Separate and Combined Effects of Paratylenchus neoamblycephalus and Criconemoides xenoplax on 'Myrobalan' Plum

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This research was supported by the California Prune Advisory Board.
Accepted for publication 9 October 1974.

ABSTRACT

Weights of potted Myrobalan plum seedlings at harvest were inversely proportional to the numbers of *P. neoamblycephalus* or *C. xenoplax* added at planting time. Growth of seedlings was limited most at the temperatures which favored multiplication of each species, 20 C for *P. neoamblycephalus* and 26 C for *C. xenoplax*. High inoculum levels of either nematode species suppressed low inoculum levels of the other. Both nematodes caused darkening of roots and reduction in feeder roots, which led to waterlogging.

Phytopathology 65:328-330

Additional key words: population levels, temperature.

The pin nematode *Paratylenchus neoamblycephalus* Geraert, and the ring nematode *Criconemoides xenoplax* Raski, occur commonly in California prune orchards (8), often concomitantly. They are present in the cooler orchards in coastal counties and also in the Central Valley where soil temperatures are higher. *P. neoamblycephalus* is favored by a soil temperature of 20 C (1, 4) and *C. xenoplax* by 26 C (6). In the experiment reported here, we studied the separate and combined effects of these two nematodes at 20 and 26 C on plum *(Prunus cerasifera* Ehrh. 'Myrobalan') which is used as a rootstock for prunes.

TABLE 1. Six-week survival or reproduction of different numbers and combinations of *Paratylenchus neoamblycephalus* (P) and *Criconemoides xenoplax* (C) on Myrobalan plum seedling roots maintained at two temperatures

Temperature and Inoculum	(Nematodes per pot[a]) P	C
20 C		
2,000 C		11,403 ± 1,253
20,000 C		103,185 ± 11,077
20,000 C + 2,000 P	2,880 ± 633	77,786 ± 14,709
20,000 P + 2,000 C	41,028 ± 7,121	4,549 ± 1,219
2,000 P	15,306 ± 2,778	
20,000 P	48,183 ± 9,790	
26 C		
2,000 C		34,188 ± 6,975
20,000 C		116,796 ± 31,671
20,000 C + 2,000 P	833 ± 137	59,190 ± 8,837
20,000 P + 2,000 C	23,716 ± 2,686	11,583 ± 2,313
2,000 P	8,980 ± 708	
20,000 P	28,818 ± 2,787	

[a] Mean of six replicates and standard error.

MATERIALS AND METHODS.—Dormancy of Myrobalan seeds obtained from Herbst Bros., Brewster, N. Y. was broken by incubation at 2.2 C in a shallow layer of distilled water containing 10 μg/ml Arasan® (75% by weight tetramethylthiuramdisulfide) until germination, which occurred in 3-4 months. Seedlings for use in this experiment were obtained by planting the treated seeds in a mixture of peat moss, vermiculite, and sand (1:1:1, v/v).

C. xenoplax and *P. neoamblycephalus* were obtained from an Oakville, California prune orchard infested with both nematodes. The species were isolated by hand-picking, and increased on Myrobalan seedlings. Jenkins' (5) sugar-flotation method was used to obtain nematode

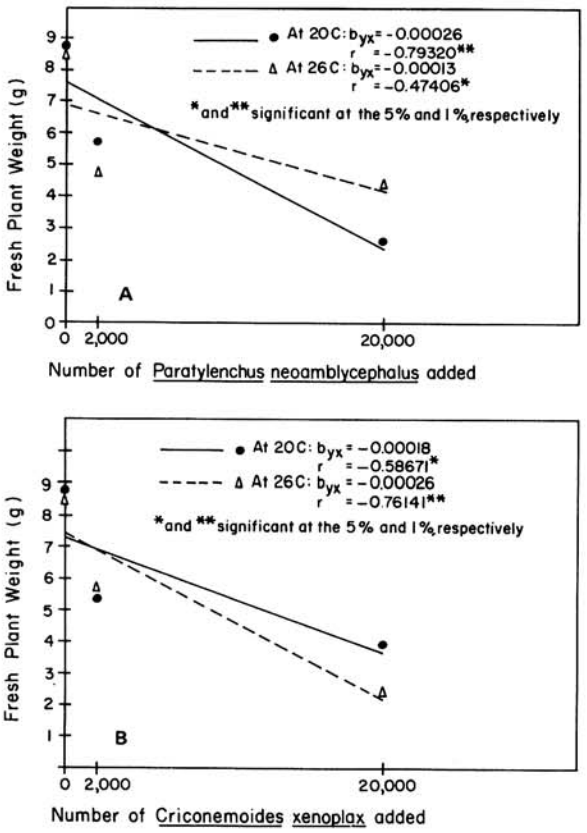

Fig. 1-(A,B). Fresh plant weight of Myrobalan plum seedlings grown 6 weeks at two soil temperatures after inoculation with different numbers of **A)** *Paratylenchus neoamblycephalus* or **B)** *Criconemoides xenoplax*.

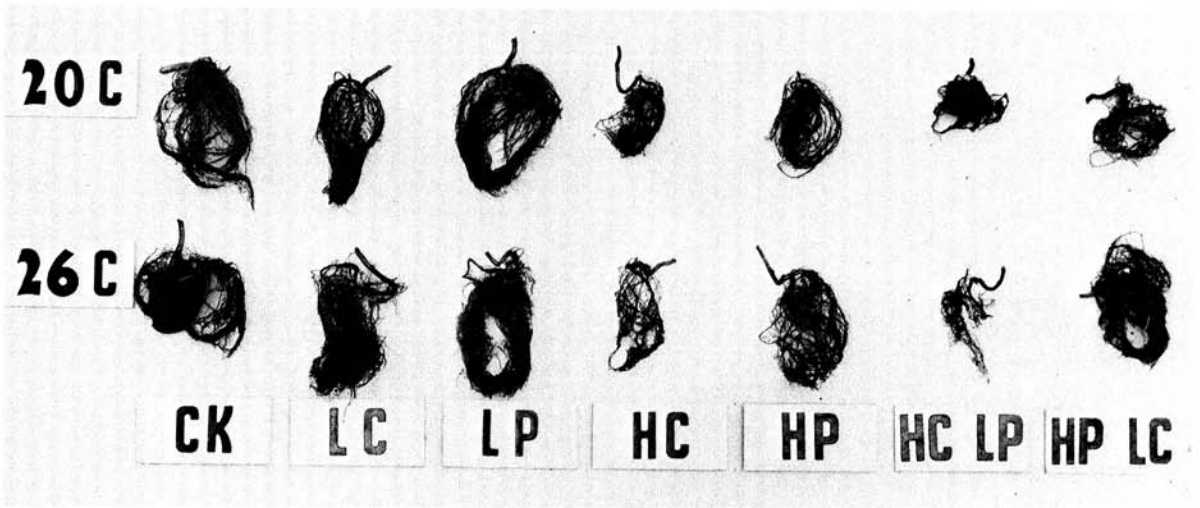

Fig. 2. Roots of Myrobalan seedlings grown 6 weeks at 20 and 26 C after inoculation with distilled water (CK); 2,000 (LC) or 20,000 (HC) *Criconemoides xenoplax;* 2,000 (LP) or 20,000 (HP) *Paratylenchus neoamblycephalus;* or combinations of these (HC LP and HP LC).

inoculum. One-month-old Myrobalan seedlings were inoculated with each of two population levels of *P. neoamblycephalus,* each of two population levels of *C. xenoplax,* and combinations of population levels of the two species (Table 1). These numbers, or combinations of numbers, were added in 100 ml of water, and a 100-ml water control was included. Inoculations were made by pouring the nematode suspension onto the roots of seedlings when these were transplanted into 15-cm diameter plastic pots containing a sandy loam soil (2) with field capacity of 5.8% (determined by pressure plate technique with one-third atmosphere), porosity 50.9%, and pH 6.5. This soil had been autoclaved for 4 hours at 118 C under a pressure of 1.0 atmosphere (15 psi) and then stored for a month to restore chemical stability.

Pots were supported by their collars inside glazed crocks immersed in controlled-temperature water baths (3) to achieve the desired soil temperatures. Six replicates of each nematode treatment were maintained at 20 C, and six at 26 C. Plants were irrigated with distilled water. A single foliar spray of malathion was used to control mites and white flies.

Plant measurements and nematode populations were assayed after 6 weeks. Roots were carefully freed from soil, washed, blotted dry with paper towels, and weighed. Soil from each pot was mixed for homogeneity, and nematodes were recovered from 50-cc samples of it, using Lownsbery and Serr's (9) method for *P. neoamblycephalus*, and Jenkins' (5) method for *C. xenoplax*. Soil moisture content in each replicate was determined at the time of harvest by weighing soil samples before and after 24 hours of incubation at 105 C.

RESULTS AND DISCUSSION.—At either 20 or 26 C, final plant weights of Myrobalan plum seedlings were inversely proportional to the number of *P. neoamblycephalus* or *C. xenoplax* added (Fig. 1). Growth limitation by each species was greater ($P = < 0.1$) at the temperature most favorable for nematode multiplication, 20 C for *P. neoamblycephalus* and 26 C for *C. xenoplax*. The regression coefficients (b_{yx}) for final plant weight vs. initial population level for the two nematode species are identical if the coefficients for the better temperature for each species are used for comparison.

Low numbers (2,000) of either nematode species had no effect (Fig. 2) on growth limitation by the higher inoculum level (20,000) of the other species. In this situation, increase of the species added in low numbers was supressed (Table 1). When this suppression was coupled with a 26 C temperature unfavorable to *P. neoamblycephalus,* that species failed to increase.

Both species caused roots of Myrobalan seedlings to become dark-brown or black in color, and reduced the feeder root system (Fig. 2). These symptoms have been observed in previous tests of the effect of these nematodes on Myrobalan plum (1, 10).

Final soil moisture was inversely proportional to the final weights of Myrobalan plants ($P = < 0.01$) and directly proportional to the number of nematodes added. With *P. neoamblycephalus* at 20 C, the coefficient of correlation (r) for the latter relation was 0.71 ($P = < 0.01$), and the regression coefficient for soil moisture as a function of number of nematodes added was 0.00017. With *C. xenoplax* at 26 C, corresponding figures were 0.80 ($P = < 0.01$) and 0.00014. Moisture in soil around uninfested control plants was at field capacity, whereas it was higher than field capacity for plants infected with 20,000 nematodes of either species. Apparently the impaired root systems of nematode-infected plants absorbed less water, leading to waterlogging and oxygen deficiency, which augmented nematode pathogenicity. This same effect was reported (7) for container-grown peach trees infected with *C. xenoplax*. Waterlogging is more apt to occur in containers than in the field, but we suspect that it also augments nematode pathogenicity in orchards.

LITERATURE CITED

1. BRAUN, A. L. 1974. The pin nematode, Paratylenchus neoamblycephalus, and its effect on Myrobalan plum (Prunus cerasifera Ehrh.). Ph. D. Thesis. University of California, Davis. 39 p.
2. BUCKMAN, H. O., and N. C. BRADY. 1960. The nature and properties of soils. 6th ed. Macmillan, New York. 567 p.
3. FERRIS, J. M., B. LEAR, A. W. DIMOCK, and W. F. MAI. 1955. A description of Cornell temperature tanks. Plant Dis. Rep. 39:875-878.
4. FISHER, J. M. 1967. Effect of temperature and host on Paratylenchus neoamblycephalus and effect of the nematode on the host. Aust. J. Agric. Res. 18:921-929.
5. JENKINS, W. R. 1964. A rapid centrifugal-flotation technique for separating nematodes from soil. Plant Dis. Rep. 48:692.
6. LOWNSBERY, B. F. 1961. Factors affecting population levels of Criconemoides xenoplax. Phytopathology 51:101-103.
7. LOWNSBERY, B. F., H. ENGLISH, E. H. MOODY, and F. J. SCHICK. 1973. Criconemoides xenoplax experimentally associated with a disease of peach. Phytopathology 63:994-997.
8. LOWNSBERY, B. F., E. H. MOODY, and A. L. BRAUN. 1974. Plant parasitic nematodes in California prune orchards. Plant Dis. Rep. 58:633-636.
9. LOWNSBERY, B. F., and E. F. SERR. 1963. Fruit and nut tree rootstocks as hosts for a root-lesion nematode, Pratylenchus vulnus. Am. Soc. Hortic. Sci. 82:250-254.
10. MOJTAHEDI, H. 1974. The biology of Criconemoides xenoplax and its pathogenicity to plum rootstocks. PhD. Thesis. University of California, Davis. 56 p.