



# Little Green Weevils:

Annual Bluegrass Weevil  
Control with Civitas Turf  
Defense™

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**Pennsylvania State University  
Intelligro Research Lunch, San Antonio, TX**

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# Today's Talk



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# The Annual Bluegrass Weevil (ABW)

*Listronotus maculicollis*

- Most severe golf course-turf insect pest in eastern N. America



# Insecticide Use

- Heavy reliance on synthetic insecticides (McGraw and Koppenhöfer 2017)
  - 4 insecticide apps/yr average
  - \$9,270/yr (\$500 - \$75K)



# Controlling Overwintering Adults



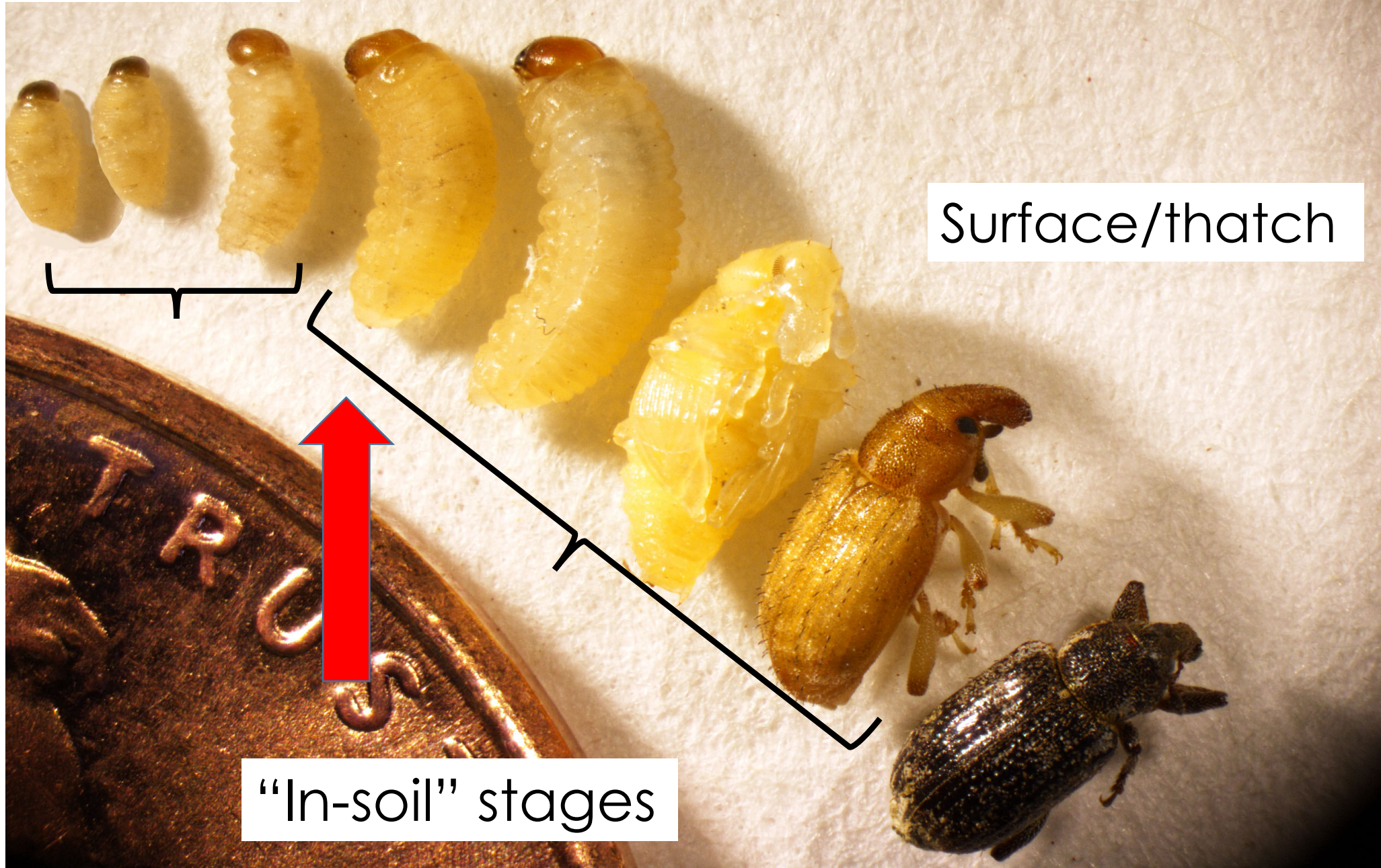
- Walking migration of overwintering adults occur over several weeks
- Adulticides applied when population peaks (all out of overwintering/pre-egg laying)



**If adults are left uncontrolled...**



In Plant stages





# ABW - Civitas Turf Defense™ Research

## 1. Early 2000s: Spray and Pray

- “Doesn’t work”



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## 2. 2015: Small plot field studies + Lab Studies

- “Wow – this is a game changer”

# ABW - Civitas Turf Defense™ Research



## 1. Early 2000s: Spray and Pray

- “Doesn’t work”

## 2. 2015: Small plot field studies + Lab Studies

- “Wow – this is a game changer”

## 3. 2016 – current: Understanding variability and field optimization

- “How can we make this work consistently”

# Controlled Field Trials - 2015

- Adults seeded (10 ♂ + 10 ♀) in 4' x 4' plots – enclosed
- 4 applications (1 wk prior to adults, then every 2 wks through 5<sup>th</sup> instar)

Treatment	Rate/M	ABW per ft <sup>2</sup>	% Control <sup>1</sup>
UTC		33.33	
<u>Civitas ONE</u>	17 fl. <u>oz</u>	21.67	35%
<u>Civitas ONE</u>	8.5 fl. <u>oz</u>	21.67	35%
<u>Talstar S</u>	0.5 fl <u>oz.</u>	0	100%
<u>Civitas ONE</u> + <u>Talstar</u>	8.5 fl. <u>oz</u> + 0.25 fl. oz.	11.67	65%

# Residual Activity ?



%

No adult mortality through contact w/  
dried residues or feeding

# What does 100 yrs of research on oils and soaps say ?



1. No residual activity
2. Only toxic when wet
3. May work synergistically with pyrethroids
4. No documented cases of resistance !

# Soaps and Oils – What We Don't Know

- **Mode of Action ?**

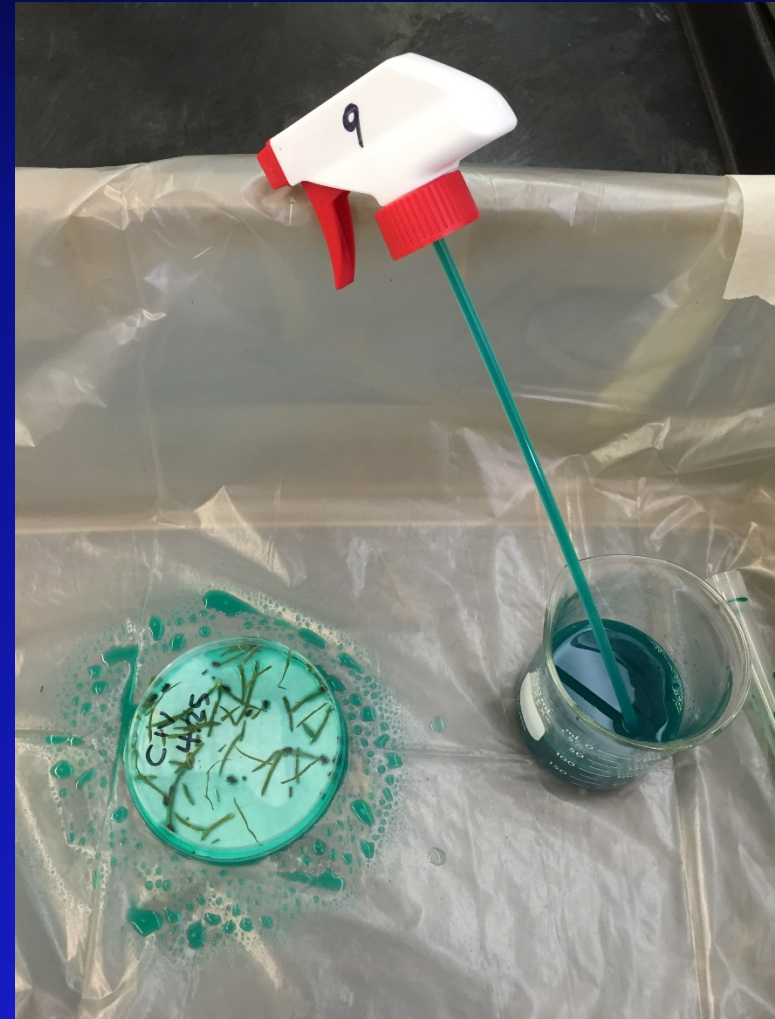
1. Cytolysis – disruption of cell membranes
2. Dehydration – dissolves wax layer of cuticle
3. Suffocation – clogging trachea  
(suspected w/ oils)



# Taking a Step Back: Lab Trials



Direct Sprays





# Direct Spray = Mortality



- High level of control (90%+) at 24 - 72 hours
- Contact activity



# Entomology 101: How is the product working ?

## Exoskeleton:



**Waxy outer layer, covered in scales**

# Entomology 101: Three Segments

Head

Thorax

Abdomen

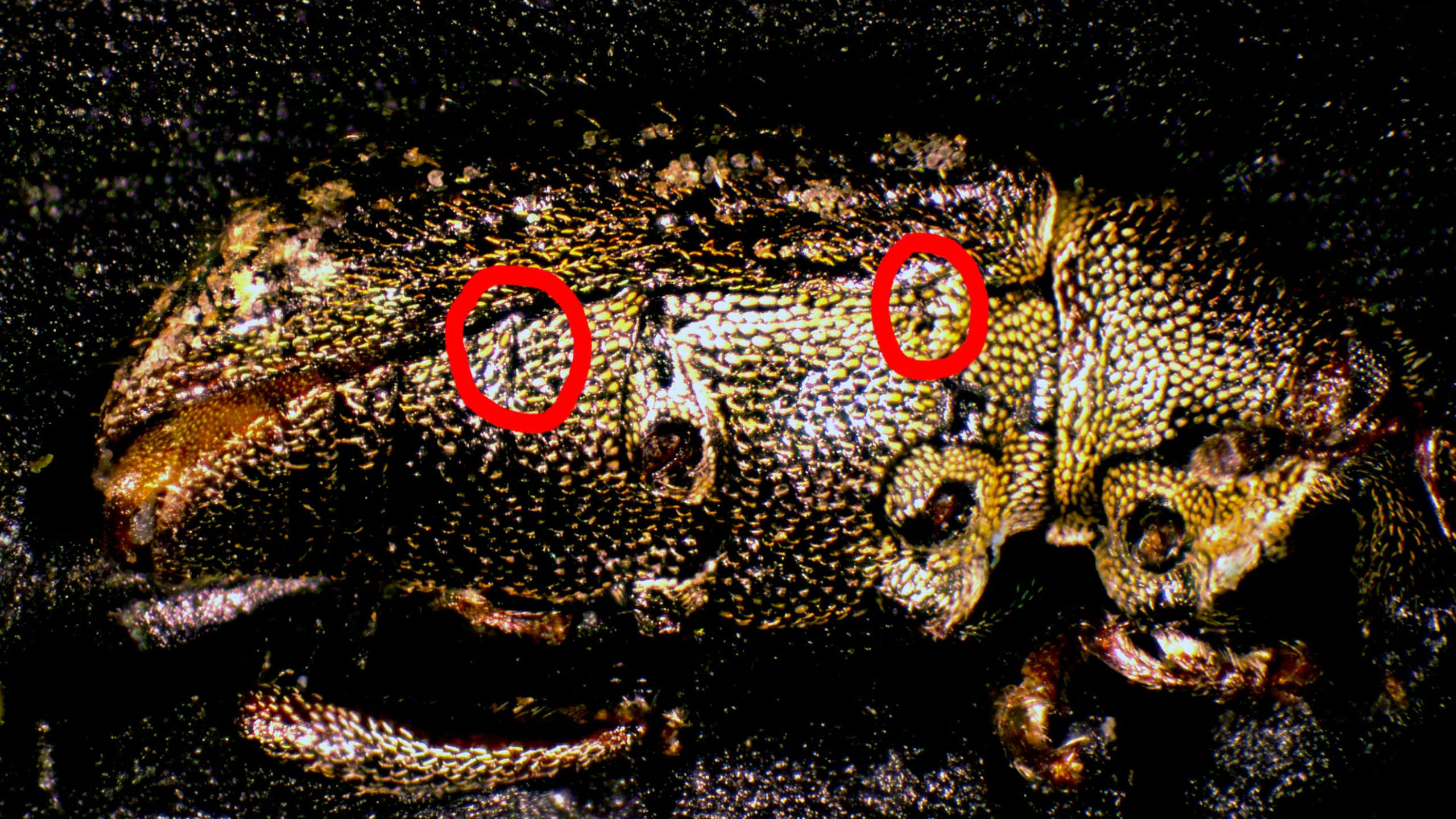


# Entomology 101: Breathing Spiracles



Openings on sides of abdomen +  
thorax

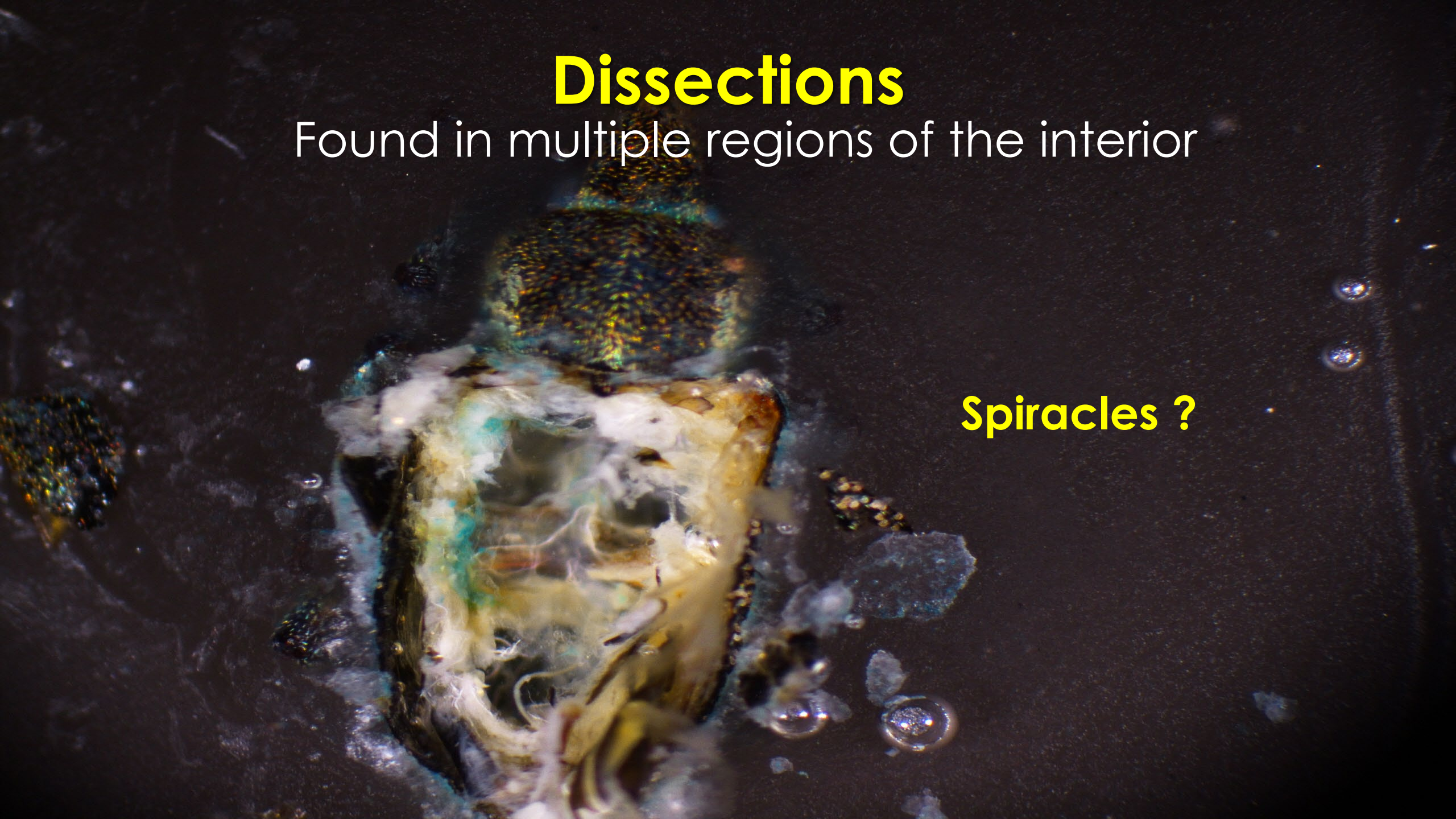


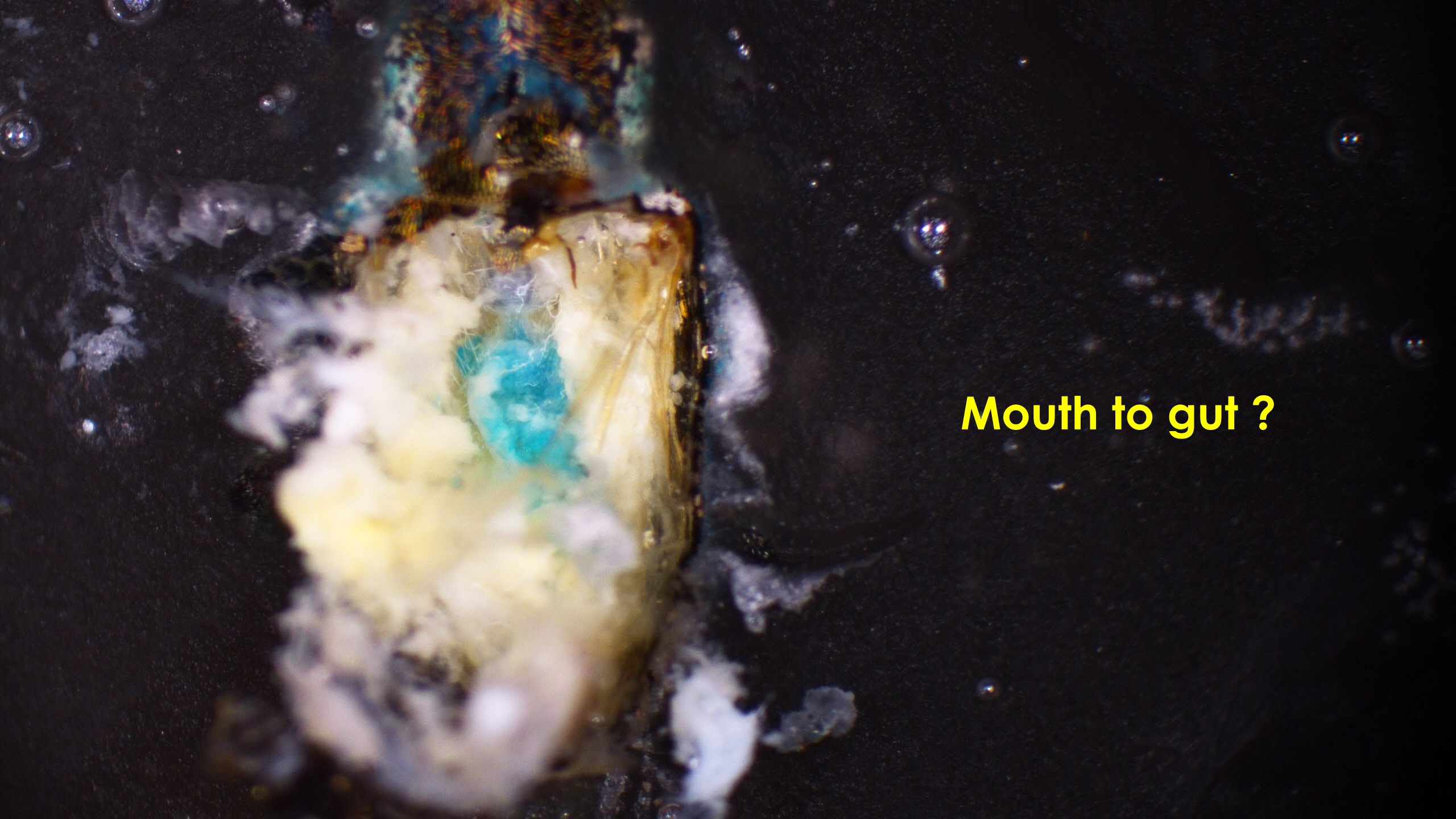


# Dissections

Found in multiple regions of the interior

Spiracles ?





**Mouth to gut ?**





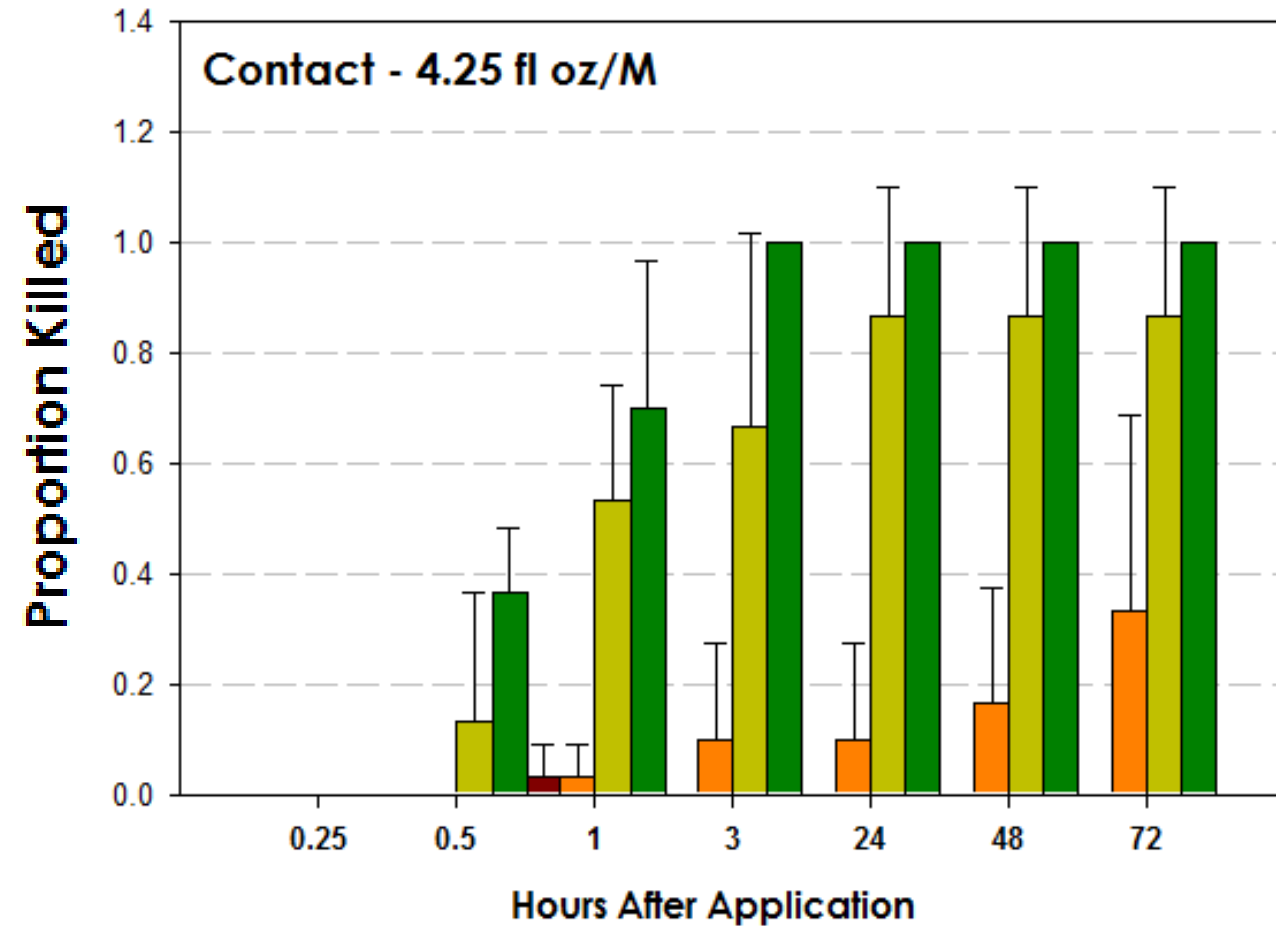
# 2016 Lab Trials

1. Contact vs Direct Hit
2. Effect of rate
  - 1.7 to 17 fl. oz./M
- 2. Effect of carrier volume**
  - 2, 4, 6, 8 gals/M
- 3. Speed-of-kill**



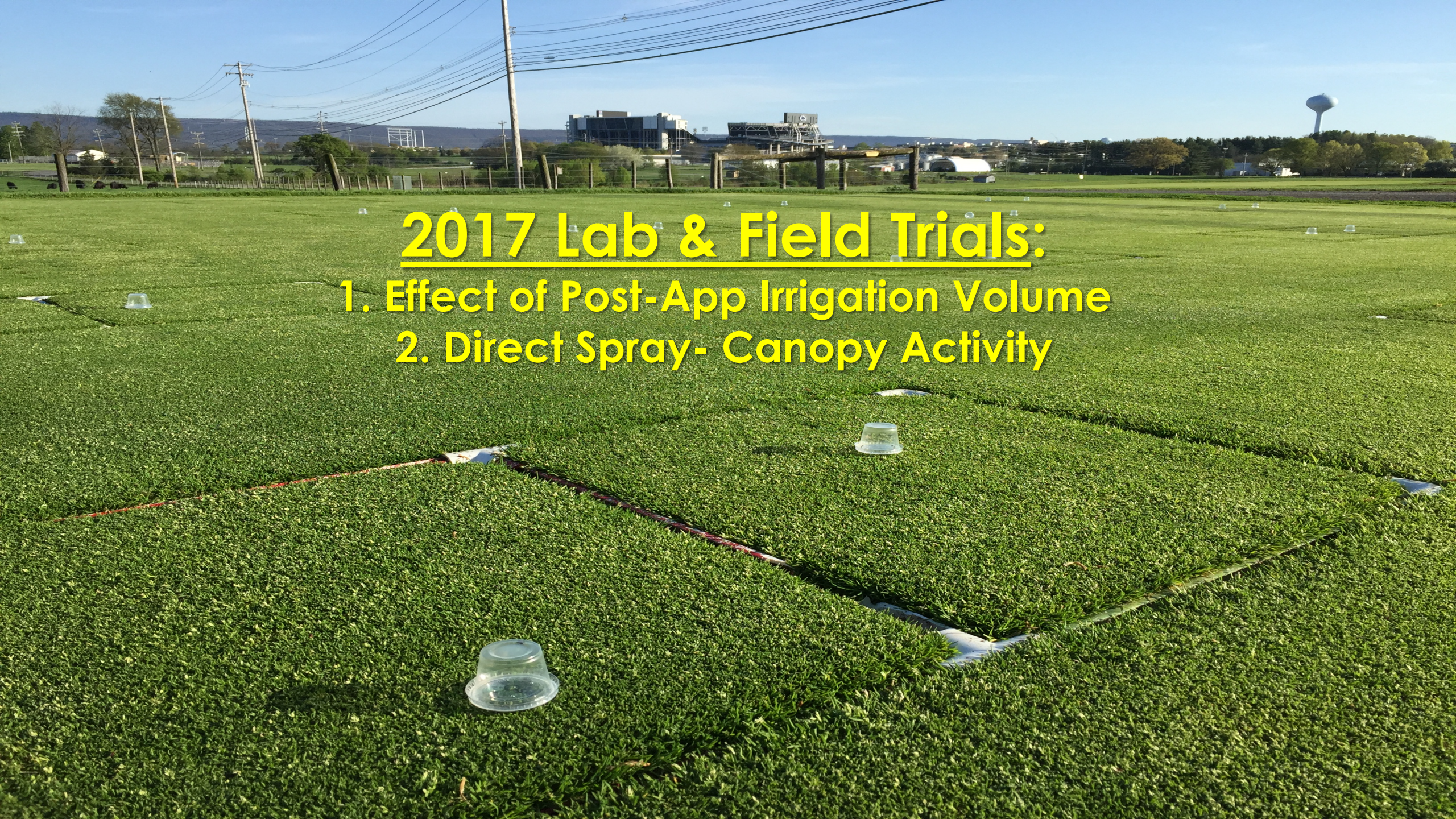
## Effect of Carrier Volume on Control

- LOW rates effective  
4.25 fl oz./ M
- High level of control (80 - 100%) w/in 3 hours at high water volumes
- Lower volumes (2-4 gal/M)
  - Need direct hit



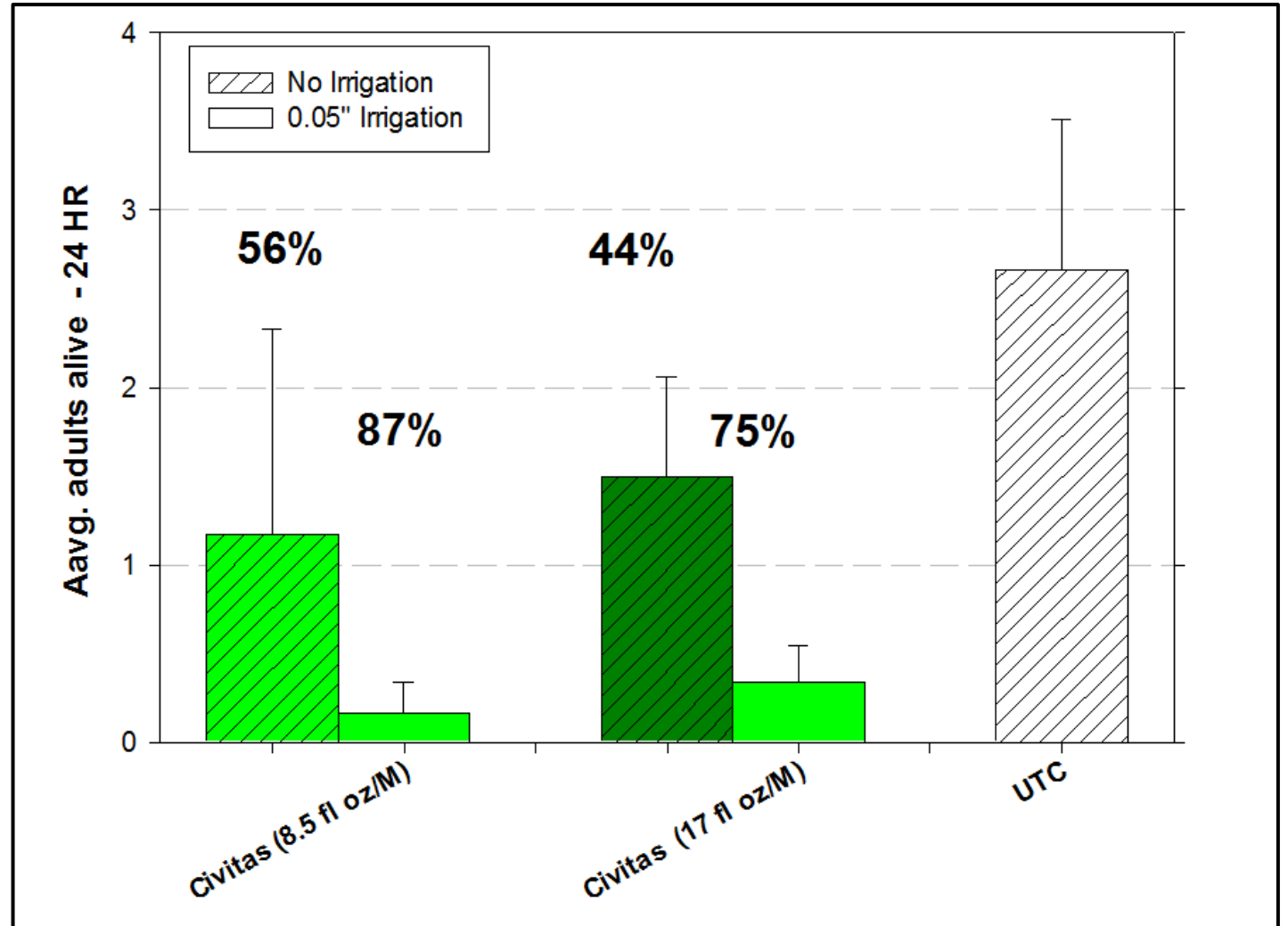
# 2017 Lab & Field Trials:

1. Effect of Post-App Irrigation Volume
2. Direct Spray- Canopy Activity



# Effect of Irrigation & Rate on Adult Mortality

- Saturated Soils
- 2 rates (17 & 8.5 fl. oz./M)
- 2 gal/M carrier volume
- w/ and w/o Post application irrigation



## 2. Direct Spray Assays:

When are adults most active on top of the canopy ?

- Behavioral studies and modelling predicts max activity between 14- 18° C (57-64° F) (McGraw and Czyzewski, in prep)

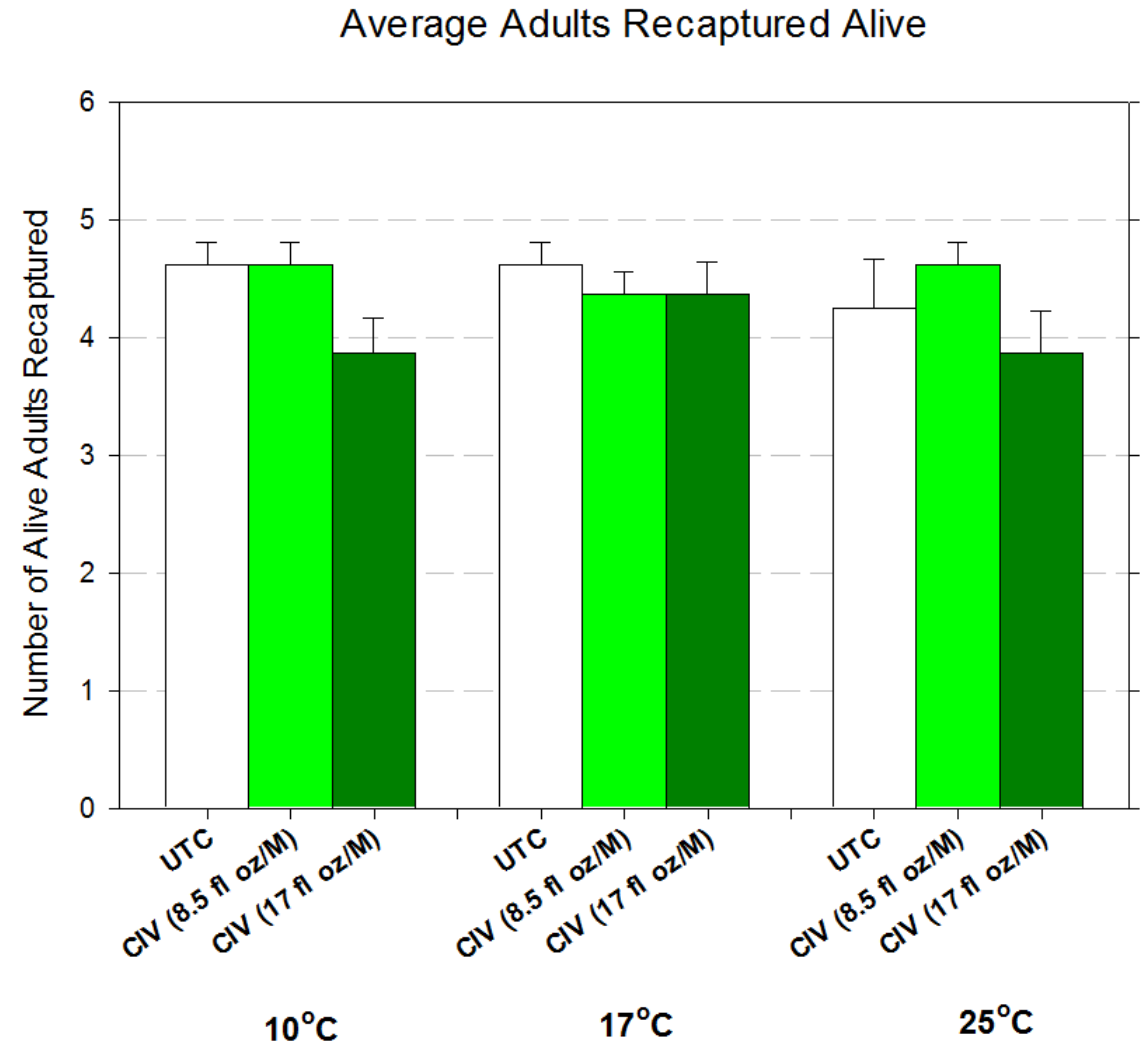
# Direct Spray Mortality at Different Temps

- Weevils held at 10, 17, and 25° C (50, 63, and 77° F) for 24 HR
- Removed > Photographed > Sprayed > Returned to incubator for 24 HR



# Direct Spray Mortality at Different Temps

- Weevils held at 10, 17, and 25° C (50, 63, and 77° F) for 24 HR
- Removed > Photographed > Sprayed > Returned to incubator for 24 HR
- Results = 0- 16% control
  - No difference in canopy activity





# Summary on Early Results with Civitas Turf Defense™

- Lots of work to do to optimize control !!  
(unfortunately science is trial & error!)
- Effect of rate, but larger effect of carrier volume
  - Soil saturation?
- Must come in contact w/ insect
  - Feeding treated foliage = no effect
  - No residual control = time it right !
  - *Moist environment = improved control*

# Why This Is Important

- Adulticide options
  - Few options (2-3)
  - Environmental profiles
- Resistance issues
  - Maybe be used synergistically in combination with insecticides
- Unlikely to develop resistance
  - Oils/soaps: 100+ yrs research w/ 0 cases



Off with their Heads !

# Questions ??

## Acknowledgements

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