

MONITORING THE EVOLUTION OF THE PATHOGENIC AGENTS IN VARIETIES GROWN IN THE COPOU WINE CENTER, IN THE CONTEXT OF CLIMATE CHANGE

MONITORIZAREA EVOLUȚIEI AGENȚILOR PATOGENI LA SOIURILE CULTIVATE ÎN CENTRUL VITICOL COPOU, ÎN CONTEXTUL SCHIMBĂRILOR CLIMATICE

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Abstract. *In the present, the vine culture is dependent on phytosanitary treatment applied against the pathogenic agents whose evolution can cause significant crop damage. Performing rational treatments in closely linked with the vine growth phenophases and climatic conditions influences the development and degree of attack of pathogens. The present paper aims to present the results of monitoring the evolution of pathogens in nine genotypes grown in the Copou wine center during two different years in terms of climate, 2020 and 2021, under the influence of the application of treatment schemes meant to maintain a low level of intensity, frequency and degree of attack of each pathogen. The studied genotypes have been assessed with the OIV scores of resistance level between 5-9 for the downy mildew, powdery mildew and gray mold attack.*

Key words: pathogens, climate conditions, resistance, vine.

Rezumat. *În prezent, cultura viței de vie este dependentă de tratamentele fitosanitare aplicate împotriva agenților patogeni a căror evoluție poate provoca pagube însemnate de recoltă. Efectuarea rațională a tratamentelor în strânsă legătură cu fenofazele de creștere a viței-de-vie și condițiile climatice influențează dezvoltarea și gradul de atac al agenților patogeni. În lucrare sunt prezentate rezultatele monitorizării evoluției agenților patogeni la nouă genotipuri cultivate în centrul viticol Copou pe parcursul a doi ani diferiți din punct de vedere climatic, 2020 și 2021, sub influența aplicării unor scheme de tratament menite să mențină la un nivel cât mai scăzut intensitatea, frecvența și gradul de atac al fiecărui agent patogen. Genotipurile studiate au fost apreciate cu note de rezistență în scara OIV cuprinse între 5 – 9, pentru atacul de mană, făinare și putregai cenușiu.*

Cuvinte cheie: agenți patogeni, condiții climatice, rezistență, viță-de-vie

INTRODUCTION

The pathogens control in vineyards is a strictly necessary action to obtain quantitative and qualitative superior grapes production. The losses caused by the pathogens attack can reach up to 35%, and in some exceptional cases, the harvest can be completely compromised (Diaconu *et al.*, 2017). In present, the most

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damaging diseases of the vine are downy mildew (*Plasmopara viticola*), powdery mildew (*Uncinula necator*) and gray mold (*Botrytis cinerea*) (Bois and colab., 2017). For a most effective protection of vine crops, phytosanitary treatments must be carried out in close connection with the evolution of the climatic condition, which varies according to the latitude and the region where the vineyard is located (Ballabio *et al.*, 2018; Banas *et al.*, 2010).

The thermal and hydric regime in continuous change contributes to the appearance of the diseases outbreaks by changing the development stages of the life cycle of pathogens and increasing the degree of aggressiveness (Mahato, 2014; Chakraborty and Datta, 2003). For this reason, monitoring the evolution of pathogens and application on time of phytosanitary treatments is a key tactic in the control of vine diseases (Jeyanthi and Kombairaju, 2005).

MATERIAL AND METHOD

The study was carried out in the years 2020-2021 and consisted on monitoring the evolution of the main pathogens to nine genotypes: Fetească regală 1 ls., Frâncușă 14 ls., Gelu, Busuioacă de Bohotin 5 ls, Mara, Bujoru, Columna, Mamaia and Arcaș cultivated to Research-Development Station for Viticulture and Winemaking, Iași. The application of phytosanitary treatments was held according to the vine cultivation technology practiced to SCDVV Iași. Monitoring and identification of pathogens were performed by periodic field observation, collecting plant materials and laboratory determination. In order to evaluate the effectiveness of the applied treatments and the evolution of the pathogens in the crop under the influence of the treatments scheme and of the climatic conditions from 2020-2021, the values regarding intensity (I%), frequency (F%) and degree of attack (DA%) were calculated for each pathogen studied.

RESULTS AND DISCUSSIONS

The thermal regime in the two years of study was different, 2020 was warmer, with average monthly temperatures during the vegetation period higher than normal values and 2021 was cooler, with lower temperatures. Maximum absolute temperatures of 36.2°C, respectively 34.5°C were recorded, which did not exceed the multiannual values. The minimum absolute temperatures recorded in the air were within normal limits, which did not affect the vines (tab. 1).

Table 1

Thermal regime during the vegetation period

Month	Medium temperature, °C			Maximum absolute temperature, °C			Minimum absolute temperature, °C		
	normal	2020	2021	normal	2020	2021	normal	2020	2021
IV	10.3	11.3	8.1	29.8	25.8	23.1	-4.8	-5.0	-1.3
V	16.3	14.0	15.4	34.5	29.0	28.1	-0.6	3.2	3.6
VI	19.5	20.9	19.7	37.0	32.7	33.3	5.5	6.6	9.5
VII	21.3	22.7	23.4	42.3	35.4	34.5	8.5	10.8	13.7
VIII	20.6	23.5	20.9	40.7	36.2	33.5	6.7	12.8	12.1
IX	15.6	19.6	14.7	33.4	34.7	27.2	1.3	7.4	4.2

The pluviometric regime was deficient in 2020, being considered the driest year, the precipitation was irregular distributed and quantitatively reduced. In 2021, the amounts of precipitation recorded were sufficient, in some places were higher than normal, only September was more deficient by only 10.4 mm (tab. 2).

Table 2

Pluviometric regime during the vegetation period

Month	Rainfall (mm)			No. days with rainfall >10		Hygroscopicity %		
	Normal	2020	2021	2020	2021	Normal	2020	2021
IV	46.6	8.4	53.2	0	1	68	35	63
V	61.4	102.2	68.6	4	1	66	64	64
VI	82.5	108.4	93.6	4	4	70	67	73
VII	83.8	42.0	87.6	2	4	71	57	66
VIII	62.7	9.2	95.4	0	3	70	48	67
IX	61.1	29.8	10.4	1	-	74	53	65
total	398.1	300.0	408.8	11	13	70	54	66

The application of phytosanitary treatments in the period 2020-2021 was carried out according to warnings, climatic conditions and the economic damage threshold of each pathogen, aiming to maintain the level of infection outbreaks as low as possible. Compared to 2020, when six phytosanitary treatments were carried out, in 2021, the heavy rainfall in the summer months required the performance of two additional treatments, both at the beginning the ripening and during it (tab. 3).

Table 3

Phytosanitary treatments program – 2020-2021

No. crt.	Phenological stage	Pathogen	2020		2021	
			The product used	Applied dose (kg, L/ ha)	The product used	Applied dose (kg, L/ ha)
1.	Sprout 3-5 cm	Powdery mildew	Sulfocalcic gravy	20 L	Sulfocalcic gravy	20 L
2.	Sprout 10-25 cm	Downy mildew Powdery mildew	Folpan Kumulus	1.5 kg 3.0 kg	Dithane Kumulus	2.5 kg 3.0 kg
3.	Before flowering	Downy mildew Powdery mildew	Profler Topas	2.5 kg 0.25 L	Zorvec Talendo	0.2 L 0.2 L
4.	End of flowering	Downy mildew Powdery mildew	Forum Gold Vivando	1.5 kg 0.2 L	Profler Topas	2.5 kg 0.25 L
5.	Growing grains	Downy mildew Powdery mildew Gray mold	Ridomil Vivando Cantus	2.5 kg 0.2 L 1.2 kg	Ridomil Sercadis -	2.5 kg 0.15 L -
6.	Compaction of bunches	Downy mildew Powdery mildew Gray mold	Dithane Kumulus Cantus	2.0 kg 3.0 kg 1.2 kg	Delan Pro Kumulus Cantus	4.0 L 3.0 kg 1.2 kg
7.	Beginning the ripening	Gray mold	-	-	Cantus	1.2 Kg
8.	Ripening	Downy mildew	-	-	Bouillie bordelaise	5.0 kg

The phytosanitary treatments applied during the vegetation period of the vine in the years 2020, respectively 2021 with systemic and contact products aimed to maintain the healthy of the foliar system. Also, in order to avoid the risk of the toxicity phenomenon to the vine and to prevent the phenomenon of pesticide resistance of the pathogens, the active substances of the products used were different from one year to another.

Observations and determinations on the evolution of the main pathogens showed that the attack on the leaves manifested itself differently depending on the variety and clone, the treatments scheme and the climatic conditions specific to the wine-growing area. Thus, in case of downy mildew attack, a disease caused by *Plasmopara viticola*, in 2020 it manifested itself in all nine genotypes studied, the most affected was Busuioacă de Bohotin 5 Is, with an intensity of 9.6%, a frequency of 5.5% and a degree of attack of 0.5%. Comparing with the previous year, in 2021 the presence of downy mildew was reported in seven of the nine genotypes studied, with an intensity of 10.9%, a frequency of 4.7% and an degree of attack of 0.5% (tab. 4).

Table 4

The attack of the main pathogens on the leaves

Genotype	Pathogen	Determined items						OIV scores of resistance level	
		I %		F %		DA %		2020	2021
		2020	2021	2020	2021	2020	2021		
Gelu	<i>Plasmopara viticola</i>	5.3	3.0	7.5	1.47	0.4	0.04	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
Mara	<i>Plasmopara viticola</i>	1.9	3.0	1.0	1.09	0.02	0.03	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
Columna	<i>Plasmopara viticola</i>	6.2	3.0	4.5	1.9	0.3	0.05	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
Bujoru	<i>Plasmopara viticola</i>	8.8	4.7	2.5	3.2	0.2	0.1	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
Arcaș	<i>Plasmopara viticola</i>	5.6	0	4.0	0	0.2	0	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
Mamaia	<i>Plasmopara viticola</i>	8.1	0	3.5	0	0.3	0	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
Fetească regală 1 Is	<i>Plasmopara viticola</i>	6.5	3.7	5.0	4.7	0.3	0.1	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
Frâncușă 14 Is	<i>Plasmopara viticola</i>	6.6	10.9	4.0	4.7	0.3	0.5	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
Busuioacă Bohotin 5 Is	<i>Plasmopara viticola</i>	9.6	3.0	5.5	2.5	0.5	0.07	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9

The presence of powdery mildew on the leaves, a disease caused by the fungus *Uncinula necator*, was not reported during the study (2020-2021) in any of the varieties observed.

Regarding the attack on grapes of the main pathogens of the vine, it is considered that their appearance and development were influenced by the precipitations, which was more abundant in 2021, compared to those in 2020.

Thus, the values of the degree of attack obtained for most genotypes are higher in 2021, compared to the previous year.

The attack of the pathogen that produces downy mildew, *Plasmopara viticola*, on grapes recorded the highest values in 2020, in the case of the variety Frâncușă 14 Is, with an intensity of 6.6%, frequency of 5.0% and a degree of attack of 0.3%. In 2021, the variety most affected by the attack of this pathogen was Gelu, with an intensity of 26.3%, a frequency of 9.4% and a degree of attack of 0.1% (tab. 5).

Table 5

The attack of the main pathogens on the grapes

Genotype	Pathogen	Determined items						OIV scores of resistance level	
		I, %		F, %		DA, %		2020	2021
		2020	2021	2020	2021	2020	2021		
Gelu	<i>Plasmopara viticola</i>	4.0	26.3	3.5	9.4	0.1	2.4	9	8
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
	<i>Botrytis cinerea</i>	3.0	3.0	2.5	3.3	0.1	0.1	9	9
Mara	<i>Plasmopara viticola</i>	0	3.7	0	6.7	0	0.2	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
	<i>Botrytis cinerea</i>	3.6	0	5.5	0	0.2	0	9	9
Columna	<i>Plasmopara viticola</i>	2.0	3.0	3.0	5.5	0.1	0.1	9	9
	<i>Uncinula necator</i>	0	7.4	0	3.5	0	0.2	9	9
	<i>Botrytis cinerea</i>	4.7	4.0	6.0	4.8	0.3	0.2	9	9
Bujoru	<i>Plasmopara viticola</i>	5.3	3.0	3.0	7.8	0.2	0.2	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
	<i>Botrytis cinerea</i>	6.5	31.2	2.0	68.5	0.1	21.4	9	5
Arcaș	<i>Plasmopara viticola</i>	3.5	6.0	4.0	4.4	0.2	0.2	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
	<i>Botrytis cinerea</i>	4.6	0	4.5	0	0.2	0	9	9
Mamaia	<i>Plasmopara viticola</i>	3.0	3.0	1.5	6.7	0.1	0.2	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
	<i>Botrytis cinerea</i>	8.8	4.6	3.0	20.8	0.3	0.9	9	9
Fetească regală 1 Is	<i>Plasmopara viticola</i>	6.0	14.5	3.5	12.1	0.2	1.7	9	8
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
	<i>Botrytis cinerea</i>	9.0	6.6	3.0	6.4	0.3	0.4	9	9
Frâncușă 14 Is	<i>Plasmopara viticola</i>	6.6	14.1	5.0	26.0	0.3	3.6	9	8
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
	<i>Botrytis cinerea</i>	8.3	4.7	7.5	36.4	0.6	1.7	9	8
Busuioacă Bohotin 5 Is	<i>Plasmopara viticola</i>	5.2	3.5	5.5	6.98	0.3	0.24	9	9
	<i>Uncinula necator</i>	0	0	0	0	0	0	9	9
	<i>Botrytis cinerea</i>	9.1	3.0	6.0	3.8	0.5	0.1	9	9

The observations regarding the powdery mildew on grapes showed the attack occurred only at the Columna variety, in 2021 with an intensity of 7.4%, a frequency of 3.5% and a degree of attack of 0.2%.

Regarding the attack of gray mold on grapes, produced by the fungus *Botrytis cinerea*, it is considered that its appearance and development were influenced by heavy rainfall that caused the cracking of grapes, allowing much

faster installation of the pathogen. In 2020, the most affected genotype was Frâncușa 14 Is, with the intensity of the attack 8.3%, the frequency of 7.5% and the degree of attack of 0.6%. In 2021, the attack had higher values, attributed to the optimal conditions for the development of the pathogen, the most affected variety being Bujoru, where the intensity was 31.2%, the frequency was 68.5% and the degree of attack was of 21.4%.

CONCLUSIONS

1. The aggressiveness of the pathogens attack was influenced by different climatic conditions from one year to another, in 2021 the studied vine genotypes were more affected due to the heavy rainfall during the vegetation period.

2. In order to limit the negative effects of the main pathogens attack reported in the vineyards of SCDVV Iași, it is necessary to constantly monitor their appearance and evolution, as well as to adapt control technologies according to the specific climatic conditions and sensitivity of vine genotypes.

Acknowledgments: The work was developed under the Sectorial Plan the ADER 2022, PS 7.3.3 "Research on the classification of vine varieties for table grapes and wine in the context of climate change in wine-growing areas"

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