Influence of Different Maceration Times on the Anthocyanin Composition and Sensory Properties of Blatina Wines

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Summary

Skin maceration contact time is essential winemaking technique to affect anthocyanin concentration and high quality of red wines. The aim of this work was to investigate the changes in basic composition, anthocyanin profile and sensory properties of Blatina wines obtained with skin contact time from 4, 8, 12 to 16 days. Results indicate that longer period of maceration positively influenced the quality of Blatina wines. Blatina wines obtained by 12 or 16 days of maceration presented a significant increase of the dry extract, ash, total phenol and pH value. It was observed that the concentration of total and individual anthocyanins significantly increased reaching a maximum value within 12 days of the skin maceration. In all wines, the dominant anthocyanin was malvidin 3-glucoside. Best organoleptic properties were observed in the wines macerated for 16 days.

Key words

skin maceration, anthocyanin concentration, sensory properties, Blatina

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Introduction

Anthocyanins are phenolic compounds that are mainly responsible for the color of the grapes and wines. This compounds are pigments of red, blue and purple colors, mainly occurring in cellular vacuoles of grape skin (Ribéreau-Gayon et al. 2000). While the color is one of the most important parameters influencing red wine quality, many factors affecting it were studied. The grape variety and the vinification technique affect the concentration and composition of wine anthocyanins, so these factors affect the wine color, too (Auw et al., 1996). Anthocyanins are mainly located in the grape skins, with the exception of the teinturier varieties that also contain anthocyanins in the pulp (Moreno-Arribas and Polo, 2009). Besides the influence on color, anthocyanins also contribute to the taste and chemical characteristics of wine as a result of their interactions with colorless phenolics, polysaccharides, metals and anthocyanins themselves (Mazza and Brouillard, 1987, 1990). *Vitis vinifera* anthocyanins appear in grapes at veraison as 3-*O*-monoglucosides and respective 3-*O*-acylated monoglucosides of five main anthocyanidins- delphinidin, cyanidin, petunidin, peonidin and malvidin (acylation is made with *p*-coumaric, caffeic and acetic acids). It has been reported that about 20 different anthocyanin compounds may be present in the skin of grape and the most abundant anthocyanin found is malvidin-3-glucoside (Glories, 1999; Mazza, 1995; Ribéreau-Gayon and Glories, 1987).

During red winemaking process, anthocyanins are extracted from grape skins by maceration and transferred to the must. Maceration conditions have the largest impact on anthocyanins and other sensory characteristics of the red wines (Kelebek et al., 2006). The most commonly used vinification technique, as in this study, is the traditional vinification, when maceration occurs during vatting, while the pomace soaks in the juice. Alcoholic fermentation occurs in the juice, producing ethanol and raising the temperature. Both ethanol and temperature participate in the dissolution of pomace constituents (Ribéreau-Gayon et al., 2000). Another important factor in red vinification process is the length of maceration. The effect of maceration time varies according to grape varieties and species (Gómez-Plaza et al., 2002). After reaching a maximum level after a few days of fermentation, the concentration of anthocyanins decreases as a consequence of their adsorption on yeast cell walls, precipitation in the form of colloidal material together with tartaric salts and elimination during filtration and fining. Hydrolysis reactions, as well as condensation reactions with other phenols during winemaking process also modify the anthocyanin composition of wines (Moreno-Arribas and Polo, 2009). Temperature is an essential factor in standard maceration. It should be sufficiently high to assure satisfactory extraction of phenolic compounds (Ribéreau-Gayon et al. 2000). Although the anthocyanin composition of red wines have been studied by many researches (Gómez-Míguez and Heredia, 2004; Kelebek et al., 2006; Budić Leto et al., 2006; Gómez-Míguez et al., 2007; Kovačević Ganić et al., 2008; Maletić et al., 2009; Gordillo et al., 2010) there has been no study on the anthocyanin profile of the Blatina wines produced in Bosnia and Herzegovina. With regard to the importance of anthocyanin (polyphenol) content in wine and limited information about local grown grape, the aim of this study was to detect the influence of different maceration time on changes in basic composition, anthocyanin profile and sensory properties of Blatina wine.

Materials and Methods

Wine making

Blatina red wine grapes from the wine region of Herzegovina, vineyard Žitomislići (Neretva river valley), were harvested during 2006 season, destemmed and crushed. Must was treated with 50 mg/L SO_2; 1.5 g/hL of pectinase enzyme Lallemand Oe was added. Alcoholic fermentation was started with selected wine yeast Uvaferm BDX. Maceration and alcoholic fermentation of must were carried out in "GANIMEDE" fermenter in controlled temperature conditions, with maximum temperature of 26°C.

The experiment included four treatments: maceration and fermentation in time period of 4 days; maceration and fermentation in time period of 8 days; maceration and fermentation in time period of 12 days, and maceration and fermentation in time period of 16 days. After maceration and fermentation process, must of each treatment was obtained with draining off trough press, and divided in 3 repetitions. The wine was racked after 5 months and treated with 30 mg/L SO_2.

Chemical analysis

The samples of all treatments were chemically analysed. The common analyses of basic wine components were analyzed by O.I.V. methods. Anthocyanin compounds were determined by HPLC according to method of Berente et al. (2001). Sensory evaluation of each wine was obtained by the 100-point O.I.V. method, with a panel of 8 judges. One-way analysis of variance and Least Significant Difference (LSD) comparison test were used to statistically interpret mean differences in mean values if any, at 95% accuracy level.

Results and discussion

The effect of maceration times on wine composition

Basic chemical composition of the wines obtained with different maceration times from Blatina cultivar is given in Table 1. Significant differences between the wines obtained from the different treatments were observed in total acidity, ash and pH

Table 1. Chemical composition of the Blatina wines

Chemical compound	Maceration (days)			
	4	8	12	16
Alcohol % vol.	12.6a	12.6a	12.6a	12.6a
Total extract g/L*	26.7a	27.6a	28.8a	29.6a
Volatile acidity g/L**	0.5a	0.5a	0.6a	0.6a
Total acidity g/L	5.2a	5.3b	5.3b	5.1c
Ash g/L	2.7a	2.9b	3.2c	3.3c
Residual sugar g/L	2.17a	2.1a	1.8a	1.8a
pH	3.5a	3.6b	3.6b	3.8c

Different letters beside the mean of a compound denote a significant difference among treatments (a, b, c for 5%); *as tartaric acid; **as acetic acid

values. The total acidity value of wines from 16 days maceration treatment was significantly lower compared with the wines obtained by the 4 days maceration treatment. Results presented in Table 1 are in accordance with a previous study reported by Herjavec et al. (2002) whereas the skin maceration resulted in a decrease of the total acidity and an increase in pH values of wines. According to Ribéreau-Gayon et al. (2000) these changes are linked to the liberation of potassium from the skins and the resulting partial salification of tartaric acid. Thus, pH value increased with longer skin contact period. Ash amounts were increased with longer maceration period with differences of 0.6 g/L, between 4th and 16th day of maceration, which is due to extraction of minerals in maceration process (Ribéreau-Gayon et al., 2000). Maceration time had no significant effect on ethanol concentration, volatile acidity, total extract and residual sugar.

The effect of the maceration times on anthocyanins composition of the wines

The values of the main individual anthocyanins during different maceration treatments is given in Table 2. Five main anthocyanin compounds (delphinidin-3-glucoside, cyanidin-3-glucoside, petunidin-3-glucoside, peonidin-3-glucoside, and malvidin-3-glucoside) and total phenols were identified and quantified in Blatina wines. The sum of individual anthocyanins reached a maximum of 200.23 mg/L in the wines produced with a skin maceration time of 12 days, and after that, a significant decrease was noticed. Longer maceration results with decreasing in anthocyanins content due to the fixation of compounds on yeast or solid parts, by reactions of degradation and condensation with tannin, polymerization reactions and formation of pyroanthocyanins (Auw et al., 1996; Ribéreau-Gayon and Glories, 1987). The total phenol content has constantly increased and reached its maximum of 2235.59 mg/L in wine made with 12 days of skin maceration and after that their concentration decreased. If we compare this result with Rastija et al. (2009) who reported that total phenols content in red wines originating from Central and Southern Dalmatia was 1665 mg/L in average (varying from 1156 to 2619 mg/L) we can conclude that Blatina has high amounts of total phenols. Malvidin-3-glucoside was the most dominant anthocyanin in all Blatina wines obtained under different conditions. A maximum concentration of malvidin-3-glucoside (162.93 mg/L) have been found in the wines macerated for 12 days. These findings are in accordance with previous studies that established that malvidin is the major anthocyanidin in red grape varieties (Ribereau-Gayon et al., 2000). The maximal extraction time of five mentioned anthocyanins was delayed in comparison to other studies that reported the maximal extraction at fourth or sixth day of maceration time (Gómez-Míguez and Heredia, 2004; Budić Leto et al., 2006; Kelebek et al., 2006). The rest of detected anthocyanin compounds were acting similar but in notably lower concentrations than malvidin-3-glucoside. Delphinidin-3-glucoside reached maximum concentration within 12 days of maceration, with significant difference compared to other treatments. Petunidin-3-glucoside and peonidin-3-glucoside reached maximum concentration at the same treatment but not significant compared to 16 days of maceration time. Differences in concentration of cyanidin-3-glucoside were not detected in regard to different maceration time. As previously stated, cyanidin-3-glucoside is the anthocyanin present in the lowest concentration in *Vitis vinifera* L., with the exception of some varieties (Revilla et al., 1999). When we compare total monoglucosides of Blatina wine with the wines produced from other varieties, we can see that the Blatina wine had higher contents than the Syrah wine (Gómez-Míguez and Heredia, 2004) and lower than the Babić wine (Budić Leto et al., 2006).

Table 2. Anthocyanins content of the Blatina wines (mg/L)

Anthocyanins (mg/L)	Maceration (days)			
	4	8	12	16
Delphinidin-3-glucoside	5.91d	7.92c	10.82a	9.33b
Cyanidin-3-glucoside	1.31a	1.37a	1.38a	1.36a
Petunidin-3-glucoside	8.71c	10.12b	13.03a	12.72a
Peonidin-3-glucoside	9.58c	11.53b	12.07a	11.76ab
Malvidin-3-glucoside	110.03c	132.64b	162.93a	145.19b
Total antocyanins monoglucosides	135.54a	163.58b	200.23d	180.36c
Total phenols	1786.71c	1979.23b	2235.59a	2158.75b

Different letters beside the mean of a compound denote a significant difference among treatments (a, b, c for 5%).

Table 3. Average results of sensorial evaluation of Blatina wines by the 100-points O.I.V. method

Maceration 4 days	Maceration 8 days	Maceration 12 days	Maceration 16 days
78.5	81.25	81.75	84

Sensory properties of Blatina wines

Anthocyanins contribute little to the taste of wine but there is a close association between anthocyanins and wine color. Sensory evaluation of four types of Blatina wines produced at different maceration times was conducted by 8 panellists and 100-points O.I.V. (Table 3). Results showed that prolonged maceration time had a positive influence on Blatina wines quality. The best evaluated Blatina wine was the wine macerated for 16 days (84 points), characterized by varietal flavours, with ripe fruit and tobacco aroma and deep ruby color. Prolongation of the pomace contact time resulted in "full-bodied" and "rounded" taste with well structured tannins. The lowest evaluation gained Blatina wine macerated for 4 days, and there was no difference in quality between wines produced at 8 and 12 days of maceration.

Conclusions

The Blatina wine macerated for 12 days contained the highest amount of monoglucosides and total phenols. Shorter maceration time (4 and 8 days) gave wines with lower amount of anthocyanins and total phenols resulting with lower sensory evaluation. The Blatina wine macerated for 16 days obtained the highest sensory evaluation. According to results of our study, we can conclude that 12 and 16 days of maceration seems to be appropriate for Blatina wines since they showed a higher anthocyanins content together with a higher sensory evaluation. In

addition, the increased extraction of phenols during extended maceration time of 12 and 16 days, produced wines with considerable aging potential.

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