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THE EFFECT OF SEED EXTRACTS OF PHYSIC NUT (*Jatropha curcas* L.) ON SOME QUALITY PARAMETERS OF STORED MAIZE GRAINS (*Zea mays* L.)

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ABSTRACT

This study was carried out in the Laboratory of Crop Science and Biotechnology of Faculty of Agriculture and Veterinary Medicine, Imo State University Owerri, to determine the viability (radicle and plumule emergence) and grain damage (exit holes) of maize grains treated with crude liquid and crude powder extracts of seeds of *Jatropha curcas* L, earlier used in the control of maize weevils. Treatment levels of 0.0, 0.1, 0.2, 0.3, 0.4mls for crude liquid and 0.0, 0.1, 0.2, 0.3, 0.4grams for crude powder extracts were applied on ten maize *(Zea mays* L.*)* grains in each experimental unit. Results showed that there was significant ($P\leq0.05$) difference in the germination of treated maize grains in petri dishes and jute bags, an indication that the maize grains retained their viability after treatment. On the other hand, there was no significant ($P\leq0.05$) difference on grain damage (exit holes) in the treatments with crude liquid extract except the control. For crude powder extract, exit holes increased with decrease in weight of the levels of crude powder extracts used.

Key words: Grain damage, *Jatropha curcas*, jute bag, petri dish, *Zea mays*, viability
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INTRODUCTION

Food security in sub-saharan Africa largely depends upon improved food productivity, through the use of sustainable good agricultural practices (GAPs) and the reduction of post harvest losses caused by pests and diseases. To ensure high food quality and safety standards which are acceptable to the consumer, quality control, including good storage and handling practices must be observed at all times Kenny, (1998), Whitehead, (1998).

For decades, the pest control policy in developing countries has been dependent upon the use of synthetic pesticides. Although, synthetic pesticides are known to have undoubted benefits, their adoption rate and use for insect pest control in grain storage has remained remarkably low in the resource-poor farming environment. The subsistence nature of agriculture in developing countries coupled with the high cost, poor information and erratic supply of synthetic pesticides have emerged as reasons for farmers' reluctance to adopt pesticides (Tembo and Murfitt, 1998, Ogendo, 1998). Most farmers' in these environments store their agricultural produce on the farm for short (less than 3 months) or long periods (6 months)

Wanjekeche, (1996), Ogendo, (2003) and use a variety of indigenous plant species with insecticidal properties for pest control (Bekele et al., 1997, Ogendo, 2000).

Some studies showed that synthetic insecticides penetrate into stored grain and may be toxic (Lalah and Wandiga, 1996; El-sheamy *et al*., 1988). Moreover, Jood, *et al*., (1993) reported that plant products and insect infestation adversely affected the taste, aroma and over all acceptability of “chapatis” from treated maize, rendering the maize grains unsuitable for human consumption. However, oils and crude powders of several plant species have been shown to protect maize grains and have no adverse effects on the germination of maize, sorghum, pigeon pea and green gram (Pandey, *et al*., 1986; Kasa and Tadese, 1995; Obeng-ofori, 1995).

This has stimulated scientists to search for natural products that are environmentally friendly, safe to man and other non-target organisms and have no adverse effects on the organoleptic, germinability and market quality of stored grains. *Jatropha curcas* L has earlier been shown to exhibit insecticidal effects on *Sitophilus zeamais* Mots in stored maize grains, supporting indigenous farmer practice on their widespread use as grain protectant with environmentally and eco-friendly properties (Ohazurike, *et al*., 2003). In the light of these facts, this study was aimed at evaluating the effects of the seed extracts of *Jatropha curcas* L on some maize quality parameters: viability (radicle and plumule emergence) and grain damage (exit holes) in stored maize grains.

MATERIALS AND METHODS

The experiment was conducted in the Crop Science and Biotechnology Laboratory of Faculty of Agriculture and Veterinary Medicine, Imo State University Owerri between November 2005 and February 2006. Ripe fruits of *Jatropha Curcas* L. weighing 1kg were sundried and grounded into powder with manual grinder and later in an electric blender. This method was used to produce the required crude powder extract. Crude liquid extract was obtained by putting 500g of the ground *Jatropha curcas* L. seed in soxlet apparatus where 2.25L of 40% petroleum ether was added. The extraction process yielded about 150mls of crude liquid extract, which gave a stock concentration of 0.45g/ml (calculated as 2250 / 500g/ml=0.45g/ml). The following treatment levels, measured with a sensitive electronic scale, model were made from crude powder extract P0=0.0g (control), P1=0.1g, P2=0.2g, P3=0.3g, and P4=0.4g. Similarly, treatment from the crude liquid extracts were L0=0.0ml (control), L1=0.1ml, L2=0.2ml, L3=0.3ml, and L4=0.4ml. These were measured with disposable syringe graduated in milliliters. Yellow maize crop variety DMR-LSR-Y was used where 25g (about 104 grains) of the maize was weighed and put in each of the 40 petri-dishes and 40 jute bags. 20 perti-dishes and 20 jute bags were assigned to the experiment with crude powder extract, while 20 jute bags and another 20 petri-dishes were assigned to crude liquid extracts. Treatment levels of crude powder extracts were introduced into the petri-dishes and jute bags containing 25g of maize grains. The petri-dishes and jute bags were thoroughly shaken to ensure adequate contact of the maize grains with the crude powder extract. Similarly, the treatment levels of the crude liquid extract were introduced into another set of

20 petri-dishes and 20 jute bags containing 25g of maize grains. The petri-dishes and jute bags were thoroughly shaken and then left for 5 minutes to allow any trace of the petroleum ether to evaporate from the petri-dishes and jute bags. After that, the petri-dishes were covered while the bags were tied with tiny nylon ropes. Three months later, after treatment applications, ten grains of maize from each of the treated experimental units were placed on moist (Whatman NO.1) filter paper in petri-dishes and observed for radicle and plumule emergence. Three days later, grains with radicle and plumule evidence were counted and recorded. Furthermore, three months after treatment application, the treated experimental units were observed for grain damage (exit holes). In the treated units where exit holes were observed, the grains with holes were counted and recorded except the control. Besides, in each experiment, the treatments were arranged in a Completely Randomized Design (Steel and Torrie, 1980) having five treatments and four replications. One-way Analysis of Variance was carried out on the data collected and Duncan's New Multiple Range Test (DNMRT) (Steel and Torrie, 1980) was used in the mean separation of the treatments. Records were taken on the following parameters: grain quality - grain viability (radicle and plumule emergence) and grain damage - exit holes.

RESULTS

Grain viability (radicle and plumule emergence) and grain damage (exit holes)

The result on grain viability showed that germination occurred in grains treated with crude liquid extract and crude powder extract of *Jatropha curcas* L. at all levels of treatment in petri-dishes and jute bags after 3 months of application. The following results as shown in table 1 were obtained on the application of different concentrations of crude liquid extracts of *J. curcas* L. The application of 0.0, 0.1, 0.2, 0.3, 0.4mls in petri dishes produced 0, 8, 6, 5, 6 grains with emerged radicle and plumule. Treatment 0.1 ranked highest followed by 0.2, 0.4 and 0.3mls. No significant ($P \leq 0.05$) differences exist between treatments 0.1, 0.2, and 0.4mls. However, 0.1ml varied significantly from 0.3ml. Treatments 0.2, 0.3 and 0.4mls did not vary significantly. In jute bags, the application of 0.0, 0.1, 0.2, 0.3, 0.4mls gave 0, 5, 5, 6, 5 grains with emerged radicle and plumule. Treatment 0.3ml ranked highest followed by treatments 0.4, 0.2, and 0.1mls. Moreover, there were no significant ($P \leq 0.05$) differences amongst these treatments except the control.

On the application of different weights of the crude power extract of the same material in petri-dishes and jute bags after three months duration, produced the results shown in (Table 2).

The different weights, 0.0, 0.1, 0.2, 0.3, 0.4g in petri-dishes yielded 0, 5, 8, 5 and 9 seeds respectively with emerged radicle and plumule. Treatment 0.4g produced the highest number of grains that germinated followed by 0.2g, 0.3g, and 0.1g. There was no significant ($P \leq 0.05$) difference between 0.4g and 0.2g but they differed significantly ($P \leq 0.05$) from 0.3g and 0.1g. No significant difference existed between 0.3g and 0.1g.

In jute bags, the application of 0.0, 0.1, 0.3, 0.4 produced 0, 8, 9, 7, 8 grains with emerged radicle and plumule. Treatment 0.2g produced the highest number of grains with radicle and plumule, followed by 0.4g, 0.1g, and 0.3g. There was no significant (P≤0.05) difference between 0.1g, 0.2g, 0.3g and 0.4g but they differed significantly from the control.

Grain damage (Number of exit holes)

There were no exit holes in the treatments with crude liquid extract either in petri-dishes or jute bags, except the control where several exit holes were noticed on the seeds. For crude powder extract, the number of exit holes increased significantly (P≤0.05) with decrease in weight of the levels of crude powder extracts applied. As shown in Table 3, treatment levels 0.1, 0.2, 0.3, 0.4g had corresponding exit holes of 24, 4, 1 and 1 respectively, in petri-dishes. The 0.1g recorded the highest number of exit holes, followed by 0.2g, 0.3g and 0.4g. The control, 0.0g was not counted because the exit holes were so many. The 0.1g was significantly (P≤0.05) different from 0.2, 0.3 and 0.4g. Besides, there were no significant differences (P≤0.05) in the number of maize grains with exit holes in 0.2, 0.3 and 0.4g. In jute bags, the following results of maize grains with exit holes were obtained 25, 4, 2, 0 with the application of 0.1, 0.2, 0.3, 0.4g respectively. Treatment 0.1g gave the highest number of maize grains with exit holes, followed by 0.2, 0.3 and 0.4g. Besides, treatment 0.1g differed significantly (P≤0.05) from treatments 0.2, 0.3 and 0.4g while none of the later three treatments differed significantly from each other except the control.

Means having the same superscript letters are not significantly different at 5% level of probability using Duncan's New Multiple Range Test (DNMRT)

DISCUSSION

The storage of agricultural products is an acute problem under the tropical environment. The severity of this problem depends on the storage methods, which in Nigeria vary from one part of the country to another.

The result of the investigation on the viability of maize grains treated with seed extracts of *Jatropha curcas* L. as indicated in Tables 1 and 2 showed that the crude extracts either in petri-dishes or jute bags had no inhibitory effects on radicle and plumule emergence. The seed viability was maintained with duration of storage for all treatments. This result is in agreement with the earlier studies by Pandey *et al.*, (1986), which stated that petroleum ether extracts of *Lantana camara* L. and four other plants species had no adverse effects on the germination of green gram, *Vigna radiata.* Similarly, Kasa & Tadese, (1995), Obeng-Ofori, (1995), established that oils and crude powders of several plant species have been shown to have no adverse effects on the germination of maize, *Zea mays* L sorghum and pigeon pea. From the result of this trial, it can be explained that the effect of seed extracts of *Jatropha curcas* L. on the viability of stored maize grains had no adverse effects on grain germination.

Similarly, the observation on the number of exit holes (grain damage) and the high potency of the crude liquid extract, could not allow the maize weevils to have normal feeding activity on the maize seeds (Ohazurike *et al.,* 2003). Furthermore, it was also observed that exit holes were noticed on maize seeds treated with lower levels 0.1 and 0.2g and the control more than 0.3g and 0.4g. This was in consonance with Ohazurike *et al*., (2003) which stated that *Jatropha curcas* L. exhibited insecticidal effects on *S. zeamais Mots.* in maize storage.

Further studies on the levels of residues remaining on treated maize grains and their potential adverse effects should be evaluated before the use of these treatments are institutionally promoted as part of a sustainable insect pest management system for farm-level storage. Hence, this method is beneficial considering the local availability of *Jatropha curcas* L. plant and non-pollutant property of its derivatives to the environment.

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APPENDIX

Table 1: Effect of different concentrations of crude liquid extract of *J. curcas* L. on the viability of maize grains in petri-dishes and jute bags after 3 months

	No. of maize grains that germinated	
Conc (mls)	Petri-dishes	Jute bags
0.0	0^{c}	0^{b}
0.1	8^{a}	5^{a}
0.2	6^{ab}	5^{a}
0.3	5^{b}	6^{a}
0.4	6^{ab}	5^{a}
S. E	0.79	0.59

*Means in each column having the same superscript letters are not significantly different at 5% level of probability using DNMRT.

Table 2: Effect of different weights of crude powder extracts of *J. curcas* on number of grains with radicle and plumule emergence in petri-dishes and jute bags after 3 months.

	No. of maize grains that germinated	
Weights in (G)	Petri-dishes	Jute bags
0.0	0^{c}	0^{b}
0.1	5^{b}	8^{a}
0.2	8^{a}	9^{a}
0.3	5^{b}	7^{a}
0.4	9^{a}	8^{a}
S. E	0.94	0.73

*Means in each column having the same superscript letters are not significantly different at 5% level of probability

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TABLE 3: The effect of crude powder extract *of J. curcas* L. on the development of exit holes by *S. zeamais* Mots after 3 months

Quantity in mls	Petri dish	Jute bags
0.0	All damaged	All damaged
0.1	24^a	25^a
0.2	4^b	4^b
0.3	1^b	2^b
0.4	1^b	0^b
S. E	1.8	2.2