Efficacy of Insecticides against American Serpentine Leaf Miner, *Liriomyza trifolii* (Burgess) on Tomato Crop in N-W region of Uttar Pradesh, India


1. Krishi Vigyan Kendra, IISR (ICAR), Lucknow, 226002, U.P, India
2. Krishi Vigyan Kendra, Lohaghat, GBPUA&T, Pantnagar, India
5. C.S.S.S.P.G. College Machhara, Meerut, U.P, India

Corresponding author email: deepakrai75@gmail.com; Authors


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**Abstract** The American serpentine leaf miner, *Liriomyza trifolii* (Burgess) was observed as an important pest of tomato crop. Studies were conducted on the efficacy of selected insecticides against this pest. Larval mining cause greater injury. Among eight insecticides tested for their efficacy against *L. trifolii* on variety Avinash of tomato, Profenophos 40% + Cypermethrin 4% was found to be the most effective over control, while other insecticides were also showed significant result on the leaf miner infestation.

**Keywords** Tomato; Serpentine leaf minor; *Liriomyza trifolii* (Burgess); Insecticides

**Background**

Tomato *Lycopersicon esculentum* (Mill.) is one of the important vegetable crops covering an area of 0.485 m ha. in India, which has increased considerably in recent years with the introduction of new hybrid varieties. These varieties have excellent transportable quality and a long post-harvest shelf life.

Tomato crop is affected by several biotic and physicochemical factors. Among the major biotic factor the insects which damage the tomato crop substantially is the American Serpentine leaf miner (*Liriomyza trifolii*). Other major pests of tomato crop are tomato fruit borer (*Helicoverpa armigera*) aphids (*Aphis gossypii, Myzus persicae*). Jassids (*Amarasca biguttula*) and root knot nematodes, Meloidogyne species along the several diseases like leaf curl and mosaic viruses. American serpentine leaf minor, *L. trifolii* is one of the recently introduced pests of tomatoes, in India, whose infestation is increasing every year at an alarming rate. Other than serpentine leaf miner (*L. trifolii*), tomato fruit borer *Helicoverpa armigera* (Hb.) is the most destructive pest of tomato on India. The infestation by fruit borer occurs in autumn-winter and spring summer crops. Insecticides applications have commonly been responsible for outbreak of *Liriomyza* because insecticides used are often toxic to the large parasite complex than to the leaf miners themselves (Oatman and Kennedy, 1976). Indiscriminate and continuous use of same chemical pesticides had lead to development of resistance, destruction of beneficial insects leading to pest resurgence and pesticide residues, destruction in feeds, foods and environment. To avoid these desperate situations, it is necessary to focus the judicious use of selective pesticides at the time of pest incidence at a certain time interval. Chemical insecticides being the main tool of IPM especially in emergency need to be used. Therefore, continuing services of pesticides with new made of action and subject to new pathway of detoxification could be tested and developed to replace old ones showing resistance.

In this study, an attempt has been made to screen tomato varieties against leaf miner infestation and to test the relative efficacy of different insecticides used against serpentine leaf minor *L. trifolii*.

**Result and Discussion**

Eight insecticides were tested for their efficacy against the American Serpentine leaf miner *L. trifolii* on variety Avinash. The data regarding the efficacy of different insecticides on the upper leaves of tomato crop and yield is appended in Table 1. Mean number of leaf mines per 15 leaves on upper leaves
Table 1 Relative efficacy of different insecticides treatments against serpentine leaf miner, *Liriomyza trifolii* (Burgess) on tomato crop and effect on yield

<table>
<thead>
<tr>
<th>SN</th>
<th>Treatment Insecticides/Doses</th>
<th>Mean number of leaf miner per 15 leaves ex-portions of the tomato plant</th>
<th>Whole Plant (82 DAT)</th>
<th>Yield (q/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Upper leaves Pretreatment (70 DAT*) Post treatment (82 DAT)</td>
<td>Lower leaves Pre treatment (70 DAT) Post treatment (82 DAT)**</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Azadirachtin (1500 ppm) (4 mL/lit. water)</td>
<td>2.905 11.3</td>
<td>7.16 24.04</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>Profenophos50EC (1.0 mL/lit. water)</td>
<td>2.9375 10.5</td>
<td>6.8475 21.71</td>
<td>12.8</td>
</tr>
<tr>
<td>3</td>
<td>Endosulfan35EC (2.0 mL/lit. water)</td>
<td>3.0325 13.6</td>
<td>6.95 19.44</td>
<td>14.1</td>
</tr>
<tr>
<td>4</td>
<td>Dimethoate50EC (1.5 mL/lit. water)</td>
<td>2.9325 12</td>
<td>6.9925 21.32</td>
<td>17.2</td>
</tr>
<tr>
<td>5</td>
<td>Profenophos-40%+Cypermethrin 4% (0.6 mL/lit. water)</td>
<td>2.8925 11.8</td>
<td>6.9425 19.18</td>
<td>12.6</td>
</tr>
<tr>
<td>6</td>
<td>Cypermethrin25EC (0.3 mL/lit. water)</td>
<td>2.98 12</td>
<td>6.985 23.91</td>
<td>15.1</td>
</tr>
<tr>
<td>7</td>
<td>Imidachloprid600 FS (0.6 gm/lit. water)</td>
<td>3.01 11.5</td>
<td>6.88 19.58</td>
<td>18.3</td>
</tr>
<tr>
<td>8</td>
<td>Thiamethoxan20SG (0.0.6 gm/lit. water)</td>
<td>3.0225 11.1</td>
<td>7.105 22.89</td>
<td>17.5</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>3.0425 13.1</td>
<td>8.8925 24.35</td>
<td>20.1</td>
</tr>
<tr>
<td>CD (5%)</td>
<td>0.0661 0.198</td>
<td>0.0595 0.157</td>
<td>0.17</td>
<td>0.918</td>
</tr>
</tbody>
</table>

Note: * DAT-Days after transplanting; **DAT- Population also represented the leaf miner population one day before the second spray of the tomato plant differ significantly in different treatments. All the insecticides showed significant differences over control. However non-significant difference was recorded amongst the treatment. Profenophos 50 EC, Imidachloprid 600 FS, Thiamethoxan 20 SG and Azadirachtin (1 500 ppm) were most effective to reduce the incidence of leaf miner on tomato crop when compared with the control.

There was no-significant difference in between the yield and mean number of leaf mines per 15 leaves but the yields obtained in the entire treated plot was higher than the control. Among the treatments, yield was highest in Profenophos 40%+Cypermethrin 4%. Application of Profenophos 40%+Cypermethrin 4%, Endosulfan 35 EC, Dimethoate 50 EC, and Imidachloprid 600 FS, significantly reduced the infestation over control.

There was significant correlation between mean number of leaf mines on lower leaves and yield of the tomato crop. The yield was more in Profenophos 40%+Cypermethrin 4% (573.1 q/ha) followed by Dimethoate 50 EC (571.1 q/ha), Imidachloprid 600 FS (568.2 q/ha), Profenophos 50 EC (564.2 q/ha), Cypermethrin 25 EC (539.0 q/ha) Thiamethoxan 20 SG (535.9 q/ha) Endosulfan 35 EC (521.9 q/ha), Azadirachtin (1 500 ppm) (480.8 q/ha) over control (419.4 q/ha).

Insecticides like Profenophos 50EC was found most effective against leaf miner infestation on upper leaves and followed by Thiamethoxan 20 SG, Imidachloprid 600 FS, Azadirachtin (1 500 ppm), Profenophos 40%+Cypermethrin 4%, Dimethoate 50 EC, Cypermethrin 25 EC and Endosulfan 35 EC over control. While application of Profenophos 40%+Cypermethrin 4% was most effective on lower leaves to reduce leaf miner incidence. Other insecticides like Endosulfan 35 EC, Imidachloprid 600 FS, Diamethoate 50 EC, Profenophos 50 EC, Thiamethoxan 20 SG, Cypermethrin 25 EC and Azadirachtin (1 500 ppm) were also effective. These results are in conformity of the findings of Pawar et al (1996). While Dimetry et al (1995) evaluated two neem seed kernel extracts against *Liriomyza trifolii* (Burgess) (Diptera: Agromyzidae). Laboratory evaluation of Neem Azal-S and Margosan-O was carried out against the adults and larvae of
Liriomyza trifolii. The feeding deterrent activity of both compounds was significant against the adults particularly at high concentration and lasted for 5 days after treatment. Both formulations also deterred the females from laying eggs and the percentage or oviposition deterrent index (ODI) reached 80.7 and 52.6 for Neem Azal-S and Margosan-O (2%) respectively. The sex ratio between the resulting adults was virtually unaffected with the exception of individuals whose larvae were treated with 2% Neem Azal-S, where all the resulting progeny were female. Walunj et al (2002) conducted a field experiment during rabi 1999/2000 in Maharashtra, India to evaluate the efficiency of the new insecticides, abamectin (Vertimec 1.8 EC), at 5.0 g a.i./ha, 7.0 g a.i./ha and 10.0 g a.i./ha, against serpentine leaf miner L. trifolii on tomato (Namdhari Hybrid- 815). The following treatments were used for comparison: Fluvalinate 25 EC [Cypermethrin+ profenfos] at 440 g a.i./ha Bacillus thuringiensis 50 wp at 500 g a.i./ha. All insecticide treatments were significantly superior to the untreated control in minimizing the incidences of the leaf miner. Abemectin was superior over the rest of the treatments. Abemectin at 10 g a.i./ha recorded the lowest percentage of affected leaflets (17.78%), followed by abemectin at 10 g a.i./ha (21.11%) and reduced at 14 days after treatment in each treatment. The highest yield (150.00 q/ha) was recorded in the plot treated. The highest yield (150.00 q/ha) was recorded in the plot treated with abemectin at 10 g a.i./ha, which was at par with abemectin at 7.0 g a.i./ha and polytron at 440 g a.i./ha with yields of 138.78 and 137.0 q/ha respectively. The study of cumulative number of leaf mines on whole plants one day before the second spray revealed that all insecticides were effective to reduce the leaf miner infestation, in which Profenophos 40%+Cypermethrin 4% and Profenophos 50 EC were most effective over control. The data of yield also showed that all insecticides were effective over control, in which yield obtained in the treatment of Profenophos 40%+Cypermethrin 4% (573.1 q/ha.) was highest. The enhancement in yield in different treatment, despite low level of leaf miner infestation may be attributed to other biotic stresses of the plant.

Materials and Methods

Experiment was conducted in summer season year 2003-2004 in north-western region of Uttar Pradesh, India. Efficacy of eight insecticides i.e. Azadirachtin (1500ppm), Profenophos 50EC, Endosulfan 35EC, Dimethoate 50EC, Profenophos 40%+Cypermethrin 4%, Cypermethrin 25, Imidachloprid 600FS and Thiamethoxam 20SG were tested against L. trifolii at different rates. Two sprays were given, 1st at flowering stage on 70 DAT and 2nd at fruiting stage on 82 DAT. Pre and Post treatment observations were recorded. The data regarding the efficacy of insecticides was recorded for upper as well as lower leaves and for the whole plants. The crop has been transplanted in Randomized block design with four replications. The individual plot size was kept 3 m× 5 m with the plant-to-plant and row-to-row distance at 50 cm. The recommended agronomic practices have been adopted during the entire course of experiment. In case of serpentine leaf miner, observation have been randomly taken from 15 plants from each of the replication and number of miner infestation counted on a single compound leaf of the upper as well as the lower portion of plant.

Authors Contribution

Dr. Deepak Rai had conducted the experiment and wrote the manuscript; Dr. A.K.Singh and Dr. S.N.Sushil had critically analyzed the data; Dr. M.K. Rai, Mr.J.P.Gupta and Dr.M.P. Tyagi had checked the manuscript critically responsibility for appropriate portions of the content.

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