DIFFERENTIATION OF CLONES OF VARIETIES OF GRAPEVINES THAT ARE TRADITIONALLY CULTIVATED IN NW SPAIN (GALICIA) AND ELABORATION OF DETERMINATION KEY FOR APPLICATION OF PHILOMETRIC MEASURES

DIFFÉRENCIATION DES CLONES DE CÉPAGES CULTIVÉS TRADITIONNELLEMENT EN ESPAGNE (GALICE) ET ÉLABORATION D'UNE CLÉ DE DÉTERMINATION POUR L'APPLICATION DE MESURES PHYLLOMÉTRIQUES

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Abstract : Application of philometric methods in the differentiation between clones of the varieties of grapevines that are traditionally cultivated in Galicia (NW Spain) has been studied. Our aims is to work whith a number of leaf'parameters as large as possible to ensure differences among clones.
Experimental measurements have been obtained using Computer Techniques (ROMANI *et al.*, 1993). They have been analyzed by commercial statistic package using of Discrimination Analysis (SAS Statistical Programme). We have to establish separation at clone level for each variety, by means of using certain discrimination parameters which allow us to elaborate determination keys. The parameters which best explain the differences between the clones would be the shape and size of the dentation, leaf bosoms and the whole leaf in general.

Résumé : Cette étude fait partie des recherches que nous avons entreprises pour mieux connaître les caractères morphologiques des cépages de *Vitis* autochtones de Galice (Nord-Ouest de l'Espagne), capables de produire des vins de qualité dans les lieux de production des VQPRD : Rías Baixas, Ribeiro et Valdeorras.
Nous avons utilisé la phyllométrie pour rechercher les caractères qui différencient le mieux les clones de ces cépages traditionnels et élaborer une clé de détermination basée uniquement sur des caractères mesurables.
Pour réaliser ce travail, nous avons considéré au total 80 clones de six cépages inscrits, depuis 1984, au plan de sélection clonale et sanitaire de la Galice : Godello, Treixadura, Dona Blanca, Torrontés, Loureira et Mencía. À l'aide d'un système informatique, les mesures ont porté sur 14 feuilles par clone, à raison de 150 paramètres par feuille. L'analyse discriminante a permis de sélectionner les paramètres qui peuvent différencier les clones des cépages étudiés et ces paramètres ont servi à élaborer une clé de détermination. Deux catégories de paramètres ont été utilisées : les données brutes, fournies par la mesure des longueurs ou des angles, et les rapports. Pour les paramètres asymétriques, le système informatique utilisé a calculé le petit côté, le grand côté et la moyenne des deux. Compte tenu des paramètres discriminants, on observe qu'il existe des différences entre les clones. Les caractères les plus significatifs sont l'ouverture du sinus pétiolaire, la profondeur des sinus latéraux, la taille et la forme des dents, les dimensions des nervures et la taille de la feuille. Dona Blanca et Godello ont des clones offrant le plus de variations dans la forme de la feuille. Les clones de Dona Blanca peuvent être définis par la longueur des dents de N1, la taille de la feuille et la profondeur des sinus latéraux. Les clones de Godello peuvent être définis par la forme des dents de N2, la longueur des dents de N4, la profondeur des sinus latéraux inférieurs et la dimension du lobe inférieur. La forme des feuilles des cépages Loureira Mencía et Torrontés étant plus homogène, il est possible de différencier certains de leurs clones en ne considérant qu'un seul caractère. Pour le Loureira, le caractère le plus discriminant est l'ouverture du sinus pétiolaire ; pour le Mencía, c'est la profondeur des sinus latéraux inférieurs et pour le Torrontés, c'est la taille de la feuille. Le Treixadura a deux caractères discriminants : l'ouverture du sinus pétiolaire et la longueur des dents de N4.
L'élaboration d'une clé de détermination uniquement basée sur les caractères mesurables de la feuille s'avère très difficile. Il est possible de différencier certains clones, mais il est aussi fréquent que des groupes de plusieurs clones ne puissent être différenciés par les branches de la clé.

Key words : *Vitis vinifera*, philometric measures, ampelography.

Mots-clés : *Vitis vinifera*, mesures phyllométriques, ampélographie.

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INTRODUCTION

This study forms part of a series of investigations that will lead to a better knowledge of the varieties of grapes that are traditionally cultivated in Galicia for the production of well-known quality wines such as « Rias Baixas », « Ribeiro » and « Valdeorras ».

The description of grapevine varieties, using morphological characteristics, has been customary since the middle of the 19th Century. The organs of the plant that are described vary according to the authors. Leaves (RAVAZ,1902 ; RODRIGUES,1939,1942a and 1942b GALET, 1951 and 1985 ; CARNEIRO *et al.*, 1987 ; CAMPOSTRINI *et al.*, 1993), bunches of grapes (RODRIGUEZ, 1954 and 1955 ; EIRAS-DIAS, 1984), in the pollen characters (PANDELIEV and ROYTCHEV, 1996) and mature shoots (DURQUETY and BISSON, 1952 ; BISSON, 1991).

Various studies have been carried out with the application of statistical methods for the description of the morphological characters of the vine, using the length and angles of different parts of the leaf, nerves, dentation, bosoms, lobes, stomas (SWANEPOEL and VILLIERS, 1987) , as variables, together with the state of development of the plant (LACROIX and POSLUSZNY, 1991).

The use of the personal computer has eased the use of ampelographycal files for the recognition of varietes (ALLEWELDT and DETTWEILER, 1986 ; TRUEL and BOURSIQUOT, 1986 ; DETTWEILER, 1987 ; COSTACURTA and ZAMBON, 1986 ; COSTACURTA and FRANCESCHET, 1987 ; CALO *et al.*, 1986 and 1989 ; BOURSIQUOT *et al.*, 1989 ; DIAZ *et al.*, 1991 ; ROMANI *et al.*, 1993 ; SHIRAISHI M. and SHIRAISHI S., 1997).

Also, in the specialised bibliography, data can be found on the elaboration codes for vine varieties using statistical programmes (VIGNAU, 1988 ; CID *et al.*, 1994), and how to obtain data with the help of computers (SCHEIDER and ZEPPA, 1988 ; ROMANI *et al.*,1992).

The specific objectives of this study have been, in the first place, to characterize the varieties included in « The Clonal Selection and Health Maintenance Plan of Galicia ». This was begun in 1984 to provide superior varieties capable of producing quality wines that would compete with the best in the market. These varieties are : Godello, Treixadura, Torrontés, Dona Blanca, Loureira and Mencía, and the most representative clones have been selected from each of them. This test has been carried out with different varieties in a previous study (CID *et al.*, 1994) with excellent results, convincing us to continue. In a second phase we have attempted to establish, within each variety, separation at the clone level using differential parameters which at the same time would permit us to define determination keys.

MATERIAL AND METHODS

The vines, on which this study is based, belong to autochtonous varieties selected from numerous Galician vineyards and have been placed together in the « A Quinza Estate » (Leiro, Orense). A certain number of clones for each variety have been selected according to their availability and the results of quality tests carried out by technicians of the « Selection Plan » (table I).

The application of statistical methods and terms to the description of the morphological characters of the vine has been employed as the method, using variables supplied by parameters measured only on the leaf. In fact this organ offers an important amount of information and allows the analysis of a large number of quantifiable characters.

Adult leaves, which do not show any signs of disease, have been collected. These have then been pressed and dried, in order to obtain a greater degree of uniformity and capacity for comparison of the sample. Those situated on one-year-old wood, between the 7th and 13th node, have been selected, taking into account that the leaf series ranking from 6 to 26 have

TABLE I
Clones of varieties of grapevines studied for elaboration of determination key for application of philometric measures

Table I - Clones des cépages étudiés pour l'élaboration d'une clé de détermination pour l'application de mesures phyllométriques

Dona blanca	CA-7, CA-25, CA-27, CA-28, CA-30, CA-1, CA-6, CA-8, CA-10, CA-11, CA-2, CA-12, CA-18, CA-19, CA-31
Torrontes	ES-4, ES-1, ES-9, ES-13, ES-13, ES-14, ES-16, ES-22, ES-23, ES-26, ES-27, ES-28, ES-3, ES-31, ES-32, ES-46
Godello	GD-4, GD-6, GD-32, GD-37, GD-38, GD-44, GD-52, GD-56, GD-58, GD-74, GD-75, GD-76, GD-78, GD-84, GD-86
Mencia	ME-4, ME-5, ME-6, ME-7, ME-11, ME-13, ME-14, ME-15, ME-20, ME-21, ME-22, ME-24, ME-25, ME-26, ME-29
Treixadura	RA-4, RA-5, RA-10, RA-12, RA-14, RA-24, RA-25, RA-26, RA-27, RA-30, RA-36, RA-41, RA-43, RA-50
Loureira	LO-13, LO-15, LO-17, LO-22, LO-25

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a lower level of variability (BARTHOU *et al.*, 1986). Fourteen leaves for defining each clone, were collected between the middle of July and the beginning of September.

The measurements were made using a computer system that was designed for this purpose by a research team from the Faculty of Science in Orense (University of Vigo). This system consists of a mini-computer connected to a graphic tablet and a programmer, which obtains co-ordinates of different points of the leaf (figure 1). From these it calculates numerous parameters of the longest and shortest side of the leaf and their average values. This data is immediately registered in data files for later export to a statistical programme (ROMANI *et al.*,1993).

We feel that it is extremely important to use a method of this character which, due to its speed, saves a considerable amount of time and, due to its precision, permits the accentuation of the small differences that can be expected between clones of autochthonous varieties from the same region.

The data was obtained by placing the sheet on a digitalizing tablet GRAPHTECT, model KD 3300, connected to a PC GOUPIL G5-286 computer. Using a pointing device, the dots that the programme was showing us on the screen were transferred to the sheet.

The data has been analyzed using the SAS Statistical Programme and a Discrimination Analysis (DA) has been carried out and the average maximum and minimum values along with typical deviation calculated. More complete information about the SAS System and its characteristics can be found in the « SAS Introductory Guide for Personal Computers, Version 6 » and « SAS/STAT Guide for Personal Computers, Version 6 », published by the SAS Institute Inc. NC, USA 1987.

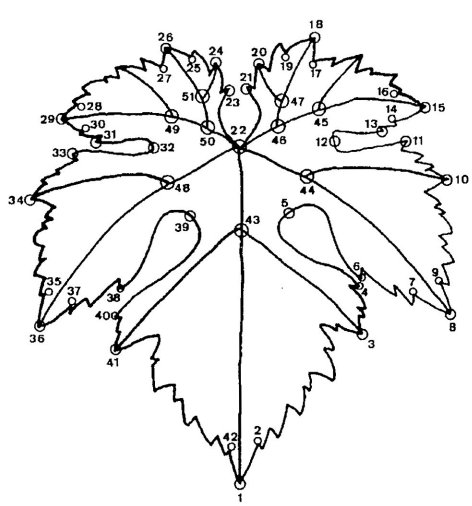


Fig. 1 - To mark the representative points of the leaf a pencil-type pointer has been used that performs the measure when light pressure is applied to it (ROMANI *et al.*, 1993).

Fig. 1 - Points de la feuille demandés par le système informatique pour le calcul des paramètres (ROMANI *et al.*, 1993).

The discrimination analysis consists of obtaining, using the F value (discriminant function), the parameter which better establishes the difference between classes. This parameter will have a greater degree of discrimination and its F value will be higher the larger the differences in the average values between groups and the lower the typical deviation which indicates its stability. The idea is to select in each case the variable which has the closest values, for the individuals in the same group, and the most distant values, for individuals belonging to different groups.

In the differentiation between clones we wanted to work with a large number of parameters in order to guarantee, as far as possible, the differences between them. All those that are considered to be important by different authors have been included, with a special interest in those that are least influenced by the environment (DETTWEILER, 1987) and those of low variability (BARTHOU *et al.*, 1986). With these parameters, the programme supplies a total of 175 numeric values for each leaf (16). It has been decided to dispense with the average relational parameters, in order to reduce the values to 150, which number is considered to be sufficient to define the description.

In the application of statistical terms to the philometric measures of the 6 varieties of « The Selection Plan » only 22 characters have been used. These characters were the most significant differentiators found in a previous study of 17 Galician autochthonous varieties (CID *et al.*, 1994). These characters, are the following: N2g, N5, N6, Ug, L2, A2, L4, L, Lg, ENS, NL, NLp, SS, A, ABEg, ABEp, LA1, LA2g, PLNg, U023g, U012g, AUg (table I and figure 2a, b). In their selection, the asymmetry of the leaf has been taken into account. For the Galician varieties the parameters of the large side and the average of each are significant (CID *et al.*, 1994), However, other authors (BOURSIQUOT *et al.*, 1989) have considered the small side to be more stable.

Two types of parameters are considered :

- direct : These are longitudinal or angles (eg : N1 = length of the central nerve, A = angle between N1 and N2).

- relational (eg: ALT/AN = height of the leaf/width of the leaf).

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For the asymmetric parameters, the computer system calculates the longest side, the smallest side and the average between both of them (eg : N2g = the length of the longest side of the superior lateral principal nerve, N2p = the same nerve on the shortest side, and N2 = the average of N2g and N2p).

For the specification of determination keys, the group of parameters corresponding to each of the varieties is subjected to a DA, to find the parameter with the highest F value. For each clone, this parameter is defined by an interval constructed from the average value ± the typical deviation. Positioning these intervals on a straight line, we find individuals that are perfectly separated and individuals that are astride different groups. This makes it difficult to specify the key. It was finally decided that separate groups would be established for the latter and that the former would be subjected to further DA's until the maximum separation was obtained. That is to say, that the difficulty of differentiation at clone level, led us to establish three options in each step: « a », « b », neither « a » nor « b ». In this way, step by step, the group of characters which best explained the differences (if there were any) between the selected clones, were defined.

RESULTS AND DISCUSSION

In table II, can be found the six varieties of « The Clonal Selection Plan of Galicia », characterised by 22 parameters that we consider to be highly significant. At the same time, this table acquires a determination function on observing in them a separation of intervals between some varieties, an action which is repeated in all the characters. That is to say, in the case of doubt about the identification of a variety under consideration in this section, we carry out a series of measurements on a significant sample of the variety and compare them with the obtained data. In them we will always find a clear difference between two varieties, excepting in the case of Torrontés and Dona Blanca. Overlaying of intervals occurs in these and it is necessary to resort to supplemental characters in order to separate them. Among the other varieties numerous differentiating parameters are observed, Mencía being the variety that shows the highest number of characters that are different to the rest. For example, Mencía and

TABLE II
Distances, angles and relationships of leaf highly significant for determination of varieties of grapevines (CID *et al.*, 1994)

Tableau II - Longueurs, angles et rapports de la feuille les plus significatifs pour la détermination des variétés (CID *et al.*, 1994)

	Treixadura	Dona blanca	Mencia	Godello	Torrontès	Loureira
N2g (cm)	10.1 - 12.9	10.6 - 12.5	7.9 - 9.3	9.6 - 11,8	10.6 - 13.0	9.1- 10.9
Ug (cm)	7.8 - 9.8	4.2 - 6.4	4.7 - 7.5	5.1 - 7.6	4.2 - 5.6	3.8 - 5.1
Lg (cm)	9.8 - 13.9	10.4 - 14.3	8.5 - 11.1	10.4 - 12.8	11.4 -15.5	13.1 - 15.8
NLp (cm)	5.7 - 7.3	7.7 - 7.0	4.3 - 5.4	5.1 - 6.3	5.2 - 7.1	4.7 - 6.4
N5 (cm)	2.5 - 3.3	2.3 - 3.4	1.9 - 2.7	1.5 - 2.2	2.5 - 3.6	2.3 - 3.0
N6 (cm)	0.9 - 1.4	0.9 - 1.4	0.5 - 0.9	1.3 - 1.7	0.6 - 1.2	1.0 - 1.4
L2 (cm)	0.8 - 1.0	0.7 - 1.2	0.6 - 0.8	0.6 - 0.8	0.8 - 1.2	0.6 - 0.9
L4 (cm)	0.6 - 0.9	0.8 - 1.0	0.5 - 0.6	0.5 - 0.9	0.6 - 1.0	0.4 - 0.7
A2 (cm)	1.1 - 1.4	1.1 - 1.5	0.9 - 1.2	1.2 - 1.6	1.0 - 1.4	1.2 - 1.7
L (cm)	9.7 - 13.7	10.3 - 13.8	8.6 - 10.7	10.2 - 12.2	10.8 - 14.4	12.9 - 15.7
ENS (cm)	6.8 - 10.1	7.0 - 9.2	5.4 - 7.5	7.3 - 8.7	6.0 - 9.9	8.7 - 10.8
NL (cm)	5.8 - 7.2	5.9 - 7.1	4.5 - 5.5	5.2 - 6.5	5.4 - 7.4	5.0 - 6.4
SS (cm)	-0.2 - 0.5	0.3 - 1.6	-0.3 - 0.8	0.05 - 0.9	0.6 - 2.4	-0.6 - 1.2
A (°)	47 - 54	48.5 - 58.4	49.0 - 56.3	49.7 - 56.9	50.0 - 57.8	61.3 - 69.5
LA1	0.56 - 0.84	0.56 - 0.84	0.58 - 0.84	0.38 - 0.55	0.63 - 0.97	0.38 - 0.58
LA2g	0.66 - 0.83	0.61 - 0.85	0.62 - 0.81	0.42 - 0.54	0.74 - 1.05	0.39 - 0.62
PLNg	0.6 - 0.83	0.61 - 0. 85	0.62 - 0.81	0.8 - 1.1	0.7 - 1.0	0.7 - 1.0
U023g	0.75 - 0.84	0.42 - 0.56	0.68 - 0.82	0.59 - 0.76	0.48 - 0.55	0.50 - 0.60
U012g	0,64 - 0.71	0.35 - 0.46	0.55 - 0.63	0.50 - 0.67	0.40 - 0.47	0.41 - 0.51
AUg	0.05 - 0.06	0.08 - 0.13	0.06 - 0.11	0.07 - 0.10	0.09 - 0.13	0.12 - 0.18
ABEg (°)	150.5 - 169.6	150.5 - 173.4	157.9 - 174.1	135.5 -151.4	161.9 - 184.6	173.3 - 188.1
ABEp (°)	149 - 163.8	148.4 - 172.0	160.6 - 17	137.4 - 149.5	161.7 - 175.3	169.7 - 190.5

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Loureira have 12 of the 22 measurements used that are different between them : N2g, N6, Lg, L, ENS, A, LA1, LA2g, PLNg, U023g, U012g and AUg (CID *et al.*).

As expected, the specification of the determination keys with clones is much more delicate than with varieties or categories. The parameters of leaf highly significant for determination of varieties of clones are represented in table III. The schematic diagram of the leaf with the graphic sign of parameters is shown in figures 2a and 2b. In general very short keys, with very few steps and with large groups of individuals which are impossible to separate, are obtained.

Explanatory list of distances, angles and relationship of leaf for characterisation of the clones and varieties of grapevines is given in attach 1.

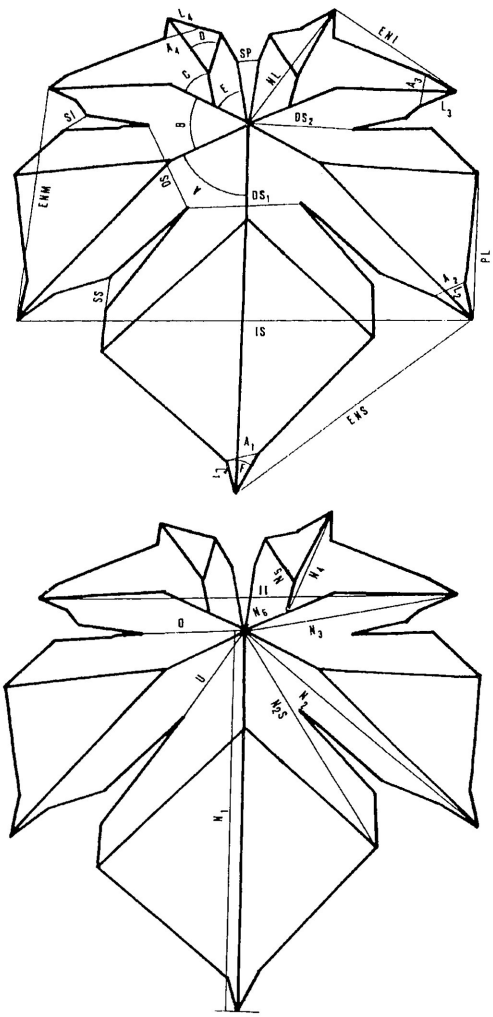


Fig. 2a, b - Schematic diagram of a leaf with the graphic sign of the parameters (ROMANI *et al.*, 1992)

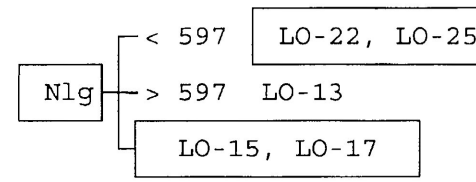
Fig. 2a, b - Représentation schématique des caractères sur la feuille (ROMANI *et al.*, 1992)

TABLE III
Parameters of leaf highly significant, using a discrimination analysis, for determination of clones of varieties of grapevines studied

Tableau III - Paramètres sélectionnés grâce à l'analyse discriminante pour la différenciation des clones des cépages étudiés

Characters of leaves	Distances	Angles	Relationships
Large side	NLg, N2g		43p
Small side			UO23g, LA2g
Average values	ENI, DS, A4,	O, C	
No symetric	L		L4

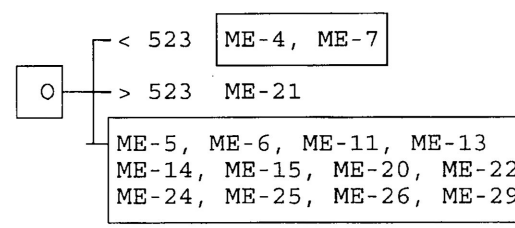
Loureira (Key 1) : The discriminating character is « Nlg » which represents the distance that exists between the point of the petiole and the very end of the « N4 » nerve. That its value is more or less in this case, is a consequence of the petiole bosoms being open or closed. In LO-22 and LO-25 « Nlg » is greater then 5.97 cm and its petiole bosoms is closed. In LO-13- « Nlg » is less than 5.97 cm and its petiole bosoms is open. LO-15 and LO-17 are astride these two cases with a greater variability for this character.



Key 1 - Determination of clones of grapevines Loureira

Clé 1 - Détermination des clones des cépages Loureira

Mencia (Key 2) : The character discriminating is the distance between the point of the petiole and the inferior bosoms, « O ». It reflects the depth of the inferior lateral bosoms (average of « Og » and « Op »). A clear difference exists between clones ME-4, ME-7 on one hand and ME-21 on the other. The first two, with « O » measuring more than 5.23 cm, have shallow sinuses, whilst ME-21, with « O » measuring less than



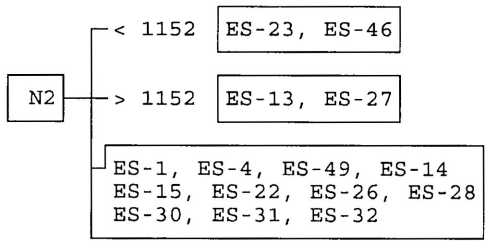
Key 2 - Determination of clones of grapevines Mencia

Clé 2 - Détermination des clones des cépages Mencia

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5.23 cm, have deeper inferior lateral bosoms. In the rest of the clones no substantial differences were found.

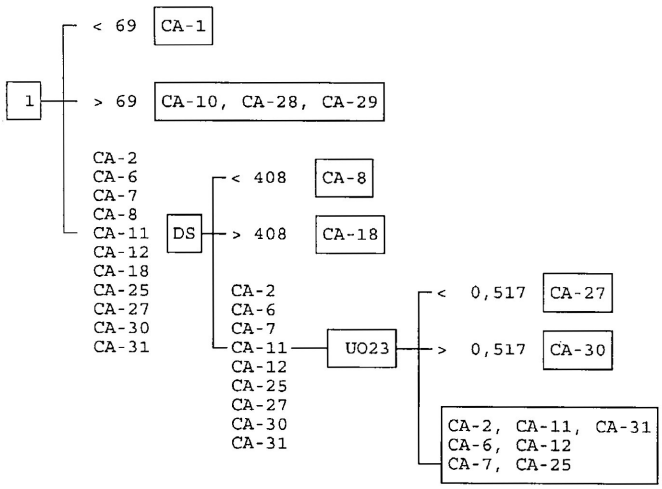
Torrontes (Key 3) : « N2 » is the length of the principal superior lateral nerve (average of « N2g » and « N2p ») and is directly related to leaf size. Leaves of ES-23 and ES-46 have an « N2 » below 11.52 cm and its size is less than that of ES-13 and ES-27. The rest of the clones have variable sized leaves.



Key 3 - Determination of clones of grapevines Torrontes

Clé 3 - Détermination des clones des cépages Torrontes

Dona Blanca (Key 4) : « L1 » is the length of the dentation of « N1 ». This parameter establishes a clear difference between clone A-1, which has a longer dentation of the principal central nerve, and the group of clones CA-10, CA-28 and CA-29, which have a shorter one. « DS », distance between the base of the lateral bosoms, characterises CA-8 and CA-18. Not because one of these has sinuses of a different depth to the other one, but because of the difference in leaf size. That is to say, CA-18 has leaves that are noticeably larger than those of CA-8. UO23g is a character which does indicate the depth of the lateral bosoms. It separates clone CA-30, with shallower sinuses, from clone CA-27, with deeper lateral bosoms.

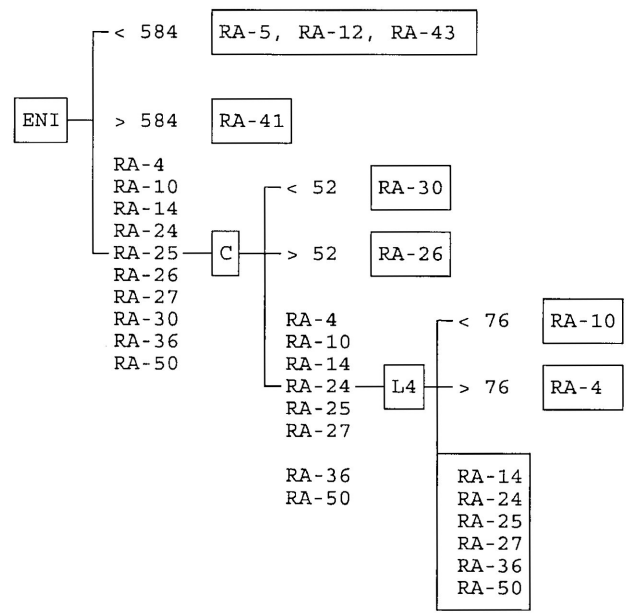


Key 4 -Determination of clones of grapevines Dona Blanca

Clé 4 - Détermination des clones des cépages Dona Blanca

Treixadura (key 5) : « ENI » is the distance between the « N3 » and « N4 » nerve ends and « C »is the angle between them. Both characters supply information about the opening of the petiole bosom and it can be seen clearly that the petiole bosoms of RA-41 and RA-26 is not as open as those of RA-5, RA-12, RA-43 and RA-30. The differentiation of clones RA-10 and RA-4 is provided by « L4 », the length of the dentation of « N4 » and the average between « L4g » and « L4p ». We can see that RA-4 has a longer dentation, with a length greater than 0.76 cm, and a shorter RA-10, as the length of this is always going to be less than that measurement.

It has not been possible to find any other characteristic that differentiated in the rest of the Treixadura clones.

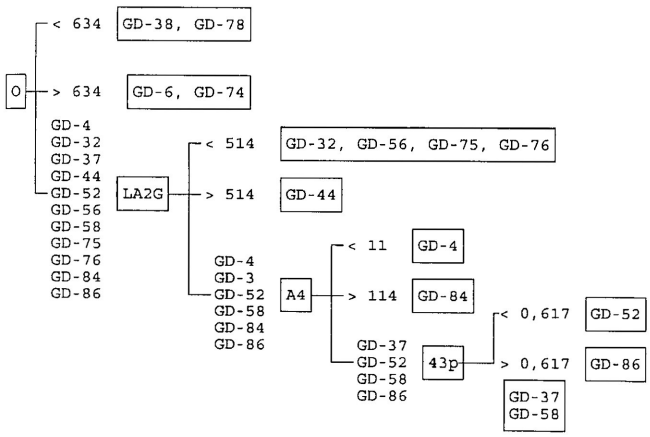


Key 5 - Determination of clones of grapevines Treixadura

Clé 5 - Détermination des clones des cépages Treixadura

Godello (Key 6) : « O », as we saw for Mencía, is the distance between the point of the petiole and the inferior bosoms. It reflects the depth of the inferior lateral bosoms (average of « Og » and « Op »). We will separate on one hand GD-38 and GD-78 with deeper sinuses, as the measurement of « O » is less than 6.34 cm, and GD-6 and GD-74 on the other, with shallower bosoms and an « O » higher than 6.34 cm. « LA2g » is a character which indicates the shape of the dentation of « N2g ». We find that GD-44 has a sharper dentation than those of clones GD-32, GD-56, GD-75 and GD-76. « A4 » refers to the length of the

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Key 6 - Determination of clones of grapevines Godello

Clé 6 - Détermination des clones des cépages Godello

dentation « N4 » (average of « A4g » and « A4p »). It establishes the difference between GD-84, with wider dentation (>1.14 cm) and GD-4 with narrower dentation (<1.14 cm). « 43p » is the relation between « N4p » and « N3p ». This parameter gives us an idea of the size of the inferior lobe. In GD-86 this is seen to be shorter and wider and in GD-52 longer and thinner.

It has been impossible to separate the other two clones, GD-37 and GD-58. In any case, this variety is the one that has the most complete key. This is almost certainly due to the fact that it was the most widely distributed throughout the region, when the Clonal Selection Plan was begun and the varieties were collected in the whole of Galicia.

As a result, it has the largest clonal diversity of the collection. The characters that have been shown to be the most discriminating in the separation of the clones are shown in table III. Dona Blanca and Godello are the varieties that offer the most variations in the leaf form. Their clones are defined by the length of the dentation N1, size and depth of the lateral sinuses in the first one and the form of dentation N2, length of the dentation N4, depth of the inferior lateral sinuses and size of the inferior lobe in the second one.

Loureira, Mencía y Torrontés are shown to be varieties with a more homogenous foliar morphology. The separation of their clones is possible using one unique character in each case: the opening of the petiole sinus in Loureira, the depth of the inferior lateral sinuses in Mencia, and the size of the leaf in Torrontes. Finally, Treixadura has two discriminating foliar characters: the opening of the petiole sinus and the length of the dentation N4. It would represent, in the categorisation we are proposing, a middle level of leaf form variations.

CONCLUSIONS

The application of statistical methods and terms to the description of the morphological characters of the vine is very useful for the characterisation of the varieties of grapevines in « The Galician Clonal Selection Plan ». It's a method which helps to complete the data derived from the classical system.

Diversity exists in the differentiating parameters of the varieties. The opening of the petiole sinus, the depth of the lateral sinuses, morphology, size of principal nerve dentation,and leaf size, according to the variety

The elaboration of determination keys for clones, based on measurements or numerical data, for specific areas or a defined region and using a limited number of individuals, although it is still very difficult to achieve total segregation. It is true that groups with large numbers of individuals have been found, where segregation has been impossible. To a certain extent this should be considered as logical, as the contrary would contradict the definition of clone.

Finally, we would emphasise the fact that all the methods, used or developed from the classical system, have come to make important complementary contributions, but have never served as a substitute. The search for new methods, further research into studies already carried out, should be considered in the future, to increase the information available about our varieties.

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Attach 1 - Explanatory list of distances, angles and relationships of leaf for characterisation the clones and varieties

Annexe 1 - Liste explicative des longueurs, angles et rapports de la feuille pour la différenciation des clones de cépages

N1 : length main nerve.
N2 : length lower lateral nerve.
N4 : length larger petiole nerve.
N5 : length smaller petiole nerve.
N6 : distance petiole vertex to fork N3-N4.
U : distance petiole vertex to upper bosom.
O : Distance petiole vertex to lower bosom.
ND : number of teeth between 10 and 8.
PL : distance end N2 and end of its first secondary nerve.
L2 (8-(7-9)) (36-(35-37)) : length lower lateral nerve tooth measured to the middle point of the base.
L4 (18-(17-19)) : length petiole nerve tooth measured to the middle point of the base.
A2 (7-9) (35-37) : Tooth width N2.
L (1-15) (1-29) : Projection distance ends N2 and N1 on shaft of the leaf.
ENS : distance ends N1-N2.
NL : distance petiole point-end N4.
SS : opening upper bosom.
A : angle between N1 and N2.
B : angle between N2 and N3.
E : angle between N3 and petiole bosom.
LA2 : L2/A2.
PLN : PL/ND.
UO23 : (U+O)/(N2+N3).
UO12 : (U+O)/ (N1+N2).
AU : A/U.
DS : Distance between upper and lower bosom bases.
ENI : Distance ends N3-N4.
C : Angle between N3 and N4.
L4 (18-(17-19)) (26- (25-27)) : Length petiole nerve tooth measured to the middle point of the base.
A4 : Tooth width N4.
43p : N4/N3.

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