Vitis **47** (4), 231–233 (2008)

Reactions of some grape cultivars to *Dematophora necatrix*

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Summary

White root rot of grape caused by *Dematophora necatrix* is prevalent in Jahrom and Mimand of Fars province, Iran. In a greenhouse tests 30 gr of colonized wheat kernels per 1,200 g soil amended with peat moss were used to inoculate rooted cuttings of 29 *Vitis vinifera* and one hybrid cultivar in the pots. After 150 days most cuttings belonging to 27 *V. vinifera* cultivars and the hybrid died and were evaluated susceptible. However, 9 seedlings from 'Bidaneh Sephid Gazvin' and 3 from 'Bidaneh Ghermez Gazvin' remained alive. Roots of these cuttings were totally free from mycelium and looked healthy. The seedlings were transplanted after root disinfection with benomyl, in soil near Zarghan Vineyard Collection for further studies.

K e y w o r d s : Grape, resistance, white root rot, *Rosellinia necatrix*, *Dematophora necatrix*.

Introduction

White root rot of fruit trees caused by *Dematophora necatrix* Hartig.(Anamorph of *Rosellinia necatrix* (Hartig) Prill.) is widespread in temperate regions of the world (IMI, 1987). The disease causes a 10 % loss annually in a number of irrigated orchards in Iran (Behdad 1975). The fungi survive on infected plant remains in soil for a long period of time. Indeed many plant species which serve the pathogen occur in the vineyards as perennial weeds. Thus an infested land could not be safely planted. Although several control measures such as cultural, chemical, biological, combined biological and solarization are recommended a total control could not be achieved (Hoopen and Krauss 2006).

Using resistant root stocks are environmentally safe and most efficient. Except a few plants which are naturally resistant, mostly fruit trees are susceptible (Sztejnberg and Madar 1980). Experiments indicated clones and hybrids of apple and persimmon were resistant to *D. necatrix* (Sztejnberg and Jabaricen 1986, Lee *et al*. 2000). Phenolic compounds present in the root skins prevent infection (Sztejnberg 1983).

In Europe and the United States rootstocks of native *Vitis* species are used for the control of biotic (phylloxera and nematodes) and abiotic factors (environmental stresses, soils acidity, drought etc.) affecting the vineyards. Their reactions to *D. necatrix* , as one of the important grape pathogen, is not understood. However in the literature a number of cultivars such 'Carignane', 'Dog Ridges', 'Iona', 'Palomino', 'Red Malaga', 'Salt Creek', 'Stolonis' and 'St George' were mentioned to remain alive after planting in infested vineyards (Pearson and Goheen 1994). No experimental data were presented. In this study the reactions of 29 *V. vinifera* grape varieties and one hybrid was examined to *D. necatrix* in the pot experiments.

Materials and Methods

An isolate of *D. necatrix* from grape vine which showed typical symptoms of the disease *i.e.* chlorosis, leaf fall, and dieback was used in this experiment. Pathogenicity of the isolate was determined on grape rootstocks. Twenty-nine commercial grape cultivars and one hybrid were used in this study, collected from several different vine plants from various parts of Iran. Cuttings 30 cm long, were planted in March 2001 on a site in Zarghan Experimental Station Fars province, Iran. This site was previously solarized to eliminate any possible soil borne fungal pathogens. After one year rooted cuttings were transferred into dark plastic pots containing the inoculums. The inoculum was made from mixing 30 g of colonized wheat grain with 1,200 g soil amended with peat moss in pots. Three to five seedlings from each cultivar were inoculated with sterilized wheat kernels as control. Observations were made every week for 80, 120, and 150 d. Twenty cuttings each from cultivars 'Bidaneh Germez Gazvin' (BGG) and 'Bidaneh Sephid Gazvin' (BSG) which were evaluated resistant (Table), were examined for their reactions by doubling the inoculums and extending the period of exposure. All experiments were repeated twice.

Results

Grapevine cuttings were rooted after one year with large differences between cultivars. American X European cultivar is rooted only when treated with rooting hormones. The cuttings at the time of inoculation were without leaves and shoots. Buds gradually appeared and the symptoms such as yellowing of leaves followed by leaf drops, wilting and death of the plants appeared almost 80 d after inoculation in a number of cultivars. Only two commercial cultivars, 'BGG' and 'BSG' were evaluated resistant, others died due to heavy root colonization after 150 d and evaluated susceptible or intermediate in their reactions (Table). *D. necatrix* was re-isolated randomly from a number of diseased vines. Doubling the inoculum and extending exposure time, death rates of BGG and BSG increased to 85 % and 55 % which was regarded susceptible and intermediate in reaction. A number of cuttings, 3 from 'BGG' and 9 from

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T a b l e

Reactions of some grapevine cultivars as rootstocks to white root rot *Dematophora necatrix*

Cultivars	Mean* inoculated cuttings	Mean of dead cuttings (d)			Total dead cuttings	Percent dead cuttings	Reactions[a]
		80	120	150			
Alhaghi	15	8	2	1	11	73	S
American	5	2	3	-	5	100	S
American European Hybrid	15	0	8	7	15	100	S
Askari	9	0	4	3	7	77	S
Bidaneh Bavanat	8	1	3	2	6	75	S
BidanehGermez Gazvin[b]	14	4	0	0	4	28	R
Bidaneh Sephid Gazvin[c]	15	1	2	0	3	20	R
Cezdonk	12	1	6	3	10	71	S
Gheihei	15	5	3	2	10	66	I
Ghorjashem	18	7	5	2	14	77	S
Jahrom G1	13	2	4	4	10	71	S
Jahrom G2	11	2	5	2	9	81	S
Kalehei	15	7	3	2	12	80	S
Khalili	15	7	3	2	12	80	S
Khaledi Sephid	16	3	7	3	13	81	S
Lorkosh	7	3	4	0	7	77	S
Monagha Sidan	20	7	6	4	17	85	S
Mirzaei	20	7	3	4	14	71	S
Naloni	5	3	1	0	4	80	S
Pyghami Mashhad	7	2	5	0	7	100	S
Rajabi Saphid	6	0	3	2	5	83	S
Rajabi Siah	10	1	4	2	7	70	I
Rajabi Zarghan	13	5	4	0	9	70	I
Rotabi	21	13	4	2	19	90	S
Sahebi Sephid	15	11	4	0	15	100	S
Samarghandi Golestan	14	0	6	4	10	71	S
Siah Bavanat	13	0	6	5	11	84	S
Tokhme Kabki	15	8	2	1	11	73	S
Torkamanestan	20	3	6	5	14	70	I
Yaghoti Siah	3	3	0	0	3	100	S

* Mean from two repeated experiments.

[a] Percent of dead seedlings were calculated and reactions of cultivars classified into one of three categories: R = Resistant (0 to 30 %); I = Intermediate (31-70 %) and S = Susceptible (71 to 100 %) according to Lee *et al.* (2000).

[b, c] Three clones were identified to be resistant after inoculation of cuttings with 60 gr inoculums /1200 soil amended with peat moss and extending period of assessment to 360 d.

'BSG' remained alive after 360 d. All the attempts to re-isolate the pathogen were not successful.

Discussion

In greenhouse tests inoculations of 29 cultivars (*V. vinifera*) and one hybrid of table grape cuttings with *D. necatrix* indicated that none were resistant to *D. necatrix.* Except two commercial cultivars, 'Bidaneh Germez Gazvin' and 'Bidaneh Sephid Gazvin', they are not recommended to be planted directly or used as rootstocks in the infested soils. Clones BGGC 1- 3 and BSGC 1- 9, in spite of the presence of high amounts of inoculums, did not show any symptoms, and did not support mycelia growth of the fungus on their roots. Attempts to re-isolate the pathogen from the roots of these clones were not successful.

Although in plants variations are mostly derived from sexual segregation, self mutation (sort) is another source propagated asexually by cuttings (Janick and Moore 1975). This phenomenon is used for clonal selection to improve characteristics in plants propagated by cuttings, including grape (Winkler *et al.* 1973). Similar attention was towards other soil borne diseases of grape. Greenhouse experiments indicated that among eight cultivars and clones, cultivars 'Freedom', 'St.George', 'Ramsay' and clone 110R were moderately resistant to *Armellaria mellea* (Baumgartner and Rizzo 2006), and 'Gloire' and clones 101-14M, 140R 3309 and 33EM to *Agrobacterium tumefaciens* (Roh *et al.* 2003). These cultivars and clones were recommended to be used in integrated control of these pathogens. Pot experiments seem more valid than field observations to assess the potential and consistency of grape germplasms reactions to *D. necatrix*. Khan (1955) reported grape rootstocks 1613

and Salt Greek were resistant to *D. necatrix* in an infested vineyard. However, later reports indicated both are susceptible, as they died after 40 and 56 d in a pot experiment (Sztejnberg and Madar 1980). Although the differences might have resulted from the high levels of the inoculums and/or optimal conditions of the greenhouse, these conditions enforce truly resistant varieties and clones selection for persisting in the infested soils alive as rootstocks for a long period of time.

Acknowledgements

This study was a research project under code no. 113-11-12-81-150 funded by the Agricultural Extensions, Education and Research Organization, Tehran-Iran. We extend our thanks to Mr. Mehdi Entezar Mahdi and Abdolah Jafari for his technical assistance.

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Received January 14, 2008