RESEARCH NOTES

Journal of Nematology 16(2):207–208. 1984.

A New Pathotype of Root-knot Nematode on Grape Rootstocks

D. W. CAIN,[1] M. V. MCKENRY,[2] AND R. E. TARAILO[3]

Key words: Meloidogyne, Vitis, rootstock breeding, pathotype.

Root-knot nematodes can infest and seriously limit growth of susceptible grapevines growing in warm sandy soils. All of the major commercial cultivars grown in California are *Vitis vinifera.* While cultivar differences in susceptibility to *Meloidogyne arenaria* have been found in *V. vinifera* (1), all *vinifera* grapes tested under field conditions are too susceptible to withstand severe infestations of root-knot nematodes (5). Rootstocks resistant to *Meloidogyne* spp. are used only on severely infested sites because of undesirable horticultural characteristics and added propagation expense associated with these stocks. Use of grower rooted cuttings in combination with preplant and postplant fumigation provided a more economical control method in the past. Current bans on the use of effective postplant nematicides have prompted a new interest in resistant rootstocks. Several native American *Vitis* species exhibit a high level of resistance to *Meloidogyne* spp. (5). Five of the most widely tested rootstocks in the interior valleys of California are 'Dogridge,' '1613' ('Couderc 1613'), 'Ramsey' (commonly misidentified as 'Salt Creek'), 'Harmony,' and 'Freedom' (2). Mature *M. incognita* have been identified on 1613, mature *M. arenaria thamesi* on Dogridge, 1613, and Salt Creek (Ramsey), and *M. javanica* on Dogridge and 1613 (3). However, in extensive field tests, these stocks exhibited very low levels of galling (3–5).

Pathotypes of *Meloidogyne* spp. differ in their ability to attack certain host plants. Such pathotypes have been found attacking resistant peach rootstocks (7), and they are a serious concern in rootstock breeding programs for tree and vine crops because of the time required to develop and test new rootstock cultivars. No reports exist of specific pathotypes occurring on grape rootstocks. Viglierchio (6) found that 10 populations of *M. incognita* isolated from California soils differed in their ability to produce galls on several crops. In order to breed nematode-resistant cultivars adapted to a wide geographic area, it is essential to identify commonly occurring pathotypes and locate sources of host resistance to each pathotype.

In 1979 at the USDA research station in Fresno, California, rooted cuttings of 41 named rootstock cultivars and advanced selections, growing in autoclaved sand in 16-cm-d plastic pots, were screened in a greenhouse for resistance to populations of *M. incognita, M. javanica,* and a mixed population of *M. incognita* and *M. arenaria.* The three populations, originally isolated from single egg masses, were increased on tomato (*Lycopersicum esculentum* Mill.). Infected tomato roots were used to inoculate five replicates of each of the 41 rootstock clones with approximately 10,000 juveniles per pot. Ninety days after inoculation, the root systems were rated on a 0 to 5 scale where 0 = no galling, 1 = a few very small galls, 2 = a few medium size galls, 3 =

Received for publication 20 May 1983.

[1] Formerly Research Horticulturist, USDA ARS, Fresno, California. Present address: Department of Horticulture, Clemson University, Clemson, SC 29631.

[2] Associate Professor, Department of Nematology, University of California, Riverside. San Joaquin Valley Agricultural Research and Extension Center, 9240 So. Riverbend Ave., Parlier, CA 93648.

[3] Agricultural Research Technician, USDA ARS, Fruit Production Research, Fresno, CA 93747.

TABLE 1. Response of selected grape cultivars to a root-knot nematode isolated from infested 'Harmony' roots.

Cultivar	No. of replicates	Root galling*
A × R 1	4	4.5 a†
Freedom	4	4.2 a
Harmony	5	4.1 a
Dogridge	2	4.0 ab
1613	5	2.8 b
Vinfera‡	5	2.5 b
James	5	0.0 c
M42-13B	4	0.0 c

* Root galling was rated on a 0–5 scale where 0 = no galls and 5 = very severe galling.

† Means followed by the same letters are not significantly different ($P = 0.05$) according to Duncan's multiple-range test.

‡ Because of limited plant material, vinifera replicates had a mixture of two pure *V. vinifera* L. clones: 'Seeded Thompson' and 'B29-82.'

a few large galls, 4 = many large galls, and 5 = the root system completely distorted by galls. Dogridge, Ramsey, 1613, Harmony, and Freedom all exhibited a high degree of resistance to each of the three nematode populations. The highest rating among the five rootstocks was 0.3 (for *M. javanica* on Dogridge). In contrast, 'St. George' and 'A × R #1' ('Ganzin #1'), known to be highly susceptible, were rated 3 or above in all replicates of each nematode population. These results conform to those of Snyder (5).

Rooted cuttings of these 41 cultivars were also screened in field plots at the USDA station in Fresno in 1979 and 1980. The screening plot, which had been used to screen grape rootstocks for root-knot nematode resistance for more than 30 years, had a high natural population of root-knot nematodes of undetermined species in addition to being inoculated with the three root-knot species listed above. Unexpectedly, large galls were found in both years on all five of the supposedly resistant cultivars. Harmony and Freedom exhibited especially severe galling, with some individual replicates of Harmony receiving a gall rating of 5.

Microscopic examination of infected Harmony roots revealed many mature gravid females. Egg masses were removed from individual females and transferred to separate tomato plants growing in autoclaved sand to establish pure cultures. After two subcultures on tomato, one population was used to inoculate Dogridge, 1613, Harmony, Freedom, A × R #1 and two *V. vinifera* clones, 'Seeded Thompson' and 'B29-82,' in a greenhouse screening test. Since Snyder (5) found that all of 154 *vinifera* clones tested were highly susceptible to root-knot nematodes and because of the limited number of plants available, the two *vinifera* clones were combined and are referred to as 'vinifera.' The muscadine (*Vitis rotundifolia*) cultivars 'James' and 'Mississippi 42-12B' were also included as immune controls. After three months 1613 had moderate to severe galling and the other four rootstocks were severely galled (Table 1). The 'vinifera' plants exhibited less severe galling than expected. The two muscadine cultivars had no galls. These results indicate that the nematode population we tested can attack and reproduce on root-knot nematode resistant grape rootstocks in both the field and the greenhouse.

Preliminary evaluation of perineal patterns indicates that this nematode population is a race of *M. incognita*. The prevalence of this pathotype in California is not known, but its presence could explain the occasional complaints by growers that their supposedly resistant rootstocks exhibit severe galling. The discovery of this pathotype illustrates the necessity for identifying the frequency, incidence, and geographic distribution of such pathotypes and the importance of searching for sources of resistance to them as part of a comprehensive program for breeding grape rootstocks.

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