



EVALUATION OF PLANT POWDER/ OIL AGAINST PULSE BEETLE (*CALLOSOBRUCHUS CHINENSIS* L.) ON GREEN GRAM

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ABSTRACT

Six plant powders viz. neem leaf powder, neem seed powder, neem cake powder, curry leaf powder, chili fruit powder and bael leaf powder each at 5 g/ kg and mustard oil at 5 ml/ kg of powder grains were evaluated for their effectiveness as grain protectants against *Callosobruchus chinensis* on green gram in storage. The results revealed that mustard oil and neem seed powder were more effective. The order of efficacy of remaining treatments was neem cake > neem leaf powder > curry leaf powder > chili fruit powder > bael leaf powder which were significantly superior over control. It was also found that treatments do not affect the germination of seeds.

Key words: *Callosobruchus chinensis*, green gram, botanicals, mustard oil, neem based treatment

Green gram (*Vigna radiate* L.) is one of the important pulse crops grown in India after chickpea and pigeonpea. It is highly nutritious and also helps in improving soil fertility status (Ashraf and Shahbaz, 2003). *Callosobruchus* spp. (Chrysomelidae, Coleoptera) is a serious pest which poses a great threat to pulses both in storage and field. The insect passes its developmental stage in a single seed where it causes losses in weight, nutrition, germination, moisture etc., thus decreasing its marketing as well as nutritive value of commodity. In storage 55-60% losses in seed weight and 45.5 to 66.3% losses in protein content was due to bruchid infestation (Gujar and Yadav, 1978). The germination of these grains was also found to be lost when it was eaten by the pest (Ahmed et al., 2003). The use of insecticidal protectants is a common preventive measure to protect stored grain from insect's damage. But usage of chemical insecticides under storage is not safe for consumption due to its hazardous effects and also pulse beetle is developing resistance to many insecticides and inducing pest outbreak due to pest resistance. In contrast, the use of plant extracts/oil is gaining importance in the present scenario as they are affordable, safer and biodegradable. Therefore, studies were undertaken to evaluate the effect of plant powder/oil against pulse beetle on green gram under laboratory condition and to find the viability of the treated seeds.

MATERIALS AND METHODS

A laboratory experiment was conducted at Department of Entomology, Dr. RPCAU, Pusa, Bihar

(25°59'05.1" N, 85°40'26.4" E) during Rabi 2019-20 on green gram variety HUM-16. The average room temperature and relative humidity was 32.26 to 24.87° C and 89.19 to 75.16%, respectively. The plant materials used as treatments were neem leaf powder, neem seed powder, neem cake, curry leaf powder, chili fruit powder and bael leaf powder each at 5 g/ kg of seed, mustard oil at 5 ml/kg of seed and control. Each treatment was replicated thrice. The plant materials were collected, dried in shade for one week, processed into powder and sieved through a mesh of size 50 to get fine and uniformity except mustard oil and neem cake powder which was purchased as such from local market. The botanicals were then thoroughly mixed with the samples of 1 kg green gram.

The insects of *C. chinensis* were collected from local market, carefully identified and separated on the basis of morphological character. It was reared separately to get pure, uniform and uniparental culture. After 7 days of treatment, five pairs of freshly emerged adult beetles (0-24 hr) from this uniparental culture were released to each treatment. The treated and inoculated receptacles were covered with white muslin cloth for proper aeration and were kept undisturbed in laboratory condition. Observations on % seed damage and % germination were recorded after 30, 60, 90 and 120 days of treatment by taking 1000 number of seeds and the effects of treatments over control were calculated. The data obtained were then analyzed statistically. The design used for the study was Completely Randomized Design with three replication.

RESULTS AND DISCUSSION

The results obtained on seed damage (%) stated that all the treatments were superior over control (98.93 %) (Table 1). Among all the treatments, mustard oil was found to be highly effective during entire study period followed by neem seed powder. Effectiveness of different treatments at the end of experiment was mustard oil 5 ml > neem seed powder 5 g > neem cake 5 g > neem leaf powder 5 g > curry leaf powder 5 g > chili fruit powder 5 g > bael leaf powder 5 g/ kg of seed (Table 1). The result is in accordance with Ratnasekera and Rajapakse (2009), Khalequzzaman et al. (2007) and Venkatsham et al. (2014) who reported that mustard oil is highly effective in reducing damage against pulse beetle because of its harmful effect. It is also in accordance with Rathod et al. (2012) who reported that neem leaf and kernel powder decrease the infestation of *Callosobruchus* species by decreasing the number of eggs laid by female. Tiwari et al. (2013) and Venkatesham et al. (2014) reported that curry leaf powder and chilli fruit powder were least effective in protecting grain from pulse beetle. The active compound present in the above plant products offer ovicidal activity, repellent properties which protect the pulse seed against pulse beetle attack. Although the results obtained depicts that, by treating the seed with different plant products pulse grain can be protected from the attack of *C. chinensis*

but the effectiveness of all these treatments was slowly reduced as illustrated by the increase in % seed damage (Table 1). This observation is in confirmation with the result of Tripathy et al. (2001) and Singh and Yadav (2003) who have stated that the efficacy of plant products extended for a short period and Jat et al. (2013) stated that with increase in storage period the loss will also increase.

The germination percentage of untreated seed 96.33% before storage which reduced tremendously to 0.67% at 120 days after treatment. These findings were in confirmation with the result of Dhorey et al. (1987) who observed that after 120 days after treatment there was cent % loss in germination of black gram seed affected by *C. chinensis*. Generally germination is the combined effect of botanicals treatment as well as *C. chinensis* infestation on the seed. The initial germination of treated seed was varied from 95 to 97.67%. At the end of experimental period the germination % was found to be reduced in all the treatments due to increase in the pest population and damage caused by them but the germination percentage in treated seed is more than that of untreated seed. This showed that the botanical does not have any harmful effect on seed germination. These findings are in accordance with Tandon et al. (2004), who reported that seed treated with plant extracts did not affect the seed germination. Ramazeame

Table 1. Effect of botanicals on % seed damage in green gram

Sl. No.	Treatments	Dosage per kg	% seed damage*				% seed germination*			
			30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT	120 DAT
T1	Neem leaf powder	5g	4.17 (11.78)	13.20 (21.30)	26.97 (31.28)	36.90 (37.41)	93.00 (74.66)	83.33 (65.92)	70.67 (57.21)	63.67 (52.94)
T2	Neem cake	5g	3.07 (10.08)	9.90 (18.34)	21.47 (27.60)	31.83 (34.35)	93.33 (75.05)	87.00 (68.88)	76.33 (60.89)	68.00 (55.55)
T3	Neem seed powder	5g	1.93 (7.99)	3.93 (11.44)	9.97 (18.40)	14.20 (22.14)	95.33 (77.54)	91.67 (73.25)	87.33 (69.16)	83.00 (65.66)
T4	Bael leaf powder	5g	7.53 (15.93)	25.73 (30.48)	47.70 (43.68)	52.77 (46.59)	87.33 (69.18)	70.67 (57.21)	50.00 (45.00)	48.00 (43.85)
T5	Chili fruit powder	5g	7.27 (15.64)	23.67 (29.11)	45.70 (42.53)	51.93 (46.11)	88.00 (69.74)	72.33 (58.27)	48.33 (44.04)	47.00 (43.28)
T6	Curry leaf powder	5g	5.87 (14.02)	16.77 (24.17)	30.50 (33.52)	40.03 (39.25)	90.67 (72.22)	77.67 (61.81)	64.00 (53.13)	57.00 (49.02)
T7	Mustard oil	5ml	0.83 (5.23)	1.60 (7.26)	3.03 (10.03)	4.23 (11.87)	92.00 (73.59)	89.00 (70.64)	87.33 (69.16)	86.33 (68.31)
T8	Control	-----	15.13 (22.89)	55.57 (48.20)	92.20 (73.79)	98.93 (84.10)	82.33 (65.16)	37.33 (37.66)	8.33 (16.73)	0.67 (3.91)
SEm±			0.12	0.07	0.11	0.17	0.52	0.597	0.447	0.757
CD (0.05)			0.36	0.21	0.31	0.50	1.54	1.789	1.342	2.271

DAT: Days after Treatment; *Mean of three replications; Figures in bracket arc sine transformed value

et al. (2014) reported that the germination percentage will decrease in both treated and untreated seeds as the storage period increase and highest germination % was found in the seed treated with neem kernel powder. Hence, the botanicals have not only showed its effectiveness against *C. chinensis* but also it does not cause any harm in germination percentage of seed. Mustard oil 5 ml/ kg, neem seed powder 5g/ kg can be used for successful protection of green gram seeds but all these treatments were found to be economical.

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AUTHOR CONTRIBUTION STATEMENT

SPNS designed the research, guided in implementation and collecting desired material. SL conducted the experiment, collected the above research data and wrote the manuscript. The information or data is further checked and revised by MKS and SPNS. All authors read and approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

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