

Insecticide Resistance in Bed Bug

Eggs and First Instars

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INTRODUCTION: Why should **YOU** care?

- **Bed bugs** (*Cimex lectularius*) are a **growing epidemic worldwide** and have currently been documented in all 50 United States
 - They aren't going anywhere! Their populations continue to increase and spread across the US and world.
- Bed bugs **bites may cause itchiness, redness, rash, secondary infections** and can lead to **psychological distress**
- **Pyrethroid resistance** (the most commonly used mode of action for bed bug control in the US) has been **documented in adult bed bugs** (Romero et al. 2007, Moore and Miller 2006, Yoon et al. 2008, Adelman et al. 2011)
- Not only are bed bugs resistant, they have **multiple mechanisms of resistance** (1-3 different ways to fight insecticides)
- The mechanisms are **enhanced detoxification, cuticular penetration resistance and KDR resistance** (cite); basically, they have enzymes that can knock out the insecticide, or they have an altered nerve target site that can block the insecticide, or they have a thick or enhanced exoskeleton that won't let the insecticide through, OR they have all three mechanisms and this makes bed bugs difficult to kill!
- Now, we knew this about adult bed bugs, but **what about** one of the more difficult life stages to kill (**eggs**) and then the supposedly easiest life stage to kill (**first instars**)?



Bed Bug Eggs: Note
Red Eye Spots



Bed Bug First Instar
Feeding

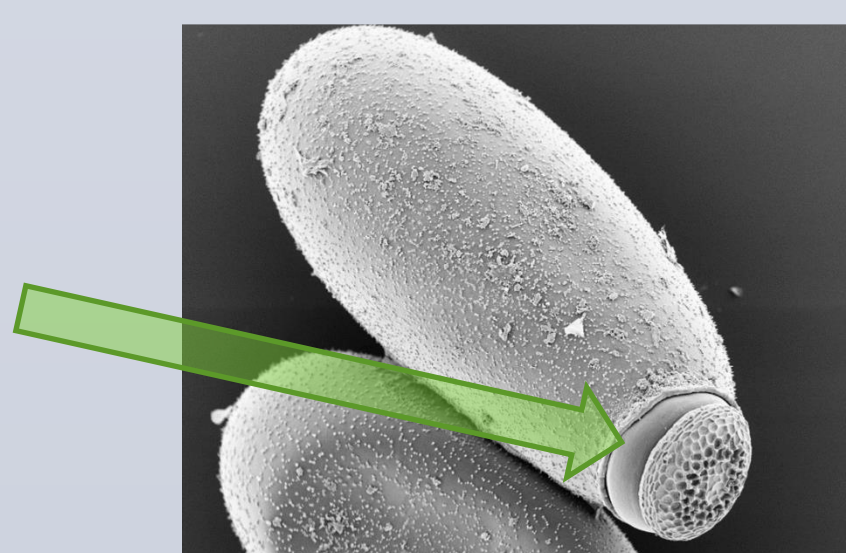
OBJECTIVE

Determine and compare the lethal concentration to **kill 50% (LC₅₀)** of a bed bug population of **eggs and first instars** between three different bed bug strains

MATERIALS and METHODS

- Used **three different bed bugs strains** for all experiments: 1 pyrethroid-susceptible strain = Harlan, and two pyrethroid-resistant strains = Epic Center (collected in Ohio, US) and Richmond (collected in Virginia, US)
- Bed bug **eggs were dipped** for 5 seconds **into** different concentrations **Temprid** (imidacloprid + beta-cyfluthrin) or **into Transport** (acetamiprid + bifenthrin)
- **First instar bed bugs** were **placed onto treated filter papers** with the same insecticides
- A **control treatment** was used of only **water**
- Over **1,000 bed bug eggs** were **treated** and over **500 first instars** were treated
- After 14 days, we checked and **counted how many eggs and first instars were dead**

Scanning electron micrograph
of a bed bug egg hatching



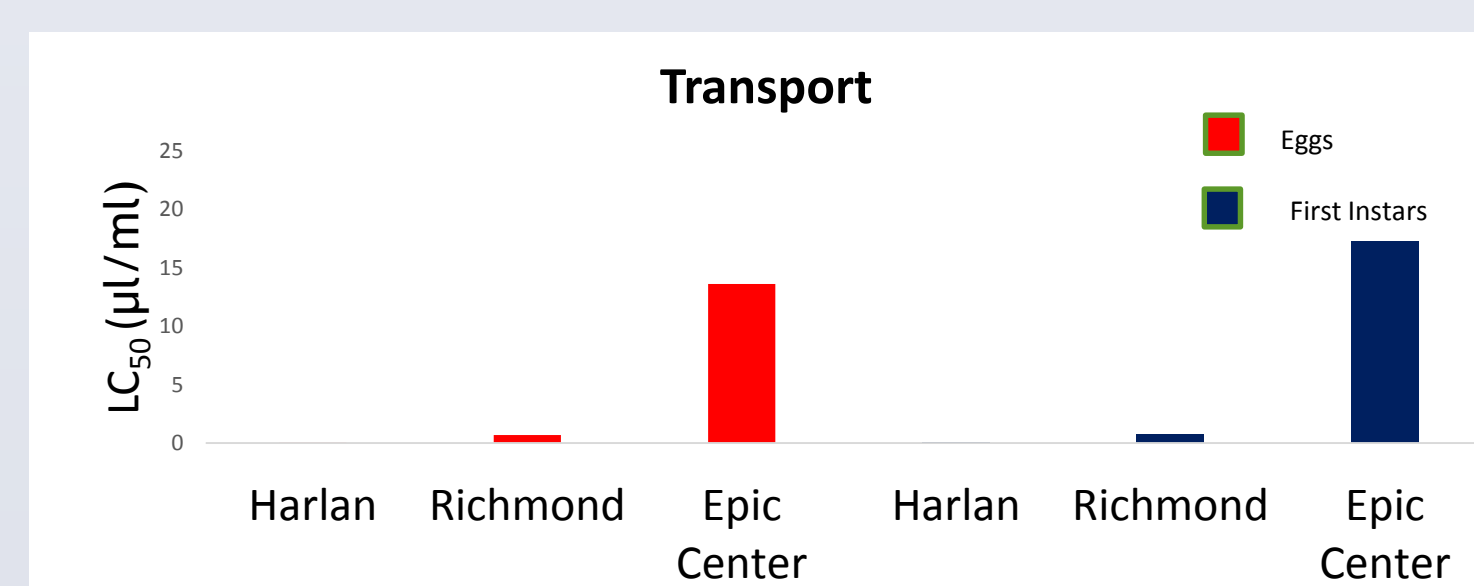
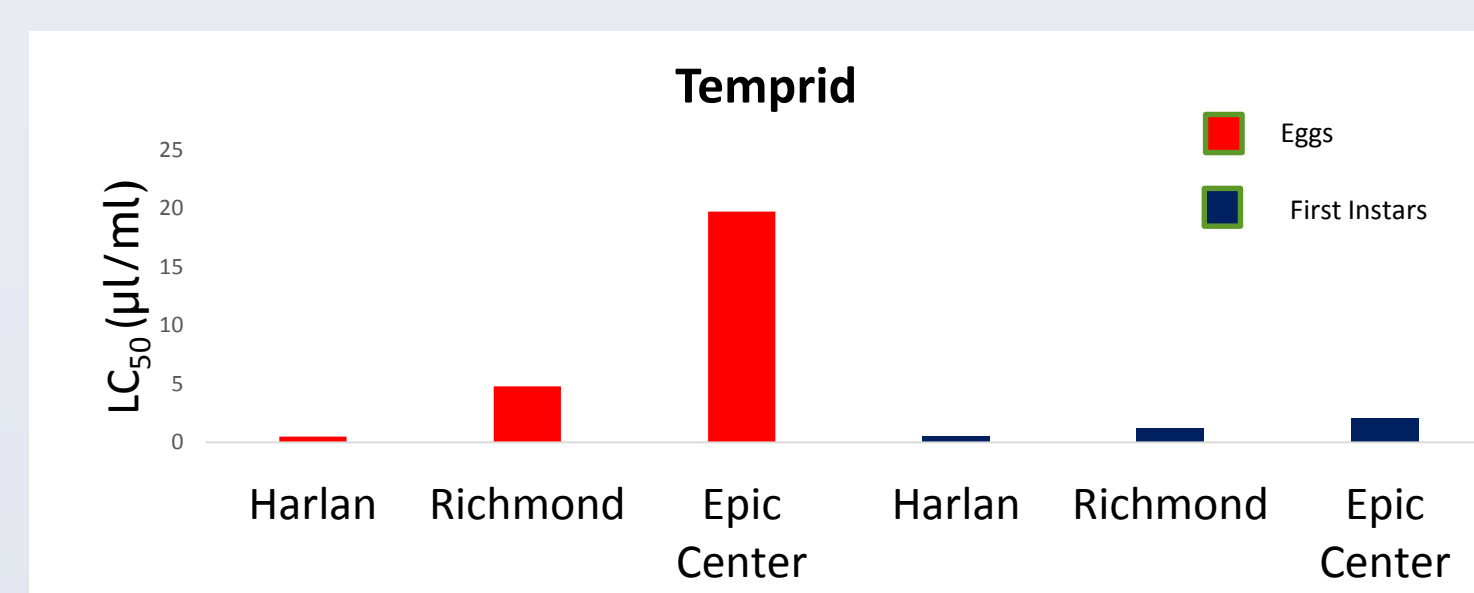
Brittany Campbell®



First instars on
treated filter papers



Brittany Campbell
treating bed bug eggs



RESULTS and CONCLUSIONS

- Bed bug **eggs and first instars** are also **resistant to insecticides**.
- The **Epic Center strain was the most resistant** (it took the highest concentration (LC₅₀ on the graphs) to kill the eggs and first instars of this strain).
- The **Richmond strain eggs were more resistant** compared to the Harlan strain **to Temprid**.
- Interestingly, Epic Center first instars were not that resistant to Temprid compared to Transport.
- **This research has implications for the pest control industry because not only are bed bug adults hard to kill with insecticides, this research shows that other life stages are also really hard to kill and resistant to even combination products (pyrethroid + neonicotinoid).**

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