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THE PERFORMANCE OF SPINTOR DUST AND ACTELLIC 2% DUST FOR MANAGING *Sitophilus zeamais* (MOTSCHULSKY) (COLEOPTERA, CURCULIONIDAE) IN DIFFERENT MAIZE VARIETIES IN THE NIGER DELTA.

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ABSTRACT

Potency of two insecticides (Actellic 2% dust and Spintor dust at 0.02g/20 g maize grains) in managing Sitophilus zeamais in stored maize was evaluated using three varieties (Bende, Ogbia muno, and ACR 97 TZL Comp. 1-W) under prevailing laboratory conditions (25-30^{O}C and 70-90 % R. H.). Four pairs of 7-day old S. zeamais adults were introduced on each of the four 20 g lots of each variety in 1-L Kilner jars. Adult progeny, weight loss and developmental periods were assessed. The interactive effect of the insecticides and maize variety under investigation showed that considerably more adult progeny developed in control jars than in jars containing maize treated with test insecticides. Weight losses for one generation of infestation by S. zeamais in maize treated with Spintor dust, Actellic 2% dust and insecticide free maize were 8%, 12% and 14 %, respectively. Adult progeny development period was ranked in a decreasing order as Spintor dust < Actellic dust < Untreated maize. The use of Spintor dust as a pesticide for managing stored maize by S. zeamais is being reported, perhaps, for the first time to me.

Key words: *Sitophilus zeamais*; Actellic dust; Spintor dust; Maize variety; Infestation.

INTRODUCTION

Food situation has remained insecure and unpredictable in sub-Saharan Africa, leading to high levels of cyclic famine and poverty (Othiro, *et al*., 2008). Maize (*Zea mays*) is the third most important cereal crop cultivated in the world after wheat and rice (Purseglore, 1983). The grains constitute the most important staple food-stuff for the growing population in the tropics (Purseglove, 1983). In the Niger Delta area of Nigeria, maize is the most important cereal grown and eaten (Udoh *et. al*., 2000). While in storage, cereal crops are subject to damage from attack by a variety of insect pests which leads to loss in weight, seed quality, germination ability and market value (Komolafe, *et. al*., 1980) and substantial post harvest food grain loss (Othira, *et al*., 2009). Global post-harvest grain losses caused by insect damage and other bioagents range from 10-40% (Raja, *et al*., 2001). The maize weevil is a cosmopolitan pest of wholesome grains in both tropics and warm temperate regions of the world (Ofuya and Lale, 2001). *S. zeamais* poses a serious threat to food security, particularly in developing countries and is a serious primary pest of maize (Wanyika, *et al.*, 2009) it is said to be the principal post-harvest pest where infestation commences in the field as soon as maize cobs begin to turn yellowish (Haines, 1991). Adedire (1998) observed the effects and damage pattern of *Sitophilus zeamais* (Motschulsky) on stored maize and noted that adult weevils and larvae feed on the undamaged grains and reduce them to a powdery form. Such loss has been reported to be up to 30% of grain dry weight in maize stored on-farm due to *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae) and *S. zeamais* (IITA, 1995). Pest problems are most intense in the Niger Delta where the environmental conditions especially temperature and relative humidity are favourable for insects' development and survival (Udoh, *et. al*., 2000).

Lale and Kartey (2006) have shown from their study on testing testae thickness, seed size and kernel hardness, and other seed quality parameters that some cultivars of maize were relatively resistant to *S. zeamais* attack. The current work was carried out to determine the performance/potency of a newly introduced Spintor dust (Spinosad 1.25 g/kg) (Lachlan Kenya, 2008) and to compare with the existing one (Actellic 2% dust) on 3 maize varieties in the Niger delta region of Nigeria.

MATERIALS AND METHODS

Insect Rearing

Adult maize weevils used to establish the culture were obtained from an infested grain in an open market at Choba, Rivers State, Nigeria. They were subsequently maintained on a local variety Bende in 1-L Kilner jar under prevailing laboratory conditions (25-30^{O}C and 70-90% r.h.) in the Faculty of Agriculture, University of Port Harcourt.

Experimental Procedure

Three maize varieties comprising one hybrid (ACR 97 TZL Comp. 1-W) obtained from IITA Ibadan, Nigeria and two local cultivars (Bende and Ogbiamuno) that are normally grown by farmers in the area were screened. The experiment was conducted in the Research Laboratory of Faculty of Agriculture, University of Port Harcourt. The grains were sterilized at 78^{o}C for 30 minutes in a Gallenkamp Oven and conditioned for 24 hours in a laboratory before introducing the adult weevils. The experimental jars were also sterilized at the same condition in order to kill any external pest and pathogens that might be present.

For each variety, 20 g were weighed using a Sensitive Electronic Weighing balance **(**AB 204 Mettler Toledo balance (Max 210 g, Min 10 g =0.1 mg) into 1-L Kilner jar and admixed with 0.02 g of Acteillic and Spintor dust, infested with four pairs of 7 day old *S. zeamais* adults. For each variety control which consisted of pure maize was included. Each treatment was replicated four times. On day 7 these insects were sieved out using a Metal laboratory test sieve (Endo Cotts Ltd, Tolerance Full; Aperture 2.00 mm, Bs 410) and the eggs laid were allowed to develop to adulthood. The adult progeny that developed in each were counted and removed daily by emptying the content of each jar on a white paper and any adult seen was then removed and counted, and the maize grains and the dust were returned carefully into each jar and placed in its original position. This was done continuously until no teneral adult was observed for 4 consecutive days in all the jars. The final weight was then taken and the difference between this weight and the original weight of the produce introduced was regarded as the quantitative loss of material due to *S. zeamais* infestation. Development period of *S. zeamais* in each replicate was recorded as the number of days from the first oviposition to the emergence of first *F*1 adult.

Data Analyses

The experiment was arranged in CRD with 4 replicates with the maize varieties and chemicals

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as factors. Data obtained were subjected to two-way ANOVA with crop variety and chemicals forming the factors. Differences between means were separated using the technique of LSD (least significant difference) at 5% level of probability.

RESULT

Table 1 shows that at the end of the experimental period (51 days) higher numbers of adult *S. zeamais* progeny developed in control jars but there were no significant differences (P> 0.01) in the numbers of adults that developed on Actellic and Spintor dust. However, Spintor dust performed better in reducing the number of adult progeny of *S. zeamais* in all the varieties.

In all the factors considered, adult progeny development took significantly longer periods ($P \leq 0.05$) in Spintor dust which was closely followed by Actellic and *S. zeamais* spent the shortest development time in untreated maize (control) but there was no significant difference between the varieties tested (Table 2). Table 3 shows that maize treated with Spintor dust had the least weight loss (8%) though it did not differ (P> 0.05) significantly from others. On the basis of quantitative loss the chemicals tested were ranked in order of increasing efficacy as: control > Actellic dust > Spintor dust.

Table 1: Mean number of *Sitophilus zeamais* (Motschulsky) adults that developed in maize varieties

	Maize variety				
	ACR 97 TZL Comp. 1-W	Bende	Ogbiamuno	Total	Mean
Actellic	138(46)	148(49.33)	108(36)	394	43.78
Spintor	102(34)	98(32.67)	128(42.67)	328	36.44
Control	249(83)	269(89.67)	209(69.67)	727	80.78
Total	489	515	445		
Mean	54.33	57.22	49.44		

SED=8.734; LSD (0.05) =18.518; LSD (0.01) = 25.574

Table 2: Mean number of days it took *Sitophilus zeamais* (Motchulsky) to complete development to adult hood in maize varieties.

	Maize variety				
	ACR 97 TZL Comp. 1-W	Bende	Ogbiamuno	Total	Mean
Actellic	102(24)	104(34.67)	103(34.33)	309	34.33
Spintor	107(35.67)	109(36.33)	109(36.33)	325	36.11
Control	100(33.33)	100(33.33)	101(33.67)	301	33.44
Total	309	313	313		
Mean	34.33	34.78	34.78		

SED = 0.506; LSD (0.05) = 1.073

Table 3: Mean weight losses (g) in maize varieties infested by *Sitophilus zeamais* (Motschulsky)

	Maize variety				
	ACR 97 TZL Comp. 1-W	Bende	Ogbiamuno	Total	Mean
Actellic	7.44(2.48)	8.05(2.68)	6.63(2.21)	22.12	2.46
Spintor	6.57(2.19)	2.98(0.99)	4.35(1.45)	13.9	1.54
Control	8.85(2.95)	7.6(2.53)	8.11(2.70)	24.56	2.73
Total	22.86	18.63	19.09		
Mean	2.54	2.07	2.12		

SED = 0.569; LSD (0.05) = 1.21

DISCUSSION

The effect of the chemicals had a significant impact on the bionomics of the *S. zeamais* when applied at 0.02 g/20 g maize grains; this finding therefore concurs with that of Katinila (1998) who suggested the use of insecticides such as Malathion and Actellic or a preformulated mixture of Permethrin 0.5% and Primiphos methyl 2% (Actellic Super dust) applied at 100 g per 90–100 kg of grain as a protective measure against the menace of *S. zeamais* in store. Nsemwa and Lyimo (2005) reported that the cheapest storage chemical in the largest distributor (TFA in Njombe, Tanzania) was Actellic Super dust, which cost Tsh 1500 and only sufficient to treat two 90 kg sacks of maize, while Spintor dust was highly in demand by farmers and a 50 g was sufficient to treat one sack of 90 kg sack. The biopesticide Spinosad controls many insect pests of stored-food products and it caused high mortality of adult *C. maculatus* and decreased the number of eggs laid by females (Antoine, *et al.*, 2010). Othira *et al*. (2009) reported that *Hyptis spicigera* oil a botanical insecticide exhibited strong dose and exposure time dependent repellence against *S. zeamais* and *Tribolium casteneum* Herbst. They further showed that *Hyptis* oil at a concentration

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of 0.2ul/l air was potent enough to achieve 68% kill of *S. zeamais* 7 days after treatment offers a practical potential. Ogendo (2000) and Avannilewa, *et al.* (2006) reported a number of botanical oils and extracts to have been found to be potent against adult weevils of *S. zeamais.* Daramola (1985) however, stressed the current use of chemicals as a major trend in Nigeria, Spintor dust which has just been introduced into the market has shown a great promise as it suppressed the development of *S. zeamais* significantly and prolonged its developmental period (Table 2); It is therefore suggested that it can be a better alternative to Actellic 2 % dust for managing the menace of this pest.

However, the ability of adults to survive and reproduce on both chemicals (Table 1) does not indicate their inefficiency in controlling the pests. Possible reasons have been advanced by Nwaubani (2006) who suggested that the waxy plug with which the female insect seals its eggs protect the fewer eggs laid from deleterious effects of the dust. In supporting this postulation, Adedire (2001) reported that the developing larvae feed within a single grain, pupate within it and the adult eventually emerges. Reduction of adult progeny development in *S. zeamais* in treated maize can be attributed to either deterrence in mating activities (Mc Farlane, 1989) or irritation response by the weevil to the dust (Finney and Fisher, 1964) thus conferring protection to stored grains. The level of losses incurred (Table 3) have confirmed the report that *S. zeamais* is probably the most important primary pest of stored maize and that its infestation results in substantial losses in weight.

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