EVALUATION OF SOME REDUCED-RISK PRODUCTS FOR MANAGEMENT OF POWDERY MILDEW IN GREENHOUSE TOMATOES

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ABSTRACT

Tomato powdery mildew, caused by the fungus Leveillula taurica, is more common in greenhouses in Albania especially in second growing season where the infected plants can suffer to the point of severe economical damage if left unchecked. Growers often depend on pesticides for its control. In this study, some alternative reduced-risk products were evaluated for their efficacy to control powdery mildew in greenhouse tomatoes. Trials included Serenade WP (Bacillus subtilis QST 713: 10%), Armicarb® 100 (Potassium bicarbonate 85%), UFO (Ultra Fine Oil), Microthiol disperse WG (Sulphur 80%), compared with the untreated control. Each one of these products was applied as single treatment every 7-10 days to each of four replicates of the experimental plot at the same day. Disease severity, expressed as a percentage of the foliar infected area was assessed before each spray and five days after the last treatment. Obtained data show that Serenade, Armicarb and UFO provided more disease control evidencing a severity level by 9,2%, 12,4%, and 18,8% respectively. Microthiol disperse also shows better control compared with untreated control resulting in a disease severity respectively by 20,5 and 30,4%. Experimental results show that reduced-risk products to human health and the environment tested by this study may be considered as potential substitutes of the synthetic fungicides to control powdery mildew in greenhouse tomatoes especially in organic cropping.

Key words: Tomato powdery mildew disease, reduced-risk products

INTRODUCTION

Tomato is a major vegetable crop in Albania cultivated the year round in greenhouses and high tunnels (Pace - Kreta). Both provide the option of off-season production and expansion of markets over traditional outdoor field systems (Selly Miller -). While greenhouse tomato culture tends to be very high-tech and capital-intensive, high tunnels expand the growing season in both spring and fall with much lower capital investments. The “protected culture” production typically provide ideal conditions for disease development and spread. That is why these systems pose unique pest management challenges.

Powdery mildew caused by Leveillula taurica (Anaomorph: Oidiopsis taurica) fungus is spread in Albania and often occurs on tomato and other solanaceous hosts including pepper and eggplant (Kaltani 1982).
As in other parts of the world the infected greenhouse grown tomatoes can suffer to the point of severe economic damage. The disease occurs primarily on foliage, resulting in reduced photosynthetic activity. Which leads to premature leaf drop and a reduction in fruit size and yield.

As with cucurbits, tomato powdery mildew must be managed proactively – by regular scouting and application of fungicides as soon as the disease appears. Use of chemical pesticides for the management of diseases is being restricted due to environmental and human health concerns. Therefore, an integrated approach should be used to control powdery mildew in the greenhouse. Various products such as Serenade ASO (Bacillus subtilis QST 713 strain), Actinovate (Streptomyces lydicus), JMS stylet oil (paraffinic oil), Kocide 3000 (copper hydroxide), Microthiol Dispers (sulfur), Milstop (potassium bicarbonate), etc are available or in development that have the potential to contribute to the management of powdery mildew of tomato (Baysal-Gurel, F. and Miller, S.A. 2015).

The main objective of this study was to assess the potential of the reduced-risk products to control powdery mildew in greenhouse tomato production encouraging to growers the adoption of alternative pest management approaches, practices and technologies.

**MATERIAL AND METHODS**

This study was conducted during the second cropping season of 2014 on tomatoes grown in a plastic house. It is located at k\[mishtaj, a province of the Lushnja district to the central low part of Albania rather 15 km in proximity of Adriatic coast. Tomato plants of 1912 variety were sown into house in the first week of August in rows distanced of 0.7 m and 0.35 m between the plants providing about 4 plant/m² of space.

A randomized complete block design was set up where each of the five treatments was replicated four times. Each treatment consisted of 10 tomato plants and represented applications with these products according to recommended concentrations (Table 1):

<table>
<thead>
<tr>
<th>Treatment / products</th>
<th>Active ingredient</th>
<th>Used concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serenade</td>
<td>Bacillus subtilis QST 713: 10%),</td>
<td>0.7%</td>
</tr>
<tr>
<td>Armicarb® 100</td>
<td>Bikarbonat potasi 85%),</td>
<td>0.6%</td>
</tr>
<tr>
<td>UFO</td>
<td>Ultra Fine mineral Oil</td>
<td>1%</td>
</tr>
<tr>
<td>Microthiol disperse WG</td>
<td>Sulphur 80%</td>
<td>0.25%</td>
</tr>
<tr>
<td>Untreated control</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

There was a natural infection of powdery mildew on tomato plants within the plastic house. Some treatment applications were carried out as foliar spraying starting from first appearance of the disease and repeated every 7-10 days. Sprays were carried out within a day on the whole experimental plot using a back pack sprayer spending 500-1000 litres/ha spraying solution.

Observations for powdery mildew infection or disease severity evaluation are carried out within a day on all plants included in the experimental plot. The first assessment is initiated when disease symptoms were appeared just before the first treatment application. The other evaluations were carried out just before the next application too and the last one 5 days after the last application.

Powdery mildew level infection assessment was adopted following the recommendations of EPPO (1990) for fungicide activity to control vegetable powdery mildew disease. To this aim 10 tomato leaves selected at random from two of ten tomato plants from each treatment and each replication were evaluated visually for disease development.

Disease severity was determined by rating the severity of powdery mildew on the lower leaf surfaces using the following Horsfall-Barratt modified ranking system: 0= no powdery mildew present; 1= up to 3% of leaf surface covered by powdery mildew colonies; 2= up to 6% of leaf surface covered by powdery mildew colonies; 3= up to
12% of leaf surface covered by powdery mildew colonies up to 10% to 100% of leaf surface covered by powdery mildew and calculating the severity through the pondered average according to McKinney (1923). All the other agricultural practices applied on the tomato plants included in experimental plot were the same as on the other plants into that plastic house.

RESULTS

Experimental plot for testing efficacy of some reduced-risk plant protection products to control powdery mildew was established on tomato plants grown as a second cultivation in a plastic covered house of 0.4 ha surface. Cultivation technology and cultural practices were the same as in the other plants out of experiment trial. Tomato plants of 1912 variety were sown into house in the first week of August rather of 3.2 plant/m² of space. Second cropping season of 2014 was characterized by an warm and humid weather and in these conditions a natural infection of powdery mildew on tomatoes was appeared. By the end of the growing period tomato plants out of experimental plot resulted in a moderate to high level of disease development showing often dropping of heavy infected leaves. The same situation occurred on some tomato plants of the untreated control too. Shading of the plants during growing in height, decreasing of sunlight intensity and day shortening during the fall seem to encourage the disease.

First symptoms of powdery mildew were appeared in last days of September. The first evaluation of the infection, before any treatment resulted in a disease severity of 11.2% and the first spray according to scheme of treatments was applied immediately on 26 September. The following sprays were realized on 04.10., 13.10., and 20.10.2014. Other fungicides such as a combination of metalaxyl and mancozeb were added to protect plants from other diseases (for example late and early blight, etc.).

Data on the disease development and severity recorded before the next application and 5 days after the last application are presented graphically (Table 2.)

Table 2. Data on the disease development and severity recorded before the next application and 5 days after the last application are presented graphically

<table>
<thead>
<tr>
<th>Evaluation / treatment time</th>
<th>% of infected leaf surface</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Serenade</td>
<td>Armicarb</td>
</tr>
<tr>
<td>26.09.2014</td>
<td>10.0</td>
<td>10.5</td>
</tr>
<tr>
<td>04.10.2014</td>
<td>10.2</td>
<td>11.2</td>
</tr>
<tr>
<td>13.10.2014</td>
<td>9.6</td>
<td>11.8</td>
</tr>
<tr>
<td>20.10.2014</td>
<td>9.2%</td>
<td>12.4%</td>
</tr>
</tbody>
</table>

Obtained data from disease evaluation show that disease severity was increased during growing period. It is evidenced in untreated control where disease severity was increased progressively from 11.2% to 30.4% at the last assessment. In the other treatments such as Serenade, Armicarb and UFO disease severity resulted respectively 9.2, 12.4 and 18.8%. It seems that those products more or less have influenced to impede disease progression whereas the plants are grown in height. In the Microthiol disperse treatment disease severity resulted was increased up to 20.5%. Evaluation recordings indicate that all used products have contributed to sustain the powdery mildew infection in lower levels than the untreated control. However, the efficacy of Serenade and Armicarb is more conspicuous compared with untreated control. Less protection provided microthiol disperse treatment.
CONCLUSIONS

Efficacy of some reduced-risk products to control powdery mildew on tomatoes grown in high tunnels on second cropping season was evaluated in comparison with untreated control. In situation of the progressive development of the disease on tomato plants during trial time use of protective measures resulted necessary. By a heedful reading of the obtained data it was evidenced that reduced-risk products such as biological fungicide Serenada and potassium bicarbonate Armicarb provided a better protection from powdery mildew disease. Both these products considered as non synthetic fungicides possess much positive features to be inserted in the integrated management programs of powdery mildew on tomato especially in protected culture and in organic cropping. These products can be used succesfully on the other crops for powdery mildews control.

REFERENCES

Guzmán-Plazola, R.A., Fajardo-Franco, M.L. and Coffey M.D. 2011. Control of tomato powdery mildew (Leveillula taurica) in the Comarca Lagunera, Coahuila State, Mexico, supported by the spray forecast model Tomato.PM. Crop Protection Volume 30, Issue 8, August 2011, 1006–1014;
Kaltani, T., Çelo, B. 1982. Fitopatologjia Bujqësore (pjesa e veçantë). Botim i Institutit të Lartë Bujqësor 1982; 545 f.;