

is good, seed germination percentages were zero for some time. Higher germination rates have been achieved with white and purple-splashed white cultivars, but reddish-purple rates remain low.

Seeds germinate in May when sown in late March. Seedlings are transplanted to No.3 pots in June and transplanted again to a #5.5 pot for overwintering; flowering occurs the following May. Pots are kept in a 20-cm-deep water bed all year round. Flower stalks of the larger-flowered types frequently emerge diagonally, but this can be rectified over several generations of selective breeding.

Root Rot Caused by *Pythium helicoides* in Ebb and Flow Culture of Potted Roses

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Miniature roses growing in an ebb and flow watering system showed die back during the summer growing season in Gifu Prefecture.

The main diagnostic symptoms were leaf chlorosis and a brown water-soaked rot of the roots which finally caused die back. The root rotting occurred from August to September 1997. In a greenhouse in Kaizu, Gifu, the disease incidence peaked from the 18 Aug. until 13 Sep. However, no root rot disease was found when minimum temperatures fell.

Both B-5 and H-5 isolates from the rotted roots of the roses showed similar growth rates at all tested temperatures. They did not grow below 10C or above 45C. Hyphal growth increased with rising temperatures in the range of 15 to 35C. The optimal temperature was 35C and the growth rate was 34 mm per 24 h. There was a sudden drop to about 15 mm per 24 h in hyphal growth at 40C.

The sporangia were terminal, ellipsoidal, papillate, and proliferating inside and outside sporangia. Oogonia were terminal, lateral or intercalary, smooth and 30.5 ± 2.24 mm in diameter. The antheridia were lobulate, elongate, monoclinal or diclinal and 1 to 3 per oogonium. The oospores were aplerotic, smooth, spherica, 1 and 25.5 ± 1.93 mm in diameter. The isolates were identified as *P. helicoides* Drechsler on the basis of these characteristics.

Three representative isolates were used for pathogenicity tests on the miniature roses ('Lavender Parade'). The isolates showed severe pathogenicity on miniature rose. Seven days after inoculation, the leaves showed both chlorosis and necrosis. No symptoms were observed in the controls. The plants inoculated had 100% disease incidence, and all isolates showed severe pathogenicity. The same isolates were consistently re-isolated from the diseased roots.

Pythium helicoides was not isolated from the soil outside the greenhouse used for potted rose production.