Antifungal activity of volatile organic compounds from essential oils against the postharvest pathogens *Botrytis cinerea*, *Monilinia fructicola*, *Monilinia fructigena*, and *Monilinia laxa*

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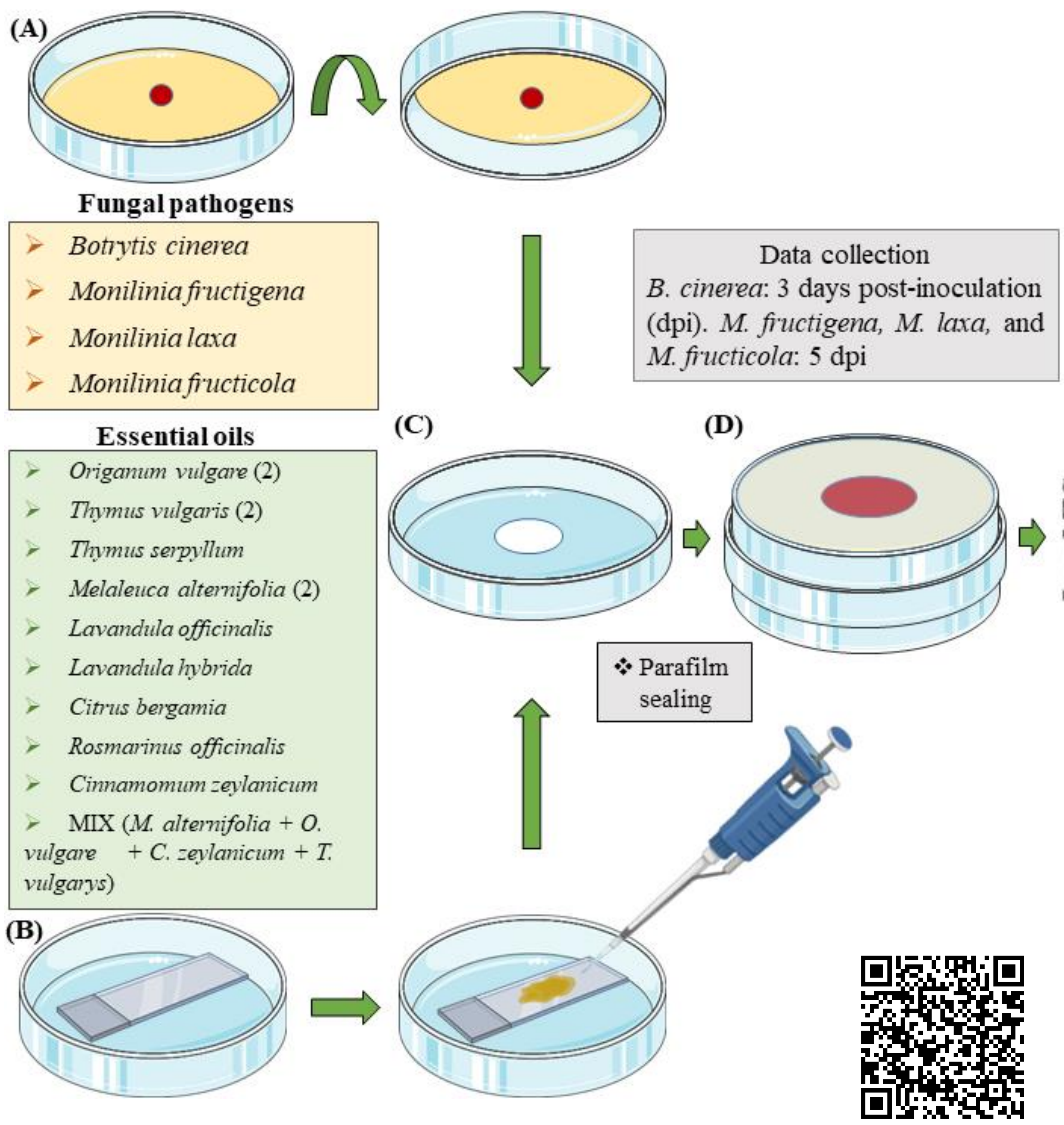
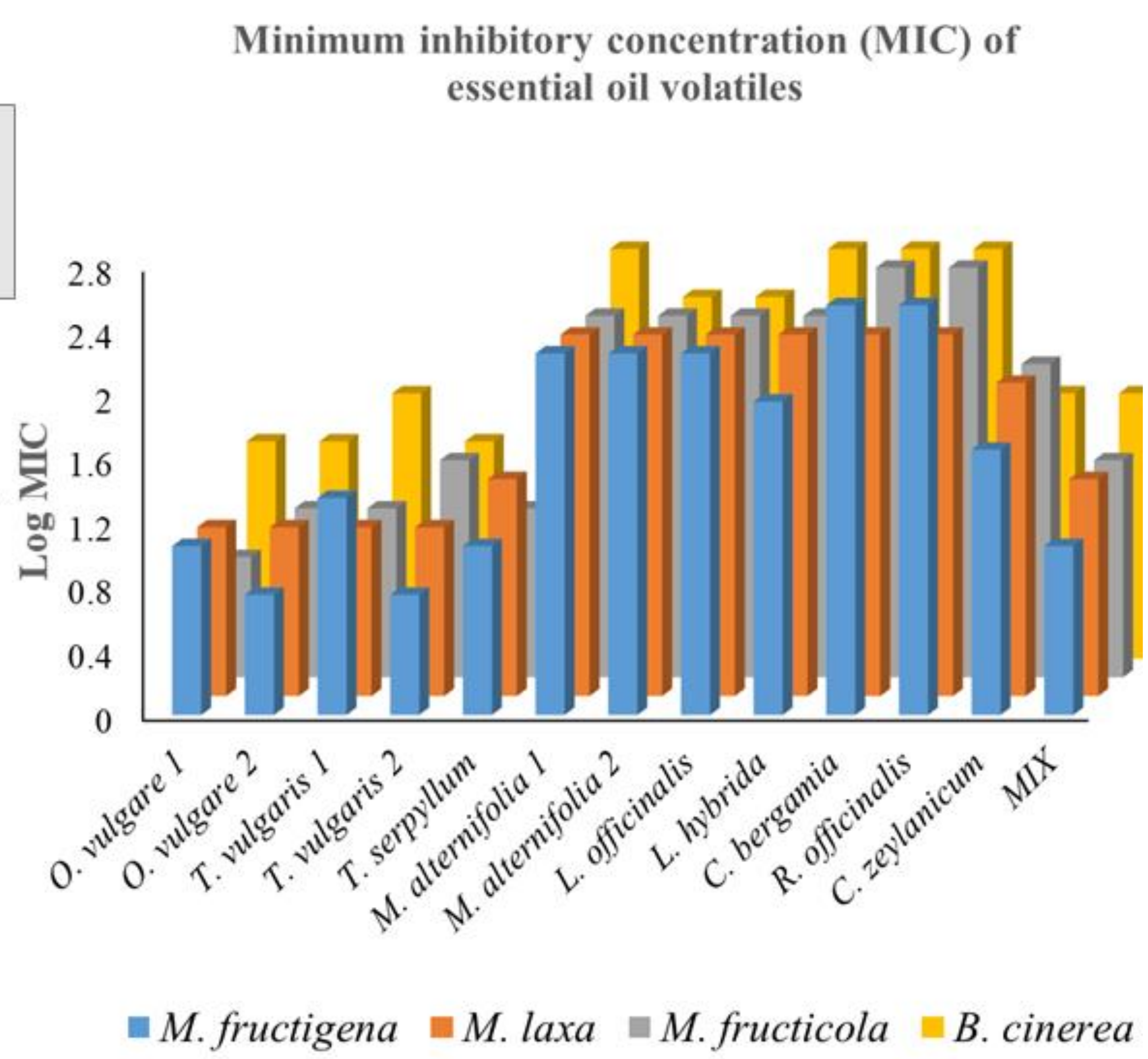
ABSTRACT

Gray mold and brown rot, caused by *Botrytis cinerea* and *Monilinia* spp., are postharvest diseases that produce significant losses during fruit and vegetables storing. In this study, the antifungal activity of *Origanum vulgare*, *Thymus vulgaris*, *Thymus serpyllum*, *Melaleuca alternifolia*, *Lavandula officinalis*, *Lavandula hybrida*, *Citrus bergamia*, *Rosmarinus officinalis*, *Cinnamomum zeylanicum* essential oils (EOs) in vapor phase was tested in vitro against *B. cinerea*, *Monilinia fructicola*, *Monilinia fructigena*, and *Monilinia laxa*. For the experiments, a protocol using a volatile organic compounds (VOC) chamber was designed. Results indicate a dose-dependent inhibitory activity of all the tested EOs, with O. vulgare, T. vulgaris, and T. serpyllum being the most active ones, with minimum inhibitory concentrations (MIC) of 22.73, 45.45, and 22.73 µl/L, respectively, against *B. cinerea* and a range between 5.64 and 22.73 µl/L against the three *Monilinia* spp.





MATERIAL AND METHODS

Twelve commercial essential oils were tested individually to assess their vapor-phase antifungal activity against the referred fungal strains: *Origanum vulgare*, *Thymus vulgaris*, *Thymus serpyllum*, *Melaleuca alternifolia*, *Lavandula officinalis*, *Lavandula hybrida*, *Citrus bergamia*, *Rosmarinus officinalis*, and *Cinnamomum zeylanicum*. EOs from two different providers were tested in the case of *O. vulgare*, T. *vulgaris*, and *M. alternifolia*. A commercial mixture (MIX) composed of 25% *M. alternifolia*, 25% *O. vulgare*, 25% *C. zeylanicum*, and 25% *T. vulgaris* was also assayed. Fungi were exposed to volatile EOs in different concentrations using non-vented VOC Chambers. EOs were placed on top of a glass slide inside the lower plate of the chamber and fungi were inoculated on PDA and placed upside down forming the upper plate of the VOC Chamber.

RESULTS

	MIC (µL/L of air)			
Essential oil	*B. cinerea*	*M. fructicola*	*M. fructigena*	*M. laxa*
***O. vulgare* 1**	22.73	5.64	11.36	11.36
***O. vulgare* 2**	22.73	11.36	5.64	11.36
***T. vulgaris* 1**	45.45	11.36	22.73	11.36
***T. vulgaris* 2**	22.73	22.73	5.64	11.36
T. serpyllum	22.73	11.36	11.36	22.73
***M. alternifolia* 1**	363.64	181.82	181.82	181.82
***M. alternifolia* 2**	181.82	181.82	181.82	181.82
L. officinalis	181.82	181.82	181.82	181.82
L. hybrida	363.64	181.82	90.91	181,82
C. bergamia	363.64	363.64	363.64	181.82
R. officinalis	363.64	363.64	363.64	181.82
C. zeylanicum	45.45	90.91	45.45	90.91
MIX*	45.45	22.73	11.36	22.73

*** 25% *M. alternifolia*, 25% *O. vulgare*, 25% *C. zeylanicum*, 25% T. *vulgaris*.**

CONCLUSIONS

VOC chambers proved to be an effective method to evaluate the antimicrobial activity of volatile EOs. The tested EOs presented significant concentration-dependent antifungal activity against *B. cinerea*, *M. fructicola*, *M. fructigena*, and *M. laxa*. Further in vivo assays should be conducted to elucidate whether some of these EOs could be of use for the postharvest control of gray mold and brown rot infections in fruits and vegetables.

Álvarez-García, S., Moumni, M., Romanazzi, G., 2023. Antifungal activity of volatile organic compounds from essential oils against the postharvest pathogens *Botrytis cinerea*, *Monilinia fructicola*, *Monilinia fructigena*, and *Monilinia laxa*. Frontiers in Plant Science, 14. https://doi.org/10.3389/fpls.2023.1274770