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## THE IMPACT OF AUTOCHTHONOUS AND COMMERCIAL YEAST STRAINS ON FERMENTATION AND QUALITY OF WINES PRODUCED FROM VRANEC GRAPE VARIETY FROM TIKVEŠ WINE-GROWING REGION, REPUBLIC OF NORTH MACEDONIA

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### Introduction

Nowadays, mainly pure selected cultures of wine yeasts are used in winemaking, which led to a significant improvement of the wine technology and respective final quality, because of multiple benefits, viz.: the ability to a quick and effective fermentation of grape juice or must with high sugar concentration; resistibility to high levels of ethanol ( $C_2H_6O$ ) and sulfur dioxide ( $SO_2$ ); and resistibility to high temperatures during fermentation .

Indeed, the increasing usage of traded selected yeasts for winemaking leads inevitably to a loss of the autochthonous yeast populations naturally present in regional grapes. Largely, the specificities, authenticity, uniqueness and, mostly important, the quality characteristics of wine are dependent on the natural microbiota found in the grapes of each viticulture region and, of course, the quality of the grapes by itself – which deeply depends on soil and climate conditions of the geographic region and the employed viticulture techniques, and also drives the type of microbiota present therein.

The main aim of the current research effort was the estimation of the best winemaking procedure and most favorable yeast strain for production of high-quality premium wines from Vranec rape variety from the “Tikveš” wine-growing region. The wines were fermented by two autochthonous yeast strains, F-8 and F-78, and a commercial yeast strain, D-80. The microbial dynamics of alcoholic fermentations were ascertained and the quality of the produced wines estimated. The enological parameters under scrutiny were the percentage of alcohol, sugar content, total and volatile organic acids and pH of the wines. Furthermore, total phenolic content, total anthocyanin and color intensity (IC) were also determined in order to estimate the best winemaking procedures to yield in such high-quality premium wines from Vranec grape variety from the “Tikveš” wine-growing region of the Republic of North Macedonia.

### Results

Table 2. Sugar content, titratable acidity, and pH values of grapes for vintage years 2016 and 2017.

Grape variety	Vintage year	Sugar content g/L	Titratable acidity (TA) (g/L)	pH
Vranec	2016	245	6.7	3.51
Vranec	2017	249	7.1	3.54

Table 3. Mean values and standard deviations (Mean  $\pm$  STDV) of enological parameters of wines fermented by autochthonous and commercial yeast strains.

Wine designation	Alcohol % (vol.)	Total reducing sugars ( $g_{sugars}/L_{wine}$ )	Titratable Acids (TA) ( $g_{TA}/L_{wine}$ )	Volatile Acids (VA) ( $g_{VA}/L_{wine}$ )	pH
V1	14.96 $\pm$ 1.51 <sup>a</sup>	2.2 $\pm$ 0.0 <sup>a</sup>	6.89 $\pm$ 1.01 <sup>b</sup>	0.68 $\pm$ 0.09 <sup>a</sup>	3.32 $\pm$ 0.11 <sup>a</sup>
V2	14.11 $\pm$ 2.01 <sup>a,b</sup>	2.0 $\pm$ 0.1 <sup>b</sup>	7.13 $\pm$ 0.98 <sup>a</sup>	0.43 $\pm$ 0.07 <sup>c</sup>	3.26 $\pm$ 0.23 <sup>b</sup>
V3	14.53 $\pm$ 1.09 <sup>a</sup>	2.2 $\pm$ 0.4 <sup>a</sup>	7.34 $\pm$ 0.44 <sup>a</sup>	0.61 $\pm$ 0.05 <sup>a</sup>	3.24 $\pm$ 0.49 <sup>b</sup>

Table 4. Mean values and standard deviations (Mean  $\pm$  STDV) of total phenolic compounds, total anthocyanin and color intensity (IC) of wines fermented by autochthonous and commercial yeast strains.

Wine designation	Total phenolic compounds (TPC) ( $mg_{analty}/L_{wine}$ )	Total anthocyanin ( $mg_{analty}/L_{wine}$ )	Color intensity (a.u.)
V1	1512.7 $\pm$ 23.55 <sup>b</sup>	653.3 $\pm$ 11.08 <sup>a</sup>	31.31 $\pm$ 4.21 <sup>a</sup>
V2	1528.9 $\pm$ 39.01 <sup>b</sup>	583.7 $\pm$ 22.65 <sup>b</sup>	21.02 $\pm$ 5.28 <sup>b</sup>
V3	1617.2 $\pm$ 24.72 <sup>a</sup>	637.1 $\pm$ 19.87 <sup>a</sup>	23.62 $\pm$ 3.97 <sup>b</sup>
CS1	1495.9 $\pm$ 23.55 <sup>b,c</sup>	540.7 $\pm$ 12.04 <sup>c</sup>	31.05 $\pm$ 2.99 <sup>a</sup>
CS2	1450.5 $\pm$ 34.21 <sup>c</sup>	472.9 $\pm$ 20.11 <sup>c,d</sup>	21.01 $\pm$ 4.01 <sup>b</sup>
CS3	1610.8 $\pm$ 13.90 <sup>a</sup>	573.8 $\pm$ 17.91 <sup>b</sup>	32.72 $\pm$ 3.87 <sup>a</sup>



### Materials and Methods

Grapes from Vranec variety for this study were harvested in September 2016 and 2017 in the area of “Crveni Bregovi”, located at the “Tikveš” wine-growing region (Republic of North Macedonia). The procedure of isolation and selection of endogenous yeast strains F-8 and F-78 was previously described by the research group of Ilieva (2016, 2017, 2019) [17-19]. Briefly, a spontaneous fermentation of 5 different lots Vranec from different micro-regions was held. After destemming, crushing and sulfiting (dosage 20 mg/kg, 5% sulphureous acid), the spontaneous fermentation took place at 25-28 °C in PET vessels. From the experimental trials pure yeast cultures were isolated following the Koch method (Bambalov and al., 2000) [20]. The microbial isolation was executed from single colonies, cultivated in test tubes with nutrient agar culture medium with sterilized grape juice, in a thermostat in water bath at 25 °C. Subsequently, the isolated and purified strains were subjected to a three-stage selection based on their fermentation ability. The experimental wines were produced from Vranec grape variety by application of autochthonous yeast (F-7 and F-78) and commercial yeast (D-80) strains.

Table 1 Experimental design for the wines produced with Vranec grape varieties and fermented by autochthonous and commercial yeast strains .

Wine designation	Yeast strain	Oenological parameters
V1	F-8	Alcohol (ethanol)
V2	F-78	Total reducing sugars*
V3	D-80	Titratable (TA) acidity*
		Volatile (VA) acidity
		Color intensity (IC)
		Total monomeric anthocyanin
		Total phenolic compounds

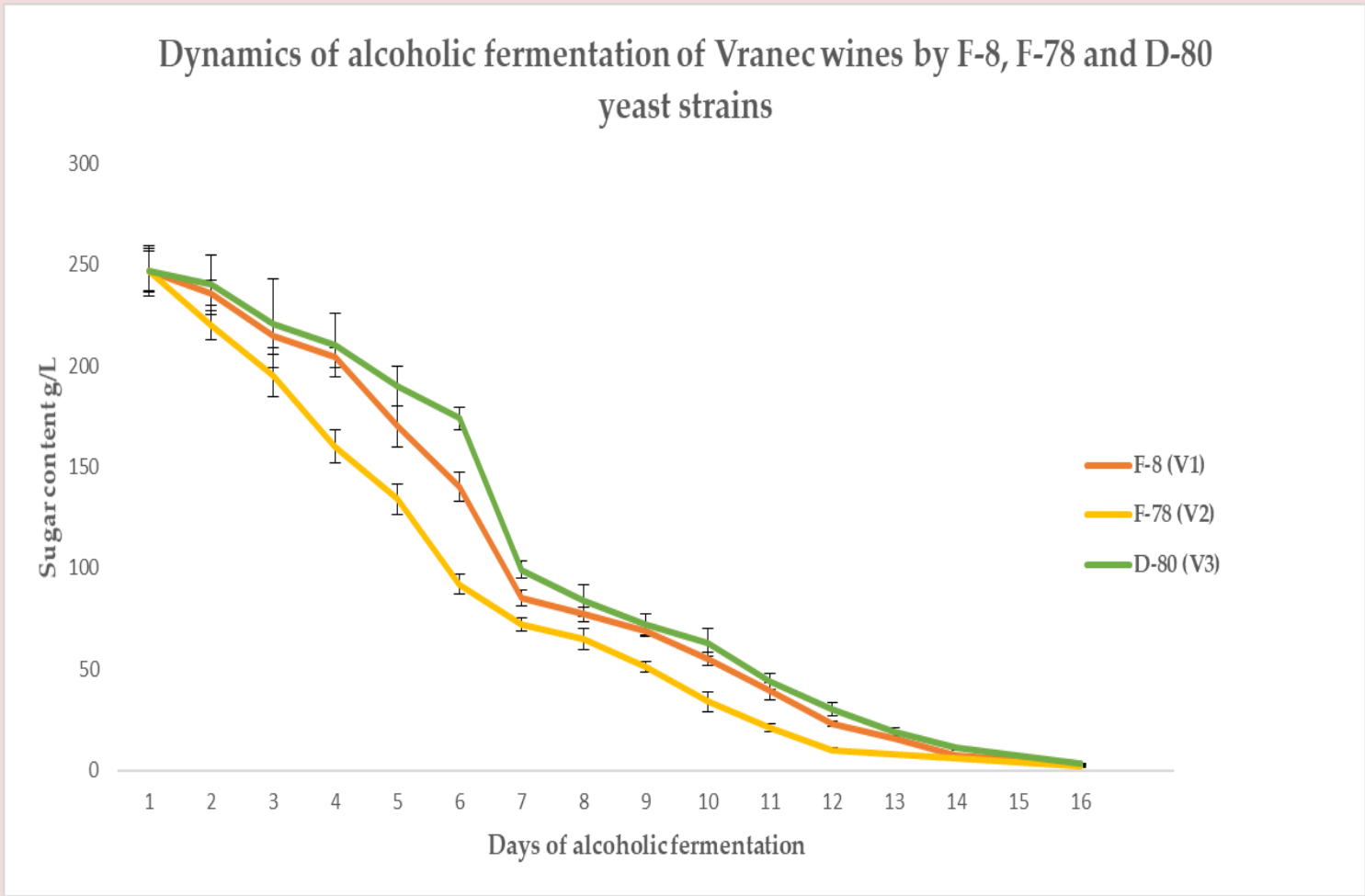


Figure 1 Dynamics of alcoholic fermentation of Vranec wines produced by autochthonous and commercial yeast strains

### Conclusions

- ✓The object of this study was the impact of newly isolated autochthonous yeast strains called F-8 and F-78 on the fermentation and quality of wines from Vranec grape varieties.
- ✓The fermentation process and quality of the produced wines were compared to the wines produced from the same grape varieties, but with a commercial yeast strain (D-80).
- ✓The highest alcohol content was detected in Vranec wine fermented with autochthonous F-8 yeast strain. Conversely, Vranec wine fermented by the F-78 yeast strain contained the lowest alcohol content (14.11%).
- ✓The low sugar amount (2–3 g/L) in both grape varieties is indicated the production of dry wines.
- ✓The alcohol content, Vranec wine produced by commercial yeast strain D-80 indicated the highest concentration of total phenolic compounds (1450 mg/L) and total anthocyanins (572 mg/L), while the lowest concentrations were observed in wine fermented by autochthonous yeast strain F-78 (1612 mg/L and 470 mg/L, respectively).

### Reference

- Zabukovec, P.; Čadež, N.; Čuš F. Isolation and Identification of Indigenous Wine Yeasts and Their Use in Alcoholic Fermentation. *Food Technol. Biotechnol.* 2020, 58(3), 337-347.
- Raymond Eder, M.L.; Conti, F.; Rosa A.L. Differences between indigenous yeast populations in spontaneously fermenting musts from *V. vinifera* L. and *V. labrusca* L. Grapes Harvested in the Same Geographic Location. *Front. Microbiol.*, 2018, 9:1320, doi: 10.3389/fmicb.2018.01320.
- Kostadinović Veličkovska, S.; Mirhosseini, H.; Bogeva, E. Isolation of anthocyanins by high-speed countercurrent chromatography and application of the color activity concept to different varieties of red grape pomace from Macedonia. *J Nutr Food Sci*, 2013, 3:6. 243-250.
- Ilieva F., Kostadinović Veličkovska, S.; Dimovska, V.; Mirhosseini, H.; Spasov, H. Selection of 80 newly isolated autochthonous yeast strains from the Tikveš region of Macedonia and their impact on the quality of red wines produced from Vranec and Cabernet Sauvignon grape varieties. *Food Chem*, 2017, 216, 309-315.