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Evaluation of antifeedant activity of some herbal oils against *Spodoptera litura* (Fab.) under laboratory condition

MS Wankhede, US Kulkarni and Vrunda S Thakare

Abstract
The present study was aimed to evaluate the antifeedant activity of essential herbal oils *viz.* Karanj (*Pongamia glabra*) oil @ 2%, Neem (*Azadirachta indica*) oil @ 2%, Sesame (*Sesamum inidicum*) oil @ 2% against the *Spodoptera litura* (Fab.) larva under laboratory conditions using 'No choice' feeding bioassay technique. The result shows that all the herbal oils used in the present investigation caused reduction in feeding over control. But the maximum antifeedant activity (i.e. 61.51%) against *S. litura* was exerted by karanj oil @ 2% and maximum (i.e. 44.86%) feeding inhibition was observed in karanj oil @ 2%, it was followed by neem oil @ 2% (32.74%) and sesame oil @ 2% (10.45%). Experiment concludes that these herbal oils have good antifeedant activity against *S. litura* that can be used in pest management.

Keywords: Herbal oils, *Spodoptera litura* (Fab.), laboratory

Introduction
The tobacco caterpillar, *S. litura* is an economically important polyphagous pest in India and is considered as one of the major threats to the present-day intensive agriculture and changing cropping patterns worldwide, next only to *Helicovera armigera* (Hubner). *Spodoptera litura* is reported to feed on 150 species of plants [15] causing 26-100 per cent yield loss under field conditions [7]**.** For the management of *S. litura* in soybean growers have been depending exclusively on application of various insecticides. As a result, *S. litura* have developed multiple resistances and field control failure is often more frequent [11]. Indiscriminate use of insecticides, multiple generations of insects per annum, year-round availability of host crops contributed to the insecticide resistance. Recently, resistance to some newer insecticides such as abamectin, spinosad and indoxacarb has also been documented [6], [1], [16]. Due to the development of insect resistance to many chemical pesticides [2], [5], [8], alternative strategies to control the insects are gaining ground. In this context, plants are important natural sources of bioactive compounds and many such plant compounds have been included in commercial botanical pesticides [3]. The compounds present in the neem oil are reported as strong antifeedants and growth inhibitors against lepidopteran larvae [10]. Hence the present investigation was undertaken to evaluate antifeedant activity and the effects of some herbal oils on growth parameters of *Spodoptera litura*.

Materials and Methods
The antifeedant activity of different plant oils *viz.* Karanj (*Pongamia glabra*) oil @ 2%, Neem (*Azadirachta indica*) oil @ 2%, Sesame (*Sesamum inidicum*) oil @ 2% was evaluated against the *Spodoptera litura* (Fab.) under laboratory conditions using 'No choice' feeding bioassay technique (Plate 6). Castor, *Ricinus communis* L. was utilized to treat and feed the 3rd instar larvae of *S. litura* during the experiment.

The fresh and matured leaves of castor were plucked and thoroughly washed and dried with the help of filter paper and the leaf discs of measured area (using leaf area meter) were cut from them. These were later dipped in the respective plant oils for approx. 2 to 3 minutes and air dried for a while. These leaf discs were kept in the centre of pre-sterilized corning glass petridishes (Fig. 1) containing an inner lining of moist filter paper. All the treatments were replicated three times along with one control. Already starved (3 hrs) and freshly moulted 2 larvae of same age were released in each Petri dish and were allowed to feed until more than75% leaf discs were eaten away in control.

Fig 1: Preparation of Bioassay set

Fig 2: Leaf area after consumption by *S. litura*

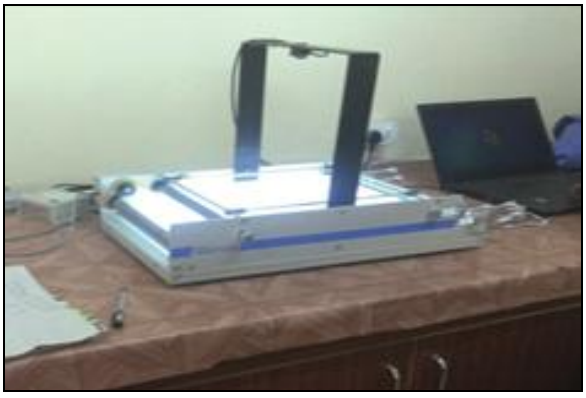

Fig 3: Measurement of Leaf Area by Leaf Area Meter (Make-Biovis)

The data on the leaf area consumed (Fig. 2) was recorded with leaf area meter (Fig. 3) and the computation was made on the per cent leaf area protection over control and the antifeedancy was rated using following formulas given by [4], Antifeedant activity (A.A.) by [18], Feeding Inhibition (FI) by [12].

$$\text{Leaf Area Protected} = \frac{\text{Leaf area left}}{\text{Total leaf area supplied}} \times 100$$

Antifeedant activity (A.A.) was calculated using formula given by

$$\text{Antifeedant activity} = \frac{\text{[Leaf protection in treated disc (\%)]} - \text{[Leaf protection in control disc (\%)]}}{100 - \text{[Leaf protection in control disc (\%)]}} \times 100$$

$$\text{Feeding Inhibition (FI)} = \frac{C - T}{C + T} \times 100$$

Where,
C = Consumption of control discs
T = Consumption of treated discs

Results

Effect of different herbal oils on leaf area consumption by *S. litura*

Data indicated that all the herbal oils used in the present investigation caused reduction in feeding over control (4.44 cm^2).

Mean leaf area

In this context, the highest (i.e. 3.60 cm^2) mean leaf area consumed by 3 rd instar larvae of *Spodoptera litura* (Fab.) was observed in sesame oil (*Sesamum indicum*) @ 2%, followed by neem oil (*Azadirachta indica*) @ 2% (2.25 cm^2) and karanj oil (*Pongamia glabra*) @ 2% (1.69 cm^2).

Per cent leaf area consume

Results showed that the highest per cent leaf area consumed by 3 rd instar larvae of *Spodoptera litura* (Fab.) was observed in sesame oil @ 2% (8.44%), followed by neem oil @ 2% (5.22%) and karanj oil @ 2% (3.98%) over control (10.34%).

Per cent leaf area protected

Data presented in Table 1 and Fig. 4 showed that the highest per cent leaf area protected against the 3 rd instar larvae of *Spodoptera litura* (Fab.) was observed in karanj oil (*Pongamia glabra*) (96.02%) followed by neem oil (*Azadirachta indica*) (94.78%) and sesame oil (*Sesamum indicum*) (91.56%) over control (89.66%).

Antifeedant activity

Data presented in Table 1 and Fig. 4 showed that the maximum (i.e. 61.51%) antifeedant activity against *S. litura* was exerted by karanj oil @ 2%. It was followed by neem oil @ 2% (49.51%) and sesame oil @ 2% (18.38%).

Feeding inhibition

In this case karanj oil @ 2% showed maximum feeding inhibition i.e. 44.86%, followed by neem oil @ 2% (32.74%) and sesame oil @ 2% (10.45%).

Table 1: Effect of herbal oils on food consumption and feeding inhibition of *S. litura* (Fab.)

Treatments	Mean leaf area consumed (cm^2)	Leaf area consumed (%)	Leaf area protected (%)	Antifeedant activity (%)	Feeding inhibition (%)
Karanj (*Pongamia glabra*) oil @2%	1.69	3.98	96.02	61.51	44.86
Neem (*Azadirachta indica)* oil @2%	2.25	5.22	94.78	49.51	32.74
Sesame (*Sesamum indicum)* oil @2%	3.60	8.44	91.56	18.38	10.45
Control (untreated)	4.44	10.34	89.66		

Discussion

The present results are in conformity with [19] who reported that karanjin had high antifeedant activity against fourth instar larvae of *S. litura* [13]. Also reported that out of the several plant extracts tested in laboratory, karanj oil had the highest antifeedant activity against third instar larvae of *S. litura*. Pongamia oil at 0.1% acted as excellent antifeedant and protected 83.5 per cent of the treated leaf as reported by [17], though [9] reported 15% extracts of seeds of *P. glabra* gave 66.4% protection. The results were more prominent in Karanj oil as observed in the present studies. [14] Reported that karanjin extracted from Karanj seed oil (*P. glabra*) was found to have an effect on larvae of *Tribolium castaneum* similar to that of a juvenile hormone.

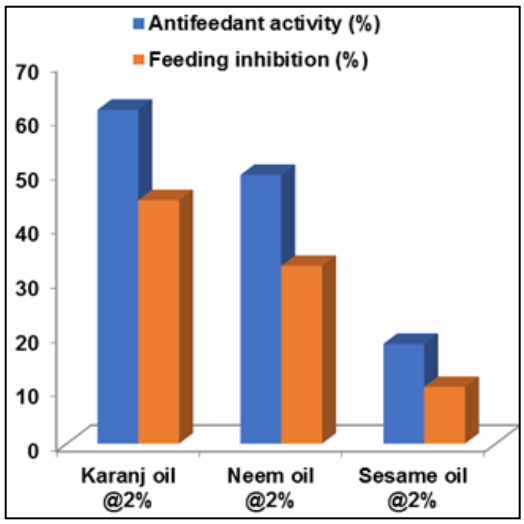

Fig 4: Effect of herbal oils on food consumption and feeding inhibition of *S. litura* (Fab.)

Conclusion

The maximum antifeedant activity in 3rd instar larvae of *S. litura* was exerted by Karanj oil @ 2% followed by Neem oil @ 2% and Sesame oil @ 2%. The maximum feeding inhibition in 3rd instar larvae of *S. litura* was observed in karanj oil @ 2%. It was followed by neem oil @ 2% and sesame oil @ 2%. From the present investigation, we inferenced that karanj oil was most effective antifeedant activity against *Spodeptera litura.*

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