

LC50s of some Insecticides on Convergent Lady Beetles (*Hippodamia convergens*), are they compatible?

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Introduction

Biological control is an important tactic of integrated pest management (IPM). One common commercially available biological control agent, the convergent lady beetle (*Hippodamia convergens*), provides effective control through predation on insect pests in both fields and greenhouses. Insecticides applied in these settings may also include synergists like piperonyl butoxide (PBO), and may be harmful to the lady beetles, but their effects are unknown. Understanding these effects is essential for an IPM system in which both biological control agents and insecticides are used.

Objectives

1. Observe effects of some insecticides on lady beetles over 24, 48, and 72-hour time periods and record mortality caused by insecticides and insecticides + PBO.
2. Find lethal concentration at 50% (LC50) of insecticides and insecticides + PBO on convergent lady beetles.

Hypothesis

1. The use of the synergist PBO will result in higher mortality rates when added to insecticides applied to convergent lady beetles.
2. Lady beetles will exhibit a higher tolerance to thiamethoxam in comparison to other insecticides.

Methods

1. Sachets of 4500 male and female lady beetles were ordered from the commercial insectary Rincon Vitova (Fig. 1).
2. Sex of lady beetles was determined under a microscope. Only females were used for this experiment. (Fig. 2b).
3. Five females were added to one petri dish containing plaster and filter paper, as well as a cotton tube with sugar water to provide for up to 72 hours (Fig. 3).



Figure 1.

Figure 2. a. (left) male b. female

Figure 3.

Methods Cont.

4. A 25-microliter applicator was used to topically apply eight insecticides with and without PBO, in eight serial dilutions each (Fig. 3).
5. Recordings of mortality were taken every 24 hours for up to 72 hours (Fig. 4).
6. SAS software (v9.4) was used for statistical analysis. Probit curves were used to determine individual LC50s (Fig 5, 6, 7).



Figure 4. Notebook used to record mortality.

Results

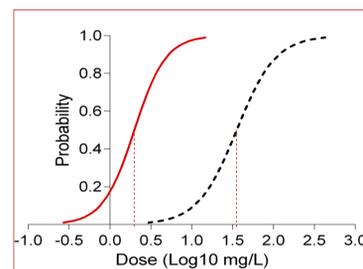


Figure 5. Probit curve for lambda-cyhalothrin.

Lambda-cyhalothrin resulted in low LC50 at approximately 1.5 mg/L. Adding PBO decreases this value to approximately 0.3 mg/L. This suggests higher toxicity and therefore lower chemical compatibility.

Chlorantraniliprole showed higher LC50s than lambda-cyhalothrin at approximately 2 mg/L. Adding PBO decreases this value to approximately 1 mg/L. This suggests a lesser toxicity, and a higher chemical compatibility.

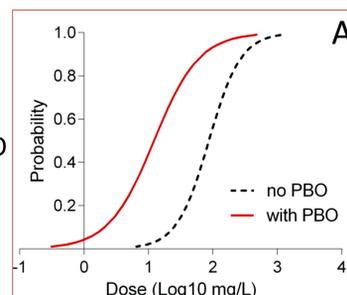


Figure 6. Probit curve for chlorantraniliprole.

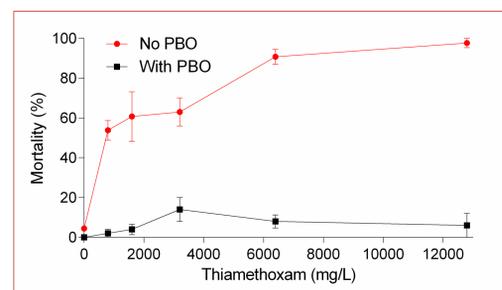


Figure 7. Probit curve of thiamethoxam.

Thiamethoxam showed a high LC50 approx. 1000 mg/L. Adding PBO did not register, as such high quantities suggest tolerance.

Conclusions

Based on these findings, it can be concluded that the LC50s of these insecticides produce a gradient, with some insecticides being more compatible with lady beetles. Convergent lady beetles are tolerant to thiamethoxam and are susceptible to chlorantraniliprole and lambda-cyhalothrin. Adding PBO resulted in higher toxicity.

In the future, a broader range of insecticides will be tested.

References

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Acknowledgements

Jonathan Lee, Nuris Acosta,
Canas Lab
Ranger Lab

Funding Sources: USDA-ARS Award # 58-5082-8-018



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