Macrowine 2021 Virtual
Verona, June 23-30 2021

ENOLOGICAL AND NUTRACEUTICAL POTENTIAL OF SOME GRAPE VARIETIES TOLERANT TO DOWNY MILDEW AND POWDERY MILDEW

Fabiola De Marchi, Mirko De Rosso, Massimo Gardiman, Luigi Sansone, Annarita Panighel, Riccardo Flamini
Council for Agricultural Research and Economics – Research Center for Viticulture & Enology, Viale XXVIII aprile, 26 – 31015 Conegliano (TV), Italy

Introduction

Since 2012 the Veneto Region regulations allow the cultivation of twenty hybrid grapevine varieties tolerant to downy and powdery mildew, the main fungal diseases affecting grapevines. These varieties are characterized by high vigor and grape productivity, require a reduced pesticide use, and are suitable to develop sustainable viticulture in mountain areas located at medium altitudes (400-800 m a.s.l.), such as Veneto higher foothills and lower areas of Dolomites (North-East of Italy). The main aim of project VINIRES (started in 2018) is to evaluate the enological potential of four resistant vine varieties and their aptitude to produce high-quality wines: three white grape cultivars (Souvignier gris, Johanniter, Bronner), and the red grape cv Cabernet Cortis. The metabolomics study performed using high-resolution mass spectrometry techniques (UHPLC/QTOF) provided the complete profiles of the metabolites which determine the enological potential of the varieties. They include polyphenolic compounds belonging to the chemical classes of anthocyanins (natural colorants), flavonols, flavanols and procyanidins (antioxidant and astringent compounds), *trans*-resveratrol and stilbenes (nutraceutical compounds), and aroma glycoside precursors responsible for fruity/floral and floral/spicy notes of wines.

Experimental

Samples. Ripe grapes of varieties Cabernet Cortis, Bronner, Souvignier gris, and Johanniter were collected in 2019 and 2020 from vineyards located in Belluno province (Italy). Grape berries were randomly collected from different vines and immediately frozen at -20 °C until sample preparation for analysis.

Sample preparation. Twenty berries were weighed and homogenized using liquid nitrogen. The resulting powder was added of pure methanol by a ratio of 1:2 w/v and 200 µL of internal standard 4,5,7-trihydroxyflavanone of 520 mg/L solution (Sigma-Aldrich, Milan, Italy). Extraction was carried out at room temperature for 20 min. The extract was centrifuged at 4200 rpm for 12 min at 18 °C and filtered by a 0.22 µm GHP Acrodisc filter (Pall) by collecting the solution in a vial for analysis. For each sample, two replicate analyses were performed.

UHPLC/QTOF analysis. Extracts were studied by using an Ultra-High Performance Liquid Chromatography (UHPLC) Agilent 1290 Infinity system coupled to Agilent 1290 Infinity Autosampler (G4226A) and Agilent 6540 accurate-mass Quadrupole-Time of Flight (Q-TOF) Mass Spectrometer (nominal resolution 40.000) equipped with Dual Agilent Jet Stream Ionization source (Agilent Technologies, Santa Clara, CA). Full scan acquisition in the *m/z* 100–1700 range, was performed. Targeted identification of the metabolites by using the homemade database *GrapeMetabolomics* (Flamini et al., 2013) (1).

UV-Vis analysis. Polyphenolic indexes were determined using the analytical methods proposed by Di Stefano and Cravero (1991) (2).

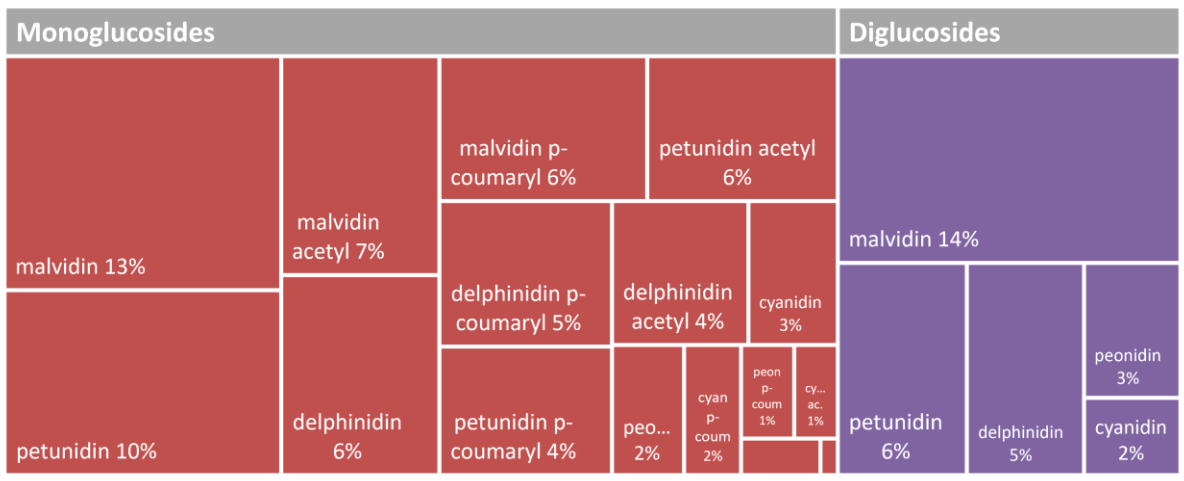

Fig. 1. Percentages of anthocyanins identified in the profile of Cabernet Cortis.

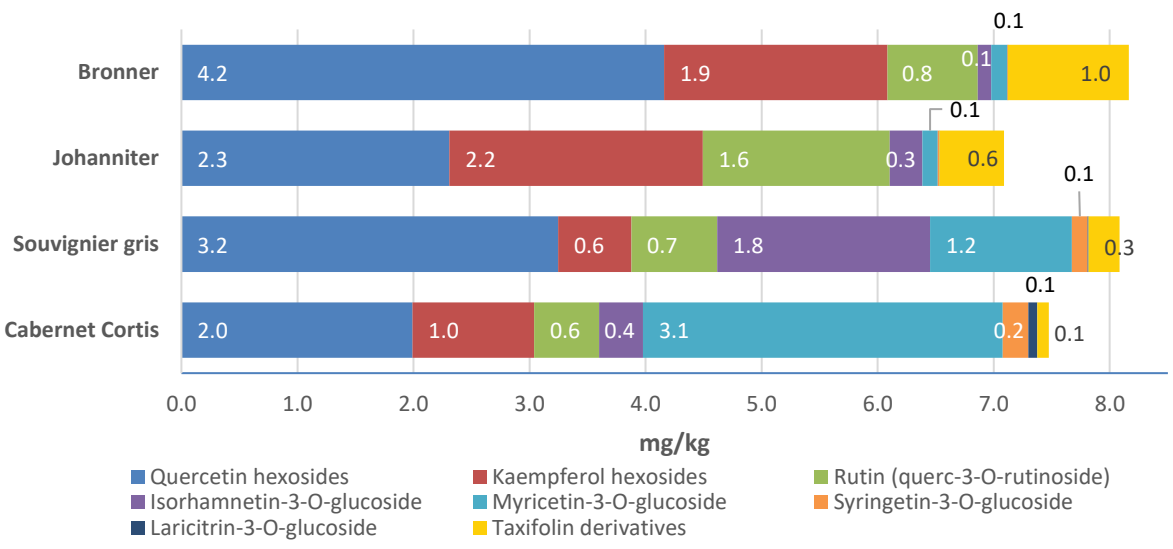

Fig. 2. Contents of flavonols and taxifolin (mg IS/kg grape) found in the four grape varieties.

Conclusions

Study of oenological potential of grapes coupled to evaluation of the experimental wines produced in 2019 and 2020 showed that these varieties have a high potential to produce both still and sparkling wines suitable to match the consumers' satisfaction. Cabernet Cortis has a secondary metabolites profile which makes this variety suitable to produce wood-aged wines with floral notes. Souvignier gris is characterized by the presence of α-terpineol (floral aroma) and of interesting stilbenes which confer nutraceutical properties to the wines. Johanniter, characterized by high levels of geraniol, has a high aptitude to produce aromatic sparkling wines. Semi-aromatic character of Bronner makes this variety interesting for producing fresh and fruity still white wines.

Spreading of these resistant varieties can promote the development of eco-sustainable viticulture at medium-high altitudes, such as Belluno Prealps and low Dolomites, an area which is of increasing interest in the context of the ongoing climate changes.

References

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Main results

On average 600-800 compounds were identified in UHPLC/QTOF profile of extracts. The study then focused on the main 104 secondary metabolites directly correlated to the enological proprieties of grapes.

In the anthocyanin profile of Cabernet Cortis 21 compounds, were identified, with a significant presence of diglucosides inherited by the non-*V. vinifera* parental (Fig. 1). The total anthocyanin content was comparable to some *V. vinifera* varieties such as Cabernet Sauvignon, Raboso Piave, and Refosco (2100-2900 mg/kg grape, Mattivi et al., 2006) (3). Relevant content of antioxidant compounds, in particular flavonols trisubstituted at B-ring (myricetin, syringetin, laricitrin), was found (Fig. 2). As main aroma precursors linalool and geraniol glycosides (floral notes), were found (Fig. 3).

Souvignier gris is a pink grape variety and the skin contains some anthocyanins. In particular, the presence of cyanidin monoglucoside and cyanidin diglucoside was found, even if at low levels, as well as traces of other anthocyanins. Interesting relevant presence of *trans*-resveratrol and other stilbene derivatives, was found. Aroma precursors profile was characterized by the presence of vomifoliol (C_{13}-norisoprenoid compound) and α-terpineol (floral aroma) (Fig. 3).

In Johanniter, relevant presence of rutin (Fig. 2) and prodelphinidin was found. Geraniol glycosides were the dominant aroma precursors (floral note) (Fig. 3).

Bronner was characterized by a higher level of flavonoids characterized by relevant antioxidant activity, such as quercetin and taxifolin (Fig. 2). Relevant presence of glycoside monoterpene diols, was found (Fig. 3).

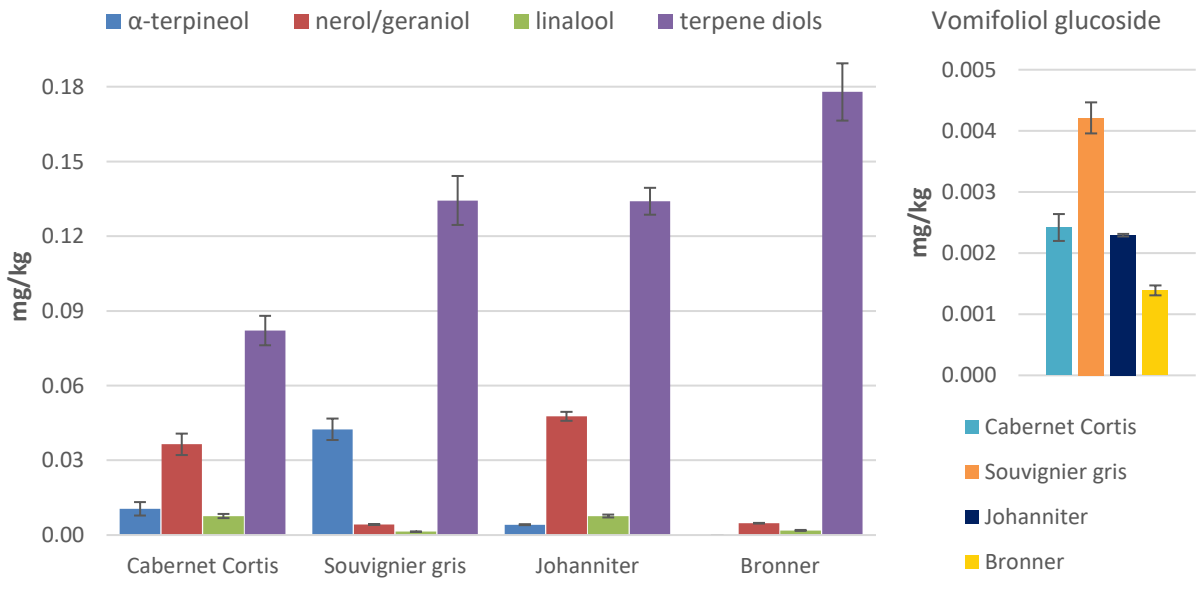

Fig. 3. Content of the main aroma precursors found in the four grape varieties (mg/kg): α-terpineol, nerol/geraniol, and linalool pentosyl-hexosides; terpene diols: furan/pyran linalool oxides, 8-hydroxy-linalool, *p*-menthenediol I, diendiol I, terpendiol isomers pentosyl-hexosides.

Acknowledgements: Financial support Vinires project, Rural development program for Veneto Region 2014-2020.

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