



Final Report

***'Dickeya solani'* – survey of seed crops in England & Wales 2012**

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CONTENTS

1. SUMMARY.....	4
2. INTRODUCTION.....	4
3. MATERIALS AND METHODS.....	5
4. RESULTS.....	5
5. DISCUSSION.....	6
6. CONCLUSIONS.....	7
7. REFERENCES.....	7
8. ACKNOWLEDGEMENTS.....	7

1. SUMMARY

A survey conducted in England and Wales during the 2012 growing season identified '*Dickeya solani*' in 1.8% (5 crops) of those seed potato stocks entered for classification in which blackleg infected plants were found during field inspections. As in the previous year, this accounted for around 0.6% of all stocks entered for classification in 2012. Three of these crops had been grown from seed directly obtained from the Netherlands in 2012 and one from seed previously multiplied in England and Wales from Dutch seed obtained in 2011. The other crops had been grown from a seed stock twice multiplied in England and Wales (in 2010 and 2011) from seed originally obtained in 2010 from Germany. The cause of blackleg identified in the large majority (84.1%) of affected seed stocks was *Pectobacterium atrosepticum*. These stocks were almost exclusively grown from seed of GB origin and represented some 28.4% of all stocks entered for classification in 2012.

2. INTRODUCTION

'*Dickeya solani*' was first isolated on potato in England and Wales in 2007 and has also been found on potato crops in Belgium, Czech Republic, Denmark, Finland, France, Germany, Israel, Netherlands, Spain, Switzerland and Poland. All cases previously identified in England and Wales have been in crops originating from Dutch seed, although some had already been multiplied for one or more seasons before being identified.

The ongoing research project (R437) "Investigating the biology and appropriate control of *Dickeya* spp. affecting GB potato" is jointly funded by the Potato Council and Scottish Government, and began in July 2010. This project has five main objectives:

- a) Refine, validate and apply diagnostic methods for specific detection and typing of '*D. solani*'.
- b) Determine the extent of '*D. solani*' infection in the GB potato crop and evaluate the risks of spread to home-grown GB seed potatoes.
- c) Improve understanding of the epidemiology of '*D. solani*' infections and risks of pathogen establishment and spread following introduction of infected crops.
- d) Assess the aggressiveness of a range of '*D. solani*' isolates in response to changes in temperature and humidity, and in comparison with earlier data obtained for *P. atrosepticum* and *D. dianthicola*.
- e) Refine specific recommendations for avoidance and control of this pathogen.

The work to determine extent of '*D. solani*' infection in the GB potato crop and to evaluate the risks of spread to home-grown GB seed potatoes was originally agreed to involve a single survey of seed crops in England and Wales, in addition to access to information from the annual *Dickeya* Growing Crop Inspection Survey for Scotland. The original project did not include provision for a further survey of seed stocks in England and Wales. However, in discussion with Potato Council it was agreed that additional surveys in England and Wales in 2011 and 2012 would provide valuable information on the extent and geographical distribution of '*D. solani*' infections.

In 2010 the survey of seed crops in England and Wales showed that, '*D. solani*' was identified as the causal bacterium in 18 of 257 seed stocks (7%) in which blackleg was observed during field inspections. Of these, 15 stocks had been grown from seed obtained directly from the Netherlands. The other three stocks had been grown from seed multiplied in England but which had originated in the Netherlands. A similar survey in 2011, showed that '*D. solani*' was isolated from only 4 (2.3%) of 172 seed stocks in which blackleg was observed. All of these *Dickeya* cases occurred in crops which had been grown from seed imported directly from the Netherlands. This report describes the findings of the 2012 survey.

3. MATERIALS AND METHODS

Collection of plants with blackleg symptoms

As in 2010 and 2011, samples of blackleg plants were collected by Fera PHSI inspectors during routine seed certification inspections and mailed directly to Fera. At least one sample was provided for every seed stock entered for certification in England and Wales in which blackleg symptoms were observed during first or second field inspections. Samples were analysed from 278 seed stocks in which blackleg symptoms were observed, representing around 35% of all stocks entered for certification in 2012. The samples were labelled in such a way that the grower or business was not identified, but further trace-back of the stock could be done for samples testing positive for *Dickeya* and for which the origin of the seed stock was not known.

Isolation and identification of pectolytic bacteria

Pectolytic bacteria were isolated from the leading edge of blackleg affected stems on double layer selective CVPm medium. Pectolytic colonies were purified on PDA, NA and TSBA media and identified according to fatty acid profile, according to Stead (1992). Isolates identified as *Dickeya* spp. were further identified by *recA* sequence determination, as described by Parkinson *et al.* (2009) and real-time PCR assays specific for *D. solani* and *D. dianthicola* (Elphinstone *et al.*, 2011; Prichard *et al.*, 2013).

4. RESULTS

Of the 270 seed stocks in which blackleg was observed during PHSI field inspections, *Dickeya* was identified as the causal bacterium in only 8 (3%) of these stocks, accounting for around 1% of all stocks entered for classification in 2012. '*Dickeya solani*' was isolated in five of these cases and *Dickeya dianthicola* in the other 3 cases.

The five crops infected with '*D. solani*' represented 1.8% of the seed crops affected by blackleg. Of these, three had been grown in the Wales/West Midlands area, 2 from seed stocks directly obtained from the Netherlands in 2012 and the third from seed which had been once multiplied in England/Wales from seed obtained from the Netherlands in 2011. The other two '*Dickeya solani*' infected seed crops were grown in the Yorkshire Wolds area, one of which was produced from seed imported directly from the Netherlands in 2012. The second of these had been grown from seed multiplied in England/Wales in 2011. Further trace-back of this stock indicated that no blackleg had been observed in the 2011 crop which had been grown from seed

multiplied in England/Wales in 2010. No blackleg was observed during inspections in the 2010 crop which had been grown from seed imported from Germany.

The three seed crops (1.1% of the total with blackleg) where *Dickeya dianthicola* was identified (2 in the Yorkshire Wolds and 1 in Cambs.) had all been grown from seed imported directly from the Netherlands in 2012.

227 other cases of blackleg (84.1%) were attributed to infection by *Pectobacterium atrosepticum*, only 3 of which involved seed directly obtained from the Netherlands. All other seed grown in 2012 had been produced in GB in 2011, except for one stock which was of French origin.

There were also 31 cases (11.5% of the total) where only *Pectobacterium carotovorum* was isolated from blackleg plants. It is not known in these cases whether *P. carotovorum* was the original cause of the blackleg symptom observed.

No pathogen was isolated from the remaining 4 plants with suspected blackleg symptoms.

Summary of blackleg findings in seed potato stocks entered for classification in England and Wales 2010-12.

	2010	2011	2012
% seed stocks with blackleg	32.1	21.5	33.8
% blackleg with ' <i>D. solani</i> '	7.0	2.3	1.8
% blackleg with <i>D. dianthicola</i>	0.4	0.6	1.1
% blackleg with <i>P. atrosepticum</i>	92.6	74.4	84.1

5. DISCUSSION

As in 2010 and 2011, the results from the 2012 England and Wales seed potato survey strongly suggest that the principal source of '*Dickeya*' was infected seed originating from the Netherlands. All 2011 crops with detected *Dickeya* infections had been grown from seed imported directly from the Netherlands. In 2012, seven of the eight stocks with *Dickeya* infections originated from Dutch seed. The one stock of German origin is the first case since 2007 when '*D. solani*' infections were not traced back to seed originating from the Netherlands. This case also indicated the possibility that *Dickeya* infections had remained undetected over at least two seasons (2010 and 2011) before blackleg development was detected during the 2012 inspections.

As in the previous two years, the majority of blackleg was caused by *Pectobacterium atrosepticum* coming from seed of GB origin. The absence of *Dickeya* amongst seed stocks of GB origin again indicated that this pathogen is not established in England and Wales, being spread only via infected seed of non-GB origin.

The cause of blackleg in plants from which only *P. carotovorum* subsp. *carotovorum* (*Pcc*) could be isolated requires further investigation. Although strains of this subsp. have been implicated as causes of blackleg in other countries, including the Netherlands, it is also possible that environmental strains which are common and widespread can act as secondary invaders which out-compete the primary blackleg-causing species during isolation. These *Pcc* strains are also often isolated from

aerial stem soft rots which develop on damaged stems or senescent plants late in the season. Furthermore, in the light of unconfirmed reports of the spread of *Pectobacterium brasiliensis* and *Pectobacterium wasabiae* on potatoes around the world, there is a need to confirm the identification of the *Pcc* isolates from blackleg plants to ensure that they have not been confused with these other closely-related pathogens.

6. CONCLUSIONS

- As in the previous year, imports of non-GB origin seed stocks appeared to be the source of '*Dickeya solani*' found to be causing blackleg in around 0.6% of the seed potato stocks entered for classification in England and Wales.
- However, *Pectobacterium atrosepticum* from seed of UK origin remains the most prevalent cause of blackleg disease, found to occur in some 16% of the total number of seed stocks entered for classification.
- Further investigation is warranted to confirm the identification and pathogenicity of isolates from blackleg plants which were classified in this study as *P. carotovorum* subsp. *carotovorum*.

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8. ACKNOWLEDGEMENTS

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