Phytophthora Gummosis and Root Rot of Citrus- Effect of Temperature on Disease Development

M. Matheron and J. Matejka

Abstract

Experiments were conducted to examine the effect of temperature on development of Phytophthora gummosis and root rot of citrus as well as the influence of temperature on sporulation of Phytophthora citrophthora and P. parasitica. Maximum production of sporangia by each fungus occurred at 25 C, while slight or no sporangia production occurred at 10, 15, and 35 C. Minimal growth of lesions was observed when stems of rough lemon were inoculated with P. citrophthora or P. parasitica and incubated at 5 and 30 C or 10 and 30 C, respectively. The inhibitory and stimulating effect of certain temperatures on sporulation and disease development could be useful for determination of optimum times for application of fungicides or other disease control measures.

Introduction

Phytophthora citrophthora or P. parasitica have been recovered from over 85% of tested citrus plantings in Arizona. Both pathogens can cause gummosis (canker formation at the base of the tree) and root rot.

The focus of this study is temperature: specifically, the effect of temperature on sporulation of P. citrophthora and P. parasitica and the effect of temperature on development of Phytophthora gummosis and root rot. We hope to use this information to improve overall disease control by more precise timing of application of control measures.

Materials and Methods

To examine the effect of temperature on sporangia formation, agar disks containing P. citrophthora or P. parasitica were incubated in soil extract at selected temperatures for 96 hr. The number of sporangia then were counted that formed on the edge of the disks.

To study the effect of temperature on lesion development, rough lemon seedlings growing in pots were inoculated in a circular wound made in the stem of each plant. An agar disk containing mycelium of P. citrophthora or P. parasitica was placed on the wound and the inoculated area was wrapped with plastic tape. Plants were maintained at selected temperatures for one week, then the length of resulting stem lesions was recorded.

Results and Discussion

Maximum production of sporangia by each fungus occurred at 25 C, moderate sporulation was observed at 20 and 30 C, while minimal sporulation occurred at 10, 15, and 35 C (Table 1). Maximum growth of lesions on

rough lemon stems inoculated by P. citrophthora and P. parasitica was observed at 10-20 C and 15-25 C, respectively, while slight or no growth of lesions occurred at 5 and 30 C for P. citrophthora and 10 or 30 C for P. parasitica.

Average soil temperatures 10 cm below the soil surface ranged from 12.7 C in January to 33.9 C in July, according to the AZMET recording station at the Yuma Mesa Agricultural Center. If we can compare the average soil and air temperatures in a citrus production area with the known effects of these temperatures on sporulation of Phytophthora and disease development, then it is possible to use the data generated by these studies to determine when fungicide protection or other control measures are most critical. For example, soil temperatures recorded in Yuma for at least January and July are not favorable for sporulation of Phytophthora. Furthermore, July temperatures are inhibitory to lesion development on rough lemon inoculated with either P. citrophthora or P. parasitica. On the other hand, temperatures recorded during March-June and September-November are conducive to sporangia formation and disease development.

This report outlines preliminary results of these studies. The completed project should help citrus growers achieve the maximum potential utility from the application of disease control measures.

Table 1. Effect of temperature on sporangium formation by Phytophthora citrophthora and P. parasitica

Temperature	Number of sporangia per agar disk	
	P. citrophthora	P. parasaitica
10 C (50 F)	0	1
15 C (59 F)	0	11
20 C (68 F)	66	27
25 C (77 F)	158	79
30 C (86 F)	83	35
35 C (95 F)	0	0

Table 2. Effect of temperature on canker development on stems of rough lemon seedlings inoculated with Phytophthora citrophthora or P. parasitica

Temperature	Length of canker (mm)*	
	P. citrophthora	P. parasitica
5 C (40 F)	2.9 d	--
10 C (50 F)	23.3 a	0.4 d
15 C (59 F)	22.5 ab	3.0 bc
20 C (68 F)	19.8 ab	3.2 ab
25 C (77 F)	8.4 c	4.5 a
30 C (86 F)	0.7 d	1.3 bcd
35 C (95 F)	0 d	0 d

*Numbers in each column followed by the same letter do not differ significantly (P = 0.05) according to Duncan's multiple range test.