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Original Article

A preliminary study on changes in phenolic content during Bianchetta Trevigiana winemaking

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ABSTRACT

Autochthonous grapevine varieties are considered a biodiversity resource in viticulture and an opportunity for Italian sustainable wine production. In this study, the ancient white wine variety Bianchetta Trevigiana, considered part of the agricultural history of the Veneto region, was vinified alone, with or without maceration, in order to better understand its technological and organoleptic characteristics, with the overall objective of valorising and re-evaluating it. The evolution of phenols—compounds that are very important for the organoleptic and technological profile of wine—was monitored during the winemaking process. Results show that contact with grape skins and seeds enhance phenol extraction and produces must and wine with higher concentrations of these compounds. Moreover, it was found that the concentration of flavanols in Bianchetta Trevigiana is similar or even higher than that of red wines.

1. Introduction

Wines, in particular autochthonous ones, are today considered as an expression of territory since they are part of the local cultural heritage which is original, typical and unique. Thus large numbers of grapevine varieties, seen as biodiversity resources in viticulture and an important opportunity for Italian wine to develop and improve in quality, are in the process of being recovered. Bianchetta Trevigiana, an ancient grapevine variety, is part of the agricultural history of the Veneto region. It was first mentioned in the 1500 s, when the generic name "Bianchetta" was assigned to several white grapevine varieties. Currently, Bianchetta Trevigiana is included in some Denominazione di Origine Controllata (DOC), wines that are produced in specific well-defined regions, according to specific rules designed to preserve the traditional winemaking practices of the individual regions. These include the "Montello e Colli Asolani" for Prosecco wine production. Bianchetta Trevigiana is often utilized for wine blending, although some attempts of winemaking using Bianchetta Trevigiana alone have given good results. Because of its thick skin, juicy and sweet pulp and astringent taste, Bianchetta Trevigiana has been utilized for raisin wine production and vinified with skin maceration.

In general, the skin of grapes is rich in molecules which confer to wine not only important oenological characteristics such as flavour, colour, stability and astringency, but also antioxidant activity. These substances are mainly represented by phenols which occur naturally in plants (Katalini et al., 2004). Phenols are classified according to their chemical structure into two groups: non-flavonoids and flavonoids. In grapes, the non-flavonoids comprise stylbens, hydrocynnamic and benzoic acids, while flavonoids include flavonols (e.g. quercetin, myricetin), flavan-3-ols (e.g. catechin, epicatechin and epigallocatechin) and polymers of the latter defined as procyanidins and anthocyanin (Minussi et al., 2003; Soleas and Goldberg, 1999).

Grape phenol composition is a varietal characteristic, but it can change during berry ripening depending on edafo-climatic conditions (Escribano Bailón et al., 1995). The highest concentration of phenols is found at the veraison. After this phenological stage, concentration declines slowly until maturity, when it remains constant. Phenols are located in both the skins and the seeds, but composition in the two parts is qualitatively and quantitatively different. In particular, skins contain both catechins and gallocatechins and their derived proanthocyanidins, whereas seeds present only catechins and procyanidins. Catechin is the

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most abundant phenol in these two parts of the berry, while the concentration of epicatechin is a varietal characteristic (Escribano Bailón et al., 1995; Santos-Buelga et al., 1995). Phenols are released from skins and seeds during winemaking, and for this reason oenological practices can affect the quality and quantity of these compounds in wine (Cheynier et al., 1997; Minussi et al., 2003). Red vinification is characterized by the contact of the skins and seeds with the grape juice, a process known as maceration.

In some regions maceration is becoming a common practice for white wine production as well (Selli et al., 2002). The skins and seeds of crushed and destemmed white grapes are macerated in the juice and wine under controlled conditions in order to obtain good-quality white wines (Darias-Martín et al., 2000). Taking into consideration that temperature strongly influences the rate of polyphenol extraction, Gómez-Míguez et al. (2007) reported the highest increases of all phenolic compounds after long skin contact times and low skin contact temperatures.

Phenols release from grape skins more quickly and easily than from seeds. For this reason, some authors assert that the higher contribution to the phenolic composition of wine comes mainly from the skins, in spite of their lower phenolic concentration, than from the seeds (Gómez-Míguez et al., 2007; Gonzalez-Manzano et al., 2004). These authors observed that extending maceration beyond the end of alcoholic fermentation leads to a large increase in phenolic content, in particular flavan-3-ols, released from the seeds (Gonzalez-Manzano et al., 2004).

The aim of this research was to assess the ancient grapevine variety Bianchetta Trevigiana by vinifying it alone and evaluating its technological and organoleptic characteristics. Moreover, Bianchetta Trevigiana was vinified both with and without maceration contact with skins and seeds, in accordance with historical traditions. In this respect, the length of maceration was emphasized in order to monitor the change in content of phenols, which are very important compounds for the organoleptic and technological profile of the wine. Since to our knowledge nothing has yet been published concerning the behaviour of this ancient white grape variety, the winemaking itself was considered as the experimental condition, making it possible to better characterize an autochthonous variety that clearly deserves to be better known.

2. Materials and methods

2.1. Materials

In 2006 Bianchetta Trevigiana (*Vitis vinifera* L. cv. Bianchetta) grapes were harvested in the Colli Asolani area (Italy) and vinified with maceration treatment (BM) and without maceration treatment (BB). In the latter treatment, contact with skin and seeds was maintained for the entire trial. Musts and wines samples were taken at different times during winemaking (0–190 days). The winemaking conditions were the same for both the treatments; in particular, once the commercial yeast strain *Saccharomyces cerevisiae* IOC18 2007 had been inoculated into the fermentation tanks, the process was kept at constant temperature of 13.5 °C.

2.2. Determination of oenological parameters

The equipment used was a Winescan FT 120 FTIR analyses (Foss) validated by AOAC (Official Methods, 2003). The infrared measurement range was 926–5012 cm^{-1}. Samples were injected after being degassed and filtered (Lachenmeier, 2007). A calibration for the analysis of several wine control parameters using a PLS algorithm was obtained. The analytical reference results for all parameters were obtained according to the European Community Regulation No. 2676/90 (Moreira and Santos, 2004). The oenological parameters analyzed were pH, total and volatile acidity, alcohol, glycerol, reducing sugars, total polyphenols and colour changes at an optical density of 420 nm.

2.3. HPLC analyses

Samples of must and wine were analyzed by HPLC 2700 coupled with 1806 UV/Vis (Finningan) detector. Samples were filtered (0.45 μm) and directly injected. The stationary phase was constituted by the column (Supelcosil TM-LC 18) and precolumn (Pelliguard TM-LC 18) of Supelco. The mobile phase (1 L) was constituted by n-butanol (18 mL) and acetic acid 50% (1.5 mL). Phenolic compounds were separated at room temperature (loop 20 μL) and with a flux of 1.2 mL min^{-1}. The analyzer was a UV detector at 275 nm. Each run lasted 30 min. Seven standards, including gallic and caffeic acids, (+)-catechin, (−)-epicatechin and epigallocatechin, procyanidin B1 and B2, were used for the calibration curves.

2.4. Sensory evaluation

A casual taste panel tested sight (limpidity, colour), bouquet (refinement, intensity, genuineness) and taste/flavour (body, harmony, persistence, aftertaste).

2.5. Statistical analysis

Three independent vinifications were performed for each treatment and all analytical and chromatographic determinations were analyzed in duplicate. Mean, standard deviation (SD) and the coefficient of variation (CV%) were calculated. Furthermore, the data were analyzed by CoStat version 6.312 of CoHort Software. Analysis was performed using independent-samples *t*-test procedure. $P < 0.05$ were regarded as significant and $P < 0.01$ as very significant.

3. Results and discussion

The oenological parameters of Bianchetta Trevigiana samples vinified with maceration and without maceration (identified as BM and BB, respectively) were determined at the beginning and the end of the winemaking process. The results (Table 1), obtained using a scientific apparatus for the fast analysis of musts and wines validated by AOAC, are in accordance with data referred to white grapevine varieties as reported in the literature (Fregoni et al., 2004; Ribéreau-Gayon et al., 2000).

The quantitative variation of total phenols in the BB and BM treatments during the winemaking period, respectively 800 and 1800 mg L^{-1}, revealed that contact with the skin and seeds enhances phenols extraction and produces musts and wines with higher concentrations of these compounds, in accordance with Hernanz et al. (2007). To demonstrate that the extension of the maceration over the end of the alcoholic fermentation leads to a high increase in the content of flavanols released from seeds (Gonzalez-Manzano et al., 2004), these compounds were detected and quantified with HPLC (Figs. 1 and 2).

It is known that caffeic and gallic acids, which belong respectively to the cynnamic and benzoic acids, are the phenolic

Table 1
Compositional factors of Bianchetta Trevigiana samples determined by FOSS.

Days	Ph		Glycerol		Sugar (g L^{-1})		Ethanol (%)	
	BM	BB	BM	BB	BM	BB	BM	BB
0	3.09	3.08	0.0	0.0	176.77	178.25	0.24	0.05
190	3.38	2.90	6.0	6.62	0.0	0.0	12.29	12.49

BM samples made with maceration; BB samples made without maceration.