

## Effect of Edible Plant Powders on Quality Characters of Treated French Bean Seeds Damaged by *Callosobruchus maculatus* F.

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A number of insect-pests attack the stored food grains/seeds having different patterns of behaviour and nutritional requirements. In India, food grain losses during storage approximate 10 per cent of the farms produce [1]. Among the important insect-pests of stored grains, the pulse beetle, *Callosobruchus maculatus* F. (Bruchidae: Coleoptera) is a major pest of economically important leguminous grains such as cowpea, lentil, green gram, black gram and frenchbean [2-6]. The use of synthetic organic pesticides for the control of insect-pests of stored seeds has led to the development of resistance, toxic residues in food grains [7, 8], besides being costly. Therefore, there is a need to develop safe alternatives with the use of conventional insecticides and fumigants to protect stored grains/ seeds from insect-pests infestation and its effect on quality parameters of seeds.

The use of plant products as grain protectants is an age old practice [9] and appears to be quite safe and promising [10]. Therefore, keeping above factors under consideration, the present study was undertaken to study the effect of plant powders on quality characters of treated french bean seeds infested with the pulse beetle.

The pure culture of *C. maculatus* was raised on French bean seeds (*Phaseolus vulgaris* L.) and maintained under controlled condition at  $27 \pm 1^\circ\text{C}$

and 70 per cent R.H. The freshly harvested seeds of French bean were sterilized in oven at  $55^\circ\text{C}$  for 4 hours as per method of Mookherjee *et al.*, [11]. The sterilized seeds were put in half kg capacity glass jars and 5 pairs of freshly emerged *C. maculatus* adults were released in the jars. The jars were tightly covered with muslin cloth and were kept in BOD incubator for raising the culture. The plant products namely rhizomes of turmeric (*Curcuma longa* L.), rhizomes of ginger (*Zingiber officinale* L.), seeds of black pepper (*Piper nigrum* L.), fruits and seeds of red chilli (*Capsicum annuum* L.) and fruits of aonla (*Emblica officinalis* L.) were sun dried and ground to obtain fine powder. There were five plant products viz. T<sub>1</sub>-Turmeric, T<sub>2</sub>-Ginger, T<sub>3</sub>-Black pepper powder, T<sub>4</sub>-Red chilli, T<sub>5</sub>-Aonla used to coat the seeds @ 1, 3 and 5 per cent concentration. Thorough mixing of these powders at all the proposed concentrations by vigorous shaking was done to treat the seeds in different plastic containers. Five pairs of the newly emerged adults of *C. maculatus* were released in each plastic container which was covered with muslin cloth and was tightened with rubber band. The treatments were maintained in three replications including Control (T<sub>6</sub>). After 7 days of exposure, all the adults were removed and the seed was kept upto 5 months under room temperature. After storage period of 5-months data on seed damage, seed weight loss

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and seed germination was recorded. The per cent seed damage was calculated by adopting the procedure given by Adams and Schulten [12]. Loss in seed weight was calculated by taking initial weight and final weight of the seed and per cent weight loss was calculated. The per cent seed germination was calculated by taking 100 seeds from each container. The seeds were sandwiched between towel paper as proposed by Sen and Ghosh [13]. The paper towel was then kept in seed germinator at  $25 \pm 1^\circ\text{C}$ . The germination percentage was calculated as per the ISTA procedure [14].

Data presented in Table 1 revealed that minimum mean seed damage (3.73 %) recorded in seed treated with black pepper powder was statistically superior to other treatments. The highest seed damage (11.88 %) was recorded in seed treated with aonla powder. The damage in control was as high as 99.56 %. All the treatments were statistically superior over control. Seed damage decreased as the dose of product was increased from 1 to 3 per cent. Minimum seed damage (2.62 %) was with black pepper powder at 5 per cent concentration as compared to 3.61 per cent and 4.95 per cent seed damage at 3 per cent and 1 per cent concentrations, respectively. The interaction studies on plant products and their concentrations, revealed the superiority of black pepper at 5 per cent concentration. It

was at par with black pepper 3 per cent and turmeric 5 per cent. The present results are in conformity with the results of Kumari and Singh [15] who reported black pepper powder effective in reducing damage to grains of mung bean caused by *C. chinensis*. Reuben [16] reported reduced damage to cowpea seeds treated with black pepper whereas Onu and Aliyu [17] found that chilli powder at 1 to 2 per cent mixed with cowpea seeds effectively reduced damage caused by *C. maculatus*.

Data tabulated in the Table 2 revealed that minimum weight loss (2.42 %) recorded in seed treated with black pepper powder was significantly superior to other plant product treatments while highest weight loss was recorded in seed treated with aonla powder. Weight loss recorded with black and red chilli powder at 5 per cent concentration was equally effective to its lower concentration and weight loss ranged from 1.62 to 9.59 per cent. Weight loss recorded at 5 per cent concentration with turmeric, ginger and aonla powders were at par with 3 per cent concentration and were superior to 1 per cent concentration. The present findings corroborate the findings of Aslam [18] who observed minimum weight loss with black pepper powder against pulse beetle infesting chickpea grains. Similar observations were reported by Onu and Aliyu [17] who reported that chilli

Table 1. Effect of edible plant products on French bean seed damage by *C. maculatus*

Treatments	*Mean seed damage (%) at concentration			
	1%	3%	5%	Mean
T <sub>1</sub> -Turmeric	9.02(17.47)	6.87(14.97)	4.07(11.63)	6.65(14.69)
T <sub>2</sub> -Ginger	10.04(18.46)	8.97(17.41)	6.13(14.31)	8.37(16.73)
T <sub>3</sub> -Black pepper	4.95(12.84)	3.61(10.95)	2.62(9.31)	3.73(11.03)
T <sub>4</sub> -Red chilli	10.87(19.23)	8.25(16.68)	6.70(14.82)	8.61(16.91)
T <sub>5</sub> -Aonla	19.09(25.90)	9.77(18.17)	6.78(15.08)	11.88(19.72)
T <sub>6</sub> -Control	99.56(86.42)	99.56(86.42)	99.56(86.42)	99.56(86.42)
Mean	25.06(30.05)	22.83(27.43)	20.97(25.26)	

\*Average of three replications figures in parentheses are arc sine transformation CD (P= 0.05)  
Treatment : (1.49); Concentration : (1.05); Treatment X Concentration : (2.59)

Table 2. Effect of edible plant powders on per cent weight loss of treated French bean seeds caused by *C. maculatus*

Treatments	*Mean wt. loss (%) at concentration			
	1%	3%	5%	Mean
T <sub>1</sub> -Turmeric	7.19(15.53)	6.19(14.40)	3.37(10.56)	5.58(13.49)
T <sub>2</sub> -Ginger	10.67(18.93)	6.52(14.68)	3.52(10.78)	6.90(14.79)
T <sub>3</sub> -Black pepper	3.39(10.59)	2.24(8.61)	1.62(7.28)	2.42(8.83)
T <sub>4</sub> -Red chilli	9.59(17.20)	6.85(15.00)	4.69(12.49)	7.04(14.90)
T <sub>5</sub> -Aonla	13.49(21.38)	6.65(14.82)	4.77(12.59)	8.31(16.26)
T <sub>6</sub> -Control	52.62(46.50)	52.62(46.50)	52.62(46.50)	52.62(46.50)
Mean	16.16(21.69)	13.51(19.00)	11.77(16.70)	

\*Average of three replications; Figures in parentheses are arc sine transformation CD (P= 0.05) for treatment : (2.53); Concentration: (1.78); Treatment x concentration : (4.38)

Table 3. Effect of edible plant products on per cent seed germination of treated french bean seeds in response to damage caused by *C. maculatus*

Treatments	*Mean seed germination (%) of treated french bean seeds at concentration			
	1%	3%	5%	Mean
T <sub>1</sub> -Turmeric	86.33(68.39)	90.67(72.37)	95.33(77.58)	90.78(72.78)
T <sub>2</sub> -Ginger	71.67(57.97)	74.67(61.83)	83.33(66.02)	76.56(61.94)
T <sub>3</sub> -Black pepper	96.67(79.59)	100.00(90.00)	100.00(90.00)	98.89(86.53)
T <sub>4</sub> -Red chilli	80.00(63.92)	87.33(72.77)	94.00(78.83)	87.11(71.84)
T <sub>5</sub> -Aonla	65.00(53.75)	72.00(58.07)	81.00(64.39)	72.67(58.74)
T <sub>6</sub> -Control	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
Mean	66.61(53.94)	70.78(59.17)	75.61(62.80)	

\*Average of three replications; Figures in parentheses are arc sine transformation CD (P= 0.05); for treatment : (6.31); Concentration : (4.46); Treatment x concentration : (10.93)

powder @ 2.5-5g/250g cowpea seeds against *C. maculatus* was effective in reducing seed damage, while Misra [19] reported no loss in seed weight in black gram seeds against *C. chinensis* in red chilli treated seeds @ 3 per cent concentration.

It is extrapolated from Table 3 that maximum seed germination (98.89 %) was recorded with black pepper powder and minimum seed germination (72.67 %) was recorded with aonla powder. Seed germination recorded with black

pepper powder was statistically superior to other treatments. Seed germination recorded with turmeric and red chilli powder was at par with each other and superior to ginger and aonla powder. Cent per cent seed germination was recorded with black pepper powder at 5 and 3 per cent concentration while minimum seed germination (65 %) was recorded with aonla powder at 1 per cent concentration. All the tested plant powders were equally effective at 5, 3 and 1 per cent concentration with respect to seed germination and were superior over control

where no seed germination was recorded. In the present studies it was found that none of the treatments apparently reduced the seed germination. However, Zibokere [20] reported little loss of viability of cowpea seeds treated with chilli powder against *C. maculatus*. The treatment with plant products is safe for germination of seeds seeks support from the work of George and Patel [21] who reported no adverse effect of 10 per cent mint (*M. spicata*) dry leaf powder on green gram and Affifa [22] reported fenugreek powder used against storage insects (5g/kg wheat) was safe from germination point of view.

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