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Biological activity of plant protection products against *Tuta absoluta* (Meyrick) in tomato grown in greenhouses

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**Abstract.** Tomato leaf miner *Tuta absoluta* (Meyrick) (*Lepidoptera: Gelechiidae*) is a dangerous pest in tomato grown in greenhouses. The control of this pest is difficult because of the latent way of life of the larvae in the mines, high reproductive potential, polyvoltine development and manifestation of resistance to great part of applied insecticides. Integrated Plant Protection programmes including a complex of measures are developed for successful control of the pest. The most frequently used practice for control on *T. absoluta* is still the application of chemical insecticides. During the period 2011-2012 experiments were performed for determination of the effectiveness of some insecticides in tomato variety Velocity grown in heated greenhouses. A very good biological activity towards the larvae (L1-L4) of tomato leaf miner (*Tuta absoluta* Meyrick) was established in the products Avant 150 EC 250 ml/ha (*E*=79.38% 14° day after treatment) and Coragen 20 SC 0.018% (*E*=79.18% 14° day after treatment).

**Keywords:** *Tuta absoluta*, insecticide, tomato, effectiveness

**Introduction**

Tomato leaf miner *Tuta absoluta* (Meyrick) (*Lepidoptera: Gelechiidae*) has become one of the dangerous pests in tomato greenhouse production in recent years. Larvae make damages attacking all above-ground parts of the tomato plant - extensive mines on the leaves, carving turns in the stem, entrances in the top bud, in the green and ripe fruits could be observed.

Control of this pest is difficult because of the latent way of life of the larvae in the mines, high reproductive potential, polyvoltine development and manifestation of resistance to great part of the applied insecticides (Sequera et al., 2000; Lietti et al., 2005). Integrated plant protection systems including a complex of practices (crop rotation, use of pheromone traps, installation of insect nets, application of bioagents and bioproducts, treatment with insecticides) are developed for successful control of the pest (EPPO Bulletin, 2005; Benvenga et al., 2007; Faria et al., 2008; Huber and Drozby, 2010). It was established that the product Afarm possesses good effectiveness towards the pest (a. i. emamektin) (López et al., 2011). Products with active ingredient (a. i.) deltamethrin, lambda cyhalothrin and indoxacarb are also used for control of *T. absoluta* (Salazar and Araya, 2001; Korycinska and Moran, 2009). Collavino and Giménez (2008) report that for control of tomato leaf miner products with a. i. imidakloprid could be used. Preliminary studies in Spain show that the products with a. i. spinosad and indoxacarb have been effective against the larvae of the pests and the insecticides based on deltamethrin and metomyl could be used for control of adults although the latter have negative side effect on the natural enemies and pollinators (Potting et al., 2010).

The most frequently used practice for control of *T. absoluta* is still the application of chemical insecticides. There are many studies for determination of the effectiveness of plant protection products with a view to create successful plant protected strategy for control of tomato leaf miner with minimum risk of appearance of resistance in the populations (Lietti et al., 2005; Bielza, 2010; Karadzhova et al., 2010; NSPP, 2010; BFSA, 2012; Braham and Hajji, 2012).

The purpose of the study is to establish the biological activity of plant protection products with different active ingredients towards tomato leaf miner in tomato grown in greenhouses.

**Material and methods**

The trials were carried out in Plovdiv in 2011-2012 in heated greenhouses with tomato variety Velocity. The effectiveness of 4 plant protection products was established: deltamethrin (Decis 2.5 EC 0.05%), imidakloprid+deltamethrin (Confidor Energy OD 0.08%), indoxacarb (Avant 150 EC 170 ml/ha, Avant 150 EC 250 ml/ha) and rinazipir (Coragen 20 SC 0.016%, Coragen 20 SC 0.018%). Observations were made on preliminary fixed plants and leaves at natural population density (*Tuta absoluta* Meyrick) larvae 1-4 instar (L1-L4). Number of replications per variant - 4. Living larvae were counted before treatment and in intervals 3rd, 7th and 14th day after treatment. The effectiveness (E%) was calculated by the Henderson-Tilton formula. A comparative analysis by the method Duncan's multiple range test was made (1955). The results were processed mathematically by three-way analysis of variance (Lidanski, 1988).

**Results and discussion**

It was established that the best biological activity towards larvae of tomato leaf miner (*Tuta absoluta* Meyrick) have the products Avant 150 EC 250 ml/ha (*E*=79.38% 14° day after treatment) and Coragen 20 SC 0.018% (*E*=79.18% 14° day after treatment) (Table 1). The recorded values for these insecticides are comparatively...
higher than the maximum effectiveness in Decis 2.5 EC 0.05% (E=55.02% 7th day after treatment). The results obtained confirm the
data by Potting et al. (2009) for good contact action of the pyrethroids
that make them suitable against the adults but towards larvae. This
tendency was also observed in the picture of infestation by the pest
expressed as average number of larvae per leaf. The lowest
average number of larvae treatment was recorded in the variant
treated with product Avant 150 EC 250 ml/ha and Coragen 20 SC 0.016% (Figures 1 and 2).
The product Confidor Energy OD 0.08% has middle position. The
maximum value of effectiveness established for this product
(75.88% 14th day after treatment) is close to that recorded in Coragen
20 SC 0.016% (73.99% 14th day after treatment) and Avant 150 EC
170 ml/ha (72.86% 14th day after treatment).
The products tested Avant 150 EC and Coragen 20 SC demonstrated good effectiveness towards the larvae of *T. absoluta* in the two studied doses/concentrations and depending on the status of the population these products could be used successfully for control of the pest in particular conditions. The good biological activity of Confidor Energy OD 0.08% gives a reason to include it in the plant protected systems as an alternative of the products with different active ingredients and mechanisms of action in order to avoid the possibility of appearance of resistance. On the basis of a three-way analysis of variance it was established that among the factors of variation: variant (plant protection product) (A), days after treatment (B) and year (C) considerable effect on the variation of the effectiveness have only the factors variant and days after treatment (Table 2). Including products with different mechanism of action in plant protection systems is a possibility to limit the risk of the emergence of resistance in the population of *T. absoluta* and a basis for the implementation of successful control.

**Conclusion**

Very good biological activity towards the larvae of tomato leaf miner (*Tuta absoluta* Meyrick) was established in products Avant 150 EC 250 ml/ha (E=79.38% 14th day after treatment) and Coragen 20 SC 0.018% (E=79.18% 14th day after treatment). It was established on the basis of a three-factor analysis of variance that only the factors variant and days of treatment exert an influence on the variation of effectiveness.

**References**


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**Table 2.** Effect of the variation factors on the effectiveness of plant protection products against tomato leaf miner (*Tuta absoluta* Meyrick)

<table>
<thead>
<tr>
<th>Variation factors</th>
<th>Degree of freedom</th>
<th>Variance</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>df</td>
<td>MS</td>
<td>%</td>
</tr>
<tr>
<td>Product for plant protection (A)</td>
<td>5</td>
<td>1569.64***</td>
<td>26.41</td>
</tr>
<tr>
<td>Year (B)</td>
<td>1</td>
<td>119.75 **</td>
<td></td>
</tr>
<tr>
<td>Days after treatment (C)</td>
<td>2</td>
<td>4795.64***</td>
<td>32.27</td>
</tr>
<tr>
<td>Interaction A x B</td>
<td>5</td>
<td>87.09 **</td>
<td></td>
</tr>
<tr>
<td>Interaction A x C</td>
<td>10</td>
<td>148.83 **</td>
<td></td>
</tr>
<tr>
<td>Interaction B x C</td>
<td>2</td>
<td>0.02 **</td>
<td></td>
</tr>
<tr>
<td>Interaction A x B x C</td>
<td>10</td>
<td>46.82 **</td>
<td></td>
</tr>
<tr>
<td>Residuary</td>
<td>108</td>
<td>90.43 **</td>
<td></td>
</tr>
</tbody>
</table>

* p<0.05, ** p<0.01, *** p<0.001, n.s. – non-significant
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