EPPO Datasheet: *Pantoea stewartii subsp. stewartii*

Last updated: 2022-02-24

IDENTITY

more photos...

Preferred name: *Pantoea stewartii subsp. stewartii*
Authority: (Smith) Mergaert, Verdonck & Kersters
Taxonomic position: Bacteria: Proteobacteria: Gammaproteobacteria: Enterobacterales: Erwiniaceae
Other scientific names: *Aplanobacter stewartii* (Smith) McCulloch, *Bacterium stewartii* (Smith) Smith, *Erwinia stewartii* (Smith) Dye, *Pseudomonas stewartii* Smith, *Xanthomonas stewartii* (Smith) Dowson
Common names: Stewart's disease, Stewart's wilt of maize, bacterial leaf blight of maize, bacterial wilt of maize, jackfruit bronzing
view more common names online...
EPPO Categorization: A2 list
view more categorizations online...
EU Categorization: A1 Quarantine pest (Annex II A)
EPPO Code: ERWIST

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 transfer of *E. stewartii* to the genus of *Pantoea* and the creation of two separate subspecies within *P. stewartii*, the *Pantoea stewartii* subsp. *stewartii* and *Pantoea stewartii* subsp. *indologenes***.** It is important to distinguish these two subspecies as only subspecies *stewartii* can cause Stewart's wilt.

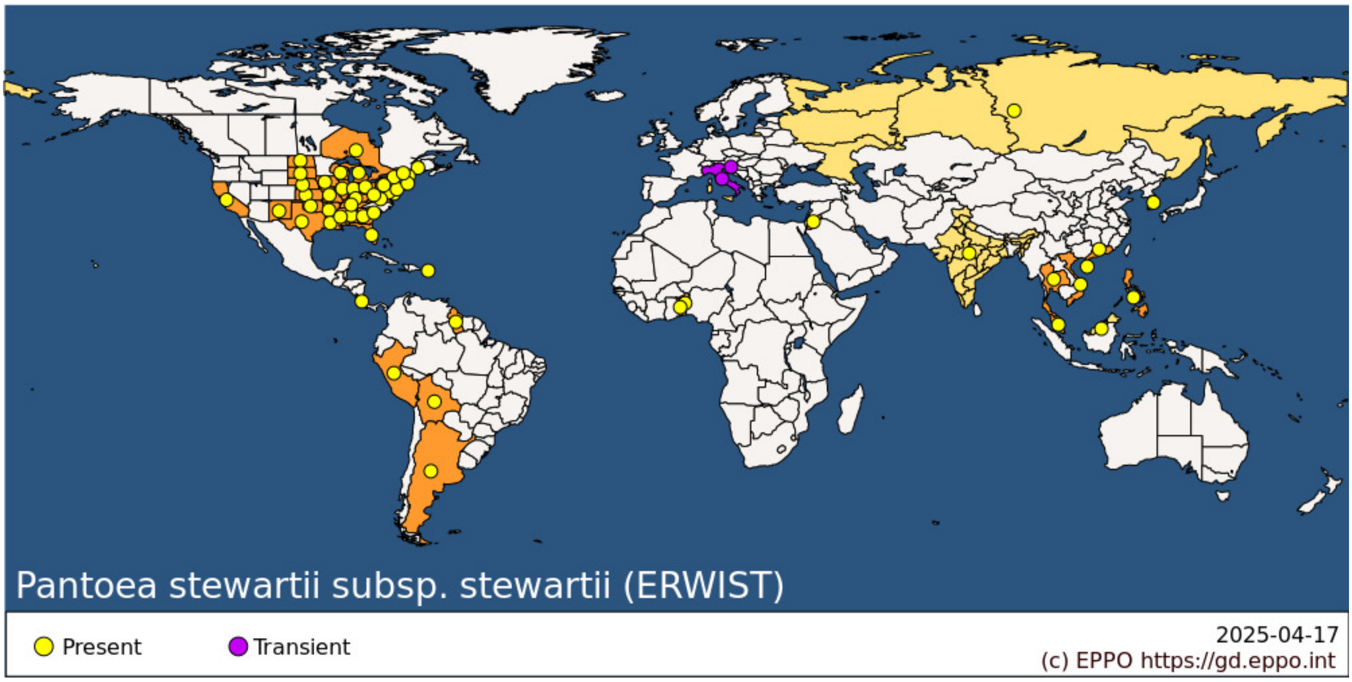
HOSTS

The main host is *Zea mays* (maize), especially *Zea mays* subsp. *saccharata* (sweetcorn), but also *Zea mays* subsp. *indentata* (dent), *Zea mays* subsp. *indurata* (flint), *Zea mays* subsp. *amylacea* (flour) and *Zea mays* subsp. *everta* (popcorn). The bacterium has also been reported to have been isolated from other plant species or to infect plant species when artificially inoculated, however in all cases reliable scientific evidence is missing to prove that the strains isolated from these plant species can be identified as *Pantoea stewartii* subsp. *stewartii* or can cause vascular wilt and leaf blight (EFSA, 2018). These species are *Agrostis gigantea, Artocarpus heterophyllus, Coix lacryma-jobi, Dactylis glomerata, Digitaria (crabgrass), Dracaena sanderiana, Oryza sativa, Panicum capillare, Panicum dichotomiflorum, Poa nemoralis, Poa pratensis, Setaria lutescens, Sorghum sudanense, Tripsacum dactyloides, Triticum aestivum* (CABI, 2020; Poos, 1939).

Host list: *Artocarpus heterophyllus*, *Dracaena sanderiana*, *Oryza sativa*, *Poaceae*, *Saccharum sp.*, *Setaria pumila*, *Tripsacum dactyloides*, *Zea mays*, *Zea mexicana*

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: Italy (mainland), Jordan, Russian Federation (the), Slovenia
Africa: Benin, Togo
Asia: China (Guangdong, Hainan), India, Jordan, Korea, Republic of, Malaysia (West), Philippines, Thailand, Vietnam
North America: Canada (Ontario), United States of America (Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia, Wisconsin)
Central America and Caribbean: Costa Rica, Puerto Rico
South America: Argentina, Bolivia, Guyana, Peru

BIOLOGY

P. stewartii subsp. *stewartii* can be transmitted with seed, but the seed-to-seedling transmission rate of the pathogen is very low (Khan *et al.*, 1996; Block *et al*., 1998.; Michener *et al*., 2002). The bacterium also occasionally overwinters in soil, manure, or maize stalks. However, the main mode of spread of the pathogen is with insect vectors. The main vector in the USA is *Chaetocnema pulicaria*. The beetles overwinter as adults and can carry the bacteria in their gut throughout their life. They migrate and can be carried over considerable distances in air currents (Elliott & Poos, 1940). Other vectors such as *Chaetocnema denticulata*, *Diabrotica undecimpunctata howardi* (both adult and larva), *Diabrotica longicornis and Phyllophaga* sp are considered as inefficient, or non important vectors under field conditions (Rand and Cash, 1933; Poos, 1936; Elliott and Poos, 1940).

Delia platura and *Agriotes mancus* proved to be able transmit *Pantoea stewartii* subsp. *stewartii* to maize in cage experiment, only for a few weeks, therefore the bacterial cells are not able to overwinter in the organism of these insects (Frutchey, 1936). Insect species present in Italy (where outbreaks were recorded prior to the 1950s) were considered as inefficient vectors (EPPO, 1997), however recent outbreaks (EPPO, 2018, 2020 a & b and 2021) show that further investigation on possible vectors in the EPPO region is needed.

Seedlings are mainly infected via vector feeding (or to a much lesser extent via seed transmission). 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. This criterion is used in forecasting models in USA to predict disease risk and infection levels. If the average daily temperature during December, January and February is above freezing, the insect vector survives, and the disease may be severe when susceptible hybrids are grown. If the average daily temperature is less than –3 °C, flea beetles are less likely to survive, and it is unlikely that the disease will be severe (Boewe, 1949; Castor *et al.*, 1975).

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 be confused with other leaf blights (EPPO 2016b): Goss's bacterial wilt and leaf blight, *Clavibacter michiganensis* subsp. *nebraskensis* which can be very similar to Stewart's wilt; 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*, cause well-defined, tan to brown spots. Leaf blotches and spots and brown stalk rot of maize, caused by *Pantoea ananatis* can also be confused with Stewart's wilt.

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

Morphology

P. stewartii subsp. *stewartii* is 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 Diagnostic Protocol, based on isolation, IF (immunofluorescence cell staining), ELISA (enzyme-linked immunosorbent assay), molecular tests (conventional and real-time PCR, barcoding), and fatty acid profiling is available for the detection and identification of the pathogen (EPPO, 2016b). ELISA-based seed health testing method is recommended in the USA to test maize seed lots (Lamka *et al*., 1991; NSHS, 2021).

PATHWAYS FOR MOVEMENT

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

PEST SIGNIFICANCE

Economic impact

Bacterial wilt can be a serious disease of sweetcorn, causing yield reduction and susceptibility to stem rot. Heavy losses were not reported in the USA until 1930-1931, although the disease had already been known for approximately 30 years. Losses can range from 40 to 100 % if susceptible sweetcorn hybrids are grown and the plants are infected at the seedling stage (Pataky *et al.*, 1995). The development and use of resistant and moderately resistant hybrids reduced the yield losses to the minimum (Pataky, 2003).

Control

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

Phytosanitary risk

Serious damage occurred in Italy (Veneto region) prior to the 1950s in connection with the use of seed imported from the USA. There have been isolated outbreaks in the EPPO region, first in Italy in 1980’s (FAO, 1983; Mazzucchi, 1984), presumably associated with new imports of seeds, and later in other countries e.g. Slovenia (EPPO, 2020b), Ukraine (EPPO, 2018). In all these countries eradication measures have been implemented. Given the serious damage reported for this disease, it is important to continue excluding it from the EPPO region.

PHYTOSANITARY MEASURES

Seeds should originate in areas free from *Pantoea stewartii* subsp. *stewartii* or consignments of seeds should be tested (EPPO, 2016a). Seed testing methods are available (Lamka *et al*., 1991; EPPO, 2016b; NSHS, 2021). 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.

REFERENCES

Block CC, Hill JH & McGee DC (1998) Seed transmission of *Pantoea stewartii* in field and sweet corn. *Plant Disease* **82**, 775-780.

Boewe GH (1949) Late season incidence of Stewart’s disease on sweet corn and winter temperatures in Illinois, 1944-1948. *Plant Disease Reporter* **33**, 192-194.

Bradbury JF (1967) *CMI Descriptions of Pathogenic Fungi and Bacteria* No. 123. CAB International, Wallingford, UK.

CABI (2020) CABI Invasive species compendium. Datasheet on *Pantoea stewartii* (bacterial wilt of maize). Available online, https://cabi.org/isc/datasheet/21939 [accessed on 2021-12-01].

Castor LL, Ayers JE, MacNab AA & Krause RA (1975) Computerized forecasting system for Stewart's bacterial disease on corn. *Plant Disease Reporter* **59**, 533-536.

EFSA (2018) EFSA Panel on Plant Health (EFSA PLH Panel) Pest categorisation of *Pantoea stewartii* subsp. *stewartii*. Available online https://www.efsa.europa.eu/en/efsajournal/pub/5356 [accessed on 2021-12-01].

Elliott C (1941) Bacterial wilt of dent corn inbreds. *Phytopathology* **32**, 262-265.

Elliott C & Poos FW (1940) Seasonal development, insect vectors and host range of bacterial wilt of sweetcorn. *Journal of Agricultural Research* **10**, 645-686.

EPPO (2016a) Phytosanitary procedures PM 3/78 (1) Consignment inspection of seed and grain of cereals. *EPPO Bulletin* **46**, 49–57.

EPPO (2016b) EPPO Standards PM 7/60 (2) Diagnostics. *Pantoea stewartii* subsp. *stewartii*. *EPPO Bulletin* **46**(2), 226–236.

EPPO (2018) First report of *Pantoea stewartii* in Ukraine EPPO Reporting Service no. 03 - 2018, Num. article: 2020/059

EPPO (2020a) Update of the situation of *Pantoea stewartii* subsp. *stewartii* in Italy. *EPPO Reporting Service* no. 06 - 2020, Num. article: 2020/130.

EPPO (2020b) Update on the situation of *Pantoea stewartii* subsp. *stewartii* in Slovenia. *EPPO Reporting Service* no. 06 - 2020, Num. article: 2020/129.

EPPO (2021) Update of the situation of *Pantoea stewartii* subsp. *stewartii* in Italy. *EPPO Reporting Service* no. 09 - 2021, Num. article: 2021/201.

EPPO (1997) *Pantoea stewartii* subsp. *stewartii* EPPO data sheets on quarantine pests. Available online. https:// gd.eppo.int/taxon/ERWIST

FAO (1983) Reappearance of *Erwinia stewartii* in the Po Valley. *FAO Plant Protection Bulletin* **31**, 96.

Guo YF, Liang ZQ, Lu GQ & Xie BC (1987) [Survival conditions of *Erwinia stewartii* in stored corn]. *Acta Phytophylactica Sinica* **14**, 39-44.

Heichel GH, Sands DC & Kring JB (1977) Seasonal patterns and reduction by carbofuran of Stewart's bacterial wilt of sweetcorn. *Plant Disease Reporter* **61**, 149-153.

Khan A, Ries SM & Pataky JK (1996) Transmission of *Erwinia stewartii* through seed of resistant and susceptible field and sweet corn. *Plant Disease* **80**, 398-403.

Lamka GL, Hill JH, McGee DC, & Braun EJ (1991) Development of an immunosorbent assay for seed-borne *Erwinia stewartii*. *Phytopathology* **81**, 839-846.

Mazzucchi U (1984) [Bacterial wilt of maize]. *Informatore Fitopatologico* **34**, 18-23 (in Italian).

Mergaert J, Verdonck L & Kersters K (1993) Transfer of *Erwinia ananas* (synonym, *E. uredovora*) and *Erwinia stewartii* to the genus *Pantoea* emend. as *Pantoea ananas* (Serrano 1928) comb. nov. and *Pantoea stewartii* (Smith 1898) comb. nov., respectively and description of *Pantoea stewarttii* subsp. *indologenes* subsp. nov. *International Journal of Systematic Bacteriology* **43**, 162-173.

Michener PM, Pataky JK & White DG (2002) Rates of transmitting *Erwinia stewartii* from seed to seedlings of a sweet corn hybrid susceptible to Stewart's wilt. *Plant Disease* **86**, 1031-1035.

NSHS (2021) ELISA –based seed health testing method for *Pantoea stewartii*. Available online https://seedhealth.org/files/2021/03/Mz-10.1-Pantoea-stewartii-ver-1.2.pdf [accessed on 2021-12-01].

Pataky JK, Hawk JA, Weldekidan T & Fallah Moghaddam P (1995) Incidence and severity of Stewart's bacterial wilt on sequential plantings of resistant and susceptible sweet corn hybrids. *Plant Disease* **79**, 1202–1207.

Pataky JK (2003) Stewart's wilt of corn. Available online https://www.apsnet.org/edcenter/apsnetfeatures/Pages/StewartsWilt.aspx [accessed on 2021-12-01].

Pepper EH (1967) *Stewart's bacterial wilt of corn.* Monographs of the American Phytopathological Society No. 4. American Phytopathological Society, St. Paul, Minnesota (US).

Poos FW (1939). Host plants harboring *Aplanobacter stewarti* without showing external symptoms after inoculation by *Chaetocnema pulicaria. Journal of Economic Entomology* **32**(6), 881-882

Robert AL (1967) *Bacterial wilt and Stewart's leaf blight of corn. Farmers' Bulletin, US Department of Agriculture* No. 2092, 12 pp.

Shurtleff MC (Editor) (1980) A compendium of corn diseases*. American Phytopathological Society, St. Paul, Minnesota* (US).

ACKNOWLEDGEMENTS

This datasheet was extensively revised in 2022 by J. Németh. His contribution is gratefully acknowledged.

How to cite this datasheet?

EPPO (2025) *Pantoea stewartii subsp. stewartii*. EPPO datasheets on pests recommended for regulation. Available online. https://gd.eppo.int

Datasheet history

This datasheet was first published in the EPPO Bulletin in 1978 and revised in the two editions of 'Quarantine Pests for Europe' in 1992 and 1997, as well as in 2022. It is now maintained in an electronic format in the EPPO Global Database. The sections on 'Identity', 'Hosts', and 'Geographical distribution' are automatically updated from the database. For other sections, the date of last revision is indicated on the right.

CABI/EPPO (1992/1997) *Quarantine Pests for Europe (1st and 2nd edition)*. CABI, Wallingford (GB).

EPPO (1978) Data Sheet on Quarantine Organisms no 54: *Erwinia stewartii. EPPO Bulletin* **8**(2), 30-35. https://doi.org/10.1111/j.1365-2338.1978.tb02766.x

Co-funded by the European Union