THE INFLUENCE OF MACERATION DURATION ON THE QUALITY OF RED WINES FROM THE MURFATLAR VINEYARD

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ABSTRACT

Maceration is the main technological stage in red vinification. The duration of maceration is the main technological factor that influences the intensity of extraction of phenolic compounds and aromas from grapes. In this study we applied different maceration times to the vinification of three red varieties from the Murfatlar vineyard and we found significant differences between wines in terms of composition and sensory properties.

INTRODUCTION

Phenolic compounds play a major role in the intensity and characteristics of wine astringency (Vidal Leticia et. al., 2018). Wine astringency is important for quality and consumer acceptance. Perception of this mouthfeel is temporal and can be separated further into unique textural sub-qualities. Quantitative data on these astringent sub-qualities in wine however are poorly understood (Kang W. et. al., 2019). Extraction and stabilization of wine phenolics can be challenging for wine makers (Carew Anna et al., 2013).

The different maceration times affected the qualitative and quantitative proanthocyanidin composition of the resulting wines, the total proanthocyanidin content increasing with the maceration time. The percentage of skin-derived proanthocyanidins was always higher than that of seed-derived proanthocyanidins for all the maceration time assayed, although the contribution of seed proanthocyanidins to wine composition increased for the longest maceration time (Busse-Valverde N. et. al., 2012). Phenolic compounds are among the most important quality factors of wines. They contribute to the organoleptic characteristics of wine such as color, astringency, and bitterness. Although tannins found in wine can come from microbial and oak sources, the main sources of polyphenols are grape skins and seeds (Rousserie Pauline et. al., 2019).

Wine color depends not only on the amount of anthocyanin present in the grapes, but also on the amount of them that may be extracted from grapes and their interactions with other phenolic compounds. Color stabilization is also specially important in poor color wines (Baca-Bocanegra Berta et. al., 2018). Formation of all classes of anthocyanin derivatives starts quickly after anthocyanin extraction from grape. Their maximum levels are reached a few days after apex of anthocyanins during maceration/alcoholic fermentation. Indirect condensation derivatives showed less stable behavior than that of the direct flavanol–anthocyanin products during fermentations and aging (Berrueta L. et. al., 2020). The ability to predict the effect of process variables, either controlled by winemakers or that naturally change throughout fermentation, on the extraction of anthocyanins is vital to producing red wine of high quality (Setford P. et. al., 2019).

Maceration and fermentation time and temperatures are important factors affecting wine quality (Șener H., Kalkan Yıldırım Hatice, 2013). Color and anthocyanin concentration decreased when the maceration was longer, whereas polysaccharide and proanthocyanidin concentrations did the opposite (Gil Mariona et. al., 2012).

In red winemaking, the extractability of condensed tannins (CT) can vary considerably even under identical fermentation conditions, and several explanations for this phenomenon have been proposed. Recent work has demonstrated that grape pathogenesis-related proteins (PRPs) may limit retention of CT added to finished wines, but their relevance to CT extractability has not been evaluated (Springer L. et. al., 2016).

MATERIAL AND METHOD

We studied 3 red varieties grown in Murfatlar, one of the most famous vineyards in Romania. The 3 varieties are: Mamaia (a Romanian variety, obtained even at Murfatlar), Merlot (one of the most famous and extensive varieties in cultivation worldwide) and Băbească neagră (a traditional Romanian variety). For each variety we adopted three different maceration durations (7, 14 and 21 days) to which was added a control variant without maceration. All varieties were harvested by hand on the same date and the grapes were subjected to microvinification at the Murfatlar Viticulture-Vinification Research Development Station under the same fermentation conditions and with the same doses of sulfur dioxide. The chemical analyzes were performed one month after harvest, in the Oenology laboratory of the Research Station, in accordance with the official methods of analysis of the International Organization of Vine and Wine (OIV).

RESULTS AND DISCUSSIONS

The data in table 1 show that the different maceration durations influenced the parameters of the main composition parameters of the wines obtained from the 3 studied varieties. Data on the alcoholic strength of wines show that the influence of maceration time was different between varieties. Thus, for the Mamaia and Merlot varieties, the control variant (without maceration) had the lowest value, while for the Băbească neagră variety it had the highest value. In all 3 varieties, the 14-day maceration variant had values of alcoholic strength that were not between the values of the 7- and 21-day maceration variants.

In the Romanian varieties Mamaia and Băbească neagră, the highest content in total acidity was in the control variant but there were differences between the other variants with different maceration durations. Thus, in the Mamaia variety, the increase of the maceration duration was accompanied by the decrease of the total acidity, but in the Băbească neagră variety the total acidity increased in parallel with the increase of the maceration duration but without exceeding the control variant. For the Merlot variety, the lowest total acidity was for the 14-day maceration variant and the highest for the 21-day variant.

In the Merlot and Băbească neagră varieties, the volatile acidity varied very little between the variants with different maceration duration. In the Mamaia variety, the variations were within wider limits but followed an evolution similar to that of total acidity.

Regarding the density values relative to 200C, in all 3 varieties, they were higher in the control variant compared to the variants with maceration durations and, in general, they decreased as the maceration duration increased, with very small exceptions. . In 3 of the 4 variants (Control, 7 and 14 days of maceration), the highest values of this parameter were in the Mamia variety, followed by the Merlot variety and the lowest were in Băbească neagră. Only in the variant with extended maceration (21 days) the highest density relative to 200C was in the Merlot variety, followed by the Mamaia variety, so that the Băbească neagră variety had the lowest values in all 4 maceration variants.

Regarding the density values relative to 20^{0}C, in all 3 varieties, they were higher in the control variant compared to the variants with maceration durations and, in general, they decreased as the maceration duration increased, with very small exceptions. In 3 of the 4 variants (Control, 7 and 14 days of maceration), the highest values of this parameter were in the Mamia variety, followed by the Merlot variety and the lowest were in Băbească neagră. Only in the variant with extended maceration (21 days) the highest density relative to 20^{0}C was in the Merlot variety, followed by the Mamaia variety, so that the Băbească neagră variety had the lowest values in all 4 maceration variants.

The highest residual sugar content was in all varieties at the control variant and in all cases was over 4 g/L, the threshold above which, in accordance with Romanian wine legislation, the wines are no longer dry. In the Merlot (11 g/L) and Băbească neagră (8.8 g/L) varieties, the residual sugar contents were adequate for the semi-dry wine category, but for the Mamaia variety, the content of 13.3 g/L led to the entry of this wine. in the category of semi-sweet wines (over 12 g/L residual sugar). In fact, this was the highest content of all 12 wines and the only case in which the threshold of 12 g/L was exceeded, which is the upper limit for the category of semi-dry wines. In the Mamaia variety, all 4 variants had over 4 g/L residual sugar but the values decreased continuously as the maceration time increased. For the Merlot and Băbească neagră varieties, all the variants with maceration duration were dry wines, with one exception - the 21-day maceration variant for the Merlot variety (5.4 g/L).

In all 3 varieties, the control variant had the lowest pH values (3.22 Mamaia and Băbească neagră and 3.31 Merlot). All the variants with maceration duration had a higher pH compared to the control variants, the biggest difference being for the Merlot variety, the variant with 14 days of maceration (3.52 compared to the control 3.31).

The control variant (without maceration) had the highest content of tartaric acid and malic acid in all varieties. In all cases, the increase in maceration time led to a decrease in the contents of the two main grape acids, even though the causes of the decreases were different. In the case of tartaric acid, its values decreased due to the formation and precipitation of tartaric salts (potassium bitartrate) which were all the longer the longer the maceration time. In contrast, in the case of malic acid, the decreases were higher (even over 1 g / L) and were determined by malolactic fermentation, whose onset was faster in variants with a longer maceration duration.

CONCLUSIONS

Maceration is the main technological stage in red vinification. In this study, the application of different maceration times led to important changes in the basic chemical composition of red wines obtained from the 3 varieties grown in the Murfatlar vineyard. These changes in the composition and quality of the wines could not be fully captured given that the chemical analyzes were carried out when the wines were very young, only one month after the grapes were harvested. Therefore, the evolution of wines will be monitored further. However, an obvious influence of maceration on the wine contents in alcohol, total and volatile acidity, pH, tartaric and malic acid, residual sugar and relative density at 20^{0}C could be found.

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Table 1

Chemical composition of wines

Variety	Chemical composition	Duration of maceration			
		Control	7 days	14 days	21 days
Mamaia	Alcohol concentration (% vol.)	11,71	12,16	11,88	12,03
	Total acidity (g / L in tartaric acid)	5,98	5,95	5,71	5,56
	Volatile acidity (g / L in acetic acid)	0,63	0,67	0,64	0,56
	Relative density at +20 ºC	0,9968	0,9953	0,9948	0,9933
	Reducing sugars (g/L)	13,3	7,9	6,8	4,7
	pH	3,22	3,32	3,31	3,29
	Tartaric acid (g/L)	2,66	2,62	2,54	2,62
	Malic acid (g/L)	2,33	1,71	1,42	1,29
Merlot	Alcohol concentration (% vol.)	12,33	12,56	12,62	12,56
	Total acidity (g / L in tartaric acid)	5,44	5,49	5,23	5,53
	Volatile acidity (g / L in acetic acid)	0,76	0,70	0,69	0,72
	Relative density at +20 ºC	0,9957	0,9946	0,9945	0,9951
	Reducing sugars (g/L)	11	3,4	3,2	5,4
	pH	3,31	3,49	3,52	3,45
	Tartaric acid (g/L)	2,31	2,03	2,03	2,06
	Malic acid (g/L)	2,31	2,03	2,03	2,06
Băbească neagră	Alcohol concentration (% vol.)	12,05	11,33	11,43	11,30
	Total acidity (g / L in tartaric acid)	6,37	5,73	5,77	5,87
	Volatile acidity (g / L in acetic acid)	0,69	0,76	0,74	0,75
	Relative density at +20 ºC	0,9949	0,9932	0,9928	0,9935
	Reducing sugars (g/L)	8,8	0,6	0,1	0,5
	pH	3,22	3,35	3,33	3,36
	Tartaric acid (g/L)	2,58	2,26	2,23	2,05
	Malic acid (g/L)	2,57	1,38	1,40	1,60