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Evaluation of botanical powders on pulse beetle, *Callosobruchus chinensis* (Linn.) in green gram (*Vigna radiata*)

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Abstract
Nine botanical plant powders like Neem, Tulasi, Notchi, Adhathoda, Bitter gourd, Black pepper, Turmeric, Ginger and Sweetflag were treated against pulse beetle, *C. chinensis*. After 24, 48 and 72 HAR of *C. chinensis*, the botanical powders like Turmeric and Ginger exhibited to be the maximum numbers of adults were oriented in green gram (13.00 & 15.33, 11.33 & 12.33, 9.66 & 10.00). Whereas, minimum number of adults oriented was recorded in Sweetflag, Notchi and Neem treated seeds (3.66, 5.00 & 7.00), (3.33, 4.00 & 5.33, 2.00) and (2.00, 2.66 & 4.00). Longevity was recorded to be high in male and female observed in Turmeric and Ginger 6.00, 7.33 and 7.00 and 8.33 respectively. Short longevity period was observed in Sweetflag treated seeds; whereas in male it was 1.33 and in female was 2.66 followed by Notchi and in Neem the longevity period of male and female was 2.33, 3.33 and 4.00, 5.00 respectively, while in control the longevity period of male and female was 10.00 and 11.33 days.

Keywords: Sweetflag, botanical powders, longevity, orientation preference

1. Introduction
The Pulse beetle, *Callosobruchus chinensis* (Coleoptera: Bruchidae) is a major pest of stored products like green gram, cowpea, chickpea and Bengal gram [3]. It causes substantial loss to pulses during storage period in house and as well as in godowns. The larvae destroy seeds by feeding inside partially or completely and making the seeds unfit for human consumption. Use of synthetic insecticides leads to serious problems of pest resistance, pest resurgence, residual toxicity, environmental and human health hazards [2]. Plant derived materials (Botanical Powders) are more readily bio-degradable, less toxic to mammals and are economically feasible. In this present study, nine botanical powders were tested against pulse beetle on green gram by using laboratory experiments like orientation preference under free-choice condition and longevity studies on adult pulse beetle (Both male & female) was carried out at PG laboratory, Department of Entomology, Annamalai University. The pulse beetle was reared on green gram seeds in a glass jar covered with muslin cloth (Fig.1). Nine botanical plant powders like Neem, Tulasi, Notchi, Adhathoda, Bitter gourd, Black pepper, Turmeric, Ginger and Sweetflag were prepared after shade drying of the desired plant parts and the required dosage is 2g of botanicals per 100g green gram seeds. Botanical powder treated seeds are free from pulse beetle attack. Keeping the above views in mind, the present study was conducted to evaluate the effect of botanical powders on pulse beetle in green gram.

2. Materials and Methods
2.1 Orientation Preference under Free choice condition
Hundred grams of green gram treated with different botanical powders and one untreated check was arranged in a circular manner in the glass trough of size (120 cm x 15 cm). 50 pairs of 10 day old males and females of *C. chinensis* were released in the centre of the glass and covered with muslin cloth (Fig.2). The experiment was replicated thrice. The number of adults oriented in each variety was recorded by counting the adults at 24, 48, 72 Hour after Release (HAR) [4].

2.2 Longevity Studies of pulse beetle

To study the life span of the adult male and female pulse beetle on seeds of green gram treated with different botanical treatments, 10g of treated seeds were kept in each glass vials and individual insect (male and female) was released in each vial [5]. The data on total life span duration was recorded daily in days (Fig.3).

3. Results and Discussion

After 24, 48 and 72 HAR of *C. chinensis*, the botanical powders like Turmeric and Ginger exhibited to be the maximum numbers of adults were oriented in green gram (13.00 & 15.33, 11.33 & 12.33, 9.66 & 10.00). Whereas, minimum number of adults oriented was recorded in Sweetflag, Notchi and Neem treated seeds (3.66, 5.00 & 7.00), (3.33, 4.00 & 5.33, 2.00) and (2.00, 2.66 & 4.00) (Fig.4). In control (Untreated check) highest number of adults (22.66, 34.66 & 41.00) were oriented (Table 1). Among the entire pulses, chick pea and green gram is the most preferred host for *C. chinensis*. The untreated seeds were preferred mostly by the pulse beetles than the treated seeds.

The longevity period of adult male and female was recorded daily after the application of different botanicals treated on green gram. Longevity was recorded to be high in male and female observed in Turmeric and Ginger 6.00, 7.33 and 7.00 and 8.33 respectively. Short longevity period was observed in Sweetflag treated seeds; whereas in male it was 1.33 and in female was 2.66 followed by Notchi and in Neem the longevity period of male and female was 2.33, 3.33 and 4.00, 5.00 respectively, while in control the longevity period of male and female was 10.00 and 11.33 days (Table 2). Female had a longer life span than male [1]. The adult life span for male was 4.76±0.64 days and 6.01±0.13 where as for female 8.36±0.12 and 9.13±0.09 days in average.

Table 1: Effect of botanicals on Orientation Preference of *C. chinensis* in Green Gram under Free-Choice test

Treatment	Orientation Under Free-Choice Condition		
	HAT*		
	24	48	72
T_1 - Neem	7.00 (2.645)^{b}	5.33 (2.308)^{ab}	4.00 (2.000)^{bc}
T_2 – Tulasi	8.33 (2.886)^{bc}	7.00 (2..645)^{c}	5.66 (2.379)^{cd}
T_3 – Notchi	5.00 (2.236)^{a}	4.00 (2..000)^{a}	2.66 (1.630)^{ab}
T_4 – Adhathoda	10.00 (3.162)^{c}	8.66 (2.942)^{cd}	7.66 (2.767)^{de}
T_5 - Bitter Gourd	7.33b (2.707)^{c}	6.33 (2.515)^{c}	5.00 (2.236)^{c}
T_6 - Black Pepper	9.66 (3..108)^{c}	6.33 (2.515)^{bc}	5.66 (2.379)^{cd}
T_7 – Turmeric	13.00 (3.605)^{d}	11.33 (3.366)^{de}	9.66 (3.108)^{e}
T_8 – Ginger	15.33 (3.915)^{d}	12.33 (3.511)^{e}	10.00 (3.162)^{e}
T_9 - Sweet Flag	3.66 (1.913)^{a}	3.33 (1.824)^{a}	2.00 (1.414)^{a}
T_{10} – Control	22.66 (4.760)^{e}	34.66 (5.887)^{f}	41.00 (6.403)^{f}
S.Ed	1.024	1.458	1.465
CD (0.05)	2.150	3.064	3.078

Mean of 3 replications, Values in parenthesis are square root transformed values, Values with various alphabets differ significantly, *Hours after Treatment

Table 2: Effect of botanicals on Longevity of *C. chinensis* in Green Gram

Treatments	Days	
	Male	Female
T_1 - Neem	4.00 (11.473)^{c}	5.00 (12.874)^{b}
T_2 – Tulasi	5.00 (12.874)^{cd}	5.66 (13.754)^{bc}
T_3 – Notchi	2.33 (8.741)^{b}	3.33 (10.491)^{a}
T_4 – Adhathoda	6.00 (14.141)^{de}	6.66 (14.948)^{cd}
T_5 - Bitter Gourd	4.66 (12.455)^{cd}	5.33 (13.335)^{bc}
T_6 - Black Pepper	5.00 (12.874)^{cd}	6.00 (14.173)^{bc}
T_7 – Turmeric	6.00 (14.141)^{de}	7.33 (15.698)^{de}
T_8 – Ginger	7.00 (15.336)^{e}	8.33 (16.766)^{e}
T_9 - Sweet Flag	1.33 (6.534)^{a}	2.66 (9.356)^{a}
T_{10} – control	10.00 (18.413)^{f}	11.33 (19.649)^{f}
SEd	0.873	0.686
CD (0.05)	1.834	1.441

Mean of 3 replications, Values in parenthesis are $\sqrt{x+1}$ sine transformed, Values with various alphabets differ significantly

Fig 1: Mass culturing of *C. chinensis*

Fig 2: Orientation Preference test (Free- choice Condition)

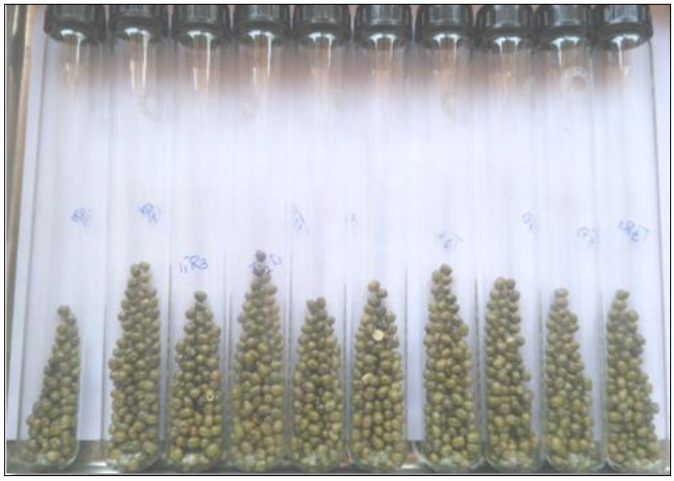

Fig 3: Longevity studies

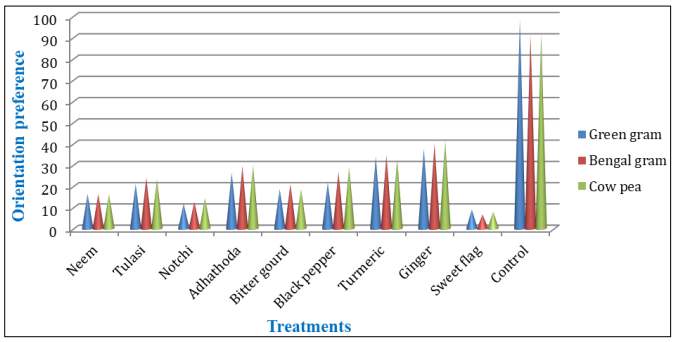

Fig 4: Orientation Preference of *C. chinensis* in Green Gram under Free-Choice test

4. Conclusion

Farmers are very familiar to Sweetflag rhizome powder. These materials are easier to prepare and apply than other products. Especially the use of botanicals, inert materials and edible oils could be considered as an integrated management for *C. chinensis*. Botanical extract based pest control technology is constrained by a number of socio-economic factors. Farmers have insufficient data on product effectiveness under farm conditions to convince themselves of the benefits. Therefore, extensive research work and detailed economic analysis from grassroot levels to macro levels are needed so that Government and other institutions could formulate policies on the vitality of botanical extract use.

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