Bioprospection of *Metschnikowia* sp. isolates as biocontrol agents against postharvest fungal decays on lemons with their potential modes of action

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Postharvest Biology and Technology, Volume 181, November 2021, 111634

Abstract

In this study, various fruit were employed as biocontrol yeast reservoirs, and eleven distinct yeast cultures of *Metschnikowia* sp. belonging to 6 different species were identified with sequence-based analysis of the D1/D2 domain of 26S rDNA. For initial creening, *Metschnikowia* isolates were tested on *Fusarium oxysporum, Botrytis cinerea, Penicillium digitatum, Penicillium expansum,* and *Alternaria alternata*. The highest antagonism was obtained on green and blue *Penicillium* (83.63–100 %). All tested yeasts showed chitinase activity, while some had protease, pectinase, cellulase, β-1–3 glucanase, and gelatinase activities. Since lemons have high pectin content, three pectinase-free cultures at tested conditions with high *in vitro* antagonism on *Penicillium* were selected and used on lemons. The activities of the *in vitro* antifungal studies were found to be compatible with those of the *in vivo*, and *P. digitatum*'s incidence was found to be higher than that of *P. expansum* on lemons. All tested pectinase-free *Metschnikowia* sp. lead to a significant reduction in the disease incidences and lesions at varying levels. The combined effect of lytic enzyme secretion, iron depletion, and volatile organic compounds (VOCs) production determined the antifungal mechanism of action. *M.* aff. *fructicola* demonstrated the highest biocontrol efficacy against *Penicillium* on lemons with an increasing shelf-life. The use of tentatively pectinase-negative *Metschnikowia* sp. as an antifungal biocontrol agent on lemons was considered for the first time. The findings will shed light on the effective use of *Metschnikowia* sp. as a potential biofungicide against the growth of postharvest fungal pathogens.