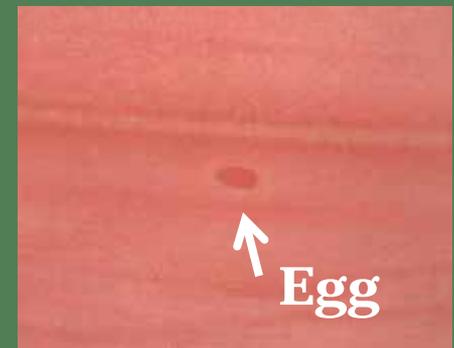


# Onion Thrips: Contributions of Egg Survival and Adult Dispersal to Populations on Plants



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2008 Rocky Mtn. Agribusiness Assoc. Convention



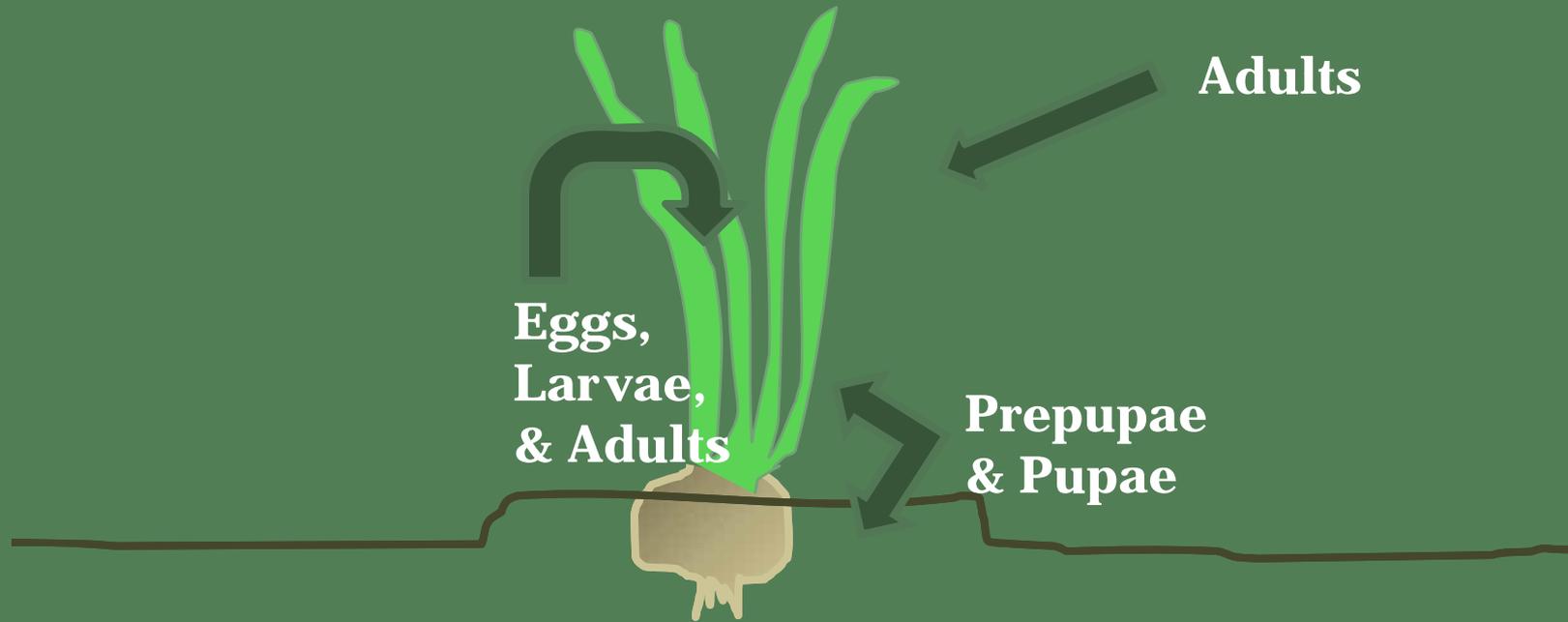
# Why are onion thrips such a pest?

- Life history and ecology are well-adapted to onions
  - Females reproduce asexually (parthenogenesis)
  - Short generation time (2-3 wk)
  - High mobility of adults
  - Rapid development of resistance to insecticides
  - Life stage survival strategies
    - Later larval instars are non-feeding & protected (“prepupae” & “pupae”)
    - Eggs are protected – females insert them into leaf tissue



**Thrips life stages**

# Sources of onion thrips



# Thrips sampling tools

## 1. Whole plant wash

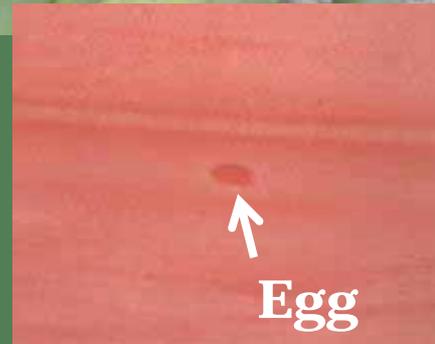


Larva



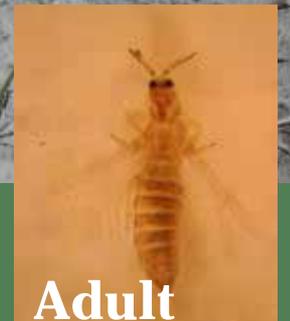
Adult

## 2. Stain 3<sup>rd</sup> leaf



Egg

## 3. Aerial sticky traps



Adult

# **1. Quick knock-down (short-term suppression)**

## **Insecticide efficacy on motile life stages: adults and larvae**

Examples from 2006 & 07 insecticide trials  
USU Experiment Station, Kaysville, UT

# Thrips sampling tools

## 1. Whole plant wash



**Larva**



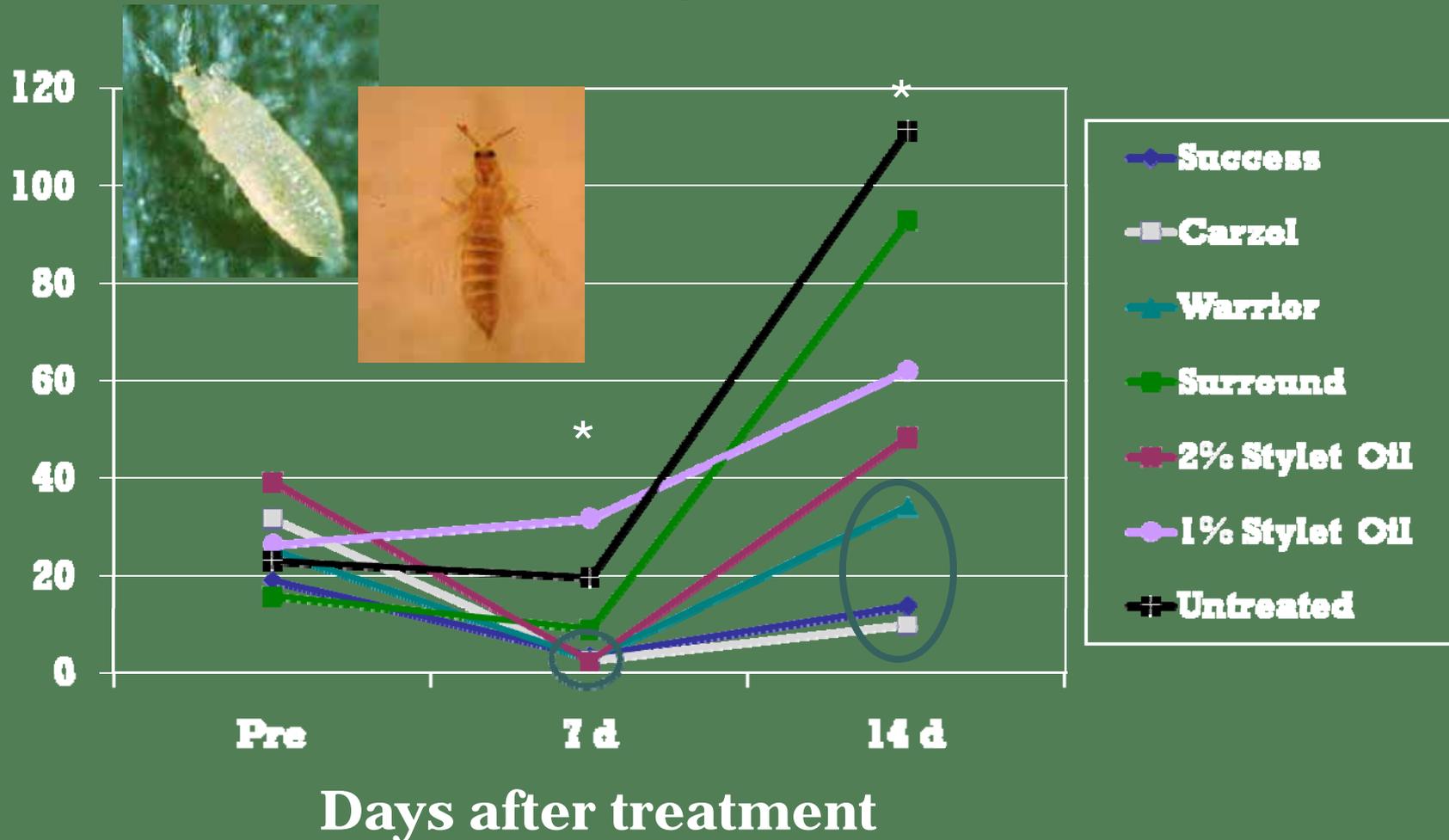
**Adult**

# Insecticide efficacy

## Motile thrips (Adults and Larvae)

### July, 2006

Mean # of thrips per plant

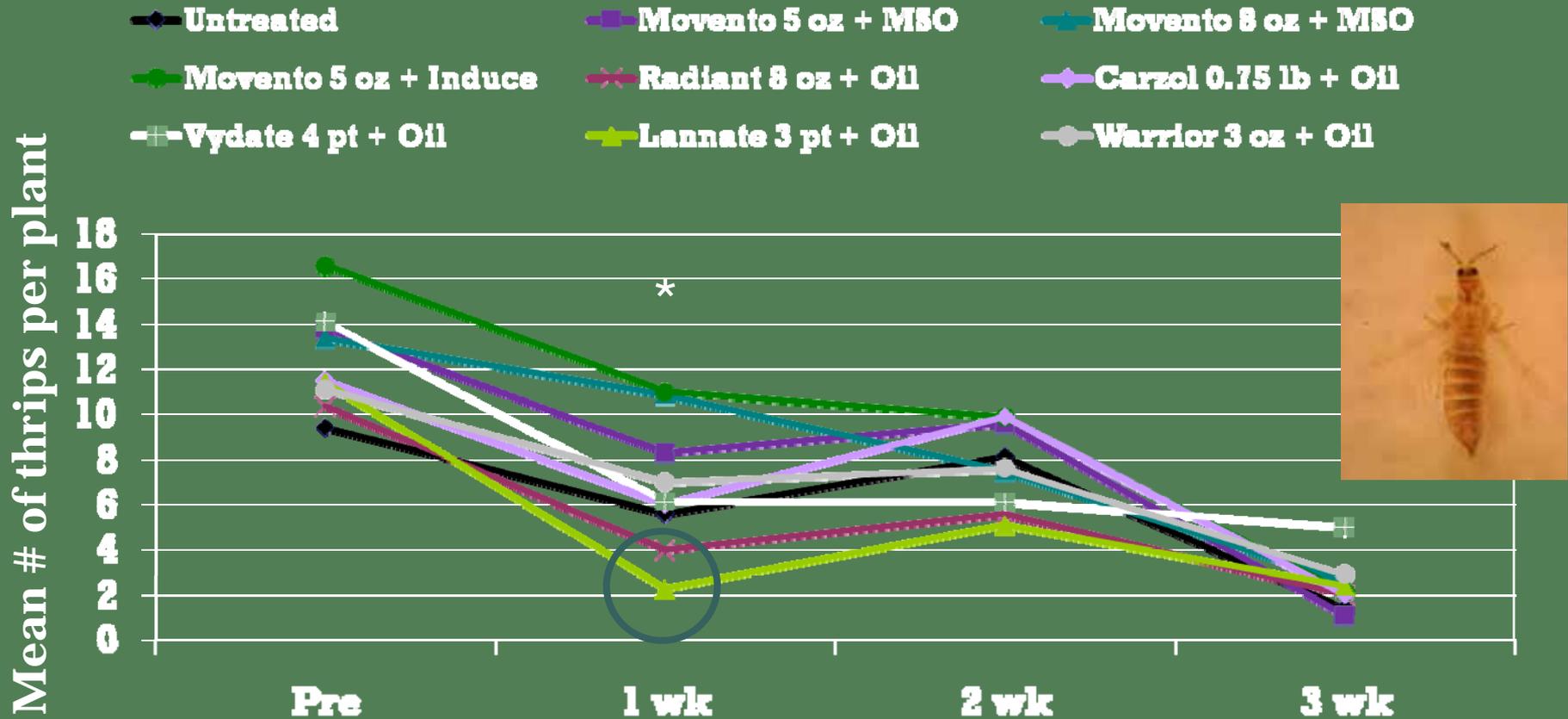


1% Stylet oil added to Success, Carzol, and Warrior treatments

# Insecticide efficacy

## Adult Onion Thrips (*Thrips tabaci*)

### July, 2007

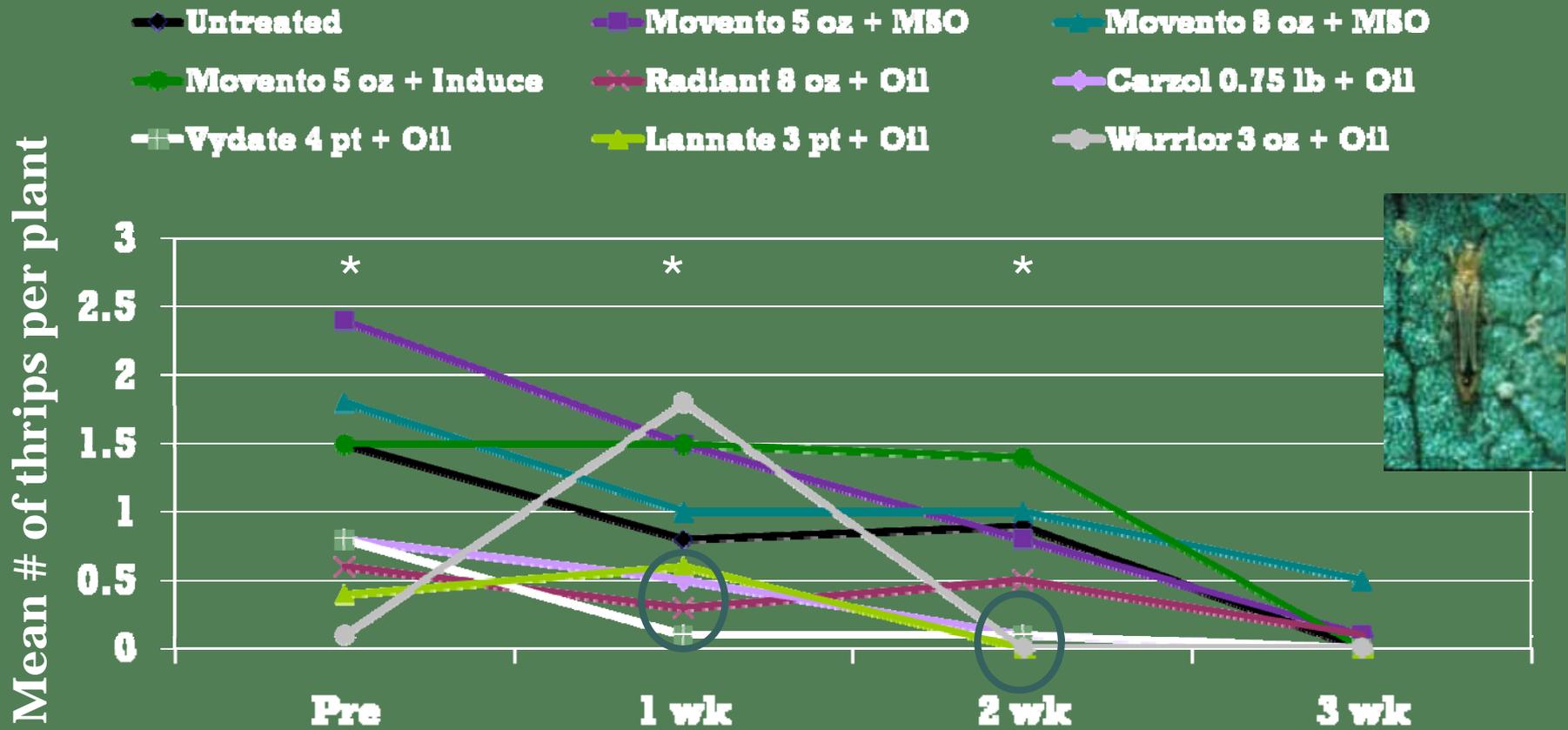


In an August trial, NS differences among treatments

# Insecticide efficacy

## Adult Western Flower Thrips (*Frankliniella occidentalis*)

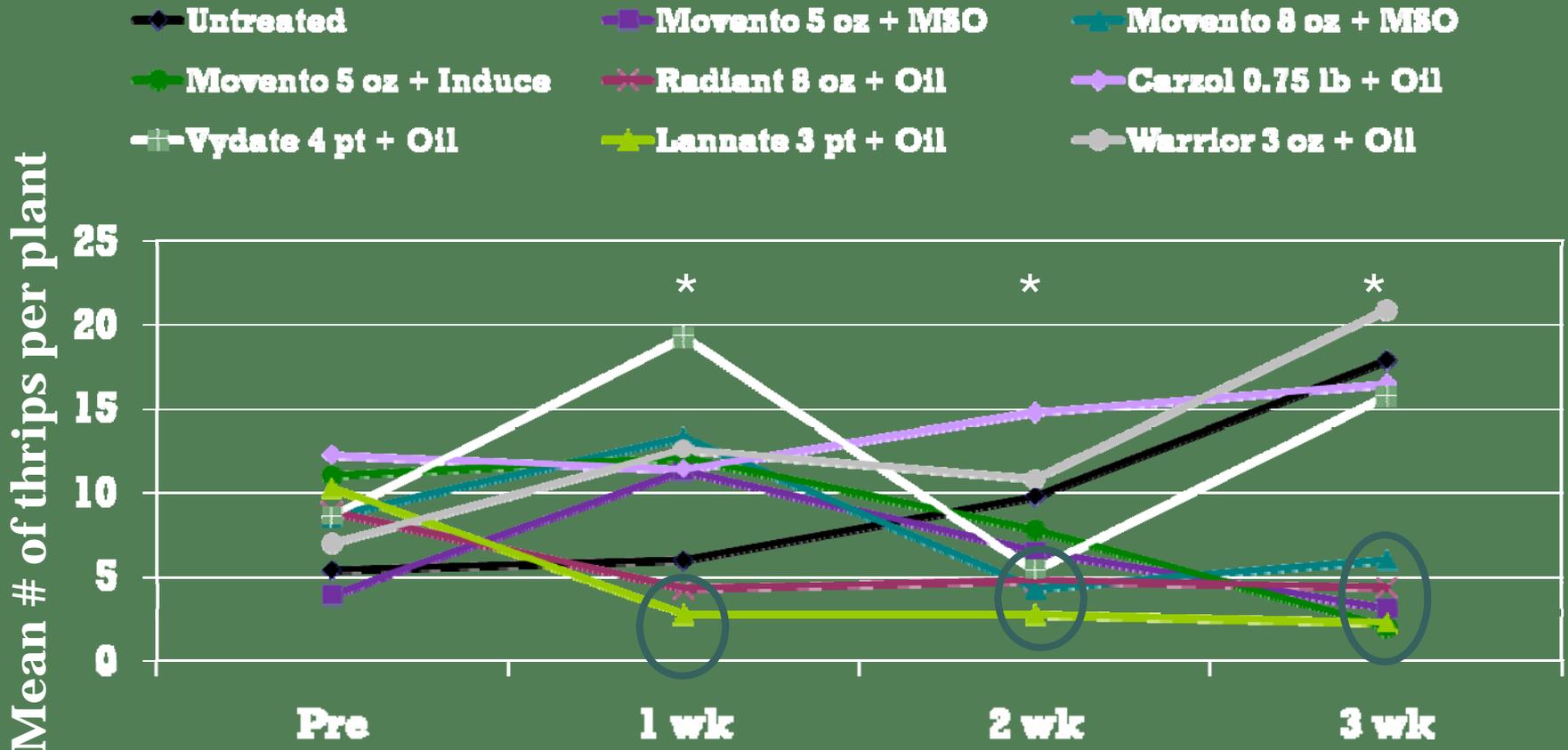
### July, 2007



# Insecticide efficacy

## Thrips Larvae

### July, 2007



Similar results in an August trial

# Summary of insecticide efficacy on adult thrips

- In 2006:
  - Success, Carzol, and Warrior effectively suppressed adults & larvae for 14 days
  - Surround & 2% Stylet oil slowed thrips for 7 days
- In 2007:
  - Adult OTs were minimally affected
  - Adult WFTs densities were 10-100X less than OTs & a number of insecticides suppressed WFTs for 14 days
    - Vydate, Carzol, Lannate, Radiant, Warrior
- Adults may escape whole plant wash method

# Summary of insecticide efficacy on larvae

## ○ In 2007:

- Lannate & Radiant most consistently suppressed larvae (2 trials)
- Movento showed delayed effects of 2-3 wks
  - Systemic - delay in uptake & translocation within plant
- Vydate, Carzol, & Warrior performed better in an August trial (data not shown), but not as well as Lannate, Radiant, and Movento

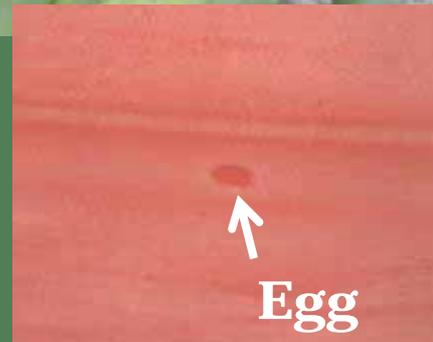
## ○ Insecticide resistance (Warrior, Carzol) after 2-3 yrs of use?

**2. Reduce re-infestation  
(longer-term suppression)  
Insecticide efficacy on thrips  
egg densities & egg hatch**

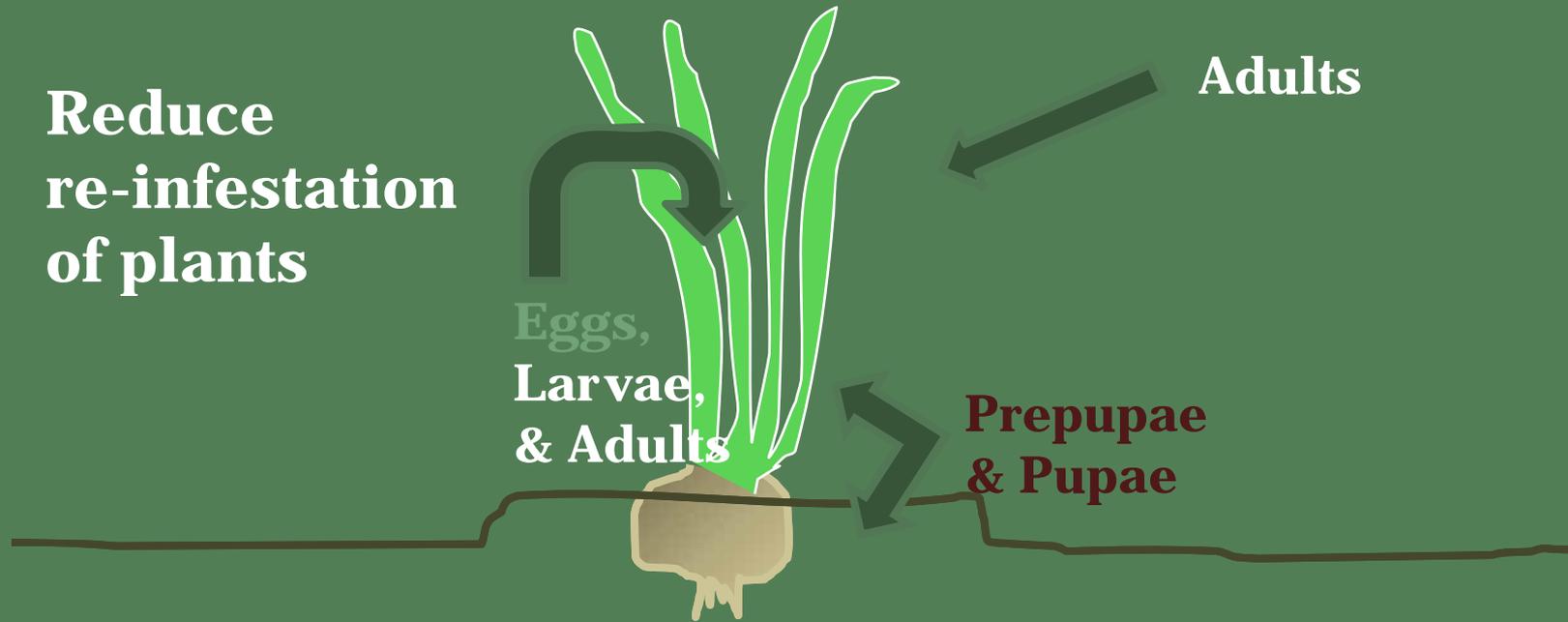
Examples from 2006 & 07 insecticide trials  
USU Experiment Station, Kaysville, UT

# Thrips sampling tools

## 2. Stain 3<sup>rd</sup> leaf



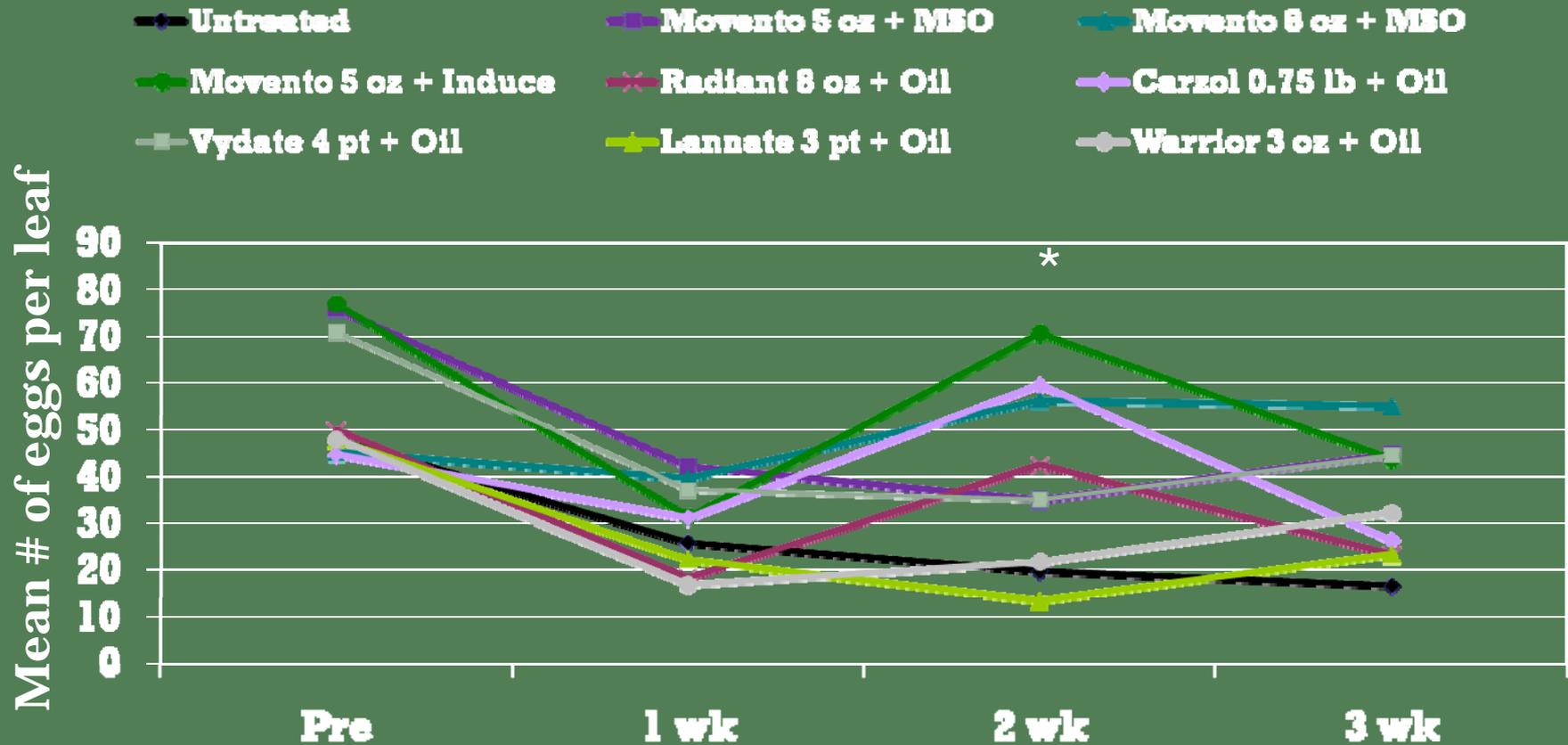
# Effect of immobile life stages on plant thrips populations



# Insecticide efficacy

## Thrips Eggs (Stained within leaves)

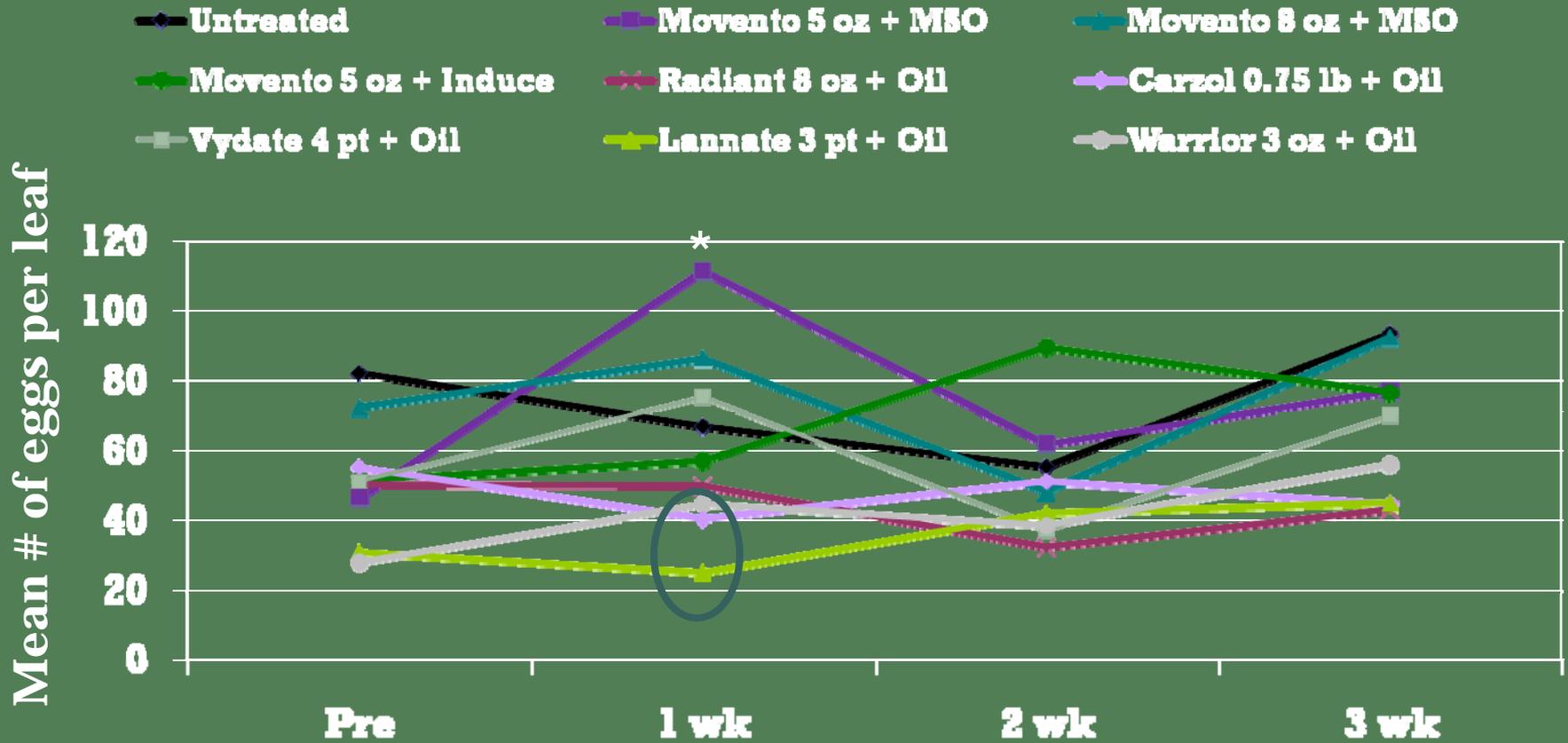
### July, 2007



# Insecticide efficacy

## Thrips Eggs (Stained within leaves)

### August, 2007



## Composition of thrips populations on plants (2005-07)

<b>Life stage on plant</b>	<b>% composition of total population</b>
<b>Eggs in leaves</b>	<b>60-75%</b>
<b>Larvae in neck</b>	<b>15-30%</b>
<b>Adults in neck</b>	<b>1-3%*</b>

**\*Adults are likely under-represented in whole plant wash samples**

# Egg hatch from leaves

## ○ Egg hatching chamber

- Heavy-duty gallon-sized ziplock plastic bags
- Collect onion leaves (3<sup>rd</sup> leaf) from field plants 1, 2, & 3 wk after insecticide treatment (8 leaves per treatment)
- Wash leaves & place in hatching chamber with moist filter paper
- Placed at 25°C for 2 wk
- Wash to collect thrips from leaf & inside of bag at 1 & 2 wk

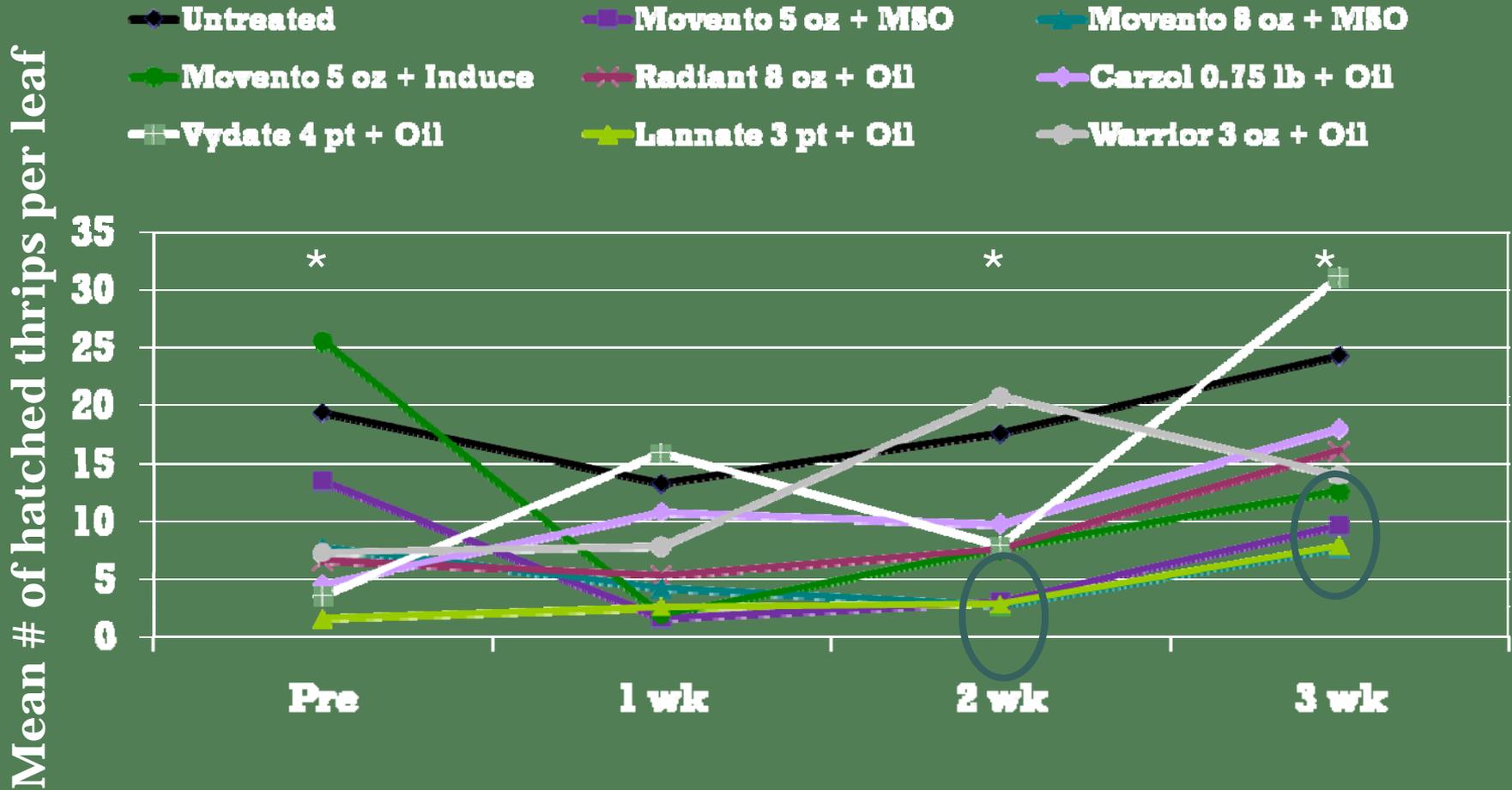


**High-tech thrips hatching chamber**

# Insecticide efficacy

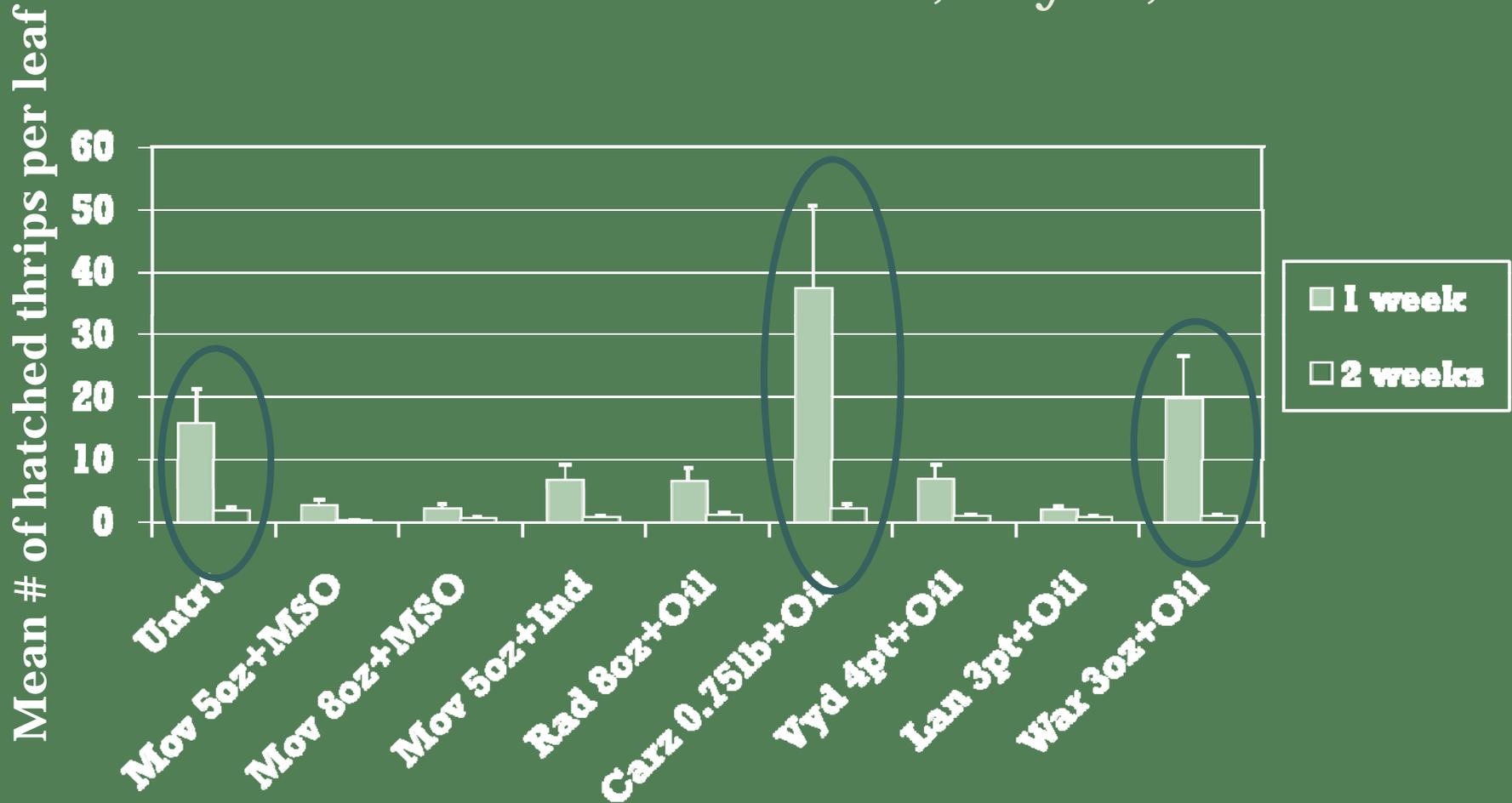
## Thrips egg hatch (over 2 wk)

### July, 2007



Results from an August trial were similar

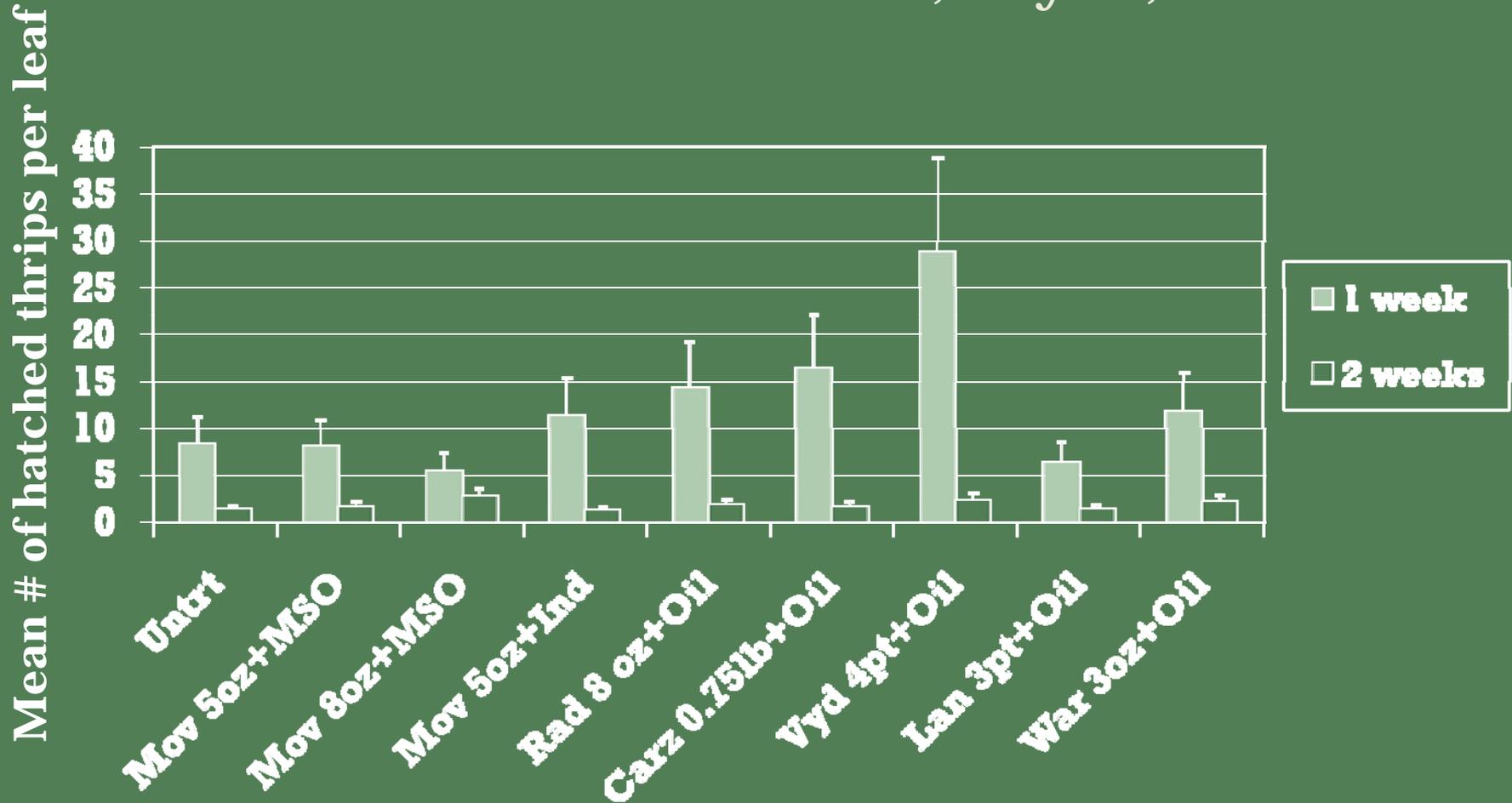
# Influence of insecticides on rate of thrips egg hatch – 2 weeks after treatment, July 10, 2007



Week 1 > Week 2:  $p < 0.001$

Trt x Week interaction:  $p = 0.007$

# Influence of insecticides on rate of thrips egg hatch – 3 weeks after treatment, July 17, 2007



Week 1 > Week 2:  $p < 0.001$

# Summary of insecticide efficacy on egg densities in leaves

- ⦿ Eggs are the major contributor to populations on plants (60-75%)
  - Eggs abundant in leaves (13-112 per 3<sup>rd</sup> leaf)
  - Previous study: total eggs per plant  $\approx 3 \times$  3<sup>rd</sup> leaf
- ⦿ Insecticides had little effect on numbers of eggs within leaves
  - Similar to minimal effects on adult OTs

# Summary of insecticide efficacy on egg hatch

- ◎ Some insecticides suppressed egg hatch up to 3 wk (4-5 wk):
  - Lannate & Movento (+ MSO) – greatest reductions; kept hatch < 14 thrips per leaf
  - 1-54 eggs hatched per leaf across 2 trials
- ◎ Most eggs hatched within 1 week
- ◎ Future studies: Larger sample sizes needed (8 leaves)

**3. Reduce re-infestation by adult  
immigrants  
(longer-term suppression)**

**Influence of immigration on  
thrips populations on plants**

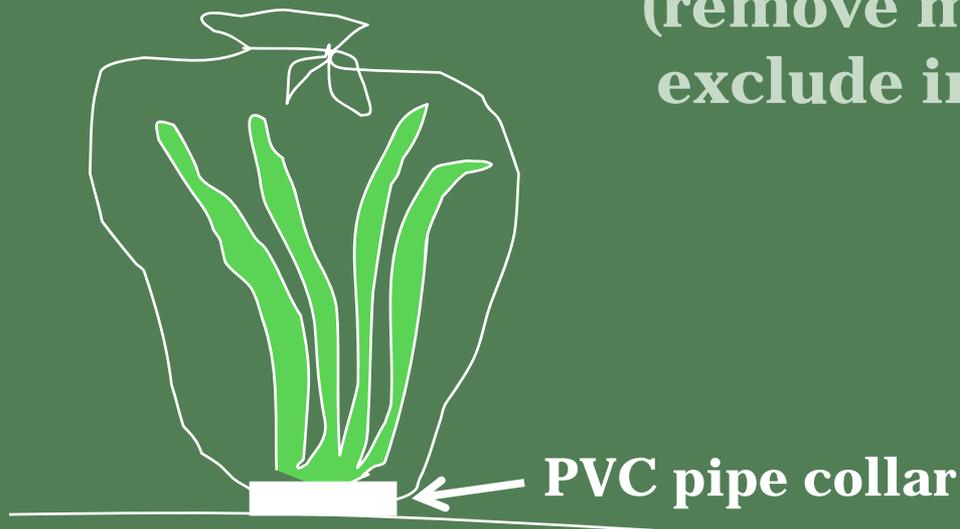
Examples from 2006 & 07 insecticide trials  
USU Experiment Station, Kaysville, UT

# Thrips survival on plants vs. immigration



Immediately after  
insecticides were applied:

- **Open** plants (allow immigration & natural enemies)
- **Spray with soap and Caged** plants (remove motile stages & exclude immigrants & NEs)



# Importance of egg survival

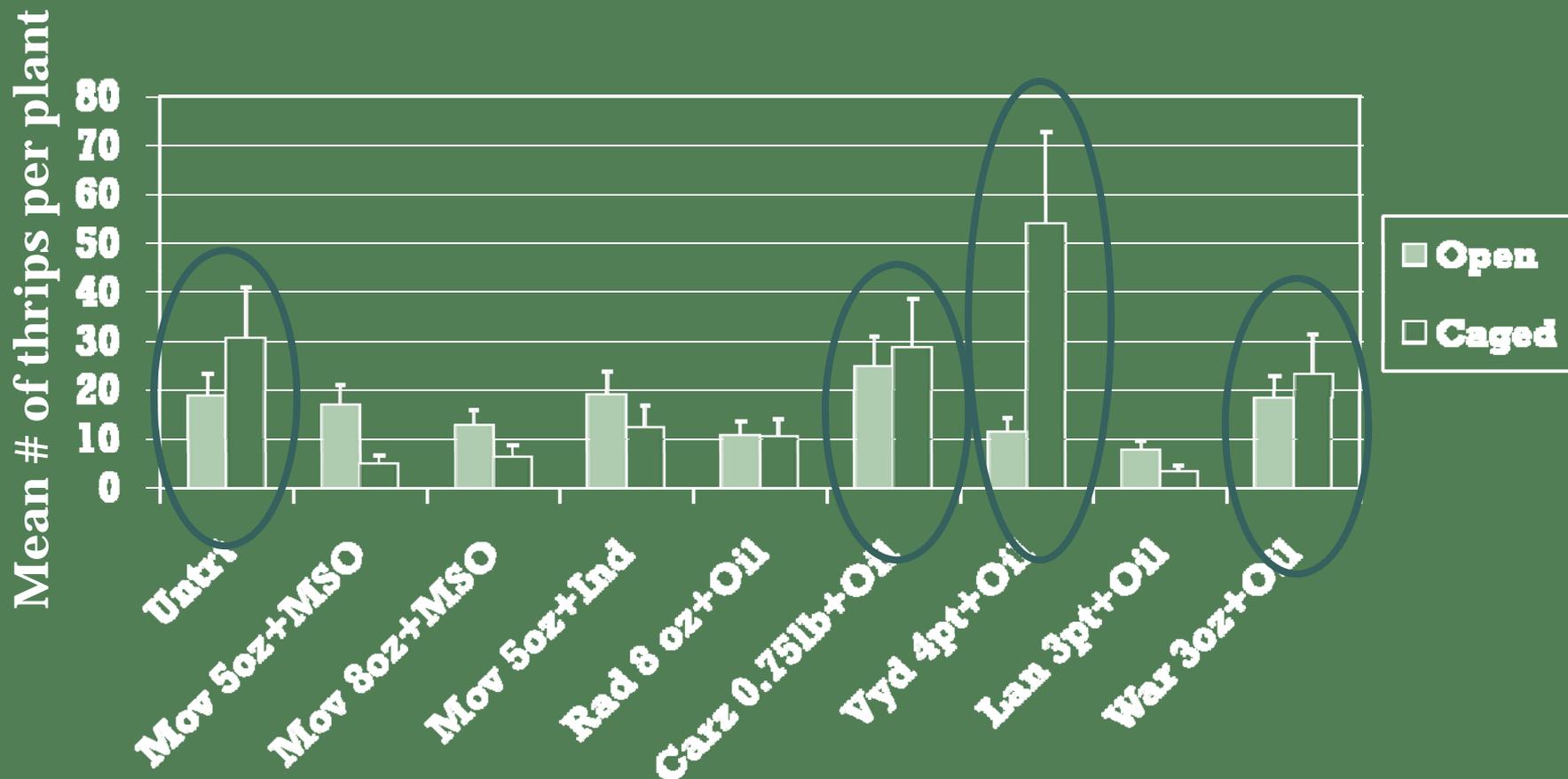
Influence of exclusion (caging) on onion thrips populations on plants 2 wk after insecticides  
populations on plants 2 wk after insecticides  
2006



Egg survival  
was more  
important  
than new  
immigrants

# Influence of exclusion (caging) on onion thrips densities (adults and larvae) on plants 2 wks after treatment

July 10, 2007

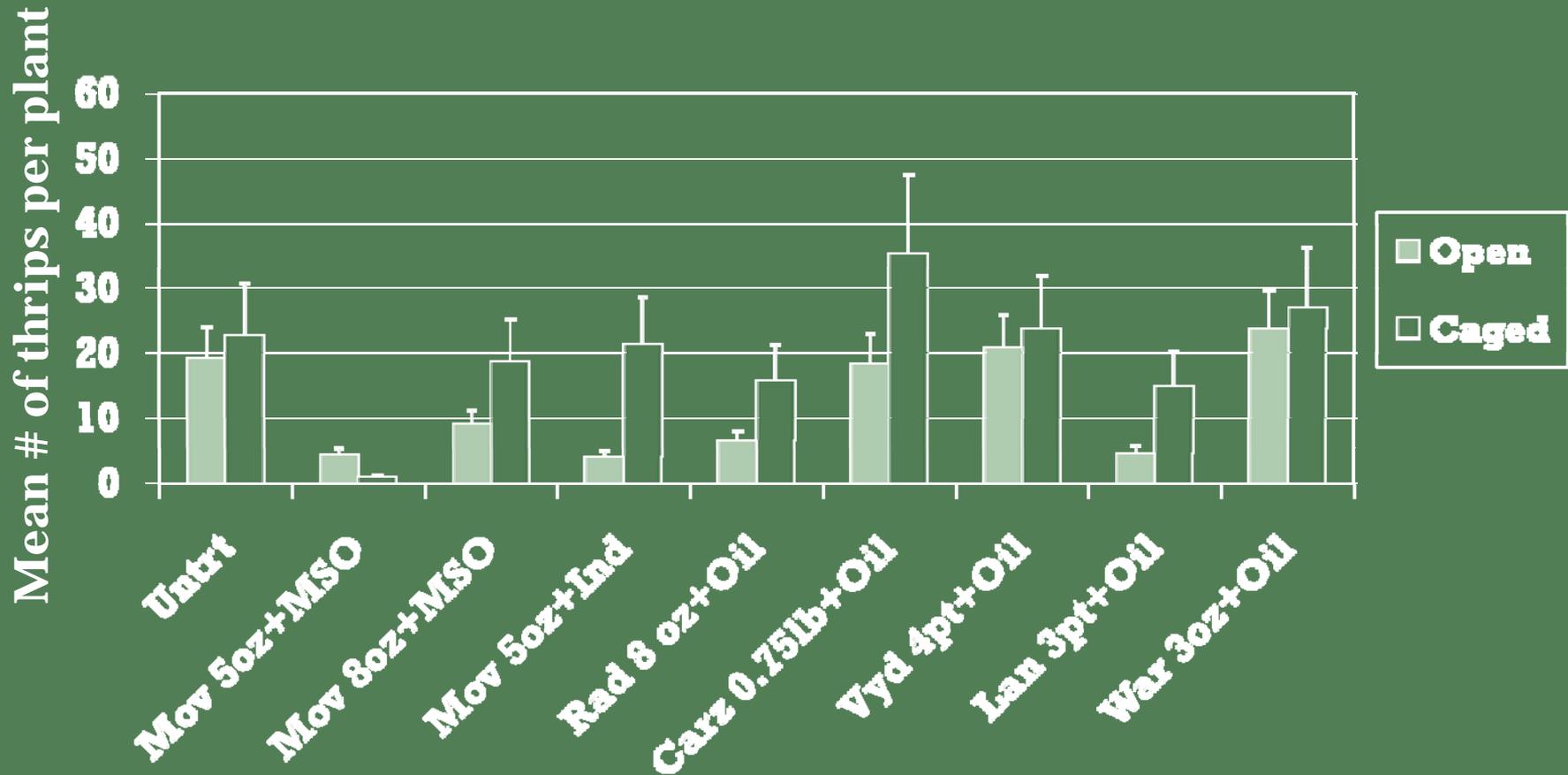


Open is not different from Caged:  $p = 0.86$

Presence of cage X insecticide interaction:  $p = 0.007$

# Influence of exclusion (caging) on onion thrips densities (adults and larvae) on plants 3 wks after treatment

July 17, 2007



Caged > Open:  $p = 0.05$

# Thrips sampling tools

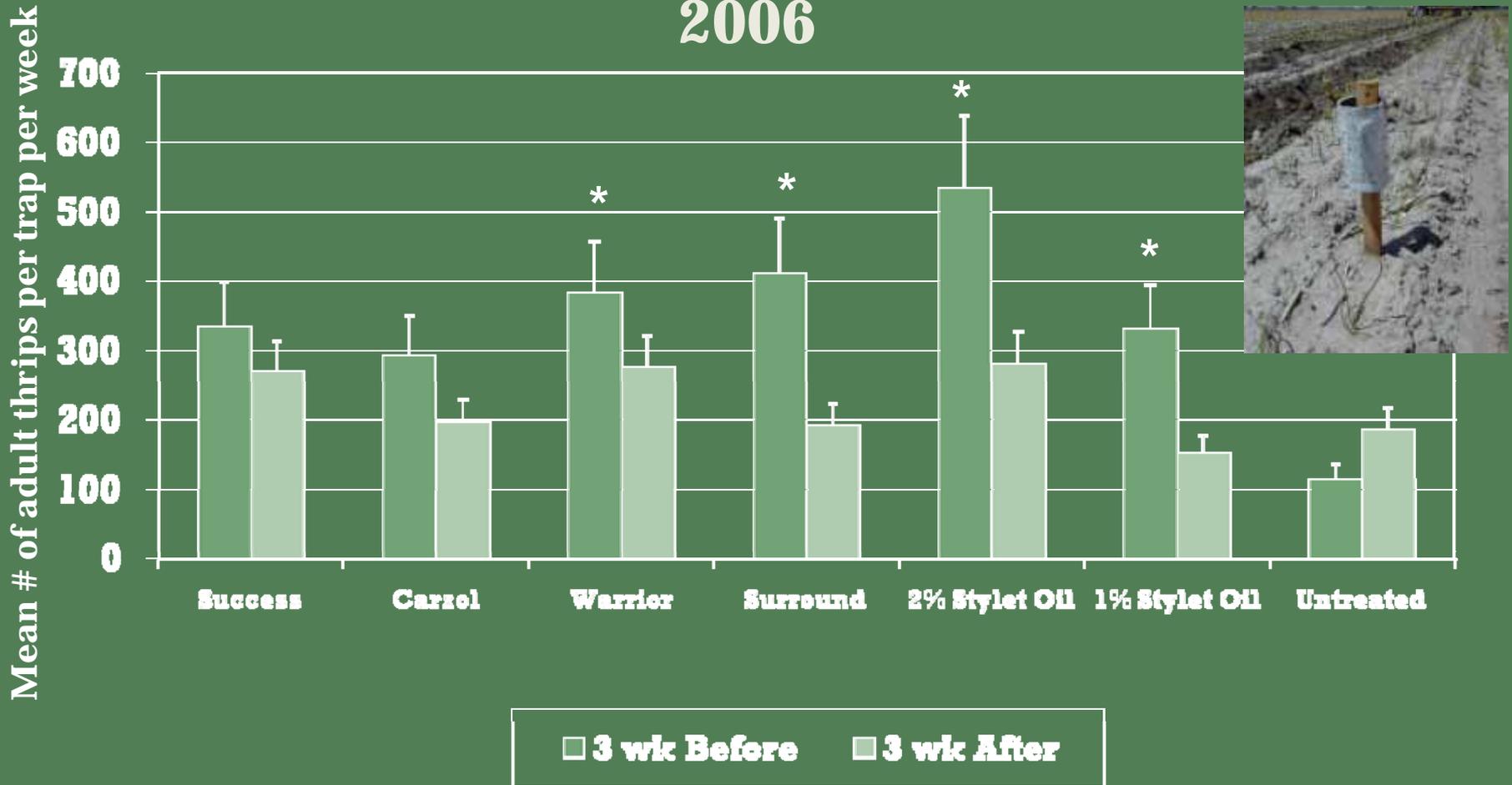
## 3. Aerial sticky traps



**Adult**

# Abundance of Immigrating Adults

Influence of insecticides on thrips adult dispersal: before compared to after insecticides  
2006



1% Stylet oil added to Success, Carzol, and Warrior treatments

## Summary of insecticide effects on adult immigration and egg survival on plants

- ◎ In general, more thrips occurred on caged than open plants 2-3 wk after treatment
  - Egg reservoir in leaves is important to re-infestation of plant
  - Exceptions: Lannate, Movento, & Radiant – longer-term suppression of thrips on plants
- ◎ Flying thrips adults: highly abundant
  - ~ 150-300 adults per trap per week after insecticide applications

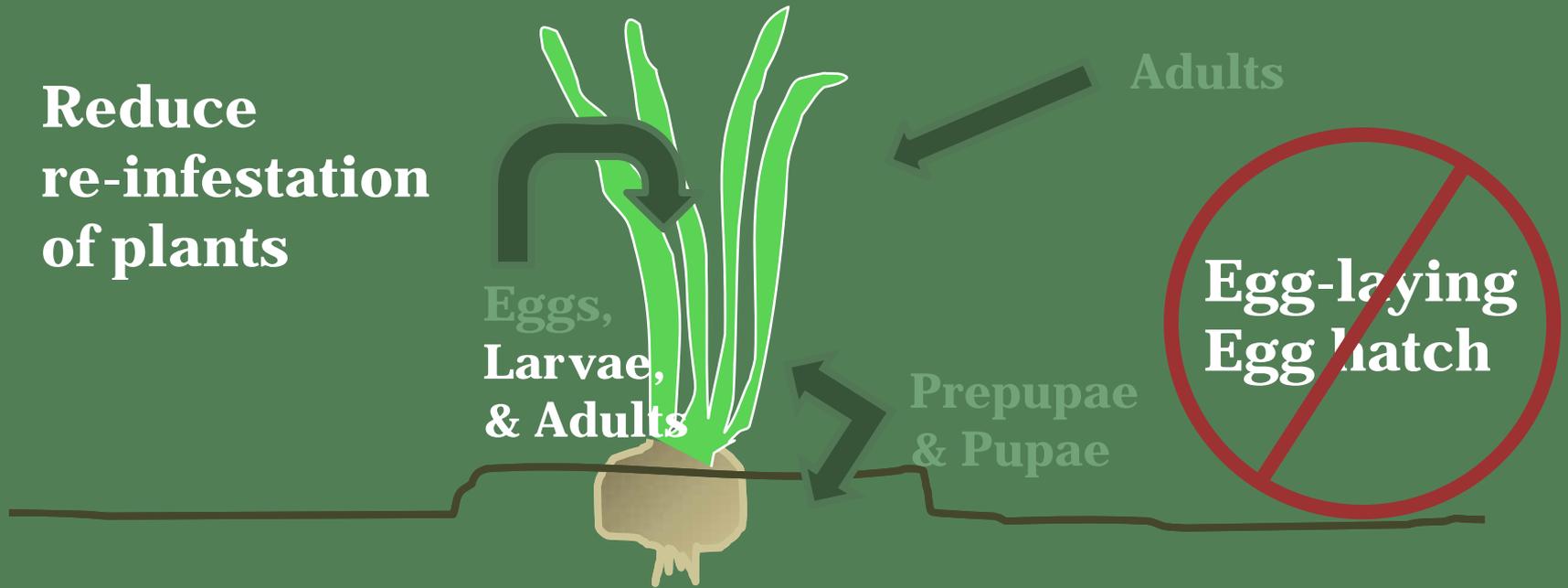
# Summary of insecticide effects on adult immigration and survival on plants

- ◎ Egg survival and immigrating adults following insecticide applications help perpetuate thrips population on onions
- ◎ Suppression strategies: include prevention of egg-laying and egg hatch
- ◎ Future studies:
  - Larger sample sizes (improve consistency)
  - Evaluate survival of non-feeding 3<sup>rd</sup> and 4<sup>th</sup> instar larvae (pre-pupae & pupae)

# Onion thrips life history

Reduce/repel  
dispersing adults

Reduce  
re-infestation  
of plants



Many ways to “skin a cat” -  
Multi-pronged approach will be the most sustainable

◎ Mortality factor (insecticide):

- Short-term → quick knock-down of adults & larvae
- Longer-term → egg reservoir in leaves (2 wk)
- Longer-term → immigration of adults
- Longer-term → survival of pre-pupae & pupae

**Multi-pronged approach will be the  
most sustainable**

**Sustained  
Mortality /  
Repellency**

**Cultural practices:**

- **Sprinkler irrigation**
- **Varietal tolerance**
- **Mulches**
- **Trap crops**
- **Nitrogen management**

**Insecticides:**

- **Manage use to prevent resistance**
- **Systemic activity**
- **Slow release (microencap)**
- **Ovicide, larvicide, adulticide**
- **Repellents**
- **Combinations**

# Thrips population suppression strategies

- Make onions as tolerant / unattractive to thrips as possible
- Start suppression early in the season
- Use long-term suppressive controls
  - Target egg reservoir in leaves
  - Target multiple life stages



**Morgan Reeder field on 2006 Utah Onion Tour, Corinne, UT**