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INTENSITY OF ATTACK OF *BOTRYTIS CINEREA* PERS. EX FR. ON THE CV. GRAŠEVINA AND TRAMINAC GRAPES AND THE EFFICIENCY OF BOTRYTICIDES

Brankica Svitlica [(1)], Jasenka Ćosić [(2)], Karolina Vrandečić [(2)], J. Mesić [(1)]

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SUMMARY

Botrytis gray mold caused by Botrytis cinerea is an important pathogen of grapevines all over the world. In order to determine the intensity of B. cinerea attack on mature grapes and efficiency of botryticides (cv. Traminac - iprodion, pyrimethanil, fludioxinil + cyprodinil; cv. Graševina - fenhexamid, fludioxinil+cyprodinil, tebuconazol+diclofluanid) a two-year experiment (2001-2002) was set up on locations Mladice (Traminac) and Škomić (Graševina). By evaluation of the intensity of B. cinerea infection on the Graševina and Traminac grapes the strongest infection determined on the control, and the weakest on the variant with botryticides Switch. Comparison of infection intensity on the Traminac grapes with the Graševina grapes led to no differences concerning the sensitivity of varieties. The disease intensity primarily depended on climate conditions. Both experimental years were charactized by the quantity of precipitation in the vine-yards which were in favour of the high humidity allowing high disease intensity.

Key-words: Botrytis cinerea, grapevine, botryticides

INTRODUCTION

Botrytis cinerea Pers. ex Fr., causal fungus of grey mould on grapevines, causes significant damages in vineyards, thus seriously reduces the grape quality and yield. Parasitic fungus also affects the vinification process, so more intensive attacks mean poorer quality of vine. Grey mould is a "high standard" disease, the more intensive production of grapevine, the greater the attacks of the fungus, i.e. the greater the damages (Kišpatić 1992).

Infection with grey mould and disease intensity are difficult to predict, as the fungus attacks grapes in the blooming stage or at the end of it, and it usually does not behave like a parasite (Mc Clellan and Hewit 1973). The disease reaches its highest stage in the ripening period and lasts up to the end of harvest, being marked by softening and decay of grape berries.

Intensity of *B. cinerea* development depends on several factors, such as environmental conditions, especially moisture and temperature (Jarvis 1977, Kišpatić 1980, 1992), additional food sources for fungus (Bekesi 1979), sensitivity of cultivars and factors of passive and active resistance (Topolovec-Pintarić 2000). Based on some previous practical experiences referring to the disease intensity, more important are environmental factors than cultivar resistance.

Despite many researches, the problem of controling *B. cinerea* has not been solved. Application of fungicides - botryticides is the most efficient way of grapevine protection up to date, although there is a known phenomenon of fungus resistance to some botryticides (Cvjetković et al. 1994, Milling and Richardson 1995, Muramatsu and Miura 1996, Topolovec-Pintarić 2000).

The aim of this research was: a) to determine the intensity of attack of *B. cinerea* during a two-year period on two grapevine cultivars, on two locations, and b) to examine the efficiency of botryticides with different action mechanisms when applied in particular phenological phases.

(1) MSc. Brankica Svitlica and Josip Mesić, BAgr - Veleučilište u Požegi, Ulica Pape Ivana Pavla II br. 6, 34000 Požega;(2) DSc Jasenka Ćosić, Assistant Professor and MSc Karolina Vrandečić – University of J.J.Strossmayer in Osijek, Faculty of Agriculture, Trg sv. Trojstva 3, 31000 Osijek

MATERIAL AND METHODS

In order to determine the intensity of *B. cinerea* attack on mature grapes of cv. Graševina and Traminac, as well as to examine the efficiency of botryticides (Table 1), a two-year experiment (2001-2002) was set up on two locations, Mladice (Traminac) and Škomić (Graševina).
The experiment was set up in a random block system with four repetitions focused on different objectives (botryticide, intensity of infection, year, cultivar) at the same time.
There were 15 grapevines in a repetition, i.e. 60 grapevines for each treatment.
The botryticides of different action mechanisms were used in the experiment (Leroux 1995, Rosslenbroich et al. 1998) were as follows:

1. respiratory inhibitors - dicofluanid (Euparen) combined with tebuconazol (Folicur)
2. hyphae (mycelium) growth inhibitors - iprodion (Kidan), pyrimethanil (Mythos), fludioxinil + cyprodinil (Switch)
3. a new group whose action is based on the ergosterol biosynthesis inhibition - fenhexamid (Teldor)

The control was nontreated. Treatments were carried out according to the phenological method, by using a 10-liter Koplast back sprayer, and applying 1000 l/ha of botryticide solution in all. Intensity of grape infection was evaluated on the EPPO scale (1982), which assigns 0 to healthy bunches and 5 to bunches with more than 50% of infected berries. Mean value of infection intensity was calculated by to Towsend-Heuberger (1943) formula.

Table 1. Overview of botryticides and treatment plan during a two-year experiment
Tablica 1. Pregled botriticida i plan tretiranja u dvogodišnjem pokusu

Botryticide *Botriticid*	Active ingredient *Djelatna tvar*	Conc. % Konc. %	Phenological phase* *Fenološke faze*			
			A	B	C	D
Location (*lokacija*): Mladice, cv. Traminac						
Kidan	iprodion (25,0%)	0.30	+	+	+	+
Mythos	pyrimethanil (30,0%)	0.25	+	+	+	+
Switch	fludioxinil (25,0%) + cyprodinil (37,5%)	0.08	+	+	+	+
Control (*Kontrola*)			-	-	-	-
Location (*lokacija*): Škomići, cv. Graševina						
Tedor	fenhexamid (50,0%)	0.15	+	+	+	+
Switch	fludioxinil (25,0%) + cyprodinil (37,5%)	0.08	+	+	+	+
Folicur + Euparen	tebuconazol (25,0%) + diclofluanid (50,0%)	0.025 + 0.25	+	+	+	+
Control (Kontrola)			-	-	-	-

* A - end of blooming (*kraj cvjetanja*); B - bunch closing (*zatvaranje grozdića*); C - veraison (*šaranje bobica*); D - bunch ripening (*zrenje*)

Harvest was performed manually per each treatment and repetition on each location. Bunches were sorted by EPPO scale (1982), each value group was weighed and the average grape weight per each experiment, yield per 60 grapevines and yield per hectare were calculated.
Results were analyzed by ANOVA and the LSD test.

Meteorological conditions in 2001 and 2002

Climatic characteristics of the two experiment years were presented in Table 2.

Table 2. Meteorological data in 2001 and 2002
Tablica 2. Meteorološki podaci za 2001. i 2002. godinu

Month *Mjesec*	2001		2002	
	Temperature *Temperatura* (ºC)	Precipitation *Oborine* (mm)	Temperature *Temperatura* (ºC)	Precipitation *Oborine* (mm)
I	2.2	67.2	4.2	15.5
II	4.4	6.7	10.5	60.5
III	10.1	93.0	14.5	16.4
IV	10.7	48.7	15.1	117.5
V	17.7	38.9	23.8	94.2
VI	17.6	129.5	20.1	53.1
VII	21.9	48.6	22.6	81.8
VIII	22.4	75.4	19.9	94.6
IX	14.6	190.5	15.1	141.2
X	13.8	21.5	12.5	66.6
XI	3.9	87.9	10.8	57.1
XII	-2.9	34.3	2.2	19.1
Average - *prosjek*	11.36		14.28	
Total - *ukupno*		842.2		817.6

The data presented in Table 2 prove that both years were humid. There was a total of 842.2 mm of rain in 2001, and 817.6 mm in 2002. In the period of May-October 2001, there was 504.4 mm of rain, compared to 531.5 mm of precipitation in 2002. In September of both years, more intensive precipitation was registered. September is a month of grape ripening and a time of the most intensive disease development. Hot weather with average monthly temperature of 18.0˚C (2001) and 19.0˚C (2002) in the period May-October was in favor of *B. cinerea* development. In such environmental conditions, development of grey mould was especially intensive on control grapevines.

RESULTS AND DISCUSSION

Evaluation results of infection intensity of grapes with *B. cinerea* are given in Tables 3 and 4.

Table 3. Intensity of infection on cv. Traminac
Tablica 3. Intenzitet zaraze cv. Traminac

Botrycides Botriticid	Conc. (%) *Konc. (%)*	Intensity of infection (%) *Intenzitet zaraze (%)*		Average (%) *Prosjek (%)*
		2001*	2002*	
Kidan	0.30	25.43[a]	18.10[b]	21.27
Mythos	0.25	19.45[a]	17.57[b]	18.51
Switch	0.08	16.59[a]	6.14[a]	11.36
Control	-	43.94[b]	31.16[c]	37.77
		LSD $P_{0.01}$=5.91	LSD $P_{0.01}$=10.19	

*values marked with the same letter do not show significant differences (P=0.01) – *vrijednosti označene istim slovima ne pokazuju značajne razlike (P=0.01)*

Table 4. Intensity of infection on cv. Graševina
Tablica 4. Intenzitet zaraze cv. Graševina

Botryticides *Botriticid*	Conc. (%) *Konc. (%)*	Intensity of infection (%) *Intenzitet zaraze (%)*		Average (%) *Prosjek (%)*
		2001*	2002*	
Teldor	0.15	10.45[a]	15.25[a]	12.87
Switch	0.08	9.76[a]	13.93[a]	11.85
Folicur+Euparen	0.025+0.25	17.30[b]	18.37[a]	17.84

Control	-	39.81[c]	37.17[b]	38.49
		LSD $P_{0.01}$=6.42	LSD $P_{0.01}$=10.85	

*values marked with the same letter do not show significant differences (P=0.01) - *vrijednosti označene istim slovima ne pokazuju statističke razlike (P=0.01)*

Based on the infection intensity evaluation of cv. Traminac and Graševina grapes with *B. cinerea*, statistically significant differences were reported between control and all examined botryticides. However, among botryticides no statistically significant differences were found out. The best results were achieved with Switch on both cultivars in both years. Satisfactory results were also obtained on Mythos and Teldor, and slightly more efficient was Kidan and combination Folicur + Euparen (Table 3 and 4). With respect to the cultivar sensitivity to *B. cinerea* attack, there were no differences between cv. Traminac and Graševina. In the given conditions on the Mladice and Škomić locations, disease intensity depended primarily on environmental conditions. During both years, precipitation was in support of high relative air moisture, which was in favor of many infections caused intensive decay of ripening bunches.
Weight of bunches and yield per hectare are in accordance with the results of disease intensity evaluation (Table 5 and 6).

Table 5. Grapevine yield (kg/ha) in 2001 and 2002, cv. Traminac
Tablica 5. Prinos grožđa (kg/ha) u 2001. i 2002., cv. Traminac

2001				
	No. of grapevines *Broj čokota*	Average weight of bunches (g) *Prosječna težina grozdova (g)*	Yield (kg/60 bunches) *Prinos (kg/60 grozdova)*	Yield (t/ha) *Prinos (t/ha)*
Kidan	60	65.15	46.19	3.06
Mythos	60	84.75	60.26	4.00
Switch	60	80.82	61.98	4.09
Control	60	53.87	48.27	3.17
2002				
Kidan	60	69.37	72.35	4.80
Mythos	60	85.27	82.13	5.44
Switch	60	82.35	83.34	5.52
Control	60	57.01	60.48	4.01

Table 6. Grapevine yield (kg/ha) in 2001 and 2002, cv. Graševina
Tablica 6. Prinos grožđa (kg/ha) u 2001. i 2002., cv. Graševina

2001				
	No. of grapevines *Broj čokota*	Average weight of bunches (g) *Prosječna težina grozdova (g)*	Yield (kg/60 bunches) *Prinos (kg/60 grozdova)*	Yield (t/ha) *Prinos (t/ha)*
Teldor	60	111.64	158.86	10.52
Switch	60	119.51	185.84	12.26
Folicur+Euparen	60	108.97	149.18	9.88
Control	60	73.25	111.05	7.34
2002				
Teldor	60	90.39	97.71	6.47
Switch	60	99.33	107.67	7.10
Folicur+Euparen	60	90.33	106.95	7.06
Control	60	76.21	84.97	5.60

Traminac was less fertile than Graševina, regardless the environmental conditions and applied protection measures. All botryticides reduced infection intensity and increased the grape yield.

Treatments with Switch had the best yield, being 4.09 t/ha in 2001, and 5.52 t/ha in 2002 for Traminac, and 12.26 t/ha in 2001, and 7.10 t/ha in 2002 for Graševina.

REFERENCES

1. Cvjetković, B., Topolovec-Pintarić, S., Jurjević, Ž. (1994): Resistance of B. cinerea Pers. ex Fr. to dicarboximides in Croatian vineyards. Atti Giornate Fitopatologiche, 3:181-186.
2. EPPO (1982): Guideline for the biological evaluation of pesticides 12(3):272-274.
3. Jarvis, W.R. (1977): Botryotinia and Botrytis species: taxonomy, physiology and pathogenicity. Monograph No. 15, Ontario.
4. Kišpatić, J. (1980.): Bolesti voćaka i vinove loze. Zagreb.
5. Kišpatić, J. (1992.): Bolesti voćaka i vinove loze. Agronomski fakultet, Zagreb.
6. Leroux, P. (1995): Progress and problems in the control of B. cinerea in grapevine. Pesticide Outlook, 10:13-19.
7. McClellan, W.D., Hewit, W.B. (1973): Early Botrytis rot of grapes: time of infection and latency of B. cinerea Pers. in Vitis vinifera. Phytopathology 63:1151-1157.
8. Milling, R.J., Richardson, C.J. (1995): Mode of action of the anilo-pyrimidine fungicide pyrimethanil. 2. Effects on enzime secretion in B. cinerea. Pesticides Science, 45:43-48.
9. Muramatsu, N., Miura, I. (1996): Methods for evaluating the sensitivity of B. cinerea to mepanipyrim using cucumber cotyledons and paper discs. Bulletin OEPP 26:181-197.
10. Rosslenbroich, H.J., Brandes, W., Kreuger, B.W., Kuck, K.H., Pontzen, R., Stenzel, K., Suty, A. (1998): Fenhexamid (KBR-2738) - A novel fungicide for control of B. cinerea and related pathogens. Pest and Diseases - The Brighton Crop Protection Conference, Proceedings, 2:327-334.
11. Topolovec-Pintarić, S. (2000): Urođena i stečena otpornost B. cinerea Pers. ex Fr. na botriticide u vinogradima i suodnos rezistentnih patotipova. Doktorska disertacija, Zagreb.
12. Towsend, G.R., Heuberger, J.W. (1943): Methods of estimating losses caused by diseases in fungicide experiments. Plant Disease Reporter, 17.

INTENZITET NAPADA *BOTRYTIS CINEREA* PERS. EX FR. NA SORTAMA GRAŠEVINA I TRAMINAC I DJELOTVORNOST BOTRITICIDA

SAŽETAK

Siva plijesan, koju uzrokuje Botrytis cinerea, značajna je bolest vinove loze diljem svijeta. S ciljem utvrđivanja intenziteta napada B. cinera na zrelim grozdovima i učinkovitosti botriticida (Traminac - iprodion, pirimetanil, fludioksinil+ciprodinil; Graševina - fenheksamid, fludioksinil+ ciprodinil, tebukonazol+ diklofluanid), postavljen je dvogodišnji pokus (2001.-2002.) na lokacijama Mladice (Traminac) i Škomić (Graševina). Procjenom intenziteta napada Botrytis cinerea na Graševini i Tramincu utvrđene su najjače zaraze na kontroli, a najslabije u varijanti pokusa s botriticidom Switch. Usporedbom jačine zaraze grozdova sorte Traminac, u odnosu na Graševinu, nisu nađene razlike koje se mogu pripisati različitoj osjetljivosti sorata. U konkretnim uvjetima lokaliteta Mladice i Škomić, jačina zaraze zavisila je, u prvom redu, o klimatskim čimbenicima. U obje pokusne godine količina i raspored oborina podržavale su visoku vlažnost u vinogradima, omogućivši brojne infekcije i intenzivan razvoj bolesti.

Ključne riječi: Botrytis cinerea, vinova loza, botriticidi

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