NEWLY CREATED ČAČAK'S SOUR CHERRY VARIETIES AS A RAW MATERIAL FOR SPIRIT PRODUCTION

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Abstract: According to the average annual production, sour cherries take the third place in Serbian fruit production. In the assortment, the most represented is the autochthonous variety 'Oblačinska', which is characterized by a very small fruit. In recent decades, large-fruited varieties bred at the Fruit Research Institute in Čačak, have become more widespread in sour cherry orchards. Some of the newly bred varieties, similar to 'Oblačinska', are characterized by combined properties and can be used as fresh fruit and/or for various types of processing. Sour cherries are mainly used in Serbia as raw material for obtaining numerous products. Frozen cherries dominate, but juices, sour cherry in brine, dried fruits, candied fruits, compote, wine, vinegar, liqueurs are also produced, and in recent years, sour cherry spirit is gaining interest. The paper presents the results of two-year examinations of the suitability of two varieties of sour cherries with combined properties - 'Šumadinka' ('Köröser Weichsel' × 'Heimanns Konservenweichsel') and 'Sofija' ('Čačanski rubin' × 'Heimanns Konservenweichsel'), bred in Čačak, and standard variety 'Heimanns Konservenweichsel', for the production of spirits. The sour cherry spirits were produced from spontaneously fermented mashes of sour cherry fruits with stones, followed by double distillation in alembic of traditional design. The obtained monovarietal sour cherry spirits differed significantly in spirit yields and contents of the ten major volatile components. Based on the results of sensory analysis in both years, all obtained monovarietal sour cherry spirits can be classified as high-quality spirit drinks.

INTRODUCTION

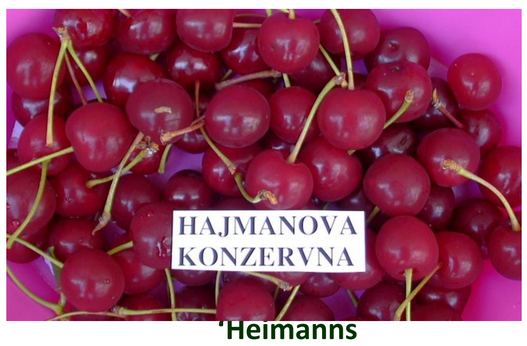
Serbia is the fourth producer of sour cherries in Europe, and the seventh in the world. The small-fruited cultivar 'Oblačinska', whose fruit weight depending on the clone varies between 2.62 and 3.52 g, and which is mainly used for processing, dominates in the sour cherry production with a share of 60 to 70%. There is a tendency for spreading varieties with large fruit, larger than 5 g, which can be used for processing, but also for fresh consumption. Among large-fruited varieties, in addition to the most commonly grown introduced variety 'Heimanns Konservenweichsel', 'Šumadinka' and 'Sofija' resulting from the breeding work at the Fruit Research Institute in Čačak - are also grown in Serbia. Sour cherries in Serbia are mainly used for processing; production of frozen cherries. The rest is used in industry and households for the production of juices, syrups, candied fruits, sour cherries in brine, liqueurs, and more recently for the production of dried sour cherries and sour cherry spirit. Sour cherry spirit is a delicacy product, consumed colorless, as an aperitif. Beside the method of production, the sour cherry variety has a decisive effect on the quality of the sour cherry spirit. Similar to some plum varieties bred in Čačak that were not primarily aimed as brandy varieties, but were used in this way, Čačak's sour cherry varieties also were not bred with the intention of being brandy varieties, but were used in this way in certain years. Thus the aim of this work was to examine the suitability of Čačak's sour cherry varieties for the production of brandy (spirit).

MATERIALS AND METHODS

Fully ripe fruits without stalks of the sour cherry cultivars 'Šumadinka', 'Sofija' and 'Heimanns Konservenweichsel' were picked (70 kg fruits from each cultivar tested) in experimental orchard in Čačak, Serbia, during 2016 and 2017. The Mettler technical scale was used for the fruit and stone mass determination; stone ratios were calculated from these values. Standard methods were used for determination of soluble solids contents (SSC) (by refractometry), total sugars, invert sugars and sucrose contents (Luff-Schoorl method), total acids (by neutralisation with 0.1 M NaOH) and pH values (by pH metry). The sugar/acid ratio was calculated.

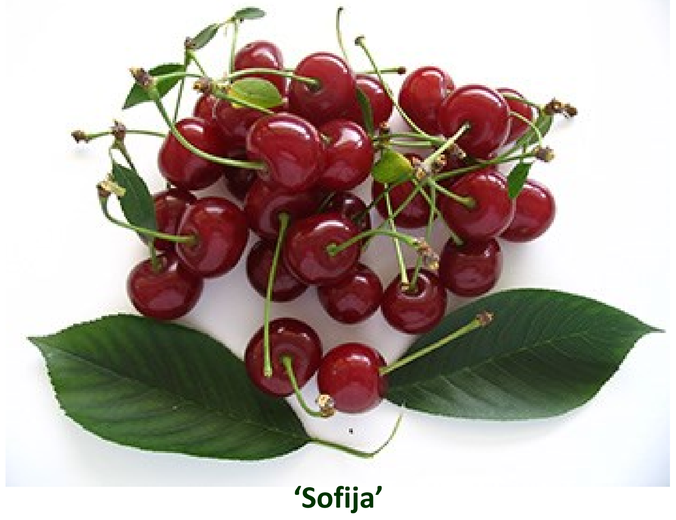
Polyethylene vessels for alcoholic fermentation (three replications for each cultivar) were filled with 20 kg of manually crushed fruits with stones. Sour cherry mashes with stones were spontaneously fermented at a temperature of approximately 20 °C. The dynamics of mash alcoholic fermentations was monitored daily (by refractometry). The mashes were distilled immediately after completion of alcoholic fermentation. Pilot-scale copper alembic (volume of the boiler was 25 L) was used for fermented mashes distillation; the first distillates with an ethanol content of 22 vol.% were obtained. For the second distillation (redistillation of the first distillate), the same distillation equipment was used; three fractions were separated during the second distillation: head (1% of the first distillate volume put in the boiler of alembic), heart (60 vol% ethanol content) and tail. Only the middle fractions (hearts) were used for further chemical and sensory analyses. Before analyses, the ethanol content in the heart-fractions obtained by the second distillation was reduced with deionised water from 60 to 42 vol.%. Yield of the sour cherry distillates was expressed as the yield of the first distillate (expressed in L, with an ethanol content of 22 vol%) obtained by distillation of 20 kg of mash, and then multiplied by 5, to be expressed on 100 kg fruits (L of distillate containing 22 vol% ethanol/100 kg fruits with stones).

The methanol, higher alcohols, ethyl acetate and acetaldehyde contents in the sour cherry spirits were determined by gas chromatography with flame ionization detection (GC/FID) method (Popović et al., 2021), and the content of benzaldehyde was determined by the official spectrophotometric method (Sl. list SFRJ 70, 1987). The sensory analysis of colourless sour cherry spirits was conducted by a four-member expert panel using the Buxbaum method (Popović et al., 2021). Correlation analyses were performed using STATISTICA 7.0 software (Statsoft, Tulsa, OK, USA).



'Heimanns Konservenweichsel'

'Šumadinka'



'Sofija'

Figure 1. Tested sour cherry varieties

RESULTS AND DISCUSSION

Table 1. Fruit characteristics of sour cherry varieties

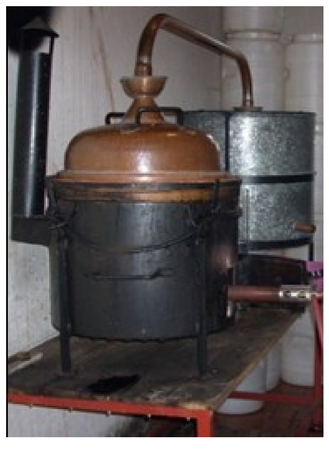
Characteristics	Varieties					
	Heimanns Konservenweichsel		Šumadinka		Sofija	
	2016	2017	2016	2017	2016	2017
Fruit mass (g)	6.70	6.65	7.54	7.52	7.09	7.01
Stone mass (g)	0.52	0.54	0.68	0.67	0.54	0.50
Stone ratio (%)	7.76	8.12	9.02	8.91	7.62	7.13
Soluble solids (%)	13.60	14.30	11.90	12.70	13.10	12.00
Total sugars (%)	8.44	9.20	6.48	6.96	8.16	7.44
Inverted sugars (%)	7.85	8.10	6.10	6.48	7.85	7.10
Sucrose (%)	0.56	1.04	0.46	0.47	0.29	0.32
Total acids (%)	1.88	2.15	1.86	0.95	1.34	1.96
pH	3.30	3.24	3.19	3.16	3.38	3.08
Sugars/acids ratio	4.49	4.28	3.48	7.33	6.09	3.80

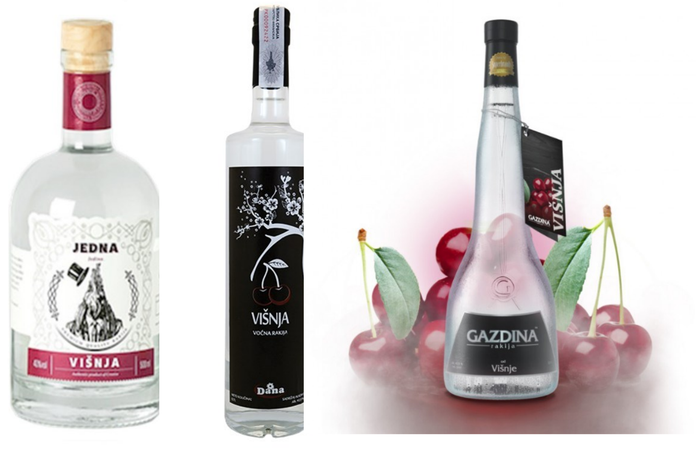
Table 2. Duration of alcoholic fermentation (DAF, days) and yield of sour cherry distillates (YSCD, L 22 vol. % distillate/100 kg mash)

Characteristics	Varieties					
	Heimanns Konservenweichsel		Šumadinka		Sofija	
	2016	2017	2016	2017	2016	2017
DAF (days)	13	12	12	12	15	18
YSCD (L 22 vol.% distillate/ 100 kg mash)	20.4	21.1	15.8	14.9	23.3	21.1

Table 3. Chemical composition (mg/L a.a.) and sensory assesment (points) of sour cherry spirits

Characteristics	Varieties					
	Heimanns Konservenweichsel		Šumadinka		Sofija	
	2016	2017	2016	2017	2016	2017
Methanol	3480	4170	4730	6330	3410	4080
Acetaldehyde	70	116	70	148	45	225
Ethyl acetate	584	836	500	638	556	1339
1-Propanol (1-P)	1385	1836	1590	2073	1227	1794
2-Methyl-1-propanol (IB)	1250	975	1297	1490	967	1033
1-Butanol	12	9	6	6	11	5
2/3-Methyl-1-butanol (IA)	2801	2280	2172	2372	2323	2071
1-Hexanol	13	17	7	17	6	8
Total higher alcohols	5461	5117	5072	5958	4534	4911
Benzaldehyde	16.2	27.3	61.5	86.2	25.7	66.5
IA/IB ratio	2.24	2.34	1.67	1.59	2.40	2.00
IB/1-P ratio	0.90	0.53	0.81	0.72	0.79	0.58
IA/1-P ratio	2.02	1.24	1.37	1.14	1.89	1.15
Sensory assesment	18.16	18.21	18.25	18.34	18.19	18.19





CONCLUSION

The large-fruited sour cherry varieties ('Šumadinka' and 'Sofija'), bred at the Fruit Research Institute in Čačak, are an interesting raw material for the production of sour cherry spirit. From both varieties, spirit of excellent sensory quality can be obtained. However, it should be taken into account that, considering the characteristics of the fruits, the processing of the variety 'Šumadinka' can yield up to 36% less distillate than the processing of the variety 'Sofija'.

Acknowledgement

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