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Assessment of the *Bacillus thurengesis* Product Halt WP for Controlling Insect Pests in Soapnut

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Abstract

The effectiveness of a commercial *Bacillus thuringiensis* product, Halt WP, was evaluated at concentrations of 0.1, 0.2, 0.5, 1.0, and 1.5 g/l against the first to fifth instar larvae of the Semilooper. The larvae showed high susceptibility to *B. thuringiensis* across all concentrations. Larval death began after 24 hours, with the highest mortality observed after 48 hours of continuous feeding on *B. thuringiensis* treated leaves. Among the tested concentrations, higher concentrations (1.0 and 1.5 g/l) were most effective in killing larvae. Complete larval mortality, up to 100%, was observed in younger larvae (up to the third instar) at all concentrations, regardless of the product used, while older larvae showed lower mortality rates.

***Key words*: *Bacillus thuringiensis*, Semilooper, Soapnut, Toxicity, Pathogenicity**

Sapindus trifoliatus, a tree species belonging to the Sapindaceae family, is primarily found in the Western Ghats and plains of South India. It is renowned for its medicinal uses in Ayurveda, Unani, and Tibetan medicine, where it is employed to treat various ailments, including diabetes and epilepsy [1-2]. *Sapindus trifoliatus* has been widely used in traditional medicinal systems such as Ayurveda, Unani, and Tibetan medicine due to its diverse therapeutic properties. Scientific studies have identified bioactive compounds in *Sapindus trifoliatus*, including saponins, flavonoids, and alkaloids, which contribute to its medicinal benefits. *Sapindus trifoliatus* stands as a multifunctional tree with immense medicinal value, particularly in traditional medicine systems. Ongoing research continues to explore its therapeutic potential, especially for diabetes and neurological disorders, further solidifying its role as a valuable medicinal resource. Despite its benefits, the health and productivity of *Sapindus trifoliatus* are increasingly threatened by insect pests, which is the central concern of this project. The declining productivity and rising mortality rates of *Sapindus trifoliatus* are mainly due to infestations by insect pests [3]. While *Sapindus trifoliatus* (South Indian Soapnut) is highly valued for its medicinal, agricultural, and commercial applications, its health and productivity are under increasing threat due to insect pest infestations. These infestations are leading to declining yields, increased tree mortality, and compromised plant health, posing a significant challenge for conservation and sustainable utilization of this species. The Andhra Pradesh Forest Department has recognized the need for an Integrated Pest Management (IPM) system to safeguard these trees from further harm. IPM is an eco-friendly pest control strategy that combines biological control, chemical methods, cultural practices, and physical techniques to manage pest populations sustainably [4]. Beyond its economic importance, *Sapindus trifoliatus* also plays a vital role in the local ecosystem, offering habitat and food for various organisms. However, the ongoing pest problems pose a serious threat to its survival and productivity, emphasizing the need for an effective pest management strategy [5]. Among the pests identified, Semilooper insects have caused 100% damage to soapnut trees in the Kangiri Prakasam district, making them a significant concern. Further research is needed to understand the full spectrum of pest species, their population dynamics, and the stages of the tree's life cycle most vulnerable to infestations.

MATERIALS AND METHODS

Larvae of Semilooper from first to fifth instars were reared in the IFB Hyderabad, Entomology laboratory on soapnut, and eggs collected from adult moths on mating were used for the study. A commercial formulation of *Bacillus thuringiensis* (such as Halt) was tested for its pathogenicity against the semi looper. The product was diluted with distilled water and applied at concentrations of 0.1, 0.2, 0.5, 1.0, and 1.5 g/l. Four different product concentrations were sprayed directly onto two-year-old soapnut seedlings. After treatment, the leaves were collected and used as food for larvae ranging from the third to fifth instars. Fresh soapnut leaves were collected from the field, washed with tap water, and cut into circles of 10 cm in diameter. These leaf discs were then dipped in five concentrations of *Bacillus thuringiensis* (0.1, 0.2, 0.5, 1.0, and 1.5 g/l), and larvae of the first and second instars were placed

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on the discs. A water spray served as the control. Each treatment, including the untreated control, was replicated three times, with each replication consisting of 10 larvae. The number of dead and moribund larvae was recorded at 24-, 48-, and 72-hours post-treatment. Mortality data were collected for up to 72 hours and analyzed using ANOVA. Total mortality was corrected for control mortality using Abbott's formula [6].

$$\text{\% corrected mortality} = \frac{\text{\% test mortality - \% control mortality}}{\text{100 - \% control mortality}}$$

The extraction was carried out in the Soxhlet's extraction apparatus. The sample containing leaves of the selected plant material was air-dried for 6-7 days. After complete drying the plant parts were pulverized into powder with the help of mixer grinder. The plant material was extracted by Soxhlet extraction method.

RESULTS AND DISCUSSION

Similar to other commercial products of *B.t,* Halt was also proved to be effective on younger larvae recording 95.5 to100.0 percent mortality from first to third instars (Table 1). Low mean larval mortality of 44.0 and 22.5 percent was recorded by fourth and fifth instar larvae and differed significantly with each other. The Halt tested at 0.1, 0.2, 0.5, 1.0 and 1.5 g/l. concentrations recorded the mean larval mortality of 63.5, 70.5, 73.0, 74.0, and 81.0 percent, respectively. Wherein the dosage is used at 1.0 and 1.5 g/l. recorded the percent mean larval morality which was significantly superior to the rest of the dosages [7-9]. The interaction effect between concentrations and larval instars revealed that there was a direct relationship of dosage v/s age of the larvae as evidenced by recording higher mean larval mortality up to 100.0 percent up to third instars irrespective of concentrations tested [10]. The efficacy of Halt decreased as the age of the larvae increased (Table 1).

Halt WP, a commercial formulation of *Bacillus thuringiensis* (B.t.), was tested for its efficacy against different larval instars of semilooper under laboratory conditions. The study revealed that younger larvae (first to third instars) were highly susceptible, with mortality rates reaching 95.5–100%, whereas older larvae (fourth and fifth instars) exhibited lower susceptibility. The efficacy of Halt was also found to be concentration-dependent, with higher doses (1.0 and 1.5 g/L) leading to significantly higher mortality rates. To counteract these threats, a comprehensive pest management approach is required, integrating biological, chemical, and cultural control methods to ensure the sustainability of *Sapindus trifoliatus* plantations [11-17].

Table 1 Efficacy of *Bacillus thuringiensis* (Halt WP)* on different larval instars of semilooper under laboratory conditions

Larval instars	0.1				0.2				0.5				1				1.5				
	Percent larval mortality after (hr)																				
	24	48	72	Total	24	48	72	Total	24	48	72	Total	24	48	72	Total	24	48	72	Total	Mean
I	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)
II	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)
III	-	15.0 (22.7)	-	77.5 (31.6)	90.0 (71.6)	10.0 (18.4)	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)	-	-	100 (90.0)	100 (90.0)
IV	-	27.5 (31.6)	-	27.5 (31.6)	7.50 (15.9)	32.5 (34.8)	-	40.0 (39.2)	15.0 (22.8)	20.0 (26.4)	-	35.0 (36.3)	12.5 (20.7)	35.0 (36.3)	-	47.5 (43.6)	7.5 (15.9)	40.0 (39.2)	22.5 (28.3)	70.0 (56.8)	44.0 (41.6)
V	-	7.5 (15.9)	5.0 (12.9)	12.5 (20.7)	-	10.0 (18.4)	2.5 (9.1)	12.5 (20.7)	10.0 (18.4)	20.0 (26.6)	-	30.0 (33.2)	-	20.0 (26.6)	2.5 (9.1)	22.5 (28.3)	2.5 (9.1)	30.0 (33.2)	2.5 (9.1)	35.0 (36.3)	22.5 (28.3)
Mean	-	-	-	63.5 (52.8)	-	-	-	70.5 (57.0)	-	-	-	73.0 (58.7)	-	-	-	74.0 (59.3)	-	-	-	81.0 (64.2)	

Factor	SEm ±	CD at 0.05	CV %
Instar	1.1	4.64	10.35
Concentration	1.37	5.13	-

CONCLUSION

In conclusion, future research should prioritize improving the effectiveness of *Bacillus thuringiensis* (Bt) as an insect pathogen. Exploring its ability to manage pest populations in field conditions, especially when combined with other biological control techniques, has the potential to enhance pest management strategies. This approach offers a sustainable alternative to chemical pesticides, helping to maintain ecological balance within forest ecosystems. The increasing threat posed by insect pests is a major concern for the conservation and commercial viability of *Sapindus trifoliatus*. Without intervention, declining productivity and rising mortality rates will continue to impact its availability for medicinal and industrial uses. By implementing integrated pest management strategies, we can safeguard this valuable tree species and ensure its sustainable cultivation and utilization.

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