

**Title** Characterization of fungicide-resistant isolates of *Penicillium digitatum* collected in California

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### Abstract

Isolates of *Penicillium digitatum*, cause of citrus green mould, were collected in California from infected fruit from packing houses or groves. The fungicide sensitivity of 166 isolates to imazalil (IMZ), thiabendazole (TBZ), sodium *ortho*-phenylphenate (SOPP), and pyrimethanil (PYR) were determined. All of these fungicides except PYR were in use in packing houses. None were used in groves. Isolates resistant to IMZ, TBZ, and SOPP occurred within packing houses but not in groves. Many were simultaneously resistant to two or more fungicides. Resistance to PYR was found only in three isolates from relatively isolated groves in northern California. The EC<sub>50</sub> levels of IMZ and SOPP among resistant isolates varied, while those resistant to TBZ were primarily of one level. The colony colour, lesion expansion rate and days to sporulate on infected lemons, and the magnitude of sporulation were determined for many isolates. Some minor alterations in colony colour and a slightly reduced lesion size occurred among fungicide-resistant isolates, particularly those resistant to more than one fungicide. Lemons were inoculated with a mixture of conidia from one sensitive and one resistant isolate in equal portions, and then conidia were collected one week later from lesions. The resistant isolates were all resistant to IMZ and some were also resistant to SOPP and TBZ. The proportion of IMZ-sensitive and -resistant conidia was determined and comprised the inoculum to initiate a subsequent decay cycle. A total of 28 pairs of sensitive and resistant isolates were evaluated over four cycles. IMZ-resistant conidia declined rapidly in 26 pairs; few or no IMZ-resistant conidia were present after four cycles. In two pairs the resistant conidia persisted over four cycles with little decline, which suggests that in the absence of IMZ use some resistant isolates may persist for long periods. All of the fungicides would effectively control green mould on fruit arriving from groves with incipient infections, because sensitive isolates predominate there, however, control of infections initiated within packing houses, where resistant isolates predominate, remains a difficult problem. The recently introduced PYR controls resistant isolates that now occur in packing houses, but resistance to this fungicide, which was detected in three isolates from locations where PYR had not been used, indicates it must be used with good resistance management practices.