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Research Note

Inheritance of downy mildew resistance in two interspecific crosses between Chinese wild grapes and European grapes

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K e y w o r d s : Grapevine, Chinese grapes, wild germplasm, disease resistance.

Introduction: Grape downy mildew [*Plasmopara viticola* (Berk. and Curt.) Berl. and de Toni] is an economically important fungal disease (Brown 1999). Because *Vitis vinifera* is particularly susceptible to downy mildew, breeders make efforts to use resistant germplasm to increase the resistance of cultivars (Brown 1999). Commonly, American *Vitis* species served as the resistant parent in breeding program (Alleweldt and Possingham 1980). Another potential source of disease resistance genes resides in Chinese wild species (Alleweldt and Possingham 1988, He 1994, Reisch and Pratt 1996). Mechanisms of resistance to downy mildew are not completely understood (Reisch and Pratt 1996). Some reported its resistance was controlled by a single dominant gene (Eibach 2000). Others figured out that the resistance was maternally inherited (Becker and Zimmermann 1978, Doazan and Kim 1978). And yet others found the resistance to downy mildew was controlled by two genic systems, one of which involves several genes (Reisch and Pratt 1996).

This study was conducted to determine inheritance of downy mildew resistance in two interspecific crosses between European grapes and Chinese wild species.

Material and Methods: Crosses of '88-110' ['83-4-96' (*V. qinquangularis*) × 'Muskat rozovyi' (*V. vinifera*)] and '86-2' ['Maiskii chernyi' (*V. vinifera*) × 'Guangxi-2' (*V. pseudoreticulata*)] were performed by Prof. P. He of NWAFU at Yangling, Shaanxi, China, and in 1988 and 1986, respectively. In 2001-2003, downy mildew resistance in the parents, the 48 hybrid progenies of '88-110' and the 79 of '86-2' were evaluated in a natural setting under conditions most conducive to downy mildew infection and growth. The symptoms observed were scored from 0 to 7 based on the estimated percentage of lesion over the entire leaf, then the grade were converted into a susceptibility index (SI). The resistance level of each accession was rated in five categories based on its SI value (He 1994). To analyze the inheritance features, the ratio of resistant to susceptible plants in F1 progenies was tested according to χ^2-test distribution. Susceptibility Index of all progenies from each cross, categorized into five groups, was used to analyze their distribution features.

Results and Discussion: The numbers of resistant F1 plants were 22 and 26 for the '88-110' and '86-2' crosses respectively, and the numbers of susceptible plants were 26 and 43 respectively. The ratio of the resistant plants to the susceptible plants in both crosses was determined in accordance with $\chi^2_{0.01}$ test of 1:1 segregation ($\chi^2_{88\text{-}110}$=0.188; $\chi^2_{86\text{-}2}$=3.17; $\chi^2_{0.01}$=3.84). In both crosses, the parents '83-4-96' and 'Guangxi-2' were resistant to downy mildew, while the parents 'Muskat rozovyi' and 'Maiskii chernyi' expressed susceptibility. Susceptibility Index of the F1 progenies in both crosses demonstrated quantitative genetic traits with a successive distribution (Figure). The SI values of the majority of the progeny of '88-110' and '86-2' were distributed between the two parents as such (13+16+4=33 and 23+15+18=56), respectively (Table). Also, a small number of progenies had higher SI value than that of the high (susceptible) parent, and a few had lower SI values than that of the low (resistant) parent (Table). Therefore, we infer that downy mildew resistance in both '83-4-96' and 'Guangxi-2' may be controlled by a major gene in combination with minor genes. This was of similar resistance to *V. rotundifolia*, which was controlled by a major gene and a few

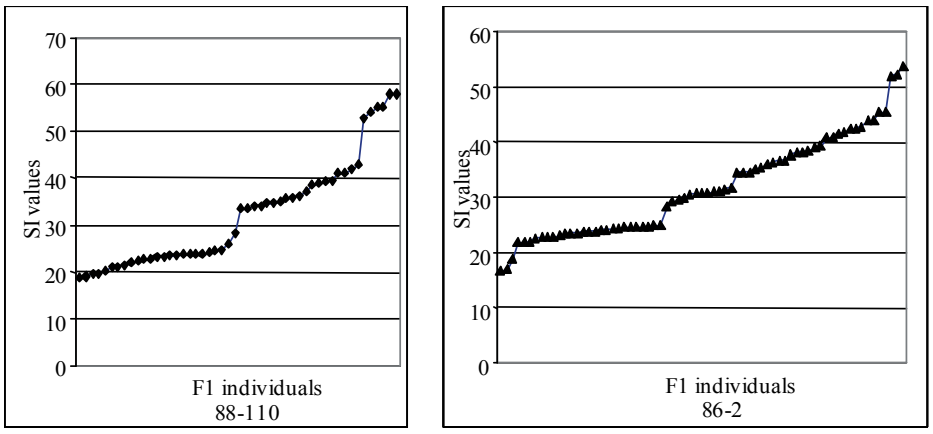

Figure: Distribution of average SI value of F1 progenies in '88-110' and '86-2' (data collected in 2001-2003).

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T a b l e

Distribution features of SI value of F_1 progenies in '88-110' and '86-2'

Cross	Numbers of progenies				
	$SI<P_1$	$P_1 \leq SI<[P_1+(P_2-P_1)/3]$	$[P_1+(P_2-P_1)/3 \leq SI<[P_2-(P_2-P_1)/3]$	$[P_2-(P_2-P_1)/3] \leq SI<P_2$	$SI \geq P_2$
88-110	11	13	16	4	4
86-2	6	23	15	18	7

Note: P_1 is the parent with low SI value; P_2 is the parent with high SI value.

complementary genes (PATIL *et al.* 1997). Regarding both crosses, the progenies with the SI value closest to that of Chinese wild grapes were greater than the progenies with the SI values closest to that of European grapes (Table). This indicates that these two Chinese wild grapes may have stronger inheritance than European Grapes for downy mildew resistance.

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