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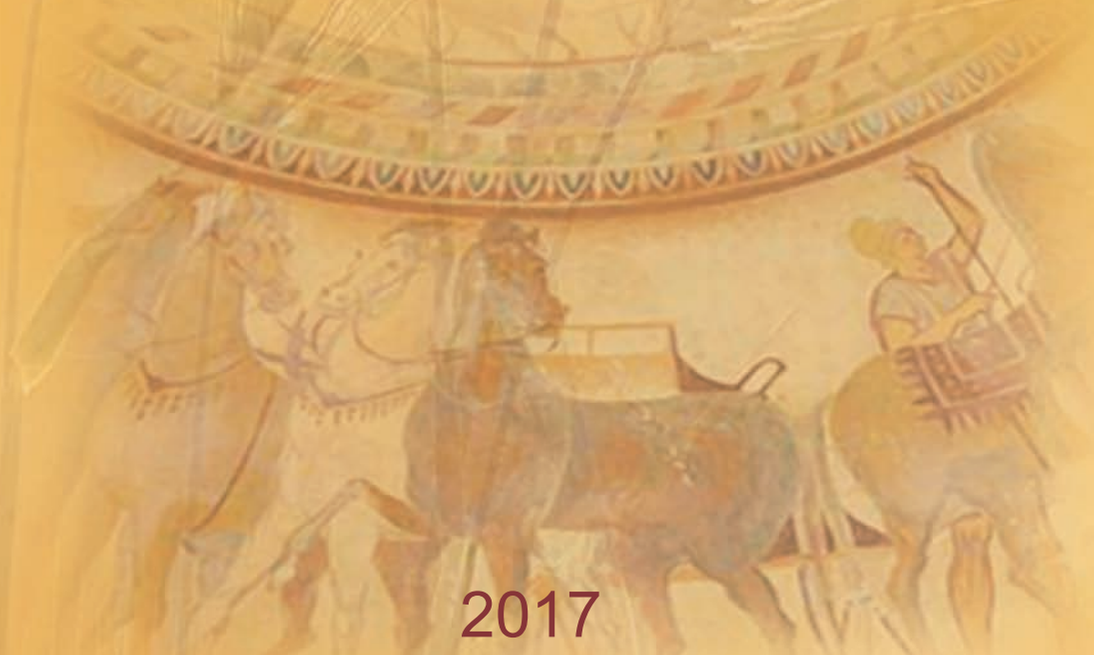

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Chemical composition and technological characteristics of wines from red grape varieties, selected in Bulgaria

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Abstract. *Chemical analysis of grapes and technological characterization of wines from red varieties Storgoziya, Kaylashky rubin, Trapezitza, Rubin and Bouquet, created by the method of intraspecific and interspecific hybridization at the Institute of Viticulture and Enology – Pleven, Bulgaria were made. The technological maturity of the grapes as raw material for producing quality red wines was determined. Rubin variety was with the highest sugar content - 23.10±0.73 %, titratable acids - 6.18±0.34 g/dm^3 and pH 3.40±0.71. The other varieties were with optimal condition for the production of red wines in terms of sugars and titratable acids. The chemical composition and organoleptic characteristics of the experimental wine samples were established. The ethyl alcohol content in the produced wines was in the range from 12.33±0.23 vol. % (Bouquet) to 13.31±0.34 vol. % (Kaylashky rubin). The content of titratable acids was in the range of 5.33±0.43 g/dm^3 (Trapezitza) up to 6.88±0.21 g/dm^3 (Kaylashky rubin). There were no significant differences in the analyzed indicators and taste evaluation between experimental wines and wine of Vitis vinifera – Pinot noir grape variety used as control sample.*

Keywords: new grape varieties, wine, chemical composition, organoleptic profile

Introduction

Grapes as genotype and raw material has certain capabilities. They are realized under appropriate weather conditions and farming practices of cultivation (Ivanov et al., 1979; Abrasheva et al., 2008). Key role and importance for the wine quality has the composition and quality of the grapes used. It depends on the combination between a variety of genetic characteristics and environmental conditions in the area of its cultivation (Pandaliev et al., 2010; Chobanova, 2012). From a technological point of view it is well known that the varietal characteristics, climate, soil and climatic conditions and the quality of wine are functionally related parameters (Katerov et al., 1990). They give uniqueness in the aroma and taste of regional and especially in the quality wines produced in certain regions (Marinov, 1990; Yankov, 1992; Mandjukov, 2010).

In recent years a trend of increasing interest in grape varieties and wines has been observed that highlight the specific natural and climatic conditions of the vine-growing regions and taste qualities of the produced wines. The effort of Bulgarian winemakers is to find their own niche on the international market with original Bulgarian grape varieties. The Institute of Viticulture and Enology, Pleven works on promoting newly bred varieties, intraspecific and interspecific hybrids (Ivanov, 2011).

The favorable combination and ratio of wine chemical indicators has a significant impact on the formation of its specific taste and taste characterization defines its quality. In the selection of the vine when creating new hybrid grape varieties, it is important to apply objective criteria for proper assessment of the resulting grapes and wines. The evaluation of the new hybrid forms can be performed on the basis of level and ratio of various technological indicators of their wines, by analyzing and using the established optimal chemical indicators (Roytchev, 2014).

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The aim of this study was to investigate the changes and variations in chemical composition and organoleptic properties of wines produced from red grape varieties, created at the Institute of Viticulture and Enology, Pleven, central part of North Bulgaria.

Material and methods

The study was done at the Institute of Viticulture and Enology (IVE) - Pleven in 2015. The objects of research were red wine grape varieties Storgoziya, Kaylashky rubin, Trapezitza, Rubin and Bouquet selected in IVE, Pleven in the way of intra- and interspecific hybridization. These varieties are distributed in individual micro areas in the whole country (Pleven, Sadovets, Barkach, Suhindol, Pavlikeni, Brestovitza, Karnobat, Burgas, Blagoevgrad and Sandanski).

The vine plantation is located at the experimental base of IVE on an area of 0.3 hectares. The climate is continental characterized by cold winters and hot summers. The sum of the average daily temperatures during the growing season ranges from 3535 – 4500°C. The average temperature of the warmest month is always more than 20°C. These data show that the region of Pleven provides suitable conditions for obtaining quality red grapes as raw material for the production of red wines. The soil is leached chernozem on loess base suitable for the vine culture growth. Interspecific varieties Storgoziya, Kaylashky rubin and Trapezitza have increased resistance to stress factors (low winter temperatures and mildew).

The parental forms of the studied varieties are:

Storgoziya – Bouquet x SV 12375;

Kaylashky rubin – Pamid x Hybrid VI-2-15 x Gamay Noir x *Vitis amurensis*;

Trapezitza – Danube Gamza x Marseillaise early

Rubin – Nebbiolo x Shiraz

Bouquet – Mavrud x Pinot Noir

Pinot Noir variety of *Vitis vinifera* was used as control sample.

The ripening dynamics of grapes was researched. Vintage has been made upon reaching technological maturity of the grapes. Vinification was conducted by the traditional scheme for dry red wine production in the experimental wine cellar of IVE - Pleven: crushing, pressing, sulphitation (50 mg/kg SO_2), inoculating with pure culture wine yeasts *Saccharomyces cerevisiae* (10 g/hl), temperature of fermentation (25-28°C), removing of solids, malolactic fermentation, further sulphitation, storage.

The composition of grape pulp and the obtained experimental wines from the studied varieties in terms of basic chemical indicators (ethyl alcohol content, vol. %; sugars, g/dm^3; glucose g/dm^3; fructose g/dm^3; density, kg/dm^3 ; total extract, g/dm^3; titratable acids, g/dm^3; volatile acids, g/dm^3, free SO_2, mg/dm^3; total SO_2, mg/dm^3; TPC, g/dm^3; anthocyanins, mg/dm^3; intensities – I; nuance –T; pH) and organoleptic evaluation (color, smell, taste and overall impression) were defined by generally accepted winemaking methods (Ivanov et al., 1979; Chobanova, 2007). All analyses were performed in triplicate (n=3) and average values were calculated.

One hundred point scale for evaluation of wine organoleptic characteristics was used. The obtained results were processed by MS Office Excel software (Microsoft Corporation, USA).

Results and discussion

In 2015, the grapes of the studied varieties reached technological maturity for production of quality dry red wines despite the rainy period in September. With the highest sugar content was characterized the Rubin variety (23.10±0.73%), with slight etiolation, making the raw material suitable for production of wine. The other varieties were with optimal condition in terms of sugars and titratable acids for the production of dry red wines, which correspond to the calculated values of Gluco Acidimetric Index (GAI). Fructose content was higher than glucose content, which is an indicator for well ripened grapes (Table 1).

Titratable acids in all studied varieties, except Trapezitza, were slightly higher, which was reflected in the resulting wines. Tartaric, malic acids and pH were within normal limits and comply with the technological maturity of the grapes. Pinot Noir control reached physiological maturity (sugars – 24.70±0.24% and titratable acids – 6.70±0.45 g/dm^3) with slight etiolation. It was suitable for the production of quality red wines. The composition of the obtained experimental wines is presented in Table 2.

Alcohol content value in wines corresponds to the amount of sugar in grapes. Titratable acidity (Kaylashky rubin and Bouquet) was slightly higher in comparison to the control sample and pH was within normal limits for quality red wines (3.15±0.21 to 3.38±0.16).

Table 1. Chemical composition of grapes from the studied varieties (n = 3), (Mean ± SD)

Grape variety	Date of vintage, 2015	Content of sugars, g/dm^3	Content of glucose, g/dm^3	Content of fructose, g/dm^3	Content of titratable acids, g/dm^3	GAI	pH
Storgoziya	06.10.	22.50±0.12	85.35±0.62	139.65±0.63	6.18±0.82	3.64±0.54	3.30±0.71
Kaylashky rubin	16.09.	21.20±0.23	79.00±0.13	133.00±0.54	7.15±0.42	2.96±0.44	3.20±0.33
Trapezitza	02.09.	21.00±0.55	89.10±0.54	120.90±0.35	5.48±0.23	3.83±0.24	3.50±0.45
Rubin	03.09.	23.10±0.73	111.38±0.82	119.62±0.21	6.18±0.34	3.73±0.72	3.40±0.71
Bouquet	20.09.	22.00±0.33	87.20±0.33	132.80±0.43	6.90±0.72	3.18±0.61	3.10±0.63
Pinot Noir (Control)	03.09.	24.70±0.24	86.18±0.44	160.82±0.75	6.70±0.45	3.68±0.33	3.20±0.42

Table 2. Chemical composition of red wines (n = 3), (Mean ±SD)

№	Indicators	Bouquet	Trapezitza	Kaylashky rubin	Storgoziya	Rubin	Pinot Noir (Control)
1.	Ethyl alcohol content, vol. %	12.33±0.23	12.46±0.24	13.31±0.34	12.12±0.54	12.33±0.43	13.25±0.76
2.	Sugars, glucose, fructose, g/dm^3	1.64±0.32	1.71±0.21	1.86±0.43	1.91±0.35	2.35±0.32	2.52±0.23
3.	Density – kg/dm^3	0.9945	0.9940	0.9941	0.9937	0.9922	0.9917
4.	Total extract, g/dm^3	27.90±0.24	26.90±0.32	29.70±0.34	25.20±0.34	21.50±0.32	28.30±0.21
5.	Titratable acids, g/dm^3	6.30±0.46	5.33±0.43	6.88±0.21	5.85±0.43	5.18±0.52	5.80±0.16
6.	Volatile acids, g/dm^3	0.66±0.32	0.36±0.54	0.66±0.43	0.72±0.25	0.66±0.31	0.78±0.17
7.	Free SO_2, mg/dm^3	11.50±0.11	16.60±0.26	16.60±0.46	10.20±0.27	15.40±0.31	16.60±0.21
8.	Total SO_2, mg/dm^3	19.20±0.21	30.70± 0.43	55.10±0.52	24.30±0.26	32.00±0.43	37.10±0.65
9.	TPC, g/dm^3	3.35±0.32	2.63±0.65	1.43±0.21	2.22±0.65	5.96±0.41	3.54±0.41
10.	Anthocyanins, mg/dm^3	40.31±0.43	72.94±0.57	189.58±0.14	54.86±0.17	210.99±0.23	86.06±0.27
11.	Intensities - I	9.52±0.37	4.05±0.76	6.52±0.15	5.67±0.19	14.42±0.74	11.88±0.21
12.	Nuance -T	0.69±0.54	1.11±0.64	0.68±0.16	0.80±0.31	0.66±0.44	0.73±0.26
13.	pH	3.23±0.47	3.18±0.54	3.19±0.15	3.24±0.19	3.15±0.21	3.38±0.16
14	Organoleptic evaluation	77.20±0.34	74.30±0.45	76.00±0.26	73.20±0.58	75.20±0.32	80.10±0.44

Table 3. Organoleptic characteristics of wines from the studied grape varieties (n = 3), (Mean ±SD)

Indicators	Grape variety	Bouquet	Trapezitza	Kaylashky rubin	Storgoziya	Rubin	Pinot Noir (Control)
Color	Limpidity	5.00±0.02	4.90±0.03	4.90±0.02	5.10±0.03	5.10±0.03	5.20±0.02
	Nuance	5.40±0.03	4.20±0.01	5.10±0.01	5.60±0.05	5.60±0.04	5.60±0.04
	Intensity	5.50±0.01	4.20±0.02	4.80±0.02	5.70±0.04	5.70±0.02	5.70±0.03
Smell	Clarity	5.30±0.02	4.80±0.04	4.70±0.02	4.70±0.05	4.70±0.03	4.80±0.03
	Intensity	6.90±0.04	6.10±0.02	6.10±0.02	6.00±0.04	6.00±0.01	6.30±0.02
	Finesse	6.80±0.02	6.00±0.03	6.20±0.02	6.10±0.01	6.10±0.04	6.20±0.05
	Harmony	6.80±0.05	6.00±0.02	6.00±0.02	6.20±0.04	6.20±0.02	6.40±0.04
Taste	Clarity	4.40±0.03	4.40±0.04	4.50±0.02	4.50±0.06	4.50±0.03	4.70±0.03
	Intensity	5.60±0.01	6.00±0.01	6.10±0.02	5.50±0.03	5.50±0.01	6.10±0.06
	Body	5.20±0.01	5.60±0.05	5.70±0.02	5.40±0.07	5.40±0.03	6.20±0.04
	Harmony	5.40±0.04	6.00±0.06	5.80±0.02	5.50±0.04	5.50±0.01	6.00±0.02
	Durability	5.40±0.02	5.80±0.03	5.90±0.02	5.50±0.06	5.50±0.03	6.10±0.01
	Aftertaste	3.80±0.02	4.30±0.05	4.30±0.02	4.00±0.05	4.00±0.01	4.70±0.02
General Impressions		5.70±0.02	6.00±0.04	5.90±0.01	5.50±0.03	5.40±0.02	6.10±0.03
Total points		77.20±0.34	74.30±0.45	76.00±0.26	73.20±0.58	75.20±0.32	80.1±0.44

All studied wines showed high levels of total extract – 25.20±0.34 g/dm^3 in Storgoziya to 29.70±0.34 g/dm^3 in Kaylashky rubin. The Rubin wine sample was distinguished by the highest content of total phenolic compounds (TPC) and anthocyanins, 5.96±0.41 g/dm^3 and 210.99±0.23 mg/dm^3, respectively, followed by Bouquet wine sample (3.35±0.32 g/dm^3 and 40.31±0.43 mg/dm^3, respectively). The control sample Pinot Noir wine showed values for TPC and anthocyanins – 3.54±0.41 g/dm^3 and 86.06±0.27 mg/dm^3, respectively. With the lowest indicator for TPC content were the Kaylashky rubin wines (1.43±0.21 g/dm^3), but in contrast, they were with high levels of anthocyanins (189.58±0.14 mg/dm^3). These indicators reflect the corresponding values of wine intensity and nuance, respectively 14.42±0.74 and 0.66±0.44 (Rubin); 6.52±0.15 and 0.68±0.16 (Kaylashky rubin). There were no significant statistical differences in the chemical indicators of wines from the studied varieties compared with the wine from the control grape variety (p>0.01). The data from the organoleptic indicators are shown in Table 3.

Tasting evaluation of the wines from the approved interspecific and intraspecific hybrids almost do not differ from the control. The wine of Bouquet grape variety by general organoleptic assessment (77.20±0.34) was the closest to control Pinot Noir (80.10±0.44) followed by Kaylashky rubin (76.00±0.26). The wine from Storgozia was characterized by coarse tannins. It had the lowest assessment - 73.20±0.58 points.

The wines were characterized by good limpidity, intense dark red color, high extract level, pleasant, balanced, with a good combination of alcohol and acids and harmonious taste. They were suitable for aging with the exception of Trapezitza wine, which is lighter and more less extractive; it was suitable for consumption as a young wine.

Conclusion

The obtained results give reason to conclude that there is no significant difference in the chemical indicators (ethyl alcohol content, vol. %; sugars, g/dm^3; glucose g/dm^3; fructose g/dm^3; density, g/dm^3; total extract, g/dm^3; titratable acids, g/dm^3; volatile acids, g/dm^3, free SO_2, mg/dm^3; total SO_2, mg/dm^3; TPC, g/dm^3; anthocyanins, mg/dm^3; intensities – I; nuance, T; pH;) and organoleptic (color, smell, taste and overall impression) evaluation between wines from the studied grape varieties (Storgoziya, Kaylashky rubin, Trapezitza, Rubin, Bouquet) and wine from control grape variety Pinot Noir. The produced wines are characterized by intense dark red color, high extract content and harmonious taste. They are suitable for aging. The wine produced from Trapezitza grape variety is lighter and less extractive. Therefore, it is suitable for consumption as young wine. The investigated grape varieties are suitable for vine-growers and wine-makers for planting new arrays with vineyards in Bulgaria.

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