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Bioefficacy of botanicals on pulse beetle (*Callosobruchus chinensis* L.) of stored green gram seeds

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Abstract
Callosobruchus chinensis is a major stored pest of pulses in India. Efficacy of botanicals against pulse beetle in stored green gram was studied at the laboratory of Department of Entomology, Faculty of Agricultural Sciences, SOADU, Bhubaneswar during the month of June to January in the year 2019-20. Eight treatments including untreated (control), comprising of Tulsi leaf powder (5g/kg seed), Neem leaf powder (5g/kg seed), Black pepper seed powder (5g/kg seed), Sweet flag (*Acorus calamus*) rhizome powder (5g/kg seed), Dry chilli powder (5g/kg seed), *Lantana camara* leaf powder (5g/kg seed) and Tobacco leaf powder (5g/kg seed) were used against adult pulse beetle, *C. chinensis* in stored green gram seed. Effect of seven botanicals on mortality of *C. chinensis* Linn. were studied. Observations were taken on 2, 4 and 6 days after treatment. Among all the plant products, neem leaf (5g/kg seed) was found more effective with 35.63 % mortality whereas black pepper powder (5g/kg seed) was found least effective with 10.25 % mortality.

Keywords: bioefficacy, neem leaf, *Callosobruchus chinensis*, black pepper seed powder

Introduction
The importance of the storage life of seeds, for retaining them as viable seed and unspoiled food reserves, are known. Regardless of how the grains are stored, they are subjected to different storage insect pests, which affect their nutritive value of grains. The most vulnerable place is the farmer's store, both at farm and at home, where 60-70er cent of produce is retained. Losses are maximum here, since storage methods at the farm and at home are still traditional in several areas. Improper storage conditions affect the pulses, both in quantity and quality. Although attempts have been made to quantify the losses (Girish *et al.* 1975; Sudhakar *et al.* 1981; Vimala and Pushpamma, 1983) [1, 2, 3], very little research has been done on quantitative changes in stored pulses, especially on home level storage of pulses. Insects cause severe damages to stored grains, which are about 20-35per cent and 5-10 per cent in tropical and temperate zones, respectively. *Callosobruchus chinensis* is a common and major pest of stored legumes. Preferred hosts are *Vigna radiata* (mungbean), *Pisum sativum* (pea), *Vigna unguiculata* (cowpea), *Cajanus cajan* (pigeonpea), *Vigna unguilaris* (adzuki bean), *Lens culinaris* (lentil). It is distributed throughout the tropics and subtropics. It is dominant pest species on legumes in Asia. It was first described from China in 1758 due to which the name chinensis was given to the species. Synonyms of *C. chinensis* are *Mylabris chinensis* and *Bruchus chinensis* and common English names are Chinese bruchid, Oriental cowpea bruchid and Adzuki bean weevil. About 15 per cent damage to gram grain is estimated to be caused by these beetles, *Bruchus chinensis* and *Bruchus theobroma*, which while feeding scoop out the contents of grains. The pulse beetles assume serious proportions usually during July-August in the stores (Nakakita, 1998) [4].

Indiscriminate use of synthetic organic insecticides leads to several health hazards to human being and development of resistance against pesticide is alarming. Therefore, there has been an increased need to explore suitable alternative methods of pest control. A number of plant derived products are potential candidates. Plant products as insecticides will be eco-friendly and biodegradable. Because of universal compatibility, non-residual and non-toxic nature, it finds a key role in IPM. Bajya (2002), Sundria (2001) and Vyas and Motka (2005) [5, 6, 7] studied the efficacy of plant products as grain protectant against *C. chinensis* on different

pulses. With this view, the present experiment was carried out to study the efficacy of different botanicals in management of pulse beetle (*Callosobruchus chinensis* Linn.) in stored condition.

Material and Methods

Study site

Studies on the host preference of pulse beetle, *Callosobruchus chinensis* (Linn.) (Coleoptera: Bruchidae) on stored green gram were carried out in the laboratory of the Department of Entomology, Faculty of Agricultural Sciences, Siksha 'O' Anusandhan, Deemed to be University, Bhubaneswar during the year, 2019-2020. The materials used and techniques adopted for carrying out various experiments is presented in the current chapter.

Rearing of test insect in the laboratory

Adults were collected directly from mother culture of *C. chinensis* and introduced into green gram containing plastic jars and allowed them to lay eggs for seven days. Then adults were transferred into another set of containers and such procedure was repeated. At the time of release of pulse beetle in treatment, the culture was sieved before four days 0 to 4 day's old beetles. This culture was maintained in laboratory condition at 27 ± 2 ^{0}C and relative humidity 70-80 percent.

Observation taken on mortality

The treatment included were dried leaf powders Tulsi leaf, Neem leaf, Black pepper seed, Sweet flag (*Acorus calamus*) rhizome, Dry chilli, *Lantana camara* and Tobacco leaf. A control without any admixtures was also taken. The plant products dried under shade, powdered in electric mixer, sieved and then mixed with clean and sterilized seeds of green gram at 55 ^{0}C for 4 hrs. to remove insect hidden infestation, if any, with doses (5 gram per kg of seeds). All the treatments were replicated thrice including the untreated grain samples of 1kg were kept in separate plastic containers. Ten pairs of freshly emerged (0-24 hrs old) adults of *C. chinensis* were released in each container and covered with muslin cloth on the top tied with rubber bands including the control. The bottles were suitably labeled and kept in incubator at a temperature of 28±1 ^{0}C and 70±5 relative humidity. Observations were recorded after 2, 4 and 6 days after treatment. The data obtained were statistically analysed by adopting suitable transformation.

Table 1: Treatments details

Sl. No.	Treatment	Dose/kg seed
1	Tulsi leaf powder	5g
2	Neem leaf powder	5g
3	Black pepper seed powder	5g
4	Sweet flag (*Acorus calamus*) rhizome powder	5g
5	Dry chilli powder	5g
6	*Lantana camara* leaf powder	5g
7	Tobacco leaf powder	5g
8	Untreated (control)	5g

Table 2: Relative efficacy of different plant products on *C. chinensis* on green gram

Treatment No.	Mean Mortality Rate			Total Mean
	2DAT	4DAT	6DAT	
T1	15.81 (4.03)*	17.01 (4.18)	19.09 (4.42)	17.30 (4.21)
T2	25.66 (6.11)	26.17 (5.16)	39.19 (6.30)	30.34 (5.52)
T3	9.00 (3.08)	10.65 (3.33)	11.12 (3.40)	10.25 (3.27)
T4	10.78 (3.35)	11.98 (3.53)	13.14 (3.69)	11.96 (3.52)
T5	9.04 (3.08)	11.90 (3.52)	12.63 (3.62)	11.19 (3.40)
T6	34.81 (5.94)	35.66 (6.01)	36.42 (6.07)	35.63 (6.00)
T7	11.91 (3.52)	14.04 (3.81)	15.37 (3.98)	13.77 (3.77)
T8	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)	0.00 (0.70)
F'Test	Significant			
SE(m)±	0.17			
CD at 5%	0.51			
CV	7.73			

*Figures in Parenthesis are corresponding Square root transformation value

Result and Discussion

Result presented in table 2 revealed that all treatments were found statistically superior over untreated control. The bioefficacy of all the seven plant products tested in this study significantly caused adult mortality of the pulse beetle 6 days after treatment in comparision to untreated (control). The percentage adult mortality was increased from 2nd day to 6th day of treatment with a dose of plant product at 5 g per kg of green gram seeds. The maximum mortality was recorded in the treatment of neem leaf powder (35.63%) at all the three doses but least mortality was reported from black pepper seed powder treatment (10.25%). Treatments like, T1 (Tulsi leaf powder), T4 (Sweet flag rhizome powder), T5 (Dry chilli powder) and T7 (Tobacco leaf powder) were at par.

These results are in conformity with the findings of Sunil Kumar (2003) [9] who reported that, sweet flag rhizome powder and custard apple seed powder recorded significantly minimum damage to seeds with 17.20 and 20.00 percent, respectively against *S. oryzae* in sorghum at 180 days after storage. Similar work was done by Jadhav (2006) [8] who reported that no seed damage was reported at 180 days after treatment when treated with *A. calamus* rhizome powder @ 1 percent, while custard apple seed powder, neem seed powder @ 5 percent and malathion 5D @ 5 percent recorded significantly less percentage of damaged seeds. Kudachi (2008) [10] who reported that, seeds treated with *A. calamus*

rhizome powder @ 1 percent was significantly superior with no damage to seeds. While, significantly maximum damage to seeds was noticed in untreated check (82.00 percent).

Conclusion

Thus, it is concluded from the present studies that, locally available plant materials like shade dried leaf powders of Tulsi, Neem, Black pepper seed, Tobacco, Dry chilli, *Lantana camara* and Sweet flag (*Acorus calamus*) rhizome were effective in reducing oviposition and give protection to green gram against the pulse beetle, *C. chinensis* Linn.

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