



## EFFECT OF BOTANICALS AGAINST *Callosobruchus chinensis* IN STORED CHICKPEA

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### ABSTRACT

This Experiment evaluated the effect of botanicals against *Callosobruchus chinensis* in stored chickpea with seven botanicals viz., pepper @ 3g/ kg, turmeric powder @10g/ kg, clove powder @ 3g/ kg, groundnut oil @ 5 ml/ kg, castor oil @ 5 ml/ kg, soybean oil @ 5ml/ kg and untreated control. All treatments were significantly superior over untreated control in minimizing oviposition and adult emergence. Results reported that castor oil @ 5 ml/ kg (14.67), pepper powder @ 3g/ kg (29.33) and clove powder @ 3g/ kg (30.37) was most effective in minimizing the fecundity of pulse beetle up to 6 months stored period. Chickpea seeds treated with castor oil @ 5 ml/ kg (5.67), pepper powder @ 3g/ kg (9.33), clove powder @ 3g/ kg (12.00) was observed the best in checking adult emergence, followed by groundnut oil @ 5 ml/ kg (19.33), turmeric powder @ 10g/ kg (40.00) and soybean oil @ 10 ml/ kg (32.00) was found most effective.

**Key words:** *Callosobruchus chinensis*, chick pea, botanicals, castor oil, groundnut oil, pepper powder, clove powder, egg laying, adult emergence, fecundity, chickpea,

Chickpea (*Cicer arietinum* L.) is the largest produced food legume in South Asia and the third largest produced food legume globally, after common bean (*Phaseolus Vulgaris* L.) and field pea (*Pisum sativum* L.). India is the world's largest producer, accounting for 65% of global chickpea production. Chickpea is an important source of protein for millions of people in the developing countries, particularly in South Asia, who are largely vegetarian either by choice or because of economic reasons. In addition to having high protein content (20-22%), fibre, minerals (phosphorus, calcium, magnesium, iron and zinc) and its lipid fraction is high in unsaturated fatty acids. Chickpea play a significant role in improving soil fertility by fixing the atmospheric nitrogen. Chickpea meets 80% of its nitrogen (N) requirement from symbiotic nitrogen fixation and can fix up to 140 kg N ha<sup>-1</sup> from air. It leaves substantial amount of residual nitrogen for subsequent crops and adds plenty of organic matter to maintain and improve soil health and fertility. Because of its deep tap root system, chickpea can withstand drought conditions by extracting water from deeper layers in the soil profile. Two distinct types of chickpeas are recognized. chickpea with colored and thick seed coat are called desi type. The seeds are generally small and angular with a rough surface. The desi types account for 80 -85% of chickpea area. The splits and flour are invariably made from desi type. The Kabuli type chickpea are characterized by white or beige colored seed with ram's head shape,

thin seed coat and smooth seed surface. As compared to desi types, the Kabuli types have large sized seeds and receive higher market price than desi types. One of the major constraints in chickpea production is the insect pests which inflict severe losses both in the field and storage. The pulse beetle, *Callosobruchus chinensis* (L) (Chrysomelidae: Coleoptera), cause 49 – 52% damage under the storage conditions Singh et al., (2001). Pulse beetle lay white eggs on the seeds and the larvae bore into seeds. The infested seeds are unfit for sowing and consumption. The control of pulse beetle infestation includes use of organophosphates and fumigants such as methyl bromide and phosphine, which are still the most effective means of protection of stored food and other agricultural commodities EPA, 2001. Even though effective, such synthetic pesticides cause consequently residual pollution of the environment and toxicity to consumers. Many of the stored insects have developed resistance to the used chemicals (Srivastava and Singh, 2002).

In view of these problems together with the upcoming WTO regulations, there is a need to restrict their use globally and implement safe alternative methods of insect management utilizing botanical products are being used in many countries. Use of seed protectants such as various types of plant part powder and various species of plant, have been found to provide adequate protection for longer duration against insect

infestation (Subramanyam and Hagstrum, 1995). In the present study, the relative effect of different botanicals such as pepper powder, turmeric powder, clove powder, groundnut oil, castor oil and soybean oil, were used against pulse beetle in stored chickpea.

#### MATERIALS AND METHODS

The experiment was conducted at the laboratory, Department of Entomology, Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola, Maharashtra, India during 2020 to March 2021 under laboratory conditions lasting for a period of 180 days. Complete Randomised Design (CRD), followed with seven treatments and three replications. Seven treatments were selected on the basis of local usage for farmers to manage the storage grain pest on chickpea. These botanicals are easily available in market. The botanicals are viz., pepper powder @ 3g/ kg, Turmeric powder @ 10g/kg, clove powder @ 3g/ kg, groundnut oil @ 5 ml/ kg, castor oil @ 5 ml/ kg and soybean oil @ 5ml/ kg. The pulse beetles *C. chinensis* having same age required for the research work were obtained from the Pulse Research Unit, Dr P D K V, Akola. The pulse beetle was reared and multiplied under laboratory conditions, inside a growth chamber at 25± 2°C and 65± 5% RH. The antennae of females and males were used for sex differentiation. Males have highly serrated antennae and a pygidium that is free of black spots. Females have pygidium with two black spots, one on either side of the mid-line, and weakly serrate antennae. Females are typically slightly larger than males (Devi and Devi, 2013).

Initially 40 pairs of freshly emerged beetles were leaved in a plastic jar of 2 kg capacity containing 1000g of chickpea seeds. The jars was covered with muslin cloth and secured tightly with rubber band. A maximum of 5 to 6 days were allowed for oviposition and mating. Then parent adults were removed and seeds of chickpea containing eggs was transferred to fresh chickpea seeds in the multiplying jars that were protected with muslin cloth with rubber band to avoid the contamination and escape of insects. The mass culture of the pulse beetles were used for all experiments. A residual toxicity test was organized according to the methodology of Talukder and Howse (1994), with some minor modifications. For each treatment, one kg of freshly harvested seeds with a high % of germination and low moisture content not more than 10% were used. To treat the seeds of chickpea with oils and powders of various plant products, the necessary quantities were weighed and taken. For each treatment, one kg of chickpea seeds was placed in a 2

kg plastic container, and plant products were mixed thoroughly by shaking the container. For each treatment, the same procedure was repeated thrice. The one kg treated chickpea seeds were placed in a two kg plastic container to held at 25± 2°C and 65± 5% RH. From one kg treated seeds, 0.1 kg of treated seed were taken out in the plastic container of 0.5 kg capacity. Five pairs of pulse beetle, *C. chinensis* (newly emerged) were released in 100g treated sample and the observations were recorded in every month.

Number of eggs laid on chickpea was evaluated based on the total number of eggs laid by pulse beetle. After fourteen days, seeds were carefully accounted using magnifying lens and seeds with eggs and without eggs were separated. Then total number of eggs on seeds and total number of eggs per 100g seeds in plastic container were recorded. After recording data, seeds with eggs were returned to their respective plastic container and covered with cap and left for further development. The adults started emerging after 24 days of egg- laying and continued for several days. The emerged adults were counted and removed every day from the plastic container up to no adult emergence.

#### RESULTS AND DISCUSSION

The results obtained from the present investigation are presented in Table 1. In that a significant variation was observed among various treatments on number of eggs laid by *C. chinensis* and number of adults emerged at distinct storage periods starting from first to six months on chickpea. Seed treated with castor oil @ 5 ml/ kg was found to be most effective throughout the storage period. Table 1 revealed that the minimum number of eggs laid was recorded in castor oil @ 5 ml/ kg (14.67/ 100g seed) and followed by pepper powder @ 3g/ kg (29.33/ 100g seed). The maximum number of eggs deposition was recorded in turmeric powder @ 10g/ kg (44.67/ 100g seed) and soybean oil @ 5 ml/ kg (48/ 100g) as they were least effective. These present findings are in accordance Pathania and Thakur (2020) observed that black gram seed treated with pepper powder @ 3g/ kg provides complete protection of egg deposition from *C. chinensis*. Similarly, Ahmed et al. (2016) reported that in chickpea seed is treated with clove powder at medium dosage found that lowest number of egg laid. This research work, it was also recorded that the number of eggs deposition increased gradually. Because effect of botanicals are gradually decreased. Effect of botanicals on adult emergence of pulse beetle on stored chickpea

The results presented in Table 1 indicate significant

Table 1. Effect of botanicals on fecundity and adult emergence of *C. chinensis* on stored chickpea

S.No.	Treatments	Doses g/kg seed	No. of eggs laid after 14 days of beetle release/ 100g											
			In 1 <sup>st</sup> month	In 2 <sup>nd</sup> month	In 3 <sup>rd</sup> month	In 4 <sup>th</sup> month	In 5 <sup>th</sup> month	In 6 <sup>th</sup> month	In 1 <sup>st</sup> month	In 2 <sup>nd</sup> month	In 3 <sup>rd</sup> month	In 4 <sup>th</sup> month	In 5 <sup>th</sup> month	In 6 <sup>th</sup> month
1	Pepper powder	3 g	29.33 (1.47)	32.67 (1.51)	52.67 (1.72)	56.67 (1.75)	88.33 (1.95)	102.67 (2.01)	9.33 (0.97)	21.67 (1.33)	31.67 (1.50)	47.67 (1.68)	66.67 (1.82)	93.33 (1.97)
2	Turmeric powder	10 g	44.67 (1.65)	55.33 (1.74)	71.00 (1.85)	91.67 (1.96)	156.67 (2.19)	160.67 (2.19)	40.00 (1.59)	43.33 (1.64)	58.33 (1.77)	85.00 (1.93)	103.33 (2.01)	123.33 (2.09)
3	Clove powder	3 g	30.37 (1.48)	46.33 (1.67)	56.00 (1.75)	58.67 (1.77)	93.33 (1.97)	135.33 (2.13)	12.00 (1.07)	36.67 (1.55)	36.67 (1.55)	55.00 (1.74)	76.67 (1.88)	96.67 (1.99)
4	Groundnut oil	5 ml	20.39 (1.55)	48.33 (1.68)	68.33 (1.83)	68.33 (1.83)	116.67 (2.07)	98.33 (1.99)	19.33 (1.28)	40.00 (1.59)	48.33 (1.68)	61.67 (1.79)	101.67 (2.01)	103.33 (2.01)
5	Castor oil	5 ml	14.67 (1.16)	30.00 (1.48)	43.33 (1.63)	53.33 (1.73)	83.33 (1.92)	160.0 (2.20)	5.67 (0.69)	19.33 (1.28)	32.67 (1.51)	43.33 (1.64)	58.33 (1.76)	80.00 (1.90)
6	Soybean oil	5 ml	48.00 (1.67)	61.67 (1.79)	76.67 (1.88)	88.33 (1.95)	140.00 (2.15)	433.33 (2.64)	32.00 (1.47)	48.33 (1.68)	66.67 (1.81)	91.67 (1.96)	125.00 (2.10)	140.00 (2.15)
7	Control (untreated)	-	262 (2.42)	293.33 (2.47)	313.33 (2.50)	340.0 (2.53)	416.67 (2.62)	433.33 (2.64)	253.00 (2.40)	281.67 (2.24)	293.33 (2.47)	316.67 (2.50)	386.67 (2.59)	401.67 (2.60)
F <sup>2</sup> test		sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig	sig
SE (m)±		0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.08	0.05	0.07	0.02	0.02	0.02
CD (p=0.05)		0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.25	0.17	0.15	0.05	0.06	0.07
CV		2.75	2.13	2.18	1.67	1.71	1.93	2.4	5.92	4.77	1.57	1.77	2.04	2.04

Figures in parentheses corresponding logarithmic transformation

difference in adult emergence with different botanicals. Minimum adults emergence was found in chickpea treated with castor oil @ 5 ml/ kg ( 5.67 adults/ 100g seed) followed by pepper powder @ 3g/ kg (9.33 adults/100g), clove powder @ 3g/ kg (12 adults/ 100g seed), groundnut oil @ 5 ml/ kg (19.33 adults/ 100g), turmeric powder @ 10g/ kg (32 adults/ 100g), soybean oil @ 5 ml/ kg (40 adults/ 100g) and control (253 adults/ 100g) in the first month. These result agree with those of Aslam et al. (2002) reported that minimum number of adult emergence observed in clove powder treated with chickpea seed which found effective. After 6 months, cumulative mean of average no.of adult emerged was derived and it was found that similar order of effectiveness of botanicals on average number of adult emergence after six month. The gradual reduction in adult emergence that was recorded. Because treatments affected the physiological process associated with embryonic development.

#### ACKNOWLEDGEMENTS

The authors are thankful to the Department of Agricultural Entomology, Post Graduate Institute, Dr Panjabrao Deshmukh Krishi Viidyapeeth – Akola. For their support and providing necessary facilities.

#### FINANCIAL SUPPORT

Financial assistance was provided by Department of Agricultural Entomology, Post Graduate Institute, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra.

#### AUTHOR CONTRIBUTION STATEMENT

M Suguna carried out the experiments, mass culturing of pulse beetle and analyzed the date, and

wrote the manuscript, P.K. Rathod supervised the laboratory work provide technical support and critically revised the manuscript for intellectual content. All author read and approved the final manuscript.

#### CONFLICT OF INTEREST

No conflict of interest.

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(Manuscript Received: August, 2022; Revised: May, 2023;

Accepted: May, 2023; Online Published: May, 2023)

Online First in [www.entosocindia.org](http://www.entosocindia.org) and [indianentomology.org](http://indianentomology.org) Ref. No. e23698