Niger Agric. J. 30 (1999): 41 - 48

ASSESSMENT OF SOYBEAN OIL AND FERNASAN D FOR THE CONTROL OF Callosobruchus maculatus Fab.

P. O. ONOLEMHEMHEN, E. BOSSEY and V. B. OKAKA,

Department of Agronomy
Faculty of Agriculture
Edo State University
Ekpoma

(Accepted May 1998)

ABSTRACT

Effects of Soybean oil and Fernasan D used as surface protectants against Callosobruchus maculatus F. infestation were studied.

Admixture of soybean at the rates of 1,5 and 10 ml kg^{-1} of cowpea seeds, effectively controlled adult C. maculatus infestation. At 5-10ml kg^{-1}, 100% mortality was recorded 3-4 days after treatment but it took 6 days after treatment, with 1 ml kg^{-1}. Soybean oil also inpaired oviposition by female C. maculatus and significantly affected offspring emergence. Only 1.7% to 8.3% of the eggs deposited in 10ml kg^{-1} treatment seeds emerged as adult weevils, as against 12.6% for 5ml kg^{-1} and 54.23% for 1ml kg^{-1}. About 100% of the eggs deposited in the control emerged as adult weevils. Albino rats fed on seeds treated with soybean oil, externally showed no signs of ill health and all their organs examined at the end of the experiment showed no abrasions or damage. The rats showed appreciable gain in body weight.

Fernasan D. at the rates applied recorded 100% kill within 24h and effectively impaired oviposition and adult weevil emergence.

INTRODUCTION

Plant materials and plant extracts have been used over the years to control storage pests of legumes (Naik and Dumbre, 1984); cereals (Ivbijaro, et al; 1985); and to a limited extent, field pests (Olaifa, et al, 1987). Oils of cotton seed, maize, ground-nut and oil palm have been used to preserve grains in storage (Naik and Dumbre, 1984). Yuntai and Burkholder (1981) observed that cotton seed oil, ground-nut and to

some extent soybean oil suppress (Sitophilus grainarius development on wheat. Studies by Ivbijaro (1984), Ali et al (1984) and Ivbijare et al (1985), indicate that dosage rates of 10-20 ml kg^{-1} of most plants oils give complete control of weevil infestation of cereals and pulses. At lower rates of 5-10ml kg^{-1} of test seeds, Schoonhoven (1978), reported complete control of Zabraotes subrasciatus Bohema infestation of Phaseolus vulgeris L. for up to 75 days, indicating that soybean oil can be applied at doses lower than 10-20 ml kg^{-1}.

Onolemhemhen and Oigiangbe (1991), observed that Thioral, a seed dressing agent, at 0.25 and 0.50g kg^{-1} of test seeds, gave effective control of C. maculatus on pigeon pea and successfully preserved the seeds for up to 120 days without impairing their viability. In view of the increasing cost of preserving grains for domestic consumption and as planting materials, there is need to examine oils like soybean oil, which is readily available in the Nigerian market, and Fernasan D. a seed dressing agent, as possible protectant for stored cowpea in Nigeria. This study therefore assessed the use of soybean oil and Fernansan D. for the control of Callosabruchus maculatus F. infestation of cowpea (Vigna unguiculata Walp).

MATERIALS AND METHOD

The study was carried out from March to August, 1993 at the Department of Botany Laboratory, Edo State University, Ekpoma, and repeated from March to August, 1994.

Cultures of cowpea weevils, which were established on 1st March, 1993 and 1st March, 1994 were used. Ife brown variety of cowpea, obtained from (ADP) Agricultural Development Project, Irrua was used in establishing the culture and carrying out the study in both years. Clean uninfested cowpea seeds of 500g - each were kept in 4 Kilner jars, and Callosobruchus maculatus Fab were introduced to establish the culture. The weevil culture was kept at a temperature of 29°c in a Gallenkamp plus series incubator. The rates of application were 0, 1, 5 and 10ml per kg of the cowpea seeds; 0 served as the control where no oil was applied. Fernasan D (80% WW Thiram and 20% Lindane) an established seed dressing agent, was applied at the rate of 0.5 and 1.0g/1kg of cowpea seeds.

Prior to surface treatment of the test grains with soybean oil, clean, uninfested cowpea seeds

are fumigated with phostoxine (Aluminium phosphide) for 24hrs, sieved, aerated and kept for 7 days. These fumigated seeds were then admixed with soybean oil and Fernasan D at the rates stated above.

The oil and Fernasan D treated seeds were split into 50g seeds, put in a 100ml beaker and replicated thrice. The three oil treatment rates, two Fernasan D treatment rates and the control were replicated thrice, giving a total of fifteen treatments.

All treatments were arranged on a labouratory bench, using completely randomized block design. Ten adult weevils made up of 8 females 2 males from the culture were introduced into the replicated beakers containing the treated seeds and the following data observed.

- Mortality and days to 100% mortality
- Oviposition of the weevils at 20 and 90 days after infestation. (twenty days was used to avoid damage to eggs laid).
- Effect of the treatments on progeny emergence and
- Use of the treated grains in feeding the albino rats.

The treated cowpea seeds were ground into the powder form and made into cakes, sun dried and fed ad lib to the albino rats.

Data obtained was analysed, using analysis of variance (ANOVA) and means compared using LSD at 5% level of probability. The mean of the 2 - year data is presented as the results.

RESULTS

The soybean oil admixed with grains, adversely affected the activities of C. maculatus and caused their mortality. The soybean oil at the rates of 5-10ml kg^{-1} recorded 100% mortality at 3 and 4 days after treatment respectively (Table 1). By the third day (98hr) after treatment, when 10ml kg^{-1} attained 100% mortality, difference between the control and treated means was significant ($P \leq 0.05$). At 24h after treatment soybean oil at the rate of 10ml kg^{-1}, 13.4 to 17.5% of adult weevils were killed (Table 1). Difference between the treated and control was not significant. At the lowest dose of 1ml kg^{-1} 100% mortality was attained at 6 days after treatment.

Table 1: Effects of soybean oil and Fernasan D. on percentage mortality of adult of weevils *Callosobruchus maculatus.*

Rate of Application $ml kg^{-1}$ or $g kg^{-1}$	Days after Treatment						
	1	2	3	4	5	6	7
Soybean oil							
Control	0.00	3.30	19.80	19.80	-	24.80	87.95
1	0	16.70	32.00	65.30	83.3	100	-
5	0.00	26.70	71.70	100.00	-	-	-
10	13.40	46.70	100.00	-	-	-	-
Fertilizer							
0.5	100.0	-	-	-	-	-	-
1.0	100.0	-	-	-	-	-	-
LSD (P/ 0.05)	3.75	14.50	17.50	13.50	-	-	-

Fornasan D applied at the rate of 0.5 and $1.0 gl kg^{-1}$ cowpea seeds, recorded mortality 24hrs after treatment. More eggs were laid in the control than the oil treated seeds; irrespective of the rate of oil application C. maculatus oviposited some eggs on the treated cowpea seeds (Table 2), 20 and 90 days after treatment. The total number of eggs laid varied from one treatment dose to another with the $1ml\ kg^{-1}$ recording the highest number of eggs and the $10ml\ kg^{-1}$ the least number of eggs.

No egg was recorded on the Fernasan D treated seeds. By 90 days after treatment, analysis of variance showed highly significant (P/ 0.05) dosage effects on oviposition as fewer eggs were laid on $10ml\ kg^{-1}$ soybean oil treated cowpea seeds.

Table 2:Effects of surface treatment of cowpea grains with soybean oil and Fernasan D. on number of eggs laid by *C. maculatus*

Rate of Application ($mlkg^{-1}$ or gkg^{-1})	Days 20	90
Soybean		
Control	91.33	333.00
1	62.17	284.00
-5	50.67	224.00
-10	24.00	27.60
Fernasen D.		
0.5	9.00	00.00
1.0	0.00	0.00
LSD (P / 0.05)	14.80	71.08

The cumulative number of emergent and live adults of C. maculatus are presented in Table 3. Although many eggs were oviposited on the cowpea grains, very few offsprings emerged. The oil treatment rates, significantly affected the emergence of the offspring (Table 3).

Table 3: Effect of soybean oil on *C. maculatus* progeny emergence

Rate of Application (Soybean Oil) ($mlkg^{-1}$ or gkg^{-1})	Cumulative number of emergent adults of C. maculatus 30 and 90 days after emergence
1	34.7
5	6.3
10	0.7
Control	108.0
LSD (P / 0.05)	34.62

The guinea pigs fed with cowpea grains at the different treatment rates, in addition to grass cuttings showed body weight grain (Table 4). With 5ml kg^{-1}, 17.00% body weight gain was recorded, followed by 13.30% grain in 1 and 10ml kg^{-1} and 10% for the control. Thus the oil treatment recorded more body weight gain than the control that was fed on grass and untreated cowpea seeds. No abrasions of the organs was noticed, nor were any of the organs enlarged.

Table 4: Effect of Soybean Oil treated seeds on albino guinea pigs three weeks of feeding.

Rate of Soybean Oil Application ($mlkg^{-1}$ or gkg^{-1})	Initial Weight (g)	Weight at the end of the experiment (g)
1	250	270
5	250	275
10	250	270
Control	250	265
LSD (P / 0.05)	NS	NS

DISCUSSION

Soybean oil and Fernasan D at the rates they were applied caused mortality of C. maculatus and affected oviposition and progency emergence. The observed high mortality with the use of Fernasan D within few hours of infestation, agrees with the report of Onolemhemhen and Oigiangbe (1991), who also recorded 100% mortality within a few hours of infesting thioral treated pigeon pea seeds with cowpea weevils. The insecticidal activities of Fernasan D was perhaps due to its lindane constituent.

With the soybean oil, 100% mortality attained 3-4 days after oil treatment partly agrees with the views of Su, et al (1972) and Ali, et al (1984), that plant oils cause 100% mortality of weevils in stored pulses and legumes 1-7 days after treatment. Rubber seed oil which had similar properties with soybean oil, has also been observed to cause 100% mortality of C. maculatus and C. chinensis 2-5 days after treatment depending on the rate of application (Onolemhemhen, 1990). Its observed toxic effect on C. maculatus agrees with the findings of Schoonhoven (1978), that soybean oil admixed at the rates of 5-10ml kg^{-1} with Phaseolus vulgnris L. beans, effectively controlled Zabrotas subfasciatus (Bohemia) in storage.

The better performance of 5-10ml kg^{-1} of soybean oil was probably due to more seed coverage/coating of the cowpea seeds which presented a smoothened surface to the C. maculatus. This certainly resulted in reduced contact between the C. maculatus and cowpea seeds and perhaps reduced the total number of eggs laid. The few offsprings recorded indicated that soybean oil had marked effect on C. maculatus emergence. It is very likely that the thin layer of oil on the

seed coat, blocked oxygen supply to the developing embryo as suggested by Su et al (1972), Yuntai and Burkholder (1981) and Ivbijaro et al (1985), and consequently resulted in few emergent adult C. maculatus.

Soybean is well cultivated in Nigeria and its oil now abound in our markets. Its culinary significance, observed non-toxicity to the test rate, ease of application and its assumed non-toxicity to man, makes it an oil of significant importance in storage entomology. Since the soybean seeds and oil are available in our markets, its adoption in rural and domestic grain preservation, may go a long way in expanding its scope of utilization in Nigeria, and perhaps, provide a good substitute for kerosene and relatively costly synthetic insecticides. Fernasan D. for now should be used only on those seeds that are reserved for planting.

REFERENCES

Ali S. I., O.P. Singh,. and U.S. Misra. (1993). Effectiveness of plant oils against Pulse beetles Callosobruchus chinesis L. India J. Ento. 45 (1) 6-9.

Ivibijaro M. F. (1984). Groundnut oil as a protectant of maize from damage by the maize weevil Sitophilus zeamais M. Protection Ecology 6: 207-270.

Ivbijaro M. F., Liganl. and A.Youdeowi. (1985).Control of rice weevils Sitopshilus oryzae L in stored maize with vegetable oils. Agric. Ecosystems and Envt. 14: 237-242.

Naik R. L. and Dumbre R. E. (1984). Effect of some vegetable oils used in protecting stored cowpea on biology of pulse beetle C. maculatus Fab. Bulletin grain tech. 22(1): 26-32.

Olaifa J. I., W.O. Erhun and A.E.Akingbohunghe (1987). Insecticidal activity of some Nigerian plants. Insect Sci. Applic. 8(2): 221-234.

Onolemhemhen P. O. (1990). Control of cowpea weevil Callosobruchus maculatus Fab. (Coleoptera, Bruchidae) with rubber seed oil, Nig. Agric. J. 25: 87-93.

Onolemhemhen P. O. and O.N.Oigiangbe (1991). The biology of Callosobruchus maculatus Fab. On Cowpea and Pigeon pea

treated with vegetable oil and thioral. Samaru J. Agric. Res. 18: 57-63.

Schoonhoven A. V. (1978). Use of vegetable oil to protect beans from brunchid attack. J. Econ. Ent. 71, (2): 254-257.

SU H. C. F., R.O. Spiers and P.G. Mahany. 91972). Of citrus oil to be stored product insects Laboratory Evaluation J. Econ. Ent. 65: 1438 - 1441.

Yuntai Q and W.E. Burholer (1981). Protection of stored wheat from granary weevil by vegetable oils. J. Econ. Ent. 74: 502-505.