

INSECTICIDAL POTENCY OF *Ocimum suave* (WILD BASIL) LEAVE OIL EXTRACT AGAINST MAIZE WEEVILS (*Sitophilus zeamais* Motschulsky) AND TEST OF MAIZE SEEDS' VIABILITY.

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ABSTRACT

The insecticidal potency of the crude oil of fresh leaves of *Ocimum suave* against maize weevil (*Sitophilus zeamais* Motschulsky) adult were determined under laboratory conditions, using contact toxicity assay method of different concentration 0.02, 0.04, 0.06, 0.08ml/20g of maize seed and 0.00ml/20g of maize seed as the control. 20g of maize seeds were weighed in the Petri dishes and 10 adult weevils were introduced and replicated four times. Each treatment was observed for 6 hours and mortality recorded every 1 hour. The effect of crude oil of *Ocimum suave* on the germination power of maize grain was assessed to test for the viability of the maize seed. The crude oil extract had significant difference ($p < 0.05$) on the mortality of the adult weevil as the concentration increased from 0.02-0.08ml/20g of maize seed. The highest mortality (87.5%) was achieved at 0.08 concentration by contact with treated grain with LC_{50} -0.0229 conc. /20g and LT_{50} - 4hrs.48mins/20g. There was no significant difference ($p > 0.05$) in the germination of the treated maize seeds compared to the untreated control, which shows that seeds still remained viable. This result showed that *Ocimum suave* crude oil is effective in the protection of maize against maize weevil.

INTRODUCTION

Maize (*Zea mays* L.) is one of the foremost cereals cultivated in the world today, and it is a major source of dietary carbohydrate in the tropics (Asawalam and Hassanali, 2006; Ajayi, 2013). It forms a cheap source of dietary carbohydrate for human and livestock in Nigeria (Rouanet, 1992). Maize is the largest cereal crop in sub-Saharan Africa along with rice and wheat and it is one of the three most widely grown cereals in the world. The heavy post-harvest losses and quality deterioration caused by storage pests are a major problem facing maize cultivation in developing countries such as Nigeria (Adedire and Ajayi, 1996).

The maize weevil *Sitophilus zeamais* (Coleopteran: Curculionidae) is a serious pest of stored grain in Africa (Asawalam and Emosairue, 2006). In maize, attack starts in the mature crop when the moisture content of the grain has fallen to 18-20% (Parugrug and Roxas, 2008; Suleiman and Yusuf, 2011). Initial infestation of maize grain occurs in the field just before harvest and insects are carried into the store where the population builds up rapidly. To prevent losses, farmers rely on the use of synthetic insecticides; but the high cost, toxicity to non-target organisms, inherent environmental hazards and the development of resistance by insect pests have limited their effective use for maize storage (Al- Moajel, 2006) thus the need for an effective, easy to use, biodegradable pesticide that is safe to human and the environment (Arannilewa *et al.*, 2006, Ajayi, 2013), herein the need for this research. The aim of this study is to determine the toxicity of *Ocimum suave* leaf oil extract on adult *Sitophilus zeamais* and the viability test of maize seed.

MATERIALS AND METHODS

INSECT STOCK CULTURE

Adult maize weevil were obtained from already infested maize and identified as *Sitophilus zeamais* in Nigerian Stored Product Research Institute (NSPRI) Sapele, Delta State, Nigeria. The *S. zeamais* adults obtained were introduced into undamaged and clean maize seeds (*Zea mays* L.) purchased from Abraka market, Delta State. They were kept in large specimen containers with fine mesh gauze covering the opened end in the laboratory of the Department of Animal and Environmental Biology, Delta State University. The emergence of the insects was checked daily and observed on the third week which was then used for the experiment.

PREPARATION OF INSECTICIDAL PLANT POWDER

The research plant (*Ocimum suave*) used for this experiment was identified taxonomists in the Department of Botany, Delta State University, Abraka, Nigeria. The plant was obtained from Issele-Azagba (Aniocha North) Local Government Area of Delta State. Fresh leaves from the plant were slowly direct for 3 weeks in an open wooden cabinet under room temperature before pulverization in the motorized high speed grinder. The powders were put in the tight container to prevent active components from evaporating (Denloye *et al.*, 2007; Ojjanwuna and Umoru, 2010).

EXTRACTION OF OIL

The *O. suave* oil was extracted by soxhlet extraction method. Extraction of the essential oil was carried out in a 1000 ml Soxhlet apparatus at 65°C on a heating mantle using hexane. The solvent was separated from the oil using rotary evaporator and thereafter exposed to get rid of traces of hexane in it. The oil thus obtained was kept in dark bottle and stored in a dark cupboard at room temperature (Ajayi, 2013).

INSECTICIDAL BIOASSAY CONTACT TOXICITY OF *O. SUAVE* EXTRACT

Contact toxicity assay was done according to Kim *et al.*, 2003 and Ojjanwuna *et al.*, 2013 with some modifications. 20g of maize grains in Petri dishes were coated with 20g of plant extract dissolved in 10ml of distilled water at the required concentration. Ten unsexed insect pair was then introduced into dish and exposed to treatments. The evaluated doses of oil were 0.02, 0.04, 0.06 and 0.08ml while untreated grains in the other petridish acted as control. Four replicates were made per treatment. The treatments were kept in a bioclimatic chamber at a temperature of 30±1°C. Insect mortality was assessed at 1, 2, 3, 4, 5 and 6 hours of exposure to the crude oil to determine the LC₅₀ and LT₅₀.

GERMINATION TEST

The effect of crude oil of *O. suave* on the germinating power of the maize grain was assessed using the methodology described by Perez *et al.* (2001).

DATA ANALYSIS

All data collected were subjected to Probit Analysis (Finney 1971), Analysis of Variance (ANOVA) and Multiple Comparisons using Turkey Multiple Comparison test.

RESULT

ACUTE TOXICITY TEST

The insecticidal effect (mortality) of the plant extract (*Ocimum suave*) on the insect mortality showed significant difference ($p < 0.05$) as the concentration increased from 0.02ml to 0.08ml/20g. The median lethal concentration LC₅₀ was 0.0229 conc./20g of maize seed (Fig 1). As the period of exposure of the crude oil extract on the insect increased from 1-6 hours (Table 1) there was significant difference ($p < 0.05$) on the mortality of the adult weevil. The median lethal time LT₅₀ was 4 hours, 48 minutes (Fig 2).

Table 1: Mortality, probit mortality, percentage mortality, mean and mean x of kil l cause by *O. suave* crude oil on adult *Sitophilus zeamais*

Conc. in ml/20g of maize	Exposed periods (hours)						Total mortality	% probit mortality	Mean (x)
	1	2	3	4	5	6			
0.00 (control)	0	0	0	0	0	0	0	0	0 ^a
Mean value	0	0	0	0	0	0			
0.02	4	1	2	6	3	3	19	47.5	0.79 ^b
Mean value	1	0.25	0.5	1.5	0.75	0.75			
0.04	5	5	3	6	3	1	24	60	0.95 ^b
Mean value	1.25	1.25	0.75	1.5	0.75	0.25			
0.06	8	3	7	5	1	3	27	67.5	1.13 ^b
Mean value	2	0.75	1.75	1.25	0.25	0.75			
0.08	10	4	8	7	1	5	37	87.5	1.46 ^b
Mean value	2.5	1	2	1.75	0.25	1.25			
Mean (x)	1.35 ^a	0.65 ^{ab}	1.0 ^{ab}	1.2 ^{ab}	0.4 ^b	0.6 ^{ab}			

Means of the same superscript letter to do not differ significantly (p<0.05) using Turkey honest comparison test.

Table 2: Mortality and % probit kill caused by *O. suave* oil extract

Mortality test container	No. of weevil in each container	Mortality A B C D	Conc. of toxicant	Log conc.	% mortality	% probit kill
Control	10	0 0 0 0	0.00	-0	0	0
1	10	7 5 3 4	0.002	-1.70	47.5	4.9373
2	10	5 8 5 6	0.004	-1.40	60	5.2533
3	10	6 7 7 7	0.006	-1.22	67.5	5.4538
4	10	9 8 9 9	0.008	-1.10	87.5	6.1603

GERMINATION TEST OF TREATED SEED

The germination of the grain showed that seeds with *O. suave* crude oil extract do not have any significant difference (p>0.05) (table 3).

Table 3: Germination Test. Maize grain germination expose to different concentration.

Days	4	5	6	7	%
Control	0	4	7	10	100
0.002	5	7	7	8	80
0.004	4	6	8	9	90
0.006	4	7	8	10	100
0.008	6	9	10	10	100

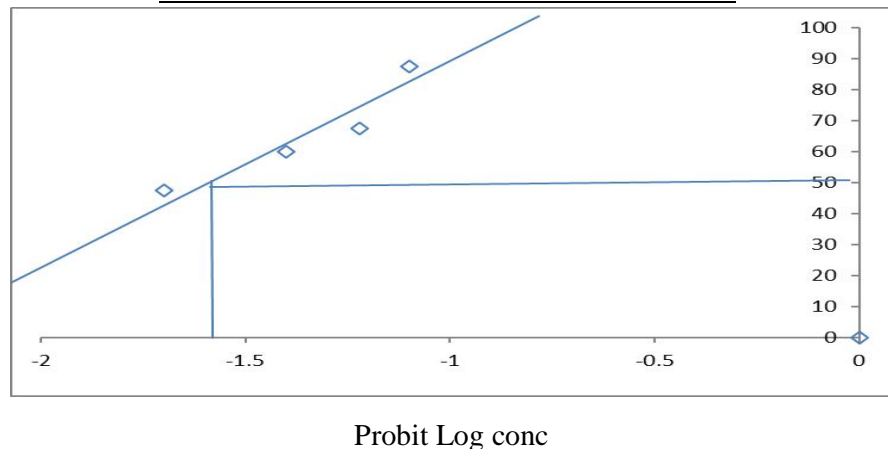


Fig 1: Log Concentration of the oil extract (toxicant) and percentage Probit kill of *S. zeamais*

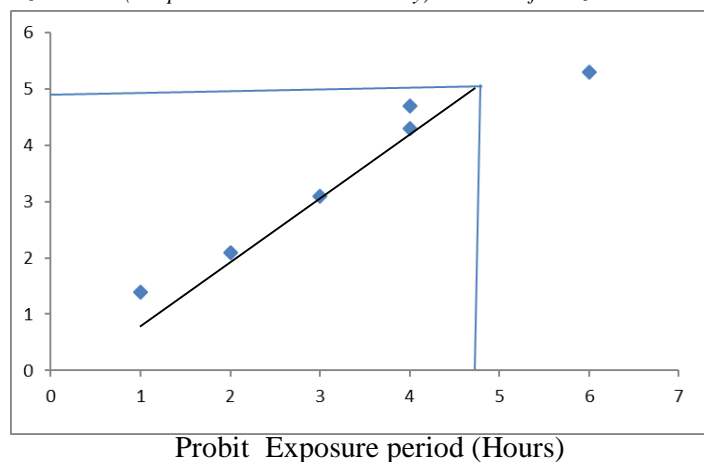


Fig 2: Lethal Time of the oil extract (toxicant) and percentage Probit kill of *S zeamais*

DISCUSSION

The plant material was toxic to the insects as the concentration increased from 0.02ml-0.08ml/20g of maize seeds from the first hours to the sixth hours, there was significant difference ($p < 0.05$) as the percentage mortality of *S. zeamais* sprayed with *Ocimum suave* oil increased. The toxicity of *Ocimum suave* leaf oil in different proportion could be as a result of the volatile compound in the plant material which acted as fumigant with insecticidal effect on the insect (Hassanali 1990). Similarly, Ojianwuna et al., (2013) reported that *Ocimum suave* contain fumigants which produced insecticidal effect and caused 85.5% mortality of the adult insects after 4days post treatment.

Mortality increased with increased exposure time to crude oil (Perez et al., 2007; Biltner et al., 2008; Ajayi et al., 2013). The medium lethal concentration for *Ocimum suave* oil was 0.0229 conc./20g of maize seed which suggests that to achieve 100% mortality of adult *Sitophilus zeamais* the quantity of the plant materials need to be increased to allow easy penetration of the active constituents through the body of the adult *S. zeamais*. The low mortality rate recorded at the early period of exposure i.e. the first and second hours of exposure of adult *S. zeamais* to lower concentration of plant materials may be attributed to the fact that not enough content of the volatile compounds has reached the respiratory tracts of the tested organism (Betaucur et al. 2001).

The percentage of germination of the grain varied from 80% to 100% without significant difference ($P > 0.05$). This may be that the plant material has no effect on the seeds viability, and makes the maize seeds still viable for cultivation.

CONCLUSION

Ocimum suave (wild basil) is alternative source for synthetic organic insecticide for control of pests on maize seeds.

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