REPELLANT ACTIVITY OF ACKEE (*BLIGHIA SAPIDA KOENIG*) SEED OIL IN THE CONTROL OF BEANS WEEVILS (*CALLOSOBRUCHUS MACULATES FABRICIUS*).

Akhideno, L.O[1]; Iroko, O[1] ; Ogburu, R.O[2] and Yusuf; A.S.[1] ,
[1] College of Forest Resource & Management, Benin City, Edo State.
[2]Forestry Research Institute, Nigeria, Ibadan.
Email: lawsonakhideno@yahoo.com
Phone: +2348060366046

Abstract
The insecticidal of Ackee (Bligha Sapida Koenig) seed oil in the control of *callosobruschus maculates*. (Beans weevils) was investigated in the Biochemistry laboratory Department of Ambrose Alli University, Ekpoma. Edo State, Nigeria. The seed oil was applied at the rate of O as control 10, 25, 50 and 100kg^{-1}. The findings in the study revealed that ackee seed oil at 25gkg^{-1} to 100gkg^{-1} were effective in the control of *callosobruschus maculates* at 0.01% level of significance. It also shows strong insecticidal action of Ackee (*Bligha Sapida Koenig*) on beans weevils. However, increased in the concentration of the Ackee seed oil with 100gkg^{-1} gave the highest mortality rate, residual action and egg hatchability. This finding is important to resource poor beans farmer who will find this trial affordable.

Key words: Ackee seed oil Beans Weevils (*callosobruschus maculates*), and toxic smell

Introduction

Agriculture is the bedrock of man's survival on earth, but pests, diseases and weed are the major enemy to crop production (FAO 2006). Insect pest damage to stored grain results in major economic losses for crop production to meet food security. Grain lose caused by insect pests in the store reduce the quantity, quality, nutritive value and viability of the crops such as beans is a serious issues; (Udo 2000). Crop production is however, at a risk as a result of losses that occur due to high infestation of insect pests to stored grains (Wayne and Wendy, 2015).

Legume crops especially beans is widely attached by grain weevil *callosobruschus maculates*, causing 25-100% post harvest losses in storage (Okonkwo, 1998 and Remison 2005). Beans is a staple and most popular food crops of high nutritional value grown and consumed in Nigeria, (Central Bank of Nigeria, (CBN, 2008) and Akhideno *et al, 2017* Presently, beans constitute a critical component in the food basket of over 16% in the population in West Africa (Remison 2005).

Callosobruschus maculates is a major specie known to attack beans production in Nigeria. Also, their insidious feeding habits are often undetected until damage has occurred. Many farmers in Nigeria records losses due to their feeding activities and damage of the beans grain pests; it is essential that necessary control measures are put in place (Koehlen 2000; Ulebor and Onolemhemhem 2001).

Insect pest control in field and stored food product depend heavily in the use of gaseous fumigant and residual contact insecticides. Murugan 2006 the Nigeria Vanguard (2018) and Akhideno *2020* reported that European Union has criticized the use of chemicals in control of insect pest in field and especially stored products, resulting in residual effects to human and environment. Thus, this problem has created the need to find plant materials that will effectively protect field and stored grains, that are readily available, affordable, less poisonous and environmental friendly.

Ackee is an important ingredient for compounding insect pest infestation on beans weevil (*callosobruschus maculates*). Ackee (Bligha Sapida K.D. Koenig) belongs to the family *sapindaceae*. It is a timber, medicinal plants, fuel plant and vegetable oil and it is marketed as Ukpe, Ukpe-aghaba in Edo, Okpu in Igbo, Isiri-jeje, Usin in Yoruba (Keay *et al.*, 1989 and Aigbokhan, 2014).

Ackee which is in abundance in rain forest vegetation belt has some potentials in protecting our beans grains from *callosobruschus maculates*, which can be harnessed in the form of seed oil for use. This trial is aimed to determine the efficiency of Ackee seed oil in the control of insect pest especially (*callosobruschus maculates*) weevils in storage.

Materials and Methods

The experiment was carried out in Bio-chemistry Laboratory Department of Ambrose Alli University, Ekpoma, Edo State, Nigeria, which is located between latitude 6^0 46^{-1} North and longitude 6^0 8^1 East. The area has a mean air temperature of 29^0c, relative humidity of 70^0c sunshine of about 5-7 hours/day and mean rainfall of 1200-1500mm (Ighalo and Remision, 2010).

Rearing of Beans Weevils

Adult *callosobruschus maculates* were obtained from naturally infected beans grain from Ekpoma Market in Esan West Local Government Area of Edo State. These were raised in two kilner jars containing 200g of beans grain capped with muslin cloth and kept at an ambient temperature of 20^0c and relative humidity of 75 – 50%. The muslin cloth

allowed for vertilation but precluled entry or exit of bronchidis and other insects.

Plant Material

The fruits of Ackee were collected from Iruekpen Forest, Esan West Local Government Area, Edo State. The fruit were dried to a constant weight of 60^0c in an oven. The dry plant material crushed in a mortar to a fine powder, a little water is added so as to form a workable paste which forms on almost solid ball. This ball is kneaded for several minutes over a bowl until oil collect on the surface of the ball. Then pressed firmly and squeezed and the oil will come out.

The beans grains obtained from the ADP office at Irua Esan Central Local Government Area of Edo State were used. The beans were fumigated for 48 hours and acrated for 7days, this was to ensure that any developing larva/pupa within the grains were killed as suggested by (Ivbijaro, 1984).

The test material (oil) from the fruit of Ackee was admixed with the beans grain at different rate (0, 10, 25, 50, and 100kg^{-1}). Twenty beans weevils made up of 10 male and 10 female were introduced into the treated beans grains and mortality counts taken. Three replicates for each experiment were set up. All treatment were arranged using the completely randomized design and the following parameter were taken.

Mortality

For mortality studies, the beans grain were treated with the seed oil of Ackee at different rates (0, 10, 25, 50, and 100k/kg) before the introduction of beans weevils. The jar was covered with a Muslin cloth, held in place with a rubber band. Mortality of *callosobrushchus maculatus* were determined from daily counts for dead adults for 15days after which all surviving adults were removed as suggested by (Onolemhemhem and Oigiangbe (1991), and Ivbijaro, (1984).

Reproductive Capacity

The effect of Ackee seed oil on the reproductive capacity of adult beans weevil were also investigated 25 days after infestation by treating Jars set aside with gentian violet as suggest by (Ivbijaro 1954) to reveal egg plugs of the weevils. Progeny emergence was recorded from 25days after infestation till 60 days after infestation.

Residual Effect of the Test Materials

The oil of Ackee treated Jars was infested with the test weevils 10, 20, 40, 60, 50 and 100 days after application. The 20 beans weevils made up of 10 males and 10 females used mortality of the test weevils were determined by daily mortality counts. The reproduction of the test weevils were also studied using the methods adopted by Onolemhemhen and Oigangbe (1991).

Data collected were subjected to Analysis of Variance (ANOVA) using the Genstat Release 8.1 statistical software and means separated using Turkey's Test at 1% level of significance.

Results and Discussion

Table 1: Effects of Ackee Seed Oil on Adult *Callosobruschus maculatus mortality*

Ackee g/kg^{-+} Seed Oil	24hrs	48hrs	72hrs	96hrs	120hrs
0	0.08^a	0.20^e	1.35^e	2.60^e	3.32^e
10	0.00^d	1.00^d	2.20^d	3.00^d	4.06^d
25	1.24^c	2.60^c	5.00^e	6.78^c	8.50^c
50	3.00^b	4.54^b	10.01^b	13.50^b	15.23^b
100	4.56^a	5.04^a	11.56^a	14.68^a	18.00^a
Means	1.76	2.68	6.02	8.11	9.82
LSD	0.20	0.80	1.86	0.49	1.28
CV(%)	18.2	15.2	17.00	3.40	8.00

Means followed by the some letters within the column are not significantly different at 1% level.

Table 2: Residual effect of Ackee seed Oil on Adult *Callosobruschus Maculatus*

(DAT)

Ackee seed Oil gkg^{-1}	10days	20days	40days	60days	50days	100days
0	0.00^e	0.00^e	0.00^d	0.00^d	0.00^c	0.00^c
10	4.50^d	3.60^d	2.14^c	1.56^c	0.00^c	0.00^c
25	6.32^c	5.36^c	3.01^b	1.10^c	0.30^b	0.00^c
50	7.00^b	6.46^b	3.01^b	2.82^b	1.38^b	0.35^b
100	15.71^a	10.48^a	9.52^a	6.81^a	3.13^a	1.56^a
Means	6.71	5.18	3.54	2.46	0.96	0.38
LSD	1.06	0.87	0.36	0.57	1.13	0.63
CV(%)	8.10	9.01	6.00	2.43	6.36	8.53

Means followed by the some letters within the column are not significantly different at 1% level.

Table 3: Effects of Ackee seed oil on the reproductive capacity of *Callosobruschus Maculatus*.

Ackee seed Oil gkg^{-1}	Plus	Adults	cycle
0	28	25	30.0[a]
10	17	10	30.8[a]
25	10	6	35.2[a]
50	2	1	40.6[a]
100	0	0	0.00[b]
Means			27.32
LSD			4.50
CV(%)			3.30

Means followed by the some letters within the column are not significantly different at 1% level.

The effect of Ackee seed oil on the mortality of *callosobruschus maculatus* presented, in Table 1 shows that 24hrs after infestation, the jar treated with $100gkg^{-1}$ recorded the highest mortality value. In 48, 72, 96 and 120 hours after infestation, the trend remained the same, at ($p<0.01$) significant. Increasingly concentration of the seed oil $25gkg^{-1}$ to $100gkg^{-1}$ recorded mortality values than $0gkg^{-1}$ at ($p<0.01$) 18.00, 15.23 and 8.50 while 0gkg recorded 3.32 respectively. Ackee seed soil exhibited insecticidal properties that had a great effect on *callosobruschus maculatus*. This is agreement with the report of (Khan *et al.,* 2002), that powder seeds/oil of Ackee were toxic to three store product pests – cowpea beetle *callosobructus maculates* f_1 (Coleoptera: Bruchidea). Rusty grain beetle *cryptolestes ferrugineus* (Stephens) (Coleoptera: Cucujidae) and maize weevil *sitophilus zeamais* motschulsky (Coleoptera: Curculionidae). The insecticidal feature from the plant shows a significantly difference at ($p<0.01$) among the treatment tested with $100kgk^1$ Ackee seed oil recorded the highest value of mortality. The control ($0gkg^{-1}$) recorded the lowest value 3.32. Thus Ackee seed oil has some residual effect on the beans weevil causing up to 60% mortality at 60 days after treatment in $50gkg^{-1}$ treated seed oil. Thus the insecticidal effects of Ackee seed oil are supported by previous reports that extracts from plant have been shown to possess repellant properties against insect pests (Ulebor and Onolemhemhem, 2001; Enobakhare and Dan Ogbomo, 2002)and Akhideno 2020) The life cycle of the beans weevil was significantly ($P < 0.01$) affected by Ackee seed oil. It shows that Ackee seed oil was very effective in the control of the egg plug of the weevils. It also shows that ackee seed oil impaired not only oviposition but also affected the length of the cycle of the weevil. This is in confirmation with the report of Khan and Gumbs 2003 that extracts from ackee has ethanol and acetone which are toxic to weevils. Furthermore, the efficacy of this insecticidal action of *C. Maculatus* increased with increasing the concentration of the ackee seed oil with $100gkg^{-1}$ giving the highest mortality rate, residual action and egg hatchability. The toxic smell is enough to suffocate the beans weevils resulting to residual killing of the weevils over a period of time, thus indicating the very strong insecticidal properties of the test species.

RECOMMENDATION

The result obtained from this study indicate that using natural plant extract as grain protection in storage pest management system is very important. The use of this plant extract to control pest are readily available, safe to apply, affordable, environmental friendly and harmful to human health.

REFERENCES

Aigbokhan, E.I. (2014): Annotated checklist of Vascular plant of Southern Nigeria Pg 30.

Akhideno, L.O; Adeyemi, T. O.A; Ogboru, R.O and Owoeye E.A. (2017) Toxicity Effect of Xyhopia aethiopica seed powder in the control of Insect Pest of Maize. International Journal of Science and Research (IJSR) pp. 995 – 997.

Akihideno L.O;(2020): repellent effect of Irivingia gabonensis powder in the control of bean weevil callosobruschs maculantus (fiber). The Nigeria journal of agriculture and forestry (NJAF) vol. 7 pgs 123-130.

Central Bank of Nigeria (CBN), (2008): Integrated Cereals Production and Export in Nigeria. A paper presented by Director of Agriculture, Abuja-Nigeria.

Enobakhare, D.A. and Ogbomo-Law, K.E; (2002): Reduction of Post harvest loss caused by sitophilus zeamais (Motsch) in three varieties of maize treated with plant products. Journal, post-harvest science (1) 1-6.

FAO (2006): FAOSTAT: Food and Agriculture Database result.

Ivbijaro, M.F; (1984): Toxic efficiency of seed oils of Azadirachta Indica A. juss and Pepier guineense Schum and Thonn on the control of Collosobruchus Maculatus F. insect science and its Application 11 (2): 149 – 152.

Keay, R.W. J.; Onochie, C.F.A. and Stanfield, D.P. (1989) Trees in Nigeria pp. 357 – 358.

Khan, A. and Gumbs, F.A., (2003): Repellant Effects of Ackee (B lighia Sapida Koenig)

component fruit parts against stored product insect pest. Trop. Agric 80:19-27.

Khan, A.; Gumbs, F.A; and Persad, A, (2002): Pesticidal Bioactivity of Ackee (Blighia Sapida Kuenig) against three stored product insect pests. Trop Agric 79, no 4: 217-223.

Koehlen, P.G. (2002): Rice weevil, sitophilus oryzae (Coleoprera Curculionidae). Entomology and Nemotology Department, Cooperative Extension Service, institute of food and Agricultural science, University of Florida, Gainesville (32): 611.

Murugan, K. (2006): Biopesticides as environmentally soft tool for the management of insect / mosquito vectors. Int. Symp on Biocont. And biotech Madurai p. 34.

Okonkwo, E.U. (1998): Bibliography, A bibliography of part materials used for controlling insect pest of stored products in Nigeria. Review of Agricultural Entomology 30pp.

Onolemhemhem, P.O and Oigangbe, C.N., (1991): Biology Callosobruchus Maculates (Fabr) on Cowpea (Vigina Unguiculata) and pigeon pea (Cajanus Cajan L. Druce) treated with vegetable oil and Thriol Samaru J. Agric. Ros. (8): 57 – 63.

Remision, S.U. (2005): "Maize" in Arable and vegetable crops Gift – Prints Associates, Benin City", pp. 2042.

The Nigeria vanguard (2018): Effect pf chemical on stored export beans in Nigeria published 12th November, (2018).

Udo, I.O. (2000): Efficacy of Candle wood Zanthoxylum Xanthoxyloide Lam, for the control of three stored product pests. M. Phil. Thesis, University of Ghana Legion, Accra 81. Pp.

Ulebor, J.A. and Onolemhemhem, P.O. (2001): Laboratory Investigation of Xylopia aethiopica and piper guineense seed powder and oil extracts on sitophilus oryzea. Msc Thesis, Ambrose Alli University, Ekpoma. 61pp.

Wayne, G.G. and Wendy – Ann, P.I. (2015): Sustainable Food Production Practices in the Caribbean pp. 430.