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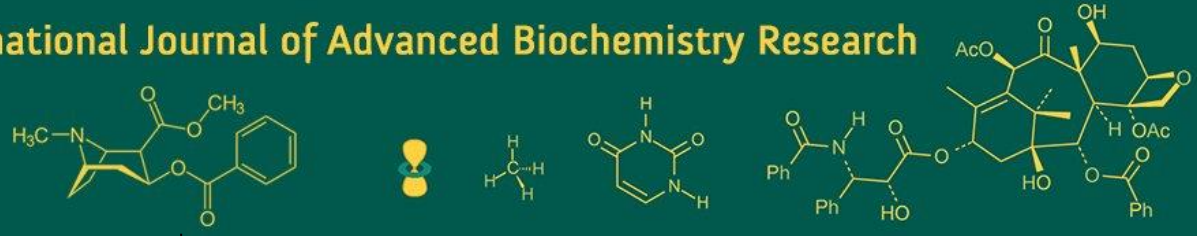

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Evaluate the effects of seed protectants on pupation percentage and pupal period of *C. chinensis*

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Abstract
Chickpea (*Cicer arietinum* L.) is a richest source of protein, among various pulses to human diet and occupies an important position in the agriculture economy of our country. *Callosobruchus chinensis* L. is the major insect-pest and causes huge loss in storage besides affecting the quality by contaminating and decreasing the nutritive value of the grain. Study of the the present investigation was carried out on growth and development of *C. chinensis* on Bengal gram (variety-Radhey) and to evaluate effects of seed protectants on pupation percentage and pupal period of C. *chinensis.* The least pupation was recorded 14.11 percent in *neem* leaf powder @ 15 g/kg of seed, which was at par i.e., 17.15. The pupal period in the grains treated with *neem* leaf powder (10.11 days) differed significantly from *dhatura* leaf powder (10.75 days).

Keywords: Evaluate effects of seed protectants on pupation percentage and pupal period of C. *chinensis*

Introduction
Pulses have been considered as the poor man´s-meat which play an important role in food categories that have been extensively used as staple foods. The pulses contain about 20-25 percent protein which is higher than that of cereals. Hence, pulses are major source of protein to meet the increasing dietary demand in Indian people. The global pulse market is estimated about 60 million tonnes. For various reasons pulses are playing an important role in Indian agriculture. Chickpea is used in wide range of different preparation in our country and has a good source of energy 416 calories per 100g chicken along with protein 18 to 20 percent carbohydrate 51 to 70 percent 4 to 10 percent minerals, calcium, phosphorus and iron and vitamins also. In India, chickpea is the premier *rabi* followed by lentil, field pea and lathyrus. As far as production is concerned, India ranks first in the world and contributes around 70 percent (Anonymous, 2015) [2]. In Indian context, total pulse grown area is about 25.25 mh and production is only 16.47 mt (Directorate of economics and statistics, 2016). One of the major pulses cultivated and consumed in India, is chickpea and commonly known as Gram, Bengal gram or White gram. India is the major producing country for chickpea, contributing for over 75% of total production in the world (Anonymous, 2016) [3] *Callosobruchus chinensis* L. is cosmopolitan and a serious pest of pulses and has also been reported attacking cotton seed, sorghum and maize (Ahmed *et al*., 2003) [1]. Due to invasion of the beetle, deterioration in quality and quantity of stored pulse. The grubs bore into the pulse grains which become unsuitable for human consumption and for the production of sprouts. This is important pests of pulse crop in India under storage conditions (Tapondjou *et al*., 2002) [13] and cause annual loss of nearly 0.21 million tonnes amounting to rupees 315 million. The extensive application of insecticides is directly related with the development of resistance of stored product insect species, raising serious concerns for human health as a result of food contamination with residues and possible environmental hazards (Boyer *et al*. 2012; Stadler *et al*. 2012) [4, 11] Serious problems of genetic resistance by insect species, pest resurgence, residual toxicity, phytotoxicity, vertebrate toxicity, widespread environmental hazards and increasing cost of application of the presently used synthetic pesticides have directed the need for effective biodegradable pesticides (Talukdar and Howse, 1994) [12].

This awareness has created worldwide interest in the development of alternative strategic including the re-examination of using plant derivative materials is more readily biodegradable. Some are less toxic to mammals, may be more selective in action and may disgrace the development of resistance. The main advantage is that they may be easily and cheaply produced by farmers and small-scale industries as crude or partially purified extracts. In two decades, Considerable efforts have been made at screening plants in order to develop new botanical insecticides as alternative to the existing insecticide. The present investigation was carried out on growth and development of C. *chinensis* on Bengal gram (variety-Radhey) and to evaluate effects of seed protectants on pupation percentage and pupal period of C. *chinensis.*

Materials and Methods

The present investigation was carried out on growth and development of C. *chinensis* on Bengal gram (variety-Radhey) and to evaluate effects of seed protectants on pupation percentage and pupal period of C. *chinensis.*
Test insect: *Callosobruchus chinensis* Linn.

Taxonomy of insect

Phylum	:	Arthopoda
Class	:	Insecta
Order	:	Coleoptera
Supper Family	:	Chrysomelidea
Family	:	Bruchidae
Genus	:	*Callosobruchus*
Species	:	*chinensis*

The present study was conducted in the Insectary, Department of Agricultural Entomology, Chandra Shekhar Azad university of agriculture and technology, Kanpur, Madurai during 2017-18. The chickpea variety Radhey was selected to conduct the investigation on *C. chinensis* which was obtained from Economic Botanist (legumes), C. S. A. University of Agriculture and Technology Kanpur. The adults of pulse beetle were initially collected from infested stock of local granaries and brought to the laboratory for the mass culture and rearing on gram variety (Radhey) kept in 2 kg capacity plastic container filled with 1 kg chickpea. 20 freshly emerged pairs of males and females of pulse beetle were released in a plastic container filled with fresh seeds of gram and covered with muslin cloth and tied around with rubber band and kept at room temperature. The food of container culture was replaced with fresh one, as and when it is needed. The newly emerged adult from the culture were used in the present study. The seeds of gram were properly sterilized in an electric oven at a temperature of 55 °c for 24 hours to make it free from any contamination. The seeds were again conditioned in regulated temperature and 75 ± 5% relative humidity under desiccators. The experiments were based on "complete randomized design" (CRD) with 7 treatments and 3 replications. The 50 g grains of gram was weighted with the help of physical balance. Five pairs of *C. chinensis* of same age obtained from the laboratory culture were introduced in each jar, covered by muslin cloth and tied with rubber band and kept under the room temperature in the P.G. laboratory of the department. With a view to study the adult emergence. The observations were recorded daily to note the actual timing of pupation for larval period. The date of adult emergence were noted to work out the pupal period & calculate the percentage of pupation for each treatment.

Results and Discussion

Pupation percentage was reduced considerably due to application of protectants. The least pupation percent 14.11 was noted in *neem* leaf powder @ 15g/kg of seed, which was at par with other treatments i.e. 17.15, 13.32, and 11.30 percent pupation in *dhatura* leaf powder @ 15g/kg of seed, mustard oil and linseed oil @ 3ml/kg of seed, respectively. The protectants coconut oil @ 3ml/kg of seed and castor leaf powder and oak leaf powder @15 g/kg of seed were also provided decreased pupation percentage i.e., 10.56, 12.53 and 10.78 percent, respectively, as compared to control (77.29 percent). These results were supported by Pandey and Singh (1997) [6] that *neem* bark powder @ 0.2 - 0.8% w/w provided reduced seed damage and insect population of *C. chinensis*. All the tested grain protectants significantly affected the pupal period of the pest in comparison to untreated check. The pupal period in the grains treated with *neem* leaf powder (10.11 days) differed significantly from *dhatura* leaf powder (10.75days). The efficacy of *dhatura* leaf powder, mustard oil, linseed oil, castor leaf powder, coconut oil and *oak* leaf powder were found to be at par in maximizing the pupal period i.e. 10.11, 10.00, 9.74, 7.76, 7.39, and 7.20 days, respectively.

Table 1: Effect of different indigenous plant products on pupation percent of *Callosobruchus chinensis* L:

SR. No.	Treatment	Dosages (g/ml) per kg. of seed	Pupal Periods (Days)
1.	Neem Leaf Powder	15g	9.93
2.	Dhatura Leaf Powder	15g	9.28
3.	Castor Leaf Powder	15g	8.42
4.	Oak Leaf Powder	15g	7.76
5.	Mustard Oil	3ml	8.86
6.	Linseed Oil	3ml	8.45
7.	Coconut Oil	3ml	7.93
8.	Untreated		7.00
	CD 5%		1.64
	SE, (d)		0.77

Table 2: Effect of different indigenous plant products on A pupal period of *Callosobruchus chinensis* L. in gram grains

SR. No.	Treatment	Dosages (g/ml) per kg. of seed	Pupation percent
1.	Neem Leaf Powder	15g	14.11 (3.82)
2.	Dhatura Leaf Powder	15g	17.15(4.20)
3.	Castor Leaf Powder	15g	12.53(3.60)
4.	Oak Leaf Powder	15g	10.75 (3.35)
5.	Mustard Oil	3ml	13.32 (3.71)
6.	Linseed Oil	3ml	11.30 (3.43)
7.	Coconut Oil	3ml	10.56 (3.32)
8.	Untreated		77.29 (8.81)
	CD 5%		2.79
	SE, (d)		1.30

Conclusion

On the basis of results which was obtained present experiment, the following conclusion are brought out, which may be useful for scientists, research workers and farmers.

The least pupation was recorded 14.11 percent in *neem* leaf powder @ 15g/kg of seed, which was at par i.e., 17.15, 13.32, and 11.30 percent pupation in *dhatura* leaf powder @ 15 g/kg of seed, mustard oil and linseed oil @ 3ml/kg of seed, respectively. The protectants as coconut oil @ 3ml/kg of seed, castor leaf powder and oak leaf powder @ 15g/kg of seed were also provided decreased pupation percentage i.e., 10.56, 12.53 and 10.78%, respectively, as compared to control (77.29 percent).The pupal period in the grains treated with *neem* leaf powder (10.11 days) differed significantly from *dhatura* leaf powder (10.75days). The efficacy of *dhatura* leaf powder, mustard oil, linseed oil, castor leaf powder, coconut oil and *oak* leaf powder were found to be at par in maximizing the pupal period i.e. 10.11, 10.00, 9.74, 7.76, 7.39, and 7.20 days, respectively.

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