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Potato seed: Physiological age, diseases and variety testing in the Nordic countries

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Characterisation of erwinias causing blackleg and soft rot in Finland

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Contamination of seed tubers with soft rotting bacteria is one of the biggest problems in seed potato production. These bacteria cause blackleg (rotting of the of potato stems in the field) and soft rot of tubers during storage. In the temperate climate blackleg is caused mainly by *Erwinia carotovora* subsp. *atroseptica* (Eca) and rotting of the tubers by the subspecies *carotovora* (Ecc). *E. chrysanthemi* (Ech) is a virulent pathogen that causes both kinds of symptoms in warm climate. It has been spreading fast in the middle Europe during the last years possibly due to changing climate. At the moment seed potato fields and harvested tubers are screened visually for rotting in Finland and large amounts of contaminated plants and tubers are discarded. Because also healthy-looking seed potatoes can contain latent infections, the occurrence of the disease is unpredictable, which leads to reclamations and reduced markets for seed potatoes. Furthermore, after wet and cold summers soft rot of harvested tubers can spoil hundreds of tons of potatoes in the food processing industry. Therefore, new diagnostic tools are needed for soft rot erwinias to prevent the spreading of contaminated stocks in potato production. To reach that goal we first need to know what *Erwinia* species and subspecies are causing the problem at the moment.

Potato stems showing blackleg or wilting were collected during 2003-2004 and the erwinias were isolated based on cavity forming on pectate-containing media followed by anaerobic growth test. Bacteria were also isolated from rotting tubers and from water samples collected from rivers in southern and western Finland. The isolated bacteria were verified as *Erwinia* by PCR–tests and sequencing the 16S–23S rDNA intergenic region and some of the results were confirmed by fatty acid analysis. Among the strains isolated from stems showing blackleg symptoms, 45% was identified as Eca, 31% as Ecc, and surprisingly, 24% as Ech. Among the strains isolated from tubers, majority was Ecc (52%) and only few Ech strains were isolated (9%). Strains isolated from river waters were all identified as Ech. Phylogenetic trees based on the 16S–23S intergenic sequences verified known results showing that Eca strains were similar, whereas Ecc and Ech groups showed larger variation. Pathogenicity assays on potato tubers and stems showed that virulent Ech strains had been isolated from all sources, including river water. These results suggest that Ech is no longer contained to warmer countries but has spread to northern Europe. Therefore, any new methods in *Erwinia* diagnostics should even detect Ech. Furthermore, the results suggest that Ech can spread to clean stocks when contaminated river water is used for irrigation.