

3.6 Les terroirs volcaniques

Rares en France, les matériaux volcaniques sont le support de très nombreux vignobles dans le monde. Les conditions d'éruption et la composition des laves expulsées dans l'atmosphère conduisent à des résultats très différents. Les plus importants se trouvent dans le Rio Grande do Sul au Brésil, où d'énormes quantités de basalte se sont épanchées sur plusieurs centaines de mètres d'épaisseur pendant une grande partie de l'ère secondaire. On y trouve les vins de la Vale dos Vinhedos. La Hongrie a connu aussi un volcanisme intense en 2 épisodes, l'un au miocène responsable des tufs rhyolitiques de Tokaj, qui ont permis le creusement d'importants réseaux de caves souterraines, l'autre au pliocène avec des épanchements basaltiques dans la partie ouest du pays dont il ne reste parfois que les cheminées des volcans comme sur la colline de Somló. Enfin les terroirs les plus spectaculaires liés au volcanisme sont ceux des Iles Canaries (Espagne). Ici, ce sont des cendres volcaniques qui, au début du 18^{ème} siècle, ont recouvert de plusieurs mètres les sols anciens. Les vigneron y ont construit un des terroirs les plus extraordinaires du monde où chaque pied se

trouve au fond d'un entonnoir de plusieurs mètres de diamètre.

4 CONCLUSIONS

Les grands phénomènes géologiques liés à la dérive des continents ont façonné le relief des terres émergées. La vigne y a trouvé d'innombrables situations favorables à son implantation. Mais l'homme a joué un rôle considérable dans le développement de ses zones d'expansion, en adaptant la plante à des lieux, au départ, très improbables ou en développant des techniques d'amélioration du milieu physique. On peut ainsi déterminer un classement, une typologie des grands terroirs viticoles en fonction de leur origine géologique. Il est intéressant de constater que les mêmes formations géologiques conduisent très souvent à des types de terroirs identiques quelle que soit la région du monde.

RÉFÉRENCES

1. J. FANET, 2001. "Les Terroirs du Vin", Éditions Hachette, rééd. 2008 broché, 242 p.
2. <http://www.congresdesterroirs.com> consulté en ligne le 12 février 2012.

Climatic groups in Ibero-America viticulture compared to worldwide wine producer regions

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ABSTRACT

The wine production is an important activity in many Ibero-American countries. The wine producer regions of these countries configure a large use of different climate types and viticultural climates. In a vitivicultural zoning project of CYTED (Ibero-American Program for Science, Technology and Development), a viticultural climatic characterization was done in this macro viticultural region. The project have assembled a climatic database that characterizes the viticultural regions, including relevant variables for viticulture: air temperature (mean, maximum, and minimum), precipitation, relative humidity, solar radiation, number of sunshine hours, wind speed, and evapotranspiration. Using indices of the Geoviticulture MCC System (HI, CI and DI), more than 70 viticultural regions in different countries (Argentina, Bolivia, Brazil, Chile, Cuba, Spain, Mexico, Peru, Portugal and Uruguay) were characterized according to its viticultural climatic. The results, which will be integrated to the worldwide database of the MCC System, showed that the Ibero-American viticulture is placed in a wide range of climatic groups of the wine producing regions around the world. This article presents the climatic groups found in Ibero-America, identifying also some new climatic groups not yet found in other regions of the world. This work also identifies some climatic groups not found in Ibero-America viticulture. The research has also highlighted viticultural areas characterized by climates with "intra-annual climatic variability", with the potential to produce more than one growing cycle per year. The results allow to conclude that the

wide variability and climatic diversity present in Ibero-America may be one of the reasons to explain the diversity in terms of wine types, sensorial characteristics, typicity and uniqueness of wines produced on this macro-region.

Keywords: *viticultural climate, MCC System, Ibero-American countries, climatic groups.*

1 INTRODUCTION

The wine production is an important activity in many Ibero-American countries. The wine producer regions of these countries configure a large use of different climate types and viticultural climates. In a vitivinicultural zoning project of CYTED (Ibero-American Program for Science, Technology and Development), a viticultural climatic characterization was done in this macro viticultural region (1, 2), including a viticultural climatic characterization, done in this macro viticultural region.

The goal of this study was to characterize the viticultural climate and the climatic groups found in the wine producing regions in Ibero-American countries (a large grape-growing region) and also to compare these groups with the variability found in the viticulture worldwide.

2 MATERIAL AND METHODS

The Geoviticulture MCC System (3, 4) was used as the methodology to characterize the viticultural climate and the climatic groups of more than 70 viticultural regions in 10 Ibero-American countries: Argentina, Bolivia, Brazil, Chile, Cuba, Spain, Mexico, Peru, Portugal and Uruguay.

The CYTED project has assembled a climatic database to characterize the viticultural regions, including relevant variables for viticulture. The data base established regarding grape-growing regions

correspond to the inter-annual monthly means of climatic variables, as much as possible the normal climatic of the 1961–1990 series (minimum, maximum and mean air temperature; precipitation; relative air humidity; mean wind speed; solar radiation and/or sunshine hours; and Penman's potential evapotranspiration) from standardized meteorological stations representing the climate of the grape-growing regions. For each region the three indices of the MCC System were calculated: Heliothermal index (HI), Cool night index (CI) and Dryness index (DI).

The results of Ibero-American regions were analyzed and characterized by Principal Component Analysis (PCA). Also, the climatic groups of the different viticultural regions of Ibero-American countries were displayed with the international database of viticultural climate available in Tonietto & Carbonneau (4) in order to characterize the placement of the Ibero-America viticulture in the world context.

3 RESULTS AND DISCUSSION

The viticultural climates found in the Ibero-American region are presented in the PCA of the Figure 1. The viticultural climate of the regions belongs to 31 climatic groups, according to MCC System. These results show the high variability in terms of climate existing in Ibero-America

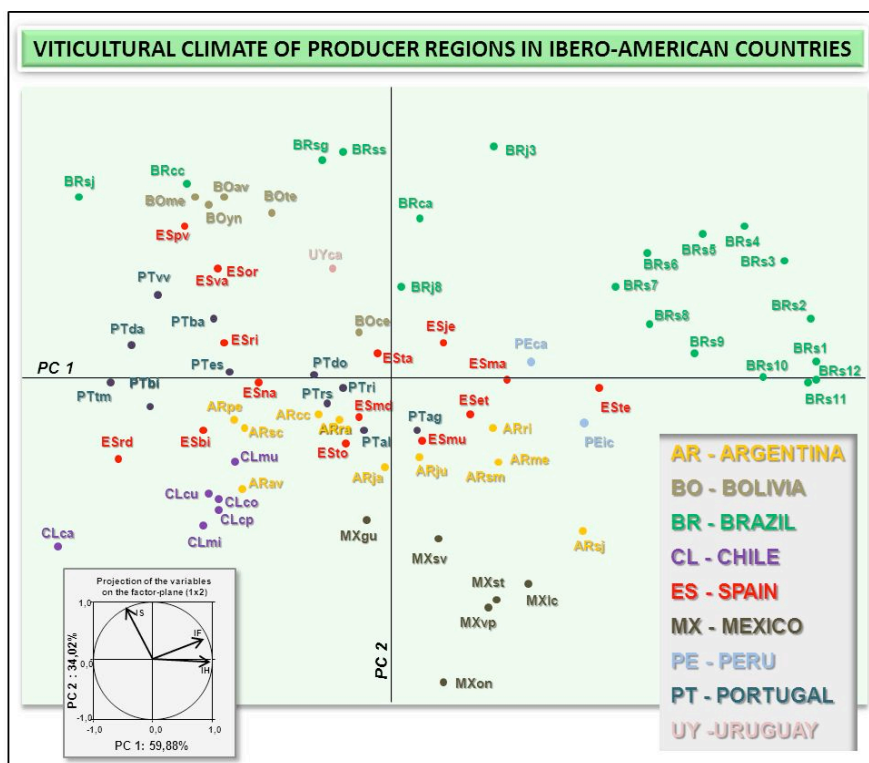


Figure 1. PCA showing the variability of the viticultural climate (HI, CI and DI indices of the MCC System) of the regions in 9 Ibero-American countries.

Considering the total variability in climate of worldwide viticultural regions described in previous works (4), the viticultural regions of each Ibero-American country have viticultural climates that cover complementary spaces, making possible a whole climate conditions for wine production. The results also shows viticultural regions characterized by tropical climates with intra-annual climatic variability: Vale do Submédio São Francisco region (BRs1 to BRs12) and João Pinheiro region (BRj3 and BRj8) (Figure 1), with the possibility to have more than one growing cycle per year. Cuba also has climates in evaluation for viticulture with intra-annual variability classified in the climatic groups IH+3 IF-2 IS-2 or IH-2 IF-1 IS-1.

The high diversity of the viticultural climate of the producers regions in Ibero-American countries is demonstrated in the PCA of Figure 2, which make possible to compare with the worldwide climatic

variability. We can observe that only climate class of IH Very cold is not identified, also with a little presence of IH Cold in Ibero-American countries (Table 1).

In terms of climatic groups the results showed that the Ibero-American viticulture is placed in a wide range of variability when compared to other wine producing regions variability around the world. Compared to the world database of the article Tonietto & Carbonneau (4), the Ibero-America viticulture is present in 31 of the 43 climatic groups identified in the world viticulture, many of them characterized, for instance, only in Ibero-America (Table 1).

The climatic variability found in the Ibero-America viticulture certainly is responsible for the numerous types and different qualities and originalities of the wines produced in Ibero-America, as demonstrated by Catania et al. (5) for Argentina.

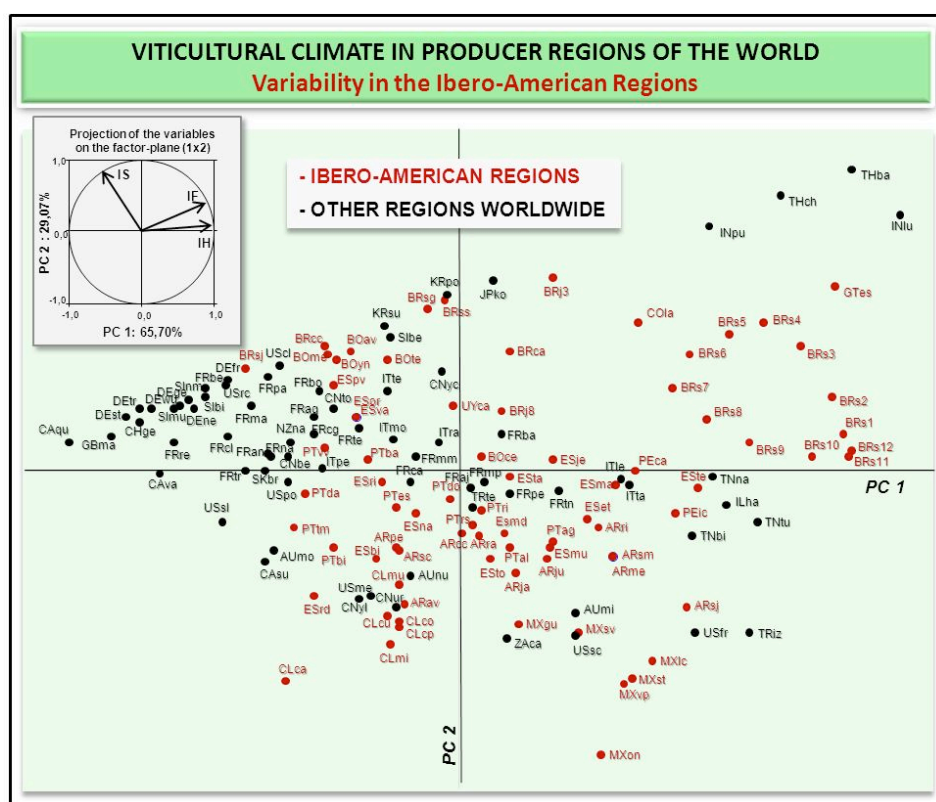


Figure 2. PCA showing the distribution of the viticultural climate (HI, CI and DI indices of the MCC System) of producer regions belonging to Ibero-American countries in relation to the context of other worldwide producer regions.

		Indice Héliothermique - IH																
		IH -3		IH -2		IH -1		IH +1		IH +2		IH +3						
Indice de Sècheresse IS		Indice de Fraîcheur des Nuits - IF																
		IF +2	IF +1	IF -1	IF -2	IF +2	IF +1	IF -1	IF -2	IF +2	IF +1	IF -1	IF -2	IF +2	IF +1	IF -1	IF -2	
IS -2	USna DEWu DEFr USAt CAQu CHPe USpe					USrc STas SIma SIBi FRBa FRBa DEEn DEFr	BRaJ			FRna UScl FRpa	BRoc SIBa			BRJy BRJy BRJy BRJy	BRJy BRJy BRJy BRJy			FRBa FRBa FRBa
IS -1	CAVa FRBa					FRBa FRBa FRBa FRBa	USna			BRJy BRJy FRBa FRBa	BRJy BRJy FRBa FRBa				CHPe CHPe USna			FRBa FRBa FRBa FRBa
IS +1						USal CAAn AlMa				FRBa FRBa FRBa FRBa	FRBa FRBa FRBa FRBa			BRJy BRJy FRBa FRBa	BRJy BRJy FRBa FRBa			FRBa FRBa FRBa FRBa FRBa FRBa
IS +2										FRBa FRBa FRBa FRBa	FRBa FRBa FRBa FRBa			FRBa FRBa FRBa FRBa	FRBa FRBa FRBa FRBa			FRBa FRBa FRBa FRBa FRBa FRBa

Table 1. Climatic groups (MCC System) of the Ibero-American regions (in yellow) integrated to the worldwide database regions (in red) of the MCC System (4).

4 CONCLUSIONS

The Ibero-American viticulture for wine production is representative of the most part of the macro climatic variability found in the world. The results allow to conclude that the wide variability and climatic diversity present in Ibero-America may be one of the reasons to explain the diversity in terms of wine types, sensorial characteristics, typicity and uniqueness of wines produced on this macro-region.

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REFERENCES

1. CYTED, 2003. Metodologías de zonificación y su aplicación a las regiones vitivinícolas Iberoamericanas. Madrid. 20 p. (Proyecto de Investigación Cooperativa; Coodinacion de Vicente Sotés Ruiz - UPM, España).
2. V. SOTÉS, J. TONIETTO, 2004. Cape Town. Proceedings. Cape Town, South Africa, South African Society for Enology and Viticulture-OIV-GESCO. p. 202. CD-ROM (Viticultural Terroir Zoning 2004).
3. J. TONIETTO, 1999. École Nationale Supérieure Agronomique de Montpellier - ENSA-M. 233 p., Thèse Doctorat.
4. J. TONIETTO, A. CARBONNEAU, 2004. Agricultural and Forest Meteorology, 124/1-2, 81-97.
5. C.D. CATANIA, S.A. DE DEL MONTE, E.M. ULIARTE, R.F. DEL MONTE, J. TONIETTO, 2007. Bento Gonçalves: Embrapa Uva e Vinho, 9-55. Available in : <<http://www.cnpuv.embrapa.br/ccm>>.

Aromatic stability of Syrah and Petit Verdot tropical wines from Brazil

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