Antifungal activities of six essentials oils against *Zymoseptoria tritici*

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Introduction

Zymoseptoria tritici, the causal agent of Septoria tritici blotch, is one of the most destructive pathogens of wheat, causing up to **50% yield losses in Europe** [1]. Management of this pathogen relies mostly on the use of **synthetic fungicides**. However, current trends based on agroecological practices requires the development of eco-friendly **alternative control methods** of this disease.

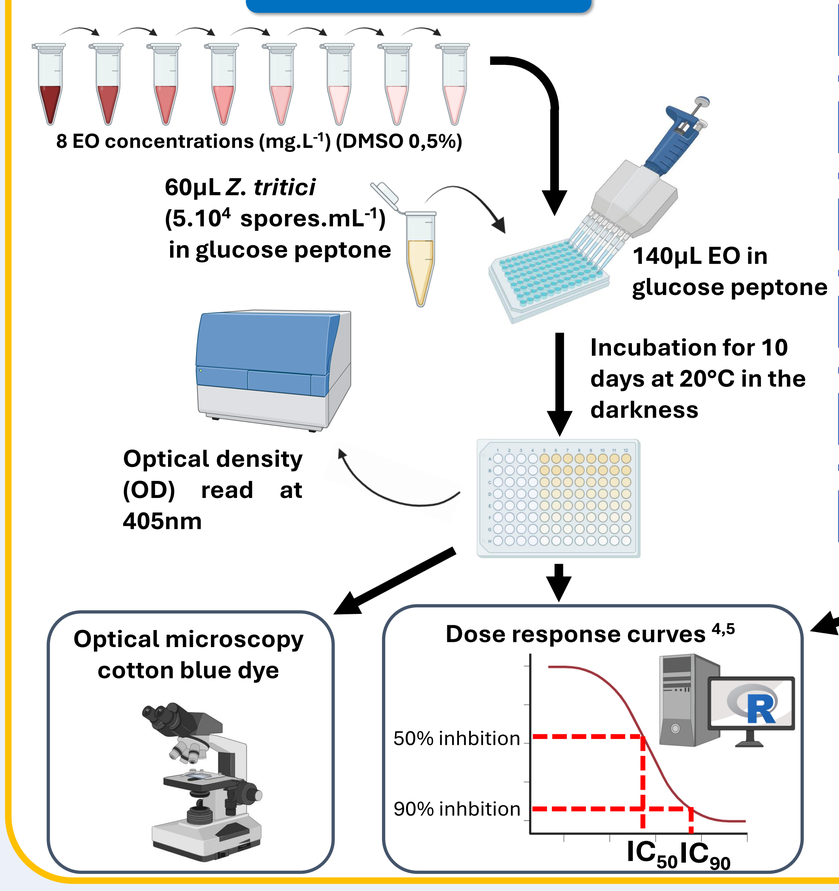
Plant secondary metabolites have been investigated for their potential application in agriculture. Volatile organic compounds, and especially **essential oils (EOs),** are gaining an interest for their **fungicidal properties** [2].

Objectives

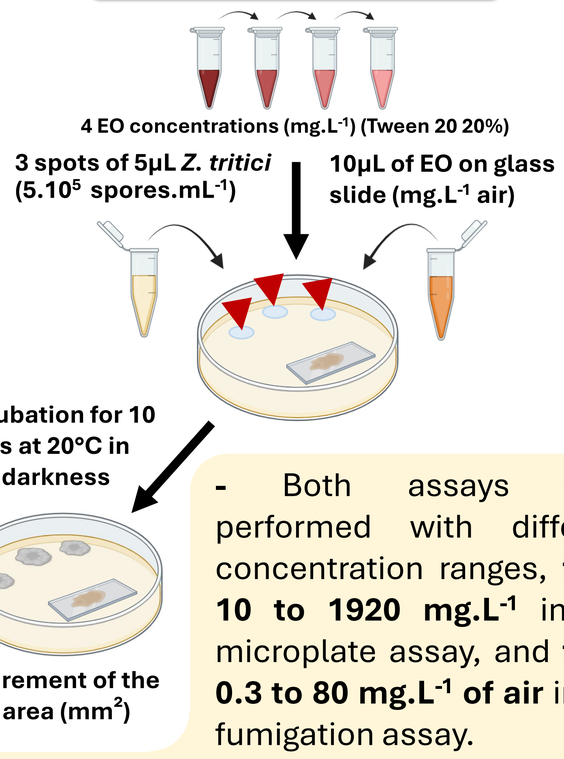
This study aims at evaluating the **antifungal activities** of six essential oils ***in vitro*** by contact and by fumigation against ***Z. tritici***

Materials and methods

Contact assay (n=8) [3]



Fumigation assay (n=6)

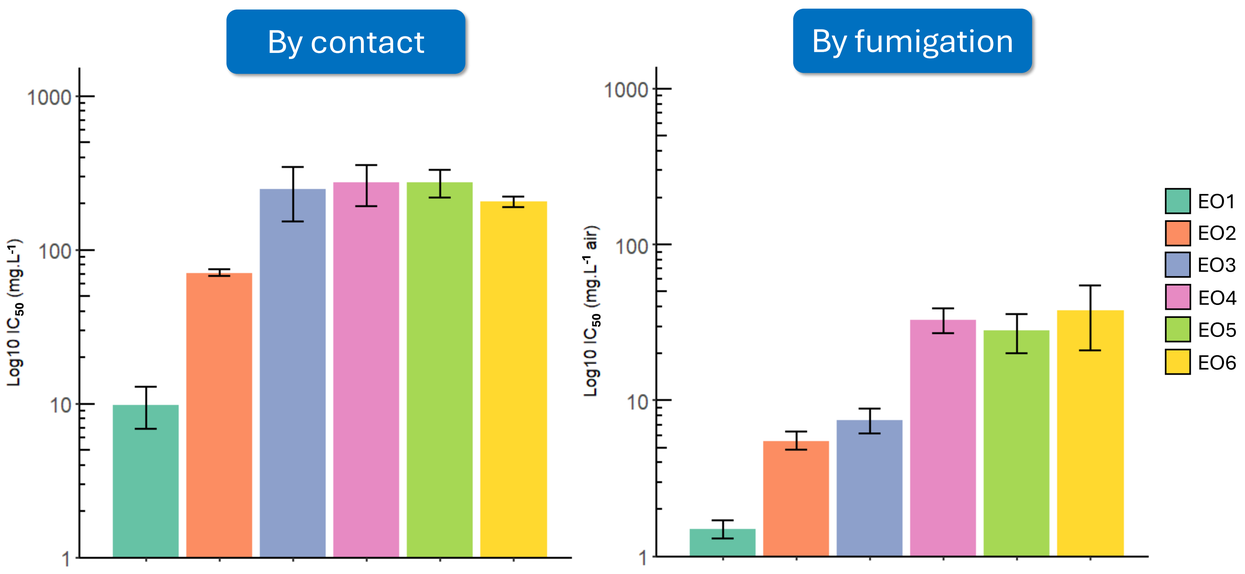


- Both assays were performed with different concentration ranges, **from 10 to 1920 mg.L^{-1}** in the microplate assay, and **from 0.3 to 80 mg.L^{-1} of air** in the fumigation assay.

- The contact assay was carried out **three times**. While the fumigation experiment was performed **once**.

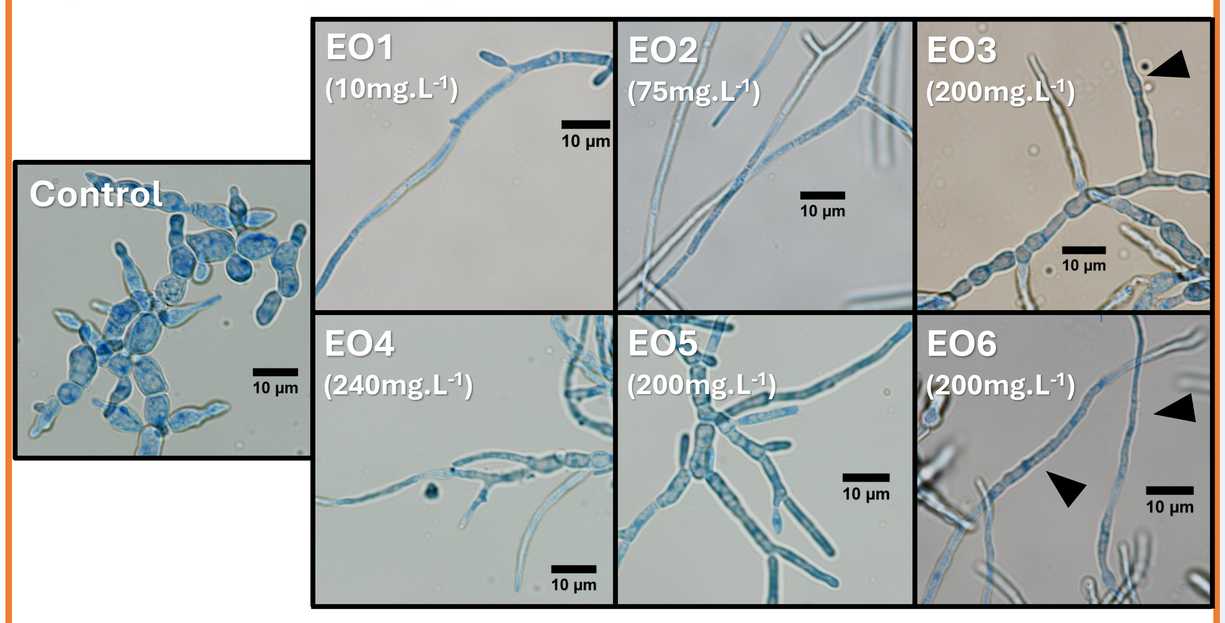
Results

IC_{50} calculated in the contact and fumigation assays



All tested essential oils **inhibited** the growth of *Z. tritici* in both bioassays. The antifungal activities were overall greater when applied by fumigation, with IC_{50} values **lowered by 10-fold**. Among the tested compounds, **EO1** displayed the best antifungal activity towards *Z. tritici*.

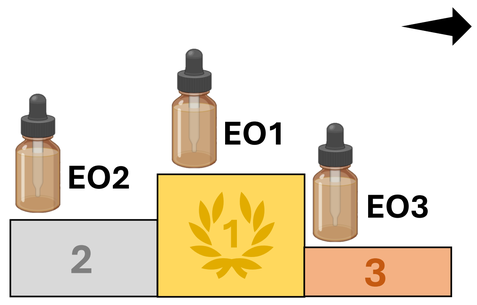
Mycelium morphology



Without any treatment, the mycelium is **dense with thick cells and many branches**. When treated with the essential oils, the mycelium has **fewer branches with thinner hyphae and observable deformations (black arrows)**.

IC_{90} calculated in the contact (in italic) and fumigation (in bold) assays

	EO1	EO2	EO3	EO4	EO5	EO6
IC_{90} (mg.L^{-1})	*11,5*	*76,4*	*288*	*376*	*345*	*364*
[standard deviation]	*[8,79-14,2]*	*[72,8-79,8]*	*[187-390]*	*[323-428]*	*[299-391]*	*[286-441]*
IC_{90} (mg.L^{-1} air)	**2,2**	**8,9**	**22**	**51**	**54**	**41**
[95% confidence]	**[1,8-2,8]**	**[6,6-11]**	**[17-27]**	**[37-65]**	**[15-93]**	**[32-50]**



IC_{90} values indicate a greater activity of **EO1** in inhibiting the growth of *Z. tritici* in both assays. The second most active essential oil is **EO2** which, is followed by **EO3.** Meanwhile, **EO4, EO5 and EO6** have the lowest antifungal activity.

Conclusion and perspectives

Among the six tested essential oils, **EO1** was the most active against ***Z. tritici*** and is a potential candidate for the biocontrol of Septoria tritici blotch. The highest antifungal activities were scored with the **fumigation method**, due likely to the **volatile nature** of essential oils, and could therefore affect **field performance**. In planta assays on the wheat-*Z. tritici* pathosystem are in progress in order to confirm the observed activities. Moreover, the **modes of action** of the most promising essential oil, on both the plant and the pathogen, will be investigated.

References

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