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ARTICLE

The Indian Bhant tree – An ecofriendly pesticide against banana pseudostem weevil, *Odoiporus longicollis*.

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Abstract

Indiscriminate and improper use of synthetic pesticides cause severe and unpredictable environmental and health problems. But it is essential to use the pesticides and fertilizers for increasing the crop yield and manage the needs of food. So, an alternative is suggested as use of natural products or biopesticides for controlling the pests. Many botanicals and their derivatives having bioactivity on insects. *Clerodendrum infortunatum* is commonly known as Indian Bhant Tree, possess medicinal values. Banana Pseudostem weevil *Odoiporus longicollis* is a serious pest of banana and is estimated that it causes 10-90% yield loss. So, the present study is a screening pesticidal activity of *C. infortunatum* on fourth instar larvae of *O. longicollis* in laboratory conditions. Certain experiments are conducted to know the effect of methanol, acetone and aqueous extracts of the plant on percentage of mortality, gaining of body weight, pupation and adult emergence of fourth instar larvae of *O. longicollis*. The results showed significant increase in mortality and reduction in body weight, and incompletion of pupation and adult emergence in dose dependent manner. The methanol extracts showed highest activity than others. The observed results focuses on the role of *C. infortunatum* on feeding deterrent and endocrine disrupting activities. Inappropriate functioning of biochemical and physiological system of insects leads less food consumption and conversion, moulting and metamorphosis. On viewing this, *C. infortunatum* can suggest for preparing a good biopesticide for controlling banana pseudostem weevil.
Keywords: Pesticidal pollution, Biopesticide, *Clerodendrum infortunatum, Odoiporus longicollis*

Introduction

Now a days, farmers are faced with the challenge of utilizing pesticides to improve their yields while simultaneously guarding human health and environmental protection. Applications of large amount of pesticides leads to death related illness including cancers. Also, exposure to traces of pesticides is damaging to the land and the ecosystem related to that. The whole living things depending the ecosystem are the victims of pesticidal pollution. Furthermore, once pesticide pollution is introduced into an ecosystem, the remaining of pesticides retain and leads to bioaccumulation through the food chains.

Agriculture is largely depends upon natural factors. So the utilization of natural products instead of synthetic pesticide is an adoptable method for pest control. Biopesticide is term that including aspects of pest control such as microbial organisms, entomophagous nematodes, plant derived pesticides, secondary metabolites from microorganisms, insect pheromones etc.. applied for mating disruption, monitoring and kill strategies and genes used to transform crops to explore resistance to insects, fungal and microbial attacks or to render them to tolerant of herbicide applictions (Copping and Menn, 2000).

Plants and their secondary metabolites are an important source for developing new pesticides. Many plants and plant products possess biocidal activities. The Indian Bhant tree, *Clerodendrum infortunatum* L. (Lamiale: Lamiaceae) is well known medicinal plant used for the treatment for fever, hepatitis, tumour, cancers, snakebites, skin disease etc.. (Ahmed et al., 2007) and not much studies on insecticidal properties.

The present study we carried out to investigate the insecticidal activity of *C. infortunatum* against the fourth instar larvae of banana pseudostem weevil, *Odoiporus longicollis*. It is a monophagous pest of banana and complete the entire life cycle on this plant (Padmanaban and Sathiamoorthy, 2001).

Materials and Methods

Plant material and extract preparation

Fresh leaves of *C. infortunatum* are collected locally. The leaves were dried in shade at room temperature and then ground in an electric grinder. The fine powders was collected and used for extract preparation using methanol, acetone and water as solvents by using soxhlet apparatus. The extracts were kept as solid form by evaporating the solvents.

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Test insects

The fourth instar larvae of *O. longicollis* was selected for the study. We studied the effects of *C. infortunatum* on percentage of mortality, changes on bodyweight, pupation and adult emergence. Ten insects with six replicates were used in each experiments. The extracts were weighed and dissolved in minimum amount of solvents and sprayed on the pseudostem. Corresponding solvents were used as control. After evaporating the solvents both in control and treated the insects were deposited in the cultural boxes and the time duration of treatment is time taken for transforming one instar to other.

Statistical analysis

Statistical analysis were done by IBM SPSS 21 and the mortality is corrected by Abbott's correction formula (1925).

Results

Effect of *C. infortunatum* on mortality and changes on bodyweight of fourth instar larvae of *O. longicollis*

Methanol extract of *C. infortunatum* is most effective compare to that of acetone and aqueous extracts (Table 1, 2 &3). All extracts showed significant increase in mortality in a dose dependent manner. More than 50% mortality was observed in 60mg treated methanol and 90m treated acetone extracts. The aqueous extracts is also capable of induce mortality in high doses. Probit analysis reveals lethal dose of 43.473mg is essential for 50% mortality in methanol extract treated insects.

Also, the body weight of larvae were reduced significantly. In sublethal doses all experiments showed weight gain is comparably very low in treated to that of control. In aqueous extract treated insects there a gain in body weight in control, while the methanol extract treated insects possess least amount gain in weight.

Table 1. Effect of *Clerodenrum infortunatum* on mortality of fourth instar larvae of *Odoiporus longicol-*

extracts/Dose	30mg	60mg	90mg	120mg
Methanol	42±0.71 d	58±0.45 e	63±0.39 f	72±0.49 g
Acetone	34±0.42 c	42±0.70 d	58±0.56 e	64±0.52 f
Aqueous	18±0.39 a	28±0.41 b	42±0.71 d	58±0.73 e

Each value is mean ± SD followed by a common letter do not differ significantly (Tukey's test; P < 0.05, n = 6)

Table 2. Probit analysis -Effect of *Clerodenrum infortunatum* on mortality of fourth instar larvae of *Odoiporus longicol*

Extract/Dose	LD50 value(mg)
Methanol	43.473
Acetone	68.115
Aqueous	106.717

Table 3. Effect of *Clerodenrum infortunatum* on gaining of body weight of fourth instar larvae of *Odoiporus longicol*

Name of the extract		4th instar
Methanol	Control	4.8±0.37 c
	Treated	2.53±0.05 e
acetone	Control	5.38±0.07 b
	Treated	3.77±0.64 d
Aqueous	Control	9.15±0.29 a
	Treated	4.87±0.05 b, c

Each value is mean ± SD followed by a common letter do not differ significantly (Tukey's test; P <

Effect of *C. infortunatum* on pupation and adult emergence of fourth instar larvae of *O. longicollis*

Pupation and adult emergence showed significant changes in treated insects (Fig 1, 2 and 3). Percentage of insects enters into pupation and became adults are very low in methanol treated insects compared to that of acetone and aqueous extracts treated.

Discussion

In the present study, *C. infortunatum* showed remarkable percentage of bioactivity against fourth instar larvae of *O. longicollis*. The plant possess different secondary metabolites including a diterpenoid clerodine. It is reported that some fractions of this plant induces antifeedant activity against Helicoverpa armigera (Abbaszadeh et al., 2014). Some of the preliminary studies showed it contain flavonoid, phenols etc.. Synergistic effect of all these compounds

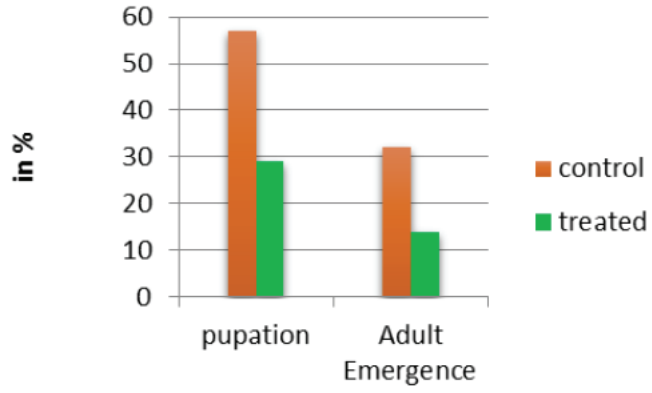

Figure 1. Effect of methanol extract of *Clerodenrum infortunatum* on percentage of pupation and adult emergence

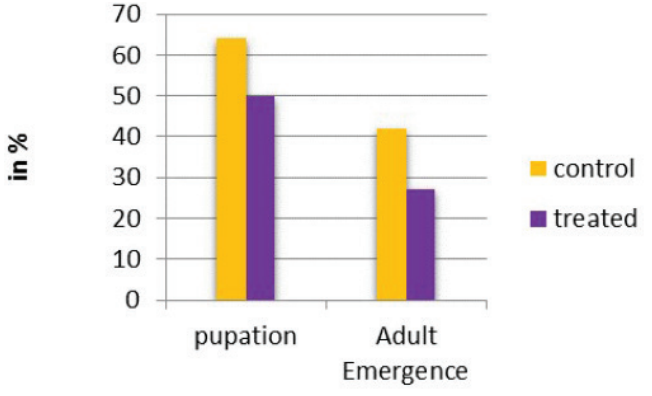

Figure 2. Effect of acetone extract of *Clerodenrum infortunatum* on percentage of pupation and adult emergence

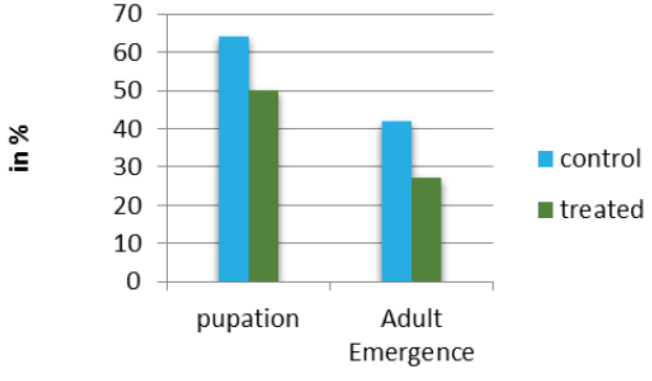

Figure 3. Effect of aqueous extract of *Clerodenrum infortunatum* on percentage of pupation and adult emergence

are responsible for insecticidal properties. Leaf extracts of the same plants possess repellent activity against Tribolium castaneum (Husain and Rahman, 2006) and the leaf dust induce repellency against T. confususm (Husain and Hasan, 2008). Diterpenes also provide insect resistance for plants through feeding inhibition and interference with metabolic processes essential to insect growth (Wagner et al., 1983). Plant extracts possess a broad spectrum of metabolites that are capable of interrupt the normal physiological and biochemical aspects of insects (Fouad et al., 2014). The tested insects showed mortality and reduction in bodyweight. It means, the metabolites present in *C. infortunatum* affect feeding and nutrient uptaking. The extracts might have retard the larval food consumption and efficacy of digested food conversion.

It is also observed, there is some effects on pupation and adult emergence. The alkaloids and other metabolites present in extracts might have acted on the neuroendocrine system of the insects and interrupted in normal metamorphosis. Disruption in moulting into pupae and adults exhibited deformed insects. One of the mentioned example is neem compound cause growth inhibition and changes in the metamorphosis of insects (Martinez, 2011).

Conclusion

Botanical insecticides are differ in their activity with having feeding deterrence, repellency, neuroendocrine disruptor, growth inhibition etc.. By this aspect, *C. infortunatum* is capable of reducing the Banana pseudostem population. This will control the infestation and increase the yield and substantiate food scarcity. Even though it is an ecofriendly approach for peat control. So it can be suggested for preparing a suitable biopesticide for the control of *O. longicollis*.

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