Original Article

The Behaviour of Vine Varieties to Downy Mildew Attack (*Plasmopara Viticola* Berk & Curt) in Ampelographic Collection in the Conditions of USAMV Cluj - Napoca

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Abstract

Viticulture is an agriculture intensive industry branch, characterized by a high recovery coefficient of the land. Grapes can be consumed in fresh condition and also they are the raw material for the obtaining of wines, sparkling wines and distillates from wine, alcoholic beverages with the significant share in consumption.

Downy mildew was and shall remain one of the major diseases present in vineyards producing significant damage. Attack frequency and intensity are influenced by the source of the inoculum, the climatic conditions and the sensitivity or resistance of crop varieties taken in culture.

The aim of this paper is the study of the behavior of some table grapes and wine from the didactic and experimental collection of the U. A. S. V. M. Cluj-Napoca at the attack of downy mildew - *Plasmopara viticola* (Berk & Curt), in the climatic conditions of year 2011

Keywords: Vitis vinifera, *Plasmopara viticola,* downy mildew, attack degree

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1.Introduction

As a branch of agricultural production, viticulture has a well-defined place in the national economy, whose importance can be appreciated from several points of view: socially - as an improvement in food and as a means of making a living, economically – recovers the lands unsuitable for other crops, provides raw material for the development of other branches of production, stimulates the development of other branches, contribute to shape the environment, etc. [6].

Grapes are the raw material for obtaining wines and the distillates from wine, alcoholic drinks with significant share in consumption. Annually about 1 million tons of grapes are made wine, which results in 8.7 million hectoliters of wine. Significant quantities of grapes are processed in the food industry, in the manufacture compotes, jams, marmalades, raisins, grape juice and other products [2]. Moreover, the grapes are composed of sugar, organic acids, minerals, vitamins and phytochemicals are also responsible for sensory characteristics of wine [9] and human health beneficial properties [8].

Downy mildew (*Plasmopara viticola*) of the wine is the most damaging disease of this crop, growing in almost all countries and in Romania

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ranks first (80.7%) followed by powdery mildew (62%) [10]. The appearance of the blight in the late last century along with phylloxera, caused the great crisis in the european viticulture witch modified the entire technology of wine making, determined a special assortment structure and gave an impulse to the researches regarding the wine diseases (Maria Oprea 1994 cited by Mihai C., 2009) [3] .

2. Materials and Methods

The biological material used has been composed of four varieties of table grapes (Someşan, Napoca, Chasselas Doré, Transilvania) and 4 varieties of wine grapes (Grasă de Cotnari, Aligote, Fetească albă, Sauvignon blanc).

The experiences for this study have been located in the vineyard of the University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca (the didactic collection) and were carried out in the course of year 2011.

Eco-climatic conditions in 2011, with an amount of rainfall of 358 mm during the growing season and mean monthly temperature ranging between 3.2°C (November) and 24.5°C (June), allows us to characterize it as a dry year.

The damages caused by Downy mildew are extremely high, not only in intensity when the disease manifests itself, but also in intensity in the coming years.

Yield losses due to this disease can range from 10% to 70 - 80%, depending on the climatic conditions of the year, leading the attack intensity and frequency of disease (Mihai, 2009) [3].

The placement of the experience was adapted to the conditions of the existing plantation, were the completely random location in repeated experimental variants was not possible. Therefore the placement was linear, the most representative of all choosing the vine inserts of the variety concerned, all that have been identified with labels three repetitions, each repetition including three hubs. In this way the results of each repetition were represented as the average of measurements/ determinations made on 3 hubs. Were randomly selected and examined thirty mature leaves/repetition (10 leaves/vine) with symptoms of downy mildew. Observations were made three days after early symptoms on leaf area (light yellow "oil spots" with clear boundaries) and the natural infection was used.

Table 1. Tested grape varieties and their reaction to the downy mildew attack (according to Olteanu et al., 2002 [5])

Cultivars	Color	Table varieties		Wine varieties	
		Downy mildew reaction	Production capacity	Downy mildew reaction	Production capacity
Someşan	Red	Good resistant	20 t/ha	-	-
Napoca	red	Good resistant	13,3-20 t/ha	-	-
Chasselas doré	white	Sensitive	9-15 t/ha	-	-
Transilvania	red	Sensitive	22 t/ha	-	-
Grasă de Cotnari	white	-	-	Resistant	5-7 t/ha
Aligote	white	-	-	Sensitive	10,7-14,5 t/ha
Fetească albă	white	-	-	Sensitive	10-13 t/ha
Sauvignon blanc	white	-	-	Sensitive	8-12 t/ha

The attack degree and the parasitic effects of phytopathogenic agents are established according on the frequency and intensity of attack [7].

The frequency of the attack (F%) represents the relative number of attacked plants or organs (n) related to the total number of plants or organs examined (N).

$$F = n \times 100/N$$

The intensity (I%) represents the percentage (which is established by visual assessment) of attacked plants or plant organs, or the yield loss

registered at one plant or at one crop per unit area compared with a healthy culture.

For the quantitative expression of intensity of the attack has been used the formula:

$$I\% = (a-b)/a \times 100$$

a = the production of the healthy plant or crop

b = the production of the attacked plant or culture

The qualitative expression, the relative intensity of the attack was calculated after the formula:

$$I\% = (i \times f)/n$$

i = the rate at which the plant is attacked (plant organs)

f = number of cases recorded

n = number of plants (plant organs) examined

The data recorded were appreciations of the intensity of the attack expressed in relative values between 0.1 and 100%.

To facilitate the assessment of attack intensity conventional are taken more classes of attack intensity corresponding to some intervals [7] presented in table 2.

Table 2. Note that characterizes the attack intensity according to the percentages of attacked plants or plant organs (acording to Puia Carmen, 2005 [7])

The proportion of attack (%)	The characteristic note
0 %	0
1-3 %	1
4-10 %	2
11-25 %	3
26-50 %	4
51-75 %	5
76-100 %	6

The attack degree (GA%) has been calculated based on the frequency and the intensity of the attack

$$G.A. \% = F \times I / 100$$

The frequency and intensity attack is usually established by surveys (fig. 1).

Figure 1. Attack of mildew on leaves

Phytosanitary treatments during the growing season were made with the following control products: Kocide 101 WP, bouille bordelaise 0.5%, 0.4% Soluble Sulfur, Ridomil Gold MZ 68 WP, Melody Duo 66.8 WP, Kurds Manox SC, Quadris Max SC, Folpet 50 WP, Dithane M 45. The mainly concerned diseases were downy mildew, powdery mildew, gray mold and mite pests.

Statistical analysis

Rezultatele au fost exprimate ca medie ± DL (diferenţe limită) a trei repetiţii pentru fiecare variantă. Pentru a determina semnificaţia diferenţelor între valorile obţinute interpretarea statistică a rezultatelor experimentale s-a făcut cu ajutorul programului ANOVA şi STATISTICA 8.

The results were expressed as mean ± DL (limit differences) of three repetitions for each variant. To determine the significance of differences between the obtained values statistical interpretation of experimental results was performed using ANOVA and statistical program 8.

3. Results and Discussion

As a result of the remarks made by applying formulas to calculate the intensity, frequency and degree of attack, we can see a difference between

the varieties studied. From the table grape varieties, Someşan variety is the most resistant, with the lowest degree of attack, and the more sensitive the variety is Chasselas doré with the most raised attack degree, confirming data points from the literature [5] (table 3).

Table 3.The behavior of grape varieties tested at the mildew attack on leaves, 2011

Nr.	Table varieties	Frequency%	Intensity%	Degree atack%
1.	Someşan	33.79	30.18	10.07
2.	Napoca	29.51	34.58	14.38
3.	Chasselas Dore	28.47	39.11	15.06
4.	Transilvania	28.12	28.32	10.91
No.	Wine varieties	Frequency%	Intensity%	Degree atack%
1.	Grasă de Cotnari	23.09	9.74	1.88
2.	Fetească Albă	17.57	5.22	0.74
3.	Aligote	16.75	3.70	0.99
4.	Sauvignon	15.58	3.89	0.60

If wine grape varieties studied, from the notary made it can be seen that the most sensitive variety was GRASĂ DE COTNARI with the highest degree of attack, all other varieties showing a higher resistance to blight attack with lower attack rate (table 3).

According to data from literature [5] the Someşan variety is a resistant cultivar to blight attack. To better observe the differences between varieties has been applied analysis of variance test taking as control the Someşan variety. From table 4 it can be observed that varieties Chasselas Dore and Napoca had the higher attack degree (GA = 14.38%

The wine grape varieties have behaved differently to blight attack. The degree of attack at

and 15.06%) from the table varieties tested, similar values for both varieties recording also Bunea (2009) at Gherla, Cluj County [1]. In terms of wine, in the climatic conditions of year 2008, in Iasi, Nicoleta Irimia et al. (2008) obtained very similar results for Napoca cultivar but the cultivar Chasselas Dore was very sensitive (GA = 50%) to attack mildew on leaves [4].

The data presented in Table 4 we can conclude that all the varieties studied were susceptible to blight attack with attack rates higher than the control variety, but with no differences statistically assured.

the tested varieties was lower than the reference variety (GRASĂ DE COTNARI) (table 5).

Table. 4.The attack degree (GA%) with downy mildew on leaves at the table grape varieties studied, of the U. A. S. V. M. Cluj - Napoca Didactic Collection, 2011

No	Cultivar	DA	%	Difference	Significance
1.	Someşan	10.07	100	0.00	Mt.
2.	Napoca	14.38	142.8	4.31	-
3.	Chasselas doré	15.06	149.5	4.98	-
4.	Transilvania	10.91	108.8	0.89	-
	LSD 5%			5.47	
	LSD1%			8.29	
	LSD 0,1%			13.32	

Table 5.The attack degree (GA%) with downy mildew on leaves at the wine grape varieties studied, of the U. A. S. V. M. Cluj - Napoca Didactic Collection, 2011

No	Cultivar	DA	%	Difference	Significance
1.	Grasă de Cotnari	1.88	100	0.00	Mt
2.	Fetească albă	0.74	39.4	-1.14	00
3.	Aligote	0.99	52.5	- 0.89	0
4.	Sauvignon blanc	0.60	31.9	- 1.25	00
	LSD 5%			0.74	
	LSD1%			1.11	
	LSD 0,1%			1.79	

Thus, two of the varieties, Fetească albă and Sauvignon Blanc showed differences distinct significantly negative, while cultivar Aligote (GA = 0.99%) had a significant negative result compared to the control. The results recorded in Cluj-Napoca are consistent with those reported by Nicoleta Irimia et al. (2008) in Iasi [3]. To determine the correlation between the degree of attack and production in the case of all studied varieties was tested the linearity of dependence between the two variables (figure 3).

$$Y = 7.897 + 0.241X$$

(chart: Production, t/ha versus AD, %)
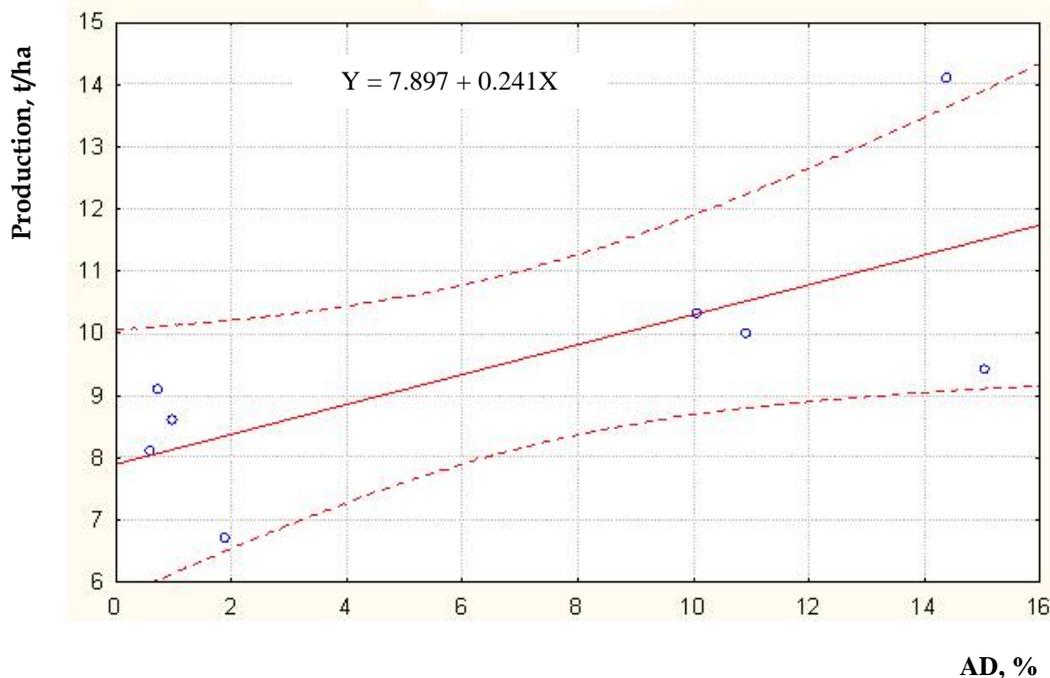
Due to the lack of linearity dependence degree attack - production it has been chosen to apply a non-parametric test (Spearman) for the correlation calculation. Correlation coefficient rs = 0.667, calculated by Spearman nonparametric test reveals a moderate correlation between the degree of attack and production, without statistical significance ($p = 0.071$, $p > 0.05$).

Conclusions
- ✓ Downy mildew was and shall remain one of the major grapevine diseases causing significant damage.
- ✓ The frequency and intensity of the downy mildew attack are influenced by the source of inoculum, eco-climatic conditions and the sensitivity or resistance of crop varieties.
- ✓ The wine varieties taken under study in 2011 showed resistance to blight attack, the attack level on leaves did not exceed 2%.
- ✓ The table varieties showed sensitivity to the blight attack, the degree of attack exceeded 10% in all varieties studied.

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