

**EVALUATION OF THE INSECTICIDAL EFFECTS OF HOT PEPPER (CAPSICUM FRUTECENT) AGAINST THE SURIVAL AND DISTRUCTIVENESS OF SITOPHILUS ZEAMAIIS ON MAISE GRAINS.**

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**ABSTRACT**

The laboratory study on the effectiveness of hot pepper as protectant for maize against *Sitophilus zeamaize* was carried out. Different treatment concentration in (gram) of hot pepper was administer in three replicates for each pepper concentration on 20 seeds of Maize grains in 15 different plastic containers with lid. Twenty adult *Sitophiluszeamaise* pest were introduced into each of the experimental container and then screw closed with the container lid and then kept on laboratory shelves under ambient environmental condition for 24 days. The number of emergence holes on the maize grains, pest survival and mortality rate in each set upwereevaluated at the end of the study period (24, days).The results reveal that 30% of the pest died during the study period (24 days) in the hot pepper treatment concentration of 1g. 50% of the pest died in the hot pepper treatment concentration of 2g. 55% of pest died in the hot pepper treatment concentration of 3.5, while 75% of the pest died in the treatment concentration of 6g corresponding to the initial evaluation of the survival rate of the pest in question. Significance of theprotectant effect of the hot pepper treatment on maize grain against *Sitophiluszeamaise* attack was evaluated by analysis of variance.The analysis of variance indicated that treatment of maize grains with 1g, 2g, 3.5g and 6g of hot pepper shows very high significance difference at ( $p=-.001$  and  $0.005$ ).The study revealed that hot pepper was effective in protecting maize seed against the survival and the destructiveness of *Sitophiluszeamaize* The trend of the results indicate that the hot pepper protectant effect increase with concentration (gram).

**Keywords:** Assessment, survival, destructiveness, zeamaais,grains.

**1. INTRODUCTION**

Global Food production is under serious threat as a result pest attack. About 35% on the field and 14% in storage approximately 50% in total crops are lost annually due to attack by insect and pest, which adversely affects the world food production during crop growth, harvest and storage (Jitendraet.al. 2009). Various methods have been adopted over the years to minimize food production losses due to insect attack. Some of the pest managementapproaches that have been conducted, include, chemical, biological, physical, and cultural methods.

Maize is a principal cereal crop in the tropics and subtropics. The crop is said to have originated from central South America. Its botanical name is *Zea mays* of the family *graminae* and is mainly cultivated from the seed or grains. In Nigeria, maize is the third most important grain crop produced; only preceded by guinea corn and millet (Olufade, 1974). The crop grows best in low land, loamy fertile soil with pH range of 5.5 – 8.0, warm temperature range of 21 – 27°C and an annual rainfall of 650 – 1,520 mm (Offoret *al*, 1998). Maize is grown as principal source of carbohydrate, but when eaten at the early stage can also provide a measure of certain vitamins like A and C (Anyanwuet *al*, 1989).

Maize is an important diet especially during the hunger season (Paladaet *al*, 1986). The grain can be eaten when the crop is still green. The grain is used industrially for the production of bread flour, in brewery, in corn flakes production, germ seed and source of corn oil. It also form basis of livestock feeds especially feed for monogastric animals. It is one of the most valuable and cheapest sources of carbohydrate feed for animals because of its digestibility and availability of its starch. The nutrient content of maize include, 70.79% starch, 9.69% protein and 4.42% oil but contributes 15.05 - 15.3% respectively of the total calories protein intake of cereal (National Agricultural Development Rep, 1971).

It is however unfortunate that in spite of the numerous importance of maize largely cultivated in this part of the continent; there is still acute shortage of maize grains to the next planting season and also for consumption during off season. One of the main causative factors attributable to shortage of maize grain is insect infestation. Pest infestation is not only restricted to the field but it continues even into the storage system. (Olufade, 1974). Adesuyi (1982) reported that insect most frequently found on stored maize are *Sitophilus zeamais*. Akinsami (1977) reported that this weevil is capable of consuming 30 -50% of grains in storage room. The adult and larva causes considerable damages on maize resulting to characteristics holes and lose of weight. Moreover, severe insect infestation causes reduction of the food quality, low biochemical responses on the photosynthetic arial plant and also affects the germinating power of the grains.

Various chemical insecticides have been used to control this insect but excessive and indiscriminate use of chemical had led to serious social and environmental problems by poisoning of livestock's, fish, wildlife and other beneficial organisms. Researches have established that use of synthetic organic pesticides, particularly the chlorinated hydrocarbons cause serious pollution of environmental media (water, air and soil), thereby affecting human health and causing death of non-target organisms (animals, plants, and fish) (Biswaset.*al*. 2014). The use of synthetic chemicals have been restricted because of their carcinogenicity, teratogenicity accompanied with high and acute residual toxicity (Feng and Zheng, 2007; Pretty, 2009 ;Dubey et al, 2011 and Khatar, 2011)

In developing countries such as Nigeria, the limited knowledge of the application of insecticides has increased the population of the insect pest which has also resulted to the pest resistance against the insecticides due to over usage/dosage. Plant extracts and essential oils are safe, eco-friendly and more compatible with environmental components compared to synthetic pesticides. For instance, Neem seed oil is reported that it possess fungicidal, nematocidal and bactericidal properties (Schmutterer, 1995). (Mehihom, 2011) also reported that neem possess Molluscidal,

diuretic and antiarthric properties. Plant extracts and essential oils use as crop protectant against insect attack are categories as green pesticides. There is an increasing trend in use of botanicals with more than 2400 bioactive plant species identified for their insecticidal and anti - pathogenic properties (Karunamoorthi, 2012).

In the course of trying to control grain pest, many natural insecticides have been proven to be more effective in the control of *Sitophilus zeamais*. For instance, in Malawi, wood ash, alkaline ash, pepper etc were used in protecting maize against the insect infestation. (Golobo *et al*, 1982). This paper is focused on the assessment of the use of hot pepper as insecticide against the survival and destructiveness on Maize grain by *Sitophiluszeamais*.

## 2. MATERIALS AND METHODS

### Maize grain.

The maize grains used for the study was the local (white) variety. The maize (*Zeamays*) was bought from Agudama- Epie market in Yenagao Local Government Area of Bayelsa State. The maize grains were already physically infested with the test pest as at the time of collection for the study. The collected grains were then air dried to 15% moisture content.

### Test Organism

The test organism (*Sitophiluszeamays*) was properly identified using the chart provided by the Natural Resource Institute (NRI) Central avenue Chatan maritime kent MB4, 4TB United Kingdom. *Sitophiluszeamays* used in the study were collected from infested maize grains bought from Odi town in Kolokuma Local Government Area of Bayelsa state. The maize grains were put in an airtight polythene bag and transported to the former Bayelsa state college of Arts and Science Agricultural Laboratory. The grains were sieved with a wire mesh basket in order to remove the grains powder formed. The test organisms were then handpicked from the sieved grains. The insects (test organism) were then cultured in fresh ventilated plastic jar containing stored maize for about seven days before the commencement of the experiment

### Method.

Twenty uninfected maize grains of about 7.2g weight were counted and put into each of 15 different plastic containers labeled A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub>, B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>, D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub>, F<sub>1</sub>, F<sub>2</sub>, F<sub>3</sub>. The pepper used as insecticide was weighed with Hausa analytical balance. 1g, of the dry pepper was put in three replicate into containers A<sub>1</sub>, A<sub>2</sub>, and A<sub>3</sub>. 2g of pepper was also put in three replicate into container B<sub>1</sub>, B<sub>2</sub>, and B<sub>3</sub>. 3.5g was put in three replicate into containers C<sub>1</sub>, C<sub>2</sub>, and C<sub>3</sub> while 6g grams of pepper was added in three replicate into containers D<sub>1</sub>, D<sub>2</sub>, and D<sub>3</sub>. No pepper was added to the maize content of containers F<sub>1</sub>, F<sub>2</sub>, and F<sub>3</sub> respectively as they were kept as control. Set ups. Twenty adults of *Sitophilus zeamais* were introduced into each of the experimental and control containers. The containers were screwed with their cover. They were then kept in the laboratory shelves under ambient environmental condition for 24 days.

Number of emergence holes was used as the destructive index. The number of holes was counted and analysis of variance was used to find the significance of the insecticidal potential of the

treatment, while least significant difference was used to indicate the different levels significance. The survived weevils were counted to determine the

death and survival rate of the insect pests in each treatment concentrations of the pepper. The counts for survived rate was taken weekly while the count for the destructive index ie. The number of holes were counted at the end of the 24 day

**Data analysis**

1) **1** Analysis of variance (ANOVA) test was conducted to determinethe insecticidal effect of the pepper treatment as maize grain protectant against Sitophilus zeamaise.

$$C.F = \frac{G^2}{N} \quad (1)$$

where N = D.F (t) (r) = 15, t (5) = number of treatments and r (3) = number replicate for treatment concentration

$$TSS = \sum X^2 - C.F \dots\dots\dots (2)$$

$$T_rSS = \frac{\sum T^2}{r} \dots\dots\dots (3)$$

$$E.SS = TSS - T_rSS \dots\dots\dots (4)$$

$$D.F(T_r) = t - 1 \text{ ie } (5 - 1) = 4 \dots\dots\dots (5)$$

$$\text{Error} = t(r - 1) = 5(3 - 1) = 5 \times 2 = 10 \dots\dots\dots (6)$$

$$\text{Total D.F} = (r) (t) - 1 = 3 \times 5 - 1 = 14 \dots\dots\dots (7)$$

$$T_r. MS = \frac{T_rSS}{D.F T_r} = \frac{T_rSS}{t-1} \dots\dots\dots (8)$$

$$EMS = \frac{ESS}{t(r-1)} \dots\dots\dots (9)$$

$$\text{Computed F} = \frac{T_r.MS}{ESS} \dots\dots\dots (10)$$

C.F = Corrected factor

G = Grand total

SS = Sum of square

T<sub>r</sub>SS = Treatment sum of squares

T.SS = Total sum of squares

D.F = Degree of freedom

E.SS = Error sum of squares.

TMS = Treatment means of square.

EMS = Error means of square.

2) Analysis of the effectiveness of hot pepper treatment on the mortality rate of the Sitophilus zeamais pests was conducted using equation (11). This analysis is useful in determining which of the pepper treatment concentration was more effective as insecticide against the targeted pest.

$$\text{Effectiveness of treatment} = \frac{P_i - P_t}{P_i} \times 100 \dots\dots\dots 11$$

Where P<sub>i</sub> is initial population of Sitophilus Zeamais at time zero.

P<sub>t</sub> is the population of Sitophilus Zeamais at time t (end of experiment)

**3. RESULTS AND DISCUSSIONS**

**Results**

**Table1: Mean value of the survived Sitophilus zeamais population in hot pepper treated maize grains**

Treatment concentration (g)	NO of Replicates			Total	Mean
	1	2	3		
0	20	20	20	60	20
1	14	14	14	42	14
2	9	11	10	30	10
3.5	9	10	8	27	9
6	6	5	4	15	5

**Table 2: Mortality rate of Sitophilus zeamais in hot pepper treated maize grains.**

Treatment concentration (g)	Total death	Mortality rate (%)
0	0	0
1	18	30
2	30	50
3.5	33	55
6	45	75

**Table 3: Showing the effectiveness of the hot pepper against the destructiveness of the Sitophilus zeamais**

Treatment concentration (g)	NO of Replicates			Total	Mean
	1	2	3		
0	200	203	195	598	199.33
1	60	89	75	224	74.87
2	44	66	60	170	56.67
3.5	20	15	17	52	17.33
6	18	4	7	29	9.67

**Table 4: Results of statistical parameters evaluation**

Parameters	Values
C.F	2018.4
G <sup>2</sup>	30276
T <sub>r</sub> SS	387.6
T.SS	393.6
D.F	14

E.SS	<b>6</b>
TMS	<b>96.9</b>
EMS	<b>0.6</b>
F	<b>161.5</b>

**Table 5:** Analysis of variance of survived *Sitophilus zeamais* population in hot pepper treatment

Sources of variation	Degree of Freedom (D.F)	SS	MS	Computed F	Tabulated F	Tabulated F
					1%	5%
Treatment	4	387.6	96.9	161.5	3.32	2.37
Error	10	6	0.6			
Total	14	393.6				

From the analysis of variance  $F_{cal} = 161.5$  while the F tabulated  $F_{crit} = 3.34$ .

**Results of analysis of the Effectiveness of pepper treatment on the death rate of *Sitophilus zeamais***

$$\text{Pepper treatment concentration of 1g was } = \frac{20-14}{20} \times 100 = 30\%$$

$$\text{Pepper treatment concentration of 2g was } = \frac{20-10}{20} \times 100 = 50\%$$

$$\text{Pepper treatment concentration of 2g was } = \frac{20-9}{20} \times 100 = 55\%$$

$$\text{Pepper treatment concentration of 2g was } = \frac{20-5}{20} \times 100 = 75\%$$

**4. DISCUSSION**

*Sitophiluszeamais* attack is one of the most serious pest problems that maizefarmers contend with annually. This insect pest causes loss of maize grain nutrient and value during storage The insecticidal effects of hot pepper on *Sitophiluszeamais* in stored maize grain were investigated. The destructiveness of the maize grain by the pest, the mortality rate and the survival rate of the pest on treatment of the stored grain with hot pepper at different concentration were

evaluated. The results of the survival rate of the *Sitophilus zeamais* pest in each pepper treatment concentration during the 24 days period of the experimentation is shown in Table 1. The results show that the entire pest survived in the experimental replicates without the pepper treatment. In the experimental replicates with 1g hot pepper treatment, there was an average population survival of 14 representing 70%. In the experiments with 2g hot pepper treatment, the average population of the pest (*Sitophilus zeamais*) that survived is 10 representing 50%, in the experiment replicates with 3.5g hot pepper concentration, average population of the pest survival is 9 representing 45%. The least survival rate was observed in experimental replicates containing hot pepper concentration of 6g. Here the average pest survival population was 5 representing only 25%. Table 2 shows the results of the evaluation of the average mortality rate of the pest in each of the pepper treatment concentration. The results reveal that 30% of the pest died during the study period (24 days) in the hot pepper treatment concentration of 1g. 50% of the pest died in the hot pepper treatment concentration of 2g. 55% of pest died in the hot pepper treatment concentration of 3.5, while 75% of the pest died in the treatment concentration of 6g corresponding to the initial evaluation of the survival rate of the pest in question. Analysis of variance in table 5 show that the F calculated 393.6 and Fcrit was 3.34 indicating that the hot pepper was significantly effective in reducing the population of the maize grain pest (*Sitophilus zeamais*) within 24 days. (Al-Mazraawi and Ateyyat, 2009; Ateyyat *et al.* 2009), conducted research on the botanical insecticidal potency of *Thymus vulgaris*, *Allium cepa*, *Allium sativum*, *Saturejahortensis*, *Achilleabiebersteinii*, *Cinnamomum verum*, *Syzygium aromaticum*, extracts against *B. tabaci* have and reported 60-100% mortality rate. (Mohanty *et al.* 1995) reported the effectiveness of neem seed kernel extract against diamond back moth (*Plutella xylostella*), tomato fruit borer (*Helicoverpa armigera*), brinjal fruit borer (*Leucinodes orbonalis*) and serpentine leaf miner (*Liriomyza trifolii*). (Chanda (2011) reported 60 - 83 %, repelling and larvicidal effects of *T. triquetrum*, against human blood sucking leech, *U. crinita*, 77-90 %, and *B. multiplex* 60- 93 % effectiveness respectively. Dimetry, 2012). Reported the insecticidal effects of neem seed oil on pest and fungi. The result of the analysis of variance as presented in Table 5, indicate that the hot pepper treatment has significant insecticidal effect on *Sitophilus zeamais* ( $p \leq 0.5$ )

## CONCLUSION AND RECOMMENDATION

Insect pest infestation is a serious threat to food production all over the world. How the effect of this menace is more pronounced in Africa as a result of none or poor access to more than food preservation technology. Many farmers depend on synthetic chemical pesticides to protect their agricultural products. However, synthetic chemical pesticides have potential and significant environment effect hence their uses is been restricted. Botanical pesticides are better alternative to synthetic chemical pesticides, as they are eco-friendly, effective, readily available and cheaper. Many natural products and essential oils from natural products have been proven to have efficient insecticidal effects on crops pest. In this paper, the effectiveness of hot pepper as insecticidal protectant of Zeamais grain against *Sitophilus zeamais* destructiveness has been reported.

It is recommended that local farmers should be made known the effectiveness of hot pepper in protecting their stored produce (maize) and should be encouraged to apply the techniques. More



research on Hot pepper insecticidal properties and other natural products should be promoted. Farmers should be train on modern application techniques of pesticides.

## REFERENCES

- Adesuyi S.A. (1982). Field Trials with permethrin Dust for the Control of Insect Infestation on Stored Maize in Southern Nigeria. *Journal of Stored product Research* vol2 :(3)
- Akinsanmi, A. (1977). *Secondary Agricultural Science* Longman.Pp 245.
- Al-Mazraawi M.S. and Ateyyat M. (2009) Insecticidal and repellent activities of medicinal plant extracts against the sweet potato whitefly, *Bemisia tabaci*(Hom.:Aleyrodidae) and its parasitoid *Eretmocerus mundus* (Hym.: Aphelinidae). *Journal of Pest Science*. 82(2):149-154.
- Ateyyat M.A., Al-Mazraawi M.S., Abu-Rjai T. and Shatnawi M.A. (2009) Aqueous extracts of some medicinal plants are as toxic as imidacloprid to the sweet potato whitefly, *Bemisia tabaci*. *Journal of Insect Science*.9(15).
- Biswas S.K., Rahman S., Kobir S.M.A., Ferdous T. and Banu N.A. (2014) A Review on Impact of Agrochemicals on Human Health and Environment: Bangladesh Perspective. *Plant Environment Development*, Vol3(2):31-35.
- Chanda Vongsombath (2011). Botanical Repellents and Pesticides Traditionally Used against Haematogenous invertebrate in Loa DPR. M.Sc. Dissertation submitted to the faculty of Science and Technology, Acta University Uppsala.
- Dubey, N.K., Shukla, R., Kuman, A., Singh, P and Prakash, B (2011). Global Scenario on the application of Natural products in integrated Pest Management. Dubey, N.K, CAB Oxfordshire. UK. Pp. 1-20
- Feng, W Zheng, X.(2007). Essential Oils to control *Almaria alternata* in vitro and in vivo. *Food control* Vol 18: 1126 – 1130.
- Jitendra K., Nitin K. and Kulkarni D.K. (2009) Plant-based pesticides for control of *Helicoverpa armigera* on *Cucumis*. *Asian Agric. History*. Vol 13(4):327-332.
- Karunamoorthi K. (2012) Medicinal and Aromatic Plants: A Major Source of Green Pesticides/ Risk-Reduced Pesticides. *Med Aromatic Plants* vol 1:137.
- Khatar , H.F (2011). *Ecosmart Biorational insecticides*. Alternative Insect control Strategies in Insecticides Perveen. F(Ed) InTech, Kijeka Croatia. ISBN 979-953-307-667; 5
- Mehihom, H., Al-Rasheid, K.S AND Abdel-Ghaffer, F. (2011). *The Neem Tree Story: Extracts that really work in Nature help*. Parasitology Research Monographs / Mehihom, H (Ed). Springer-Verag, Berlin. Pp 77-108
- Offor, U.S and Ansa, J.E.O. (1998). *Tropical Crop Husbandry Area Corps*. Pp 5-9

Olufade A (1974) Nigerian Journal of entomology, Vol 1: 57 – 62

Palada M.C., Vogel W.O., Mareck J.H (1986) IITA Res Briefs 7 No 4.

Pretty, J.(2009). The pesticide Detox towards a more sustainable Agriculture. Earth Scan, London.

SezanurRahman., Sudhangshu Kumar Biswas.,Nirmal Chandra Barman., TamannaFerdous (2016). Plant Extract as Selective Pesticide for Integrated Pest Management.Biotechnological.Research.Journal. Vol 2(1):6-10