Phytophthora Stem Blight of Cajanus cajan

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ABSTRACT

A new stem blight disease of *Cajanus cajan* was first observed in experimental plots in India in 1966, and was epiphytotic at New Delhi in 1969. It is capable of causing widespread damage. Symptoms are dark-brown to black lesions which partially or entirely encircle the stem at the base or on branches up to a meter above soil level. Rapid wilting of foliage occurs above the lesion. The pathogen appears to be a new species of *Phytophthora*.

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Additional key words: pathogenesis, host plants, symptomatology, pathogen characteristics.

Cajanus cajan (L.) Millsp. (pigeon pea) is a most important pulse crop in India; 5 million hectares are cultivated per year. In 1966, we found a serious stem blight disease of *Cajanus cajan* at New Delhi and in 1968 at Deeg and Kanpur, Uttar Pradesh. Disease incidence in the field ranged from a trace to 90% infected plants. High incidence was associated with poor surface drainage. In 1969, the disease was epiphytotic in a well-drained field at New Delhi. A species of *Phytophthora* was isolated repeatedly from the diseased plants.

Collar rot (caused by *Pythium aphanidermatum*) (3) and stem canker (caused by *Diplodia cajani*) of pigeon pea (4) have been reported from India, but this is thought to be the first authentic report of a *Phytophthora* sp. causing a disease of pigeon pea. However, its suspected occurrence was reported earlier (6).

Pigeon pea plants are susceptible to Phytophthora stem blight (PSB) from the seedling to the mature fruit stage. Symptoms include rapid wilting of the plant parts above the invasion site (Fig. 1-A); desiccation and upward rolling of leaflets, usually without chlorosis; withering of petioles and small stems; and dark-brown to black necrotic lesions encircling the stem at the base, or up to a meter or more above soil level. Lesions at the plant base often extend 15-20 cm up the stem (Fig. 1-B). Lesions on the upper parts of the plant are on the main stem, branches or petioles (Fig. 1-C), usually have definite margins, and initially have a plane surface which later becomes slightly depressed. Lesions are often centered on a leaf scar, and extend several cm in each direction from the apparent invasion site. Longitudinal cuts into newly formed lesions show brown-to-black discoloration of the bark and cambium, but not the older xylem. Later, the older xylem tissue may become discolored and the stem may break at the lesion site. Gross symptoms resemble those of Fusarium wilt (caused by *Fusarium udum* Butler), and it is possible that PSB has been confused with this disease in the past.

Stem pieces, including portions of lesions and healthy tissue, were washed in running tap water and immersed in 2.6% sodium hypochlorite solution for 1-3 minutes. Small rectangular pieces of tissue about 2-4 mm square and 1 mm in thickness were cut from the lesion margin and placed on potato-dextrose agar (PDA) medium. Fungi growing from the sections were transferred to various media and identified. Frequency of species of *Phytophthora, Fusarium, Macrophomina,* and *Curvularia* was high. Cultures were incubated at 25-30 C.

Pigeon pea plants (cultivar T-21) were inoculated by scraping the stem bark with a sterile blade, placing a disk from a 10-day-old PDA culture on the injury and wrapping it with masking tape. Other plants were inoculated without injuring the stem. Control plants were treated the same as inoculated plants except that the PDA disk was sterile. Ten or more plants were inoculated with each suspected pathogen.

Typical symptoms of stem blight developed when the cultures of *Phytophthora* were placed on abraded or noninjured stems of 1- to 2-meter-tall plants in the greenhouse. Necrotic brown lesions were visible in 2-4 days. When lateral branches were inoculated 10-30 cm from the main stem, the lesion enlarged and also spread to the main stem. Plants inoculated on the main stem usually died in 10 to 14 days.

When 13 small (20-40 cm tall) pigeon pea plants growing in pots in the greenhouse were inoculated on the stem without injury, all developed stem lesions in 5-6 days and died. No lesions developed on control plants.

Pigeon pea is grown here during July-December. The early half of the season is hot and humid, with temperatures varying from 30 to 35 C. Several hundred cultivars were inoculated in the field during two crop seasons. During the early half of the season, when the stem was inoculated with injury nearly all plants developed PSB. When the stem was not injured about 70-80% of the plants developed stem blight. However, with decreasing temperatures in the second half of the season, the kill was marginal and lesions remained confined largely to the point of inoculation.

The pathogenicity of the *Phytophthora* to pigeon pea was also tested by root inoculation in the greenhouse. Pigeon pea seeds were surface sterilized, sown in nonwashed pasteurized sand, and Hoagland's (2) solution added as needed. After 16 days the plants were carefully removed and their roots were washed in running tap water and placed in Hoagland's solution. The roots of plants to be inoculated were immersed for 10 minutes in a distilled water washed mycelial suspension made from 10-day-old culture in potato-dextrose broth. Roots of control plants remained in Hoagland's solution to prevent drying. All plants were then transplanted into pots containing either sand or a sand-loam-compost mixture previously autoclaved at 120 C for 1 hour. All pots were kept on glasshouse benches.

The inoculated plants began wilting in 5-6 days and developed stem lesions at the ground level 8 days after inoculation. All 13 inoculated plants died within 14 days.

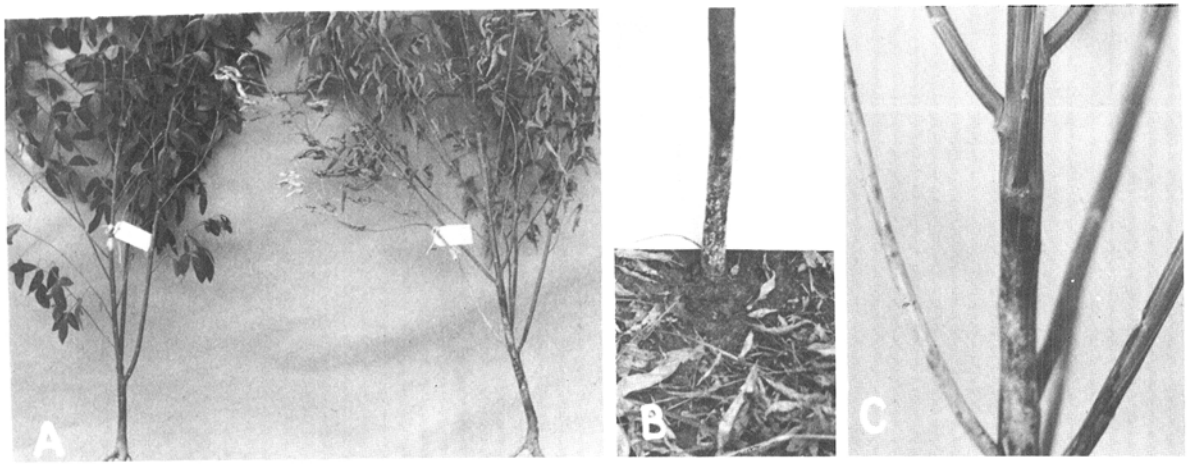

Fig. 1-(A to C). Symptoms of Phytophthora stem blight of *Cajanus cajan* **A)** control (left) and inoculated plants, **B)** typical necrotic lesions at base, and **C)** lesions on upper portion of stem and branches.

The pathogen was reisolated from inoculated plants, from both greenhouse and field experiments.

The following species and cultivars were not susceptible to our cultures of *Phytophthora* when stems of 6- to 8-week-old plants were inoculated: *Phaseolus aureus* Roxb. 'Hybrid 45', *P. vulgaris* L. 'Bountiful', *P. mungo* L. 'Type 65', *Glycine max* (L.) Merr. 'Clark', *Vigna sinensis* (L.) Savi 'Mashad', *Cicer arietinum* L. 'I-144', *Carthamus tinctorius* L. 'Pacific-L', *Xanthium strumarium* L., *Cannabis sativa* L., *Croton sparsiflorus* Morong, *Atylosia scarabaeoides* Bth.

The pathogen grew fast on common laboratory media and covered 10-cm diameter petri plates within 2 days at 30 C. Mycelium was coenocytic when young. Ovoid to obpyriform terminal sporangia were formed on glucose-nitrate-cholesterol media as described by Hendrix (1). Zoospores differentiated within the sporangium and were released one by one upon the dehiscence of the sporangial apex. Oogonia with amphigynous antheridia were formed on the same hyphae on autoclaved *Cynodon dactylon* grass leaves in distilled water, and also on lima bean agar, oatmeal agar, and cornmeal agar. Oospores were single, spherical, light-brown, smooth, and plerotic. Because of intermediate exit pore, 6.6 to 10.0 μm (average 9.4 μm), the present fungus does not fit into any of the six groups proposed by Waterhouse (5). However, due to nonpapillate persistent sporangia and amphigynous antheridia it is considered a member of group 6. Sporangia were 49-82 μm (average 60 μm) in length, which placed it close to *P. cinnamomi, P. cambivora, P. erythroseptica* var. *pisi*, and *P. oryzae,* but it differed from them by lack of botryose mycelial swellings, chlamydospores, protruberances on the oogonial wall, and medial sporangial constriction. The fungus was similar to *P. drechsleri,* but differed by having larger sporangia, undifferentiated sporangiophores and abundant production of sex organs alone on several media. Although it is close to *P. drechsleri,* it appears to be a new species of *Phytophthora.* Cultures have been deposited to Department of Plant Pathology, West Virginia University, Morgantown, U.S.A. Detailed morphology and taxonomic position will be published soon.

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