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A PHYTOPHTHORA STEM CANKER DISEASE OF PIGEON PEA IN PUERTO RICO

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ABSTRACT

A new stem canker disease of pigeon pea (Cajanus cajan) caused by Phytophthora parasitica was observed in experimental and commercial plantings at several locations in Puerto Rico. The pathogen induced necrotic, often depressed lesions on main stems, branches, and petioles of pigeon pea plants. Foliage above cankers usually wilted and died. Isolates of P. parasitica from eggplant, pigeon pea, and tomato were pathogenic to pigeon pea stems in laboratory and greenhouse inoculation trials. Optimum temperature for growth of the isolates on V-8 juice agar was 30° C. In laboratory studies, isolates infected pigeon pea stem pieces at temperatures of 15-30° C, with an optimum of 25-30° C. Wounding of stem tissues favored infection by all isolates. In greenhouse inoculation studies with five isolates of the pathogen, no infection occurred in 8 days in the absence of wounding. Pigeon pea isolates were more virulent to pigeon pea in laboratory and greenhouse inoculation trials than were isolates from eggplant and tomato.

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Pigeon pea (Cajanus cajan) is the most important food legume cultivated in Puerto Rico. In 1972, over 3000 hectares of pigeon peas were planted on the island, producing an average yield of 1060 kg/ha (3). An important industry has developed around this crop to provide fresh, frozen, and canned pigeon peas for local and export markets.

Diseases and insects can seriously affect the yields and quality of pigeon peas in Puerto Rico. Of several foliar diseases reported to affect this crop on the island (2), those caused by Uredo cajani, Colletotrichum sp., and Phoma sp. (4), are prevalent particularly during the rainy season from May to November (unpublished data).

A new canker disease of pigeon pea in Puerto Rico was first observed infecting numerous plants in experimental fields of the variety Kaki in southern and western Puerto Rico during October and November 1973. Subsequently, the disease was found affecting plants in commercial Kaki plantings at other locations. This variety is cultivated widely by home and commercial growers on the island. Because of the potential importance and increased incidence of the canker disease, studies were initiated to identify the pathogen and to examine its pathogenicity and virulence to pigeon pea.

Disease symptoms were observed on the main stems, branches, twigs, and petioles of infected pigeon pea plants. The dark brown to black cankers (Fig. 1), some up to 6 cm in length, frequently girdled stems, causing branches above infection sites to wilt and die. Branches frequently broke off at cankers. Roots are apparently unaffected.

MATERIALS AND METHODS

Diseased pigeon pea stem pieces were surface sterilized in 0.25% sodium hypochlorite for 5 min, and pieces of tissue were placed on 2% water agar (WA) or potato-dextrose agar (PDA). Fungal cultures were maintained on slants of PDA or V-8 agar (200 ml V-8 juice + 800 ml water + 20 g agar, pH 5.0).



FIGURE 1. Discolored cankers (arrows) on the stems of 'Kaki' pigeon pea plants infected naturally by Phytophthora parasitica.

Fungus isolates used in these studies were collected from pigeon pea stems and fruits of tomato (Lycopersicon esculentum) and eggplant (Solanum melongena). To determine the optimum temperature for mycelial growth, isolates were grown at five temperatures on V-8 agar.

Isolates from pigeon pea, tomato, and eggplant were tested for their pathogenicity to Kaki pigeon pea stem pieces (12-14-cm lengths) and to stems of 17- to 18-week-old plants. In greenhouse and laboratory inoculation tests, a uniform piece of V-8 agar inoculum (3-mm diam) was placed over wounded and unwounded sites on stems or stem pieces. Wounds were made by jabbing the stem once at each site with a sterile needle. The control treatments were identical to those of the inoculated series, except that sterile agar was used in place of fungus inoculum. After inoculation, stem pieces were placed in petri dish moist chambers that were incubated in the dark at 15-30° C. Inoculated plants were incubated in a misting chamber where temperatures ranged from 23-30° C. At the termination of each test, reisolutions were made from inoculated and control inoculation sites on PDA, WA, and V-8 agar.

RESULTS

A phycomycetous fungus was isolated consistently from cankers on stems of naturally infected pigeon peas. Isolates of the pathogen with similar cultural and morphological characters were obtained from eggplant and tomato, crops commonly grown in rotation with pigeon peas in Puerto Rico. Cultures of the pathogen from pigeon pea, eggplant, and tomato appeared to be similar to Phytophthora parasitica Dastur (P. nicotianae var. parasitica (Dast.) Waterhouse) (Dr. G. A. Zentmyer, personal communication). All isolates had papillate sporangia and formed chlamydospores on V-8 agar. These cultural characteristics are typical of P. parasitica. One pigeon pea isolate belonged to the A¹ mating type of P. parasitica. Isolates from tomato and eggplant did not form oospores with either A¹ or A² tester strains. The optimum temperature for growth of the Puerto Rican isolates was 30° C.

Isolates of the pathogen from pigeon pea, tomato, and eggplant were pathogenic to pigeon pea stem pieces at temperatures of 15-30° C, with an optimum of 25-30° C. Lesions developed more rapidly, and were larger, in the wounded than in the unwounded series. The eggplant isolate did not infect stem pieces in the absence of wounding.

Five isolates of *P. parasitica* infected the main stems of Kaki pigeon pea plants. Infection occurred only in the presence of wounding. Isolates from pigeon pea were more virulent to pigeon pea stems than were tomato and eggplant isolates. The cankers that developed on wounded stems were similar to those observed on naturally infected plants.

DISCUSSION

Phytophthora parasitica has a very wide geographical distribution and infects roots, stems, foliage, and fruits of numerous economic crops (7). The fungus, including *P. parasitica* var. *nicotianae*, is reported in Puerto Rico to infect various plant species, such as *Cinchona* spp. (9), *Hibiscus* spp. (1), and *Tephrosia* sp. (6). This is the first report, however, of *P. parasitica* affecting pigeon pea on the island. The fungus was also recovered from rotting tomato and eggplant fruits, and these isolates were pathogenic to pigeon pea stems. These crops are often grown in rotation with pigeon pea in Puerto Rico.

Pal, et al. (5) and Williams, et al. (8) reported pigeon pea in India to be affected by *Phytophthora drechsleri* var. *cajani* and a new species of *Phytophthora*, respectively. The symptoms induced on pigeon pea by *Phytophthora* spp. from India and Puerto Rico were similar. The Indian and Puerto Rican pathogens affected the aerial parts of pigeon pea plants, often causing wilting and death of branches located above cankers. Spread of these fungi seemed to be aided by rainfall that might affect the amount of inoculum that is splash-dispersed into the upper canopy of plants. Because wounding of pigeon pea stems favors infection, leaf scars and other injuries, such as those caused by foliar-feeding insects, may provide susceptible sites for infection by splash-dispersed inoculum of the pathogen under field conditions in Puerto Rico (5, 8).

Several pigeon pea lines were susceptible to *P. parasitica* when inoculated with Puerto Rican isolates of the pathogen in the greenhouse (unpublished data). It is not known whether sources of resistance to *P. parasitica* occur in pigeon pea. Pal, et al. (5) found three of 228 pigeon pea lines with moderate resistance to *P. drechsleri* var. *cajani*. If the canker disease becomes more widespread and damaging in Puerto Rico, it may be necessary to screen the pigeon pea germplasm collection maintained by the University of Puerto Rico to locate sources of resistance to the pathogen that can be used in a breeding program to develop new commercially acceptable, disease-resistant varieties.

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