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Control of Southern Bacterial Wilt caused by *Pseudomonas solanacearum* (Smith) on Tomatoes in the Caribbean

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Southern bacterial wilt caused by *Pseudomonas solanacearum*, E.F. Smith, a soil borne bacterial pathogen, is one of the most threatening plant diseases in the Caribbean, and elsewhere in the hot humid tropics. The disease affects all solanaceous crops; eggplant, pepper, tomato and tobacco. No one control measure is effective against this disease, but varietal resistance combined with adequate cultural practices is effective. Though some soils were known to be resistant (black clay vertisols), the disease appeared recently in such soils. In 1966, a local wild tomato, CRA 66, was found resistant to the disease in Guadeloupe. CRA 66 was used in breeding for resistance which led to the release of cv. Caraibo, whose resistance has been assessed worldwide. Other resistant sources, such as PI 126408, Hawaii 7996 and introductions from Taiwan (AVRDC) and Japan, are used in our current breeding program to ensure stability of the resistance.

Keywords: Tomato; *Pseudomonas solanacearum*; Cultural practices; Genetic control

Introduction

Of all diseases found on solanaceous crops, and on tomatoes in particular, Southern bacterial wilt is the most widespread and the most threatening in the Caribbean. Yet this disease is still unknown by many growers and often confused with other diseases such as *Fusarium* or *Verticillium* wilts. Due to the extent and severity of *Pseudomonas* it is important to find effective means of control. The only one appears to be varietal resistance associated with appropriate cultural practices. For this reason, research is going on in several countries to breed *Pseudomonas* resistance in various solanaceous crops; the most extensive work being done on tomatoes.

Causal agent of bacterial wilt

Pathogen and hosts

Bacterial wilt was first described by E. F. Smith almost a century ago and the causal agent named as the bacterium *Pseudomonas solanacearum* (Smith, 1896). Three races of *P. solanacearum* are described:

Race 1, which affects solanaceous crops and other plants;
Race 2, which affects bananas and Heliconia and
Race 3, which affects potatoes and tomatoes.

Different pathotypes are known in each race. Differences in reaction to the pathogen according to locations can be attributed to differences in strains of the pathogen; thus, cultivar Floradel is considered as susceptible in Guadeloupe (100% mortality). This susceptibility has been confirmed in Florida by Sonoda (1977), but the

variety is moderately resistant in Taiwan. Saturn and Venus, which are resistant in North Carolina, have shown 57% and 60% mortality respectively in Florida.

Infection and symptoms

The soilborne pathogen penetrates the roots during the emergence of young radicles or when the roots are damaged mechanically. The presence of nematodes enhances the penetration. The bacteria can also be propagated from plant to plant by clipping or by any inappropriate cultural practices such as moving of infested plants or infested soil, use of irrigation water, tools or machinery that were in contact with infested soil or plants. Nothing is known regarding the possibility of seed transmission. After penetration, the bacteria multiplies in the xylem vessels producing a browning which can be observed on a section of the stem. The youngest leaves become flaccid and wilt. On the bottom of the stem many protuberances appear. These signs may sometimes be attributed to Fusarium wilt. Diagnosis of the disease can be made by cutting off the stem after uprooting, and by dipping the root in a container full of water. On the cut section of the stem, a bacterial exudate of a white creamish colour will be seen. A sero-agglutination test can be applied directly to this exudate to confirm the diagnosis (Digat and Escudie, 1967).

Control Methods

Cultural practices

Development of the disease is closely related to cultural conditions. In conditions which favour a good physiological state of the plants, the infection remains latent and there are few symptoms. The infected plants constitute at this time a source of inoculum able to spread very rapidly in less favourable conditions. Several factors determine the spread of the disease, (Kelman, 1953).

Ferralitic soils (pH 5.5 - 6.5) are the most easily contaminated; very acid soils (pH 4.5 to 5.5) are less susceptible and calcareous soils (limestone/coral soils as found in Barbados, Grande-Terre in Guadeloupe and Antigua with pH greater than 7) are considered resistant (Berniac & Beramis, 1973). However, pH is not the main factor *per se*, but its association with varying calcium levels. The disease is increased by high temperature, rainfall and humidity.

Repetitive planting of solanaceous crops on the same soil leads to soil exhaustion and accumulation of inoculum in the soil to the point where even resistant varieties can be affected. Chemical control of *Pseudomonas* is difficult, costly and not very effective. The most effective means of control is crop rotation in association with soil improvement through mineral liming and organic amendments. Grafting tomatoes onto resistant solanaceous rootstocks is also effective. However, none of these means of control are fully satisfactory. It is necessary to associate them with resistant varieties.

Genetic control

Attempts in Florida to find resistant varieties of tomato date back to 1898 (Rolphs, 1898). In many areas of the world, including North Carolina, Florida, Guadeloupe, Martinique, Puerto Rico, Taiwan, Japan, South Africa and Australia, breeding work is going on to obtain

resistant varieties (Anais, 1986; Kaan, 1977). Some have already been successful. The most common procedure is inoculation with the bacteria and testing in the field.

The genetic type of resistance most commonly found is a polygenic additive type such as in Caraibo derived from CRA66. However, dominant resistance is suspected in the Hawaii 7996 line.

Conclusion

With the breeding work going on, more and more resistant tomato varieties will be made available to the grower, but to ensure success good cultural practices must be employed.

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