Effect of Plant Formulations on Larvae and Adults of *Callosobruchus Chinensis*

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Abstract

Two medicinal plants *Centella asiatica* and *Boerhavia diffusa* were found to be effective in controlling the larval instars and adults of *Callosobruchus chinensis.* Formulations of granules of the two plants were prepared and they caused significant mortality in adults and larvae of the insect. Thus the plants are proved to be effective in controlling the pest.

Keywords: *Boerhavia diffusa, Callosobruchus chinensis, Centella asiatica,* Formulation, Mortality, Medicinal plants

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Introduction

Researchers in most of the countries have investigated more than 100 different kinds of botanicals for their efficacy in crop protection against pest degradation especially stored product pests and diseases.(Olufolaji, 2008,) Ofuya (2003) reported that botanicals used as pesticides against stored product pests merit scientific formulations.

A pesticide formulation is a mixture of chemicals which effectively controls a pest. Formulating a pesticide involves processing it to improve its storage, handling, safety, application, or effectiveness. (Ware, 1994) The pesticide formulation is a mixture of active and other ingredients. An active ingredient is a substance that prevents, kills, or repels a pest or acts as a plant regulator, desiccant, defoliant, synergist, or nitrogen stabilizer.

Formulations contain the active ingredient in a definite concentration together with other materials such as inert carriers, emulsifiers, wetting agents, solvents, thickeners, encapsulants, etc.(Label Review Manual 1998). Pesticides come in many different formulations due to variations in the active ingredient's solubility, ability to control the pest, and ease of handling and transport. According to the intended mode of application, there are different groups of formulations like - for spraying after mixing with water/ oil, for dry application directly from the container, for application as a gas or vapor and other formulations like seed protectants, baits for rodents, slugs, flies, cockroaches, etc. (Pal and Das Gupta, 1994) Solid formulations like pellets and granules and wet formulations are normally used to control pests.

The present study focuses on the effect of solid formulations using powdered leaves of two medicinal plants namely, *Boerrhavia diffusa* and *Centella asiatica* on *Callosobruchus chinensis.*

Materials and Methods

Culturing of test insects: Experiments were conducted in the Entomology Research Laboratory, Department of Zoology, University College Thiruvananthapuram. The pulse beetle, *Callosobruchus chinensis* L. adults were obtained from naturally infested green gram seeds from local markets. The adult male and female beetles were reared on clean and un-infested green gram (*Vigna radiata* L). The seeds were made uninfected by washing with clean water. Three jars each of 300 gm were used. Each jar was filled with 200gm chickpea grains and about 100 beetles were added to each jar. The jars were then covered.

Preparation of plant leaf powder: The leaves of *Boerrhavia diffusa* and *Centella asiatica* were collected and washed well with distilled water. The leaves were dried in shade and ground thoroughly separately using grinder and made to fine powder by sieving and was stored in glass containers.

Preparation of plant formulations: Powdered leaves of the plants and powdered oil cake were weighed using common weighing balance. By adding distilled water powdered oil cake was mixed with leaf powder of the two plants separately and leaf formulations in the form of granules were made. Oil cake was the inert material used in the preparation of formulation of granules. These granules were packed into 6X6 cm size clean cotton white clothes. Formulation of granules of 15%, 20%, 25%, 30% and 35% (1.5g, 2.0g, 2.5g, 3.0g and 3.5gms of plant leaf powder and 8.5g, 8.0g, 7.5g, 7.0g

and 6.5 gms of powdered oilcake respectively) of the two plants were prepared.

Treatment of larvae of *Callosobruchus chinensis* with plant formulations: First, second, third and fourth instar larvae were treated with *Centella asiatica* and *Boerhavia diffusa* plant leaf formulation of doses 15%, 20%, 25%, and 30% respectively. Separate containers were used for both larval instars and treatment with granules containing different doses. In each container 10 grams of seed, a granule of the plant leaf formulation and five first, second, third and fourth in stars were introduced separately so that each larvae may get two grams of feed. For each treatment control were also set up without applying plant formulation. Oil cake alone was used in the control. Six replicates were kept for each treatment and its control. Observations were recorded on each day until the larvae emerged into adults.

Treatment of adults of *Callosobruchus chinensis* with plant formulations: Granules of formulation of two plant leaves having 35% dose (3.5g plant powder and 6.5 g powdered oil cake) and five one day old adults were introduced into a plastic container separately along with ten grams of feed. For each treatment control were also set up without applying plant formulation. Oil cake alone was used in the control. Six replicates were kept for each treatment and its control. Observations were recorded on the fifth day of treatment.

Results

Effect of plant formulation on larvae: When first, second, third and fourth in stars were treated with formulation of doses 15%, 20%, 25%, and 30%, there was significant mortality. There was no mortality in the control. The plant *Centella asiatica* was found to be comparatively more effective in causing mortality. Results are shown in Table 7.1.

Effect of plant formulation on adult insects: When one day old adult insects were treated with formulation of the plants *Centella asiatica* and *Boerhavia diffusa* (35%), the mortality rate was 57±0.04 and 55±0.02. In control insects there was no mortality Table 1.

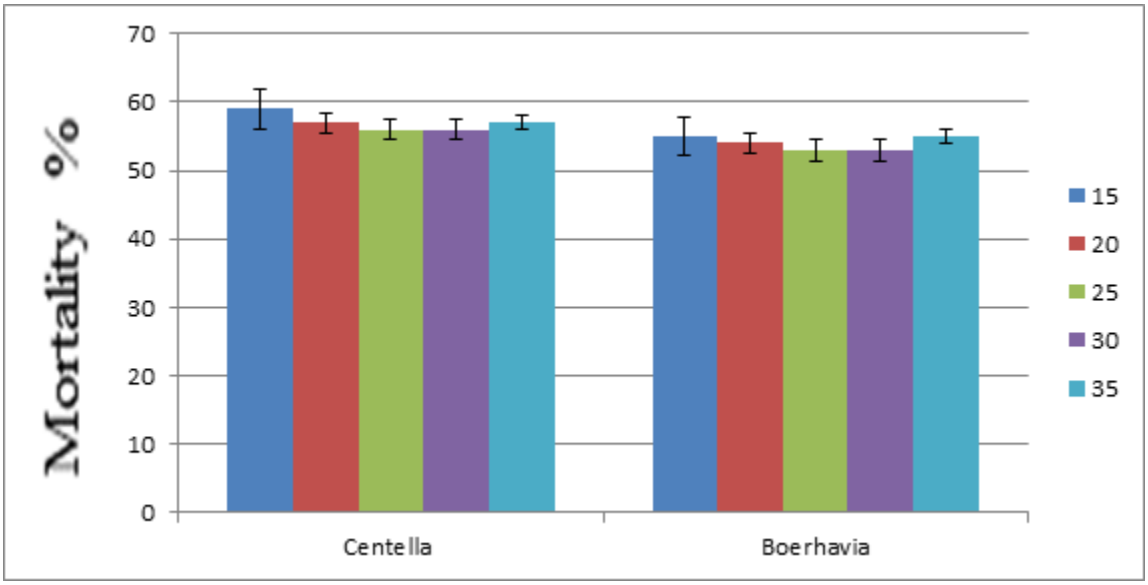
Statistical analysis of data: The data obtained were recorded as mean ± standard deviation. For testing the significance of the data obtained, statistical analysis were carried out using ANOVA ($p \leq 0.05$) using SPSS software. (Daniel 2006).

Table 1:

Plants	Insects	Dose (%)	Mortality (%)
Centella asiatica	First Instar	15	59±0.02
	Second Instar	20	57±0.03
	Third Instar	25	56±0.01
	Fourth Instar	30	56±0.04
	Adult	35	57±0.04
Boerhavia diffusa	First Instar	15	55±0.01
	Second Instar	20	54±0.02
	Third Instar	25	53±0.03
	Fourth Instar	30	53±0.05
	Adult	35	55±0.02

Values are mean±SE; all values are significant at $p \leq 0.05$ level of significance

Graph showing the effect of *Centella asiatica* and *Boerhavia diffusa* plant leaf formulation on four larval instars and adult of *Callosobruchus chinensis*



Values are mean±SE; all values are significant at p≤0.05 level of significance

Discussion

Pesticides are the key input in meeting world food needs and a factor in overcoming the continuing periods of serious food shortage. Pesticides have reduced the damage caused by insect pests. There are different kinds of pesticides including chemical and biological. But biological pesticides were given more importance because of their less pollution causing and easily biodegradable nature. Thus plant formulations have become very important in controlling pests. Different formulations of plant extracts mixtures cause various degrees of reductions of the target pests and also offered various levels of protection to the flowers and pods against damage by thrips, pod borer larvae and pod sucking bugs.(Oparake et al 2005)

Oil and powder formulations of *Melia azedarach* is effective in controlling larvae of *Diabrotica speciosa* (Germar) in corn and plant enhancement. (Souza et al 2015). Sreerag and Jayaprakash (2014) reported that neem oil formulations are effective in controlling two sucking pests, the papaya mealy bug, *Paracoccus marginatus* and cowpea aphid, *Aphis craccivora*. Plant latex based anti-termite formulations were used against Indian white termite Odontotermes obesus (Isoptera: Odontotermitidae) Ravi Kant Upadhyay (2013).

Plant formulations tested in this study caused more than fifty percentage mortality after exposure when compared to control insect and higher doses of the plants are currently being tested.

Conflicts of Interested: None

Source of Support: Nil

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