

# Anti-*Candida* activity of *Cymbopogon* spp. essential oils: a promising new treatment strategy for superficial infections

Sandra Simões Tomás<sup>1,2</sup>, Daniela Marques Almeida<sup>1,2</sup>, Ana Sofia Oliveira<sup>1,2</sup>, Joana Domingues<sup>3,4</sup>, Rita Palmeira-de-Oliveira<sup>1,2,5</sup>, José Martinez-de-Oliveira<sup>1</sup>, Fernanda Delgado<sup>3,4,6</sup>, Ana Palmeira-de-Oliveira<sup>1,2,5</sup>, Joana Rolo<sup>1,2</sup>

<sup>1</sup> CICS-UBI – Health Sciences Research Centre, University of Beira Interior, Covilhã, Portugal; <sup>2</sup> Faculdade de Ciências da Saúde, Universidade da Beira Interior, Covilhã, Portugal; <sup>3</sup> Escola Superior Agrária do Instituto Politécnico de Castelo Branco, Portugal; <sup>4</sup> Centro de Biotecnologia de Plantas da Beira Interior, Castelo Branco, Portugal; <sup>5</sup> Labfit-HPRD: Health Products Research and Development Lda, Covilhã, Portugal; <sup>6</sup> CERNAS: Research Center for Natural Resources, Environment and Society, Agriculture Science Research Group, Castelo Branco, Portugal.

sandra.tomas@ubi.pt

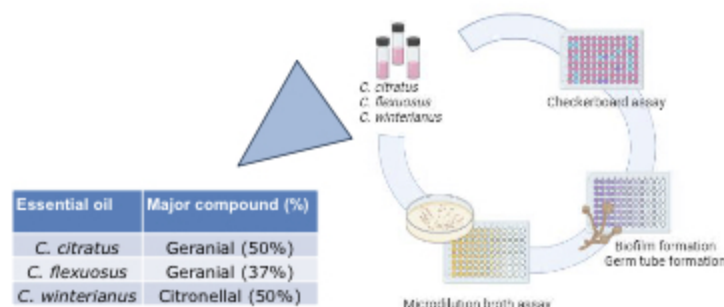
## INTRODUCTION

- Candida albicans* is recognized by the World Health Organization as a priority critical fungal pathogen [1].
- Treatment is almost limited to the use of azole compounds, for which the resistance rates is alarmingly increasing [2].
- Natural compounds like the ones present in essential oils have been described as excellent antifungals [3].
- Essential oils, due to their antimicrobial activity, are a sustainable alternative for the development of new topical drugs.

## OBJECTIVES

We aim to explore the potential of essential oils obtained from the peel of *Cymbopogon* spp., extensively produced in Portugal.

## METHODOLOGY



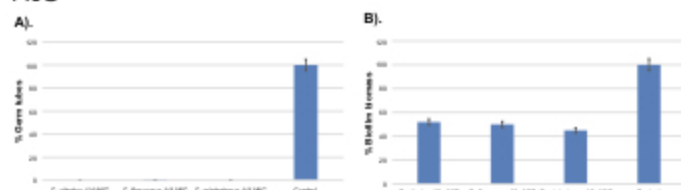
## RESULTS

The MIC ranged from 0.12% (V/V, *C. citratus* and *C. flexuosus*) to 0.25% (V/V, *C. winterianus*). The MLC ranged from 0.12% (V/V, *C. citratus*) to >1% (V/V, *C. winterianus*) (Table 1).

**Table 1.** Minimum inhibitory concentration (MIC) and minimum lethal concentration (MLC) of the tested essential oils.

Essential oil	MIC (% V/V)	MLC (% V/V)
<i>C. citratus</i>	0.12 %	0.12%
<i>C. flexuosus</i>	0.12 %	0.25%
<i>C. winterianus</i>	0.25%	>1 %

Total inhibition of germ tube growth was recorded in the presence of all *Cymbopogon* spp. essential oils. In addition, 50% of destruction of biofilm biomass was achieved for all essential oils after treatment with 10x MIC.



**Figure 1.** A) Inhibition of germ tube formation (%) in the presence of essential oils. B) Biofilm biomass (%) after treatment with essential oils.

Synergy with clotrimazole was observed in the inhibition of growth of planktonic cells for *C. citratus* essential oil.

**Table 2.** Fractional inhibitory concentration Index (FICI) for the inhibitory activity of the essential oils in combination with clotrimazole.

Essential oil	FIC Index	Interpretation
<i>C. citratus</i>	0.31	Synergy
<i>C. flexuosus</i>	0.62	Additive
<i>C. winterianus</i>	1.06	Indifferent

## CONCLUSIONS

*C. citratus*'s essential oils have significant anti-*Candida* activity, probably related to their main compound, geranial. There is great potential in the applicability as a co-adjuvant constituting a new treatment strategy for superficial infections as a topical ointment.

References: [1] <https://www.who.int>; [2] Gao, J., et al., Nature Communications, 2018; [3] Palmeira-de-Oliveira, A., et al., J Ethnopharmacol, 2012.

Acknowledgements: The work was developed within the scope of the CICS-UBI projects [UIDB/05709/2020] and [UIDP/00709/2020], financed by national funds through the Portuguese Foundation for Science and Technology (MCTES) (FCT).