

DEVELOPMENT OF DECISION-MAKING TOOLS FOR THE
CONTROL OF THE WESTERN FLOWER THRIPS
Frankliniella occidentalis (Pergande)
IN PROTECTED SWEET PEPPER IN THE ARAVA VALLEY

THESIS

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Summary:

The Western Flowers Thrips (WFT), *Frankliniella occidentalis* Pergande (Thysanoptera: Thripidae), is a cosmopolitan polyphagous pest vegetables, ornamentals and fruit trees. The damage inflicted by WFT is a result of feeding and oviposition in the epidermal tissue. In Israel, no action threshold has been defined for WFT on either greenhouse vegetables in general, or sweet peppers in particular. Control measures are therefore implemented based on the grower's subjective observations rather than a clear decision-making tools for the control of WFT on sweet peppers grown for export in greenhouses in the Arava valley. Three methods of monitoring and sampling adults and nymphs of WFT were studied while following the population dynamics of the pest in sweet pepper greenhouses. Population density was monitored once a week during two consecutive seasons (November to April) by means of blue sticky traps, counts adults and nymphs in flowers, and counts adults and nymphs in three different strata of the plant (upper, middle, and lower).

It was found necessary to differentiate between three periods during the cultivation season: a first flowering period (November-February), a period without flowers (February-March), and a second flowering period (March-May). Most thrips were found in the middle stratum of the plants, and this distribution patterns on the plant was similar during all three periods of the season. During the two flowering periods, a positive, significant correlation was found between the number of WFT (adults and nymphs) on the flowers and their numbers on the entire plant. Monitoring of WFT on flowers may therefore be used as a reliable and practical tool for assessing its level in sweet peppers during the flowering periods. During the period without flowers a positive, significant correlation was found between the number of adults counted in the traps and the number of adults and nymphs on the whole plant. This indicates that monitoring of WFT in traps may be used as a reliable and practical tool for assessing its level in sweet peppers during the period without flowers.

Overall, WFT population density was higher in the 1997-98 than the 1998-99 growing season. Number of nymphs were 3.5 times higher in 1997-98, on the

average, than in 98-99. In addition, the density of the nymph population was 1.65 times higher in 1997-98 than that of the adult population, while the opposite was true in the second season, when adults were 1.3 times more numerous than nymphs. Nevertheless, the dynamic of WFT populations were similar in both seasons, with two population peaks by the end of March.

The minute pirate bug *Orius albidipennis*, the predominant naturally-occurring species in the study area, readily infiltrates into open sweet pepper greenhouses. In this study, the density of the WFT population was lower in experimental plots in where *O.albidipennis* was present, than in plots from which the predatory bug had been eliminated by a chemical treatment that did not affect WFT. The activity of *O.albidipennis* is also evident from the low numbers of adults trapped during both seasons in the greenhouses inhabited by the predator. The presence of the *O.albidipennis* reduced the adult population of WFT significantly during all three cultivation periods. The density of the WFT population was similar in 'Turqal' (red) and 'Bosanova' (yellow) varieties.

A significant cross-interaction was recorded during both seasons between the periods with and without flowers, and the level of WFT (adults and nymphs) on different sections of the plants. A significant cross-interaction between *O. albidipennis* activity and the dispersion of WFT in the different levels of the plant was recorded for the number of adults and nymphs.

Damage was assessed by picking the fruit once a week and estimating the area of pericarp silvering (cm^2) caused by WFT.

The extent of WFT damage differed between greenhouses with and without *O.albidipennis*. In the 1998-99 season, there was a significantly lower level of WFT than in 1997-98; as a result, less silvering of the fruit was observed. During both seasons, *O.albidipennis* reduced the damage to less than 2 cm^2 per fruit, and enabled the peppers to be sold for export.

Infestation of the fruit during the 1997-98 season was higher on 'Bosanova' than on 'Turqal', a tendency that did not prove significant during the following season.

The effect of time of infestation on the degree of fruit damage was investigated. It was found that economic damage is caused when the fruit is infested six weeks prior to harvest, when the peppers are small and green. In

order to determine the economic threshold of the pest, accumulation of Thrips-days must thus be initiated six weeks pre-harvest.

With regard to the monitoring of adult WFT on flowers, a significant relationship was seen between Thrips-days and damage during the second flowering period on the 'Turqal' variety. In case of WFT nymphs on flowers, monitoring showed no significant relationship between Thrips-days and damage during the first and second flowering periods. When adults and nymphs were monitored together, the relationship proved significant for both varieties during both flowering periods.

The economic threshold of the WFT in sweet pepper greenhouses in the Arava valley was determined by monitoring adults on traps during the period without flowers.

During the first flowering period, damage reached 2 cm² on both varieties at 350 Thrips-days, 8.3 adults and nymphs per flower. During the second flowering period, damage reached to 2 cm² on 'Bosanova' at 225 Thrips-days, 5.3 adults and nymphs per flower but on 'Turqal' it did not attain this level. During the intermediary period without flowers, monitoring of adult WFT using sticky traps showed the relationship between Thrips-days and damage to be significant on both 'Turqal' and 'Bosanova'.

When data from both varieties are treated together, damage reaches to 2 cm² per fruit at 16200 Thrips-days, or 386 Thrips per trap per week.

The action threshold is dependant upon the market price of the sweet peppers, the cost of pest control, the grower's additional expenses, weather conditions and other factors. Flexibility is therefore required in calculating the action threshold. The action threshold can be utilized by the farmer to optimize timing of chemical pest control, and to determine the maximal density of WFT for biological control.