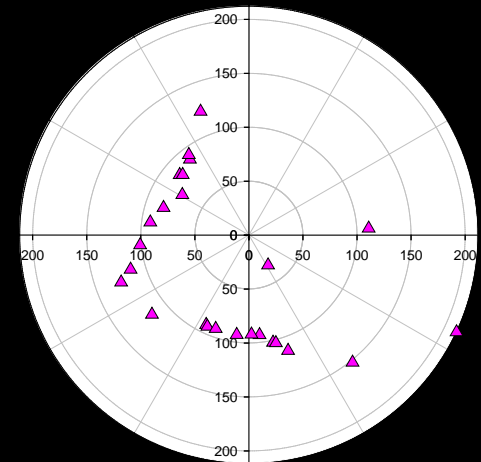
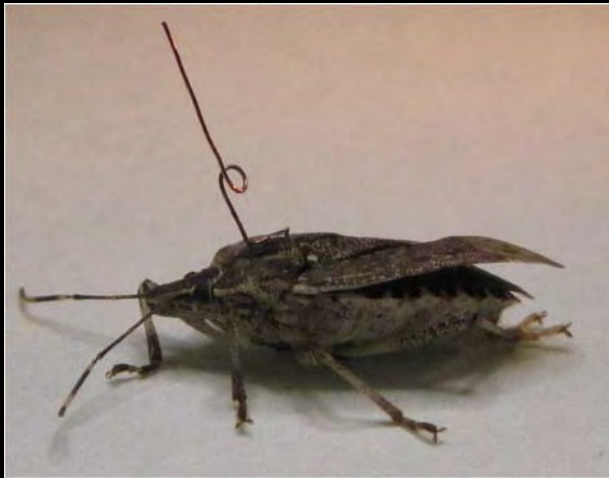
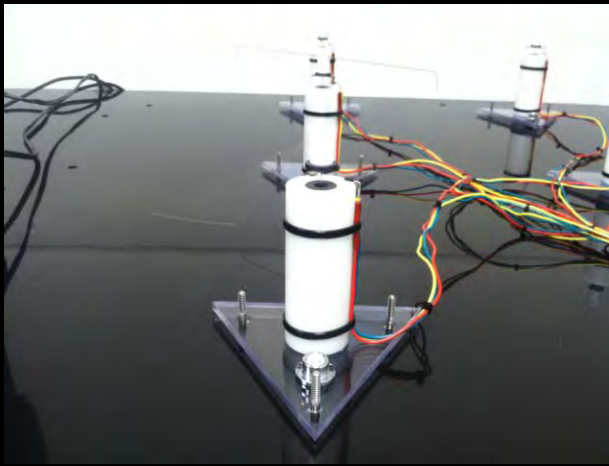


# Defining dispersal ecology and behavior of adult *Halyomorpha halys*

Doo-Hyung Lee, Cameron Scorza, Starker Wright, and Tracy Leskey

USDA-ARS, AFRS, Kearneysville, WV



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- Background: Why dispersal?
- Flight mill
- Harmonic radar
- Free-flight observation

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We found overwintering *H. haly* in **dead trees**.





## ***H. halys* positive trees**

- 1. Standing**
- 2. Large**
- 3. Oak / Locust**
- 4. Peeling bark**
- 5. Porous**
- 6. Dry**





**13%**

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- 1. Standing**
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Arden Nolville Rd

Image © 2011 GeoEye  
© 2011 Google  
Image USDA Farm Service Agency

Google earth

4864 ft

Imagery Date: 5/25/2010

39°27'34.75" N 78°03'01.36" W elev 718 ft

Eye alt 21831 ft

**13%** 



Arden Nolville Rd

Image © 2011 GeoEye  
© 2011 Google  
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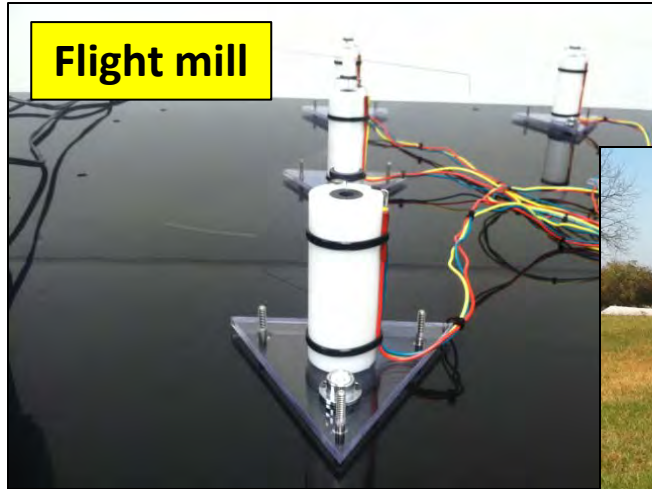
# Defining dispersal ecology and behavior of adult *Halyomorpha halys*

- Background: Why dispersal?

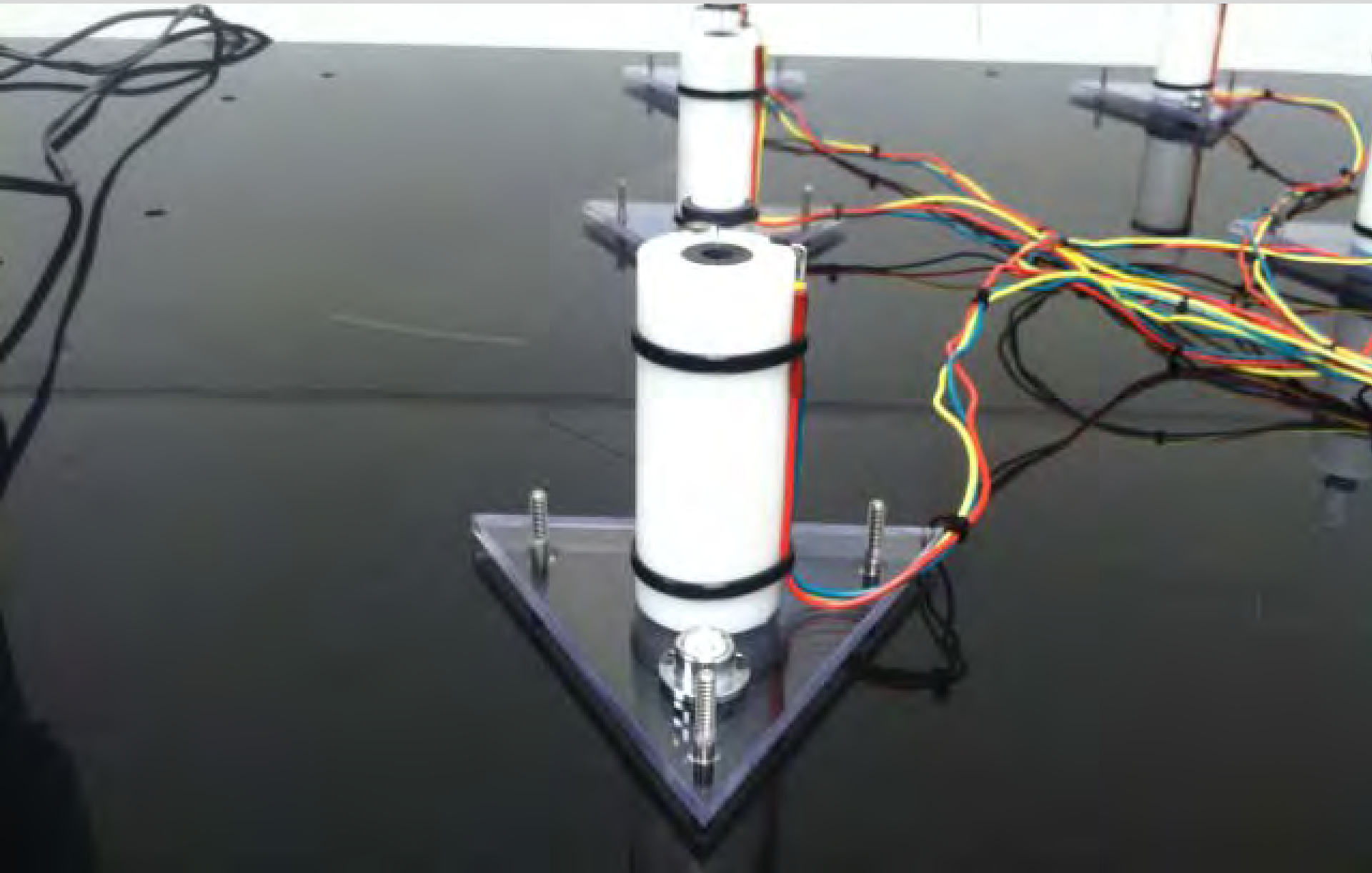
- Flight mill
- Harmonic radar
- Free-flight observation



We have used lab & field trials to better define dispersal ecology of wild *H. halys* populations.

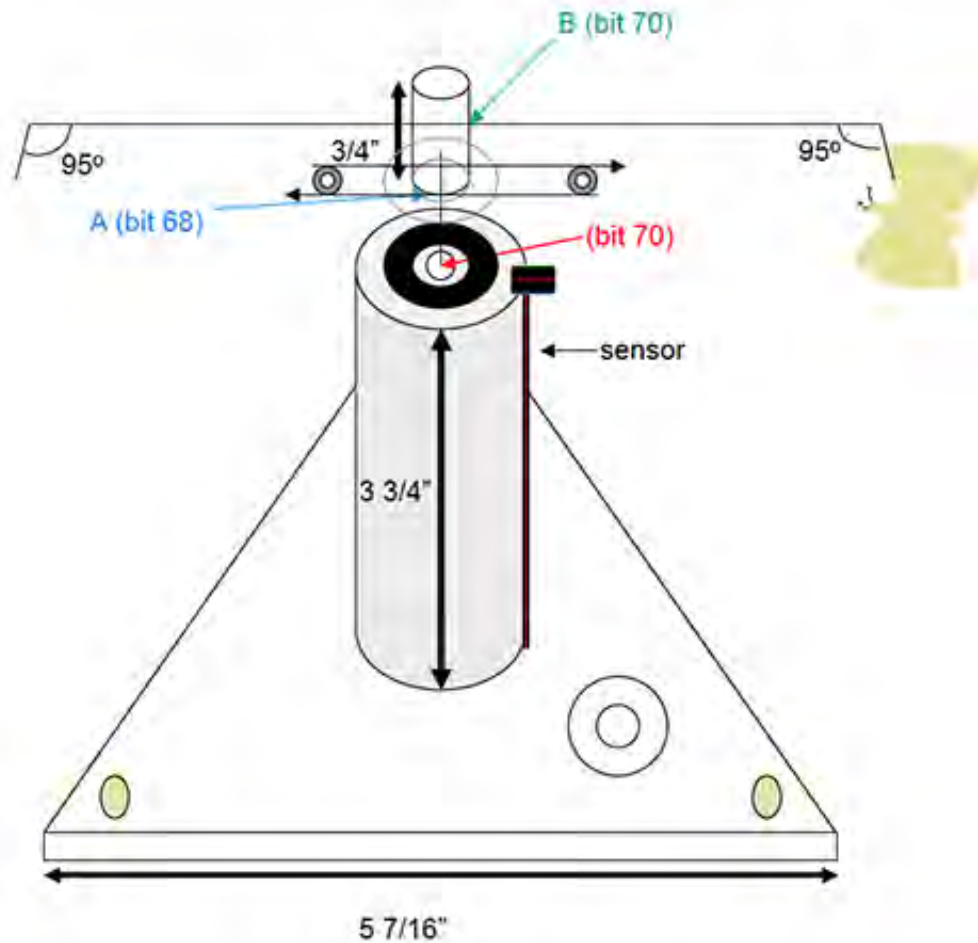


# 1. Flight mill: What is the potential flight capacity of *H. halys*?

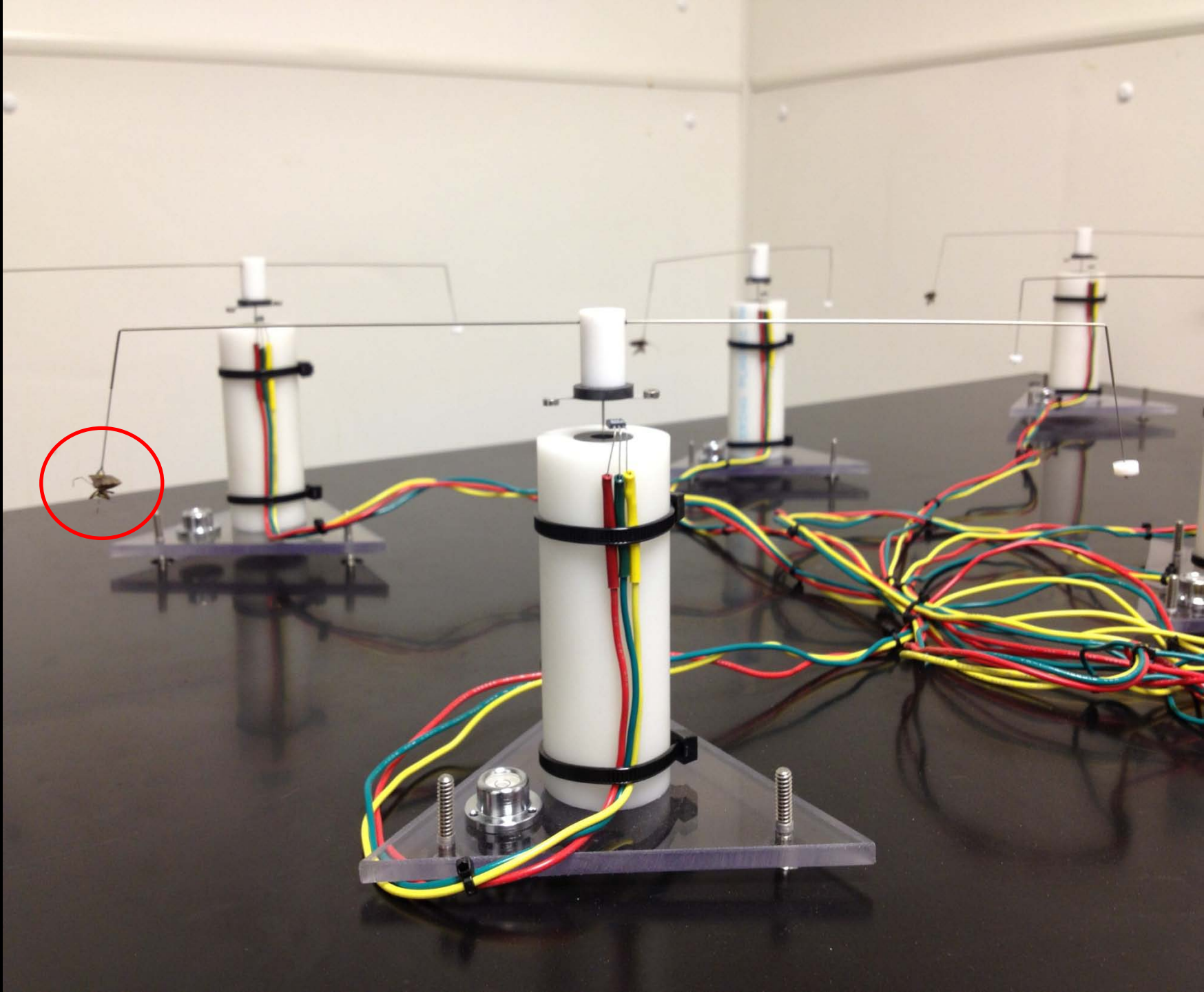




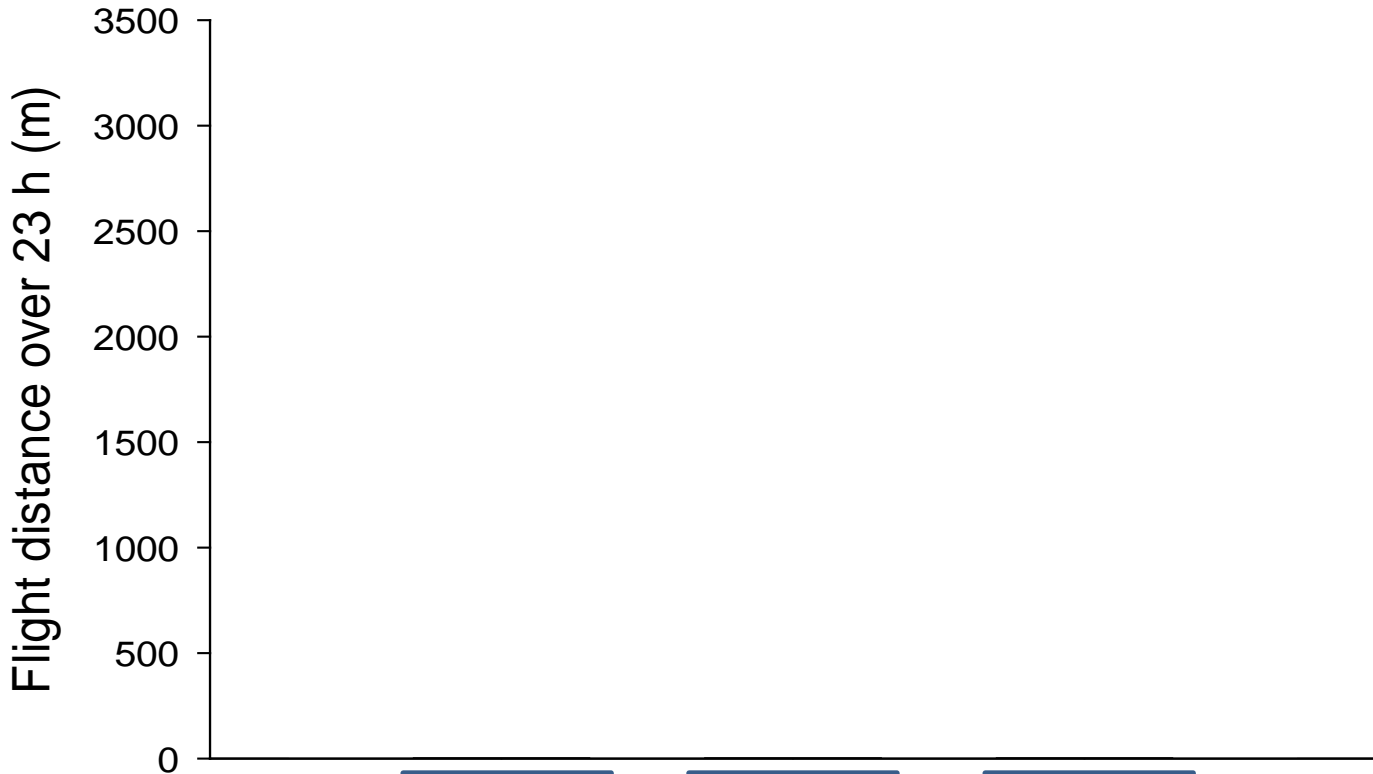
Dr. Vincent Jones



By Teah Smith at WSU TFREC







*Late Aug –  
Early Sep*



**Foraging**

*Late Sep –  
Early Oct*

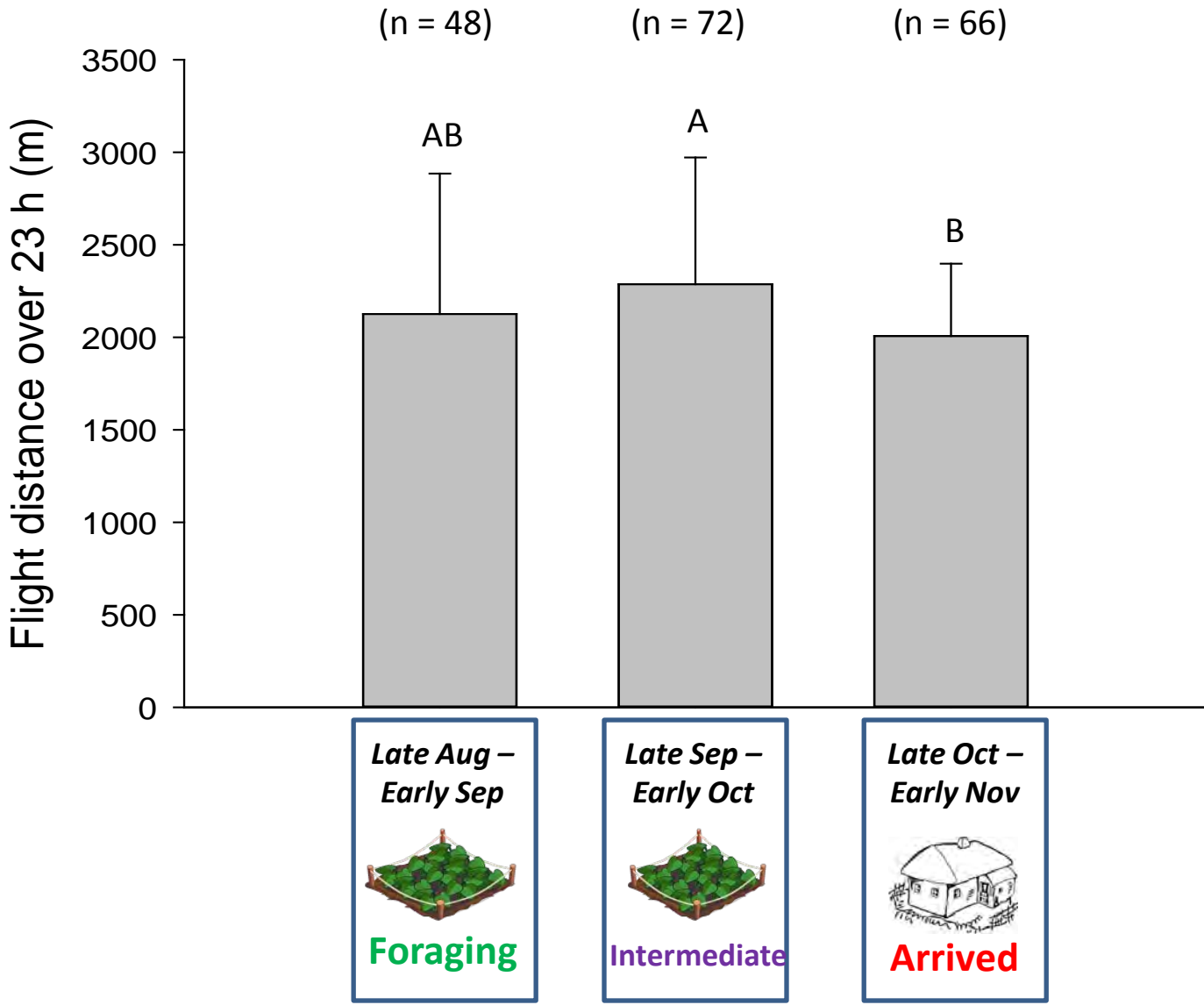


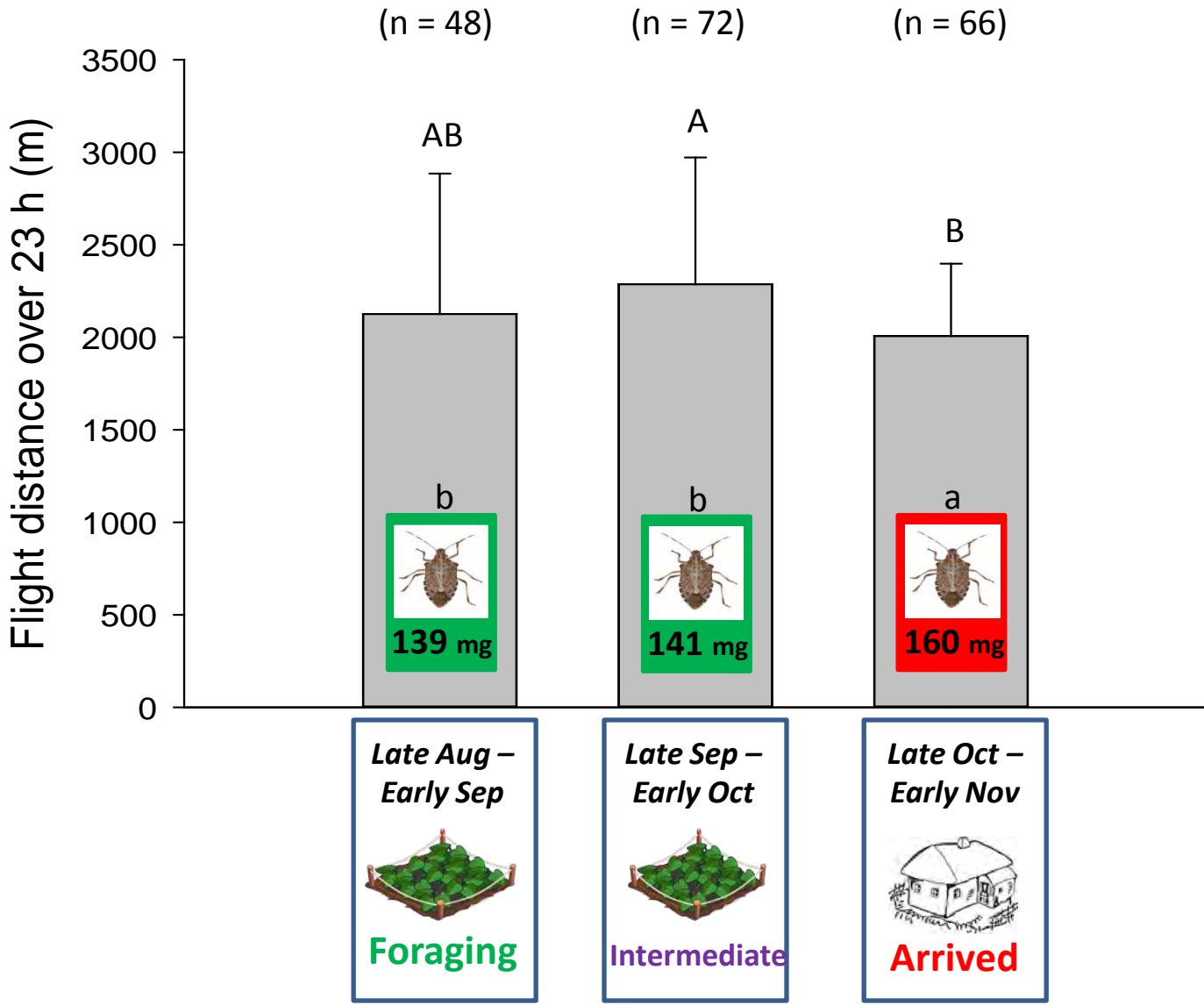
**Intermediate**

*Late Oct –  
Early Nov*



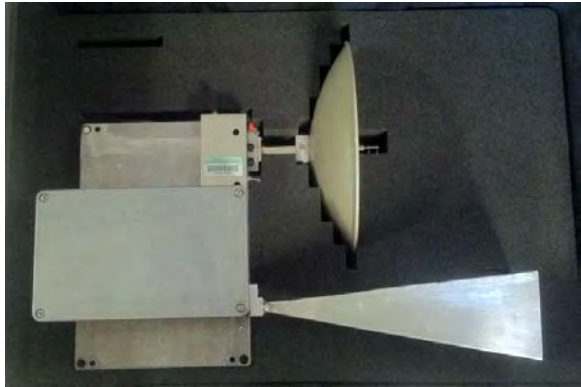
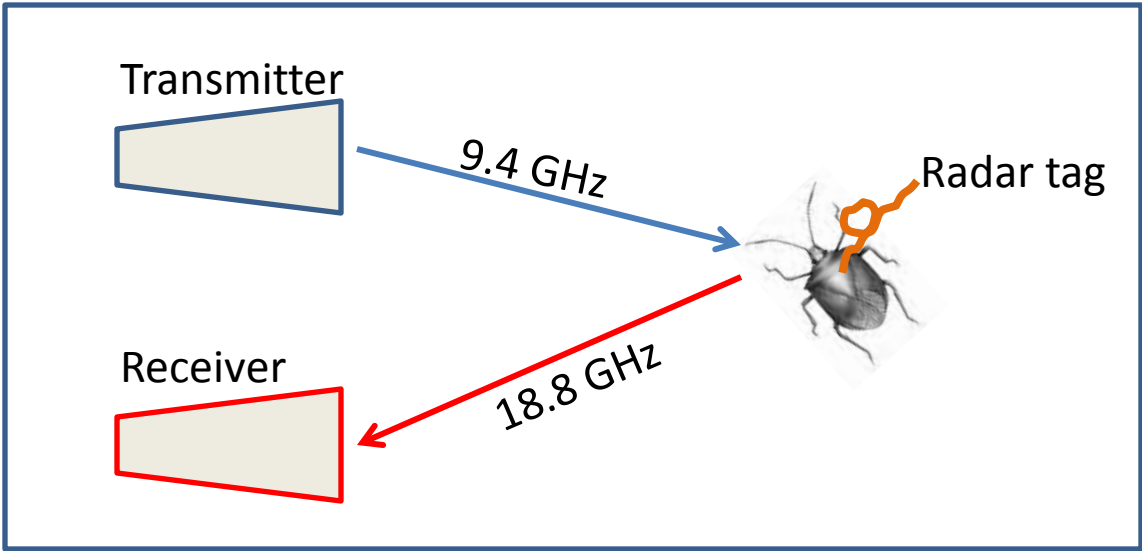
**Arrived**





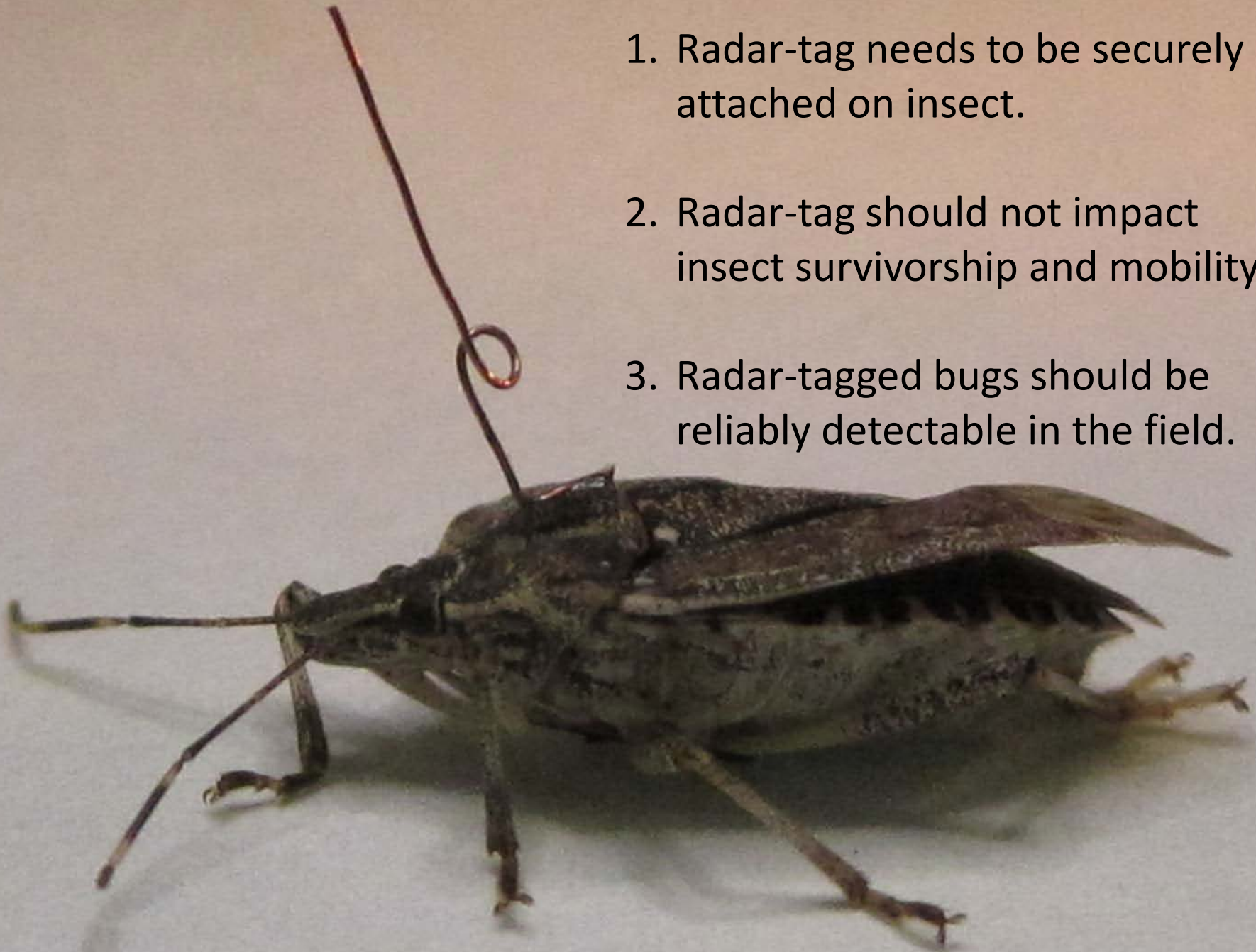


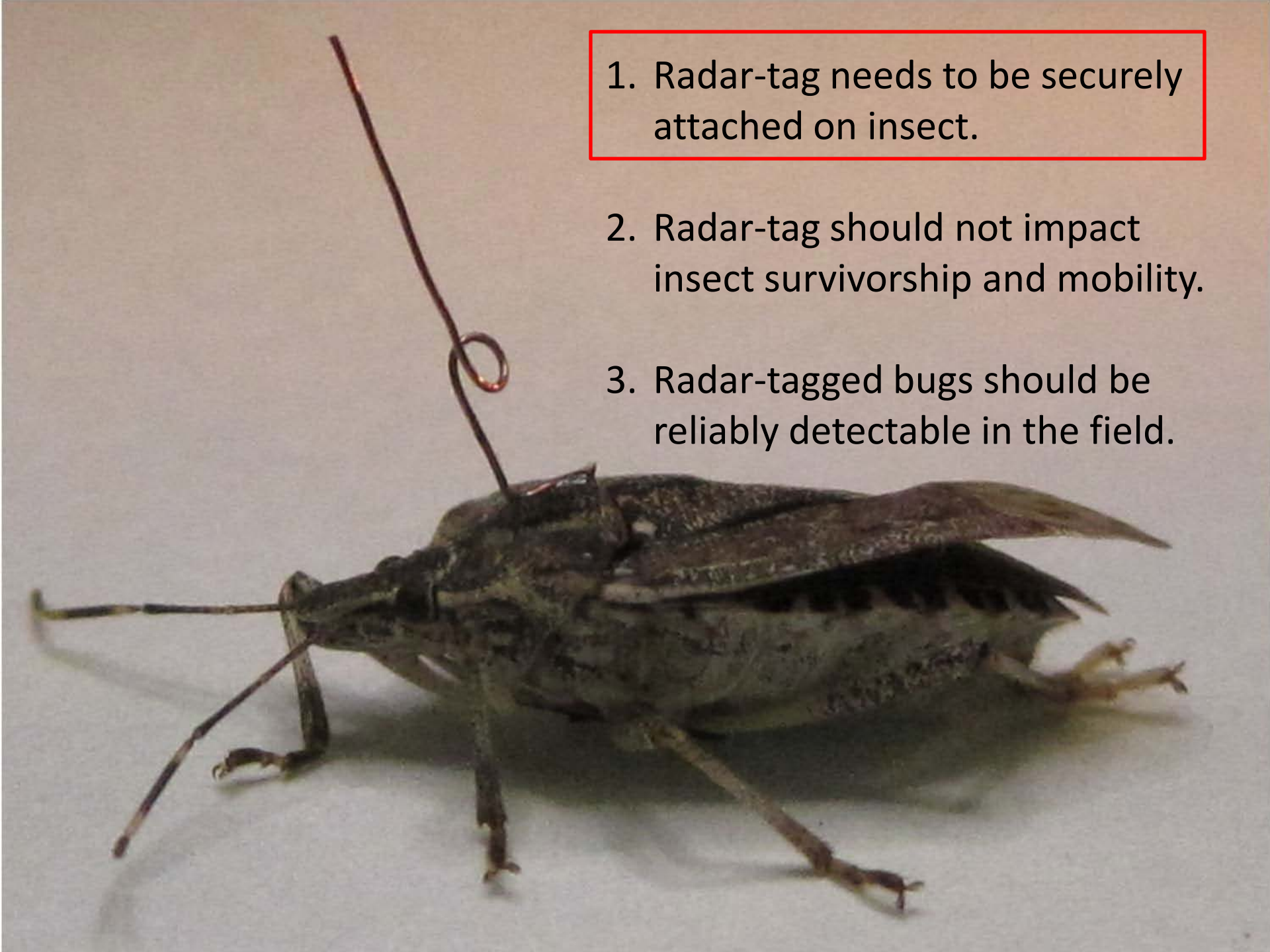
# 2. Harmonic radar: How does *H. halys* disperse at farm and landscape scales?





1. Radar-tag needs to be securely attached on insect.
2. Radar-tag should not impact insect survivorship and mobility.
3. Radar-tagged bugs should be reliably detectable in the field.





1. Radar-tag needs to be securely attached on insect.

2. Radar-tag should not impact insect survivorship and mobility.

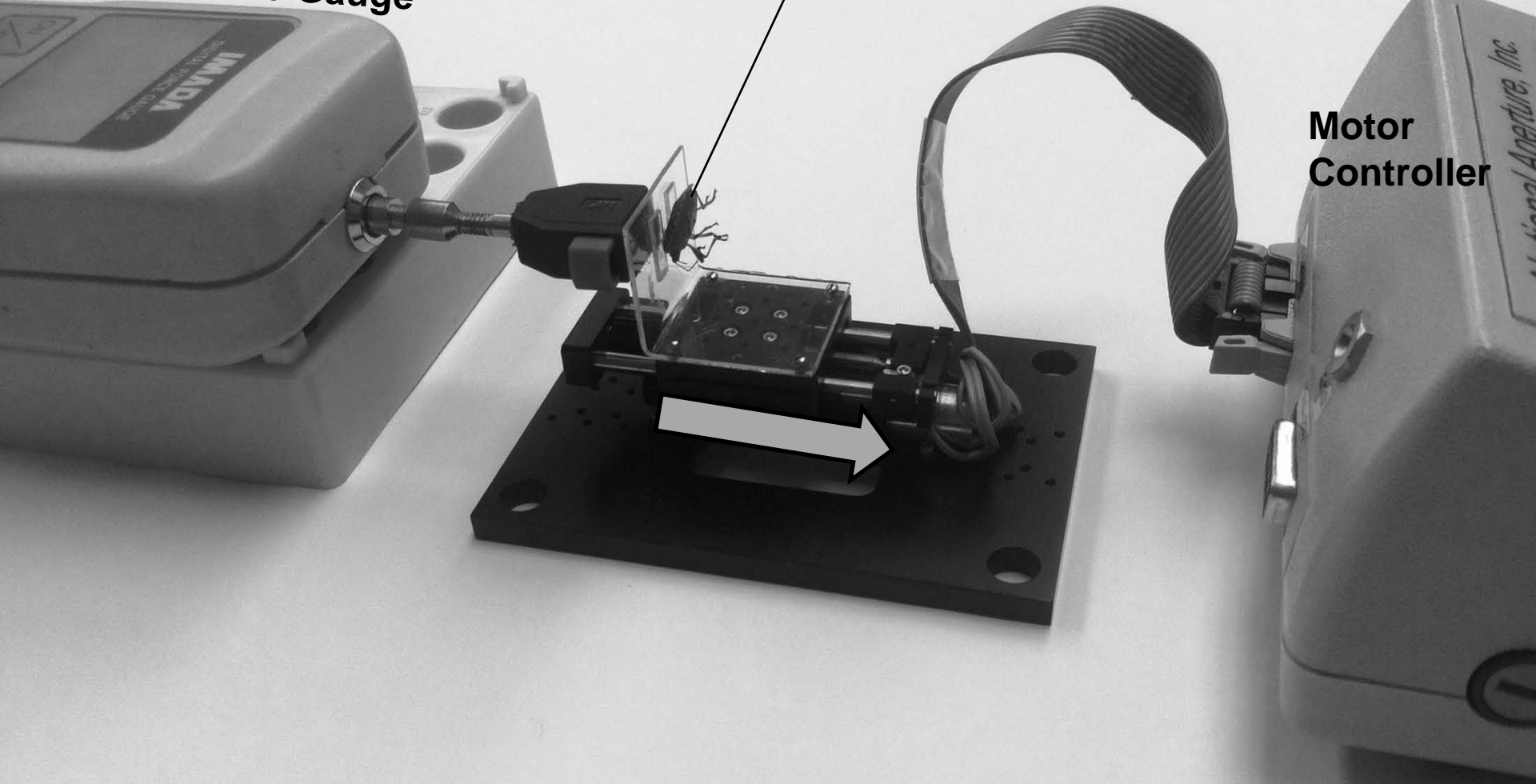
3. Radar-tagged bugs should be reliably detectable in the field.



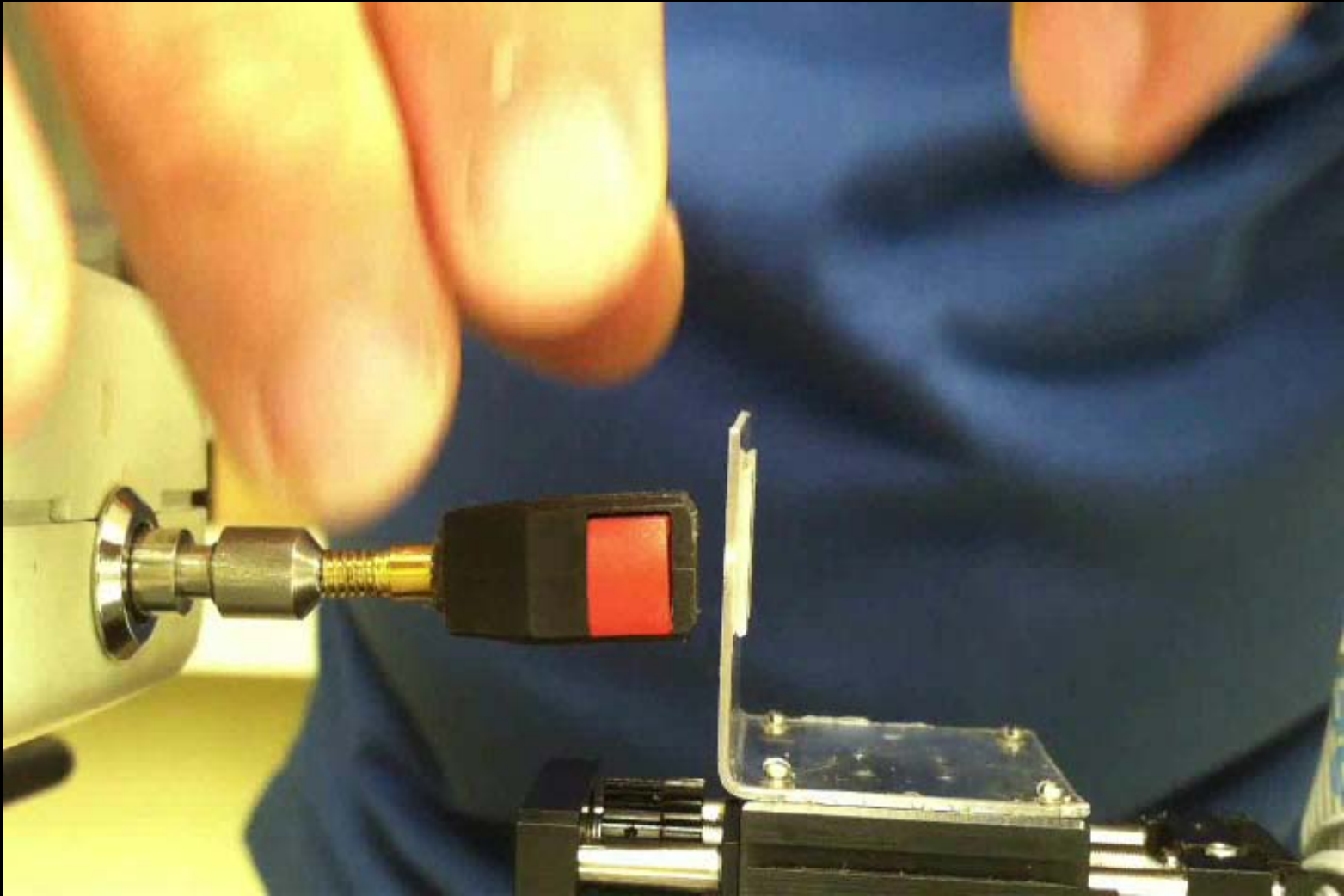
Digital Force Gauge

Radar-tagged *H. halys*

Motor Controller



# The strength of bond between radar tag and insect

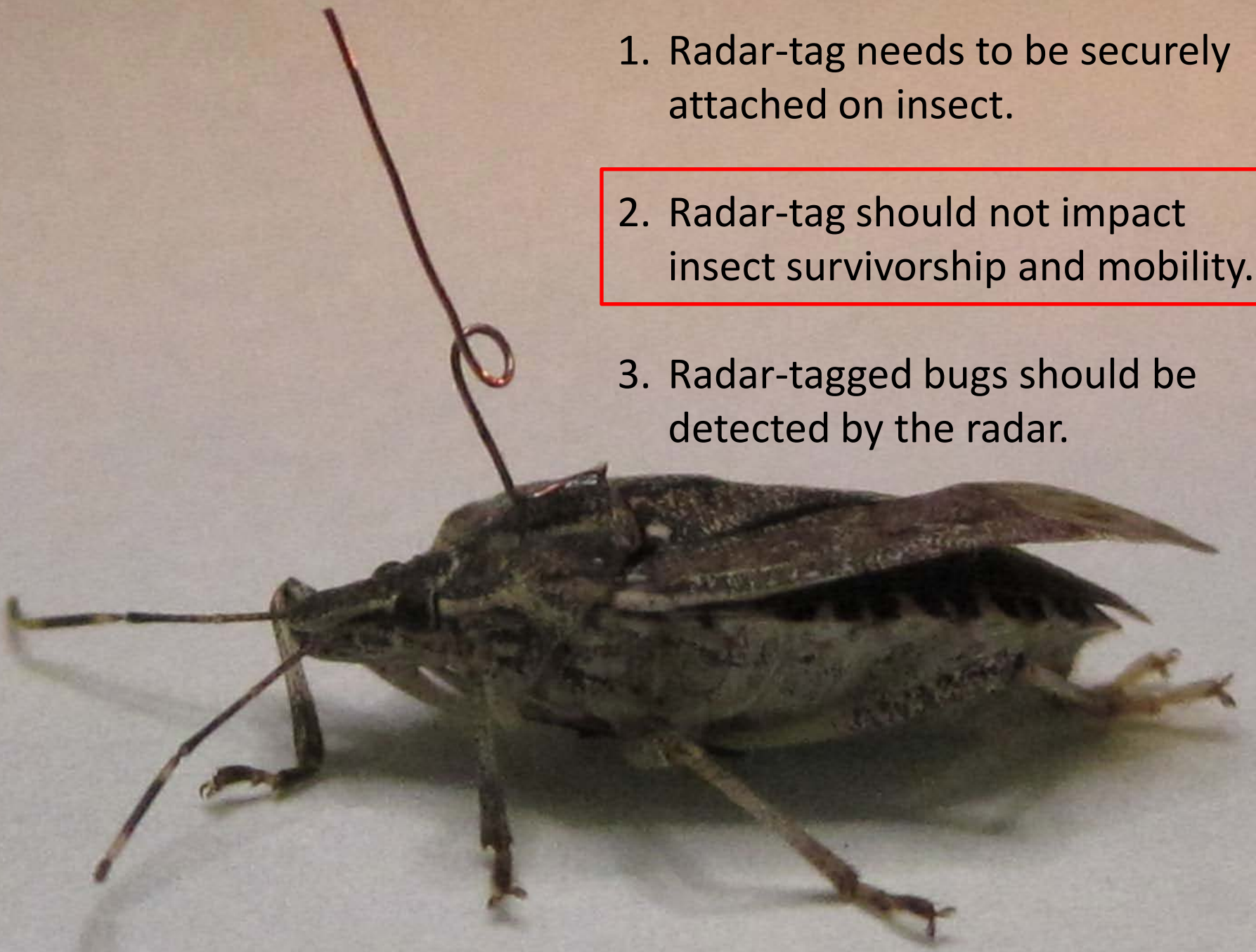


The adhesive strength of glue bond  
between radar tag and insect:

**ca. 170-g force**







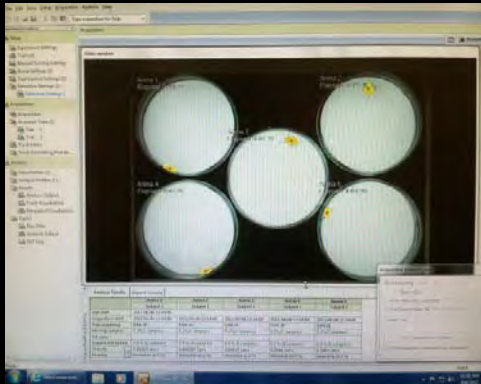
1. Radar-tag needs to be securely attached on insect.

2. Radar-tag should not impact insect survivorship and mobility.

3. Radar-tagged bugs should be detected by the radar.



# Radar-tag did not impact *H. halys*

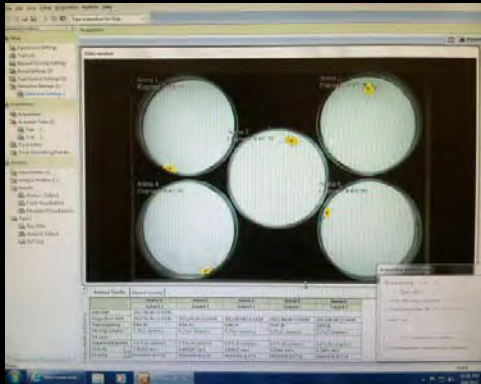


- Survivorship. (lab)
- Horizontal & vertical walking ability. (lab)
- Flight capacity. (field)





# Radar-tag did not impact *H. halys*



- Survivorship. (lab)
- Horizontal & vertical walking ability. (lab)



- Flight capacity. (field)

# Flight capacity of untagged vs. radar-tagged *H. halys*



Release station















Green pin: Untagged bug  
Pink pin: Radar-tagged bug



© 2012 Google

Image © 2012 GeoEye

39°21'28.11" N 77°53'23.17" W elev 624 ft

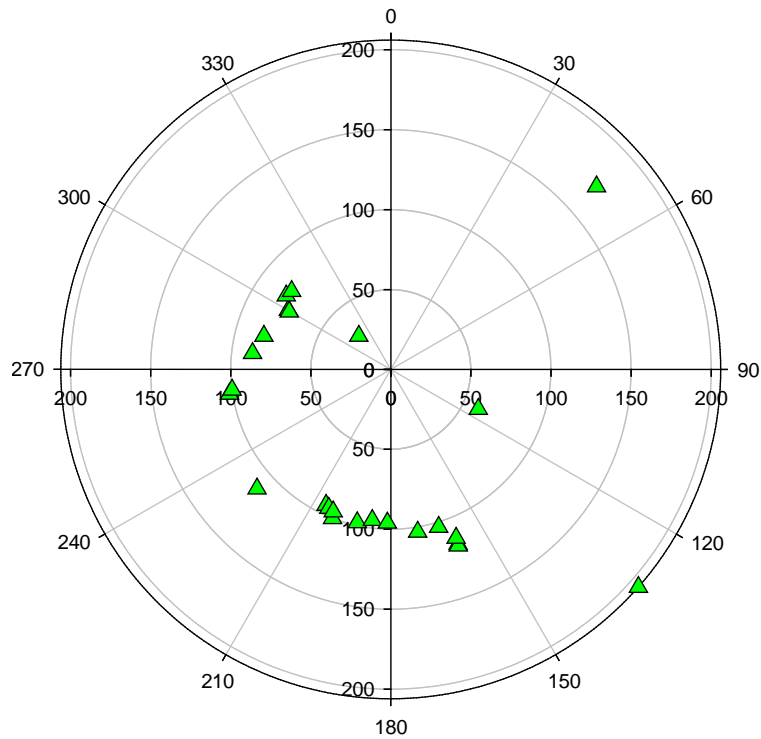
Google earth

Eye alt 2799 ft

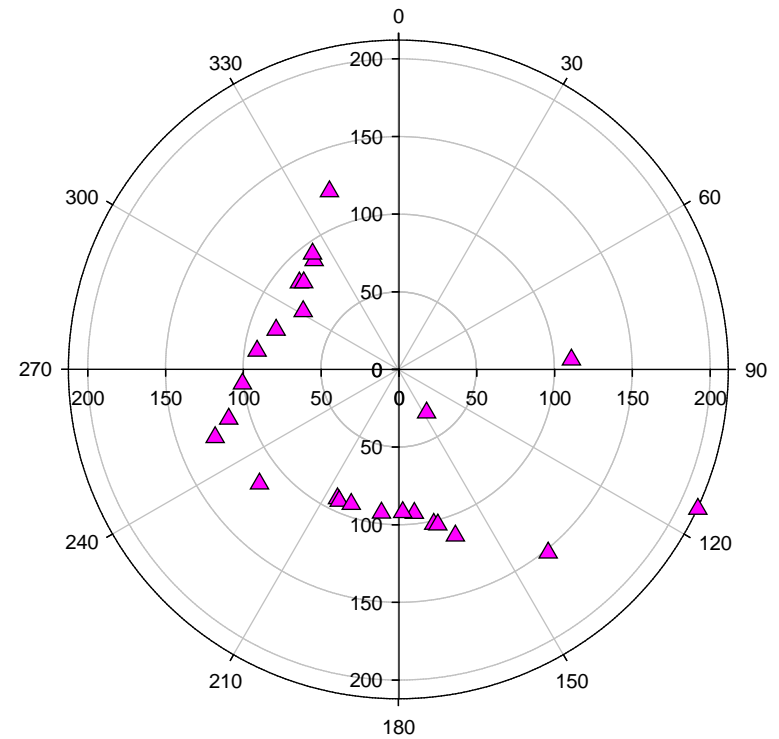
Imagery Date: 5/25/2010

# Flight capacity of untagged vs. radar-tagged *H. halys*

[Untagged]



[Radar-tagged]





*Made in  
Canada*



Radar-tagged bugs were reliably detectable from ca. 15 m.



### 3. Free-flight observation: What is the diurnal flight behavior and pattern of *H. halys*?

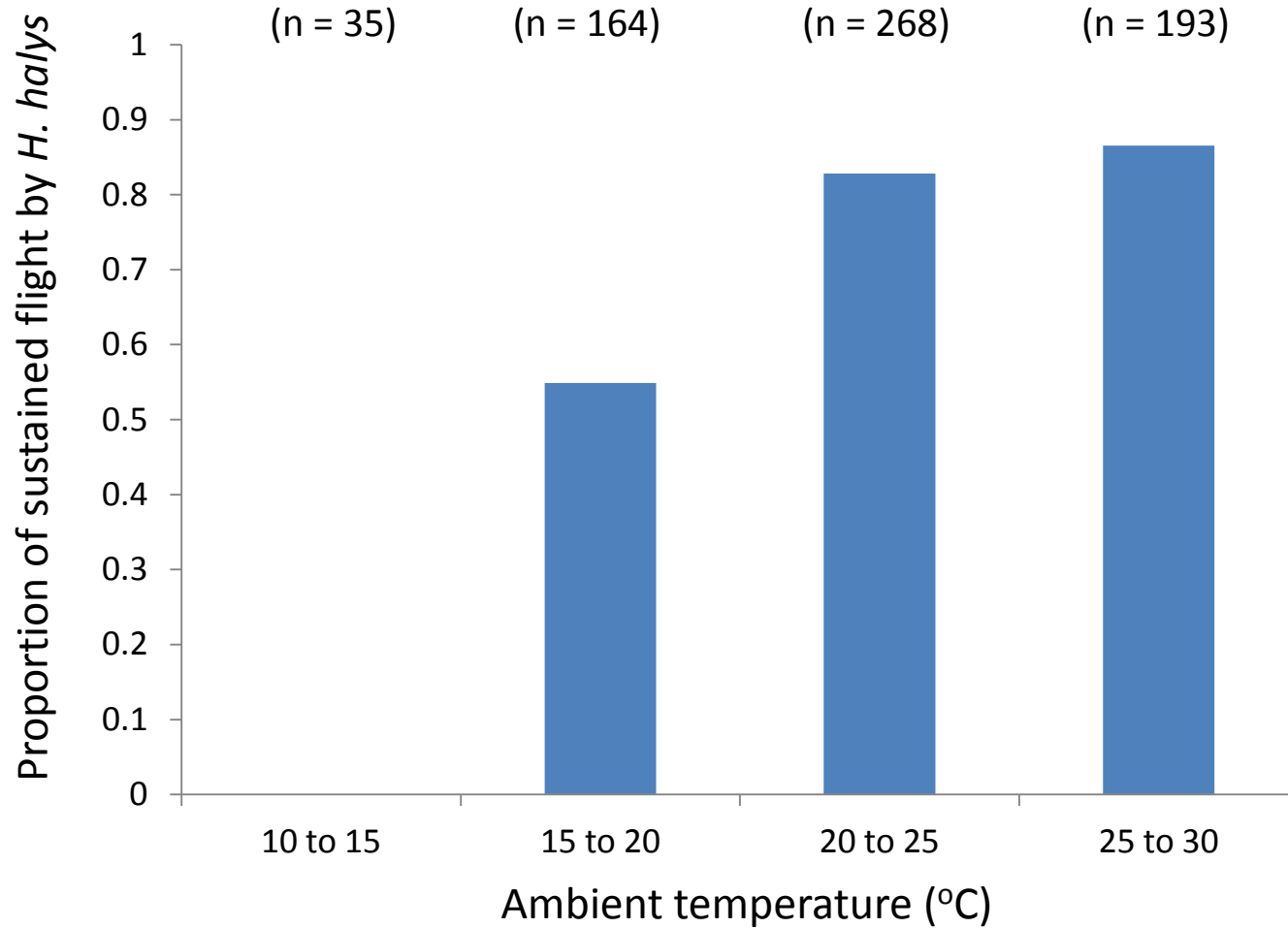


### 3. Free-flight observation: What is the diurnal flight behavior and pattern of *H. halys*?

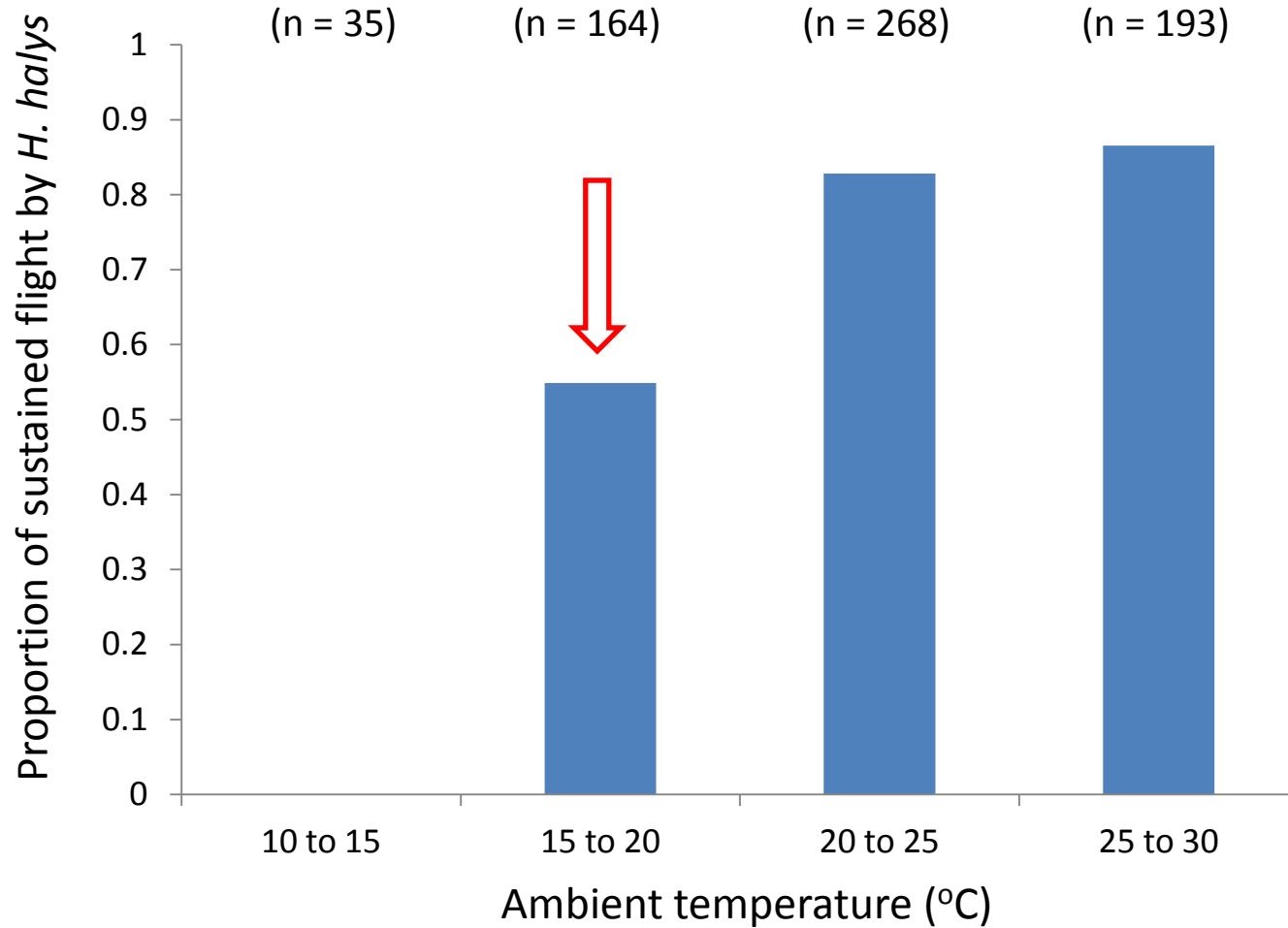




# Likelihood of sustained flight



# Likelihood of sustained flight



# Prevailing flight direction over time



# Flight direction: 8:00-10:00

(n = 36)



# Flight direction: 10:00-12:00

(n = 96)



# Flight direction: 12:00-14:00

(n = 109)



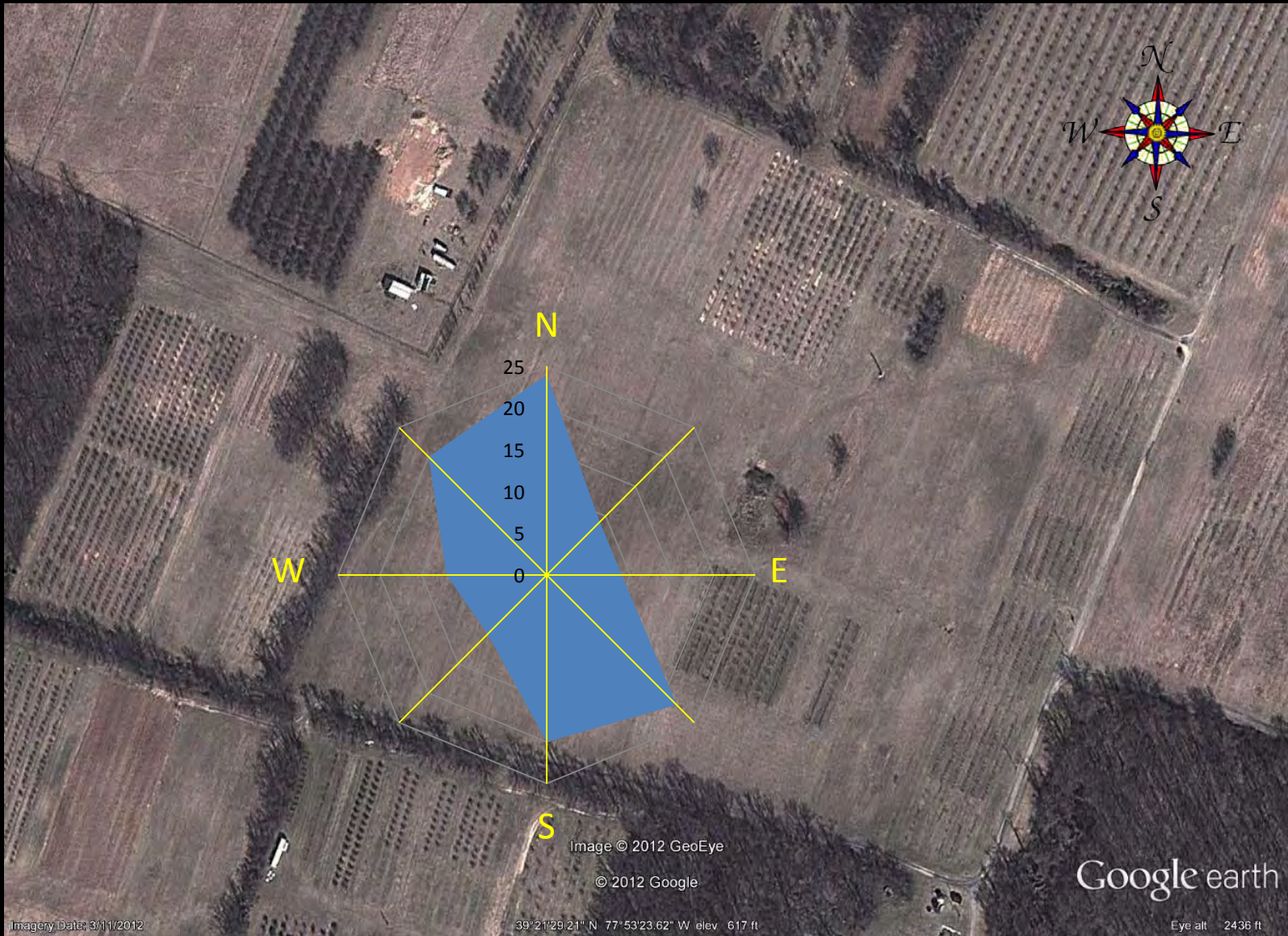
# Flight direction: 14:00-16:00

(n = 112)



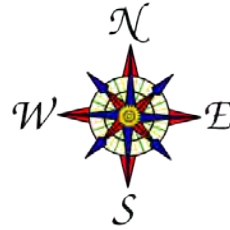
# Flight direction: 16:00-18:00

(n = 126)

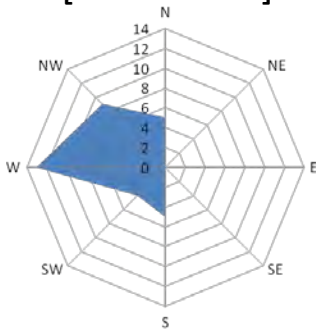




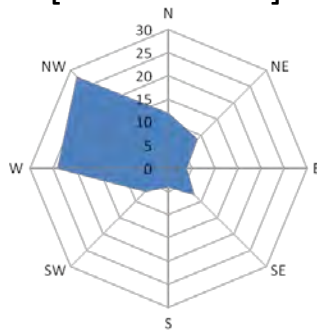
# Prevailing flight direction over time



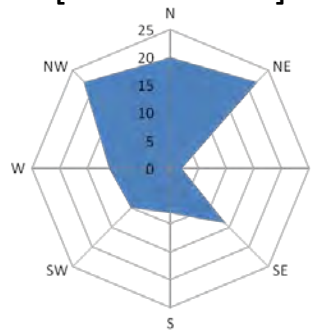
[8:00-10:00]



[10:00-12:00]



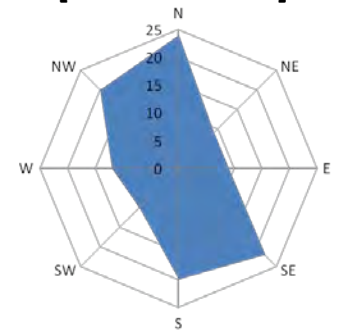
[12:00-14:00]



[14:00-16:00]



[16:00-18:00]



# Summary

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- Harmonic radar system has a promising potential for use with *H. halys*.

# Summary

- 13% of dead trees can potentially harbor overwintering *H. halys*.
- *H. halys* have capacity to fly >1 km within a day.
- Harmonic radar system has a promising potential for use with *H. halys*.
- Flight by *H. halys* was affected at least by temperature and sun's position.

# Leskey Lab



USDA-NIFA SCRI Award#: 2011-51181-30937