Control of Dry Seed Weevils with Cooking Oil[1]

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ABSTRACT

Purified soybean oil, with and without additives, purified corn oil with additivies, and raw corn oil without additives were tested for the control of *Callosobruchus chinensis* in highly infested cowpea seeds (*Vigna unguiculata*). Each oil type was tested at rates of 0, 5, 10, and 15 ml/kg of dry seeds. The two higher dosages provided a very effective weevil control for the duration of the test (8 months). Seed germination was not affected by the oil treatments. The appearance and palatability of the seeds were improved.

INTRODUCTION

The dry seed weevils are a serious pest of stored seeds. There are two species of importance in Puerto Rico: *Acanthoscelides obtectus,* attacking dry beans (*Phaseolus vulgaris*), and *Callosobruchus chinensis,* attacking cowpeas (*Vigna unguiculata*) and pigeon peas (*Cajanus cajan*). Cooking oils (peanut and other groundnut oils) used since ancient time for the control of the cowpea seed weevil (*C. maculatus*) in India, were found effective in Ibadan, Nigeria as reported by scientists at the International Institute of Tropical Agriculture (IITA). They reported that 5 ml of peanut oil can coat a 1 kg of cowpea seeds[3] and prevent weevil damage. Recently, Schoonhoven[4], in Cali, Colombia, reported similar results with several cooking oils for the control of the bean weevil, *Zabrotes subfasciatus.* In Puerto Rico, several cooking oils found in the local markets have been reported as effective for weevil control[5] on pigeon peas, beans, and cowpeas, without a significant effect on seed germination.

The main effect of the oil coating is on the weevil eggs: It prevents the hatching of new weevil larvae. The scientists from IITA found that the oil can penetrate minute openings on the surface of the egg. They found that biological activity stops immediately in eggs at any stage of development, following the oil treatment.

The objective of this work was to obtain further results on this means of control with crude and purified oils, and oils with and without the common additives used during processing.

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[3] Mcheleny, V. K., 1976. Technology: Protection of grains from plague in developing lands, New York Times, 27th ed, October 1976.

[4] Schoonhoven, A. V., 1978. Use of vegetable oils to protect stored beans from brunchid attack, J. Econ. Entomol. 71: 254–6.

[5] Cruz, C., 1979. Aceites vegetales controlan gorgojos semillas, Estación Experimental Agrícola, Adelantos Científicos Núm. 88 2 pp.

MATERIALS AND METHODS

Purified soybean oil with and without additives, and purified corn oil either with or without additives were obtained from a local cooking oil refinery[6]. Three dosages of each type of oil (0, 5, 10, and 15 ml/kg of seeds) were applied to samples of 50 grams of recently harvested dry seeds of different cowpea varieties field infested with the seed weevils. The seed samples were stored in baby food jars and mixed with the seeds by an electric agitator[7] for 10 minutes. Two sets of controls were established, one with the field infestation and without any treatment, and another treated with Endosulfan to maintain the seeds undamaged. These served to compare the germination at the end of the test. Each treatment was replicated four times and kept in a dark drawer at room temperature.

TABLE 1.—*Populations of the cowpea weevil,* Callosobruchus chinensis, *from field infested cowpea seeds untreated and treated with different types and dosages of cooking oils, 1978–1979.*

Treatment[1]	Dosage/ kg	Number of weevils/unit[2] at the indicated days to harvest				% Germination
		36	59	115[3]	250	
Corn oil—						
Raw without additives	5 ml	96.7**[4]	217.7**	732.0	—	—
	10 ml	43.0**	11.7**	25.0**	0	71
	15 ml	30.7**	0.7**	0.3**	0	74
Purified with additives	5 ml	64.3**	94.3**	399.3**	—	—
	10 ml	46.0**	9.3**	31.3**	0	58
	15 ml	38.0**	2.3**	0.3	0	51
Soybean oil—						
Purified without additives	5 ml	31.7**	30.7[5]**	266.7[5]*[6]	0	77
	10 ml	9.7**	0.3**	0.0**	0	69
	15 ml	33.3**	3.7**	0.0**	0	47
Purified with additive	5 ml	73.3**	157.7**	429.7	—	—
	10 ml	29.7**	7.0**	3.7**	0	62
	15 ml	43.7**	1.3**	0.0**	0	60
Untreated control	0	250.0	841.7	128.7	—	—
					Control	59

[1] Treatments were applied 13 days after harvest.

[2] Each unit consisted of 50 grams of seed in a baby food jar, replicated 3 times.

[3] Comparison with the highest infestation.

[4] Significant at the 1% level.

[5] Population of one replicate, the other two were free of weevils.

[6] Significant at the 5% level.

[6] Best Foods Caribbean, Inc., Bo. Islote, Arecibo, P. R.

[7] Precision Scientific, Ser. No. 10-AC-9, 112 volts, HZ-60.

The tests began August 28 (harvesting date); however, the oil treatments were applied September 11, 1978, in order to allow time for egg development. Adult emergence was recorded and weevils removed 36, 59, 115 and 250 days after harvest. Germination tests in wet sand were conducted 1 week after treatment and at the end of the test, 8 months later (250 days).

RESULTS AND DISCUSSIONS

Table 1 shows the results of the test. One month after treatments, adult emergence was high from the three groups of treated seeds of both types oils. However, there was a highly significant (P = 0.01) reduction in adult emergence from the treated seeds in comparison with that from the untreated seeds. This was the first generation from the field infestation; subsequent adult emergence was considered to be after treatment generations. At 59 days, adult emergence was effectively reduced or eliminated by the two higher dosages (10 and 15 ml/kg of seeds). At the lowest dosage (5 ml) it was still fairly high, although significantly (P = 0.01) lower than in the untreated check. At 115 days, emergence of adults was eliminated by the highest dosage and was very low in the 10 ml dosage. However, in cowpeas treated with the 5 ml dosage, emergence was higher than in the check, with the exception of two replicates of seeds treated with soybean oil without additives. At 250 days seeds treated with 10 and 15 ml, and two replicates treated with 5 ml/kg, were free of weevils. The rest of the peas treated with 5 ml and those of the untreated check had deteriorated completely.

These results differ from those reported (3, 4, 5), since effective control had been obtained with 5 ml/kg of seeds. It should be mentioned that the results reported in the literature used clean seeds that were artificially infested after the oil treatment. Furthermore, the failure to control weevils with the 5 ml dosage could be due to a heavy field infestation and the delay (on purpose) of the oil treatment giving the eggs an opportunity for hatching. Apparently, when there is a heavy field infestation, 5 ml of oil/kg of seeds is not enough to stop the infestation of the first generation from the field, since enough weevils will survive to re-infest the seeds. Even at dosages of 10 and 15 ml of oil/kg of seeds there was a fairly high emergence of weevils after the treatment. However, the infestation was effectively reduced after the emergence of the first adults.

Seed germination 1 month after treatment was 70.5% as determined in the insecticide-treated check. Eight months later, seed germination ranged from 47 to 74% on the oil-treated seeds. The germination in most of the oil-treated seeds was higher than in the check (59%) and apparently there were no ill effects due to the oil treatments. These results agree with those reported by Schoonhoven[4].

The palatability of the oil-treated seeds was improved according to the authors and several other persons who tasted them. The appearance also improved. Schoonhoven[4] also reported that the physical appearance of beans is often improved as they are shinier after treatment, and appear to be newly harvested.

CONCLUSIONS

Cowpea seeds exposed to a heavy field infestation of seed weevils need 10 to 15 ml of vegetable oil/kg to stop the infestation during storage. This treatment will affect neither the palatability nor the germination of the seeds. Also, it is cheap.

RESUMEN

Aceite de soya purificado, con y sin aditivos, y de maíz, purificado con aditivos y crudo sin aditivos, fueron evaluados para el control en almacén, del gorgojo de la semilla *Callosobruchus chinensis,* en frijoles, *Vigna unguiculata,* altamente infestados. Las cantidades usadas fueron de 0, 5, 10 y 15 ml/kg de semilla seca recién cosechada. Las dos dosis más altas fueron eficaces para controlar el gorgojo durante los 8 meses que duró la prueba sin afectar el sabor ni la germinación de las semillas.