Pathogenicity and Virulence of *Phytophthora capsici* Isolates from Taiwan on Tomatoes and Other Selected Hosts

G. L. HARTMAN, Research Plant Pathologist, Agriculture Research Service, U.S. Department of Agriculture, and Department of Plant Pathology, University of Illinois, Urbana 61801; and Y. H. HUANG, Research Assistant, Asian Vegetable Research and Development Center, P.O. Box 42, Shanhua, Tainan, Taiwan 74199, Republic of China

ABSTRACT

Hartman, G. L., and Huang, Y. H. 1993. Pathogenicity and virulence of *Phytophthora capsici* isolates from Taiwan on tomatoes and other selected hosts. Plant Dis. 77:588-591.

In container experiments, black nightshade, cabbage, cucumber, pepper, potato, tobacco, and tomato plants were inoculated with isolates of *Phytophthora capsici* obtained from either pepper stems or tomato foliage. Inoculum was applied by atomizing foliage or by drenching soil with zoospore suspensions of 1×10^4 zoospores per milliliter. Foliage and stem blight developed on black nightshade, pepper, and tomato plants but not on the other plant species. Tomato and pepper seedlings were inoculated with five isolates of *P. capsici* by spraying foliage or drenching soil. Response to individual isolates varied from no symptoms to 100% blighting and death of foliar-inoculated pepper plants. Regardless of isolate, basal stem blight was not observed on soil-inoculated tomato plants, whereas reaction of pepper plants varied from no symptoms to severe crown lesions causing death. Seedlings of 11 tomato lines foliar-inoculated with one isolate were all susceptible, although the amount of foliage blighted differed among lines. Detached tomato leaves inoculated with a zoospore suspension had more blight at 24 and 28 C than at higher and lower temperatures 3 days after inoculation. In the field, two foliar-inoculated tomato lines developed leaf blight by 3 days after inoculation, and by 14 days, 45–60% of the leaf area was blighted.

Phytophthora capsici Leonian causes blight, root and crown rot, and other symptoms on many hosts. The fungus is soilborne and is difficult to control, partly because of its broad host range and its ability to survive in the soil. On peppers (*Capsicum annuum* L.), the fungus causes cankers on lower portions of stems resulting in plant death (15) and also causes foliar blight and fruit rot (15,23).

In Taiwan, *P. capsici* was first reported on peppers in the Chusan area in 1977 (11). Island-wide surveys in 1981 showed that Phytophthora blight occurred in most hot and sweet pepper fields from May to October during the rainy season (16). In addition to peppers, the fungus has been reported on 13 hosts in Taiwan, including cucumbers (*Cucumis sativus* L.), eggplants (*Solanum melongena* L.), onions (*Allium cepa* L.), and tomatoes (*Lycopersicon esculentum* Mill.) (10).

On tomatoes, *P. capsici* has been reported primarily on roots, lower stems, and fruits (14,24). More recently, *P. capsici* was identified as the causal agent of field-blighted tomato leaves and isolates from peppers and tomatoes were reported to be cross-pathogenic (8). Other than that report, there is a lack of information about the occurrence, pathogenicity, and virulence of *P. capsici* on tomato foliage.

Late blight of tomatoes, caused by *P. infestans* (Mont.) de Bary, was first reported in Taiwan in 1919 (25). Late blight apparently occurs on potatoes and tomatoes in Taiwan, although Ho (10) failed to find *P. infestans* in a survey of *Phytophthora* species and stated that herbarium material collected in 1919 was the last documented occurrence of the fungus in Taiwan. Recently, *P. infestans* was isolated from tomato foliage in Taiwan, and cultures and pathogenicity of *P. capsici* and *P. infestans* were compared (7).

Variability in morphological, cultural, and physiological characteristics as well as in results of tests on pathogenicity and fungicide resistance has been reported for many of the *Phytophthora* species (4). As early as 1972, isolates of *P. capsici* were shown to differ in virulence (20). On pepper seedlings, oospore progeny of pathogenic isolates were shown to vary in virulence (2). Ristaino (22) showed that intraspecific variation of virulence occurred among *P. capsici* isolates from cucurbits and peppers. In studies on host plant resistance, *P. capsici* isolates on pepper were shown to differ in virulence (12,19,21).

P. capsici has been identified by using morphological characteristics, and several taxonomic keys are available to distinguish it from other *Phytophthora* species (5,9,18,27). Recently, a revised species description of *P. capsici* was published (26).

The objective of our study was to compare the pathogenicity and virulence of isolates of *P. capsici* from Taiwan on tomatoes and other selected hosts. A portion of this research was previously reported (6).

MATERIALS AND METHODS

Six isolates of *P. capsici* were used in our experiments. Five isolates were obtained from diseased pepper stems (Pc1, Pc2, Pc3, Pc4, and Pc5) and one isolate (Pc9) from blighted tomato foliage. The fungus was isolated from infected tissue by surface-sterilizing 1- to 2-mm pieces of tissue with 0.525% NaOCl for 3 min, rinsing the tissue in sterile distilled water once for 3 min, then plating the sections on water agar. After 2–3 days, tips of peripheral hyphae from a growing colony were transferred to potato-dextrose agar (PDA). Two additional isolates of *P. capsici* were used for comparison of morphological characteristics. An isolate from pepper was obtained from W. H. Hsieh of National Chung Hsing University and an isolate from eggplant was obtained from H. S. Chang from Academic Sinica in Taiwan. Cultures were maintained on PDA slants at room temperature and were routinely transferred every 3 mo on PDA for maintenance.

To confirm that our isolates were *P. capsici*, we cultured them on V8 agar (17) at 28 C for 7 days in the dark before measuring morphological characteristics. Agar pieces (2 cm^2) with mycelium were cut from colonized areas of the medium, rinsed twice in sterile distilled water, and incubated at room temperature for 2–3 days. Sporangia were dislodged from the agar blocks by agitation, and the length and width of 25 sporangia and the length of 25 pedicels were measured for each isolate. The length: breadth ratio (L:B) of sporangia was calculated. Isolates were identified by comparing our data with known descriptions of *P. capsici* (5,26,27).

Host range. Seedlings (1 mo old) of cabbage (*Brassica oleracea* L. 'KY Cross'), cucumber cv. Chungshih No. 6, pepper cv. Blue Star, tobacco (*Nicotiana tabacum* L. 'Van-Hicks'), and tomato cv. PT4121 planted in 9.5-cm-diameter pots were inoculated by atomizing foliage to the point of runoff or by drenching soil with 50 ml of a suspension of 1×10^4

Accepted for publication 17 February 1993.

This article is in the public domain and not copyrightable. It may be freely reprinted with customary crediting of the source. The American Phytopathological Society, 1993.