CLIMATIC INFLUENCES ON MENCÍA GRAPEVINE PHENOLOGY AND GRAPE COMPOSITION FOR AMANDI (RIBEIRA SACRA, SPAIN)

I. Rodríguez [1], J. Queijeiro [1], A. Masa[2], and M. Vilanova[2]

[1] Sciences Faculty of Ourense, Edificio Politécnico, As Lagos s/n 32004. Ourense (Spain).
[2] Misión Biológica de Galicia-CSIC. PO BOX 28. Pontevedra (Spain).
Email: mvilanova@mbg.cesga.es

ABSTRACT

During the year 2009 we have studied the phenology and grape composition of Mencía cultivar in seven different situations (orientation and altitude) for Amandi subzone (D.O. Ribeira Sacra, Spain). The results showed the influence of *terroir* on the Mencía growth stages (budburst, floraison, veraison, and harvest). All phenological data indicate that there is a delay in budburst for V-2 of 15 days respect to V-5 and V-6. A delay for floraison also was found for V-2 and V-3 (8 days respect to the others vineyards). In the veraison the delay was for V-1 and V-2 (3 days) respect to other vineyards studied. Significant differences were found in grape composition: total acidity, pH, malic acid, color intensity and anthocyanins. The volatiles also were influenced by the *terroir*, showed higher concentration of free compounds for V-2 (416 and SW) than the others vineyards and the total bound composition shower the highest values for V-4.

KEYWORDS
Mencía, Phenology, Amandi, Spain

INTRODUCTION

Phenology is the study of the timing of natural phenomena that occur periodically in plants and animals. For grapevines, phenology refers to the timing of grown stages and the influence of climate and weather on them (Pearce, Coombe, 2004). Grapevines are grown in distinct climate regimes worldwide that provide ideal situations to produce high quality grapes.

Amandi is a subzone of Denomination of Origen Ribeira Sacra, NW Spain. This area has some orographic and weather characteristics that make it particularly suitable for growing grapes and wines of high quality. With a south-southwest direction, the vineyards are protected from cold winds from the north and the sun bathes the terraces throughout the day. The stone warmed by the sun during the day blunted the lower night temperatures avoiding frost. These are the characteristics that differentiate the Mencía grape in Amandi from other denominations and sub-areas of the D.O. Ribeira Sacra.

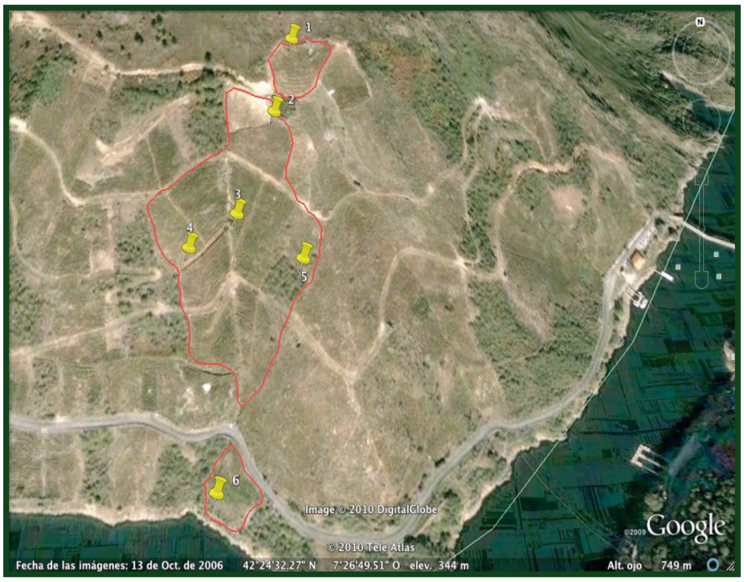
The aim of this study was to know the effect of orientation and altitude in the phenological stages of Mencía grapes from Amandi (D.O. Ribeira Sacra, Spain) and perform a multivariate analysis to evaluate this possible differentiation according to the *terroir*.

MATERIALS AND METHODS

Viticulture

Vitis vinifera Mencía grape grown in Amandi subzone from Denomination of Origin Ribeira Sacra (Spain), during 2009 vintage, was considered in this study. Six vineyards (V-1 to V-6) with different situation (altitude and orientation) were analyzed. The characteristics of the six vineyards studied in Amandi are shown in Fig. 1 and Tab. 1.

Figure 1. Situation of vineyards in Amandi (D.O. Ribeira Sacra)



Vineyard	Altitude	Latitude	Length	Coordinates	UTM	Orientation
V-1	466m	42º 24´ 38.58" N	7º 26´51.76" O	29T 0627801	4696742	153ºSSE
V-2	416m	42º 24´36.68" N	7º26´53.20" O	29T 0627796	4696703	213ºSW
V-3	352m	42º 24´34.20" N	7º 26´51.41" O	29T 0627759	4696620	162ºSSE
V-4	351m	42º 24´33.32" N	7º 26´56.81" O	29T 0627712	4696591	198ºS
V-5	355m	42º 24´32,85" N	7º 26´52.00" O	29T 0627798	4696590	144ºSE
V-6	240m	42º 24´27.97" N	7º 26´55.57" O	29T 0627741	4696426	136ºSE

Table 1. Characteristics of vineyards studied in Amandi subzone from Ribeira Sacra.

Mencía Phenology

The phenological data from these referenced vineyards are for the average dates of budburst, floraison, veraison and harvest for 2009 vintage. The budburst, floraison and veraison are considered to occur when, for a given varietal, 50% of the plants are exhibiting the physiological response. Harvest data is recorder as the point as which, due to the optimun sugar levels, the harvest commences.

Grape composition

At harvest chemical analyses of Mencía grape must from the six different vineyards were carried out. In each vineyard a sample of 300 berries from different points were collected. All chemical analyses were carried out in triplicate by Foss analyzer. Volatiles (free and glicosidically) were analized by GC-MS.

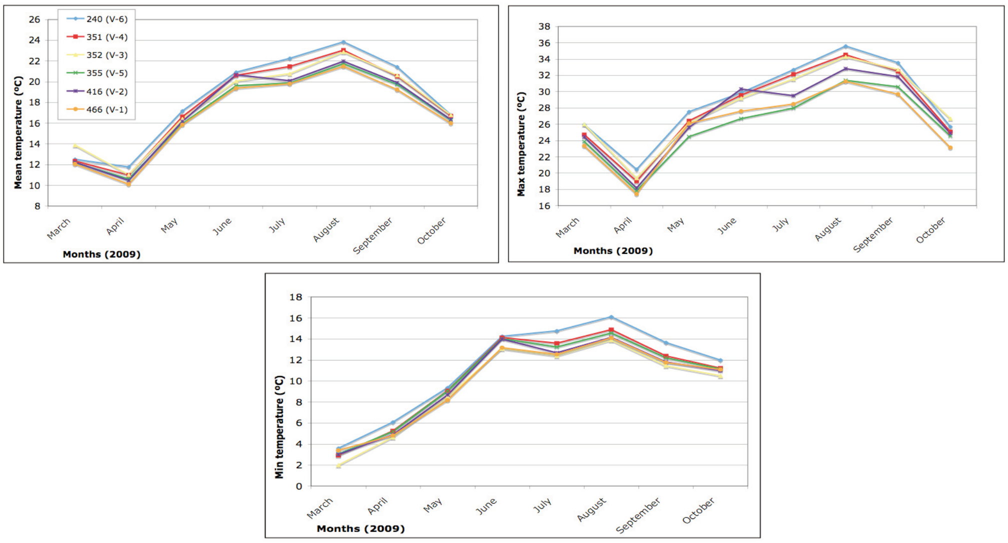
Climate

The climatic conditions from D.O. Ribeira Sacra were analyzed in 2009 vintage. Micro stations climatic-HOBOS were situated in the six points referenced (Tab. 1). The data consist of daily observations of maximum, minimum and average of temperature. The data of mean, maximum and minimum temperature vs altitude is showed in Fig. 2.

Statistical analysis

An analysis of variance was performed using the XLSTAT statistical package (Addinsof, 2009). The effect of *terroir* (orientation, altitude and climate parameters) was evaluated using *a priori* contrasts ($p<0.05$).

Figure 2. Temperature vs altitude in different vineyards of Amandi (D.O. Ribeira Sacra)



RESULTS AND DISCUSSION

In Amandi subzone (D.O. Ribeira Sacra), phenological observations have been followed in six Mencía vineyards with different altitude and orientation from the 2009 vintage. The phenological data from these reference vineyards are showed in Tab. 2.

In the most viticulture regions, on average, budburst starts to occur when the mean daily temperature exceeds 10ºC for five consecutive days (Amerine et al. 1980; Mullins et al. 1992). Therefore, for 2009 vintage, the mean daily temperature was compiled and analyzed.

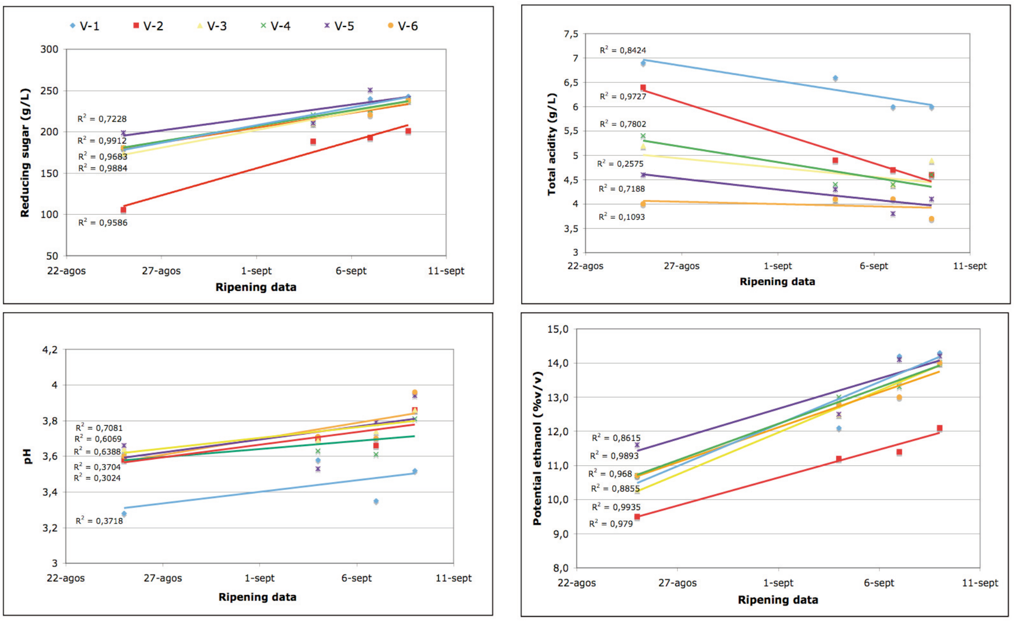
The mean data of budburst was 23 March and ranged from 24 March (eleven consecutive days when the temperature exceeds 10ºC) for V-5 and V-6 to 8 April for V-2. The floraison occurred as early 2 June for V-1, V-4, V-5 and V-6 and later as 10 June for V-2 and V-3. Budburst and floraison are later in vineyards with South and West orientation (V-2 and V-3) and earlier in vineyards oriented to east (V-5 and V-6). The average veraison data for these vineyards was 1 to 4 August. The veraison was produced for V-1 (466m) and V-2 (416m) later than the others vineyards (with minor altitude). The harvest commenced 10 September for V-2, V-3, V-4 and V-5 and the 11 September harvest data for V-1 and V-6 is the latest. In V-6 the grape size also is higher.
Often more important than the date of phonological stage is the interval between stages, which gives an indication of the overall climate during those periods (Jones and Davis, 2000). Short intervals are associated with optimum conditions that facilitate rapid physiological growth and differentiation (Coombe 1988). Long intervals among stages indicate less than ideal climate conditions and a delay in growth and maturation (Calo and Tomasi, 1996; Gladstones, 1992). One of the more important intervals is the length of the growing season (budburst to harvest) and it was ranged from 172 days for V-5 and V-6 and 158 days for V-2. The interval between floraison and veraison was 63 days (V-1) and 55 days (V-2). The maximum period of time from flowering until harvest was 154 days.
All phenological data indicate that there is a delay in budburst for V-2 of 15 days respect to V-5 and V-6. A delay for floraison also was found for V-2 and V-3 (8 days respect to the others vineyards). In the veraison the delay was for V-1 and V-2 (3 days) respect to the other vineyards studied.

Major stages	V-1	V-2	V-3	V-4	V-5	V-6
Budburst	27-Mar	8-Apr	31-Mar	27-Mar	24-Mar	24-Mar
Floraison	2-Jun	10-Jun	10-Jun	2-Jun	2-Jun	2-Jun
Veraison	4-Aug	4-Aug	1-Aug	1-Aug	1-Aug	1-Aug
Harvest	11-Sep	10-Sep	10-Sep	10-Sep	10-Sep	11-Sep
Weigth/100 berries (g)	196	259	217	235	226	319

Table 2. Dates for major stages for Mencía grape variety grown in six vineyards situated to different altitude in Amandi subzone from D.O. Ribeira Sacra (Spain).

In addition to phenology, grape composition has also been tabulated from the evaluation of the reference vineyards. Fig. 3 shows the results for the general chemical analysis (sugar content, potential ethanol, pH and total acidity) of musts obtained from Mencía cultivar grown in Amandi during ripening. V-5 showed the highest values for reducing sugar and therefore potential ethanol during ripening. Total acidity was highest for V-1.
Near harvest time, the key vintage quality characteristics are the chemical composition of grapes (Jones, Davis, 2000). Tab. 3 shows the musts composition of Mencía cultivar grown in Amandi at harvest. Significant differences were found for five parameters among samples: Total acidity, pH, malic acid, color intensity and anthocyanins. The highest value of glucose+fructose, Brix was for V-5, vineyard sited to 355m and with orientation SE. The total acidity and tartaric acid of the musts was higher for V-1 (466m, SSE). V-2 (416, SW) showed higher malic acid than the other vineyards studied and V-3 showed the highest color intensity.

Figure 3. Chemical composition of Mencía grapevine during ripening from Amandi.

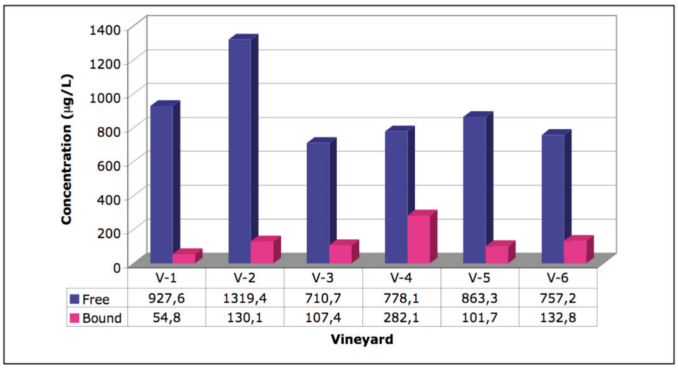


Parameters	V-1	V-2	V-3	V-4	V-5	V-6	Sig
Glucose-Fructose (g/L)	219.50	182.00	210.50	217.00	223.00	207.00	ns
ºBrix	21.90	18.90	21.30	21.75	22.30	21.00	ns
Total acidity (g/L)	3.96	2.59	2.48	2.37	2.14	1.97	***
pH	3.25	3.54	3.56	3.49	3.60	3.52	**
Tartaric acid (g/L)	4.55	3.80	4.20	4.20	4.45	4.00	ns
Malic acid (g/L)	1.30	1.70	1.35	1.00	0.65	0.70	**
Folin index	231.20	202.30	233.25	187.65	231.75	177.80	ns
Color intensity	4.30	4.20	5.10	4.65	4.85	4.10	*
Anthocyanins (mg/L)	50.50	117.00	99.50	80.00	110.50	81.00	**

Table 3. Chemical composition, at harvest, for vineyards referenced in Amandi.

Fig. 4 shows the total concentration of free (A) and bound (B) volatile compounds identified the references vineyards in Amandi at harvest.
The total concentration was obtained as the sum of individual concentrations of all compounds detected under the experimental conditions used, including C_6-compounds, alcohols, monotepenes, C_{13}-norisoprenoids, volatile acids, volatile phenols and carbonyl compounds. The total free volatile composition was higher for V-2 (416 and SW) than the others vineyards and the total bound composition shower the highest values for V-4, the only vineyard oriented to SE in our study.

Figure 4. Free and bound compounds concentration (µg/L) of Mencía grapevine



CONCLUSIONS

This work showed the effect *terroir* (orientation and altitude) on phenology and chemical and volatile composition of Mencía grapevine from Amandi.
Budburst and floraison are later in vineyards with South and West orientation (V-2 and V-3) and with high values of altitude and earlier in vineyards oriented to East (V-5 and V-6) and with low values of altitude. In wine composition the highest total acidities and malic acid were found for V-1, V-2 and V-3 according to phonological data.

ACKNOWLEDGMENTS

We would like to thank the Consellería de Innovación e Industria from Xunta de Galicia (Spain) for the financial support of this research project (08MRU029403PR) and Isidro Parga Pondal" program. We would like to acknowledge to the D. O. Ribeira Sacra for their assistance.

BIBLIOGRAPHY

Amerine M.A. and Berg H.W., 1980. The technology of wine making (4 ed). 795 pp. AVI Publishers Company, Inc., Westport, CT.

Calo A. and Tomasi D., 1996. Relatuionship between environmental factors and the dynamics of growth and composition of the grapevine. Proceedings of the workshop strategies to optimize wine grape quality. S Poni, E. Peterlunger et al (Eds) pp 217-231. Acta hhorticulturae.

Coombe B.G., 1988. Grapevine phenology. In: Viticulture, Vol. 1, pp.139-153. Australian Industrial Publishers, Adelaide.

Gladstones J., 1992. Viticulture and Environment. 310 pp. Winetitles, Adelaide.

Jones G.V. and Davis R.E., 2000. Climate influences on grapevine phenology, grape composition, and wine production and quality for Bordeaux, France. *American Journal of Enology and Viticulture,* 51: 249-261.

Mullins M.G., Bouquet A. and Williams L.E.,1992. Biology of grapevine 239 pp. Cambridge University Press, Great Britain.

Pearce I. and Coombe B.G., 2004. Grapevine phenology. *In:* Viticulture, Vol. 1, pp.150-166. Australian Industrial Publishers, Adelaide.