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# Efficacy of selected insecticides and essential oils of botanicals against thrips (*Scirtothrips dorsalis* Hood) on chilli (*Capsicum annuum* L.)

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**Abstract**
A field trail was conducted at the Central field, Department of Entomology SHUATS, Prayagraj during *kharif* August to November 2019. Seven treatments were evaluated against *Scirtothrips dorsalis i.e* T1 fipronil 5 SC @ 2ml/lit, T2 Acetamipride 20 SP @ 0.3g/lit T3 Imidacloprid 17.8 SL @ 0.2ml/lit, T4 Pongamia oil @ 6ml/lit, T5 Eucalyptus @ 10ml/lit, T6 Basil oil @ 1ml/lit, T7 Neem oil @ 2.5ml/lit against chilli thrips (*Scirtothrips dorsalis*). Result revealed that among the different treatments T1 Fipronil (93.82%) proved to be the most effective treatments followed by T3 Imidacloprid (92.30%), T2 Acetamipride (90.13%), T7 Neem oil (88.69%), T5 Eucalyptus oil (87.28%) and T4 Pongamia oil (86.48%), whereas T6 Basil oil (84.28%) was found to be least effective against this pest. the plot treated with T1 Fipronil 5 SC show highest yield (112 q/ha), followed by T3 Imidacloprid 17.8 SL (105 q/ha), T2 Acetamipride 20 SP (96 q/ha), T7 Neem oil (86 q/ha), T5 Eucalyptus oil (80 q/ha), T4 Pongamia oil (75 q/ha) and T6 Basil oil (72 q/ha) as compared to control T0 (55 q/ha).

**Keywords:** *Capsicum annuum*, Cost-Benefit ratio, Efficacy, Insecticides, Essential oils, *Scirtothrips dorsalis*

## Introduction
Chilli (*Capsicum annum* L.) popularly known as 'mirch' in Hindi. It belongs to the family Solanaceae. Chilli is one of the important vegetable and commercial spice crops. Green fruits are a good source of vitamin A and C besides traditional use of chillies in vegetables, spices, sauces and pickles [7]. The pungency in chillies is due to crystalline volatile alkaloid 'Capsaicin'. The red color of chillies is due to the presence of pigment 'Capsanthin' [1].

India is the world leader in chilli production followed by China and Pakistan. The major chilli exporting countries with their percentage share in world exports are India (25%), China (24%), Spain (17%), Mexico (8%), Pakistan (7.2%), Morocco (7%) and Turkey (4.5%). the bulk share of chilli production in the world is held by Asian countries. In India it is cultivated throughout the country in about 775 thousand hectares with an annual productivity of 1492 thousand Mt, where as in the erstwhile state of Andhra Pradesh it was cultivated in 131.32 thousand hectares with a production of 601.99 thousand Mt. In India, it is intensively cultivated in Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu, Rajasthan and in hilly areas of Uttar Pradesh [10].

In India Andhra Pradesh is the major chilli growing state in the country, contributing 33 per cent of national production with an area of 2.35 lakh hectares [11]. The area occupied in India is 14.5m ha and the production is 8.2 lakhs or 0.8 million tons and Uttar Pradesh occupies about 1.8 thousand ha area and 1.7 thousand tons production respectively [9]. The area occupied in Allahabad region is 2455 ha and the production is 2993 tons [4].

In recent years, various types of insecticides belonging to different botanicals and chemical group were used as spray to manage the pest complex. Sometimes we don't know about best insecticide for thrips control so best one can be identified for the management of thrips in chilli by potential evaluation of few selected insecticides through their comparative effectiveness.

## Materials and Methods
The present investigation was conducted at the Agricultural Research Farm of "Sam Higginbottom University of Agriculture, Technology and Science" Prayagraj, Uttar Pradesh during *Kharif* season, 2019.

In a randomised block design with eight treatments, using variety Suryamukhi in a plot size of (2m x 2m) at a spacing of (45x30cm) with recommended package of practices excluding plant protection.

The spraying was done after the population reaching its ETL (5 thrips/plant). The observation of the pests was recorded from three tender leaves of five randomly selected plants from each net plot area and three leaves (top, middle, and bottom) from each plant were selected. The average percent reduction of pest population of two sprays was worked out by using Henderson and Tilton's formula described as under.

**Preparation of Insecticidal Spray Solutions**

The spray solution of a desired concentration will be prepared by adopting the following formula:-

$$V = (C \times A) \div a.i\%$$

Where,

V = Volume/ weight of formulated insecticide required.
C = Concentration required.
A = Volume of solution to be prepared.
a.i % = given percentage of active ingredient.

**Population reduction**

The population of chilli thrips was recorded on 3rd day, 7th and 10th day after insecticidal application.

$$\% \text{ population reduction} = 100 \times \left[1 - \frac{T_a \times C_b}{T_b \times C_a}\right]$$

Where,
$T_a$ = Number of insects after treatment
$T_b$ = Number of insects before treatment
$C_a$ = Number of insects in untreated check after treatment
$C_b$ = Number of insects in untreated check before treatment

**Results and Discussion**

**Table 1:** Percent reduction of *Scirtothrips dorsalis* population due to application of certain chemical insecticides and Essential oils of botanicals (1st spray)

| S. No | Treatments | Population of *S. dorsalis* / 3 leaves per plant | | | | |
|---|---|---|---|---|---|---|
| | | 1DBS | 3DAS | 7DAS | 10DAS | MEAN |
| $T_1$ | Fipronil 5 SC | 8.06 | 0.67 | 0.87 | 1.06 | 0.86 |
| $T_2$ | Acetamipride 20 SP | 8.26 | 1.14 | 1.34 | 1.54 | 1.33 |
| $T_3$ | Imidacloprid 17.8 SL | 7.86 | 0.87 | 1.07 | 1.26 | 1.06 |
| $T_4$ | Pongamia oil | 8.0 | 1.67 | 1.87 | 2.06 | 1.86 |
| $T_5$ | Eucalyptus oil | 7.8 | 1.47 | 1.66 | 1.86 | 1.66 |
| $T_6$ | Basil oil | 8.06 | 1.87 | 2.07 | 2.26 | 2.06 |
| $T_7$ | Neem oil | 7.66 | 1.47 | 1.46 | 1.66 | 1.56 |
| $T_0$ | Control | 7.93 | 8.54 | 10.00 | 11.66 | 10.06 |
| Over all mean | | 7.95 | 2.21 | 2.54 | 2.92 | 2.55 |
| F-Test | | NS | S | S | S | S |
| S.Ed.(±) | | 0.282 | 0.296 | 0.226 | 0.142 | 0.279 |
| C.D. (P = 0.05) | | NS | 0.849 | 0.685 | 0.430 | 0.859 |

The data on population reduction of *Scirtothrips dorsalis* over control on third, seventh and tenth day after spraying revealed that all the treatments were significantly superior over control. Among all the treatments $T_1$ Fipronil (2ml/l) recorded highest reduction of *Scirtothrips dorsalis* population *i.e.*, (0.86) which was significantly superior over control followed by $T_3$ Imidacloprid 0.2ml/l (1.06), $T_2$ Acetamipride 0.3gm/l (1.33), $T_7$ Neem oil 2.5ml/l (1.56), $T_3$ Eucalyptus oil 10ml/l (1.66), $T_4$ Pongamia oil 6ml/l (1.86), and $T_6$ Basil oil 1ml/l (2.06) was least effective among all the treatments.

**Table 2:** Percent reduction of *Scirtothrips dorsalis* population due to application of certain chemical insecticides and Essential oils of botanicals (2nd spray).

| S. No. | Treatments | Population of *S. dorasalis*/ 3 leaves per plant | | | | Percent reduction of chilli thrips over control |
|---|---|---|---|---|---|---|
| | | 3DAS | 7DAS | 10DAS | MEAN | |
| $T_1$ | Fipronil 5 SC | 0.53 | 0.66 | 0.86 | 0.68 | 93.82 |
| $T_2$ | Acetamipride 20 SP | 0.93 | 1.13 | 1.33 | 1.13 | 90.13 |
| $T_3$ | Imidacloprid 17.8 SL | 0.66 | 0.86 | 1.06 | 0.86 | 92.30 |
| $T_4$ | Pongamia oil | 1.46 | 1.33 | 1.86 | 1.56 | 86.28 |
| $T_5$ | Eucalyptus oil | 1.26 | 1.46 | 1.66 | 1.46 | 87.48 |
| $T_6$ | Basil oil | 1.66 | 1.86 | 2.06 | 1.86 | 84.28 |
| $T_7$ | Neem oil | 1.06 | 1.26 | 1.46 | 1.26 | 88.69 |
| $T_0$ | Control | 13.33 | 14.66 | 16.66 | 14.88 | 93.82 |
| Over all mean | | 2.61 | 2.90 | 3.36 | 2.96 | 90.13 |
| F-Test | | S | S | S | S | |
| S.Ed.(±) | | 0.263 | 0.270 | 0.114 | 0.304 | |
| C.D. (P = 0.05) | | 0.798 | 0.515 | 0.345 | 0.925 | |

Among all the treatments $T_1$ Fipronil (2ml/l) recorded highest reduction of *Scirtothrips dorsalis* population *i.e.*, (0.68) which was significantly superior over control followed by $T_3$ Imidacloprid 0.2ml/l (0.86), $T_2$ Acetamipride 0.3gm/l (1.13), $T_7$ Neem oil 2.5ml/l (1.26), $T_3$ Eucalyptus oil 10ml/l (1.46), $T_4$ Pongamia oil 6ml/l (1.56), and $T_6$ Basil oil 1ml/l (1.86) was least effective among all the treatments. Patil *et al.*, (2018) [8] resulted that, the treatment of fipronil 0.005 per cent found significantly superior in controlling the chilli thrips with significantly higher fruit yield. Hosamani *et al.*, (2015) [3] the

results revealed that the Imidacloprid 17.8% SL recorded highest per cent reduction of thrips over untreated control**.** Samota *et al.,* (2017) [12] on the basis of mean per cent reduction in thrips population in all the three sprays the treatment of acetamiprid was found to be the most effective.

**Benefit cost ratio**

**Table 3:** Economics of cultivation

| S. No. | Treatments | Yield (q/ha) | Cost of yield Rs/q | Total cost of yield (Rs) | Common cost (Rs) | Treatments cost (Rs) | Total cost in (Rs) | Net returns in (Rs) | C:B ratio |
|---|---|---|---|---|---|---|---|---|---|
| 1. | Fipronil 5 SC | 112 | 2500 | 280000 | 33200 | 1770 | 34970 | 245030 | 1:7.00 |
| 2. | Acetamipride 20 SP | 96 | 2500 | 240000 | 33200 | 2060 | 35260 | 204740 | 1:5.80 |
| 3. | Imidacloprid 17.8 SL | 105 | 2500 | 262500 | 33200 | 2100 | 35300 | 227200 | 1:6.43 |
| 4. | Pongamia oil | 75 | 2500 | 187500 | 33200 | 1160 | 34360 | 153140 | 1:4.45 |
| 5. | Eucalyptus oil | 80 | 2500 | 200000 | 33200 | 2800 | 36000 | 164000 | 1:4.55 |
| 6. | Basil oil | 72 | 2500 | 180000 | 33200 | 3000 | 36200 | 143800 | 1:3.97 |
| 7 | Neem oil | 86 | 2500 | 215000 | 33200 | 1500 | 34700 | 180300 | 1:5.19 |
| 8. | Control | 55 | 2500 | 137500 | 33200 | 0.00 | 33200 | 104300 | 1:3.14 |

**Economics of various treatments**

The yield among these treatments were significant. The highest yield was recorded in Fipronil 2.0 ml/l (112 q/ha) followed by Imidacloprid 0.2ml/l (105 q/ha), Acetamipride0.3g/l (96 q/ha), Neem oil 2.5 ml/l (86 q/ha), Eucalyptus oil 10ml/l (80 q/ha), Pongamia oil 6ml/l (75 q/ha), Basil oil 1 ml/l (72 q/ha) as compared to the control $T_o$ (55 q/ha).When cost benefit ratio has obtained interesting results was achieved. Among the treatments studied, the best and most economical treatments was Fipronil (1:7.00) followed by Imidaclopride (1:6.43), Acetamipride (1:5.80), Neem oil (1:5.19), Eucalyptus oil (1:4.55), Pongamia oil (1:4.45), Basil oil (1:3.97) as compared to control To (1:3.14). Sandeep *et al.,* (2017) [13] reported that among insecticides,
imidacloprid 17.8 SL reduced maximum thrips population (82.46%) as well as in increasing yield. Mandi *et al.,* (2009) [6] reported that acetamipride was found most effective in reducing the population of *Scirtothrips dorsalis* as well as in increasing yield. Maity *et al.,* (2015) [5] Fipronil proved most promising in keeping the thrips population much lower as compared to control and producing the highest yield. Tripti and ashwani, (2018) [14] Fipronil 5SC (1.02) was the most effective treatment indicating recorded lowest population of thrips (*Scirtothrips dorsalis* Hood) and producing the highest yield.

**Conclusion**

From the critical analysis of the present findings revealed that chilli thrips population reached peak during 45th week @ 16.6 insects/ 3 leaves is concluded that incidence among all the treatment Fipronil 2ml/l. proved to be the best treatment followed by Imidacloprid 0.2ml/l., Acetamipride 0.3gm/l., Neem oil 2.5ml/l., Eucalyptus oil 10ml/l., Pongamia oil 6ml/l and Basil oil 1ml/l also effective in managing the thrips, *Scirtothrips dorsalis* reduction. Among the treatments studied the best most economical treatment fipronil (1:7.00) and followed by imidacloprid (1:6.43). Hence more trails are needed to be conducted in future for further findings which can be useful for the farmers in feasible manner for sustainable production of chilli from the scientific community to fill up the lacuna of losses occurring from these insect pests infesting the crop.

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