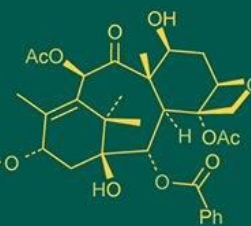
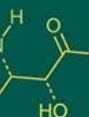
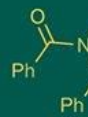


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Deepa M
ICFRE-Institute of Forest
Biodiversity, Dulapally,
Hyderabad, Telangana, India

K Rahul
DAATTC, Jogipet, Telangana,
India

Yuvaraj Praveen
ICFRE-Institute of Forest
Biodiversity, Dulapally,
Hyderabad, Telangana, India

Antifeedant and feeding deterrent activity of *Sphaeranthus indicus* Leaf extract against *Achaea janata* (Lepidoptera: Noctuidae)

Deepa M, K Rahul and Yuvaraj Praveen

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Abstract

The present investigation evaluated the antifeedant potential of *Sphaeranthus indicus* leaf extracts against the castor semilooper, *Achaea janata*, under laboratory conditions. Leaf extracts were prepared using Soxhlet extraction and tested at different concentrations (0.25, 0.50, 0.75 and 1.0%) and compared with a neem-based formulation (Nimbecidine 0.5%), a chemical insecticide (Profenophos 0.05%) and untreated control. Significant differences were observed in leaf consumption, uneaten leaf weight and faecal pellet excretion among treatments. Maximum antifeedant activity was recorded in Profenophos, followed by Nimbecidine and 1.0% *S. indicus* extract, indicating strong feeding deterrence. Increasing concentrations of *S. indicus* resulted in progressive reduction in leaf consumption and increased faecal pellet excretion, suggesting physiological disturbance in larvae. The study confirms the potential of *S. indicus* as a botanical antifeedant for eco-friendly management of *A. janata*.

Keywords: *Sphaeranthus indicus*, antifeedant activity, *Achaea janata*, botanical insecticide, Soxhlet extraction

Introduction

The semilooper, *Achaea janata* L., is a serious defoliator of *Gmelina arborea* and several other host plants, causing considerable yield losses. Management of this pest largely depends on synthetic insecticides, which often lead to problems such as pesticide resistance, environmental contamination and adverse effects on non-target organisms. In recent years, botanical insecticides have gained importance due to their biodegradability, safety and compatibility with integrated pest management (IPM) programmes.

Sphaeranthus indicus Linn., a medicinal plant widely distributed in India, is known to possess diverse bioactive compounds with insecticidal, antifeedant and growth regulatory properties. However, systematic studies on its feeding deterrent effects against *A. janata* are limited. The present study was therefore undertaken to assess the antifeedant activity of *S. indicus* leaf extracts at different concentrations and to compare their efficacy with neem-based and chemical insecticides.

Methods and Materials

Larvae of *Achaea janata* were collected from *Gmelina arborea* fields and reared under laboratory conditions at room temperature. Healthy and uniformly grown larvae were used for the bioassay. Fresh leaves of *Sphaeranthus indicus* were collected, shade-dried and powdered. The powdered material was subjected to Soxhlet extraction using a suitable organic solvent. The extraction was continued until the solvent in the siphon tube became colourless. The extract was concentrated by evaporating the solvent under reduced pressure and stored at 4 °C. Required concentrations (0.25, 0.50, 0.75 and 1.0%) were prepared using distilled water with a suitable emulsifier. The treatments consisted of *S. indicus* extract at four concentrations (0.25, 0.50, 0.75 and 1.0%), Nimbecidine (0.5%), Profenophos (0.05%) and an untreated control. Fresh castor leaves were weighed and treated with respective concentrations. After air drying, treated leaves were offered to individual larvae. After 24 hours, the weight of leaf material consumed, uneaten leaf and faecal pellets excreted were recorded.

Corresponding Author:
Deepa M
ICFRE-Institute of Forest
Biodiversity, Dulapally,
Hyderabad, Telangana, India

The experiment was conducted in a completely randomized design and data were subjected to statistical analysis.



Fig 1: Collection of *S. indicus* from Kurnool Andhra Pradesh



Fig 2: Separation of *S. indicus* collected from Kurnool Andhra Pradesh



Fig 3: Shade drying of *S. indicus* in IFT, Hyderabad Laboratory



Fig 4: Powder making



Fig 5: Soxhlet Extraction

Results and Discussion

The results revealed significant differences in leaf consumption among treatments. Larvae consumed the least quantity of leaf material in Profenophos treatment (0.979 g), followed by Nimbecidine (1.661 g) and *S. indicus* at 1.0% concentration (2.201 g). In contrast, the maximum consumption was observed in the untreated control (5.288 g) (Table 1). A gradual decrease in feeding was noticed with increasing concentrations of *S. indicus*, clearly indicating dose-dependent antifeedant activity.

Table 1: Relative feeding potentiality of *Achaea janata* at different concentrations of *S indicus*.

Sl. No	Treatment/Concentration (%)	Average Wt. of leaf Feed eaten (gms)	Average Wt. or leaf feed uneaten (gms)	Average Wt. of Faecal Pallets excreted (gms)
1	0.25	4.604	1.755	0.746
2	0.50	3.829	2.531	0.953
3	0.75	2.998	3.362	1.322
4	1.0	2.201	4.181	1.783
5	Nimbecidine (0.5)	1.661	4.707	2.182
6	Profenophos (0.05)	0.979	5.381	1.755
7	Control	5.288	1.085	0.762
	C.D	0.1758	0.1758	0.0896

The quantity of uneaten leaf material differed significantly among the various treatments, clearly reflecting the feeding deterrent effect of the test substances. Maximum uneaten leaf was recorded in the Profenophos treatment (5.381 g), indicating the strongest suppression of feeding activity, followed by the neem-based formulation Nimbecidine (4.707 g) and *Sphaeranthus indicus* at 1.0% concentration (4.181 g). In contrast, the untreated control recorded the least quantity of uneaten leaf (1.085 g), confirming unrestricted and normal feeding behaviour in the absence of deterrent compounds. Similar reductions in feeding and

increased leaf rejection due to antifeedant compounds have been reported earlier for several botanical extracts (Isman, 2006; Koul *et al.*, 2008; Pavela, 2016) ^[1, 3, 4]. The gradual increase in uneaten leaf with increasing concentrations of *S. indicus* extract suggests a clear dose-dependent antifeedant response, which is characteristic of many plant-derived secondary metabolites (Warthen and Morgan, 1990) ^[7].

Significant variation was also observed in the quantity of faecal pellets excreted by *Achaea janata* larvae under different treatments. Higher faecal pellet production was recorded in larvae fed on Nimbecidine-treated leaves (2.182

g) and *S. indicus* at 1.0% concentration (1.783 g) compared to lower concentrations and the untreated control. Increased faecal excretion may indicate physiological or biochemical disturbances in the larval gut caused by bioactive compounds, leading to reduced digestive efficiency and poor nutrient assimilation. Similar effects of neem and other botanical extracts on gut physiology, digestion and metabolism in lepidopteran larvae have been reported by Senthil-Nathan (2013) ^[6] and Jeyasankar *et al.* (2012) ^[2].

Based on leaf consumption data, the descending order of antifeedant activity was Profenophos > Nimbecidine > *S. indicus* 1.0% > 0.75% > 0.50% > 0.25% > untreated control. Although Profenophos and Nimbecidine showed superior feeding deterrence, the efficacy of *S. indicus*, particularly at higher concentrations, was noteworthy and comparable to neem-based formulations. Botanical antifeedants are known to deter feeding by affecting chemoreceptors and disrupting normal feeding behaviour (Saxena, 1989; Isman, 2006) ^[5, 1]. The strong antifeedant activity exhibited by *S. indicus* at 1.0% concentration highlights its potential as an eco-friendly and sustainable alternative to synthetic insecticides for the management of *A. janata*, especially within integrated pest management programmes.

Conclusion

The study highlights the potential of *Sphaeranthus indicus* leaf extracts as an effective antifeedant against *Achaea janata*. Its dose-dependent feeding deterrence and physiological effects on larvae suggest its suitability for incorporation into eco-friendly pest management strategies.

Disclaimer

(Artificial intelligence) Author(s) hereby declare that no generative AI technologies such as Large Language Models (Chat GPT, COPILOT, etc) and text-to-image generators have been used by them during writing or editing manuscripts.

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Competing Interests Author(s) declared that no conflict of interests exists.

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