

TITLE: SYNERGISTIC EFFECT OF *VARRONIA CURASSAVICA* JACQ. ESSENTIAL OIL ASSOCIATION AGAINST THE PHYTOPATHOGEN *XANTHOMONAS CAMPESTRIS* PV. *CAMPESTRIS*.

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ABSTRACT:

The increased use of pesticides applied to treat diseases caused by bacteria of the genus *Xanthomonas campestris* pv. *campestris* (Xcc), has caused serious environmental problems. Their inappropriate use has directly and indirectly affected the environment, including soil and water, as well as the soil microbiota and insects. However, there are few fungicides/bactericides for the treatment of plant diseases caused by Xcc only two natural products with general bactericidal/fungicidal use are available on the market. Thus, this study evaluated the antimicrobial activity of essential oils (EOs) and their combinations from seven distinct genotypes of *Varronia curassavica* Jacq. (VCUR) against Xcc 629 IBSBF. GC/MS chemical analysis revealed α -pinene, sabinene, (E)-caryophyllene, *ar*-curcumene, β -sesquiphellandrene, 7-cyclodecen-1-one and *ar*-turmerone as the major compounds of the seven EOs of VCUR. All seven genotypes showed growth inhibition of Xcc. The minimum inhibitory concentration of the EOs was between 500 and 1000 $\mu\text{g mL}^{-1}$, with genotypes VCUR-202 and -302 demonstrating the most potent antimicrobial activity. Gas chromatography/mass spectrometry analysis verified that (E)-caryophyllene and α -humulene were the only compounds present in all samples analyzed and that the major compounds varied among the studied genotypes. In relation to the associations made by the fixed-rate method, 59.52% of the total combinations between the seven EOs from VCUR genotypes had an additive effect. However, the combinations between VCUR-002 \times (-302, -202) and VCUR-302 \times (-601) showed a synergistic effect, with mean fractional inhibitory concentration FIC_{50} values of 0.28, 0.42 and 0.46, respectively ($\text{med}\Sigma\text{FIC}_{50}\leq 2$). This study demonstrates that combinations of *V. curassavica*

EOs have antimicrobial activity and a potential to be used in the control of black rot.

Keywords: Black rot, cruciferous, fluorescence microscopy, flow cytometry, thymol, carvacrol.

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