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Evaluation of selected pesticidal plant extracts against diamondback moth (*Plutella xylostella*)

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Abstract
An evaluation of methanolic extracts of *Lantana camara* (L.), *Eupatorium adenophorum (Spreng), Artemisia brevifolia (Wall), Melia azedarach* (L.) and *Rumex nepalensis* were studied at 1.25, 2.5 and 5.0% concentrations for their efficacy against Diamondback moth. Studies revealed that ovicidal activity was more pronounced at highest concentration tested. Out of all the plants tested *Melia azedarach* (5%) concentration inhibited the oviposition by Diamondback moth completely. This was followed by *Eupatorium adenophorum* and *Artemisia brevifolia*

Keywords: Plant extracts, pest, moth, ovicidal

Introduction
Over the last few decades there has been an increasing focus on plant based products to fight against the pests and disease of major vegetable crops (Devi and Gupta,2000; Ssekyewa, 2008) [3, 11]. Cabbage is a vegetable crop grown by farmers in all the states of India. This crop is majorly attacked by a large number of pests *viz.* tobacco caterpillar, diamondback moth, cabbage leaf Webber, aphids, painted bug, and flea beetle (Rao and Lal, 2005) [9] of these pests, *Plutella xylostella* commonly known as diamondback moth has been reported to cause significant losses to the crop (Akhtar and Isman, 2004) [1]. Development of proper management schedule is required to control this pest because most of the pesticides are ineffective owing to development of insect resistance and objectionable pesticide residues (Sharma and Singh, 1993) [10]. Several plant parts and extracts are known to possess pesticidal properties (Djomaha *et al*, 2016) [2].

Material and Methods
Collection and Extraction of Plant Material
The aerial parts of five plant species *viz. Lantana camara* (*L.*), *Eupatorium adenophorum* (*Spreng*), *Artemisia brevifolia* (*Wall*), *Melia azedarach* (*L.*), and *Rumex nepalensis* were collected from different agro climatic zones of Himachal Pradesh. The samples were air dried in shade for a week at room temperature and dried in oven at 40^0 C for 24 hours. Finally the dried plant material was extracted in methanol by simple distillation process.

Rearing of Test Insect
Rearing of Mass culture of test insect Diamondback moth (*P. xylostella*) was done under laboratory conditions.

Antioviposition activity
Antioviposition properties of five selected plant extracts were studied against *P. xylostella* adults. Freshly plucked leaves of cabbage were sprayed with different concentrations of the Methanolic extract with the help of atomizer and dried in air. These leaves were placed in small glass vials containing water and were covered with glass chimney. These leaves were exposed to pair of 2 days old Diamondback (*P. xylostella*) moth for two days. The number of eggs laid on leaves was counted. A control treatment was maintained exposing untreated leaves to Diamondback moth adults and percent reduction in oviposition over control was worked out.

Results and Discussion

An examination of data (Table1) revealed that Methanolic extract of the five plants exhibited significant antioviposition activity against *P. xylostella* at different concentrations. Moderate to high antioviposition activity was observed in different plant extracts. Out of all the plants tested, *Melia azedarach* (5%) concentration inhibited the oviposition by Diamondback moth completely. This was followed by *Eupatorium adenophorum* at same concentration which in turn was at par with *Artemisia brevifolia* (2.5 and 5%). Concentration of the plant extract evaluated had inverse and significant relationship with oviposition deterrence. Extract of *Rumex nepalensis* (1.25%) proved to have minimum antioviposition activity. *Eupatorium adenophorum* and *Melia azedarach* at 2.5% concentration exhibited moderate oviposition deterrence.

Table 1: Anti oviposition activities of methanolic extracts against *P. xylostella*

Plant	Per cent reduction in egg laying			
	5.0	**2.5**	**1.25**	**Mean**
M. azedarach	100.0 (89.0)	89.8 (71.5)	69.1 (56.2)	86.3 (72.2)
R. nepalensis	87.6 (69.3)	48.3 (44.0)	23.5 (28.9	53.1 (47.4)
A. brevifolia	91.1 (72.9)	87.3 (69.3)	67.8 (55.5)	82.1 (65.9)
E. adenophorum	94.8 (77.0)	92.6 (74.3)	69.3 (56.5)	85.6 (69.3)
L. camara	78.6 (62.8.)	63.2 (53.1)	38.0 (37.9)	59.9 (51.3.)
Mean	90.4 (74.2)	76.2 (62.4)	53.5 (47.0)	-

Figures in parenthesis are the angular transformed values CD (P=0.05)
Plant = 3.8
Concentration = 3.6
Plant × Concentration = 8.4

From the present study, it is quite obvious that some plant extracts are effective for checking the egg laying stage of *P. xylostella*. Further isolation of active components from these plants will prove to be an eco- friendly and sustainable component in the management of Diamondback moth.

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