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Push and pull strategy to reduce *Hyalesthes obsoletus* population in vineyards by *Vitex agnus castus* as trap plant

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Abstract

In Israel, *Vitex agnus castus* (VAC) is the preferred host plant of *Hyalesthes obsoletus*, the vector of stolbur phytoplasma to grapevines. In this work, small potted VAC plants caged in insect-proof nets were placed around vineyards. *H. obsoletus* specimens were successfully and significantly lured at distances of 50 to more then 400 m from the vineyards as compared to those attracted to potted vines. When the potted VAC plants were placed 5 meters from the vineyard edge, *H. obsoletus* population in adjacent vineyard rows was significantly reduced to less then half of that in control rows (0.04 and 0.09 /trap/day respectively). The use of VAC plants to reduce *H. obsoletus* population in vineyards with the hope of reducing Stolbur phytoplasma incidences is suggested.

Key words: phytoplasma, push and pull, attract and kill, *Hyalesthes obsolethus*.

Introduction

Hyalesthes obsoletus Signoret (Homoptera Cixiidae) is the only proved vector of stolbur phytoplasma (Sp) to grapevines (Maixner, 1994). However, the adults hardly survive on grapevines, their life cycle can not be completed on grapevines, and other plants species are preferred as hosts. Thus, in Germany, France and Italy, *H. obsoletus* was found to colonize *Convolvulus arvensis* (bindweed) and *Urtica dioica* (nettle), on which it can complete the whole life cycle (Langer and Maixner, 2004). It was shown that higher incidences of infected grapevines are found near patches of those plants species (Maixner and Reinert, 1997). In Israel, the preferred host by far is Abraham's balm- *Vitex agnus castus* (VAC), a perennial bush (Sharon *et al*., 2005).

In the present work we are trying to utilize VAC in push and pull strategy (Cook *et al*., 2007) to reduce *H. obsoletus* population in the vineyard and subsequently reduce grapevine yellows incidence.

Methods

Caged VAC plants as a source of lures to attract and trap *H. obsoletus* were used. Potted plants were encaged in insect-proof nets and yellow sticky traps were set on four sides of the cage to trap the lured insects.

The study was conducted in two steps: first we studied the capability of the small caged VAC plants to attract the insect in the field. Then, in the second step, we tested the affectivity of the caged plants to reduce *H. obsoletus* population in the vineyard. We hypothesized that if the push and pull strategy is successful it will reduce trapping of *H. obsoletus* in grapevine rows adjacent to the traps but not in others. This in turn will lead to decrease in Sp occurrence.

The first step was done in three experiments: 1. Eight caged VAC plants were placed at three distances from the vineyard (10 m, 50 m, 70 m) together with four adjacent empty cages as control. This was done in 2006 during the spring flight period of *H. obsoletus*. 2. Five caged VAC plants were placed at two distances from the vineyard (50 m, 70 m) with five adjacent caged grapevine as control. 3. Groups of three caged VAC plants and three adjacent caged grapevines as controlwere placed The groups were positioned every 350 m at 6 localities (spots) between two vineyards (the first spot more than 400 m away from the vineyards). Traps were replaced every week from the 12 of September to the 4th of October. Both experiments were conducted durinf the autumn flight period of 2006 (September-October).

The second-step experiment was conducted in a Cabernet Sauvignon vineyard, with 30% Sp infected vines. The grapevine rows, 240 m long, run south-north and spacing 1.5 m. between grapevines and 3 m between rows. The experimental setup of each replicate included six caged VAC plants, one meter apart in a line perpendicular to the grapevine rows. Those were placed ca. 5 m from the end of the grapevine rows. Four such replicates were set at one end of the rows (north side) with 60 m (20 rows) between replicates. and four at the other end of the same rows (south). *H. obsoletus* population in the vineyard was monitored with yellow sticky traps hanged along grapevine rows - 11 traps in each row, 20 m apart. The sticky traps were hunged in four rows (one for each replicate) that were perpendicular to the sets of traps (treatment) and three on rows between two sets of traps (control). The traps were replaced every 10-14 days throughout the *H. obsoletus* flight period (end of May to mid July).

Results

The first step results showed that, in each distance and locality (spots), significantly more *H. obsoletus* specimens were caught on the caged VAC plants compared to the control cages (P=0.0011), whether we used caged vines as control (figure 1) or empty cages.

The second step results showed high attractiveness of the lure cages to the pests (figure 2). Significantly ($p<0.00001$) more *H. obsoletus* specimens were caught on the traps attached to the VAC cages (average of 0.24/trap/day) three times the number that was caught inside the vineyard. Moreover, significantly ($p<0.001$) less *H. obsoletus* were found in the "treatment" rows (average of 0.04/trap/day) as compared to the numbers found in "control" rows (average of 0.09/trap/day). We could not detect a gradient in the population from the edge to the center of the vineyard.

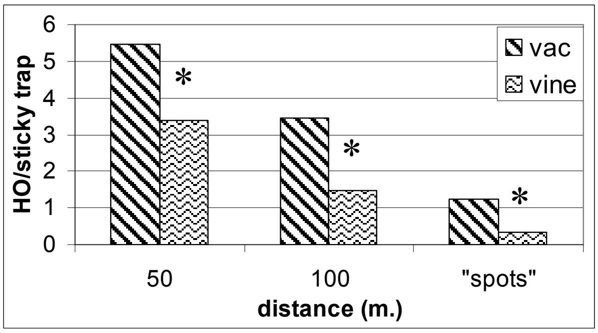

Figure 1. Average number of *H. obsoletus* specimens/yellow sticky trap/week lured by caged VAC plants (VAC) or caged vine plants (vine) at each distance or locality (spots).

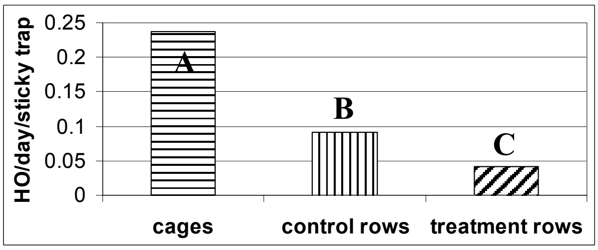

Figure 2. Average number of *H. obsoletus* (specimens /yellow sticky trap/day) caught by caged VAC (cage), in vine rows adjacent to the cages (treatment rows) and in control rows.

Discussion

The results obtained so far indicate that *H. obsoletus* attraction to VAC bushes can be used in development of attract and kill strategy to keep the Sp vector away from the grapevines. It remains to be seen whether the reduction we got in the population of the vector will have an effect on disease incidence.

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