

Presence of *Scaphoideus titanus* on American grapevine in woodlands, and infection with “flavescence dorée” phytoplasmas

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Abstract

Studies on the occurrence of *Scaphoideus titanus* Ball (Auchenorrhyncha Cicadellidae) on American grapevine (AGV) in brushwood areas and in close vineyards, and on its infection with “flavescence dorée” phytoplasmas (FDp) were conducted in Piedmont during 2005-2006. *S. titanus* nymphs were sampled on AGV leaves, whereas adults were captured with yellow sticky traps placed inside vineyards and brushwood areas, and on the borderline. FDP were detected via PCR both on nymphs and adults that fed on AGV.

Many *S. titanus* nymphs were found on AGV in brushwoods. Captures of adults were significantly higher in woodlands than in vineyards, whereas no difference was detected between captures within and on the edge of the vineyard. FDP were detected in nymphs and adults captured on AGV, the infection ranged 27-66%. It may be concluded that woods with AGV can harbour both *S. titanus* and FDP, but at present they do not seem a serious threat for viticulture if a good pest management is applied.

Key words: American grapevine, “flavescence dorée”, vector, polymerase chain reaction.

Introduction

“Flavescence dorée” (FD) is a serious disease of grapevine caused by phytoplasmas belonging to the elm yellow group 16Sr-V subgroups C and D (Boudon-Padiou, 2003). Its vector is *Scaphoideus titanus* Ball (= *S. littoralis*) (Auchenorrhyncha Cicadellidae), a nearctic species introduced into Europe in the fifties; *S. titanus* is monophagous on grapevine, and is univoltine (Vidano, 1964). Nymphs can acquire phytoplasmas by feeding on infected plants, and after a latency period of 4-5 weeks adults are able to transmit the disease to healthy plants (Schvester *et al.*, 1969). Compulsory measures against FD include insecticide application against *S. titanus*, and removal of infected plants (Barba, 2005). One of the incoming problems is the presence, in some vine growing areas, of woodlands containing abundant American grapevine (AGV), as overgrowing of rootstocks, where *S. titanus* may find a suitable ecosystem to develop, although not with population densities so high as those detected in untreated vineyards (Lessio and Alma, 2006). However, it is not clear yet if *S. titanus* adults can move considerably from brushwood areas to close vineyards; another unsolved matter consists in the possibility that wild grapevine in woodlands can host not only *S. titanus* but also FDP. This research focuses on these two aspects.

Materials and methods

Studies were conducted in 2005-2006 in Piedmont (NW Italy) in three different plots consisting in vineyards affected by FD, and close to brushwoods containing AGV. In the vineyards, insecticides were applied twice a year according to compulsory measures against FD. At the middle of June, *S. titanus* nymphs were counted on up to 100 AGV leaves per plot, and then collected

with a pooter and kept in glass tubes until they were brought to the laboratory and frozen. For capturing adults, three yellow sticky traps were placed inside and on the border of the vineyards, and in close brushwood areas (up to 5 m apart). Traps were placed at the beginning of July, changed every 15 days and removed at the end of September. In the laboratory *S. titanus* adults were counted on traps with a 20x stereomicroscope, and detached with a drop of xylene. Afterwards, molecular analyses were performed on *S. titanus* nymphs and adults captured on AGV to determine the presence of FD phytoplasmas (FDP). Total DNA was extracted from single field-collected *S. titanus* and analyzed. Samples were amplified in direct PCR with the group specific ribosomal primer pair fAY/rEY (Marzachi *et al.*, 2001). PCR products were analyzed by electrophoresis through 1% agarose gel, stained with ethidium bromide and visualized on a U.V. transilluminator.

Data were analyzed via One-Way ANOVA to determine if there was any difference in captures of *S. titanus* adults on traps placed at the border and inside the experimental plots; data were square root transformed to satisfy the assumptions of normality and equal variances.

Results

Up to 45 *S. titanus* nymphs per 100 leaves were found on AGV in brushwood areas. On a total of 37 nymphs analyzed via PCR, 28 were found to be FD positive (75.6%); infection rate of adults captured on AGV was 56% (table 1). AGV in brushwood never showed FD symptoms. Few adults were captured inside and on the border of treated vineyards, whereas significantly many more were found in brushwood areas; no significant differences were detected between captures inside and on the border of treated vineyards (figure 1).

Table 1. Infection with FD phytoplasma of different instars of *Scaphoideus titanus* Ball captured on AGV.

Instar	Total tested	FD+	%
III	11	7	63.6
IV	10	9	90.0
V	16	12	75.0
Adults	64	36	56.2

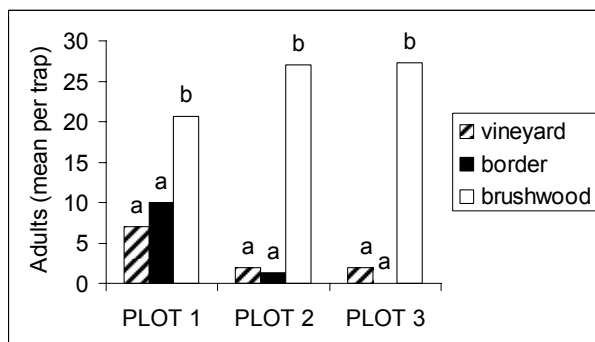


Figure 1. Captured *S. titanus* adults inside and on the border of vineyards, and in surrounding brushwood areas with AGV. Different letters indicate significant differences between captures (ANOVA, $P < 0.05$).

Discussion

The data obtained suggest how *S. titanus* is unlikely to perform considerable flights from AGV in brushwood areas to close vineyards; these results are in accord with our previous research, that demonstrated how *S. titanus* does not fly so far away from its host plant (Lessio and Alma, 2004). Another research conducted in Virginia showed how *S. titanus* adults are more abundant on AGV in the forest rather than in the close vineyard, although at the end of the season a possible movement of adults into the vineyards is theorized (Beanland *et al.*, 2006). Yet, it has to be proven if the adults that are captured in the vineyards at the end of the season come from outside, or if they are due to later egg-hatching inside the vineyards, given that nymphs can be found up to the middle of August (Vidano, 1964).

Natural infection with FDp of *S. titanus* nymphs and adults captured on AGV was quite high, especially if compared to the rates reported on European grapevine (Bressan *et al.*, 2006); this could be due to a higher acquisition efficiency of the vector, or to a higher infection rate of AGV with FDp. As a result, it may be concluded that woodlands containing AGV can host *S. titanus* and FDp; however, at present there is no evidence that *S. titanus* adults can perform massive movements from AGV to the vineyards nearby.

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References

- BARBA M., 2005.- La lotta obbligatoria alla flavescenza dorata e al suo vettore *Scaphoideus titanus*, pp. 135-138.- In: *Flavescenza dorata e altri giallumi della vite in Toscana e in Italia* (BERTACCINI A., BRACCINI P., Eds).- ARSIA Regione Toscana, Firenze, Italy.
- BEANLAND L., NOBLE R., WOLF T. K., 2006.- Spatial and temporal distribution of North American grapevine yellows disease and of potential vectors of the causal phytoplasmas in Virginia.- *Environmental Entomology*, 35 (2): 332-344.
- BOUDON-PADIEU E., 2003.- The situation of grapevine yellows and current research directions: distribution, diversity, vectors, diffusion and control, pp. 47-53.- In: *Proceedings of XV International Conference of Virus and Virus-like diseases of Grapevine*, Locorotondo, 12-17 September. Department of Plant Protection and Applied Microbiology, University of Bari, Italy.
- BRESSAN A., CLAIR D., SÉMÉTEY O., GIROLAMI V., BOUDON-PADIEU E., 2006.- Infectivity of *Scaphoideus titanus* in "flavescence dorée" infected vineyards, pp. 93-95.- In: *Proceedings of XV International Conference of Virus and Virus-like diseases of Grapevine*, Stellenbosch, 3-6 April. South African Society for Enology and Viticulture, Stellenbosch, South Africa.
- LESSIO F., ALMA A., 2004.- Dispersal patterns and chromatic response of *Scaphoideus titanus* Ball (Homoptera Cicadellidae), vector of the phytoplasma agent of grapevine Flavescence dorée.- *Agricultural and Forest Entomology*, 6: 121-127.
- LESSIO F., ALMA A., 2006.- Influence of grapevine presence in different ecosystems on the density of *Scaphoideus titanus* Ball (Homoptera: Cicadellidae).- *IOBC/WPRS Bulletin*, 29 (11): 155-159.
- MARZACHI C., PALERMO S., BOARINO A., VERATTI F., D'AQUILIO M., LORIA A., BOCCARDO G., 2001.- Optimization of a one-step PCR assay for the diagnosis of "flavescence dorée" related phytoplasmas in field-grown grapevines and vector populations.- *Vitis*, 40 (4): 213-217.
- SCHVESTER D., CARLE P., MOUTOUS G., 1969.- Nouvelles données sur la transmission de la flavescence dorée de la vigne par *Scaphoideus littoralis* Ball.- *Annales de Zoologie et Ecologie animal*, 1 (4): 445-465.
- VIDANO C., 1964.- Scoperta in Italia dello *Scaphoideus littoralis* Ball, cicalina americana collegata alla "flavescence dorée" della vite.- *L'Italia agricola*, 101 (10): 1031-1049.

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