Comparative field efficacy of selected insecticides against chilli thrips (Scirtothrips dorsalis Hood) on chilli at Naini, Prayagraj (U.P.)

Ramireddy Nagaraju and Ashwani Kumar

Abstract
A field trial was conducted at Central Research Farm, SHUATS, Naini, Prayagraj during rabi season. Two applications of seven insecticides were used against Scirtothrips dorsalis. Result revealed that among the different treatments Fipronil 5% SC (94.06%) proved to be the most effective treatment followed by Spinosad 45% SC (93.16%), Imidacloprid 17.8% SL (92.27%), Nisco Sixer plus (87.34%), Nisco MECH 333 (84.68%), Profenophos 50% EC (84.37%), where as Neem oil 1500 ppm (60.69%) was found to be least effective against this pest. The plot treated with Fipronil 5% SC show highest yield (87.9 q/ha) followed by Spinosad 45% SC (82.2 q/ha). Among the treatments the best and most economical treatment was Fipronil 5% SC (1:11.36) followed by Spinosad 45% SC (1:10.64) and Imidacloprid 17.8% SL (1:10.32).

Keywords: Chilli, chilli thrips, evaluation, insecticides, Scirtothrips dorsalis

Introduction
Chilli (Capsicum annuum: Solanaceae) is one of the most important profitable spices crop grown all over India (Sarkar et al. 2014) [18]. It is an important condiment used for imparting pungency and colour to the food being rich in vitamin A, B, C, oleoresin and red pigment (Hossain et al., 2020) [6]. The Indian chilli is considered to be world famous for two important commercial qualities namely, its colour and pungency levels (Balraj and Arockiasamy 2018) [2]. The world production of chilli crop to around 7 million tonnes, which is cultivated on 1.5 million hectares of land. India is the world leader in chilli production followed by China and Pakistan (Balraj and Arockiasamy 2018) [2]. In India, chilli is cultivated in an area of 7.67 lakh hectares and the production is estimated at 12.34 lakh tones (Priyadarshini et al. 2019) [14].

The major growing states for chilli are Andhra Pradesh (46%), Karnataka (15%), Maharashtra, Madhya Pradesh, Orissa, West Bengal, Rajasthan and Tamil Nadu. In Uttar Pradesh, it is estimated that, the production during 2016-17 was 11.34 million tonnes of chilli from an area of 13.23 hectares (Patel and Kumar 2017) [13]. Among various insect pests attacking chilli crop, thrips Scirtothrips dorsalis is a major pest causing huge economic losses to chilli growers (Reddy and Sreehari 2009) [10]. Chilli thrips considered as one of the most destructive pest of this crop. Thrips cause necrosis of tissues by extracting contents from the epidermal cells. Both nymphs and adults suck the sap from tender crop canopy, resulting in shriveling of leaves, heavy infestation of chilli thrips causes “chilli leaf curl” also called “Murda disease” (Priyadarshini et al. 2019) [14]. In the affected leaves are black dirt of thrips. Paroxysm occurs when thrips act as vectors of viruses that cause disease in chilli plants (Tirkey et al. 2019) [23]. Chemicals is one of the most common and popular methods of thrips control on chilli crop and in recent times, a large number of newer insecticides are available in the market for use.

Materials and Methods
The experiment was conducted during rabi season 2021-22 at Central Research Field (CRF) of Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, Uttar Pradesh, India, in a randomized block design with eight treatments replicated three times using variety G4, Surajmukhi seeds in a plot size of 2mx2m at a spacing of 45cm x 30cm with a recommended package of practices excluding plant protection.
The soil of the experimental site was well drained and medium high. The observations on population of chilli thrips were recorded visually using a magnifying lens of 10x early on three leaves at top, middle and bottom canopy from five randomly selected and tagged plants in each plot. The insecticides were sprayed at recommended doses when thrips reaches its ETL level. The population were recorded a day before spray and 3, 7 and 14 days after spray and the per cent reduction were worked out using the formula. Reduction of pest population in different treatments over control was calculated from the following formula as described by Fleming and Retnakaran (1985).

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

Where

\(T_a\) = Post-treatment population in treatment
\(T_b\) = Pre-treatment population in treatment
\(C_a\) = Post-treatment population in untreated control
\(C_b\) = Pre-treatment population in untreated control

Maity et al. (2015) [9]

**Benefit Cost Ratio**

Cost effectiveness of each treatment was assessed based on net returns. Net return of each treatment was worked out by deducting total cost of the treatment from gross returns. Total cost of production included both cultivation as well as plant protection charges.

\[
\text{Gross return} = \text{Marketable yield} \times \text{Market price}
\]

\[
\text{Net return} = \text{Gross return} - \text{Total cost}
\]

\[
\text{BCR} = \frac{\text{Gross return}}{\text{Total cost}} \times 100
\]

Where

\(\text{BCR}\) = Benefit Cost Ratio

(Sujay et al. 2010) [20]

**Results and Discussion**

The data on the mean per cent population reduction of first spray and second spray overall mean revealed that all the treatments except untreated control are effective and at par. Among all the treatments lowest per cent reduction of chilli thrips was recorded in Fipronil 5% SC (94.06 %). Similar findings made by Venkateswarlu et al. (2021) [24] with (93.82 %), Babu et al. (2021) [1] with 92.86 %, Indumathi et al. (2017) [7], Tukaram et al. (2017) [22], Spinosad 45% SC (93.16 %) was found to be the best treatment which is in line with the findings of Lakshmi and kumar (2021) [8] with (94.11 %), Ravikumar et al. (2016) [15], Patel and Kumar (2017) [13], Manjunatha et al. (2018) [10] highest per cent reduction of chilli thrips. Present finding is in conformity with Venkateswarlu et al. (2021) [24]. Chinniah et al. (2016) [4] reported that Imidacloprid 17.8% SL (92.27 %), Profenophos 50% EC (84.37 %) was found effective in reducing thrips population. Chinniah et al. (2016) [4] who reported that Profenophos showed the effectiveness against thrips reduction. Neem oil 1500ppm (60.69 %) was found to be least effective but comparatively superior over the control, these similar findings are supported by Barot and Patel (2012) [2] and Meena and Tayde (2017) [11] resulting (55.64 %) percent reduction in chilli thrips.

**Economics of various treatments**

The yields among the treatments were found to be significant. The highest yield was recorded in Fipronil 5% SC (87.9 q/ha) which is in line with the similar findings of Sasmal et al. (2020) [19] with pooled data (87.9 q/ha), Maity et al. (2015) [9] with (88.67 and 84.79 q/ha), Mondal et al., (2021) [12] with (86.94 q/ha). Spinosad 45% SC (82.2 q/ha) which is in line with the similar findings of Samota et al. (2017) [17] with (84.74 q/ha), Imidacloprid 17.8% SL (76 q/ha) which is in line with the similar findings of Vanisree et al. (2017) [23] with (77.28 q/ha), Nisco Sixer Plus (68.4 q/ha), Nisco MECH 333 (62.6 q/ha), Neemol 1500ppm (54.2 q/ha) with similar findings of Barot and Patel (2012) [2] with (55.65 q/ha) as compared to control plot (32 q/ha).

When cost benefit ratio was worked out, interesting result were achieved. Among the treatment studied, the best and most economical treatment was Fipronil 5% SC (1:11.36) with the similar findings of Samota et al. (2017) [17] with (1:10.90) followed by spinosad 45% SC (1:10.64) with the similar findings of Meena and Tayde (2017) [14] with (1:11.36), Imidacloprid 17.8% SL (1:10.32) with the similar findings of Meena and Tayde (2017) [14] with (1:10.80), Nisco Sixer Plus (1:8.70), Nisco MECH 333 (1:8.09), Profenophos 50% EC (1:7.79) with similar findings of Turkey et al. (2019) [21] with (1:7.08), Neem oil 15000 ppm (1:7.03) with the similar findings of Patel and Kumar (2017) [13] with (1:7.79) as compared to Control (1:4.50).

**Table 1:** Efficacy of selected insecticides on the population of chilli thrips (S.dorsalis) during first and second spray

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Treatments</th>
<th>Population of Scirtothrips dorsalis / 3 leaves</th>
<th>Per cent population reduction of Scirtothrips dorsalis / 3 leaves</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1DBS</td>
<td>3DAS</td>
<td>7DAS</td>
<td>14DAS</td>
<td>3DAS</td>
<td>7DAS</td>
<td>14DAS</td>
</tr>
<tr>
<td>T1</td>
<td>Imidacloprid 17.8% SL</td>
<td>8.60</td>
<td>93.5</td>
<td>91.76</td>
<td>87.2</td>
<td>95.33</td>
<td>93.96</td>
<td>91.90</td>
</tr>
<tr>
<td>T2</td>
<td>Fipronil 5% SC</td>
<td>8.13</td>
<td>94.23</td>
<td>93</td>
<td>89.63</td>
<td>96.33</td>
<td>95.63</td>
<td>94.70</td>
</tr>
<tr>
<td>T3</td>
<td>Profenophos 50%EC</td>
<td>7.86</td>
<td>81.41</td>
<td>81.63</td>
<td>79.96</td>
<td>88.16</td>
<td>86.66</td>
<td>88.40</td>
</tr>
<tr>
<td>T4</td>
<td>Spinosad 45% SC</td>
<td>8.40</td>
<td>93.50</td>
<td>92.4</td>
<td>88.46</td>
<td>95.83</td>
<td>96.13</td>
<td>92.70</td>
</tr>
<tr>
<td>T5</td>
<td>MECH 333</td>
<td>7.86</td>
<td>82.13</td>
<td>81.63</td>
<td>79.36</td>
<td>89.40</td>
<td>88.90</td>
<td>86.70</td>
</tr>
<tr>
<td>T6</td>
<td>Sixer Plus</td>
<td>8.26</td>
<td>86.4</td>
<td>85.46</td>
<td>81.76</td>
<td>90.83</td>
<td>90.93</td>
<td>88.70</td>
</tr>
<tr>
<td>T7</td>
<td>Neem oil 1500 ppm</td>
<td>8.60</td>
<td>50.01</td>
<td>54.42</td>
<td>52.70</td>
<td>67.63</td>
<td>70.46</td>
<td>68.98</td>
</tr>
<tr>
<td>T0</td>
<td>Control</td>
<td>8.73</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F-test</td>
<td>NS</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>S. Ed (±)</td>
<td>0.57</td>
<td>1.76</td>
<td>1.81</td>
<td>1.71</td>
<td>1.26</td>
<td>1.11</td>
<td>1.10</td>
<td>0.67</td>
</tr>
<tr>
<td>C.D. (P = 0.5)</td>
<td>1.21</td>
<td>3.79</td>
<td>3.89</td>
<td>3.68</td>
<td>2.71</td>
<td>2.40</td>
<td>2.38</td>
<td>1.46</td>
</tr>
</tbody>
</table>

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Fig 1: Field evaluation of selected insecticides against chilli thrips (Scirtothrips dorsalis) (Mean)

Table 2: Economics of Cultivation

<table>
<thead>
<tr>
<th>S. No</th>
<th>Treatment s</th>
<th>Yield of q/ha</th>
<th>Cost of yield / ₹/q</th>
<th>Total cost of yield (₹)</th>
<th>Common cost (₹)</th>
<th>Treatment cost (₹)</th>
<th>Net return (₹)</th>
<th>Total cost (₹)</th>
<th>C:B ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Imidacloprid d 17.8% SL</td>
<td>76</td>
<td>4250</td>
<td>32300</td>
<td>30166</td>
<td>1125</td>
<td>263781</td>
<td>31291</td>
<td>1:10.32</td>
</tr>
<tr>
<td>2</td>
<td>Fipronil 5% SC</td>
<td>87.9</td>
<td>4250</td>
<td>373575</td>
<td>30166</td>
<td>2700</td>
<td>302484</td>
<td>32866</td>
<td>1:11.36</td>
</tr>
<tr>
<td>3</td>
<td>Profenophos 50% EC</td>
<td>59.8</td>
<td>4250</td>
<td>254150</td>
<td>30166</td>
<td>2450</td>
<td>188304</td>
<td>32616</td>
<td>1:7.79</td>
</tr>
<tr>
<td>4</td>
<td>Spinosad 45% SC</td>
<td>82.2</td>
<td>4250</td>
<td>349350</td>
<td>30166</td>
<td>2640</td>
<td>279904</td>
<td>32806</td>
<td>1:10.64</td>
</tr>
<tr>
<td>5</td>
<td>MECH 333</td>
<td>62.6</td>
<td>4250</td>
<td>266050</td>
<td>30166</td>
<td>2688</td>
<td>201424</td>
<td>32854</td>
<td>1:8.09</td>
</tr>
<tr>
<td>6</td>
<td>Sixer Plus</td>
<td>68.4</td>
<td>4250</td>
<td>290700</td>
<td>30166</td>
<td>4192</td>
<td>254574</td>
<td>34358</td>
<td>1:8.70</td>
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<tr>
<td>7</td>
<td>Neem oil 1500ppm</td>
<td>54.2</td>
<td>4250</td>
<td>230350</td>
<td>30166</td>
<td>2600</td>
<td>126904</td>
<td>32766</td>
<td>1:7.03</td>
</tr>
<tr>
<td>8</td>
<td>Control</td>
<td>32</td>
<td>4250</td>
<td>136000</td>
<td>30166</td>
<td>0</td>
<td>78254</td>
<td>30166</td>
<td>1:4.50</td>
</tr>
</tbody>
</table>

Conclusion
From the experiment discussed above, the results revealed that the most effective insecticide against Scirtothrips dorsalis was found to be Fipronil 5% SC @ 2ml/lit followed by Spinosad 45% SC @ 0.3ml/lit. Fipronil had the best cost-benefit ratio followed by Spinosad, Imidacloprid and Sixer Plus. Recommended dose of chemicals may be useful in devising integrated pest management strategy against chilli thrips.

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