

Host plant effects on *Halyomorpha halys* (Hemiptera: Pentatomidae) development and survival



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1.8 Diet Optimization and Physiological Status of BMSB and 2.1.2 Monitoring Movement of Nymphs

Orchard Crops



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Collaborating Institutions



Cornell University



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Objectives and sub-objectives

Objective 1. Establish knowledge of BMSB biology, ecology and behavior in specialty crops

1.8 Diet Optimization and Physiological status of BMSB

Objective 2. Develop monitoring and management tools for BMSB

2.1.2 Assess other types of monitoring tools (nymphal movement)

The PEST

Nuisance pest



Agricultural pest



IMPACT ON TREE FRUIT PRODUCTION



Feed and reproduce on wild tree hosts bordering orchards



What are the tree species growing in the wooded areas surrounding orchards in Virginia and West Virginia?

ORCHARD

WOODLOT

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GOO

Orchards surveyed

2 sites

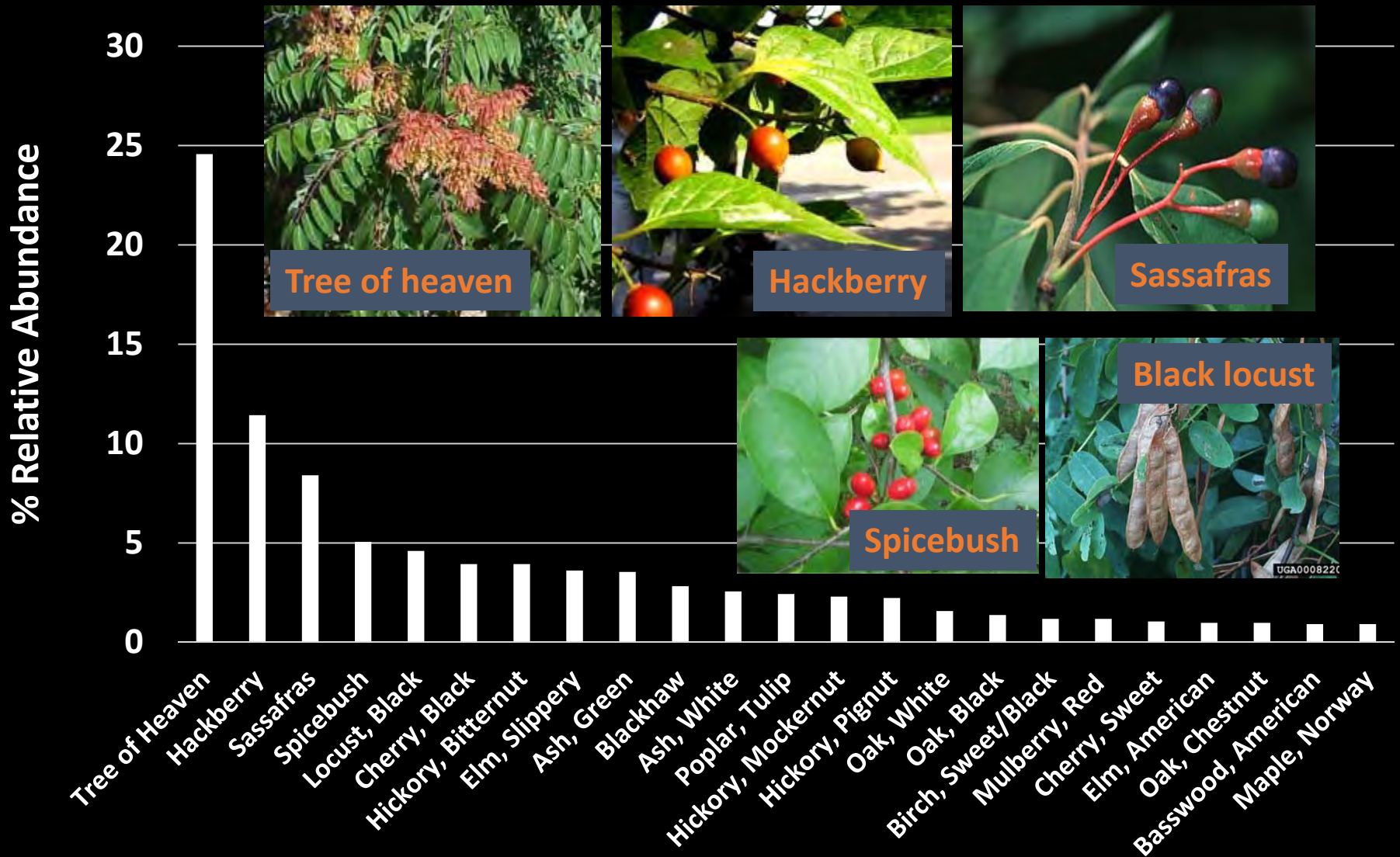
7 sites

3 sites

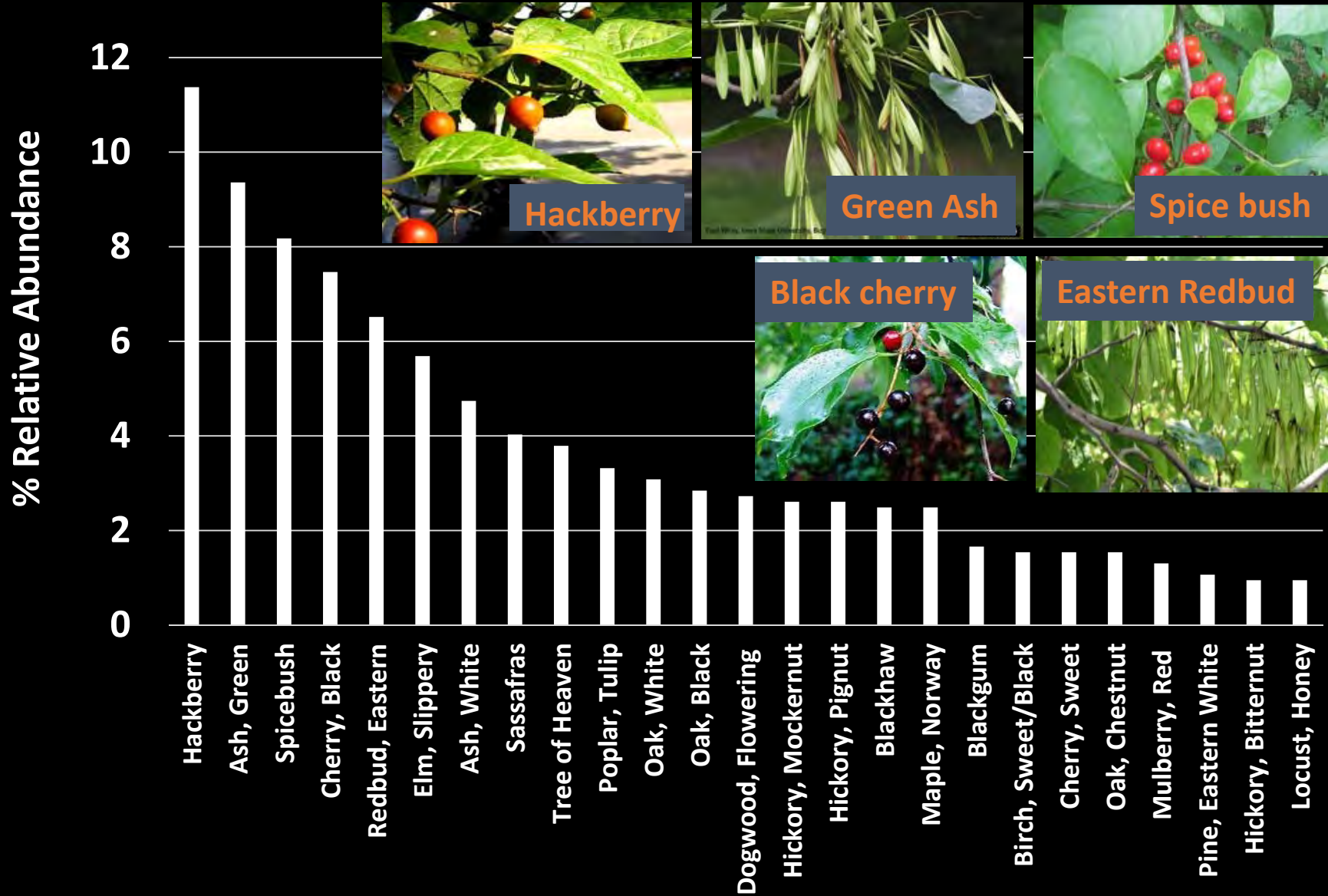
3 sites



EXTERIOR: TOP 5 Most abundant



INTERIOR: TOP 5 Most abundant



**Determine the relative suitability of selected fruit trees
and wild hosts on BMSB development and
survivorship**

Tree fruit hosts:



Apple



Peach

Wild hosts:



Catalpa

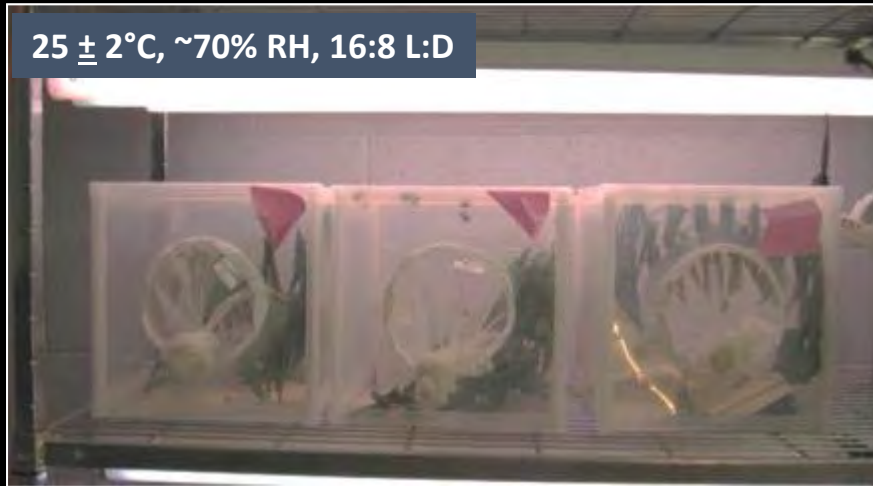


Tree of heaven

**Determine the relative suitability of selected fruit trees
and wild hosts on BMSB development and
survivorship**

- ◆ Are reproductive structures important for BMSB development and survival?
- ◆ Are mixed diets better for BMSB development and survival?
- ◆ Does host plant suitability vary between early and late season?

Methods: Egg collection



Mating cages with field-collected adults



Tree of heaven foliage as oviposition substrate



1 egg mass (~28 eggs)/treatment



Individual egg masses in diet cups

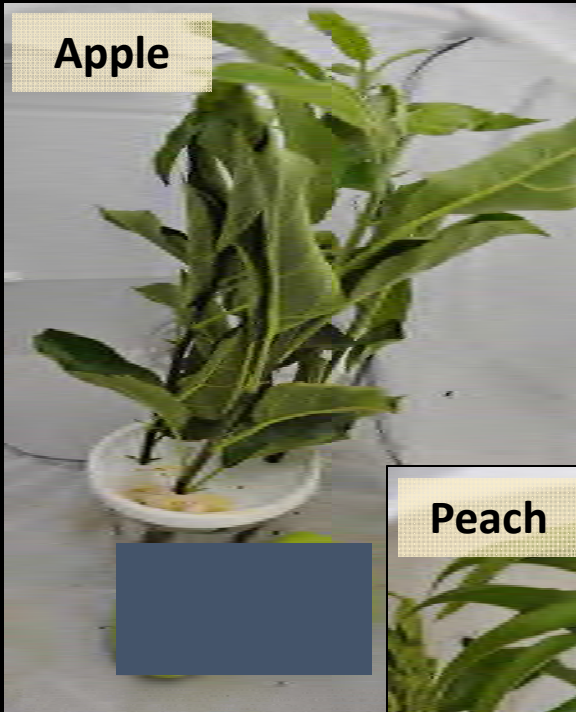
We measured and compared...

- ◆ Survivorship
- ◆ Developmental time
- ◆ Adult live body weight
- ◆ Adult pronotal width (size)

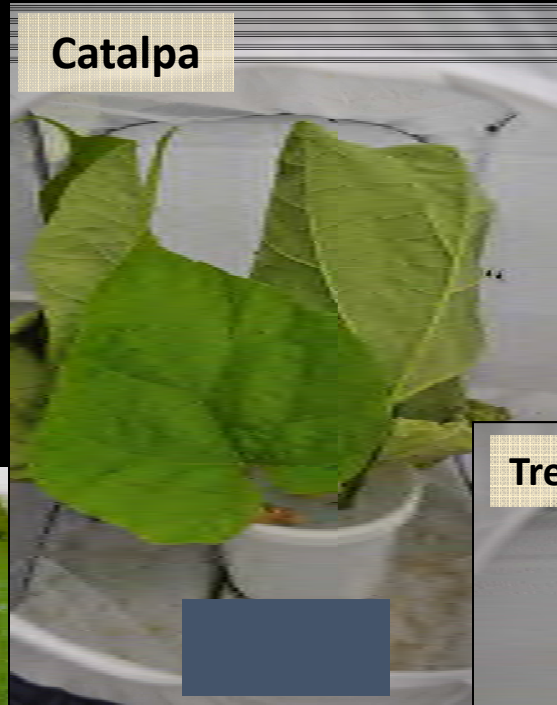


FOLIAGE + REPRODUCTIVE

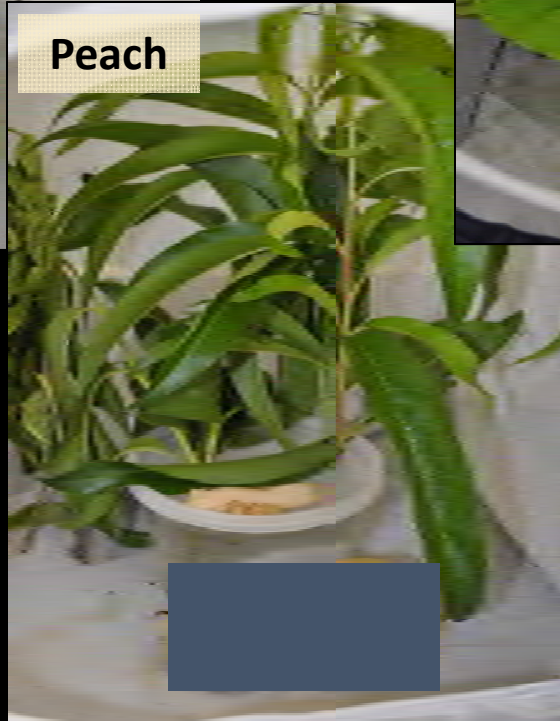
Apple



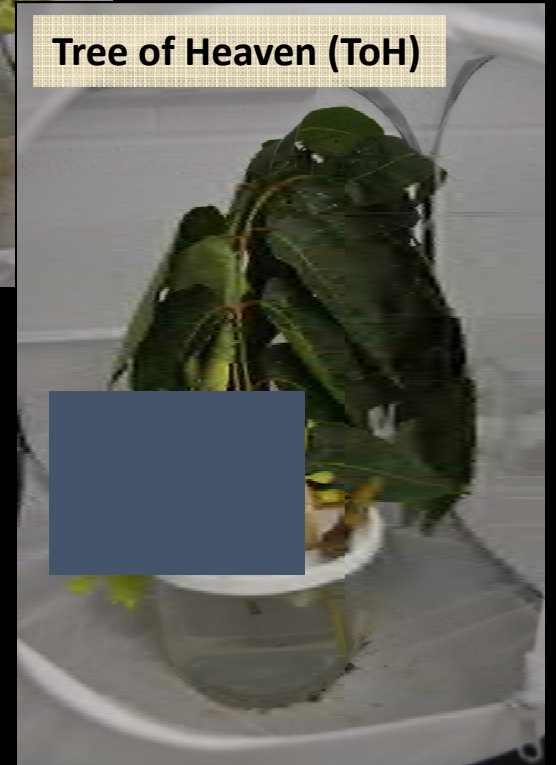
Catalpa



Peach



Tree of Heaven (ToH)



SINGLE

Apple



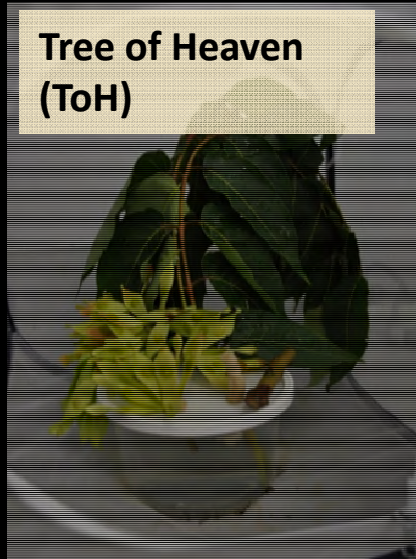
Catalpa



Peach

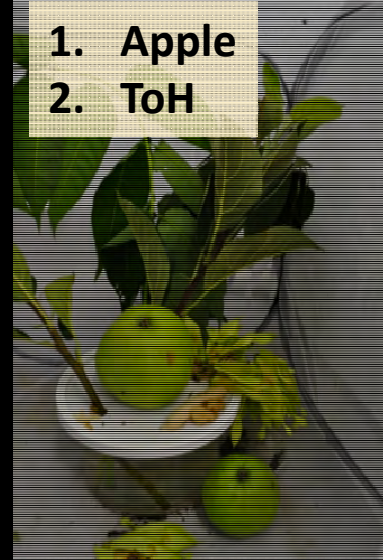


**Tree of Heaven
(ToH)**

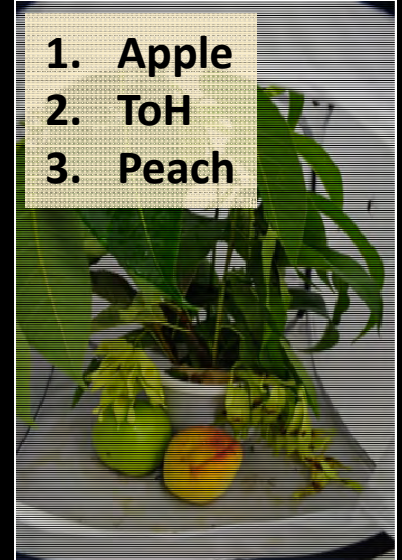


MIXED

1. Apple
2. ToH



1. Apple
2. ToH
3. Peach



1. Apple
2. ToH
3. Peach
4. Catalpa



Methods

Plant materials collected from the field and replaced at 3- to 4-day intervals

2nd experiment conducted twice:
early and late- season

Reproductive structures used were dependent on their availability in the field.

ToH reproductive structures:



Early June

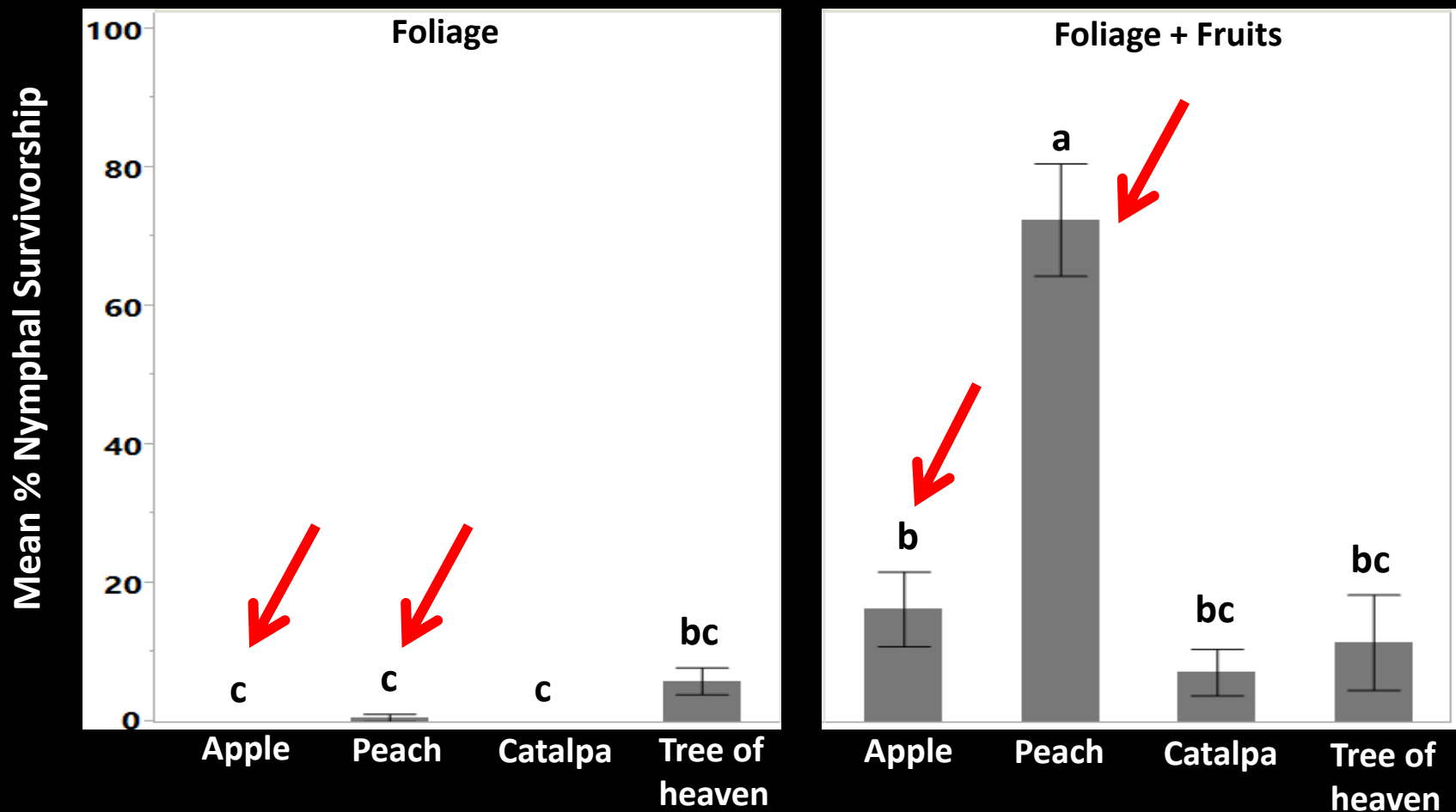
mid-June to early-September

Mid-September to Nov.



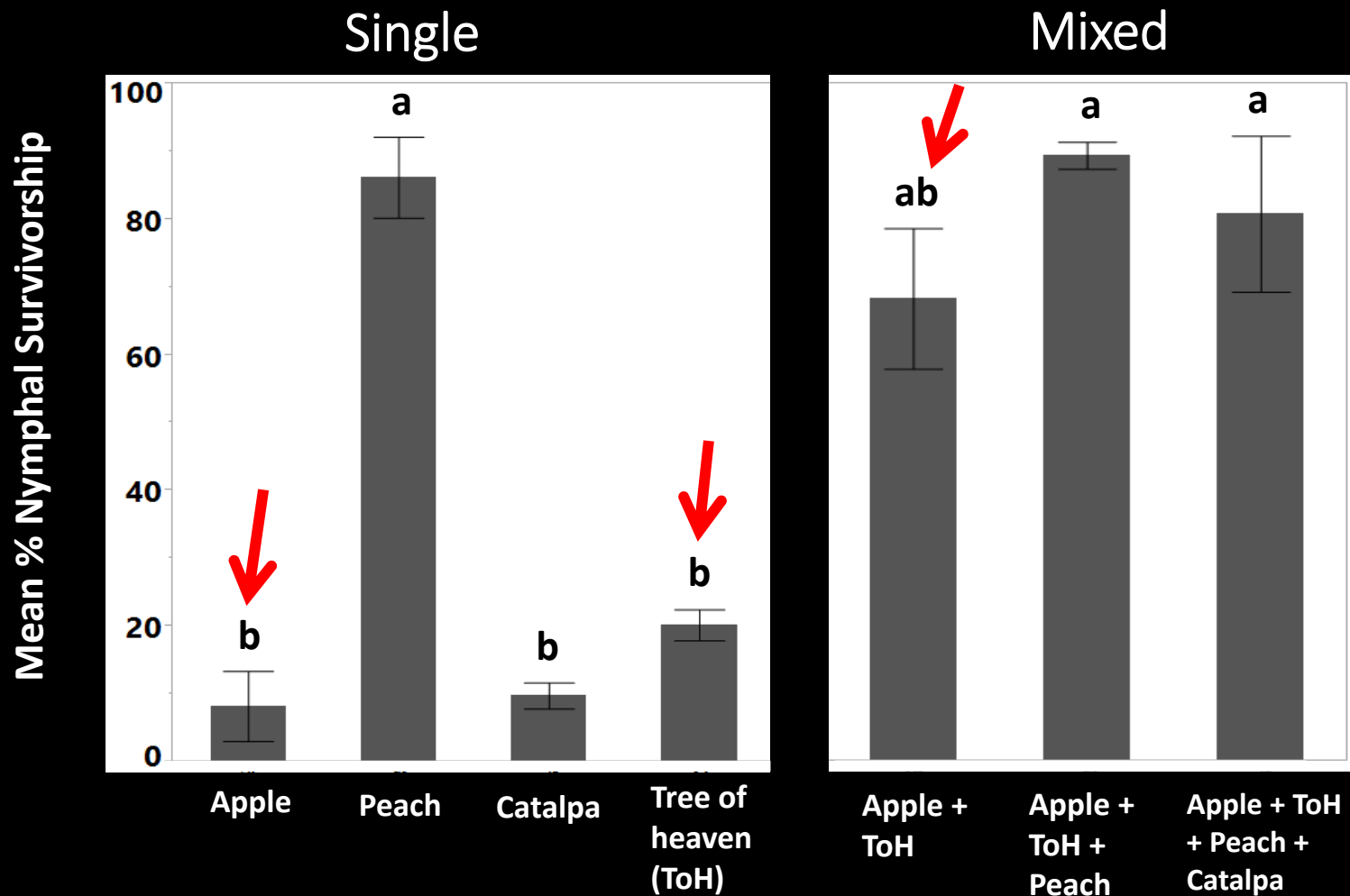
RESULTS

- ◆ Are reproductive structures important for BMSB development and survival?



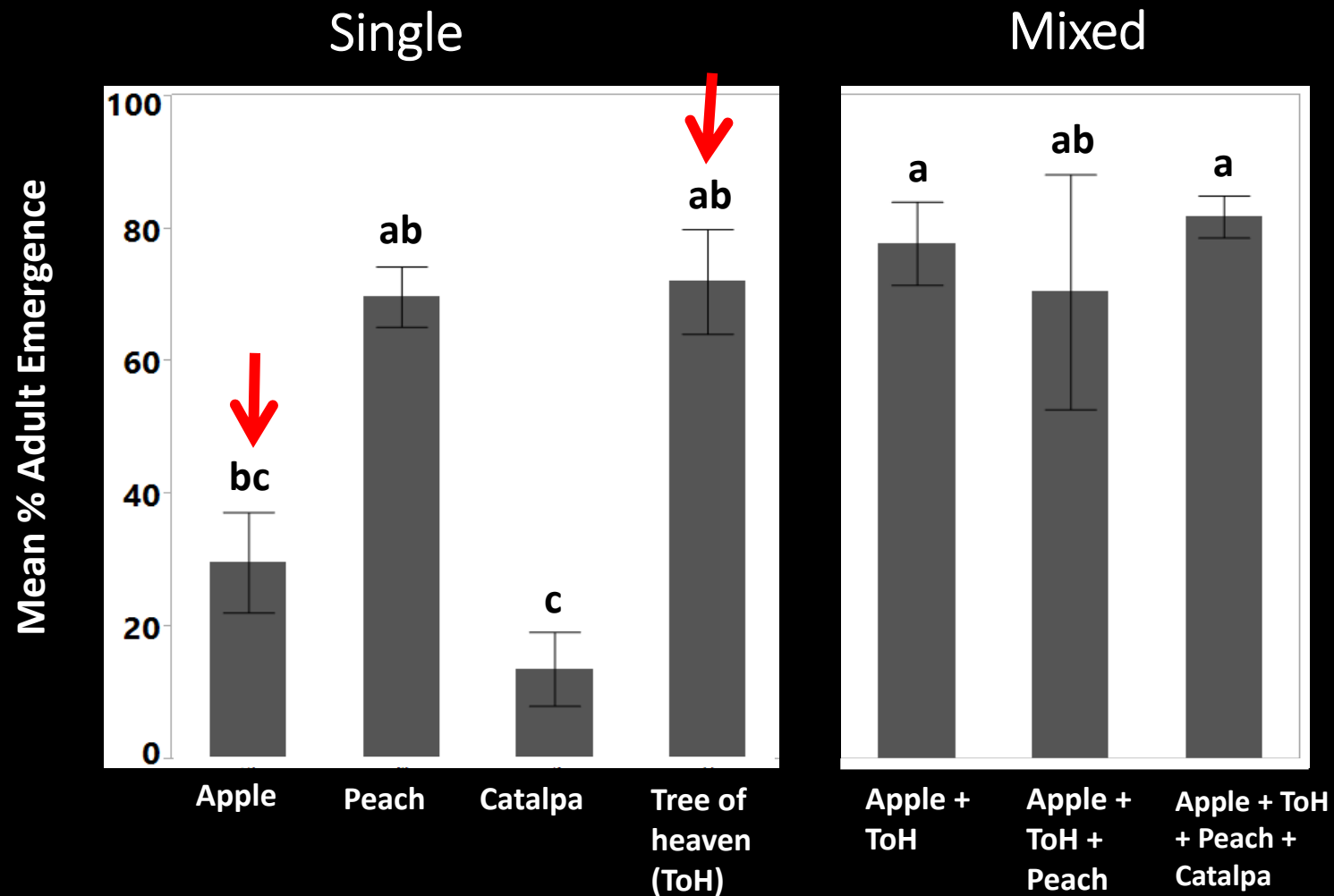
RESULTS

- ◆ Are mixed diets better for BMSB development and survival earlier in the season?



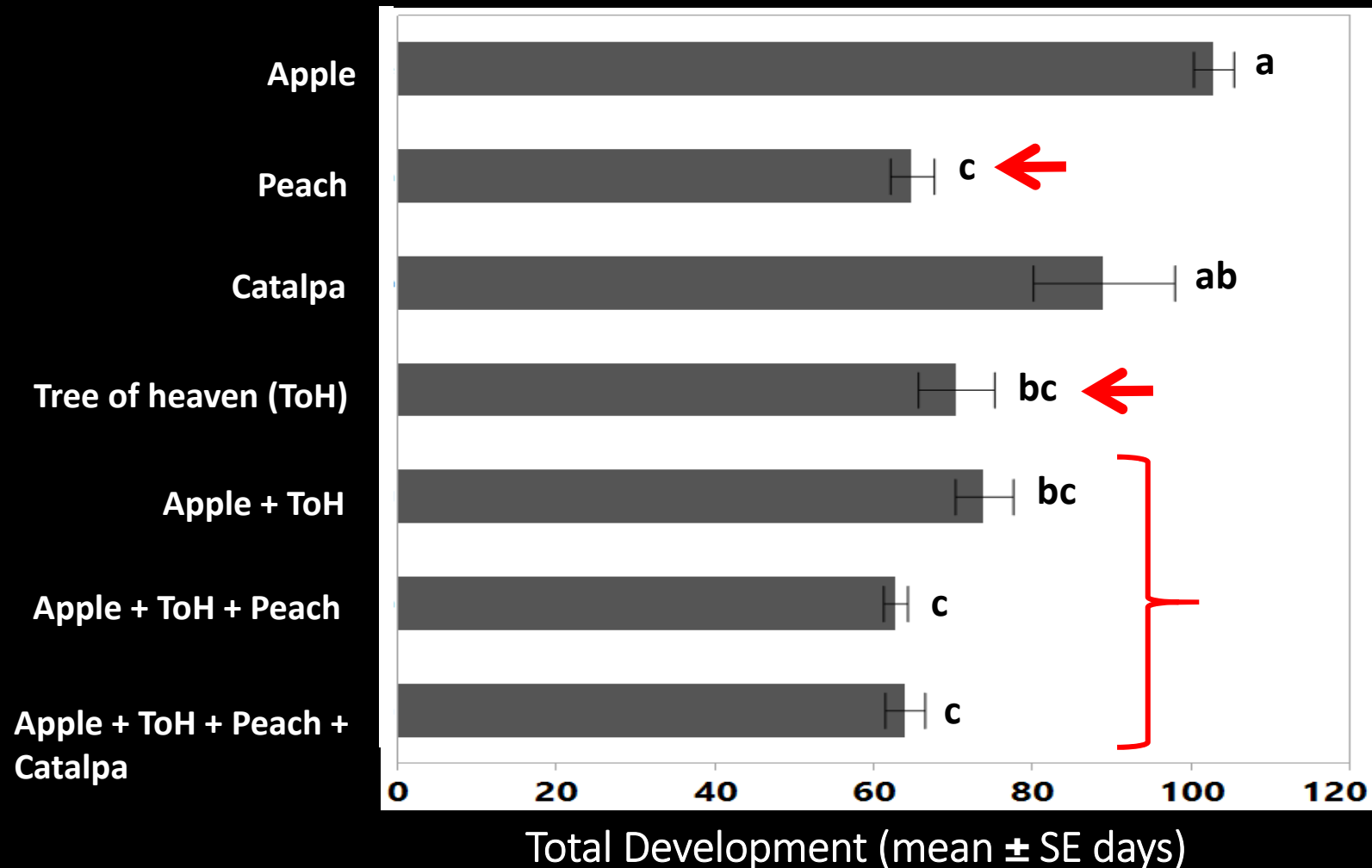
RESULTS

- ◆ Are mixed diets better for BMSB development and survival later in the season?



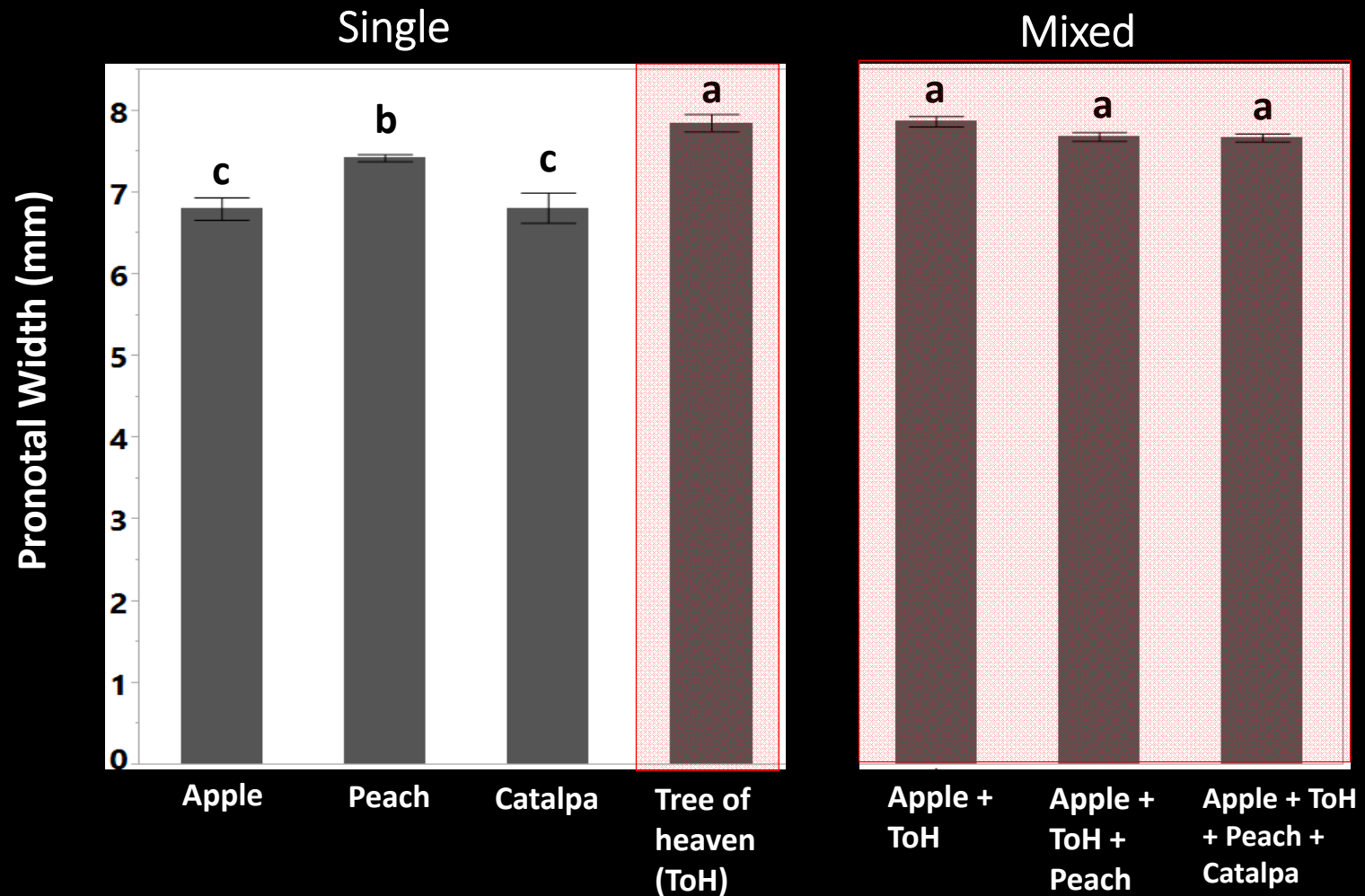
RESULTS: Developmental Time

- ◆ BMSB developed faster on mixed diets and single diets of peach and ToH
- ◆ Longer development on single diets of apple and catalpa



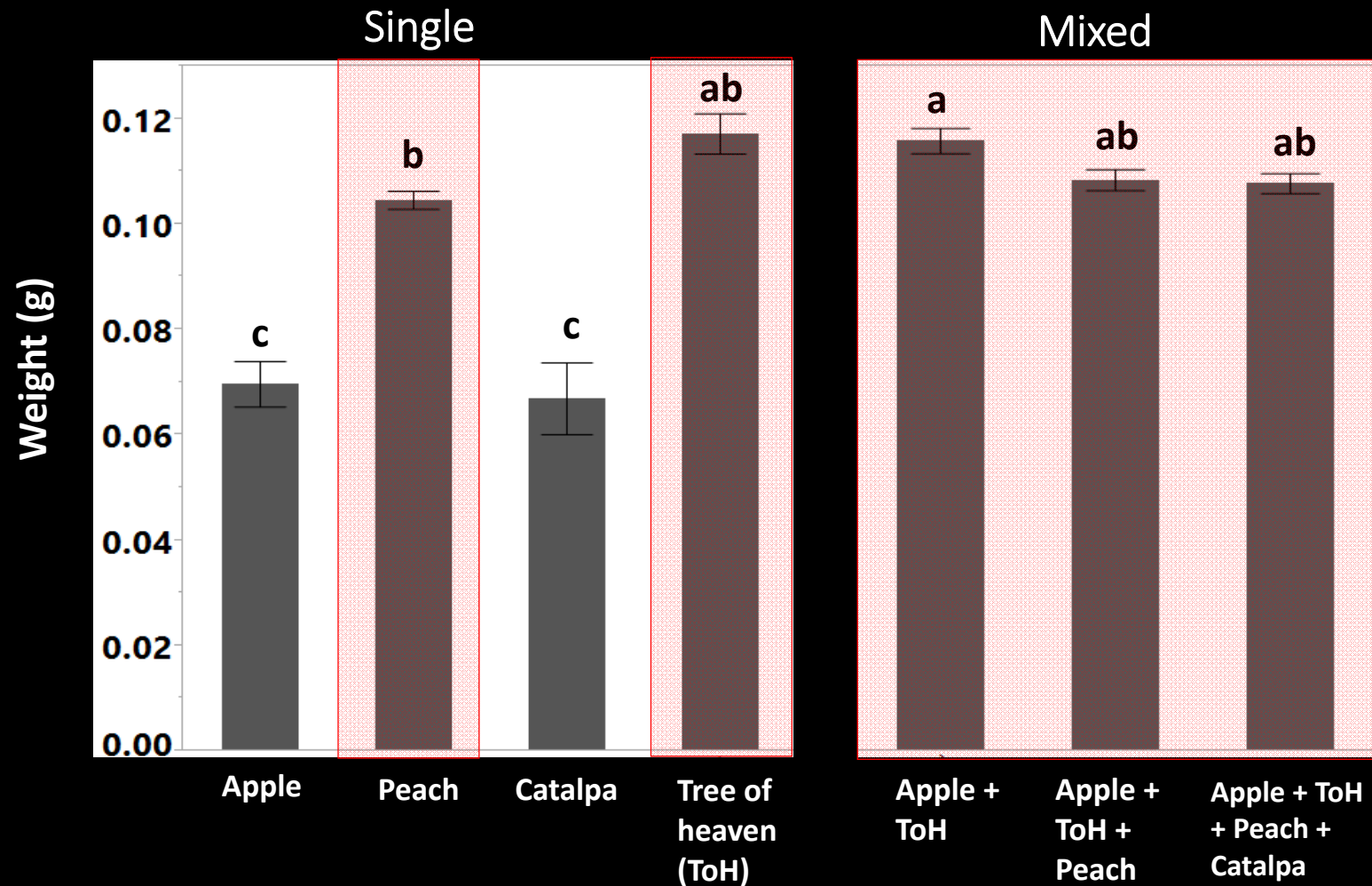
RESULTS: Size

- ◆ Adults reared on mixed diets and ToH (single diet) were larger



RESULTS: Weight

- ◆ Adults reared on mixed diets and single diets of ToH and Peach were heavier



RESULTS SUMMARY

- ◆ **Mixed diets proved to be optimal for nymphal survivorship and development**
 - ◆ **Nymphs reared on mixed diets and ToH resulted into bigger and larger adults**
- ◆ **Peach appeared to be the most suitable single host for BMSB development among the host plants tested**
- ◆ **Tree of heaven showed higher suitability toward the latter part of the growing season**
- ◆ **Implications on nymphal dispersal and movement?**

RELATED RESEARCH QUESTION

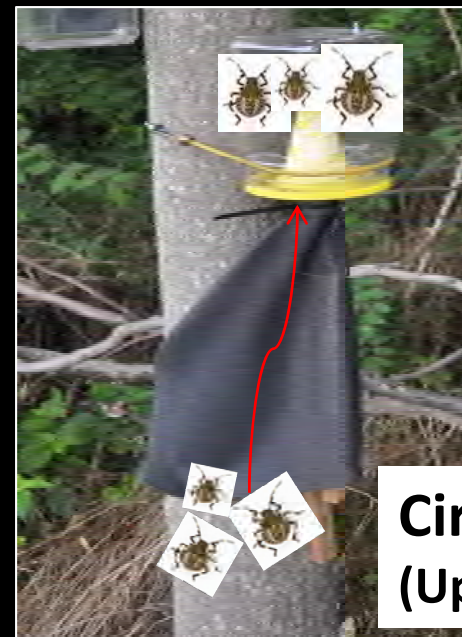
Strong nymphal dispersal capacity

Monitor movement of nymphs onto and from tree hosts at the orchard-woodland interface

Does nymphal movement vary among wild and cultivated tree fruit hosts?



**M&M
(Down Trap)**



**Circle
(Up Trap)**

EXPERIMENTAL SET-UP

- Sites: 2 peach and 3 apple orchards
- Traps installed on fruit and wild tree hosts
- Checked weekly mid-May to mid-October
- BMSB nymphs and adults counted

- Apple or Peach
- Tree of heaven
- Other wild hosts

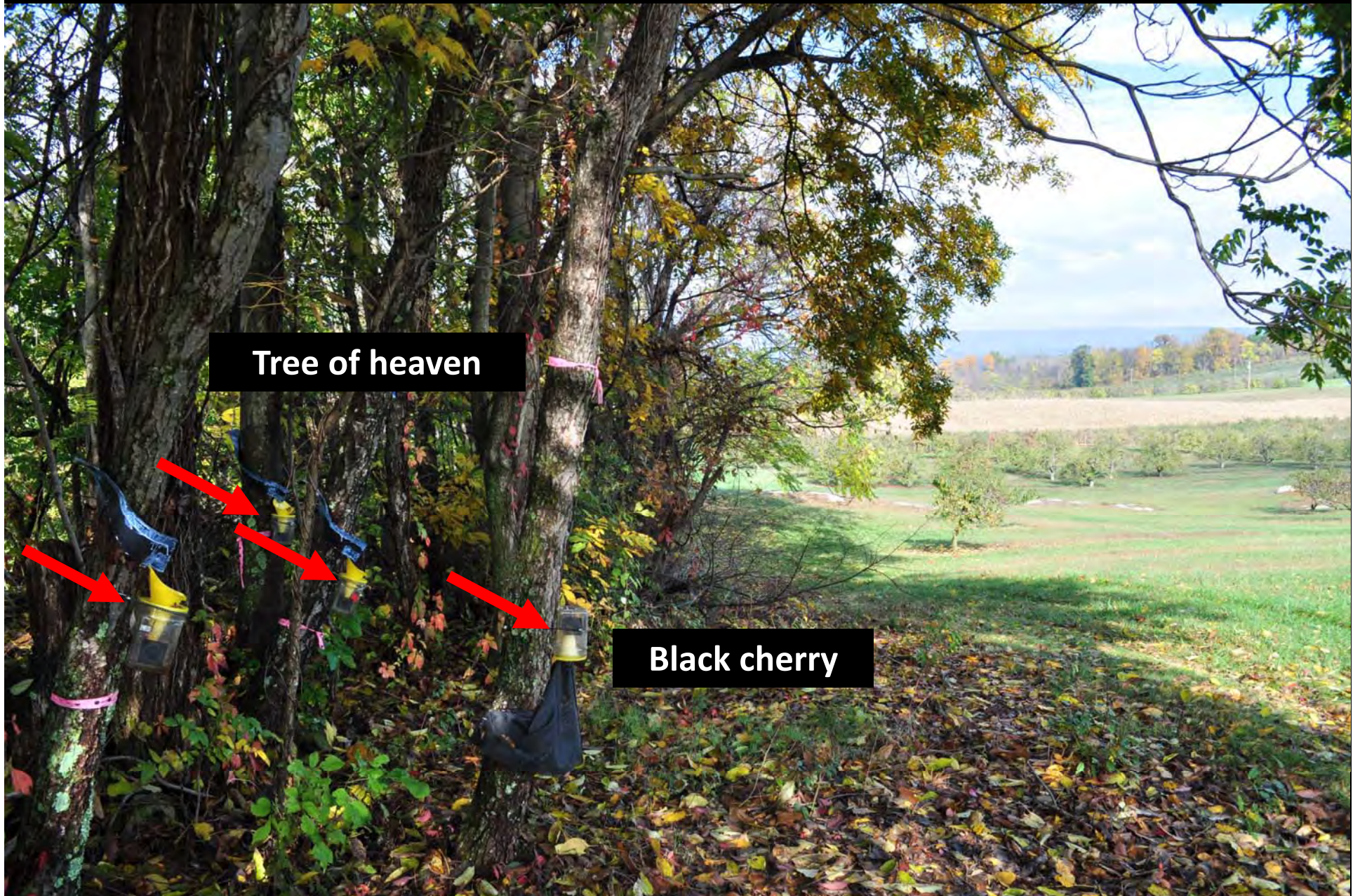


Traps on tree fruits



Peaches

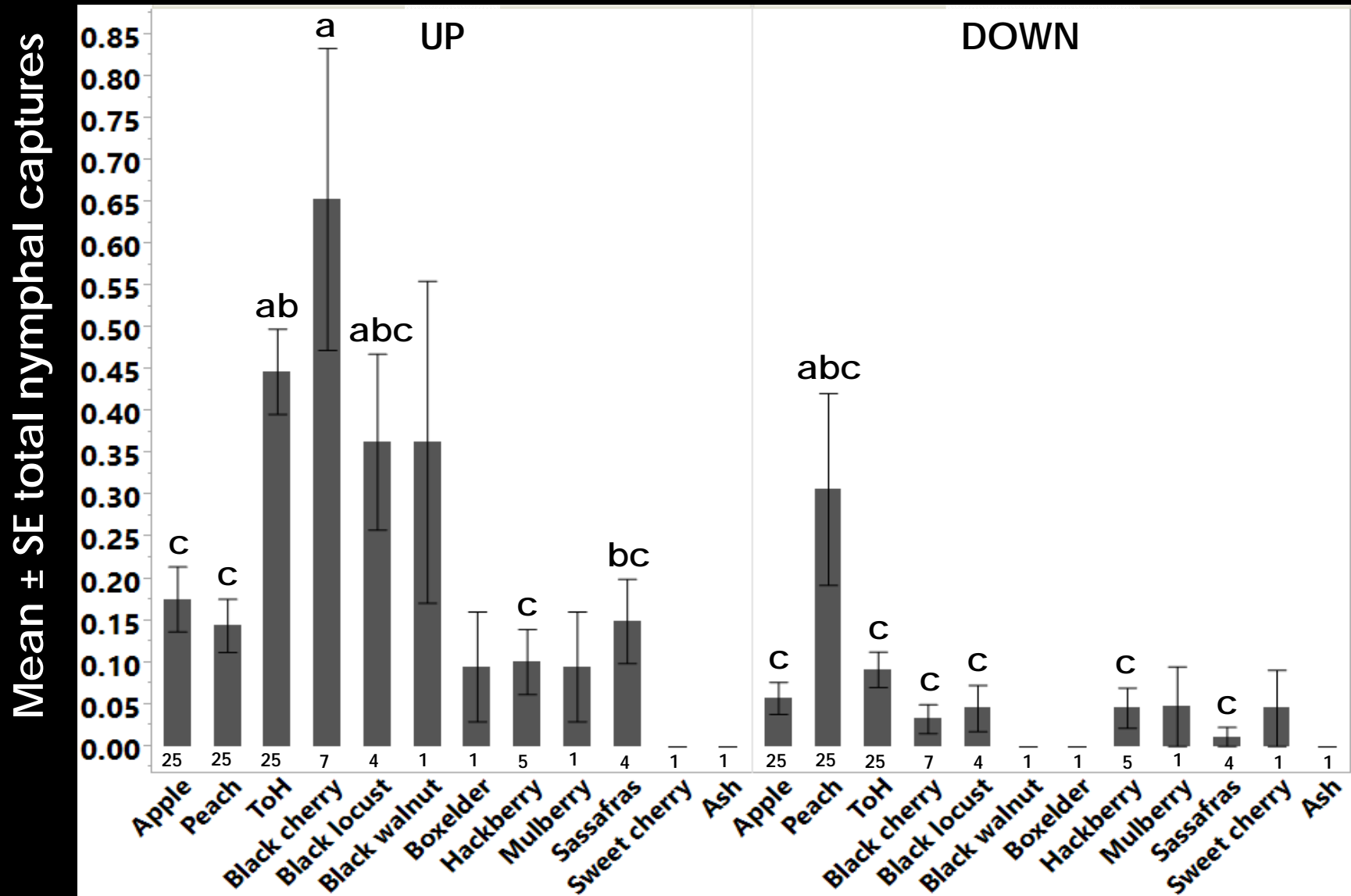
Traps on wild hosts



Tree of heaven

Black cherry

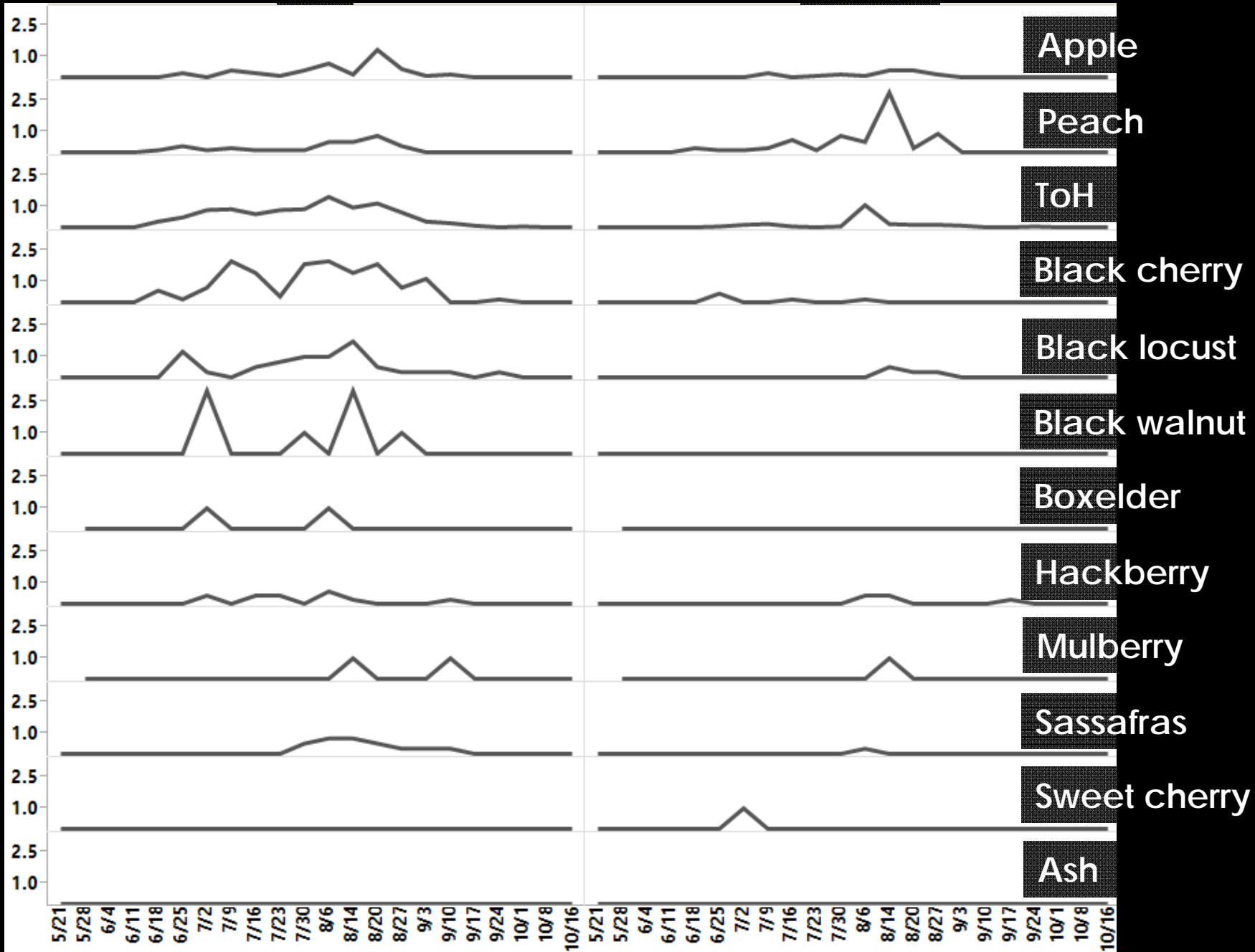
RESULTS: Varying nymphal movement among wild and fruit tree hosts



Mean weekly nymphal captures

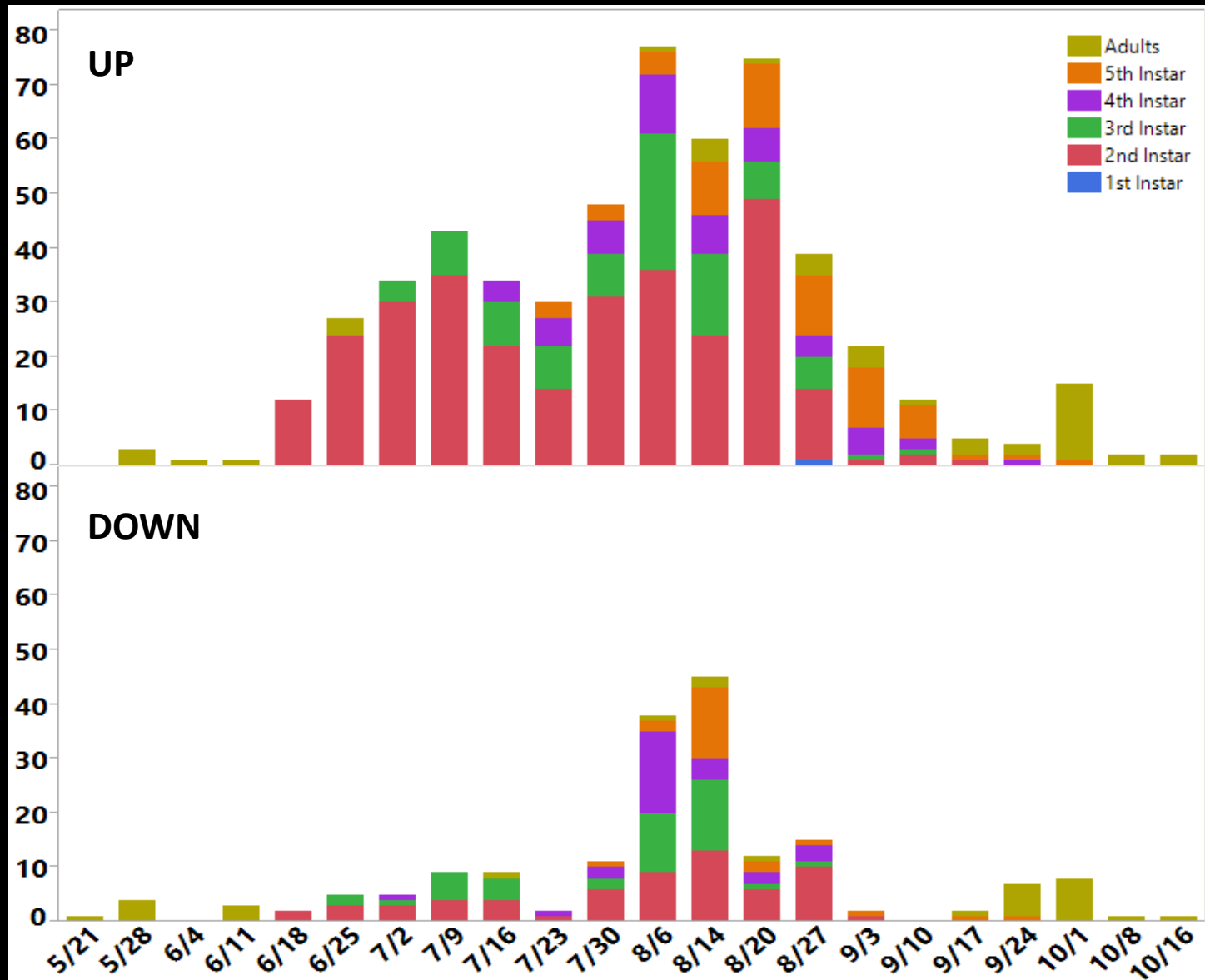
UP

DOWN

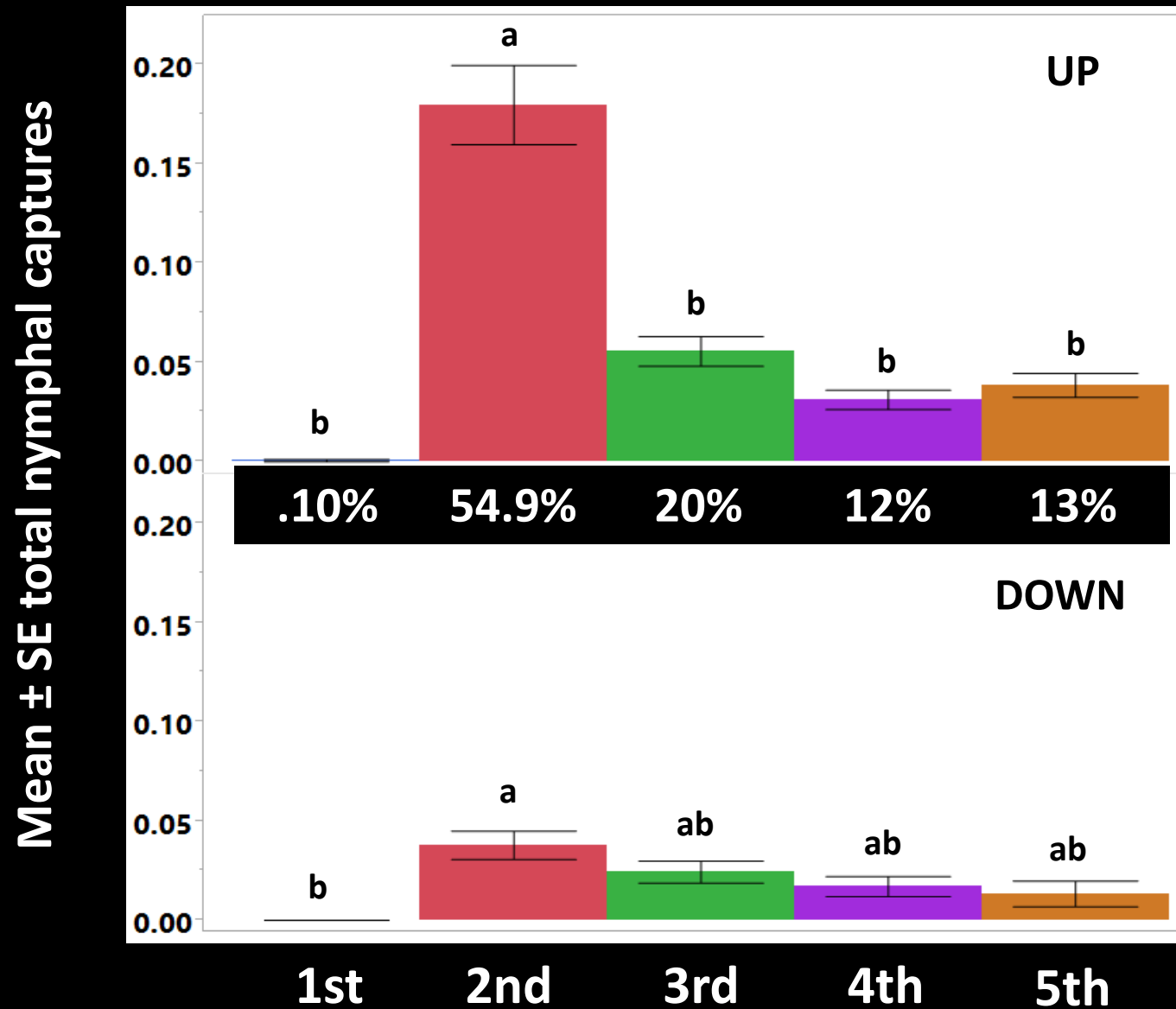


RESULTS: Varying nymphal instar distribution

Total weekly BMSB captures



RESULTS: Mostly 2nd instar nymphs



Where we go next...

◆ 1.8 Diet Optimization and Physiological Status of BMSB

Nutrient content analyses of stink bugs reared on different diets

Host choice experiments

◆ 2.1.2 Monitoring Movement of Nymphs

Seasonal differences need to be verified during another field season

Implications

- ◆ Movement monitoring (nymphs)
- ◆ Modeling population dynamics (host plant effects)
- ◆ Development of temporally- and spatially-precise management approaches for BMSB

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