

Chemical characterization and antimicrobial activity

of 6 plant essential oils against

Pseudomonas syringae pv. *actinidiae* and *P. s.* pv. *actinidifoliorum*

M. Nunes da Silva^{1,2}, J. Machado², A. Mazzaglia³, G. M. Balestra³, M. W. Vasconcelos^{2*} and S. M. P. Carvalho^{1*}

¹GreenUP/CITAB-UP, Faculdade de Ciências da Universidade do Porto, Campus Agrário de Vairão, Rua Padre Armando Quintas 7, 4485-661 Vairão, Portugal.

²Universidade Católica Portuguesa, CBOF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Arquiteto Lobão Vital, 172, 4200-374 Porto, Portugal.

³Department of Science and Technologies for Agriculture, Forestry, Nature and Energy (DAFNE), Via S. Camillo de Lellis, Viterbo, Italy.

*E-mails: mvasconcelos@porto.ucp.pt; susana.carvalho@fc.up.pt



Introduction

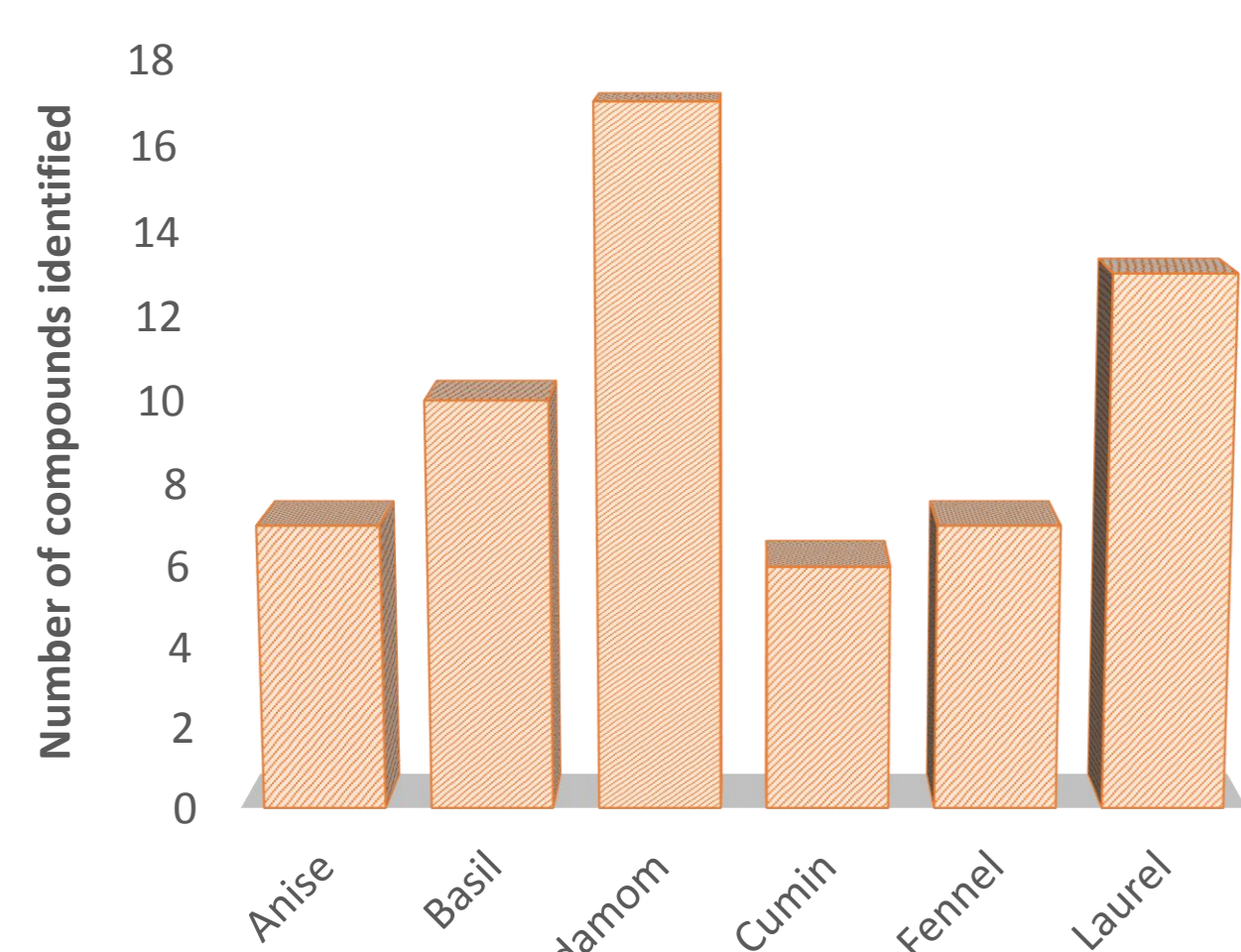
Kiwifruit bacterial canker (KBC), caused by *Pseudomonas syringae* pv. *actinidiae* (PSA), is currently the most destructive disease of kiwifruit worldwide. It was introduced in Portugal in 2010, leading to drastic production losses and plant mortality. Conversely, a closely related pathovar, *P. syringae* pv. *actinidifoliorum* (PSAF), only causes necrotic spots, not being associated with plant mortality.

Current control techniques are expensive, consisting in the application of copper- and antibiotics-based compounds, with serious risks of environmental contamination and development of resistant bacteria. Therefore, the aim of this work was to characterize six plant essential oils against (anise, basil, cardamom, cumin, fennel and laurel) by gas chromatography–mass spectrometry (GC-MS) and evaluate their antimicrobial potential against different strains of PSA and PSAF.

Methods

1. Two highly virulent PSA strains (CFBP 7286 and 1F, isolated from Italy and France, respectively) and two less virulent PSAF strains (ICMP 18804 and ICMP 19441, isolated from New Zealand and Australia, respectively) were grown overnight in LB broth at 27 °C and with shaking.
2. Bacterial inoculum ($1-2 \times 10^7$ CFU.mL⁻¹) was plated onto Nutrient Sucrose Agar medium and 20 µL droplets of each essential oil concentration were placed in 5 mm diameter paper discs (N = 3).
3. Plates were incubated at 28 °C for 48 h, after which the inhibition zone was measured.
4. Essential oils chemical characterization was performed by GC-MS.

Results and Discussion



Cardamom showed the most diversified composition, with 17 identified compounds, whereas anise, cumin and fennel appeared to be the least complex essential oils, with up to 7 compounds identified.

Anise seemed to be the most effective essential oil, presenting generally lower minimum inhibitory concentrations (MICs) than the others, except for PSAF 19441 where cumin was able to inhibit bacterial growth even at the lowest concentration tested (0.1 %). Nevertheless, basil and cumin promoted wider inhibition zones, especially in the less virulent PSAF strains. In general, PSAF 19441 seemed to be the most sensitive to all essential oils.

Fig. 1 – Number of organic compounds identified by GC/MS analysis.

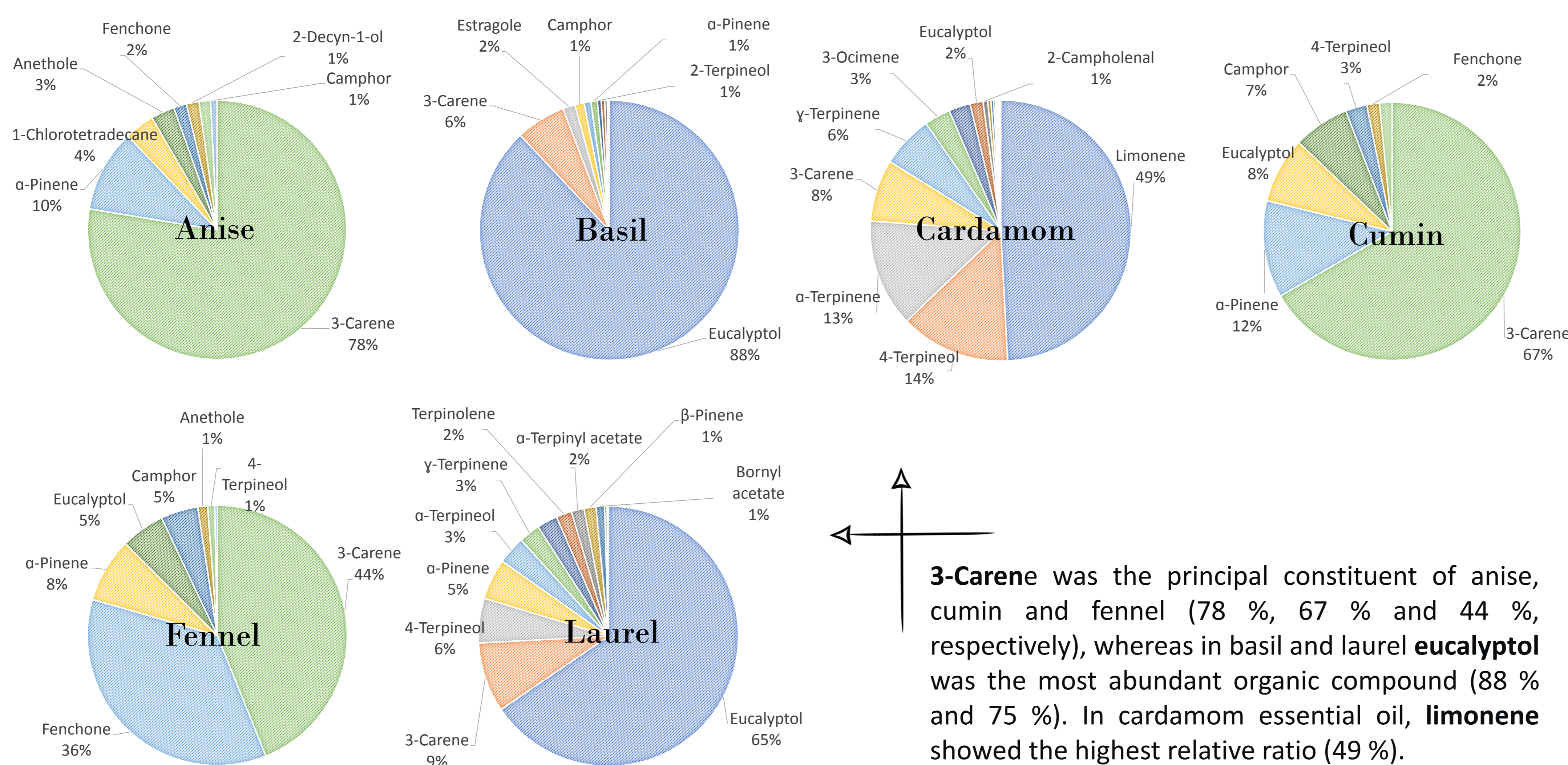


Fig. 2 – Relative composition of the main organic compounds of anise, basil, cardamom, cumin, fennel and laurel essential oils revealed by GC/MS analysis.

Conclusions

- ✓ Plant essential oils differed in their composition; however, compounds such as 3-carene, eucalyptol, camphor, fenchone and 4-terpineol were detected transversely in all oils.
- ✓ Although cumin presented the most simple composition, it showed MIC as low as 0.1 % for PSA 19441.
- ✓ In general, basil, cardamom and fennel had higher MICs, whereas anise had the lowest.
- ✓ PSAF strain 19441 was the most sensitive to almost all essential oils tested.

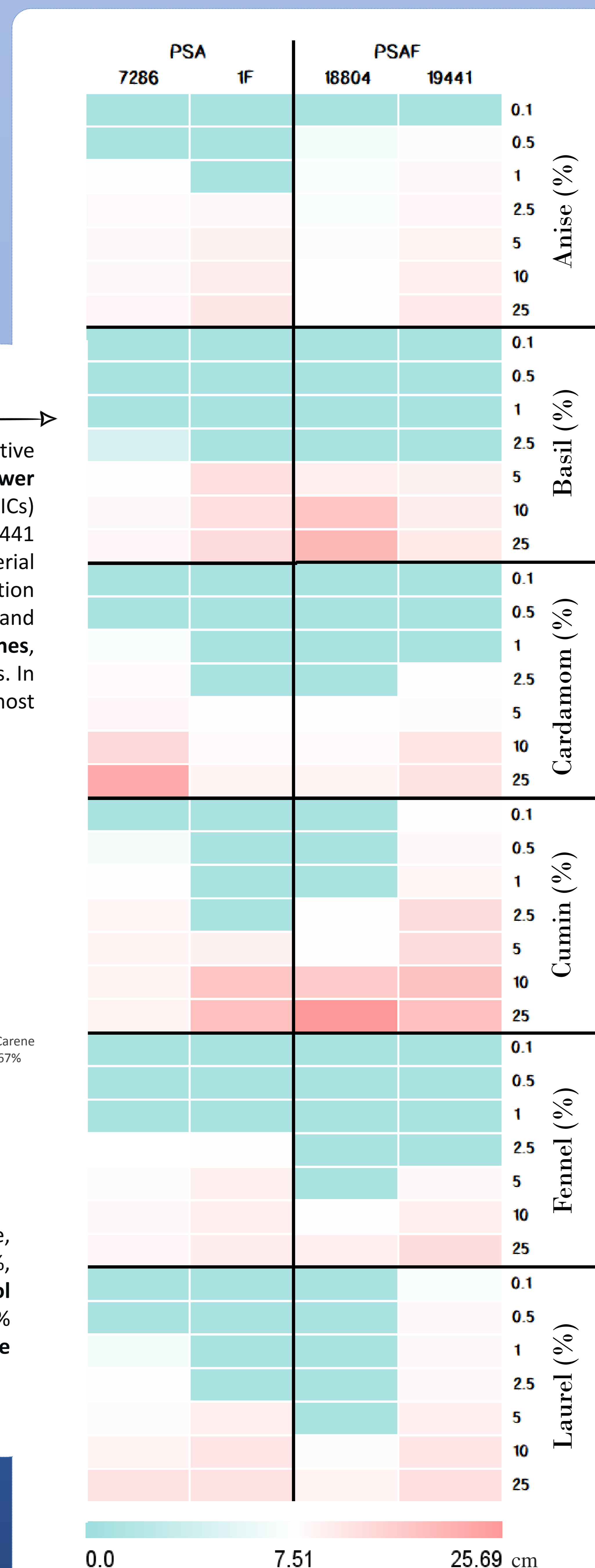


Fig. 3 – Inhibition zone in PSA and PSAF bacterial cultures after exposure to 0.1, 0.5, 1, 2.5, 5, 10 and 25 % of anise, basil, cardamom, cumin, fennel and laurel essential oils. The diameter of the bacteria inhibition zone ranged from 0 cm (dark green) to 25.69 cm (dark red).

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