SOURCES OF INOCULUM FOR POTATO PLANT INFECTION BY ERWINIA CAROTOVORA

by
Mary L. Powelson
Department of Botany and Plant Pathology
Oregon State University, Corvallis, Ore. 97331

Tuber and plant infection by the soft rotting erwinias, Erwinia carotovora subsp. carotovora (Ecc) and E. carotovora subsp. atroseptica (Eca) usually results in maceration and rotting of tissue; however, symptoms observed can be quite diverse. In the irrigated circles of Oregon's Columbia Basin, the two most common primary disease symptoms encountered are blackleg and stem soft rot. With the former, stems typically exhibit an inky black decay; whereas with the latter, the decay appears water soaked and translucent. With both symptoms decay may extend up the stem only a few inches or for its entire length. Foliage becomes chlorotic and leaves eventually senesce.

Generally, blackleg predominates early in the growing season whereas stem soft rot is more frequently observed later. Symptoms of post-emergence blackleg can be first observed in May, and by mid June the variation observed among fields of plants exhibiting symptoms is approximately 0.1 to 25%. In contrast, stem soft rot symptoms may be first observed at the end of June, and depending upon the field 25 to 75% of the plants can be exhibiting symptoms by the later part of July. However, if the percentage of plants with blackleg and stem soft rot symptoms is plotted over time a bell shaped distribution results. Rapid death of a potato vine follows severe attack by these pathogens. Vines that have died from Ecc and Eca attack will frequently have a shredded appearance and the pith area will be hollow. For example, in some fields 50 to 95% of the vine death has been attributed to these two diseases. Death of vines during the season from blackleg and stem soft rot follows a normal S-shaped disease progress curve. Diagnosis of vine death can be difficult. However, we have found that if the number of plants with specific symptoms is plotted over time we can better explain the cause of vine death within a potato field.

Studies on blackleg, caused by Eca, have shown that the seed piece is an important source of inoculum. However, recently Ecc has also been associated with "typical" blackleg symptoms in Arizona, Colorado, and Oregon. Ecc is the primary pathogen associated with stem soft rot symptoms in Oregon.

In Oregon's certification program where stem cuttings are used to reduce the risk from tuber-borne pathogens, seed tubers produced under field conditions have become contaminated with Ecc and/or Eca. In addition, in a study where plants were grown from Erwinia-free seed pieces approximately 30% of the plants were showing symptoms of stem soft rot by mid-July, and the pathogen was determined to be Ecc. This suggests that the seed piece may not be the only source of inoculum.

Epidemiological studies on this disease complex has been hampered by the difficulty in identifying strains of Ecc and Eca, but a recent serotyping scheme by DeBoer has allowed rapid classification of Ecc and Eca isolates into serogroups using diffusible somatic antigens.

The role of seed-borne and soil-borne inoculum of Ecc in potato plant infections was studied at three locations in Oregon in 1980. Isolations from tubers of a Russet Burbank seed lot contaminated with Ecc produced 68 isolates of one serogroup and 44 of another serogroup. Tubers from this seed lot were planted at three locations in Oregon, and the serological identity of Ecc isolates recovered from potato stems produced by this seed during the growing season was determined. At two of the locations, 73% and 88% of the stem isolates were serologically

This Presentation is part of the Proceedings of the 1982 Washington Potato Conference & Trade Fair.

identical to the ones found on the seed pieces (Fig. 1). This supports the concept that the seed is an important source of inoculum. However, at the third location only 8% of the stem isolates were serologically identical to the seed strains. Thus, seed-borne inoculum was not the only source involved in plant infection at this location. Three known Ecc soil strains were involved to some extent in plant infection in all locations.

In recent years, sources of Ecc and Eca inoculum, other than seed piece, have been implicated as hosts. In studies conducted in British Columbia and Colorado, Eca and Ecc were recovered from the rhizosphere of several weed species. In Oregon and Colorado, Ecc has been recovered from the rhizosphere of winter wheat and barley, respectively.

The ability of these bacteria to colonize the rhizosphere of weeds and certain cultivated crops and to survive in plant debris, and soil needs to be examined more closely. With the new techniques available for detecting soft rotting erwinias in the soil, rhizosphere, etc. and the use of serological techniques coupled with marker strains, we should gain new insights into the relative importance of these various inoculum sources in the blackleg and stem soft rot diseases.

Figure 1. Percent Erwinia carotovora subsp. carotovora stem isolates serologically similar to seed tuber isolates at three locations in Oregon (RF and EF are plots in the Columbia Basin, OR, and KF are plots in the Klamath Basin, OR.)