DOWNY MILDEW CONTROL IN GRAPEVINE BY COMBINING CULTIVARS, FUNGICIDES, AND TREATMENT TYPES

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Abstract

This study aims at controlling downy mildew (*Plasmopara viticola)* infestation in Istog area, Kosovo. Two grape cultivars were tested in combination with fungicide types and treatment methods. The obtained results showed statistically significant differences among grapevine cultivars with regard to susceptibility to *Plasmopara viticola*, the efficiency of different fungicides as well as their combination to control this pathogen. The most susceptible cultivar proved to be Frankovka (15.38%), whereas the highest efficiency fungicides in controlling *Plasmopara viticola* resulted Ridomil (*metalaksil*) in combination with Dithane M-45 (*mankozeb*).

Key words: Grapevine; Plasmopara viticola; Plant Protection Products; Efficacy.

1. Introduction

Downy mildew (*Plasmopara viticola*) is the most important grapevine disease [3], [2]. According to several authors, downy mildew may reduce the grape yield up to 50 – 80 % [7]. Other authors report losses up to 100% [7]. These data make evident the necessity to control this plant disease. According to Ciglar [1], the control of downy mildew actually is done via copper based fungicides such as copper sulphate, copper hydroxide, copper oksisulphate, some organic fungicides, as well as a combination of both groups of fungicides. Considering the above mentioned problems this study aims at *(i)* evaluating the performance of widespread grapevine cultivars in Kosovo in the presence of downy mildew, (*ii*) defining the monitoring methods, and (*iii*) evaluating the efficiency of different fungicides and treatment methods

2. Material and Methods

The study was carried during 2005 growing season, in Burim municipality, village Vrellë. The grapevine cultivars under the study were *Game (black)* and *Frankovka*. Fungicides mostly used to control downy mildew by Kosovo farmers are used in this experiment. The applied concentrations in the experiment were the following:

Quadris/Azoxistrobin (0,075%), Antracol / Propineb (0,2%), DithaneM-45/Mankozeb (0,25%), Ridomil/Metalaksil (0,35%), Kurzate/Cymoxamil (0,3%), Copper sulphate (1,5%), Mikal/Fosetil aluminum (0,4%). An experimental design for combining factor A (cultivars), factor B (fungicides), and factor C (methods of treatment) was established in three replications. The methods of treatment were the following: (a) traditional (every 15 day treatments), (b) sum of effective temperature (sum of 61 degrees), and (c) daily percentage of incubation.

The variants were the same for both grapevine cultivars:

(1) Quadris (*azoxistrobin*) for 2-3 first treatments, after that Dithane M-45,

(2) Antracol EP-70 (*propineb*) + Dithane M-45 (*mankozeb*) in alternate application,

(3) Ridomil (*metalaksil*) + Dithane M-45 (*mankozeb*), in alternate application,

(4) Kurzate (*cymoxamyl*) + copper preparation, in alternate application,

(5) Ridomil (*metalaksil*) + Copper sulphate, in alternate application,

(6) Mikal (*fosetil aluminum*) + DithanM-45 (*mankozeb*), alternate application,

(7) control (no treatment).

The evaluation with regard to disease infestation was done in three phases: before blooming, before pollination, and during grape color change. Each time 100 leaves and 50 grapes were evaluated according to class system [6]: class 0 = number of infection (with 0%), I^{rst} class = weak infection (up to 10%),

IInd class= medium infection (11-25%),

III^{d} class = high infection (26-50%) and IVth class= very high infection (over 50 %). The Index of disease infestation was calculated according to Mc. Kinney formula: I Mc = $\sum$ (n x k) x 100 / N x K, were I = index of disease infestation, n = number of plants by categories, k = number of special categories, N = number of all plants evaluated (leaves and grapes), and K = the value of the highest class.

3. Results and discussion

Data on the infection rate caused by *Plasmopara viticola* are provided by monitoring grapevine cultivars throughout the vegetation period. Average values and final results of ANOVA are presented in tables 1(leaf infection) & table 2 (grape infection).

Factor A (table 1). ANOVA revealed statistically significant differences among cultivars with regard to the rate of disease infestation in leaves (Frankovka 15.38 %, Game 12.79 %).

Factor B. Significant differences were found in relation to fungicide efficiency. The lowest level of infection was recorded in variant B$_3$ (6,22) where Ridomil and Dithane M-45 were used, whereas the highest within the control (45.76).

Factor C. Highly significant differences were found in relation with treatment

method. The highest index was recorded in C_1 (15,78%) while the lowest in C_3 (12,61%).

With regard to **AxB** interaction cultivar Frankovka showed the highest infestation index. Significant differences were found with respect to fungicide type as well.

For **AxC** interaction (cultivar x treatment method) significant differences were found. The highest infection index was present in Frankovka with variant C_1 (17,15 %) whereas the lowest in Game with variant C_3 (11,34%).

Significant differences were found also for BxC interaction (fungicide x method of treatment). The highest index was found in control variant whereas the lowest one in the interaction B_3 x C_3 (4,63 %).

Other authors have reported similar results with respect to fungicide efficiency in controlling downy mildew on grapevine [4], [5].

Differences of downy mildew infection were also found in grapes (**table 2**). These differences were subject to cultivars, fungicide type and treatment method.

Factor A. ANOVA showed no significant differences between cultivars.

Factor B. Highly significant differences were evident with respect to factor B. The highest infestation index was recorded in the control variant (48.42 %) while the lowest one in variant B_3 (7,11 %).

Factor C. Highly significant differences were also shown in relation to factor C (Method of treatment). The highest infestation index was recorded with traditional method (C_1) whereas the lowest with method (C_3).

Different levels of significance were found in relation to interactions: AxB, AxC, BxC, and AxBxC (table 2).

For **AxB** interaction, B_2 variant had the highest infestation index. In this case Antracol WP-70 and Dithane M-45, were used. The lowest infestation index was recorded in cultivar Game, variant B_3 were Ridomil and Dithane were used.

In the case of **AxC** interaction (cultivar x treatment method), the highest infestation index was recorded in cultivar Frankovka (variant C_1 - 19,59%), whereas the lowest one in cultivar Game (variant C_3 - 12,55%).

BxC interaction (fungicide x treatment method) had the highest infestation index in the B_2 x C_1 combination (17,59 %), and the lowest one B_3 x C_3 combination (4,67%).

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Table 1. Downy mildew index of infestation in grapevine leaves (%).

Cultivar Factor (A)	Fungicides Factor (B)	Method of treatment Factor (C)			Average (AxB)	Average (A)
		C_1	C_2	C_3		
Frankovka	B_1	11.67	9.50	7.42	9.53	15.38**
	B_2	15.50	13.50	10.75	13.25 **	
	B_3	9.17	7.17	5.50	7.28	
	B_4	13.58	10.83	8.58	11.00	
	B_5	12.83	10.33	7.67	10.28	
	B_6	10.25	7.75	6.33	8.11	
	B_7	47.08	46.58	50.92	48.19**	
	Average (AxC)	17.15**	15.09	13.88		
Game	B_1	8.67	6.42	5.50	6.86	12.79**
	B_2	12.50	10.42	8.08	10.33	
	B_3	6.83	4.92	3.75	5.17**	
	B_4	12.50	9.17	7.25	9.64	
	B_5	10.42	8.50	6.50	8.47	
	B_6	7.67	5.83	3.75	5.75	
	B_7	42.25	43.17	44.58	43.33**	
	Average (AxC)	14.40	12.63	11.34**	Average (B)	
Average (BxC)	B_1	10.17	7.96	6.46	8.19*	
	B_2	14.00**	11.96	9.42	11.79**	
	B_3	8.00	6.04	4.63**	6.22**	
	B_4	13.04	10.00	7.92	10.32	
	B_5	11.62	9.42	7.08	9.38*	
	B_6	8.96	6.79	5.04	6.93	
	B_7	44.67**	44.87**	47.75**	45.76**	
Average (C)		15.78**	13.86**	12.61**	Interaction (AxBxC)	

Factors	A	B	C	AB	AC	BC	ABC
LSD 1 %	0.96869	4.03750	0.92314	6.44792	1.43252	3.50928	7.81983
LSD 5 %	0.73591	2.94746	0.70130	4.48776	1.05251	2.31648	4.26001

Legend: Ns = No significant, * significant and ** highly significant

Table 2. Downy mildew index of infestation in grapes (%).

Cultivar Factor (A)	*Fungicides Factor (B)*	*Method of treatment Factor (C)*			*Average (AxB)*	*Average (A)*
		C_1	**C_2**	**C_3**		
Frankovka	B_1	14.33	10.67	8.33	11.11	15.91 NS
	B_2	19.67	15.17	10.85	15.23**	
	B_3	11.33	8.50	5.33	8.39	
	B_4	14.17	11.00	8.00	11.06	
	B_5	13.833	10.00	7.67	10.50	
	B_6	12.83	8.33	6.33	9.17	
	B_7	50.33	44.00	43.50	45.94**	
	Average (AxC)	19.50**	15.38	12.86		
Game	B_1	10.67	9.17	7.50	9.11	15.29 NS
	B_2	15.33	12.33	9.83	12.50	
	B_3	7.67	5.83	4.00	5.83**	
	B_4	13.67	10.58	7.33	10.53	
	B_5	12.50	10.50	7.33	10.11	
	B_6	10.33	8.17	5.67	8.06	
	B_7	56.67	49.83	46.17	50.89**	
	Average (AxC)	18.12	15.20	12.55**	Average (B)	
Average (BxC)	B_1	12.50	9.92	7.92	10.11	
	B_2	17.50**	13.75	10.34	13.86**	
	B_3	9.50	7.17	4.67**	7.11**	
	B_4	13.92	10.79	7.67	10.79	
	B_5	13.17	10.25	7.50	10.31	
	B_6	11.58	8.25	6.00	8.61	
	B_7	53.50**	46.92**	44.83**	48.42**	
Average (C)		18.81**	15.29**	12.70**	Interaction (AxBxC)	

	Factors	**A**	**B**	**C**	**AB**	**AC**	**BC**	**ABC**
LSD	**1 %**	0.91906	3.64016	0.70133	5.81337	1.08832	2.66608	5.94092
	5 %	0.69820	2.65739	0.53279	4.80461	0.79961	1.75989	3.23643

Legend: Ns = No significant, * significant and ** highly significant

4. Conclusions

Referring to obtained results, the following conclusions can be drawn:

- Cultivar Game seems to be less susceptible to downy mildew infection then cultivar Frankovka.
- The most successful treatment method resulted the one showing percentage of incubation, based on daily average temperature and relative air humidity.
- The traditional method seems to be less efficient in controlling the downy mildew as this method relies entirely on the experience of grapevine growers.
- The most efficient fungicides were Ridomil (metalaksil) in combination with Dithane M-45 (mankozeb).

5. References

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