

# Occurrence of *Nosema maddoxi* in BMSB Populations in Eastern & Western States of the US

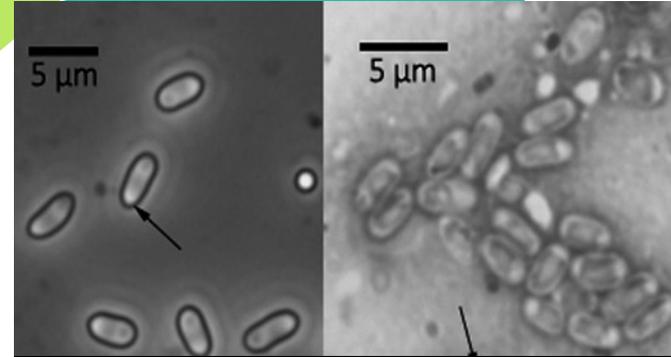
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# *Nosema maddoxi* (Microsporidia, Nosematidae)

- 🪲 An insect pathogen was discovered in Illinois by Joseph Maddox in 1970s in the green stink bug (*Chinavia hilaris*)
- 🪲 Described by Hajek et al. 2017 as *Nosema maddoxi*
- 🪲 Found in green stink bug, brown stink bug (*Euschistus servus*), dusky stink bug (*Euschistus tristigma*), and brown marmorated stink bug (BMSB)



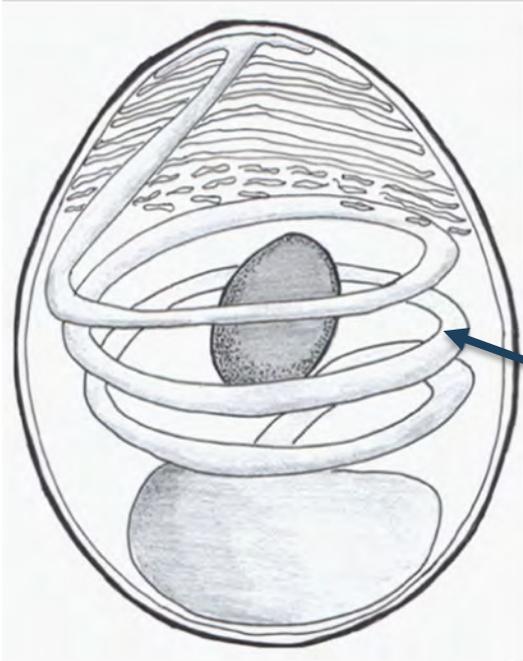
*N. maddoxi* spores

Hajek et al. 2018 *J. Eukaryot. Microbiol.*  
65: 315-330



BMSB

# What are Microsporidia?



Lallo, M.A. 2013

- Classified as Fungi; obligate unicellular parasites
- Microsporidia can be transmitted horizontally, vertically or both
- Key feature: polar filament
- Microsporidian infections known to decrease longevity, fecundity, and slow down nymphal development

# Microsporidia and biocontrol

- 🐛 *Antonospora* (= *Paranosema*) *locustae* can effectively control rangeland grasshopper populations
- 🐛 Produced in the US and available commercially as a bait
- 🐛 Microsporidia occur naturally in the environment
- 🐛 Known to decrease populations of numerous insect pests



# Insect Lab Colonies

- Microsporidia infections have been known to cause the collapse of insect colonies
- In Honey bees: *Nosema apis* and *Nosema ceranae*
- Silkworm industry: *Nosema bombycis*
- BMSB lab colonies: *Nosema maddoxi*



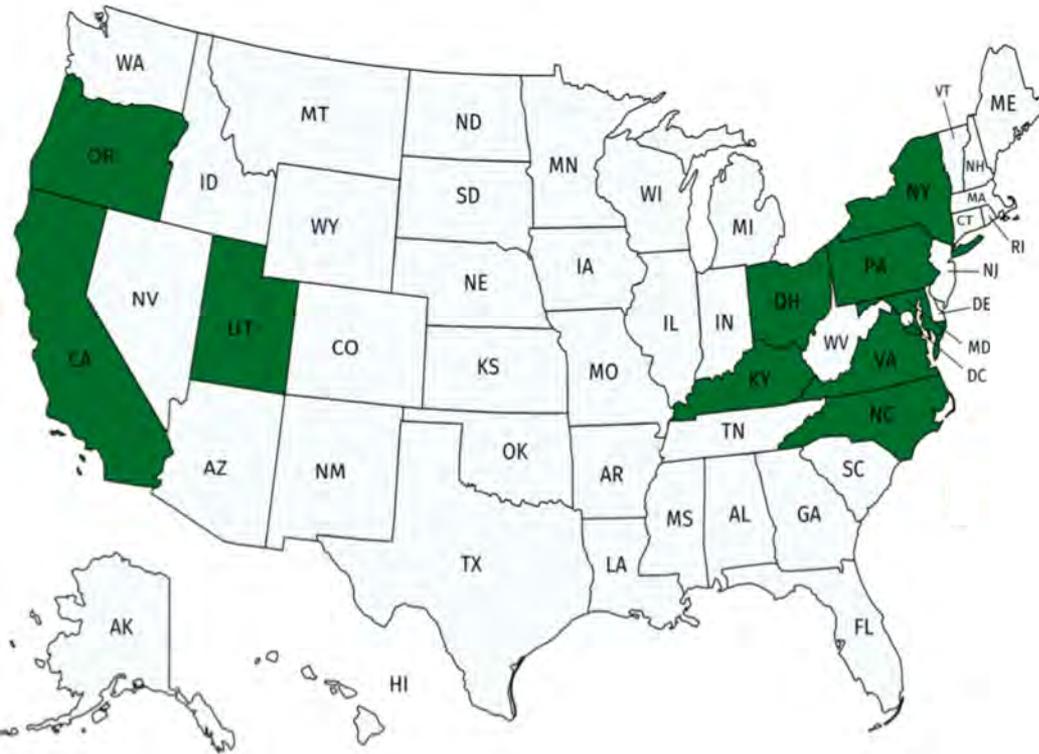
# Questions asked

- Where is *Nosema maddoxi* found in BMSB populations in the US?
- Is there an association between BMSB population density and the % infected?
- Is one sex infected more than the other?
- Are there physical features that are visible on an individual to indicate a *Nosema maddoxi* infection?



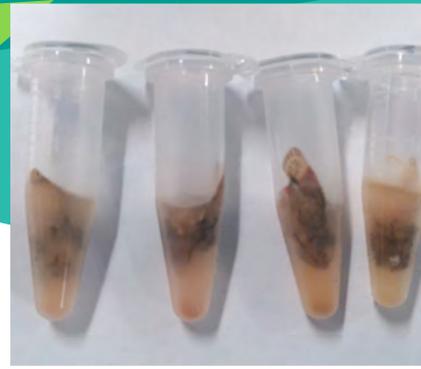
# Methods

## 2017 Field Survey/ Collections



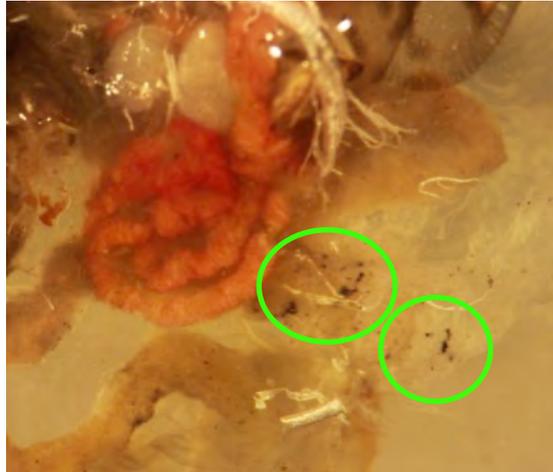
-  Date collected
-  Site location
-  Population density (1-5)
-  BMSB samples collected in 10 states (30 sites and 46 collections)

# Methods



- 5 fields of view (FOV) at 400X with phase contrast
  - High intensity infection  $\geq 21$  spores (FOV average)
  - Low intensity infection 1-20 spores (FOV average)
- All collections used for distribution analysis
- All Sept. collections (16) used for density/sex analyses
  - Average # samples/site: 90 bugs (15-278 bugs per site)

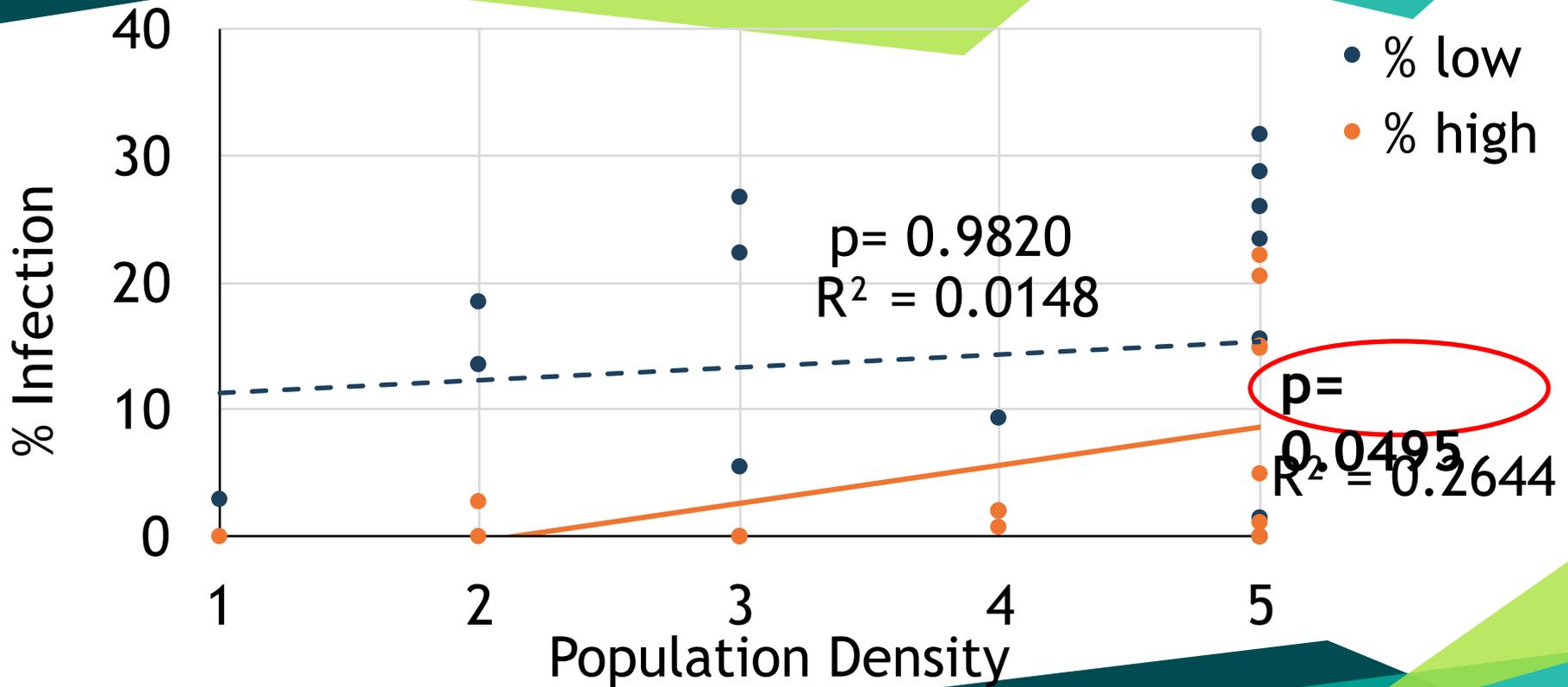
# Physical features of infection



- 🐛 In 2017 found several BMSB infected and with brown spots
- 🐛 Brown spots were from tissue melanization seen through the cuticle

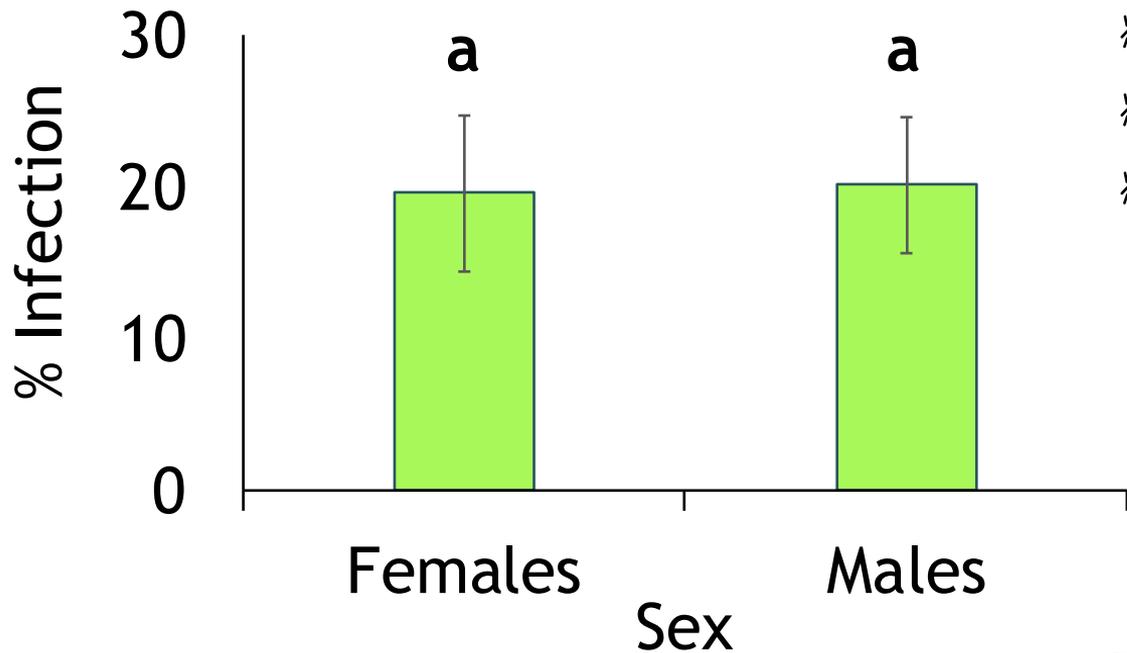


# High and low intensity infections compared to BMSB population density



# One sex was not infected more frequently than the other

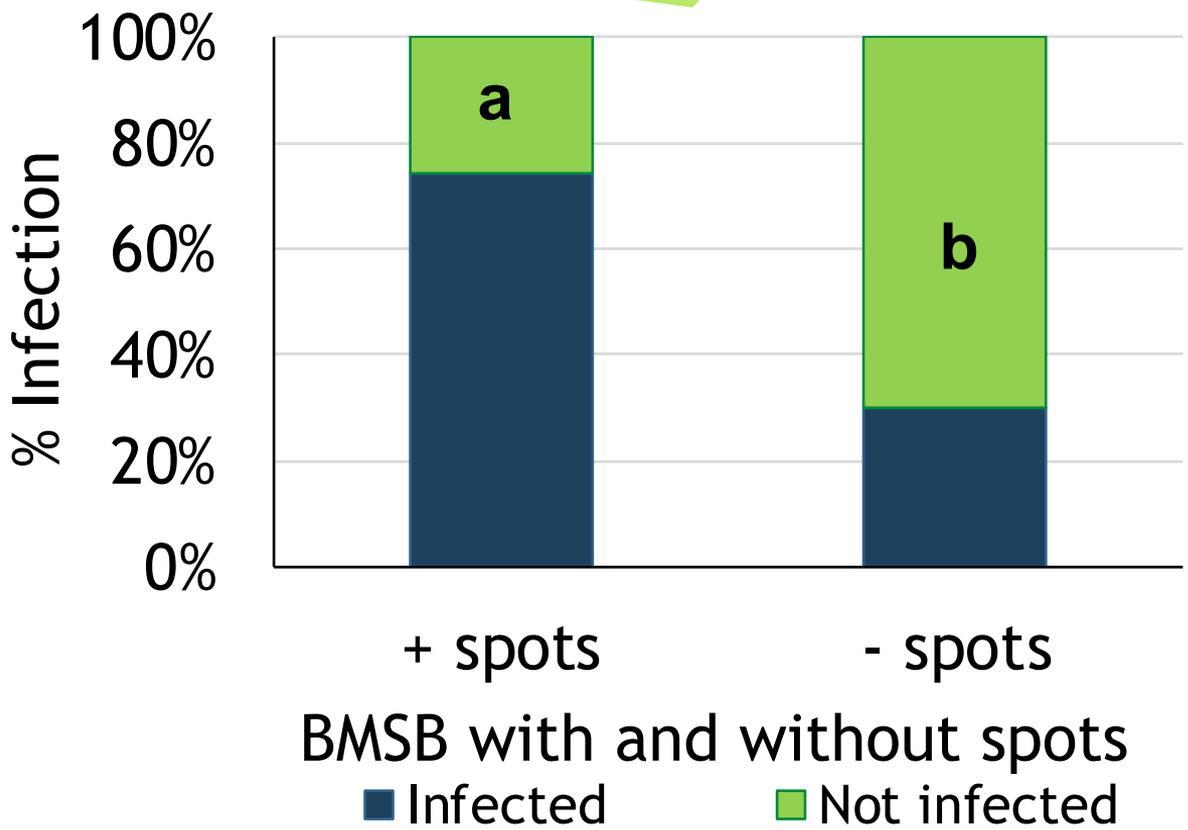
*N. maddoxi* infection and sex



- ♂ Total males: 750
- ♀ Total females: 675
- ♂ Not significant:  $p=0.849$



# Presence of brown spots in BMSB and infection



 Total of 62 bugs with spots and 70 without spots

$p < 0.0001$ , Chi-square

# Summary

- 🪲 *N. maddoxi* was found in every state where BMSB populations were sampled
- 🪲 As BMSB population density increased, the percentage of high-intensity infections increased
- 🪲 *N. maddoxi* infection levels did not differ according to sex
- 🪲 Brown spots can *potentially* indicate the presence of infection, but not always. Microscopy or a molecular diagnosis are required to confirm

# Stay tuned...

Effects of *N. maddoxi* on:

- 🐛 BMSB nymphal development
- 🐛 BMSB adult survival
- 🐛 BMSB female fecundity

Also looking at:

- 🐛 Seasonality of *N. maddoxi* infection in BMSB populations



# Acknowledgments

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