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Antifeedant activity of aerial and root extracts of *Sphagneticola trilobata* (L) Pruski on *Spodoptera litura* (F.) (Lepidoptera, Noctuidae)

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ABSTRACT: Antifeedant activity of methanol and hexane extracts of aerial and root extract of *Sphagneticola trilobata* (L) pruski was tested against seven day old larvae of *Spodoptera litura* (Fab.) (Lepidoptera, Noctuidae) by no choice method of bioassay. A maximum antifeedant activity of 52.96 per cent was recorded at 0.1 per cent of methanol extract of aerial parts after 24 h of feeding. Root extracts exhibited low level of antifeedant activity against *S. litura*. At lower concentrations of 0.005, 0.01 and 0.03 per cent, there was no significant antifeedant activity. Antifeedant activity recorded after 48 h of feeding was similar to 24 h experiment but a slight reduction was noticed for 0.1 per cent of the methanol extract.

KEYWORDS: Leaf disc, choice bioassay, pre-starved larvae, crude extract, Asteraceae

Botanical pesticides are safe and effective alternatives to conventional pesticides, and they would help to reduce their use. Botanical pesticides have a number of properties that make them effective against agriculturally important pests, including pest toxicity, antifeedancy and insect growth regulatory activities. *Sphagneticola trilobata* (L.) Pruski is an herb included in the Asteraceae family that naturally grows in coastal regions, barren lands and forests, or as weed in crops, in many countries. This plant is also known as Singapore daisy, Wedelia, trailing or creeping daisy, water zinnia, and rabbits' paw in some countries (Meena *et al*., 2011). Muscle cramps, rheumatism, stubborn burns, swellings, and arthritic swollen joints are all treated with *S. trilobata* in folk medicine (Arvigo and Balik, 1993). Junhirun *et al.* (2018) reported antifeedant activity of ethyl acetate extract of *S. trilobata* against *Spodoptera litura* (Fab), *S. exigua* (Hub) (Lepidoptera, Noctuidae) and *Plutella xylostella* (Lin) (Lepidoptera, Plutellidae).

The present study aimed at studying the antifeedant activity of methanol and hexane extracts of aerial and roots of *S. trilobata* against *S. litura.* Plant material collected from KAU campus were shade dried for two weeks. After the complete removal of moisture they were ground to fine powder and stored in zip lock cover at 4°C. Dried, powdered *S. trilobata* plant materials (100 g) were steeped in (300 ml) hexane and mixed properly by placing in a rotary shaker. After 24 h, the mixture was filtered through a Whatman No.42 filter paper and concentrated in vacuo in a rotary evaporator at a lower temperature. This process was performed

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three times to get crude hexane extract. The plant materials after extraction with hexane were subjected to re extraction with methanol (300 ml). Same procedure of extraction was followed as similar to hexane extract. After the removal solvents by rotary evaporator, crude methanol extract was obtained. Separate extraction was conducted for both aerial and root parts of *S. ttrilobata.* Methanol and hexane extracts of aerial parts were named as SP2 and SP1 and root extracts were named as SP3; SP4.

Castor leaf discs with a diameter of 4 cm were punched out from washed and dried castor leaves. Different concentrations of aerial and root extracts (0.005%, 0.01%, 0.03%, 0.05% and 0.1%) were made in carrier solvent. The punched-out castor leaf discs were thoroughly dipped in each concentration and air dried for one hour. Glass petri plates of 9 cm diameter were used for the experiment. Single treated leaf disc was placed at the centre of petri plate on which single prestarved one day old larvae of *S. litura* was released. Leaf disc treated with acetone was kept as control. Each treatment replicated 12 times. The leaf area consumed after 24 h of treatment was measured by using a mobile application (Easy7 leaf area free). Another set of experiment was kept and leaf area was measured after 48 h of feeding. Data was analysed in completely randomized design.

All the four extracts (SP1, SP2, SP3 and SP4) were sent to SAIF IIT, Bombay for GCMS and LCMS analysis. GCMS analysis was done for hexane extracts and LCMS was done for methanol extract. Major compounds present in the extracts were recorded. Antifeedant activity of various extracts of *S. trilobata* was tested against *S. litura* by no choice method. Concentrations ranging from 0.005 to 0.1 per cent were evaluated for 24 and 48 h of exposure. Among different extracts methanol extract of aerial parts exhibited maximum antifeedancy of 52.96 per cent at 0.1 per cent of the extract after 24 h of feeding. For all other extracts an antifeedant activity, less than 40 per cent was recorded even at higher dose. Activity was high in methanol extracts compared to hexane extracts. Lowest antifeedant activity was exhibited by hexane extract of roots. On comparing the activity of roots and aerial parts, aerial parts were superior in nature. At the lowest concentration of 0.005 per cent hexane extract of aerial parts exhibited higher antifeedant activity than other three extract. The decreasing order of antifeedancy of

Table 1. Antifeedant activity (%) of various extracts (SP1 to SP4) of *Sphagneticola trilobata* against 7 day old larvae of *Spodoptera litura* at 24 and 48 h

Conc (%)	SP 1		SP2		SP3		SP4	
	24h	48h	24h	48h	24h	48h	24h	48h
0.005	9.462^{b}	4.974^{c}	5.169^{d}	6.76^{d}	3.21^{d}	4.53^{d}	6.693^{c}	7.96^{d}
0.01	10.00^{b}	10.08^{bc}	16.07^{c}	15.12^{c}	3.16^{d}	9.44^{c}	9.287^{c}	9.70^{d}
0.03	17.25^{b}	11.37^{b}	21.64^{c}	21.05^{bc}	12.38^{c}	16.92^{b}	19.88^{b}	17.47^{c}
0.05	19.13^{a}	24.17^{a}	31.23^{b}	27.28^{b}	21.56^{b}	22.31^{b}	24.96^{b}	26.18^{b}
0.1	39.67^{a}	35.83^{a}	52.96^{a}	51,09^{a}	33.49^{a}	30.67^{a}	36.10^{a}	33.76^{a}

Figures in the column followed by same letter is not significantly different at $p < 0.05$ by Tukey's test

four extract was SP2>SP1>SP4>SP3. Similar results were obtained after 48 h of feeding. Maximum antifeedant activity was recorded for SP2 (51.9 %) at highest dose of 0.1 per cent. At lower concentrations no significant difference in activity was recorded for any of the extract. For all the extracts, antifeedant activity reduced after 48 h of exposure at highest concentration of 0.1 per cent. Similar to 24 h treatments, root extracts exhibited lower antifeedant activity compared to aerial parts.

LC/MS analysis of methanol extract of *S. trilobata* showed the presence of 12 phytochemical compounds; Xylitol, de-hydro epi androsterone, andrographolide, genistein, taxifolin, emodin, galangin, methyl caffeate, (-) - Caryophyllene oxide and artemisinin. Compounds like artemisinin, andrographolide, taxifolin and galangin *etc.* identified from methanol extract of aerial parts have previous record of antifeedant and growth inhibitory activities against many phytophagous insects. While in GCMS analysis of hexane extracts, only fewer compounds were reported.compared to aerial extracts, active molecules were less in root extract.

The present result closely matches with the findings of Junhirun *et al*. (2018) who reported that methanol extract was superior with a median antifeedant index of 0.33 mg ml^{-1} and 9.47 mg ml^{-1} against *P. xylostella* and *S. litura* respectively. The results are in close proximity with Pathrose *et al*. (2011) who evaluated antifeedant activity of andrographolide by no choice method against *S. litura* and recorded a maximum antifeedance (64.20% at 0.1 % concentration after 24 h of feeding). Similarly, antifeedant activity of artemisinin was evaluated by Maggi *et al.* (2005) by no choice method against *S. eridania* and recorded a maximum antifeedance of 87 per cent at 1.5 mg per ml of the test compound.

Wang *et al*. (2009) reported methanol extract of *Wedelia chinensis* for its antifeedant activity against third instar larvae of *S. litura* by no choice method of bioassay and recorded a gradual increase in antifeedant activity from lower concentrations to higher concentrations and a highest antifeedant activity of 90 per cent was recorded at 5 per cent concentration of extract of *W. chinensis*, corroborating the present observations. Similarly 80 per cent antifeedant activity was obtained at 1 per cent methanol extract of *W. chinensis* against larvae of *Cnaphalocrosis medinalis* (Qinglong *et al.,* 2012) and supports the present findings. Reduced antifeedant activity of root extract of *S. rilobata* was agreeable with the findings of Cayiun *et al*. (2006), where they reported lower antifeedant activity for roots (AFC50 = 6618.8 µg ml^{-1}) of *W. chinensis* against *Ostrinia furnacalis* compared to aerial parts including flowers (AFC50 = 3408.31µg ml^{-1}). Reduced antifeedant activity *S. trilobata* root extracts might be due to presence of less bioactive molecules in roots compared to aerial parts.

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