Journal of Advances in Science and Technology

Vol. III, Issue No. VI, August-2012, ISSN 2230-9659

EFFECT OF MUSTARD OIL AND TURMERIC POWDER ON THE ADULT MORTALITY AND EGG LYING OF THE PULSE BEETLE, CALLOSOBRUCHUS CHINENSIS (L.) ON STORED CHICKPEA SEEDS

AN INTERNATIONALLY INDEXED PEER REVIEWED & REFEREED JOURNAL

www.ignited.in

Journal of Advances in Science and Technology
Vol. III, Issue No. VI, August-2012, ISSN 2230-9659

Effect of Mustard Oil and Turmeric Powder on the Adult Mortality and Egg Lying Of the Pulse Beetle, Callosobruchus Chinensis (L.) On Stored Chickpea Seeds

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Abstract – There were a total of 4 treatments(Mustard oil@ 7.5ml/kg, Turmeric powder @ 3.5g/kg, Mustard oil@ 3.75ml+ Turmeric powder @ 1.75ml/kg seed) replicated thrice. Among all the treatments, mustard oil at 7.5 ml/kg seed gave significantly higher adult pulse beetle mortality as compared to untreated control. Turmeric powder @ 3.5 g/kg seed was least effective when compared with control after 160 days of storage. All the seed protectants treatments resulted in significantly lesser number of eggs/500 seeds as compared to untreated control after 1, 50, 110 and 160 days of storage. Mustard oil at 7.5 ml/kg seed was most effective followed by mustard oil at 3.75 ml/kg + turmeric powder at 1.75 ml/kg seed as compare to untreated control and in treated seeds there was reduction in the fecundity of pulse beetle up to 160 days of storage.

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INTRODUCTION

In India pulses occupy 23.28 million hectares area and contribute 14.66 million tones to the world's food basket. Chickpea is the most important pulse crop of India and occupies 8.17 million hectares with production of 7.48 million tones, accounting for 35.09 % and 51.02 % of total area and production, respectively. The chickpea producing areas mainly are the upper basin Ganga and Yamuna viz, Punjab, Haryana, Uttar Pradesh and Bihar and the adjoining tracts of central India viz, Rajasthan, Madhya Pradesh and Maharastra. In Haryana total production of chickpea during 2009-2010 was 0.06 % million tones covering about 0.08 million hectares (Anonymous, 2011).

The beetle family Bruchidae is closely associated with the plant family leguminoseae. Among the pulse beetles, Callosobruchus chinensis (L.), C. maculatus (Fabricius) and C. analis (Fabricius) are the major pests of stored pulses (Mookerjee et al.1970). They are responsible for causing serious losses in store and field with the estimated loss of nearly 0.21 million tones, costing around 315 million rupees (Rathore and Sharma, 2002). In India, loss of chickpea seeds due to bruchids has been estimated to be 8.5% (Agrawal et al., 1988), thus becomes essential to protect the seeds from insect-pests during storage.

Generally, fumigants are used for both preventive as well as curative measures against stored grain insect pests but these carry a high risk for the loss of germinability especially at high moisture content of the seeds which causes direct effect on production of the pulse crop.

The use of fumigant is not advisable in the absence of appropriate storage structures and skilled personnel. The other prophylactic treatment i.e. mixing of insecticidal dusts with seed in storages has been practiced. However, wide spread use of these pesticides has significant drawbacks including the development of insecticide resistant strains (Zettler and Cuperus, 1990), increase in costs, handling hazards, concerns about insecticide residues in grains and threats to human health and environment. In Haryana, mixing of mustard oil and groundnut oil @ 7.5 ml/kg seed & 7 cm covering of seeds with sand are the only recommendations for safe storage of pulses (Anonymous, 2003). Earlier, several workers have reported various vegetables and other oils effective in checking multiplication of insect pests in storage (Ahmed et al., 1999).

Tabu et al. (2012) revealed that the botanicals, inert materials and edible seed oils were caused high adult mortality, reduced egg laid, reduced F1 progeny emergence, low seed damage and low seed weight loss without affecting seed germination in stored chickpea grains .Seed powder of A .indica at the rate of 20 g kg-1 and the leaf powder of C. ambrosioides at the rate of 40 g kg-1 caused high adult mortality next to Malathion 5 % dust at the rate of 0.5g kg-1, while the other botanicals, inert materials and the oils showed better performance than the untreated check. B. juncea, L. usitatissimum and G. abyssinica seed oils applied at the rate of 5.0 ml k g-1 resulted in high

reduction in progeny emergence. Likewise, sand and wood ash at all the levels tested, gave effective inhibition in F1 progeny production. The biology of C. chinensis was also studied on chickpea and the results showed that 6 days of oviposition period, 49.5 percent of average number of eggs laid, 91.5 percent of eggs hatched, 79.5 percent of average number of adult emergence, 25.3 days of developmental period, 9.6 and 7.5 days of adult longevity for male and female beetles respectively. These results indicated that botanicals, inert materials and edible seed oils can effectively control Adzuki bean beetle, C. chinensis in stored chickpea.

MATERIALS AND METHODS

Test insect

The test insect included in the studies was pulse beetle, Callosobruchus chinensis (L.) [Coleoptera: Bruchidae]. The culture of pulse beetle C. chinensis (L.) was maintained to make available the test insect during the conduct of the experiment. Many pairs of healthy C. chinensis adults (0-24h old) were isolated from stock culture maintained on chickpea by applying key for sex differentiation as given by Raina (1970) and released in jars (2 kg capacity) containing Chickpea seeds of genotype HC-3 to 1/3 of its capacity.

Treatments

Different doses of seed protectants used in the present study were as follows:

Treatment	Dose(w/w)
T1 Mustard oil	7.5ml/kg of seed
T2 Turmeric powder	3.5gm/kg of seed
T3 Mustard oil+ Turmeric powder	3.75ml+1.75g/kg of seed
T4 Control	Untreated

Thus, in all there were four treatments which were replicated thrice. In each treatment 500g seed were stored in plastic jars of 2.0kg capacity.

Seed treatment with protectants

The seed protectants (mustard oil, turmeric powder) were mixed with chickpea seed in a jar (2.0 kg capacity). The required doses of seed protectants were mixed with half kilogram of chickpea seeds by shaking it manually for five minutes after closing the open end of the flask with a piece of butter paper. This was done to ensure uniform adherence of the protectants with the seeds. The seeds were dried in shade on pucca floor overnight before transferring them to plastic jars. Ten pairs of newly emerged (0-24 hr old) adult beetles were released in each plastic jars after treatments. The “untreated” seeds were taken as control. Each treatment was replicated thrice. Samples of 500 seeds were drawn from each replication (2 kg capacity). Five pairs of freshly emerged pulse beetle (0-24 h old) were released in each plastic jar and covered with lid. The following observations were recorded after 1, 50,110 and 160 days of the release of beetles:

1. Per cent adult mortality

2. Number of eggs laid

RESULTS AND DISCUSSION

Adult mortality of pulse beetle, Callosobruchus chinensis (L.)

The data presented in Table 1 showed that treatments of chickpea seeds with different seed protectants turmeric powder @ 3.5 g/kg proved least effective for adult mortality of C. chinensis as compared to the control after storage intervals i.e. 1, 50, and 110 days.

Table 1. Efficacy of seed protectants on mortality of pulse beetle, Callosobruchus chinensis (L.) on chickpea, Cicer arietinum (L.) seeds at different storage intervals

Treatment & Doses	Per cent Adult mortality (DAS)*			
	1	50	110	160
Mustard oil @7.5 ml/kg	78.33 (62.25)	46.66 (43.06)	13.33 (21.13)	13.00 (20.60)
Turmeric powder@3.5 g/kg	0.00 (1.00)	3.33 (6.68)	0.00 (1.00)	10.00 (15.26)
Mustard oil@3.75 ml/kg +Turmeric powder @ 1.75 g/kg	13.33 (21.13)	10.00 (15.26)	3.33 (6.68)	26.66 (30.28)
Control (untreated)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	6.66 (9.39)
SE (m)	(6.98)	(5.16)	(3.26)	(6.68)
CD at 5 % level	(20.49)	(15.14)	(9.58)	(19.63)

*DAS = Days after storage

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Figures in the parenthesis are Angular transformed values

After one day of storage, mustard oil at 7.5 ml/kg of seeds gave 78.33 % adult mortality. Among all the treatments turmeric powder at 3.5g/kg seed resulted in no adult mortality and it was at par with untreated (control) seeds when observed after one day of storage.

After 50 days of storage, maximum 46.66 % adult mortality was recorded in mustard oil at 7.5 ml/kg seed and minimum 3.33 % in turmeric powder at 3.5 g/kg seed which was not significantly differ with untreated (control) seeds.

After 110 days of storage, maximum 26.66 % adult mortality was recorded in mustard oil at 3.75 ml/kg + turmeric powder at 1.75 ml/kg seed followed by 13.00 % in mustard oil at 7.5 ml/ kg and minimum 10.00 % in turmeric powder at 3.5 g/kg seed.

The results of present studies indicated that, on the basis of adult mortality up to 160 days of storage Turmeric powder at 3.5 g/kg seed were the least effective treatment, when compared with the control.

The results of mustard oil at 7.5 ml/kg seeds are in agreement with those of Bhargava and Meena (2002), who reported 76.8 and 73.4 % adult mortality of C. chinensis (L.) with mustard oil at 1ml/100 g seeds and groundnut oil at 1ml/100g seeds of cowpea after 3 days of release of beetles.

1.2 Number of eggs laid

The data presented in Table 2 showed that chickpea seeds treated with all the seed protectants resulted in significantly lesser number of eggs laid by C. chinensis as compared to control, when observed at 1, 50, 110 and 160 days after storage.

After one day of storage, the number of eggs laid by 5 females ranged from 2.89 to 129.66 eggs/500 seeds in different treatments as compared to 161.02 eggs in untreated (control) seeds. Amongst the seed protectants, maximum (129.66 eggs/500 seeds) eggs were laid in the treatment with turmeric powder at 3.5

g/kg seeds and it was followed by mustard oil at 3.75 ml/kg + turmeric powder at 1.75 ml/kg seed (36.00 eggs/500 seeds).These treatments differed significantly from rest of the treatments. Minimum (2.89 eggs/500 seeds) eggs were observed in the treatments with mustard oil at 7.5 ml/kg seeds.

After 50 days of storage, the same trend was observed as after one day of treatment. Among all seed protectants, maximum (132.36 eggs/500 seeds) eggs were observed in chickpea seed treated with turmeric powder at 3.5 g/kg seed and 33.33 eggs/500 seeds were observed in mustard oil at 3.75 ml/kg + turmeric powder at 1.75 ml/kg seed. Minimum (6.00 egg/500 seeds) eggs were recorded in mustard oil at 7.5 ml/kg seeds.

Table 2. Efficacy of seed protectants against eggs laid by pulse beetle, Callosobruchus chinensis (L.) on chickpea, Cicer arietinum (L.) seeds at different storage intervals

Treatment & Doses	Average no. of eggs laid by 5 pairs/500 seeds (DAS)*			
	1	50	110	160
Mustard oil @7.5 ml/kg	2.89 (1.45)	6.00 (2.62)	10.00 (3.12)	41.66 (6.70)
Turmeric powder @3.5 g/kg	129.66 (11.42)	132.36 (11.57)	127.64 (11.24)	141.36 (11.76)
Mustard oil@3.75 ml/kg +Turmeric powder @1.75 g/kg	36.00 (6.05)	33.33 (5.84)	38.33 (6.23)	40.06 (6.27)
Control (untreated)	161.02 (12.54)	163.00 (12.70)	159.33 (12.51)	171.02 (13.04)
SE (m)	(0.29)	(0.29)	(0.20)	(0.16)
CD at 5 % level	(0.86)	(0.86)	(0.61)	(0.47)

*DAS = Days after storage

Figures in the parenthesis are √n+1 transformed values

After 110 days of storage, among the seed protectants the number of eggs laid ranged from 10 to 127.64/500 seeds. The minimum (10.00 egg/500 seeds) eggs were observed in mustard oil at 7.5 ml/kg seed, while maximum number of eggs observed in turmeric powder at 3.5 g/kg seed i.e. 127.64 eggs/500 seeds followed by mustard oil at 3.75 ml/kg + turmeric powder at 1.75 ml/kg seed with 38.33eggs/500 seeds. All the treatments found significantly better than the untreated (control) seeds where the total number of eggs laid were 159.33 eggs/500 seeds.

After 160 days of storage, among the seed protectants, minimum (40.06 egg/500 seeds) eggs were observed in chickpea seeds treated with mustard oil at 3.75 ml/kg + turmeric powder at 1.75 ml/kg seed and these were followed by mustard oil at 7.5 ml/kg seed (41.66 eggs). Maximum numbers of eggs were recorded in the turmeric powder at 3.5 g/kg seed i.e. 141.36 eggs/500 seeds.

The result of present study indicate that on the basis of number of eggs laid/5 females, seed treatment with mustard oil at 7.5 ml/kg seed was equally effective throughout the storage period up to of 110 days. Treatment with turmeric powder at 3.5 g/kg seed was least effective followed by mustard oil at 3.75 ml/kg + turmeric powder at 1.75 ml/kg seed.

The results differed with Singh (2003) in respect of mustard oil, who reported 1.85, 2.62 and 0.0 eggs/20 gm seed of pigeonpea by 5 pair of pulse beetle adult after 3, 6 and 9 months, respectively.

CONCLUSION

After harvest of the crop, the seeds are stored before they are actually used for sowing purpose in the next season. Under normal conditions of storage, chickpea is damaged by a bruchid viz. Callosobruchus chinensis (L.) up to a great extent especially at the small scale farmer/trader level where storage conditions are susceptible for the insect attack and pesticides are vital for successful storage.

Synthetic organic chemicals are used to protect stored pulses and found effective in controlling the pest but having the toxic effect to grain and human beings. This has led to diversify the control measures that should be non-toxic and effective approach against the pulse beetle i.e. Callosobruchus chinensis (L.).

There were a total of 4 treatments replicated thrice the experiments. Among all the treatments, mustard oil at 7.5 ml/kg seed gave significantly higher adult pulse beetle mortality as compared to untreated control. Turmeric powder @ 3.5 g/kg seed was least effective when compared with control after 160 days of storage. All the seed protectants treatments resulted in significantly lesser number of eggs/500 seeds as compared to untreated control after 1, 50, 110 and 160 days of storage. Mustard oil at 7.5 ml/kg seed was most effective followed by mustard oil at 3.75 ml/kg + turmeric powder at 1.75 ml/kg seed as compare to untreated control and in treated seeds there was reduction in the fecundity of pulse beetle up to 160 days of storage.

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