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Short Communication Report

LABORATORY ASSESSMENT OF THE SUSCEPTIBILITY OF SOME VARIETIES OF *ZEA MAYS* INFESTED WITH *Sitophilus zeamais,* Motsch. (Coleoptera, Curculionidae) IN JOS, PLATEAU STATE, NIGERIA.

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INTRODUCTION

Maize is an important staple food and a source of invaluable nutrients. Weevils are known to be among the economically important insect pests of maize in Nigeria. These insects bore into maize kernels in the field or in storage and lay eggs. The young insects grow to maturity inside the kernels, eating them from the inside out. This causes loss in the maize's nutritive value and weight. A contaminated supply of seed will most likely contaminate other stores within a certain range. This sort of damage is especially severe on subsistence farmers, who may depend on one year store of grain to provide germinating seeds for the next. While boring through the seed, the insects create powder and kernel fragments that encourage infestation by other secondary storage pests (Kevin 2002).

Maize weevil *Sitophilus zeamais,* mostch, (Coleoptera: Curculionidae) is an important pest of maize in the tropics, causing serious losses to many poor farmers who store grains on farm for use as food and seed (Thanda & Kevin, 2003). *S. zeamais* is a very serious pest of stored maize in low land, mid-altitude, hot, and humid environments (Longstaff 1981, Devries & Toenniessen, 2001, Pingali & Pandey, 2001). About 140 million hectares of maize is grown world wide, approximately 96 million in the developing world. About 90% of maize produced in the industrial countries is grown in the temperate regions (Pingali & Pandey, 2001). In United States of America (USA) and Europe, grain is usually stored in commercial quantities in silos, with moisture kept under control and fumigated to control insects (CIMMYT, 2001). Unfortunately vast majority of tropical maize are stored on farm, with no moisture control and without fumigation. The authors observed that grain is usually susceptible to weevil damage under high moisture content, which implied that maize weevil is a greater problem in developing than in developed countries. Bergvinson (2004) observed that maize weevils can consumed as much as 15% of a harvest in a few months and have the ability to reduce maize quality. Several authors (Mutiro *et al.*, 1992; Pingali & Pandey, 2001; Gerald, 2008) reported that weevils were responsible for causing more than 20% weight loss of hybrid maize stored in traditional structures, 40% lost due to poor post harvest storage and 80% loss on farm stores in the tropics. The aim of this study is to evaluate the susceptibility of seven varieties of maize infested with *Sitophilus zeamais.*

The study was conducted between December, 2007 and May, 2008. Seven varieties of maize were used that included S123, Coca, Coca Hybrid, TZB, Single Cross, LI and LII. The varieties Coca Hybrid and Single Cross were obtained from United Trading Company (UTC) Motors Limited, (Utceeds section) in Jos, Plateau State, Nigeria. Varieties S123 and TZB were bought directly from Kasuwan doya market in Jos while LI and LII were local varieties obtained from Pankshin Local Government Council of Plateau State.

Morphological Description: Morphological description was made for the seven varieties of maize. It was based on size of the grains. Ten grains were hand picked from each variety and measured using venier caliper. For each variety, size ranges were recorded as in Table 1.

TABLE 1. SIZE RANGES OF THE SEVEN VARIETIES OF MAIZE.

S/No.	Maize Variety	Size range (mm)
1	S123	0.92 - 0.95
2	Coca	1.20 – 1.28
3	Coca-Hybrid	0.74 – 0.80
4	TZB	1.30 – 1.37
5	Single Cross	1.02 – 1.08
6	LI	0.88 – 0.96
7	LII	1.01 – 1.07

Nutritional and Moisture Contents: The nutritional and moisture content of the seven varieties of maize were determined by proximate analysis before the weevils were introduced on the maize varieties. The same proximate analysis was again repeated after the termination of the experiment. The maize varieties were fumigated by aluminium phosphate in an air tight container to eliminate any form of contamination or pre-infestation by insect pests. A relapse period was allowed before the insects were introduced. 500 gm of each test variety were introduced into a 25cl Kilner jar. This treatment was replicated four times for each variety of maize. Ten adult *S. zeamais* were introduced into each of the Kilner jars except the control. The Kilner jars were covered with a fine mesh net and allowed to stand for six months at room temperature. The number of insects in each jar was counted every two weeks and presented as a mean for the six months of study.

Statistical Analysis: The results were subjected to one way analysis of variance and correlation (product-moment correlation coefficient) analysis by manual calculation.

The highest number of *Sitophilus zeamais* was found in TZB with mean number of 260 insects pest, followed by Single-Cross, Coca, LII, LI, Coca-Hybrid and S123 with 149, 118, 90, 26, 22 and 18 insects respectively. Analysis of variance (ANOVA) shows a significant difference ($P < 0.05$) in the level of susceptibility among the varieties of maize. Similarly, more insects' pest were found in maize varieties with higher initial moisture content, suggesting that moisture plays an important role in maize susceptibility to insects pest.

Correlation analysis shows no significant statistical difference (P> 0.05) between insects pest attack in relation to the food nutrient analyzed. However, results of ANOVA on the susceptibility of the maize varieties to infestation with *S. zeamais* were significant (P< 0.05), suggesting that none of the maize varieties tested was completely resistant. This indicates that the food nutrient does not contribute to maize resistance to insect pest infesting the varieties tested.

TABLE 2. NUMBER OF SITOPHILUS ZEAMAIS AND MOISTURE CONTENT OF THE SEVEN VARIETIES OF MAIZE AFTER THE EXPERIMENT

Varieties	Seeds (gm)	Mean No *S. zeamais*		Moisture content	
		Initial	Final	Initial	Final
S123	200g	10	18	9.85	13.48
Coca	200g	10	118	10.3	16.85
Coca-Hybrid	200g	10	22	9.88	13.7
TZB	200g	10	260	11.02	13.28
Single Cross	200g	10	149	10.6	13.61
LI	200g	10	26	9.89	12.84
LII	200g	10	90	10.06	13.09

n= 4 for each variety.

TABLE 3. THE NUTRIENT CONTENT OF SEVEN VARIETIES OF MAIZE BEFORE AND AFTER INFESTATION BY *S. ZEAMAIS*

Variety	Mean *S. zeamais*	Crude Protein		Crude fiber		Lipid (fat)		Ash		Calcium		Phosphorus	
		initial	final	initial	final	initial	final	initial	final	initial	final	initial	final
S123	18	8.47	11.92	4.35	14.41	5.32	8.75	1.50	1.78	0.17	0.21	0.16	0.20
Coca	118	11.72	14.38	6.59	14.77	4.34	2.95	1.37	2.72	0.20	0.25	0.12	0.14
Coca-Hybrid	22	10.15	13.78	8.67	9.21	4.68	3.42	1.43	2.18	0.17	0.24	0.14	0.17
TZB	260	11.99	14.35	9.41	10.09	4.78	2.40	1.45	2.26	0.17	0.21	0.16	0.20
Single-Cross	149	12.20	15.44	8.28	12.48	6.75	9.72	1.44	2.56	0.20	0.21	0.15	0.17
LI	26	11.84	14.42	7.99	12.14	4.33	3.62	1.11	2.16	1.17	0.21	0.16	0.20
LII	90	12.15	14.44	8.21	12.13	4.80	3.74	1.32	1.97	0.17	0.21	0.16	0.20

The results of this study revealed that none of the seven varieties of maize tested for susceptibility to infestation by *S. zeamais* resistant to insect infestation. Five of the varieties were improved hybrid maize while LI and LII were local varieties.

It was discovered that the size of the grains varied considerably among the varieties. The study also shows that a relationship exists between size and moisture content of the varieties tested. Smaller seeds that were hard and compact had less moisture and were therefore more resistant to the maize weevil attack. On the other hand bigger grains were loose, soft and contain higher moisture and hence more easily attacked by the weevils. The harder a seed is, the more resistant it is to storage pests, such as the maize weevils. Kelvin (2002) reported a relationship between seed hardness and thickness, both in the pericarp and the whole kernel by noting that maize with thick and hard pericarp was very hard to penetrate by the weevils. The same author observed a correlation between the seed variety, the pericarp and kernel's thickness. Schoonhoven *et al.,* (1975) reported that resistance was located in the undamaged pericarp, which act primarily as a barrier against and so reduced the number of insects progeny. This factor, therefore, influences the number of *S. zeamais* recorded in each variety during the present study. Dobie (1976) observed increased susceptibility to infestation after removal of the pericarp. Bergvinson (2004) revealed that maize with tighter husks or a harder kernel was insect resistant.

Nutrient content of the maize variety did not modify its resistance to weevil infestation. The number of insects pest recorded in each maize variety did not vary according to the variation in the nutrient content of the maize varieties studied in this Correlation analysis showed no relationship between nutrition and development of insects pest (P>0.05). The findings in this study are in agreement with Dobie (1976) who reported a negative correlation between protein and beetle attack. He therefore, concluded that crude-protein was independent of maize kernel hardness or softness. This means that resistance is not dependent on the nutritional content of the maize varieties studied. However, both Sing & McCain (1963) and Dobie (1977) reported the factors contributing to grain resistance to weevils to include increased sugar content. Ferulic acid has also been named as contributing significantly to maize resistance to weevils (Classen *et al.,* 1990; Arnason *et al.,* 1994).

Results from study shows that increase in moisture seems to modify susceptibility of maize to weevil infestation, making the maize varieties more susceptible to insect pest attack (Table2), agreeing with and CIMMYT (2001) who reported that high moisture content make grains susceptible to weevil damage.

Since none of the maize varieties used for this experiment was completely resistant to insect pest, and because of the relationship observed between maize size and moisture content, it is recommended that thorough sun drying of maize grains should be undertaken to reduce post harvest losses due to pest infestation.

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