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STUDIES REGARDING THE COLOR EVOLUTION DURING MATURATION OF CABERNET SAUVIGNON AND PINOT NOIR WINES

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Abstract
During maturation of red wines their chromatic characteristics change due to degradation reactions of anthocyanin pigments and polymers formation. It was studied the polyphenolic composition of young red wines Cabernet Sauvignon and Pinot Noir and its evolution during wines maturation. The wines were obtained in the Ceptura vine center, from the harvest year of 2015. The polyphenolic composition of wines was judged by the content in polyphenols, tannins and anthocyanins. A wine tannin structure was analyzed by their concentration in condensed tannins, astringent tannins and tannin-polysaccharide complex. Analyzes have been carried out in the wine by UV-VIS spectrometry techniques. Total content of polyphenols have been determined by spectrophotometric technique (DO_{280}). Tannins have been determined by the Ribereau-Gayon method (1996), tannin structure after Glories method (1978); anthocyanins were determined by the discoloration technique with SO_2. The study on color of red wines analyzed during their evolution referred to the study of chromatic parameters, the content of anthocyanin monomers and polymers (Glories method). Our results showed a decrease of the percent of anthocyanin monomers accompanied by an increase the percent of polymers, in both wines, during their maturation.

Keywords: anthocyanin monomers, polyphenolic composition, polymers

1. INTRODUCTION

Although they are secondary metabolites of vines, polyphenols play a very important role in the quality of red wines but also in the health and hygiene of consumers of black grapes and red wine (Landrault et al., 2001). The polyphenolic composition of red wines (anthocyanins, tannins, phenolic acids) is a result of several factors, among which the most important are the variety, the maturation state, the phytosanitary status of the harvest and the ecoclimatic conditions (Mazue, 2001).

Besides the influence on the organoleptic characteristics of red wines (color, astringency, flavor), polyphenolic compounds have an important role in the evolution of wines during the mature time (Mazza et al., 1995; Mazza et al., 1999). The evolution of red wines leads to the modification of the structure and chromatic proprieties tanks to polymerization reactions, condensation and oxidation.

Our studies refer to the polyphenolic composition of the young red wines of Cabernet Sauvignon and Pinot Noir, obtained in the center of Ceptura viticulture area, the 2015 harvest, as well as its evolution during the maturing in wood barrels.

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2. MATERIALS AND METHODS

Cabernet Sauvignon and Pinot noir wines, from the Ceptura vineyards, the 2015 year harvest, were analyzed in terms of physico-chemical: alcoholic strength (vol% alcohol), total acidity (g/L sulfuric acid), volatile acidity (g/L acetic acid), total dry extract (g/L) and glycerol (g/L). Based analyzes were performed by standard methods: simple distillation method for alcoholic strength; titrimetric method for total acidity; distillation method Saunier-Cazenave for acidity volatile; Tabarié method for total dry extract and volumetric method for glycerol.

The polyphenolic composition of wines was judged by the content in polyphenols, tannins and anthocyanins (Harbertson et al., 2003). Analyzes have been carried out in the wine by UV-VIS spectrophotometric techniques (Giusti, 2001). Total content of polyphenols have been determined by spectrophotometric technique (DO_{280}). Tannins have been determined by the Ribereau-Gayon method (1996) and tannins structure after Glories method (1978), based on the following indicators: gelatin index (for astringent tannins); HCl index (for condensed tannins); ethanol index (for the macromolecular associations tannins-polysaccharides).

These indicators was determined by spectrophotometric method at λ = 280 nm (Glories Y, 1984). The anthocyanins were determined by the discoloration technique with SO_2 (Dallas C., 1994). Color intensity was determined at λ=420 nm and λ=520 nm. The study on color of red wines analyzed during their evolution referred to the study of chromatic parameters, the content of anthocyanin monomers and polymers (Glories method). Wines have been noted: CS – Cabernet Sauvignon wine; PN – Pinot noir wine.

3. RESULTS AND DISCUSSIONS

The Cabernet Sauvignon wine, produced from the grape harvest of 2015 has a medium alcohol content, due to accumulation of 220 g/L of sugars at full grape maturity. The Pinot noir wine shows a higher alcoholic strength of 13.5 vol% alcohol, the content in sugars at full maturity being of 232 g/L. Both wines shows a good acidity, are extrative (Cabernet Sauvignon wine shows a dry extract greater value, figure 1).

Regarding the polyphenolic composition, the Cabernet Sauvignon wine is rich in phenolic compounds, both in tannins as well as in anthocyanins (570 mg/L); the total content of polyphenols from the Pinot Noir wine is lower, as the content in anthocyanins (225 mg/L) and tannins (figure 2).

Regarding the structure of tannins, the Cabernet Sauvignon wine has a higher proportion of quality tannins (ethanol index) that give to the wine the corpulence and smoothness and a higher proportion of condensed tannins (HCl index). Astringent tannins (gelatin index) are found in a average proportion, lower than in the case of Pinot Noir wine.

The Pinot Noir wine, produced in the same year and the same wine-growing area as well as the same technological conditions, shows a different tannic structure having a lower proportion of quality tannins and a higher proportion of astringent tannins (figure 3).

The anthocyanin content in wines is different, the Cabernet Sauvignon wine has a anthocyanin content of about 2.5 times higher compared with Pinot Noir. The wine is strongly colored, the value of the coloring intensity being 1.02. The Pinot Noir wine recorded an IC value of 0.6.

The poliphenols compounds structure is change during the wine maturation due to polymerization reactions, condensation and oxidation, leading to the change of the chromatic proprieties. As regarding anthocyanins, at the red wines color participate the anthocyanin monomers, polymersand copigmented, they change during wine maturation (Davies et al., 1993). Therefore, the anthocyanin monomers turns into the polymeric form.

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In figure 4 we can see the proportion of anthocyans monomers, polymers and co-pigmented in the younger wines of Cabernet Sauvignon and Pinot noir. If at the young Cabernet Sauvignon wine the percent of anthocyanin monomers is 23.2% (132.3 mg/L cianidin-3-glucozide) this records drops during the wine maturation, at 96.9 mg/L cianidin-3-glucozidă) after 6 months and 71.25 mg/L after one year of aging (figure 5).

Regarding the color evolution along the wine maturation, we can see that the percentage of the polymer pigments has steadily increased over the 12 months of aging, in the same rate as the decrease the content in anthocyanin monomers and co-pigmented. There is a stabilization of color of the wine due to the lower content of these pigments and the increasing of the polymers anthocyanins that are very stable compounds (figure 6).

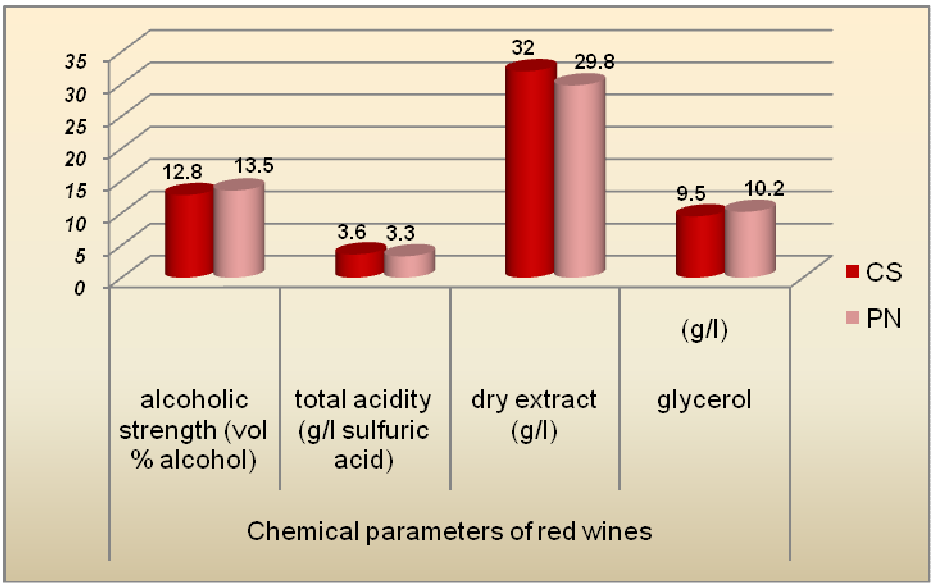

Figure 1.The main chemical parameters in young red wines Cabernet Sauvignon and Pinot noir

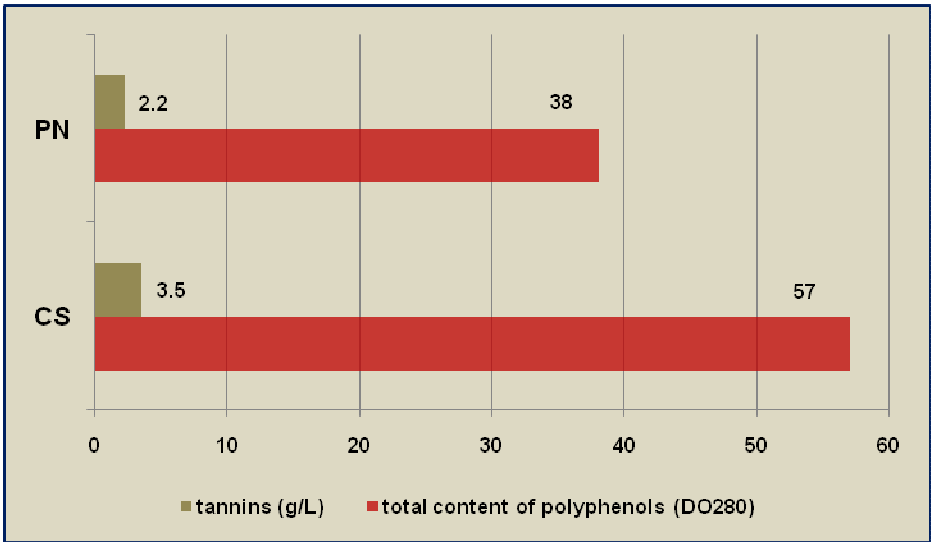

Figure 2. Total content of polyphenols and tannins in young red wines Cabernet Sauvignon and Pinot noir

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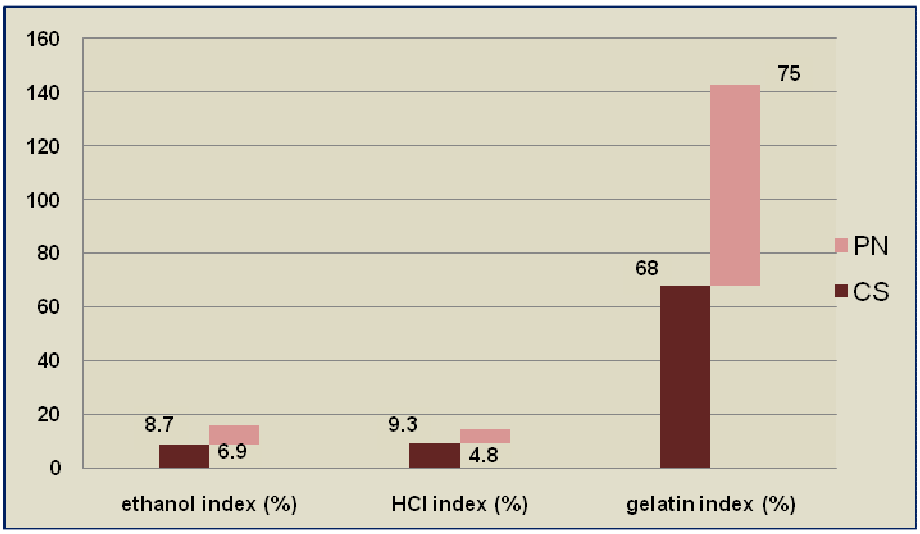

Figure 3. Structure of tannins in young red wines Cabernet Sauvignon and Pinot noir (ethanol index, HCl index, gelatin index)

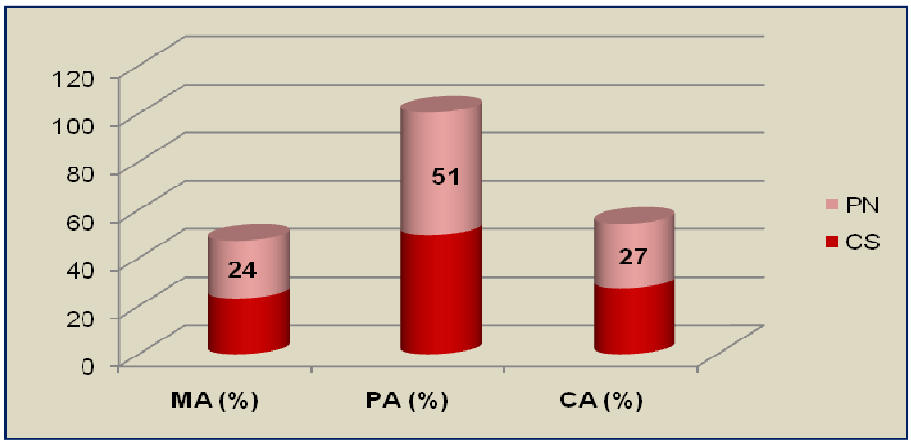

Figure 4. Percentage of anthocyanin monomers (MA%), polymers (PA%) and copigmented (CA%) in young red wines Cabernet Sauvignon and Pinot noir

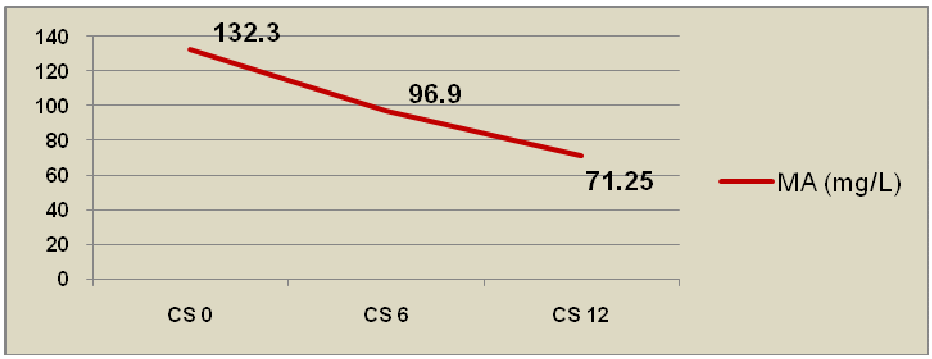

Figure 5. Evolution of anthocyani nmonomers (mg/L cianidin-3-glucozidă) during the Cabernet Sauvignon wine maturation

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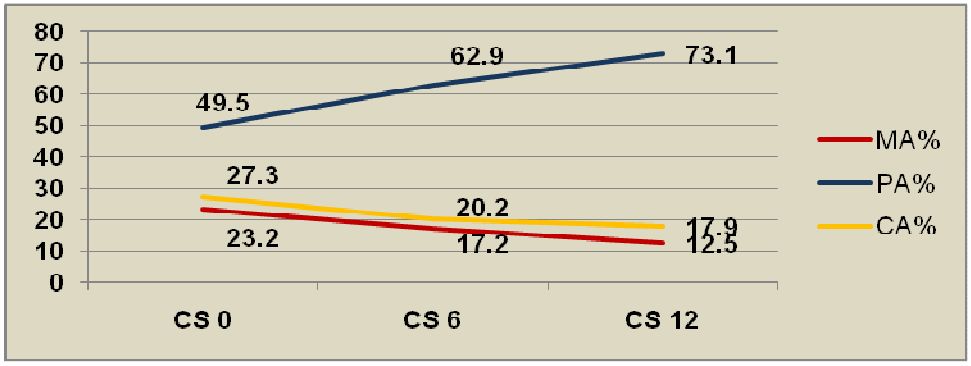

Figure 6. Evolution of anthocyanin (%) during the Cabernet Sauvignon wine maturation

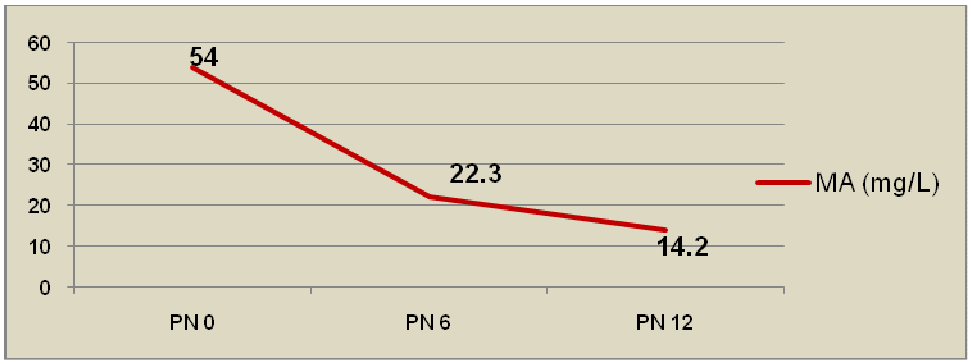

Figure 7. Evolution of anthocyanin monomers (mg/L cianidin-3-glucozidă) during the Pinot noir wine maturation

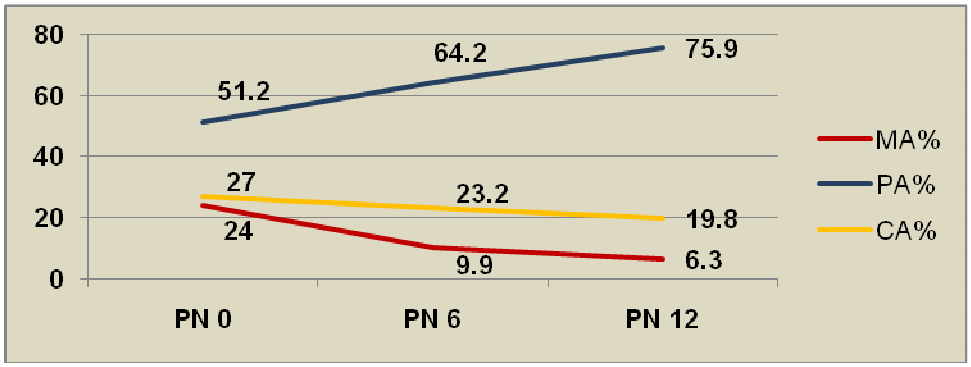

Figure 8. Evolution of anthocyanin (%) during the Pinot noir wine maturation

At the Pinot Noir young wine the content in monomer pigments is lesser (54 mg/L cianidin-3-glucozide) and decreasing along the 12 months of maturation is more obvious especially in the first 6 months, the color stabilization due to higher percentage of polymer pigments occurs after about 10 months of maturing wine (figure 7, figure 8).

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4. CONCLUSIONS

The Cabernet Sauvignon wine produced in the Ceptura wine center, the harvest of 2015 has an average alcoholic strength, a total normal acidity and with an average content of glycerol;
The Cabernet Sauvignon wine is rich in phenolic compounds, both in tannins and anthocyanins;
The tannin structure of Cabernet Sauvignon is represented by a higher percentage of quality tannins and low astringent tannins;
The young wine is strongly colored, the anthocyanin content is high (570 mg/L) as the value of CI (1.02);
During wine maturation the percentage of monomer anthocyanins steadily decrese, from 132.3 mg/L cyanidin-3-glucoside in the young wine and 71.25 mg/L cyanidin-3-glucoside after 12 months of aging;
The wine color stabilizes after about 1 year of maturation due to higher percentage of pigments polymers;
The Pinot Noir wine produced in Ceptura wine center, 2015 shows a high alcoholic strength, sugar content accumulated at full maturity is higher than the Cabernet Sauvignon wine; the wine is rich in glycerol, but it has a lower dry extract than Cabernet Sauvignon wine;
Polyphenol content is lower, both in terms of content in tannins as in anthocyanins;
Tannins have in their structure a low proportion of condensed tannins (HCl index = 4.8) and quality tannins (ethanol index = 6.9) and a higher proportion os astringent tannins (gelatin index = 75);
The content of anthocyanin is low (225 mg/L) and the color intensity has a value of 0.6;
Percentage of anthocyanins monomers decreses during maturation of Pinot Noir wine from 54 mg/L cyanidin-3-glucoside in young wine to 22.3 mg/L cyanidin-3-glucoside after 6 months of aging, the decrease is more evident than the Cabernet Sauvignon wine.
The wine color stabilizes after about 1 year of maturation due to the increasing percentage of the polymers pigments and the decrease percentage of monomers anthocyanins and copigmented.

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