

Variation in chloride accumulation in some American species of grapevine

by

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Unterschiedliche Chloridanreicherung bei amerikanischen Rebarten

Zusammenfassung. — Sämlinge von *Vitis berlandieri* sammelten in ihren Blattstielen relativ geringe Chloridmengen an. Sämlinge von *V. cinerea*, *V. rupestris* und *V. champini* × *V. rupestris* reicherten durchschnittlich 3- bis 4mal soviel Chlorid an wie *V. berlandieri*, obgleich einzelne Individuen mit *V. berlandieri* vergleichbar waren. Die (*V. berlandieri* × *V. rupestris*)-Unterlagen 99 und 110 Richter, 140 Ruggeri und 1103 Paulsen zeigten alle ähnliche Chloridkonzentrationen wie die *V. berlandieri*-Sämlinge.

Introduction

The possibility of using rootstocks to restrict the entry of chloride into grapevines has been raised by SAUER (1968), BERNSTEIN *et al.* (1969) and DOWNTON (1977 a). The variation in chloride exclusion in hybrid populations suggests that deliberate breeding to obtain rootstocks or even fruiting cultivars superior in this character may be worthwhile (SYKES *et al.* 1983). DOWNTON (1977 b) has given some data for chloride accumulation for different species of *Vitis* but in view of the wide variation within *V. vinifera* (GROOT OBBINK and ALEXANDER 1973) more data on the variation within other species of *Vitis* would be helpful. This paper gives further data for *V. berlandieri*, *V. cinerea* and *V. rupestris* and some hybrids involving these species and also *V. champini*.

Materials and methods

Some of the seed of *V. berlandieri* and *V. rupestris* was collected from open pollinated vines growing wild in North America which would almost certainly have been pollinated by their own species. The rest of the seed was collected in the vineyard of the University of Illinois, from deliberate crosses in the case of *V. berlandieri* and *V. cinerea*, and after open pollination in the case of *V. champini* and *V. rupestris*. There were no male vines of *V. champini* in the vineyard, and from observations on relative flowering times, it is most likely that both *V. champini* and *V. rupestris* were pollinated by *V. rupestris*. Seed was also collected from deliberate crosses of one clone of *V. cinerea* and two hybrids of *V. berlandieri* × *V. cinerea* by a clone of *V. rupestris*.

The seeds were germinated and the seedlings planted 1 m apart in 9 adjacent rows 2.5 m apart at the Merbein vineyard of the CSIRO Division of Horticultural Research. The soil type was Coomealla loam (PENMAN *et al.* 1939) and the vines were furrow-irrigated during each growing season with water delivered from outlets at the tops of the vine rows containing about 2 to 3 mM Cl⁻. With the time taken for the water to reach the bottom of the row (a fall of 0.4 m in 116 m) and the decrease in flow down the fur-

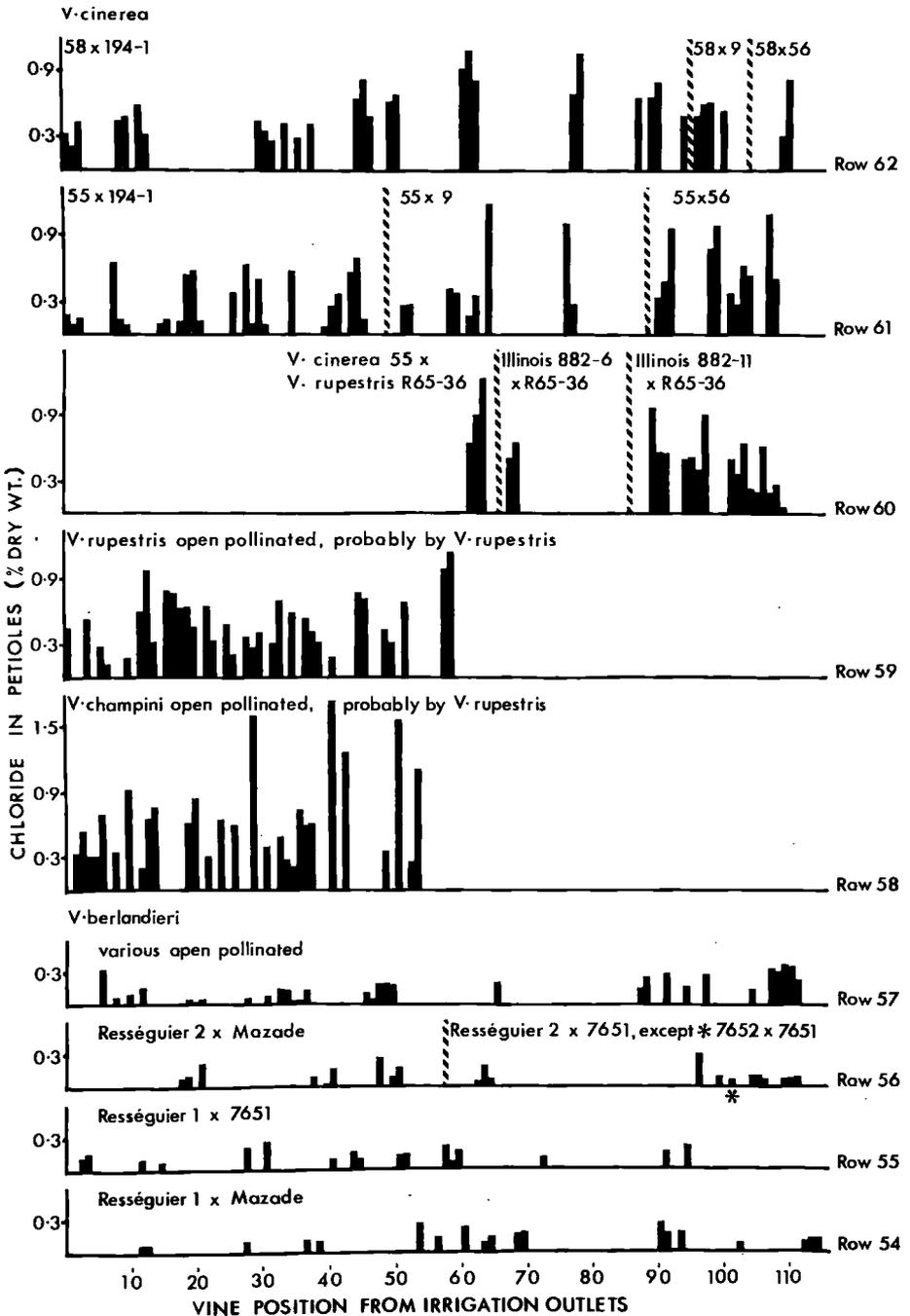


Fig. 1: Chloride concentration in petioles of seedlings from various American species and hybrids of grapevine. Illinois 882-8 and 882-11 are *V. berlandieri* Resseguier no. 2 x *V. cinerea* 9.

Chloridgehalt in den Blattstielen von Sämlingen aus verschiedenen amerikanischen Rebart- und -kreuzungen. Illinois 882-6 und 882-11: *V. berlandieri* Nr. 2 x *V. cinerea* Nr. 9.

Chloride levels (% dry weight) in petioles of seedlings from various crosses within *V. cinerea*
 Chloridgehalt (Trockengewichts-%) in den Blattstielen von Sämlingen aus verschiedenen intraspezifischen Kreuzungen von *V. cinerea*

Cross	No. of seedlings	Chloride
58 × 194-1	27	0.578
58 × 9	4	0.570
58 × 56	2	0.570
55 × 56	11	0.639
55 × 9	9	0.487
55 × 194-1 all	24	0.305
high	11	0.526
low	13	0.118

row due to soakage, the amount of water applied would decrease progressively from the top of the row apart from ponding at the bottom of the row. There were previously installed tile drainage lines at a depth of about 1.5 m between rows 54 and 55, and rows 60 and 61 (see Fig. 1). Unless enough water was applied over the whole area to leach salt through to the drainage lines, chloride would tend to accumulate about 80–100 m from the top of the row and in the areas furthest from the drainage lines (THOMAS 1939).

Petioles were sampled for chloride determination in January 1982 when the vines were 13 years old. Various rootstocks involving *V. berlandieri*, *V. rupestris* and *V. champini*, including some experimental rootstocks from the University of California, Davis, were sampled at the same time. Petioles were collected from primary leaves on nodes 4–7 of primary shoots, oven-dried at 70 °C and ground in a Wiley mill to pass a 1 mm sieve. Chloride concentration was measured by silver ion titration with a Buchler-Cotlove chloridometer (Nuclear Chicago, New Jersey, USA) using cold water extraction.

Results

The data for the vines raised from seed are presented in Fig. 1. Among the species, seedlings from *V. berlandieri* showed the least chloride, with a mean value of 0.145 % dry weight (89 vines, range 0.03–0.37), compared with 0.490 (77 vines, range 0.07–1.20) for *V. cinerea* and 0.519 (34 vines, range 0.12–1.14) for *V. rupestris*. There were no significant differences between the means for the various crosses within *V. berlandieri*, but within *V. cinerea* the cross of clones 55 and 194-1 showed a significantly lower mean than the other crosses. About half of the seedlings from the cross 55 × 194-1 gave values similar to those for the other crosses, but the remainder gave low values comparable with those for *V. berlandieri* (Table).

The 3 *V. cinerea* × *V. rupestris* hybrids had a mean value of 0.927 % dry weight (range 0.64–1.24) while the 18 (*V. berlandieri* × *V. cinerea*) × *V. rupestris* had a mean of 0.482 (range 0.06–0.97); of these 18, 5 came within the range of the simple hybrid, 6 came within the range for *V. berlandieri*, and the rest were intermediate.

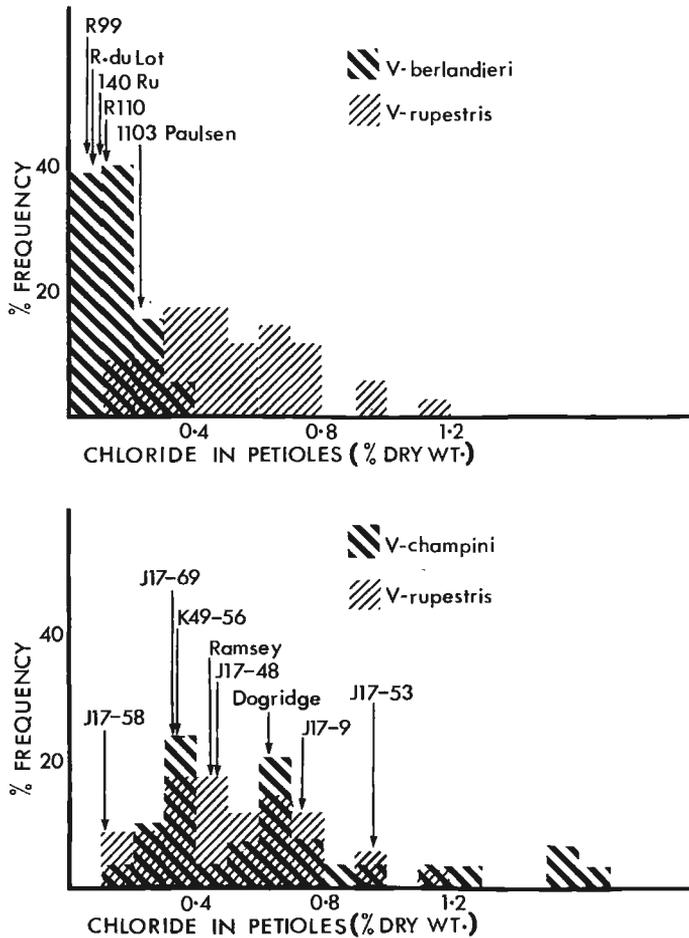


Fig. 2: Chloride concentration in petioles of a number of grapevine rootstock cultivars compared with frequency diagrams for seedlings of their parent species.

Chloridgehalt in den Blattstielen etlicher Unterlagssorten im Vergleich zu den Histogrammen für Sämlinge ihrer Elternarten.

The 29 *V. champini* seedlings gave a mean of 0.668 % dry weight with a range of 0.20—1.73. The vine with the highest value had hermaphrodite flowers and leaves with many characters of *V. vinifera*, indicating that it was a hybrid with a pure or predominantly *V. vinifera* cultivar, but none of the others showed any obvious signs of not being hybrids with *V. rupestris*.

Fig. 2 shows the chloride values for a number of rootstocks (means of from 2 to 6 vines each) in relation to the frequency distributions of the seedlings from their parent species. From the upper graph it can be seen that all 5 rootstocks shown there fell within the range of *V. berlandieri*. Rupestris du Lot had a lower chloride value than any of the *V. rupestris* seedlings, and while the other 4 stocks are *V. berlandieri* × *V. rupestris* hybrids, all except 110 Richter have Rupestris du Lot as the male parent so their low values are not surprising. The lower graph shows that the 6 experimental *V.*

champini × *V. rupestris* rootstocks from Davis all fall within the range of the presumed *V. champini* × *V. rupestris* seedlings, as do the 2 *V. champini* rootstocks Ramsey and Dogridge.

Discussion

While the various species are planted separately from one another (Fig. 1), if there were any reason to suspect differences in salinity across the field it would be related to the position of the drainage lines. Thus, for example, differences would be likely to be greater between rows 55 and 57 than between rows 57 and 58. The data reported are clear enough to suggest some revision of the order of ability to exclude chloride found by DOWNTON (1977 b). The relative order of *V. berlandieri*, *V. champini* and *V. cinerea* remains much the same, but the only clone of *V. rupestris*, Rupestris du Lot, examined by DOWNTON has proved not to be typical of the species. The present data suggest that *V. rupestris* is comparable with *V. cinerea*. It may be significant that Rupestris du Lot shows signs of introgression from some other species, in greater vigour, lower frost resistance in winter buds and a more robust root system than is typical of *V. rupestris*. On the other hand it is clear that individuals capable of excluding chloride well are present in *V. cinerea* and perhaps also in *V. rupestris* so that breeding aimed at incorporating this character into fruiting cultivars need not be restricted to using *V. berlandieri*.

To the rootstock cultivars found by DOWNTON (1977 b) to be effective chloride excluders can now be added the *V. berlandieri* × *V. rupestris* hybrids 110 Richter, 140 Ruggeri and 1103 Paulsen.

Summary

Seedlings of *Vitis berlandieri* accumulated relatively small amounts of chloride in their petioles. Seedlings of *V. cinerea*, *V. rupestris* and *V. champini* × *V. rupestris* accumulated on average 3—4 times as much chloride as *V. berlandieri* although some individuals were comparable with *V. berlandieri*. The *V. berlandieri* × *V. rupestris* rootstocks 99 and 110 Richter, 140 Ruggeri and 1103 Paulsen were all comparable with the *V. berlandieri* seedlings.

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