Efficacy of Selected Botanicals against Cowpea Weevils (*Callosobruchus maculatus F.*) on Stored Cowpea (*Vigna unguiculata (L) Walp*).

Lawal, I. H[1]., *Ibrahim, Iro, I[1]., Yaroson, A. Y[1]., and Idris, J. A[2].

[1]Crop Production Technology Department

Federal College of Forestry, Jos, Plateau State, Nigeria.

[2]College of Advanced and Remedial Studies, Tudun Wada, Kano State, Nigeria.

Correspondence Email: ammani328@gmai.com

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Abstract

The experiment was conducted at the Federal College of Forestry, Jos Biology laboratory to determine the efficacy of selected botanicals against cowpea weevils (*Callosobruchus maculatus F.)* on stored cowpea *(Vigna unguiculata (L) Walp).* The experiment consist of eight treatment laid in complete randomized design (CRD); control, actellic dust 5g, citrus peel powder 5g, citrus peel powder 10g, paw-paw leaf powder 5g, paw-paw leaf powder 10g, annona seed powder 5g, anonna seed powder 10g. Each treatment replicated three times. Data collected include adult mortality, number of eggs, larval development, percentage grain damage, percentage weight loss and percentage germination. The data collected were subjected to analysis of variance (AVONA) at 5% probability level. Mean separations was carried out using student Duncan Multiple Range Test (DMRT) where significance was declared. The result indicated that, there were significantly differences between plant products treatments and the synthetic treatment over the control throughout the period of the experiment (1 to 8 weeks). However, among the various treatment of the plant products used, 5g pawpaw leaf powder/100g and 5g annona seed powder/100g of cowpea grains proved to be most effective in grain damage and also 5g pawpaw leaf powder and 10g citrus peel powder proved to be most effective on adult emergence and adult mortality of *C. maculatus* at 8 weeks of

the storage. However, 5g actellic dust was the most effective in controlling grain damage while 5g pawpaw leaf powder and 5g annona seed powder proved to be most effective in controlling grain damage among the natural botanicals, adult mortality and number of eggs laid by *C. maculatus* on the stored grains. Finally, the result of the study showed that, plant products tested at different concentrations displayed some potentials as food poison, repellants, antifidant and contact poison. The result clearly indicated the potential values of using plants extracts as complimentary to chemicals pesticides in controlling *C. maculatus* on cowpea grains.

KEYWORDS: Cowpea, Botanicals, Stored Weevils, *Callosobruchus maculatus, Vigna unguiculata.*

Introduction

Cowpea (*Vigna unguiculata L. Walp*) is an important grain (food) legume of significant economic importance worldwide. It is the most important indigenous legume in the dry savannah of the tropics covering 12.5million hectares with annual production of about 3.million tons (FAO, 2005). Nigeria is one of the world's largest producer of cowpea with an average production of 2.92million tons followed by Niger with 1.10million tons (FAO, 2012). With about 22-26% protein, cowpea constitutes a major source of protein for resource poor rural and urban people (Singh et al., 2002). The crop can be used at all stages of growth for several purposes.

The primary insect causing losses to stored cowpeas in West Africa is the cowpea weevil, (*Callosobruchus maculates*). Infestation begins in the field at low level. The infestation which start in the field causes damage that ranges from rendering cowpea unsuitable for consumption to reduced viability and as population build up, great loses can be recorded (Ibrahim and Garba, 2011). The seeds lose 30% of their weight (Udo, 2011). After the crop is placed in storage, the insect population continues to grow until the cowpea is completely damaged (Joana and Daniel, 2010). Once infestation of pest (C. maculatus) is established in stored cowpea, farmers generally resort to application of synthetic insecticide otherwise loss of the entire stored product is inevitable (Mohammad et al., 2013). Unfortunately, most farmers in the tropics are resource-poor and cannot afford the use of synthetic pesticides (Emmanuel, 2013). Synthetic insecticides are costly, toxic to humans, low biodegradability and consequently when used excessively may be harmful to the environment (Sharah and Ali 2008). Increasing cost of synthetic

insecticide and dwindling farmers' income in face of ever decreasing value of national currencies have made these insecticides too expensive for the ordinary farmers. All these have called for an alternative to these synthetic products (Mohammad et al., 2013). There are considerable literatures that indicates that the use of some plant extracts are promising alternative control measures to synthetic chemicals (Schmutterer, 1990).

Results show that insecticides are the most effective control measures against pests and majority of the farmers rely heavily on the use of synthetic insecticides in the management of their cowpea pests. Hence the need for an alternative control measure that exclude or minimise the use of synthetic insecticides in the management of cowpea pests. It is an established fact that peasant farmers all over the world use plant materials for storage of their excess harvest as protactants against pest infestation (Mohammad et al., 2013). The past three decades have witnessed reawakening in research efforts to ascertain the effectiveness of these plant products. Available literature shows over 66 plants from 30 families have been subjected to laboratory test for their effects on different store and field (Mohammad et al., 2013). The broad objective of this study therefore is to investigate the Efficacy of selected botanicals against cowpea weevils (*Callosobruchus maculatus F.)* on stored cowpea *(Vigna unguiculata (L) Walp).*

MATERIALS AND METHODS

Table 1: Botanicals and its common and scientific name

S/N	Botanicals	Common Names	Scientific Names	Plant Part Used
1	Anona seed powder	Chup-chup	*Anona muricata*	Fruit Seed
2	Pawpaw leaf powder	pawpaw	*Carica papaya*	Leaf
3.	Citrus peel powder	Sweet orange	*Citrus sinensis*	Fruit Bark

Source: Dick Gross, 2003

Types of Materials

Translucent Bama bottles measuring 16cm and 8cm in diameter were acquired and used as experimental containers. 100g of cowpea grain (variety TAR 48) was measured and transfered separately into each of the translucent Bama containers with each contain 5g of actelllic dust, 5g and 10g of citrus peel powder, 5g and 10g paw-paw leaf powder, and also 5g and 10g annona seed powder. Ten pairs of *C. maculatus* were introduced in each of the containers including the treated and non-treated control treatments. The experimental containers together with the treated grains and insects were covered with a piece of white cloth and tightened with firm rubber band. The whole setup were kept in the laboratory and maintained at ambient temperature and relative humidity.

Sources and Rearing of the Experimental Insects

Initial culture of cowpea weevil *C. maculatus* was obtain from infested cowpea grains from Laranto Market, Jos and maintained at ambient temperature and relative humidity as stated above. The insect were allowed to massively reproduce in the laboratory. Fresh and uninfected cowpea grains (variety TAR 48) were purchased from Plateau Agricultural development pogramme (PADP) cleaned and disinfected, new insect culture were set up by transferring cowpea grains that was purchased from PADP and transfered into earthen pot. 500 unsex adult *C maculatus* were released into the earthen pot containing 500g of clean, fresh and uninfected cowpea grains. The pot was covered with a small piece of white cloth and secure firmly with rubber band. This will be incubated at ambient temperature and relative humidity of 28.20^{0}C to 32.20^{0}C and 55% to 75%, respectively with alternative light-dark cycle of 12hrs for about 2 weeks. After 2 weeks, the original adult (*C. maculatus*) were removed from the earthen pot by sieving and discarding while the newly emerged experimental insects were kept in separate containers until when needed.

Collection and Preparation of Plant Materials

Collection: Citrus peel, paw-paw leaf, annona seed and actellic dust were collected in the Plant Nursery of Federal College of Forestry, Jos.

Preparation: Citrus peel, paw-paw leaf, annona seed were dried under room temperature of about 28^{0}C-32^{0}C and grind with mortar and pestle. After grinding it was passed through a mesh size of about 600um

to obtain fine powder of the product as described by Asawalan and Arukwe (2004). The fine powder of each of the plant was kept separately in a container until when needed.

Experimental Design

Completely randomized designed (CRD) was used in the experiment. There were eight treatments in the experiment namely: control, actellic dust 5g, citrus peel powder 5g, citrus peel powder 10g, paw-paw leaf powder 5g, paw-paw leaf powder 10g, annona seed powder 5g, anonna seed powder 10g. Each treatment will be replicated three times

Data Collection

Data to be collected includes; adult mortality, number of eggs, larval development, percentage grain damage, percentage weight loss and percentage germination.

Adult Mortality: Data on adult morality was obtained by counting the number of dead weevil in the translucent plastic cup after application of treatment. The data was recorded on weekly basis for a period of about 8 weeks as recommended by (Aswallam and Arukwe, 2004; Jembere *et al.,* 1995).

Number of Eggs: Data on number eggs was obtained by counting the number of eggs laid on the stored cowpea grains using magnifying hand lens as recommended by (Jembere *et al.,* 1995).

Larval Count: Data on larval count was obtained by counting the number of larvae that emerged in each translucent container after application of treatment using a hair of camel brush as recommended by Jembere *et al.,* (1995).

Percentage Grain Damage: Percentage grain damage was assessed by randomly selecting 10 cowpea seeds from each translucent container and count the number of holes of attack embryo from each translucent plastic cup. The percentage damage can be calculated using this formula recommended by Adedire and Ajayi (1996).

$$\text{Percentage Grain Damage} = \frac{G1}{G2} \times 100$$

Where, G1 = Number of grain with hole or attacked embryo

G2 = Total number of the randomly selected cowpea grains

Percentage Weight Loss: Data on percentage weight loss can be obtain using this formula recommended by Yusuf and Ahmed, 2005) as show below.

$$\text{Percentage weight loss} = \frac{P - Q}{P} \times 100$$

Where: P = Initial weight of the grain

Q = Final weight of the grain

Percentage Germination: The effect of treatment, storage duration and their interaction on seed viability, will be calculate by selecting (10) seeds from each container. The ten (10) was place separately in clean petri dish contain moist filter paper. Thereafter, the Petri dish together with the seeds were covered and daily germination count was recorded and computed appropriately. Final percentage germination calculated using the formula recommended by Haines (1991).

$$\text{Viability index (\%)} = \frac{N\,G}{T\,G} \times 100$$

Where: NG = Number of seed that germinate

TG = Total number of test seeds.

Data Analysis: The data collected was subjected to analysis of variance (AVONA) to determine the Efficacy of Some Selected Botanicals Against Cowpea Weevils (*Callosobruchus maculatus F.)* on Stored Cowpea *(Vigna unguiculata (L) Walp)*, at 5% probability level. Mean separations was carried out using student Duncan Multiple Range Test (DMRT) where significance was declared.

RESULTS AND DISCUSSIONS

Table 2 shows the adult mortality from 1 – 8 weeks of storage. When efficacy of plant products were compared and evaluated at 1 week after application of treatment, the result indicates that there was no significant difference between the treatments although high adult mortality of (3.33[a]) was recorded in 10g Anona seed powder and 10g pawpaw leaf powder respectively, followed by 10g citrus peel powder (2.66a), then 5g Actellic dust (2.00a), 5g Anona seed powder and 5g Pawpaw leaf powder has an adult mortality of 1.66a respectively, while the lowest adult mortality (0.00[a]) was recorded in the control. At 2weeks after treatment, significant difference was observed. The lowest adult mortality was obtained in 5g citrus peel powder (2.66a) followed by 5g annona seed powder (3.33ab), 5g actellic dust and 5g annona seed powder (3.66a), 10g citrus peel powder (4.00ab), 10g annona seed powder and 10g pawpaw leaf powder (5.66a) . Significant difference was declared of adult mortality at 3weeks after treatment. The highest recorded for 10g Pawpaw leaf powder (8.33[ab]), 7.33ab for 5g Actellic dust, 6.33b for 5g Pawpaw leaf powder, 6.00 for 5g Anona seed powder, 10g Anona seed powder and 5g citrus peel powder respectively. 10g citrus peel powder has 4.33a and the least was the control with 3.66.

Adult mortality was found to be significant at 4 weeks of treatment even though all the treatments shows mean mortality of 10.00 with the exception of 5g Anona seed powder (9.00) and the control. At 5 weeks of treatment, same adult mortality (10.00) was recorded in all the plant products and the synthetic treatments also showing marked significance. At 6weeks, 5g pawpaw of powder was significantly less effective than the remaining treatments the highest adult mortality was recorded on 10g annona seed powder (27.33b) while 5g pawpaw leaf powder found to be less effective with the lowest number of adult mortality (10.00c) recorded from the treatment. The result showed that all plant materials tested had varying insecticidal activities at 7 weeks after application of treatment, 5g actellic dust (15.66ab), 10g citrus peel powder (15.00d), followed by 5g citrus peel (17.00c), 5g pawpaw leaf powder (18.00d), 10g pawpaw leaf powder (27.00c) 5g annona seed powder (30.66d) and 10g annona seed powder (42.00c). At 8 weeks after application of treatment, the number of adult mortality ranged from (59.33e) in 5g annona seed powder, (59.33d) in 10g annona seed powder to (23.00b) in 5g actellic dust significantly higher mortality were recorded in 5g annona seed powder, 10g annona seed powder, 10g pawpaw leaf powder, 10g citrus peel powder, 5g pawpaw leaf powder, and 5g actellic dust.

Table 2: Effect of plant products and synthetic treatment on Adult mortality

	ADULT MORTALITY							
Treatment	**1st wk**	**2nd wk**	**3rd wk**	**4th wk**	**5th Wk**	**6th Wk**	**7th Wk**	**8th Wk**
Control	0.00[a]	0.66[a]	3.66[b]	9.00[c]	10.00[c]	11.00[c]	15.33[d]	19.00[e]
5g Actellic dust	2.00[a]	3.66[a]	7.33[ab]	10.00[ab]	10.00[ab]	10.33[ab]	15.66[ab]	23.00[b]
5g Anona seed powder	1.66[a]	3.33[ab]	6.00[ab]	9.00b[c]	10.00b[c]	13.66[c]	30.55[d]	59.33[e]
10g Anona seed powder	3.33[a]	4.33[a]	6.00[ab]	10.00[a]	10.00[a]	27.33[b]	42.00[c]	59.33[d]
5g citrus peel powder	1.33[a]	2.66[a]	6.00[a]	10.00[b]	10.00[b]	11.66[b]	17.00[c]	34.66[d]
10g citrus peel powder	2.66[a]	4.00[ab]	4.33[a]	10.00[c]	10.00[c]	11.00[c]	15.00[d]	32.33[e]
5g Pawpaw leaf powder	1.66[a]	3.66[a]	6.33[b]	10.00[c]	10.00[c]	10.00[c]	18.00[d]	28.66[e]

10g Pawpaw leaf powder	3.33[a]	5.66[a]	8.33[ab]	10.00[ab]	10.00[ab]	15.33[b]	27.00[c]	39.00[d]
LS	NS	x	x	x	X	x	x	x

Means within a column followed by the same letters are not significantly difference (P = 0.05%) using Duncan Multiple Range Test.

x = Level of significant at 0.05% level of probability

LS = level of significant

NS = Not significant

Summary of the study showed that the application of 5g and 10g annona seed powder/100g cowpea grain was found to be more effective than all other plant products. This result was in conformity with the findings of Rajapakse *et al.,*(1998), which showed that there was significant reduction in adult mortality of *C. maculatus* when treated with annona seed powder. Similarly, Moussa, (2001) indicated that the flora of savannah consist of plant species that possesses insecticidal properties and plant product treatment acted either as stomach or contact poison or both because they were all found to be effective in suppressing the growth of the bruchids. Annona seed powder proved to be most effective in controlling of *C. maculatus* because it provided good protection to cowpea grain against damage and loss on the grain weight (Seneinyak *et al.,* 1998). Malungu *et al.,* (2007) also reported that the use of plant powders has been reported to produce higher death of insects because of physical barrier with the tendency of blocking the spiracles of the insects, thus impairing respiration leading to death of the insects. Although, annona seed powder have not been used frequently by our farmers in controlling *C. maculatus,* the high mortality rate exhibited under the current investigation indicates the possibility of success in control of storage insects (Bamaiyi *et al.,* 2007).

Effect of plant product and synthetic treatment on Larva development

Table 3 shows the number of eggs laid from 1-8 weeks of storage. The data shows that all the tested different concentrations (5g and 10g) of various plants product were significantly better than the control treatment throughout the period of observations (1 to 8 week after treatment). However, when efficacy of plants product were compared and evaluated at 1 week after application of treatment, high number of eggs (10.00c) was recorded in 5g citrus peel powder while the lowest number of eggs (0.66a) 5g pawpaw leaf powder (1.00a) 10g, pawpaw leaf powder (1.66a) 5g annona seed powder (2.66a), 10g citrus peel powder (7.33a), and 5g citrus peel powder (10.00a) respectively. Similarly when plant products and synthetic treatment were compared and evaluated at 2 weeks after treatment application, the lowest number of eggs was obtained l 10g annona seed powder (5.00b), followed by 5g pawpaw leaf powder (8.66a) 10g pawpaw of leaf powder (9.33b), followed by 10g citrus peel powder (16.00a) and 5g citrus peel powder (21.66a). the statistical analysis obtained at 3 weeks after application of treatment, showed that, lowest number of eggs were obtained in 5g actellic dust (6.33bc) followed by 5g annona seed powder (8.33b), 10g annona seed powder (9.66b), followed by 10g pawpaw leaf powder (10.33b), 5g

pawpaw leaf powder (13.00bc) followed by 5g citrus peel powder (28.33a) and 10f citrus peel powder (34.66a)).

Statistical analysis of data obtained at 4 week, showed that number of eggs ranged from (53.33a) in 10g citrus peel powder to (9.00c) 5g actellic dust. Treatment with significantly higher number of eggs were 10g citrus peel powder (53.33a) and citrus peel powder (38.33a) and treatment with lowest number of egs were 10g pawpaw leaf powder (12.00b), 5g annona seed powder (12.33c), 10g annona seed powder (13.33b) 5g pawpaw leaf powder (17.66cb), and 5g actellic dust (9.00c). At 5 weeks after application of treatments, highest number of eggs (69.00a) was recorded in 5g citrus peel powder and the lowest number of eggs of (13.33a) was obtained in 5g actellic dust. The order of increase in number of eggs were as follows 5g actellic dust (13.33a) 10g annona seed powder (15.33cd), 10g pawpaw leaf powder (17.33b), 5g pawpaw leaf powder (22.66b), 5g citrus peel powder (69.00a) respectively.

Table 3: Effect of plant product and synthetic treatment on Larva development

	NUMBER OF EGGS LAID AFTER							
Treatment	**1st wk**	**2nd wk**	**3rd wk**	**4th wk**	**5th Wk**	**6th Wk**	**7th Wk**	**8th Wk**
Control	6.33[a]	28.00[a]	31.33[a]	47.33[a]	123.66[a]	275.66[a]	606.66[b]	821.00[b]
5g Actellic dust	1.00[a]	3.33[b]	6.33[bc]	9.00[c]	13.33[d]	13.33[d]	17.00[e]	17.00[e]
5g Anona seed powder	2.66[a]	5.00[ab]	8.33[b]	12.33[c]	15.33[cd]	16.00[cd]	18.33[d]	18.33[d]
10g Anona seed powder	0.66[a]	2.00[b]	9.66[b]	13.33[b]	15.00[b]	16.00[b]	16.00[b]	16.00[b]
5g citrus peel powder	10.00[a]	21.66[a]	28.33[a]	38.33[b]	69.00[a]	129.66[a]	251.33[a]	528.00[b]
10g citrus peel powder	7.33[a]	16.00[a]	34.66[a]	53.33[a]	57.00[a]	153.66[ab]	257.66[ab]	389.00[b]
5g Pawpaw leaf powder	1.00[a]	8.66[b]	13.00b[c]	17.66[cb]	22.66[b]	23.33[b]	24.00[b]	24.33[b]

10g Pawpaw leaf powder	1.66[a]	9.33[b]	10.33[b]	12.00[b]	17.33[b]	18.66[b]	18.66[b]	18.66[b]
Ls	NS	x	x	x	x	x	x	x

Means within a column followed by the same letters are not significantly difference (P = 0.05%) using Duncan Multiple Range Test.

x = Level of significant at 0.05% level of probability

LS = level of significant

NS = Not significant

At weeks after application of treatments, 10g citrus peel powder was significantly less effective than the remaining plant products treatments. The highest number of eggs of (153.66ab) was recorded on 10g citrus peel powder, while 5g actellic dust was found to be significantly effective with the lowest number of eggs of (13.33d) recorded from the treatment.

The result showed that all plant materials had varying degree of insecticidal activities at 7 weeks after application of treatments, 10g citrus peel powder was found to be less significantly effective than the remaining plant products treatments, with the highest number of eggs (257.66ab) was recorded while 10g annona seed powder was found to be significantly effective witht eh lowest number of eggs (16.00b) recorded from the treatment. At 8 weeks after application of treatment, the number of eggs ranged form (528.00b) in 5g citrus peel powder to (16.00b) annona seed powder. Significantly higher mortality were recorded in 5g citrus peel powder, 10g citrus peel powder, 10g pawpaw leaf powder, 5g anona seed powder, and 5g actellic dust.

The findings of the experiment showed that the number of eggs of *C. maculatus* was significantly high in the control treatment as compared to cowpea grain treated with plant products and synthetic treatments, indicating that insect's reproduction and development were impaired in all botanicals pesticides. The result agrees with the findings (Bekele *et al.,* 1997) who reported that the toxic properties of plants products compiled within the growth and development of eggs decreased the number of progeny that emerged in treated cowpea grains. The result also revealed that the use of annona seed powder 5g and 10g and also pawpaw leaf powder 10g/100g at concentration level provided significantly high protection in the number of eggs of *C. maculatus* (Rajapakse *et al.,* 1998). Also according to Mushobozy *et al.,* (2007) powder annona seed significantly affected survival and egg laying capacity of *C. maculatus.*

Effect of plant products and synthetic treatment on % Grain damage

Table 4 show the percentage damage from 5 to 8 weeks of storage. The data shows that the tested concentrations (5g & 10g) of various plant products were significantly better than the control treatment throughout the period of observation (5 to 8 weeks after treatment). However, when efficacy of plant products were compared and evaluated at 5 weeks after application of treatment, high percentage grain damage (%) of (13.66ab) was recorded in 10g citrus peel powder while the lowest percentage grain damage of (0.00a) 5g actellic dust was recorded for the treatment. The order of the increase in

percentage grain damage was 5g actellic dust (0.00a) 5g annona seed powder (0.00a) 10g annona seed powder (0.00a) 5g pawpaw leaf powder (1.33ab), 10g pawpaw leaf powder (1.66a), followed by 5g (1.33ab), 10g pawpaw leaf powder (1.66a), followed by 5g citrus peel powder (13.00b) and 10g citrus peel powder (13.66ab) respectively.

At 6 weeks after application of treatment, 10g of citrus peel powder was significantly less effective than the remaining plant products. The highest percentage (%) grain damage of (36.00b) has recorded on citrus peel powder, while 5g annona seed powder found to be significantly effective wit the lowest percentage grain damage of (1.33a). The result showed that all plant material tested had varying degree of insecticidal activities at *7* weeks after application of treatment, 5g actellic dust (10.33b) 5g, annona seed powder (11.33b), 10g annona seed powder (3.33a), 5g citrus peel powder (4.66d) 10g citrus peel powder (68.66b), 5g pawpaw leaf powder (7.66c) and 10g pawpaw leaf powder (10.33bc).

Table 4: Effect of plant products and synthetic treatment on % Grain damage

	GRAIN DAMAGE AFTER			
Treatment	**5th Wk**	**6th Wk**	**7th Wk**	**8th WK**
Control	9.0a[b]	32.66[a]	80.00[c]	117.00[c]
5g Actellic dust	0.00[a]	2.33[a]	10.33[b]	10.33[b]
5g Anona seed powder	0.00[a]	1.33[a]	11.33[b]	11.66[b]
5g citrus peel powder	13.00[a]	27.00[c]	43.66[d]	77.33[e]
10g citrus peel powder	13.66[ab]	36.00[b]	68.66[b]	86.66[b]
5g Pawpaw leaf powder	1.33[ab]	4.66b[c]	7.66[c]	10.00[d]
10g Pawpaw leaf powder	1.66[a]	7.00[b]	10.33b[c]	12.66[c]
LS	X	x	x	x

Means within a column followed by the same letters are not significantly difference (P = 0.05%) using Duncan Multiple Range Test.

x = Level of significant at 0.05% level of probability

LS = level of significant

At 8 weeks after application of treatment, the percentage grain damage, ranged from (86.66b) in 10g ciotrus peel powder to 5g actellic dust (10.33b). Significantly higher percentage grain damage were recorded in 10g citrus peel powder, 5g citrus peel powder while significantly lower percentage grain damage were recorded in 10g pawpaw leaf powder, 5g annona seed powder, 10g annona seed powder, 10g pawpaw leaf powder, 5g actellic dust and 5g pawpaw leaf powder.

The level of damage recorded was significantly higher in the untreated cowpea grains than in those treated with plant products and the synthetic treatment. This agrees with the findings of Comes (1973) who reported that the potential for exploiting insecticides from plant source is quite high in Nigeria. In addition quality and quantity of cowpea grains treated with plant products were not adversely affected by cowpea bruchids during the period of the experiment. This agrees with the result obtained by Operake and Dike, (2005) who reported that cooking quality and test of cowpea grains were negative due to the damage caused on the grain by the insects pest. The result is also in conformity with the findings of Lale (1995) who reported tendency of possession of insecticidal properties by some plants. However, according to Mushobozy *et al.,* (2007), the percentage damaged of seeds differed significantly amongst the treatment. Also seeds treated with 5g pawpaw leaf powder and 5g actellic dust gave significantly lowest percentage damaged for the whole period of the experiment. Among the natural botanicals 5g and 100g citrus peel powder had the highest seed damage, almost similar to the control treatment throughout the period of the experiment.

Effect of plant products and synthetic treatment on Percentage Weight loss

Table 5 shows the percentage weight loss from (1-8weeks) of storage. The data shows that all the tested different concentrations (5g and 10g) of various plant products were significantly better than the control treatment throughout the period of observations (1 to 8) weeks after treatment. However, when efficacy of plant products were compared and evaluated after 8 weeks high percentage weight loss was recorded at 5g citrus peel gave highest % weight loss of (18.73b) while the lowest percentage weight loss of (0.30d) was recorded in 5g actellic dust. The order of increase in percentage weight loss was 5g actellic dust (0.33b), 10g of annona seed powder (10g) annona seed powder (1.06d), followed by 5g pawpaw leaf powder 5g annona seed powder (10.6d) 10g annona seed powder (1.06d), followed by 5g pawpaw leaf powder 5g annona seed powder (5.40cd) 10g citrus peel powder, and 5g pawpaw seed

powder (5.56cd) 10g citrus peel powder (14.33bc) 5g citrus peel powder (18.73b) respectively. The result showed that the seed viability of treated and control grains were all significantly influenced by the duration of storage and concentration of the plant products treatment and synthetic treatment.

The result is in conformity with the findings of crop production Compedium, (2004) who reported that cowpea bruchid is an internal feeder, thus the different life stage developed successfully inside the grain can cause decrease in grain weight accordingly. Also the result indicated that the insects activities lead to depletion of food stock and reduction of grains to powder. This confirmed the findings of Agboola, (1996) who reported that weight losses in grains were proportional to the level of damage, loss in grain weight depends on the damage in the grain as seen in 5g citrus peel powder with (18.73^{b}) and the least weight loss recorded in 5g actellic dust (0.30^{d}) and 10g pawpaw leaf powder. The loss of weight of cowpea grains infested with *C. maculatus* could be a good index for assessing damage and waste during storage.

Table 5: Effect of plant products and synthetic treatment on Percentage Weight loss

Treatment	% weight loss after 8 weeks
Control	29.57^{a}
5g Actellic dust	0.30^{d}
5g Anona seed powder	5.40^{cd}
10g Anona seed powder	1.06^{d}
5g citrus peel powder	18.73^{b}
10g citrus peel powder	14.33^{bc}
5g Pawpaw leaf powder	5.63^{cd}
10g Pawpaw leaf powder	1.06^{d}
LS	x

Means within a column followed by the same letters are not significantly difference (P = 0.05%) using

Duncan Multiple Range Test.

x = Level of significant at 0.05% level of probability

LS = level of significant

Germination Test

Table 6 shows the number of seeds that germinated from 1-4 days. The data shows that ll the tested different concentrations (5g and 10g) of varying plant product were significantly better than the control treatment throughout the observations (1 to 4 days after treatment). Therefore, when efficacy of plant product were compared and evaluated at day one (1) after applciaiton of treatment, high number of germination of (3.33a) in 5g annona seed powder was recorded while the lowest number of germination of (0,.00a) was recorded in 5g actellic dust, 10g annona seed powder, 5g citrus peel powder, 10g citrus peel powder, and 10g pawpaw laf powder and the least germination in 5g pawpaw leaf powder (0.33a) treatment.

Table 9: Germination Test

	Days after germination			
Treatment	**Day 1**	**Day 2**	**Day 3**	**Day 4**
Control	0.00[a]	1.00[a]	1.00[a]	1.00[a]
5g Actellic dust	0.00[a]	5.00[b]	7.00[c]	10.00[d]
5g Anona seed powder	3.33[a]	4.33[b]	6.33[c]	8.00[c]
10g Anona seed powder	0.00[a]	5.33[b]	6.33[b]	9.00[c]
5g citrus peel powder	0.00[a]	0.00[a]	2.00[b]	2.00[b]
10g citrus peel powder	0.00[a]	2.00[b]	2.33[b]	2.33[b]
5g Pawpaw leaf powder	0.33[a]	5.00[b]	7.00[bc]	8.00[c]

10g Pawpaw leaf powder	0.00[a]	5.33[b]	6.66[b]	8.66[c]
LS	NS	x	x	x

Means within a column followed by the same letters are not significantly difference (P = 0.05%) using Duncan Multiple Range Test.

x = Level of significant at 0.05% level of probability

LS = level of significant

NS = Not significant

The order of increase in the number of germination was 5g annona seed powder, 5g pawpaw leaf powder (0.33a) and 5g actellic dust, 10g annona seed powder, 5g citrus peel powder, 10g citrus peel powder and 10g pawpa leaf powder product and synthetic treatment were compared and evaluated days after treatment aoppliation, the lowest number of germination was obtained in 5g citrus peel powder (0.00a) , followed by 10g citrus peel powder (2.00b), 5g annona seed powder, 5g actellic dust (5.00b)= 5g pawpaw leaf powder (5.00b), and 10g annona seed powder (5.33b) = 10g pawpaw leaf powder (5.33b). The statistical data obtained at 3 days after application of treatment, showed that, lowest number of germination were obtained in 5g citrul peel powder (2.00b) followed by 10g citrus peel powder (2.33b), 5g annona seed powder (6.33c), 10g annona seed powder (6.33b), 5g pawpaw leaf powder (7.0bc) and 5g actellic dust (7.00c). At 4 days showed that 5g actellic dust gave the highest percentage germination (10.00a) followed by 10g annona seed powder (9.00c), followed by 5g annona seed powder (8.00c) = 5g while the lowest percentage germination were 10g citrus peel powder and 5g citrus peel powder (2.33b) and (2.00b) respectively. The result showed that seed viability of treated and control grains were all significantly influenced by the duration of storage and the concentration of the plant products treatment. The result agrees with the findings of Bamaiyi *et al.,* (2009) who reported that the effectiveness of the plant powders was observed to be directly proportional to their concentration. Equally, the study confirms with the result of Emmanuel *et al.,* (2006) who showed that a large difference can be observed between germination percentage of the control and the treated and infested seed of cowpea grains.

According to Beyond Control, (2009) even slight bruchids feeding damage the embryo impairs germination feeding in the cotyledon will not affect germination but the vigour of the young plant can be reduced.

Conclusion

The result indicated that, there was significantly differences between plant products treatments and the synthetic treatment over the control throughout the period of the experiment (1 to 8 weeks). However, among the various treatment of the plant products used, 5g pawpaw leaf powder/100g and 5g annona seed powder/100g of cowpea grains proved to be most effective in grain damage and also 5g pawpaw

leaf powder and 10g citrus peel powder proved to be most effective on adult emergence and adult mortality of *C. maculatus* at 8 weeks of the storage. However, 5g actellic dust was the most effective in controlling grain damage while 5g pawpaw leaf powder and 5g annona seed powder proved to be most effective in controlling grain damage among the natural botanicals, adult mortality and number of eggs laid by *C. maculatus* on the stored grains. Finally, the result of the study showed that, plant products tested at different concentrations displayed some potentials as food poison, repellants, antifidant and contact poison. The result clearly indicated the potential values of using plants extracts as complimentary to chemicals pesticides in controlling *C. maculatus* on cowpea grains.

REFERENCE

Adedire., C.O., and Ajayi, T.S. (1996). Assessment of insecticidal properties of plant as grain protectant against cowpea weevil *(Callosobruchus maculatus). Niergian agricultural journal* 14:92-201

Agboola, S.D. (1996). Assessment of Insecticidal Properties of Some Plant as Grain Protectant against Cowpea weevil (*Callosobruchus maculates*) *Nigeria Agricultural Journal.* 14:92 – 101.

Aswalam, E.F. and Arukwe, E.U (2004). Effects of some combination of some plant powders for the control *(Callosobruchus maculatus). Nigerian Agricultural journal* 35.75:86

Bamaiyi, L.J., I.I., Dike, M.O., and Onu, I. (2009). Relative Resistance of Sorghum Varieties to Rice Weevil *Sitophalus oryzae. Journal of Sustainable Agriculture.* 13:5 – 11.

Bekele, A.J., Obeng – Ofori, D. and Nassanali, A. (1997). Evaluation of Ocimu kenyense as source of repellent, toxicants and protectants in storage against three stored product pests. *Journal of Applied Entomology* 12:169 – 172

Comes, M.A. (1973), A check list of the insects association with stored product in Nigeria. Annual Report Nigeria Stored Product Research Institute. 240p.

Crop Protection Compendium. (2004) Compendium on Pest and Diseases CAB International Publishing, Wallingford United Kingdom. 310pp.

Dick Gross (2003). "Papaya" A tantalizing taste of the tropics. Maricopa country mast Gardewer volunteer information, university of Arizona cooperative extension.

Emmanuel O. Ogah (2013) Field Evaluation of Plant Extracts in the Management of Megalurothrips sjostedti and Maruca vitrata of Cowpea in Southeastern Nigeria. World Essays Journal / 1 (1): 11-17, www.worldessaysj.com

FAO, (2005). Cowpea production database for Nigeria, 1990-2004. Food and Agricultural Organisation. http://www.faostat.fao.org/.

Food and Agriculture Organization (FAO)., 2012. Grassland species index. Vigna unguiculata http://www.fao.org/ag/AGP/AGPC/doc/Gbase/data/pf000090.htm

Ibrahim, N.D and S Garba, 2011 use of garlic powder in the control of maize weevil. Proceeding of the 45th annual conference of agricultural society of Nigeria pp: 177-181.

Jembere, B., Obohy-Ofori, D., Hassananali, A. and Ngamosyo, G.N.N. (1995). Products derived from leaves Ocimum Kilimanscharium (Labiate) as post harvest grain protectant against the infestation of three major stored products insects, pest bulletin of Enthomological research 85:361-367.

Joana O. Ilesanmi and Daniel T. Gungula (2010) Preservation of Cowpea (Vigna unguiculata (L.) Walp) Grains against Cowpea Bruchids (Callosobruchus maculatus) Using Neem and Moringa Seed Oils. International Journal of Agronomy. Volume 2010, Article ID 235280, 8 pages http://dx.doi.org/10.1155/2010/235280

Lale, N.E.S (1995). An overview of the use of Plant Production in the Management of Stored Production in the Tropics. Post harvest news and information, 6 (6): 69-75.

Mohammad, G., Patience, N. E. and Grace, N. E. (2013) Comparative Studies of Effect of Extracts of Zanthoxylum zanthoxyloides (Lam) Zepernick & Timler on Callosobruchus maculatus F Infestation in Stored Vigna unguiculata (L) Walp. Journal of Biological Sciences and Bioconservation Volume 5, Number 2, 2013 ISSN: 2277-0143

Moussa, S.K. (2001). Efficacy of Essential Oil of *Occimum gratissimum* and *O. bassilicu* as an Insectidal Fumigant and Powder to Control *Callosobruchus maculates. Journal of Stored Product Research.* 37.219-256.

Mulungu, L.S., Lupenza G., Reuben, S.O. and Misangu, R.N. (2007). Evaluation of Btoanical Products as Stored Grain Protectant against Cowpea weevil *Callosobruchus maculatus. Journal of Entomology.* 4(3): 258 – 349.

Musholobozy D.M.K and Swella G.B., (2007). Evaluation of the efficacy of Protectants against cowpea bruchids (*Callosobruchus maculatus)* on cowpea seeds (*Vgina unguiculata* L.) Walp. *Plant Project Science.* 42: 68-72.

Oparaeke, A., and Dike, M.C. (2005). Monodora Mysristica (Gaertn) Dunal. And Alliu cepa L. As Protectants against cowpea Seed Bruchid, (*Callosobruchus maculatus)*. Infesting Stored cowpea seeds. *Nigerian Journal of Enotomology.* 22: 84-92.

Rajapakse R., Seneinayaks G., N., Ratnasekera D. (1998), Effect of five botanicals on oviposition, adult emergencne and mortality to (*Callosobruchus maculatus)*(Caleoptera: Bruchidea) infesting cowpea, *Vigna unguiculata* L. Walp. *Jouranla of entomological research year:* 1998.

Sharah HA Ali EA .2008. Impact of Insecticide Spray Regimes on Insect Abundance in Cowpea (Vigna unguiculata) in North Eastern Nigeria. International Journal of Agriculture and Biology 10:255 – 260

Singh, B.B., Ehlers, J.D. Sharma, B. and Freire-Filho, F.R (2002). Recent progress in cowpea breeding In. Fatokun C.A., S.A. Tarawali, B.B. Singh, P.M. Kormawa, and M. Tamo (eds). Challenges and opportunities for enhancing sustainable cowpea production. Proceedings of World Cowpea Research Conference III held at the International Institute of Tropical Agriculture (IITA). Ibadan Nigeria 4-8 September 2000. IITA, Ibadan, Nigeria. Pages 22-40.

Udo U. O., 2011. Efficacy of zanthozylum xanthoxyloids bark and root powder for the control of sitophilus zeamays on stored maize. Proceeding of the 45th annual conference of agricultural society of Nigeria, pp: 239-241.