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Effect of groundnut oil in protecting stored cowpea (*Vigna unguiculata*) from attack by cowpea weevil (*Callosobruchus maculatus*)

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Abstract
The effect of groundnut oil was evaluated in the laboratory against *Callosobruchus maculatus* by admixing 1.5ml, 3.0ml and 5.0ml with 50g of grains to assess progeny development, damage caused, insect mortality and effect on grain germination. The experiment was laid out in a complete randomized design and data generated were subjected to analysis of variance while means were separated using DMRT. Results obtained showed groundnut oil significantly ($P<0.05$) reducing damage caused and inhibiting progeny emergence at 20ml treatment level while adult mortality was significantly affected at 10ml treatment level. The oil did not affect the germinating ability of the seeds and the potential of groundnut oil as stored cowpea protectant against *C. maculatus* infestation is discussed.
Keywords: *Callosobruchus*, groundnut oil, mortality, progeny development, stored cowpea

1. Introduction

Cowpea (*Vigna unguiculata*) as a pulse is commonly stored as staple for man and animals. Enormous losses of between 20-50% have been reported on stored cowpea due to attack by cowpea weevil (*Callosobruchus maculatus*) and sometimes the loss could be complete accounting for 100% loss (Abulude et al., 2007; Nyambo, 1993). Apart from direct damage to grains, losses also occur as a result of contamination with insect faecal material, nitrogenous waste (frass) and exuviae (Udo, 2000). Efforts have been made by farmers and governmental agencies to control and or reduce infestation and attack of stored cowpea by the bean weevil. Amongst the methods used is the application of synthetic insecticides with various shortcomings including high level of persistence in the environment, toxic residues, high mammalian toxicity and development of resistance in pest species. Alternatives therefore to chemical treatment of stored cowpea have been developed consistently over the years with many researches being turned to the use of botanicals and plant products in the safe storage of cowpea (Ogunleye, 2004). This work therefore evaluated the use of groundnut oil at different concentrations against *C. maculatus* in stored cowpea.

2. Materials and Methods

2.1 Insect species

C. maculatus was obtained from an infested stock of grains from the Uyo main market, Akwa Ibom State, Nigeria and cultured in the Crop Protection Laboratory, University of Uyo, Nigeria with culture conditions being 28 ± 2^{o}C, 66% relative humidity and 12L: 12D photo regime. After seven days of oviposition, the parent adults were discarded and the emerging progeny was used for the various bioassays.

2.2 Grain samples and groundnut oil

Grain and oil samples were obtained from Uyo main market, Akwa Ibom State, Nigeria. The grains were cleaned to remove impurities before being refrigerated for 14 days to remove any hidden infestation. Fifty grams of the grain samples were placed into 200 ml plastic cups and covered with white muslin cloth held in place with rubber bands to which each of the treatment was added.

2.3 Treatment

Each of the containers with the grains was treated with groundnut oil by mixing thoroughly to ensure adequate contact and twenty adult insects were introduced into each treatment. Prior to the introduction of the insects into treated and control grains, the insects were chilled in a freezer for three minutes to reduce their mobility and were picked individually using entomological forceps. Each treatment was replicated four times while the control had no

groundnut oil added to it.

2.4 Bioassay and data analyses
The different experiments conducted were damage assessment, progeny development, adult insect mortality and effect on seed germination. Results obtained were subjected to analysis of variance and means were separated using DMRT.

3 Results and Discussion
The result of the effect of groundnut oil on the mortality of *C. maculatus* is shown in Table 1. There was a significant mortality of the insect species compared with the untreated control. Also there was increased mortality of insects with increased concentration with 25 ml treatment inducing 100% mortality after 72 hours of treatment. The present result agrees with the observations made by other researchers (Ohazurike et al., 2003; Abulude et al., 2007; Udo, 2011). Mixing of groundnut oil with *V. unguiculata* probably resulted in thin smooth oil coating on treated grains and this may had limited contact between the grains and the weevils. Death of the weevils may have resulted from interference with normal respiratory activity.

There were no signs of oviposition by the insect pest in all the treatment levels during a 30-day observation period except in the control treatment (Table 2). The reason for this may have been absence of oviposition due to high mortality observed in treated grains. This agrees with reports elsewhere that besides causing mortality of grain weevils, plant oils also impair oviposition and progeny emergence (Onolemhenhem, 2001)

There was a significant reduction in damage caused by the weevils to stored cowpea compared with the untreated control (Table 3). There was a corresponding reduction in the number of exit holes with increased in the quantity of groundnut oil as a result of limited contact of the pest with treated grains.

The application of groundnut oil did not affect seed viability as treated grains germinated favourably (Table 3) compared with the control treatment that had no groundnut oil added. This therefore has put to rest speculations that the oils could clog the seed testa thus preventing germination. The implication is that groundnut oil could be used to preserve and protect grains in storage. This will ensure that undamaged and viable seeds are available for human consumption, feed for livestock and distribution at periods of demand. From the results obtained from the study, it could be inferred that the use of groundnut oil in pest management is eco-friendly and should be incorporated into traditional grain storage in the tropics to reduce cost and hazards of synthetic insecticides.

References

Abulude, F.O., M. O. Ogunkoya, R.F. Ogunleye, A.O. Akinola & A.O. Adeyemi (2007) Effect of palm oil in protecting stored grains from *Sitophilus zeamais* and *Callosobruchus maculatus*. *Journal of Entomology*, 4: 393-396

Nyambo, B. T. (1993) Post harvest maize and sorghum grain losses in traditional and improved stores in South Nyanza district, Kenya. *International Journal of Pest Management* 39: 181-187

Ohazurike, M.C., M.O. Onuh & E.O. Emeribe (2003) The use of seed extracts of the physic nut (*Jatropha curcas* L.) in the control of maize weevil (*Sitophilus zeamais* M.) in stored maize grains (*Zea mays* L.). *Global Journal of Agricultural Scienc*, 2: 86-88

Ogunleye, R.F. (2004) Effect of Zanthoxylum dusts and extract on the fecundity, fertility and developmental periods of *Callosobruchus maculatus* (F.) Coleoptera: Bruchidae. *Bioscience Research Communications*, 16: 53-57

Onolemhenhem, O.P. (2001) Evaluation of rubber seed oil for the control of the rice weevil, *Sitophilus oryzae* L. *Journal of Agriculture, Forestry and Fisheries*, 2: 23-26

Udo, I. O. (2000). Efficacy of Candlewood *Zanthoxylum xanthoxyloides* (Lam.) for the control of three stored product pests. *M. Phil. Thesis, University of Ghana, Legon*. 79pp.

Udo, I. O. (2011) Laboratory evaluation of toxic and repellent properties of *Dracaena arborea* against *Sitophilus zeamais* and *Callosobruchus maculatus*. *Pakakistan Journal of Scientific and Industrial Research* 54(3): 152 – 156.

Table 1: Effect of groundnut oil on mortality of *C. maculatus* at different time (hours) after treatment.

Treatment (ml)	Mean % mortality at different hours after treatment			
	24	28	72	96
0	0^{c}	0^{c}	0^{c}	0^{c}
1.5	20^{b}	45^{b}	60^{b}	80^{b}
3.0	40^{ab}	70^{a}	90^{a}	100^{a}
5.0	60^{a}	80^{a}	100^{a}	100^{a}

Means in the same column and followed by different letter(s) are significantly (P<0.05) different, DMRT.

Table 2: Effect of groundnut oil on progeny of *C. maculatus* at different days after treatment.

Treatment (ml)	Mean progeny at different days after treatment			
	7	14	21	28
0	0^{a}	48^{a}	115^{a}	110^{a}
1.5	0^{a}	0^{b}	10^{b}	25^{b}
3.0	0^{a}	0^{b}	0^{b}	0^{c}
5.0	0^{a}	0^{b}	0^{b}	0^{c}

Means in the same column and followed by different letter(s) are significantly (P<0.05) different, DMRT.

Table 3: Effect of groundnut oil on level of damage caused by *C. maculatus* to stored cowpea and germination of treated and untreated cowpea seeds

Treatment (ml)	Mean percent damage	Mean percent germination
0	80.00[a]	90[a]
1.5	5.00[b]	85[a]
3.0	1.80[c]	95[a]
5.0	0.79[c]	90[a]

Means in the same column and followed by different letter(s) are significantly ($P<0.05$) different, DMRT.

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