

**COMPOSITION OF WINES FROM INTERNATIONAL CULTIVARS  
GROWN IN ATLANTIC CLIMATE (GALICIA, NW SPAIN)  
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## ABSTRACT

Different *Vitis vinifera* international cultivars as *Merlot*, *Cabernet-Sauvignon*, *Pinot noir*, *Tempranillo*, *Sauvignon blanc*, *Riesling*, *Chardonnay*, *Pinot gris*, *Pinot blanc* and *Gewürztraminer* are grown in *Estación de Viticultura y Enología de Galicia* (EVEGA) Collection (Ribadumia-Pontevedra) situated in the coast Atlantic from Galicia (Spain). Varietal and fermentative aroma compounds, were identified and quantified in wines by GC-FID, which include terpenes and C<sub>13</sub>-norisoprenoids, alcohols, acids, esters, phenol volatiles and C<sub>6</sub> compounds. The results shown important differences in varietal composition with wines produced in other international geographic areas.

## INTRODUCTION

Galicia is situated in the NW Spain of the Iberian Peninsula, just north of Portugal and so sharing a mild, maritime climate, certain vine species and a number of long-standing viticultural traditions. The situation is racing the Atlantic ocean with its rain-bearing winds, and the presence of a mountainous barrier running N-S facilitate the precipitation of rain from the wet fronts in their course eastward inland and favors areas of rain shadow leeward very suitable for vine growing. In Galicia Atlantic and Mediterranean currents intertwine following dynamics whose results strongly depend on distance from the sea.

The aim of this work is know the aromatic characteristics of wines from international cultivars grown in Atlantic climate in NW Spain.

## MATERIALS AND METHODS

### Grapes and Wines

Ten International *Vitis vinifera* grape varieties (six white grape varieties and four red grape varieties) grown in Galicia (NW Spain) from 2006 vintage were consider in this study. Monovarietal wine production was carried out in *Estación de Viticultura y Enología de Galicia* (EVEGA) Winery from Ribadumia (Galicia). All fermentations were conducted in the same conditions. Climatic information is showed in Figures 1 and 2. Annual mean temperature was 15.4 °C, total sunshine hours was 2573 and total rainfall was 1715 mm.

### Extraction of wine volatiles

In a 10 mL culture tube (*Pyrex, ref. 1636/26MP*), 8 mL of wine, 2.4 µg of internal standard (4-nonanol, *Merck ref. 818773*) and a magnetic stir bar (22.2 mm x 4.8 mm) were added. Extraction was done by stirring the sample with dichloromethane (*Merck, ref. 1.06054*) according Oliveira et al (2006). The extractions were realized in triplicate.

### GC-FID analysis

A Chrompack CP-9000 gas chromatograph equipped with a Split/Splitless injector and a flame ionization detector (FID) with a capillary column, coated with CP-Wax 52 CB (50 m x 0.25 mm *i.d.*, 0.2 µm film thickness, Chrompack), was used. Quantification of volatiles, as 4-nonanol equivalents, was performed with Varian MS Workstation version 6.6 by comparing retention indices with those of pure standard compounds.

### Statistical analyses

To establish the relationship between volatile compounds and the wines produced from different cultivars, principal component analysis (PCA) was carried out. The calculations were performed using the XLstat (Addinsoft).

## RESULTS AND DISCUSIÓN

Thirty-seven and thirty-one volatile compounds were analyzed in wines produced with six white and four red international *Vitis vinifera* cultivars in vintage 2006 (Table 1 and 2). The results show that only 1-hexanol, ethyl acetate and ethyl 3-methylbutirate in white wines, and ethyl acetate in red wines no show significant differences among wines.

In white wines, the terpene composition was very important in *Gewürztraminer* cultivar, dominated by linalool. Other investigations have shown linalool to be an important monoterpene of *Gewürztraminer* (Skinkis et al. 2008). The total concentration of monoterpenes in *Gewürztraminer* was minor than 1 mg/L, in contrast with other studies where the total concentration was 2 to 3 mg/L (Reynolds and Wardle 1989; Reynolds 1996; Skinkis et al. 2008). Volatile phenols were important compounds in *Pinot gris* and *Chardonnay* and *Gewürztraminer* were characterized by the alcohols family (Figure 3). Guaiacol was present only in *Riesling* wine and 4-ethylphenol only in *Pinot gris* wine.

In red wines alcohols had a highest concentration in all cultivars and volatile phenols and ethyl esters were the major compounds in *Cabernet sauvignon* and *Tempranillo* (Figure 4). 4-ethylphenol was observed only in *Tempranillo* and *Cabernet sauvignon* wine. Dodecanoic acid was observed only in *Pinot noir* wine. *Merlot* and *Cabernet sauvignon* wines show the major total higher alcohols contents, whereas *Pinot noir* wine shows the lowest content. Similar results for *Pinot noir* and *Merlot* were found (Viviani et al. 2007).

Figure 5A shows the PCA plot of the intercorrelations of volatile compounds in white wines from several international varieties. The first two principal components (Prin 1 and Prin 2) accounted for 59.13 % of the variance (32.27 % and 26.97 %, respectively). The resulting graphs illustrate relationships among wines. A good separation among four groups was observed, *Riesling/Pinot blanc*, *Sauvignon blanc/Pinot gris*, *Chardonnay* and *Gewürztraminer*. The first principal component (Prin1) was characterized by nerol, citronelol, 1-butanol and linalool compounds, having positive loadings, and ethyl lactate displaying a negative loading. For the second principal component (Prin2), the etanal, ethyl

acetate, 3-methyl-1-pentanol showed positive loadings while ethyl decanoate, ethyl octanoate and decanoic acid was loading negatively on PC2.

Figure 6B shows the PCA performed on red wines volatile compounds. The two principal components (Prin 1 and Prin 2) accounted for 82.31 % of the variance (61.50 % and 20.81 %, respectively). There are a good variety differentiation, three groups were observed, *Cabernet/Tempranillo*, *Pinot noir* and *Merlot*. 2-methyl-1-propanol, 3-methyl-1-pentanol, 1-hexanol and 2-phenylethanol, were the high weight in the positive loading of the first principal component and ethyl hexanoate, ethyl decanoate, ethyl octanoate,  $\alpha$ -terpineol and octanoic acid in the negative loading. For the second principal component (Prin2) ethyl 2-methylbutyrate, ethyl 3-methylbutyrate, hexyl acetate and 4-vinylphenol showed positive loadings while ethyl lactate, (E)-3-hexen-1-ol and 4-ethylphenol shown negative loading.

## CONCLUSIONS

*Vitis vinifera* international cultivars *Merlot*, *Cabernet-Sauvignon*, *Pinot noir*, *Tempranillo*, *Sauvignon blanc*, *Riesling*, *Chardonnay*, *Pinot gris*, *Pinot blanc* and *Gewürztraminer* wines were studied in Atlantic climate. The results shown important differences, in varietal composition, with wines produced from the same varieties grown in other international geographic areas. It shows the importance of geographic origin of the grapes and their influence in volatile composition of wines.

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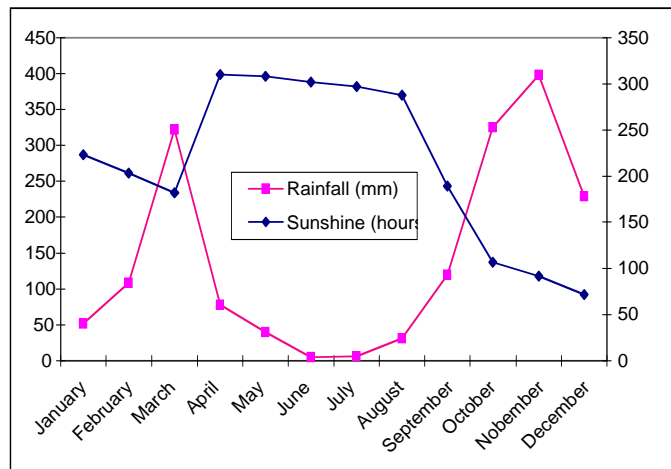
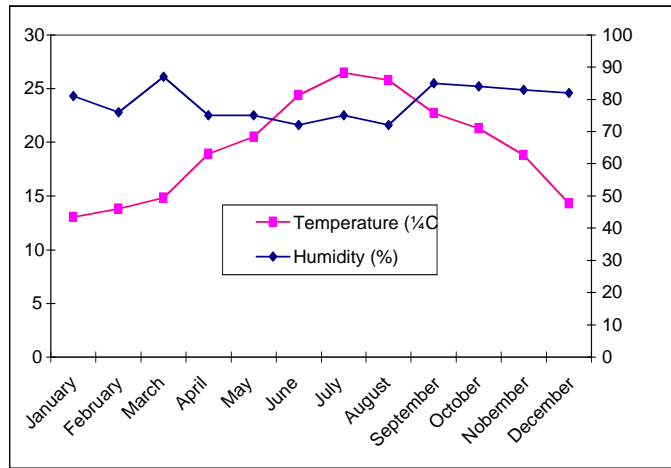
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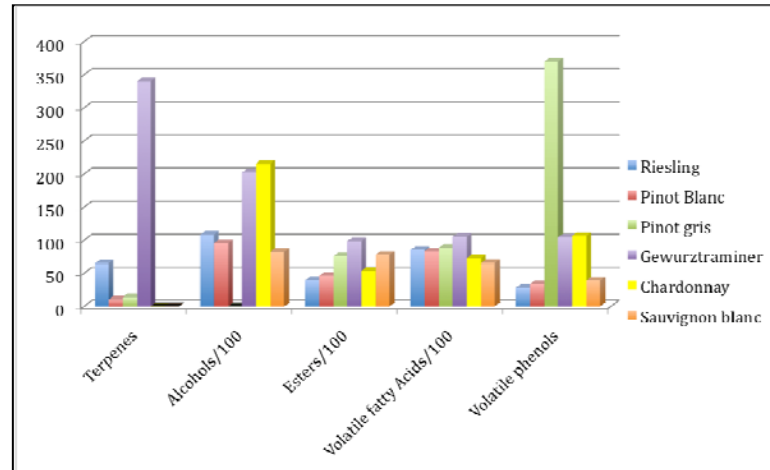
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Tables 1 and 2. Climatic conditions in 2006 Vintage

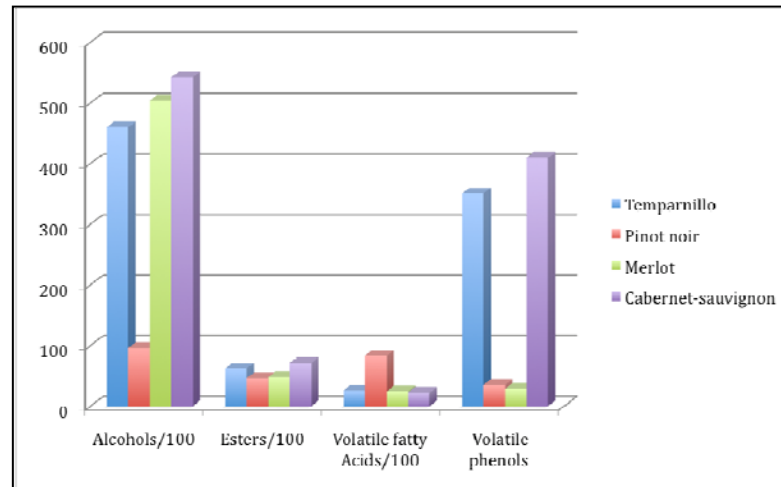


Figures 1. Volatile composition of different international varieties grown in Galicia.  
 A) white varieties and B) red varieties

A)

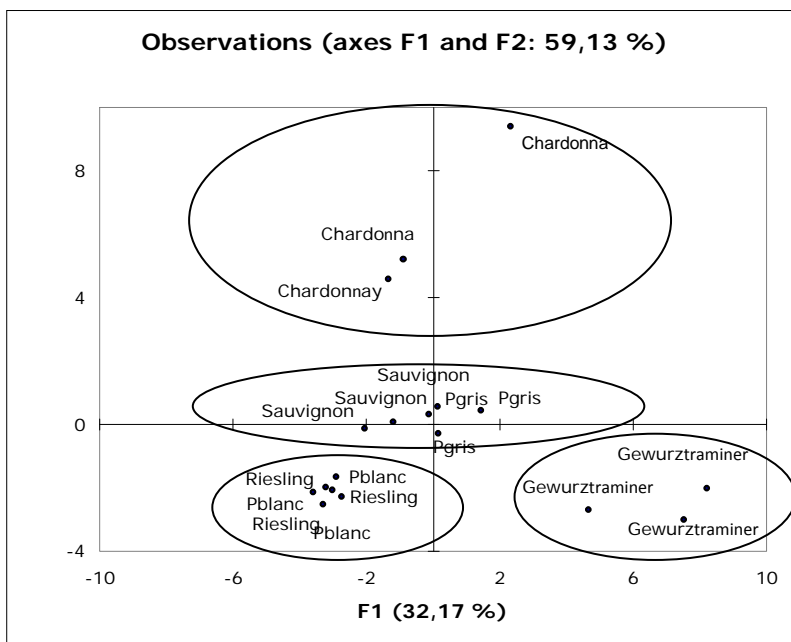


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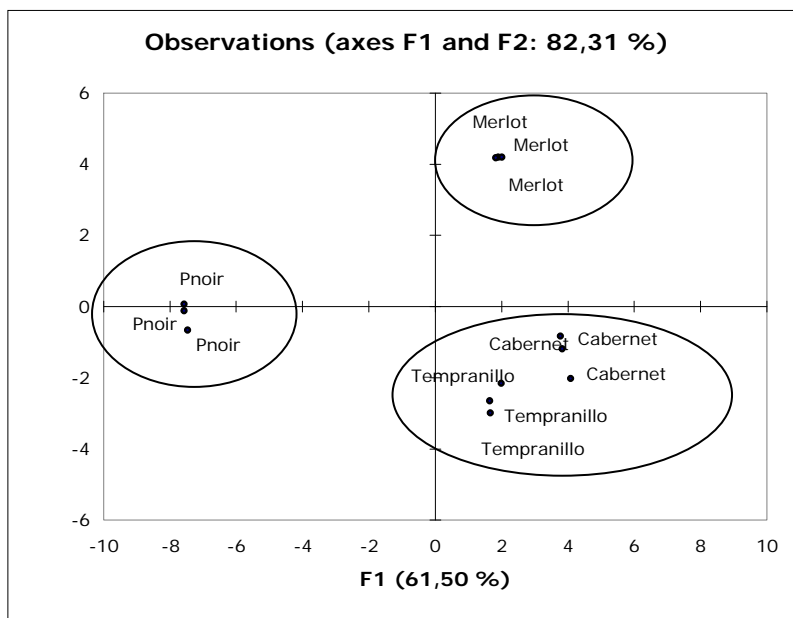


Figures 2. Principal Components Analysis of international varieties grown in Galicia.  
 A) white varieties and B) red varieties

A)



B)



Pnoir: Pinot noir; Pblanc: Pinot blanc; Pgris: Pinot gris