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First International Symposium on Macromolecules and Secondary Metabolites of Grapevine and Wines

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Program and Abstracts
List of Participants

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Poster 22

Phenolic Characteristics and Wine Quality of Autochthonous Brunetta di Rivoli (*Vitis vinifera L.*)

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The wine market seems to look with an increasing interest to minor and native grapevine varieties, due to the appeal of their unique personalities and to their historical link to specific viticultural areas. The exploration of the enological potentialities and the value of these scarcely known or underestimated cultivars, is the first step towards their economic exploitation.

In order to recover and safeguard the old Italian grape germplasm and to promote the sustainable use of local biodiversity, a research project on assessing the enological value of these old grapevine varieties has been started in Piedmont alpine valley.

The aim of this work was to study the phenolic composition and wine quality of autochthonous "Brunetta di Rivoli" (*Vitis vinifera* L.), an ancient grapevine variety diffused in moraines hills of Rivoli (Province of Turin) and in Susa Valley (Piedmont, North West Italy Alps).

The phenolic composition of grape (skin and seeds) was studied for the first time during two vintages (2004-2005), involving spectophotometric and High Performance Liquid Chromatography analytic methods.

The total amount of anthocyanins was 1040 mg/kg berries while the flavonoids concentrations in berry skin and seeds were respectively 3080 mg/kg berries and 760 mg/kg berries. The anthocyanin profile was particularly unfavourable for winemaking, with Cyanidin-3-glucoside and peonidin-3-glucoside as principal anthocyanins representing respectively 36,5% and 24,2% of grape skin total anthocyanins.

The trans-*p*-coumaroyl tartaric acid was the most important grape hydroxycinnamoyl tartaric acid (97 mg/ kg berries).

The wine was characterized by low contents of total anthocyanins (205 mg/L) and proanthocyanidins (1210 mg/L).

1. *Zeppa G., Rolle L., Gerbi V. and Guidoni S. (2001) – Anthocyanin composition of four autochthonous Vitis Vinifera grapevine varieties from the Piedmont. Ital. J. Food Sci, 4, 13, 405-412.*
2. *Gerbi V., Rolle L., Zeppa G., Guidoni S. and Schneider A. (2005) – Indagine sul profilo antocianico di vitigni autoctoni piemontesi. Industrie delle bevande, 34, 195, 23-27.*
3. *Guidoni S., Schneider A., Rolle L., Zeppa G., Ferrandino A. and Gerbi V. (2003) – Relationships among grape cultivars "Neretti" ("The Black Ones") autochthonous of western alps, based on their phenolic profiles. Atti 7th International Symposium of Oenology, France, Bordeaux, 19-21 June 2003, 155-158.*

Macromolecules and Secondary Metabolites of Grapevine and Wine

Fruit Development, Biotic and Abiotic Stresses, Mechanisms of Plant Defense Responses, Polyphenolics, Aroma Compounds and Secondary Metabolites, Proteins, Glycoproteins, Polysaccharides, Physico-Chemical and Enological Aspects

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PREFACE

Macromolecules and Secondary Metabolites of Grapevine and Wine summarizes some of the presentations made at the First International Symposium on Macromolecules and Secondary Metabolites of Grapevine and Wine (Macrowine 2006) held in Reims in May 2006 under the aegis of the University of Reims, the Europol'Agro Institute and the International Organization of Vine and Wine (O.I.V.). Of the 82 oral and poster communications made during this Symposium, 61 are presented here in the form of short articles or mini-reviews. The aim of this book is to constitute a Forum concerning macromolecules and secondary metabolites of grapevine and wine (that is, polyphenolic compounds, aromas, proteins, glycoproteins and polysaccharides...) in relation to the physiology of grape ripening (genomics and proteomics, defense mechanisms of grapevine against phytopathogenic microorganisms), on one hand, and, on the other hand, in relation to physico-chemical phenomena in wines (color, co-pigmentation, haze, wine stabilization, foam and physics of bubbles in Champagne and Sparkling....). Papers will be shared into the following sections:

Section 1: Fruit Development, Biotic and Abiotic Stresses, Mechanisms of Plant Defense Responses (18 articles)

Section 2: Proteins, Glycoproteins, Polysaccharides (12 articles)

Section 3: Polyphenolics, Aroma Compounds and Secondary Metabolites (18 articles)

Section 4: Physico-Chemical and Enological Aspects (13 articles)

The Editors thank the sponsors that made the Symposium possible, i.e., the Regional Council of *Champagne Ardenne*, the *Ville de Reims*, the General Council of *Marne*, the Ministry of Research, the *Association Recherche Oenologique Champagne et Université*, the *Union des Oenologues de France*, the *Station Oenotechnique de Champagne- Sofralab*, *Moet et Chandon*, the CNRS and the INRA. We would also like to thank all the authors for their contributions.

The Second International Symposium on Macromolecules and Secondary Metabolites of Grapevine and Wine (Macrowine 2008) will be hosted by the INRA of Montpellier in 2008.

Opinions expressed in the following articles are under the sole responsibility of their Authors and do not implicate Editors'responsibility.

The Editors,
Philippe Jeandet,
Christophe Clément,
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Phenolic Characteristics and Wine Quality of the Autochthonous Grapevine Variety Brunetta di Rivoli (*Vitis vinifera* L.): Promotion of the Sustainable Use of Local Biodiversity

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In order to recover and safeguard the old alpine grape germplasm and to promote the sustainable use of local biodiversity, a European Research Project on assessing the enological value of these old grapevine varieties has been performed in Western Alps (Piedmont, Ain, Isère, Drôme, Savoie, Hautes Alpes) [10].
Autochthonous grape varieties, as well as those grown here for long times, are usually well adapted to the severe alpine environment, more than others recently introduced.
For Piedmont, the viticulture of Susa Valley, the most important valley in the province of Torino was examined. The assessment of the enological potentialities and the value of these scarcely known or underestimated cultivars, is the first step towards their economic exploitation.
Autochthonous "Brunetta di Rivoli" (*Vitis vinifera* L.) is a very rare grapevine variety (< 1,000 vines currently in production) diffused historically in this valley. Scientific information on this cultivar are scarce. Its ampelographic characteristics and agronomical performances were investigated in precedent works [9]. The aim of this work was to study the phenolic composition of berry skin, pulp and seeds and appraise the quality of the resulting wines.

Materials and Methods

The grapes were obtained from only one vineyard in production situated in Rivoli (TO). Grapes were sampled for two years. Three hundred berry samples were picked fresh randomly at harvest.
Phenols were extracted from skin and seeds by mean of hydro-alcoholic buffer at pH 3.20, followed by homogenization. Analyses were carried out by spectrophotometry (total anthocyanins, TA; proanthocyanidins, PR; phenols reactive to vanillin, VAN) and by HPLC, regarding both the anthocyanin profile and the hydroxycinnamoyl tartaric acid content (HCTA) [2].
Winemaking experiments were carried out in stainless steel tanks and about 100 kg of grapes were used for each trial. Three microvinifications were performed for each year. 50 mg /L of SO_2, and 150 mg /L di ammonium sulphate were added to the must obtained from crushing and destemming the grapes and inoculated with 200 mg /L of dried yeast BRL97 (Lalvin). Skin contact was made for 120 hours during

which one pumping over day was made. 0.01 mg /L of malo-lactic bacteria starter (MBR Lalvin) was added and the wine was maintained at 20 °C until the end of the malo-lactic fermentation. 15 days after completion of the malolactic fermentation, wines were analyzed according to the following parameters: alcoholic content, ashes, total acidity, pH, total dry matter and acids (by HPLC).
The phenolic compound indexes examined were: proanthocyanidins (PR), phenols reactive to vanillin (VAN), total anthocyanins (TA), monomeric anthocyanins (MA) and anthocyanins by HPLC [3]. The chromatic properties determined were: color intensity and tint, CIELAB index with reference to illuminant C* using cuvettes of 1 mm optical pathway [7].

Results and Discussion

Table 1 shows the polyphenolic composition of Brunetta di Rivoli grapes. The content of PR and TA are similar to that of other important and diffused varieties cultivated in Italy as Montepulciano and Teroldego [5]. Moreover, the anthocyanin concentration is similar to well known cultivars such as Tempranillo [8], Cabernet Franc and Merlot [6]. Trans-*p*-coumaroyl tartaric acid was the most important grape hydroxycinnamoyl tartaric acid (97 mg /kg berries).

Table 1: Polyphenolic composition of Brunetta di Rivoli grapes. Means of two vintage and three replicates. (Avg = average; SD = standard deviation)

		Avg	SD
Berry skin	TA (mg malvidin 3 monogl.chloride/kg berries)	1040	126
	PR (mg cianidin chloride/kg berries)	3080	184
	VAN (mg (+) catechin/ kg berries)	646	32
Seeds	PR (mg cianidin chloride/kg berries)	760	65
	VAN (mg (+) catechin/ kg berries)	452	28
Berry skin and seeds	% skin total PR	80.2	1.89
	% seeds total PR	19.8	1.89
	% skin total VAN	58.8	2.25
	% seeds total VAN	41.2	2.25
Pulp	*Cis* caffeoyl tartaric acid (mg/kg berries)	0.53	0.07
	Trans caffeoyl tartaric acid (mg/kg berries)	58.55	6.10
	Cis p-coumaroyl tartaric acid (mg/kg berries)	20.5	1.16
	Trans p-coumaroyl tart. acid (mg/kg berries)	97.1	1.69

Table 2 shows the anthocyanin profile of Brunetta di Rivoli grapes. The group of simple glucosides represented the highest proportion among all anthocyanin forms (96.85 %).

Table 2: Percentage distribution of the anthocyanins of Brunetta di Rivoli grapes. Means of two vintage and three replicates. Cinnamoyl-glucosides included both p-coumaroyl and caffeoyl anthocyanin forms. (Avg = average; SD = standard deviation)

		Avg	SD
Total glucosides (%)	Simple glucosides	96.86	0.14
	Acetyl-glucosides	1.20	0.05
	Cinnamoyl-glucosides	1.94	0.12
Total anthocyanidins (%)	∑ of delphinidin derivative forms	14.74	0.30
	∑ of cyanidin derivative forms	37.43	2.25
	∑ of petunidin derivative forms	9.95	0.39
	∑ of peonidin derivative forms	24.91	1.18
	∑ of malvidin derivative forms	12.97	0.94
	Acetyl-glucosides/ Cinnamoyl-glucosides	0.62	0.04
	Malvidin deriv. forms/ Peonidin deriv. forms	0.52	0.02

Di-substituted anthocyanins (sum of cyanidin and peonidin derivative forms) are the main colored pigments (62.34%). The ratios between cinnamoyl and acetyl-glucosides (0.62) and particularly between malvidin and peonin derivative forms (0.52) could be proposed as varietal markers.
Wine was characterized by low contents of PR (1.210 mg /L) and particularly of TA (205 mg /L) (**Tables 3-4**).

Table 3: Chemical characteristics of Brunetta di Rivoli wines after completion of the malo-lactic fermentation. Means of two vintages, three vinifications for year. (Avg = average; SD = standard deviation)

		Avg	SD
Chemical analysis	Alcohol content (% vol.)	12.6	0.14
	Total dry matter (g/L)	25.4	1.91
	Ash (g/L)	2.51	0.08
	pH	3.45	0.04
	Total acidity (g/L tartaric acid)	6.35	0.92
	Tartaric acid (g/L)	3.20	0.08
	Lactic acid (g/L)	2.82	1.15
Phenolic characteristics	PR (mg cianidin chloride/L)	1210	77
	VAN (mg (+) catechin/ L)	465	30
	TA (mg malvidin 3 monogluc. chloride/ L)	205	18
	MA (mg malvidin 3 monogluc. chloride/ L)	80	24
Chromatic properties	Color intensity (P.O 1mm)	0.587	0.04
	Tonality	0.748	0.15
	L*	31.15	1.93
	a* (red-green)	60.01	6.07
	b* (yellow-blue)	47.91	3.52

Table 4: Percentage distribution of anthocyanins in Brunetta di Rivoli wines after completion of the malolactic fermentation. Mean of two vintages, three vinifications for year. Cinnamoyl-glucosides included both p-coumaroyl and caffeoyl anthocyanin forms. (Avg = average; SD = standard deviation)

		Avg	SD
Total glucosides (%)	Simple glucosides	97.44	1.22
	Acetyl-glucosides	1.61	0.44
	Cinnamoyl-glucosides	0.95	0.32
Total anthocyanidins (%)	∑ of delphinidin derivative forms	16.24	1.52
	∑ of cyanidin derivative forms	12.70	1.02
	∑ of petunidin derivative forms	10.75	2.01
	∑ of peonidin derivative forms	17.25	2.66
	∑ of malvidin derivative forms	43.06	3.75
	Acetyl-glucosides/ Cinnamoyl-glucosides	1.69	0.12
	Malvidin deriv. forms/ Peonidin deriv. forms	2.49	0.29

The wine anthocyanin content of the Brunetta di Rivoli variety was shown to decrease as compared to that of the grape, especially di-substituted anthocyanins and namely those with a catechol type structure on the B-ring. The remarkable loss of di-substituted anthocyanins, compounds which are easily extractable during the first phases of maceration [4], is probably due to their oxidation [1].

Conclusion

The Brunetta di Rivoli grapevine variety is well adapted to its environment. The phenolic composition of Brunetta di Rivoli grapes indicates that this variety exhibits valuable enological potentialities. Innovative techniques of vinification are needed to preserve anthocyanin pigments in wine. Recovery and safeguarding this rare and old cultivar is a critical point in promoting the sustainable use of local biodiversity.

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