COMPREHENSIVE RESEARCH ON PRUNES

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PROGRAM AREA - Root and root zone problems.

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OBJECTIVES.

To determine whether Prunus material exists which has a resistant or tolerant reaction to the root lesion nematode, Pratylenchus vulnus, and could serve as rootstock material for prunes.

To improve methods for detecting resistance or tolerance to P. vulnus.

To obtain further information regarding the ability of nematodes associated with prunes in the field (Pratylenchus vulnus, Criconemoides spp., Paratylenchus spp., and Xiphinema americanum, to limit the growth of prunes, or interact with other limiting factors.

WORK IN PROGRESS.

A. Root-lesion nematodes. Because Marianna 2624 showed some tolerance of P. vulnus in the 1969 greenhouse trial, we used six other Mariannas in the 1970 trial. We used "Etter's Best" (probably Prunus subcordata x P. domestica) because L. H. Day and E. F. Serr had noted (Proc. Amer. Soc. Hort. Sci. 57:150-154. 1951.) that this plant was little injured by P. vulnus in an orchard trial. P. subcordata was tested because of its probable relation to "Etter's Best". Marianna 2624 was included as a common denominator with the 1969 trial. Other items tested are shown in Table 1. Prunus americana was propagated from stratified seed. All other cultivars were propagated from softwood cuttings. Most of these were obtained from Pomology Department plantings to which we were directed by Professor C. J. Hansen. Rooted cuttings, or germinated seedlings, were grown 4 months in the greenhouse in two-gallon pots, with and without addition of 25,000 P. vulnus. Results obtained thus far, in terms of plant growth and nematode reproduction, are given in Table 1. As in 1969, the nematodes multiplied on all plants which grew well, and we are forced to look at degrees of tolerance of them. When all the results are obtained, we will judge tolerance using the mean weights of plants grown with nematodes, and the ratio of mean weight with nematodes to mean weight without nematodes. All plants tested were stunted by this nematode, some much more than others.

B. Ring nematodes, mostly Criconemoides xenoplax, have been found in 43 of the 82 prune orchards from which we have had samples.

Increased growth of Myrobalan seedlings resulting from fumigation of soil infested with C. xenoplax suggests that this nematode is a prune pathogen.

Table 1. Heights and weights of a number of possible prune rootstocks after 4 months growth in the greenhouse with, and without, 25,000 root-lesion nematodes. Numbers of nematodes at the end of the growth period.

Possible prune rootstocks	Final plant height in cm[a]		Final plant weight in grams[a]		Final number of *P. vulnus* per pot[a]	
	25,000 *P. vulnus* added	no *P. vulnus* added	25,000 *P. vulnus* added	no *P. vulnus* added	25,000 *P. vulnus* added	no *P. vulnus* added
Marianna 2624	52 ± 13	113 ± 4	32 ± 6	77 ± 9	69,461 ± 26,938	0 ± 0
Marianna 2623	---------- data still being obtained for this cultivar----------					
Marianna 4001	97 ± 22	157 ± 4	69 ± 30	128 ± 15	94,351 ± 16,196	0 ± 0
Marianna F	---------- data still being obtained for this cultivar----------					
Cody Marianna	74 ± 10	139 ± 9	52 ± 14	93 ± 13	179,606 ± 57,367	0 ± 0
Corotto Marianna	118 ± 5	154 ± 4	104 ± 19	240 ± 14	239,140 ± 47,692	0 ± 0
Myrobalan 29 C	90 ± 15	152 ± 5	46 ± 10	154 ± 19	92,725 ± 33,642	0 ± 0
Etter's Best	123 ± 9	158 ± 5	88 ± 12	155 ± 13	89,864 ± 22,711	0 ± 0
Prunus mexicana	13 ± 0.5	23 ± 9	2 ± 0.4	8 ± 3	17,259 ± 7,502	0 ± 0
Prunus moseri	18 ± 6	71 ± 5	5 ± 3	26 ± 3	15,377 ± 4,498	0 ± 0
Prunus subcordata	---------- data still being obtained for this cultivar----------					
Prunus americana	---------- data still being obtained for this cultivar----------					
Peach (2-16-8) x almond	---------- data still being obtained for this cultivar----------					

[a]Mean of 10 replicates and the standard error of this mean.

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However, C. xenoplax was not the only organism in the fumigated orchard soil which might have been killed by soil fumigation. To determine conclusively the effect of this ring nematode on roots of prune rootstocks, it is desirable to conduct an experiment using nematodes and plant material free from all other organisms. We have found it possible to free Myrobalan seeds from organisms with 16 hours agitation in 2 per cent chloramine T solution in a mechanical shaker. C. xenoplax can be freed from other organisms by 1) recovery from soil using the Cobb (1918) sieving and gravity method, 2) separation from debris using the Jenkins (1964) centrifugal-flotation technique and 3) surface-sterilization of the nematodes using a one-hour treatment with "Zephiran chloride" (a mixture of alkyl dimethyl benzyl chloride and ammonium chloride). A chamber is being constructed in which the effect of the treated nematodes on seedlings from treated seeds can be studied under sterile conditions.

Our only experience with ring nematodes on prunes has been with Myrobalan. It is possible that Marianna or other rootstocks may not be as good hosts for C. xenoplax as Myrobalan. A comparison of the effect of Myrobalan seedlings, Myrobalan 29C, Marianna 2624, Marianna 2623, Marianna 4001, Corroto Marianna, Etter's Best, and fallow, on populations of C. xenoplax is in progress.

It would be easier to work with ring nematodes if they could be cultured in the laboratory on tissues, as we do for the root lesion nematode, Pratylenchus vulnus. This possibility is being investigated. We do not plan to spend a great deal of time with this, however. This kind of culture has not been successful with external parasites, like C. xenoplax, in the past.

C. Pin nematodes, Paratylenchus spp., have been found in 52 of the 82 prune orchards from which we have had samples.

We have tried to get a measure of the effect of one of these (from the Money ranch on the Napa River near Oakville) by treating infested soil with the nematicide ethylene dibromide (Dowfume W 85) and comparing growth of Myrobalan seedlings in treated and untreated soil. Two experiments of this kind were run, the first using Dowfume W 85 at the rate of 16 gallons per acre; the second using the same material at 40 gallons per acre. Although these are much higher than the rates at which we usually use this material successfully, they failed to eliminate pin nematodes in the experiments. The nematodes returned to a high level and there were no differences in growth of Myrobalan seedlings in treated and untreated soil. We believe that the Dowfume W 85 treatments failed because this Paratylenchus is difficult to kill, and because the soil is a clay loam, in which fumigants are less effective than in sandier soils.

In a third experiment growth of Myrobalan seedlings in untreated Money ranch soil was compared with growth in soil steamed (15 lbs. pressure) for four hours. Thirty Myrobalan seedlings grown 3 months in the steamed soil now average 107 ± 4 cm in height. This is higher ($P = L\ 0.01$) than the height (86 ± 2) of the seedlings grown in untreated soil. The heat treatment eradicated the Paratylenchus. Since there was a positive response to the steam treatment, more precise experiments dealing with the pathogenicity and control of this Paratylenchus are warranted.

EXPERIMENTS COMPLETED.

A. Root lesion nematode. In the 1969 trial of Prunus spp. for resistance or tolerance toward Pratylenchus vulnus we found no resistance in any of the twelve cultivars tested (Myrobalan 3 J, Marianna 2624, White Damson, St. Julian, an Idaho wild plum, Lovell, Nemaguard and Rancho Resistant peaches, three experimental root-knot nematode resistant peach selections, and Blenheim apricot). Pratylenchus vulnus reproduced in roots of all the plants and reduced their growth, as compared to uninoculated controls. Marianna 2624 was an excellent host for P. vulnus, but was stunted less by the nematode than the other eleven plants tested. We concluded that Marianna 2624 had some tolerance toward this nematode.

B. Ring nematode. Preplanting soil fumigation with Dowfume W 85 at the rate of 16 gallons per acre improved the subsequent growth of Myrobalan 3 J seedlings in a soil in which Criconemoides xenoplax was the predominant plant parasitic nematode species.

C. Pin nematode. A test of the host range of the Paratylenchus from Money Ranch, Napa Co. was conducted to assist us in identifying and culturing this nematode. Results of this test (Table 2) confirm our opinion, based on morphology, that this is not Paratylenchus hamatus, which occurs on figs and other crops in California.

Table 2. Numbers of Paratylenchus sp. (Money Ranch, Napa Co.) per 6 inch pot of soil, before and after $4\frac{1}{2}$ months' growth of a number of different kinds of plants or fallow.

	Number of Paratylenchus sp. per pot
Before planting	27,780 ± 2,358
$4\frac{1}{2}$ months after planting	
Rose	70,680 ± 15,226
Marianna 2624	43,415 ± 13,886
Apricot	18,640 ± 4,422
Kadota fig	846 ± 332
Northern California black walnut	435 ± 60
Cowpea	106 ± 17
Fallow	246 ± 24

WORK PLANNED.

Work described above, as in progress, will be completed.

Prunus cultivars which show the most desireable reactions to Pratylenchus vulnus in the greenhouse tests will be tested in an infested orchard situation with Myrobalan included for comparison.

We will set up a growth chamber designed to keep out all organisms from prune seedlings except those under study. This is to be used to determine effects of selected nematodes on prunes, and effects of specific nematode x fungus interactions.

Trial of periodic application of DBCP in Butte County will continue.

If we find a situation in which prunes are being replanted in nematode infested soil we will establish a trial of preplanting soil fumigation using higher than conventional fumigant dosages and deeper than conventional placement.

MAJOR ACCOMPLISHMENTS.

We have learned that possible prune rootstocks vary greatly in their tolerance of the root lesion nematode Pratylenchus vulnus. In our tests Marianna 2624 was more tolerant than Myrobalan 29 C and Myrobalan 3 J. In this year's test other Mariannas and Etter's Best resemble Marianna 2624 in their degree of tolerance of P. vulnus. None of these cultivars are resistant to P. vulnus. The nematode increases in all of these, but they remain fairly vigorous despite high nematode population.

We have observed that growth of Myrobalan seedlings in soil infested with either the root lesion nematode, Pratylenchus vulnus, or the ring nematode, Criconemoides xenoplax, can be improved by preplanting nematicidal soil fumigation.

We have found that several species of pin nematodes, Paratylenchus spp. are among the commonest kinds of plant parasitic nematodes found in prune orchards, and that it is difficult to keep populations of these nematodes at a low level by soil fumigation.

EVALUATION OF PROJECT.

When the project was begun, the nematode parasites of prunes were the least understood of the nematodes of fruit tree crops in California. Because of this project this situation is improving. Information being obtained regarding nematode pathogenicity and rootstock reactions should make possible more intelligent use of soil fumigation and rootstocks for nematode control.

PUBLICATIONS OR REPORTS.

1. Lownsbery, B. F., J. T. Mitchell, W. H. Hart, F. M. Charles, M. H. Gerdts, and A. S. Greathead. 1968. Responses to postplanting and preplanting soil fumigation in California peach, walnut, and prune orchards. Plant Disease Reporter 52(11):890-894. (This publication slightly preceded this project, but is cited here because it is pertinent).