

# The aroma of carbonic maceration wines: An in-depth chemical composition analysis

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## 1.-Introduction

Carbonic maceration (CM) is an anaerobic maceration technique used in different countries, and specially in the French region of Beaujolais, to produce young wines with a unique fruity aroma. CM has been studied before but the exact chemical nature of the volatiles causing this characteristic aroma is still not completely clear. Researchers have linked the fruity aroma of these wines to higher contents of ethyl cinnamate, benzaldehyde, ethyl esters and volatile phenols, and lower contents of C6 compounds (1-2).

In the present study, we have carried out an exhaustive analysis of the volatile chemical composition and sensory profile of three monovarietal wines during three vintages to fully understand the changes induced in their chemical profile and aroma by CM treatment. With this data, we have prepared a reconstitution model of the CM wines.



## 2.-Experimental design

In order to study CM, vinifications following this procedure were conducted for 3 years on Grenache, Carignan and Fer Servadou monovarietal wines (n=14). Fourteen standard vinifications were also carried out with the same grapes as control wines (CTR).

Conventional enological parameters and 78 volatile compounds were analysed (3-5) in the bottled wines. Sensory evaluation was conducted by a specialized trained panel consisting of 8 tasters, and also by including the wine samples in a sorting task experiment with 14 panelists.

A 2-way ANOVA treatment (carbonic maceration x variety) was performed on the collected data. Aroma reconstitution models were prepared by mixing compounds in a solution of propylenglycol and ethanol.

## 3.-Sensory evaluation

Different types of vinification of the same grapes were compared in a sorting task experiment. The data treatment was a multidimensional scaling (MDS) and further Hierarchical Cluster Analysis (HCA) in order to establish clusters of wines sharing a common aroma.

The examination of the HCA plots derived from the MDS showed that CM wines emerged as a single cluster, which clearly indicated that these wines were globally perceived as very different from the rest of samples according to their general aroma.

The individual cluster corresponding to CM wines was described by the aromatic terms "strawberry", "lactic" and "floral".

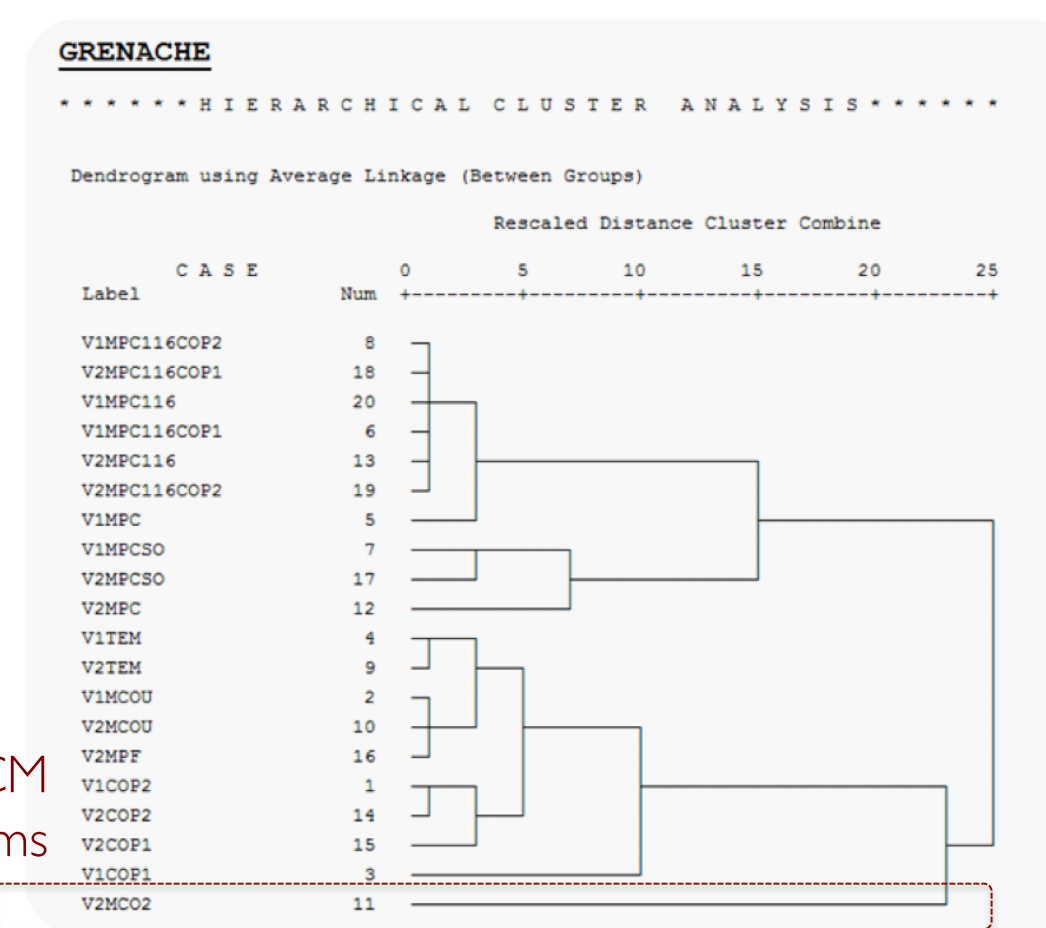
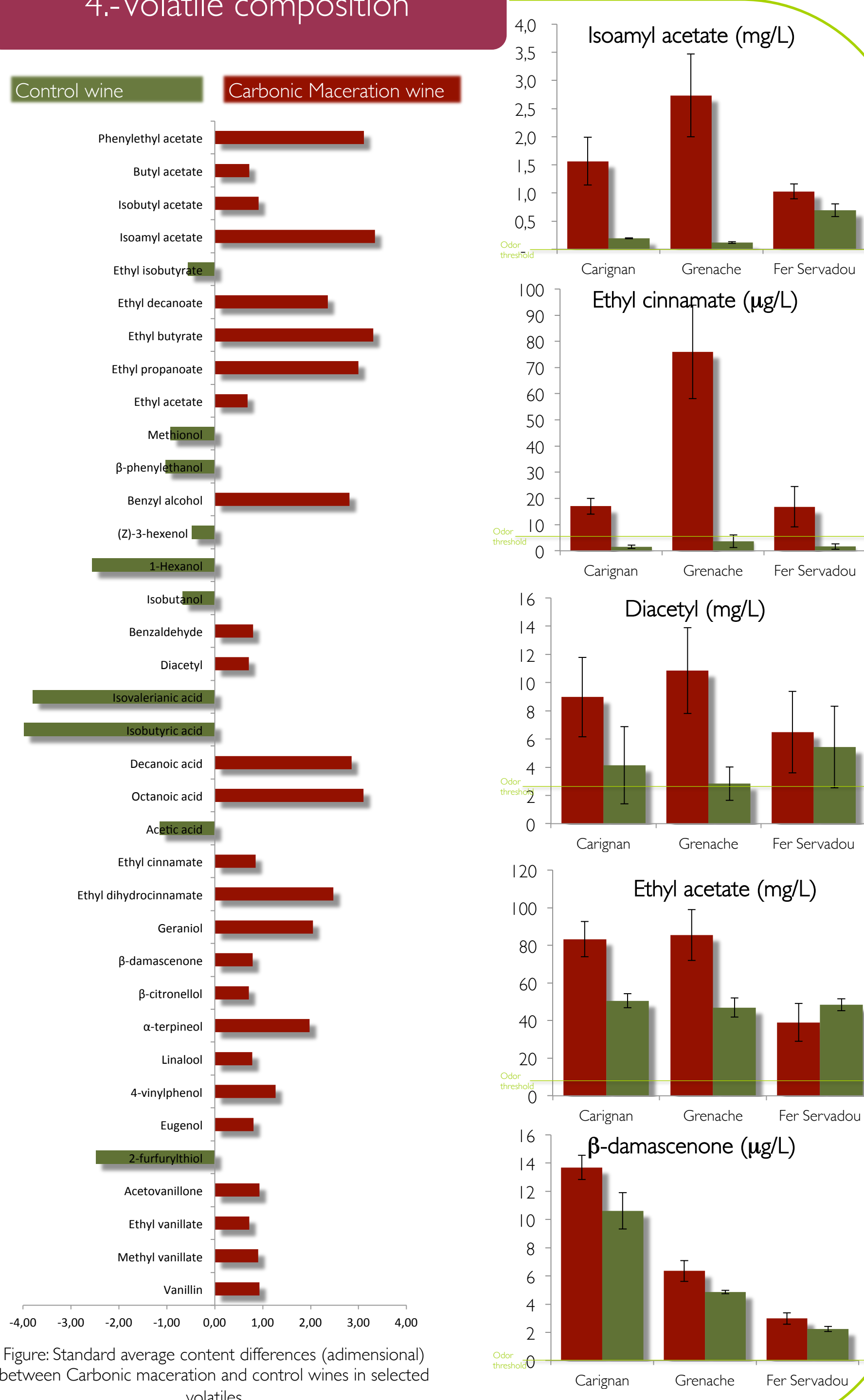


Figure: Hierarchical cluster analysis for Grenache wines 2010

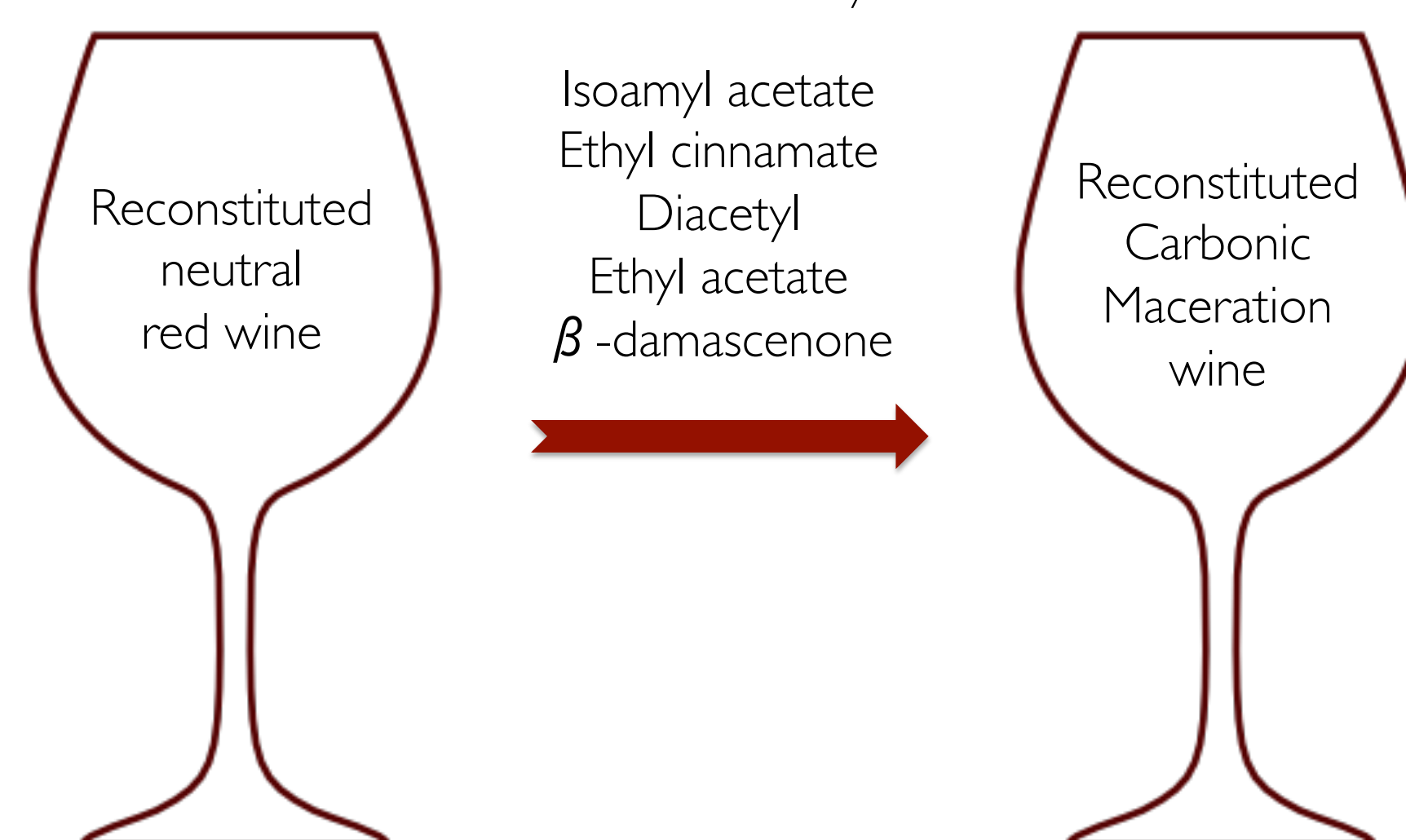
## 4.-Volatile composition



## 5.-Aroma reconstitution

Aroma reconstitution experiments on the basis of quantitative differences in OAV were undertaken to mimic the aroma of carbonic maceration wines.

The five compounds with highest  $\Delta$ OAVs between Carbonic Maceration wine and Control wine were enough to produce a reconstituted wine described by tasters as typical carbonic maceration style.



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## 6.-Conclusions

- 1.- The carbonic maceration wines presented significantly higher contents of ethyl esters of cinnamate and dihydrocinnamate, acetates, fatty acids and their ethyl esters, monoterpenols,  $\beta$ -damascenone, vanillin derivatives and some volatile phenols.
- 2.- Comparing with control wines, carbonic maceration wines had lower contents of C6 and fusel alcohols, and also of branched acids and their ethyl esters.
- 3.- A strong varietal influence was observed. Fer servadou wines showed less changes than Grenache or Carignan wines.
- 4.- Five key components were enough to give a neutral model wine the characteristic aroma of carbonic maceration wines

## 7.-References

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