Bio-efficacy of essential oil formulations of mint, *Basil* and *Geranium* against onion thrips, *Thrips tabaci* Lindeman and chilli thrips, *Scirtothrips dorsalis* Hood under field conditions

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ABSTRACT: Three essential oil formulations (25 % EC) of Mint, coded as M-CT, M-T and M-KT were developed and evaluated for their bio-efficacy against thrips under field conditions. They were first tested against onion thrips *Thrips tabaci* Lindeman at three doses i.e., 0.5, 1.0 and 2 ml of the formulations/litre, i.e., 0.0125 %, 0.025 and 0.05 % a. i. of Mint oil, during February- May 2012 and were found to be highly promising. These three EC formulations of essential oils of mint were further evaluated against chilli thrips *Scirtothrips dorsalis* Hood under field conditions along with 25 % EC formulation of *Basil* coded as B-T and *Geranium* coded as G-T each at 1 ml/litre dose i.e. 0.0125% a.i. of essential oil. These formulations at this dose were again found to be effective against chilli thrips. This is the first report of development of any EC formulation of essential oils and their evaluation under field conditions.

Keywords: *Basil*, essential oils, *Geranium*, Mint, *Scirtothrips dorsalis*, *Thrips tabaci*

INTRODUCTION

Farmers generally rely on synthetic insecticides to control insect pests. Many of the organochlorine, organophosphate and carbamate insecticides are no longer in use due to environmental concerns and reduced efficacy. Though many new insecticides have been developed with less waiting period and applied at much lower dose in the recent past, they are also becoming less effective due to excessive use and development of resistance by target insect pest. Thus people worldwide are concerned about the use and misuse of synthetic insecticides. It is recognised that the use of synthetic insecticides should be restricted to promote environmentally safe alternative strategies for managing insect pests. An overview of the scientific publications by Isman and Grieneisen (2013) showed that there is increasing focus by scientific community on botanicals, particularly in essential oils and neem.

Essential oils are defined as any volatile oil(s) that have strong aromatic components which give distinctive odour, flavour or scent to a plant. Aromatic characteristics of essential oils attract or repel insects, protect plant from heat or cold and also utilize them for defence. Essential oils are liquids that get evaporated easily at room temperatures or at slightly higher temperatures. These are generally used in preparing perfumes and incense sticks. They are also used as additives in food, cosmetics, plastics and resins to get distinct flavour. In recent years, considering the safe nature of essential oils many studies have been conducted on insect pest and disease management. Koul (2008) and Tripathi et al. (2009) have reviewed the current status of essential oils in insect pest management. Work done at the Indian Institute of Horticultural Research, Bengaluru, showed that spraying of commercial essential oil preparations of *Basil* (*Ocimum tenuiflorum* syn. *O. sanctum*) (also called as *Tulsi*) and Mint (*Mentha arvensis* Linn.) were found promising against *Scirtothrips dorsalis* Hood in Capsicum (Krishna Moorthy et al., 2013a). We have also found that essential oils of Mint, *Basil*, and scented *Geranium* (*Pelargonium graveolens*) were effective on onion thrips, *Thrips tabaci* (Krishna Moorthy et al. 2013b). We have developed essential oil formulations and tested their bio-efficacy against thrips in chilli and onion. The results of these studies are presented in this paper.

MATERIALS AND METHODS

Evaluation of Mint Essential oil Formulations on onion thrips (2012 summer)

As a first step in developing EC formulations of essential oils, Mint was used. Three 25% EC formulations of mint essential oil, coded as M-T, M-CT and M-KT were prepared in the laboratory. Commercial essential oil products purchased from a local vendor at Bengaluru, India was used to prepare the formulations. These three formulations at 0.5, 1.0 and 2.0 ml/litre i.e.,
with 0.0125 %, 0.025 and 0.05 % mint essential oil active principles were evaluated on their bio-efficacy against onion thrips under field conditions during February – May 2012. Onion variety “Arka Niketan” was planted on 6–2-2012 in plots of 1.1 x 2m with a spacing of 10 cm from plant to plant and 30 cm from row to row. There were 60 plants in each plot. At 30 DAP when the thrips incidence was about 100 per plant, spray treatments of the formulations were given. Each formulation was sprayed at 0.05, 0.1 and 0.2% concentrations given above. Mint essential oil spray at 2 ml/litre of water i.e., 0.2% a.i. of the essential oil was taken as the check treatment along with untreated control. The design was Completely Randomised Design. Three sprays were given at 10 days interval on 30, 40, 50 DAP. Observations on the incidence of thrips were taken at 30 DAP (before spray), 40, 50 and 60 DAP (10 days after last spray); 10 plants at random in each plot were examined very closely in situ. The data on thrips incidence was subjected to Analysis of Variance by taking each plant as a replication.

Evaluation of new formulations of essential oils on chilli thrips

Based on the above study further studies were taken to evaluate these three formulations of mint essential oil against chilli thrips (S. dorsalis) in summer 2012. Chilli F1 hybrid NS 1701 planted on 6-3-2012 for the study. In this study, 25% EC formulations of Basil and Geranium (coded as B-T and G-T respectively) were also taken up for evaluation at 1 ml/litre of water (0.1% i.e. 0.025% a.i. of the essential oils) in addition to the three mint formulations evaluated earlier, namely M-T, M-CT and M-KT. In this study, Fipronil, (5% SC), a popular synthetic insecticide used to control sucking insects, was used as the standard check along with untreated control treatment. A total of seven treatments were taken up with four replications. Plot size was 4 x 3 m. Sprays were given 10 days interval starting from 40 DAP and total of 7 sprays were given. Observations of leaf damage due to thrips incidence were taken at 10 days interval in a damage rating scale of 0-5 developed by Krishna Kumar et al. (1996) just before spray and also at 10 days after each spray. Total of seven observations were taken. The data on the thrips damage rating were statistically analysed to know the differences in treatments by Analysis of Variance.

RESULTS AND DISCUSSION

Results of the preliminary studies with the bio-efficacy of Mint essential oil formulations on onion thrips are provided in Table 1. The incidence of thrips was very high during the experiment period and it ranged from 179-269 on 30 DAP (before spray). In spite of this high level of pest incidence, all the three formulations at the tested doses of 2, 1, and 0.5 ml/L i.e., with a.i. of 0.05%, 0.025% and 0.0125% and mint alone at 0.2% were effective in reducing onion thrips. At 40 DAP all the treatments except M-CT at 0.0125% a.i. dose reduced thrips incidence to less than 100. In control plots, thrips incidence was 216/plant at 30 DAP and this incidence decreased to 146, 60 and 77/plant at 40 and 50 and 60 DAP respectively. At 50 and 60 DAP all the formulations at 0.05% and 0.025% of essential oil, 208

Table 1. Incidence of thrips/plant in onion on different days under different doses of EC formulations of mint

<table>
<thead>
<tr>
<th>Formulation</th>
<th>Dose per litre</th>
<th>30 DAP Pre (Spray)</th>
<th>40 DAP</th>
<th>50 DAP</th>
<th>60 DAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-CT</td>
<td>2 ml</td>
<td>269</td>
<td>36.5&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>19.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.7&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>M-CT</td>
<td>1 ml</td>
<td>265</td>
<td>80.1&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>22.0&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>15.0&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>M-CT</td>
<td>0.5 ml</td>
<td>222</td>
<td>117.0&lt;sup&gt;d&lt;/sup&gt;</td>
<td>29.5&lt;sup&gt;e&lt;/sup&gt;</td>
<td>25.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>M-T</td>
<td>2 ml</td>
<td>222</td>
<td>57.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>20.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.5&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>M-T</td>
<td>1 ml</td>
<td>258</td>
<td>59.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>31.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>14.5&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>M-T</td>
<td>0.5 ml</td>
<td>179</td>
<td>59.0&lt;sup&gt;b&lt;/sup&gt;</td>
<td>25.0&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>19.0&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>M-KT</td>
<td>2 ml</td>
<td>184</td>
<td>51.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>28.0&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>15.5&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>M-KT</td>
<td>1 ml</td>
<td>249</td>
<td>29.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>28.0&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>20.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>M-KT</td>
<td>0.5 ml</td>
<td>259</td>
<td>49.5&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>22.5&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>26.5&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Commercial Mint</td>
<td>2 ml</td>
<td>208</td>
<td>54.0&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>39.0&lt;sup&gt;c&lt;/sup&gt;</td>
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<tr>
<td>Control</td>
<td>-</td>
<td>216</td>
<td>146.0&lt;sup&gt;c&lt;/sup&gt;</td>
<td>60.0&lt;sup&gt;d&lt;/sup&gt;</td>
<td>77.0&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>CD (P=0.05%)</td>
<td>-</td>
<td>NS</td>
<td>26.0</td>
<td>10.9</td>
<td>9.1</td>
</tr>
</tbody>
</table>

Figures in columns followed by same alphabet are at par with each other.
Essential oil formulations against onion thrips

(i.e., 1 ml and 2 ml of the formulation/litre) were at par with mint alone given at 0.2% i.e., 2 ml/litre. However, M-T formulation was better than other formulations as its lowest dose of 0.0125% was at par with higher doses of the formulations and also mint alone given at 0.2%. Overall, all the three formulations were able to bring down the thrips incidence to less than 27/plant as compared to 77/plant recorded in control at 70 DAP and they were also either superior to mint alone or at par with mint alone on this date of observation.

The data pertaining to the bio-efficacy of the essential oil formulations on thrips damage rating on leaves of chilli are given in Table 2. On first observation day (60 DAP) there was no significant difference between any of the treatments. Subsequently significant differences were observed between treatments. All the formulations of essential oils tested were at par with Fipronil on all the dates of observation. They were also superior to control except on 80 DAP. This clearly showed that the formulations developed are effective on thrips in onion and chilli under field conditions.

Again and again essential oils have been found to be effective on many insect pests and mites (Chang et al. 2006), Kaoul (2008), Thripathi et al. (2009). Our earlier studies have shown that essential oils of Mint, Basil and Geranium can be used in the management of thrips in onion and capsicum (Krishna Moorthy et al. 2013 ab). The main constraint in using essential oils as such is their cost and also the quality. The cost can be reduced when the essential oil companies come out with formulations in bulk. The 25% EC formulations developed by us is not very expensive. A few commercial ready to use essential oil formulations are available in USA and Canada against mosquitoes, bed bugs, lawn insects, etc. However, ours is the first report of any EC formulation of essential oil and also about their bio-efficacy on two important thrips species, *T. tabaci* and *S. dorsalis*. Even the lowest dose of 0.5 ml/litre of all the EC the formulations was as effective in onion as higher doses on many dates. We have been getting consistently good results against thrips in capsicum under polyhouse conditions by Mint and Basil formulations (unpublished report by the authors). Hence, there is a great potential in using essential oils and their formulations in IPM of thrips in these crops. There is a need to test their efficacy on different insect pests on other crops to develop alternative and eco-friendly IPM programmes.

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**REFERENCES**


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