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The management of *Phomopsis viticola* in Tarnave vineyards

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ABSTRACT

***Phomopsis viticola*, in poorly managed vineyards, can produce a lot of damage due to its year-to-year infection pattern. In combination with a high spore reserve from the previous year, this causes reduced grape yields. This study aims to assess the *Phomopsis viticola* attack in Tarnave vineyards during May-July 2020. The data (frequency and intensity of the attack) was collected from Craciunelu de Jos, and the attack degree (AD) was calculated before and after the treatments applied to 'Saugvinon blanc', 'Riesling italian', 'Fetească regală' and 'Traminer roz' grapevine cultivars. The AD before the treatment with contact and systemic products had values between 27.80% and 4.10%, after the treatments of the first period (May-June 2020) the AD was reduced at values between 3.40% and 0.83% and after the treatments of the second period (June-July 2020) the AD had the values between 9.00% and 12.40%. In Tarnave vineyards, 'Fetească regală', 'Sauvignion blanc' and Riesling italian cultivars have shown a higher susceptibility to the *Phomopsis viticola* attack and Traminer roz' a lower one. The fungicide treatments administrated were efficient in managing *Phomopsis viticola* in vineyards from Transylvania.**

Keywords*: Vitis vinifera*, *Phomopsis viticola*, pathogen of grapevine, fungicide treatment, attack degree

INTRODUCTION

Grapevines (*V. vinifera L.* and *Vitis spp*.) are one of the most economically important and extensively grown woody perennial fruit crops in the world (Torregrosa *et al.*, 2015 Gramaje *et al.*, 2018).

V. vinifera and many other species belonging to the *Vitis* genus together with their interspecific hybrids are important especially for rootstock development, wine production, table grapes and other secondary products. With 175590 ha productive vineyards in 2020 (FAOSTAT), Romania ranks 5th in Europe.

One of the important vineyards of Romania is Tarnave vineyards having as primary production the high quality white wines, high quality aromatic white wines, sparkling wines and table grapes (Oprea, 2001; Comsa *et al.*, 2021).

Grapevines are attacked by many species of fungi, the most damaging being: *Plasmopara viticola* (Gessler *et al.,* 2011) which causes downy mildew, *Uncinula necator* (Doster and Schnathorst, 1985) which causes powdery mildew, Esca which is an amalgamation of fungi species (Fischer and Peighami-Ashnaei, 2019) that cause physiological decline and *Phomopsis viticola* which causes *Phomosis* dieback or excoriosis (Ùrbez-Torres *et al.,* 2013; Gamaje *et al.*, 2018) and also cane and leaf spot (Savu *et al.*, 2020, Baumgartner *et al.*, 2012; Urbez-Torres *et al.*, 2013).

Excoriosis is present everywhere grapevines are grown and the most damage is done when the precipitation levels are high in the early season.
The disease can cause bud death, poor shoot growth and stunted leaves and later in the season when the shoots are heavier breaking from the base can occur. The spreading pattern of excoriosis is fairly slow, but in time it builds up, leading to declined vigour and yield of the vines (Pearson and Goheen, 1988; Phillips, 1998).
The term excoriosis was introduced by Ravaz and Verge (1925) (Ravaz and Verge 1925; Phillips, 1998). According to them, the following symptoms are typical: early in the season, the fungus invades the young shoots causing elongated black lesions on the internodes (Phillips 1998; Gramaje *et al.*, 2018; Ùrbez-Torres *et al.,* 2013).
Affected branches become swollen at the base and the blackened cortex may rupture. Such branches are very brittle and readily collapse under their–weight, while others may dieback. After harvest, the black areas on the canes turn grey or white and are spotted with black fruit bodies immersed in the host tissues. All these symptoms are seen now as typical, also including bud death and a possibility of shoot dieback (Pearson and Goheen, 1988).
In Romania, excoriosis was found in vineyards in Valea Calugareasca at the beginning of the growing season (Muntean *et al.*, 2022), Odobeşti, Coretesti – Vrancea, Pietroasele and Dragasani (Oprea and Podosu, 2008), Ciumbrud (Savu *et al.*, 2020), and Tarnave vineyards (Comşa *et al.*, 2021). In Europe first reports about excoriosis came from France in 1925 (Ravaz and Verge, 1925). Later the disease has spread in all parts of the world where grapes are grown (Galet, 1977).

MATERIALS AND METHODS

The experimental plots were located in Craciunelu de Jos belonging to the Research and Development Station for Viticulture and Enology Blaj (SCDVV Blaj). The plots (0,5 ha) were cultivated with the following cultivars: 'Sauvignon blanc' (SB), 'Riesling italian' (RI), 'Fetească regală' (FR) and 'Traminer roz' (TR) trained in demi-high Guyot system. Each plot had 5 repetitions placed in a diagonal pattern, the number of vines in each repetition being between 25 and 40.
The experimental plots were examined and the frequency (representing the number of grapevine affected from the total number in the repetition) and the intensity (representing the area, in percentage, of vegetative organs affected by *P. Viticola*) were determined.
The evaluations were done three times, first in 12.05.2020, second on 04.06.2020 and third on 13.07.2020. The attack degree (AD) was calculated using the following formula: (frequency x intensity)/100; this was done for all repetitions.
Treatments with fungicides applied during the experimental period are shown in Table 1.
Agrotechnical operations were applied at a standard level in the studied period.
The elimination of basal and excess shoots and harrowing were done.
The experimental data were analyzed with the program Statview 5.0 performing a one-way analysis of variance (ANOVA), followed by a Fisher-protected least significant difference (PSLD) test. The average and SEM (standard error of the mean) were calculated and P values lower than 0.05 were considered significant.

Table 1. Treatments applied for grapevine fungal diseases in Caciunelu de Jos vineyard for the period May-July 2020

No.	Date	Active substance
1	14.05.2020	Benalaxyl-M 4%+ Mancozeb 65%; Wetable sulfur 80%
2	22.05.2020	Metiram 70%; Penconazol 100 g/l
3	28.05.2020	Cimoxanil 30% + Fomaxadon 22,5%; Penconazol 100 g/l
4	11.06.2020	Azoxistrobin 93,5 g/l + Folpet 500 g/l
5	19.06.2020	Trifloxistrobin 25% +Tebuconazol 50% Aluminum fosetil 50%+Folpet 25%
6	29.06.2020	Aluminum fosetil 50 %+ Folpet 25%
7	9.07.2020	Mancozeb 60%+Valifenalat 6%
8	19.07.2020	Copper hydroxide 40%

RESULTS AND DISCUSSIONS

Excoriosis symptoms have been found on all observed vines in the Craciunelu de Jos vineyard. In Table 2, is presented the evolution of the disease for all the cultivars during the studied period.

Table 2. The degree of excoriosis attack (AD%) during the studied vegetation period

Grape cultivars	The attack degree (AD %)/ observation date		
	12.05.2020	04.06.2020	13.07.2020
'Sauvignon blanc'	22.50 ±0.23 (SB1)	3.40 ±0.03^{a} (SB2)	11.80 ± 0.11$^{a, b}$ (SB3)
'Riesling italian'	27.86 ± 0.25$^{a, g}$ (RI1)	1.24 ±0.01^{c} (RI2)	11.40 ± 0.08$^{c, d}$ (RI3)
'Fetească regală'	28.06 ±0.24 $^{a, g}$ (FR1)	1.10 ± 0.01^{e} (FR2)	12.40 ±0.07 $^{e, f}$ (FR3)
'Traminer roz'	5.70 ± 0.02^{a} (TR1)	2.76 ±0.01 (TR2)	11.00 ± 0.07$^{g, h}$ (TR3)

The attack degree values are expressed as mean ± standard error of the mean (n = 5). Superscript 'a' indicates a significant difference ($p < 0.05$) as compared to SB1, superscript 'b' indicates a significant difference ($p < 0.05$) as compared to SB2, superscript 'c' indicates a significant difference ($p < 0.05$) as compared to RI1, superscript 'd' indicates a significant difference ($p < 0.05$) as compared to RI2, superscript 'e' indicates a significant difference ($p < 0.05$) as compared to FR1, superscript 'f' indicates a significant difference ($p < 0.05$) as compared to FR2, superscript 'g' indicates a significant difference ($p < 0.05$) as compared to TR1, superscript 'h' indicates a significant difference ($p < 0.05$) as compared to TR2 as performed by one-way ANOVA, PSLD test.

At the beginning of the treatments, AD was quite high for 'Sauvignon blanc' (22.50%), 'Riesling italian' (27.86%), and 'Fetească regală' (28.06%), the only exception was 'Traminer roz' (5.70%) (Table 2). After the treatments of the first period (Benalaxyl-M 4%+ Mancozeb 65%, Wetable sulfur 80%; Metiram 70%, Penconazol 100 g/l; and

Cimoxanil 30% + Fomaxadon 22,5%, Penconazol 100 g/l), for 'Sauvignon blanc', 'Riesling italian' and 'Fetească regală' cultivars the AD decreased significantly: for 'Sauvignon blan'c AD=3.40% for SB2 vs AD=22.50% for SB1: for 'Riesling italian' AD=1.24% for RI2 vs AD=27.86% for RI1 and for 'Fetească regală' AD=1.10% for FR2 vs AD=28.06% for FR1 .The second treatments with fungicides (Azoxistrobin 93,5 g/l + Folpet 500 g/l; Trifloxistrobin 25% +Tebuconazol 50%, Aluminum fosetil 50%+Folpet 25%; Aluminum fosetil 50 %+ Folpet 25%; Mancozeb 60%+ Valifenalat 6%) helped to control excoriosis at values of AD significantly lower than the initial observed for all the cultivars mentioned above (AD= 11.80% for SB3 vs AD=27.86% for SB1; AD=11.40% for RI3 vs AD=27.86% for RI1; AD=12.40% for FR3 vs AD=28.06% for FR1). The treatments done in the first period were more efficient compared with the ones done in the second interval (AD=3.40% for SB2 vs AD=11.80% for SB3; AD=1.24% for RI2 vs AD=11.40% for RI3; AD=1.65% for FR2 vs AD=12.40% for FR3). This may be explained by the fact that in case of the first treatments the foliage was just emerging, and in case of the others the foliage was grown and vigorous, therefore a complete coverage with a solution was impossible. The evolution of excoriosis for 'Traminer roz' was different: at the first evaluation the AD was very low (AD=5.70%), for the second evaluation, compared to the first, was not statistically different with an AD= 2.76%, but the third compared to the second was statistically different with an AD= 11.00%.

Overall, all the three cultivars followed the same pattern, high AD at the start of the season, then a significant drop and a slow rise again until they remained at a level which do not seem to affect the vines. 'Traminer roz' was the exception at the first evaluation, the second and third following the pattern described above. These data show a different sensitivity of the grapevine cultivars to the attack of *Phomopsis viticola,* but the same type of response to the fungicide treatments. Some cultivars can have a higher susceptibility to the fungal attack, primarily due to their genetic characteristics ('Fetească regală', 'Sauvignion blanc' and 'Riesling italian').

Oprea and Podosu (2008) indicated that excoriosis was found also on the cultivars: 'Fetească albă' (20%), 'Chasselas d'ore' (38%), Cabernet sauvignon' (26%), 'Riesling italian' (15.6%), 'Cardinal' (50%), 'Clairete' (21.6%), 'Merlot' (7.8%), 'Pinot Noir' (11.2%), in the following vineyards: Odobesti, Coretesti – Vrancea, Valea Calugareasca, Pietroasele and Dragasani. The grapevine affected by excoriose was planted in the areas presenting a clay compact acid soil, watered in excess and industrially polluted (Oprea and Podosu, 2008). In the Blaj vineyards, in 2010, *Phomopsis viticola* had a higher intensity and this allowed the authors to establish correlations between disease intensity and weather conditions (Comşa *et al*. 2012). Also, in the Ciumbrud vineyard, Savu *et al*. (2020) have found at the beginning of the season an excoriosis frequency of 4%-12% in the climatic conditions of spring 2020 with less rain in January, April and May as compared to the average and with higher temperature in January, February, March and June.

One of the most common fungal pathogens found in Tarnave vineyard was, among others, *Phomopsis viticola*. In the Ciumbrud vineyard it was also causing excoriosis mainly on Traminer cultivar (Comşa *et al*., 2021). Excoriosis produced by *Phomopsis viticola* was present at the beginning of the vegetation period in the studied vineyards, in Valea Caugareasca (Oprea and Podosu, 2008). Oprea and Podosu observed that before the budding period, the tendrils of the vine showed dark colored spots, isolated or associated, having about 0.5 – 2.0 cm x 0.3 – 1.0 cm, usually placed at the base of the shoot. The budding period was 12 - 14 days delayed, and the buds located at the tendril of the vine base were dead. A detailed observation on the damaged shoots of vines revealed that the first 3 - 4 basal buds were dead, and only the buds located upper on the shoot were viable (Savu *et al.*, 2020; Comşa *et al.*, 2012; Oprea and Podosu, 2008). In our case, as the observations were done later (May-July), we observed only cane and leaf spots (Figure 1).

Several studies have reported yield losses of up to 30% caused by Phomopsis cane and leaf spots (Erincik *et al.*, 2001; Pscheidt and Pearson, 1989; Urbez-Torres *et al.*, 2013).

Figure 1. Cane and leaf spots caused by *Phomopsis viticola* on the grapevine.

CONCLUSIONS

Four cultivars widely grown in the Tarnave vineyards, 'Sauvignon blanc', Riesling italian', 'Fetească regală' and 'Traminer roz' trained in demi-high Guyot system, were evaluated for their susceptibility to the excoriosis, a grapevine trunk disease often found in this area. In the studied Craciunelu de Jos vineyard, excoriosis symptoms caused by the pathogen *Phomopsis viticola* have been found on all observed vines. However, an infection pattern influenced by the administrated fungicide treatments could be observed during the vegetation period. Thus 'Sauvignon blanc', 'Riesling italian' and 'Fetească regală' cultivars had a high attack degree at the start of the season, then a significant drop and a slow rise again until they remained at a level which do not seem to affect the vines. 'Traminer roz' was the exception at the first evaluation, having an attack degree four times lower that the other cultivars, but for the second and third observations it followed the pattern described above. Thus, we can conclude that in Tarnave vineyard, 'Fetească regală', 'Sauvignion blanc' and 'Riesling italian' cultivars have shown a higher susceptibility to the *Phomopsis viticola* attack and 'Traminer roz' a lower one. These data show a different sensitivity of the grapevine cultivars to the attack of *Phomopsis viticola,* but the same type of response to the fungicide treatments, which overall were efficient in controlling the excoriosis.

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