Fungus and Bacterial Disease Research

Summary of 1983 Results
and
Proposal for 1984

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Summary of 1983 Results

1. Blackleg Research

Objectives:

Blackleg research in 1983 continued to emphasize the epidemiology of Erwinia carotovora in Colorado. Surveys to determine the presence and approximate populations of E. carotovora in surface and underground water samples were continued in 1983. Additionally, research was initiated to determine the role of irrigation water in the recontamination of Erwinia-free potatoes and possible means to reduce this threat.

New findings on the long distance transport of E. carotovora and its potential relationship to weather systems were made in 1983. Support from a USDA grant enabled initiation of this research.

Objective a. The association of Erwinia carotovora with surface and underground water in Colorado.

Surveys made in Colorado showed that E. carotovora was consistently found in water collected from the South Platte and Big Thompson Rivers during a 20 month period from January 1982 through August 1983. Populations of E. carotovora ranged from undetectable to 700 colony forming units (cfu)/ml. The lowest populations were found during the winter months in samples collected at mountainous sites while the greatest populations were found at sites located in the plains during late spring, summer and early autumn.

E. carotovora subsp. carotovora (Ecc) represented 98.0% of the isolates characterized with E. carotovora subsp. atroseptica (Eca) comprising the remaining 2.0%. Eca was isolated primarily during the autumn, winter and early spring months.

Samples of water from rivers, canals, lakes and wells in the San Luis Valley were also tested for the presence of E. carotovora. Almost all of the surface water samples (90%) collected had detectable levels of E. carotovora present. Results showed that Ecc was the predominant isolate found throughout the year. Eca was also isolated from seven Rio Grande samples (8% of all

positive samples) and, usually, early in the year when water temperatures were cool.

The populations of Erwinia in surface waters were quite low, typically below 1 cfu/ml of water and were generally lower than populations estimated in water samples collected in northeastern Colorado. However, populations increased to 1 to 12 cfu/ml of water in late summer and autumn (July-November) in arable regions of the San Luis Valley.

Erwinia was also routinely isolated from water samples collected from the Arkansas River.

Erwinia was infrequently isolated from well water used for irrigation in Northeastern Colorado and in the San Luis Valley. Erwinia was also detected in several well water samples collected near Greeley. However, since well water samples were not consistently positive for Erwinia and samplings were not extensive, more rigourous testing is needed before definite conclusions can be made concerning the presence of Erwinia in underground water.

Objective b. The role of suppressive soil in the recontamination of potatoes by Erwinia.

A study was made in the San Luis Valley to determine if an "Erwinia-suppressive" soil could reduce Erwinia recontamination of Centennial tubers increased from micropropagation seed stocks.

Potato root samples collected on July 19 had 0% and 2% contaminated with Erwinia for "suppressive" and "conducive" (i.e., normal) soil field plots, respectively. Samples collected on August 18 showed an increase in the level of contamination with 6% and 18% of the potato roots contaminated for the "suppressive" and "conducive" field plots, respectively. Fifty potato root samples were assayed for each field plot on each date. Weed-root rhizosphere samples (100 samples) were also collected from the "suppressive" plot. None of the weed root samples had detectable Erwinia present.

Objective c. The long distance transport of Erwinia.

Two coastal surveys for Erwinia were made in Oregon during 1983. Ocean water, rain water and aerosol samples were collected. One rain sample (out of 1 sample collected) in July and 12 out of 13 samples collected in December had detectable levels of Erwinia present. Both E. carotovora subsp. carotovora (Ecc) and E.c. subsp. atroseptica (Eca) were found and often both were present in the same rain sample. Nearly 100% of all ocean water samples were positive for Erwinia, also.

Limited aerosol collections in July failed to detect airborne Erwinia cells. Aerosol collections in December resulted in 16 Erwinia isolates collected over a period of five consecutive days. Although humidity levels were always very high, positive air samples were collected both when it was raining and when it was not. Characterization of aerosol isolates showed a ratio of seven Ecc isolates to 9 Eca isolates with both subspecies being present in the air simultaneously (i.e., Ecc and Eca both being present on some of the same exposed plates).

2. Ringrot Research

Objectives

Ringrot research continued to emphasize the effect of inoculum concentration on symptom expression. Studies comparing new methods for detection of ringrot were also initiated. Because of problems with the ELISA test for tuber infection, results for this study are not complete.

Ojective a. To determine the effect of Corynebacterium sepedonicum inoculum concentration on symptom expression in potatoes.

The effect of inoculum concentration on ringrot symptom development in both plants and daughter tubers was studied for the third year in Colorado. Results for 1983 support the previous conclusions that tubers can become infected in the absence of foliar symptom expression in the parent plant. Furthermore, data from 1981 and 1982 show tubers can appear healthy based on visual inspection with latent ringrot infection being detected only by bioassay on eggplant (cv Black Beauty). One treatment (10 cells per tuber) inoculated in May 1981 required three growing seasons before any symptom expression occurred in the field.

3. General Potato Pathology

Objective. To determine the effect of TOPS 2.5, Mertect and Zineb seedpiece treatment on Russet Burbank potatoes in the San Luis Valley.

Treatment of cut Russet Burbank potato seed with fir bark amended by addition of TOPS 2.5, Mertect or Mertect + Zineb significanctly increased total tuber yield in the San Luis Valley ($P = 0.05$). Visual beneficial effects of seedpiece treatment, when compared to the fir bark control, were evident in terms of plant vigor, color and degree of defoliation during the latter part of the growing season. There were, however, no measurable effects on plant stand, seedpiece decay, Rhizoctonia stem-cankering, Verticillium stem infection or early blight foliage infection. Generally, TOPS 2.5 and Mertect treatments were similar and appeared to produce more vigorous plants than treatment with Mertect in combination with Zineb.

Proposal for 1984

Blackleg Research

The following aspects of blackleg epidemiology will be studied:

A. The role of irrigation water in the recontamination of Erwinia-free seed stocks.

Emphasis will be placed on determining the significance of Erwinia cells in irrigation water in the recontamination of Erwinia-free seed. Serological methods will be used to determine if Erwinia recovered from tubers produced by Erwinia-free stocks are the same as those present in irrigation water. Some monitoring of water sources will continue also.

B. Sources of Erwinia in surface waters.

Since we now know that Erwinia is continuously present in surface water, including the Rio Grande River, Sagauche Creek, the Arkansas River, the South Platte River, and many other streams in Colorado, it is important to determine the source of the contamination. Studies will be made to determine if the bacteria are residents in the water (or stream bed) where they persist and multiply indefinitely or if they are introduced from external sources such as deposition with precipitation from cloud moisture derived from the Pacific Ocean. Intensive studies using funds from the USDA Grant (received in July 1983) supplemented by funds requested in this proposal will be made to determine the occurrance and extent of long distance dispersal of Erwinia cells with weather systems.

C. Biological control of Erwinia recontamination of clean seed stocks.

Results from 1983 indicate that a "suppressive factor" exists in a potato field at the Research Center which has been cropped to potatoes for 22 years continuously. Attempts will be made, based upon the availability of funds and time, to determine the nature of the factor. If it is biological in origin, it will be tested as a means of preventing or slowing recontamination of clean potato seed stocks by Erwinia introduced with irrigation water or from other external sources.

Ringrot Research

Due to the serious nature of ringrot in the San Luis Valley and because some new techniques for detection and identification of the ringrot organism have been developed, it is now feasible (except for a question of an adequate location to do the work) to begin a detailed study of ringrot in Colorado. As resources will permit it is proposed that we begin in 1984 a study on the following aspects of the ringrot problem:

1. Latency in the tubers in relation to inoculum concentration, variety and the environment.

2. Sources of inoculum and means of spread, including water, insects, machinery and other possible sources.

3. Factors which affect expression of symptoms in the presence of different concentrations of inoculum.

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Proposed Budget

Labor	$ 2700.00
Travel	1500.00
Supples/Equipment	1500.00
Total	$ 5700.00