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## Efficacy of *Datura* leaf extract against fruit borer, *Helicoverpa armigera* (Hubner) on Tomato, *Lycopersicon esculentum* (Mill)

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### Abstract

A field and laboratory experiments were conducted during *rabi* season, 2014-15 to find out the efficacy of different concentration of the *Datura alba* @ 5%, 10%, 15%, 20%, and 25%, were sprayed, Cypermethrin 25 EC (0.07% ) also sprayed including a untreated control. Cypermethrin 25 EC (0.07%) shows significant reduction in the larval population of *Helicoverpa armigera* Hubner in field condition, and also recorded highest mortality percentage in laboratory condition. Among the different concentration of *D. alba*, *D. alba* 25% performed significant reduction in field condition and highest mortality in laboratory condition as compared with other *D. alba* concentration.

**Keywords:** *D. alba*, *Helicoverpa armigera*, Tomato (*Lycopersicon esculentum* (Mill))

### Introduction

Tomato, *Lycopersicon esculentum* (Miller) is one of the most important and remunerative vegetable crops grown around the world for fresh market consumption and processing. *Helicoverpa armigera* (Hubner) is a polyphagous pest and attacks over 182 host plants. Among them, tomato is one of the most suitable host often found attacked where varieties grown. In worst years, the pest causes as high as 88% fruit damage. A single caterpillar may eat and destroy 2 to 8 fruits. Therefore, a thorough knowledge on the role of insecticides, identification of resistant cultivars and dominant natural enemies are essential to integrate them with other IPM options for devising an environmentally sound pest management strategy for this pest. This has necessitated for detailed study to develop and evaluate different IPM modules against *Helicoverpa armigera*, in tomato.

### Materials and methods

**Collection and rearing of insect:** The larvae of the *Helicoverpa armigera* were collected from infested tomato field of Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed-to-be University) Allahabad; Culture of *H. armigera* (Hub.) was reared in laboratory in sterilized plastic containers containing crushed artificial diet. The artificial diet was made as suggested by [2]. The plastic containers were pierced for proper aeration and the culture was maintained at 28 °C ± 2 °C temperature and 70 ± 5 percent relative humidity

***D. alba* against fruit borer in field condition:** Field experiment was conducted with tomato var. "selection-22" in the experimental field of Department of Entomology, SHIATS, Allahabad during *rabi* season of 2013-14. The experiment was laid out in a randomized block design (RBD) with 7 treatments including untreated control and replicated 3 times. The crop was raised with recommended agronomic practices with a plot size of 4m<sup>2</sup> (2x2m) at 60 x 45cm spacing. The treatments evaluated were different concentration of *D. alba* @5%, 10%, 15%, 20% and 25%. along with one conventional insecticide, cypermethrin as check. The appearance of *Helicoverpa armigera* was keenly monitored and when the population crossed ETL level. The test treatments were applied as foliar spray by a high volume knapsack sprayer twice at 10 days interval. Water was sprayed in the untreated control plots. Observations on the larval population of *Helicoverpa armigera* were recorded at 24 hours before application (pre-treatment count) and 3<sup>rd</sup>, 7<sup>th</sup> and 10<sup>th</sup> days after application (post-treatment count) on five randomly selected plants in each plot, direct visual counting method was used. To estimate the reduction larval population of *Helicoverpa armigera* use of following formula:-

$$\text{Percent of population reduction over control} = \left\{ 1 - \left( \frac{\text{After treatment}}{\text{before treatment}} * \frac{\text{before control}}{\text{after control}} \right) \right\} * 100$$

**D. alba against fruit borer in laboratory condition:** For laboratory studies, The 45 larvae collected from central field of SHIATS in the morning. For the evaluated mortality percentage of *Helicoverpa armigera* (Hubner), 1 larva were released in to each petriplates, 3 larvae were released in 3 treated replicates then treated with different concentration (5%, 10%, 15%, 20%, 25%) dead larvae were counted and calculate mortality percentage by the use of following formula (Abott 1925):-

$$\text{Mortality \%} = [\text{No. of dead larvae} / \text{No. of released larvae}] \times 100$$

## Results and discussion

### Effect of *D. alba* on larval population of *Helicoverpa*

**Table 1:** Effect of *Datura alba* in reduction the larval population of *Helicoverpa armigera* after (1<sup>st</sup> and 2<sup>nd</sup> Spray).

Treatments	% Reduction in larval population of <i>Helicoverpa armigera</i>					% Reduction in larval population of <i>Helicoverpa armigera</i>				
	B S	3DAS	7DAS	10DAS	Mean	B S	3DAS	7DAS	10DAS	Mean
Cypermethrin	4.13	80.05 (63.53) <sup>a</sup>	83.26(65.95) <sup>a</sup>	85.44(67.63) <sup>a</sup>	82.92	1.46	86.78(68.72) <sup>a</sup>	87.08(68.97) <sup>a</sup>	89.84(71.63) <sup>a</sup>	87.90
<i>Datura</i> 5%	4.80	30.05 (33.24) <sup>b</sup>	34.87 (36.20) <sup>b</sup>	49.82(44.91) <sup>b</sup>	38.25	3.30	50.63(45.38) <sup>b</sup>	57.22(49.18) <sup>b</sup>	58.09(49.68) <sup>b</sup>	55.31
<i>Datura</i> 10%	4.87	41.45 (40.09) <sup>c</sup>	42.20 (40.54) <sup>c</sup>	50.50 (45.30) <sup>b</sup>	44.72	2.80	51.70(46.00) <sup>bc</sup>	55.76(48.33) <sup>b</sup>	63.73(53.02) <sup>c</sup>	57.07
<i>Datura</i> 15%	4.60	46.29 (42.89) <sup>cd</sup>	48.39(44.09) <sup>cd</sup>	54.12 (47.39) <sup>b</sup>	49.60	2.53	56.87(48.97) <sup>bc</sup>	59.96(50.83) <sup>b</sup>	64.62(53.53) <sup>c</sup>	60.48
<i>Datura</i> 20%	4.93	47.33(43.48) <sup>cd</sup>	51.95 (46.13) <sup>d</sup>	56.06 (48.51) <sup>b</sup>	51.78	2.53	59.34 (50.41) <sup>c</sup>	62.68(52.37) <sup>b</sup>	67.08(55.03) <sup>c</sup>	63.03
<i>Datura</i> 25%	4.33	48.65 (44.24) <sup>d</sup>	55.34 (48.09) <sup>d</sup>	58.25(49.78) <sup>c</sup>	54.08	2.26	60.24 (50.95) <sup>c</sup>	64.01(53.16) <sup>b</sup>	68.37(55.81) <sup>c</sup>	64.21
Control	5.00	0.00	0.00	0.00	0.00	5.66	0.00	0.00	0.00	0.00
F-Test	-	S	S	S	-	-	S	S	S	
S.Ed(+)	-	1.889	1.857	2.157	-	-	2.14	2.166	2.787	
C.D.(P= 0.05)	-	4.004	3.937	4.573	-	-	5.16	4.592	5.909	

BS – Before Spray, DAS – Days After Spray. Figures in parentheses are  $\sqrt{(X+0.5)}$  transformed values, Figures in parentheses are arc sine transformed values, In a column means followed by common letter (s) are not significantly different by DMRT (P=0.05).

These results were Similar to the findings reported by Patra *et al.* (2009) [5]; Mandal *et al.* (2002) [2]. Nath and Sinha (2010) [6] also reported cypermethrin was quite effective against sucking pest of okra. Osipitan *et al.*, (2013) [8] reported that this implies that the extract of *Datura metel* could effectively manage the population of termites on the field. Abbasipour *et al.*, (2010) observed that the results can be compared with other studies on *Datura stramonium*. Larvicidal effects of *Datura stramonium* against *T. castaneum* were also observed (Pascual-Villalobos and Robledo 1997). In addition, the acaricidal activity of this plant against the 2-spotted mite, *T. urticae*, was demonstrated (Kumral *et al.* 2009) [4].

### Effect of *D.alba*on mortality percentage of *Helicoverpa armigera*

Significantly higher mortality was achieved Cypermethrin 25

*armigera*: The mean *Helicoverpa armigera* population reduction data recorded after the post treatment counts (3, 7 and 10 DAS) revealed that Cypermethrin 25 EC (82.92%) after 1<sup>st</sup> spray and (87.90) after 2<sup>nd</sup> spray recorded the highest reduction of larval population and proved to be the most effective treatment, followed by *D. Alba* 25% (64.21%) and of *D. alba* 20% (65.03 %) respectively. While, lowest reduction (55.31%).

In *D. alba* 5% respectively. It was revealed that all the insecticidal treatments resulted in significant reduction of the *Helicoverpa armigera* population over control (Table 1).

EC (86.67%). All the treatments were superior in mortality of *Helicoverpa armigera* in comparison to untreated control. Among all the treatments of *D. alba*, *D. alba* 25% (80.00%) recorded the highest larval mortality and proved to be the most effective treatment, followed by *D. alba* 20% (71.11%) and of *D. alba* 15% (64.44%) respectively. Among all the treatments *B. bassiana* 5% recorded lowest mortality (46.67%) (Table 2).

Shah *et al.*, (2003) [3] studied on mortality % of *H. armigera*. His results were corroborated with my results that Cypermethrin 25 EC and *Datura* leaf extract 25% % gave highest mortality % in 24 hours (80.00 % and 73.33 %), 48 hours (86.67 % and 80.00 %) and 72 hours (93.33 % and 86.67 %) after spraying respectively.

**Table 2:** Percent net mortality of larvae of *Helicoverpa armigera* at 24, 48 and 72 hours after spray.

Treatments	Mortality percentage			
	24 Hr	48 Hr	72 Hr	Mean
T1 Cypermethrin	80.00(63.46) <sup>a</sup>	86.67(72.32) <sup>a</sup>	93.33(81.18) <sup>a</sup>	86.67
T2 <i>Datura</i> 5%	33.33(35.02) <sup>b</sup>	46.67(43.09) <sup>b</sup>	60.00(50.79) <sup>b</sup>	46.67
T3 <i>Datura</i> 10%	46.67(43.09) <sup>bc</sup>	53.33(46.94) <sup>bc</sup>	66.67(55.01) <sup>bc</sup>	55.56
T4 <i>Datura</i> 15%	53.33(46.94) <sup>bc</sup>	66.67(55.01) <sup>bc</sup>	73.33(59.24) <sup>bc</sup>	64.44
T5 <i>Datura</i> 20%	60.00(50.79) <sup>bc</sup>	73.33(59.24) <sup>bc</sup>	80.00(63.46) <sup>bc</sup>	71.11
T6 <i>Datura</i> 25%	73.33(59.24) <sup>c</sup>	80.00(63.46) <sup>c</sup>	86.67(72.32) <sup>c</sup>	80.00
T0 Control	6.67(8.85) <sup>d</sup>	13.33(17.71) <sup>d</sup>	20.00(26.57) <sup>d</sup>	13.33
Overall Mean	50.48	60.00	68.57	
F - test	S	S	S	
S. Ed. (±)	8.483	9.085	7.274	
C. D. (P = 0.05)	17.984	19.260	15.421	

DAS: Days After Spray

Figures in parentheses are  $\sqrt{(X+0.5)}$  transformed values, Figures in parentheses are arc sine transformed values, In a column means followed by common letter (s) are not significantly different by DMRT (P=0.05)

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