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# Evaluation of Some Biopesticidal Formulations Against Teak (*Tectona grandis* Linn. f.) Skeletonizer, *Eutectona machaeralis* Walker (Lepidoptera: Pyralidae) in India

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**Abstract:** Efficacy of five commercial modern biopesticidal formulations was evaluated against the penultimate instar larvae of *E. machaeralis* in field-cum-lab experiments. These were; plant derived product (Ozomite® @ 0.0025% to 0.02%), *Beauveria bassiana* with combinations of other entomopathogenic fungi (Bioseal plus® @ 0.05% to 0.30%, i.e., $5x10^5$ to $3.0x10^6$ spores/ ml) and *Metarhizium anisopliae* with combinations of other entomopathogenic fungi (Biomet plus® @ 0.05% to 0.30%, i.e., $5x10^5$ to $3.0x10^6$ spores / ml), Actinomycete product (Spinosad) 45%EC (Conserve® @ 0.005% to 0.10%), botanicals with *Bacillus thuringiensis* (Agropest*Bt*® @ 0.01% to 0.05%) apart from water spray as control. The plant derived commercial formulation (Ozomite®) (with 94.44% mortality at 0.01%), Actinomycete product (Conserve®) (with 100% mortality at 0.05%) and botanicals with *Bt* (Agropest*Bt*®) (with 77.78% mortality at 0.05%) proved promising against the *Eutectona machaeralis* larvae. The plant derived commercial formulation (Ozomite®) was the most effective, followed by Actinomycete product (Conserve).

**Keywords:** Biocontrol, Biological Control, Bioefficacy, Biopesticides, Botanical Formulations, Forest Insect Pests, IPM, Teak

## 1. Introduction

The over-realization on the chemical insecticides and resulting hazardous environmental implications, in the form of direct or indirect impacts on over-all biodiversity and the human beings has increased impetus to integrate the bio-rational and ecofriendly methods for the management of insect pests. Thus, the evaluation of modern biocontrol formulations time to time is the suitable alternative to the use of chemical pesticides [1] for promoting use of biocontrol options and integration in the management practices against major insect pests. The same is also true for insect pests affecting forest tree species [2, 3, 4].

Teak is the major timber tree species in central India, which is attacked by a major defoliator, *Eutectona machaeralis* Walker. As per the available reports, this skeletonizer, causes annual growth loss of 13 to 65% in plantations [5] and much higher growth loss to teak seedlings in forest nurseries, i.e., up to 54.77% [6]. A variety of different control methods were experimented in the past like chemical, botanical pesticides and biological control agents to minimize the population of the *E. machaeralis* from forest nurseries, plantations and natural forest [3]. While, some biopesticides of microbial and botanical pesticides have been experimented against this pests earlier [7, 8, 9], not much work on their management by evaluating alternative methods has been carried out.

Laboratory and field evaluation of modern biopesticides has not yet been taken up except some fragmentary reports discussed above. The present paper reports evaluation of modern commercial bipesticidal formulations against teak skeletonizer, which will be valuable for developing Integrated Pest Management module against the pest, in future.

# 2. Material and Methods

### *2.1. Collection of Insects*

The larvae of teak skeletonizer, *E. machaeralis* were collected from teak plantations available within the institute campus and from adjoining forest areas under Mandla Forest Division, Mandla (M. P.), during the month of August, when the larvae are available in plenty. The insect culture was maintained in the laboratory, during the season, in glass beakers covered with muslin cloth and reared on fresh leaves in the laboratory. On emergence, the adults were released into wooden cages containing teak seedlings for oviposition. Newly hatched instars were fed with the fresh teak leaves in the laboratory and the culture was maintained. The penultimate instar larvae of the same ages separated from the laboratory culture were used in bioassay experiments as in earlier works by [10].

### *2.2. Bioassay Experiments*

The desired concentrations of five insecticides, of natural origin, *viz.,* plant derived product (Ozomite®) (@ 0.0025% to 0.02%), *Beauveria bassiana* with combinations of entomopathogenic fungi (Bioseal plus®) (@ 0.05% to 0.30%, i.e., $5x10^5$ to $3.0x10^6$ spores/ ml) and *Metarhizium anisopliae* with other combinations of entomopathogenic fungi (Biomet plus) (@ 0.05% to 0.30%, i.e., $5x10^5$to $3.0x10^6$ spores/ ml), Actinomycete product, ie, Spinosad 45%EC (Conserve®) (@ 0.005% to 0.10%), botanicals with *Bacillus thuringiensis* (Agropest*Bt*.®) (@ 0.01% to 0.05%) were sprayed on the teak leaves of marked tree in plantations at Tropical Forest Research Institte, Jabalpur, India and these treated leaves were fed daily to ten penultimate instar larvae of *E. machaeralis* and mortality in 24 hrs interval was recorded in three replications of treatments and untreated control, thus total larvae exposed for each treatment and control sets were 30 [10].

### *2.3. Statistical Analysis*

The mortality data obtained in per cent values were suitably transformed into angular values (arc √ sin), Log Base ($Log_{10}$) or Square Root [√(x+0.5)], to get the symmetrical data. Mortality recorded in control set was adjusted using Abbott's correction [11] Transformed data were subjected to ANOVA for comparison of means [12].

# 3. Result and Discussion

The results on mortality observed till one week indicated products; Ozomite® (with 94.44% mortality at 0.01%), Conserve (with 100% mortality at 0.05%) and Agropest*Bt*® (with 77.78% mortality at 0.05%) proved promising against the *Eutectonamachaeralis* larvae in teak nurseries. The botanical pesticide, Ozomite® proved significantly ($P$<0.05) effective with all the treatments significantly superior ($P$<0.05) over control. However, concentrations at and above 0.01% provided the best results with mortality observed above 90% (Table 1). The lower concentrations 0.002% and 0.005% caused 50% and 54.17% mortality, respectively.

The larval mortality in all the treatments was statistically superior ($P$<0.05) over control except Bioseal plus® 0.05% with only 11.26% mortality. Bioseal plus® 0.30% caused 64.71% mortality, which was statistically at par ($P$>0.05) with Biomet plus® 0.30% (52.94% mortality) (Table 2).

The field–cum-laboratory experiment with Agropest *bt*® carried out against penultimate instar teak skeletonizer larvae indicated all the concentration tested to be significantly ($P$<0.05) superior over control. Mean corrected mortality varied from 59.26% in the lowest concentration of 0.125% to 77.78% at the highest concentration of 0.05%. However, there was no statistical difference ($P$<0.05) in the mortality obtained with the three concentrations evaluated in the present study (Table 3).

The microbial product of Spinosad (Actinomycete), Conserve® at and above 0.05% proved significantly ($P$<0.05) effective with 100% Mortality in the larvae of teak skeletonizer, followed next by concentration 0.025 with 58.95% mean corrected mortality. The lowest concentration of 0.005% was least effective with only 5.26% mean corrected mortality, which was at par with the control ($P$<0.05) (Table 4). No report on this actinomycete is available against this insect to compare.

The effect of medicinal, microbial and other botanicals product on teak skeletonizer larvae has also been investigated earlier; *A. indica* [7, 13], *Lantana camara* var. *aculeate* and *Aloe vera* [14] and with promising results.

***Table 1.*** *Botanical product Ozomite against the larvae of E. machaeralis.*

| Treatments (%) | Mean corrected mortality (%) |
|---|---|
| 0.002% | $50.00\pm0.00^{b}$ (45.00) |
| 0.005% | $54.17 \pm 15.96^{b}$ (47.43) |
| 0.01% | $95.83\pm8.33^{a}$ (83.98) |
| 0.02% | $100.00\pm 0.00^{a}$ (90.00) |
| Control | $0.00\pm0.00^{c}$ (0.00) |
| *F* | 100.10 |
| *P value* | <0.001 |
| $SE_{(d)}\pm$ | 5.11 |
| $LSD_{(P<0.05)}$ | 11.14 |

Figures in parenthesis are Arc Sin √n values of percentages.

***Table 2.*** *Microbial product of EPF against the larvae of E. machaeralis.*

| Treatments (%) | Mean corrected mortality ±*sd* |
|---|---|
| Bioseal plus 0.05% | $11.76 \pm0.00^{ab}$ (20.06) |
| Bioseal plus 0.10% | $47.06\pm 3.57^{cde}$ (43.61) |
| Bioseal plus 0.30% | $64.71\pm6.65^{e}$ (54.01) |
| Biomet plus 0.05% | $17.65\pm1.19^{bc}$ (24.32) |
| Biomet plus 0.10% | $17.65\pm1.19^{bc}$ (24.32) |

| Treatments (%) | Mean corrected mortality ±*sd* |
|---|---|
| Biomet plus 0.30% | 52.94±1.19[bc] (46.76) |
| Control | 0.00±0.00[a] (0.00) |
| *F* | 13.79 |
| *P value* | <0.001 |
| $SE_{(d)}$± | 7.13 |
| $LSD_{(P<0.05)}$ | 15.54 |

Figures in parenthesis are Arc Sin √n values of percentages.

***Table 3.*** *Botanical product Agropestbt. against the larvae of E. machaeralis.*

| Treatments (%) | Mean corrected mortality (%) |
|---|---|
| 0.0125% | 59.26±40.15[b] (55.88) |
| 0.025.% | 62.96± 13.09[b] (52.77) |
| 0.05% | 77.78±20.29[b] (65.07) |
| Control | 0.00±0.00 (0.00) |
| *F* | 11.85 |
| *P value* | <0.001 |
| $SE_{(d)}$± | 12.09 |
| $LSD_{(P<0.05)}$ | 26.34 |

Figures in parenthesis are Arc Sin √n values of percentages.

***Table 4.*** *Actinomycete product, Spinosad (Conserve® against the larvae of E. machaeralis.*

| Treatments (%) | Mean corrected mortality (%) |
|---|---|
| 0.005% | 5.26±0.00[a] (13.26) |
| 0.01% | 17.89± 9.12[b] (24.50) |
| 0.025% | 58.95 ±18.23[c] (50.26) |
| 0.050% | 100.00± 0.00[d] (90.00) |
| 0.10% | 100.00± 0.00[d] (90.00) |
| Control | 0.00±0.00[a] (0.00) |
| *F* | 295.72 |
| *P value* | <0.001 |
| $SE_{(d)}$± | 3.78 |
| $LSD_{(P<0.05)}$ | 7.89 |

Figures in parenthesis are Arc Sin √n values of percentages.

# 4. Conclusion

The plant derived commercial formulation (Ozomite®), Actinomycete product (Conserve®)and botanicals with *Bt* (Agropest*Bt*®) proved promising against the *Eutectona machaeralis* larvae. The results obtained against the teak skeletonizer larvae may be utilized, which may result in development of biopesticidal product against the pest. The study is significant in judicious management of this pest in forest nurseries.

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