

Abstract

Penicillium digitatum and *P. italicum* cause postharvest diseases of citrus fruit known as green and blue mold, respectively. Three fungicides, imazalil, thiabendazole, and o-phenylphenol, are used in California to control the postharvest decay these fungi cause. The fungicides have selected for fungicide-resistant (R) *Penicillium* biotypes which reduce the efficacy of the fungicide treatments. Levels of resistance (EC_{50} values) in *P. digitatum* to imazalil, thiabendazole, and o-phenylphenol remained constant between 1988 and 1994. The proportion of collected isolates that were resistant to all three fungicides increased from 43% in 1988, to 77% in 1990, and to 74% in 1994.

The EC_{50} value for imazalil inhibition of *P. digitatum* was dependent upon the age of inoculum and the pH of the substrate. The EC_{50} increased 2-3 fold with inoculum age of 12-24 h. Sensitivity to imazalil increased with pH of the culture medium. Imazalil-R *P. italicum* was rare.

P. ulaiense was identified as a pathogen of citrus fruit. This species was probably mistaken for *P. italicum* in previous years. A revised, comprehensive mycological description is given. The role of this fungus as a pathogen of citrus fruits was investigated. *P. ulaiense* was abundant in California packinghouses, but not in citrus groves. Isolates from Arizona, Florida, and Texas, and seven other citrus growing areas outside of the United States were positively identified as *P. ulaiense*. The disease *P. ulaiense* causes was named "whisker mold" because of its whiskerlike appearance, caused by 2-8 mm long coremia, of the pathogen on citrus fruit. *P. ulaiense* was less virulent and less parasitically fit on citrus fruit than *P. digitatum* and *P. italicum*. All isolates of *P. ulaiense* collected in California were resistant to imazalil and thiabendazole with EC_{50} values of 0.7 and 45.7, respectively.

Generally, imazalil-R *P. digitatum* was less competitively fit than wild-type (S) *P. digitatum* when spore mixtures containing both types were inoculated into citrus fruit and culture medium. Reduced competitiveness was more pronounced in fruit than in culture medium. Reduced competitiveness may not be a universal characteristic of imazalil-R isolates since some R biotypes persisted in R/S mixtures. There was no apparent correlation between relative competitiveness of R and S isolates and the number of harvested spores from fruit and from culture medium, in vitro radial growth rates, or latent period in fruit.