

Developing essential oil based bioinsecticides against *Macrosiphum euphorbiae* (Thomas, C., 1878) (Hemiptera: Aphididae) in tomato crops

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Context

Macrosiphum euphorbiae (potato aphid):

- Polyphagous aphid
 - Common on tomato plants causing damages both through direct feed and virus transmission.
- Essential oils (EOs): widely studied as alternatives to conventional insecticides to control aphid populations.

Amongst these EOs:

- *Cymbopogon citratus* EO has previously demonstrated repellency effects on other aphid species [1]
- *Lippia alba* and *Lantana camara* EOs, less studied for their aphicidal activities and yet promising given results on other insect pests [2,3].

Objectives

Evaluate the potential of these EOs to control *M. euphorbiae* on tomato plants and understand the effect of these EOs on aphids' natural predators.

Method



1 LT50 and LC50

Treatments :

- Essential oils: *L. alba*, *L. camara* and *C. citratus* (1, 2.5, 5, 7.5, 10 µl/ml with Tween 80 at 0.01%)
- Negative control: Tween 80 0.01 %
- Positive control: Lambda-cyhalothrin (40 mg/l)

Selection of 10 *M. euphorbiae* (L3 stage, 6 days)
Pulverisation of 1 ml of EO emulsion

Aphids placed on tomato leaves

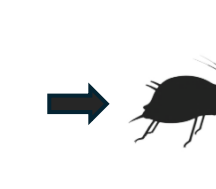


Mortalities observed daily, determination of:
LT 50: Kaplan-Meier survival curves and log-rank tests
LC 50: Probit regression based on non corrected mortalities at eight days



2 Phytotoxicity

Pulverisation of EO emulsions (5 µL/mL) on tomato plants
Visual inspection of phytotoxicity 24h post pulverisation



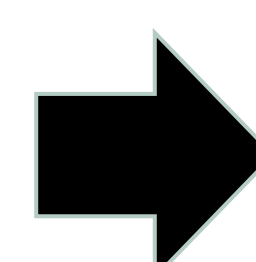
3 Repulsion effect on aphids



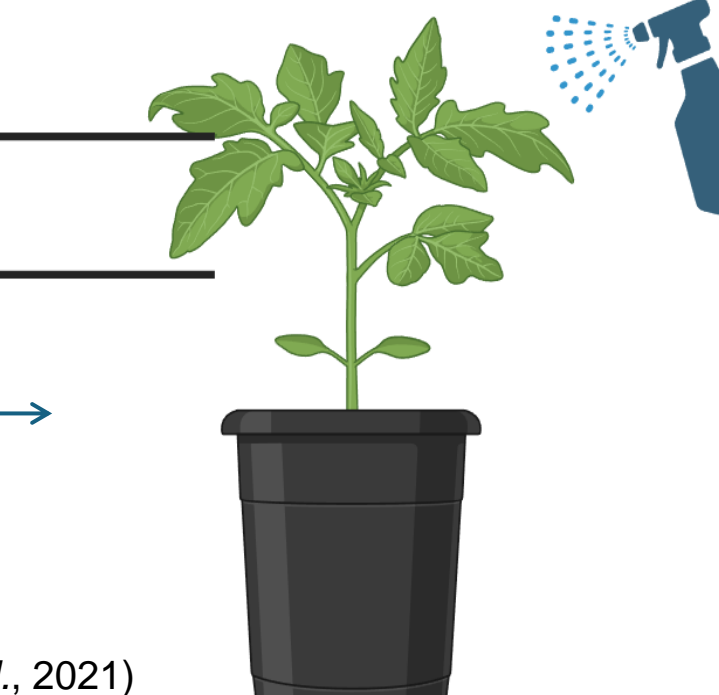
4 (Non) repulsion effect on ladybugs

Negative control (0.01 % tween 80)

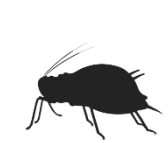
EO emulsion (5 µL / mL)



Adapted from (Khaled-Gasmi et al., 2021)

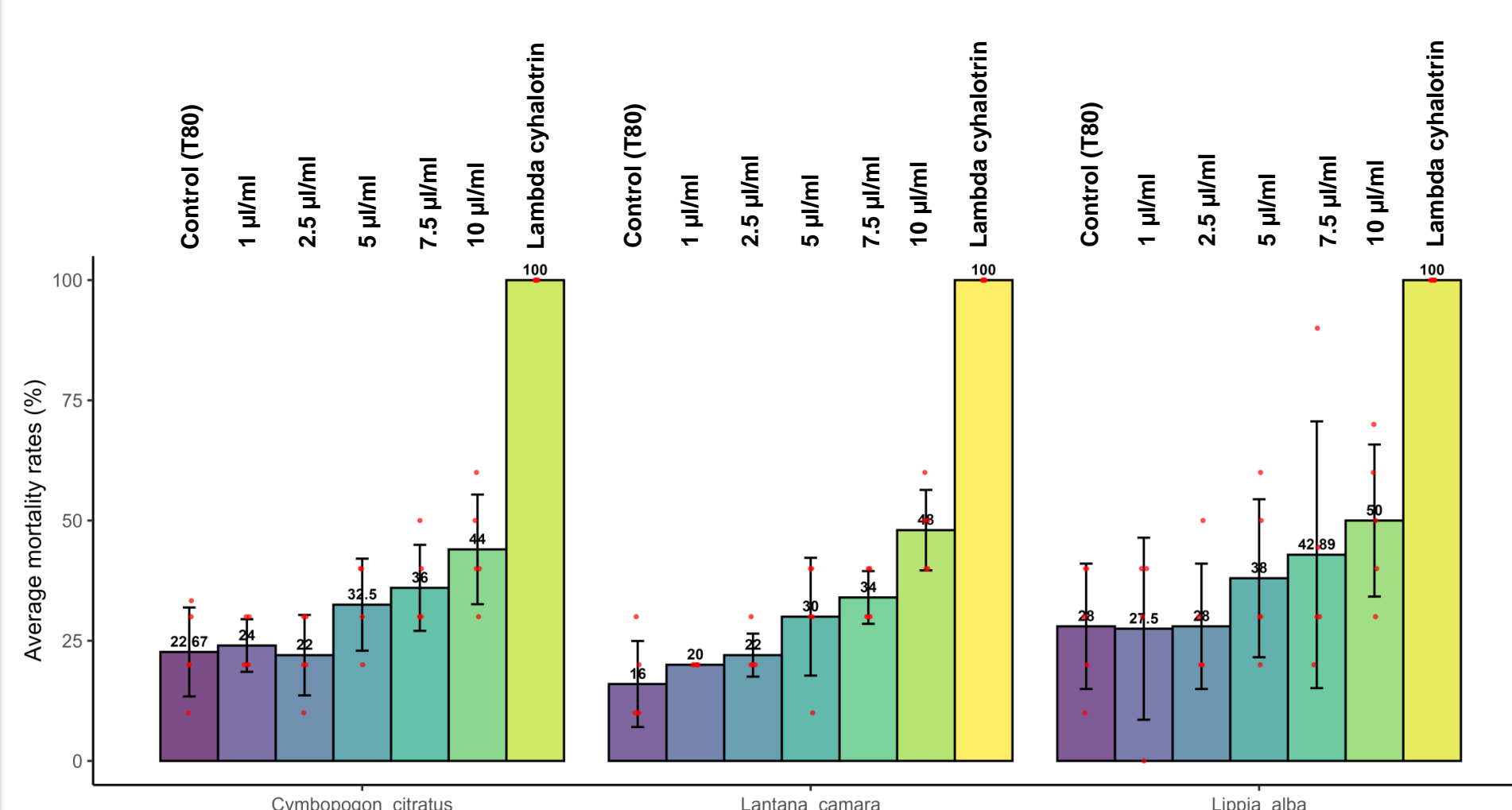


Results and discussion

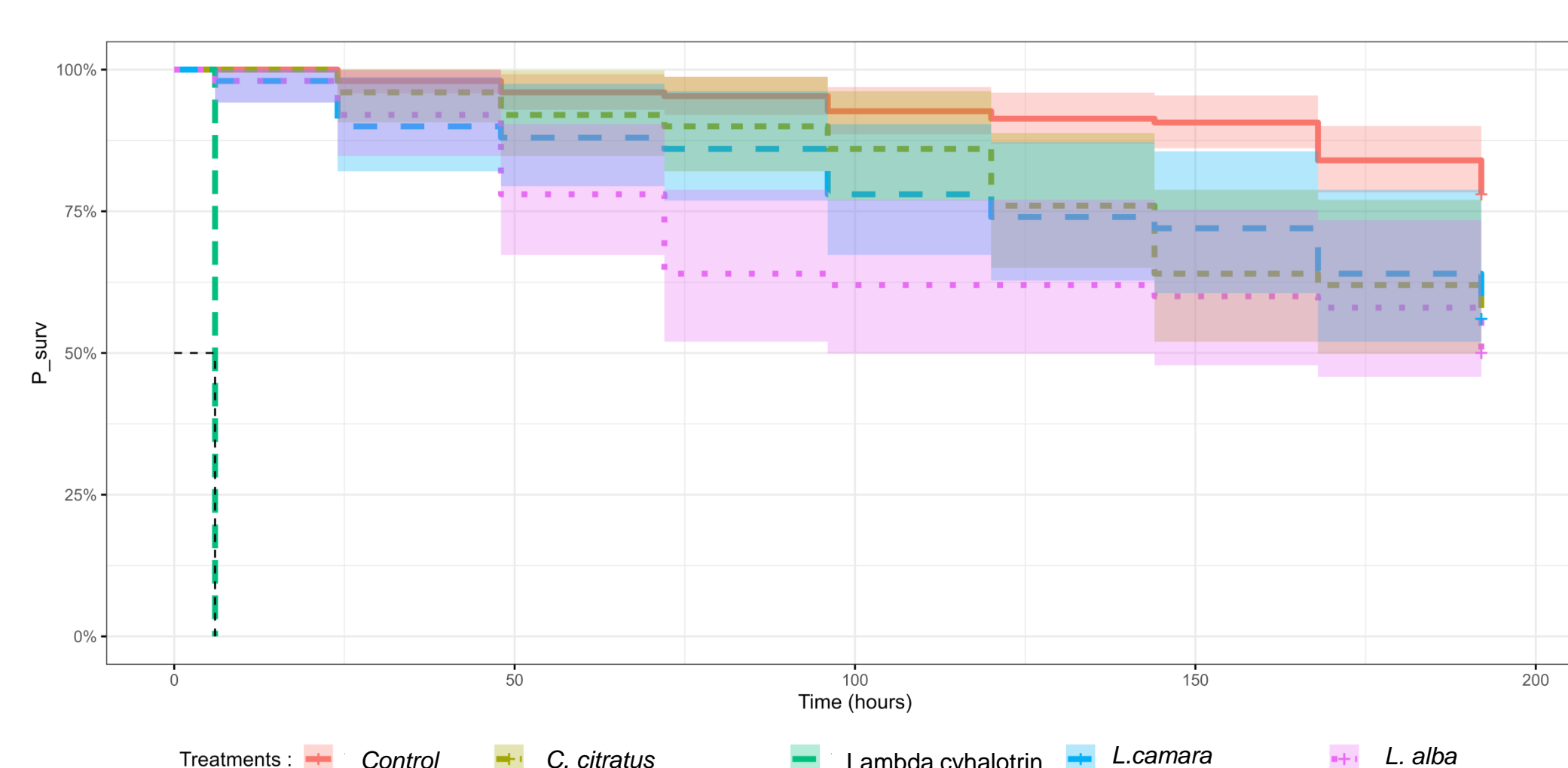


1 LT50 and LC50

Mortality rates at 192 h after treatment



Kaplan-Meier survival curves



Probit regressions and LC 50

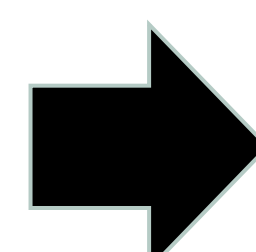
Treatment	Time (h)	n	Probit linear regression	R ²	pval (F)	LC50 (µg/ml)
<i>Cymbopogon citratus</i>	192	25	$y = 0.57 \times \log_{10}(\text{dose}) + 4.16$	0.39	0.0011	29.33
<i>Lantana camara</i>	192	25	$y = 0.71 \times \log_{10}(\text{dose}) + 4.05$	0.53	4 e-5	21.96
<i>Lippia alba</i>	192	25	$y = 1.11 \times \log_{10}(\text{dose}) + 3.90$	0.29	0.005	9.86

- EOs show low aphicidal activity on *M. euphorbiae* when compared to commercial reference (mortality rate and LT50)
- *L. alba* displays the lowest LC50 out of the three EOs.
- Higher LC50 are observed for *M. euphorbiae* compared to other aphid species.



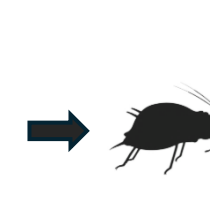
2 Phytotoxicity

No phytotoxicity observed



Cymbopogon citratus
Lantana camara
Lippia alba

Relative non-attractive effect



3 Repulsion effect on aphids

	x ²	df	pvalue	Conclusion
<i>Cymbopogon citratus</i>	56.67% (17/30)	0.53	1	0.46 A H0 : No specific non-attraction
<i>Lantana camara</i>	60% (18/30)	1.2	1	0.27 A H0 : No specific non-attraction
<i>Lippia alba</i>	70% (21/30)	4.8	1	0.02 R H0: Specific non-attraction



4 (Non) repulsion effect on ladybugs

- Tests performed on young adults of ladybeetles, which showed no response
- Only sexually mature adults respond to the experimental device (i.e., more than 12 days old)
- Tests are in progress

Conclusion and perspectives

- All three essential oils displayed high LC 50, implying poor aphicidal properties
- Promising results are obtained at 5 µL/mL in terms of repulsive effect for *L. alba*
- Further experiments should be performed at higher concentrations to further enhance the repulsive effects of *L. alba*
- Non repulsiveness of *L. alba* must be verified on adult ladybugs

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All figures were created with www.biorender.com

References

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