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21 Carnation Varieties Tested For Their Reaction To *Pseudomonas Carophylli*

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The bacterial wilt disease of carnation was first reported in 1941. The pathogen, *Psuedomonas caryophylli,* has caused serious economic losses to the carnation growers of the U.S. and Europe since its discovery. Control has been achieved by the culture-indexing method, but disease-resistant commercial varieties also would be beneficial to the industry. Sources of resistance in commercially acceptable varieties have been sought by several investigators, but some of the newer varieties have not been tested. Therefore, the purpose of these investigations was to develop a standardized testing technique and to determine the reaction of selected current and former commercial varieties to the pathogen.

Varieties Tested

Carnation varieties used in this experiment were selected to give a representative sample of varieties currently grown commercially; a few varieties grown commercially in past years also were included. Var. Tangerine, Improved White Sim, Mamie, Tetra-Red, Harvest Moon, Scarlet Sim, and Red Sim were selected as representatives of the Sim varieties. Var. Light Pink Littlefield, Nancy Thompson, and Sidney Littlefield were chosen as representative of the Littlefield varieties and var. Dark Pink Virginia, Virginia Hercules, and Virginia Supreme as representative of the Virginia varieties. Miscellaneous varieties selected were Durango, C. W. Weld, Puritan, Apollo, Elegance, Starlite, and Northland.

Testing Methods

Cuttings were selected from plants which had been culture-indexed and rooted under mist in a previously steam-treated rooting medium. After 25-31 days, the cuttings were removed from the propagation bench; the roots were washed free of the rooting medium and immediately placed in a bacterial suspension of *P. caryophylli* for 1 hour. Roots of uninoculated cuttings were immersed in sterile water for 1 hour. The cuttings were planted in 4-inch pots containing steam-treated soil and placed in the greenhouse. The soils, analyzed by the Spurway method, contained 2 ppm P, 20 ppm K, and 135-150 ppm Ca. The values for K and Ca agree closely with those recommended by Nelson and Runnels for the reduction of losses due to bacterial wilt. The pH varied between 6.6 and 6.9. A commerical fertilizer was applied at weekly intervals.

Cuttings of each variety were inoculated with each of 14 isolates of the pathogen. Isolates were obtained from plants collected in commercial greenhouses from Colorado, Pennsylvania and New York.

All tests for each variety were replicated at least 3 times except for var. Puritan. The tests were conducted during 2 seasons of the year; 1 lot of cuttings was inoculated on July 17, 1961; and the other on October 3, 1961. They were terminated 136 days after inoculation. The mean maximum and minimum greenhouse air temperatures for the summer test were 86° and 65°F, respectively; the respective mean air temperatures for the fall test were 85° and 65°F. Although the mean maximum and minimum air temperatures for the summer and fall tests are in close agreement, there was more daily fluctuation in temperature and more days with higher maximum temperatures (near 100°F) during the summer test. The mean soil temperatures recorded in the evening and morning were 73° and 66°F respectively, for the summer test; and 68° and 65°F for the fall test.

The plants were observed every other day for the development of typical wilt symptoms. When a plant wilted, it was removed from the pot and the presence or absence of basal stem rot was recorded. Stem pieces, ¼-½ inch long and taken from 3 internodal areas of the plant, were removed for culturing. Each piece was immersed 5 minutes in a 20% solution of commercial Clorox to which had been added 1 drop of Triton X 100/100 ml of solution. The pieces then were rinsed in sterile distilled water for 1 minute, removed, and placed on absorbent paper toweling. Sterilized forceps and scalpel were used to cut a thin slice of the stem from the middle of the piece and then to place it immediately in a test tube containing previously sterilized Bacto-nutrient-broth plus 1.5% dextrose. The tube was incubated at 90°F and observed for 5 days for bacterial growth in the medium. When growth was observed in a tube of broth, a petri plate containing 15 ml of potato-dextrose agar was streaked with the broth medium. The plates were incubated at 90°F for 5 days and then examined for the development of bacterial colonies characteristic of the isolate of *P. caryophylli* used to inoculate the plant. The results for susceptibility were con-

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quently from plants which had not wilted at the termination of the test, it would be expected that these infected plants would wilt if the test were continued over a prolonged period of time. The significance of the difference in susceptibility is uncertain, however, for it may be that slow development of *P. caryophylli* in the stems of these varieties and the presence of unidentified bacteria in many plants may interfere with detection of the pathogen by the method used.

Although basal stem rot and disintegrated roots usually are associated with bacterial wilt of carnation, it certainly cannot be considered as a definite diagnostic characteristic. Culturing of wilted plants is the only reliable method of determining whether the wilting of carnations is caused by *P. caryophylli.*

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