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Blackleg on Potatoes in Australia

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Dickeya dianthicola, *Pectobacterium parmentieri* (*Pectobacterium wasabiae*), *Pectobacterium atrosepticum*, and *Pectobacterium carotovorum* subsp. *brasiliense*, are among several species of bacteria that cause blackleg disease of potato. *Dickeya dianthicola*, *Pectobacterium atrosepticum* and *P. carotovorum* subsp. *brasiliense* have been identified in Australia. Blackleg disease can cause significant economic losses for potato growers.

Dickeya, first reported as a potato pathogen in the Netherlands in the early 1970s, was later reported in Denmark, Finland, France, Hungary, Poland, Slovenia, Spain, and Switzerland. *Dickeya* spp. (formerly *Pectobacterium chrysanthemi*, *Erwinia chrysanthemi*) has emerged as an aggressive potato pathogen worldwide. These bacteria cause wilts and soft rots of many plants and are responsible for wilting and tuber rot of potato. All potato varieties are susceptible to these pathogens, with some varieties expressing more dramatic symptoms.

Dickeya dianthicola was first reported on potatoes in Australia in 2017. *Pectobacterium carotovorum* subsp. *brasiliense* and *Pectobacterium parmentieri* were first reported on potatoes in Australia in 2019.

It is likely that these pathogens were present before reported, but probably not for as long as they have been present elsewhere in the world.

The taxonomy of the *Pectobacterium* genus is rapidly evolving. *Pectobacterium parmentieri* (*Pectobacterium wasabiae*) has been associated with field and storage losses in Maine. *Pectobacterium carotovorum* subsp. *brasiliense* is widely present in the field and in storages around the world.

As a seed-transmitted pathogen, *Dickeya dianthicola* and *Pectobacterium* spp. can increase during multiplication of seed stocks, particularly where no effort has been made to purge the diseased seed stock. The pathogens can be latent in

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plant material and may be multiplied while escaping notice. *Dickeya dianthicola* and *Pectobacterium* spp. epidemics are particularly troubling, as they can initiate from very low inoculum levels and spread quickly and aggressively.

Symptoms

Dickeya dianthicola, *Pectobacterium parmentieri*, and *Pectobacterium carotovorum* subsp. *brasiliense* cause typical blackleg symptoms of dark brown to black stem decay. Disease development with *Dickeya dianthicola* can be rapid, often affecting the entire plant and resulting in death. These pathogens have a tendency to rot from the inside, often showing internal necrosis, and tend not to smell.

Pectobacterium atrosepticum, on the other hand, has a tendency to rot the cortical tissue on the outside of stems, be inky black in colour, and smell rather unpleasant.

Dense canopies, warm conditions, and long periods of leaf wetness or irrigation favor the development of blackleg.

In cool growing areas, *Dickeya dianthicola* symptoms can be under expressed or even masked. When an infected seed crop from a cool growing area is planted in a warm growing area, the potential exists for nonemergence and stand losses to be expressed dramatically.

Both *Dickeya* spp. and *Pectobacterium* spp. can reduce emergence and adversely affect plant health and plant stand. Seed-piece breakdown and nonemergence is a field symptom of *Dickeya dianthicola*. In cases of delayed emergence, some affected plants can be stunted. Wilting and rapid death can occur shortly after emergence. Under severe *Dickeya dianthicola* infection, stand losses can be severe.

Infected seed pieces can break down in the field and not emerge, or they can emerge and produce weak, unthrifty plants with wilting foliage. Often, the infected foliage is lighter in color than healthy foliage.

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All these pathogens produce pectinolytic enzymes, which are the major cause of rotting potato tubers. *Dickeya dianthicola* produces creamy, tan to yellow tuber rot that can be granular. The foul odor associated with tuber breakdowns is owing to secondary invaders. *Pectobacterium parmentieri* and *Pectobacterium carotovorum* subsp. *brasiliense* have been associated with tuber rot and storage losses.

Disease cycle

Potato seed tubers harboring *Dickeya dianthicola* or *Pectobacterium* spp. are a confirmed source of these pathogens. The reported length of survival time in the soil without a host is from 1 week to 6 months, depending on climate. Longer survival is possible on an unharvested infected tuber. The bacteria can survive in surface water or on the roots of some weeds.

The source of the inoculum, and hence the source of the disease, is seed that is internally infected, or seed that is infested with pathogens on the seed surfaces. The disease cycle starts with planting infested or infected seed. Infected seed tubers may have the pathogens present in the stem end of the tuber. More commonly, infested tubers carry pathogens on the surface, particularly in and around the lenticels.

Potato tuber lenticels open under wet soil conditions, thereby providing enhanced infection courts. The spread of these pathogens appears to occur below-ground rather than above-ground. Saturated soil conditions, irrigation, and soil water movement spread these bacteria. Warm conditions favor the development of *Dickeya dianthicola*, *Pectobacterium parmentieri* and *Pectobacterium carotovorum* subsp. *brasiliense*. *Dickeya dianthicola* can cause potatoes to wilt at any point in the growing season.

Potatoes rotted by *Dickeya dianthicola* or *Pectobacterium* spp. contaminate harvesting and handling equipment. The infested equipment can transfer the pathogens to a previously uncontaminated lot.

Dickeya dianthicola has been isolated from potatoes in storage, but storage breakdown has not been attributed to this pathogen. However, storage breakdown has been attributed to *Pectobacterium parmentieri* and *Pectobacterium carotovorum* subsp. *brasiliense*.

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Management

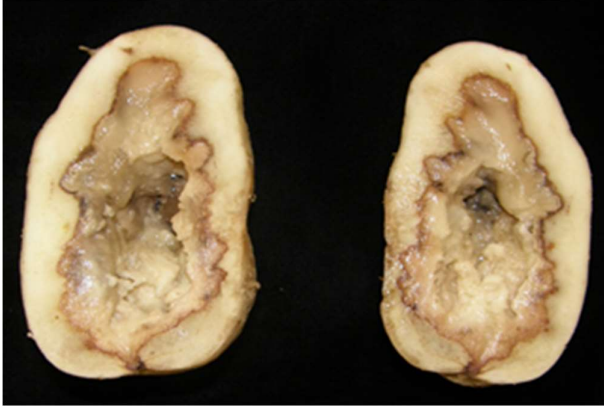
Integrating a disease management strategy throughout the entire potato planting, growing, and harvesting cycle is the key to mitigating losses from *Dickeya dianthicola*, *Pectobacterium parmentieri* (*Pectobacterium wasabiae*), *Pectobacterium atrosepticum*, and *Pectobacterium carotovorum* subsp. *brasiliense*.

- Identify potential problem lots of potato seed before they are planted.
- Preferably select seed from fields where *Dickeya dianthicola*, *Pectobacterium parmentieri*, or *Pectobacterium carotovorum* subsp. *brasiliense* have not been detected, and seed marketed in previous years has not been associated with *Dickeya dianthicola* or *Pectobacterium carotovorum* subsp. *brasiliense* or *Pectobacterium parmentieri*.
- Avoid seed from fields where symptoms of *Dickeya dianthicola* or *Pectobacterium carotovorum* subsp. *brasiliense* or *Pectobacterium parmentieri* have been observed, even if the affected plants were rogued out.
- Avoid bruising and damage during planting and harvest, as well as during the loading of storage bins and shipping trucks, to reduce the risk of disease.
- Avoid harvesting wet fields or tubers with pulp temperatures higher than 18°C and promote rapid drying of harvested tubers.

Seed growers should consider disinfesting the potato handling equipment between lots. Potato handling equipment is anything that handles the potatoes. Harvesters, windrowers, truck bodies, bin pilers, seed racks, and the like are included.

Tubers harbouring *Dickeya* or *Pectobacterium* may show no evidence of disease going into storage and may not decay in storage. However, bacteria on asymptomatic tubers may survive and are likely to cause and spread disease the next year if such tubers are planted.

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Dickeya dianthicola on potato tubers



Dickeya dianthicola field wilt

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Dickeya dianthicola field wilt

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Dickeya dianthicola stand losses



Dickeya dianthicola stand losses

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Dickeya dianthicola stem infection



Dickeya dianthicola stem infection

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Pectobacterium carotovorum subsp. *brasiliense* and *Pectobacterium parmentieri* in Australia.



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Pectobacterium carotovorum subsp. *brasiliense* and *Pectobacterium parmentieri* in Australia.