Control of Bacterial Soft Rot on Hosta during Cold Storage

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Nature of Work:

Hosta spp. Tratt., commonly known as plantain lilies, are herbaceous perennial plants native to the temperate regions of China and Japan (1). Since the introduction of hostas into the United States in 1790 (2), they have become one of the most popular perennials across the country (5).

Nurseries in warmer regions of the United States, USDA Plant Hardiness Zones 8B and below, have difficulty in producing hostas because normal winter environmental conditions often do not satisfy hosta dormancy-breaking requirements. As a result, hostas produced in southern nurseries are often slower to emerge in the spring and exhibit poor growth in comparison to plants grown in cooler climates (4). The use of cold storage, provided by refrigerated coolers, enables growers in warmer climates to supply an artificial chilling period and complete the dormancy requirement of the plant.

Many diseases can develop under conditions of cold storage. While there has been extensive postharvest research conducted on fruits and vegetables in cold storage (3), diseases of ornamental plants have not been studied. A soft rot on hosta caused by the bacterial pathogen *Erwinia carotovora* subsp. *carotovora*, was observed at a large wholesale nursery in South Carolina in 1999. The disease caused 70-90% loss in some hosta cultivars following storage at 0°C for 8-16 weeks in a chilling facility. The epidermal tissue covering the fleshy roots remained intact, while the parenchymatous tissue dissolved into a watery rot. Infected foliage was yellow and wilted with water-soaked petioles that eventually collapsed at the soil line. Infected plants had a distinctive malodorous aroma once the rhizome began to rot. Bacterial soft rot was known to occur on hostas, but *E. carotovora* subsp. *carotovora* had not been previously reported as the pathogen.

The objectives of this study were 1) to determine if cold storage temperature or duration affect bacterial soft rot development on hosta and 2) identify a recommendation to satisfy chilling requirements without causing disease.

Tissue-cultured plugs of hosta cv. Suzanne produced in 72-cell flats were inoculated separately with 10^2, 10^4 and 10^8 colony-forming units per milliliter (cfu/ml) of *E. carotovora* subsp. *carotovora*. The bacteria were prepared by growing isolates on nutrient yeast dextrose agar (NYDA) for 24 hrs at 30°C. Plates were flooded with sterile distilled water and diluted to the inoculation concentrations. Using a chromatographic sprayer, the bacterial suspensions were applied to the plants until runoff occurred (~2 ml/plant). One 72-cell flat was sprayed with sterile distilled water as a control. The foliage was allowed to dry for 24 hrs to allow epiphytic colony establishment. Each flat of 72 plants, representing a different bacterial concentration, was divided into three treatments for placement at 0, 2 or 4°C. Temperatures chosen are actual temperatures used by hosta producers for chilling purposes. Each treatment of plants was

placed in a sterile plastic bag prior to cold storage to prevent contamination. All treatments of plants were held at their respective temperatures of 0, 2 or 4°C for increments of 24 hrs to six weeks in separate Percival coolers. Eighteen single-plant replications per bacterial concentration and storage temperature were potted into 0.35 L containers filled with sterile potting media (Pro-Mix BX, Premier Horticulture Co., Red Hill, PA) and placed in a randomized block design on greenhouse benches at the University of Georgia campus in Athens, Georgia. Plants were irrigated daily, and day/night temperatures were held at 27/16°C. Plants were observed for two weeks for possible soft rot development. Suspected soft rot infected tissues were cultured for the presence of *E. carotovora* subsp. *carotovora*. The experiment was conducted twice from October to November, 2000.

Results and Discussion:

Regardless of bacterial concentration applied to the hosta plants, no disease occurred unless the plants were held at 0°C for at least 24 hours. Inoculated plants stored at 2 and 4°C showed no decline or soft rot symptoms. No soft rot symptoms developed on any non-inoculated plants, but water-soaking of the foliar tissue indicative of freeze injury was observed on control plants held at 0°C.

Bacterial concentration affected soft rot development on plants held at 0°C, with 46, 77, and 83% of plants developing soft rot when inoculated with 10^2, 10^4, and 10^8 cfu/ml of bacteria, respectively, but did not affect the severity of symptoms. Soft rot development reached 100%, regardless of bacterial concentration, when plants were held at 0°C for 48 hr. Since none of the plants held at temperatures above 0°C were infected with *E. carotovora* subsp. *carotovora* and soft rot reached nearly 100% after only 24 hr at 0°C, it is assumed that storage temperature and not duration affects soft rot disease development on hosta. Freeze injury, due to storage at 0°C, may have provided an entryway for *E. carotovora* subsp. *carotovora*, an opportunistic pathogen.

This study determined that bacterial soft rot of hosta caused by *E. carotovora* subsp. *carotovora*, can be prevented by storing plants at temperatures above freezing. Even when epiphytic bacterial populations are relatively high, bacterial soft rot does not occur until plant injury from freezing has occurred. Chilling hostas at 4°C satisfies dormancy requirements of hosta (4), and will reduce the likelihood of developing bacterial soft rot disease.

Significance to Industry:

Hosta sp. grown in the southeastern United States benefit from an artificial chilling period. As the use of cold storage expands in perennial plant production, it will be important to understand the effect of cold temperatures in the development of disease in dormant plants. This study established that storage of dormant rhizomes at 4°C prevents disease development while allowing the plant to complete dormancy requirements.

Literature Cited

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