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Laboratory evaluation of antifeedant activities of certain aqueous leaf extracts against *Spodoptera litura* fab. (Noctuidae: Lepidoptera)

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Abstract
Antifeedant activity of aqueous leaf extracts of certain plants such as Cryptostegia grandiflora, Mansoa alliacea, Allamanda cathartica, Allamanda blanchetti and Xanthium strumarium and leaves of tree species such as Kigelia pinnata, Bauhinia Purpurea, Drypetes roxburghi, Conocarpus lancifolius and Polyalthia longifolia were studied against third instars of Spodoptera litura at different concentration (3%, 5% and 10%). The extract was prepared by drying the selected plant parts, powdered and soaked in water for 24 hrs. The third instars of S. litura were exposed to various concentrations and Percent antifeedant were recorded after 24hrs. The maximum leaf area protection was noticed in the aqueous extract of leaves (92.60%) in Xanthium strumarium @ 10% respectively. The minimum per cent antifeedancy was noticed in the treatment, Mansoa alliacea 10 % with 51.65 % antifeedancy. Results revealed that the antifeedancy was increased with increasing in concentration of the plant extracts.

Keywords: *Spodoptera litura*, aqueous extract, antifeedant activity

Introduction
Spodoptera litura Fab. is a polyphagous insect present in tropics all throughout the year (Talukder and Howse, 1994) [7] and cause extensive damage in more than 112 species of cultivated crops. The management schedule of *S. litura*, includes variety of options and one of the nonchemical methods is plant extracts. Botanicals are preferred because they manifest their effect on insects in several ways including insecticidal, antifeedant, growth inhibition, suppression of reproductive behaviour and reduction of fecundity and fertility (Jbilou *et al*., 2006) [3]. Feeding deterrency caused by the botanicals (Schmutterer, 1985) [6] prevent the motility of the gut (Leuschner, 1972) [5]. Some compounds, either separately or synergistically, makes up a barrier in plants (Vendan *et al*., 2008) [8].
Infestation by *S. litura* has been majorly controlled by the use of insecticides. This resulted in selective pressure on sprayed population and development of resistance against insecticides (Kranthi *et al*., 2001) [4]. With greater awareness of hazards associated with the use of synthetic pesticides, it has been increased need to explore a suitable alternative method of pest control. Farmers use different plant materials to protect their crops from pest infestation. Natural products in their crude form or plant extract provide unlimited opportunities as a bio pesticide.
It has been suggested that tremendous interest was generated in recent years about the use of pesticidal plants, particularly those that can be harvested, formulated and used easily. In India, several plant products have been screened and tested against these pests (Arivoli and Tennyson, 2013) [1]. However, screening of plant extracts is still continuing throughout the world to find out different kinds of effects of botanicals and to obtain an eco-friendly biopesticide. Therefore, the present study focuses on the insecticidal activity of some plant extracts against *Spodoptera litura* (Fab.).

Materials and Methods
Plant Collection and Extraction
Leaves of *Cryptostegia grandiflora, Mansoa alliacea, Allamanda cathartica, Allamanda blanchetii, Xanthium strumarium, Kigelia pinnata, Bauhinia purpurea, Drypetes roxburghi, Conocarpus lancifolius and Polyalthia longifolia* were collected from Annamalai nagar (11.3921° N, 79.7147° E), Chidambaram and properly authentied.
The leaves were shade dried and powdered in an electric blender and stored in air tight container in refrigerator till further use. From the stock 100 g of powdered leaves was extracted with 500 ml (1:5) of HPLC water and continuously shaking the bottle for 4 hrs by magnetic stirrer and kept it undisturbed for overnight separately.

Rearing of *Spodoptera litura* (Noctuidae: Lepidoptera)

Mass culturing of *S. litura* was initiated with egg masses collected from the black gram fields in and around Annamalai nagar, Chidambaram. Larvae hatched out from the collected egg masses were transferred using a pointed camel hairbrush to the fresh castor leaves placed in a rearing tray, before it treated with sodium hypochlorite solution (0.02%) and covered with muslin cloth, under the laboratory conditions of 25 ± 2º c temperature, 70 ± 5% relative humidity and 16L: 8D photoperiod. The older castor leaves were replaced by fresh leaves and regular maintenance was carried out. Sterilized moist sandy soil was provided to the fifth instars for pupation. Three-day-old pupae were treated with 0.02% formaldehyde solution to protect them from infection. Pupae took a week to emerge. Pupae were collected and placed into the oviposition cage (1' × 1' × 1'). After adult emergence, few cotton lumps dipped in 5% honey water as an adult feed and provide *Nerium oleander*, which is used for ovipositional substrate and. The plants kept in the oviposition cages were checked regularly and eggs 0.05% sodium hypochlorite solution. Emerged neonates (F1 generation) were transferred to the castor leaves and this culture was maintained eternal and the third instars were used for the experiments.

Antifeedant Assay Against *S. litura*

Leaf discs with a dimension of (6cm dia.) were cut using a leaf disc cutter. Then the measured leaf discs pieces soaked separately in the concentrations prepared (3%, 5%, and 10%) for 15 minutes, each separately and air-dried for 15 minutes. Then three numbers of treated leaf discs were placed in Petri plate (9cm dia.) and the three 3rd instars, which were pre-starved for 2h were released inside at each Petri plate. For each treatment, three replication and control was maintained. The maximum leaf area protection was calculated at 24 hours after treatment using leaf area meter. The unfed leaf area was measured using the formula,

$$\text{Percent Antifeedant} = \frac{\%\text{ protected area in treatment} - \%\text{ protected area in control}}{100 - \%\text{ protected area in control}} \times 100$$

Table 1: Antifeedant assay of selected plant species against third instars of *S. litura*

T. No.	Treatment	Percent antifeedancy over control % Mean (24HAT)		
		3%	5%	10%
T_1	*Cryptostegia grandiflora*	44.64 (41.90)^{d}	50.32 (45.17)^{c}	52.01 (46.13)^{e}
T2	*Mansoa alliacea*	38.89 (38.56)^{e}	50.02 (44.99)^{c}	51.65 (45.92)^{e}
T3	*Xanthium strumarium*	87.97 (69.98)^{a}	90.39 (72.38)^{a}	92.60 (74.94)^{a}
T4	*Allamanda cathartica*	47.23 (43.39)^{d}	66.14 (54.40)^{d}	68.58 (55.90)^{c}
T5	*Allamanda blanchetii*	65.61 (54.07)^{c}	72.44 (58.31)^{d}	75.56 (60.36)^{c}
T6	*Kigelia pinnata*	50.98 (45.54)^{d}	54.07 (47.31)^{e}	61.53 (51.65)^{d}
T7	*Bauhinia purpurea*	59.35 (50.37)^{d}	68.10 (55.61)^{d}	68.59 (55.91)^{c}
T8	*Drypetes roxburghi*	79.60 (63.15)^{b}	85.98 (68.06)^{b}	85.87 (67.96)^{b}
T9	*Conocarpus lancifolius*	85.67 (63.62)^{b}	80.21 (67.85)^{b}	82.01 (68.19)^{b}
T10	*Polyalthia longifolia*	78.68 (60.50)^{b}	75.77 (62.49)^{c}	78.77 (62.55)^{c}
T11	Control	0.00^{e}	0.00^{e}	0.00^{e}
C.D.		3.33	3.93	4.09
SE(d)		1.59	1.88	1.96

* Mean of three replications
* HAT - hours after treatment
* Values in paranthesis are arc sine transferred
* Values with different alphabets differ significantly according to LSD

Results and Discussion

Table.1 & Fig. 1 represented the per cent leaf protection of selected plant extracts against *S. litura.* The result revealed that the maximum per cent antifeedant (92.60 %) was observed in *Xanthium strumarium* leaves @ 10 % followed by 5% (90.39 %) and 3 % (87.97 %) at 24HAT followed by the tree leaves of *Drypetes roxburghi* @ 5 % and 10 % with 85% and also in *Conocarpus lancifolius* (10 %) with *m*ore than 80 % leaf protection was recorded. The minimum per cent antifeedancy was noticed in the treatment, *Mansoa alliacea* 10 % with 51.65 % antifeedancy which is followed by *Cryptostegia grandiflora* 10 % with 52.01%. All the treatments showed significantly higher antifeedant compared to control, and antifeedancy increased with increasing dosages.

The result was supported by (Roy *et al*., 2012) [2] investigated, *Xanthium strumarium* for its insecticidal effect against *Callosobruchus chinensis* and reported that 4% cocklebur fruit extract showed the highest mortality (26%) and repellency rate (53.3%) at 2 day after treatment and 3 hours after treatment, respectively. The studied insects revealed lowest fecundity (113.7 female-1), highest percentage of adult emergence inhibition (37.0%) and lowest percentage (42.3%) of seed damage when they were reared on pulse grains mixed with 4% extract. Similarly, Yadava and Jharbade (2007) [9] reported the novel bioactive triterpenoid saponion, 3-O [α-L-rhamnopyranosyl-(1→3)- O-β-D-xylopyranosyl] maniladiol (I), along with known compound ursolic acid (II) from the leaves of *Xanthium strumarium.*

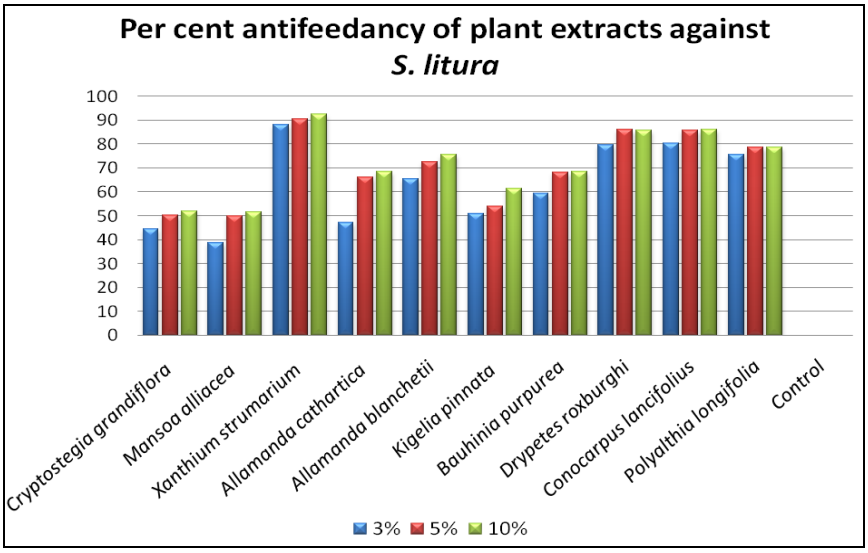

Fig 1: Antifeedant assay of selected plant species against third instars of *S. litura*

Conclusion

Many plant products have been tested against tobacco caterpillar but no similar work has been carried out with common cocklebur leaf extract. Therefore, an attempt was made to explore the antifeedant properties of common cocklebur leaf extract against *S. litura*. This study aim to evaluate the different botanicals in the form of plant extracts for proving their effect on antifeedant activity against *S. litura*. The results indicate that *Xanthium strumarium* leave extracts reveal the most leaves protection against larvae; hence this botanical was reliable source for ecofriendly management of insect pests. The main focus of pest management today not only the performance of the insecticide on the target pest but its environmental impact is of major importance, keeping this aspect in mind using botanical pesticides is one of the best alternative to chemical control. This aspect needs to be thoroughly investigated, especially in case of cocklebur whole plant, to extract, and to identify the active compounds against insect pests.

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