

Assessment of Phagodeterrent Potential of *Delonix Regia* Leaf Extract Against The Pulse Beetle, *Callosobruchus Chinensis*

Abstract

Foliar extract of *Delonix regia* in acetone was evaluated for its antifeedent properties against the pulse beetle, *Callosobruchus chinensis*. The extract exhibited 40.753, 41.795, 56.092 and 67.744 percent seed protection over control for 25%, 50%, 75% and 100% concentration levels of the extract, respectively.

Keywords: *Callosobruchus Chinensis*, *Delonix Regia*.

Introduction

Ever since the ancient hunter-gatherer man started storing food grains for future use, the stored grain insect pests have been posing potential threats on the very existence of the human beings. Despite modern scientific approaches, a significant part of annual harvest is claimed by a number of insect pests during the post harvesting storage phase. Even though it is practically impossible to knock down all insect pests on the earth, with effective pest management practices the damage caused by them could be kept below the economic threshold level. In this pursuit, the discovery of synthetic organochlorine pesticides seemed to be a decisive weapon in the war against the tiny but mighty enemies of the human civilization. Initially, these synthetic chemicals enjoyed worldwide acceptance and were welcome in the developing and developed world alike. This resulted in irrational and disproportionate use of synthetic chemical pesticides. But, in the following decades their side effects started making the wakeup calls on many aspects of ecosystems and environment. Among the wide range of the potential dangers caused by the chemicals are development of resistance in target animals, toxicity of food and drinking water, bioaccumulation of the non- biodegradable toxic chemicals, etc. The challenges raised by the synthetic organochlorine pesticides made researchers devise safer pest control methods. Along this line, the research on the plant based pesticides got momentum as they are eco-friendly and do not show biomagnifications. Present work also deals with the assessment of toxicity of *Delonix regia* leaf extract against infestation of the pulse beetle, *Callosobruchus chinensis*.

Extraction of Plant Materials

Leaves of *Delonix regia* were collected from the Botanical Garden, University of Rajasthan, Jaipur. They were washed thoroughly to remove dust and were dried in shade. With the help of an electric grinder fine powder of the shade dried leaves was prepared. The extract of the powdered leaves was prepared by Soxhlet Extraction method (Deshmukh and Borle, 1975). 30 gms of plant material was extracted using 300 ml of acetone in Soxhlet apparatus for 8 hours. After filtration and vacuum evaporation the extract was stored in refrigerator as stock solution. The desired dose levels were prepared by adding requisite volume of the solvent (acetone).

Rearing of Experimental Insect

Initial culture of experimental insect (*Callosobruchus chinensis*) was obtained from the Agriculture Research Station Durgapura, Jaipur. Rearing of *Callosobruchus chinensis* was done in pre-sterilized jars containing disinfested cowpea seeds (*Vigna unguiculata*). An optimum condition of $27 \pm 2^\circ\text{C}$ temperature and $60 \pm 10\%$ relative humidity was maintained.



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Experimental Design

5 gm of cowpea seeds were taken in plastic vials and treated with 1 ml of each desired dose level, i.e., 25%, 50%, 75% and 100%. The doses were prepared by mixing the extracts with respective volume of the solvent. Three replicas of each dose level and a control containing seeds treated with the solvent (acetone) only were run parallel. Three pairs of newly emerged adult (0-24 hrs old) were introduced in each vial for egg laying on the grains. The vials were covered with muslin cloth. The number of eggs laid on seeds and the number of adults emerged were recorded. The loss in seed weight was calculated by weighing the damaged seeds separately. Food consumption per grub (FCPG) was calculated by the following formula.

$$\text{FCPG (mg)} = \frac{\text{Loss in seed weight (gms)}}{\text{Average emergence}} \times 1000$$

Result and Discussion

The results of the phagodeterrent properties of the leaf extract of *Delonix regia* enumerated in the Table 1 depict that the average oviposition on treated cowpea seed surface was apparently dose dependent as the extract showed 152, 137.33, 121.66 and 114.33 eggs at 25%, 50%, 75%, and 100% dose levels, respectively compared to 174 eggs laid in the control group. The number of adults emerged in treatment group showed reduction with an increase in the concentration of the extract thus at 25%, 50%, 75% and 100% dose levels 52, 49.66, 47 and 39.66 adults were observed, respectively with 63 adults recorded in the control. Maximum loss in seed weight (2.217 grams) was registered at lowest dose level (25%) which was followed by loss of 2.178, 1.643 and 1.207 grams at 50%, 75% and 100% dose levels, respectively. In control, average loss in seed weight recorded was 3.742 grams. The loss in seed weight decreased with ascending concentration of the extract. At 25%, 50%, 75% and 100% dose levels the extract was noted to express 55.66, 56.44, 67.14 and 75.86 percent seed protection, respectively as compared to 25.16 percent protection in the controls. Percent seed protection over control calculated was 40.753, 41.795, 56.092 and 67.744 for 25%, 50%, 75% and 100% concentration levels of the extract, respectively. The value of FCPG did not exhibit any definite pattern however it remained higher in all the dose level in comparison with control group. The results reveal moderate protection of the treated cowpea seeds against the pulse beetle infestation.

Many researchers worked on botanicals for pest management which corroborates the present findings. Obembe (2017) conducted experiments to study the efficacies of *Delonix regia* oils on mortality and adult emergence of the maize weevil, *Sitophilus zeamais* (Coleoptera: Curculionidae). Results obtained showed that the oil at every concentration was lethal on the experimental insect which also supports present study. The neem extract of different concentrations shows significant effect to control pest of rice, betel leaf and vegetable (Rahman et al 2016). Talukder and Howse (1994) also found that ground leaves, bark and seeds of *Aphanamixis polystachya* gave good protection for mung beans against pulse beetles. Seed protectant action of pet ether extracts of *Ipomoea*, *Parthenium*, *Adathoda*, *Tridax* and *Embelia* against *Callosobruchus* was corroborated by Bhaduri et al. (1985). Similar findings were reported by Babu et al. (1989) who evaluated the seed protectant action of edible oils of *Ricinus communis* and *Pongamia glabra* against *C. Chinensis* which also supports present findings. Reduction in larval feeding and damage might have taken place as a result of larval mortality inside the cowpea seeds treated with the plant extracts.

References

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Table 1: Phagodeterrent Potential of Foliar Extract of *Delonix Regia* against *Callosobruchus Chinensis*

S. No.	Dose level	Average oviposition	Average emergence	Average loss in seed weight (gm)	Average seed protection (gm)	% seed protection	FCPG (mg)	% seed protection over control
1.	25%	152	52	2.217	2.783	55.66	42.634	40.753
2.	50%	137.33	49.66	2.178	2.822	56.44	43.858	41.795
3.	75%	121.66	47	1.643	3.357	67.14	34.957	56.092
4.	100%	114.33	39.66	1.207	3.793	75.86	30.433	67.744
5.	Control	174	63	3.742	1.258	25.16	59.396	-

Number of replications – 3

Weight of treated cowpea seeds in each replication – 5 grams

Number of adults in each replication – 6 (3 males + 3 females)