

Efficacy of indigenous plant products against pea weevil (*Callosobruchus chinensis*) in stored greengram (*Vigna radiata*)*

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Received: 22 December 2009; Revised accepted: 15 October 2010

Key words: *Callosobruchus chinensis*, Greengram, Indigenous plant product

Greengram [*Vigna radiata* (L.) L.R. Wilczek] is important pulse grown in arid and semi-arid areas of Rajasthan and used for making of *dal mungedi*, *namkin*, *papad* etc. During the storage of greengram, pea weevil (*Callosobruchus chinensis* L.), pulse beetle (*C. maculatus* F.) and *C. analis* are mainly responsible for causing damage and weight loss to stored pulses. The damage is caused inside the grains and remains unnoticed till the beetles emerge out through the emergence hole. The larvae, which are the only feeding stage, destroy the endosperm completely and only leave the seed coat. The seeds thus completely lose their viability as well as nutritive value and are rendered unfit for sowing and human consumption. In severe cases, the entire quantity of stored grain is reduced to a mass of empty shells and dust. It has been reported that *C. chinensis* also harbours certain pathogenic micro-organisms that cause food poisoning and spoilage. Efforts should be made to reduce the storage losses through eco-safe management techniques which are suitable to the economy of poor farmers at the same time utilizing the available natural resources in a compatible manner. Among the available natural resources plant material and oils possess some desirable qualities as grain protectants, which had been in practice in rural areas to protect stored grains from insect infestation. Keeping all these in mind, an experiment was conducted to study the efficacy of botanicals, oils and their combined effect at different time interval against pea weevil in stored greengram.

The experiment was conducted in the laboratory at the Department of Agricultural Zoology and Entomology, Rajasthan College of Agriculture, Udaipur after harvesting of greengram. In the laboratory, culture of pulse beetle was maintained on the greengram seed. The greengram seeds were cleaned, washed, dried and then subjected to a temperature

of 60°C for 6 hr to eliminate the hidden infestation, if any. These grains were conditioned at 20±2°C temperature and 55 to 60% relative humidity for one week to make up the losses of moisture. The initial culture was obtained from the single parent, culture multiplied by releasing 20 pairs of 1-day-old adults in each glass jar (15 cm×10 cm) half filled with disinfested and conditioned greengram. The jars were covered with muslin cloth and incubated at 27±2°C and 75±5 per cent relative humidity to obtain the same aged adults for further experimentation. To maintain a continuous supply of the freshly emerged adults, this procedure was repeated during the entire period of investigation, proper care was taken not to touch either the seed or the test insects by hand. Forceps and camel hairbrush were invariably used for transferring the seeds and insects to glass jars respectively. The experiment was laid out in completely randomized designed with three replications. For application of each treatment a sample of greengram seeds (500 g) was made and placed in the polyethylene bag and the calculated amount of oils and botanicals was poured over seeds. The polyethylene bags were shaken thoroughly till all the seeds were coated with the oil and botanical powders uniformly. A control sample was also run simultaneously. The treated green gram seeds were transferred to the 2 kg capacity plastic container and labeled. Five pairs of newly emerged (0–24 hr old) pulse beetles were released in each replication. The entire experiment was replicated thrice. For calculating per cent seed damage 10 g sample was calculated after 30, 60, 90 and 120 days of treatments by formula as described earlier.

$$\text{Percentage damage seed} = \frac{\text{Number of holed seed}}{\text{Total number of seeds counted}} \times 100$$

After 30 days of treatment complete protection from the pulse beetle damage was recorded when linseed oil applied @ 5 and 8 ml/kg seed, while the loss under control was 7.58%. After 60 days of storage, 52.34% seeds were damaged under control, while complete protection of greengram from pulse beetle was achieved with linseed oil @ 8 ml/kg seed alone,

*Short note

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Table 1 Relative efficacy of botanicals and oils against *C. chinensis* during storage

Treatment Botanicals/oils	Dose	Per cent damage during storage			
		30 DAS	60 DAS	90 DAS	120 DAS
Neem leaves powder	20 g/kg	7.33 (1.62)	31.08 (26.66)	39.61 (40.65)	52.16 (62.37)
Neem seed kernel powder	20 g/kg	1.91 (0.11)	9.88 (2.94)	15.31 (6.97)	44.23 (48.66)
Linseed oil	3 ml/kg	1.91(0.11)	11.93(4.27)	14.25 (6.06)	24.33(16.97)
Linseed oil	5 ml/kg	0.0	8.74 (2.31)	9.36 (2.64)	9.88 (2.94)
Linseed oil	8 ml/kg	0.0	0.00	0.0	0.0
Mustard oil	5 ml/kg	1.91 (0.11)	10.49 (3.31)	20.09 (11.80)	44.04(48.33)
Mustard oil	8 ml/kg	1.91 (0.11)	7.94 (1.91)	15.31 (6.97)	42.12(44.99)
Sesame oil	5 ml/kg	6.53 (1.29)	14.89 (6.61)	27.47 (21.28)	44.42(48.99)
Sesame oil	8 ml/kg	5.73 (1.00)	12.87 (4.96)	23.28 (15.63)	42.89(46.33)
Neem leaves powder + linseed oil	20 g + 3 ml/kg	0.0	6.53 (1.29)	9.26 (2.59)	12.87 (4.96)
Neem leaves powder + linseed oil	20 g + 5 ml/kg	0.0	3.82 (0.44)	5.73 (1.00)	5.73 (1.00)
Neem leaves powder + linseed oil.	20 g + 8 ml/kg	0.0	0.00	0.0	0.0
Neem leaves powder + mustard oil	20 g + 5 ml/kg	1.91 (0.11)	6.53 (1.29)	14.14 (5.97)	35.66 (33.99)
Neem leaves powder + mustard oil	20 g + 8 ml/kg	1.91 (0.11)	5.73 (1.00)	10.76 (3.48)	32.15 (28.32)
Neem leaves powder + sesame oil	20 g + 5 ml/kg	3.82 (0.44)	7.94 (1.91)	18.37 (9.94)	35.85 (34.31)
Neem leaves powder + sesame oil	20 g + 8 ml/kg	1.91 (0.11)	6.53 (1.29)	15.31 (6.97)	33.41 (30.32)
Neem seed kernel powder + linseed oil	20 g + 3 ml/kg	0.0	0.00	0.0	0.0
Neem seed kernel powder + linseed oil	20 g + 5 ml/kg	0.0	0.00	0.0	0.0
Neem seed kernel powder + linseed oil	20 g + 8 ml/kg	0.0	0.00	0.0	0.0
Neem seed kernel powder + mustard oil	20 g + 5 ml/kg	0.0	3.82 (0.44)	8.56 (2.21)	24.84 (17.64)
Neem seed kernel powder + mustard oil	20 g + 8 ml/kg	0.0	1.91 (0.11)	5.73 (1.00)	18.68 (10.26)
Neem seed kernel powder + sesame oil	20 g + 5 ml/kg	0.0	3.82 (0.44)	7.94 (1.91)	30.84 (26.28)
Neem seed kernel powder + sesame oil	20 g + 8 ml/kg	0.0	1.91 (0.11)	7.33 (1.62)	27.72 (21.64)
Control		15.98 (7.58)	46.34 (52.34)	72.31 (90.76)	90.00 (100.00)
SEm±CD (P=0.05)		1.634.77	1.253.59	1.183.38	0.932.68

*Figures in parenthesis are retransformed value

combinations of neem seed kernel powder. After three months of storage complete protection was recorded when 8 ml/kg linseed oil was applied alone or in combination with neem seed kernel powder or neem leaves. Full protection was also achieved when neem seed kernel powder @ 20 g/kg seed was applied along with linseed oil @ 3 ml/kg and 5 ml/kg seed. Application of linseed oil @ 3, 5 or 8 ml/kg in combination with neem seed kernel powder or linseed oil @ 8 ml/kg seed alone gave complete protection of greengram seeds against the pulse beetle up to four months.

Amongst the botanicals neem seed kernel powder (48.61% damage) alone was found superior over neem leaves powder (62% damage) but it was significantly superior over control. While amongst the oils linseed oil at all the levels of sole application proved more effective. The effectiveness of neem seed kernel powder was reported by Mathur *et al.* (1985) in blackgram and Al Hemayani (1994) in fababean. Similar to the findings of present investigation by Seck *et al.* (1991) reported the superiority of neem seed over neem leaves powder in protecting the leguminous seeds from pulse beetle in cowpea. The repellent effect of sesame oil was tested for pulse beetle (*Callosobruchus maculatus* L.) in the laboratory conditions was observed by Ratnasekera

and Rajapakse (*Vigna radiata* L. walp) (2009). In stored food stuff, similar results were obtained by Righi-Assia *et al.* (2010).

SUMMARY

The studies were carried out to evolve the eco-friendly methods of bruchid management in greengram (*Vigna radiata* L. walp). Different doses of neem (*Azadirachta indica* A. Juss) leaves and seed kernel powder and linseed (*Linum usitatissimum* L.), Indian mustard (*Brassica campestris* L. Czernjns coss.) and Til oils (*Sesamum indicum* L.) and combinations of botanicals and oils were used. Among the oils linseed oil 8 ml was more effective. While, application of 20 g neem seed kernel powder +3 or 5 or 8 ml linseed oil completely protected greengram up to 120 days of storage. The effectiveness of oils increased when applied in combination with botanicals.

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