

Research Report to Maine Potato Board

Determining Sources and Management of *Dickeya* and *Pectobacterium* spp. that Cause Blackleg of Potato in Maine

Jay Hao¹, Steven Johnson², Gregory Porter¹, Tongling Ge¹, Nayara Marangoni¹, Elbridge Giggie¹

¹School of Food and Agriculture; ²Cooperative Extension
University of Maine

Bacterial soft rot and blackleg continues to be a threat to the potato production in Maine. In this study, we examined sources and survival of *Dickeya* and *Pectobacterium* spp. that cause blackleg; examined the effect of major factors on the development of blackleg; and evaluated varietal materials for managing *Pectobacterium* and *Dickeya* spp.

From 2015 to 2017, 1219 samples from symptomatic plants, symptomless tubers of potato and other plants containing *Dickeya* spp. and *Pectobacterium* spp. were collected. In addition, 132 water samples were collected from pond near farm in Maine in 2016 and 2017 (Table 1). Pectinolytic bacteria were isolated from *Dickeya*-positive samples by plating on CVP medium.

Comparing the samples from Eastern states, the frequency of *Dickeya* in Maine stayed in the low or average range (Table 1). This might be related to the cooler climate. *Dickeya* spp. have been frequently isolated from potato tubers, stems and stolon, as well as surface water. However, it was not detected from soil samples (Table 2). *Dickeya* spp. isolated from surface water caused typical symptom of blackleg in the stem and soft rot of tubers of potato (Fig. 1). The species will be further identified. *Dickeya dianthicola* could stay alive for several months once they went into dormant state (Fig. 2). This indicated that the bacterium had capability to survive winter on/in potato tubers. Among the *Pectobacterium* isolates in 2015, *P. carotovorum*, *P. polaris*, and *P. parmentieri* had roughly equal frequency in total population, but *P. parmentieri* significantly decreased in 2016 and 2017 (Table 3). Our study showed that *P. parmentieri* was the most aggressive species among the three and caused severe storage problem. When seed tubers were dipped with bacterial inoculum, variety 'Green Mountain' and clone AF 5179-4 showed a high tolerance to *Dickeya* (Table 4), which can be further evaluated for resistance. For the tuber inoculation, commercial varieties showed different levels of susceptibility to bacterial inoculation (Table 5). Variety 'Pantonac' was the most tolerant to *D. dianthicola*, while 'Atlantic' was the most tolerant to *P. parmentieri* (Table 5).

Table 1. Detection of *Dickeya* spp. from potato samples collected from Northeastern states from 2015 to 2017.

State	2016		2015		2017	
	# of sample	% <i>Dickeya</i>	# of sample	% <i>Dickeya</i>	# of sample	% <i>Dickeya</i>
Maryland	2	100	0	-	0	-
North Carolina	6	16.7	0	-	0	-
Virginia	11	72.7	0	-	13	53.8
Florida	15	53.3	0	-	2	0
New York	19	52.6	6	83.3	1	0
Delaware	20	25.0	4	75.0	1	100
Rhode Island	24	54.2	0	-	18	16.7
Pennsylvania	37	27.0	36	66.7	54	50.0
New Jersey	39	25.6	18	38.9	25	12.0
Michigan	0	-	0	-	9	11.1
Massachusetts	68	38.2	3	100	18	61.1
Maine	369	33.3	466	38.0	72	22.2

Table 2. *Dickeya* spp. detected from various sources of sample in 2016 and 2017.

Sample	Total number of sample	% <i>Dickeya</i>
soil	18	0
stolon	80	17
tuber	143	35
water	114	42
stem	464	197

Table 3. Pure cultures obtained from samples during 2015 and 2017.

Bacterial species	2015	2016	2017
<i>Pectobacterium carotovorum</i>	15	24	11
<i>P. parmentieri</i>	17	3	0
<i>P. polaris</i>	14	20	11
<i>Dickeya dianthicola</i>	1	6	0



Figure 1. Pathogenicity of water isolates (*Dickeya* spp.) on potato tubers (left panel) and plant (right).

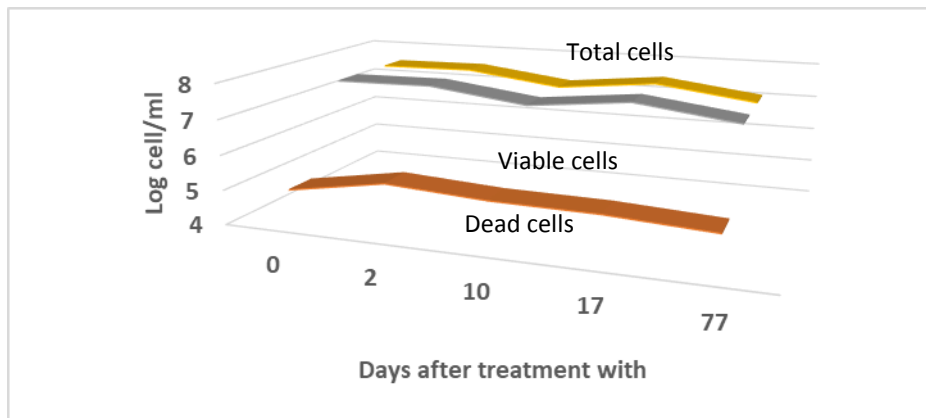


Figure 2. Population dynamic of *Dickeya dianthicola* in viable but noncultural state, which is a dormant form, induced by copper.

Table 4. Emergence of potato tubers were inoculated with *Dickeya dianthicola* ME30. Each variety had 5 replicated plants.

Variety	Emerged
Green Mountain	4 healthy, 1 undeveloped
Dark Red Norland	2, one plant showed dead branch
AF 5179 - 4	4
AF 5429-3	0

Table 5. Varietal responses (lesion area of length x width) to *Dickeya dianthicola* ME30 and *Pectobacterium parmentieri* WPP163 inoculation. Seed tubers were inoculated with one of the bacteria (10^6 cfu/ml) before planting.

Variety	<i>Dickeya dianthicola</i> (cm ²)	<i>Pectobacterium parmentieri</i> (cm ²)
Pantonac	0.7	3.4
Wasca	2.5	2.1
Rural New Yorker	2.6	3.5
Satapa	2.9	2.9
Sangre	3.1	4.1
Ranger Russet	3.1	3.7
Pioneer	3.3	2.0
Norvaley	3.3	4.6
Red Warba	3.4	3.4
Red Burt	3.7	3.5
Reba	3.7	4.1
Rideau	4.3	4.6
Nordonna	4.5	1.9
Superior Red Norland	5.1	2.6
Stately	5.2	2.5
White Cloud	5.2	3.2
Warba	5.6	4.8
Norchief	5.7	4.8
Norgleam	5.7	1.9
Atlantic	5.9	1.6
Nordak	5.9	1.8
Norland	6.0	2.6
Sebago	6.1	2.8
Rosegold	6.3	4.2