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USE OF VEGETABLE OIL FOR PROTECTION OF STORED GREENGRAM (*VIGNA RADIATA* (L.) WILCZEK) FROM ATTACK OF *CALLOSOBRUCHUS MACULATUS* (FABR.) (COLEOPTERA: BRUCHIDAE)

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The use of vegetable oil for protecting 4 varieties of greengram (*Vigna radiata* L.) Wilczek) seeds for 4 months from attack of bruchid beetle (*Callosobruchus maculatus* (Fabr.) and its effect on the germination of the treated seeds were studied. The lowest damage was recorded in seeds treated with 12.5 ml oil/kg seed. The variety NCM-9 was found to be the most susceptible as the damage percentage was 43.63, 33.80 and 4.12 at treatment levels of 7.5, 10.0 and 12.5 ml oil/kg seed respectively. However, the germination percentage of the seed treated with 12.5 ml oil dose was significantly reduced.

Key words: Vigna radiata; Callosobruchus maculatus; Mustard oil.

INTRODUCTION

Pulses are a major source of proteins in most of the tropical and subtropical countries of the world. These crops are not only severely infested by insects in the field, but their seeds during storage are also heavily damaged by bruchids. The frequent use of synthetic insecticides and fumigants in abating bruchid attack in seed stores is not feasible as these measures involve high cost and precautions which poor farmers cannot afford. Stored pulses have traditionally been protected from bruchid attack simply by coating with a thin film of edible oil in Pakistani villages since time immemorial. Although edible oil seems to be an inexpensive source of protection against bruchid attack, its impact on seed germination and quality must be evaluated. It is also necessary to work out the minimal dose of edible oil which would impart the required degree of protection without any adverse impact on the germination of the treated seeds and food qualities.

Schoonhoven [4] stated that bean seeds, *Phaseolus vulgaris* (L.), when treated with vegetable oil at the rate of 1,5 and 10 ml/kg completely controlled bruchid attack for more than 75 days. Similarly Varma and Pandey [5] tested five edible oils against the attack of *C. maculatus* on greengram and found that coconut and mustard oils proved to be effective for 5 months. Pandey *et al.* [2] reported that the greengram seed could be protected for 5-6 months against bruchids by treating them with sal, cottonseed and rice bran oil. Pereira [3] conducted studies using six vegetable oils and reported that these oils protected the cowpea, *Vigna unguiculata* (L.), and bambara groundnut, *V. subterranea* (L.), against *C. maculatus.* Frank, *et al.* [1] reported that vegetable oil, mineral oil and polyethylene glycol at dosages of 5.0 ml/kg of seed protected cowpeas from *C. maculatus.* It is apparent that no work has been done on intraspecific variations of response of different food legumes to vegetable oil treatments for bruchid attack.

In this paper the efficacy of different treatments of edible oil to protect the seeds of four greengram (*Vigna radiata* (L.) Wilczek) varieties from attack by the bruchid beetle, *Callosobruchus maculatus* (F.), a serious stored grain pest, has been assessed.

MATERIALS AND METHODS

A stock culture of *Callosobruchus maculatus* was maintained in glass jars containing abundant mungbean (*Vigna radiata*), var. (NCM-5) seeds. Seeds of 4 greengram varieties, namely, NCM-9, NCM-5, M-3854 and VC-2764, were treated with three different doses of mustard oil (7.5, 10.0 and 12.5 ml oil/kg seeds). Ten grams seed of each variety were placed in petriplates (9.5 cm x 1.5 cm) and the number of seeds was recorded. Three replications of each variety were maintained. The required quantity of mustard oil, to keep up with the respective dose levels, was mixed with 10 g seeds in separate petri-plates. The plates were shaken manually to produce a thin film of oil

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around the seeds. Thereafter three pairs of adults of *C. maculatus* (F.) were released in each petri-plate.

At monthly intervals 3 pairs of freshly emerged adult bruchids from the stock culture were introduced in the petri-plates in order to ensure the presence of ovipositing females in each case. At the end of the 4th month, which was considered as the time of maximum possible damage, the number of damaged seeds was counted and the damage percentage was worked out for all of the experiments. The data were subjected to analysis of variance and Duncan's multiple range test. All experiments were conducted in a cool/hot Gallancamp incubator at 26 ± 2°C and 40 – 50 RH.Humidity was produced by placing water containers in the incubator.

Viability of treated seeds. After completion of the experiments, 100 healthy seeds from each replicate of each variety of mungbeans undergoing treatment with 12.5 ml oil/kg seeds were washed with 0.2% sodium hypochloride for 2 min. to check for fungal contamination. The seeds were then placed on a moist filter paper in petri-dishes. The germination percentage was noted after 5 days. Smiliarly 3 sets of healthy untreated seed were maintained as control of germination for respective variety. All germination experiments were conducted in a germinator at 22 ± 2°C.

The data on germination percentage were subjected to analysis of variance and Duncan's multiple range test.

RESULTS AND DISCUSSION

The results of analysis of variance of damaged seed percentage due to attack of *C. maculatus* in the 4 varieties of mungbeans following 4 mustard oil treatments showed that both varieties and mustard oil treatments imparted significant degrees of variation in the seed damage (Table 1). There was also significant interaction between the varieties and treatments. The Ducan's multiple range

Table 1. Analysis of variance of damaged seed percentage due to *C. maculatus* in 4 varieties mungbean following mustard oil treatments.

Source of variation	Sum of squares	Degrees of freedom	Mean square	Variance ratio
Main experiment	4355.001	11	–	–
Replicates	273.713	2	136.856	1.135
Varieties (V)	3357.898	3	1119.299	9.284**
Error (a)	723.390	6	120.565	–
Treatments (T)	76979.652	3	25659.884	183.505**
V x T	3015.156	9	335.017	2.396*
Error (b)	3355.972	24	139.832	–
Total	87705.781	47		

** $P < 0.01$ * $P < 0.05$

Table 2. Mean damaged seeds (%) due to *C. maculatus* in 4 varieties of mungbean following 4 mustard oil treatments. All sets of means which do not share a common english letter significantly differ from one another at $P < 0.05$.

Variety	Mean No. of seeds/10 g	Treatments	Percentage of damaged seed after 4th month
MCM-5	231.0	7.5 ml/kg	2.24 c
	241.6	10.0 ml/kg	0.14 c
	231.0	12.5 ml/kg	0.28 c
	250.0	Control	100.00 a
NCM-9	148.0	7.5 ml/kg	43.63 b
	152.3	10.0 ml/kg	33.80 b
	154.0	12.5 ml/kg	4.12 c
	154.0	Control	100.00 a
VC-2764	210.0	7.5 ml/kg	1.83 c
	215.0	10.0 ml/kg	2.63 c
	221.6	12.5 ml/kg	3.64 c
	212.6	Control	100.00 a
M-3854	338.6	7.5 ml/kg	0.99 c
	324.3	10.0 ml/kg	1.43 c
	314.6	12.5 ml/kg	0.21 c
	323.3	Control	100.04 a

Table 3. Analyses of variance of percentage germination of 4 varieties of greengram in controlled and treated seeds.

Source of variation	Sum of squares	Degrees of freedom	Mean square	Variance ratio
Main experiment	3920.83	11	–	–
Replicates	2454.08	2	1227.04	10.05*
Varieties (V)	734.17	3	244.72	2.00
Error (a)	732.58	6	122.10	–
Treatments (T)	3174.00	1	3174.00	9.79*
V x T	3771.00	3	1257.00	3.88
Error (b)	2594.00	8	324.25	–
Total	13459.83	23		

* $P < 0.05$

Table 4. Percentage germination in 4 varieties of greengram in controlled and experimental seeds (12.5 ml/kg). All sets of mean which do not share a common english letter significantly differ from one & another at $P < 0.05$.

Variety	Control	Treated
NCM-5	43.66 b	61.33 b
NCM-9	85.00 a	41.66 b
VC-2764	89.33 a	43.66 b
M-3854	68.00 a	45.66 ab

test showed that NCM-9 was the most susceptible variety of the mungbean while the other 3 varieties differed insignificantly with respect to susceptibility (Table 2). There was highest damage in the controlled experiments and lowest in the mungbeans treated with 12.5 ml oil/kg. Other two doses of mustard oil different insignificantly from each other in effect. Except for NCM-9, all the other varieites of mungbeans responded almost equally to all oil treatments (except control). Treatment of NCM-9 with 12.5 ml oil/kg gave the highest damage. At the other two doses the seeds showed insignificant difference of damage percentage.

Results of analyses of variance and Duncan's multiple range test of percentage germination of 4 varieites of greengram in controlled and treated seeds are summarized in Tables 3 and 4. The results show that varieties insignificantly differed with respect to percentage germination. Treatment with 12.5 ml oil/kg on the other hand caused significant reduction in percentage germination ($P < 0.05$). None of the varieties interacted significantly with the treatments.

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