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THE EFFICACY OF *XYLOPIA AETHIOPICA* AND *PIPER GUINEENSE* SEEDS POWDER ON *SITOPHILUS ORYZAE* MORTALITY

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ABSTRACT
Efficacy of Xylopia aethiopica and Piper guineense seeds powders in the control of Sitophilus oryzae was investigated. In the laboratory experiment, the Xylopia aethiopica and Piper guineense seeds powders were applied at rates of 0gm (control), 10gm, 25gm, 50gm, 100gm kg-1 respectively for the control of Sitophilus oryzae. Xylopia aethiopica and Piper guineense seeds powders at the rates of 100gm kg-1 respectively were found to having effective potentials in the control of Sitophilus oryzae. Piper guineense seed powder from the experiments conducted were generally more efficacious as having the potentials in the control of insect pests as seen in tables 1-3 of this study.

Key words: *Xylopia aethiopica, Piper guineense* seeds powder, *Sitophilus oryzae* mortality

INTRODUCTION
Insect pests damage to stored grains results in major economic losses and in Africa where subsistence grain production supports the livelihood of majority of the population, grain loss caused by storage pest such as the Rice weevils *Sitophilus oryzae* (Udo, 2000) is a serious issue. Stored product insects reduce the quantity, quality, nutritive value and viability of stored crops like maize, sorghum, wheat and rice (Okonkwo, 1998). These pests and many others, threaten food security (Udo, 2000). Control of pests in stored grains is a serious problem in developing countries in the tropics due to favourable climatic conditions and poor storage structures (Bekele and Hassanali, 1997).

Cereal corps especially rice is widely attacked by the grain weevil *Sitophilus species* causing 25 – 100% post harvest losses in storage (Okonkwo, 1998). *Sitophilus zeamais* and *Sitophilus oryzae* are the two main species known to attack maize and rice in Nigeria. Owing to their insidious feeding habits, they are often undetected until damage has occurred (Koehler, 2002). Owing to the losses resulting from the feeding activities and damage of the rice grain pests, it is essential that necessary control measures are put in place to ensure adequate rice production and storage (Koehler, 2002). Insect pest control in stored food products has relied heavily on the use of gaseous fumigants and residual contact insecticides. The implications of these are serious problems of toxic residues, health and environmental hazards, development of insect strain resistant to insecticides, increasing cost of application and erratic supply in developing countries due to foreign exchange constraints (Okonkwo and Ewete, 1999).

Similarly, Teetes and Gilstrap (1986) were of the view that the use of chemical insecticides which hitherto was the control measure adopted in storage, has of recent been criticized because of the difficulties associated with it's procurement, hazards with it's use, development of pest resistance and pest resurgence problems. Thus, these problems, have created the need to find materials that will effectively protect stored grains or produce, that are readily available, affordable, relatively less poisonous and less detrimental to the environment. This has stimulated interest in the development of alternative control strategies and the re-evaluation of traditional botanical pest control agents (Niber, 1994, Talukler and Howes, 1995). Resource poor farmers in developing countries use different plant materials to protect stored grains against pest infestation by mixing grains with protestants made up of plant products. This idea is supported with the fact that the use of naturally occurring plant materials to protect agricultural products against a variety of insect pests is an old-age practice in some parts of the world (Peter, 1985). *Xylopia aethiopica* and *piper guineense* are important ingredients for compounding various types of drugs consumed by human beings or for body surface application, as the case may be (Bell, 1992).

In the light of the above, natural plant species, *Xylopia aethiopica* and *piper guineense* which are much in abundance in the rain forest vegetation belt have some potentials in grain preservation, which can be harnessed in the form of oil extracts and powders for use in storage entomology (Bekele and Obeng-Ofori *et al.* 1997, Dike, 2001). The achievement in this direction will help to increase the scope of rice production and utilization, to meet up with the ever increasing demand for rice and rice products (Okonkwo and Ewete, 1999). This study is aimed at investigating the efficacy of these plant material in the control of insect pests especially *Sitophilus oryzae* and their residual effects on test grains.

MATERIALS AND METHODS

The experiments were carried out between 2006 and 2008 at the crop science laboratory, College of Education, Agbor. Agbor is located at (latitude 6^{ON} and Longitude 6^{O} 2^{OE}) in the humid tropical climate.

Weevil Culture

A Weevil Culture of *Sitophilus oryzae* developed on rice was established in October, 2006. The Weevil obtained from this culture were use for this study. This was repeated in October, 2004.

Plant Materials

The fruits of *Piper guineense and xylopia aethiopica* were collected from the study area (Agbor). They were dried to a constant weight at 60^{O}C in hot box oven. The dry materials were ground to very fine powder and used for experiment. The experiment was to find out the comparative efficacy of the seeds powders.

Use of Materials in the Laboratory

The rice variety, labelled (ITA) 150 obtained from Azu Owa Garage rice warehouse in Agbor was used. The rice grains were fumigated with carbon tetrachloride for 48 hours and aerated for 7 days. This was to ensure that any developing larva/pupa within the grain were killed, as suggested by Ivbijaro (1990) and Wee and Nick (1998). The powders from the fruits *Piper guineense* and *Xylopia aethiopica* were mixed with rice grain differently at different rate (0, 10, 25, 50 and 100gm kg.1). Twenty rice weevils made up of 10 males and 10 females were introduced into the treated grains and mortality counts taken. There were three replicates for each experiment set up.

All treatments were arranged using the randomized complete block design. Laboratory room temperature 27± oc and relative humidity of 72± 5% was maintained as they were kept in a Gallen Kamp Laboratory incubator.

Mortality of *Sitphilus oryzae* was determined from daily counts of dead adults for 15 days after which all surviving adults were removed as suggested by Ivbijaro (1984) and Onolemhemhen (1991). Adult *Sitophilus oryzae* was presumed dead, if it failed to move when touched with a forceps/spatula.

Data Analysis

Data were analysed as Randomized complete block design using Genstat release 8.1 statistical software. Treatment means were compared using Fisher's LSD. The treatments were compared at 1% level of probability.

RESULTS AND DISCUSSION

Effect of *Xylopia aethiopica* seed powder on mortality of *Sitophilus oryzae*

Results in respect of the bioactivities of *Xylopia aethiopica* seed powder on the mortality of *Sitophilus oryzae* are presented in Table 1. The data in Table 1 show that barely 24 hours after infestation, the *Xylopia aethiopica* powder caused *Sitophilus oryzae* mortality, which ranged from 0.0 to 4.67, with 100gmkg $^{-1}$ treated seeds recording the highest mortality value.

Difference between the control and the powder treated seed were significant P<0.001. By 72 hours after infestation, the trend remained the same, with the *Xylopia aethiopica* powder treated seeds recording higher *Sitophilus oryzae* mortality than the control. Difference between the treatment means was significant (P<0.001). At 120hours after treatment, mortality recorded ranged from 3.33 to 17.53 with the control recording the least mortality value, while the 100gm kg $^{-1}$ recorded the highest value of 17.53. Difference between treatment means were significant (P<0.001). Of the treatments, 20-100kg $^{-1}$ recorded values were significantly higher than 0-10g kg $^{-1}$ treated seeds.

Table 1: Effect of *Xylopia aethiopica* seed powder on adult *Sitophilus oryzae* hours after treatment

Xylopia aethiopica Powder (20 ml kg $^{-1}$) seeds	24hrs	48hrs	72hrs	96hrs	12hrs
	←	Mean no of dead insects			→
0	0.0^{d}	0.33^{d}	1.33^{d}	2.66^{d}	3.33^{d}
10	0.0^{d}	1.00^{c}	2.33^{d}	3.00^{d}	4.00^{d}
20	1.33^{e}	2.64^{b}	5.00^{e}	6.67^{c}	8.31^{e}
50	3.33^{b}	4.67^{a}	10.00^{b}	13.67^{b}	15.33^{b}
100	4.67^{a}	5.33^{a}	11.67^{a}	14.67^{a}	17.53^{a}
Overall	1.87	2.80	5.80	8.13	9.60
LSD	0.69	0.81	1.86	0.49	1.26
CV%	19.6	1.53	17.00	3.20	7.0

Means followed by the same letters within a column are not significantly different at 1% level (P>0.001) by Duncan's multiple range test.

Effect of *Piper guineense* seed powder on *Sitophilus oryzae* mortality treatment

The results of the bio activities of *Piper guineense* on *Sitophilus oryzae* mortality is presented in data presented in Table 9, indicate that *Piper guineense* at rates applied caused mortality of *Sitophilus oryzae* adults, depending on the length of exposure to the powder. At 24hrs after infestation, the *Piper guineense* powder cause *Sitophilus oryzae* mortality, which ranged from 0.00 to 7.67, with 100mg kg^{-1} treated seeds recording the highest mortality value. Difference between the control and the powder treated seeds were significant (P< 0.001).

By 72hrs after infestation, the trend remained the same, with the *Piper guineense* treated seeds recording higher *Sitophilus oryzae* mortality than the control. Difference between the treatment means was significant (P < 0.001). At 120 hours after treatment, mortality recorded ranged from 3.67 to 20.00, with the control recording the least mortality data, while the 100gm kg^{-1} recorded the highest value of 20.00. Differences between treatment means were significant (P< 0.001). Thus *Piper guineense* powder can cause mortality of *Sitohilus oryzae* at 10 – 100g kg^{-1} rates of application.

Table 2: Effect *Piper guineense* powder on mortality of *Sitophilus oryzae* hours after treatment

Piper guineense powder (gm kg^{-1})seeds (No. of insects)	24hrs	48hrs	72hrs	96hrs	120hrs	
		Mean no. of dead insects				
0	20	0.00^{c}	0.00^{d}	0.67^{b}	3.33^{d}	3.67^{d}
10	20	3.00^{b}	4.00^{c}	6.00^{d}	8.67^{c}	9.87^{c}
25	20	4.00^{b}	6.33^{b}	9.00^{c}	13.33^{c}	16.00^{b}
50	20	6.67^{a}	9.00^{a}	14.00^{b}	15.67^{b}	17.33^{b}
100	20	7.67^{a}	9.33^{a}	16.37^{a}	18.33^{a}	20.00^{a}
Overall mean	4.27	5.73	9.20	11.67	13.33	
LSD	0.59	1.52	1.27	1.52	0.91	
CV%	7.40	14.1	7.4	6.60	3.50	

Means followed by the same letters within a column are not significantly different at 1% level (P>0.001) by Duncan's multiple range test.

Comparison of the efficacy of *Xylopia aethiopica* and *Piper guineense* seeds powders on *Sitophilus oryzae* mortality

The results of the comparison of interaction and bio activities for the efficacy of *Piper guineense* and *xylopia aethipica* powder on *Sitophilus oryzae* mortality are presented in Table 3. Result presented in Table 3, indicate that 24hrs after treatment there was significant difference (P<0.001) between the efficacy of *Piper guineense* seed powder and *Xylopia aethiopica* seed powder on the mortality of *Sitophilus oryzae.* This is clear in the differences of the mortality means of the two factors of treatment, *Xylopia aethiopica* mean mortality is 1.87 and *Piper guineense* is 4.27. The means mortality variations as seen in the different hours after treatment, shows the disparity of the efficacy of *Xylopia aethiopica* and *Piper guineense.* There are also significant difference (P<0.001) in the means mortalities as affected by the level of plant powders used. Concentration of the two factors of treatment and the potency on *Sitophilus oryzae* at rates applied, ranged from control (0mg) to 100gm kg^{-1}, where 10gm kg^{-1} recorded the highest value of 6.17 and the control recorded the least value of 0.00.

The powder extract by concentration of *Xylopia aethiopica* and *Piper guineense* showed significant difference (P<0.001) at the varied rates of treatments. It is observed from the data as seen from the treatments at 24hours, that the increase in the powder extract by concentration brought abut corresponding increase in the potency of the test materials to cause *Sitophilus oryzae* mortality. By 72 hours after infestation, the trend remained the same, with the *Piper guineense* seed powder treated seeds recording higher *Sitophilus oryzae* mortality, ranging from 0.67 to 16.33, with the control recording the least mortality data, while the 100gm kg^{-1} recorded the highest value of 16.33. *Xylopia aethiopica* seed powder which displayed lower potency of *Sitophilus oryzae* than that of *Piper guineense,* recorded mortality result ranging from 0.00 to 11.67, with the control recording the least mortality result, while the 100gm kg^{-1} recorded the highest value of 11.67.

At 120hrs after infestation treatment showed that there are significant difference (P<0.001) in the efficacy of *Piper guineense* and *Xylopia aethiopica* seed powders in their ability to cause mortality of *Sitophilus oryzae* with *Piper guineense* recording high mortality values than *Xylopia aethiopica.*

Table 3: Observation of mortality of insects of the following factors.

powder extract	24hrs	48hrs	72hrs	96hrs	120hrs
Xylopia aethiopica	1.87	2.80	5.80	8.13	9.60
Piper guineense	4.27	5.73	9.20	11.87	13.33
Overall mean	3.07	4.27	7.50	10.00	11.47
LSD	0.26	1.48	0.69	0.47	0.43

Combined mortality effect of the test materials

Concentration (gm/kg^{-1})	**24hrs**	**48hrs**	**72hrs**	**96hrs**	**120hrs**
0	0.00^c	0.17^d	0.33^e	3.00^c	3.50^c
10	1.50^d	2.50^c	4.17^d	5.83^d	6.30^d
25	2.67^c	4.50^b	7.00^c	10.00^c	12.17^c
50	5.00^b	6.83^a	12.00^b	14.67^b	16.17^b
100	6.17^a	7.33^a	14.00^a	16.50^a	18.67^a
Overall mean	3.07	4.27	7.50	10.00	11.47
LSD	0.41	0.76	1.10	0.73	0.69

Powder extract X conc.

Xylopia Sp x 0gm	0.00^i	0.33^h	0.00^n	2.67^g	3.33^i
Xylopia Sp x 10gm	0.00^i	1.00^g	2.33^g	3.00^g	4.00^i
Xylopia Sp x 25gm	1.33^h	2.67^g	5.00^g	6.67^g	8.33^h
Xylopia Sp x 50gm	3.33^g	4.67^f	10.00^f	13.67^f	15.00^g
Xylopia Sp x 100gm	4.67^f	5.33^f	11.67^f	14.67^f	17.33^f
Piper x 0gm	0.00^e	0.00^d	0.67^e	3.33^e	3.67^d
Piper x 10gm	3.00^d	4.00^c	6.00^d	8.07^d	9.60^c
Piper x 25gm	4.00^e	6.33^b	9.00^e	13.33^c	16.00^b
Piper x 50gm	6.67^b	9.00^a	14.00^b	15.67^b	17.33^b
Piper x 100gm	7.67^a	9.33^a	16.33^a	18.33^a	20.00^a
Mean	3.07	4.27	7.50	10.00	11.47
LSD	0.58	1.08	1.55	1.04	0.96

Means followed by the same letters within a column are not significantly different at 1% level (P>0.001) by Duncan's multiple range test.

The powder extracts of *Xylopia aethiopica* and powder extracts of *Piper guineense* exhibited insecticidal properties that were lethal to *Sitophilus oryzae*. These insecticidal features of the plant extracts may be due to their constituent components, pungent smell and mode of actions. This may have accounted for their effective control of *Sitophilus oryzae* and other insect pests.

Xylopia aethiopica seed powder has a pungent smell, which functioned more as an insect pest repellant and perhaps caused suffocation and death of the weevils. The striking effects of *Piper guineense* powder could be attributed to its guineensine 1 component and it's irritating and pungent smell which prevents insects physical contact with the rice grains and caused the death of introduced adult weevils. The insecticidal functions of the plant extracts are supported by the reports that extracts from plants have been shown to possess insecticidal properties against a wide range of insect pests (Golob *et al.,* 1982 Onolemhemhen and Oigiangbe 1991, Lale 1992, and Yahaya 2002).

CONCLUSION

The results obtained in this study indicate the potentials of using the various spices *Piper guineense* and *Xylopia aethiopica* as grain protectants in storage pest management systems. The spices used in this study are broad spectrum in pest control, readily available, safe to apply and can be afforded by our resources poor farmers. Thus, botanical pesticides represent an important potential for integrated pest management programme in developing countries as they are local material that can be readily sourced.

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