



MTT

CHARACTERIZATION OF POTATO BLACKLEG OUTBREAKS IN NORTH FINLAND

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EAPR Pathology Section Meeting, Jerusalem, Israel.

POTATO BLACKLEG and SOFT ROT: Symptoms

BLACKLEG



SOFT ROT

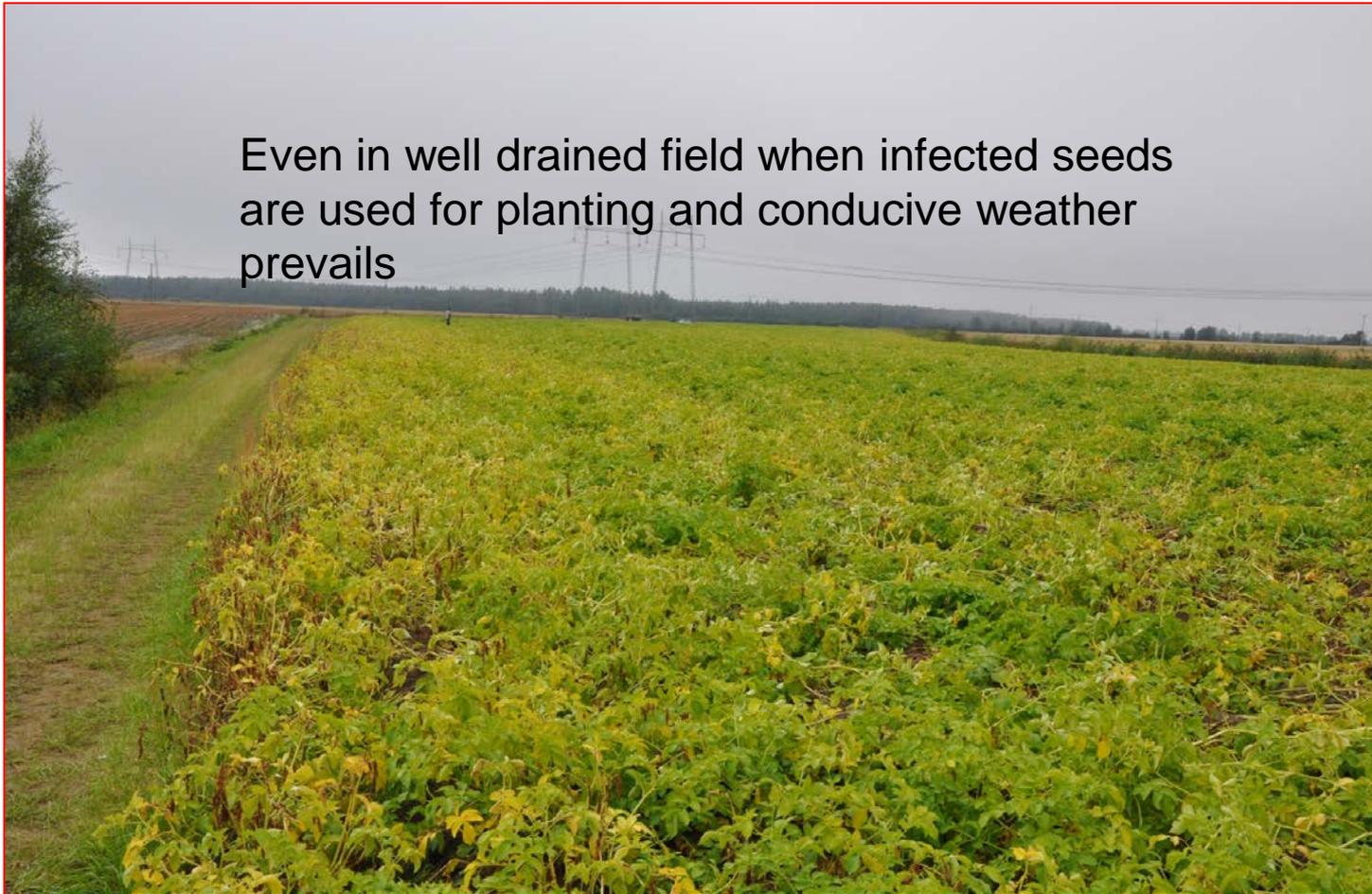
CAUSES

Pectobacterium atrosepticum
Pectobacterium carotovorum
Dickeya spp.
Pectobacterium wasabiae
Pectobacterium brazilensis

Worst cases of Blackleg : Poorly drained Field



Blackleg Outbreak



CHARACTERIZATION OF OUTBREAKS OF POTATO BLACKLEG IN NORTH FINLAND

Contents

- Potato production and North Finland
- The High Grade (HG) status, provisions and obligations
- Protecting the HG status: disease monitoring
- Blackleg outbreaks, weather conditions and characteristic bacterial strains or species predominant in the disease complex
- Characterization of the bacterial strains associated with the blackleg complex of observed outbreaks
- Conclusions



North Finland

- One of the Northeast most agricultural areas of the world
- Conducive climate and soil (smooth sandy soil) for seed potato production.
- "Northern Vigour". Northern seed vs Southern seed
- EU granted High Grade (HG) status
- Long tradition of seed potato production.

64 45'N 25 39'E



<http://carynmirriamgoldberg.com>



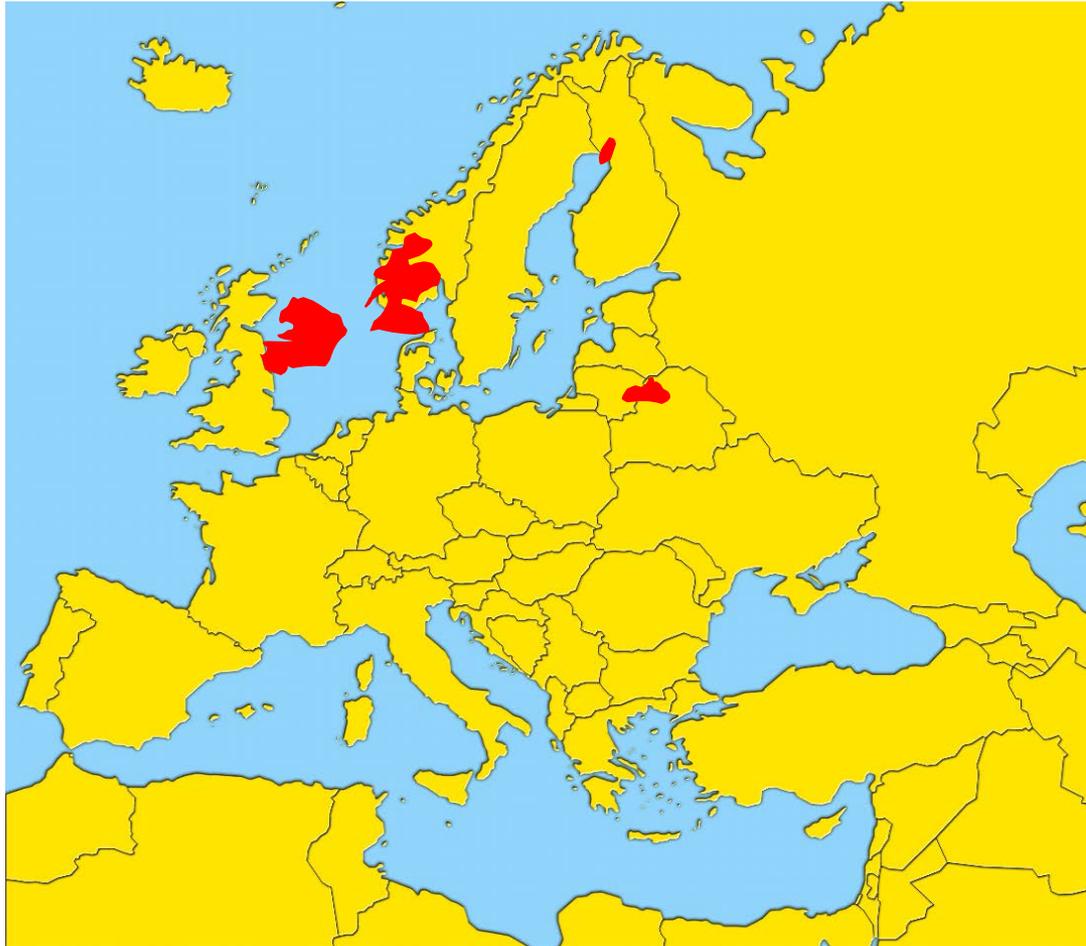
HG = Freedom from dangerous pests and diseases

EAPR Pathology Section, Jerusalem, Isreal

HG status: The Rationale

- The logic behind the HG seed area provision is to maintain the high plant health status of the national potato crop. It prevents the import of seed potatoes from areas where certain harmful organisms are present.
- OBLIGATION than RIGHT!

Areas with **High Grade (HG)** status in Europe



- North Finland
- Northern Ireland
- Scotland
- Cumbria and Northumberland in England
- parts of Germany
- The Azores.

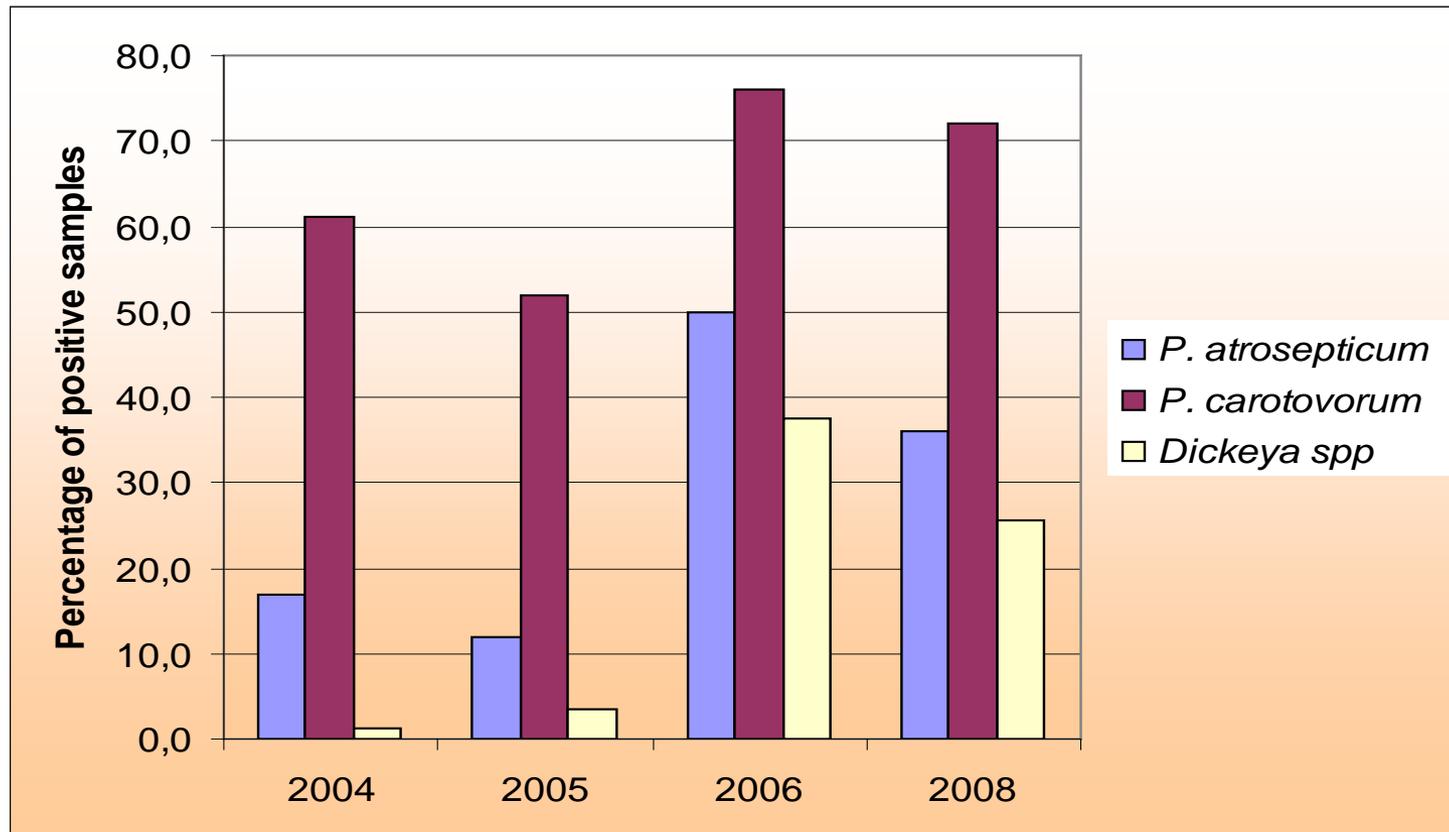
Changes in Blackleg profile

Over the past decade Finland has witnessed some changes in the incidence of blackleg and the bacterial species associated with the blackleg disease complex.

Establishment of *Dickeya* spp/ 'Dickeya solani'

Until 2004, *Dickeya* spp. has not been considered to be a problem in potato production in Finland. However, studies (Laurila *et al.*, 2008, 2010) showed that *Dickeya* strains are present and have been isolated from river water and potato. Recent detailed investigation (Degefu *et al.*, 2013) demonstrated that 'Dickeya solani' plays major role in heavy blackleg outbreaks during warm summer seasons.

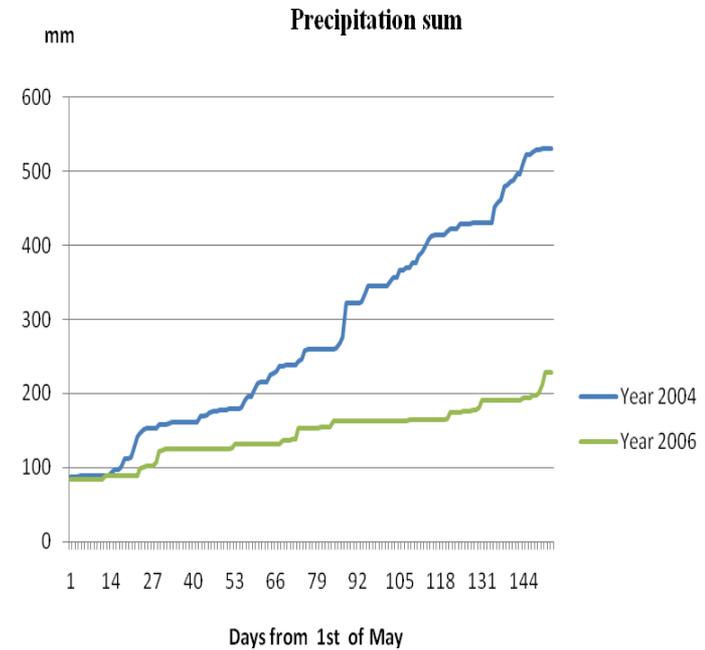
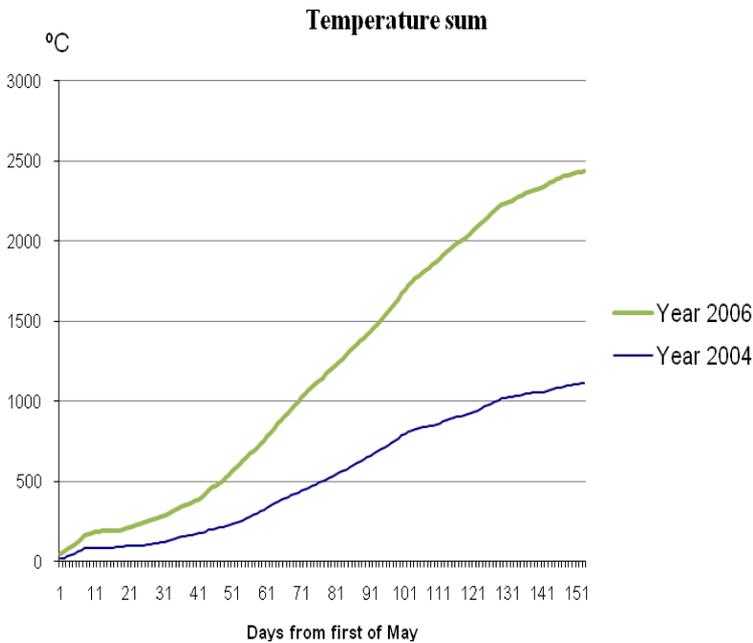
Incidence of *Pectobacterium* and *Dickeya* spp. in seed potatoes produced in Finland



What has changed?

Apart from being a newly emerging pathogen the frequent occurrence of warm springs and summers (warm Europe) in recent years in many parts of Europe including Finland is believed to favor high incidence of blackleg due to *Dickeya* spp.

Examples of extreme weather changes in Finland



Weather 2006

Lowest temperature	-43,6°C	January 20th, Kittilä Pokka
Highest temperature	32,1°C	July 8th, Lammi Evo and Suomusjärvi Taipale
Highest number of hot days	37	
The last hot day of the summer season	25,6°C	August 27th, Kauhava
The longest thermal summer during the period 1961-2006	160 days	Helsinki-Vantaa
New record for precipitation in October in the whole of Finland	228 mm	Vihti Hiiskula
The lowest precipitation in June-August	24 mm	Simo Maksniemi and Simo Simoniemi

Climate change in Finland

Climate change **already** affecting Finland (*Helsingin Sanomat International Edition*)

- **Atmosphere more humid than before, sea levels rising, and extreme weather phenomena increase**
- Summers have been exceptionally warm.
- The average temperature has risen at a rate of about one degree in 100 years. The greatest increase in warmth has been in the spring,
- Snows are melting earlier than before.
- The snow cover has become thinner, and
- The period when lakes are covered with ice has become shorter.
- The carbon dioxide content of the atmosphere has increased by 0.5 per cent in a year. This has been seen as a steady rise at the Pallas research station in Lapland.

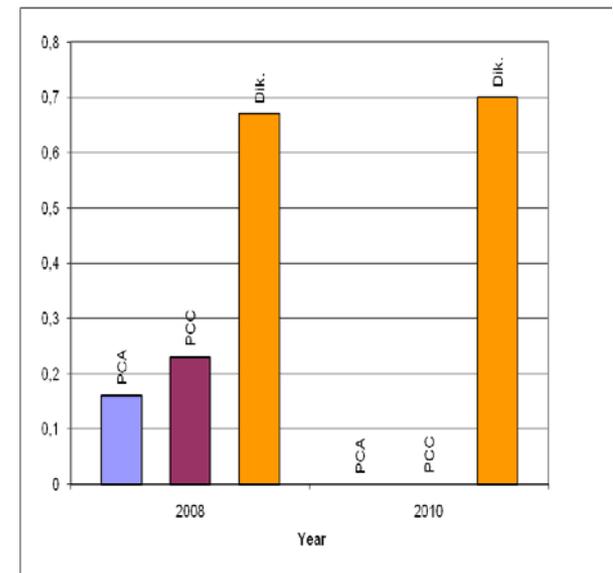
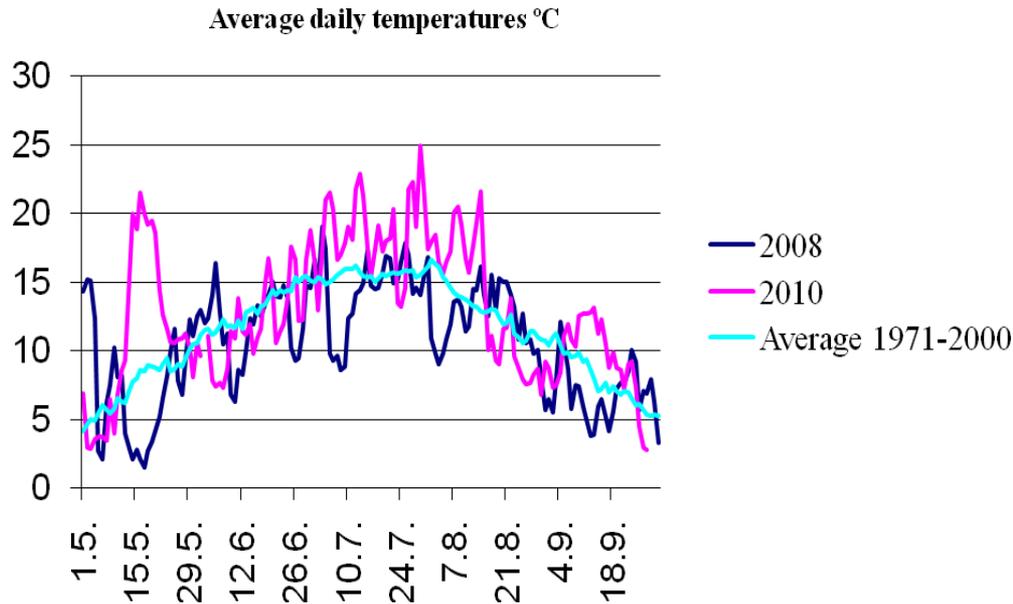
Characterization of Blackleg complex in North Finland

- Monitoring of the HG area (Municipalities of Tyrnävä and Liminka) for occurrence of blackleg in farmers fields
- Sample collection, PCR detection and isolation of strains
- Analysis of weather data
- Designation of the species/ strain of the year along with the observed weather features in the particular season the survey was conducted

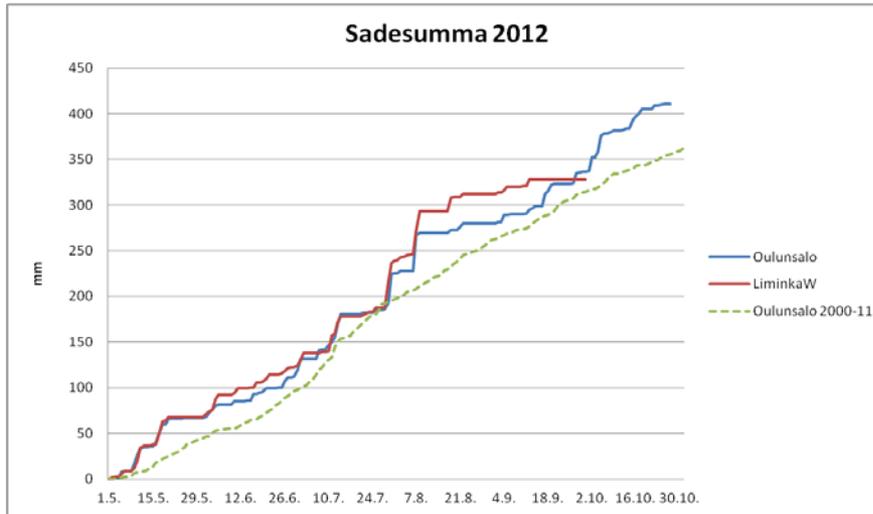
Species role in the blackleg complex under different seasonal weather regimes

2008 was warm and rainy

2010 – a year of weather extremes

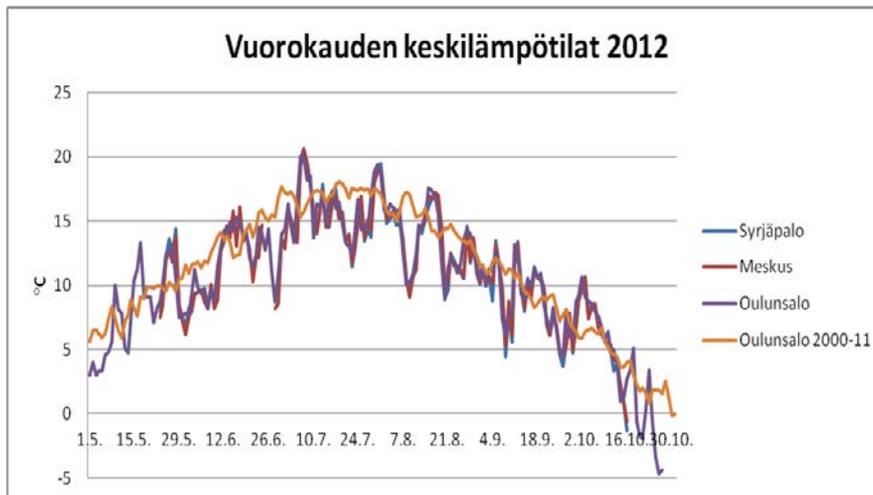


2012 cooler and heavy rain summer

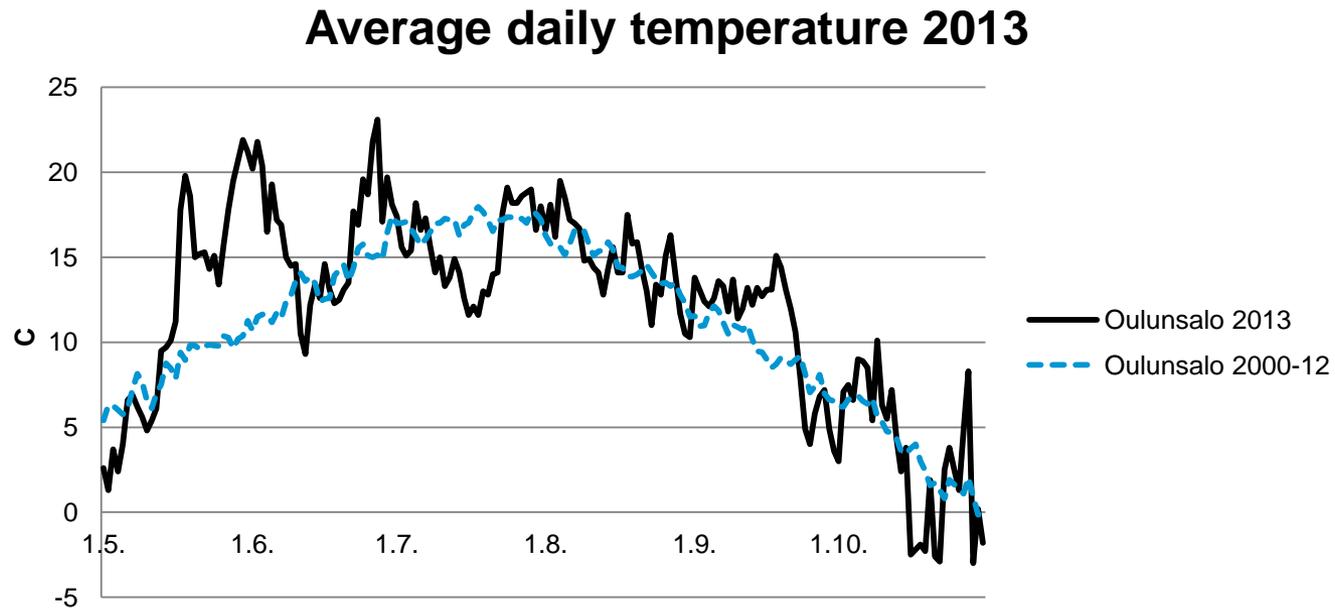


Species of the year

Pectobacterium atrosepticum



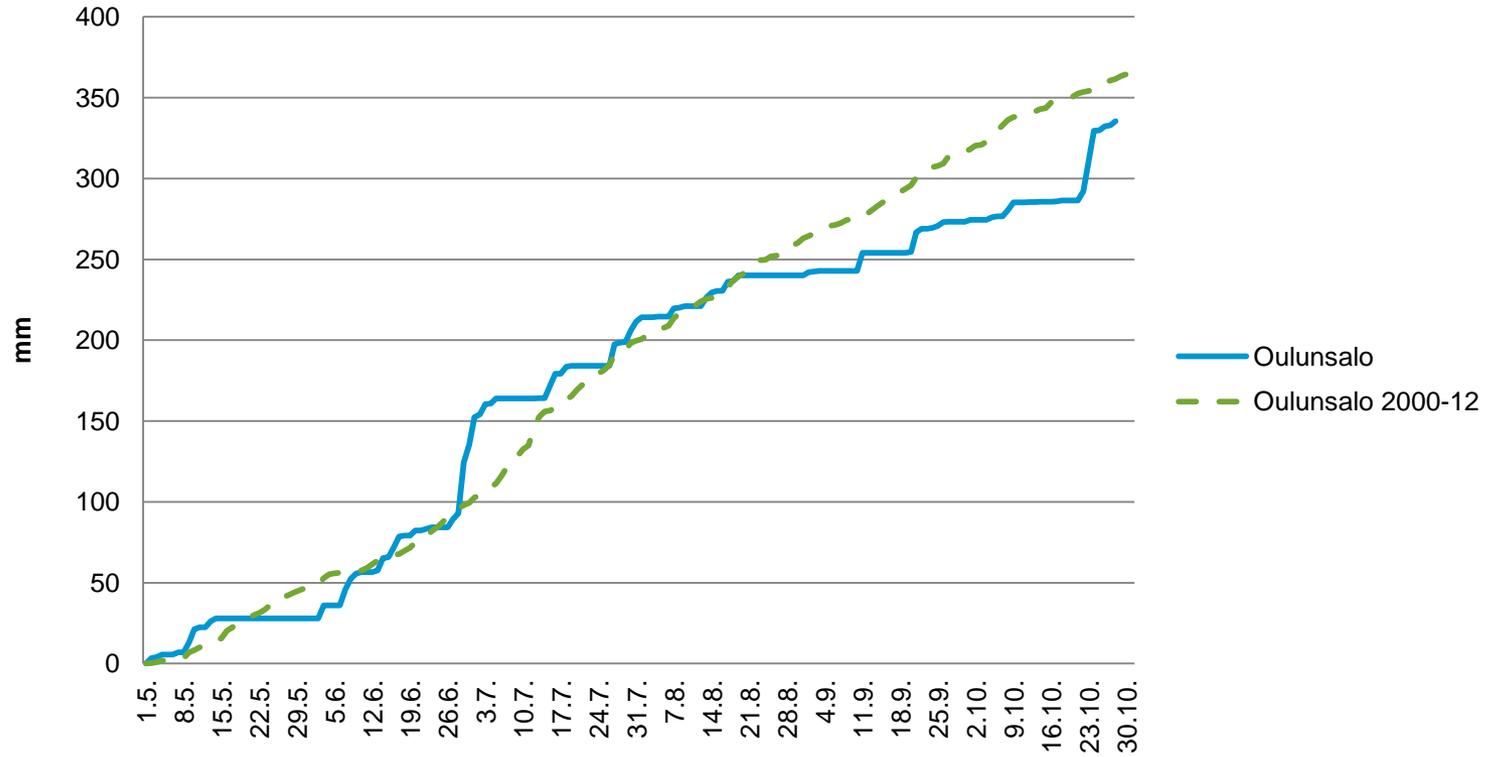
2013: warm spring and cooler summer



P. atrosepticum and *P. wasabiae* predominate. *Dickeya* spp was very rare.

Weather 2013

Rainfall 2013



The New Clade of *Dickeya* 'Dickeya solani' strikes in Finland during warm summers

Characterization of over 50 isolates of *Dickeya* spp isolated from heavy outbreaks of Blackleg in 2008 and 2010 indicated that the strains are 'D. Solani'.

Characterization: REP PCR

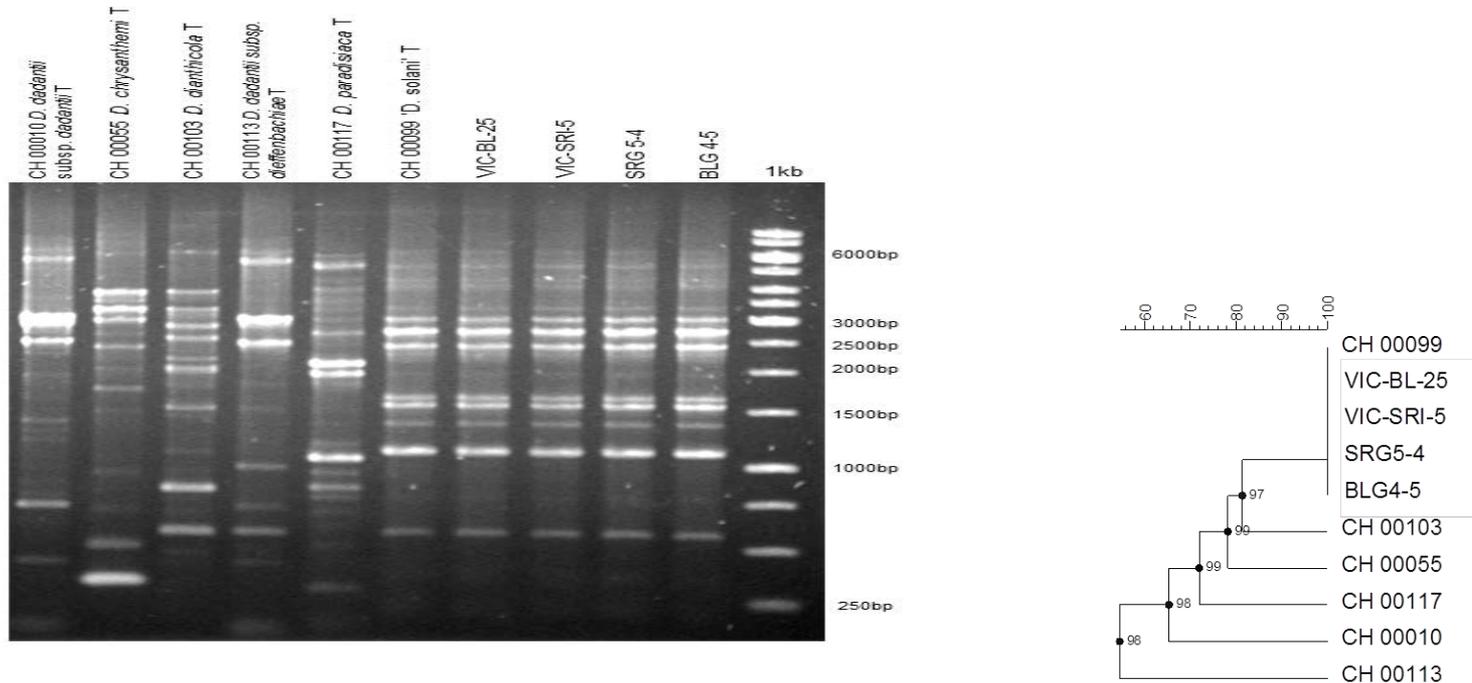


Fig.5. REP-PCR analysis. Patterns of *Dickeya* reference species and selected strains of a new clade of *Dickeya* isolated in Finland (A). Phylogenetic analysis based on REP-PCR electrophoregram made in BioNumerics Software, (B). Method of cluster analysis: UPGMA, Branch quality: Cophenetic correlation

Characterization: Pulsed Field Gel Electrophoresis (PFGE)

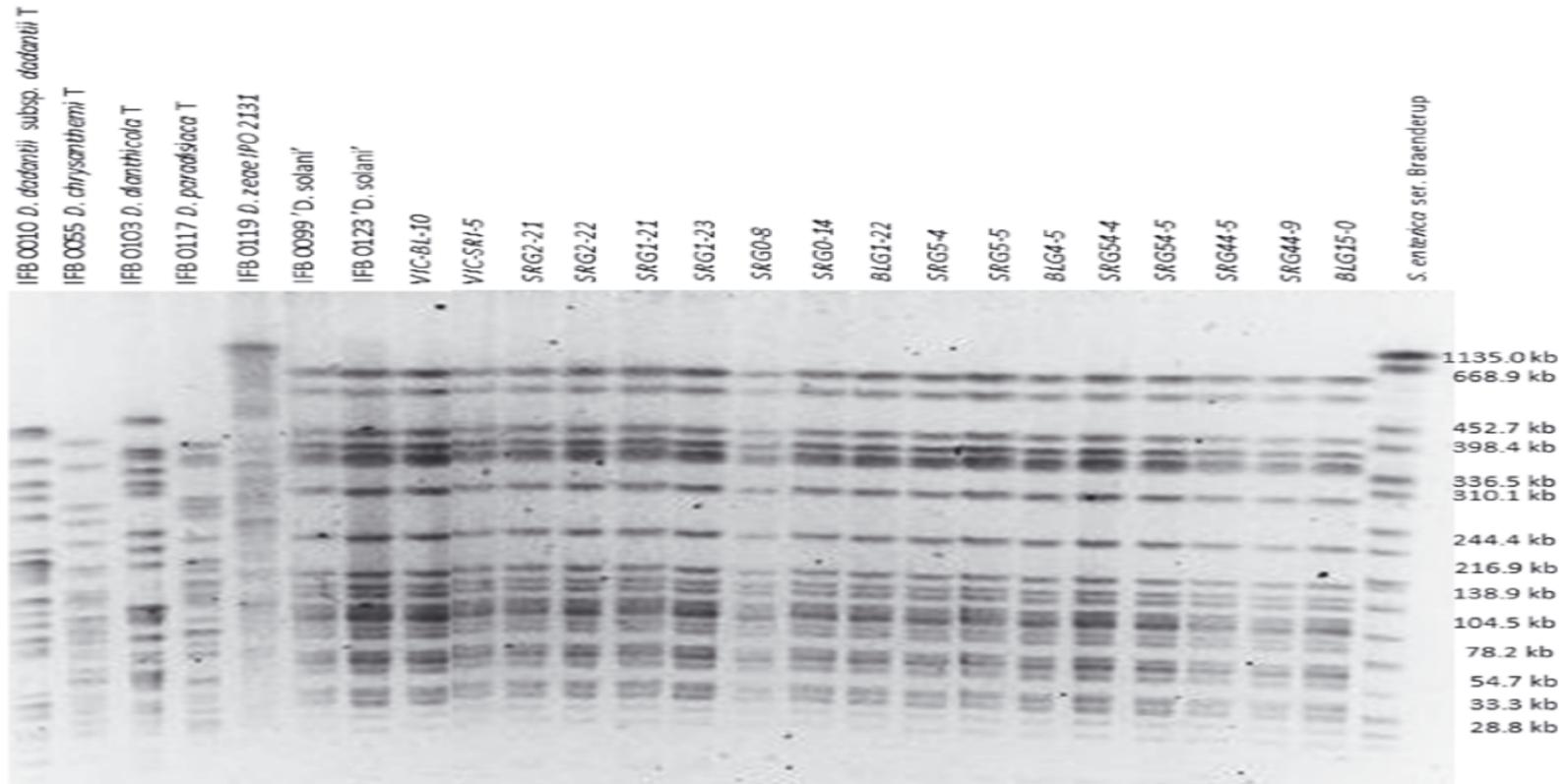


Figure 6. Comparison of the PFGE patterns of six strains of *Dickeya* spp. and tested *Dickeya* strains isolated in Finland. As a standard *Salmonella enterica* serotype Braenderup (strain H9812, ATCC) was used.

Characterization: *dnaX* Sequencing

The *dnaX* sequences of the *Dickeya* strains analysed in this study are 100% identical to the already characterized strains from the Netherlands, Israel and Poland confirming *earlier* reports that proposed new species could have a common origin.

Conclusions

- *Pectobacterium* and *Dickeya* spp adapted to different m weather (temperature) conditions exist in North Finland
- Temperature modulates which species predominate in the disease complex
- Disease outbreaks are very severe during warm summers (daily temperatures reaching 25 C) and 'D. solani' is very often responsible for the outbreaks
- *P. wasabiae* was very prevalent coming next to
- *P. Atrosepticum* in 2013 cropping season