

Data Sheets on Quarantine Pests

***Curtobacterium flaccumfaciens* pv.
*flaccumfaciens*****IDENTITY**

Name: *Curtobacterium flaccumfaciens* pv. *flaccumfaciens* (Hedges) Collins & Jones

Synonyms: *Corynebacterium flaccumfaciens* (Hedges) Dowson

Taxonomic position: Bacteria: Firmicutes

Common names: Bacterial wilt (*Phaseolus* beans), bacterial tan spot (soybeans)
(English)
Flétrissement bactérien du haricot (French)
Bakterielle Welke (German)
Marchitez bacteriana de la soja (Spanish)

Notes on taxonomy and nomenclature: Pigmented variants were formerly described as subspecies *aurantiacum* and *violaceum*, but their status in relation to the new nomenclature is dubious.

Bayer computer code: CORBFL

EPPQ A2 list: No. 48

EU Annex designation: II/B

HOSTS

The main hosts are *Phaseolus* spp., especially *P. vulgaris* but also *P. coccineus*, *P. lunatus*, *Vigna angularis*, *V. radiata* and *V. mungo*; the pathogen can also attack: soybeans, peas, cowpeas and *Lablab purpureus*.

For additional information, see Zaumeyer & Thomas (1957), Hayward & Waterston (1965).

GEOGRAPHICAL DISTRIBUTION

EPPQ region: Recorded in Albania, Ukraine. Found but not established in Greece and Hungary; locally established in Bulgaria (unconfirmed), Romania, Tunisia, Turkey (unconfirmed), Russia (Far East, Southern Russia; only on soybean) and Yugoslavia. Reports from Belgium (OEPP/EPPQ, 1982), France, Germany and Switzerland have not been substantiated.

Asia: Russia (Far East), Turkey (unconfirmed).

Africa: Mauritius, Tunisia.

North America: Canada (Ontario), Mexico (unconfirmed), USA (first reported in 1920, especially in irrigated high plains and Midwest, but not reported since early 1970s except in Iowa on soybeans; Hall, 1991. Specific records from Colorado, Connecticut, Iowa, Idaho, Michigan, Montana, Nebraska, Ohio, Oregon, Virginia, Wisconsin).

South America: Colombia, Venezuela.

Oceania: Australia (New South Wales, Queensland, South Australia, Victoria).

EU: Present.

Distribution map: See CMI (1987, No. 370).

BIOLOGY

The bacterium can be transmitted both within and on the seed; it is very resistant to drying and can remain viable for up to 24 years in seed stored in the laboratory. In the field it has been known to survive in soil for at least two winters between bean crops rotated with wheat. There are no reports of vectors, but the nematode *Meloidogyne incognita* may assist entry by providing wounds.

C. flaccumfaciens pv. *flaccumfaciens* can infect in the absence of rain; it has not been observed to enter via stomata. Once within the plant, the bacterium colonizes the vascular tissue.

There is no information on race variation.

For additional information, see also Hedges (1926), Zaumeyer (1932), Zaumeyer & Thomas (1957).

DETECTION AND IDENTIFICATION

Symptoms

On *Phaseolus*

Young *Phaseolus* plants, 5-8 cm tall, may be attacked and are usually killed. If plants survive an early attack, or are infected at a later stage of growth, they may live throughout the season and bear mature seed. The disease is characterized by a wilting of leaves or parts of leaves during the heat of the day and recovery as the temperature drops in the evening. As a result of bacterial plugging of the vessels, the water supply is cut off and the leaves turn brown and abscind.

Occasionally, these typical wilting symptoms may be absent and replaced by golden-yellow necrotic leaf lesions, closely resembling those of common blight, *Xanthomonas axonopodis* pv. *phaseoli* (EPPO/CABI, 1996); however, the lesion margin is more irregular in *C. flaccumfaciens* pv. *flaccumfaciens* infections. In general, there is no water-soaking of stems and leaves, as found in common blight and halo blight (*Pseudomonas syringae* pv. *phaseolicola*) infections.

On pods, the disease is much more conspicuous than common blight. In fact, all the seeds in a pod may be infected, while the pod remains apparently healthy. This is due to the pathogen infecting the seed via the vascular system, following the sutures of the pods. The sutures may be discoloured with darkening sometimes extending laterally. On young pods, water-soaked spots occasionally appear, the area turning to either a yellowish-green or darker than the rest of the pod. On ripe pods, lesions are more conspicuous, being an olive-green colour, in contrast to the yellow colour of the normal pod. It should be noted that seemingly vigorous plants may bear one or more shrivelled shoots or infected pods which are hidden by healthy foliage.

Seeds of white-seeded cultivars, when infected systemically, are bright-yellow; in cultivars with coloured seed coats, the coloration is less conspicuous. There may be a little yellow slime at the hilum, and seeds may be variously shrivelled. The colour mutants, *aurantiacum* and *violaceum*, produce an orange and purple discoloration, respectively, in the seedcoat.

For additional information, see Hedges (1926), Zaumeyer (1932), Zaumeyer & Thomas (1957), Schuster *et al.* (1968), Miller & Pollard (1976).

On soyabeans

Seedlings initially wilt during the day and regain turgidity in the evening. There is marginal necrosis of the lower leaves and later of the younger leaves. This necrosis is not preceded by water-soaking.

Older plants do not wilt; in drought conditions, leaves develop many small chlorotic spots. There may be a necrosis on sutures of pods, these possibly being abnormally formed and unfilled.

For additional information, see also Dunleavy (1963), Sinclair & Backman (1989), Hall (1991).

Morphology

C. flaccumfaciens pv. *flaccumfaciens* is an aerobic, motile, Gram-positive, non-sporing rod, occurring singly or in pairs, 0.3-0.5 x 0.6-3.0 µm with one to three lateral or polar flagella.

Colonies on beef agar are yellow, circular, smooth, flat or slightly convex, wet-shining, semi-opaque and have an entire margin.

For further information, see Hayward & Waterston (1965).

Detection and inspection methods

Bacteria may be detected beneath the seedcoat by means of a combined cultural and slide agglutination test. Bean seed from countries where the disease is known to occur should be inspected for discoloration of the seedcoat. Immunofluorescence staining can also be used to detect the bacterium in contaminated seed lots (Calzolari *et al.*, 1987). An EPPO quarantine procedure is in preparation.

MEANS OF MOVEMENT AND DISPERSAL

In international trade, the disease is liable to be carried on infected *Phaseolus* bean and soyabean seeds.

PEST SIGNIFICANCE**Economic impact**

Following the first report of its occurrence in 1920, *C. flaccumfaciens* pv. *flaccumfaciens* became one of the most important bacterial diseases of beans in the USA, causing up to almost total losses in some years. More recently, however, it has become very much less important and has indeed not been reported on beans since the early 1970s (Hall, 1991). In soyabeans, the disease was not reported in the USA until 1975 and is of rather minor importance (Sinclair & Backman, 1989). In the EPPO region, it is important on beans in Turkey, but causes only minor losses in other countries.

Control

Control may be effected by using disease-free seed and crop rotations. Seed grown in dry climates is usually free from infection and is, therefore, recommended for distribution. Some tolerant, but no immune, cultivars have been found.

Phytosanitary risk

EPPO has listed *C. flaccumfaciens* pv. *flaccumfaciens* as an A2 quarantine pest (OEPP/EPPO, 1982), and CPPC and IAPSC also consider it of quarantine significance. Because of its very low current importance in its area of origin, the quarantine status of the pathogen will be reviewed within EPPO. From its existing distribution, the disease seems most likely to be important in the southern part of the EPPO region, where *Phaseolus* spp. are widely grown. It is not present in the western Mediterranean countries and not

established in most eastern Mediterranean countries. The disease does not seem important enough on soyabeans to merit any special attention on this crop.

PHYTOSANITARY MEASURES

EPPO recommends that consignments of seeds of *Phaseolus vulgaris* imported from infested countries should come from an area where the disease does not occur or from a crop which was found free from the disease during the growing season (OEPP/EPPO, 1990). In future, seed-testing methods will almost certainly provide equivalent protection.

BIBLIOGRAPHY

- Calzolari, A.; Tomesani, M.; Mazzuchi, U. (1987) Comparison of immunofluorescence staining and indirect isolation for the detection of *Corynebacterium flaccumfaciens* in bean seeds. *Bulletin OEPP/EPPO Bulletin* **17**, 157-163.
- CMI (1987) *Distribution Maps of Plant Diseases* No. 370 (edition 4). CAB International, Wallingford, UK.
- Dunleavy, J.M. (1963) A vascular disease of soybeans caused by *Corynebacterium* sp. *Plant Disease Reporter* **47**, 612-613.
- EPPO/CABI (1996) *Xanthomonas axonopodis* pv. *phaseoli*. In: *Quarantine pests for Europe*. 2nd edition (Ed. by Smith, I.M.; McNamara, D.G.; Scott, P.R.; Holderness, M.). CAB INTERNATIONAL, Wallingford, UK.
- Hall, R.J.B. (Editor) (1991) *A compendium of bean diseases*. American Phytopathological Society, St. Paul, Minnesota, USA.
- Hayward, A.C.; Waterston, J.M. (1965) *Corynebacterium flaccumfaciens*. *CMI Descriptions of Pathogenic Fungi and Bacteria* No. 43. CAB International, Wallingford, UK.
- Hedges, F. (1926) Bacterial wilt of beans (*Bacterium flaccumfaciens* Hedges), including comparisons with *Bacterium phaseoli*. *Phytopathology* **16**, 1-22.
- Miller, P.R.; Pollard, H.L. (1976) *Multilingual compendium of plant diseases*. American Phytopathological Society, St. Paul, Minnesota, USA.
- OEPP/EPPO (1982) Data sheets on quarantine organisms No. 48, *Corynebacterium flaccumfaciens*. *Bulletin OEPP/EPPO Bulletin* **12** (1).
- OEPP/EPPO (1990) Specific quarantine requirements. *EPPO Technical Documents* No. 1008.
- Schuster, M.L.; Vidaver, A.K.; Mandel, M. (1968) A purple pigment producing bean wilt bacterium, *Corynebacterium flaccumfaciens* var. *violaceum* n. var. *Canadian Journal of Microbiology* **14**, 423-427.
- Sinclair, J.B.; Backman, P.A. (Editors) (1989) *A compendium of soybean diseases* (3rd edition). American Phytopathological Society, St. Paul, Minnesota, USA.
- Zaumeyer, W.J. (1932) Comparative pathological history of three bacterial diseases of bean. *Journal of Agricultural Research* **44**, 605-632.
- Zaumeyer, W.J.; Thomas, H.R. (1957) A monographic study of bean diseases and methods for their control. *Technical Bulletin, USDA* No. 865, 255 pp.