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INFLUENCE OF ROOTSTOCK ON VOLATILE COMPOUNDS OF *VITIS VINIFERA* L. CULTIVAR ITALIA. PRELIMINARY RESULTS

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INTRODUCTION

Rootstocks were originally used in Europe to protect the vine against the phyllorexa attack, but they have also assumed the role as mediators between the pedoclimatic characteristics and varietal characteristics.

Italia is a very important table grape cultivar in Spain and Italy. The grapes have a Muscat flavour that has been found to be due mainly to monoterpene compounds (DIAZ, 1979 ; GUNATA et *al.*, 1985). The importance of the terpenoid fraction in the aromatic composition of Muscat grapes in now widely accepted.

Although the synthesis of these compounds within the berry is genetically controlled, it is also influenced by environmental conditions, soil and viticultural practices. In this way, SINTON et *al.* (1978) found a significant correlation between yield and aromatic intensity of Zinfandel wines, CORINO and DI STEFANO (1984) obtained a positive effect with short pruning as against long pruning, SCHUBERT et *al.* (1987) stated the influence of active limestone content of the soil on the terpene concentration of Muscat blanc, REYNOLDS and WARDLE found in 1989 that fully sun exposed berries of Gewürztraminer had larger quantities of volatile terpenes and the basal leaf removal also improved volatile terpenes.

The studies of TORRES (1982) showed a better terpene synthesis in Muscat blanc and Muscat of Alexandria when grown on 110-R rootstock than on 99-R due to a better resistance of 110-R to dryness and the promotion of late maturation.

The levels of total volatile compounds and monoterpene levels of Italia grapes grafted onto eight rootstocks as well as yield, soluble solids, berry weight and cluster weight have been studied one year to determine if there is any difference in the aromatic composition of the berries.

MATERIALS AND METHODS

I — PLANT MATERIAL

The studies were performed in a Italia vineyard in Murcia (Spain). The plants were vertically trained ("pergola") with a density of 800 vines per ha and with drip irrigation.

This density of plantation, together with drip irrigation provide large berry weight but lower content in soluble solids and aroma compounds than other traditional irrigation and training systems. The rootstocks were planted in 1984 and grafting took place in 1985. Eight rootstocks were used in the study : *Rupestris* du Lot (*Vitis rupestris*), 1103-P, 110-R and 140-Ru (*Vitis berlandieri* x *Vitis rupestris*), 420-A, 161-49C and SO4 (*Vitis berlandieri* x ® *Vitis riparia*) and 41-B (*Vitis vinifera* x *Vitis berlandieri*).

There was an experimental design of a randomized block design with three blocks and four plants of each rootstock in each block.

II — FRUIT QUALITY ANALYSIS

Total soluble solids were measured on samples of freshly homogenate grape juice, using a hand-held refractometer.

III — VOLATILE COMPOUNDS' ANALYSIS

Grapes were crushed in a Waring blender for 30 seconds. Extraction of the volatile compounds from grapes was done with low pressure distillation at 35°C and 35 mm Hg (GÓMEZ et *al.*, 1993). For quantification, an internal standard (2-octanol) was added to the juice (100 μg/l) before the isolation step.

The distillation apparatus consisted of two traps, ice-water and liquid nitrogen, to recover the condensed compounds obtained during the two hours of distillation. To isolate the volatile compounds from the aqueous phase a solid-liquid extraction with 15 g of Chromosorb 101 (John Manville, Philadelphia), packed in a glass column (50 cm x 0.8 cm i.d.) was used. The Chromosorb was preconditioned with 50 ml of methanol and 50 ml of water. The aqueous phase passed through this column at 2 ml/min and the retained compounds were eluted with 50 ml of diethyl ether. Before the chromatographic analysis, the diethyl ether was concentrated to 0.5 ml with a low stream of nitrogen.

The chromatographic analysis was performed using a Hewlett-Packard 5890 gas chromatograph equipped with a flame ionization detector (250°C) and a Carbowax 20M column (50 m x 0.25 mm). Injections were made in split mode (split ratio 80 :1 ; sample size 1 μl). The injector temperature was 250°C and the oven was programmed from 60°C to 200°C at a rate of 2°C/min. The carrier gas was hydrogen at a flow rate of 1.5 ml/min (60°C). The identification of the volatile compounds was determined using a Hewlett-Packard 5970A mass spectrometer, and comparing the retention times with those of authentic compounds.

RESULTS AND DISCUSSION

Table I shows the results of one year for yield, soluble solids, berry weight, cluster weight, total volatile compounds and monoterpene content. No significant differences were found in yield and cluster weight between all rootstocks. That finding did not agree with most of the work done by other authors (CORINO and CASTINO, 1990 ; FOOTT et *al.*, 1989 ; McCARTHY and CIRAMI, 1990 ; BAVARESCO et *al.*, 1991) where the common result was that rootstock influenced yield. *Rupestris* du Lot gave the highest berry weight but only differed significantly with 41-B that gave the lowest berry weight. Regarding to soluble solids, *Rupestris* du Lot and 1103-P had the highest soluble solids content. The same rootstocks were found to give highest soluble solids content in Muscat blanc when comparing with other rootstocks (CORINO and CASTINO, 1990). Some authors had observed a negative correlation between yield and soluble solids (JAQUINET and SIMON, 1988) but other authors found no significant correlation between soluble solids and yield (McCARTHY and CIRAMI, 1990).

Regarding to total volatile compounds and monoterpene content, *Rupestris* du Lot gave grapes with the highest volatile compounds content but with no significant difference with 1103-P and SO4. SO4 have been found before as a rootstock giving very good must quality (FOOTT et *al.*, 1989 ; BAVARESCO et *al.,* 1991). 41-B yielded the lowest concentration on volatile compounds as well as for all the studied monoterpene compounds. Linalool, geraniol, α-terpineol and nerol were present at highest concentration in grapes grafted onto *Rupestris* du Lot and, in general, with no significant difference with 1103-P in most of the cases and with 420-A and SO4 in some cases. 161-49C, 110-R and 140-Ru resulted in less aromatic grapes.

Table II shows the correlations between total volatile compounds content and individual monoterpene content with soluble solids. Cœfficients of correlation of about 0.7 have been found, demonstrating the relationship between aroma compounds and soluble solids. These relationships have been observed by other authors, showing that aroma components have an evolution similar to that of soluble solids (WILSON et *al.*, 1984) although McCARTHY (1986) reported that soluble solids did not correlated with free volatile terpene in Riesling.

These studies showed the existence of significant differences on the volatile compounds and individual monoterpene content of Italia grapes grown on different rootstocks. Grapes grafted onto *Rupestris* du Lot and 1103P gave the highest aromatic content together with the highest soluble solids content and the best must quality. On the other hand, as a correlation between soluble solids and level of monoterpene compounds and total volatile compounds has been observed, it can not be concluded that the differences were only due to a rootstock effect.

Note reçue le 6 juin 1994

TABLE I

Mean values (one year study) of soluble solids (°Brix), berry weight (g) , yield per vine (kg), cluster weight (g), total volatile compounds (µg/kg) and monoterpene content (µg/kg)

Rootstock	Total soluble solids	Berry weight	Yield	Cluster weight	Total volatile	Linalool	Geraniol	α-Terpineol	Nerol
41-B	15.0^{a}	8.1^{a}	78.2^{a}	873.7^{a}	867.4^{a}	544.9^{a}	276.5^{a}	11.6^{a}	29.7^{a}
161-49C	15.9^{ab}	8.6^{ab}	74.2^{a}	895.0^{a}	1429.3^{ab}	1022.3^{ab}	286.9^{a}	20.7^{ab}	33.0^{a}
110-R	15.9^{ab}	8.6^{ab}	72.2^{a}	880.6^{a}	1706.3^{abc}	1174.6^{ab}	411.9^{ab}	19.4^{ab}	48.9^{ab}
SO4	15.9^{ab}	8.2^{ab}	59.7^{a}	828.7^{a}	1649.9^{abc}	1151.5^{ab}	402.6^{ab}	16.2^{ab}	55.2^{ab}
140-Ru	16.8^{bc}	8.8^{ab}	66.7^{a}	765.0^{a}	2630.0^{bcd}	2105.9^{bc}	369.1^{ab}	33.0^{abc}	42.1^{a}
420-A	16.8^{bc}	8.5^{ab}	60.4^{a}	763.7^{a}	2505.0^{bc}	1993.6^{bc}	366.0^{ab}	34.5^{abc}	44.2^{ab}
1103-P	18.0^{c}	9.3^{ab}	60.3^{a}	855.7^{a}	2908.0^{cd}	2255.6^{bc}	468.3^{bc}	35.3^{bc}	71.9^{bc}
Rupestris Lot	18.0^{c}	9.7b	67.0^{a}	846.6^{a}	3869.7^{d}	3027.0^{c}	565.8^{c}	49.1^{c}	88.6^{c}

Different letters within the same column indicate significant differences ($P<0.05$) among rootstocks

TABLE II

Regression analysis of berry weight and sugar content on total volatiles and individual terpenic compounds

Independent variable	Dependent variable	Correlation cœfficient (95 %)	F-ratio	R-squared
Berry weight	total of volatiles	0.69	20	47.44
Sugar content	total of volatiles	0.79	38	63.55
Sugar content	α-terpineol	0.69	19.9	47.59
Sugar content	*cis*-linalool oxide	0.72	24	52.21
Sugar content	*trans*-linalool oxide	0.63	13.7	39.57
Sugar content	nerol	0.77	31.9	59.18
Sugar content	geraniol	0.73	25.5	53.69
Sugar content	linalool	0.77	18	45.01

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