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RESEARCH ARTICLE **OPEN ACCESS**

TOXIC EFFECT OF NEEM LEAF POWDER (*AZADIRACHTA INDICA*, A.JUSS) AGAINST *CALLOSOBRUCHUS CHINENSIS* INFESTATION (BRUCHIDAE: COLEOPTERA) ON THE GREEN GRAM (*VIGNA RADIATA*) SEEDS

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ABSTRACT

The Bruchidae, as a family are almost entirely dependent upon legume seeds as a food source for the larvae and thus several species have become pests on legume seeds. The selected stored pest *Callosobruchus chinensis* was commonly found in stored grains. Neem leaves were collected, sun dried and powdered sin an electrical ground to get fine powder. The leaf powder was saved using 1mm mesh so as to remove larger particles. On the basis of the study on the physical and biological parameters in treated green gram seeds against *Callosobruchus chinensis* with three different concentrations at the interval of 10, 20, and 30 days, it was inferred that the neem leaf powder play a vital role in controlling the infection of *Callosobruchus chinensis* in stored seeds. It was inferred that both the neem products (NLP and NSAP) play a vital role in controlling the infestation of *C.chinensis* in stored seeds. Among the treatments, NLP treatments were found to be effective in destroying the pest. This might probably be due to the burning of neem stem to ash, which reduced the biocidal properties of neem products.

Key words: Neem leaf powder, toxic effect, *Callosobruchus chinesis, Vigna radiate* seeds.

INTRODUCTION

Pulses are our main food, which provide strength and energy for the metabolic activities. They contain protein, which is almost three times higher than in cereals. Such significant pulses can be heavily damaged by bruchids. It is necessary to protect them during storage, as most farmers cannot afford synthetic insecticide, a cheap, safe, alternative which is easy to use is needed. Over 100 insect species are reported to infest the crop. The estimated loss to world supply of a stored grain from insect damage ranges from 5 – 10% of the world's production. Pulses are more difficult to be stored than cereals as these suffer a great damage during storage due to the insect pests and microorganisms (Adams and Schulter, 1978).

The Bruchidae, as a family are almost entirely dependent upon legume seeds as a food source for the larvae and thus several species have become pests on legume seeds. The pulse production is adversely affected by *Callosobruchus chinesis* which is the most destructive pest. Vir *et. al*. (1981) and Sheokand *et al.* (1993) reported a loss of 45% due to the Pest destruction. Several conventional

insecticides such as endosulfan, monocrotophos, quinalphos, etc. are found to be effective against this pest (Daware and Dhanorkar, 1981) but recently it was reported that the pests have developed resistance towards these insecticides (Jayaswal, 1990: Phokela *et al.,* 1990 and Lande, 1992).

The botanical pesticides are safer to be in the pest control program and may prevent several adverse effects caused due to synthetic insecticide applications (Raja Sekaran and Kumarasamy, 1985). Hence, the present studies were carried out to know the efficacy of neem leaf and neem stem ash powder for the management of *Callosobruchus chinensis* on green gram (*vigna radiata*) seeds.

MATERIAL AND METHODS

The selected stored pest *Callosobruchus chinensis* was commonly found in stored grains. Neem leaves were collected, sun dried and powdered sin an electrical ground to get fine powder. The leaf powder was sieved using 1mm mesh so as to remove the larger particles.

French green gram (*Vigna radiata*) was purchased from Tamil Nadu Agricultural university Research Institute, Coimbatore and sterilized at 28 ± 2^0C to avoid any least infestation. Seeds were treated with the neem leaf powder. The treatment doses selected were 0.3, 0.5 and 0.7 mg/100g seed concentration. The green gram (100 g) was taken in plastic containers and desired quantity of neem leaf powder was poured on them. The plastic containers were shaken horizontally for 5 minutes to ensure a uniform coating of neem leaf powder on the seeds. The mixing for each dose was replicated thrice. Untreated seeds served as control. After treatment (4-6 hrs) with neem product, five pairs of newly emerged beetles were released in the jar (100 gm seeds) and covered with a muslin cloth, held tight with a rubber band (Satya vir, 1983). After 10, 20, and 30 days interval, the green gram seeds treated with different concentrations of neem leaf powder were tested for the protective effect on them. The physical parameters (colour, hardness, number of the bore holes, percent weight loss and protection of seeds) and biological parameters (number of eggs laid, number of adult emergence, percent adult mortality percent reproductive success) and growth index were analyzed.

RESULTS AND DISCUSSION

At 10 days exposure, the green gram coated with neem leaf powder showed no change in colour at all concentration. After 20 days, the colour changed from shiny dark green to light green and become dull green after 30 days of treatment.

The seeds become comparatively less hard due to the infestation of pests with the increasing dosage and duration when compared to the control .

Maximum bore holes was observed in untreated seeds than the neem treated ones at all concentration, Neem leaf powder remarkably reduced the number of bore holes in increased concentrations.

After 30 days of exposure, there was a lesser reduction of weight loss than the control. In the present study, the efficacy of neem leaf powder afforded better protection in green gram seeds against the infestation of pulse beetle, *Callosobruchus chinensis.* It was observed that neem leaf powder was found to be effective in checking seed damage, percent weight loss, percent protection of seeds, egg laying, adult emergence, percent adult mortality, percent reproductive success and growth index than the control (Tables 1-6). This might be due to the presence of a key compound azadirachtin that works as an insect feeding deterrent and also as an inhibitor of ecdysis and growth. (Doharey and Singh, 1989 and Sharma et al., 1980).

From the results obtained in this study, it is quite evident that *C. chinensis* a serious pest of green gram could effectively be controlled with high dosage of neem products especially the NLP.

In the present study, the coating of NLP and NSAP on green gram seeds at different concentrations afforded protection from damage of *C. chinensis.* The number of eggs laid / seed was less with increasing concentration and was directly proportional to the period of exposure. The maximum reduction in adult emergence noticed in NLP at 0.7mg / 100mg seeds concentration was found to be consistently effective due to the presence of azadirachitin in causing the larval mortality failure of adult emergence. The population growth of the pulse beetle *C. chinensis* reared on green gram after

treatment was significantly lower and percent adult mortality was high when compared to the control.

The highest growth index was noticed in treating green gram seeds and this might be due to the variation in grub development in the green gram. Similar reports were given by Singh & Sharma (2002) in green gram against *C.chinensis.*

Table 1. The number of bore holes / seed damage by *Callosobruchus chinensis* in treated green gram seeds withdifferent concentrations of NLP & NSAP after 10, 20 and 30 days exposure.

Period	**Green gram**					
	10 Days		**20 Days**		**30 Days**	
Concentration (mg / 100gm seeds)	**NLP**	**NSAP**	**NLP**	**NSAP**	**NLP**	**NSAP**
0.3 Mean ± 't' value	Nil	Nil	2.1 6.82***	2.5 3.28***	2.9 3.65***	3.2 1.89*
0.5 Mean ± 't' value	Nil	Nil	1.7 7.40***	2.2 5.30***	2.1 7.83***	2.6 5.84***
0.7 Mean ± 't' value	Nil	Nil	1.1 12.60***	1.5 7.96***	1.5 9.00***	2.0 9.80***
Control Mean ±	Nil	Nil	3.2	3.6	3.6	3.6

Significant level

$p < 0.05^{*}$ $p < 0.01^{**}$ $p < 0.001^{***}$

Table 2. Percent weight loss in green gram seeds infested by *Callosobruchus chinensis* after 30 days treatment with NLP & NSAP.

Concentration (mg / 100gm seeds)	**Green gram**					
	NLP			**NSAP**		
	Initial weight	**Final weight**	**Weight loss (%)**	**Initial weight**	**Final weight**	**Weight loss (%)**
0.3 't' value	100	87.3	12.7 4.2***	100	83.6	16.4 1.6*
0.5 't' value	100	90.2	9.8 6.5***	100	86.1	13.9 3.0**
0.7 't' value	100	96.5	3.5 7.8***	100	93.5	6.5 6.3***
Control	100	80.9	19.1	100	80.9	19.1

Significant level

$p < 0.05^{*}$ $p < 0.01^{**}$ $p < 0.001^{***}$

Table 3. The number of eggs laid and adult emergence of *Callosobruchus chinensis* in NLP and NSAP treated green gram at different concentrations after 10, 20 and 30 days exposure.

Period	**10 Days**				**20 Days**				**30 Days**			
Concentration (mg / 100 gm seeds)	NLP		NSAP		NLP		NSAP		NLP		NSAP	
	No. of eggs laid	No. of adults emerged	No. of eggs laid	No. of adults emerged	No. of eggs laid	No. of adults emerged	No. of eggs laid	No. of adults emerged	No. of eggs laid	No. of adults emerged	No. of eggs laid	No. of adults emerged
0.3 mean ± 't' value	2.3 3.57* **	Nil	2.5 2.33*	Nil	2.8 2.68* *	1.8 3.07*	3.1 2.61* *	2.1 2.54**	3.4 4.02** *	2.5 3.28**	3.9 2.19*	2.8 2.12*
0.5 mean ± 't' value	1.8 4.37* **	Nil	2.1 4.09* **	Nil	2.3 5.81* **	1.4 4.83** *	2.7 4.02* **	1.8 3.57**	2.9 7.67** *	1.7 5.96** *	3.3 4.62* **	2.2 5.30** *
0.7 mean ± 't' value	0.9 6.17* **	Nil	1.1 6.14* **	Nil	1.4 9.52* **	0.8 6.11** *	1.9 8.88* **	1.2 5.96** *	2.0 10.77 ***	1.1 6.83** *	2.5 7.96* **	1.6 6.19** *
Control mean ±	3.2	Nil	3.2	Nil	3.6	2.7	3.6	2.7	4.3	3.2	4.3	3.2

Significant level

$p < 0.05^{*}$ $p < 0.01^{**}$ $p < 0.001^{***}$

Table 4: Percent of adult mortality of *Callosobruchus chinensis* in treated green gram seeds with different concentrations of NLP and NSAP after 10, 20 and 30 days exposure.

Period Concentration (mg / 100 gm seeds)	**Green gram**					
	10 Days		**20 Days**		**30 Days**	
	NLP	**NSAP**	**NLP**	**NSAP**	**NLP**	**NSAP**
0.3 (%)	Nil	Nil	33.33	23.80	32	25
0.5 (%)	Nil	Nil	50	33.33	52.94	36.36
0.7 (%)	Nil	Nil	100	58.33	100	62.50
Control (%)	Nil	Nil	3.70	3.70	9.37	9.37

Table 5. Percent reproductive success of *Callosobruchus chinensis* in treated green gram seeds with different concentrations of NLP and NSAP after 10, 20 and 30 days exposure.

Period	Green gram					
	10 Days		20 Days		30 Days	
Concentration (mg / 100 gm seeds)	**NLP**	**NSAP**	**NLP**	**NSAP**	**NLP**	**NSAP**
0.3 (%) 't' value	Nil	Nil	64.28 10.22^{***}	67.74 11.64^{***}	73.52 0.35^{NS}	71.79 1.03^{NS}
0.5 (%) 't' value	Nil	Nil	60.86 21.36^{***}	66.66 10.98^{***}	62.62 6.34^{***}	66.66 3.09^{***}
0.7 (%) 't' value	Nil	Nil	57.14 15.58^{***}	63.15 18.19^{***}	55.0 6.75^{***}	64.0 3.95^{***}
Control (%)	Nil	Nil	75	75	74.41	74.41

Significant level

NS = Not significant $p < 0.05^{*}$ $p < 0.01^{**}$ $p < 0.001^{***}$

Table 6. Growth index of *Callosobruchus chinensis* in treated green gram seeds with different concentrations of NLP and NSAP after 10, 20 and 30 days exposure.

	Green gram					
Period	**10 Days**		**20 Days**		**30 Days**	
Concentration (mg / 100 gm seeds)	**NLP**	**NSAP**	**NLP**	**NSAP**	**NLP**	**NSAP**
0.3 Mean ± 't' value	-	-	1.94 2.10^{*}	2.05 1.46^{NS}	2.22 0.14^{NS}	2.17 0.38^{NS}
0.5 Mean ± 't' value	-	-	1.84 2.86^{**}	2.02 1.67^{NS}	1.77 2.29^{*}	2.02 1.55^{***}
0.7 Mean ± 't' value	-	-	1.73 2.56^{***}	1.91 2.63^{**}	1.66 2.38^{*}	1.93 2.16^{***}
Control Mean ±	-	-	2.27	2.27	2.25	2.25

Significant level

NS = Not significant $p < 0.05^{*}$ $p < 0.01^{**}$ $p < 0.001^{***}$

Conclusion

It was inferred that both the neem products (NLP and NSAP) play a vital role in controlling the infestation of *C.chinensis* in stored seeds. Among the treatments, NLP treatments were found to be effective in destroying the pest. This might probably be due to the burning of neem stem to ash, which reduced the biocidal properties of neem products.

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