

Monitoring of the leafhopper *Scaphoideus titanus* and symptoms associated with yellows diseases in vineyards in the Viticulture Region of Moldova, Romania

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Abstract Monitoring action is a key component of integrated pest management programs that aims to obtain valuable early data regarding the pests and their crop damages. By this, it is possible to select and apply the most appropriate strategies for pest control before reaching to economical threshold. The leafhopper *Scaphoideus titanus* (Hemiptera: Cicadellidae) is the main natural vector that spreads in Europe the golden flavescence diseases (Flavescence Dorée), one of the most destructive grape yellow diseases produced by phytoplasma. This paper reports the results of a 4-year survey on spreading and abundance of *S. titanus* in vineyards from Moldova region in Eastern Romania as well as specific symptoms for phytoplasma diseases. Fifty-one plantations were investigated during 2016-2018 and 2020. Visual observations were performed to evaluate the symptoms of yellows diseases and yellow double sticky traps to monitor the leafhopper. Results revealed that 84.3% of plantations showed symptoms characteristics to yellows diseases associated with phytoplasmas presence with an incidence between 0.5 and 29.5%. Chardonnay white cultivar was the most affected. The leafhopper *S. titanus* was recorded in all investigated vineyards with different abundance. Total abundance of the pest, from June to October, was between 10 and over 1600 specimens per trap per site.

Keywords: *Scaphoideus titanus*, Romanian grapevine,

1. Introduction

The North American leafhopper *Scaphoideus titanus* Ball 1932 (Hemiptera: Cicadellidae) plays a crucial role in Europe in spreading one of the most destructive yellow diseases of grapevine associated with the Flavescence Dorée (FD) phytoplasma (Galletto et al, 2014), being considered the main natural competent vector of this pathogen. Spread of the disease to S-E Europe continues despite quarantine measures applied in viticulture zones severely affected from the west and centre of the continent. As a consequence, the presence of FD phytoplasma in plants of *Clematis* and *Ailanthus* was reported in Bulgaria (Genov et al, 2018). The two species are very common and widespread around the vineyards, from where the leafhopper *S. titanus* that

lives on both plant species and grapevine can easily transfer the FD infections to the vineyards. Although the FD has not yet been detected in vineyards in S-E European countries, including Romania, the knowledge of situation on the vector *S. titanus* in vineyards is decisive for planning the control measures against it in order to prevent and limit the spread of the disease when natural outbreaks occur.

This paper reports the results of a four-year monitoring period on the presence and abundance of the leafhopper *S. titanus* as well as the symptoms specific to phytoplasma diseases from vineyards in the historical viticulture region of Moldova (Moldova Hills) in the Eastern Romania during 2016-2018 and in 2020.

2. Material and Methods

The study was performed in fifty-one vine plantations in the Viticulture region of Moldova in the Eastern Romania during 2016-2018 (forty-eight plantations) and 2020 (three plantations) (Table 1) showing yellows symptoms characteristic to phytoplasmas presence.

Table 1. The affiliation and number of vineyard plantations surveyed for *S. titanus* and specific symptoms of phytoplasma diseases in 2016 -2018 and 2020

County	Vineyard	Viticulture Centre	Monitored plots / year (2016/2017/2018/2020)
Vrancea	Odobești	Odobești	4 / 4 / 4 / 2
		Jaristea	0 / 0 / 2 / 0
	Panciu	Țițești-Sârbi	1 / 1 / 2 / 0
		Panciu	2 / 2 / 1 / 0
	Cotesti	Virtescoiu	3 / 3 / 1 / 1
		Cîrligele	1 / 1 / 1 / 0
		Dumbrăveni	1 / 1 / 0 / 0
		Beciu	0 / 0 / 1 / 0
		Faraoanele	0 / 0 / 1 / 0
	Buzau	Grebănu	1 / 1 / 0 / 0
Vaslui	Huși	Huși	3 / 3 / 3 / 0

The plantations were obtained in context of the National Support Program of Romania in wine sector (2008-2013), except for the old and abandoned one. European and local varieties were used, planting material being from European community and from the country. The plantations were distributed in four famous vineyards

and eleven viticulture centres, and belong to the local owners and to the Vine and Wine Research-Development Station Odobești (RDSVVO) in the region. All were managed in conventional system where the pest control was based on chemical products, excepting the abandoned plantation in 2020. The insecticide treatments had as main purpose the control of the mites and the grape moths. No spray was practiced against *S. titanus*.

To capture *S. titanus* and other leaf and plant hoppers, four yellow double sticky traps (15x20cm, Atra CERAS type, produced at Raluca Ripan Institute, Romania) per plantation were placed inside on the row of vines at the level of canopy each year, from June to October, changed every two weeks. The insect specimens collected on traps were identified under a stereomicroscope SZ61 type based on the morphological characters of adults and larvae.

The symptoms of yellows disease were evaluated by visual examinations in plantations during the August and September period.

2. Results

2.1. Grapevine yellows symptoms

Characteristic symptoms of yellows diseases associated with presence of phytoplasma on vine plants were observed in 84.3% out of the investigated plantations in this study. Table 2 presents the proportion of the sample plots showing symptoms.

Table 2. Proportion of vine plantations showing symptoms of yellows diseases specific infections with phytoplasma microorganisms

Year of observations	Proportion of plantations showing symptoms specific of yellows diseases
2016	100%
2017	87.5%
2018	71.4%
2020	100%
Average	84.3%

As table 2 shows, the proportion of plots displaying symptoms was different from year to year and reached high values. The highest was in 2016 and 2020 corresponding to 16 and 3 plantations evaluated, respectively.

Among the most common symptoms showed by symptomatic plants in examined vineyards were leaves as well as their veins partially or totally yellowed to the white varieties and reddish to the red ones, leaf lamina rolled downwards with a thicker texture and brittle, necrosis, berries shrived, woody canes poorly ripened resulting in strong weeping aspects. Number of plants with the specific symptoms in affected plots varied depending on the grape variety, the vineyard and the year of sampling. The white and red varieties as well as the European and traditional Romanian varieties showed specific symptoms to phytoplasma diseases presence. Some of the symptoms on vines are illustrated in figure 1.



Figure 1. Leaves rolling, weeping shoots and yellowing on Sauvignon Blanc (A), Chardonnay (B) and reddening on Fetească Neagră (C)

The highest proportion of symptomatic plants was observed on the white varieties Chardonnay and Sauvignon Blanc and the red Romanian variety Fetească Neagră. The planting material for all three varieties was produced on the EU territory. The Chardonnay variety (Virtescoiu centre) showed the highest percentages of symptomatic plants, 29.5% in 2016 and 23.7% in 2017. The Sauvignon Blanc variety showed symptoms in 5% (2016) and 7% (2017) of the plants in the viticulture centres Odobești and Virtescoiu respectively, while the Fetească Neagră variety showed symptoms in 8.3% of the plants in 2016 (Odobești centre) and 1.6% in 2018 (Cîrligele centre). These results are in consent with those previously reported for other viticulture areas in the country (Chireceanu et al., 2014). Chardonnay is reported to be one of the most sensible varieties to grape yellows phytoplasma diseases. In South African vineyards this can be 100% affected in several years (Carstens, 2014). The Romanian and European white varieties, Tămăioasa Românească, Muscat Ottonel, were among the less affected by the symptoms of yellows diseases (<1%).

2.1. The leafhopper *Scaphoideus titanus*

During the survey the leafhoppers *Scaphoideus titanus* on yellow sticky traps was identified in all sampled vine plots. The total abundance of the pest for each monitoring year and surveyed plantations is synthesized in the graphics from figure 2. As the graphics in figure 2 show, the annual total captures of *S. titanus* (adults and larvae) were variable depending on the year and grape varieties. The highest captures were recorded in 2017 and 2020 with an average of captures of 279 and 1622 specimens of *S. titanus* per trapper plot, respectively. A density over 100 specimens per trap was found in 11 of 16 plots (68.7%) in 2017, in 3 of 16 plots (18.7%) in

2018 and in all three plots (100%) in 2020. In plots surveyed in 2016 less than 90 specimens per trap were found, many of them less than 40.

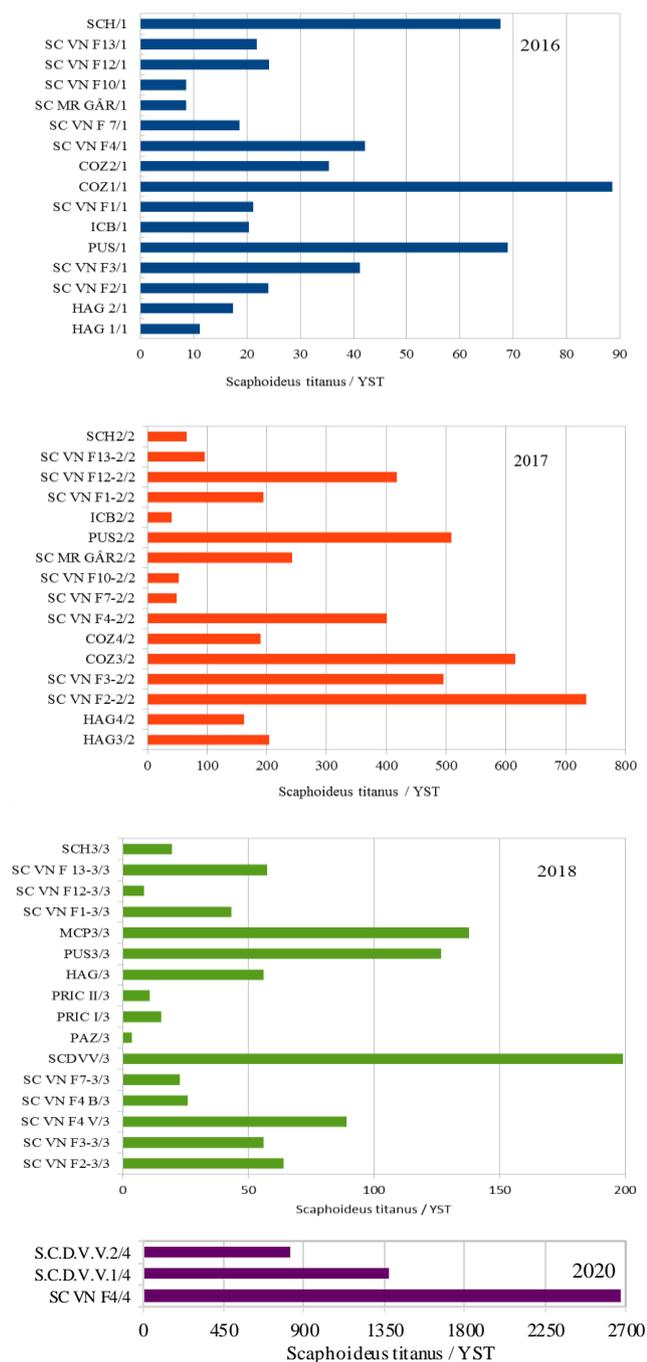


Figure 2. Total annual abundance of *Scaphoideus titanus* in vineyard plots in the viticulture region Dealurile Moldovei

Variable densities of *S. titanus* in vineyards could be the result of both chemical sprays in the programs of wine farmers used for grapevine protection and the climatic conditions varying from year to year.

3. Conclusion

Our results showed that a high percentage of the vine plantations in the viticulture zone of Moldova in the eastern part of Romania are affected by symptoms

characteristic to yellows diseases associated with presence of phytoplasmas microorganisms. This study is the first substantial report on the presence of these type of symptoms for this viticulture zone. The most affected were the white varieties Chardonnay and Sauvignon Blanc, and the red variety Fetească Neagră. The leafhopper *Scaphoideus titanus*, reported as the main natural vector of FD, was also detected in the vineyards from Moldova region. Its abundance ranged from modest to very high densities depending on year and vineyard. These results bring new data, important for grapevine in Romania and S-E part of Europe as well. The constant and considerable presence of *S. titanus* shows an increased risk of the grapevine at the attack of FD disease if this would appear in the area in the future.

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