

Data Sheets on Quarantine Pests

Xanthomonas translucens pv. *translucens***IDENTITY**

Name: *Xanthomonas translucens* pv. *translucens* (Jones *et al.*) Vauterin *et al.*

Synonyms: *Xanthomonas campestris* pv. *translucens* (Jones *et al.*) Dye
Xanthomonas campestris pv. *cerealis* (Hagborg) Dye
Xanthomonas campestris pv. *hordei* (Hagborg) Dye
Xanthomonas campestris pv. *secalis* (Reddy *et al.*) Dye
Xanthomonas campestris pv. *undulosa* (Smith *et al.*) Dye

Taxonomic position: Bacteria: Gracilicutes

Common names: Bacterial leaf streak, black chaff, BLS (English)
Glume noire, brûlure bactérienne (French)
Schwarzspelzigkeit (German)
Quemadura bacteriana, gluma negra (Spanish)

Notes on taxonomy and nomenclature: In a comprehensive study using DNA-DNA hybridization 16 DNA homology groups were recognized within the species *X. campestris*, and are now considered genomic species (Vauterin *et al.*, 1995). Most if not all of the pathovars which cause disease within the family Poaceae were grouped within the revived species of *X. translucens*. The forms on temperate cereals are here considered to belong to the same single pathovar, *X. translucens* pv. *translucens*, though Vauterin *et al.* (1995) have retained, in *X. translucens*, the separate pathovars mentioned above under Synonyms. Members of this pathovar form a distinct group by fatty acid analysis (Stead, 1989), constituting FAME cluster 9 of Yang *et al.* (1993); their affinities are confirmed by SDS-PAGE of proteins and DNA:DNA hybridization (Kerstens *et al.*, 1989; Vauterin *et al.*, 1992). Waney *et al.* (1991) have identified specific genes within *X. translucens* pv. *translucens* conferring host specificity on certain cereals.

Bayer computer code: XANTTR (the codes XANTTU, XANTSC, XANTCH, XANTCE previously used for the forms on different cereals can be considered obsolete).

EPPO A2 list: No. 183

HOSTS

The main hosts of *X. translucens* pv. *translucens* are barley (*Hordeum vulgare*), rye (*Secale cereale*), wheat (*Triticum* spp.) and triticale (*Triticum* x *Secale*). It has also been recorded on some grasses (*Bromus* spp., *Phalaris* spp., *Elymus repens*) and on other Poaceae by inoculation.

GEOGRAPHICAL DISTRIBUTION

Because of the many names under which *X. translucens* pv. *translucens* has been known in the past, and because some records may in fact refer to interceptions on imported seed lots, it is difficult to establish a completely accurate and up-to-date geographical distribution for

the pest. The records given here derive, among other sources, from Bradbury (1986), Duveiller (1989), Duveiller (1994a).

EPPO region: Belgium (found but not established), Bulgaria (Koleva, 1981; but the bacterium is now declared absent), France (found but not established), Israel, Libya, Morocco, Romania, Russia (southern, Caucasus), Spain (single outbreak; Noval, 1989), Sweden (found but not established), Syria (Mamluk *et al.*, 1990), Tunisia, Turkey (Demir & Ustun, 1992), Ukraine.

Asia: Azerbaijan, China (Henan, Xinjiang), Georgia, India (Delhi), Iran (Alizadeh & Rahimian, 1989), Israel, Japan, Kazakhstan, Malaysia (Sabah), Pakistan, Russia (Siberia), Syria, Turkey, Yemen.

Africa: Ethiopia, Kenya, Libya, Madagascar, Morocco, Senegal (probably a misidentification, since record is on rice), South Africa, Tanzania, Tunisia, Zambia.

North America: Canada (Alberta, Manitoba, New Brunswick, Quebec, Saskatchewan), Mexico, USA (Arkansas, Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, Ohio, Oklahoma, South Dakota, Texas, Utah, Virginia, Washington, Wisconsin).

South America: Argentina, Bolivia, Brazil (Matto Grosso do Sul, Paranà), Paraguay, Peru, Uruguay.

Oceania: Australia (New South Wales).

Distribution map: See IMI (1993, No. 264).

BIOLOGY

X. translucens pv. *translucens* is a seed-borne pathogen. The transmission rate is very low, but ensures serious outbreaks in the field under suitable conditions. The pathogen is disseminated by seed on a large scale (Sands & Fourest, 1989). On a local scale, bacteria are transmitted by rain, dew and contact between plants (Boosalis, 1952). Aphids trapped in sticky exudates may carry the bacterium and transmit it to wheat and barley, thus helping long-distance dissemination (Boosalis, 1952). Milus & Mirolohi (1995) concluded that other means of overwintering were insignificant by comparison with survival on the seed.

X. translucens pv. *translucens* is a true parenchymatous pathogen. Intercellular invasion occurs after entry through stomata. The spread from a single plant can affect up to 30 square metres during a growing season. However, movement in space is usually more limited. Infection cycles can be as short as 10 days (Hall *et al.*, 1981). Bacteria may survive in seeds longer than 63 months (Forster & Schaad, 1990). However, recovery is greatly decreased after some months of storage. Survival in the field does not only depend on infection of host plants, as epiphytic populations may survive on non-host species (Timmer *et al.*, 1987). Moreover, bacteria may overwinter on perennial hosts, or on crop debris in the soil (Boosalis, 1952; Mehta, 1986a).

Outbreaks of the disease are sporadic and more frequent on breeders' plots. They are prevalent during wet seasons. Inoculation experiments (Sands *et al.*, 1986) show that plants are most readily infected under wet conditions (rain or sprinkler irrigation). However, the importance of dew, rainfall or irrigation has not yet been documented and it is not certain whether free water is needed. The bacterium tolerates a wide range of temperatures (15-30°C) (Duveiller *et al.*, 1991), its optimal temperature being around 22°C. The pathogen grows best when relative humidity is high. The disease is favoured by warm, moist conditions (26-30%), especially at heading.

X. translucens pv. *translucens* has ice-nucleating activity (Kim *et al.*, 1987), and may therefore be associated with frost injury (Sands & Fourrest, 1989). Dissemination of the bacterium may in turn be favoured by this injury, since symptoms tend to appear after

periods of sub-freezing temperatures. However, ice nucleation is not a necessary condition for induction of an epidemic (Duveiller *et al.*, 1991).

Strains of *X. translucens* pv. *translucens* have been found to be host-specific, and the original *formae speciales*, later pathovars, were defined in this way: *hordei* (= *translucens*) on barley, *secalis* on rye, *undulosa* on wheat and triticale. Pv. *cerealis* had a relatively wide host range. Duveiller (1989) noted that recent isolates from wheat, rye and triticale were not host-specific. The fact that specific and non-specific strains can be found tends to support the use of a broad concept of the pathovar (Paul & Smith, 1989).

DETECTION AND IDENTIFICATION

Symptoms

Infected leaves show narrow, water-soaked streaks, yellowish in barley and triticale, necrotic at the centre with rust-coloured margins in wheat (Sands & Fourest, 1989). Bacterial slime exudes and dries to a thin scale-like layer, which can be flaked off. Seedlings hardly show any symptoms. Glumes and seeds show 'black chaff' symptoms, with purple-black discoloration of the surface. Symptoms take 10-14 days to appear. The disease may be misidentified, as physiological disorders might cause similar symptoms ('pseudo black chaff' or 'brown melanosis').

Morphology

The pathogen is a non-sporing, aerobic, motile, Gram-negative rod, occurring singly or in pairs, 0.4-0.8 x 1.0-2.5 nm, with a single polar flagellum. On Wilbrink's medium, colonies are round, bright, mucoid and yellow (Sands *et al.*, 1986).

Detection and inspection methods

X. translucens pv. *translucens* can be isolated on a modification of Wilbrink's medium (Duveiller, 1989; Sands & Fourest, 1989) and this method can be applied to suspect seed samples. Sands & Fourest (1989) also describe the X-Gal test, which can be used in the field on small samples of infected tissue, giving a result within 2 h. Mehta (1990) developed an injection technique to detect *X. campestris* pv. *undulosa* and *X. campestris* pv. *hordei* in seeds, which according to Duveiller (1994a) offers a potential tool for quarantine purposes, although it is time-consuming. Bragard & Verhoyen (1993) showed that bacteria of the '*translucens*' group are serologically homogeneous despite heterogeneity in host range. Serological methods using immunofluorescence microscopy and dot-immunobinding assays identified lots with high bacterial populations (Duveiller & Bragard, 1992). Semi-selective enrichment combined with ELISA gave good results in infested seed lots (Frommel & Pazos, 1994). A PCR-based method (Maes & Garbeva, 1995) can be used to detect pvs *translucens* and *graminis* and to distinguish them from other *X. campestris* or other bacteria which might be present in cereal seed batches.

MEANS OF MOVEMENT AND DISPERSAL

The bacteria are locally splash-dispersed over short distances. The only likely pathway for international spread is with infected seed lots.

PEST SIGNIFICANCE

Economic impact

Little quantitative information is available on losses caused by bacterial leaf streak (Duveiller, 1994a). Direct yield losses have been evaluated from 10% or less up to 40%, depending on authors. Duveiller & Maraite (1993) have developed a system for forecasting losses from infection levels earlier in the season, while Duveiller (1994b) has proposed a disease assessment key. The pathogen may also cause sterility of wheat spikes (Forster & Schaad, 1988). Finally, high infection levels may lead to a 10-30% decrease in kernel weight (Shane *et al.*, 1987). Both durum and bread wheats can be severely affected, as well as triticale, and less frequently barley. There seems to be little recent information on the disease on rye.

Control

No known control measures exist for the disease in the field (Duveiller, 1994a). Chemical control focuses on seed treatments. Organomercurial seed treatments were used in the past, and were mostly considered effective. The recent resurgence of the disease has been linked with the withdrawal of this group of pesticides. Duveiller (1994a), however, queries this and attributes the recent development to other causes: cultivation of cereals in new areas, favourable conditions for the disease, susceptible cultivars, etc. Various other treatments are now applied to seed lots to eliminate the bacterium, especially cupric acetate (Schaad *et al.*, 1981), formalin (Duveiller, 1989), and guazatine (Mehta, 1986b), but these treatments are phytotoxic. Panocrine 30 was 95% effective and without phytotoxicity. An alternative treatment is dry heat at 72°C for 7 days, as proposed by Fourest *et al.* (1989), but the effectiveness of this treatment remains to be confirmed.

Resistant cultivars are available for many cereals, the level of resistance depending on the cereal involved (Milus & Mirlohi, 1994). In the absence of any really effective seed treatment, control should centre on pathogen-free seed certification (Duveiller, 1994a).

Phytosanitary risk

X. translucens pv. *translucens* is an A2 quarantine organism for EPPO and for IAPSC. It is already present in the EPPO region, but its exact range is difficult to establish, due to confusion of symptoms and to the lack of reliable detection methods. *X. translucens* pv. *translucens* certainly has the potential to develop in most parts of the EPPO region if infected seeds are sown.

PHYTOSANITARY MEASURES

X. translucens pv. *translucens* can be excluded by accepting only pathogen-free or treated cereal seed lots from countries where the pest occurs. Breeders' material of cereal seeds exchanged between continents presents the main danger of introduction of *X. translucens* pv. *translucens*. Such seed should, if possible, be produced in a dry disease-free zone. Duveiller & Bragard (1992) recommend that immunofluorescence-positive seed lots should not be sown in areas favorable to the disease. No really satisfactory treatment exists at the moment. Further research may lead to the development of fully satisfactory detection and control methods.

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