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RESISTANCE OF GRAPEVINE ROOTSTOCKS TO *XIPHINEMA INDEX*

by

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**Summary.** The resistance of grapevine rootstocks to *Xiphinema index* from four populations (Italy, California, Israel and France) was tested in pot experiments. The results indicate *Vitis candicans* as a source of resistance to *X. index* and confirm the resistance of Dog Ridge to the Californian population as well as to the other populations tested. Differences in the reaction to the rootstocks were evident between the *X. index* populations, particularly that from California, and these need to be taken into account in breeding programmes.

*Xiphinema index* Thorne et Allen has a restricted host range but multiplies successfully on grapevine (*Vitis vinifera*) and other *Vitis* species, and also on fig (*Ficus carica*). The nematode can cause damage to grapevine roots by its feeding and because it is also a vector of grapevine fanleaf virus it is important to reduce populations in commercial grapevine plantations to the lowest possible level. The use of resistant rootstocks offers an economically and environmentally attractive alternative to the use of chemical nematicides. In California, USA, several *Vitis* species were found to have varying levels of resistance or tolerance to *X. index* (Kunde et al., 1968) and these have been hybridised with commercial cultivars.

Preliminary investigations in Italy (Coiro et al., 1984; 1988) have also shown resistance to *X. index* among a range of *Vitis* species and hybrids. Further investigations in glasshouse experiments are reported here.

## Materials and methods

The rootstocks tested were *V. berlandieri* x *V. riparia* hybrids belonging to the collection of the Istituto Sperimentale per la Viticoltura di Conegliano (Treviso) plus the *V. candicans* hybrids Dog Ridge and Salt Creek, with the commercially established rootstock *V. rupestris* du Lot as a control. The parentage of the rootstocks is given in Table I. Rooted green cuttings of the various rootstocks were planted singly in 25ml pots containing steam sterilized sand. Depending on the experiment, the pots were then inoculated either with a single female or 10 young females from four populations of *X. index* (Italy, USA-California, France and Israel) that had been cultured for several months on fig. The experiments were conducted in tem-

perature controlled boxes (22°C) within a glasshouse with 10 replicates of each combination treatment. At the end of each experiment, the nematodes were extracted from each pot by Cobb's wet sieving technique and juvenile instars and adults were counted.

## Results and discussion

In the first experiment (Table II) single females were added to pots containing six different *Vitis* cultivars and the nematodes were extracted 8 weeks later. The greatest rate of reproduction was on *V. rupestris* du Lot for all *X. index* populations except the Italian, which multiplied equally well on Salt Creek. This was somewhat surprising as the cultivar is derived from *V. candicans* which has been shown to have a high level of resistance to *X. index* in California, (Kunde et al., 1968; Meredith et al., 1982). In our experiments, the rate of multiplication of *X. index* on Salt Creek indicated a high level of resistance to the Californian population and some resistance to the French and Israeli populations. On the other hand, a high level of resistance to the four *X. index* populations was evident in Dog Ridge, which is also derived from *V. candicans*. The rootstock Harmony, which has Dog Ridge in its parentage, was highly resistant to the Italian, French and Israeli populations of *X. index*, but only moderately resistant to the Californian population.

In the second experiment, four *V. berlandieri* x *V. riparia* hybrids were grown for 33 weeks in pots each containing 10 females from the four populations of *X. index* (Table III). Teleki 5A appeared to be highly resistant to all of the *X. index* populations, except to the Californian to

which it was moderately resistant. However, there was no consistent evidence of resistance, at a moderate to high level, among the other cultivars.

Another *V. berlandieri* x *V. riparia* hybrid, Teleki 8B was tested with *V. rupestris* du Lot and Couderc 1613, a hybrid with *V. candicans* in its parentage and which showed a moderate resistance to the four *X. index* populations in the first experiment. In this experiment 10 females were added to each pot, and the nematodes were extracted from 5 of the pots after 10 weeks and the remaining 5 pots per treatment after 20 weeks (Table IV). The results were somewhat inconsistent, particularly with regard to the low rate of reproduction in some of the pots with Rupestris du Lot, but in general Couderc 1613 was resistant to all four populations of *X. index* whereas Teleki 8B showed little resistance.

The experiments indicate *V. candicans* as a source of

TABLE I - Parentage of rootstocks tested.

Name	Parentage
Rupestris du Lot	Selection of <i>Vitis rupestris</i>
Dog Ridge	Hybrids of <i>V. candicans</i>
Salt Creek	Hybrids of <i>V. candicans</i>
Harmony	Dog Ridge (Hybr. <i>Candicans</i> ) x 1613 C (Solonis x Othello)
Couderc 1613	Solonis x Othello
Kober 5BB	<i>V. berlandieri</i> x <i>V. riparia</i>
Teleki 5A	» »
Teleki 5C	» »
Teleki 8B	» »
S04	» »

TABLE II - Reproduction of four populations of *Xiphinema* index on *Vitis* rootstocks.

Rootstock	Population			
	Italy	California	Israel	France
	Reproduction (Pf/Pi)*			
Dog Ridge	1.5 (3)**	0.7 (1)	1.9 (2)	0.8 (2)
Teleki 8B	7.4 (7)	7.1 (8)	15.8 (6)	4.5 (6)
Harmony	2.7 (3)	6.2 (7)	1.0 (3)	0.5 (1)
Salt Creek	11.3 (9)	1.1 (2)	7.8 (5)	4.9 (5)
Rup. du Lot	10.0 (7)	27.7 (10)	25.6 (10)	28.8 (9)
Couderc 1613	3.4 (5)	5.9 (10)	2.9 (3)	4.3 (5)

\* Pi = 1 female per pot, Pf = nematodes extracted after 8 weeks.

\*\* Figures in brackets are number of pots, out of 10, in which reproduction occurred.

resistance to *X. index* and confirm the resistance of Dog Ridge to the Californian population (Kunde *et al.*, 1968) as well as to the other populations from Italy, France and Israel. However, the results also indicate differences between populations, particularly that from California, which have been demonstrated with respect to other aspects of their biology (Coiro and Brown, 1984; Brown and Coiro, 1985).

Thus, such differences should be taken into account in the breeding programme. The rate of reproduction which is indicative of resistance to *X. index* is a somewhat arbitrary decision, but assuming a life cycle of 9-10 weeks at 22°C (Prota *et al.*, 1977; Coiro *et al.*, 1987), a period of 10 weeks in which the young rootstocks are exposed to the inoculum of young females would appear to be adequate to decide on the levels of reproduction which they are able to support.

TABLE III - Reproduction of four populations of *Xiphinema* index on four hybrid *Vitis* rootstocks.

Rootstock	Population			
	Italy	California	Israel	France
	Reproduction (Pf/Pi)*			
Kober 5BB	19.7(5)**	3.4(6)	30.2(5)	4.7(6)
Teleki 5A	0.4(2)	7.8(8)	0.4(3)	2.0(8)
Teleki 5C	22.7(9)	3.5(5)	2.9(7)	22.2(10)
SO4	10.5(9)	12.7(10)	4.3(10)	18.1(10)

\* Pi = 10 females per pot, Pf = nematodes extracted after 33 weeks.

\*\* Figures in brackets are number of pots, out of 10, in which reproduction occurred.

Table IV - Reproduction of four populations of *Xiphinema* index on three rootstock cultivars.

Rootstock	Population				
	Italy	California	Israel	France	
	Reproduction (Pf/Pi)*				
Rupestris du Lot	10 wk	14.3	11.6	3.5	15.0
	20 wk	2.6	4.0	103.0	83.0
Teleki 8B	10 wk	7.9	16.1	1.0	12.1
	20 wk	24.2	224.6	14.7	154.7
Couderc 1613	10 wk	1.0	2.1	1.0	6.3
	20 wk	6.0	3.0	1.0	1.0

Pi = 10 females per pot

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