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Special characteristics of technological indicators of white aboriginal grape varieties

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Abstract. Sparkling wines are high in demand, and they firmly occupy their strong position in wine market. In recent years, there was a re-orientation of consumers from the low-price segment of sparkling wines to the mid-price and premium ones, motivating the manufacturer to be searching for new solutions for the unique high-quality wine production. One of the ways of its producing is the use of aboriginal grape varieties. At the same time, there is insufficient information about the distinctive technological characteristics of aboriginal grape varieties, which makes it difficult to release a product of high-quality. As a research result, significant indicators were established (the mass concentrations of titratable acids, proteins, polysaccharides, the content of phenolic substances in the must without contact with the pulp, the content of phenolic substances in the must after extraction of the pulp for 4 hours, the technological stock of phenolic substances) to differentiate grapes in accordance with the origin, and characterize their technological potential. A comparative analysis of aboriginal grape varieties with classical cultivars traditionally used in sparkling wine production was carried out. Deviations in the criterion technological indicators of aboriginal grape varieties were established to be taken into account when selecting grape processing technology for high-quality sparkling wine production.

1 Introduction

Sparkling wines are very popular, and justly occupy their niche in wine market; their contribution to the wine production segment of Russian Federation is 25%. Over the last year (2022), there is a significant increase in the production of sparkling wines (by 25% compared to 2021), amounting to 16.2 million decaliters [1]. At the same time, according to the data presented by the Expert Company "Gradus" (we used for the research their Gradus Retail Index (GRI) algorithm), an assessment of sparkling wine consumption by the price segment (in 2022 compared to 2019) showed a re-orientation of local consumers of sparkling wines from the low-price segment to mid-price and premium, showing an increase of 15% and 27%, respectively [2]. In this regard, producers are working for the output of high-quality, top requested wine products. A significant contribution to the

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formation of wine quality is made by grape variety. In recent years, the use of aboriginal grape varieties has attracted some interest of both scientists and producers. It is believed that these varieties are stress-resistant to unfavorable natural and climatic conditions, and wine products made from them are characterized by unique organoleptic profiles. Some manufacturers are already using certain varieties for the production of still and sparkling wines. Using of a more wide range of aboriginal varieties necessitates the comprehensive research to determine the prospects for their use in the output of various wine products. In recent years, the research work made it possible for aboriginal grape varieties to: create information models of indicators [3-5]; establish the influence of heat supply in the vineyards on the formation of phenolic complex of grapes [6-7]; study individual quality characteristics of wine products [8-14]; determine the feasibility of producing a specific type of product [15-18], etc. At the same time, there is not enough information about the distinctive physicochemical characteristics of aboriginal grape varieties, knowledge of which will allow us to specifically select grape processing technology for high-quality wine production. In this regard, the goal of the work was to identify the distinctive technological characteristics of white aboriginal grape varieties.

2 Materials and methods

The objects of research were white grape varieties (92 batches) of 2018-2022 harvest years: classical (‘Chardonnay’, ‘Aligote’, ‘Sauvignon Vert’), aboriginal (‘Albourla’, ‘Abla Aganyn Izium’, ‘Sary Pandas’, ‘Kok Pandas’, ‘Kokur Belyi’, ‘Shabash’, ‘Soldaiya’, ‘Keshnish Tumut’, ‘Mushketnyi’, ‘Muni Belyi’, ‘Efremovsky 2’, ‘Boulany Belyi’), and selection (‘Riesling Magaracha’, ‘Citron Magaracha’). All grapes were cultivated in different regions of Crimea: Vilino village (Bakhchisaray), Morskoye and Solnechnaya Dolina villages (Sudak), and hand-harvested at the stage of their technological ripeness.

Standard and modified methods for analyzing the physicochemical parameters of research objects were used in accordance with [19]. Grapes and must were analyzed according to the method [20]. Physicochemical and biochemical parameters of grapes and must were studied in stages. The following indicators were determined: mass concentration of sugars (Ms) – using the hydrometric method [15]; mass concentration of titratable acids (TA) – using the potentiometric method [15]; active pH acidity– using the potentiometric method [15]; technological stock of phenolic substances (TS PS) – using the colorimetric method [15]; mass concentration of phenolic substances in the must without contact with the pulp (PSinit.) – using the colorimetric method [15]; monophenol monooxygenase (MPMO) and peroxidase (Pox.) activity – using colorimetric method [16]; mass concentration of phenolic substances in the must after their oxidation during 1 hour (PSox.) – using the colorimetric method [15]; macerating ability of grape must (PSmac.) - the ability to accumulate phenolic substances when the pulp is infused during 4 hours at a temperature of 20-22°C - using the colorimetric method [15]; mass concentration of proteins (Pr.) – using the Lowry – colorimetric method [15]; mass concentration of polysaccharides (Pol.) – using the colorimetric method [15]; glucoacidimetric index (GAI) – using the calculation (GAI=Ms/TA) [15]; technical ripeness indicator (TRI) – using the calculation (TRI=MS×pH^2) [15].

The experiments were carried out in triplicate. When processing the obtained data, methods of mathematical statistics were used (confidence level $p<0.05$) using the Microsoft Excel and Satistica software.

3 Results and discussion

It is well known that standard varieties for white sparkling wine production are classical cultivars, in particular 'Chardonnay', 'Sauvignon', 'Aligote' and others. In connection with this, at the first stage, the research was aimed at searching for indicators reflecting the origin of grapes. As a result of mathematical processing of grape and must technological indicators (Ms, TA, pH, TS PS, PSinit., PSox., PSmac., MPMO, Pox., GAI, TRI, Pr., Pol.), a dendogram using cluster analysis (Fig. 1) was constructed. The analysis results show that the studied grape samples exhibit individual characteristics in pair combinations with each other and in groups.

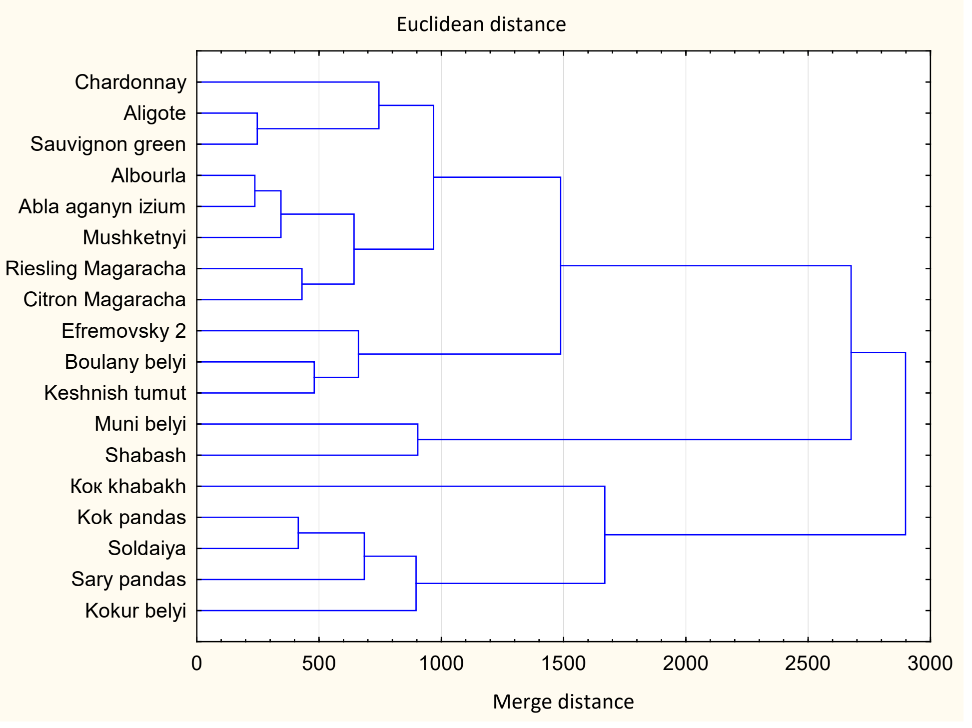

Fig. 1. Grouping of grape varieties according to their physicochemical indicators

At the next stage of the research, a discriminant analysis was applied, which made it possible to select significant (criterial) indicators from the array of experimental data, the complex accounting of which will allow us to group the studied varieties according to their type (classical, selection, aboriginal). When selecting criterial indicators, the values of Wilks lambda were assessed both individually for each indicator, and in-system. For the established system of indicators, the Wilks lambda value was 0.11 with a classification accuracy of 86.3%. The differentiation of the studied grape varieties is presented using a scattering plot of canonical values (Fig. 2). Significant (criterial) indicators that form each group of varieties were selected. The ranges of their values are presented in Table 1.

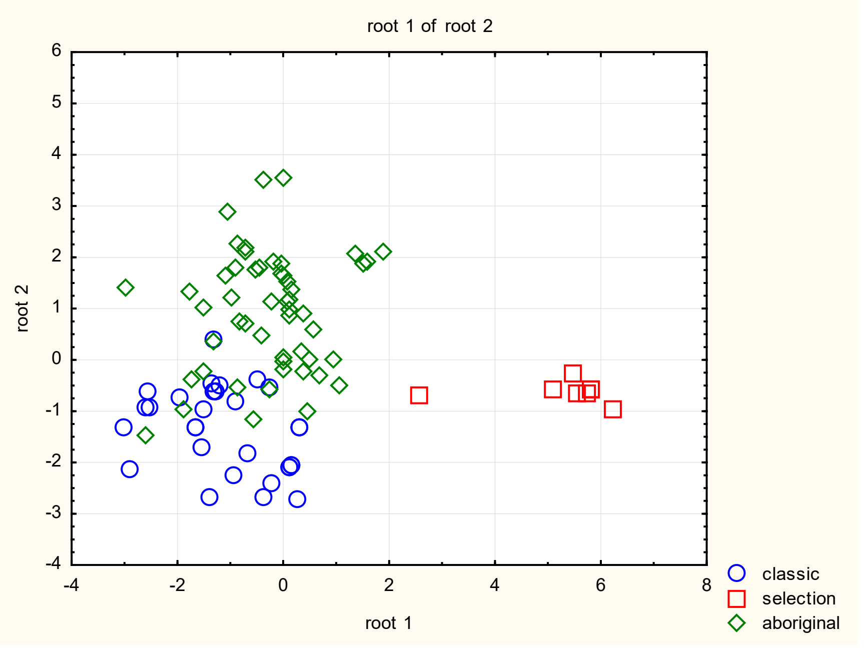

Fig. 2. Differentiation of grape varieties in accordance with grape characteristics depending on their type

Table 1. Range (numerator) and average value (denominator) of grape criterial indicators

Indicator		Group of varieties		
		classical	aboriginal	selection
Mass concentration	TA, g/dm^3	5.1-8.9 **6.5**	4.1-7.5 **5.7**	5.7-8.4 **6,6**
	PSinit., mg/dm^3	160-355 **270**	195-775 **505**	210-415 **335**
	PSmac., mg/dm^3	290-335 **305**	210-1085 **520**	250-630 **440**
	TS PS, mg/dm^3	745-1190 **930**	690-3325 **1630**	750-980 **850**
	Pr., mg/dm^3	60-158 **116**	19-108 **62**	22-98 **61**
	Pol., mg/dm^3	9-26 **13**	20-54 **28**	32-48 **41**

A discriminant analysis determined the distinctive indicators of aboriginal grape varieties from classical ones, reflected in deviation of the average indicator values, in particular: in the reduced content of titratable acids (by 14%) and proteins (by 87%), increased content of phenolic substances when processing white grapes (by 47%), technological stock of phenolic substances (by 43%), extracting ability of phenolic substances (by 41%), increased content of polysaccharides (53%).

4 Conclusion

As a research result, new information on the technological indicators of aboriginal grape varieties was obtained. Significant indicators of grapes were established, grouped in accordance with grape origin characteristics and their technological potential. The distinctive characteristics of aboriginal grape varieties (TA, PSinit., PSmac., TS PS, Pr., Pol.) in comparison with classical ones, which must be taken into account when selecting the processing technology, were identified. Thus, a systematic approach to the selection of raw materials, taking into account varietal technological characteristics, will give the opportunity to produce sparkling wines of high quality.

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