Bulgarian Journal of Agricultural Science, 14 (No 5) 2008, 454-459
Agricultural Academy

INFLUENCE OF HOST PLANT ON THE POPULATION DENSITY OF *FRANKLINIELLA OCCIDENTALIS* PERGANDE (THYSANOPTERA: THRIPIDAE) ON DIFFERENT VEGETABLE CULTURES IN GREENHOUSES

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Abstract

PAPADAKI, M., V. HARIZANOVA and A. BOURNAZAKIS, 2008. Influence of host plant on the population density of *Frankliniella occidentalis* pergande (Thysanoptera: Thripidae) on different vegetable cultures in greenhouses. *Bulg. J. Agric. Sci.,* 14: 454-459

F. occidentalis is considered one of the most harmful insect pests of vegetable crops in greenhouses in Greece. The experiments were carried out at a specially designed greenhouse at TEI of Crete, with the aim to establish the influence of host plant on the population density of nymphs and adults of the trips on the leaves and the flowers of cucumber, eggplant, melon, bean, pepper and tomato. The population density of the trips was monitored weekly by visual examination of leaves and flowers of the different vegetable cultures. According to the results, eggplant is the most attractive to *F.occidentalis,* and pepper is the least attractive. It is also found that there is difference in the preference for feeding to the leaves or to the flowers of the separate cultures. A preference to the leaves of eggplant and to the flowers of melon was observed. The least attractive were the leaves of pepper and the flowers of eggplant. For oviposition most preferred sites were flowers of melon and the leaves of eggplant.

Key words: plant-insect interactions, feeding and egg-laying preference, trips, vegetable cultures

Introduction

The host range of *F. occidentalis* includes over 250 species of herbaceous and woody plants (EPPO Bulletin, 2002). Like other insects, trips locate host using color, shape, size and volatiles associated with them. Host selection generally follows several sequential or simultaneous decision processes. Some trips live on the same host for generations, others move from host to host during the day. Some trips enclose within or near the host, especially host-specialized species or brachypterous or apterous species. The ability of anthophilous species, whose floral hosts are ephemeral, to detect subtle changes in host quality (e.g. floral age, pollen quality) and then to disperse and find new hosts or host plant parts may be the key

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to their fitness (Murai and Ishii, 1982; Kirk, 1985a; Trichilo and Leigh, 1988; Teulon and Penman, 1991). Individuals may move to different hosts several times during their larval development or throughout their adult life. For some species this dispersal may occur daily or throughout the day both within plants, such as *Thrips tabaci* on onions (Sites et al., 1992) and *Kakothips pisivorttis* on *Vicia faba* (Kirk, 1985b), and among hosts, such as *Frankliniella occidentalis* in cotton (Matteson and Terry, 1992).

Eggs are laid generally in leaf or floral tissue but some species have distinct preferences. Approximately ten times as many eggs were found in flowering as in vegetative buds, but no preference was observed between male flower buds, and mixed male and female flower buds (Leskey et al., 1995).

Cues for detection of host may be general for polyphagous species or very specific for more monophagous species. Mating, feeding and oviposition may occur on the same host, so cues used for detection of feeding sites may also serve for detection of hosts for reproduction. Others use the floral parts of some hosts or may feed and aggregate on a particular part but not breed there. Within a host plant species or cultivar, some traits may make the plant undesirable or resistant to trips. Many host plant resistance studies have identified those traits that promote or inhibit the herbivores from finding, colonizing and accepting the host (antixenosis), or traits that either promote or inhibit herbivore development or reproduction on the host (antibiosis). Morphological characteristics of the leaves, like length and thickness of trichomes, the substances they are secreting, thickness of cuticle, wax layer, etc. could play decisive role on the preference of the pest to a specific culture (Anathakrishnan and Copichandran, 1993). Trips have different preference not only to the different host species but also to the different cultivars of one species or to the different age of the plants. Some plants are being much heavily attacked than others

Material and Methods

The experiments were carried out in a specially designed greenhouse, 210 mI, with 24 compartments – each 6 mI, at the Highest Technological Educational Institute of Crete. The interior side walls and the doors were covered with fine metal netting, not allowing insect infestation from outdoors and assuring identical climatic conditions in the compartments.

Plants from 6 vegetable cultures were used for the experiments: pepper (*Capsicum annuum* L.), eggplant (*Solanum melongena* L.), melon (*Cucumis melo* L.), bean (*Phaseolus vulgaris* L.), cucumber (*Cucumis sativus* L.) and tomato (*Solanum lycopersicum* L.).The plants were transplanted on the same date and were grown under the same conditions. Three plants of each species were placed in each compartment (a total of 18 plants in each compartment).

Trips were collected from laboratory reared population of *F. occidentalis*, and were released at each experimental compartment (100 trips per compartment), when the plants had already 8 totally developed leaves. The population density of the trips was monitored on three randomly chosen leaves of the different vegetable cultures at weekly intervals using magnifying lens. At the same date three flowers of each culture were collected and checked at the laboratory for nymphs and adults of the trips. The first counts began two weeks after the release, when a sufficient number of trips have been established on the plants due to developing of the new generation. A total of 24 replicates for each culture were used in the experiment.

To avoid the differences in the size and shape of the leaves of the vegetable cultures, the population density of the trips was calculated per unit leaf area (1 dmI).

The leaf area was measured by a portable leaf area meter with 20 replications for each culture.

Results and Discussion

The resulting population, developing after the release of the trips into the experimental compartment, distributed on the different vegetable cultures, depending on the suitability of the leaves and flowers of the host-plant species for feeding and egg-laying. The trips counted or collected during the experiment from the leaves and the flowers of a separate culture were in greatest proportion on eggplant, followed by melon, cucumber, tomato, beans. Only 6% of all the individuals were found on pepper (Figure 1). According to these results, eggplant is the most attractive among the vegetable cultures, and pepper is the least attractive.

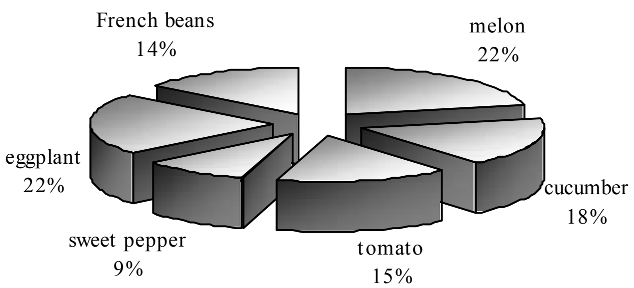

Fig. 1. Distribution of the population of *F. occidentalis* on different vegetable cultures (flowers and leaves)

There is some difference in the population density on the leaves and on the flowers of the different cultures. During the experiment, the average population density of hymphs and adults of the trips was highest on the leaves of eggplant, followed by cucumber, tomato, beans, melon, and sweet pepper (Figure 2).

The leaves of the tested cultures are quite different not only in shape, but also in area, and this could influence the real estimate of the population density of a pest. A leaf of cucumber for example, which is much bigger that a leaf of pepper would support a greater population of the trips and the damage would be less because the leaf wouldn't be so densely populated as the one of pepper. After calculating the population density of the trips per 1 dm^2 leaf area a different ranking of cultures was observed: The highest population density was recorded again on eggplant, but followed by melon, beans, tomato, cucumber, and pepper (Figure 3). The differences in the population density of *F. occidentalis* per 1 dm^2 are greatest between the leaves of pepper and eggplant, and pepper and melon (*** $t>3.29$ ($P<0.001$)) and pepper and beans (** $t>2.58$($P<0.01$)). Between pepper, tomato, and cucumber there were no significant differences.

After the formation of flowers, part of the trips population move to them. The population density of

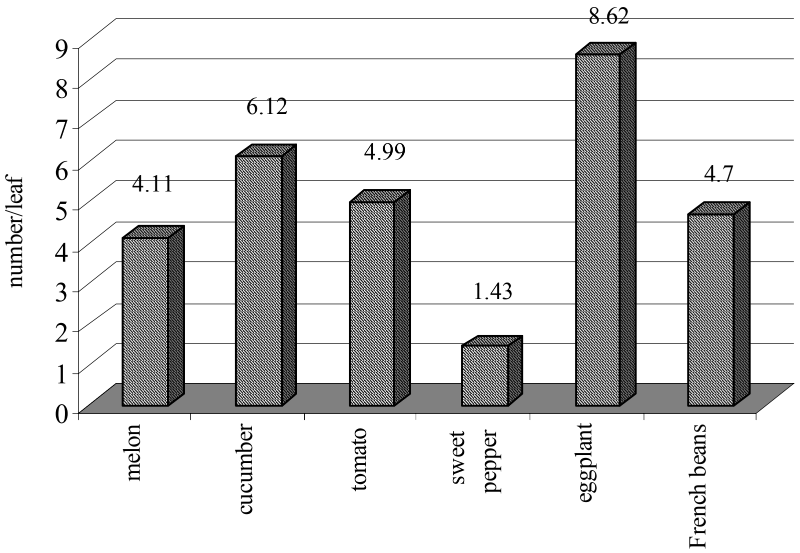

Fig. 2. Population density of *F. occidentalis* (nymphs and adults) per leaf on different vegetable cultures in glasshouses

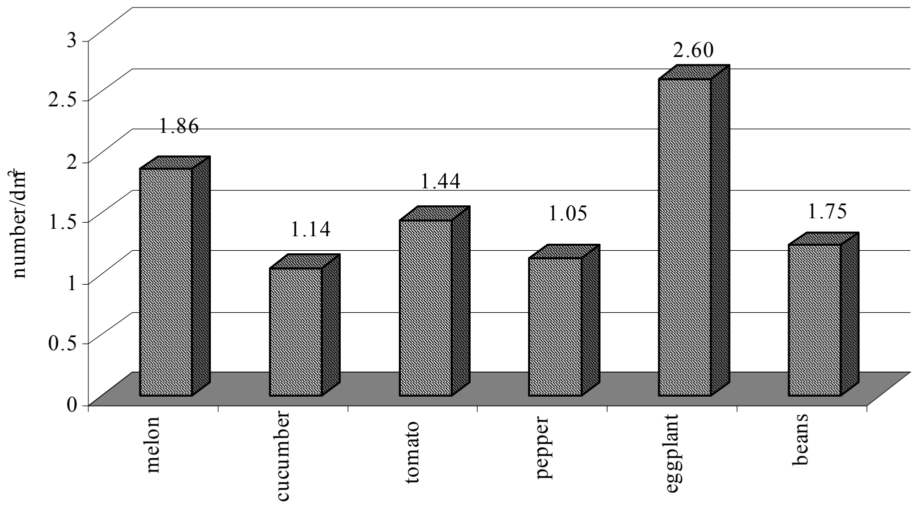

Fig. 3. Average population density of nymphs and adults of *F. occidentalis* per unit leaf area on different vegetable cultures

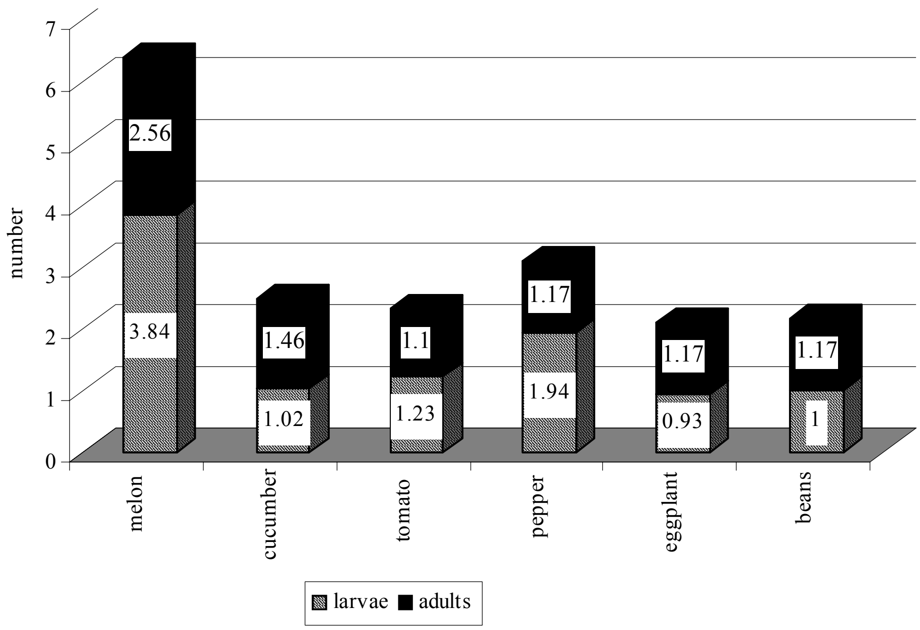

Fig. 4. Population density of *F. occidentalis* per flower on different vegetable cultures

nymphs and adults per flower was highest on melon, followed by cucumber, tomato, sweet pepper, eggplant and beans.

There was difference in the preference of the nymphs or the adults to the flowers of the tested cultures. On melon, pepper and tomato, nymphs prevailed over the adults, while on cucumber, eggplant and beans; population density of the adults was higher (Figure 4).

The highest population density of nymphs was recorded on the flowers of melon, followed by those of pepper, tomato, cucumber, beans, and eggplant. High

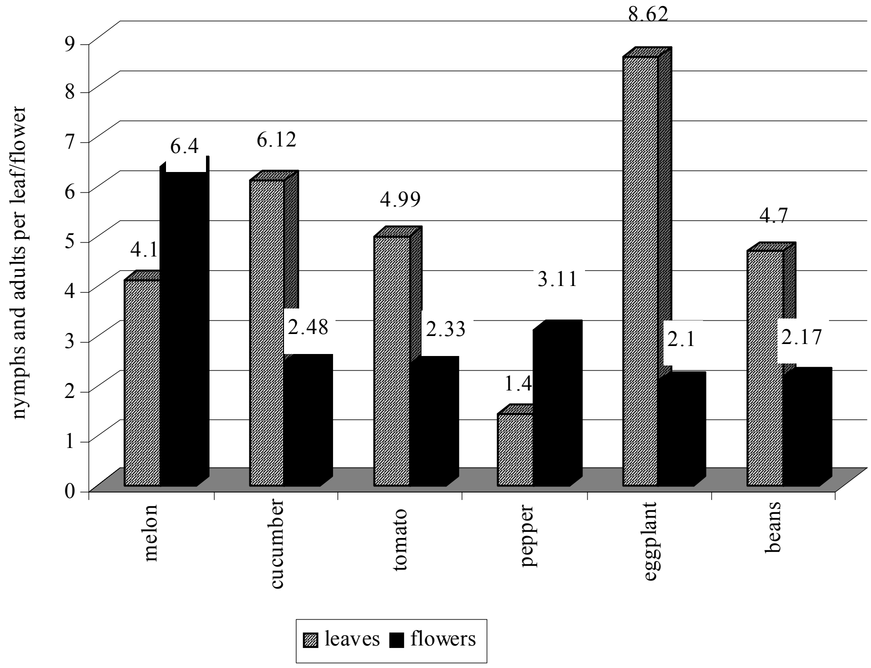

Fig. 5. Population density of *F. occidentalis* on the leaves and the flowers of different vegetable cultures

population density of nymphs which have limited abilities to move compared to the adults, on the leaves or flowers suggests the availability of suitable oviposition sites for the adults. The fact that the leaves of eggplant attract the highest population of nymphs among the tested cultures, while the flowers are least preferred, is indicative that *F. occidentalis* prefers for egg laying the leaves of this culture.

According to Boev (1997) the flowers of pepper are more attractive to *F. occidentalis*, compared to those of cucumber and eggplant. Our results confirm this conclusion. Boev also observed definite prevalence of the adults over the larvae (nymphs) in the flowers of cucumber. On melon, pepper and tomato we found higher population density of the nymphs but in the flowers of the other three cultures the adults prevailed. If we look at the data about the population density on the leaves and the flowers of the different cultures (Figure 5) we notice that again on melon and pepper trips density is higher on flowers than on the leaves. The results from the two figures (Figures 4 and 5) show that the flowers of pepper and melon may be considered suitable oviposition sites for *F. occidentalis*.

Conclusions

The results show that among the 6 tested vegetable cultures eggplant, cucumber, beans, tomato, pepper and melon, the most attractive to *F. occidentalis* is eggplant *and* least is pepper. The trips have different preference to the leaves or the flowers of one culture. The leaves of eggplant and the flowers of melon attracted greatest trips populations. The leaves of pepper and the flowers of eggplant were the least preferred. Judging on the population density of young nymphs of the trips we may conclude that among the tested vegetable cultures, *F. occidentalis* prefers to lay eggs on the leaves of eggplant, followed by the leaves of cucumber, tomato, beans, melon and pepper and on the flowers of melon, followed by pepper, tomato, cucumber, beans, and eggplant.

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Received April, 9, 2008; accepted for printing September, 12, 2008.