

Importance of Utilizing Locally Produced Seed

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The Humble Potato

- World's most important vegetable
- Complex genetically- autotetraploid
- Vegetatively propagated
- Method of propagation/crop growth makes it very susceptible to diseases
- There are >150 diseases of potato globally, ~40 of which are economically important
- All can be carried either on, or in, the seed tuber

Invasive Pathogen

- An invasive or exotic species is defined as an organism (plant, microbe, or animal) that is not native to a specific location but have been introduced.
- Because they have been introduced, they have no natural enemies to dampen their spread.
- The net result is that invasive pathogens have a tendency to spread uncontrolled due to their lack of enemies and due to their ability to go undetected.

Types of Seed Borne Pathogens

- **Type I**- Pathogen passively carried on the seed surface, usually in soil adhered to propagule.
 - Examples include any soil borne pathogen such as *Verticillium dahliae*, *Phytophthora erythroseptica*, *Spongospora subterranea*, cyst nematodes
- **Type II**- Pathogen carried in seed coat or in periderm (skin) of vegetative propagule.
 - Examples include the silver scurf and black dot pathogens, common and powdery scab pathogens, *Erwinia/Pectobacterium* in lenticels

Types of Seed Borne Pathogens^{cont'd}

- **Type III**- Pathogen in seed endosperm or vascular system of propagule (tuber).
 - Examples include ring rot bacterium, *V. dahliae*, *Erwinia/Pectobacterium*, *Dickeya* sp., phytoplasmas
- **Type IV**- Pathogen carried systemically in seed embryo or in all internal tissues of tuber.
 - Examples include all potato viruses (PVY, PLRV, PVX, PMTV, TRV).

Seed Borne Pathogens

- Role of regulatory agencies:
 - Type I and Type II pathogens are either not regulated or if they constitute an invasive pathogen they are most commonly regulated via quarantines (APHIS or CFIA).
 - Type III and Type IV pathogens are most commonly regulated through seed certification regulations, occasionally by quarantines (i.e. PMTV).

The Risk of Importing Seed

- There are valid reasons to buy out-of-state/province seed, but most common reason is to access newer varieties.
- But the risk of either importing a major disease problem, or worse yet, importing a pathogen that can do irreparable harm, are substantial. For example:
 - Powdery scab
 - BRR
 - cyst nematodes
 - New strains of LB
 - PMTV
 - Dickeya

Dickeya sp.- The New Threat

Dickeya?

Where did it come from?

Is it new?

The Genus *Erwinia*

- *Erwinia* is a genus of Enterobacteriaceae, closely related to *E. coli*, *Shigella sp.*, *Salmonella*.
- Members of this family are all facultative anaerobes.
- *Erwinia* is named after the famous plant pathologist Erwin F. Smith.
- Gram negative, rod-shaped, peritrichously flagellated.

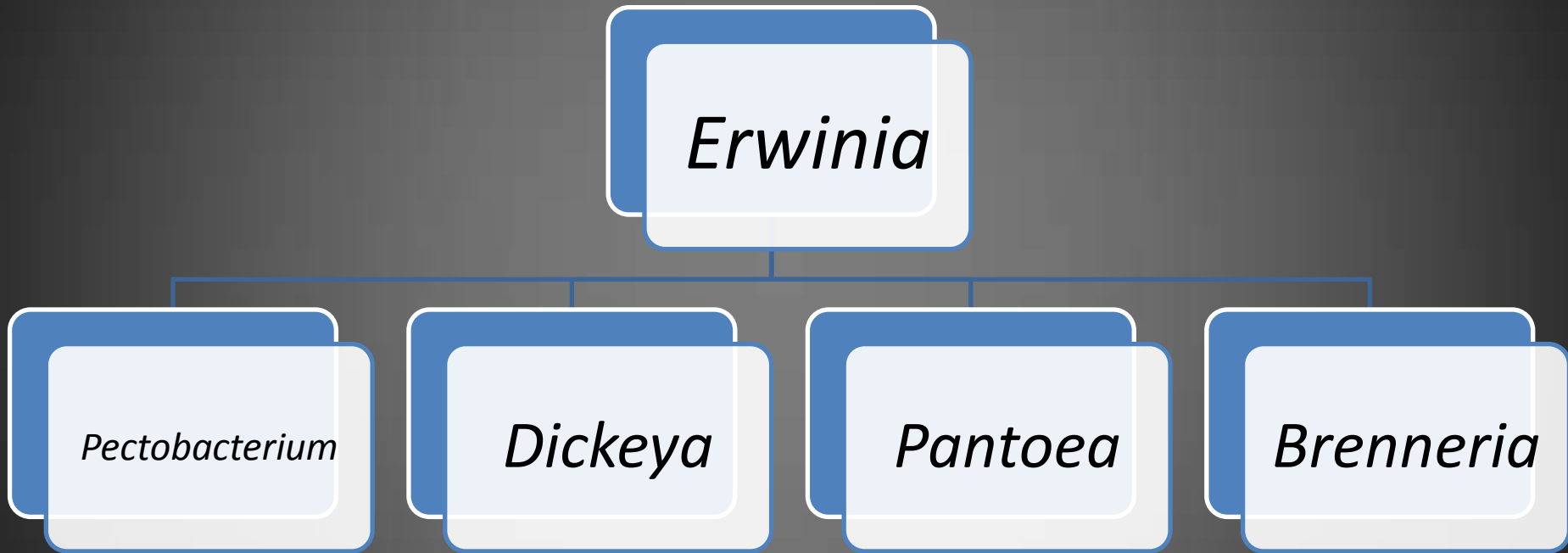
The Genus *Erwinia*

- Type species for *Erwinia* is *E. amylovora*.
- The reality is that the genus of *Erwinia* contained many species that were completely unrelated.
- A number of species cause soft rots across many (>200) plant species, highly pectolytic.
- Other *Erwinia* species caused wilts but were host specific.
- Some species caused stem rots, and host-specific

The Genus *Erwinia*

- Original species in Genus *Erwinia* included:
 - *Erwinia amylovora*- fireblight of apple/pear
 - *Erwinia carotovora*- soft rot of fleshy vegetables
 - *Erwinia atroseptica*- blackleg of potato
 - *Erwinia chrysanthemi*- stem rot of
chrysanthemum
 - *Erwinia stewartii*- Stewart's wilt of corn
 - *Erwinia tracheiphila*- bacterial wilt of cucurbits
- And many, many more species

How Erwinia was Split



Symptoms of *Pectobacterium*



Symptoms of *D. dianthicol*





Pectobacterium carotovorum

Inoculation of tuber discs
24 hours at 30°C/86°F



Dickeya dianthicola

Comparison of Symptomatology

D. dianthicola symptoms



L. Tsrer- Israel

Pc. carotovorum symptoms



J. Mathews- WF

Dickeya on Potatoes in Europe

- First report from the Netherlands early 1970s
- Early detections were identified as *D. dianthicola*
- *D. dianthicola* very aggressive in stems, not as aggressive as *Pectobacterium* in tubers
- In 2005-2006 a new more aggressive *Dickeya* sp., named *Dickeya solani*, found in Netherlands
- Subsequently detected throughout Europe

Dickeya sp. in USA?

- *Dickeya dianthicola* reportedly found in Maine.
- A. Charkowski and G. Secor have both verbally reported finding it in multiple states such as FL, NC, MD, ND, ID, MN, CO, ME & ON Canada.
- Question remains what, if anything, will APHIS and/or seed regulatory agencies in each state respond.

Summary/Recommendations

- I personally recommend that potato growers avoid, if at all possible, buying seed from out-of-state/province.
- The risks that you will “buy” a problem that does not exist in your state/province/farm are higher than you think.
- Seed has been responsible for moving new genotypes of late blight, cyst nematode, powdery scab/PMTV, and now Dickeya.
- If you must buy seed, remember to get a NA Plant Health Certificate in advance of purchase.

Thank you!
Questions?

Causes of Blackleg and Soft Rot

Hosts (Symptoms)	Old Name	New Name
Potato (blackleg, soft rot)	<i>Erwinia carotovora ssp. atroseptica</i>	<i>Pectobacterium atrosepticum</i>
Potato & a wide range of crops (blackleg, soft rot)	<i>Erwinia carotovora ssp. carotovora</i>	<i>Pectobacterium carotovorum ssp. carotovorum</i>
Potato (soft rot)	' <i>Erwinia carotovora ssp. brasiliensis</i> '	' <i>Pectobacterium carotovorum ssp. brasiliensis</i> '
Potato & Japanese horseradish (wasabi)	<i>Erwinia carotovora ssp. wasabiae</i>	<i>Pectobacterium wasabiae</i>
Potato, Dianthus, tomato, maize, chrysanthemum, etc.	<i>Erwinia chrysanthemi</i>	<i>Dickeya chrysanthemi</i> , <i>D. dadantii</i> , <i>D. diathicola</i> , <i>D. solani</i> , <i>D. zea</i> , etc.

Spread of *Dickeya solani*

- Movement of *D. solani* from area to area through infected seed.
- Spread and infection from tuber to tuber very efficient during all harvest and tuber handling practices.
- Bacterium capable of plant to plant spread in the field.
- *D. solani* causes typically 3 times more tuber rot at 81°F than at 70°F, with rotting at 70°F equivalent to that for *P. atrosepticum*

Dickeya solani Persistence & Mgmt

- *D. solani* does not survive in soil long periods of time, <3 mo.
- Does not survive on production surfaces more than a few days (as opposed to *Cms*).
- Can be found in water and on certain weeds, esp. *Solanum dulcamara*.
- Surfaces easily disinfested with standard disinfectants.

Dickeya Management cont'd

- Post-harvest testing in Europe an important component to contain spread and severe losses:
 - EU standard is 200 tubers/seed lot
 - Stem end cored as USA BRR test, incubated 24 hr in buffer
 - Homogenate centrifuged, pellet re-suspended, aliquote onto CVP medium
 - Colonies forming pits tested with PCR