Department for Environment Food & Rural Affairs

Rapid Pest Risk Analysis (PRA) for: *Xanthomonas translucens* pathovar *translucens*

Stage 1: Initiation

1. What is the name of the pest?

Xanthomonas translucens pathovar *translucens* (Xtt). There are eleven recognised pathovars of *X. translucens* affecting mainly *Poaceae* hosts. In accordance with the EPPO listing, this PRA includes only the Xtt strains that are pathogenic to cereals, the main hosts being wheat, barley, rye and triticale. In addition to Xtt, these *X. translucens* pathogens may be named as pathovars: *undulosa*, *secalis, hordei* or *cerealis*. Those pathovars that cause diseases of forage grasses are not included within Xtt. A phylogeny produced using the *gyrB* gene has clarified *Xanthomonas* taxonomy and aided species and infra-species identification (Parkinson et al., 2009). Disease names include 'bacterial leaf streak (or stripe) of wheat and barley' and 'black chaff'- when grain is blackened by infection.

2. What initiated this rapid PRA?

The need for a rapid PRA was identified during the assessment of Xtt for inclusion in the UK Plant Health Risk Register, in order to help inform the decision on whether statutory action against future interceptions is justified. This PRA is an update to the UK PRA produced in 2005.

3. What is the PRA area?

The PRA area is the United Kingdom of Great Britain and Northern Ireland.

Stage 2: Risk Assessment

4. What is the pest's status in the EC Plant Health Directive (Council Directive 2000/29/EC[1]) and in the lists of EPPO[2]?

Xtt is recommended for regulation by EPPO as an A2 listed organism but is not listed in the EC Plant Health Directive.

5. What is the pest's current geographical distribution?

Table : Distribution of Xtt [a]	
North America:	USA (widespread - occurs in 28 states), Canada and Mexico
Central America:	
South America:	Argentina, Bolivia, Brazil, Paraguay, Peru and Uruguay.
Europe:	Azerbaijan, Georgia, Romania, Russia, Turkey and Ukraine.
Africa:	Ethiopia, Kenya, Madagascar, Morocco, South Africa, Tanzania, Tunisia and Zambia.
Asia:	China, India, Iran, Israel, Japan, Kazakhstan, Malaysia, Pakistan, Syria and Yemen.
Oceania:	Australia

[a] based on EPPO PQR data

A study that developed a diagnostic test for Xtt reported the isolation of 27 virulent isolates that were collected from local wheat fields in Syria (Kayali et al., 2004). A more recent survey of bacterial pathogens from 63 Syrian wheat fields found 37 Xtt isolates, which comprised 83.3% of all isolates (Mando et al., 2012). CABI CPC (2014) reports the presence of Xtt in Spain based on some early records, however, these records were discounted in 2011 by the Spanish NPPO and Xtt declared to be considered absent, intercepted only (EPPO PQR, 2014). In the past, Xtt has also been reported in Belgium,

[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2000L0029:20100113:EN:PDF

[2] https://www.eppo.int/QUARANTINE/quarantine.htm

Bulgaria and France, but the disease is not considered to be present in these countries. Duveiller (1994) suggested that several early publications (including those for Belgium and France) may have been "based only on the observation of a melanic reaction on the glumes, incorrectly identified as bacterial black chaff."

6. Is the pest established or transient, or suspected to be established/transient in the UK/PRA Area?

Xtt has not been recorded in the UK and is not suspected as being present.

7. What are the pest's natural and experimental host plants; of these, which are of economic and/or environmental importance in the UK/PRA area?

The main hosts of Xtt are barley (*Hordeum vulgare*), rye (*Secale cereale*), wheat (*Triticum* spp.) and triticale (*Triticum* x *Secale*). CABI CPC (2014) also lists as hosts: oats (*Avena sativa*), awnless brome (*Bromus inermis*) and spelt (*Triticum spelta*). In Australia, Xtt has been implicated in pistachio dieback but this pathogen has now been named as a separate pathovar: Xt pathovar *pistaciae* (Giblot-Ducray et al., 2009).

Barley, rye, wheat and triticale are very important crops in the PRA area. There have been no reports of Xtt diseases that have significantly reduced environmental populations of wild hosts.

8. What pathways provide opportunities for the pest to enter and transfer to a suitable host and what is the likelihood of entering the UK/PRA area?

Imported cereal seed for sowing.

Graminaceae seed for planting imported from third countries must meet OECD certification requirements and seed moved within the EU must comply with the seed marketing Directive 66/402/EEC. The Marketing Directive requires seed production to be certified as meeting minimum quality standards, though there is a possibility that unidentified or undetected Xtt infection could occur because freedom from Xtt is not specifically stipulated as a requirement under this scheme. However, within the EU, currently only Romania has a record of occurrence, and it is not thought that much seed is imported from there. Seed for planting imported from Third Countries will be certified under an official certification scheme or be from "equivalent Third Countries" and require a phytosanitary certificate. However, because Xtt is not specifically mentioned in these regulations there is no specific diagnostic testing and freedom from Xtt infection cannot be guaranteed. Also as Xtt is not listed in Directive 2000/29/EU the phytosanitary certificate does not provided any assurance of freedom from the pest.

Imports of seed for planting seem to be very variable year on year, presumably depending on production within the UK and prices elsewhere. Eurostat shows that in 2011 only 8.5 tonnes of “common wheat and meslin seed” and 7.3 tonnes of “spelt for sowing” were imported from the USA. Conversely, in 2012 the UK imported 101.5 tonnes of “seed of wheat and meslin, for sowing (excl. durum)” from the USA. This ties in with overall import data as Eurostat shows that 22.8 tonnes of “common wheat and meslin seed” were imported from outside the EU in 2011, compared to 211.6 tonnes of “seed of wheat and meslin, for sowing (excl durum)”. Exactly comparable codes for 2011 and 2012 appear to be unavailable due to changes in the recording system.

The entry pathway is scored as ‘unlikely’, though there is considerable uncertainty in rating because of the difficulty in assessing the possibility of unidentified seed infections entering the country.

Imported seed	Very unlikely		Unlikely	X	Moderately likely		Likely		Very likely	
Confidence	High Confidence		Medium Confidence		Low Confidence	X				

Plants for planting

Existing regulations prohibit import of known host plants of Graminaceae for planting from third countries other than European and Mediterranean, which limits the potential for Xtt entry from these countries. Although, this would not include a number of countries where Xtt is present (Israel, Morocco, Romania, Russia, Syria, Tunisia, Turkey and Ukraine) there is no evidence that any of these countries export host plants to the UK (Eurostat, 2015). It should, however, be noted that as Romania is an EU country and therefore part of the single market, there are no passporting requirements for gramineae, therefore should any plants be imported from here they may pose a greater risk.

Plants for planting	Very unlikely	X	Unlikely		Moderately likely		Likely		Very likely	
Confidence	High Confidence	X	Medium Confidence		Low Confidence					

Soil

There is evidence that Xtt can overwinter in infested crop debris (Boosalis, 1952), but the pathogen does not survive long periods in soil unless it is associated with infested crop debris (Boosalis, 1952). Transfer of infested crop debris from countries where Xtt is present is considered very unlikely.

Soil	Very unlikely	X	Unlikely		Moderately likely		Likely		Very likely	
Confidence	High Confidence	X	Medium Confidence		Low Confidence					

9. How likely is the pest to establish outdoors or under protection in the UK/PRA area?

In the US, Xtt has established across 28 states, many of which have a continental climate characterised by hot summers and cold winters. Similarly, in Europe, the pest is found in Russia, Ukraine and Romania, again with continental climates. Cold winter temperatures in the UK would not be a barrier to Xtt establishment based on the very low temperatures survived in the USA and because, although survival of the pathogen in soil is limited, it can survive *in-planta* in over wintering crops, e.g. winter wheat. However, although the exact northerly distribution of Xtt is not known, even the northern US and southern Canada can have hotter average summer temperatures than the UK. We have therefore rated establishment as unlikely with low confidence, with southern England likely to be most suitable based on current data. The unknown susceptibility of cereal cultivars grown in the UK to Xtt further justifies the rating and low confidence score.

Outdoors	Very unlikely		Unlikely	X	Moderately likely		Likely		Very likely	
Confidence	High Confidence		Medium Confidence		Low Confidence	X				
Under Protection	Very unlikely	X	Unlikely		Moderately likely		Likely		Very likely	
Confidence	High Confidence	X	Medium Confidence		Low Confidence					

Cereals are rarely grown commercially under protection and so establishment under protection is scored as very unlikely.

10. If the pest needs a vector, is it present in the UK/PRA area?

Xtt is not vectored.

11. How quickly could the pest spread in the UK/PRA area?

Spread over short distances is through water splash and by plant to plant contact (EPPO, 1997) and so the speed of this spread is rated as “slowly”. However, dissemination of Xtt could occur quickly through long-distance trade of infected seed and this is rated as “very quickly". The low confidence score reflects uncertainty in the efficiency of seed transmission in UK conditions and the unknown susceptibility of UK-grown cereal varieties.

Natural Spread	Very slowly	☐	Slowly	X	Moderate pace	☐	Quickly	☐	Very quickly	☐
Confidence	High Confidence	X	Medium Confidence	☐	Low Confidence	☐				

With trade	Very slowly	☐	Slowly	☐	Moderate pace	☐	Quickly	☐	Very quickly	X
Confidence	High Confidence	☐	Medium Confidence	☐	Low Confidence	X				

12. What is the pest's economic, environmental and social impact within its existing distribution?

On leaves, Xtt infection produces narrow water soaked leaf streaks that become necrotic and are associated with bacterial slime that dries to a thin scale layer. Seed infection produces the disease "black chaff". In an experimental study carried out in South Dakota comparison of spring wheat yields between control plots and those artificially infected with Xtt found a reduction of 12-32% in the treated plots, though some leaf streak was found in the control plots (Kandel et al., 2011). A three year field trial in Mexico in a region of high rainfall and temperatures, found that a 5% grain yield loss could be expected when less than 5% of leaf area is affected. Yield losses rose to 20% when symptoms extended to 50% of leaf area (Duveiller et al., 1993). A further experimental trial over 3 years in Louisiana compared grain yields in untreated and Xtt treated winter wheat (Tillman et al., 1999). This study found large variations in yield loss attributable to Xtt treatment. At one site in one year, there was no difference between yields from treated and untreated plots. This compared with the maximal observed difference between yields (24%) that occurred in one year (at another site) and was associated with leaf symptoms extending to 18-40% of leaf area. Weather conditions favouring disease development were thought to have contributed to the severity of Xtt disease on this occasion. High estimated yield losses (up to 40%) have been found to be associated with the use of sprinkler-irrigated fields in south central and eastern Idaho (Forster and Schaad, 1988).

Trials done in Minnesota using naturally infected wheat and barley found that large foliar symptoms (affecting 50% of leaf area) resulted in a 13-34% grain yield loss (Shane et al., 1987). The study noted that diseased crops occurred in foci 2-5m in diameter. This report also made an unpublished reference to yield losses encountered in the region: "Recent regional yield losses in wheat and barley associated with the disease are probably low because average field severities in Minnesota have generally been below 1%". In a study on wheat cultivar susceptibility to Xtt (Adhikari et al., 2011) reference is made to an unpublished survey of 20 wheat fields at three locations in North Dakota, which found an average Xtt infection incidence of 80%. The study also refers to anecdotal evidence in North Dakota and neighbouring states suggesting that Xtt has re-emerged as a threat both to winter and spring wheat. In a further report, (Adhikari et al., 2012) reference is made to increasing bacterial leaf streak epidemics in the upper Midwest US. The authors refer to at least three factors that may have contributed to these epidemics:

1) An increase in winter wheat production and autumn sown wheat that may be more susceptible to infection.

2) Changes in wheat cultivar grown that are susceptible to Xtt.

3) Humid and mild weather conditions during late growth stages of winter wheat.

This study also reported the isolation of 226 strains of Xtt that were collected from five locations in North Dakota and that, of 16 sites surveyed at Langdon in the autumn of 2009, most showed severe symptoms of bacterial leaf streak.

Based on the reports documented, economic impacts in the existing Xtt range are scored as medium. A medium confidence score is given because the impact data all come from the USA, with limited information on incidence and typical impacts from other parts of the pathogen's range.

Impacts	Very small	☐	Small	☐	Medium	X	Large	☐	Very large	☐
Confidence	High Confidence	☐	Medium Confidence	X	Low Confidence	☐				

13. What is the pest's potential to cause economic, environmental and social impacts in the UK/PRA area?

Potential economic impacts from Xtt in the PRA area are scored as small though medium scale impacts could occur in some circumstances, if climatic conditions (high humidity and high temperature) are optimal. Seed transmission efficiency is relatively low compared with some other pathogens and the low speed of spread on farm limits potential impacts. The low confidence score reflects lack of information on the impact of the disease in regions with a similar climate to the PRA area. Whilst Xtt can only survive in soil for short periods it can survive *in-planta* over winter. Increasing planting of winter wheat may have increased UK risks from Xtt. However, it is not clear if UK summer temperatures are sufficiently warm to allow full disease development. Additional factors that contribute to uncertainty include differences in Xtt strain aggressiveness and unknown susceptibility of wheat cultivars grown in the UK.

EU seed marketing regulations require seed production to be certified as meeting minimum quality standards (Directive 66/402/EEC). Establishment of Xtt in the UK may incur costs in meeting these standards as there is a requirement that "harmful organisms, which reduce the usefulness of the seed shall be at the lowest possible level" and thus Xtt should come under this requirement (Annex II (3)).

Environmental impacts are scored as very small reflecting the absence of reports of damage to wild populations of cereals infected with Xtt. Social impacts are scored as small, due to potential effect on farmers and seed producers.

Economic Impacts	Very small	☐	Small	X	Medium	☐	Large	☐	Very large	☐
Confidence	High Confidence	☐	Medium Confidence	☐	Low Confidence	X				
Environmental Impacts	Very small	X	Small	☐	Medium	☐	Large	☐	Very large	☐
Confidence	High Confidence	X	Medium Confidence	☐	Low Confidence	☐				
Social Impacts	Very small	☐	Small	X	Medium	☐	Large	☐	Very large	☐
Confidence	High Confidence	☐	Medium Confidence	X	Low Confidence	☐				

14. What is the pest's potential as a vector of plant pathogens?

Xtt cannot serve as a vector.

15. What is the area endangered by the pest?

Southern England, the region of the PRA area with the warmest summer temperatures, is most at risk from Xtt.

Stage 3: Pest Risk Management

16. What are the risk management options for the UK/PRA area?

(Consider exclusion, eradication, containment, and non-statutory controls; under protection and/or outdoors).

Xtt is not listed in Directive 2000/29/EU so any phytosanitary certificate required for import does not provide any assurance of complete freedom from the pest. Should Xtt be encountered in the PRA area and considered a threat, action against it could be taken under existing national regulations for newly introduced, but non-regulated pests under

Article 16 (2) of Directive 2000/29/EC. Eradication and containment action would include destruction of infected crops and carry-over self-sown seedlings etc. Precautions would have to be taken to ensure that grain from infected plants was not used as seed and all harvested waste disposed of in a secure manner.

Alternatively Xtt could be managed through compliance with seed certification schemes. Graminaceae seed for planting imported from third countries must meet OECD certification requirements and cereal seed moved within the EU must comply with Council Directive 66/402/EEC. This Marketing Directive requires cereal seed production to be certified as meeting minimum quality standards but they do not guarantee complete from the pest., Freedom from Xtt or a small tolerances not presently specifically stipulated as a requirement under this scheme but this can be proposed. Seed for planting imported from Third Countries will be certified under an official certification scheme or be from “equivalent Third Countries” and require a phytosanitary certificate. However, because Xtt is not specifically mentioned in these regulations there is no specific diagnostic testing carried out and so freedom from Xtt infection cannot be guaranteed.

There are no seed treatments that eradicate Xtt without excessive damage to the seed(CABI, 2014). The use of pathogen-free seed will control the disease. The pathogen can remain viable in infested seeds for more than 5 years (CABI, 2014).

17. Summary and conclusions of the rapid PRA

Xtt is disseminated as a seed-borne bacterial pathogen that causes leaf streak diseases in wheat and other cereals. It has a widespread distribution around the world. Grain yield losses arising from infection are very variable but significant losses can occur, especially when environmental conditions are favourable for disease development. Seed dissemination is inefficient compared with other pathogens and local disease spread on farms is slow, which limits Xtt impacts. However, in parts of northern US, Xtt epidemics have occurred recently and are a cause for concern.

This rapid PRA shows:

Risk of entry

The main pathway identified for Xtt entry to the PRA area is the importation of infected cereal seed and entry risks are rated as **unlikely** due to certification requirements. The score is associated with a **low confidence** score reflecting the possibility that because Xtt is not specifically mentioned in these regulations there is no specific diagnostic testing and it could enter through undetected seed infections.

Risk of establishment

Establishment risks are scored as **unlikely** with **low confidence**. Cold winter temperatures in the UK would not be a barrier to Xtt establishment based on the very low temperatures survived in the USA and because, although survival of the pathogen in soil is limited, it can survive *in-planta* in over wintering crops, e.g. winter wheat. However, there is uncertainty over whether UK summer temperatures are sufficiently hot for extensive establishment of Xtt in the PRA area. Although the exact northerly distribution of Xtt is not known, even the northern US and Canada can have hotter average summer temperatures than the UK. Lack of knowledge of the susceptibility of UK grown grain cultivars to Xtt adds further uncertainty in the assessment.

Economic, environmental and social impact

Potential economic impacts from Xtt in the PRA area are scored as **small** though medium scale impacts could occur in some circumstances, if climatic conditions (high humidity and high temperature) are optimal. The **low confidence** score reflects lack of information on the impact and incidence of the disease in regions with a similar climate to the PRA area. Additional factors that contribute to uncertainty in this assessment include the variable nature of the disease, whether UK summer temperatures are hot enough to support full disease development, the UK grain cultivar susceptibility to Xtt and the variation in pathogen strain aggressiveness. Environmental impacts are scored as very small reflecting the absence of reports of damage to wild populations of cereals infected with Xtt. Social impacts are scored as small.

Endangered area

Southern England, the region of the PRA area with the warmest summer temperatures, is most at risk from Xtt.

Risk management options

Regulation and management of Xtt is proposed to be through compliance with the cereal seed certification scheme. Graminaceae seed for planting imported from third countries must meet OECD certification requirements and seed moved within the EU must comply with the cereal seed marketing Directive 66/402/EEC. The use of disease free seed will control the disease.

Key uncertainties and topics that would benefit from further investigation

More information on Xtt taxonomy and disease status in European (including Eastern European countries) and neighbouring states would provide a clearer analysis of the threat posed by Xtt, as would a greater understanding of the climatic requirements for this pest, especially summer temperature. Information on UK cultivar susceptibility to Xtt and whether there are differences in strain aggressiveness between US and European Xtt strains would also reduce uncertainty in the PRA.

18. Is there a need for a detailed PRA or for a more detailed analysis of particular sections of the PRA? If yes, select the PRA area (UK or EU) and the PRA scheme (UK or EPPO) to be used.

(For completion by the Plant Health Risk Group) ✓ *(put a tick in the box)*

No	✓				
Yes		PRA area: UK or EU		PRA scheme: UK or EPPO	

19. Images of the pest

Photo 1 Xtt damage to wheat  	Photo 2 Xtt damage to barley 
Photo courtesy E.A. Milus, University of Arkansas, Bugwood.org	Mary Burrows, Montana State University, Bugwood.org -

20. Given the information assembled within the time scale required, is statutory action considered appropriate / justified?

[*For completion by the Plant Health Risk Group*] *(put a tick in the box)*

Yes Statutory action	☐	No Statutory action	✓

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