Antifungal activity of thirty essential oils to control pathogenic fungi of postharvest decay

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ABSTRACT

Essential oils (EOs) extracted from aromatic or medicinal plants are biodegradable, safe, and regarded as alternatives to chemical pesticides to reduce fungal species attacking different crops. In this study, thirty EOs at 0.5 mg/mL were evaluated for in vitro growth inhibition of the main postharvest fungi, which are *Alternaria alternata*, *Botrytis cinerea*, and *Penicillium italicum*. *Cinnamomum verrum* EO completely inhibited the mycelial growth of *A. alternata* and *B. cinerea*, and *Syzygium aromaticum* EO completely inhibited the mycelia of *A. alternata*. *B. cinerea* mycelial growth was completely inhibited by *Gautheria fragrantissima*, *Cymbopogon nardus*, *Pelargonium asperum*, and *Cupressus sempervirens* EOs. *G. fragrantissima* EO inhibited the mycelia growth of *P. italicum* by 98%. Overall, *B. cinerea* displayed the highest sensitivity to EOs than *P. italicum* and *A. alternata*. *G. fragrantissima*, *C. sempervirens*, *C. nardus*, *P. asperum*, *Mentha piperita*, *Foeniculum vulgare*, *C. verrum*, and *S. aromaticum* EOs showed the highest inhibition for these three pathogens. Minimum inhibitory concentrations were lower for *C. verrum* and *S. aromaticum* EOs, ranging between 0.31 and 0.45 mg/mL and 0.37 to 0.57 mg/mL, respectively, against the three pathogens.

MATERIAL AND METHODS

The discriminatory antifungal activities of 30 EOs at 0.5 mg/mL concentration were assessed according to their contact phase effects on the mycelial growth of *A. alternata*, *B. cinerea*, and *P. italicum*. The negative control was PDA containing 0.1% (*v*/*v*) Tween 20 and positive control was based on the fungicides as 25 g/L difenoconazole plus 25 g/L fludioxonil. Subsequently, the most effective EOs were assessed at 0.05, 0.1, 0.2, 0.3, and 0.4 mg/mL concentration to obtain the MIC.

RESULTS

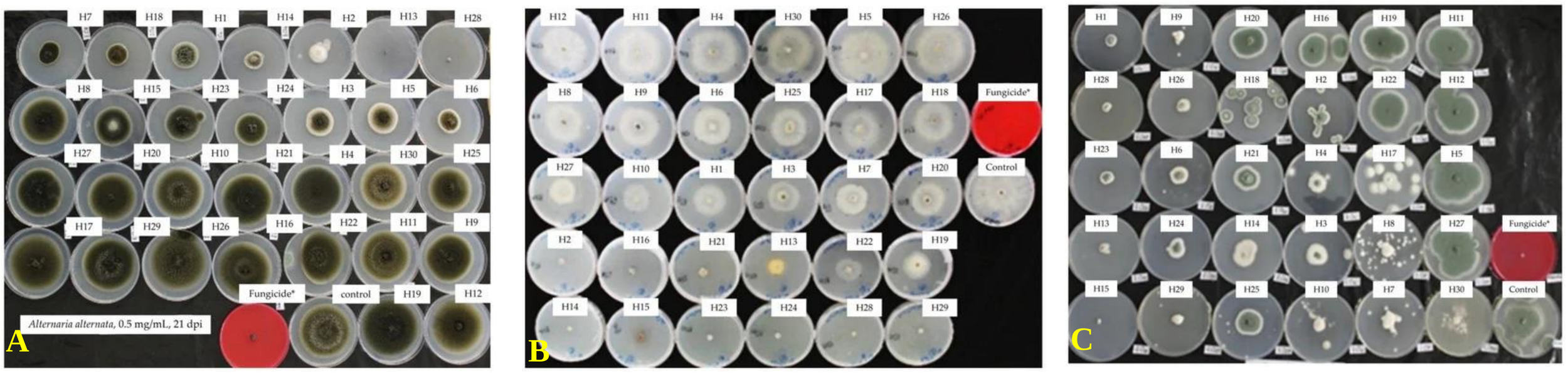

Figure 1. Mycelial growth inhibition of *Alternaria alternata* (A), *Botrytis cinerea* (B), and *Penicillium italicum* (C) in PDA amended with the essential oils used at 0.5 mg/mL. H1, *Cymbopogon martinii*; H2, *Foeciculum vulgare*; H3, *Laurus nobilis*; H4, *Melaleuca alternifolia*; H5, *Salvia sclarea*; H6, *Cananga odoranta*; H7, *Pogostemon cablin*; H8, *Melaleuca quinquenervia*; H9, *Boswellia carterii*; H10, *Lavandula angustifolia*; H11, *Citrus sinensis*; H12, *Citrus paradisii*; H13, *Syzygium aromaticum*; H14, *Menta piperita*; H15, *Gautheria fragrantissima*; H16, *Artemisia dracunculus*; H17, *Citrus limon*; H18, *Daucus carota*; H19, *Zingiber officinale*; H20, *Petroselinum crispum*; H21, *Citrus reticulata*; H22, *Citrus aurantium bergamia*; H23, *Cymbopogon nardus*; H24, *Pelargonium asperum*; H25, *Juniperus communis*; H26, *Chamaemelum nobile*; H27, *Cedrus atlantica*; H28, *Cinnamomum verrum*; H29, *Cupressus sempervirens*; H30, *Ocimum basilicum*, after 8 days of incubation at 10 °C in the dark. * 25 g/L difenoconazole + 25 g/L fludioxonil.

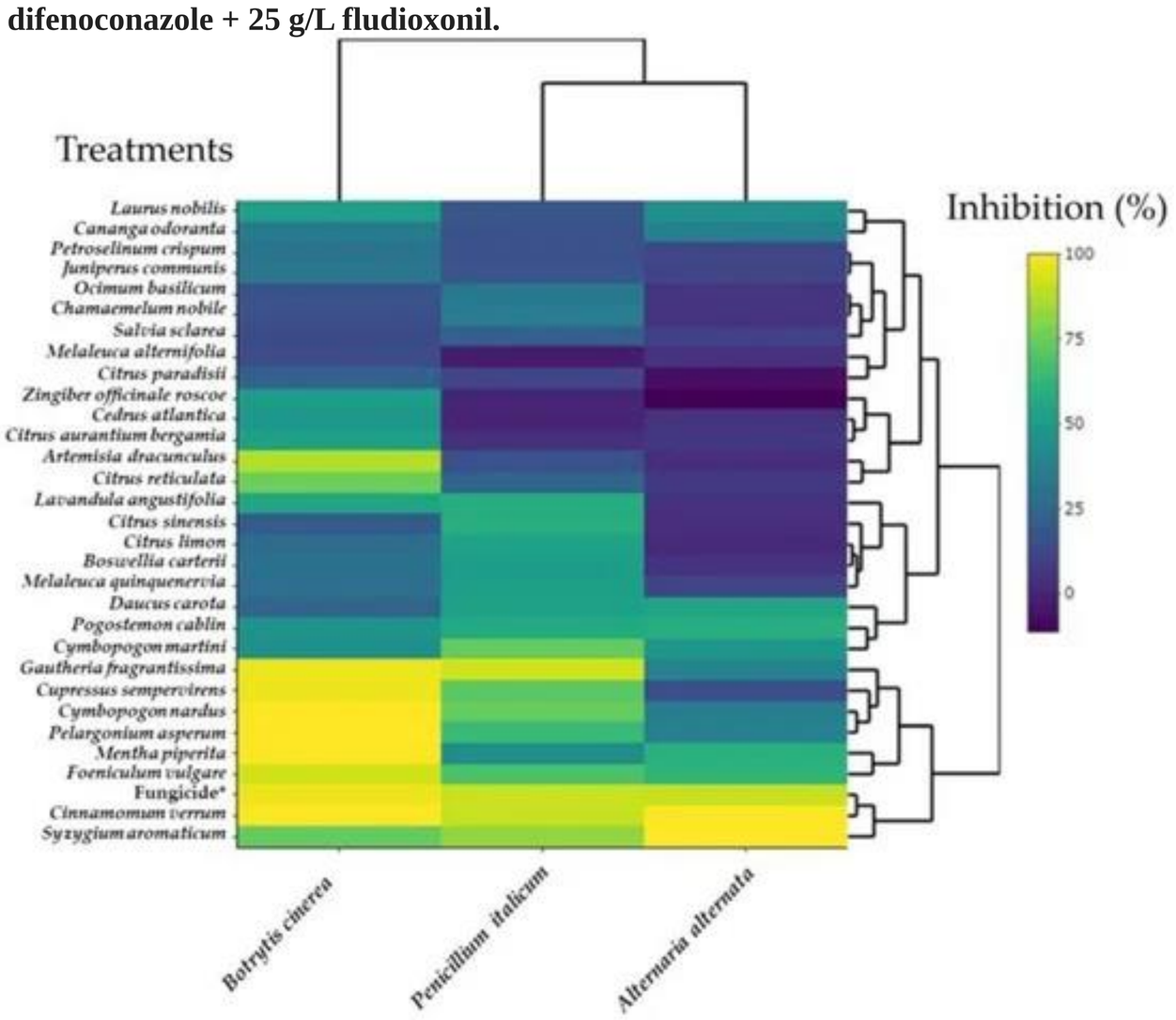

Figure 2. Heat map of the mycelial growth inhibition (%) of *B. cinerea*, *P. italicum*, and *A. alternata* by thirty essential oils at 8–23 days post-inoculation. Positive control is fungicide *: 25 g/L difenoconazole + 25 g/L fludioxonil.

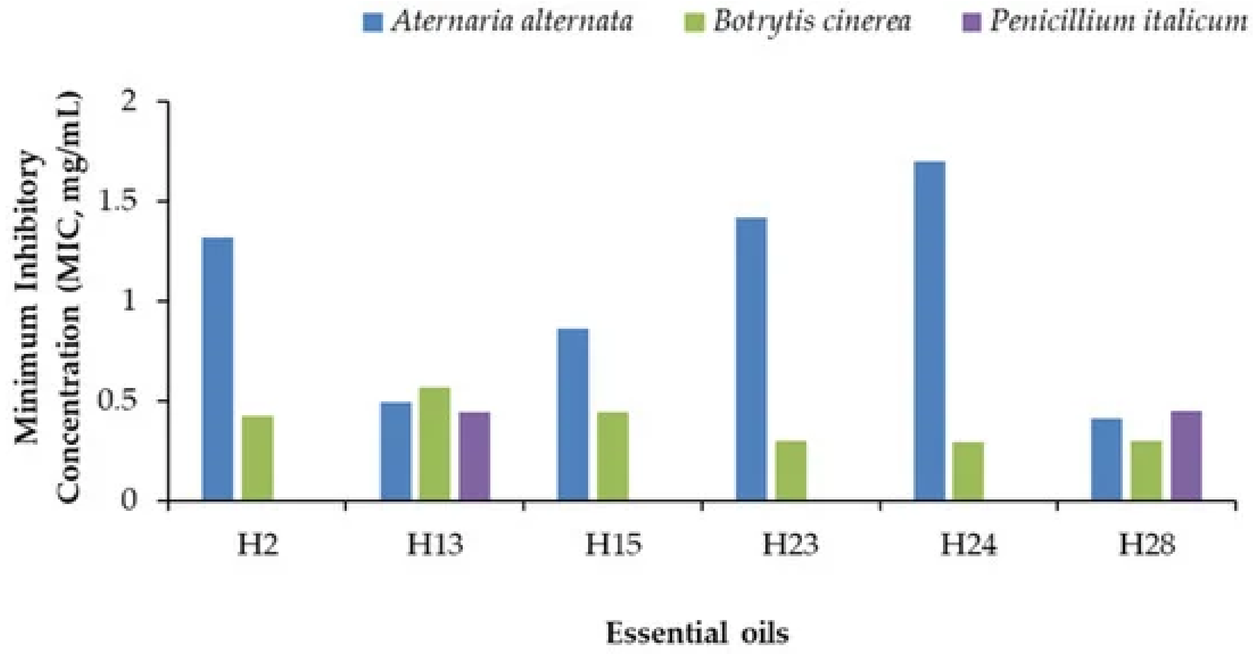

Figure 3. Minimum Inhibitory Concentration (MIC) of six essential oils against *A. alternata*, *B. cinerea*, and *P. italicum*. H2, F. vulgare; H13, *S. aromaticum*; H15, *G. fragrantissima*; H23, *C. nardus*; H24, *P. asperum*; H28, *C. verrum*.

CONCLUSIONS

The present study has demonstrated the *in vitro* activities of thirty EOs and their effectiveness against the three important fungal pathogens: *A. alternata*, *B. cinerea*, and *P. italicum*. *C. verrum* and *S. aromaticum* EOs at 0.5 mg/mL presented the highest inhibitory activity for the three pathogens. These two EOs are promising biological candidates to be included in our next program as essential preservative ingredients in the coating formulation for postharvest fruits during storage to maintain the quality and extend shelf life.

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REFERENCE

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