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Data Sheets on Quarantine Pests

Pantoea stewartii subsp. *stewartii*

IDENTITY

Name: *Pantoea stewartii* subsp. *stewartii* (Smith) Mergaert *et al.*
Synonyms: *Erwinia stewartii* (Smith) Dye
Xanthomonas stewartii (Smith) Dowson
Taxonomic position: Bacteria: Gracilicutes
Common names: Stewart's disease, bacterial wilt (English)
Maladie de Stewart, flétrissement bactérien (French)
Notes on taxonomy and nomenclature: Analysis of protein gel electrophoresis patterns and DNA-DNA hybridisation studies has led to a revision of the genus *Erwinia* (Mergaert *et al.*, 1993) and all strains of the species *E. stewartii* were assigned to *Pantoea stewartii* subsp. *stewartii*. The study of phytopathogenic members of the family Enterobacteriaceae is far from complete and further revision is possible.
Bayer computer code: ERWIST
EPPO A2 list: No. 54
EU Annex designation: II/A1

HOSTS

The principal host is maize, especially sweetcorn, but also dent, flint, flour and popcorn cultivars. The bacterium also attacks other Poaceae cultivated for fodder in North America: *Tripsacum dactyloides*, *Zea mexicana*. It has been artificially inoculated to *Coix lachryma-jobi*, *Setaria pumila* and *Zea perennis*. Various poaceous weeds have been shown to act as symptomless carriers of the bacterium.

In the EPPO region, maize, grown throughout most of the region except the north, is the only host crop concerned.

GEOGRAPHICAL DISTRIBUTION

P. stewartii subsp. *stewartii* is indigenous to America and has been introduced to other parts of the world with maize seed.
EPPO region: Reported from but not established in Austria, Greece, Poland, Romania and Russia (European). The record for Yugoslavia appearing in the first edition of the EPPO data sheet (OEPP/EPPO, 1978) is an error (Hadzistevic, 1986).
Asia: Found in the past but not established in China (Henan), Malaysia (Peninsular), Thailand, Viet Nam.
North America: Canada (Alberta, British Columbia, Ontario), Mexico, USA (Connecticut, Illinois, Indiana, Iowa, Kentucky, Louisiana, Missouri, Nebraska, New York, North Dakota, Ohio, Pennsylvania, Wisconsin).
Central America and Caribbean: Costa Rica, Puerto Rico.
South America: Brazil (São Paulo), Guyana, Peru (coast).
EU: Present.

Distribution map: See CMI (1987, No. 41).

BIOLOGY

P. stewartii subsp. *stewartii* may be transmitted in seed, and occasionally overwinters in soil, manure or maize stalks. However, these means are of little importance compared with the insect vectors which harbour the pathogen during hibernation, and transfer the bacterium from one plant to another during the growing season. The chief agent responsible for overwintering and spread in the USA is *Chaetocnema pulicaria*. This beetle migrates and can be carried over considerable distances in air currents (Elliott & Poos, 1940). Once the bacteria have been acquired, the insect can carry and transmit them throughout its life. Other vectors include *Diabrotica undecempunctata howardi* (both adult and larva), *Chaetocnema denticulata*, larvae of *Delia platura*, *Agriotes mancus*, *Phyllophaga* sp. and larvae of *Diabrotica longicornis*. Seedlings may be directly infected from the seed or, particularly after mild winters, from insect vectors carrying the bacterium. Secondary spread of the pathogen then occurs throughout the summer.

In sweetcorn the bacteria, which primarily colonize the vascular tissue, are found in roots, stalks, leaf blades and sheaths, tassels, cobs, husks and kernels. Dent maize kernels are rarely infected except when disease levels are high and the cultivar is susceptible.

Mineral nutrition influences disease intensity, high ammonium N and P levels increasing susceptibility and high Ca and K tending to decrease it. High temperatures aggravate disease severity. Disease incidence each season is correlated with the temperatures of the previous winter (through their effect on the insect vector) and this criterion can be used in forecasting infection levels. In general, the disease is not likely to be severe if the sum of the average temperatures for December, January and February is less than 20-24°C. If the sum of the average temperatures for these three months is 32-38°C, the disease is likely to be severe because of increased survival of the vectors.
For more information, see Elliott (1941), Bradbury (1967), Pepper (1967), Robert (1967), Heichel *et al.* (1977), Shurtleff (1980).

DETECTION AND IDENTIFICATION

Symptoms

Plants may be destroyed at the seedling stage or, if infected later, may reach a reasonable size.

On sweetcorn

Susceptible hybrids wilt rapidly; leaves develop pale-green to yellow, longitudinal streaks, with irregular or wavy margins, which may extend the length of the leaf. These streaks dry out and turn brown. Premature and bleached tassels are produced which wither and die before the rest of the plant. Cavities may form in the stalk pith near the soil-line of severely infected plants. Bacteria may exude in tiny droplets on the inner face of the husk. Small, irregular, water-soaked spots, which appear on the inner and outer husks, later become dried and darkened. The bacterium penetrates the seed deeply, but not the embryo.

On dent maize

Hybrids are generally resistant to the wilt phase, but are susceptible to leaf blight. Usually after tasselling, short to long, irregular, pale-green to yellow streaks, which originate from feeding marks of the corn flea beetle (*Chaetocnema pulicaria*), appear on the leaves. The treaked areas and sometimes whole leaves become straw-coloured. The weakened plants are more susceptible to stalk rots.

The disease may occur or be confused with other leaf blights: bacterial leaf blight, *Acidovorax avenae* subsp. *avenae*, causes stripes or spots which are long and narrow and

have reddish-brown edges. Leaves are easily shredded and there may be an associated rot of the upper stalk. Bacterial stripe, *Burkholderia andropogonis*, produces long, narrow, parallel, olive-green to yellow, water-soaked lesions. The upper leaves may be almost bleached. Northern corn leaf blight, *Setosphaeria turcica*, gives rise to large, spindle-shaped, greyish-green to tan spots. Southern corn leaf blight, *Cochliobolus heterostrophus*, and corn leaf spot, *C. carbonum* (EPPO/CABI, 1996), cause well-defined, tan to brown spots.

For more information, see Elliott (1941), Pepper (1967), Robert (1967), Shurtleff (1980).

Morphology

P. stewartii subsp. *stewartii* is a yellow, non-motile, non-sporing, Gram-negative rod, 0.4-0.7 x 0.9-2.0 µm, occurring singly and in short chains (Bradbury, 1967). Colonies on nutrient-glucose agar are cream-yellow, lemon-yellow or orange-yellow and flat, raised or convex, respectively.

Detection and inspection methods

If stems or leaves of infected maize plants are cut across, masses of yellow bacterial slime will exude. If sections cut through a leaf lesion are placed in a drop of water on a slide and viewed under a microscope (x 100 plus), masses of bacteria will be seen oozing from the vascular tissues. An EPPO quarantine procedure based on ELISA, immunofluorescence, biochemical tests and pathogenicity tests is in preparation.

MEANS OF MOVEMENT AND DISPERSAL

The insect vectors only carry the disease locally, and are very unlikely to be carried on traded plants. So the principal pathway for international movement is in or on infected seeds.

PEST SIGNIFICANCE

Economic impact

Bacterial wilt is the most serious disease of sweetcorn, causing yield reduction and susceptibility to stem rot. Serious losses did not arise in the USA until 1930-1931, although the disease had already been known for some 30 years previously. Heavy losses were then reported in the following two seasons. Suparyono & Pataky (1989a; 1989b) have recently analysed the effect of infection on yield.

Control

Control can be achieved by using resistant cultivars and disease-free seed, as well as by early spraying with insecticides to reduce vector populations.

Phytosanitary risk

EPPO considers *P. stewartii* subsp. *stewartii* as an A2 quarantine pest (OEPP/EPPO, 1978) and it is also of quarantine significance for APPPC and IAPSC. Serious damage occurred in Italy (Veneto region) prior to the 1950s in connection with the use of seed imported from the USA. The disease has not apparently persisted in Italy to any significant extent, presumably because the North American vectors are not present and local insect species are inefficient as vectors. Accordingly, if a field planted with imported maize seed contaminated with *P. stewartii* subsp. *stewartii* is not used for maize for several years, the disease disappears. There have been isolated outbreaks in Italy in recent years (FAO, 1983; Mazzucchi, 1984), presumably associated with new imports of seeds. Reports from other EPPO countries similarly refer to appearance followed by failure to establish. The

seriousness of the disease, and the fact that measures can probably be taken to prevent it from establishing once introduced, make it important and worthwhile to continue excluding it from the EPPO region.

PHYTOSANITARY MEASURES

EPPO recommends (OEPP/EPPO, 1990) growing-season inspection of seed crops as a specific quarantine requirement, but is currently evaluating seed test methods.
Guo *et al.* (1987) have shown that the bacterium disappears from maize seed after 200-250 days at 8-15°C and after 110-120 days at 20-25°C, and recommend storing seed under conditions suitable for eliminating *P. stewartii* subsp. *stewartii*. Seed treatment with chemicals is not effective.

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