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ABUNDANCE AND POPULATION DYNAMICS OF FLAVESCENCE DORÉE PHYTOPLASMA VECTOR *SCAPHOIDEUS TITANUS* BALL ON ABANDONED GRAPEVINE IN SOUTHERN ROMANIA

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Abstract

The abundance and population dynamics of Scaphoideus titanus, the natural vector of the quarantine grapevine yellow phytoplasma, Flavescence dorée, (FD) were evaluated with yellow sticky traps on abandoned grapevine of 1.5 ha in the Northern part of Bucharest city (Southern Romania) during 2009-2011. The results revealed that the vector has developed permanent and increased populations every year. The nymphs were recorded from June to July in the year 2009, until August in 2010 and even up to September in 2011.The activity of adults started at the end of June in the year 2009 and at the beginning of July in the years 2010 and 2011. The adult's flight usually lasted until the middle of October. The present data can be of great help in developing precise control measures against S. titanus. They are the first reported on the population dynamics of Flavescence dorée vector in Romania, and the first time when a case of an abandoned vine infested by this vector has been detected.

Key words: *abundance, population dynamics, Scaphoideus titanus, abandond grapevine, Romania*

INTRODUCTION

Scaphoideus titanus Ball (Hemiptera: Cicadelidae: Deltocephalinae) is an extremely important leafhopper pest of grapevine, causing serious damage by transmitting the pathogen '*Ca. Phytoplasma vitis*' (Elm Yellows group or 16SrV group) (Seemüller et all., 1998), a wall-less intracellular bacterium restricted to phloem sieve cells, associated with the most important grapevine yellow diseases, the Flavescence dorée (FD).

The FD phytoplasma is a quarantine organism in the EPPO region (Annex IIA2 EU2000/29) and in Romania (HG563/2007/AnnexII S2), while its vector *S. titanus* is not regulated.

S. titanus is a species of North American origin, and was reported in Europe for the first time in France, at the end of the 50s (Baggiolini et al., 1968; Arzone at al., 1987, Papura et al., 2012).

Presently, it is widely spread into vine growing regions in the Central and Southern Europe. In the countries bordering Romania, it was firstly reported in Serbia (Magud and Toševski, 2004), then in Hungary (Dér et al., 2007) and Bulgaria (Avramvov et al., 2011). In Romania, the *S. titanus* presence was recorded in 2009 (Chireceanu et al., 2011).

Also, the vector and the Flavescence dorée disease were detected in abandoned vineyards (Dér et al., 2007; Pavan et al., 2012).

The increased risk of *S. titanus* vector in grapevine economy changed its status from a regional one to one of international importance, hence it is regarded as a major threat to viticulture production throughout the world.

According to the studies on S. *titanus* biology published in literature, this is an univoltine species, monophagous on grapevine in Europe, overwintering as eggs into the bark of two years or older woody canes of plants (Gargani et al., 2013).

The eggs hatch at the beginning of May; the nymphs pass through five moults; the adults are active from July to September (Boudon-Padieu, 2003; Linder and Jermini, 2007; Rigamonti et al., 2010).

The control of vector *S. titanus* as well as the destruction of abandoned vines which are reservoirs of diseases and vector is considered among the most effective actions to mitigate

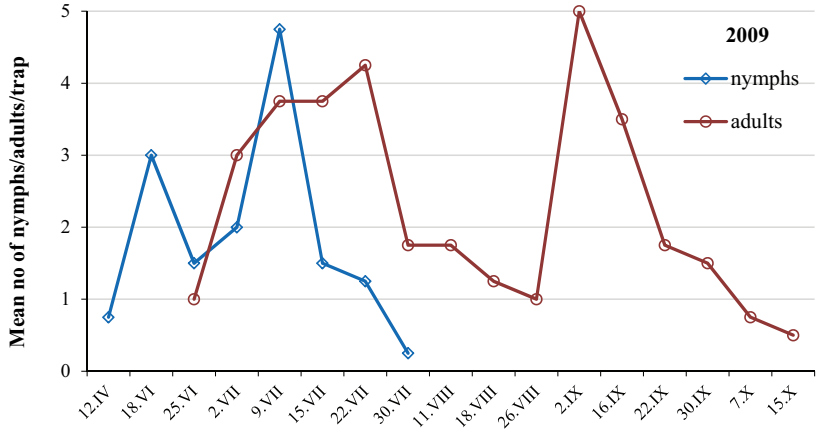
the Flavescence dorée disease spread in vineyards. For a successful control of the leafhopper a full knowledge on its biology along with other detailed studies on population dynamics and densities are needed.
The aim of this paper was to evaluate the abundance and seasonal development of the nymphs and adults of Flavescence dorée vector *S. titanus* on abandoned grapevine in the South Romanian weather conditions, in order to acquire basic knowledge for applying the control measures, according to the vector's development stages.

MATERIALS AND METHODS

The research was carried out during 2009-2011 in an abandoned grapevine of about 1.5 ha located in the Northern part of Bucharest city (Southern Romania), geographic position 260656508N, 445621388E, 89m, (WGS84/UTM zone35N).
The vine plot has shown the presence of symptomatic plants belonging to different cultivars, with symptoms of redness, yellowing and downward rolling of leaves. Shoots from rootstocks but also plant species others than of *Vitis* genera were observed (e.g. seedlings of *Acer negundo*, *Murus spp.*, herbaceous vegetation).
The sampling of *S. titanus*, nymphs and adults, was made using yellow sticky traps. Four traps were placed inside the grapevine canopy, approximately 30-50 cm above the ground.
The traps of *Atraceras* type (30×15cm) were produced at the "Raluca Ripan" Institute for Research in Chemistry from Cluj Napoca, Romania.
The traps were checked every week from June to October. All the captured *S. titanus* individuals were identified and counted under a laboratory stereomicroscope.
The populations' dynamics was designed on the basis of weekly nymphs and adults captures on the yellow sticky traps.

RESULTS AND DISCUSSIONS

In Figure 1 is presented the populations' dynamics of *S. titanus*, adults and nymphs (figure 2), performed in 2009, 2010 and 2011.
The results of this study showed that the captures of *S. titanus* nymphs were recorded from June to July in the year 2009, until August in the year 2010 and even up to September in the year 2011.
Data for the years 2010 and 2011 indicated that even though the presence of nymphs on traps was prolonged, they had a rate of 0.25-0.5/trap (1-2 nymphs/4 traps/week).
A maximum of nymphs was noticed early July in 2010 and 2011. In case of the captures of 2009, a maximum of nymphs in the middle of June and another early July were observed.
The maximum value of nymphs' density per trap was of 4.75, 39.0 and 73.75 in 2009, 2010 and 2011, respectively.



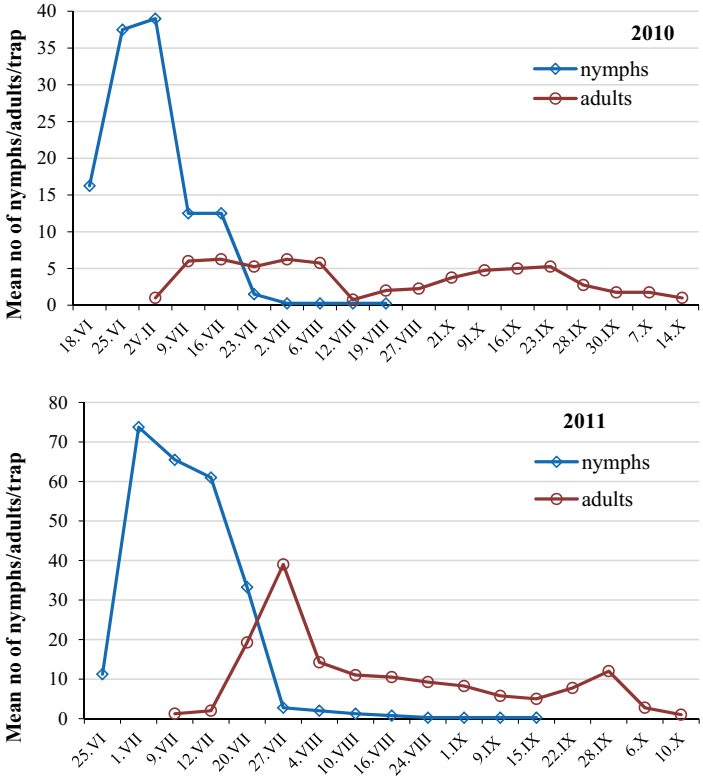


Figure 1. Seasonal population dynamics of *Scaphoideus titanus* Ball in Southern Romania (designed by means of captures per yellow sticky trap)

Figure 2. Adult and nymphs of *Scaphoideus titanus*

Considering the dynamics of captures in the three years of study (Figure 1), the *S. titanus* adult populations, the same as of nymphs, showed fluctuations in the rate of captures from one sampling date to the other and from year to year.

Data illustrated in this figure revealed that the activity of *S. titanus* adult started at the end of June in 2009 and at the beginning of July in 2010 and 2011. The earliest adults capture was recorded on June 25, in 2009. The adults' flight usually lasted until the middle of October. The entire flying time activity ranged from 93 to 112 days.

Captures of the year 2009 pointed out two periods of maximum in adult population dynamics, one in July and the other in September. But, taking into account the fact

that this pest develops only one generation a year with one flight peak in its adult and nymph dynamics, this aspect could be considered the effect of rainfall fallen from spring to summer months in the study area and also of the changes in weather conditions that, together can produce modifications in the rate and dynamics of *S. titanus* local population.
The maximum value of adults' rate per trap was of 4.25, 6.25 and 39 in 2009, 2010 and 2011, respectively.
The cumulated populations' abundance of the vector *S. titanus*, nymphs and adults, on abandoned vine, is illustrated in Figure 3.

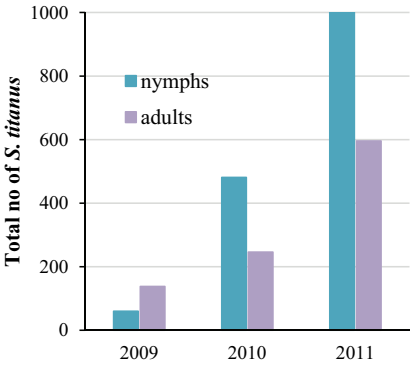


Figure 3. Total nymphs and adults of *S. titanus* population captured in the three years of trapping on abandoned grapevine in the South part of Romania

Comparison among the three sampling years revealed that the total captures of *S. titanus* were differed from one year to another, in the sense that the population has increased from the first to the third season. Both the nymphs and adults were much more numerous in the third season (2011) than in the first season (2009) and the second (2010) season of trapping.
In the year 2011, the total number of nymphs was 2.1 and 16.8 times more than in 2010 and 2009, respectively. The total number of adults in the year 2011 was 2.4 and 4.3 times more than in 2010 and 2009, respectively. The captures of nymphs were higher in number than those of adults, except for the year 2009, when more adults than nymphs were captured.
One of the factors contributing to the population densities of this pest could be the weather conditions of each year within study location. Throughout the monitoring period, local climatic conditions reached various values, such us the year 2011 that had less snowy winter and a hotter summer than 2009 and 2010. Lessio and Alma (2004) reported that the seasonal and daily activity of *S. titanus* is influenced by increased temperatures and humidity.
According to the captures data on the yellow sticky traps during the three year period of study, it was outlined that the leafhopper *S. titanus* developed permanent and stable populations every year in abandoned grapevine. Relative high number of *S. titanus*, collected in these conditions may confirm the fact that the abandoned vineyards offered optimum conditions for the vector development and can play a major role in epidemiology of FD phytoplasmas, as it has been reported in literature (Lessio et al., 2007; Beanland et al., 2006, Steffek et al., 2007, Pavan et al., 2010).
During visual observations, exuviae of *S. titanus* nymphs were commonly found on the lower side of maple trees (*Acer negundo*) leaves but also on *Cirsium arvense* leaves (Figure 4 and 5).

Figure 4. Nymphal exuviae of *S. titanus* on *A. negundo* leaf

Figure 5. Nymphal exuvia of *S. titanus* on *C. arvense* leaf

This observation is in line to others similar findings reported in literature and can be helpful in completing the range of plant species on which *S. titanus* was found in Europe, where

it is considered to feed exclusively on *Vitis vinifera* species. In Switzerland, *Trifolium repens* and *Ranunculus repens* plants in vineyards were reported to host the *S. titanus* nymphs (Trivellone et al. 2009).

The presence of an increasing number of *S. titanus* on cultivated as well as on abandoned grapevine in Romania, as briefly shown in this paper, requests the need to apply obligatory chemical control against it. At this time, no insecticide has been approved for *S. titanus* control in our country. Its populations are covered through the insecticide treatments currently applied against main vine pests, such as *Lobesia botrana* and *Empoasca vitis*.

Therefore, the results of this work bring forward the first data on the biology and population dynamics of *S. titanus* in Romania, which can be used in warning the accurate time for insecticide applications in accordance with the development stages of the vector.

CONCLUSIONS

The results of this report regarding the abundance and population dynamics of *Scaphoideus titanus* - vector of Flavescence dorée phytoplasma - estimated on abandoned vine, showed that the vector developed high populations, increasing from one year to another, that this type of vine being a huge threat for the healthy vine of the vineyards.

We belief that this information can be of great help in developing precise control measures against *S. titanus*.

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