Title Population structure of the sour rot pathogens *Galactomyces citri-aurantii* and *G. geotrichum* and evaluation of sterol demethylation inhibitors for postharvest management of citrus decays

Author McKay Alistair, Adaskaveg James E., Coffey Michael D. and Stanghellini Michael E.

Citation Thesis, Doctor of Philosophy (Plant Pathology),University of California, Riverside. 123 pages. 2011

Keywords Citrus; *Galactomyces* spp.; Postharvest; Propiconazole; Sour rot; Sterol demethylation inhibitors

Abstract

Sour rot of citrus caused by *Galactomyces citri-aurantii* (anamorph: *Geotrichum citri-aurantii* (Ferraris) Butler) is an important postharvest disease that affects all varieties of citrus fruit grown in California and is particularly prevalent in the lemon industry since the fruit is stored at approximately 12°C and 95% relative humidity. The postharvest fungicides currently registered to manage green mold caused by *Penicillium digitatum* including imazalil, thiabendazole, as well as azoxystrobin, fludioxonil, and pyrimethanil are not effective against *G. citri-aurantii.* Using a fungicide gradient dilution method, sensitivities were evaluated against selected demethylation-inhibiting triazole (DMI-triazole) fungicides including propiconazole that recently received emergency registration on stone fruit to manage sour rot caused by *G. geotrichum.* Propiconazole effectively reduced mycelial growth in vitro of *G. citri-aurantii, G. geotrichum* and imazalil-sensitive strains of *P. digitatum* with mean EC_{50} values of 0.34 μg/ml and 0.14 μg/ml and 0.008 μg/ml for the three species respectively. Species-specific PCR primers were developed from genes encoding β-tubulin and endopolygalacturonase proteins to differentiate the two *Galactomyces* species. To evaluate fungicide resistance potential, the population genetic structure and genetic diversity of the two *Galactomyces* species was studied using amplified-fragment length-polymorphic (AFLP) markers and mating-type. For three sub-populations of *G. citri-aurantii,* the mating-type segregation ratio was not statistically different from 1:1, and for both species, the index of association (I_A) and parsimony tree-length permutation test (PTLPT) analyses supported random mating. Both species showed "mixed" sexual and asexual reproduction and high levels of gene flow amongst sub-populations demonstrating a high potential for fungicide resistance. However, natural resistance frequencies could not be quantified beyond 5×10^{5} to 2×10^{6} for *G. citri-aurantii* because stable resistant isolates were not recovered. For *P. digitatum* resistance frequencies for propiconazole ranged from 8.0×10^{-8} to 1.6×10^{-7} . Fruit inoculation experiments demonstrated that propiconazole is highly effective for managing sour rot and green mold.

Propiconazole applied using a high-volume aqueous drench 12 h post-inoculation at 256 μg/ml reduced sour rot incidence by 100% in lemons. Reduced performance occurred when lower concentrations of propiconazole were used or when post-inoculation treatment times were increased to 18 to 24 hours.