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Pumpkin as a barrier-trap plant to reduce whitefly immigration into tomato greenhouses

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Abstract: *Bemisia tabaci* is a major pest of tomato crops. Barrier-trap plants involve the use of plant species that interfere with the dynamics of pests in the main crop. The objective of this work was to determine the function of *Lagenaria siceraria* as a barrier-trap for *B. tabaci* in tomato greenhouses. The presence of pumpkin in the front of greenhouses reduced significantly the abundance of the whitefly on tomato crops. This viable and environmentally friendly practice may contribute to the control of whiteflies in tomato greenhouses.

Key words: *Bemisia tabaci*, *Lagenaria siceraria*, trap crop, pest control, tomato crop

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the main horticultural crops in Spain (MAPAMA, 2017). *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) is a major problem for this crop due to the transmission of viruses (e. g. tomato yellow leaf curl virus, TYLCV) (Juárez et al., 2013). Tomato crops are conducted under Integrated Pest Mangement (IPM) in many parts of the world, but compatible practices that reduce pest incidence are always needed. Altieri and Nicholls (1994) refer to crop diversity as a recommended management strategy to reduce pest damage. Barriers of vegetation involve the use of plants that interfere with the immigration of pests to crops. Barrier plants may also work as traps when they are more attractive to phytophagous insects than the main crop (Vandermeer, 1989). Pumpkins (e. g. *Lagenaria siceraria* (Molina) Stanley, *Cucurbita pepo* L.) are considered as convenient trap plants because they offer resistance to whitefly oviposition and their presence can reduce the incidence of TYLCV in tomato plants (Schuster, 2003; 2004; Kishaba and Castle, 1992). The objective of this work was to determine the effect of *L. siceraria* as a barrier-trap plant for *B. tabaci* in tomato greenhouses.

Material and methods

An experimental greenhouse (Torreblanca, Murcia) of 8.5 × 16 m was divided by meshes into six sectors of 8.5 × 2.7 m. In each sector, 30 plants of tomato cv. Boludo were transplanted by mid February. Tomato plants were arranged in three rows, with a planting frame of 50 cm × 50 cm. In three sectors chosen at random, seven pumpkin plants (*L. siceraria*) were planted at the front of each sector. The other three sectors were used as control with no barrier plants. Tomato and pumpkin plants were trained in trellises to achieve a vertical growth. Sulfur powder was applied twice to control the mite *Aculops lycopersici* (Tryon), on tomato and fungal diseases on pumpkin.

Seven weekly releases of 1,000 *B. tabaci* adults per sector were carried out between May and July. The release of *B. tabaci* was carried out to simulate the immigration of whitefly adults into the greenhouse. *Bemisia tabaci* adults were placed on a Petri dish, 1 m apart from the front of each sector and a small fan was used to create a soft air current to help the whitefly to disperse. Whitefly monitoring was conducted weekly on 15 tomato plants randomly chosen from each sector, by counting *in situ* the number of whiteflies on three leaflets of apical, middle and bottom leaves. For nymphs, the leaflet of the middle leaf was taken from each plant for observation under a stereomicroscope. In pumpkin, the number of whitefly nymphs and adults was counted *in situ* in 40 randomly choosen leaves of each sector. Generalized linear mixed effect models (GLMMs) were used to compare the abundances of *B. tabaci* nymphs and adults between treatments. Date of sampling was introduce in the models as a random factor. The "glmmPQL" function ("MASS" package) set to the Gaussian distribution with the link "log" was used to perfomed the stastistical analyses (R-Development-Core-Team, 2017).

Results and discussion

The presence of pumpkin significantly reduced the incidence of *B. tabaci* in the tomato crops (Figure 1). In presence of pumpkin, a significantly lower number of whitefly adults ($\chi^2(1) = 29.3$, $P < 0.001$) and nymphs ($\chi^2(1) = 5.8$, $P < 0.05$) was registered. A high mortality (up to 90%) of the *B. tabaci* adults was observed in the pumpkin plants. Many adults of *B. tabaci* were stuck on the glandular trichomes of pumpkin leaves. This is in agreement with the findings of McCreight and Kishaba (1991), in various species of cucurbits, and Kishaba et al. (1992), in *L. siceraria*, who found that density and length of the trichomes were negatively correlated with whitefly survival. In conclusion, *L. siceraria* can reduce the incidence of whitefly in tomato crops by acting both as a barrier and trap plant. This is a viable and environmentally friendly practice that may contribute to the control of whiteflies, and probably other pests, in commercial greenhouses of tomato and other vegetable crops.

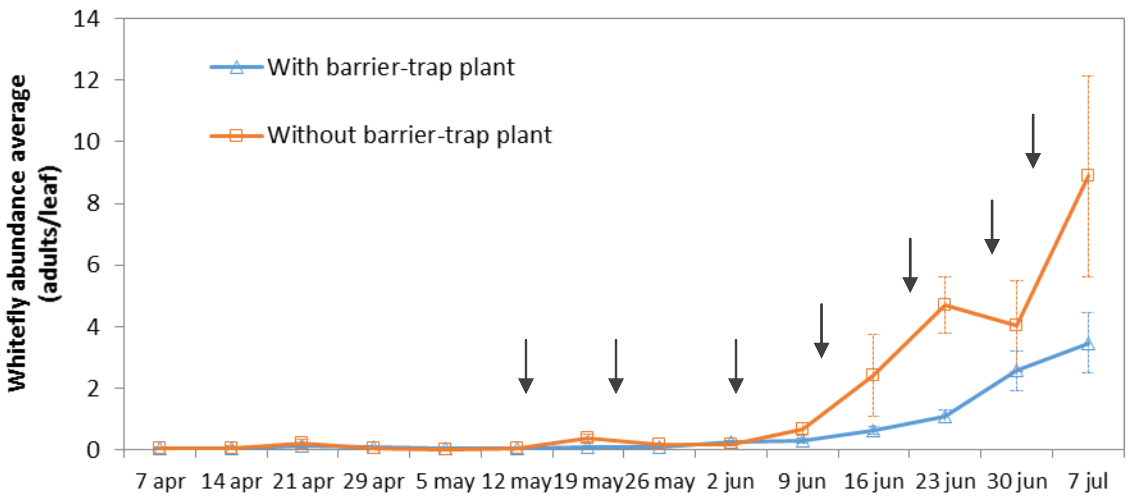

Figure 1. Population dynamics of whitefly adults per leaf in tomato plants. The black arrows indicate whitefly releases.

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