverized to individual powder in an electric mill, sieved to pass through $1mm^2$ perforations and kept in separate labelled plastic containers with tightly fitted lids kept on the laboratory work bench.

2.3 Comparison of lnsecticidal activity of plant powders

Each fruit and seed powders of *C. annum* and *C. frutescens* was tested at rate of 0.0g (control), 2.5g, 5.0g, 7.5g each thoroughly mixed with 50g of cowpea and 50g of maize in individual 250ml plastic containers.Treatments were replicated four times for each experiment.

2.4 Data analysis

Data obtained were transformed into arcsine percentage prior analysis of variance (ANOVA) and significantly different treatments were separated at 5% level of probability by Turkey's test.

3. Results

Table 1 showed cumulative effect of *Capsicum frutescens* seed powder against *C. maculatus* which caused 63.5% and 73.4% mortality of bruchids at rates of 5.0/50g and 7.5/50g of cowpea at 24hrs post treatment, likewise 67.3%, 75.7% bruchid mortality (5.0/50g and 7.5/50g) at 96hrs respectively. This was significantly higher than 58.3% mortality obtained at 96hrs post treatment with *Capsicum annum* seed powder.No adults were killed in the control within 48hrs and 96hrs. In a similar, vein in table 2 *Capsicum frutescens* seed powder produced 60.3% and 68.5% bruchid mortality at rates of 5.0/50g and 7.5/50g of maize at 24hrs post treatment and 63.7% and 69.3% mortality (5.0/50g and 7.5/50g) at 96hrs post-treatment. This was significantly higher than 50.4% and 57.5% (7.5g/50g) mortality of *S. zeamais* at 48hrs and 96hrs post treatment.

A significantly lower mortality of bruchids was obtained on seeds treated with *Capsicum annum* and *Capsicum frutescens* fruit powder. No adults were killed in the control within 48hrs and 96hrs observation.This was significantly higher than 50.4% and 57.5% (7.5g/50g) mortality of *S. zeamais* at 48hrs and 96hrs post treatment. A significantly lower mortality of bruchids was obtained on seeds treated with *Capsicum annum* and *Capsicum frutescens* fruit powder. No adults were killed in the control within 48 hrs and 96 hrs observation.

4. Discussion

Effects of some Nigerian plant powders, extracts and oils as insect protectants have been observed in the treatment of cowpea and maize weevils (Ashamo, 2007; Lale, 1992; Oni and Ileke, 2008). Ashamo (2007) have reported an average mortality of *S. zeamais* at 28 days post-treatment at three rates (0.2, 0.4 and 0.6/20g of *Capsicum frutescens*/ maize seeds). It is unequivocal that seeds powders of *Capsicum annum* (5.0g/50g) seeds and *Capsicum frutescens* at 5.0g/50g and 7.5g /50g seeds manifested contact insecticidal action against *C.maculatus* and *S.zeamais* in this study, this higher rates demonstrated superiority over powders from *Capsicum* fruits.This result is consistent with the report of Ivbijaro and Agbaje (1986): Asawalam *et al*.,(2007) using *Capsicum frutescens* giving considerable reduction in *C.maculatus* infestations in all stages of development, but contradicts report by Ashamo (2007) and Yusuf *et al*.,(1998).

Insecticidal property of any plant material would depend on the active constituents of the plant material (Asawalam *et al*., 2007). *P. guineene* was tested and reported to contain piperine, chavicine alkaloids (Lale, 1995). Fruit powders tested in this study was not very effective as seed powders, but significantly better than the control. *Capsicum annum* and *Capsicum frutescens* contain capsicin known to have insecticidal qualities resulting in bruchids mortality at higher rates and better protection of stored cowpea and maize seeds.

5. Conclusion

Capsicum frutescens and *Capsicum annum* have been shown to have insecticidal properties (Oni, 2009: Ivbijaro and Agbaje (1986) and justified at higher rates 5.0g, 7.5g and 5.0g/50g against stored products insects, *Callosobruchus maculatus* and *Sitophilus zeamais* in this study in effecting high percentage mortality. *Capsicum frutescens* and *Capsicum annum* are grown all over Nigeria and West African countries and its use as a safe and affordable source of insecticide may provide a sustainable alternative for pest-control in low input agriculture

than the harzardous and expensive synthetic insecticides.

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Table 1. Effect of *Capsicum annum* and *Capsicum frutescens* on percentage mortality of *Callosobruchus maculatus.*

Treatment	g/50g Cowpea	% mortality 48hrs	96hrs
Capsicum annum fruit powder	2.5	10.4e	18.3e
	5.0	13.3e	18.7e
	7.5	15.4e	20.4e
Capsicum annum seed powder	2.5	22.5d	24.7e
	5.0	34.2c	45.4c
	7.5	53.4b	58.3b
Capsicum frutescens fruit powder	2.5	17.5e	19.3e
	5.0	22.2d	25.4e
	7.5	25.4d	39.7d
Capsicum frutescens seed powder	2.5	37.2c	40.4c
	5.0	63.5a	67.3a
	7.5	73.4a	75.7a
Control	0.0	0.0f	0.0f

*Means in each column bearing the same letter (s) are not significantly different at the 5% level of probability by Turkey's test

Table 2. Effect of Capsicum annum and Capsicum frutescens on percentage mortality of Sitophilus zeamais.

Treatment	g/50g maize grain	% mortality 48hrs	96hrs
Capsicum annum fruit powder	2.5	9.5e	10.3e
	5.0	10.4e	12.5e
	7.5	11.3e	14.7e
Capsicum annum seed powder	2.5	20.5d	25.7d
	5.0	37.3c	39.3c
	7.5	50.4b	57.5b
Capsicum frutescens fruit powder	2.5	13.3e	15.5de
	5.0	16.5e	16.3de
	7.5	18.4e	20.7d
Capsicum frutescens seed powder	2.5	26.4d	37.5c
	5.0	60.3a	63.7a
	7.5	68.5a	63.7a
Control	0.0	0.0f	0.0f

*Means in each column bearing the same letter(s) are not significantly different at the 5% level of probability by Turkey's test.