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# MANAGEMENT OF LEPIDOPTERAN PESTS OF SESAMUM WITH CERTAIN INSECTICIDES

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## ABSTRACT

Field studies on management of lepidopteran insect pests of sesame with certain insecticides were carried out during *summer* 2017 at wet land farm, S. V. Agricultural College, Tirupati. Sesame crop (var., YLM-66) was sown on 7th March 2017 for evaluation of insecticides against sesame pests. Chlorantraniliprole @ 0.3 ml/L was found to be highly effective against *Antigastra catalaunalis* as well as *Acherontia styx.*

**KEYWORDS:** *Antigastra catalaunalis*, *Acherontia styx* and chlorantraniliprole.

## INTRODUCTION

A total of 29 insect-pests have been reported infesting sesame crop at its various growth stages in India (Rai, 1976). Out of these only three species *viz.*, the til leaf webber and capsule borer, *Antigastra catalaunalis* Duponchel; til hawk moth, *Acherontia styx* Westwood and sesame gallfly, *Asphondylia sesami* Felt, were considered as major pests (Choudhary *et al.,* 1986). Among these, *A. catalaunalis* is reported to be the most serious pest causing yield losses up to 90 per cent (Ahuja and Bakhatia, 1995).

## MATERIAL AND METHODS

A field experiment was conducted at the wet land farm, Sri Venkateswara Agricultural College, Tirupati during *summer* 2017 to evaluate the efficacy of certain new insecticides against lepidopteran pests of sesame.

### Lay out

The experiment was laid out in a randomized block design with 11 treatments including untreated control and replicated thrice. The size of the individual plot was 5 m x 4 m. with spacing of 30 cm between the rows and 15 cm between the plants. All the recommended packages of practices were adopted in managing crop to maintain a good crop stand.

### Sowing and agronomic practices

"YLM-66", a popular Sesame variety was sown on 7th March, 2017. Two seeds per hill were sown by dibbling. Gap filling was done a week after germination and thinning was completed ten days after sowing leaving one healthy seedling per hill, and the plots were irrigated as and when required.

### Preparation of Spray Fluid

Measured quantity of the insecticide formulation was mixed with required quantity of water and stirred well to obtain the desired concentration of spray fluid. In case of wettable powders and suspension concentrates, required quantities were mixed with a little quantity of water and then the remaining quantity of water was added to obtain desired concentration and stirred well.

### Test insecticides

Details of insecticides used in the experiment are given in Table 1.

### Insecticidal application

Insecticide treatments included in this experiment were applied with hand held knapsack sprayer. Spraying was done during morning hours with care to prevent the drift of the spray fluid reaching the adjacent plots by keeping a screen in between the plots. The sprayer was cleaned with water before changing the insecticide treatment.

### Method of observations

Insecticidal treatments were imposed during 50 per cent flowering season when the pest population has

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**Table 1. Particulars of treatments used**

| Treatments | Chemical name | Trade name | Formulation | Dose/litre | Source of supply |
|---|---|---|---|---|---|
| $T_1$ | Acephate | Asataf | 75% SP | 1.5 g $L^{-1}$ | Rallis |
| $T_2$ | Chlorpyriphos | Dhanwan | 20% EC | 2.5 ml $L^{-1}$ | Dhanuka |
| $T_3$ | Emamectin benzoate | Proclaim | 5% SG | 0.2 g $L^{-1}$ | Syngenta |
| $T_4$ | Lambda cyhalothrin | Karate | 2.5% EC | 1 ml $L^{-1}$ | Syngenta |
| $T_5$ | Dichlorvos | Doom | 76% EC | 1 ml $L^{-1}$ | UPL |
| $T_6$ | Chlorantraniliprole | Coragen | 18.5% SC | 0.3 ml $L^{-1}$ | Dupont |
| $T_7$ | Thiacloprid | Alanto | 240 SC | 0.3 ml $L^{-1}$ | Bayer |
| $T_8$ | Imidacloprid | Confidor | 17.8 SL | 0.3 ml $L^{-1}$ | Bayer |
| $T_9$ | Acetamiprid | IPRID | 20% SP | 0.2 g $L^{-1}$ | Indocell |
| $T_{10}$ | Pymetrozine | Chess | 50 WG | 0.4 g $L^{-1}$ | Syngenta |
| $T_{11}$ | Untreated control | - | - | - | - |

reached ETL. During the period of study sesamum crop was attacked by different insect pests *viz.,* leaf webber, hawk moth, leaf hoppers, aphids. The counts of leaf webber larvae, hawk moth larvae were taken 24 hours before spraying, and on 1DAS, 3 DAS, 5 DAS and 7DAS. The population of all the pests were counted on 15 randomly selected plants.

**Statistical Analysis**

The per cent reduction of larval population was calculated by using modified Abbott's formula given by Fleming and Retnakaran (1985).

Per cent population reduction =

$$1-\left[\frac{\text{(Post treatment population in treatment}}{\text{Pre treatment population in treatment}}\times\frac{\text{Pre treatment population in check)}}{\text{Post treatment population in check}}\right]\times 100$$

The per cent values were transformed into angular values which were subjected to statistical analysis with the help of SPSS (SPSS, 2013).

**RESULTS AND DISCUSSION**

**Management of leaf webber *Antigastra catalaunalis***

**One day after spraying**

At 1 DAS, treatment with pymetrozine @ 0.4 g/L (25.56 %) has given a significant per cent reduction in larval population followed by the rest of the treatments *viz.,* acetamiprid @ 0.2 g/L (25.00 %), emamectin benzoate @ 0.2 g/L (21.67 %), imidacloprid @ 0.3 ml/L (21.11 %), dichlorvos @ 1 ml/L (18.89 %), chlorpyriphos @ 2.5 ml/L (16.67 %), acephate @ 1.5g/L (15.56 %), thiacloprid @ 0.3 ml/L (13.89 %), chlorantraniliprole @ 0.3 ml/L (13.33 %), lambda cyhalothrin @ 1ml/L (11.11 %).

The order of efficacy of different treatments was as follows:

**$T_{10} > T_9 > T_3 > T_8 > T_5 > T_2 > T_1 > T_7 > T_4 > T_6 > T_{11}$**

**Three days after spraying:**

At 3 DAS, treatment with emamectin benzoate @ 0.2 g/L (69.44 %) has given a significant per cent reduction in larval population and followed by the rest of the treatments *viz.,* chlorpyriphos @ 2.5 ml/L (63.89 %), chlorantraniliprole @ 0.3 ml/L (63.33 %), lambda cyhalothrin @ 1ml/L (62.22 %), acephate @ 1.5g/L (57.22 %), thiacloprid @ 0.3 ml/L (55.00 %), imidacloprid @ 0.3 ml/L (48.33 %), While lowest per cent reduction was recorded in acetamiprid @ 0.2 g/L (32.78 %) followed by dichlorvos @ 1 ml/L (35.56 %) and pymetrozine @ 0.4 g/L (38.33 %).

The order of efficacy of different treatments is as follows:

$T_3 > T_2 > T_6 > T_4 > T_1 > T_7 > T_8 > T_{10} > T_5 > T_9 > T_{11}$

These results are comparable with the findings of Varma *et al.* (2013) who reported that emamectin benzoate 0.001 % recorded lowest flower and capsule damage of *Antigastra catalaunalis*

**Five days after spraying**

At 5 DAS, treatment with chlorantraniliprole @ 0.3 ml/L (93.33 %) has given a significant per cent reduction in larval population and was on par with lambda cyhalothrin @ 1ml/L (83.33 %), chlorpyriphos @ 2.5 ml/L (80.00 %), emamectin benzoate @ 0.2 g/L (76.67 %), while, next effective treatments were acephate @ 1.5g/L (70.00 %) followed by dichlorvos @ 1 ml/L (68.89 %), thiacloprid @ 0.3 ml/L (67.78 %), imidacloprid @ 0.3 ml/L (46.67 %), pymetrozine @ 0.4 g/L (37.22 %). Lowest per cent reduction was recorded in acetamiprid @ 0.2 g/L (28.33 %).

The order of efficacy of different treatments was as follows:

$T_6 > T_4 > T_2 > T_3 > T_1 > T_5 > T_7 > T_8 > T_{10} > T_9 > T_{11}$

Results of the present findings comparable with the findings of Sasikumar and Kumar (2015) who reported that treatment with lambda cyhalothrin, the per cent leaf damage of leaf webber was lowest and was superior than the other treatments.

**Seven days after spraying**

At 7 DAS, treatment with chlorantraniliprole @ 0.3 ml/L (93.33 %) has given a significant per cent reduction in larval population and was on par with lambda cyhalothrin @ 1ml/L (93.33 %), chlorpyriphos @ 2.5 ml/L (93.33 %), emamectin benzoate @ 0.2 g/L (86.67 %), thiacloprid @ 0.3 ml/L (83.33 %), acephate @ 1.5g/L (83.33 %), dichlorvos @ 1 ml/L (81.11 %). The lowest per cent reduction was recorded in acetamiprid @ 0.2 g/L (37.22 %), pymetrozine @ 0.4 g/L (47.22 %), imidacloprid @ 0.3 ml/L (52.22 %).

The order of efficacy of different treatments was as follows:

$T_6 = T_4 = T_2 > T_3 > T_7 > T_1 > T_5 > T_8 > T_{10} > T_9 > T_{11}$

The results after 7 DAS revealed chlorantraniliprole as an effective insecticide in reducing the larval population. Not much work has been done on use of Chlorantraniliprole on insect pests of sesame. Hence work on Chlorantraniliprole on other lepidopteran insects were considered here for discussion.

The results of the present investigations are in accordance with Duraimurugan and Lakshminarayana (2014) who reported that Chlorantraniliprole were very effective in suppressing the larval population of Castor semilooper *Achaea janata* during 2012 and tobacco caterpillar *Spodoptera litura* (0.0 to 0.1 and 0.0 to 0.3 larva/plant, respectively) during 2013 and significantly superior to emamectin benzoate and lufenuron (0.1 to 0.7 and 0.7 to 3.3 larvae/plant, respectively) and untreated control (1.9 to 2.4 and 4.3 to 5.3 larvae/plant, respectively). These results are supported by Sreekanth *et al.* (2015) who reported that pod damage due to legume pod borer in pigeonpea was lowest in chlorantraniliprole. The present findings were in accordance with Jakhar *et al.* (2016) who reported that chlorantraniliprole 18.5 SC @ 0.15 ml/l of water gave maximum control of pod borers of pigeonpea (3.33%).

**Management of hawk moth, *Acherontia styx***

**One day after spraying**

At 1 DAS, treatment with chlorantraniliprole @ 0.3 ml/L (40.00 %) has given a significant per cent reduction in larval population followed by imidacloprid @ 0.3 ml/L (23.33 %), lambda cyhalothrin @ 1 ml/L (23.33 %), acephate @ 1.5g/L (20.00 %), dichlorvos @ 1 ml/L (20.00 %), pymetrozine @ 0.4 g/L (20.00 %), emamectin benzoate @ 0.2 g/L (16.67 %), chlorpyriphos @ 2.5 ml/L (16.67 %). The lowest per cent reduction was recorded in acetamiprid @ 0.2 g/L (13.33 %) and thiacloprid @ 0.3 ml/L (13.33 %).

The order of efficacy of different treatments was as follows:

$T_6 > T_8 = T_4 > T_1 = T_5 = T_{10} > T_3 = T_2 > T_9 = T_7 > T_{11}$

**Three days after spraying**

At 3 DAS, though lambda cyhalothrin @ 1ml/L (66.67 %) has given more per cent reduction in larval population, no significant differences were observed among treatments.

**Effect of insecticides on per cent reduction of *Antigastra catalaunalis* larval population during *summer* 2017**

| Treatments | Dose | Pre counts per 15 plants | Per cent reduction of larval population | | | |
|---|---|---|---|---|---|---|
| | | | 1 DAS | 3 DAS | 5 DAS | 7 DAS |
| $T_1$ : Acephate | 1.5 g $L^{-1}$ | 30 | $15.56^{ab}$ (14.35) | $57.22^{abc}$ (51.29) | $70.00^{ab}$ (63.00) | $83.33^{a}$ (75.00) |
| $T_2$ : Chlorpyriphos | 2.5 ml $L^{-1}$ | 33 | $16.67^{ab}$ (15.00) | $63.89^{ab}$ (57.29) | $80.00^{a}$ (72.00) | $93.33^{a}$ (84.00) |
| $T_3$ : Emamectin Benzoate | 0.2 g $L^{-1}$ | 28 | $21.67^{a}$ (21.00) | $69.44^{a}$ (62.64) | $76.67^{a}$ (70.00) | $86.67^{a}$ (78.00) |
| $T_4$ : Lambda cyhalothrin | 1 ml $L^{-1}$ | 31 | $11.11^{ab}$ (10.70) | $62.22^{abc}$ (56.35) | $83.33^{a}$ (75.00) | $93.33^{a}$ (84.00) |
| $T_5$ : Dichlorvos | 1 ml $L^{-1}$ | 34 | $18.89^{ab}$ (17.35) | $35.56^{bc}$ (32.35) | $68.89^{ab}$ (61.29) | $81.11^{a}$ (72.64) |
| $T_6$ : Chlorantraniliprole | 0.3 ml $L^{-1}$ | 33 | $13.33^{ab}$ (13.05) | $63.33^{abc}$ (58.00) | $93.33^{a}$ (84.00) | $93.33^{a}$ (84.00) |
| $T_7$ : Thiacloprid | 0.3 ml $L^{-1}$ | 34 | $13.89^{ab}$ (13.35) | $55.00^{abc}$ (50.00) | $67.78^{ab}$ (60.64) | $83.33^{a}$ (75.00) |
| $T_8$ : Imidachlopria | 0.3 ml $L^{-1}$ | 31 | $21.11^{ab}$ (19.70) | $48.33^{abc}$ (44.00) | $46.67^{bc}$ (43.00) | $52.22^{b}$ (48.35) |
| $T_9$ : Acetamiprid | 0.2 g $L^{-1}$ | 34 | $25.00^{a}$ (25.11) | $32.78^{c}$ (29.64) | $28.33^{c}$ (26.00) | $37.22^{b}$ (33.29) |
| $T_{10}$ : Pymetrozine | 0.4 g $L^{-1}$ | 31 | $25.56^{a}$ (24.40) | $38.33^{bc}$ (35.00) | $37.22^{c}$ (33.29) | $47.22^{b}$ (42.29) |
| $T_{11}$ : Untreated Control | - | 39 | $0.00^{b}$ (0.00) | $0.00^{d}$ (0.00) | $0.00^{d}$ (0.00) | $0.00^{c}$ (0.00) |

DAS = Days after spraying
Values followed by same letters are not significantly different as per DMRT at 0.05.
Values in parenthesis are angular transformed values.

**Effect of insecticides on per cent reduction of *Acherontia styx* larval population during *summer* 2017**

| Treatments | Dose | Pre counts per 15 plants | Per cent reduction of larval population | | | |
|---|---|---|---|---|---|---|
| | | | 1 DAS | 3 DAS | 5 DAS | 7 DAS |
| $T_1$ : Acephate | 1.5 g $L^{-1}$ | 17 | $20.00^{ab}$ (18.00) | $46.67^{a}$ (42.00) | $56.67^{a}$ (51.00) | $73.33^{a}$ (72.00) |
| $T_2$ : Chlorpyriphos | 2.5 ml $L^{-1}$ | 17 | $16.67^{ab}$ (15.00) | $36.67^{a}$ (33.00) | $50.00^{a}$ (45.00) | $63.33^{a}$ (63.00) |
| $T_3$ : Emamectin Benzoate | 0.2 g $L^{-1}$ | 18 | $16.67^{ab}$ (15.00) | $63.33^{a}$ (57.00) | $73.33^{a}$ (66.00) | $73.33^{a}$ (72.00) |
| $T_4$ : Lambda cyhalothrin | 1 ml $L^{-1}$ | 17 | $23.33^{ab}$ (21.00) | $66.67^{a}$ (60.00) | $70.00^{a}$ (63.00) | $80.00^{a}$ (72.00) |
| $T_5$ : Dichlorvos | 1 ml $L^{-1}$ | 14 | $20.00^{ab}$ (18.00) | $33.33^{a}$ (30.00) | $50.00^{a}$ (45.00) | $66.67^{a}$ (60.00) |
| $T_6$ : Chlorantraniliprole | 0.3 ml $L^{-1}$ | 12 | $40.00^{a}$ (36.00) | $53.33^{a}$ (48.00) | $60.00^{a}$ (54.00) | $60.00^{a}$ (54.00) |
| $T_7$ : Thiacloprid | 0.3 ml $L^{-1}$ | 15 | $13.33^{ab}$ (12.00) | $36.67^{a}$ (33.00) | $50.00^{a}$ (45.00) | $73.33^{a}$ (72.00) |
| $T_8$ : Imidachloprid | 0.3 ml $L^{-1}$ | 14 | $23.33^{ab}$ (21.00) | $56.67^{a}$ (51.00) | $66.67^{a}$ (60.00) | $66.67^{a}$ (66.00) |
| $T_9$ : Acetamiprid | 0.2 g $L^{-1}$ | 17 | $13.33^{ab}$ (12.00) | $40.00^{a}$ (36.00) | $66.67^{a}$ (60.00) | $73.33^{a}$ (66.00) |
| $T_{10}$ : Pymetrozine | 0.4 g $L^{-1}$ | 16 | $20.00^{ab}$ (18.00) | $53.33^{a}$ (48.00) | $56.67^{a}$ (51.00) | $73.33^{a}$ (72.00) |
| $T_{11}$ : Untreated Control | - | 23 | $0.00^{b}$ (0.00) | $0.00^{b}$ (0.00) | $0.00^{b}$ (0.00) | $0.00^{b}$ (0.00) |

DAS = Days after spraying
Values followed by same letters are not significantly different as per DMRT at 0.05.
Values in parenthesis are angular transformed values.

**Five days after spraying**

At 5 DAS, though emamectin benzoate @ 0.2 g/L (73.33 %) has given more per cent reduction in larval population, no significant differences were observed among treatments.

**Seven days after spraying**

At 7 DAS, though treatment with lambda cyhalothrin @ 1ml/L (80.00 %), has given a more per cent reduction in larval population followed no significant differences were observed among treatments.

## CONCLUSIONS

Among all the insecticides tested, Chlorantraniliprole 18.5% SC at 0.3 ml/L has given a successful reduction in larval population of both *Antigastra catalaunalis* and *Acherontia styx*. In case of *A. Catalaunalis* this reduction was evident even after 7 of spraying which indicates the long residual action of Chlorantraniliprole.

Chlorantraniliprole is a new compound by DuPont belonging to a new class of selective insecticides (anthranilic diamides) featuring a novel mode of action (group 28 in the IRAC classification). By activating the insect ryanodine receptors (RyRs) it stimulates the release and depletion of intracellular calcium stores from the sarcoplasmic reticulum of muscle cells, causing impaired muscle regulation, paralysis and ultimately death of sensitive species (Cordova *et al.,* 2006). It has also been reported that because of its unique mode of action, chlorantraniliprole treated insects stops feeding within 30 minutes of treatment thus proving as an effective chemical for the management of defoliators such as *Spodoptera exigua, Plutella xylostella* and others (Hannig *et al.,* 2009). This was further confirmed in the present investigation, significantly high larval mortality of *Acherontia styx* was within 24 hrs of treatment (Table 2).

Chlorantraniliprole is a systemic insecticide and travels mainly through xylem and moves throughout the green tissue of plants (Lahm *et al.,* 2007). Because of this systemic nature, Chlorantraniliprole has a long residual effect and manage the insect pest population up to 7 days after spraying, which is also evident from the present work on *A. Catalaunalis* (Table 1). Adams *et al*. (2016) have reported that Chlorantraniliprole and flubendiamide provided long residual mortality of corn earworm when applied at the R3 growth stage. However, the authors are of the opinion that the persistence of these insecticides on crop tissues may accelerate the likelihood of resistance development because multiple generations of insect pests will likely be exposed to lethal concentrations from a single application, thereby increasing selection pressure.

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