FRAJLA AND DIONIS, NEW GRAPE VARIETIES FOR ECOLOGIAL GROWING

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Abstract

Reducing pesticide use in vineyard production in order to preserve the environment and human health is possible by growing cultivars tolerant or resistant to fungal diseases. At the experimental field of University of Novi Sad, Faculty of Agriculture in Sremski Karlovci, during last four decades, several cycles of interspecies crossings were made, putting emphases on quality improvement and resistance maintenance. The research results of the last generation of new wine grape varieties Frajla and Dionis are presented. Using molecular markers, it was found that Frajla variety carries Rpv3 and Ren3 genes, while the variety Dionis carries Rpv3 and Rpv 12 genes. The presence of the genes Rpv3 and Rpv 12, (downy mildew resistance) and Ren3 (powdery mildew resistance), were confirmed in the field conditions. Biological and production characteristics of new varieties were observed during the period 2012-2016. Frajla (Vertes csillaga x Petra) is an early ripening variety (30. 08.), solid yield, with high sugar content in the must, and enough acids to produce high quality white wine, with discreet muscat aroma. Variety Dionis (Cabernet franc E11 x Panonia), is a late ripening (01. 10.), with solid productivity, accumulates high content of sugar in the must. Dionis demonstrated a high degree of tolerance to fungal diseases, resistance to frost and excellent quality of red wines. New varieties are recommended for ecological viticulture and winemaking.

Keywords: wine quality, resistance, frost, fungal diseases.

Introduction

Ecological production of grapes promotes production systems that respect the environment and protect the human health. In the last few decades, it has been more and more recognized. A decision which variety to grow is of paramount importance for successful and economical production of quality grapes. For more than 100 years, breeders all around the world have been working on making new varieties with resistance to biotic and abiotic stress factors and high grape quality. As a result, a huge number of resistant table and wine varieties was released. These interspecific hybrids, also known as pilzwiderstandsfähing (PWI), have resistance to main fungal diseases and have the grape quality as high as remarkable *Vitis vinifera* varieties (Alleweldt, Posingham, 1988; Csepregi, Zilai, 1989; Guzun i sar. 1990; Korać, Cindrić 1995; Bleich, 1998; Eibach, 2000;, Korać, Cindrić, 2004). Many of these varieties are successfully grown in ecological production systems (Korać et al, 2011). Since 1947, at the experimental field of Faculty of Agriculture, University of Novi Sad situated in Sremski Karlovci, several succesive grapevine breeding programs have been performed. In the last four decades, the priority is on making new fungus resistant varieties. The aim is the combination of resistant traits found in Asian or American *Vitis* species and quality traits found in the cultivated *Vitis Vinifera*. Using traditional breeding concepts 15 interspecies varieties were released and several genotypes are in the progress (Cindrić, Korać, 1990; Cindrić, 1995; Korać, Cindrić, 1995; Cindrić i sar., 1997; Korać, 1989; Korać i sar 2011). In the paper we presented biological and productive characteristics of new grapevine varieties Frajla and Dionis, which could be successfully grown in ecological production of grapes and wine.

Material and methods

The experiment was conducted in Sremski Karlovci (wine region Vojvodina, Serbia) at the experimental field of the Faculty of Agriculture, University of Novi Sad (45º10´ N, 20º10´ E, 130

Altitude) during 2012-2016. Planted at 2.8 x 1 m inter and intra row spacing the vines were trained to modified Guyot training system (a cane with 12 buds and a spur with 2 buds). New varieties Frajla and Dionis were investigated under ecological conditions, while the control varieties Neoplanta and Cabernet franc E11 were trained conventionally. There were 6 wines in the replication per variety. Frajla (Vertes csillaga x Petra) is a white skin variety released in 2015. The authors are P. Cindrić, N. Korać and V. Kovač. This mid-vigour, early ripening variety accumulates high sugar content in themust and is suitable for the production of dessert wines. The wines made from the Frajla have a slightly muscat aroma. In the field the variety has high frost-tolerance and resistance to the main fungal diseases and could be successfully grown with a reduced use of pesticides. Dionis (Cabernet franc E11 x Panonia) is a red skin variety released in 2017. The authors are: P. Cindrić, N. Korać and D. Ivanišević. It has many of the characteristics of its Cabernet franc parent and the wine of Dionis is high quality with fine phenolic structure. The berries are small without touching each other in the bunch. It is a late ripening variety resistant to low winter temperatures and also has resistance to the main fungal diseases. Neoplanta (Smederevka x Traminer) was control variety for Frajla during the process of approval. Neoplanta is *Vitis vinifera* variety with high quality aromatic wines. The variety is high vigour, mid-ripening with a satisfied yield. In the field Neoplanta is susceptibile to fungal diseases and low-winter temperatures. Cabernet franc is parent of Dionis, and therefore was selected during the process of approval.

Following analyses were performed:Three key phenological stages of grapevine were observed: BBCH-07- the beginning of budburst i.e. the date when green shoot tips became visible; BBCH-60- the beginning of flowering i.e. the date when first flower hoods were detached from the receptacle; and BBCH-80-the beginning of veraison i.e. the date when berries begun to develop variety-specific colour.The resistance to *Plasmopara viticola* and *Oidium tuckeri* was tested using IBPGR »Descriptors for grape«. 8.2.3 and 8.2.4. codes were applied for leaf and bunch resistance. The mark 1 presents high resistance while the mark 9 presents high susceptibility. For the *Oidium tuckeri* examination 8.2.5. (leaf resistance) and 8.2.6 codes (bunch resistance) were used. The mark 1 also presents high resistance while the mark 9 presents high susceptibility. The analysis for susceptibility to bunch rot was performed at the time of harvest and expressed in %. Wine sensory analysis were applied using a scale up to 20 and experienced tasters participated in the sessions. Productive characteristics (grape yield, sugar content and acidity in the must, bunch weight) were examined using standard methods (Cindrić 2000). DNA analyses of leaf samples were performed at the University of Udine in Italy. Genomic DNA was extracted using a CTAB-based method. CR reactions were carried out like Ivanišević et. al. 2014 published. The following markers was used to determine the presence genes: For Rpv3 gene was used markers UDV305 and UDV373, and interval marker UDV374 (Di Gaspero et al. 2012). For Rpv12 was used markers sc36_7 and UDV350 (sc81_9.1) (Venuti et al. 2013). For Ren3 was used markers VMC4D9-2 and VVIV67 (Welter et al. 2007). During the research period climate conditions were highly variable among the years. 2012 was hot and dry, with only 268 mm of rainfall. 2013, 2015 and 2016 were moderate with enough rainfall. On the other hand, 2014 was cold and rainy which negatively affected wine quality.

Results and discussion

Phenological observations

There were no big differences in the beginning of budburst (5 days), as well in the beginning of flowering (3 days). The difference in the beginning of the veraison was higher (9 days) compared to beginning of budburst and flowering. However, the biggest difference was observed in completation of grapes maturity (31 days). Frajla is an early ripening variety, while Dionis has a long ripening period.

Table 1. Phenological observations (Sremski Karlovci, Mean: 2012-2016.)

Variety	Date of the begining			Harwest date
	Budbreak BBCH-07	Flowering BBCH-60	Veraison BBCH-80	
Frajla	05.04.	21.05.	13.07.	30.08.
Neoplanta	07.04.	23.05.	17.07.	04.09.
Dionis	09.04.	21.05.	21.07.	01.10.
Cabernet franc	10.04.	23.05.	22.07.	01.10.

Resistance to the fungal diseases

Frajla and Dionis are highly torelant to booth fungal diseases (the marks 1, 3 and 5) and could be successfully grown without using of pesticides, or at least with less number of spraying against *Plasmopara viticola* and *Oidium tuckeri* (Table 2). These results are in agreement with previous research (Korać et al, 2011 and Ivanišević et al, 2012).

Table 2. Susceptibility to fungal diseases (Sremski Karlovci, Mean 2012-2016.)

Variety	*Plasmopara viticola*		*Oidium tuckeri*	
	Leaf	Bunch	Leaf	Bunch
Frajla	5	3	3	3
Neoplanta	7	7	7	7
Dionis	3	1	3	3
Cabernet franc E11	7	7	7	7

Productive characteristics

In the ecological production system, booth varieties had a medium yield but without significant differences compared to control varieties. The Frajla had significantly lower bunch weight than Neoplanta as well as Dionis compared to Cabernet franc E 11. Results showed that Frajla has high potential for sugar accumulation, significantly higher compared to control variety Neoplanta (Table 3). Frajla also had higher must acidity compared to the control. On the other hand, Dionis had sugar and acids content as high as Cabernet franc E11. Susceptibility to bunch rot was at the acceptable levels for booth varieties. Varieties Frajla and Dionis produce high quality wines.

Figure 1. Heritage basis of the variety Frajla

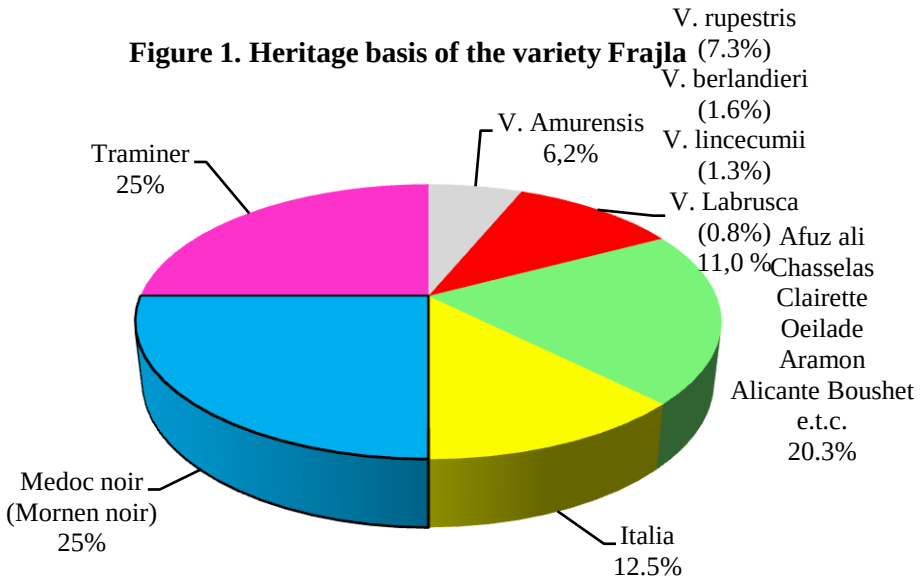
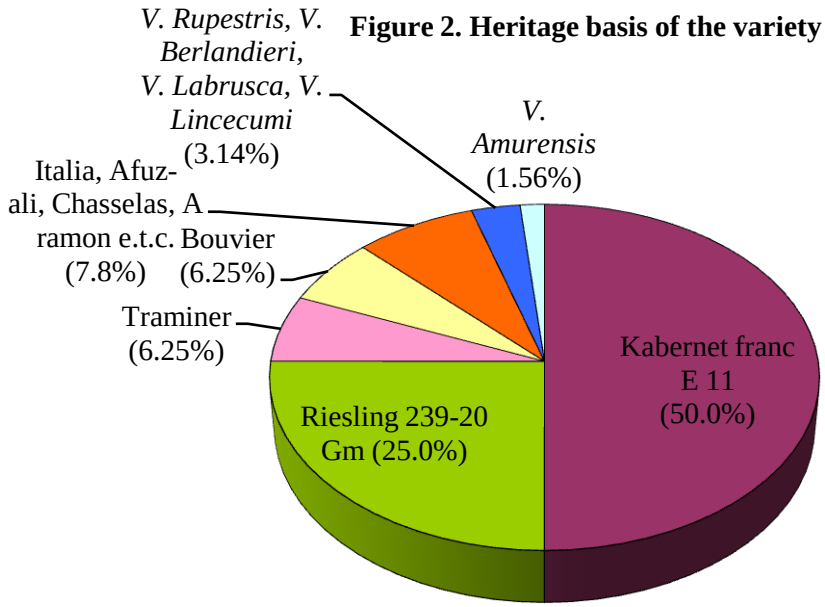


Table 3. Grape yield and quality (Sremski Karlovci, Mean: 2012.-2016.)

Cultivar	Year	Grape yield (kg/m^2)	Bunch weight (g)	Sugar in must (%)	Acidity in must (g/l)	Botrytis (%)	Wine sensory analysis (up to 20)
FRAJLA	2012	0.97	80	27.4	7.9	0	18.7
	2013	0.87	140	25.7	8.1	0	18.5
	2014	1.02	177	20.5	8.7	13	18.3
	2015	0.90	80	26.7	8.7	0	17.9
	2016	0.83	140	27.4	9.1	0	18.7
	Average	0.92 ± 0.1 [a]	123 ± 42 [b]	25.5 ± 2.9 [a]	8.5 ± 0.5 [a]	2.6 ± 5.8 [b]	18.4 ± 0.3 [a]
NEOPLANTA (control)	2012	0.71	154	22.9	3.8	0	17.8
	2013	1.18	203	18.9	4.9	13	18.3
	2014	1.04	227	17.7	6.9	23	17.7
	2015	1.19	177	17.6	4.8	0	16.7
	2016	1.73	283	18.6	6.9	5	17.8
	Average	1.17 ± 0.4 [a]	209 ± 50 [a]	19.1 ± 2.2 [b]	5.5 ± 1.4 [b]	8.2 ± 19.8 [a]	17.7 ± 0.6 [b]
DIONIS	2012	0.83	150	26.5	6.4	0	18.4
	2013	1.48	170	24.7	5.3	3	18.2
	2014	1.01	160	23.3	4.7	20	-
	2015	1.02	160	21.7	4.7	1	17.8
	2016	1.24	183	24.7	6.9	15	18.9
	Average	1.12 ± 0.2 [a]	165 ± 12 [ab]	24.2 ± 1.8 [a]	5.6 ± 1.0 [b]	7.8 ± 9.1 [a]	18.3 ± 0.5 [a]
CABERNET FRANC E11 (control)	2012	1.21	220	24.3	6.0	0	18.5
	2013	1.30	240	20.8	5.6	0	18.0
	2014	1.28	135	19.3	7.3	3	-
	2015	0.70	225	23.8	4.2	3	17.8
	2016	1.30	133	24.5	5.9	15	18.4
	Average	1.16 ± 0.3 [a]	191 ± 52 [a]	22.5 ± 2.3 [a]	5.8 ± 1.1 [b]	4.2 ± 6.2 [a]	18.2 ± 0.3[ab]

[a,b] The values marked with different lower-case letters are statistically significantly different for the significance treshold of 0.05 (LSD test)

Figure 2. Heritage basis of the variety Dionis



Genetic background and DNA profiles of the varieties Frajla and Dionis

Frajla has 82.8 % genes that originated from several Vitis vinifera varieties, 11 % belong to the American species while 6.2 % of the genes are related to *Vitis amurensis*.

The portions of *Vitis vinifera* genes and those originated from wild ancestors are presented in the Figure 1. In the heritage basis of Dionis wild genes account with only 4,7%, while 95.3 % of the genes originated from several *Vitis vinifera* varieties (Figure 2).

Detection of the genes related to the resistance to *Plasmopara viticola* and *Oidium tuckeri* confirm their resistance in the field (Table 4).

Table 4. Present genes

Genotype	Gene
Frajla	Rpv3, Ren3
Dionis	Rpv 3, Rpv12

Conclusions

The results showed that new grapevine varieties Frajla and Dionis in the ecological production system are mid-yield varieties with high quality grapes. White skin variety Frajla is an early ripening, with high potential for sugar accumulation and high quality wine. Red grapevine variety Dionis is late-ripening with satisfied yield with the wine quality at the level of Cabernet franc. Booth varieties could be successfully grown with reduced use of pesticides and it is confirmed with the presence of the genes related to the fungal resistance. Therefore, these varieties constitute a valuable genetic material and would be included in further breeding programs.

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