Volatile Composition of Red Mencía and Sousón cultivars from Rias Baixas and Valdeorras AOC. (NW Spain)

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ABSTRACT

Mencía and *Sousón* are two red *Vitis vinifera* cultivars grown in two geographic areas from Galicia (NW Spain), Appellation of Origin Controlled Valdeorras and Rías Baixas. Valdeorras AOC is situated in south east Galicia, with Continental climate, slate soil, gentle temperature and rainfall and Rías Baixas AOC is located in the southwest Galicia, near of the sea, with Atlantic climate, siliceous soil, and slightly higher temperature and rainfall than the first one. The aim of this study was to carry out a first approximation to determinate the influence of *terroir* on volatile composition of these red cultivars grown in Galicia. Grapes of *Mencía* and Sousón, collected in 2009 vintage, were crushed and the musts volatiles were extracted using Solid Phase Extraction (SPE). The identification and quantification was performed by gas chromatography-mass spectrometry (GC-MS) in free and bound form. The results showed a greater effect of *terroir* in bound compounds (alcohols, volatile phenols, C_{13}-norisoprenoids and volatile fatty acids) between geographic areas for the two cultivars studied. In free fraction C_6-compounds and carbonyl compounds showed variability between geographic areas for the cultivars.

Key Words : Mencía, Sousón, Valdeorras, Rías Baixas, terroir, volatile composition

1 INTRODUCTION

Sousón and *Mencía* are two different *Vitis vinifera* red cultivars grown traditionally in Rías Baixas and Valdeorras Appellation of Origin Controlled (AOC), in Galicia (NW Spain). Differences in soil and climate have a decisive influence in the character, quality and typical attributes of a wine [1]. Even the same grape varieties and the same brewing processes in different regions also will produce wine of different styles, which is considered as a regional typicality of wine [2].

Valdeorras AOC has mediterranean-oceanic climate with Atlantic influence. Winter is cold, with hot summer and gentle spring and autumn. The minimum, medium and maximum temperatures are 8ºC, 11ºC and 33ºC, respectively. The precipitation rate is between 850 and 1000 mm/year, and the altitude is above 450 m. The soil is very diverse, including flood-plains, alluvial-terrace, limestone, slate, clay-ferrous and granitic, with high drainage that makes this conducive for producing moderate yields with good quality of the grapes [3].

The climate in Rías Baixas AOC is Atlantic, with gentle winters and low differences between day and night temperatures. The temperature average is 9ºC, and the rainfall ranges between 600 and 1600 mm/year [4]. Early spring is rainy, with little frost because it is located near the coast. Summer is hot-tempered, so little time reaches 40 º C, and autumn is gentle and rainy. The topsoil is correspondingly alluvial and granite bedrock and slate come to the surface and the altitude is generally below 300 m [5].

The aim of this work was to obtanin a first approximation to describe the potential aroma profile of *Mencía* and *Sousón* red cultivars grown in these two recognized zones from NW of Spain, and establishing the differences and similarities between them.

2 MATERIALS AND METHODS

2.1 Samples

Samples of *Mencía* and *Sousón* grapes were harvested in 2009 vintage. About 3 kg of grapes was previously crushed in a blender (Turbo blender, Moulinex, position 4, 7 sec) and frozen at -20ºC until sample preparation.

2.2 Extraction and analysis of must extracts

The samples were processed and quantified according to Oliveira et al. [6]. Frozen must was thawed and centrifuged. About 75 mL of must was spiked with 2.35 µg of 4-nonanol like internal standard. The sample was passed through a LiChrolut EN cartridge (500 mg, 40-120 µm) previously conditioned. Free and bound analytes were recovered respectively with pentane:dichloromethane (2:1, v/v) and ethyl acetate. Bound fraction was subjected to enzymatic reaction to release bound aromas, and then to liquid-liquid extraction to recovery the aglycons. The obtained extracts were injected in a gas chromatograph-mass

spectrometer to identify and quantify the volatiles presented in grape extracts.

3 RESULTS AND DISCUSSION

The study of different families of compounds found in grapes from two AOCs in NW Spain was used to identify the differences in same grapes according to the location. About thirty-four free volatiles compounds and sixty-seven glycosidically bound analytes were identified and quantified (like 4-nonanol equivalents) in samples of *Sousón* and *Mencía* from two geographical areas.

Table 1 shows the total concentration of volatile compounds as a sum of individual concentrations found in free and bound fraction in must.

Table 1: Total concentration (µg/L) of potential volatile compounds found *Mencía* and Sousón cultivars from Rías Baixas and Valdeorras (AOC).

Vitis vinifera cultivar	***Mencía***		***Sousón***	
AOC / *Compounds*	**Valdeorras** (µg/L)	**Rías Baixas** (µg/L)	**Valdeorras** (µg/L)	**Rías Baixas** (µg/L)
Alcohols	238	300	295	339
Terpenoids	16	10	27	12
C13-norisoprenoids	36	18	53	53
C6-compounds	936	888	1174	707
Volatile phenols	28	8	149	49
Carbonyl compounds	11	3	7	20
Fatty acids	28	15	18	14

C_6-compounds showed the highest levels in all cultivars, with special contribution in *Sousón* and *Mencía* from Valderorras AOC. Volatile phenols and terpenoids were also showed greater concentrations in Valdeorras than Rías Baixas in these two grape varieties. On the other hand, alcohols presented slightly higher levels in Rías Baixas than Valdeorras.

Individual levels of volatile compounds showed little differences between geographical zones in the same cultivars. In free fraction, Valderorras contanined higher levels than Rías Baixas of several carbonyl compounds (heptanal, octanal and phenylethanal), alcohols (2- and 3-methyl-1-butanol, 2-phenoxyethanol), terpenoids (linalool,

geraniol, except for *trans*-pyran-linalool oxide) and fatty acids (hexanoic and hexadecanoic acids). Then again, Sousón showed greater levels of C_6-compounds in Valderorras than Rías Baixas. This profile has not observed in Mencía cultivar.

In bound fraction, terpenoids newly presented higher levels in Valdeorras than Rías Baixas AOC in the two different cultivars studied. The other varietal compounds, C_{13}-norisoprenoids, highlighted in Valdeorras respect to Rías Baixas except for 3,4-dihydro-3-oxo-actinidol I, II & III. Terpenoids and C_{13}-norisoprenoids were in great levels in areas with high temperatures [7]. Vilanova observed that terpenoids and C_{13}-norisoprenoids were in higher concentrations in *Albariño* wine in South of NW Galicia than the North, the coolest region [5].

The aromas responsible of fresh and grassy nuances (alcohols and C_6-alcohols) were found in most elevated quantities in Rías Baixas than Valdeorras, while compounds associated with cheese, soapy (fatty acids) and sweet, medicinal and floral (volatile phenols) aromas showed opposite profile. Aromatic alcohols and aliphatic alcohols are derived from aminoacids in grapes and thus the concentrations of those compounds may be more influenced by the ecological conditions of their geographical origins [2].

Principal component analysis (PCA) was applied to classify the cultivars grown in the two geographic zones depending of their volatile composition. The sum of individual compound concentrations by families was applied to this purpose (Figure 1).

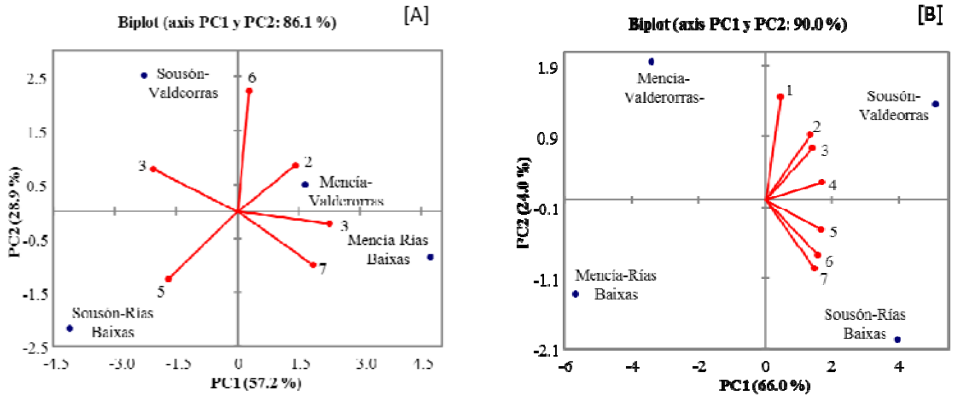

Figure 1 . Principal component analysis (PCA) of free [A] and bound [B] volatile compounds by families. 1: Fatty acids, 2: Terpenoids, 3: Volatile phenols, 4: C_{13}-norisoprenoids, 5: Carbonyl compounds, 6: C_6-compounds, 7: Alcohols.

Free volatile compounds were described by two new eigenvectors (86.1%). PC1 (57.2%) was corresponded with alcohols, volatile phenols and fatty acids, while C_6-compounds and carbonyl compounds were described by PC2 (28.9%). The geographic area was differenced in *Sousón* and *Mencía* cultivars by PC2, where Valdeorras were situated in positive axis and Rías Baixas in the negative side. Sousón cultivar was also well differenced in the two areas studied, while Mencía was near one to the other.

In the same way, PCA was applied to bound analytes. The new axes represented 90.0% of total variance. PC1 (66.0%) was described by all families of compounds with the exception of fatty acids, represented by PC2 (24.0%). Newly, Valderorras and Rías Baixas AOCs were discriminated by PC2, and the geographic area was clearly influenced by the potential volatile composition of cultivars studied. *Sousón* cultivar was characterized by high levels of C13-norisoprenoids and terpenoids.

4 CONCLUSIONS

The influence of *terroir* on volatile composition of two red grapes cultivar, *Sousón* and *Mencía*, was studied in two different geographical areas in Galicia (NW Spain). The levels of free and bound volatiles in grapes showed important differences between two locations in both cultivars. Grapes from Valdeorras AOC, were influenced by higher temperatures and lower rainfall than Rías Baixas, showing high levels of varietal compounds (terpenoids and C_{13}-norisoprenoids) and lower levels of alcohols and C_6-compounds.

PCA showed a good separation of the grapes from different *terroir*, particularly in bound glycosidically analytes.

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