

Anthocyanins and phenolics in Cabernet Sauvignon and Pinot noir wines

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Abstract Cabernet Sauvignon and Pinot Noir are among the most well-known red wines in the world. Grape variety and chemical composition of the wine are important in oenology. Phenols give to the wine the color, astringency and bitterness. Certain researches confirm the antioxidant activity and health benefits of phenols, including anthocyanins. Wine samples were collected from a set of 36 bottles of red wine (Cabernet Sauvignon and Pinot Noir) from two wineries, sold in supermarkets at the same commercial value, with a vintage range from 2011 to 2013. The lowest concentration in anthocyanins was found in Pinot noir wine from Minis winery in 2012 (214.2 ± 14.0 mg/l) while the highest value was registered in the 2013 in the Cabernet Sauvignon wine obtained in Recas winery (479.3 ± 46.64 mg/l). Cabernet Sauvignon wines from both wineries contains anthocyanins concentrations of moderate values with limits among 258.8 ± 10.29 mg/l (2012 vintage/ Minis) and 479.3 ± 46.64 mg/l (2013 vintage/ Recas). The highest total phenolics content of 2758 ± 149.9 mg/l were found in the wine obtained in the Recas winery in 2013. The lowest phenolics content was registered in Pinot noir wine from 2012 in Minis winery (1752 ± 94.9 mg/l). Overall, in the two wineries, Cabernet Sauvignon wine has a higher content in anthocyanins and phenols. Climatic events, extended drought and rainfall and soil conditions make the difference between phenolic content in the two red wines analyzed. The aim of the study was to compare the total anthocyanins and phenolics content of Cabernet Sauvignon and Pinot Noir wines from two wineries from the west of Romania.

Key words

wine, wineries,
anthocyanins, phenolic,
vintage, antioxidant

In oenology, grape variety and chemical composition of wine are very important. In 5% from the volume of a bottle of wine can be found over 1 000 different chemicals. Grapes and therefore wines are rich in phenolics and flavonoids (catechins, quercetin and anthocyanins) which are implicated in health benefits [13]. Water-soluble pigments, anthocyanins -depending of pH - can have different colors: red, blue, mauve or purple. Anthocyanins are found in all plant tissues: roots, stems, leaves, flowers and fruits. They contributing to taste of the grape berries and wine as a moderately astringent sensation but are odorless and flavorless. The main sources of wine color are given by the anthocyanins and are also responsible for the tannin retention and wine aging. Grape juices and red wines are considered to have the highest concentration of anthocyanins [2].

During vinification anthocyanins from grape skins are removed into the wine. During wine maturation the monomeric anthocyanins concentration declines constantly and new stable ones are formed and give the

final color of the wine [6]. Like resveratrol, quercetin and catechins, anthocyanins also have high antioxidant capacity and are in attention of scientists for their possible effects for reducing the risk of cancer and for fighting against cardiovascular disease and aging. Many researches confirm the anthocyanins antioxidant, anti-inflammatory and anticancer activity, apoptotic effect, vision benefits or effect on platelet aggregation [7]. Grape variety, winemaking, vinification, soil, climate, environmental conditions or harvesting determine the amount of anthocyanins in wine. These pigments can be considered markers of variety and are useful in assessing wine quality [10].

Grape berry contains many phenolics which influence the taste, astringency and the color of red wine. Polyphenols helps to preserve the wine during the aging process. A glass of red wine contains around 200 mg phenols [14]. When phenols react with the oxygen the color of wine is changing and turns brown due to oxidation [11]. Skin and seeds are the main source of phenolics compounds.

Cabernet Sauvignon and Pinot Noir are some of the most cultivated varieties worldwide. Pinot Noir is recognized as highly rich in antioxidants - resveratrol, quercetin, catechins, anthocyanins, etc. [5]. The aim of this study was to compare the total anthocyanins and total polyphenols content in Cabernet Sauvignon and Pinot Noir wines produced in Recas and Minis vineyards from the west of Romania in three consecutive years (2011-2013).

Material and Method

Wine samples were collected from a set of 36 bottles of red wine (Cabernet Sauvignon and Pinot Noir) from Recas and Minis wineries (Romania), sold in supermarkets at the same commercial value; vintage range from 2011 to 2013. All wine bottles were collected in June 2014 and were analysed for their total anthocyanins and phenolics content.

To avoid oxidation and later to alter the sensory results, samples from the bottles of wine for chemical analysis were extracted with a syringe, by removing partially the cork.

Total phenolics content in red wine samples was determined by using a HI83742 Photometer from Hanna Instruments. The instrument allows accurate (± 0.10 g/L $\pm 5\%$ of reading), quick analysis and calculates the results (in g/l) with a 0.01 resolution.

For the anthocyanins the absorption spectrum has been determined and is 520 nm. This wavelength of light is needed to measure the concentration of anthocyanins in any sample, including for red wine. Anthocyanins were determined with a high-performance liquid chromatography [HPLC] wired to a computer. For anthocyanins identification was measured the retention time from the moment when the sample was injected to the maximum peak height shown by the display.

Statistical analysis, means and standard deviation respectively for the three samples collected each year from both varieties of wine and wineries, were calculated with GraphPad Prism, ver 5, for 95 % significance level ($p < 0.05$).

Results and Discussions

Anthocyanins are an important parameter of quality, because these pigments determine the color of wines. The total content of anthocyanins are affect by many factors like clusters exposure to sunlight, berry size, time of harvest or winemaking. Values for anthocyanins and phenolic content for Cabernet Sauvignon and Pinot Noir wines from Recas and Minis wineries (2011-2013 vintage) are summarized in Table 1. Results obtained for total anthocyanins and phenolics were expressed for both parameters in mg/l.

Table 1

Content of anthocyanins and total phenolics of the red wines Cabernet Sauvignon and Pinot Noir varieties grouped by vintage 2011–2013

| | 2011 | | 2012 | | 2013 | |
|-------------------------|--------------------|-------------------|--------------------|-------------------|--------------------|-------------------|
| | Cabernet Sauvignon | Pinot Noir | Cabernet Sauvignon | Pinot Noir | Cabernet Sauvignon | Pinot Noir |
| <i>Recas</i> | | | | | | |
| Total anthocyanins mg/l | 421.2 \pm 24.19 | 311.4 \pm 15.53 | 341.7 \pm 34.32 | 346.5 \pm 36.05 | 479.3 \pm 46.64 | 326.8 \pm 34.90 |
| Total phenols, mg/l | 2341 \pm 70.63 | 2009 \pm 54.92 | 2072 \pm 81.38 | 1814 \pm 92.51 | 2758 \pm 149.9 | 2695 \pm 76.46 |
| <i>Minis</i> | | | | | | |
| Total anthocyanins mg/l | 301.7 \pm 5.16 | 298.3 \pm 11.53 | 258.8 \pm 10.29 | 214.2 \pm 14.0 | 348.1 \pm 6.43 | 286.4 \pm 8.96 |
| Total phenols, mg/l | 2055 \pm 141.2 | 2063 \pm 68.38 | 1986 \pm 163.5 | 1752 \pm 94.9 | 2531 \pm 77.76 | 2214 \pm 35.56 |

As fig. 1 shows, the lowest concentration in anthocyanins was found in Pinot noir wine from Minis winery in 2012 (214.2 \pm 14.0 mg/l) while the highest value was registered in the 2013 in the Cabernet wine obtained in Recas winery (479.3 \pm 46.64 mg/l).

Cabernet Sauvignon wines from both wineries contains anthocyanins concentrations of moderate values with limits among 258.8 \pm 10.29 mg/l (2012 vintage/ Minis) and 479.3 \pm 46.64 mg/l (2013 vintage/ Recas).

The highest total phenolics content of 2758 \pm 149.9 mg/l were found in the wine obtained in the Recas winery in 2013. The lowest phenolics content was registered in Pinot noir wine from 2012 in Minis winery (1752 \pm 94.9 mg/l).

Overall, in the two wineries, Cabernet Sauvignon wine has a higher content in anthocyanins and phenols. Without any doubt, in wines from Recas winery was

found a total anthocyanins and phenolics content higher than in wines from Minis, regardless of the year. In 2011, climate was favorable for obtaining a high yield of grapes and for a very good quality wine. In this year, in both Cabernet Sauvignon and Pinot noir wine total anthocyanins and phenolics concentration had significant values.

The succession of climatic events of the year 2012 and especially the extended air /pedological drought has dealt with a heavy blow to Romanian viticulture. Drought effects were disastrous for grapevine, both economically and phenological. Damages were between 40 and 50% for wine grapes. Spring rainfall interfered flowering hindering negatively the pollination and after, the grapes berries quality.

After three consecutive years of poor harvest, Romanian wineries reported an 80% higher wine

production in 2013 compared to 2012. Production was close to 6 million hectoliters of wine. In the same wineries, for Cabernet Sauvignon and Pinot Noir, Lengyel et al. (2012) [8] found closed values for anthocyanins and phenolics content. In their study for Serbian Cabernet Sauvignon (CS), Radovanović A. and Radovanović B.,(2010) [9],

specify a total content of anthocyanins with limits from 205.88 mg/L (CS, 2007) to 1940.28 mg/L (CS, 2008). A close value for Cabernet Sauvignon phenolics content from Recas winery (2341 mg/l) in 2011 was obtain by Dimitroska et al. (2013) [2] in Macedonia (2323±279 mg/l).

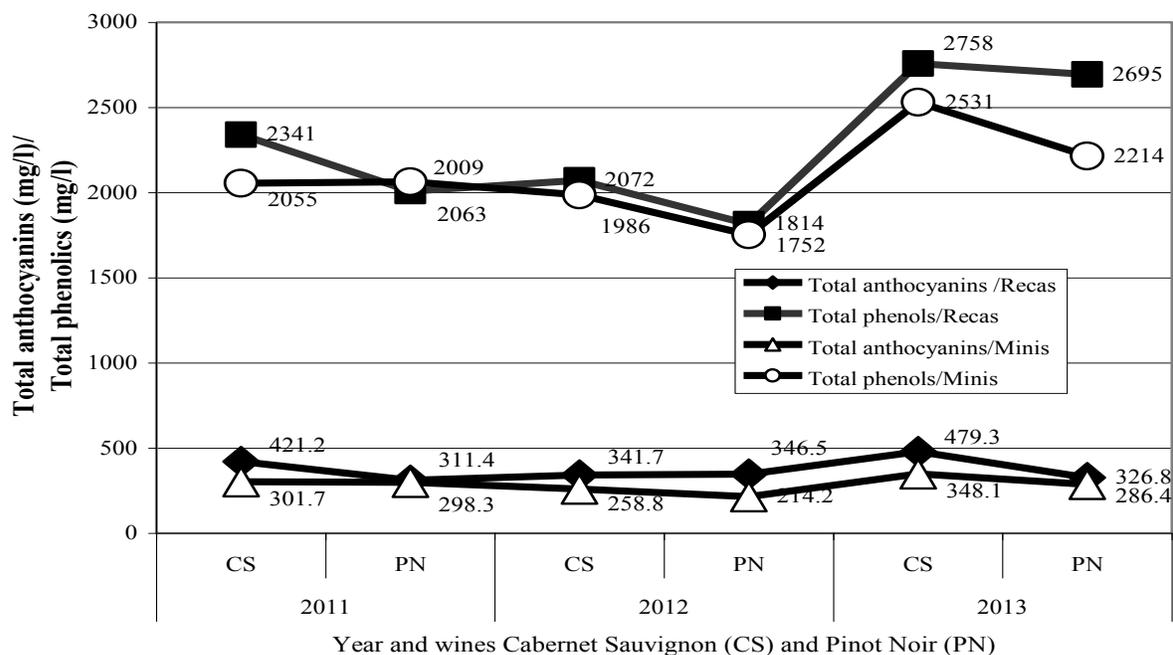


Fig. 1. Total anthocyanins and phenolic content in Cabernet sauvignon and Pinot noir red wines (2011-2013)

A concentration much higher of total phenolics of 1055 mg/l was found in Cabernet Sauvignon (CS), in a study made by Cliff et al (2007) [1], in British Columbia between 1995 and 2001. For Pinot Noir (PN) in the same research the total phenolics content was also very significant higher (1063 mg/l) compared with results obtained in wineries from Romania. Total anthocyanins for both red wines were much higher, of 476 mg/l (CS), and 242 mg/l (PN) respectively.

In a research for study the phenolic composition in commercial wines in Argentina, Fazzone et. al (2012) [4], found that Cabernet Sauvignon total anthocyanins content was 158.7±9.5g/l in expensive wines and 100.5±4.4 h/l in low cost ones.

The dark purple Cabernet sauvignon wine was the subject of study for Du B. et al (2012) [3], concerning the total phenolics and anthocyanins. They found a close value to Cabernet Sauvignon 2011 from Recas, of total phenolics content 219.5 ± 24.3 mg/100g, and a higher 67.8 ± 4.6 mg/100 g total anthocyanins content, respectively than any value registered in wines analyzed in both wineries from west of Romania.

Compared with the Cabernet Sauvignon wine from Recas and Minis, Tsanova-Savova et al. (2002) [12], found in Cabernet Sauvignon wine 1998 vintage, from Bulgaria a close value (274 mg/l) for total anthocyanin and total phenolics content (between 1699,7 mg/l and 1820 mg/l).

Conclusions

Results from this study, provide certain information about Cabernet sauvignon and Pinot Noir red wines from Recas and Minis wineries. Results suggest that wines from Recas winery with vintage 2011-2013, are richer in total anthocyanins and phenolics than those from Minis winery. The results are mostly similar to those found worldwide for wine obtained from two varieties, but in different years were registered and higher or smaller values for the two components. The climate, soil, and different winemaking technologies, from one year to another, also influenced the variable content.

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