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THE USE OF SEED EXTRACTS OF THE PHYSIC NUT (*Jatropha curcas L.)* IN THE CONTROL OF MAIZE WEEVIL (*Sitophilus zeamaise M.*) IN STORED MAIZE GRAINS (*Zea mays L.*)

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ABSTRACT

The experiment on the use of Jatropha curcas (L.) seed extracts to control maize weevil (Sitophilus zeamaise) was conducted in the Research Laboratory of the Faculty of Agriculture and Veterinary Medicine, Imo State University, Owerri, between November 2000 and February 2001. Two forms of the seed extracts were used; crude powder extract and crude liquid extracts. Results showed that both the crude powder extract and the crude liquid extract killed Sitophilus zeamaise, but the crude liquid extract was more effective and quicker in action. However, it was observed that efficacy of the two extracts increased with increase in the level of quantity or concentration of the crude powder or crude liquid extract, respectively. Seed viability test carried out about three months after treatment of the extracts on maize seeds showed significant germination over the control.

KEY WORDS: Jatropha curcas, sitophilus zeamaise, and Zea mays.

INTRODUCTION

Maize (*Zea mays L.)* is a cereal crop in the graminae family. It is a basic staple food crop for both man and other animals, where it constitutes the leading livestock feed. About 1.5m tonnes of maize is produced in Nigeria annually (IITA, 1993).

As maize is an important food crop for all animals, and insects alike, it is constantly being attacked by insect pests, both in the field and in storage. The most devastating storage pest of maize is the maize weevil *Sitophilus zeamaise* (Ngoka 1997).

Efforts have always been made in various ways in the control of *Sitophilus zeamaise*, but the use of chemicals has remained the most effective control measure (Gwinner *et al;* 1990). However, most synthetic insecticides that can effectively control the weevil are not environmentally friendly. Problems associated with the use of chemical insecticides include their pollution of the environment; effect on non-target organisms and adverse residual effects (Lindbald, 1978; Oudejans 1982). The potential toxicity of many grain protection chemicals is a matter of major concern in Nigeria and other developing countries where majority of farmers and pesticide users are not trained in safe handling and applications of these chemicals (Swaminathan, 1988).

It is in this regard that the use of natural products that are efficacious in controlling some of these pests is encouraged. Plant material and products with appropriate pest control properties may play an important role in the development of strategies which resource-poor farmers can formulate and apply with their own knowledge and skill (Ahmed and Stoll, 1996). Some tribes in Nigeria are known to mix the dried leaves of wide range of plants with stored grains to control storage pest. The species used in this way include; *Anona senegalensis* Pers; *Occimium americanum L.*, *Nicotiana spp*, and *Lufa aegyptica* Mill. (Giles 1964). Anon (1992) highlighted that *Chrysanthemium cenerriefolium* can be used as an insect contact poison and as a repellant. Oji *et al.*, (1991) investigated on the insecticidal activity of dried fruits of *Xylopia aettiopica and Piper guinensis* on maize weevil. They reported a significant insect mortality in the treated grains from 48-96 hours after treatment. Other plant products that have been implicated in the control of stored grain pests include, *Neem (Azadirachta indica) (Jotwni* and *Sincar*, 1965), *Erythrophlem suaveoleus* (Ofuya, 1989) and *Anabasis aplylla* (Adhikary, 1990).

Reports on *Jatropha curcas L.* so far centred on the use of the seed oil as a diesel substitute in Burkina Fasso (Quadrago, 1994), and the control of weevils in stored grains and snails which infect rice paddies in the Philippines (Spore, 1997). There has been little or no work to determine whether *Jatropha curcas L.* has pesticidal properties on maize weevil; *Sitophilus zeamaise*, in Nigeria. Hence, this experiment was aimed at determining the pesticidal activity of *J. curcas L.* seed extracts on *Sitophilus zeamaise* in stored maize grains.

MATERIALS AND METHODS

The experiment was carried out in the laboratory of faculty of Agriculture and Veterinary Medicine, Imo State University, Owerri, between November 2000 and February 2001.

Ripped fruits of *J. curcas* weighing 1.00kg were sun dried and then ground into powder with manual grinder. This method yielded the required powder extract. Crude liquid extract was obtained by putting 1.00kg of ground *J. curcas* powder in Soxlet apparatus, where 2.25l of 40 60% petroleum spirit was added. This yielded about 150mls of crude liquid extract.

The following treatment levels were made from the crude powder extract. P_0 0.0g (control), P_1 = 0.1g, P_2 = 0.2g, P_3 = 0.3g and P_4 = 0.4g. Similarly, treatments from the crude liquid extract are; L_0 = 0.0ml (control), L_1 = 0.1ml, L_2 = 0.2ml, L_3 = 0.3ml and L_4 = 0.4ml. Yellow maize crop variety DMR LSR-Y was used; where 25g (about 104 seeds) of the seeds was weighed and put in each of the 40 Petri dishes. Twenty Petri dishes were assigned to the experiment with crude powder extract, while the other 20 were assigned to the experiment with crude liquid extract.

The treatment levels of the crude powder extract were introduced into the Petri dishes containing 25g of maize seeds.

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The Petri dishes were thoroughly shaken to ensure adequate contact of the maize seeds with the crude powder extract. Ten (5 males and 5 females) of *Sitophilus zeamaise* were introduced in each Petri dish and covered.

Similarly, the treatment levels of crude liquid extract were introduced into the Petri dishes containing 25g of maize seeds. The Petri dishes were thoroughly shaken as well and left for 5 minutes to allow any trace of the petroleum spirit to escape from the Petri dishes. After that, 10 (5 males and 5 females) of *S. zeamaise* were introduced in each Petri dish and covered.

In each experiment, the treatments were arranged in a Completely Randomized Design having five treatments and four replications.

Records were taken on the following parameters; mortality, oviposition rate, number of insect holes (Grain damage) and grain viability (radicle and plumule emergence).

Table 1. Effects of different gramms of crude powder extract of *J. curcas* seed on mortality of *S. zeamanise* at various time intervals

Weights(g)	Time Intervals 12	24	36	48	60	72
0.0	0	0	0	0	0	0
0.1	0	0	0	0	1	2
0.2	0	0	0	0	1	2
0.3	0	0	0	0	2	5
0.4	0	0	0	0	3	6
S.E*	0	0	0	0	0.33	0.47

**S.E. Calculated from the mean of four replicates.*

Table 2. Effects of different quantities of crude liquid extract of *J. curcas* seed on mortality of *S. zeamaise* at various time intervals

Quantity (ml)	Time Intervals 12	24	36	48	60	72
0.0	0	0	0	0	0	0
0.1	5	7	8	9	10	10
0.2	7	9	10	10	10	10
0.3	9	10	10	10	10	10
0.4	10	10	10	10	10	10
S.E*	0.37	0.57	0.32	0.18	0.17	0.00

**S.E. Calculated from the mean of four replicates.*

RESULTS

The result of the effect of crude powder extract of *J. curcas* on the mortality of *S. zeamaise* is presented in Table 1. There was no death of the insect until about 60 to 72 hours of treatment.

Treatment levels with 0.3g and 0.4g caused the highest mortality of *S. zeamaise*. Though treatment levels with 0.1g and 0.2g caused death of *S. zeamaise*, but their effect was significantly different from that of 0.3g and 0.4g. On the other hand, 0.0g (control) did not cause any death of *S. zeamaise* throughout the duration of the experiment as shown in Table 1.

On the other hand, mortality of the weevil was observed after 12 hours of treatment with crude liquid extract of *J. curcas*. From the Table 2, all the levels of the crude liquid extract used caused death of *S. zeamaise*, except level 0.0ml (control). However, there was no significant difference in the effect of levels with 0.3ml and 0.4ml, but are themselves significantly different from the effect of levels with 0.1ml and 0.2ml. At 24hours, all the ten weevils had died in the 0.3ml and 0.4ml treatments as shown in Table 2.

Oviposition

Observations made for 30 days after treatment showed that; there were no observable signs of oviposition of *S. zeamaise* in either levels of the crude powder extract and crude liquid extract used, except in the controls. However, since almost all the introduced weevils died after about 72 hours of treatment, there were no living insects to undergo the reproduction process.

Number of Insect Holes (Grain Damage)

There were no exit holes in the treatments with crude liquid extract, except the control where 130 exit holes were counted in the seeds. The holes created by the weevils were many that it was difficult to count them.

On the other hand, number of exit holes increased with decrease in weight of the levels of crude powder extracts used. As shown in Table 3, levels 0.1g, 0.2g, 0.3g, and 0.4g had corresponding exit holes of 24, 4, 1 and 1, respectively. The 0.1g recorded the highest number of exit holes, while 0.3g and 0.4g recorded the lowest.

Table 3: Effects of crude powder extract of *J. Curcas* on the development of exit holes (seed damaged) by *S. zeamaise* after 3 months of treatment

Quantity (mls)	Mean* No of grains with exit holes
0.0	-
0.1	24[a]
0.2	4[b]
0.3	1[b]
0.4	1[b]

**Means having the same letter are not significantly different at P=0.05 using Duncans Multiple Range Test (DMRT).*

It was observed that almost all the grains in the control were damaged, thus, it was difficult to count the holes created by the weevils.

It will be noted that action of crude powder extract of *J. curcas* on the maize weevil did not start until about 60 hours after treatment.

Grain Viability (Radicle and Plumule emergence)

Observations made on the viability of treated maize seeds after 3 months of treatment showed emergence of the radicle and plumule in both the crude powder extract and crude liquid extracts. This was an indication of germination, which only viable seeds undergo. This observation showed that the use of *J. curcas* in the storage of maize seeds against *S. zeamaise* does not affect the viability of the seeds.

DISCUSSION

From the results of the experiments, it was observed that *J. curcas* showed effectiveness in the control of maize weevil, *S. zeamaise*. However, the crude liquid extract was more effective than the crude powder extract.

Experiment with the crude powder seed extract, showed that the efficacy of *J. curcas* crude powder extract increases with increase in the weight of the powder used. Consequently, the higher levels of 0.3g and 0.4g controlled more weevils than the 0.1g and 0.2g levels.

In a similar situation, mortality of the weevils increased with increase in the quantity of the crude liquid extract of *J. curcas*, which made 0.3ml and 0.4ml to be more effective than 0.1ml and 0.2ml. This observation confirmed the work of Anon (1997) who reported that oil extracts from *J.curcas* adequately protected weevils in stored grains.

Both the crude powder extract and the crude liquid extract weakened and killed the insects that there was no opportunity for the insects to oviposit. This was proved by the control treatment where oviposition was observed. On the observation on the number of insect holes (grain damage) the high potency of the crude liquid extract could not allow the weevils to have their normal feeding activity on the maize seeds. On the other hand it will be noted that there was a time lag in the action of crude powder extract on the weevils. It was possible that some seeds may have been damaged within this period before mortality could commence. This is proved by the records observed in the crude liquid extract where mortality commenced within 12hours of treatment, thus giving no chance to the weevil for any damage.

Germination of the treated maize seeds after 3 months of treatment showed that treatment with seed extracts of the *J. curcas* treatment did not harm the seed embryo, thus the viability of the seeds was maintained.

It is recommended that more investigations should be carried out with the liquid extract of *J. curcas* in order to determine the modalities for its use in crops protection programme. However, the powder extract can be used where it is not possible to obtain the liquid extract, especially in rural set up where adequate laboratory for liquid extraction may be lacking.

The use of natural products like *J. curcas* as pesticides will help to control problem pests of agriculture and at the same time creates a friendly environment devoid of chemical pollution.

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