Potato blackleg (Dickeya?): What we know about an emerging problem

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Keith Perry

KLP3@Cornell.edu

Uihlein Farm of Cornell University Plant Pathology and Plant-Microbe Biology Section School of Integrative Plant Science Ithaca, NY In 2015, blackleg was responsible for significant losses in potato, mainly in the Eastern US. "North American *Dickeya* Outbreak"

Poor Emergence



Disease in Foliage



Disease in Tubers



Photos kindly provided by Amy Charkowski

- Potato Blackleg and Soft Rot Diseases
- Other Seed-borne Potato Pathogens & Diseases
- Biology, Management and Control of Bacterial Soft Rot

Blackleg Pectobacterium atrosepticum: symptoms







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Blackleg – Vascular Discoloration, Wilting



Ian Toth (SCRI), John Elphinstone (FERA), Gerry Saddler (SASA)

Blackleg - Severe Wilting



Ian Toth (SCRI), John Elphinstone (FERA), Gerry Saddler (SASA)

Blackleg – Wilting, Dieback



Ian Toth (SCRI), John Elphinstone (FERA), Gerry Saddler (SASA)





Soft rot of the daughter tubers (depending on level of infection)



Ian Toth (SCRI), John Elphinstone (FERA), Gerry Saddler (SASA)

Soft Rot – Tuber symptoms



http://postharvest.ucdavis.edu/pfvegetable/Potatoe sEarlyPhotos/?repository=29974





http://www.apsnet.org/edcenter/intropp/lessons/pr okaryotes/Pages/Blacklegpotato.aspx





http://cru.cahe.wsu.edu/CEPublications/FS066E/FS066E.pdf

Bacterial Soft Rot Diseases



Blackleg

- a disease of potato vines; symptoms subsequently seen on tubers Seed piece decay, stem rot



Soft rot

- a disease of potato tubers (and many other crops)



Bacterial Soft Rot Diseases

The Pathogens



a disease of potato
vines; symptoms
subsequently seen on
tubers



Soft rot

Blackleg



Pectobacterium These two atrosepticum pathogens are present in all Pectobacterium potato growing sp. regions of the Dickeya sp. world and historically have been the Pectobacterium greatest concern caratovora for blackleg and soft Pectobacterium rot sp. Dickeya sp.

Bacterial Soft Rot Diseases



Blackleg

- a disease of potato vines; symptoms subsequently seen on tubers

So why all the concern about Dickeya?

The Pathogens

Pectobacterium atrosepticum

Pectobacterium sp.

Dickeya sp.

Pectobacterium caratovora

Pectobacterium sp.

Dickeya sp.



Soft rot

- a disease of potato tubers (and many other crops)

Blackleg

An emerging, aggressive, and damaging pathogen (*Dickeya solani*) was first observed in potato in the Netherlands ~2005 and has subsequently spread throughout Europe



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Blackleg & Soft Rot Pathogens There are Multiple Species of *Dickeya*



Global distribution of *Pectobacterium (Erwinia) atroseptica* ---The most common blackleg associated pathogen---



C CAB 1987

For list of countries in which this disease has been recorded, see overleaf

Global distribution of *Dickeya dianthicola* ---A carnation (and potato) associated pathogen---



Global distribution of *Dickeya solani* ----An emerging pathogen in potato (~2005 onward)----

Distribution Maps of Plant Diseases

Compiled by CABI in association with EPPO www.cabi.org/dmpd

Map No. 1175

Edition 1 Issued October 2015

Dickeya solani van der Wolf et al.

Gammaproteobacteria: Enterobacteriales: Enterobacteriaceae

Hosts: potato (Solanum tuberosum), hyacinth (Hyacinthus orientalis).



2015 North American Outbreak of Potato Blackleg What pathogens were associated with this oubreak? Poor Emergence Disease



Photos kindly provided by Amy Charkowski

- *Dickeya* sp. (*Dickeya dianthicola*) were associated with losses
- No evidence *Dickeya* solani was present or introduced from Europe

2015 North American Outbreak of Potato Blackleg Why the appearance of the disease in 2015?

Poor Emergence



Disease



Photos kindly provided by Amy Charkowski

- Dickeya sp. were present in potato
- Rain in 2013 and 2014; cool temperatures caused latency; pathogen spread with seed
- Warmer temperatures in 2015
- Blackleg is a seed-borne disease

Potato Blackleg and Soft Rot Diseases

- Seed-borne Potato Pathogens & Diseases
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Seed-borne Pathogens & Diseases Blackleg and Soft Rot



http://cru.cahe.wsu.edu/CEPublications/FS066E/FS066E.pdf

What other diseases might be confused with soft rot?

Seed-borne Potato Pathogens & Diseases

Associated with tuber rot (or wilting plants)

- Bacteria
- Fungi & Oomycetes
- Viruses

Seed-borne Potato Pathogens & Diseases Bacteria

Blackleg & soft rot / Pectobacterium & Dickeya

Ring rot / Clavibacter -

Common Scab / Streptomyces sp.

Seed-borne Potato Pathogens & Diseases Ring rot / Clavibacter

http://www.aces.uiuc.edu/vista/abstracts/a93 7.html

Amy Charkowski

Ring rot has not been observed in NY seed since 1987

http://fera.co.uk/plantClinic/documents/factsheet s/ringrot.pdf

Seed-borne Potato Pathogens & Diseases Fungi & Oomycetes

Silver scurf / Helminthosporium Black dot / Colletotrichum

Rhizoctonia, Verticillium, Early blight / Alternaria

Leak / Pythium Pink rot / Phytophthora erythroseptica Late blight / Phytophthora infestans

Seed-borne Potato Pathogens & Diseases Fungi & Oomycetes

Verticillium http://umaine.edu/publications/5041e/

Leak / Pythium

Late blight / Phytophthora infestans

Physiological Disorders – Blackheart (not infectious)

Seed-borne Potato Pathogens & Diseases Viruses

http://potatoes.ahdb.org.uk/mediagallery/detail/13214/2925

https://www.potato-tuberblemishes.com/Symptoms/Skin-discoloration/Otherdiscolorations

Tuber necrotic ringspot / *Potato virus* Y

http://portal.mtt.fi/portal/pls/portal/tuh_mtt.tuh _mtt_perus_pack.tul_tuhoojatiedot_kasper?p _tuhooja_seqno=59347

http://mtvernon.wsu.edu/path_team/Di seaseGallery/potato-mop-top-virus-2L.jpg

http://vegetablemdonline.ppath.cornell.edu/N ewsArticles/Potato_Virus.htm

Mop top, spraing / Potato mop top virus

Spraing / Tobacco rattle virus

Potato Blackleg and Soft Rot Diseases

- Other Seed-borne Potato Pathogens & Diseases
- Biology, Management and Control of Bacterial Soft Rot

Biology of Pectobacterium & Dickeya

- Soft rot bacteria are widespread; many have wide host ranges
- Some soft rot bacteria primarily associated with potato tubers, spread with seed.
- Spread with water
- Bacteria survive relatively poorly in soil.
- Blackleg is a seed-borne disease.
- Bacteria can persist in tubers/plants without symptoms

Blackleg Disease Cycle and Epidemiology

Management of Blackleg and Soft Rot

 Purchase and plant certified seed; check field inspection report or health certificate

FIELD I	Seed Impr	TION RI	EPORT	FOR POTATO eland Lab, Cornell Univ	CERTIF ersity, Ithaca	ICATIO	N
CERTIFICATION NUMBER (Office Use Only)]		
GROWER & ADD	RESS						
VARIETY & SOUR	CE						
FIELD NO./LOCATION					ACRES		
PLANTING DATE KILLING				DATE	HARVEST DATE		
PREVIOUS CROP	LAST YEAR			2 YEARS AGO			
	FIRST	SECOND	HARVEST		FIRST	SECOND	HARVEST
LEAF ROLL				TOBACCO RATTLE			
MOSAIC				LATE BLIGHT			
SPINDLE TUBER				EARLY BLIGHT			
BLACKLEG				VARIETAL MIXTURE			
IN TOOTONIL				INSECTS			
WILTS				GENERAL VIGOR			
RING ROT				WEEDS			
MOP TOP				ISOLATION			
CALICO				PLANT COUNT			

Management at Planting

Cutting seed will spread bacteria within a seed lot.

Kindly provided by Amy Charkowski

Sanitize seed cutting equipment and planter between seed lots.

Management at Planting

Warm the seed to soil temperature (50°F)

Reduces water condensation on tubers.

Kindly provided by Amy Charkowski

Management at Harvest

Kindly provided by Amy Charkowski

If soft rot is present in a portion of the field, do not harvest this part of the field.

Sanitize harvest equipment between lots.

Management of Blackleg and Soft Rot

- Post harvest forced ventillation

- Use post harvest grow outs

- Rotation; beans or cereals
- Avoid excessive moisture
- Copper sprays?

Management Industry-Wide

- Good diagnostic tests available
- No resistant cultivars
- Remove seed lots with high incidence of Dickeya
- Survey seed lots to avoid another outbreak.

Soft Rot Tuber Sampling and Testing for Dickeya

Select"least diseased" symptomatic tubers/stem

Kindly provided by Amy Charkowski

- Send multiple tubers

http://cru.cahe.wsu.edu/CEPublications/FS066E/FS066E.pdf

- Include random sampling of healthy appearing tubers/stems
- KLP3@Cornell.edu

Concluding Remarks

Dickeya sp. are present; D. solani not detected

Blackleg is a seed-borne pathogen

Current seed certification standards and practices will not eliminate this pathogen from certified seed; research and revisions are necessary.

Thank you!

Questions?

