BACTERIAL WILT (PSEUDOMONAS SOLANACEARUM) OF STYLOSANTHES HUMILIS IN THE NORTHERN TERRITORY

SUSAN J. ALDRICK*

ABSTRACT

Bacterial wilt due to Pseudomonas solanacearum *has been found in some* Stylosanthes humilis (*Townsville stylo*) *pastures in the northern, higher rainfall region of the Northern Territory. The disease was found each year during the mid-wet season, but usually caused only moderate damage to affected pastures.*

It is a new disease record for this annual tropical legume and also appears to be the first record of P. solanacearum *infecting a plant of the genus* Stylosanthes.

INTRODUCTION

The bacterium *Pseudomonas solanacearum* (Erw. Smith 1896) Erw. Smith 1914, causes systemic wilting diseases in a wide range of plants, and is found in most tropical sub-tropical, and warm countries, including Australia (Kelman 1953). A number of economically important crop plants is susceptible to the pathogen, particularly some members of the families *Solanaceae*, *Leguminosae* and *Musaceae*. In the Northern Territory *P. solanacearum* has previously been recorded in several solanaceous crops (Heaton and Benson 1968), on peanut, and also in two ornamental species from the family *Compositae* (Pitkethley 1970). This note concerns the occurrence of bacterial wilt due to *P. solanacearum* in the annual legume Townsville stylo (*Stylosanthes humilis*) in the Northern Territory. It is a new disease record for this important tropical pasture species, and appears to be the first record of *P. solanacearum* on a host plant of the genus *Stylosanthes*.

FIELD OBSERVATIONS

An unidentified wilting disease of Townsville stylo pastures was first noticed during the 1965-66 wet season (J. B. Heaton, unpublished reports), and it has been observed in the mid-wet season (February) each year since then. An outbreak of the disease in February 1969 led to the investigations outlined in this article.

The disease has been found at sites located approximately 10, 30, 45, and 60 miles south of Darwin. The average wet season rainfalls of the surrounding areas vary from 56 in. at Darwin to 47 in. at Adelaide River (72 miles south of Darwin), and in each case January and February are the months of highest rainfall. The occurrence of the disease was not restricted to a particular soil type or situation, and it was found to recur at certain sites which apparently had little in common. Affected pastures had been established for several years, in one case on cleared, cultivated flat land, and in another among uncleared native vegetation on a stony slope.

Symptoms were most obvious in vigorous, dense stands of Townsville stylo at the flowering stage. Occasional plants wilted suddenly, the leaves became dry and silvery green, and were later shed as the plant died. In the early wilting stage the stem and roots of the plant appeared normal, with no external lesions or rotting. In newly dead plants however the root epidermis and the fibrous roots were easily peeled or rubbed off, leaving a slimy surface which blackened on drying. Near the end of the

* Primary Industries Branch, Northern Territory Administration, Darwin, N.T., Australia.

wet season the wilting symptoms were often masked by signs of water stress or senescence, but diseased plants could still be detected on close examination.

It was difficult to assess the loss of production due to this disease in the 1969 wet season because wilted plants were usually scattered singly throughout the pasture, although some affected pastures also had numerous small patches of dead, leafless stalks, which may have been foci of infection. However, an outbreak of the disease in 1967 caused yellowing, wilting, and death of plants in 10-15% of the affected area (J. B. Heaton, unpublished report). In most cases the disease symptoms had caused some concern to the landholders, who then drew attention to its occurrence.

THE CAUSAL BACTERIUM

Isolation

Sections through the stems and main roots of wilted plants revealed a distinct brown discoloration of the vascular strands. Thin longitudinal sections of stem or root tissues when mounted in water and examined under the microscope showed profuse streaming of bacteria, some of which were motile, from the discolored vessels. A copious whitish bacterial exudate could also be observed when the cut end of the main stem of an infected plant was immersed in water. A bacterium was consistently isolated, usually in pure culture, from the stem or root exudates of newly wilted plants.

Morphology

Small to medium sized colonies were formed on nutrient agar after two to five days incubation at 28°C. Colonies were rounded with an entire margin, a smooth, glistening surface, and were of an opalescent cream colour, soon becoming streaked with brown and finally turning darker brown. The colonies had a slimy, viscid consistency on first isolation and tended to spread and coalesce on the agar surface.

The isolated bacterium was a Gram negative, short, rounded bacillus, measuring 0.3-0.5 $\mu \times 0.8$-1.5 μ, and occurring singly or in pairs. Bacteria in smears of tissue exudates stained with carbol fuchsin showed distinct bipolar staining and were somewhat shorter and more rounded than those from nutrient agar culture.

Pathogenicity

In March 1969 one of the bacterial isolates was inoculated onto potted Townsville stylo plants by either (i) pouring bacterial suspension (5 ml per plant) into the soil around the roots, or (ii) applying a small amount of bacterial culture to a wound made by cutting off a lower branch. The inoculated plants, and uninoculated controls, were kept well watered, and were exposed to day temperatures of 80-90°F.

No typical wilting symptoms were produced in any of the inoculated plants after four weeks, so plants from each treatment were then sampled at weekly intervals and examined for vascular infection.

Four to six weeks after inoculation, internal symptoms were found in three out of five plants inoculated by method (i) and in two out of five inoculated by method (ii). The affected plants showed brown discoloration in some of the vascular tissue, which exhibited bacterial streaming and from which a bacterium resembling the original isolates was cultured in each case. In the test plants with no visible vascular discoloration however, no bacteria could be observed or cultured. No vascular discoloration or bacterial streaming was visible in the control plants, and no bacteria were isolated.

Identity

The preliminary results showed that the bacterium could proliferate in Townsville stylo plants and that it was likely to be the causal agent of the wilting disease. The bacterial morphology and the colonial characteristics indicated that it was a species of *Pseudomonas*, and the disease symptoms were typical of *P. solanacearum* infections.

Cultures of the bacterium isolated from a field case of wilt and from an experimentally infected plant were subsequently identified by the Commonwealth Mycological Institute, England, as *P. solanacearum* Biotype 4.

CONCLUSIONS

This disease of Townsville stylo appears as a typical wilt caused by infection of the vascular tissue by *P. solanacearum*.

The pathogen is known to be widely established in the higher rainfall region of the Northern Territory, and may even be a member of the natural microflora of some of the soils. Diseases due to this bacterium have been recorded many times from the Darwin and surrounding districts and from several coastal and island settlements. Also, Biotype 4 of *P. solanacearum*, as isolated from Townsville stylo, was previously implicated as the cause of bacterial wilt in tomatoes (Heaton and Benson 1968). Infection by this bacterium in Townsville stylo sometimes occurred on soil that had never been cultivated or cropped, suggesting that the pathogen was either indigenous to the area or was introduced by infected seed. Although Kelman (1953) considered that *P. solanacearum* was not likely to be transmitted by seed, the possibility of the disease being spread in Townsville stylo seed, particularly in uncleaned samples containing plant trash, cannot be overlooked.

The extensive review by Kelman (1953) showed that *P. solanacearum* could be found in a very wide range of soil types; relatively high temperatures (70-90°F or higher) and high soil moisture content were said to be important factors in the initiation and severity of the disease. Conditions during much of the Northern Territory wet season should therefore favour bacterial wilt in susceptible hosts.

At present bacterial wilt does not seem to be an important or very widespread disease of Townsville stylo pastures in the Northern Territory. However, the severity of the disease in areas where the pathogen is either established or indigenous may be influenced by local and seasonal conditions, and by the stage of growth at which the plants become infected.

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