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Effectiveness of some grain protectants against pulse beetle, *Callosobruchus chinensis* (L.) infesting pigeon pea (*Cajanus cajan*)

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Abstract

Effectiveness of nine grain protectants *viz*., neem, mustard, mentha and clove oil each @ 3 ml and 5 ml/ kg seed and camphor, turmeric powder, Hg tablet and naphthalene ball each @ 1g and 2g/ kg seed as pigeon pea seed protectant against pulse beetle, *Callosobruchus chinensis*. In general the clove oil, neem oil, Hg-tablet, naphthalene ball, mentha oil, mustard oil and camphor were found to be best in order to increasing adult mortality and reduce egg laying, adult emergence and loss in grain weight due to pulse beetle at both the doses in comparison to asafoetida and turmeric powder. All the grain protectants were proved to be very effective in comparison to control. The seeds of pigeon pea treated with above grain protectant were stored for 90 days. The results showed that such treatments not any way affect the germination of pigeon pea seed.

Key words: *Callosobruchus chinensis*, vegetable oil, pigeon pea, grain protectant, egg laying

Introduction

Pulses are the major source of protein for large vegetarian population of the country. Since the leguminous grains are much suffered during storage by pulse beetle which causes heavy losses both quantitatively and qualitatively. The sad experiences of pest control with pesticides in storage have compelled the entomologist to revive reform and improve our indigenous pest control methods which are safer and economic. In recent years it has been realized that major emphasis should be given to plant based grin protectants. In past both powder and oils were used as grain protectants. Earlier it was proved that great losses caused by pulse beetles can be avoided if the vegetable oils smeared on the pulses. Parsai *et al.* 1994, Sharma *et al*. 1999, Srivastava *et al*. (1988) also suggested the use of mentha oil 0.2% which was effective in control of *C. Chinensis*. Therefore, an experiment was conducted to understand the effect of certain oils powders and non toxic materials on pulse beetle *C. Chinensis* attacking pigeon pea under laboratory condition

Materials and Methods

Stock culture of *Callosobruchus chinensis* was maintained on pigeon pea seed at 27±1 ^{0} C and 75±5% relative humidity. Pigeon pea variety KDF 2 seed was treated with different vegetable oils *viz*., neem oil, mustard oil menthe oil and clove oil @ 3 ml and 5 ml/ kg seed and some non toxic materials *viz*., asafoetida, camphor, turmeric powder, Hg tablet and naphthalene balls @ 1g and 2g/ kg seed and tested as seed protectant against *C. chinensis*. Oils, powder and non toxic materials were thoroughly mixed with required quantity of seed in plastic containers by manual operation sub sampled in three replications of 50 g of seed each and infected with 5 pairs of 24 hours old adults. All jars were kept under the room temperature of 27+ 1 ^{o}C and 75+5% relative humidity.

In order to find out the effect of oils,

powders and non toxic materials on mortality, egg laying, adult emergence, weight loss and germination of the seed, different experiments were set. Adult mortality count was made regularly. Observation on number of eggs laid was recorded after 10 days of the release of adults in each tube and number of eggs laid per female was also recorded. Progeny adults were recorded when the emergence of adults count. The per cent adult emergence was recorded on the basis of eggs laid/ sample the emergence was over the weight of damaged seed were taken separately and measured as per cent weight loss. The effect on germination of the seed after 90 days of treatment was studied and data regarding per cent germination were recorded.

Results and Discussion

The data on pigeon pea seeds treated with different vegetable oils *viz*., neem, mustard, menthe and clove oils @ 3 ml/ kg and 5 ml/ kg seed and non toxic materials viz., asafoetida, camphor, turmeric powder, Hg- tablet and naphthalene ball @ 1 g and 2 g/ kg seed presented in the No. 1 indicated that in lower dose cent per cent mortality was observed on the seeds treated with clove oil which did not differ significantly from the seed treated with neem oil, Hg- tablet and naphthalene balls in which the mortality increased up to 96.66% in each but these were found to be significantly better in increasing adult mortality than the mentha oil, mustard oil, camphor, asafoetida and turmeric powder being 83.33, 83.33, 80.00, 60.00 and 36.00%, respectively (Table 1). Significantly higher percentage mortality was recorded on all the treatments in comparison to control (13.33). As regards the seed treated with higher dose i.e. 5 ml oil and 2 g non toxic materials/ kg seed have almost similar trend as in case of 3 ml oil/ kg and 1.0 g non toxic material/ kg seed but slightly increased with adult mortality. In general all the oils, powder and non toxic materials proved to be very effective in increasing adult mortality. Similar to these finding Ali *et al*. (1983) found better results from neem oil, and mustard oil. They obtained that lower dose (0.5 ml/100 g seed) is less effective than higher dose (1.0 ml/100 g seed) which increasing adult mortality up to 100%. Kochare *et al*. (1994) found that different vegetable oil at 0.5, 0.75 and 1.0% gave good results in insect mortality. Srivastava *et al*. (1988) also suggested the use of menthe oil 0.2% which was effective in control of *C. Chinensis*.

Table 1 Effectiveness of different seed protectants against *Callosobruchus Chinensis*

Treatment	Mortality after 3 days		Fecundity		Adult emergence		Per cent weight loss		Percent germination	
	Lower dose	Higher dose	Lower dose	Higher dose	Lower dose	Higher dose	Lower dose	Higher dose	Lower dose	Higher dose
Neem Oil	96.66 (83.85)	99.66 (83.85)	2.45 (1.71)	1.64 (1.45)	1.33 (1.34)	0.66 (0.81)	1.86 (7.85)	0.66 (4.67)	96.00 (80.67)	98.66 (86.15
Mustard Oil	83.33 (66.14)	90.00 (74.99)	2.22 (1.57)	1.69 (1.46)	1.33 (1.34)	1.33 (0.93)	1.60 (7.25)	0.86 (5.33)	94.66 (76.83)	97.33 (82.31)
Mentha Oil	83.33 (66.63)	86.66 (72.28)	2.57 (1.75)	2.47 (1.72)	1.34 (1.34)	0.66 (0.88)	1.20 (6.26)	1.53 (7.08)	96.00 (80.67)	96.00 (80.67)
Clove Oil	100 (90.00)	100.00 (90.00)	1.25 (1.32)	1.21 (1.30)	1.32 (1.35)	1.22 (1.37)	1.60 (7.40)	1.40 (6.71)	96.00 (80.67)	94.66 (76.83)
Asafoetida	60.00 (50.85)	80.00 (63.92)	14.25 (3.83)	11.06 (3.38)	21.33 (4.52)	12.66 (4.46)	3.20 (10.28)	1.86 (7.77)	92.00 (73.93)	90.66 (72.81)
Camphor	80.00 (63.92)	90.00 (74.99)	1.68 (1.48)	1.68 (1.45)	1.35 (1.34)	1.00 (1.22)	2.40 (8.90)	1.60 (7.26)	97.33 (82.31)	94.66 (76.83)
Turmeric	36.00	60.00	20.32	19.38	26.00	18.00	6.20	3.73	94.66	93.33

Powder	(37.22)	(50.84)	(4.55)	(4.44)	(5.11)	(4.18)	(14.14)	(11.13)	(76.83)	(75.21)
Hg- Tablet	96.66 (83.85)	100.00 (90.00)	1.31 (1.34)	1.35 (1.35)	1.00 (2.22)	0.65 (0.81)	1.00 (5.65)	0.80 (5.02)	92.00 (73.92)	88.00 (69.91)
Naphthalene Ball	96.66 (83.85)	100.00 (90.00)	2.44 (1.71)	1.16 (1.29)	1.33 (1.35)	0.32 (0.41)	1.53 (7.06)	0.93 (5.45)	97.33 (82.31)	96.00 (80.67)
Control	13.33 (21.08)	13.31 (21.14)	21.49 (4.67)	20.58 (4.58)	48.00 (6.85)	46.33 (6.67)	9.20 (17.64)	9.73 (18.17)	98.66 (86.15)	98.66 (86.15)
S.E.	6.23	7.77	00.16	0.16	0.51	0.78	0.52	0.74	5.16	4.82
CD	13.01	16.21	00.33	0.33	1.08	1.63	1.08	1.55	10.78	10.06

It is obvious from the present results that minimum number of egg (1.25) were recorded on the seed treated with clove oil followed by Hg-tablet (1.31), camphor (1.68) but significantly superior to naphthalene balls (2.44), neem oil (2.45) and menthe oil (2.57) where as in higher dose, the minimum number of eggs (1.16) were recorded by clove oil (1.21), Hg- tablet (1.35) neem oil (1.64), camphor (1.68) and mustard oil (1.69) but these were significantly superior to asafoetida (11.06) and turmeric powder (19.38). It is clear that all the oils, camphor, Hg-tablet and naphthalene ball were found to be more effective in reducing the egg laying of the adult beetle. Similar to these finding, Doharey *et al*. (1990) also concluded that the edible oils provided complete protection in egg laying. Considerably reduced oviposition was reported by Parsai *et al*. (1994) on pigeon pea seeds treated with mustard, sesame and soybean oils at 0.25, 0.50, 0.75, and 1.00% with maximum effect at 1.00%. Sharma *et al*. (1999) observed the number of eggs laid by *C. Chinensis* on pigeon pea was comparatively low when 0.75 and 1.0% different mustard oils were used. Ratnasekera & Rajapakse (2009) also reported that mustard oil and domba oil showed a lower rate of oviposition than that of mentha oil, castor oil and batu oil.

The adult emergence has been found to be effectively checked by various treatments. It was minimum 1.0% on seed treated with Hg- tablet followed by clove oil (1.32), neem oil (1.33), mustard oil (1.33), naphthalene balls (1.33), metha oil (1.34) and camphor (1.35). These treatments were found to be different in respect of less emergence in comparison to the asafoetida and turmeric powder. In higher dose the emergence of the adult beetle was found to be less on the seeds treated with neem oil (0.66, mentha oil (0.66), camphor (1.00), clove oil (1.22) and mustard oil (1.33). It may be concluded that all the oils, Hg- tablet and naphthalene balls proved to be more effective in reducing the adult emergence. Sharma *et al*. (1999) also recorded a decrease in adult emergence on pigeon pea seeds treated with 0.50, 0.75 and 1.00% of different mustard oils. Similarly Ratnasekera and Rajapakse (2009) also reported that all the oil treatments except sesame oil had significantly reduced adult emergence at 18 DAT.

The seed treatment with lower dose of different grain protectant i.e. Hg -tablet, menthe oil, naphthalene balls, mustard oil and neem oil which registered the less weight loss having 1.00, 1.20, 1.53, 1.60 and 1.86%, respectively while more weight loss was recorded on the seeds treated with asafoetida (3.20) and turmeric powder (6.20). Minimum percentage in weight loss was observed on the seeds treated with higher dose of neem oil (0.66), Hg tablet (0.80), mustard oil (0.86), naphthalene balls (0.93), clove oil (1.40), mentha oil (1.53) and camphor (1.60%) while maximum grain weight loss was recorded on the seed treated with asafoetida and turmeric powder. Mital (1971) also observed minimum loss in grain weight when seed were

treated with oils. Kumar *et al*. (1990) evaluated some vegetable oil and found effective for reduction in per centage of loss in grain weight. Yadav *et al*. (2004) reported that the neem oil, karanj oil and ground nut oil were effective in reducing seed damage and seed weight loss were less than 1% in seed treatment with these oil. Biswas *et al*. (2010) also recorded green gram seeds treated with neem, mustard and castor oil and naphthalene ball showed significantly lower percentage of infestation over control.

The observed data indicated that there was no significant difference in per cent germination of seed treated with various seed protectants with both the doses. The germination per cent recorded in the seed treated with lower dose ranged from 92.00 to 98.66%. Slightly reduction in germination was observed on the seed treated with higher dose ranging from 88.00 to 98.66%. Similarly Singhal & Singh (1990) also reported no adverse effect on germination of chick pea seeds treated with mustard and rapeseed oils at 1, 3 and 5 ml/ kg seed. Similarly to these finding Sharma *et al*. (1999) also observed no adverse effect on germination of pigeon pea seeds treated with different species of rapeseed and mustard @ 0.50, 0.75 and 1.00%. Biswas *et al.* (2010) also recorded highest per cent germination on the green gram seed treated with naphthalene balls which was significantly different from neem, mustard and castor oil treated seeds.

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