Inheritance of chloride exclusion in grapevines

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Increased petiole C1 concentrations have been associated with a decline in health and yield of Sultana vines (1) and also with the inhibition of CO_2 fixation (2). Accumulation of Cr in vine petioles can be restricted by rootstocks (3) and there *is* considerable variation in the ability for C1 exclusion between (4,5) and within (6) species of Vitis. This presents the possibility to breed for C1 exclusion and the need to investigate the inheritance of this character in the genus Vitis.

Vineyard surveys have assessed the variation in petiole C1 concentrations in hybrid progenies between different species of Vitis (7,8). A continuous variation for petiole concentrations within progenies of Ramsey (V. champini) x Sultana (V. vinifera), Ramsey x Villard blanc (12375-SV, complex hybrid) and Villard blanc x Sultana indicated that differences between these three cultivars were heritable and transmitted polygenically. This was supported by glasshouse data. Vineyard data also suggested evidence of dominance for C1 exclusion in Ramsey x Sultana and Ramsey x Villard blanc progenies, however this was not supported by glasshouse experiments involving the former progeny. Transgressive segregants occurred in all three progenies indicating that hybrids with improved abilities for Cl exclusion may be developed.

Data from a vineyard survey of petiole C1 concentrations in some hybrids (V. berlandieri x V. vinifera) and backcrosses of these to V. vinifera (Fig. 1) suggested a single dominant gene was responsible for low petiole C1 concentrations in vines of V. berlandieri (8). A 1:1 segregation pattern for high and low petiole C1 concentrations has subsequently been confirmed by a more complete vineyard survey of the four backcross progenies (H.P. Newman - unpublished data). Further investigations under glasshouse conditions (9) using nutrient solution culture techniques have supported vineyard data indicating the expression of a dominant gene derived from V. berlandieri in two of the four backcrosses. However, segregation patterns were not as expected for the other two backcrosses. This may have been due to the action of modifying genes transmitted by vinifera parents similar to cases of disease resistance where expression in interspecific progenies is affected by minor genes from vinifera varieties which are complementary to resistance genes from other species.

Fig. 1. Hybridization program to investigate genetic basis for Cl^- exclusion in V. berlandieri.

Exclusion in grapevines *is* heritable and transmitted either as a polygenic or monogenic trait. This supports the philosophy of breeding new varieties which can tolerate rootzone salinities associated with irrigated horticulture in the Murray Valley. Indeed, C1 excluders within Fl and backcross generations between V. berlandieri and V. vinifera have good fruit quality characters which improve as the proportion of V. vinifera in hybrids increase. This suggests that C1 excluding varieties may be developed which require no top-working thus eliminating the use of rootstocks in vineyards where rootzone salinity *is* the only major viticultural problem.

1. Woodham, R.C. 1956. Aust. J. Agric. Res. 7 414-27.

2. Downton, W.J.S. 1977. Aust. J. Plant PhysioL 4 183-92.

3. Sauer, M.R. 1968. Vitis 7 223-26.

4. Downton, W.J.S. 1977. Scientia Hortic. 7 249-53.

5. Antcliff, A.J., New man, H.P. and Barrett, H.C. 1983. Vitis 22 357-62.

6. Groot Obbink, J. and Alexander, D.McE. 1973. Am. J. EnoL Vitic. 24 65-8.

7. Sykes, S.R. 1985. Am. J. EnoL Vitic. 36 30-7.

8. Newman, H.P. and Antcliff, A.J. 1984. Vitis 23 106-12.

9. Sykes, S.R. 1987. Am. J. EnoL Vitic. (in press).