

DETERMINATION OF MONOTERPENES ON PORTUGUESE WINE VARIETIES

A. BARBOSA¹, A.C. SILVA FERREIRA¹, P. GUEDES DE PINHO¹,
M. PESSANHA², M. VIEIRA², L.C. ALMEIDA², J.M. SOARES FRANCO²
and T. HOGG¹

1. Escola Superior de Biotecnologia, Universidade Católica Portuguesa,
Rua Dr. Bernardino de Almeida, 4200-072, Porto, Portugal

2. Sogrape-Vinhos de Portugal, Aldeia Nova de Avintes,
4400 V.N. Gaia, Portugal

INTRODUCTION

The monoterpenes can exist in two forms: free and glycosidically conjugated forms (1, 2). The free form is present in several wine varieties in different amounts (3, 4). The present work describes the free terpenol profile of 158 wines, white and red wines, coming from different varieties, and from different regions of Portugal. The aim of this work is to screen the free terpenol profile (linalool, α -terpineol, citronellol, nerol, geraniol) obtained through several years from different varieties, in order to select the best vinification procedure, as well as to help producers making wine. It was also intended to group the distinct wines in families, as an attempt to understand in which way the wine's free terpenol contents are influenced by grape variety.

MATERIALS AND METHODS

Wine Samples

158 wines, white and red wines, were used. They came from different varieties, and from 4 different regions of Portugal, they were all made by the same producer (SOGRAPE Vinhos de Portugal AS) using the SOGRAPE wine vinification procedures. White wines came from the Vinhos verdes region, the Bairrada region and the Dão region. From Vinhos Verdes region, Loureiro was the only wine variety studied. Arinto, Maria Gomes, Bical and Cerceal are varieties from Bairrada region. Encruzado is a white wine variety from the Dão region. Red wines came from Dão region and Alentejo region. From Dão region Touriga Nacional and Jaen were the varieties study while Alfrocheiro, Aragonês and Trincadeira are varieties from Alentejo region The wines were analysed in the year of their production.

Extraction of free terpenes and Chromatographic analysis

The method used was developed by Bertrand (5) and was modified by Guedes de Pinho (6).

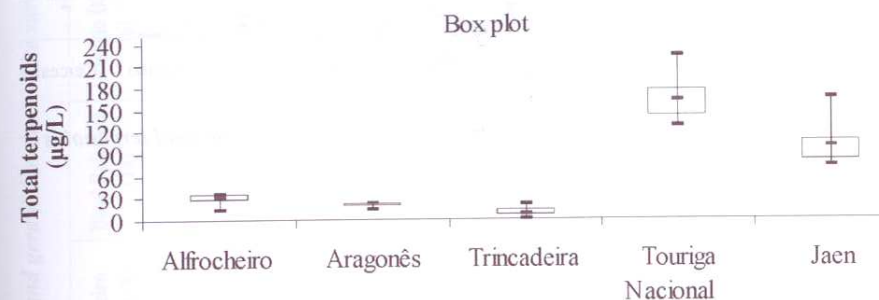


Figure 1: Box Plot representing the variation of the content of the total terpenoids detected in the 5 red varieties analysed

Table I: Concentration ($\mu\text{g}\cdot\text{L}^{-1}$) of the five free terpenoid compounds, linalool, α -terpineol, citronellol, nerol and geraniol in the 5 red varieties analysed

Red wines Region (n° of wines)		Alfrocheiro Alentejo (6)	Aragonês Alentejo (6)	Trincadeira Alentejo (6)	Touriga Nacional Dão (7)	Jaen Dão (6)
Linalool ($\mu\text{g}\cdot\text{L}^{-1}$)	Average	11,1	5,8	4,7	65,6	39,0
	minimum	7,1	5,0	nd	26,0	21,0
	maximum CI	18,4	6,3	9,4	95,0	87,0
		8,4	1,8	11,7	21,8	25,9
α -terpineol ($\mu\text{g}\cdot\text{L}^{-1}$)	Average	3,7	1,6	2,3	29,4	0,2
	minimum	nd	nd	nd	nd	nd
	maximum CI	8,2	4,7	7,0	49,1	1,1
		6,8	6,8	10,0	16,5	0,5
Citronellol ($\mu\text{g}\cdot\text{L}^{-1}$)	Average	5,2	6,9	1,0	19,2	14,8
	minimum	nd	nd	nd	11,0	nd
	maximum CI	13,9	14,7	2,0	24,0	24,7
		10,6	18,3	2,5	4,9	12,3
Nerol ($\mu\text{g}\cdot\text{L}^{-1}$)	Average	3,7	2,3	0,5	24,3	35,8
	minimum	nd	nd	nd	11,5	22,0
	maximum CI	7,5	3,8	1,6	36,2	49,7
		5,8	5,1	2,3	9,6	10,3
Geraniol ($\mu\text{g}\cdot\text{L}^{-1}$)	Average	4,4	2,9	0,9	23,5	10,7
	minimum	nd	1,9	nd	18,0	nd
	maximum CI	9,8	3,8	1,6	33,8	27,0
		6,9	2,4	2,0	4,9	12,9

Confidence interval (CI) ; Not detected (nd).

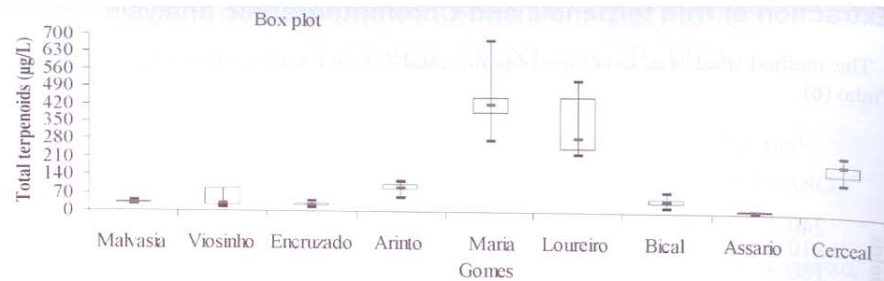


Figure 2: Box Plot representing the variation of the content of the total terpenoids detected in the 9 white varieties analysed

RESULTS AND DISCUSSION

Touriga Nacional is the red wine variety with the higher content of total terpenoids (figure 1), followed by Jaen. The most important differences between these two varieties were achieved for linalool, terpineol and geraniol compounds, which levels are higher in Touriga Nacional (table I). Citronellol and nerol levels are similar in Touriga Nacional and Jaen, not contributing to the aromatic differences among these varieties. Alfrocheiro, Aragonês and Trincadeira have the smallest contents in terpenoids. Trincadeira variety has the lowest content of free monoterpenes. Among white varieties Maria Gomes and Loureiro have the highest contents of terpenoids compounds (figure 2), these being very important to the sensorial bouquet. These results confirm some previous studies (6). In fact, the linalool average concentration of Maria Gomes is two times higher than the olfactive perception threshold, which is $100 \mu\text{g}\cdot\text{L}^{-1}$. Linalool average concentration of Loureiro is also above this threshold (table II). Wines from Cerceal varieties have lower contents of linalool than Maria Gomes and Loureiro, but they are at significant levels, considering the threshold limit. The other six white wines varieties have very low levels of these compounds. For comparison of contents in free terpenol compounds between red and white varieties, it's very clear that white varieties have higher contents on terpenols than red varieties. With exception for Touriga Nacional wines, which have only lower terpenol contents than Maria Gomes and Loureiro. As Cerceal, Touriga Nacional have levels of linalool closely to the olfactive perception threshold, which may justify the floral note regularly associated with the complex bouquet of Touriga Nacional wines.

CONCLUSION

Among the 9 white wine varieties studied, Maria Gomes and Loureiro have the highest levels of free terpenes, which participate in their sensorial bouquet. Conversely, among red varieties, Touriga Nacional wine variety has the highest levels of free monoterpenes. This study also concludes that wines from Touriga Nacional variety have similar levels of free terpenes to other white wine varieties, which may justify the floral note often associated with their wine bouquet.

Table II: Concentration of the five free terpenoid compounds, linalool, α -terpineol, citronellol, nerol and geraniol in the 9 white varieties analysed

White wines Region (n° of wines)	Average minimum maximum CI	Malvasia Douro (6)	Viosinho Douro (6)	Encruzado Dão (6)	Arinto Bairrada (23)	Maria Gomes Bairrada (35)	Loureiro Verde (8)	Bical Bairrada (14)	Assario Dão (6)	Cerceal Bairrada (23)
		Linalool ($\mu\text{g}\cdot\text{L}^{-1}$)	10,5 8,5 12,1 4,6	3,7 2,3 5,1 3,5	17,8 5,1 31,2 10,1	47,2 31,0 60,0 3,3	203,8 122,8 345,0 17,3	172,4 90,0 253,6 53,4	33,2 17,0 57,0 7,2	3,6 2,7 5,2 3,4
α -terpineol ($\mu\text{g}\cdot\text{L}^{-1}$)	Average minimum maximum CI	13,6 11,3 14,9 5,1	6,9 4,1 10,1 7,5	nd nd nd nd	21,3 nd 60,0 9,0	186,3 92,0 322,0 23,0	132,9 66,0 232,8 51,7	3,6 nd 21,0 4,3	nd nd nd nd	73,3 30,0 114,0 12,1
Citronellol ($\mu\text{g}\cdot\text{L}^{-1}$)	Average minimum maximum CI	0,3 nd 0,9 1,3	4,1 nd 7,3 9,2	0,6 nd 3,4 1,5	4,0 nd 18,0 2,5	4,9 nd 18,0 2,0	nd nd nd nd	0,5 nd 2,9 0,5	1,0 nd 3,0 4,3	9,1 nd 30,0 4,5
Nerol ($\mu\text{g}\cdot\text{L}^{-1}$)	Average minimum maximum CI	4,3 nd 10,5 13,6	4,5 1,5 6,9 6,9	3,5 nd 6,2 3,0	17,0 nd 56,1 9,5	9,0 nd 36,0 3,5	22,5 nd 45,3 17,5	5,6 nd 21,0 3,7	2,0 nd 6,0 8,6	13,7 nd 47,0 7,9
Geraniol ($\mu\text{g}\cdot\text{L}^{-1}$)	Average minimum maximum CI	0,7 nd 2,1 3,0	4,1 3,1 5,9 4,1	2,2 nd 7,0 3,5	2,3 nd 11,0 1,5	18,3 nd 51,0 5,7	11,0 nd 30,0 8,5	1,2 nd 9,0 1,6	2,4 nd 3,6 5,2	2,9 nd 9,0 1,4

Confidence interval (CI) ; Not detected (nd).

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