



## INSECTICIDAL EFFECT OF ACKEE FRUIT (*BLIGHIA SAPIDA* KOENIG) SEED POWDER IN THE CONTROL OF MAIZE WEEVILS (*SITOPHILUS ZEAMAI*S).

AKHIDENO LO <sup>a\*</sup> • YUSUF AS <sup>a</sup> • ISIBOR J <sup>a</sup> • OMOAYANA AJ <sup>b</sup> • BAKPOLOR VR <sup>a</sup>

<sup>a</sup> College of Forest Resource & Management, Benin City

<sup>b</sup> Forestry Research Institute of Nigeria, Ibadan

\*Corresponding Author's E-mail. [lawsonakhideno@yahoo.com](mailto:lawsonakhideno@yahoo.com)

Phone: +2348060366046

**ABSTRACT:** The efficacy of Ackee (*Bligha Sapida Koenig*) seed powder in the control of *sitophilus zeamais* (Maize weevils) was investigated in the science laboratory Department of Federal Polytechnic, Auchu, Edo State, Nigeria. The seed powder was applied at the rate of 0 as control 10, 25, 50 and 100kg<sup>-1</sup>. The findings in the study revealed that ackee seed powder at 25gkg<sup>-1</sup> to 100gkg<sup>-1</sup> were effective in the control of *sitophilus zeamais* at 0.01% level of significance. It was shows strong insecticidal action of Ackee (*Bligha Sapida Koenig*) on maize weevils. However, increased in the concentration of the Ackee seed powder with 100gkg<sup>-1</sup> gave the highest mortality rate, residual action and egg hatchability (87.5% ,67.8% and 0.00%) respectively. This finding is important to resource poor maize and rice farmers who will find this trial affordable.

**Key words:** Ackee seed powder, Maize Weevils (*Sitophilus Zeamais*), aromatic smell

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### 1. 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 maize is a serious issue; (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).

Cereal crops especially maize is widely attacked by grain weevil *sitophilus zeamais*, causing 25-100% post-harvest losses in storage (Okonkwo, 1998 and Remison 2005). Maize (*zea-maiys*) is a staple and most popular food crops of high nutritional value grown and consumed in the world, (Central Bank of Nigeria, (CBN, 2008) and Akhideno *et al.*;2017). Presently, maize constitute a critical component in the food basket of over 6% in the population in West Africa (Remison 2005).

*Sitophilus zeamais* and *sitophilus oryzea* are the two major species known to attack maize and rice production in Nigeria. Also, their insidious feeding

habits are often undetected until damage has occurred. Many farmers in Nigeria records issues due to their feeding activities and damage of the maize grain pests; it is essential that necessary control measures are put in place (Koehlen 2000; Uldar and Onolemherihem, 2001).

Insect pest control in field and stored food product depend heavily in the use of gaseous fumigant and residual contact insecticides. Murugan 2006 and Akhideno *et al* 2017 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 environmentally friendly.

Ackee is an important ingredient for compounding insect pest infestation on maize and weevil (*sitophilus zeamais*). 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 maize grains from *sitophilus zeamais*, which can be harnessed in the form of seed powder for use. This trial is aimed to determine the efficiency of Ackee seed powder in the control of insect pest especially (*Sitophilus zeamais*) weevils in storage.

## 2. MATERIALS AND METHODS

The experiment was carried out in the Science Laboratory Department of Federal Polytechnic, Auchi, Edo State, Nigeria, which is located between latitude  $6^{\circ} 46^{\prime}$  North and longitude  $6^{\circ} 8^{\prime}$  East with a hot humid temperature climate.

### 2.1 Rearing of Maize Weevils

Adult *sitophilus zeamais* were obtained from naturally infected maize grain from Uchi Market in Etsako West Local Government Area of Edo State. These were raised in two kilner jars containing 200g of maize grain capped with muslin cloth and kept at an ambient temperature of  $20^{\circ}\text{C}$  and relative humidity of 75 – 50%. The muslin cloth allowed for ventilation but precluded entry or exit of bronchidids and other insects.

### 2.2 Plant Material

The fruits of Ackee Apple were collected from Irukep Forest, Esan West Local Government Area, Edo State. The fruit were dried to a constant weight of  $60^{\circ}\text{C}$  in an oven. The dry plant material was grounded to a very fine powder.

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

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

### 2.3 Mortality

For mortality studies, the maize grains were treated with the seed powder of Ackee at different rates (0, 10, 25, 50, and  $100\text{kg}^{-1}$ ) before the introduction of *sitophilus zeamais*. The jar was covered with a Muslin cloth, held in place with a rubber band. Mortality of *sitophilus zeamais* was 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).

### 2.4 Reproductive Capacity

The effect of Ackee seed powder on the reproductive capacity of adult maize weevil was also investigated 25 days after infestation by treating Jars set aside with gentian violet as suggest by (Ivbijaro 1984) to reveal egg plugs of the weevils. Progeny emergence was recorded from 25days after infestation till 60 days after infestation.

### 2.5 Residual Effect of the Test Materials

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

### 3. RESULTS AND DISCUSSION

The effect of Ackee seed powder on the mortality of *sitophilus zeamais* presented, in Table 1 shows that 24hrs after infestation, the jar treated with 100gkg<sup>-1</sup> 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 powder 25gkg<sup>-1</sup> to 100gkg<sup>-1</sup> recorded mortality values than 0gkg<sup>-1</sup> at (p<0.01) 18.00, 15.23 and 8.50 while 0gkg recorded 3.32 respectively. Ackee seed powder exhibited insecticidal properties seeds that had a great effect on *sitophilus zeamais*. This is agreement with the report of (Khan *et al.*, 2002), that powdered seeds of Ackee were toxic to three store product pests – cowpea bottle *callosobructius maculates* f<sub>1</sub> (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 100gkg<sup>-1</sup> seed powder recorded the highest value of mortality. The control (0gkg<sup>-1</sup>) recorded the lowest value 3.32. Thus, Ackee powder has some residual effect on the maize weevil causing up to 60% mortality at 60 days after treatment in 50gkg<sup>-1</sup> treated seed powder. Thus, the insecticidal effects of Ackee seed powder are supported by previous reports that extracts from plant have been shown to possess repellent properties against insect pests (Ulebor and Onolemhem, 2001; Enobakhare and Daw Ogbomo, 2002).

The life cycle of the maize weevil was significantly (P < 0.01) affected by Ackee seed powder. It shows that Ackee seed powder was very effective in the control of the egg plug of the weevils. It also shows that ackee seed powder 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 *S. zeamais* increased with increasing the concentration of the ackee seed powder with 100gkg<sup>-1</sup> giving the highest mortality rate, residual action and egg hatchability. The aromatic smell is enough to suffocate the maize weevils resulting to residual killing of the weevils over a period of time, thus indicating the very strong insecticidal properties of the test species.

Table 1: Effects of Ackee Seed Powder on Adult *Sitophilus zeamais*, mortality

Ackee Seed Powder g/kg <sup>+</sup>	24hrs	48hrs	72hrs	96hrs	120hrs
0	0.08 <sup>a</sup>	0.20 <sup>e</sup>	1.35 <sup>e</sup>	2.60 <sup>e</sup>	3.32 <sup>e</sup>
10	0.00 <sup>d</sup>	1.00 <sup>d</sup>	2.20 <sup>d</sup>	3.00 <sup>d</sup>	4.06 <sup>d</sup>
25	1.24 <sup>c</sup>	2.60 <sup>c</sup>	5.00 <sup>e</sup>	6.78 <sup>c</sup>	8.50 <sup>c</sup>
50	3.00 <sup>b</sup>	4.54 <sup>b</sup>	10.01 <sup>b</sup>	13.50 <sup>b</sup>	15.23 <sup>b</sup>
100	4.56 <sup>a</sup>	5.04 <sup>a</sup>	11.56 <sup>a</sup>	14.68 <sup>a</sup>	18.00 <sup>a</sup>
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 same letters within the column are not significantly different at 1% level.

Table 2: Residual effect of Ackee seed powder on Adult *Sitophilus zeamais* (DAT)

Ackee seed Powder gkg <sup>-1</sup>	10days	20days	40days	60days	50days	100days
0	0.00 <sup>e</sup>	0.00 <sup>e</sup>	0.00 <sup>d</sup>	0.00 <sup>d</sup>	0.00 <sup>c</sup>	0.00 <sup>c</sup>
10	4.50 <sup>d</sup>	3.60 <sup>d</sup>	2.14 <sup>c</sup>	1.56 <sup>c</sup>	0.00 <sup>c</sup>	0.00 <sup>c</sup>
25	6.32 <sup>c</sup>	5.36 <sup>c</sup>	3.01 <sup>b</sup>	1.10 <sup>c</sup>	0.30 <sup>b</sup>	0.00 <sup>c</sup>
50	7.00 <sup>b</sup>	6.46 <sup>b</sup>	3.01 <sup>b</sup>	2.82 <sup>b</sup>	1.38 <sup>b</sup>	0.35 <sup>b</sup>
100	15.71 <sup>a</sup>	10.48 <sup>a</sup>	9.52 <sup>a</sup>	6.81 <sup>a</sup>	3.13 <sup>a</sup>	1.56 <sup>a</sup>
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 same letters within the column are not significantly different at 1% level.

Table 3: Effects of Ackee seed powder on the reproductive capacity of *Sitophilus Zeamais*

Ackee seed Powder gkg <sup>-1</sup>	Plus	Adults	The cycle
0	28	25	30.0 <sup>a</sup>
10	17	10	30.8 <sup>a</sup>
25	10	6	35.2 <sup>a</sup>
50	2	1	40.6 <sup>a</sup>
100	0	0	0.00 <sup>b</sup>
Means			27.32
LSD			4.50
CV(%)			3.30

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

#### 4. CONCLUSION

From this study, the following conclusions are made:

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

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