ESSENTIAL OIL NANOEMULSIONS FOR APHID CONTROL: EFFECTS ON KEY BIOLOGICAL CONTROL PREDATORS

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The increasing resistance of ***Myzus persicae*** to conventional insecticides has stimulated interest in **plant essential oils** (EOs) as alternative IPM tools. However, information on their effects on beneficial insects, including **aphidophagous hoverflies**, is still limited. This study aims to answer the following question:

Can essential oils be integrated into hoverfly-based IPM strategies?

GROUPS TESTED

- **Untreated control**
- **Emulsionant control** (T80)
- **Laurel EO** (*Laurus nobilis*)
- **Cypress EO** (*Cupressus sempervirens*)
- **Aleppo pine EO** (*Pinus halepensis*)

NATURAL ENEMIES TESTED



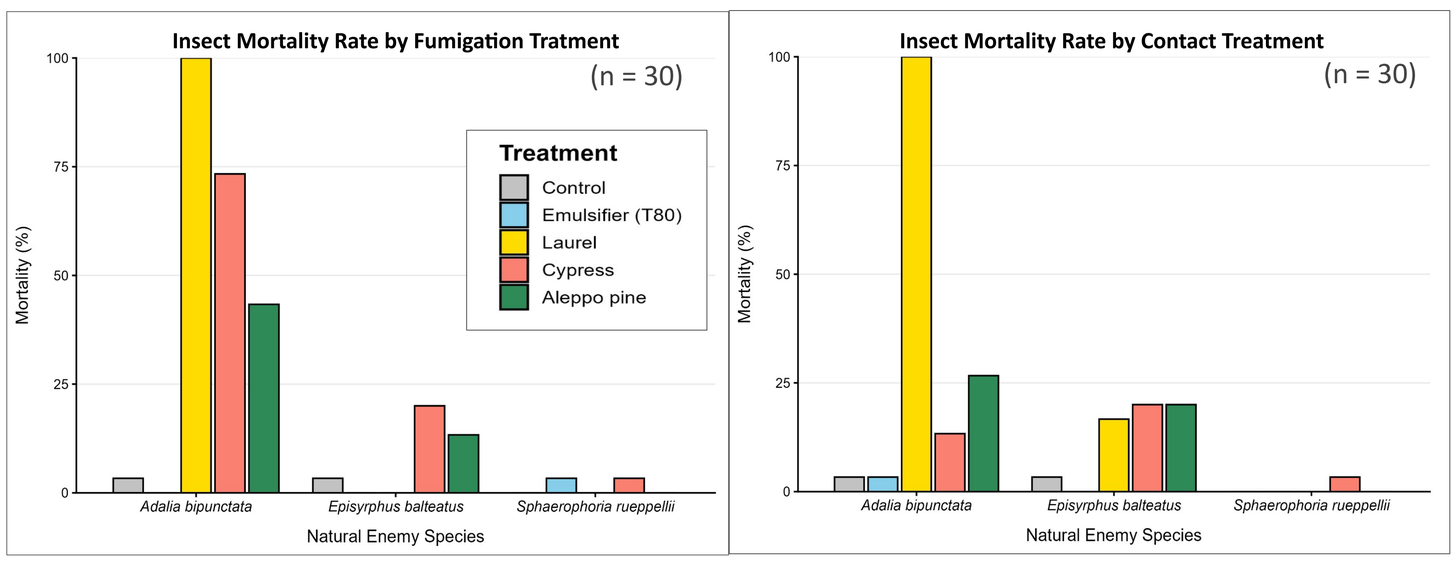
- ***Adalia bipunctata*** (Coleoptera: Coccinellidae)
- ***Episyrphus balteatus*** (Diptera: Syprhidae)
- ***Sphaerophoria rueppellii*** (Diptera: Syrphidae)

1.MORTALITY AFTER DIRECT EXPOSURE (FUMIGATION & CONTACT)

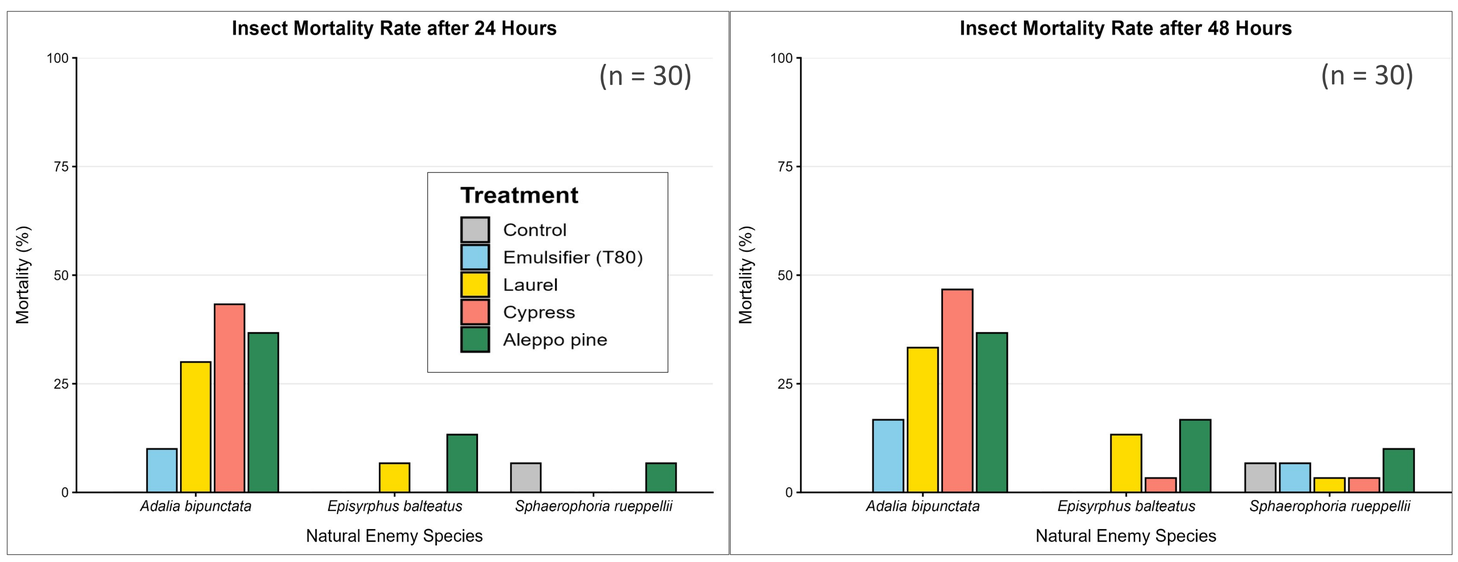
***Adalia bipunctata*:** strongly affected by both exposures ($p < 2.2 \times 10^{-16}$). Laurel EO showed total mortality in both experiments.

***Episyrphus balteatus*:** showed overall treatment effects (contact: $p = 0.016$; fumigation: $p = 0.005$), but no individual EO differed significantly from the control after Bonferroni correction ($p = 1.000$).

***Sphaerophoria rueppellii*:** demonstrated absolute tolerance to all EOs via both contact and fumigation ($p = 1.000$).



2. MORTALITY AFTER INGESTION OF TREATED APHIDS



***Adalia bipunctata*:** significant mortality occurred within 24h and 48h for all EOs tested ($p < 0.0001$).

***Episyrphus balteatus*:** an overall treatment effects is noticeable (24h: $p < 0.023$; 48h: $p = 0.016$), but pairwise post-hoc comparisons revealed no significant mortality for any specific EO ($p = 1.000$).

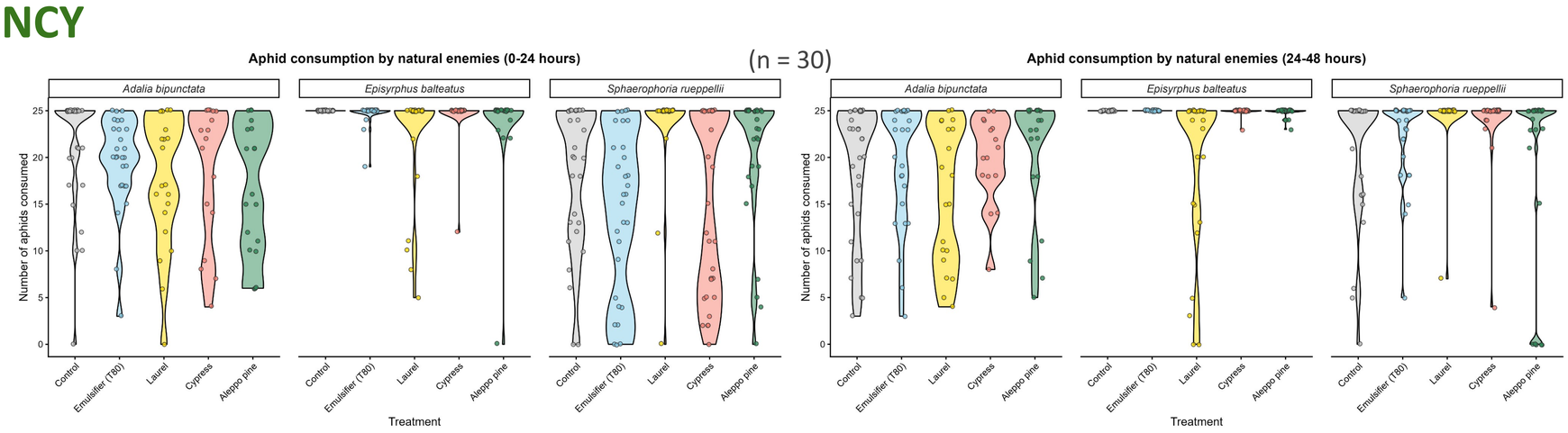
***Sphaerophoria rueppellii*:** unaffected by the ingestion of treated aphids, showing no significant treatment or temporal effects (24h: $p = 0.220$; 48h: $p = 0.935$).

3. EFFECTS ON PREDATION EFFICIENCY

***Adalia bipunctata*:** showed an overall treatment effect only during the first 24h ($p = 0.036$), while predation rate normalised across all groups at 48h ($p = 0.308$).

***Episyrphus balteatus*:** highly sensitive exclusively to laurel, which induced significant, long-lasting feeding inhibition.

***Sphaerophoria rueppellii*:** increased predatory activity when exposed to laurel.



…YES! But compatibility is species-specific

***Sphaerophoria rueppellii* emerged as the most promising candidate** for integration with EO-based aphid management, ***Episyrphus balteatus* suffered sublethal effects to Laurel EO** and *Adalia bipunctata* showed marked susceptibility to all tested EOs.

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