Frankliniella Occidentalis (Thysanoptera: Thripidae) Population Dynamics on Cucumber Crop

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Abstract. Western flower thrips, Frankliniella occidentalis (Pergande) is an important crop pest and a vector of tomato spotted wilt virus (TSWV) in many areas of the world. Its feeding can cause scarring and deformations on leaves and fruit, with seedlings and soft tissue particularly prone to feeding damage. Cucumbers and other vegetable are susceptible to fruit scarring. Population dynamics of western flower thrips was monitored both in field and protected spaces throughout different methods and on different ornamental and vegetables hosts. In this paper results regarding population dynamic on cucumber greenhouse crop are presented. Studies were conducted throughout five weeks. Shaken method was used. Ten leaves from the bottom of the plant, ten from the middle, ten from the tip of the plant and ten flowers were weekly sampled. Mean temperature and treatments applications were recorded. The fallen larvae and adults were counted. Females and males were separately noted. Sex ratio influence and spatial distribution was also followed. Data analysis demonstrated that thrips preferred to feed on younger leaves situated on tip of the plant. There was a very low difference between sex ratio in leaves as compared with the one in flowers. Regarding population dynamics of thrips on whole study period the trend was of increasing, thus treatment application were less efficient and proves its high pesticide resistance character.

Keywords: Frankliniella occidentalis, population dynamic, TSWV, cucumber.

INTRODUCTION

The occurrence of western flower thrips has been recorded in Europe, first time in Germany – 1986 (Zur Strassen), in Netherland – 1988 (Van de Vrie), Romania - 1993 (Vasiliu-Oromulu). Frankliniella occidentalis species was identified in nature, in California, where due to proper climatic condition the reproduction is continuous feeding on a broad range of plants (Vasiliu-Oromul L., 2001).

Over the past 30 years, western flower thrips has become the most important agricultural pest worldwide. It is arguably the most important thrips in the world today. The increasing importance of Frankliniella occidentalis is clearly reflected by the increasing number of publications on this species relative to the proportion of publications on all Thysanoptera in the past 30 years (Stuart R., Reitz, 2009). Western flower thrips was found on many cultivated plants in greenhouses, such as: Begonia spp., Ficus spp., Cyclamen spp., Chrysanthemum spp., Dianthus spp., egg-plant, tomato, sweet pepper and cucumber, among vegetables, Vasiliu-Oromul L., 2001, E. Baniță, 2003).

The aim of this paper regards to: 1) western flower thrips monitoring using shaking method 2) vertical distribution on plant, 3) sex ratio and 4) population dynamics.
MATERIALS AND METHODS

The research was conducted in the vegetable greenhouse of University of Agricultural Sciences and Veterinary Medicine, (Cluj-Napoca, Romania). Studies were performed on *Cucumis sativus* (Cucurbitaceae) during 5 weeks (10.04.12 – 11.05.12). *Frankliniella occidentalis* was the main thrips pest found. Shaken method was used for thrips monitoring.

Four rows of "Veloce" cucumber variety were distributed on 187.44 m², next to the tomato crop. In order to assess plant distribution of western flower thrips species, 10 leaves from different levels (low, middle and top) and ten flowers, were weekly shaken. Vegetative and reproductive plant parts were randomly chosen. Also, every week the temperature was registered. Its values ranged between 28.5°C and 32.5°C. Thrips collection was realized using a box 16.5 x 24.5 cm, initially used for insects’ conservation. On its bottom, two sticky traps were used to cover the entire surface. The box was placed under the vegetative or reproductive plant parts, and each of those was sharply beaten toward the sticky trap surface 3 times. When tapping process was completed, traps were introduced in plastic bags and transported into laboratory where the fallen thrips were counted. Plastic bags were previously labeled noting the data, the row, collection level, and part of the plant that was shaken. For insects count a stereo lupe type Motic SMZ 143, was used.

Females and males were separated for sex ratio determination. Larvae that fall from leaves and open flowers were also taken into account. Chemical treatments were applied every week of sampling period except the last one. Statistical analysis was performed using EXCEL (Microsoft, U.S.A) program. Adults and larvae stages shaken in whole plant were compared with those observed in open flowers using \( t \) test. Sex ratio at each plant level was assessed by comparing with sex proportion in flowers, using one-way ANOVA. Proportion of females and males on whole plant was compared with the one found inside the open flower, by \( t \) test.

RESULTS AND DISCUSSIONS

According to our results the differences between the number of thrips (females and males and larvae), collected on whole plant and the number of thrips removed from flowers was very low, insignificant from statistical point of view \( (t = 1.05, df = 28, P = 0.3) \). Our results differ from those obtained by C.R. Rodriguez et al. 2010. They found ten times more individuals of *Frankliniella occidentalis* in vegetative tissue of blueberry highbush, than in reproductive tissues. In cucumber proximity, tomato crops were cultivated, thus, this discrepancy might be due to cultivation of various plants in the same time, in greenhouse.

Comparing the sex ratio at each plant level with the one observed in open flowers, we found no statistical differences \( (F = 2.70, df = 3, P > 0.05) \).

Between females and males proportion found at all levels pulled together and sex ratio in flowers we observed no significant differences as well \( (t = 0.77, df = 8, P = 0.4) \).

Regarding females and males proportion, C. Mateus, 2003, found a significant difference between sex ratio in traps, where males were predominant, than in flowers, where females were predominant.

Data obtained by thrips monitoring on cucumber greenhouse crop, contradicts other studies, but it is important to be noted that only 5 sampling weeks are perhaps too less.
Cucumber variety has a considerable importance, thus further investigations are recommended for thrips resistance of this variety.

Shaken method should not be the only method used for sex ratio determination or vertical distribution monitoring. Traps or day-degrees could be used as additional tools (C.R. Rodriguez, 2010). Another important factor that should be avoided during sampling refers to chemical treatments.

Regarding vertical distribution of adult (table 1) it is remarkable that more adults females and males were found in leaves shaken from the tip of the plant. When we took into account larvae number (table 2) a higher number of thrips were counted at the middle of the plant which also provide that a higher number of larvae were registered at this plant level. A possible explanation may be that after oviposition, adult female moved toward the top of the plant for feeding on younger leaves. These are preferred by insects, due to higher level of nitrogen, an important nutrient for herbivores (M.K. Park et al.2009). Larva stages supply information about inside source of new thrips population and about population dynamics trend (C.R. Rodriguez, 2010).

A similar result as ours was obtained by Liliana-Vasiliu Oromulu, 2001, in a greenhouse, placed in the south of Romania on cucumber, and by C. Mateus, 2003 inside of a plastic greenhouse with carnation, in Portugal.

<table>
<thead>
<tr>
<th>Tab. 1</th>
<th>Number of adults thrips at different plant levels, on cucumber, in the university vegetable greenhouses, 2012</th>
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<tbody>
<tr>
<td></td>
<td>Low</td>
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<tr>
<td>Mean</td>
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<td>SE</td>
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<table>
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<th>Tab. 2</th>
<th>Number of adults and larvae thrips at different plant levels, on cucumber, in the university vegetable greenhouses, 2012</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Mean</td>
<td>12.5</td>
</tr>
<tr>
<td>SE</td>
<td>3.8</td>
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During sampling period, population dynamics in vegetative and reproductive tissues, recorded through shaken method showed a similar trend, except last week, when the thrips number in leaves increased and those in flowers decreased (fig. 1). A large number of thrips in leaves is given by larvae that have predominated. It suggests that chemical treatment were less effective.

In the same time, this result is not surprising, if we take into consideration that sampling monitoring was initiated after more than a month since cucumber was planted, thus last monitoring week overlapped with the period of growth and development of cucumber fruit, respectively with the end of flowering period.

Temperature variation could, also, have a contribution in leading of population trend.
CONCLUSION

1. On cucumber greenhouse crop, the number of thrips in leaves was not significantly differed by the one found in open flowers.
2. Between sex ratio in each plant level (low, middle, top) and sex proportion in flowers, no significantly differences were registered.
3. Overall, sex ratio in leaves did not differed by the one determined in reproductive tissue.
4. A higher number of western flower thrips adults were found feeding at the tip of the cucumber plants.
5. Population dynamics in leaves indicated an increasing trend.
6. Population dynamics in flowers indicated a decreasing trend.
7. Treatment applications were less efficient and proved thrips high pesticide resistance character.

REFERENCES