Etiology of blackleg of potato in Finland: Shift from a serotype of one species to multiple taxa.

Yeshitila Degefu
Natural Resource Institute Finland,
Green Technlogy, Agrobiotechnology Team, Oulu

Luke
LUONNONVARAKESKUS

Presentation Highlights

- Etiology, definition, significance in diagnostics and disease management
- Advances in Molecular Biology and microbial taxonomy
- Emerging pathogens, possible drivers and potential implications
- Multiplicity, synergism, antagonism ??
- Prospects

Methods used for typing and characterization of the blackleg and soft rot bacteria

- Biochemical methods
- Serological methods
- Molecular methods

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What is a Serotype?

- A subdivision of a species or subspecies distinguishable from other strains **therein** on the basis of antigenic character.

Serological properties of the blackleg bacteria (*Erwinia carotovora* subsp. *atrosepticum* - *Pectobacterium atrosepticum)*

Four groups:

- Serogroup 1 (homogeneous group)
- Serogroup XVIII
- Serogroup XX
- Serogroup XXXII

} Heterogenous groups

Serotype I

- Biochemically and serologically homogeneous and most common serogroup associated with blackleg symptom.

- Previously considered as the sole cause of typical blackleg in potato in cooler climate such as Finland.

Survey results on the incidence (%) of serogroups of *E. carotovorum* subsp. *atrosepticum (*Currently *Pectobacterium atrosepticum)* populations from North America and Scandinavia.

Country	Serotype 1	XVIII	XX	XXII	Ref.
Canada (618)	95.6	1.8	1.0	1.6	De Boer *et al*.1987
Finland (1077)	**55**	**15**	**28**	**1**	**Harju & Kankila, 1993**
Sweden (1000)	90	ND	ND	ND	Bång, Unpub.

Finland: High number belonging to the heterogenous group and relatively less of Serotype I. Numbers in bracket are no. of samples analysed

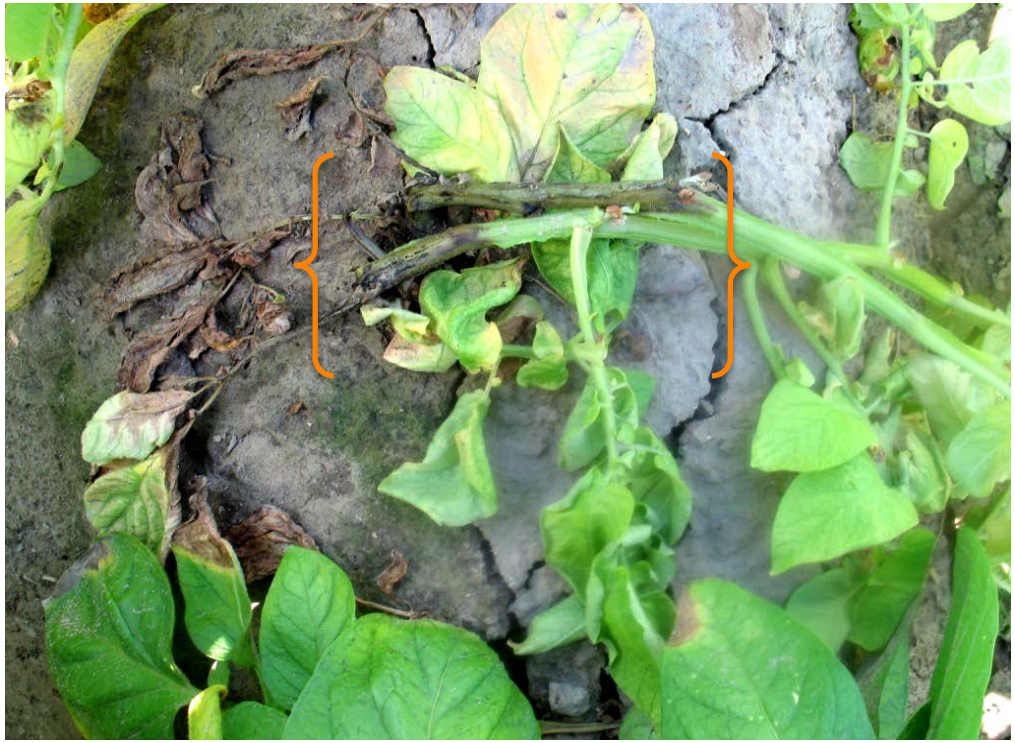
Changes observed over the last decades: Simple to complex

Most common causal agents of blackleg and soft rot of potato (current list)

- *Dickeya solani*
- *Pectobacterium atrosepticum*
- *Pectobacterium carotovorum*
- *Pectobacterium brasiliensis*
- *Pectobacterium wasabiae*

CONCLUSION:

Potato Blackleg is a Disease Complex (Several bacteria causing the same disease symptom)



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Possible drivers of the observed changes 1/2

Trade liberalizations : Movement of planting material fast and easy

Possible drivers..... 2/2

Climate change – Finland is warming, New strains of pathogens find their way to regions where they have not been present before

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

What does this diversity mean?

- Is the potato industry facing new challenges? Or is it business as usual?
- Blessing in disguise or purely curse ?

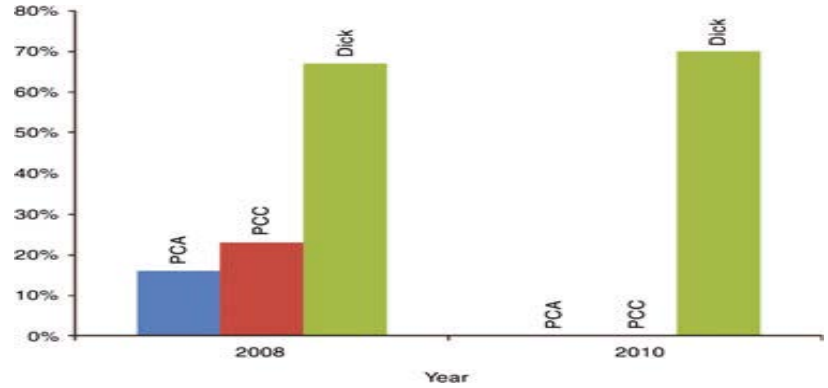
➡ Subject of investigation.

Co-occurences of *Dickeya* and *Pectobacterium* in 2013 and 2014 samples

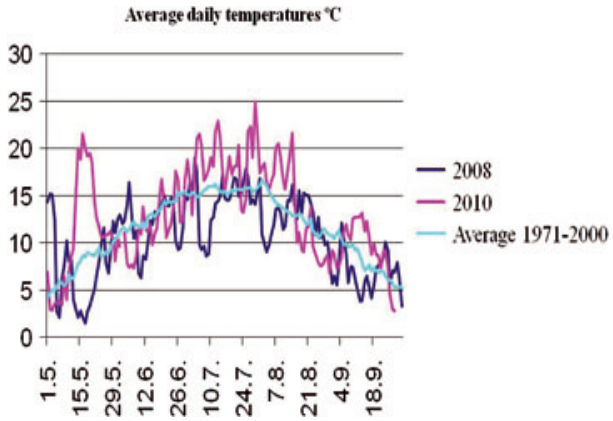
Species combination	Number of samples
Dickeya, PCA, PCC, PWA	0
Dickeya, PCA, PCC	2
PCA, PCC, PWA	6
PCA, PCC	18
PCA, PWA	10
PCC, PWA	16

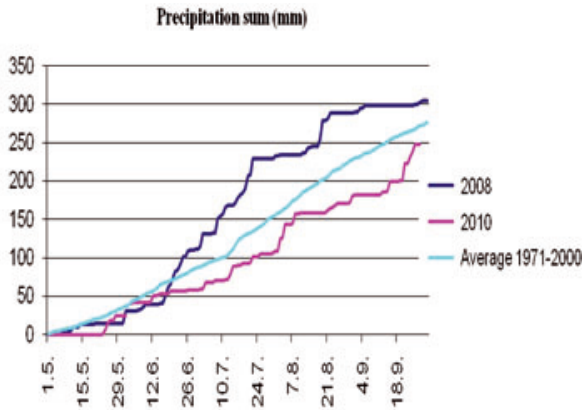
Dickeya apears to over take the other species in general and predominates totally at higher temperatures

Weather effect on incidence and importance in disease complex. *Dickeya solani* overtakes in warm (≥25 ºC) conditions.



Source: Degefu et al., 2013. Annal. Apl. Biol.





Potential implications (2/3)

❖Complexity in disease management: especially if species specific management practices are needed

Potential implications (1/3)

- Diagnostic complexity
  - ✓need for multiplex detection
  - ✓More complex and compromised diagnostic accuracy
  - ✓Costly

Potential implications (3/3)

- Maximized disease risk.

With diverity matched with adaptation to different temperature regimes, blackleg becomes a consistent threat to potato production.

Can something good come out of it? Antagonistic Symbiosis? Blackleg control?

Some evidences emerge that antagonistic interactions among the species are emerging but not published so far. It is an area for investigation!

Control Strategies

Integrated approach

o Use of clean and certified seed

- o reliable and validated certification methods
- oadequate sampling, efficient extraction, enrichment under selective conditions
- oUse of robust, specific and sensitive, multiplex detection methods

ohygenic measures and optimized cultivation methods

- o avoid using surface water for irrigation
- o avoid transmission of pathogen in and between seed lots by disinfection of machines and use of clean materials
- o avoid water logging of fields
- o rouging of diseased plants and removal of rotten tubers from harveters and graders
- o In haulm destruction, it is recommended to use full field spraying followed by flailingwhich results in less infections than flailing followed by spraying
- o Harvesting should be done under dry conditions and followed by forced drying of seed lots
- o Store tubers under dry condition preventing tuber decay

Conclusion: Test your seeds!!!


Luke
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