Зборник Матице српске за природне науке / Matica Srpska J. Nat. Sci. № 146, 115—128, 2024

UDC 634.84(497.11)
https://doi.org/10.2298/ZMSPN2446115B
ORIGINAL ARTICLE
Received: 4. 9. 2023.
Accepted: 23. 10. 2023.

Ivan Z. BRADIĆ[1*], *Miloš P. RISTIĆ*[1], *Ivana S. MOŠIĆ*[1], *Radoslav B. MILIĆ*[1], *Milan M. BEADER*[1], *Darko D. JAKŠIĆ*[2]

[1] Centre for Viticulture and Oenology Niš,
Kolonija EI 6, Niš 18116, Serbia
[2] Institute for Science Application in Agriculture,
Bulevar Despota Stefana 86b, Belgrade 11000, Serbia

UVOLOGICAL CHARACTERISTICS OF LOCAL GRAPEVINE VARIETIES: *SMEDEREVKA* AND *ŽAMETOVKA*

ABSTRACT: Research of uvological characteristics is one of the obligatory steps for determination of general production and technological value of grapevine varieties. Such research is particularly recommended for local varieties that did not previously show satisfying characteristics necessary for production of high-quality wine. Local grapevine varieties *Smederevka* (white wine variety) and *Žametovka* (red wine variety) have mostly served for production of low-quality wine in the past. With changes in the manner of production in the sense of focus on high-quality wine and production of wine with geographical indications, vineyards planted with these varieties in Serbia have mostly been grubbed up. However, due to the characteristic and favourable *terroir* conditions, they have survived in the Trstenik wine-growing district (subregion within the Tri Morave wine-growing region). With the aim of determining uvological characteristics of these two varieties in current climate conditions that are favourable for these high-yield varieties, this paper examines the mechanical composition of grape bunches (bunch weight, number of berries, stem weight), mechanical composition of berries (weight of 100 berries, weight of skin of 100 berries, weight of mesocarp of 100 berries and weight of seeds of 100 berries), as well as grape must characteristics (sugar content and total acids in grape must) of representative genotypes of local varieties *Smederevka* and *Žametovka* in production vineyards in the Trstenik wine-growing district. Research results have shown that uvological characteristics of these varieties are slightly better in comparison with previous research carried out in other wine-growing areas, that is, in comparison with general information from literature, which indicates the necessity for further research of these varieties in different agro-ecological conditions.

KEYWORDS: *Smederevka*, Trstenik wine-growing district, uvological characteristics, *Žametovka*

[*] Corresponding author. E-mail: i.bradic@cevvin.rs

INTRODUCTION

Uvology is a part of ampelography that deals with the study of the mechanical and chemical composition of grape bunches and berries (Avramov and Žunić, 2001). Mechanical and chemical composition of grape bunches and berries, and grape must quality are elements that are important for production and technological characteristics (value for cultivation and use) of grapevine varieties that need to be determined in order to achieve the goal of preservation of local varieties and for their clonal selection. Given that grapevine is predominantly cultivated for its grapes, which is intended for processing or consumption of unprocessed grapes, research and knowledge of economic and technological characteristics is very important, and these characteristics depend on a series of abiotic and anthropogenic *terroir* factors (Jakšič, 2023).

Smederevka is a very old Serbian autochthonous grapevine variety, as confirmed by its name. In addition to Serbia, it is also cultivated in other neighbouring countries (Jakšić et al., 2019). Its bunches are large, most often conical, with medium thinning, with average weight between 200 and 300 grams (Cindrić et al., 2000). Berries are mostly large, oval, yellow-green in colour, with amber spots on the insulated side (Cindrić et al., 2000). Surfaces of commercial vineyards planted with this variety amount to 149 ha (Jakšić, 2019). The majority of surfaces of commercial vineyards with this variety are located in the Vršac, Župa and Trstenik wine-growing districts. *Smederevka* is characterized by high yields and large berries and bunches. *Smederevka* used to be one of the important local varieties in Serbia, in particular in the Trstenik wine-growing district, and it is necessary to continue research into characteristics of this variety.

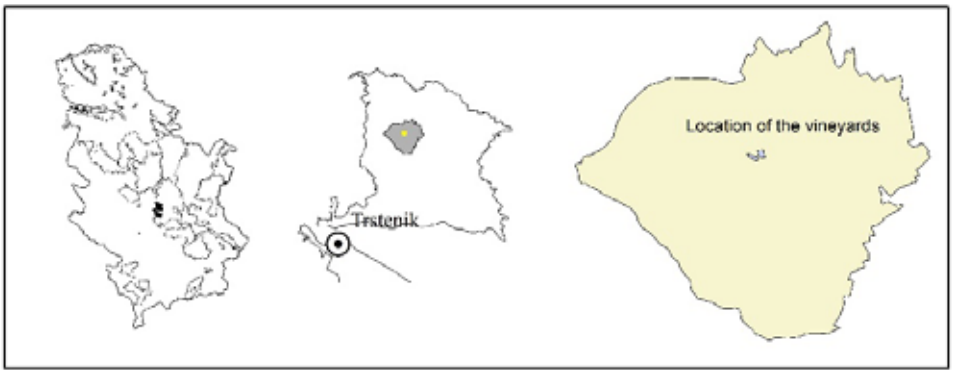
Žametovka, also known as *Kavčina*, is a red wine variety mostly cultivated in Slovenia, Croatia, Austria, Germany, and as a local variety in Serbia (Cindrić et al., 2000). *Žametovka* is the main red wine variety in production of traditional wine from grapes of several varieties with the geographical indication "Cviček" (Raspor et al., 2002; Vršić et al., 2011). The old *Žametovka* grapevine in the Slovenian city of Maribor is considered to be the oldest grapevine in the world (Vršić et al., 2011; Terčelj, 2015). The *Žametovka* variety is also characterized by high yields (Cindrić et al., 2000; Jakšić et al., 2019), with grape bunches weighing about 200 grams, branched medium-dense bunches, its berries are mid-sized and round, with thick skin, black-blue in colour and firm flesh (Cindrić et al., 2000). Surfaces of commercial vineyards with this variety in Serbia are about 10 ha (Jakšić, 2019), and the majority of these can be found in the Trstenik wine-growing district. Since this is an emerging variety, there is need for research into its characteristics with the aim of affirmation and increasing surfaces planted with this variety.

The aim of this paper is to research mechanical and chemical composition of grapes and quality of grape must from the *Smederevka* and *Žametovka* grapevine varieties.

MATERIALS AND METHODS

Research into the characteristics of grape bunches, berries, and grape must presented in this paper was carried out in 2019, 2020 and 2021 for 6 genotypes of the *Smederevka* variety and 7 genotypes of the *Žametovka* grapevine variety, through the activities: determination of mechanical composition of grape bunches and berries, and determination of chemical composition and certain qualitative characteristics of grape must.

Research was carried out in production vineyards in the Trstenik wine-growing district, which is situated in the Tri Morava wine-growing region (PDO), in the cadastral municipality of Mala Sugubina (Map 1). The vineyard with the *Smederevka* variety in which research was carried out has the surface of 0.245 ha, it was planted in 1990, average elevation of this vineyard is 334 m, and terrain exposure is south-eastern, with the terrain slope of 6.9°. The vineyard with the *Žametovka* variety has the surface of 0.232 ha, it was planted in 1979, with the average elevation of 320 m, also with south-eastern exposure, and terrain slope of 4.5°.



Map 1. Location of vineyards from which genotypes were selected

Determination of mechanical composition of grape bunches and berries

Determination of mechanical composition of grape bunches – analysis of mechanical composition of grape bunches in this paper is presented on the representative samples of grape bunches in optimal ripeness. All bunches collected from selected genotypes of the *Smederevka* and *Žametovka* varieties were analyzed. Weight (mass) of grape bunches was determined by weighing each individual bunch on an analytical scale in the oenological laboratory of the Centre for Viticulture and Oenology in Niš. After determining the weight (mass) of bunches, all berries were removed from bunches and the remaining stems were weighed on the analytical scale (g). The weight (mass) of berries on the given bunch was determined by subtracting the weight of stems from

the weight of bunches, and the number of berries per bunch was determined by counting all berries.

Mechanical composition of berries was determined through analysis on the samples of 100 berries. Further procedure for analysis of the sample of 100 berries included removing the skin and seeds from each berry. The skin was afterwards washed so as to contain no flesh and dried on an absorbent paper so as to contain no water. The seeds were also washed and dried on absorbent paper. The seeds were afterwards counted, and both the skin and seeds were weighed on a high-precision analytical scale.

Determination of chemical composition of certain qualitative characteristics of grape must

After harvesting the entirety of grape bunches from grapevine plants of the 13 selected genotypes of the *Smederevka* and *Žametovka* varieties, transport and temporary storage in cold conditions, grapes were crushed with the focus on maintaining a moderate must yield.

Analysis of chemical parametres of grape must from selected genotypes of the *Smederevka* and *Žametovka* varieties was carried out in the laboratory of the Centre for Viticulture and Oenology in Niš.

Determination of sugar content in grape must was carried out with the use of a digital refractometer in accordance with the method approved by the International Organization of Vine and Wine (hereinafter: OIV) Method OIV-MA-AS2-02 (OIV, 2016).

Determination of total acids in grape must was carried out with the use of a titrator in accordance with the OIV method: Method OIV-MAAS313-01 (OIV, 2016).

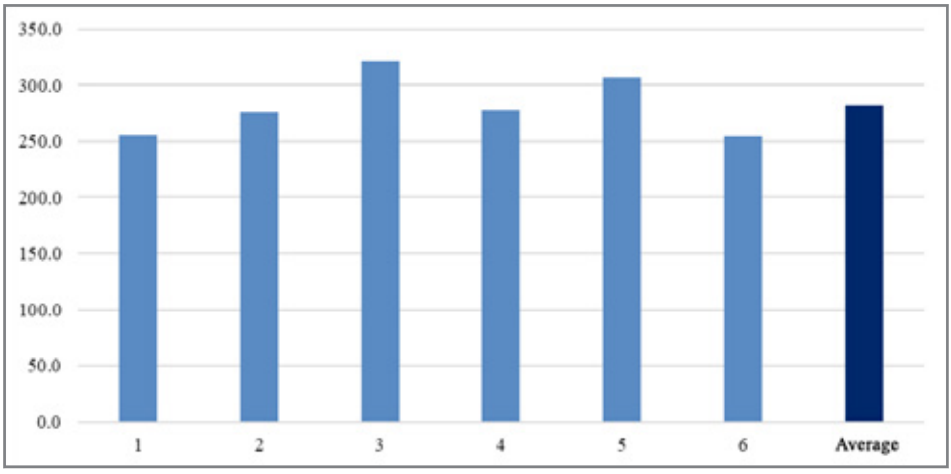
Determination of grape must pH was caried out potentiometrically in accordance with the OIV method: Method OIV-MA-AS313-15 (OIV, 2016).

RESULTS AND DISCUSSION

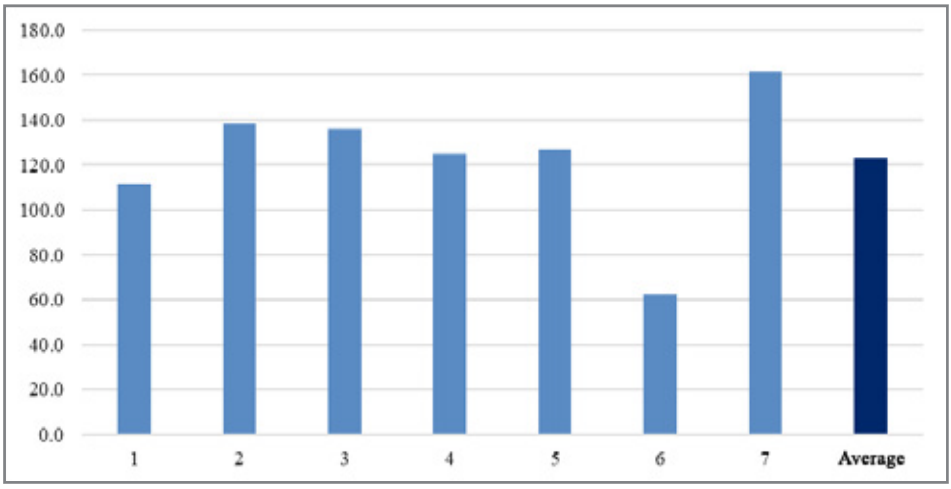
Mechanical composition of grape bunches

Research of representative genotypes of the *Smederevka* variety in the period from 2019 to 2021 in conditions prevalent in the Trstenik wine-growing district determined the average grape bunch weight of 281.8 g (Graph 1). The average grape bunch weight determined in this research is in line with information from literature (Avramov and Žunić, 2001; Žunić and Garić, 2016). However, the weight of bunches determined in these previous research papers was lower than the weight of bunches determined in the Podgorica wine-growing district (Montenegro) (Savić, 2016) and in the Čegar wine-growing district (Radojević, 2021).

Research of the weight of grape bunches on representative genotypes of the *Žametovka* variety in conditions prevalent in the Trstenik wine-growing district in the period from 2019 to 2021 determined that the average weight of bunches is 123.2 g (Graph 2). The average grape bunch weight determined in this research is lower than the weight listed in available literature (Avramov and Žunić, 2001; Žunić and Garić, 2016).



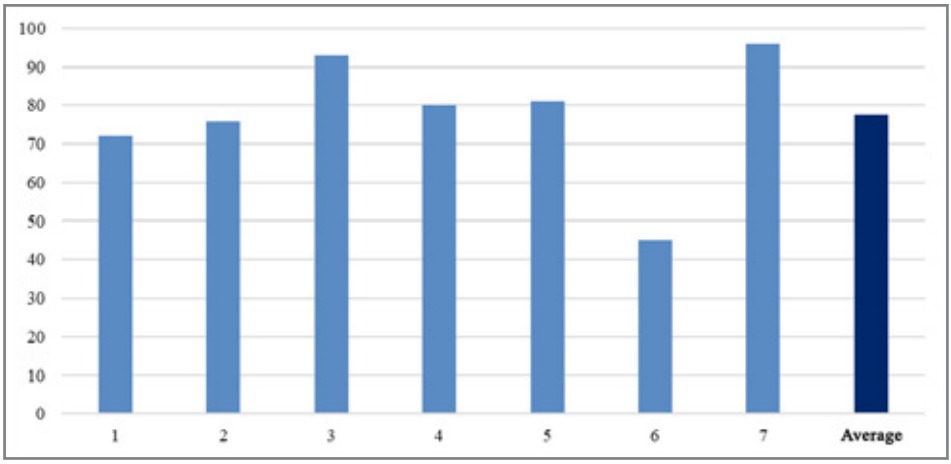
Graph 1. Average weight of grape bunches (grams) of the S*mederevka* variety in representative genotypes (1–6) and total average (2019–2021)



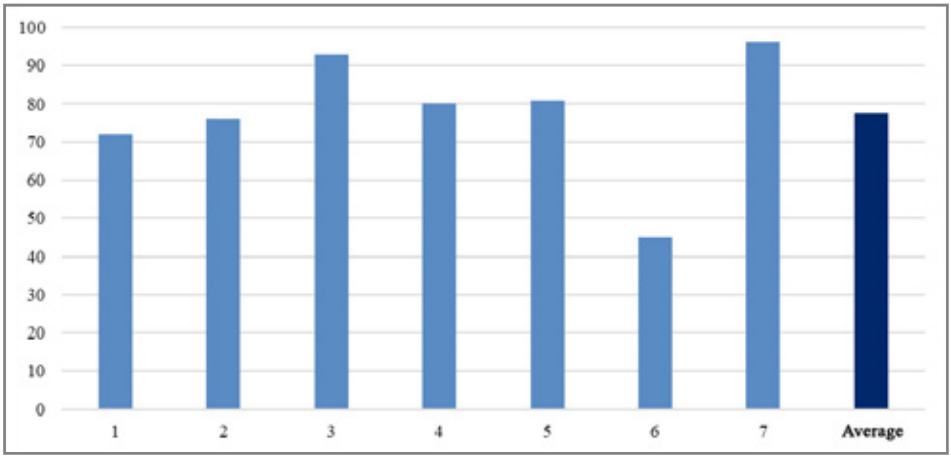
Graph 2. Average weight of grape bunches (grams) of the *Žametovka* variety in representative genotypes (1–7) and total average (2019–2021)

The determined number of berries per bunch for the *Smederevka* variety was 93 (Graph 3), which is similar (Žunić and Garić, 2016) or lower (Avramov and Žunić, 2001) in comparison with information from literature concerning this uvological characteristic of the *Smederevka* local variety. However, the number of berries per bunch was significantly lower in comparison with research into this characteristic of the S*mederevka* variety carried out in the Čegar wine-growing district (Radojević, 2021).

The average number of berries per bunch for the *Žametovka* variety was 78 (Graph 4), which is in line with information on the number of berries available in literature (Avramov and Žunić, 2001; Žunić and Garić, 2016).



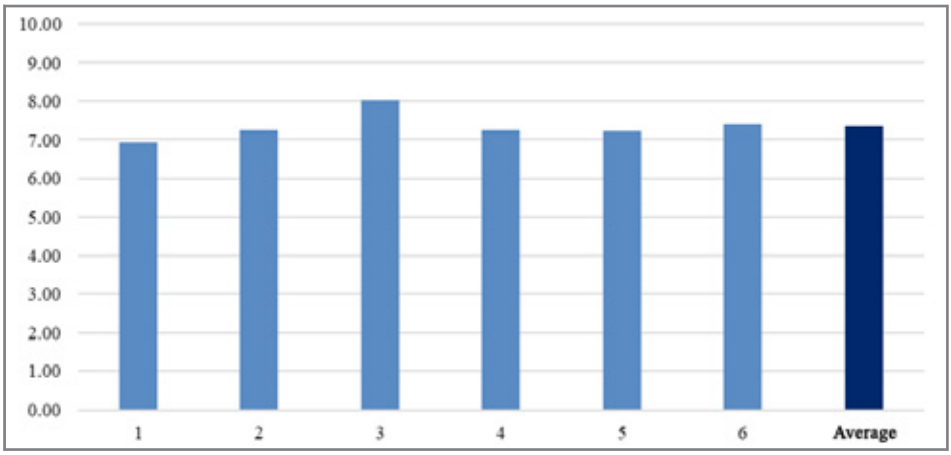
Graph 3. Average number of berries per bunch (grams) for the S*mederevka* variety in representative genotypes (1–7) and total average (2019–2021)



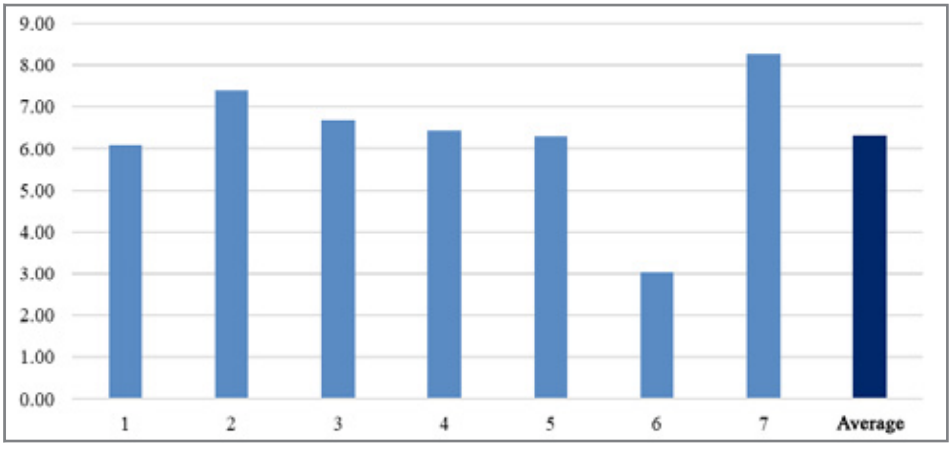
Graph 4. Average number of berries per bunch for the *Žametovka* variety in representative genotypes (1–7) and total average (2019–2021)

With respect to the average weight of grape bunch stems (g) for the *Smederevka* variety, the determined value was 7.35 g (Graph 5). Weight of bunch stems determined in this research was within values for this parametre from literature (Avramov and Žunić, 2001; Žunić and Garić, 2016). The determined weight of grape bunch stems is lower than the weight of grape bunch stems from *Smederevka* determined in the research carried out in the Čegar wine-growing district (Radojević, 2021).

The average weight of grape bunch stems for the *Žametovka* variety was 6.32 g (Graph 6). The weight of grape bunch stems determined in this research was in line with general information from available literature (Avramov and Žunić, 2001; Žunić and Garić, 2016).



Graph 5. Average weight of grape bunch stems (grams) for representative genotypes (1–6) of the S*mederevka* variety and total average (2019–2021)



Graph 6. Average weight of grape bunch stems (grams) for representative genotypes (1–7) of the *Žametovka* variety and total average (2019–2021)

Mechanical composition of grape berries

The average weight of 100 berries (g) of representative genotypes of the *Smederevka* variety was 299.1 g (Table 1). The determined average weight of 100 berries in the Trstenik wine-growing district was less than the weight of berries determined in the Čegar wine-growing district (Zirojević, 1974; Radojević, 2021).

The determined average weight of 100 berries (g) of representative genotypes of the *Žametovka* variety was 152.0 g (Table 1).

Image 1. Representative genotype 5 of the S*mederevka* grapevine variety

Image 2. Representative genotype 2 of the Ž*ametovka* grapevine variety

The determined average weight of skin of 100 berries (g) for the *Smederevka* was 27.35 g (Table 1), which is significantly less than the weight of skin for the *Smederevka* variety determined in conditions of the Čegar wine-growing district (Radojević, 2021). Unlike the *Smederevka* variety, the average weight of skin of 100 berries of the *Žametovka* variety was 15.41 g (Table 1).

The average weight of mesocarp of 100 berries of the *Smederevka* variety was 264.49 g (Table 1), which is similar (Radojević, 2021), or less (Zirojević, 1974), than the weight of the mesocarp determined in conditions in the Čegar wine-growing district. With respect to the *Žametovka* variety, average weight of the mesocarp of 100 berries (g) was 130.57 g (Table 1).

Average weight of seeds of 100 berries of the *Smederevka* variety was 7.26 g (Table 1), which is less than the value for the *Smederevka* determined in the Čegar district (Radojević, 2021). Average weight of seeds of 100 berries (g) of the *Žametovka* variety was 6.07 g (Table 1).

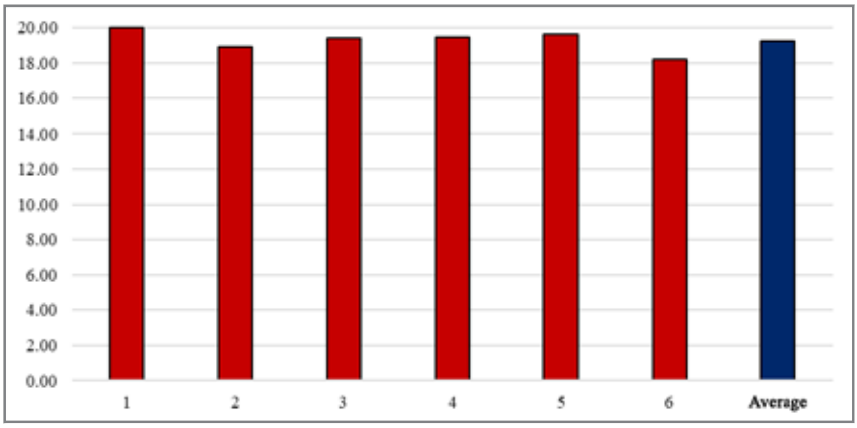
Table 1. Mechanical composition of genotypes of the *Smederevka* and *Žametovka* grapevine varieties (average 2019–2021)

Local variety	Genotype designation	100 berries (g)	Skin of 100 berries (g)	Mesocarp of 100 berries (g)	Seeds of 100 berries (g)
Smederevka	1	291.4	27.03	258.23	6.17
	2	269.5	22.4	240.25	6.82
	3	304.1	27.53	267.83	8.73
	4	308.3	30.07	270.83	7.43
	5	351.5	33.43	310.27	7.8
	6	269.8	23.63	239.53	6.6
	Average	299.1	27.35	264.49	7.26
Žametovka	1	153.1	14.73	132.08	6.32
	2	177.5	17.07	153.44	6.96
	3	145.6	14.3	125.92	5.42
	4	134.6	15.53	113.3	5.79
	5	152.9	15.33	131.85	5.7
	6	134.7	14.57	113.91	6.24
	7	165.9	16.33	143.47	6.06
	Average	152.0	15.41	130.57	6.07

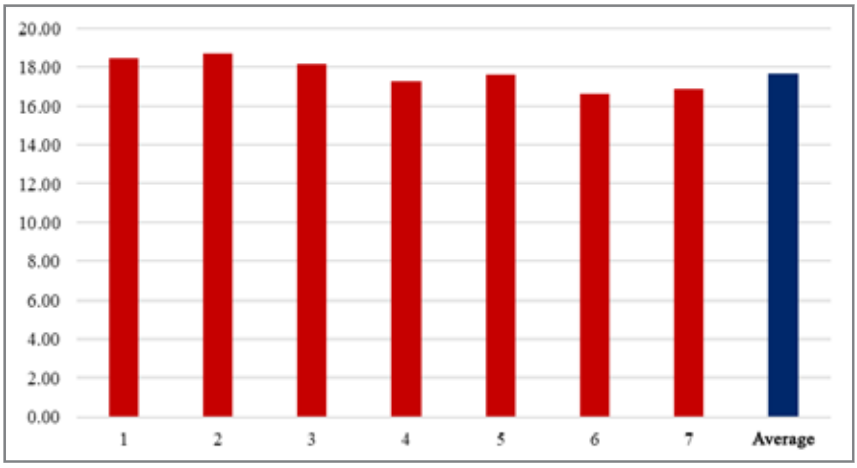
Grape must characteristics

Average sugar content for representative genotypes of the *Smederevka* variety determined in conditions in the Trstenik wine-growing district was 19.27% (Graph 7). Results for sugar content obtained in this research are in accordance with information from available literature (Avramov and Žunić, 2001; Žunić and Garić, 2016). In addition, the determined sugar content in this research was higher that the sugar content determined in conditions of the Fruška Gora (Cindrić et al., 2000), Podgorica (Savić, 2016) and Čegar wine-growing

district (Zirojević, 1974; Radojević, 2021). The determined average sugar content for representative genotypes of the *Žametovka* variety was 17.7% (Graph 8). Results of sugar content research for this paper correspond to information from available literature (Avramov and Žunić, 2001; Žunić and Garić, 2016).



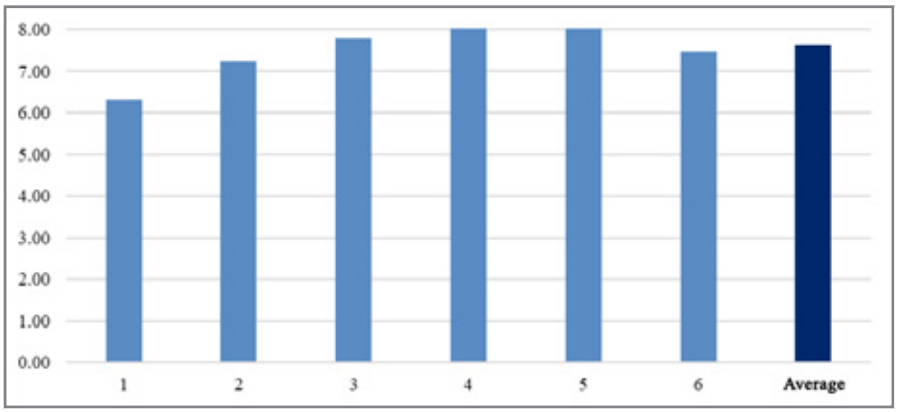
Graph 7. Average sugar content in grape must of the S*mederevka* variety, representative genotypes and total average (%) (2019–2021)



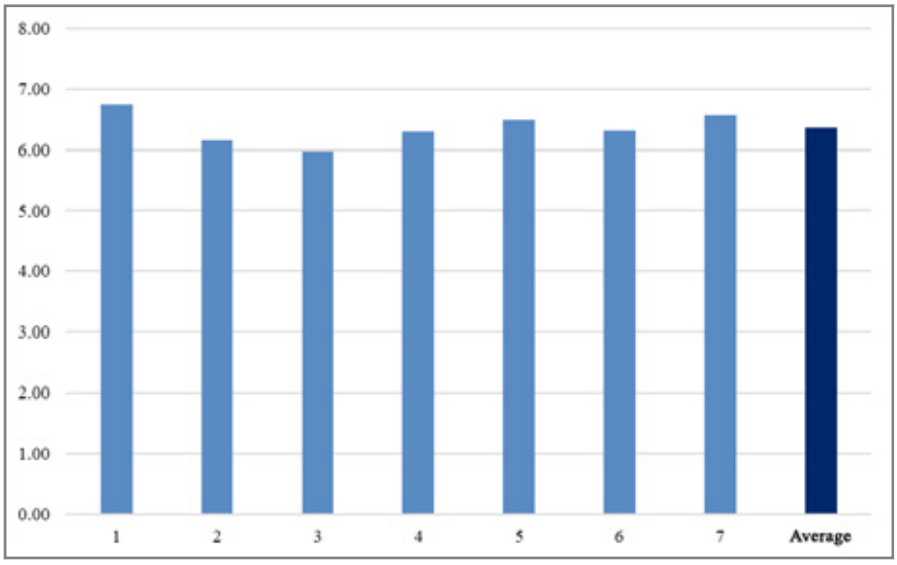
Graph 8. Average sugar content in grape must of the *Žametovka* variety, representative genotypes and total average (%) (2019–2021)

With respect to the total acids content (g/l) determined in this research for the *Smederevka* variety, it was 7.64 g/l (Graph 9). Research results for the total acids content for this paper correspond to general information from literature (Avramov and Žunić, 2001; Žunić and Garić, 2016), and are higher than the acids content determined for the *Smederevka* variety in the Podgorica

wine-growing district (Savić, 2016). The average determined acids content in our research was lower than the same parameter determined in experiments for the Grocka (Nikolić et al. 2018), Fruška Gora (Cindrić et al., 2000) and Čegar wine-growing districts (Zirojević, 1974, Radojević, 2021). Total acids content for representative genotypes of the *Žametovka* variety was 6.37 g/l (Graph 10). Research results for total acids content determined for this paper were lower than the information from available literature (Avramov and Žunić, 2001; Žunić and Garić, 2016).



Graph 9. Average total acids content in grape must from selected genotypes (1–6) of the *Smederevka* variety (%) (2019–2021)



Graph 10. Average total acids content in grape must from selected genotypes (1–7) of the *Žametovka* variety (%) (2019–2021)

CONCLUSION

Based on research of uvological characteristics of grapes from representative genotypes of local grapevine varieties *Smederevka* and *Žametovka* in conditions of the Trstenik wine-growing district, it can be concluded that there are certain differences between the examined genotypes, but that general characteristics are as usual for these varieties.

With respect to the mechanical composition of grape bunches, the average weight of bunches (g) for the *Smederevka* variety was 281.8 g, and for the *Žametovka* variety 123.2 g. The average number of berries for the *Smederevka* variety was 93, and 78 for the *Žametovka* grapevine variety. Average weight of grape bunch stems for the *Smederevka* variety was 7.35 g, and the average weight of grape bunch stems for the *Žametovka* variety was 6.32 g. The aforementioned values for the mechanical composition of grapes for the *Smederevka* and *Žametovka* varieties are in line with values from available literature, with the exception of the weight of the *Žametovka* grape bunches which was significantly lower than other available information and this is primarily explained by the age of the vineyard in which research was conducted. Furhermore, the uvological characteristics for the number of berries of the *Smederevka* variety was lower than the weight from research carried out in the Čegar wine-growing district.

Concerning the mechanical composition of berries, in particular average weight of 100 berries (g), the average value for the *Smederevka* variety was 299.1 g and for the *Žametovka* variety 152 g. The determined average weight of skin of 100 berries (g) of the *Smederevka* variety was 27.25 g and 15.41 g for the *Žametovka* variety. The average weight of mesocarp of 100 berries of the *Smederevka* variety was 264.49 g, and for the *Žametovka* variety 130.57 g. The average weight of seeds of 100 berries (g) of the *Smederevka* variety was 7.26 g and for the *Žametovka* variety 6.07 g. Characteristics of the mechanical composition of berries in research carried out in the Trstenik wine-growing district were slightly lower in comparison with the research of the *Smederevka* variety carried out in the Čegar wine-growing district.

With respect to the characteristics of grape must, that is, average sugar content (%), it amounted to 19.27% for the *Smederevka* variety and 17.7% for the *Žametovka* variety. Average total acids content (g/l) was 7.64 g/l for the *Smederevka* and 6.37 g/l for the *Žametovka* variety. Characteristics of grape must for these two varieties were mostly within the values for these parametred obtained in other research, however, sugar content for the *Smederevka* variety was higher than in all other research carried out in the Fruška Gora, Podgorica and Čegar wine-growing districts. The total acids content of the *Smederevka* variety was lower than the values for that parametre determined in other research in continental wine-growing areas. In addition, the total acids content for the *Žametovka* variety was lower than the information available in literature.

Base on the aforementioned, it can be concluded that local grapevine varieties *Smederevka* and *Žametovka* have slightly better uvological charac-

teristics in the Trstenik wine-growing district in comparison with previous research, and warrant attention and should be the subject of further research. This refers in particular to the study of the uvological characteristics of the bunches and berries of these varieties in other wine-growing areas, with special attention to future research on the sugar and acid content of grape musts under the conditions of current climatic changes.

REFERENCES

Avramov L, Žunić D (2001): *Posebno vinogradarstvo*. Zemun: Poljoprivredni fakultet u Beogradu

Cindrić P, Korać N, Kovač V (2000): *Sorte vinove loze*. Novi Sad: Univerzitet u Novom Sadu.

Jakšić D, Bradić I, Beader M, Milić R, Ristić M (2019): Autohtone i regionalne sorte vinove loze. Niš: Centar za vinogradarstvo i vinarstvo.

Jakšić D (ed.) (2019): *Vinogradarstvo i vinarstvo Srbije*. Niš: Centar za vinogradarstvo i vinarstvo.

Jakšić D (ed.) (2023): *Sorta vinove loze bagrina*. Niš: Centar za vinogradarstvo i vinarstvo.

Nikolić D, Miljković J, Rakonjac V, Radojević I, Ranković Vasić Z (2018): Inheritance and phenotypic orrelations of agronomic traits in grapevine offsprings. *Acta Sci. Pol. Hortorum Cultus*, 17: 87–99.

OIV (2021): Method OIV-MA-AS311-01A: Compendium of International Methods of Wine and Must Analysis, Vol 1, Edition 2016, OIV, Paris, France.

Raspor P, Cus F, Povhe Jemec K, Zagorc T, Cadez N, Nemanic J (2002): Yeast population dynamics in spontaneous and inoculated alcoholic fermentations of Zametovka must. *Food Technol. Biotechnol.* 40: 95–102.

Radojević I (2021): *Biološke i proizvodne osobine perspektivnih hibrida vinove loze iz različitih kombinacija ukrštanja*. Doktorska disertacija, Beograd; Poljoprivredni fakultet.

Savić S (2016): *Crnogorska ampelografija*. Podgorica: Crnogorska akademija nauka i umjetnosti

Terčelj D (2015): *The Culture of Wine in Slovenia*. Ljubljana: University of Primorska and Slovene ethnographic museum.

Vršić S, Ivančić A, Šušek A, Zagradišnik J, Valdhuber J (2011): The World's oldest living grapevine specimen and its genetic relationships. *Vitis* 50: 167–171.

Zirojević D (1974): *Poznavanje sorata vinove loze*. Tom II. Niš: Gradina.

Žunić D, Garić M (2016): *Posebno vinogradarstvo*. Kosovska Mitrovica: Poljoprivredni fakultet Univerziteta u Prištini.

ОРИГИНАЛНИ ЧЛАНАК
Примљен: 4. 9. 2023.
Прихваћен: 23. 10. 2023.

УВОЛОШКЕ КАРАКТЕРИСТИКЕ ЛОКАЛНИХ СОРТИ ВИНОВЕ ЛОЗЕ: *СМЕДЕРЕВКА* И *ЖАМЕТОВКА*

Иван З. БРАДИЋ[1], Милош П. РИСТИЋ[1], Ивана С. МОШИЋ[1], Радослав Б. МИЛИЋ[1], Милан М. БЕАДЕР[1], Дарко Д. ЈАКШИЋ[2]

[1] Центар за виноградарство и винарство Ниш, Колонија ЕИ 6, Ниш 18116, Србије
[2] Институт за примену науке у пољопривреди Београд, Булевар деспота Стефана 86б, Београд 11000, Србија

РЕЗИМЕ: Испитивање уволошких карактеристика једна је од обавеза утврђивања општих привредно-технолошких вредности сорти винове лозе. Таква истраживања је препоручљиво извршити нарочито код локалних сорти које у ранијем периоду нису показивале добре особине неопходне за производњу висококвалитетних вина. Локалне сорте *смедеревка* (бела винска сорта) и *жамето̄вка* (црна винска сорта) су у ранијем периоду углавном служиле за производњу нискоквалитетних вина. Променом начина производње у смислу потенцирања висококвалитетних вина, односно производње вина са географским пореклом, виногради са овим сортама у Србији су доста искрчени, али су се због специфичних и повољних услова *terroir*-а делимично задржале у Трстеничком виногорју (рејон Три Мораве). У циљу утврђивања уволошких карактеристика ове две сорте у садашњим условима климатских промена које погодују овим високородним сортама у овом раду испитани су механички састав грозда (маса грозда, број бобица и маса шепурине), механички састав бобице (маса 100 бобица, маса покожице 100 бобица, маса мезокарпа 100 бобица и маса семенки 100 бобица), као и карактеристике шира (садржај шећера и укупних киселина у ширу) репрезентативних генотипова локалних сорти *смедеревка* и *жамето̄вка* у производним засадима у Трстеничком виногорју. Резултати истраживања су показали да су уволошке карактеристике ових сорти углавном нешто боље у односу на ранија истраживања у другим виноградарским подручјима или у односу на опште литерарне податке, што упућује на неопходност даљих истраживања ових сорти у другим агроеколошким условима.

КЉУЧНЕ РЕЧИ: *смедеревка*, Трстеничко виногорје, уволошке особине, *жамето̄вка*