GLOBAL JOURNAL OF PURE AND APPLIED SCIENCES, VOL. 12 NO 1, JANUARY, 2006: 7-9
 ISSN 1118-0579

A COMPARATIVE STUDY ON INFESTATION OF THREE VARIETIES OF MAIZE (*Zea mays* (L.) WITH MAIZE WEEVIL (*Sitophilus zeamais*) Motschulsky (Coleoptera: Curculionidae).

G. A. ARONG and H. L. NJILA

(Received 3 September, 2003; Revision Accepted 11 May 2005)

ABSTRACT

A study was carried out to study the infestation of three maize varieties (Maize suwan I – Y, Maize T2 USR – White single cross and Maize suwan 123) by *Sitophilus zeamais* Motsch. Infestation was assessed by counting the numbers of alive and dead adults and the number of infested and uninfested seeds. It was found out that none of the variety was completely resistant to infestation, though infestation varied significantly among the maize varieties. More pests progeny were found in the susceptible varieties (suwan 123 with 55.8% and T2 USR – White single cross with 39.3%) while the resistant variety (Suwan has 35.3%). The size and hardness of the maize grains of the three varieties were found to be associated with resistance. Suwan I-Y, with its small size, is hardest and difficult to penetrate by *Sitophilus* and hence has the lowest seed infestation of 5.5%, followed by T2USR-White single cross with 50% Suwan 123, with its large size, appeared loose and soft, hence easy to penetrate. It had the highest number of seed infestation of 69.1%. The order of preference of *S. zeamais* was maize suwan 123, maize T2USR-white single cross and maize suwan I-Y. There was a continuous but gradual decrease in temperature and an increase in relative humidity. Infestation increased with decrease in temperature and increase in relative humidity. This should be considered during storage by tropical farmers.

KEYWORDS – *Sitophilus zeamais*, Maize Suwan I-Y, Maize T2 USR-White single cross; Maize Suwan 123

INTRODUCTION

Maize (Zea mays L) which accounts for about 11.2% of grains produced in Nigeria (Agboola, 1980 and 1982) is a common diet for humans and a major component of livestock feeds (wudiri et al., 1992). Maize is affected by a range of pests, both in the field and in storage (kochlar, 1986). The deterioration of stored maize is due to a number of interrelated factors which can be modified by man either by aggravating their effects, through negligence, ignorance or error, by limiting or nullifying their impact by prudent measures and good storage hygiene (Tiger et al., 1994). Deterioration of stored maize is affected by various factors, such as relative humidity, temperature, moisture content, various microflora, arthropods, vertebrate pests. Storage condition, method, duration and state of the grain can also influence deterioration (Tiger et al., 1994).

Sitophilus spp. notably *Sitophilus zeamais* are the most important storage pests of maize (Caswell, 1980) pest infestation cause direct damage to grains, causing loss of viability and nutrients, contamination of produce with excrements, lowering of quality and price of produce(Ivbijaro et al; 1985; Lale, 1992). Insect pests also feed and breed within the endosperm of seeds causing weight loss. Crop protection in storage limits reproductive success of insect pests either by disrupting mating and oviposition or inhibiting development of immature stages (Ajayi, et al., 1987, Shikaan et al; 1992). Allen et al.(1982) stated that grain produce in Nigeria are generally susceptible to insect pests attacked, though they suggested that the rate of infestation is influenced by climatic conditions.

Therefore, this study was carried to determine the susceptibility and resistance of some maize varieties to *Sitophilus zeamais*. This will provide useful information for tropical farmers on how to overcome the menace of this pest during storage.

MATERIALS AND METHODS

Caswell (1975) method for collecting samples was used in this study by taking samples using the standardised measure from each lot of grain bags as maintained in the stores and by collecting the samples from grain bags using a grain probe until a full measure was obtained.

Five kilogrammes each of the three varieties were obtained from the Plateau State Agricultural and Development Programme (P.A.D.P) Jos. The samples were bagged separately in Pioneer Milling Company (P.M.C.) sample bags and labelled serially as variety I (maize suwan I-Y) variety II (maize T2 USR white – single cross) and variety III (maize Suwan 123).

In the laboratory 12 kilner jars were put into use, with each variety assigned to four labelled jars and replicated four times. The Mettler P. 2010 weighing balance was used to measure 1000g of the seeds of each variety. One hundred adult *Sitophilus* male and female were introduced into each replicate. No insect was introduced into the control. The experiments were then covered with 0.25mm mesh size net to control the movement of the pest out of the Kilner jars but allowed ventilation. Twelve days after infestation of the insects, the total number of *S. zeamias* that were alive and dead in each replicate were counted manually. Adults that remained inside the seeds and were identified as alive or dead by the aid of the hand lens and confirmed with a dissecting microscope were also noted. The number of infested and uninfested seeds was also counted at 12-day interval. This was done by gradually pouring out the seeds of every jar into different plastic trays and then sorted out into those with holes. Those with holes were assessed as infested seeds, and those without holes were regarded as uninfested seeds. The infestation rate was compared by calculating the mean total number of *S. zeamais* that were alive and dead and the mean total number of seeds infested and uninfested for all sampling days within the experimental period of 5 months.

G. A. ARONG, Department of Zoology, University of Calabar, P.M.B. 1115, Calabar, Nigeria
H. L. NJILA, Applied Entomology and Parasitology Unit, Department of Zoology, University of Jos, P.M.B. 2084, Jos, Nigeria

Table 1: **MEAN MONTHLY VARIATION IN THE TOTAL NUMBER OF ADULT *SITOPHILUS ZEAMAIS* IN 3 MAIZE VARIETIES.**

MONTH	MAIZE SUWAN I – Y		MAIZE USR T2 SINGLE CROSS		MAIZE SUWAN 123		CONTROL (All three varieties	
	Number of Adults	Mortality Rate	Number of Adults	Mortality Rate	Number of Adults	Mortality Rate	Number of Adults	Mortality Ra
MAY	8.25^{a}	0.25^{c}	12.00^{ab}	1.00^{cb}	35.50^{dc}	7.00^{c}	0.00	0.(
JUNE	6.25^{a}	3.25^{ba}	16.00^{ab}	1.50^{b}	30.75^{dc}	16.25^{bc}	0.00	0.(
	5.25^{a}	4.75^{ba}	20.00^{ab}	2.00^{b}	71.25^{ds}	19.75^{c}	0.00	0.(
JULY	5.50^{a}	6.25^{ba}	41.50^{ab}	3.25^{b}	203.25^{dc}	39.50^{c}	0.00	0.(
	9.75^{a}	7.25^{ba}	127.75^{ab}	7.00^{b}	287.50^{dc}	68.75^{c}	0.00	0.(
AUGUST	26.25^{a}	9.00^{ba}	170.25^{ab}	14.25^{b}	363.75^{dc}	91.00^{bc}	0.00	0.(
	33.25^{a}	14.25^{ba}	207.50^{ab}	27.50^{b}	604.75^{dc}	125.75^{c}	0.00	0.(
SEPTEMBER	27.50^{a}	29.25^{ba}	354.75^{ab}	71.50^{b}	1040.25^{dc}	285.00^{c}	0.00	0.(
	73.75^{a}	58.25^{ba}	732.75^{ab}	285.00^{b}	1045.00^{dc}	643.50^{c}	0.00	0.(
	178.75^{ab}	97.50^{c}	959.25^{ab}	392.00^{b}	804.75^{dc}	1015.50^{bc}	0.00	0.(

Each value is a mean of four replicates. Within column means followed by a double superscript are significantly different (P=0.05).

Table 2: MEAN MONTHLY VARIATIONS IN THE TOTAL NUMBER OF SEEDS INFESTATION IN 3 MAIZE VARIETIES

MONTH	MAIZE SUWAN I –Y		MAIZE USR T2 SINGLE CROSS		MAIZE SUWAN 123		CONTROL (All three varieties)	
	Infested Seeds	Uninfested Seeds	Infested Seeds	Uninfested Seeds	Infested Seeds	Uninfested Seeds	Infested Seeds	Uninfested Seeds
MAY	14.50^{f}	3415.00^{dc}	31.25^{c}	2618.75^{cd}	149.00^{bc}	2537.00^{fd}	0.00	0.00
JUNE	15.50^{f}	3414.50^{dc}	38.00^{c}	2612.00^{cd}	156.00^{b}	25.4.00^{fd}	0.00	0.00
	16.00^{f}	3414.00^{dc}	53.75^{c}	2596.25^{cd}	271.25^{bc}	2388.75^{fd}	0.00	0.00
JULY	17.25^{f}	3412.75^{dc}	80.00^{c}	2570.00^{cd}	402.75^{bc}	2257.25^{fd}	0.00	0.00
	22.00^{f}	3418.00^{dc}	170.00^{c}	2480.00^{cd}	516.25^{bc}	2143.75^{fd}	0.00	0.00
AUGUST	38.50^{f}	3391.50^{dc}	212.50^{ac}	2437.50^{cd}	593.25^{bc}	2066.75^{fd}	0.00	0.00
	59.50^{f}	3379.25^{dc}	248.00^{ac}	2402.00^{cd}	769.00^{bc}	1891.00^{d}	0.00	0.00
SEPTEMBER	55.25^{f}	3374.75^{dc}	419.25^{ac}	2230.00^{cd}	1323.75^{bc}	336.25^{d}	0.00	0.00
	100.25^{f}	3329.75^{dc}	810.75^{ac}	1839.25^{c}	1407.00^{bc}	1253.00^{d}	0.00	0.00
	188.50^{f}	3241.50^{dc}	1325.75^{ac}	1324.25^{c}	1837.75^{bc}	882.25^{d}	0.00	0.00

Each value is a mean of four replicates. Within column mean followed by a double superscripts are significantly different (P=0.05).

Table 3: MEAN MONTHLY VARIATION IN TEMPERATURE AND RELATIVE HUMIDITY

MONTH	TEMPERATURE (^{O}C)	RELATIVE HUMIDITY (%)
MAY	26.42	74.87
JUNE	24.20	73.29
JULY	23.04	80.37
AUGUST	22.52	83.42
SEPTEMBER	23.10	73.35

Temperature and relative humidity measurements of the laboratory were taken twice daily (morning and afternoon) and the means of both readings noted. The mean monthly records were also calculated. Data were subjected to analysis of variance (ANOVA) and chi-square tests.

RESULT AND DISCUSSION

There was a significant difference in the numbers of infested and uninfested seeds ($P<0.05$) (Table 2,). The size of the maize grains varied considerably among the three varieties and hardness of each maize grain appeared to depend on the size of maize seeds. These two factors appeared to have influenced the numbers of *Sitophilus zeamais* recorded in each variety. Small maize grains were too compact and hard, while large grains appeared loose and soft. Maize suwan I-Y with its small size appeared to be hardest and hence very difficult to penetrate. This accounted for fewer numbers of adult *S. zeamais* in this variety (Table 1). Maize T2 USR white single cross and maize suwan 123 with their large size appeared loose and soft and hence easy to penetrate by *S. zeamais*, which accounted for their high numbers of adult *S. zeamais* (Table 1). There was a significant difference ($P<0.05$) between the means of adults alive in the 3 varieties (Table 1). Villacis *et al.*, (1977) also made similar observation. Mortality rate varies considerably within the maize varieties (Table 1). Maize Suwan I-Y shows a significant difference from maize T2 USR white single cross and maize suwan 123. Mortality rate was higher in maize suwan 123 at the close of this study (Table 1). This may be due to increase metabolic activities of the pests, stress and large numbers of *S. zeamais* encountered in each experiment. This observation was also reported by Oxley and Wicken den (1968). Oxygen depletion reported by them as a mortality factor may not hold in this work since jars were ventilated, rather competition is the suspected factor.

Infestation rate from May – September was high; this may be due to low temperature and high relative humidity which brought about increase in the moisture content of the grains (Table 2). This agrees with the findings of Giles (1964) who found that infestation and damage by insect pests was low during the dry season, but increases during the raining season from June – October. Hall (1975) also observed that high relative humidity and low temperature during raining season stimulate insects and mould growth and at the same time increase the respiratory rate of products. The appearance of holes and powdery nature of the seeds in the middle to the close of this study, served as an indicative of the infestation caused by the pests. This was however absent in the control as it was not infested with the pest.

The study has shown that Maize suwan 1-Y was able to withstand infestation and prevent complete development of *S. zeamaiz* variety. The maize variety should be adopted for storage especially by subsistence farmers in the tropics and resistant genes incorporated into other susceptible varieties. Maize suwan 1-Y has a general acceptance, its cheap and readily available.

REFERENCES

Agboola, S.D., 1980. The role of the Nigerian Stored Products Research Institute in Nigeria March Towards self-sufficiency in food. NSPRI Occasional Paper Series No. 1. 17 pp.

Agboola, S.D., 1982. Research for Effective Food Storage in Nigeria. NSPRI Occasional Paper Series No. 1. 17 pp.

Ajayi, O., Arokoyo, J. T., Nezan, J. T., Olayinka, O.O., Ndirmbula, B. M. and Kannike, O.A., 1987. Laboratory assessment of the efficiency of some local plant materials for the control of storage insects. Samaru Journal of Agricultural Research. 4: 24-30.

Allen, B.O. and Ohiagu, C.E., 1982. Review ons Harvest and Post Harvest Handling of Stored Sorghum In Nigeria *L.A.R./A.B.U.* Zaria Tech. Report 1 Project PFL/002. 1.

Caswell, G. H., 1975. The storage of cowpeas in the northern states of Nigeria. Proceedings of Agricultural Society Of Nigeria. 5: 4 -6

Caswell, G.H., 1980. A Review of the work done in the Entomology section of the Institute for Agriculture Research on Postharvest attack of Stored grain. Samaru miscellaneous Papers 99: 1-2.

Giles, P.H., 1964. The storage of cereals by farmers in Northern Nigeria. Trop. Agric. Trinidad, 41(3): 197 – 212.

Hall, D. W., 1980. Handling and Storage of food grains in tropical and subtropical areas. Food And Agricultural Organization Review paper, No. 90

Ivbijaro, M. F., Ligan, C. and Youdeowei, A., 1985. Control of rice weevil, *Sitophilus oryzae* L. in stored maize with vegetable oil. Agricultural Ecosystems and Environment. 14: 237 – 242.

Kochlar, S.L., 1986. Tropical crops. A Textbook of Economic Botany Macmillan, London Pp 467.

Lale, N.E.S., 1992. A Laboratory study of the comparative toxicity of products on three species to the maize weevil. Postharvest Biology and Technology. 2: 61 – 64.

Oxley, T. A. and Wickenden, G., 1963. Effects of restricted air supply on some insects which infest grains. An. Appl. Biol. 51: 313 – 324.

Shikaan, T.O. and Uvah, I. I., 1992. Effect of some plant materials on progeny development in *Callosobruchus maculatus* (F). Nigeria Journal of Entomology, 12: 70 – 77.

Tiger, B.S, Key, G.E, Flores, S.M.E. and Vazque, A. M., 1994. Field and post maturation Infestation of maize by stored product pest in Mexico. Journal of Stored Product Research. 30 (1): 1 – 8.

Villacis, S.J, Sosa, M.C. and Ortega, C. A., 1977. The nutritional and reproductive effects of five types of maize on the development of *Sitophilus Zeamais* Motschulsky, (Coleoptera: Curculionidae). Journal of Stored Product Research. 30(1): 147 – 152.

Wudiri, B. B. and Fatobi, T.O., 1992. Cereals in the food Economy of Nigeria.Media forum for Agriculture International Institute for Tropical Agriculture, Ibadan, Nigeria Pp. 13 – 32.