

Activity of *Satureja montana* Allelochemical Volatiles Against the Pinewood NematodeGonçalo Pereira¹ and Jorge M. S. Faria^{1,2}

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INTRODUCTION & AIM

Plant parasitic nematodes are widespread damaging pests that can cause up to 12 % loss in crop yields [1]. The pinewood nematode (PWN) *Bursaphelenchus xylophilus*, is responsible for pine wilt disease (PWD), which causes significant economic and ecological damage to pine wood dependent industries.

Current pest management strategies rely on chemical pesticides, however these have become increasingly restricted, owing to environmental and human health concerns. This has led to an increase in demand for more ecological and sustainable pesticides.

Satureja montana essential oil (EO) exhibits the highest nematocidal activity of the Lamiaceae family (0.26 - 0.38 $\mu\text{L/mL}$) [2]. The study of synergistic and / or antagonistic interactions between compounds of *S. montana* EO can help identify possible candidates to be used as biopesticides.

METHODS

- S. montana* EO main compounds (carvacrol, *p*-cymene and γ -terpinene) were tested at the proportions present in the EO.

Compound / Combination	Concentration in 1 mg / mL of EO (mg / mL)		
	carvacrol (64)	γ -terpinene (18)	<i>p</i> -cymene (8)
carvacrol	0.64		
γ -terpinene		0.18	
<i>p</i> -cymene			0.08
carvacrol + γ -terpinene	0.64	0.18	
carvacrol + <i>p</i> -cymene	0.64		0.08
γ -terpinene + <i>p</i> -cymene		0.18	0.08
carvacrol + γ -terpinene + <i>p</i> -cymene	0.64	0.18	0.08

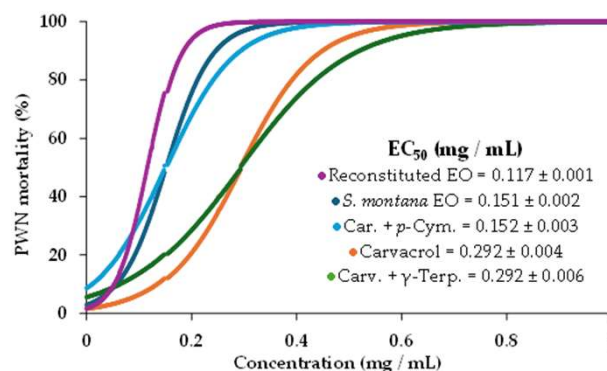
- Direct control bioassays were carried out with **60 mixed-life-stage PWNs** for 24 h
- Volatiles were tested at **decreasing concentrations** to calculate EC_{50}/EC_{100}
- PWN mortality was assessed using an **Olympus SX12 stereomicroscope (40x)**

RESULTS & DISCUSSION

- Carvacrol was the EO main compound with the highest activity (**100 \pm 0.0%**)

EO / compounds	Mortality % at 1 mg/mL	EC_{50} (mg/mL)	EC_{100} (mg/mL)	<i>P</i>	R^2
<i>Satureja montana</i> EO	100 \pm 0.0	0.151 \pm 0.002	0.59 – 0.78	10.1 \pm 0.5	0.98
carvacrol	100 \pm 0.0	0.292 \pm 0.004	0.84 – 0.99	6.1 \pm 0.3	0.99
γ -terpinene	23.5 \pm 0.3				
<i>p</i> -cymene	16.4 \pm 0.4				
carvacrol + γ -terpinene	100 \pm 0.0	0.292 \pm 0.006	0.71 – 0.81	4.2 \pm 0.2	0.97
carvacrol + <i>p</i> -cymene	100 \pm 0.0	0.152 \pm 0.003	0.66 – 0.79	6.7 \pm 0.3	0.97
γ -terpinene + <i>p</i> -cymene	63.7 \pm 1.2				
γ -terpinene + <i>p</i> -cymene + carvacrol ¹	100 \pm 0.0	0.117 \pm 0.001	0.38 – 0.62	14.9 \pm 0.8	0.99

- p*-cymene + γ -terpinene showed synergistic interactions with **63.7 \pm 1.2%** mortality instead on the expected **ca. 40%**



- carvacrol + *p*-cymene showed **0.152 \pm 0.003 mg/mL** mortality similar to *S. montana* EO
- Reconstituted *S. montana* EO exhibited highest activity **0.117 \pm 0.001 mg/mL**

CONCLUSION

- The monoterpene phenol carvacrol was the most active compound of *S. montana* EO
- Carvacrol acted synergistically with the hydrocarbon *p*-cymene; their activity was higher with γ -terpinene (reconstituted EO)
- Possible antagonistic interaction between dominant (>5 %) and minor volatiles

REFERENCES

[1] Poveda et al. (2020) doi:10.3389/fmicb.2020.00992

[2] Faria et al. 2021, doi:10.3390/plants10122614