Journal International des Sciences de la Vigne et du Vin, 1993, **27**, N° 3, 159-177

BEHAVIOUR OF *VITIS VINIFERA* L. CV. ALBARIÑO PLANTS, PRODUCED BY PROPAGATION *IN VITRO*, WHEN USING SINGLE BUD CUTTINGS

Maria del Carmen MARTINEZ R. and J.L.G. MANTILLA

Instituto de Investigaciones Agrobiológicas de Galicia (C.S.I.C.),
Apartado de correos 122, 15080 Santiago de Compostela (España).

Abstract : *Single bud cuttings were produced from cane taken from vines propagated in vitro which had been held for a year in pots. During this period we had observed, in the mother plants, that three areas appeared which showed a clearly different morphology. In the basal area the leaves were cordiform or pentagonal without sinuses, with high density of erect hairs, a low density or absence of horizontal hairs and a strong anthocyanic pigmentation. In the intermediate area the leaves were pentagonal, with deep sinuses, a high density of erect hairs and a strong anthocyanic pigmentation in the principal nerves. In the apical area the leaves were pentagonal, without sinuses, with a high density of horizontal hairs, total absence of erect hairs and absence of anthocyanic pigmentation in the principal nerves (typical of adult Albariño). The single bud cuttings were planted in pots and it was observed that during the first year all the plants, as much those taken from the basal area as those from the intermediate and apical areas, produced leaves having very deep sinuses (juvenile character). Three years more were allowed to pass, they were subjected to pruning as low down as possible on same year wood and then were restudied. It was seen that the vine produced from single bud cuttings taken from the basal area showed very juvenile characters, those taken from the intermediate area showed characters somewhere between the juvenile and adult stages, and those taken from the apical area showed adult characters.*

INTRODUCTION

In previous studies we observed that the *Vitis vinifera* L., cv. Albariño vines that had been multiplied *in vitro*, presented some basal and intermediate areas with juvenile characteristics (very similar to those of vines of the same type grown from seeds), and an apical area showing characteristics similar to those of adult plants of the same type. This also occurred in other types of plants studied by other authors in different places (GRENAN, 1982a, b ; CANCELLIER and COSSIO, 1987, 1988).

In view of this, we thought it would be of interest to study the behaviour of these plants when grown from single budded cuttings, and to see if the juvenile or adult characters of each area were conserved or not.

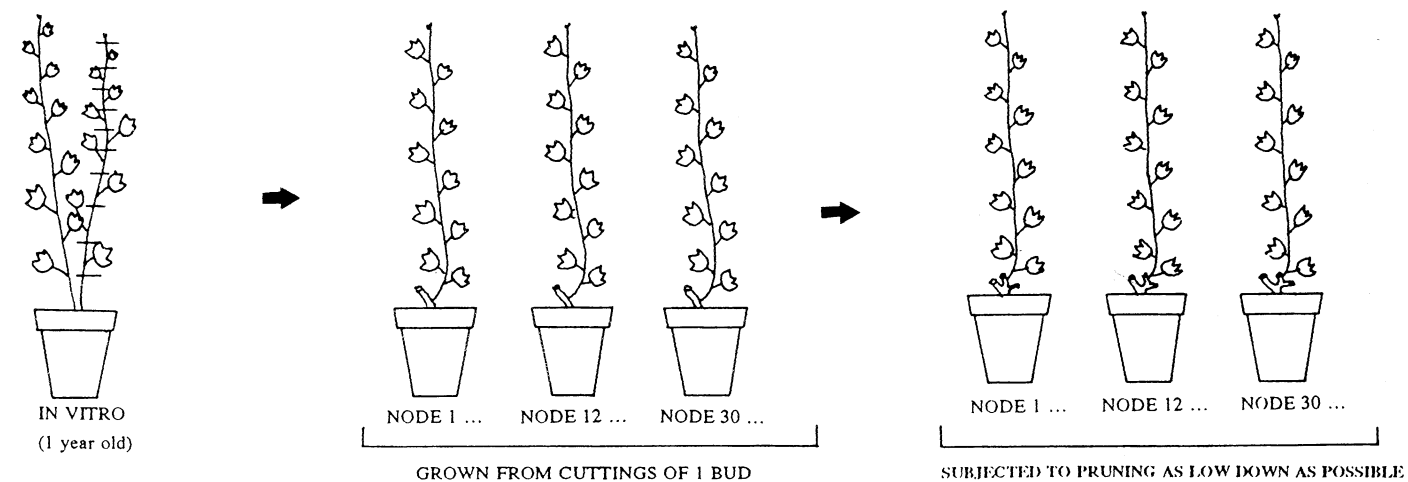


Fig. 1 — Phases of the experiment

MATERIALS AND METHOD

I — VEGETABLE MATERIAL

This study was carried out using *Vitis vinifera* L., cv. Albariño plants produced by propagation *in vitro*, according to the method of FERRO (1989). Five canes were selected, they were cut in sections with a single bud and planted in pots that were placed in a greenhouse belonging to the Instituto de Investigaciones Agrobiológicas de galicia (C.S.I.C.) (figure 1).

This study was carried out during two different periods. In the first period, the vines were one year old and in the second period they were three years older, and had been subjected to pruning as low down as possible on same year wood.

Four plants grown from single bud cuttings taken from the basal area (nodes 1, 2, 3, 4), four from single bud cuttings taken from the intermediate area (nodes 12, 13, 16, 17), and four from single bud cuttings taken from the apical area (nodes 33, 36, 37, 38) were studied.

II — PARAMETERS MEASURED AND INSTRUMENTS USED

In the first year, adult leaves were selected (between setting and veraison) from the middle third of the shoot of each of the plants, as proposed by the O.I.V. (1983), and the following parameters were measured by hand :

- Lengths :

Nc, S1d, N1d, S2d, N2d

N2i, S2i, N1i, S1i, a

- Ratios :

Using the lengths measured on adult leaves, the following ratios were calculated :

$\sum S1/\sum N1$ $\quad$ $Nc/\sum N1$

$\sum S2/\sum N2$ $\quad$ $a/\sum N1$

Three years later, in different stages of the vegetative cycle, the parameters of the different organs were again studied and measured. The parameters measured during this year are shown in figure 2. The parameters shown in this figure, that are not referred to the O.I.V. (1983) nor to the Minimum List (DETTWEILER, 1991) (with the exception of the adult leaf), are proposed as new ones or are modifications, made by us, of others that actually exist.

Most of the quantitative parameters of the adult leaf have been selected using as a basis the work of different authors (CARBONNEAU, 1976 ; GRENAN, 1982a,b ; GALET, 1985, 1988 ; O.I.V., 1983 ; BOURSIQUOT et *al.*, 1987, 1989 ; ALLEWELDT and DETTWEILER, 1986, 1989 ; DETTWEILER, 1987, 1989, 1991). The nomenclature has been modified by adapting the initials to the Spanish language to facilitate their manipulation and interpretation, and because it does not seem correct to mix the nomenclature of the parameters of all the different authors used. Others are proposed as new ones by us.

a) Observation at a shoot length of 10 to 30 cm
Young shoot

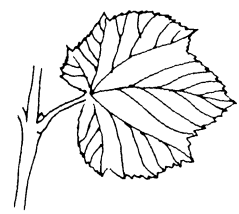


- Qualitatives :

  • Codes O.I.V.

001	004
002	005
003	

b) Observation before flowering
Young leaf



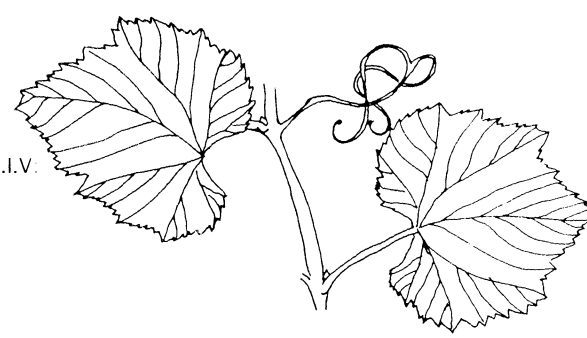
- Qualitatives :

  • Codes O.I.V.

051	053	055
052	054	056

  • Density of erect hairs on the margin of teeth
  • Anthocyanin coloration on main veins on the upper side

c) Observation during flowering
Shoot — Tendrils — Inflorescence

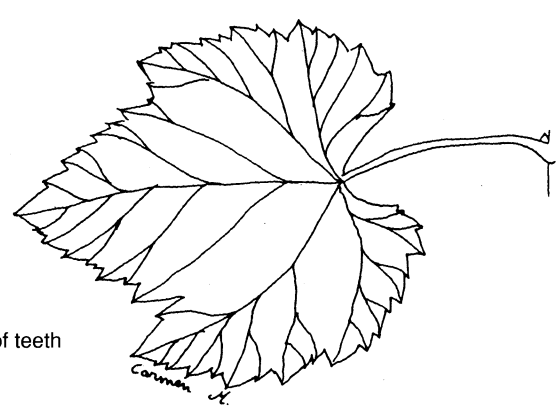


- Qualitatives :

  • Codes O.I.V.

006	011	016	151
007	012	017	152
008	013		
009	014		
010	015		

d) Observation from berry set to veraison
Mature leaf



- Qualitatives :

  • Codes O.I.V.

067	075	082	087
068	076	083	088
069	079	084	089
070	080	085	090
071	081	086	091

  • Mimimal list 083 - 1
  • Density of erect hairs on the margin of teeth

- Quantitatives :

Lengths, Angles, Ratios, Anothers

Fig. 2 — Parameters measured in different organs and at different moments of the vegetative cycle

The quantitative parameters of adult leaves, that are denominated as "Lengths" in figure 2, are shown in figure 3 and 4.

The quantitative parameters of adult leaves, that are denominated as "Angles" in figure 2 are shown in figure 5.

The quantitative parameters of adult leaves, that are denominated as "Ratios" in figure 2 are the following rations between the previously described parameters.

LD1d/AD1d	S1d/N1d	∑S2/∑N2
LD3d/AD3d	S1i/N1i	Nc/∑N1
LD3i/Ad3i	S2d/N2d	a/∑N1
LD1i/AD1i	S2i/N2i	A+B
LDt/Adt	Nc/a	A+B+G
Lp/Nc	S1d+S2d/Nc+N1d	A`+B`
N1d/Nc	S1i+S2i/Nc+N1i	A`+B`+G`
N2d/Nc	S1d+S2d/N1d+N2d	A+B/S1d+S2d
N3d/Nc	S1i+S2i/N1i+N2i	A`+B`/S1i+S2i
N1i/Nc	N5d/N2d	ASP/D+D`
N2i/Nc	N5i/N2i	
N3i/N	∑S1/∑N1	

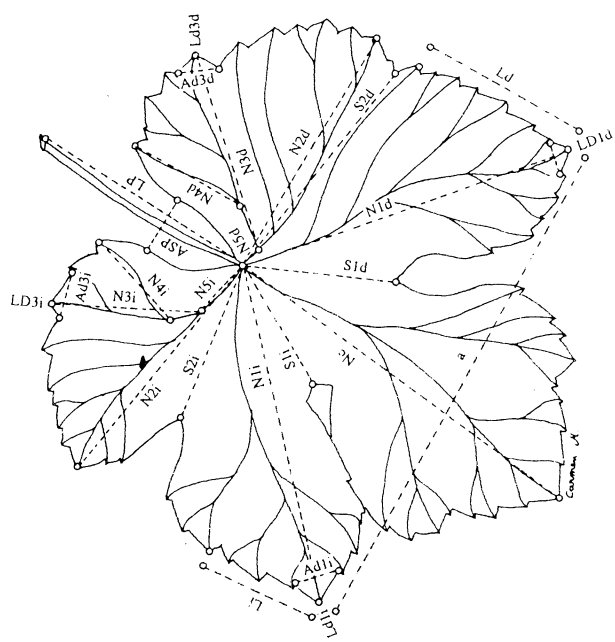


Fig. 3 — Lengths measured in the adult leaves (cm)

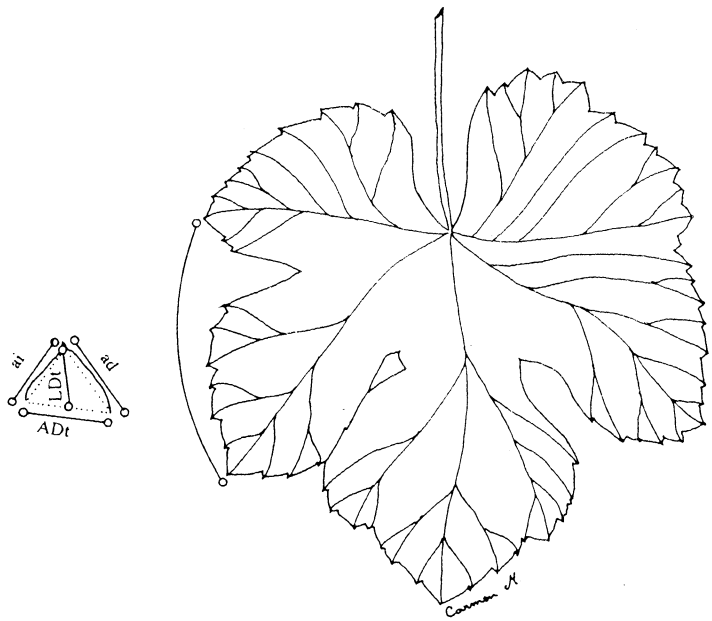


Fig. 4 — Localization in the adult leaf of the teeth measured and lengths mesured in each tooth (cm)

The quantitative parameters of adult leaves, that are denominated "Others" in figure 2, are a series of parameters obtained automatically using The Digital Image Processing System MIP 1.4 (MICROM). These measurements only refer to the blade of the leaves, excluding the petiole, and are the following :

- Area
- Perimeter
- Convex perimeter

Is the length of the perimeter of the figure formed by joining all the most protruding points of the leaf.

- Circular Form Factor

This parameter was proposed by KEEFE and DRAPER (1988) in order to study the form of the leaves and seeds of diverse species, using image analysis.

Other authors such as WEST and NOBLE (1984) or KEEFE and DRAPER (1986, 1988), used it to measure leaves and seeds and they denominated it as "Form factor". This factor is calculated using the perimeter of the leaf and its area, taking values of between 1 (for circular forms) and 0 (for more estended forms).

$$FOR.CIRC.= \frac{4\pi \times AREA}{PERIMETRO^2}$$

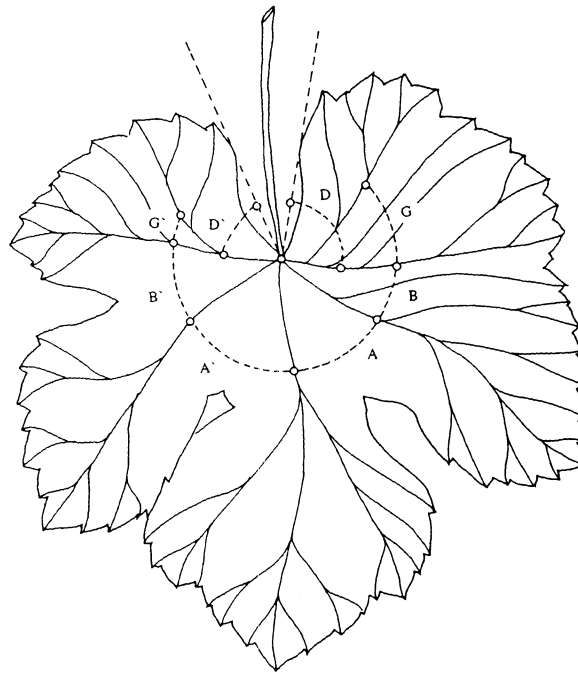


Fig. 5 — Angles measured in the adult leaves (°)

- Elongation Factor

Ratio between the minimum and maximum diameter of the leaf.

- Rugosity Factor

This parameter measures the ratio between the convex perimeter and the perimeter.

$$\text{FOR.RUG..} = \frac{\text{PERIMETRO CONVEXO}}{\text{PERIMETRO}}$$

The qualitative parameters corresponding to the pubescence were studied with the aid of a binocular magnifying glass.

All the quantitative parameters of the adult leaves were obtained from pressed leaves, using a Digital Image Processing System MIP 1.4 (MICROM). A black and white video camera was used (Hitachi CCTV Camera Microm) and the images were filmed using natural light.

III — STATISTICAL ANALYSES CARRIED OUT.

Variance analysis : Applied to the quantitative data and was carried out using the BMDP statistical packet, version 1988 (BMDP7D- "One Way Analysis of Variance").

TABLE IA

Average quantitative parameters of the adult leaf of plants from single budded cuttings taken from the basal, intermediate and apical areas of Albariño vines *in vitro* when they are one year old

Parameters	E. 1	E. 2	E. 3	E. 4	E. 12	E. 13	E. 16	E.17	E. 33	E. 36	E. 37	E. 38
Nc	6.16	6.62	6.10	5.54	5.76	7.20	5.96	7.66	7.78	7.38	7.20	7.60
S1d	3.06	3.18	2.80	2.78	2.56	4.20	3.52	4.46	5.42	4.32	4.56	5.06
N1d	5.0	5.42	4.84	4.44	4.72	5.98	5.52	6.78	6.68	6.28	6.32	6.62
S2d	2.48	2.84	2.28	2.30	2.46	3.84	3.38	3.94	4.30	3.80	4.02	4.10
N2d	3.14	3.26	2.70	2.62	2.84	3.74	3.78	4.42	4.62	4.06	4.32	4.38
N2i	3.10	3.38	3.00	2.60	2.82	3.64	3.54	4.50	4.76	4.04	4.14	4.22
S2i	2.50	2.90	2.68	2.28	2.42	3.46	3.72	4.00	4.44	3.78	3.90	3.90
N1i	4.68	5.20	5.00	4.36	4.52	5.88	5.34	6.82	6.78	6.46	6.30	6.50
S1i	2.98	3.10	2.72	3.00	3.08	4.84	3.76	4.58	5.44	4.96	4.54	4.48
a	6.74	7.02	6.66	5.94	5.92	6.98	5.92	7.62	8.02	7.18	7.34	7.76
$\Sigma S1/\Sigma N1$	0.62	0.59	0.56	0.60	0.60	0.76	0.67	0.66	0.80	0.72	0.72	0.73
$\Sigma S2/\Sigma N2$	0.79	0.86	0.87	0.88	0.86	0.94	0.96	0.89	0.93	0.93	0.93	0.92
$Nc/\Sigma N1$	0.63	0.62	0.62	0.63	0.62	0.61	0.54	0.56	0.57	0.58	0.57	0.57
$a/\Sigma N1$	0.69	0.65	0.67	0.67	0.63	0.58	0.54	0.55	0.59	0.56	0.58	0.59

E.1=Cutting node1.

.

.

.

E.12=Cutting node38.

Non- parametric analysis of Kruskal-Wallis : Applied to the qualitative data, and indicates if there is a significant difference for a given parameter between the different areas of the plant (basal, intermediate and apical). Afterwards it is repeated on pairs and in this case indicates between which specific areas these differences are found (basal-intermediate, basal-apical...). In order to carry out this analysis a BMDP statistical packet, version 1988, was used. (BMDP3S- "Non-parametric Statistics, Kruskal-Wallis one way").

RESULTS AND DISCUSION

In the first year study, the only point noticed was that the cuttings taken from the basal area (with cordiform or pentagonal leaves without sinuses in the mother vine) (figure 1) showed leaves of a slightly smaller size (table IA) especially with respect to those of the apical area, between which there was a significant difference when comparing nerves N1, N2 and the distances S1 and S2 (table IB).

All of them, both those from the basal area and those from the intermediate and apical areas, had leaves with very deep lateral sinuses. It can be seen in table IA that S1 is considerably smaller than N1 in both the basal area and the intermediate and apical areas. In all of them the depth of the sinuses was similar as there is practically no significant difference in the ratio $\sum S1/\sum N1$ (table IB). This does not coincide with the observations of GRENAN (1979) using *in vitro* plants of the variety Grenache N, all of wich had adult characteristics during the first year after being grown from cuttings. This could have been due to the optimum conditions of cultivation which favour rapid growth, which also influences (as was demonstrated by the aforesaid author in that study) the maintenance of the juvenile characteristics in the leaf over a period of years. It could also be due to the fact that it is a different variety and, as such, has a different deportment.

None of these plants produced bunches of grapes.

After three years, and when subjected to pruning as low down as possible on same year wood, it was observed that the shoots of the basal area maintained their juvenile characteristics, such as a low density of horizontal hairs and a higher density of erect hairs on the extremity, as well as (in the young and dult leaves) the dark green colour of the blade, the red colour of the nerves, nodes and internodes (tables IIIA and IIIB), an increased depth of the superior lateral sinuses and a decrease in the size of the leaves (tables IIA and IIB).

The apical area showed characteristics similar to those of adult Albariño, such as an increased density of horizontal hairs, almost no erect hairs, the small size or absence of lateral sinuses (tables IIA and IIB), and larger leaves.

Those from the intermediate area showed characters that were somewhere between those shown by shoots from the basal and apical areas. Although they were a little closer, as far as erect hairs are concerned, to those from the basal area (tables IIIA and IIIB), they were closer to those from the apical area as far as the depth of the lateral sinuses are concerned (tables IIA and IIB).

TABLE IB

Quantitative parameters with significant differences between plants from single budded cuttings taken from the basal, intermediate and apical areas of Albariño vines *in vitro* when they are one year old

Parameters		Parameters		Parameters	
Nc	EN4 - EN13**	**S2d**	EN2 - EN36**	**N2d**	EN12 - EN13*
	EN4 - EN33*		EN2 - EN37***		EN12 - EN16*
	EN4 - EN36***		EN2 - EN38***		EN12 - EN17***
	EN12 - EN33*		EN3 - EN13***		EN12 - EN33***
S1d	EN2 - EN33*		EN3 - EN16***		EN12 - EN36***
	EN3 - EN13*		EN3 - EN17***		EN12 - EN37***
	EN3 - EN33***		EN3 - EN33***		EN13 - EN33*
	EN3 - EN36*		EN3 - EN36***	**N2i**	EN1 - EN17***
	EN4 - EN33**		EN3 - EN37***		EN1 - EN33***
	EN12 - EN13*		EN3 - EN38***		EN1 - EN36***
	EN12 - EN33***		EN4 - EN13***		EN1 - EN37***
	EN12 - EN36*		EN4 - EN16***		EN1 - EN38***
	EN12 - EN38*		EN4 - EN17***		EN2 - EN4*
	EN13 - EN33**		EN4 - EN33***		EN2 - EN17***
N1d	EN1 - EN17***		EN4 - EN36***		EN2 - EN33***
	EN1 - EN33**		EN4 - EN37***		EN2 - EN37*
	EN1 - EN36*		EN4 - EN38***		EN2 - EN38**
	EN1 - EN37*		EN12 - EN13***		EN3 - EN17***
	EN1 - EN38***		EN12 - EN16**		EN3 - EN33***
	EN2 - EN17**		EN12 - EN17***		EN3 - EN36***
	EN2 - EN33*		EN12 - EN33***		EN3 - EN37***
	EN2 - EN38*		EN12 - EN36***		EN3 - EN38***
	EN3 - EN17***		EN12 - EN37***		EN4 - EN13***
	EN3 - EN33*		EN12 - EN38***		EN4 - EN16***
	EN3 - EN36**		EN13 - EN33*		EN4 - EN17***
	EN3 - EN37**		EN16 - EN33**		EN4 - EN33***
	EN3 - EN38***	**N2d**	EN1 - EN17***		EN4 - EN36***
	EN4 - EN13**		EN1 - EN33***		EN4 - EN37***
	EN4 - EN17***		EN1 - EN36*		EN4 - EN38***
	EN4 - EN33***		EN1 - EN37***		EN12 - EN13**
	EN4 - EN36***		EN1 - EN38**		EN12 - EN16*
	EN4 - EN37***		EN2 - EN17***		EN12 - EN17***
	EN4 - EN38***		EN2 - EN33***		EN12 - EN33***
	EN12 - EN13*		EN2 - EN37**		EN12 - EN36***
	EN12 - EN17***		EN2 - EN38**		EN12 - EN37***
	EN12 - EN33***		EN3 - EN13**		EN12 - EN38***
	EN12 - EN36**		EN3 - EN16**		EN13 - EN17**
	EN12 - EN37***		EN3 - EN17***		EN13 - EN33***
	EN12 - EN38***		EN3 - EN33***		EN16 - EN17***
	EN16 - EN17*		EN3 - EN36***		EN16 - EN33***
S2d	EN1 - EN13***		EN3 - EN37***		EN33 - EN36*
	EN1 - EN16**		EN3 - EN38***	**S2i**	EN1 - EN13**
	EN1 - EN17***		EN4 - EN13**		EN1 - EN16***
	EN1 - EN33***		EN4 - EN16***		EN1 - EN17***
	EN1 - EN36***		EN4 - EN17***		EN1 - EN33***
	EN1 - EN37***		EN4 - EN33***		EN1 - EN36***
	EN1 - EN38***		EN4 - EN36***		EN1 - EN37***
	EN2 - EN17***		EN4 - EN37***		EN1 - EN38***
	EN2 - EN33***		EN4 - EN38***		EN2 - EN17***

* 95%; ** 99%; *** 99,9%
EN... = Cutting node...

TABLE IB (continuation)

Quantitative parameters with significant differences between plants from single budded cuttings taken from the basal, intermediate and apical areas of Albariño vines *in vitro* when they are one year old

Parameters		Parameters	
S2i	EN2 - EN33***	**S1i**	EN1 - EN38**
	EN2 - EN36*		EN2 - EN13***
	EN2 - EN37**		EN2 - EN17**
	EN2 - EN38**		EN2 - EN33***
	EN3 - EN16**		EN2 - EN36***
	EN3 - EN17***		EN2 - EN37**
	EN3 - EN33***		EN2 - EN38*
	EN3 - EN36***		EN3 - EN13***
	EN3 - EN37***		EN3 - EN17***
	EN3 - EN38***		EN3 - EN33***
	EN4 - EN13***		EN3 - EN36***
	EN4 - EN16***		EN3 - EN37***
	EN4 - EN17***		EN3 - EN38***
	EN4 - EN33***		EN4 - EN13***
	EN4 - EN36***		EN4 - EN17**
	EN4 - EN37***		EN4 - EN33***
	EN4 - EN38***		EN4 - EN36***
	EN12 - EN13**		EN4 - EN37**
	EN12 - EN16***		EN4 - EN38**
	EN12 - EN17***		EN12 - EN13***
	EN12 - EN33***		EN12 - EN17**
	EN12 - EN36***		EN12 - EN33***
	EN12 - EN37***		EN12 - EN36***
	EN12 - EN38***		EN12 - EN37**
	EN13 - EN33**		EN12 - EN38*
N1i	EN1 - EN17**		EN16 - EN33***
	EN1 - EN33*	**a**	EN4 - EN33**
	EN1 - EN36**		EN4 - EN38*
	EN1 - EN37*		EN12 - EN33**
	EN3 - EN17**		EN12 - EN38*
	EN3 - EN33**		EN16 - EN33**
	EN3 - EN36*		EN16 - EN38*
	EN3 - EN37*	**ΣS1/ΣN1**	EN3 - EN33*
	EN4 - EN13*		EN12 - EN33*
	EN4 - EN17***	**Nc/ΣN1**	EN1 - EN16*
	EN4 - EN33***		EN1 - EN17*
	EN4 - EN36***		EN2 - EN16*
	EN4 - EN37**		EN3 - EN16*
	EN12 - EN17**		EN4 - EN16**
	EN12 - EN33**		EN12 - EN16*
	EN12 - EN36*	**a/ΣN1**	EN1 - EN16**
	EN12 - EN37*		EN1 - EN17**
	EN16 - EN17*		EN1 - EN36*
	EN16 - EN33*		EN3 - EN16**
S1i	EN1 - EN13***		EN3 - EN17*
	EN1 - EN17**		EN4 - EN16**
	EN1 - EN33***		EN4 - EN17*
	EN1 - EN36***		
	EN1 - EN37**		

* 95%; ** 99%; *** 99,9%
EN... = Cutting node...

TABLE IIA

Average values of the quantitative parameters of plants from single budded cuttings taken from basal, intermediate and apical areas of Albariño vines *in vitro*, three years old and which have been subjected to pruning as low down as possible on same year wood

Parameters		Area	Parameters		Area
Nc	Bas.	4.70	AD3d	Bas.	0.51
	Int.	5.87		Int.	0.56
	Api.	6.62		Api.	0.65
S1d	Bas.	2.47	LD3d	Bas.	0.33
	Int.	3.74		Int.	0.39
	Api.	4.80		Api.	0.45
N1d	Bas.	3.91	AD3i	Bas.	0.47
	Int.	4.92		Int.	0.60
	Api.	5.69		Api.	0.78
S2d	Bas.	2.16	LD3i	Bas.	0.30
	Int.	2.75		Int.	0.37
	Api.	3.43		Api.	0.43
N2d	Bas.	2.39	Li	Bas.	2.01
	Int.	3.06		Int.	2.38
	Api.	3.67		Api.	3.02
N3d	Bas.	1.29	AD1i	Bas.	0.64
	Int.	1.41		Int.	0.73
	Api.	2.10		Api.	0.72
N4d	Bas.	0.39	LD1i	Bas.	0.40
	Int.	0.17		Int.	0.40
	Api.	0.73		Api.	0.54
N5d	Bas.	0.46	LP	Bas.	5.10
	Int.	0.51		Int.	5.88
	Api.	0.52		Api.	6.78
ASP	Bas.	1.13	LDt	Bas.	0.22
	Int.	1.44		Int.	0.22
	Api.	1.71		Api.	0.27
N5i	Bas.	0.35	A	Bas.	47.91
	Int.	0.57		Int.	47.12
	Api.	0.65		Api.	41.79
N4i	Bas.	0.31	B	Bas.	50.44
	Int.	0.11		Int.	49.49
	Api.	0.61		Api.	44.84
N3i	Bas.	1.39	G	Bas.	44.75
	Int.	1.43		Int.	44.83
	Api.	2.25		Api.	42.13
N2i	Bas.	2.37	D	Bas.	38.88
	Int.	2.95		Int.	34.86
	Api.	4.07		Api.	46.36
S2i	Bas.	2.14	D'	Bas.	47.34
	Int.	2.74		Int.	39.51
	Api.	3.66		Api.	47.41
N1i	Bas.	3.95	G'	Bas.	45.51
	Int.	4.69		Int.	41.65
	Api.	6.04		Api.	45.88
S1i	Bas.	2.58	B'	Bas.	47.46
	Int.	3.79		Int.	46.85
	Api.	5.10		Api.	50.43

Bas. : Basal ; Int. : Intermediate ; Api. : Apical

TABLE IIA (continuation)

Average values of the quantitative parameters of plants from single budded cuttings taken from basal, intermediate and apical areas of Albariño vines *in vitro*, three years old and which have been subjected to pruning as low down as possible on same year wood

Parameters	Area		Parameters	Area	
a	Bas.	5.49	A'	Bas.	44.87
	Int.	6.98		Int.	49.53
	Api.	7.88		Api.	48.09
AD1d	Bas.	0.62	LD1d/AD1d	Bas.	0.70
	Int.	0.80		Int.	0.55
	Api.	0.74		Api.	0.60
LD1d	Bas.	0.43	LD3d/AD3d	Bas.	0.66
	Int.	0.45		Int.	0.71
	Api.	0.45		Api.	0.70
Ld	Bas.	2.12	LD3i/AD3i	Bas.	0.66
	Int.	2.47		Int.	0.62
	Api.	2.85		Api.	0.54
LD1i/AD1i	Bas.	0.65	$\Sigma S1/\Sigma N1$	Bas.	0.64
	Int.	0.54		Int.	0.78
	Api.	0.75		Api.	0.84
LDt/ADt	Bas.	0.47	$\Sigma S2/\Sigma N2$	Bas.	0.90
	Int.	0.41		Int.	0.91
	Api.	0.51		Api.	0.91
LP/Nc	Bas.	1.08	$Nc/\Sigma N1$	Bas.	0.59
	Int.	1.00		Int.	0.61
	Api.	1.02		Api.	0.56
N1d/Nc	Bas.	0.83	$a/\Sigma N1$	Bas.	0.70
	Int.	0.84		Int.	0.72
	Api.	0.85		Api.	0.67
N2d/Nc	Bas.	0.50	A+B	Bas.	98.36
	Int.	0.51		Int.	96.62
	Api.	0.55		Api.	86.63
N3d/Nc	Bas.	0.27	A+B+G	Bas.	143.11
	Int.	0.23		Int.	141.45
	Api.	0.31		Api.	128.76
N1i/Nc	Bas.	0.84	A'+B'	Bas.	92.33
	Int.	0.79		Int.	96.38
	Api.	0.91		Api.	98.52
N2i/Nc	Bas.	0.50	A'+B'+G'	Bas.	139.68
	Int.	0.49		Int.	135.90
	Api.	0.61		Api.	145.93
N3i/Nc	Bas.	0.29	$\frac{(A+B)}{(S1d+S2d)}$	Bas.	21.59
	Int.	0.24		Int.	15.29
	Api.	0.34		Api.	10.89
S1d/N1d	Bas.	0.63	$\frac{(A+B)}{(S1i+S2d)}$	Bas.	19.94
	Int.	0.77		Int.	15.41
	Api.	0.84		Api.	11.34
S1i/N1i	Bas.	0.64	ASP/D+D'	Bas.	0.01
	Int.	0.80		Int.	0.01
	Api.	0.84		Api.	0.02

Bas. : Basal ; Int. : Intermediate ; Api. : Apical

TABLE IIA (continuation)

Average values of the quantitative parameters of plants from single budded cuttings taken from basal, intermediate and apical areas of Albariño vines *in vitro*, three years old and which have been subjected to pruning as low down as possible on same year wood

Parameters	Area		Parameters	Area	
S2d/N2d	Bas.	0.90	Area	Bas.	20.47
	Int.	0.89		Int.	33.21
	Api.	0.93		Api.	47.88
S2i/N2i	Bas.	0.90	Perimeter	Bas.	24.4
	Int.	0.93		Int.	27.6
	Api.	0.89		Api.	33.1
(S1d+S2d) / (Nc +N1d)	Bas.	0.53	Convex Perimeter	Bas.	17.1
	Int.	0.60		Int.	19.6
	Api.	0.66		Api.	24.8
(S1i+S2i) / (Nc +N1i)	Bas.	0.54	For. Circ.	Bas.	0.43
	Int.	0.61		Int.	0.55
	Api.	0.69		Api.	0.54
(S1d+S2d) / (N1d+N2d)	Bas.	0.73	For. Elong.	Bas.	0.90
	Int.	0.81		Int.	0.87
	Api.	0.87		Api.	0.90
(S1i+S2i) / (N1i+N2i)	Bas.	0.73	For. Rug.	Bas.	0.70
	Int.	0.85		Int.	0.74
	Api.	0.83		Api.	0.74
Nc/a	Bas.	1.17			
	Int.	1.19			
	Api.	1.19			
N5i/N2i	Bas.	0.09			
	Int.	0.11			
	Api.	0.10			
N5d/N2d	Bas.	0.19			
	Int.	0.16			
	Api.	0.14			

Bas. : Basal ; Int. : Intermediate ; Api. : Apical

It was also noticed that, in many cases, in both the single bud cuttings taken from basal area and in those taken from the intermediate and apical areas the nerves N4d and N4i were missing.

None of the vines produced bunches of grapes.

Therefore it would appear that during the first year the juvenile characters are accentuated even more by growing from single bud cuttings, as all of them (including those from the apical area) produce divided leaves. As time passes, and when subjected to pruning at the lowest possible level, it would appear that in some way these bud cuttings "remember" their old position on the vine. Buds taken from the basal area show very juvenile characters, buds taken from the intermediate area show intermediate characters between juvenile and adult, and buds taken from the apical area show adult characters.

TABLE IIB

Quantitative parameters with significant differences between plants from single budded cuttings taken from the basal, intermediate and apical areas of Albariño vines *in vitro*, three years old, and which have been subjected to pruning as low down as possible on same year wood

Parameters		Parameters	
Nc	1-3**	LDt/ADt	2-3*
S1d	1-3**	N1i/Nc	1-3*
N1d	1-3*	N2i/Nc	2-3*
S2d	1-3*	N3i/Nc	2-3*
N2d	1-3*	S1i/N1i	1-2**
			1-3**
N3i	1-3*	(S1d+S2d) / (Nc+N1d)	1-3*
	2-3*		
N2i	1-3**	(S1i+S2i) / (Nc+N1i)	1-2*
	2-3*		1-3***
S2i	1-3**	$\Sigma S1/\Sigma N1$	1-2*
	2-3*		1-3**
N1i	1-3**	(A+B) / (S1d+S2d)	1-3**
	2-3*		
S1i	1-2*	(A'+ B') / (S1i+S2i)	1-3*
	1-3***		
a	1-3**	Area	1-3**
AD3i	1-3*	Perimeter	1-3*
Li	1-3*	For. Circ.	1-2*
LP	1-3*		
	1-3*		

* 95% ; ** 99% ; *** 99,9%
1 : Basal area ; 2 : Intermediate area ; 3 : Apical area

CONCLUSION

After being grown from single bud cuttings all of them show juvenile characters, as far as the sinuses of the leaves is concerned, during the first year.

After three years and after pruning as low down as possible on same year wood, those taken from the basal area shown very juvenile characters, those taken from the intermediate area show characters between the juvenile and adult stages, and those taken from the apical area show adult characters. That is to say that they "remember" their old position on the mother vine.

TABLE IIIA

Average, maximum and minimum values of the qualitative parameters of plants from single budded cuttings taken from basal, intermediate and apical areas of Albariño vines *in vitro*, three years old, and wich have subjected to pruning as low down as possible on same year wood

Parameters	Area	Med.	M	m	Parameters	Area	Med.	M	m
O.I.V.:	Bas.	7.00	7	7	I	Bas.	9.00	9	9
001	Int.	7.00	7	7		Int.	9.00	9	9
	Api.	7.00	7	7		Api.	3.75	2	5
O.I.V.:	Bas.	1.00	1	1	O.I.V.:	Bas.	1.00	1	1
002	Int.	1.00	1	1	060	Int.	1.00	1	1
	Api.	1.00	1	1		Api.	1.00	1	1
O.I.V.:	Bas.	1.00	1	1	O.I.V.:	Bas.	2.00	2	2
003	Int.	1.00	1	1	008	Int.	1.75	1	2
	Api.	1.00	1	1	010	Api.	1.00	1	1
O.I.V.:	Bas.	3.75	3	4	O.I.V.:	Bas.	2.00	2	2
004	Int.	4.45	3	5	007	Int.	2.00	2	2
	Api.	5.00	5	5	009	Api.	2.00	2	2
O.I.V.:	Bas.	4.75	4	5	O.I.V.:	Bas.	2.00	1	3
005	Int.	4.50	4	5	013	Int.	3.50	3	4
	Api.	3.25	2	4	014	Api.	3.75	3	4
O.I.V.:	Bas.	2.00	2	2	O.I.V.:	Bas.	1.00	1	1
051	Int.	2.00	2	2	011	Int.	1.00	1	1
	Api.	1.00	1	0	012	Api.	1.00	1	1
O.I.V.:	Bas.	1.00	1	1	O.I.V.:	Bas.	5.25	5	6
052	Int.	1.00	1	1	015	Int.	5.00	5	5
	Api.	1.00	1	1		Api.	3.00	3	3
O.I.V.:	Bas.	1.00	1	1	O.I.V.:	Bas.	1.00	1	1
053	Int.	1.00	1	1	016	Int.	1.00	1	1
	Api.	1.00	1	1		Api.	1.00	1	1
O.I.V.:	Bas.	7.00	7	7	O.I.V.:	Bas.	1.50	1	3
054	Int.	6.25	5	7	017	Int.	1.00	1	1
	Api.	1.00	1	1		Api.	1.25	1	2
O.I.V.:	Bas.	1.00	1	1	O.I.V.:	Bas.	3.00	3	3
055	Int.	1.50	1	3	067	Int.	3.00	3	3
	Api.	2.50	3	2		Api.	3.00	3	3
O.I.V.:	Bas.	9.00	9	9	O.I.V.:	Bas.	2.75	2	3
056	Int.	8.50	7	9	068	Int.	2.00	2	2
	Api.	2.75	3	2		Api.	2.25	2	2
O.I.V.:	Bas.	5.00	5	5	O.I.V.:	Bas.	1.75	1	4
069	Int.	5.00	5	5	084	Int.	2.25	1	3
	Api	5.00	5	5		Api.	2.25	1	4
O.I.V.:-	Bas.	1.75	1	2	O.I.V.:	Bas.	1.75	1	3
070	Int.	1.00	1	1	085	Int.	1.00	1	1
	Api.	1.00	1	1		Api.	1.00	1	1
O.I.V.:	Bas.	2.75	2	3	O.I.V.:	Bas.	3.00	2	4
071	Int.	1.00	1	1	086	Int.	3.25	3	4
	Api.	1.00	1	1		Api.	3.75	3	4

TABLE IIIA (continuation)

Average, maximum and minimum values of the qualitative parameters of plants from single budded cuttings taken from basal, intermediate and apical areas of Albariño vines *in vitro*, three years old, and wich have subjected to pruning as low down as possible on same year wood

Parameters	Area	Med.	M	m	Parameters	Area	Med.	M	m
O.I.V.:	Bas.	1.00	1	1	0.I.V.:	Bas.	3.75	3	5
075	Int.	1.00	1	1	087	Int.	4.00	3	5
	Api.	1.00	1	1		Api.	1.25	1	2
O.I.V.:	Bas.	3.00	3	3	O.I.V.:	Bas	1.00	1	1
076	Int.	3.00	3	3	088	Int.	1.00	1	1
	Api.	3.00	3	3		Api.	1.00	1	1
O.I.V.:	Bas.	3.25	3	4	O.I.V.:	Bas.	3.75	2	6
079	Int.	3.25	3	4	089	Int.	3.00	1	6
	Api.	3.00	3	3		Api.	1.75	1	2
O.I.V.:	Bas.	2.00	2	2	O.I.V.:	Bas.	1.25	1	2
080	Int.	2.00	2	2	090	Int.	2.00	1	4
	Api.	2.00	2	2		Api.	1.75	1	2
O.I.V.:	Bas.	1.00	1	1	O.I.V.:	Bas.	2.00	1	4
081	Int.	1.00	1	1	091	Int.	2.25	1	4
	Api.	1.00	1	1		Api.	1.00	1	1
O.I.V.:	Bas.	1.00	1	1	II	Bas.	4.75	4	5
082	Int.	1.00	1	1		Int.	4.25	4	5
	Api.	1.00	1	1		Api.	2.75	1	4
LIST. MIN.	Bas.	1.75	2	1					
083-1	Int.	2.00	2	2					
	Api.	2.00	2	2					

I : Young leaf : density of erect hairs on the margin of the dentation ;
II : Adult leaf : density of the erect hairs on the margin of the dentation
Med .: Average ; M : Maximum ; m : Minimum

Acknledgement :

This work has been financed by the Ministry of Education and Science. We would like to thank Dr. FERRO for his collaboration in the cultivation *in vitro* of the plants and in the redaction of this text.

Manuscrit reçu le 2 mars 1993; accepté pour publication le 7 avril 1993

TABLE IIIB

Qualitative parameters with significant differences between plants from single budded cuttings taken from basal, intermediate and apical areas of albariño vines in vitro, three years old, and which have been subjected to pruning as low as possible on same year wood

Parameters		Parameters	
O.I.V.: 004	1-3*	O.I.V. 056	1-3* 2-3*
O.I.V.: 005	1-3*	I	1-3** 2-3**
O.I.V. 008, 010	1-3** 2-3*	O.I.V.: 068	1-2*
O.I.V.: 013, 014	1-2* 1-3*	O.I.V.: 070	1-2* 1-3*
O.I.V.: 015	1-3* 2-3**	O.I.V.: 071	1-2* 1-3*
O.I.V.: 051	1-3** 2-3**	O.I.V.: 087	1-3* 2-3*
O.I.V.: 054	1-3** 2-3*	O.I.V. 089	1-3*
O.I.V.: 055	1-3*	II	1-3* 2-3*

I = Young leaf: density of erect hairs on the margin of the dentation.
II = Adult leaf: density of the erect hairs on the margin of the dentation.
* 95% ; ** 99% ; *** 99,9%
1= Basal area. ; 2= Intermediate area.; 3= Apical area

REFERENCES

ALLEWELDT G. and DETTWEILER E., 1986. Ampelographic studies to characterize grapevine varieties. *Vignevini*, **13**, Suppl. n°12, 56-59.

ALLEWELDT G. and DETTWEILER E., 1989. A model to differentiate grapevine cultivars with the aid of morphological characteristics. *Riv. Vitic. Enol.*, **1**, 59-63.

BOURSIQUOT J.M., FABER M.P., BLANCHIER O. and TRUEL P., 1987. Utilisation par l'informatique et traitement statistique d'un fichier ampélographique. *Agronomie*, **7**, n°1, 13-20.

BOURSIQUOT J.M., VIGNAU L. and BOULET J.C., 1989. Ricerche sull'utilizzazione dell'ampelometria. *Riv. Vitic. Enol.*, **1**, 37-51.

CANCELLIER S. and COSSIO F., 1987. Field observations on three clones of "Corvinia Veronese" (*Vitis vinifera* L.) multiplied by *in vitro* culture. *Acta Horticulturae*, **212**, 391-399.

CANCELLIER S. and COSSIO F., 1988. Risultati di osservazioni su un clone di "Corvinia veronese" (*Vitis vinifera* L.). Moltiplicato traverso la coltura "i*n vitro*". *Riv. Vitic. Enol.*, **3**, 1-10

CARBONNEAU A., 1976a. Principes et méthodes de mesure de la surface foliaire essai de caractérisation des types de feuilles dans le genre *Vitis*. *Ann. Amélior. Plantes*, **26**, n°2, 327-334.

DETTWEILER E., 1987. Ein modell zur unterscheidbarkeit von rebsorten mit hilfe blattmorphologischer merkmale. *Dissertation Universitat*, Hohenheim.

DETTWEILER E., 1989. *Minimal Descriptor List for Grapevine Varieties.* Institut für Rebenzuchtung Geilweilerhof, Siebeldingen.

DETTWEILER E., 1991. *Prelyminary Minimal Descriptor List for Grapevine Varieties.* Institut für Rebenzuchtung Geilweilerhof, Siebeldingen.

FERRO E., 1989. Aplicación de las técnicas de cultivo "*in vitro*" de ápices caulinares en el saneamiento de clones seleccionados de vid cv. Albariño. *Tesis Doctoral*, Santiago de Compostela

GALET P., 1985. *Précis d'ampélographie pratique*. Imp. Déhan, 5rd, ed. Montpellier.

GALET P., 1988. *Cépages et vignobles de France. Vol. I. Les vignes américaines*. Imp. Déhan, 2rd. ed. Montpellier.

GRENAN S., 1979. Possibilités d'élimination des modifications foliaires, apparues sur la variété Grenache N. après sur un passage prolongé en culture *in vitro*. *Progrès Agric. Vitic.*, 152-57.

GRENAN S., 1982a. Quelques réflexions à propos de modifications morphogénétiques consécutives à la culture *in vitro* chez la vigne (*Vitis vinifera* L.). *Ann. Sci. Nat. Bot. Sér.*, **13**, 4, 135-146.

GRENAN S., 1982b. Implications fondamentales et appliquées de conséquences de la culture "*in vitro*" de "*Vitis vinifera*" L. *Thèse*, Orsay.

KEEFE P.D.and DRAPER S.R., 1986. The measurement of new characters for cultivar identification in whear using machine vision. *Seed Sci and Technol.*, **14**, 715-124.

KEEFE P.D.and DRAPER S.R., 1988. An automated machine vision system for the morphometry of new cultivars and plant genebank accesions. *Plant Varieties and Seeds*, **1**, 1-11.

O.I.V., 1983. *Código de los caracteres descriptivos de las variedades y especies de Vitis*. Ed. A. Dedon, Paris.

WEST J.G. and NOBLE I.R., 1984. Analyses of digitised leaf images of the Dodonaea viscosa complex in Australia. *Taxon*, **33**, n°4, 595-613.