Spiders as natural biological control agents in and around human dwellings

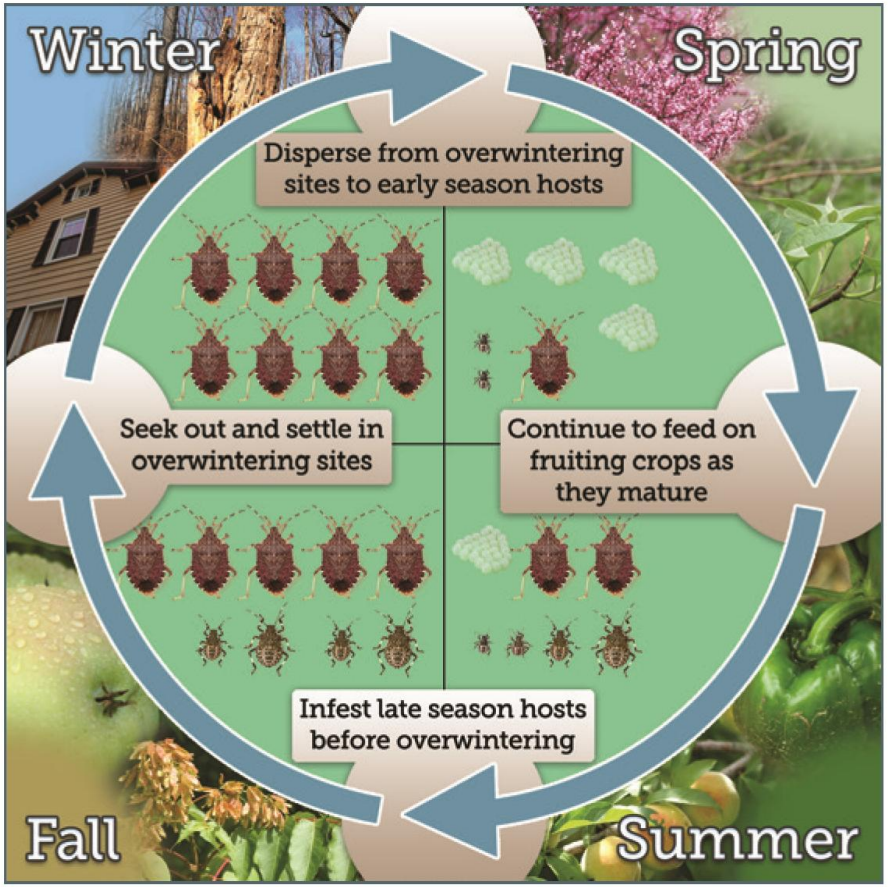
Rob Morrison, A. N. Bryant, B. Poling, N. F. Quinn, and T. C. Leskey

USDA-ARS Appalachian Fruit Research Station

BMSB IPM Working Group Meeting

June 16th, 2016

Life Cycle of BMSB



(Kuhar et al. 2016)

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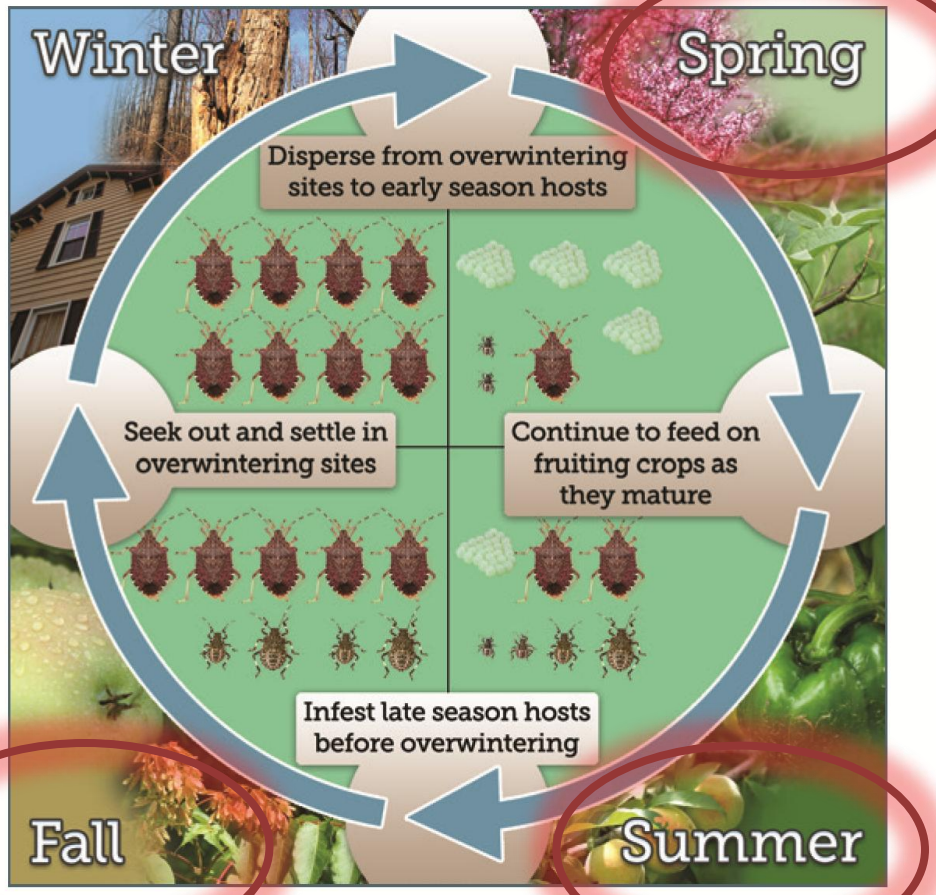
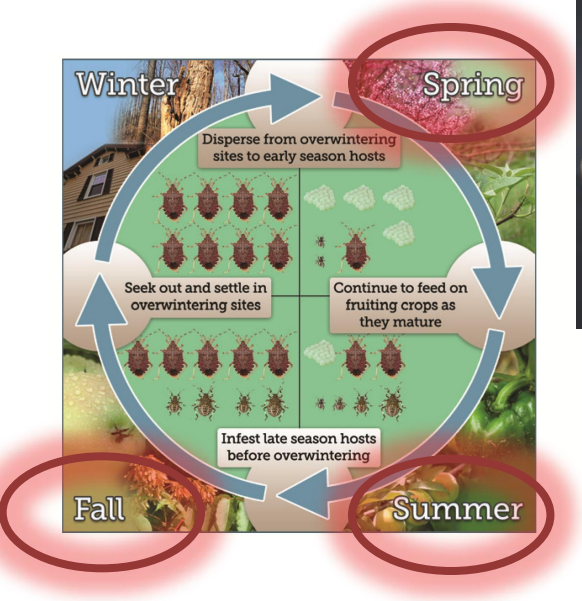


(Kuhar et al. 2016)

Much is known about the natural enemies in agriculture during the growing season

Natural Enemies of BMSB

e.g. Parasitoids



Anastatus reduvii

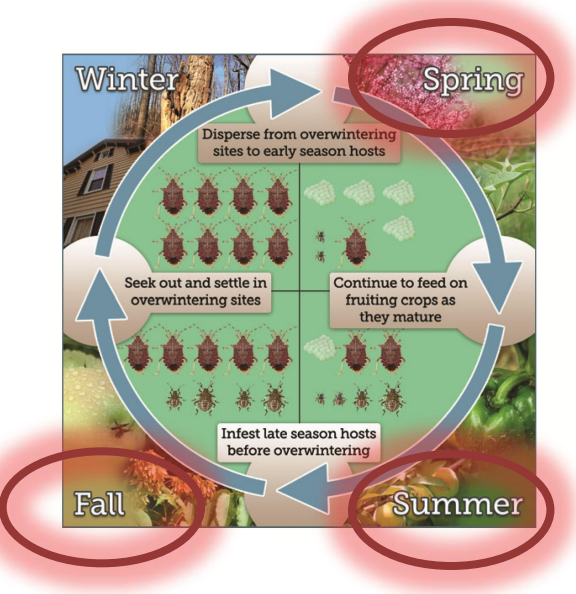
Trissolcus japonicus

T. brochymenae

(Rice et al. 2014; Jones et al. 2014)

Natural Enemies of BMSB

e.g. Parasitoids



Anastatus reduvii

Trissolcus japonicus

T. brochymenae

e.g. Predators

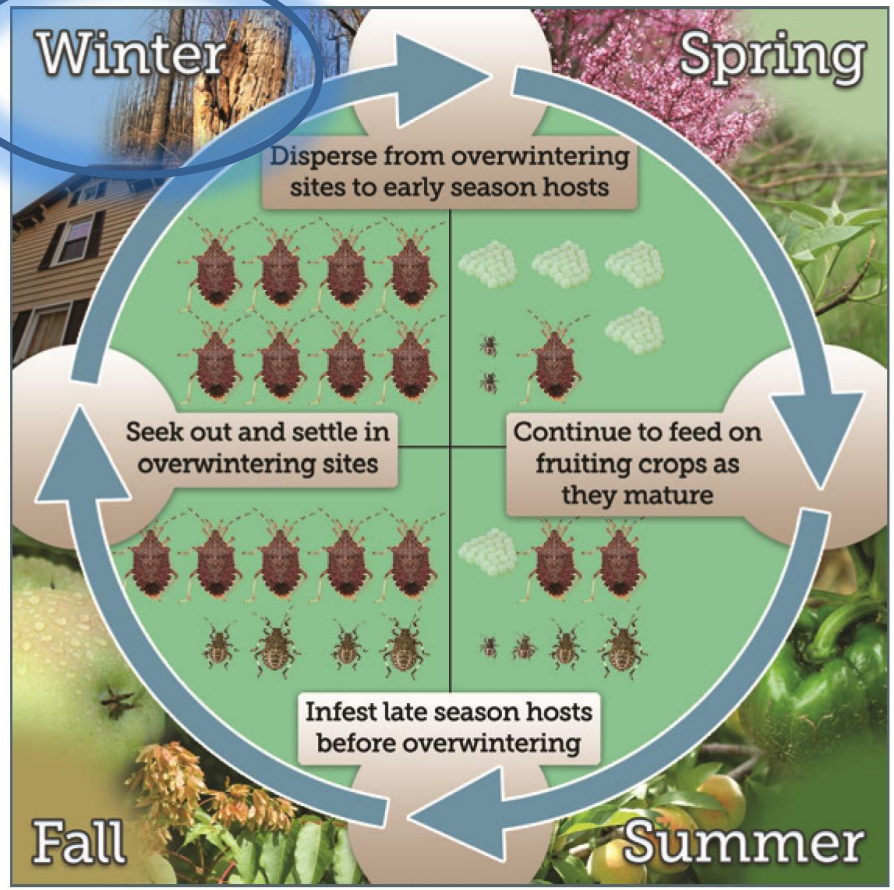
Katydids

Ground Beetles

Jumping Spiders

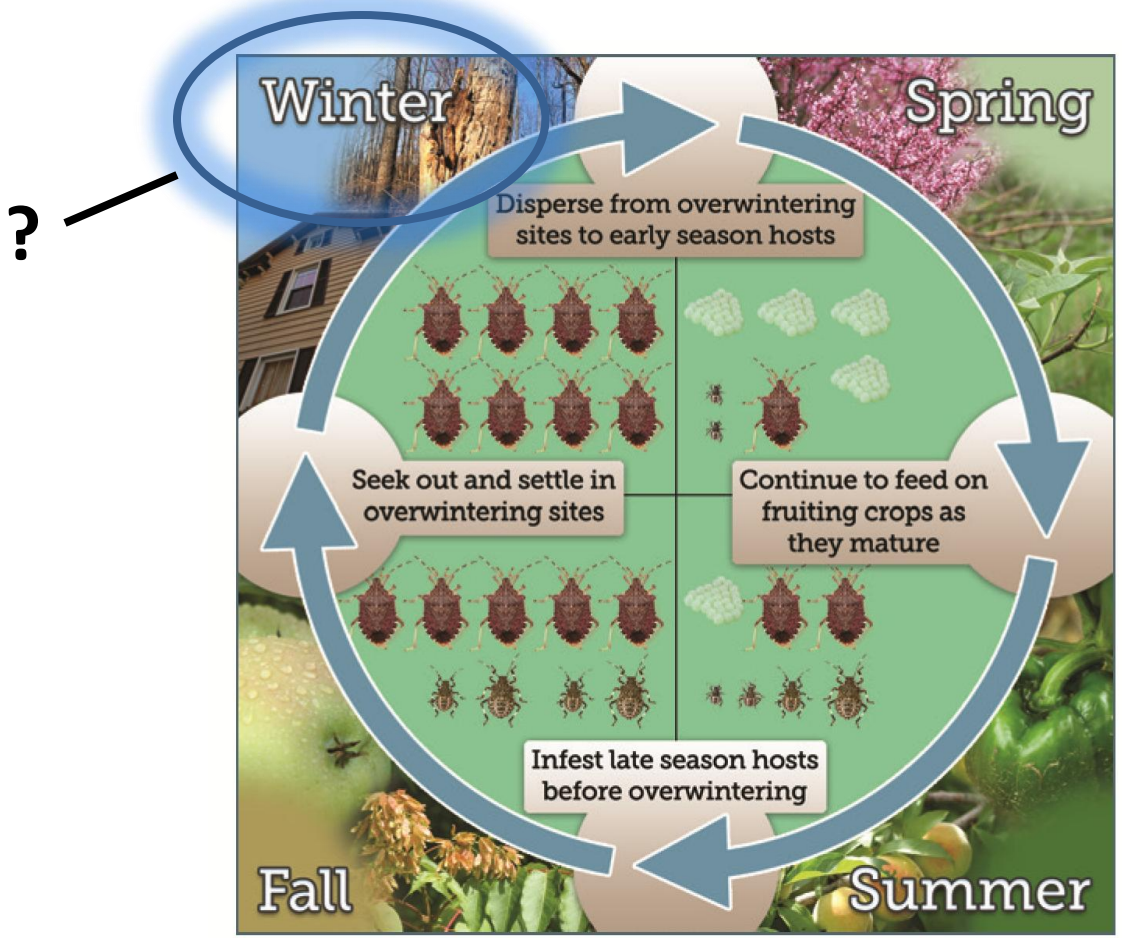
(Morrison et al. 2016)

Life Cycle of BMSB



(Kuhar et al. 2016)

Life Cycle of BMSB

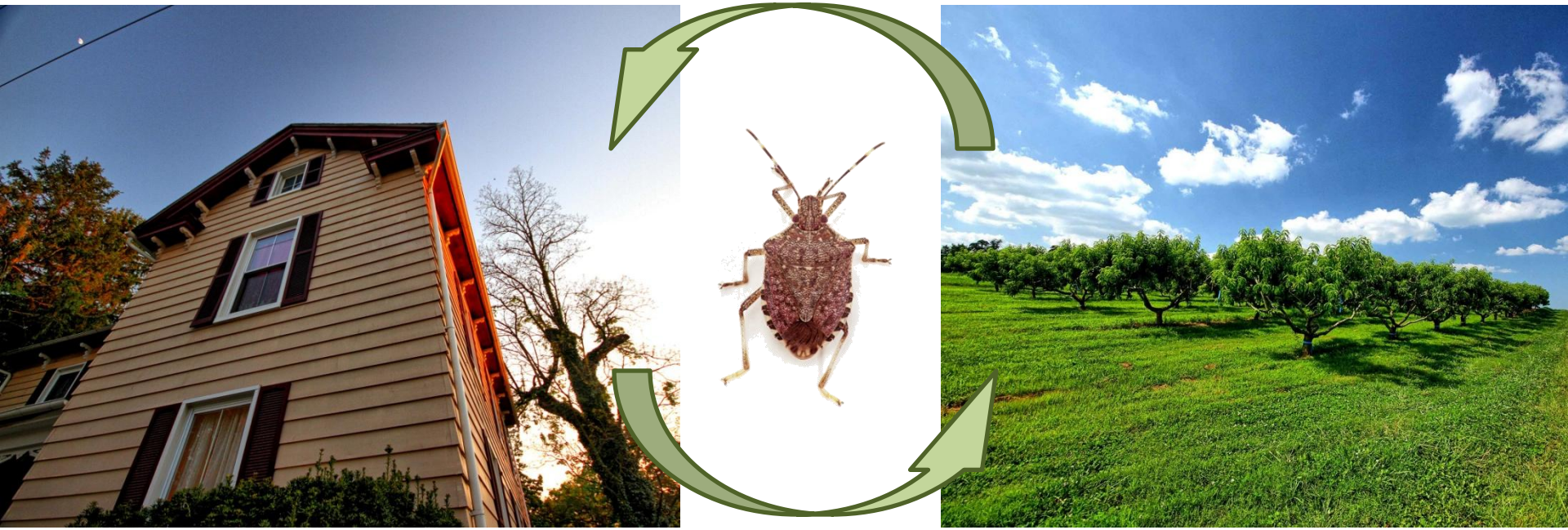


(Kuhar et al. 2016)

Nothing is known about the natural enemies at overwintering sites during the winter

Anthropogenic Overwintering Sites

Fall dispersal to homes



Spring dispersal to crops

Anthropogenic Overwintering Sites

Significant barrier: spiders and their webs in and around dwellings

Aims

1. Assess whether spider webs can ensnare BMSB
2. Evaluate whether ensnarement leads to predation
3. Understand whether the spider community that eats BMSB is different from the community that does not eat BMSB
4. Examine the background rate of BMSB predation by spiders under ambient conditions

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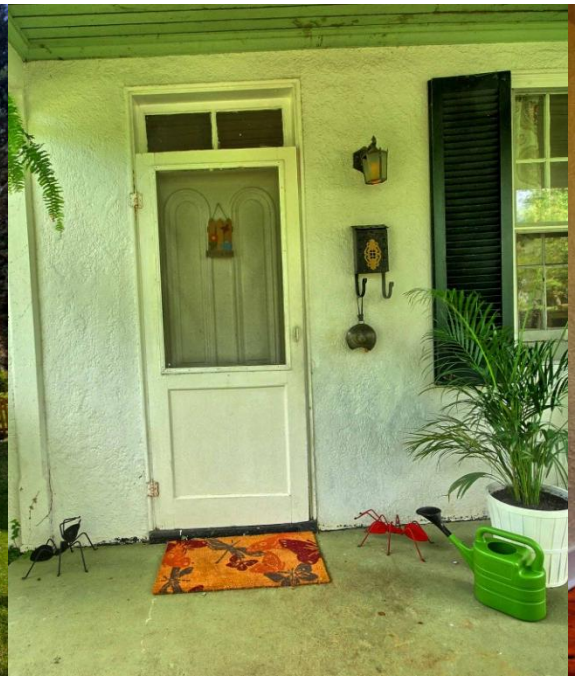
Methods: Source Material

- Introduced BMSB into webs from wild, ambient populations during the spring and fall

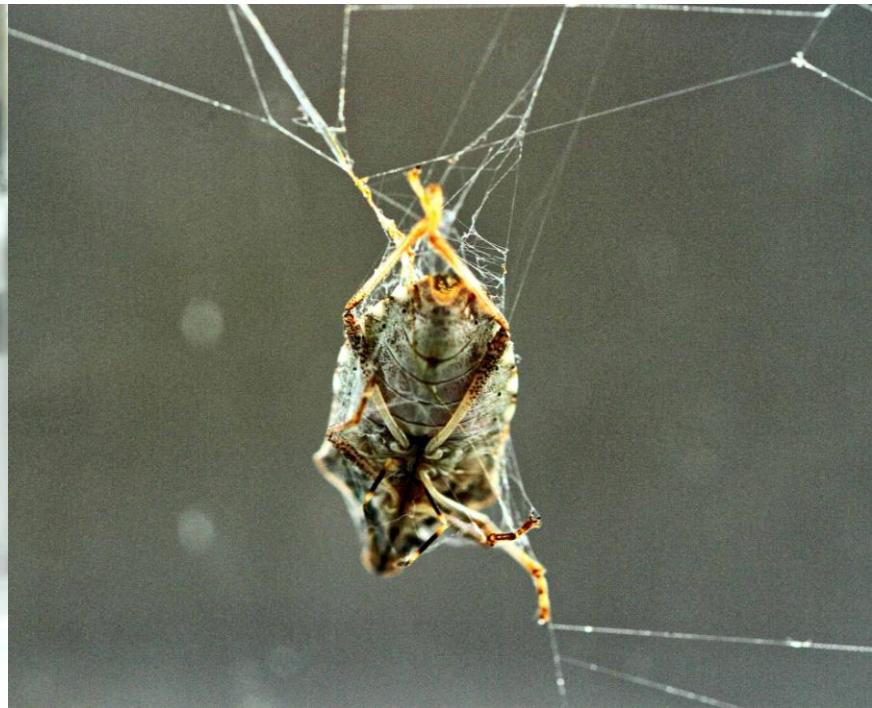
Methods: Site Selection

- Webs at three sites were chosen, and adults were placed in webs found in: landscape, building exterior, and building interior.


Methods: Introducing BMSB to Webs

- Observed the web for 5-min periods at 0, 1, 2, and 24 h after introduction.
- Recorded whether the adult escaped, and whether it was eaten, then saved the spider as a voucher.

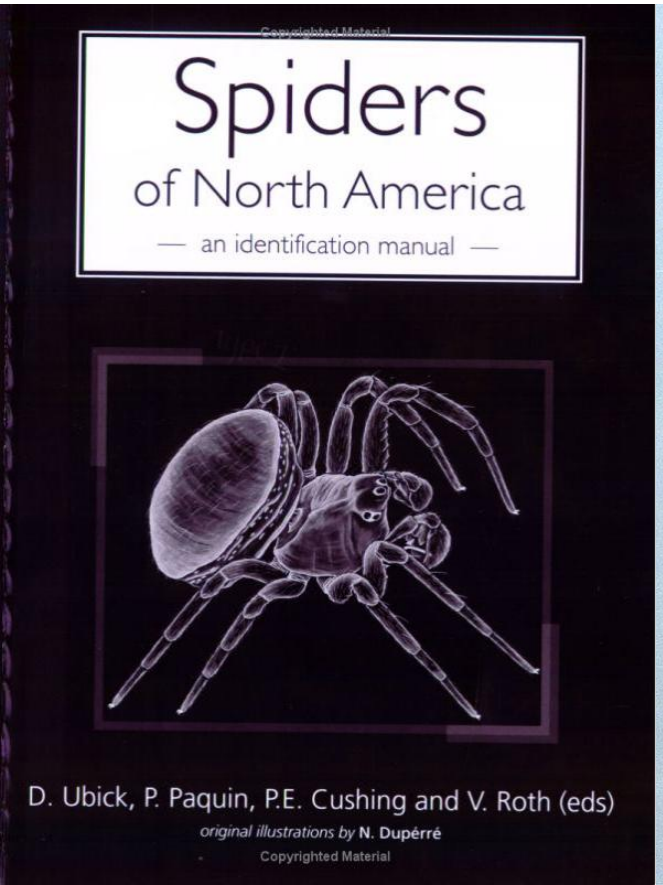


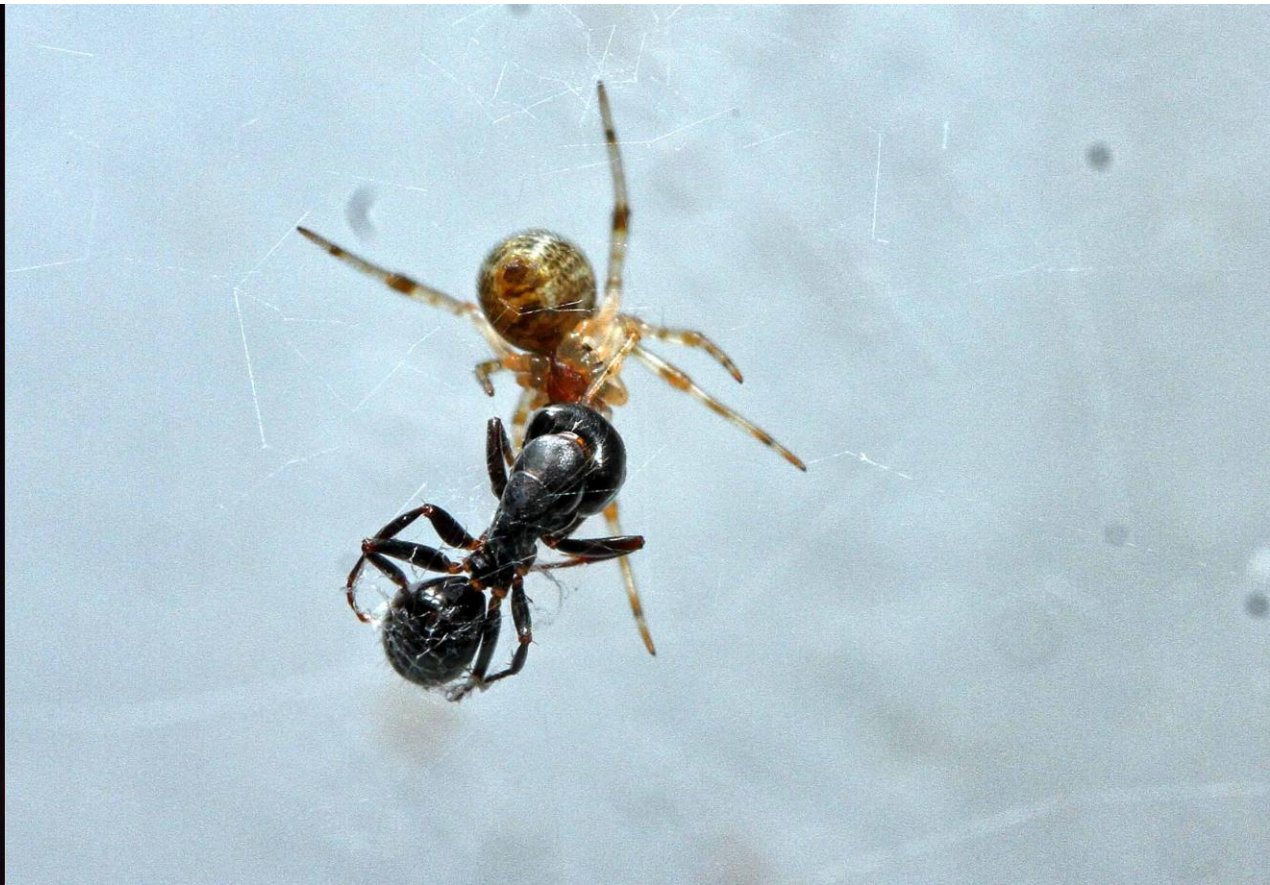
Methods: Size Classes

- Spiders were then sorted into three size classes:
  - **Small** < 4 mm
  - **Medium** 4-7 mm
  - **Large** > 7 mm

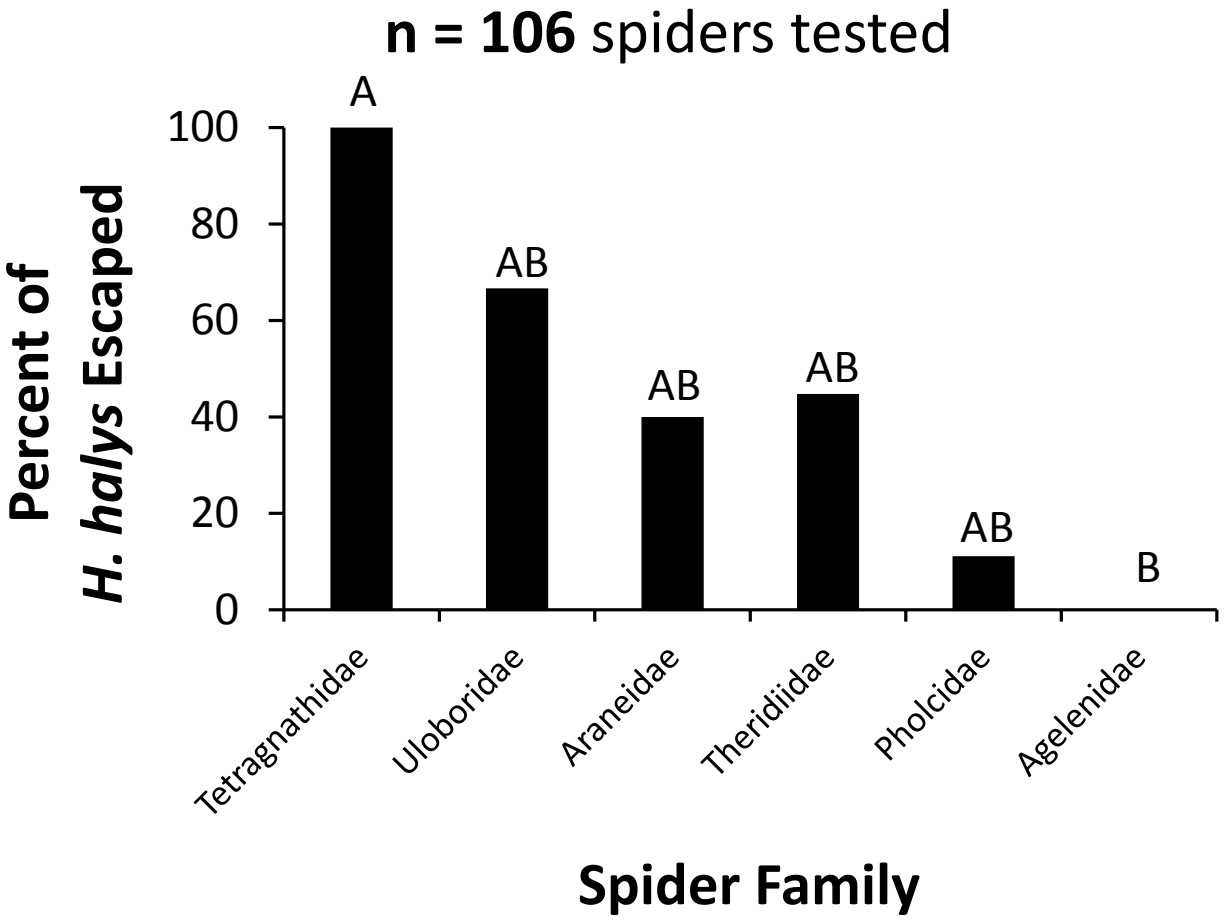
Methods: IDs

- Spiders identified using Cushing and Ubick (2009)





Results: Predation of BMSB



Logistic Regression

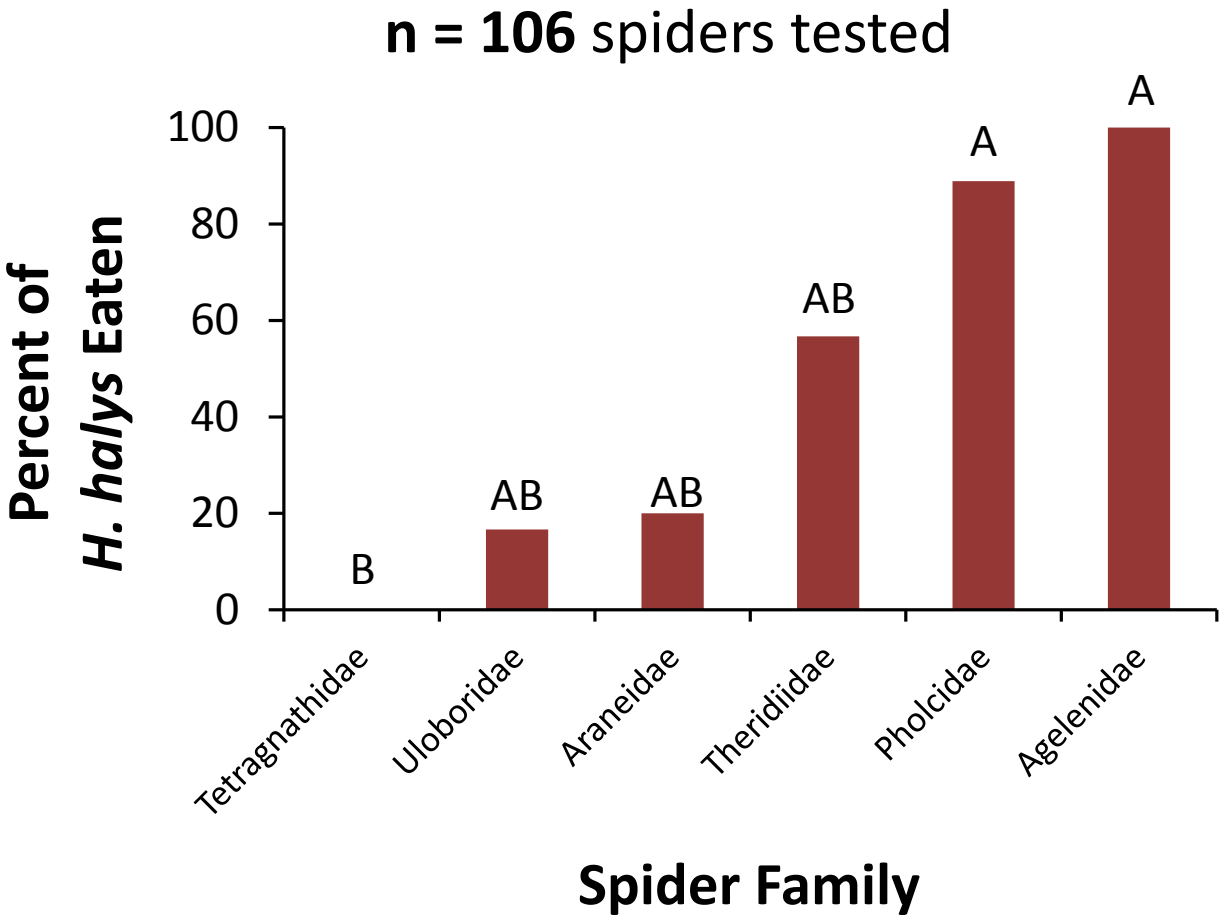
df = 6

$\chi^2 = 13.7$

$P < 0.04$

Chi-Square Pairwise

Results: Predation of BMSB



Logistic Regression

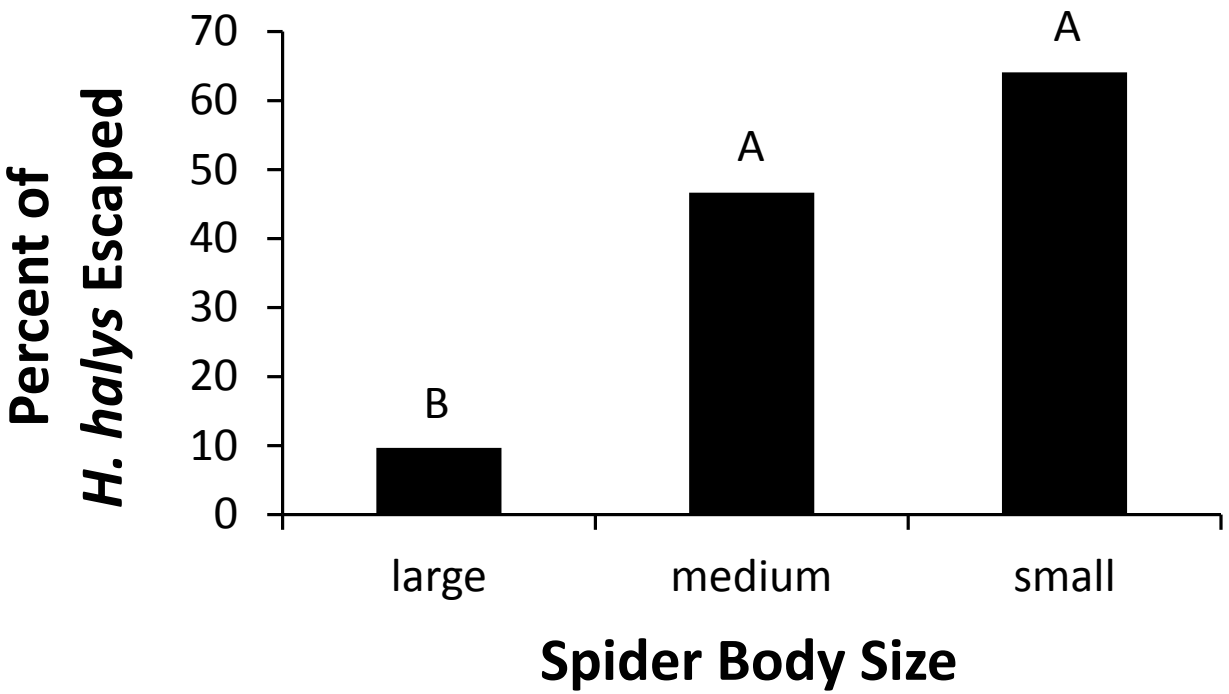
df = 6

$\chi^2 = 17.0$

$P < 0.01$

Chi-Square Pairwise

Results: Predation of BMSB



Logistic Regression

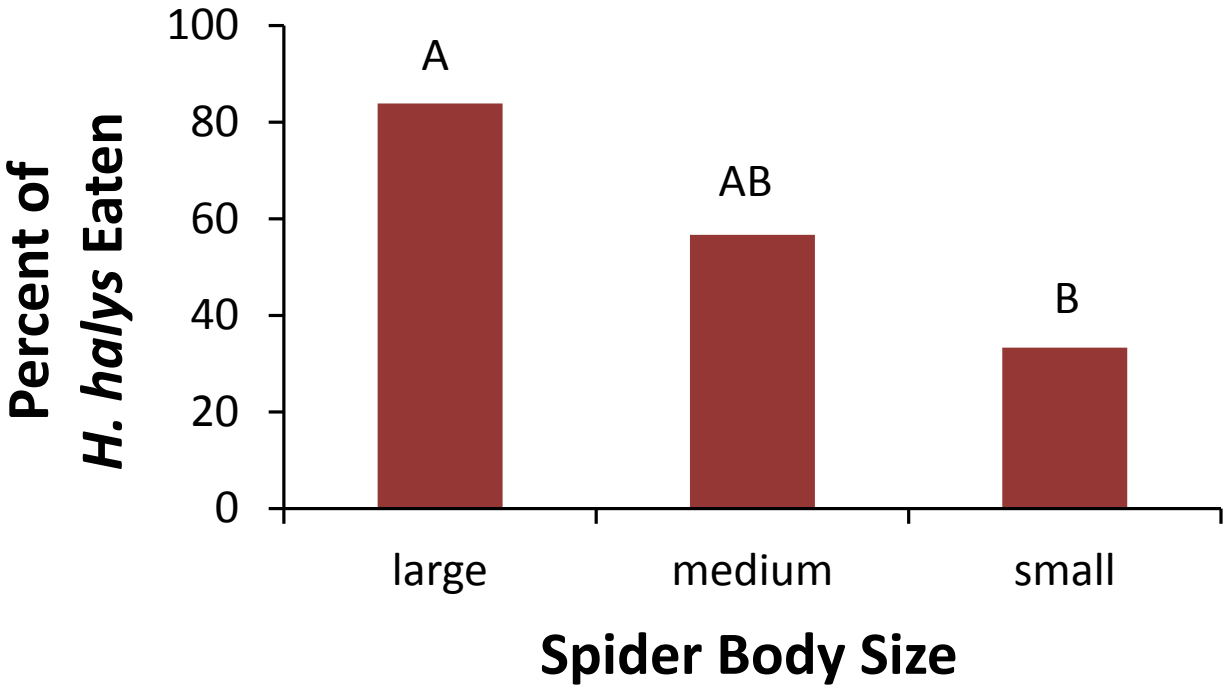
df = 2

$\chi^2 = 13.3$

$P < 0.002$

Chi-Square Pairwise

Results: Predation of BMSB



Logistic Regression

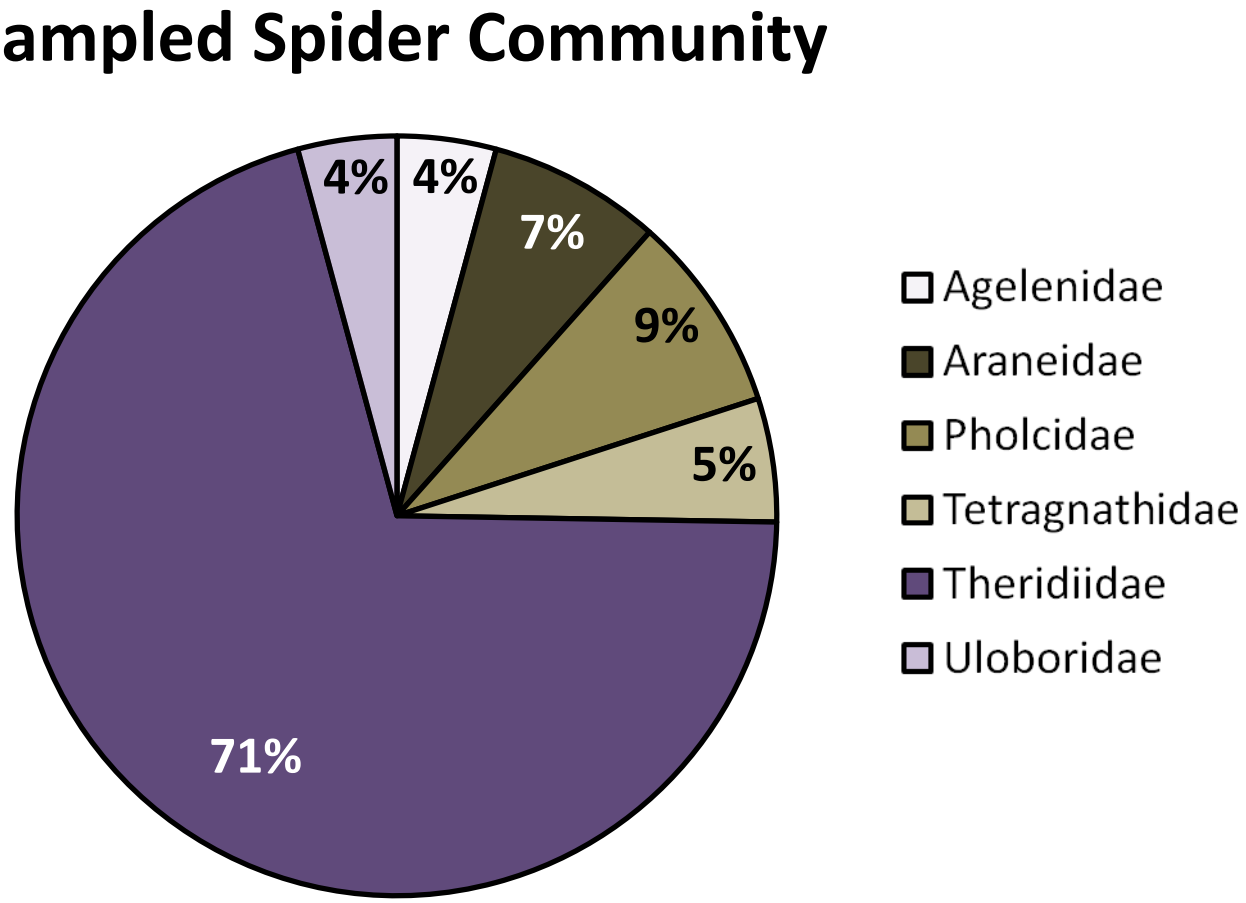
df = 2

$\chi^2 = 8.39$

$P < 0.02$

Chi-Square Pairwise

Results: Community Composition



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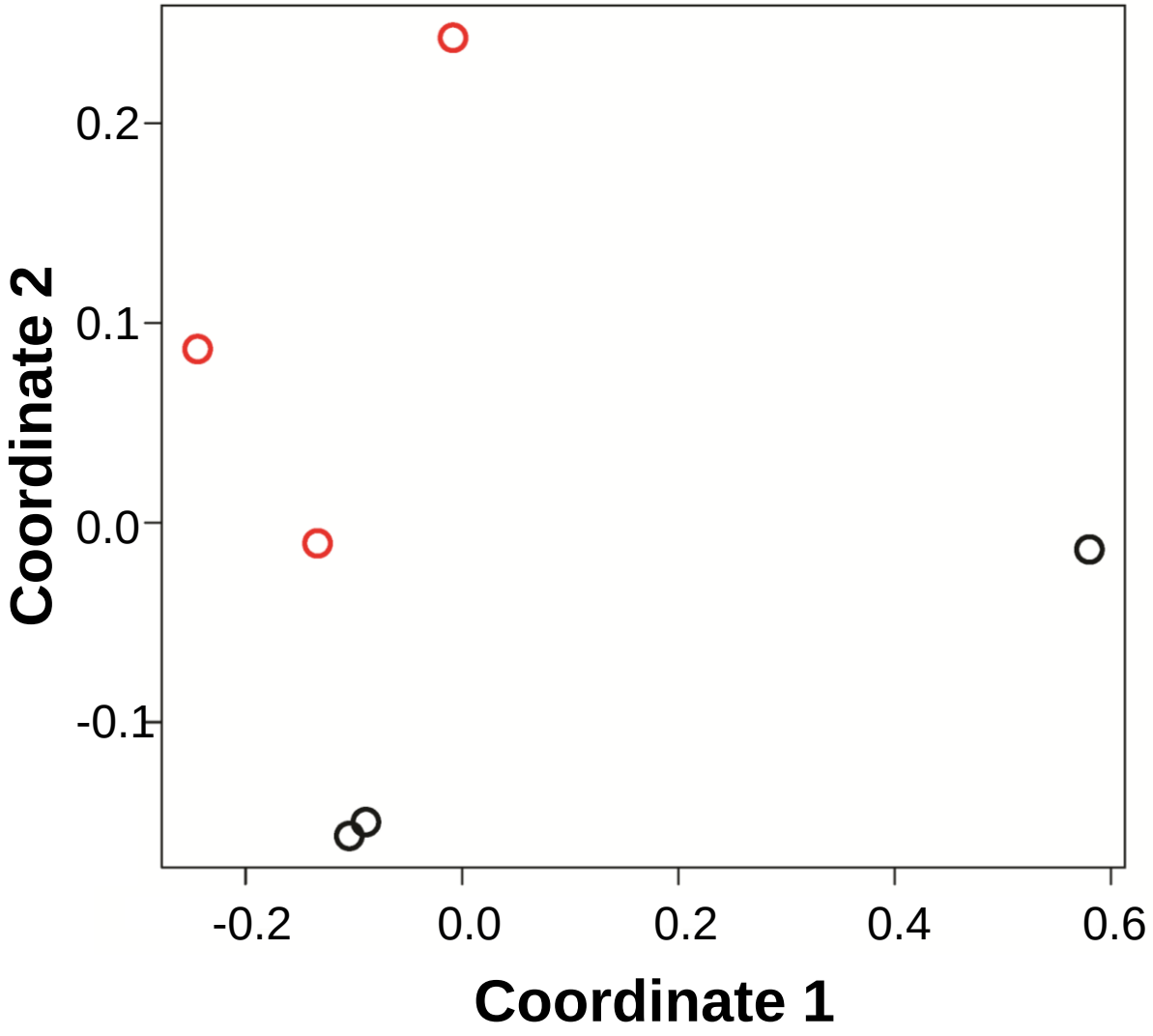


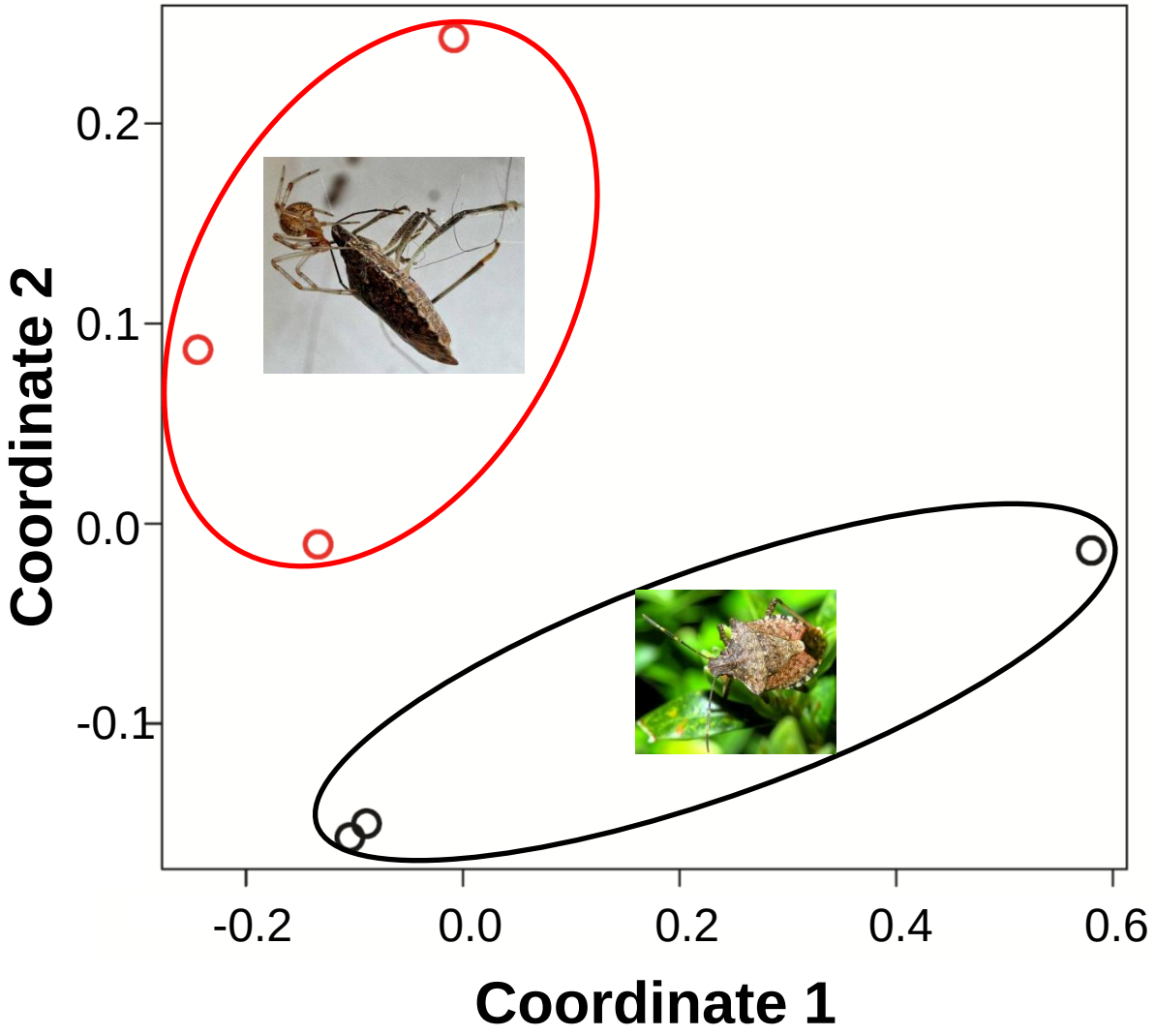
ANOSIM

Perm N = 10,000

R = 0.22

P < 0.05

Results: Community Composition



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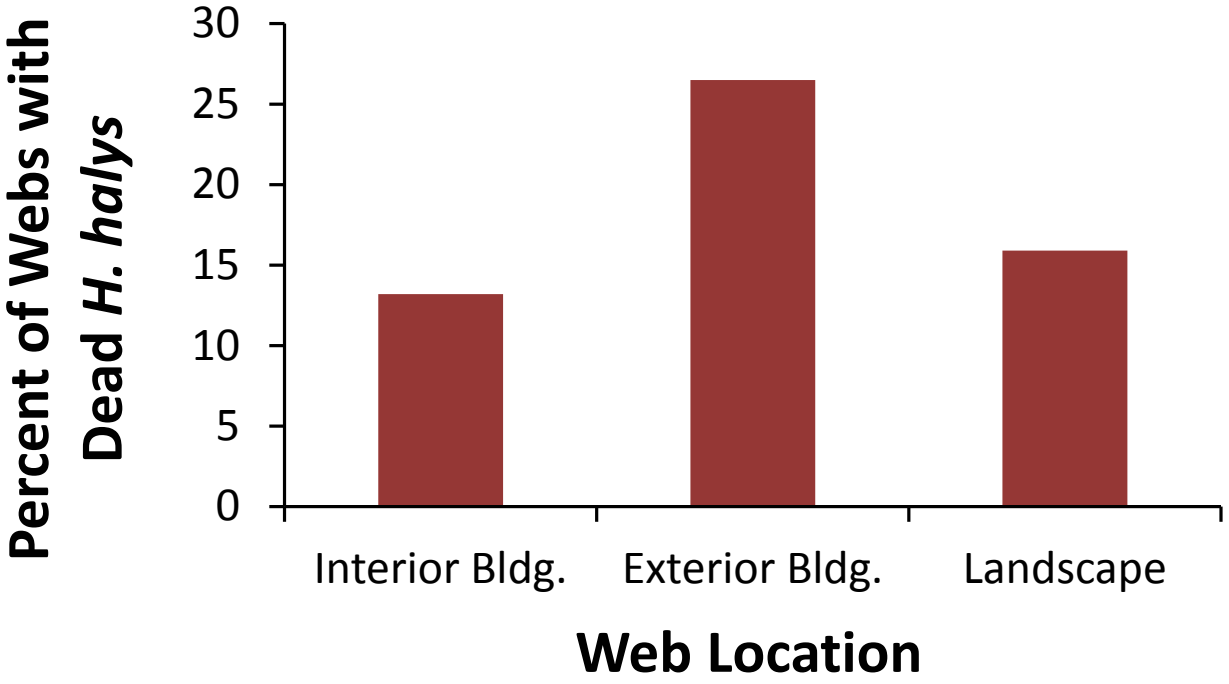
Methods: Background Predation

- Wild spider webs indoors were checked at a private residence in WV and AFRS in fall and spring 2015
- Wild spider webs outdoors were checked for several bushes at a private resdience in WV and AFRS at the end of the season in 2015.

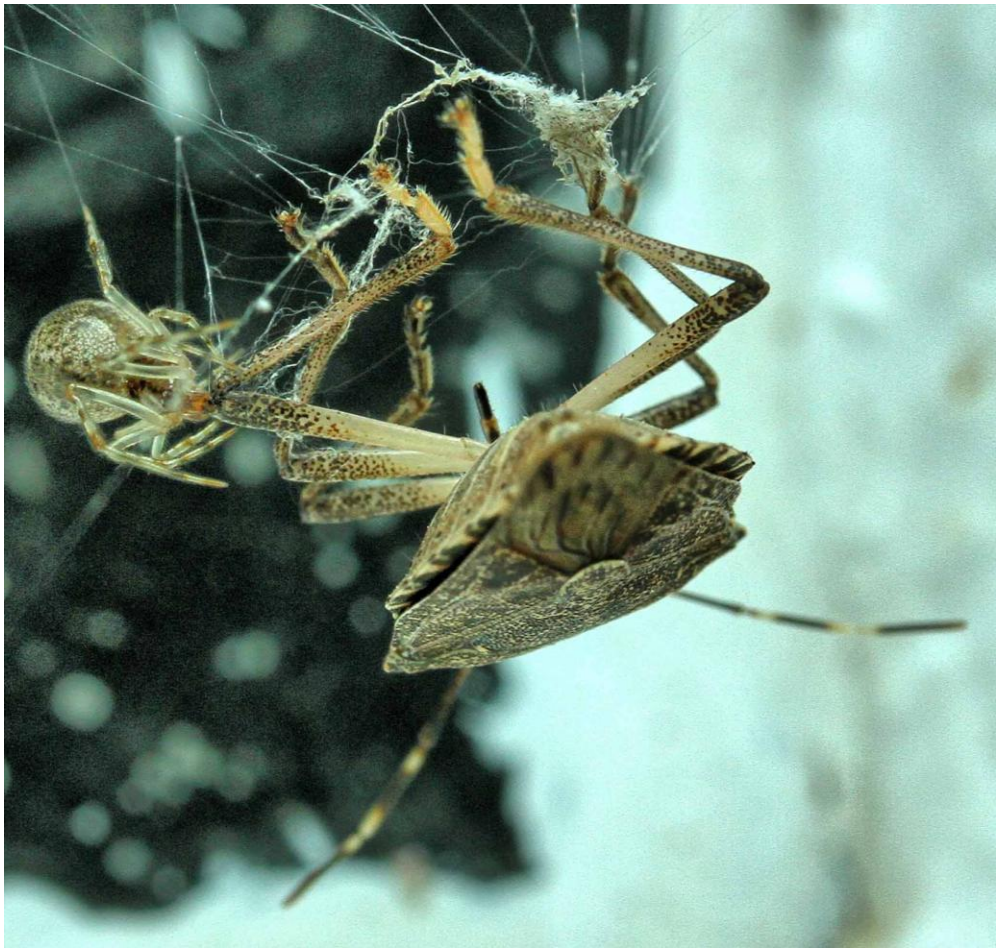
Results: Background Predation

n = 487 webs surveyed



Summary

- Larger spiders more likely to consume BMSB
- ~50% chance of a spider ensnaring and eating BMSB adult
- Top three spider taxa: Theridiidae, Pholcidae, Agelinidae
- Low background level of predation at ~18.5%



Implications

- Illustrates the benefit of having spiders in and around the house
- Natural enemies at overwintering sites may be helping to reduce population
- But, not enough to provide sufficient control alone

Future Directions

- What about other natural enemies at overwintering sites?

Acknowledgements

- USDA-ARS, USDA NIFA SCRI # 2011-51181-30937

United States Department of Agriculture
National Institute of Food and Agriculture

To learn more about this project and find links to BMSB information, visit StopBMSB.org