A Disease of Winged Bean (*Psophocarpus tetragonolobus*) Caused by *Pseudomonas solanacearum* in Malaysia

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ABSTRACT

ABDULLAH, H. 1980. A disease of winged bean (*Psophocarpus tetragonolobus*) caused by *Pseudomonas solanacearum* in Malaysia. Plant Disease 64:798-799.

Psophocarpus tetragonolobus, which has great potential as a source of protein, was infected with *Pseudomonas solanacearum* in Malaysia. Although the pathogen occurs worldwide, this is the first report of this pathogen on this host in Malaysia or elsewhere.

Winged bean (*Psophocarpus tetragonolobus* (L.) DC.), also known as four angled bean and in Malaysia as kacang botor or kacang kelisah, is cultivated in gardens in Malaysia. Recently, interest in the crop has increased because of its potential as a source of protein for human and animal consumption (1). During January until March 1979, in the experimental area of the University of Agriculture farm in Serdang, a new wilt disease that caused death of plants was observed on plants growing in peat soil.

The first symptoms were noticed when plants were about 2 mo old. Plants continued to wilt even when they reached the fruiting stage. The leaves became flaccid, followed by dropping and wilting (Fig. 1). The leaves finally dried and the plants eventually died.

Affected roots were sticky because of slime that exuded when pressed. Sections through the stems and taproots of newly dead plants showed distinct brown discoloration of the vascular system. When cut and immersed in water, stems and roots showed steady streaming of copious whitish exudates of bacterial slime.

Laboratory and glasshouse tests were done to identify the causal organism and determine varietal susceptibility.

MATERIALS AND METHODS

The bacterium in the roots and stems of newly wilted plants was isolated on triphenyl tetrazolium chloride medium (TZC) (7). The plates were incubated at 30 ± 1 C. Pure cultures of the colonies were made on Hayward's (3) sucrose-peptone medium and maintained in approximately 5 ml of sterile tap water for further studies. Cultural and biochemical tests were done to identify the bacterium.

Pathogenicity tests were performed by stem pinprick inoculation of 1-mo-old seedlings using a 48-hr culture of the bacterium grown on sucrose-peptone medium or by root injury of 3-wk-old seedlings. This was done by cutting the roots on either side of the plants approximately 3–4 cm from the stem and 5–6 cm deep with a sharp sterilized scalpel. Fifty milliliters of the bacterial inoculum prepared by Jenkins and Kelman's method (5) and containing approximately 2.6×10^9 bacteria/ml were poured into the cut surface.

For each of the techniques, control plants were inoculated with sterile distilled water. Plants of the varieties TPt 4 Nigeria, UPS 45, and UPS 122 Papua, New Guinea, were used.

The bacterium was also inoculated onto tomato (*Lycopersicum esculentum* Mill.) and chili (*Capsicum annuum* L.) by both inoculation methods.

Fifteen cultivars of winged bean were also tested for their susceptibility to *Pseudomonas solanacearum*. The plants were planted in 10 × 15 cm planting bags, with 10 replications of five bags per replicate. Treatments were arranged in a completely randomized design. Plants were root-inoculated at 3 wk of age as described above. Readings were taken at weekly intervals for 5 wk after inoculation. Disease rating and conversion to disease index were done as described by Winstead and Kelman (11). The data were analyzed statistically by the new Duncan multiple range test (10).

RESULTS AND DISCUSSION

The bacterium appeared on TZC plates within 48 hr. Colonies were fluidal white and some developed light pink to red centers. On nutrient agar the colonies were rounded with entire margins, were opaque and cream colored but became dark brown with age. On TZC medium containing 0.1% L-tyrosine but without tetrazolium salts (2), varying amounts of brown diffusible pigments were produced after 48–72 hr. No fluorescent pigment was observed on King's medium B (8), and no growth was observed on medium D_4 of Kado and Haskett (6).

Oxidase activity was detected in a 48-hr culture of the organism grown on Kovacs' sucrose-peptone medium (9). The bacterium was able to utilize citrate but not malonate, did not hydrolyze starch, and did not produce indole and hydrogen sulfide after incubation for 48–96 hr. Oxidation of selected carbohydrates and denitrification tests, performed as described previously (4), indicated that the bacterium was in biotype 3 of *P. solanacearum*.

Control plants showed no wilting. Both inoculation techniques resulted in successful infection of plants. Plants with wilting were examined for bacterial

Fig. 1. Initial symptoms of *Pseudomonas solanacearum* on winged bean plants: wilting and epinasty of leaves.

0191-2917/80/08079802/$03.00/0

exudate from cut portions of affected roots, and the bacterium was reisolated. Tomato and chili plants showed typical wilting.

Based on symptoms on inoculated hosts and on cultural and biochemical characteristics, the organism isolated was identified as *P. solanacearum* E. F. Smith. This pathogen has not been previously recorded on winged bean.

All cultivars from Papua, New Guinea (UPS 89, UPS 47, UPS 102, UPS 122, UPS 31, UPS 32, UPS 45, and UPS 99) were susceptible except UPS 121, which was moderately susceptible, and UPS 132, which was resistant. The Indonesian cultivar UGM 1 was moderately resistant. Other resistant cultivars were the Indonesian cultivar UGM 19, a local (Malaysian) cultivar, and two lines of Northern Thailand and Burmese origin.

ACKNOWLEDGMENTS

I am grateful to G. E. Eagleton for providing the seeds and the samples from his research plots, to G. Varghese and A. Kelman for advice, and to the Commonwealth Mycological Institute, England, for confirmation of the isolates and their biotypes.

LITERATURE CITED

1. ANONYMOUS. 1975. The winged bean, a high protein crop for the tropics. National Academy of Science, Washington, DC.
2. FRENCH, E. R., and L. SEQUEIRA. 1970. Strains of *Pseudomonas solanacearum* from Central and South America. A comparative study. Phytopathology 60:509-512.
3. HAYWARD, A. C. 1960. A method for characterizing *Pseudomonas solanacearum*. Nature 186:405.
4. HAYWARD, A. C. 1964. Characteristics of *Pseudomonas solanacearum*. J. Appl. Bacteriol. 27(2):265-277.
5. JENKINS, S., and A. KELMAN. 1976. Techniques for the study of *Pseudomonas solanacearum*. Pages 143-147 in: Proc. 1st Int. Conf. & Workshop on Ecology & Control of Bacterial Wilt Caused by *P. solanacearum*. North Carolina.
6. KADO, C. I., and M. G. HESKETT. 1970. Selective media for isolation of *Agrobacterium, Corynebacterium, Erwinia, Pseudomonas* and *Xanthomonas*. Phytopathology 60:969-976.
7. KELMAN, A. 1954. The relationship of pathogenicity in *Pseudomonas solanacearum* to colony appearance on a tetrazolium medium. Phytopathology 44:693-695.
8. KING, E. O., W. K. WARD, and D. E. RANEY. 1954. Two simple media for the demonstration of pyocyanin and fluorescein. J. Lab. Clin. Med. 44:301-307.
9. KOVACS, N. 1956. Identification of *Pseudomonas pyocyanea* by the oxidase reaction. Nature 178:703.
10. LeCLERG, E. L., W. H. LEONARD, and A. G. CLARK. 1962. Field Plot Technique. Burgess Publishing Co., Minneapolis, MN. 373 pp.
11. WINSTEAD, N. N., and A. KELMAN. 1952. Inoculation techniques for evaluating resistance to *Pseudomonas solanacearum*. Phytopathology 42:628-634.