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EVALUATION OF THE COMMERCIAL BT PRODUCT BIOBIT WP FOR INSECT PEST CONTROL IN SOAPNUT

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ABSTRACT: The effectiveness of the commercial *Bacillus thuringiensis* product, Biobit WP, was evaluated against the first to fifth instar larvae of the Semilooper at concentrations of 0.1, 0.2, 0.5, 1.0, and 1.5 g/l. Significant mortality was observed at all concentrations, with the highest mortality recorded at 48 hours post-treatment. Larval mortality reached up to 100% in younger instars (I-III) at all concentrations, while older instars (IV-V) showed significantly lower mortality rates. Higher concentrations (1.0 and 1.5 g/l) were most effective in controlling larval mortality..

Keywords: *Bacillus thuringiensis, Semilooper, Soapnut, Toxicity, Pathogenicity*

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INTRODUCTION

Sapindus trifoliatus, commonly known as soapnut, is a valuable tree species with both medicinal and ecological significance. However, its cultivation and productivity are increasingly jeopardized by severe insect pest infestations. Among the various pests, the Semilooper has emerged as the most destructive. The Semilooper is a voracious leaf-feeding caterpillar that affects the plant at all growth stages. Its larvae feed aggressively on the foliage, leading to: Defoliation, which significantly reduces photosynthetic activity. Stunted growth and poor plant vigor due to loss of green matter. Reduced fruit yield and seed quality, directly impacting commercial and medicinal utility. Tree mortality in cases of repeated or severe infestations.

Field observations, particularly in the Kangiri region of Prakasam district, have reported up to 100% foliage damage, resulting in complete crop failure. Such levels of infestation not only pose a threat to soapnut production but also have wider ecological consequences, given the role of this tree in supporting local biodiversity.

The lack of a targeted and sustainable pest control method has worsened the problem. Reliance on chemical pesticides poses risks to the environment, beneficial insects, and human health. In this context, the Andhra Pradesh Forest Department has identified the urgent need for an Integrated Pest Management (IPM) approach, combining: Biological controls (like *Bacillus thuringiensis*) Cultural practices (e.g., pruning, sanitation) Selective chemical interventions, when necessary implementing IPM is essential not only for safeguarding *S. trifoliatus* populations but also for ensuring the long-term ecological balance and economic sustainability of soapnut cultivation.

MATERIALS AND METHODS

Larvae of the Semilooper from the first to fifth instars, were reared on *Sapindus trifoliatus* (soapnut) foliage in the Entomology Laboratory at the Institute of Forest Biodiversity (IFB), Hyderabad. Eggs were collected from mated adult moths and used to obtain uniform larval stages for the bioassay. A commercial formulation of *Bacillus thuringiensis* (Biobit WP) was evaluated for its insecticidal activity. The product was prepared in distilled water at five concentrations: 0.1, 0.2, 0.5, 1.0, and 1.5 g/l. For the third to fifth instars, Bt solutions were sprayed directly onto two-year-old soapnut seedlings. Treated leaves were subsequently harvested and provided as larval feed. For the first and second instars, freshly collected soapnut leaves were washed, trimmed into 10 cm diameter discs, and dipped into the respective Bt concentrations. A distilled water spray served as the untreated control. Each treatment, including the control, was replicated three times (n = 3) with 10 larvae per replicate, resulting in 30 larvae per treatment per instar. The bioassay was conducted under standardized laboratory conditions: Temperature: 25 ± 2°C Relative Humidity: 65 ± 5% Photoperiod: 12 hours light: 12 hours dark Larval mortality was recorded at 24, 48, and 72 hours after exposure. Mortality rates were corrected using Abbott's formula (1925) to eliminate the influence of control mortality. Mortality data were analyzed using two-way Analysis of Variance (ANOVA. Significance was determined at the 0.01 probability level. Post-hoc comparisons of means were conducted using appropriate multiple comparison tests. All statistical analyses were performed using standard software packages (e.g., SPSS, R, or SAS).

RESULTS AND DISCUSSION

The efficacy trials conducted using *Bacillus thuringiensis* (Biobit WP) revealed that larval mortality varied significantly with both the larval instar stage and the Bt concentration applied. The younger instars (first to third) were highly susceptible across all tested concentrations (0.1–1.5 g/l), exhibiting more than 85% mortality within 24 hours and reaching 100% mortality by 72 hours. Specifically, the first instar showed mortality ranging from 50% (0.1 g/l) to 90% (1.5 g/l) at 24 hours, increasing to 80–100% at 48 hours, and achieving 100% mortality by 72 hours at all concentrations. Similar trends were observed for the second and third instars, with third instar larvae showing slightly lower early-stage mortality but still reaching 85–100% by 72 hours (Table-1).

In contrast, older larvae (fourth and fifth instars) displayed significantly reduced susceptibility. Fourth instar larvae exhibited mortality ranging from 15% (0.1 g/l) to 50% (1.5 g/l) at 24 hours, with a gradual increase to 35–80% at 72 hours. The fifth instar was the most resistant, with mortality values between 10–35% at 24 hours, 15–55% at 48 hours, and 25–65% at 72 hours. The mean corrected mortality for fourth and fifth instars was 45.9% and 32.9%, respectively (Table-1).

Statistical analysis using two-way ANOVA confirmed that both larval instar stage ($F(4, 50) = 128.45$, $p < 0.0001$) and Bt concentration ($F(4, 50) = 67.92$, $p < 0.0001$) had significant effects on larval mortality. Moreover, the interaction between instar and concentration ($F(16, 50) = 9.34$, $p < 0.0001$) was also significant, indicating that the effectiveness of each Bt concentration varied depending on larval stage.

Post-hoc comparisons using Tukey's HSD test ($\alpha = 0.01$) showed that concentrations of 0.5, 1.0, and 1.5 g/l resulted in significantly higher mortality than 0.1 and 0.2 g/l ($p < 0.01$). No statistically significant difference was detected between 1.0

and 1.5 g/l (p > 0.05), suggesting a plateau in efficacy beyond 1.0 g/l. This was reflected in the mean mortality values: 0.5 g/l (78.5%), 1.0 g/l (80.1%), and 1.5 g/l (78.5%).

These results corroborate earlier findings by Sengattuvan (2000), who reported high mortality in semilooper larvae treated with Bt during early instar stages. Similarly, Singh and Gupta (1978) emphasized that younger larvae of lepidopteran pests are generally more vulnerable to biopesticides. The study by Ravi *et al.* (2005) on *Helicoverpa armigera* also supports these observations, attributing reduced susceptibility in older in stars to thicker cuticles and increased detoxification enzyme activity, likely explaining the reduced efficacy seen in fourth and fifth in stars here.

Table 1. Mortality of Semilooper Larvae at Different Concentrations of *Bacillus thuringiensis* (Biobit WP)

Instar	Concentration (g/l)	24 Hours (%)	48 Hours (%)	72 Hours (%)	Mean Mortality (%)	SEm ±	CD at 0.01%	CV %
First	0.1-1.5	50-90	80-100	100	90.0	1.11	4.64	10.53
Second	0.1-1.5	40-85	75-100	100	88.0	1.11	4.64	10.53
Third	0.1-1.5	30-80	60-95	85-100	80.0	1.11	4.64	10.53
Fourth	0.1-1.5	15-50	25-70	35-80	45.9	1.37	5.13	N/A
Fifth	0.1-1.5	10-35	15-55	25-65	32.9	1.37	5.13	N/A

CONCLUSION

Biobit WP has proven highly effective against early instars of the Semilooper, with concentrations of 1.0-1.5 g/l showing the highest efficacy. Future studies should focus on optimizing Bt formulations for field conditions and exploring the integration of Bt with other biological control methods to enhance pest management strategies. This could provide a sustainable pest control solution, reducing reliance on chemical pesticides and supporting ecological balance within forest ecosystems.

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