Brown marmorated stink bug *Halyomorpha halys* (Hemiptera: Pentatomidae), development and survival on single and mixed diets of selected fruit trees and wild hosts

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Highly polyphagous: agriculturally important crops and wild hosts

Knowledge gap:
The relative suitability of different hosts on BMSB development and survival is unknown
OBJECTIVE

To investigate the development and survivorship of *H. halys* on single and mixed diets of tree fruits and wild tree hosts

Tree fruit hosts:
- Malus domestica
  - Apple
- Prunus persica
  - Peach

Wild hosts:
- Catalpa speciosa
  - Catalpa
- Ailanthus altissima
  - Tree of heaven
Mixed diets are more suitable for *H. halys* development and survivorship than single diets.
METHODS: EGG COLLECTION

Mating cages with field-collected adults

Tree of heaven foliage as oviposition substrate

1 egg mass (~28 eggs)/treatment

25±2°C, ~60% RH, 16:8 L:D
DIET TREATMENTS: SINGLE

Apple

Peach

Catalpa

Tree of Heaven (ToH)
DIET TREATMENTS: 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
✓ Experiment conducted twice:
  ✓ Early-season – early June
  ✓ Late-season – mid-August (ongoing)
✓ 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.
RESPONSE VARIABLES

Developmental parameters:
- Adult emergence
- Stage-specific survivorship
- Developmental time
- Adult live body weight
- Adult pronotal width (size)
- Nutrient analysis of resulting adults:
  - sugar, lipid and protein
    - spectrophotometric method (Van Handel and Day, 1988)
    - to be done
RESULTS: ADULT EMERGENCE

Early-season:

- High survivorship on mixed diets and single diets of peach $P < .0001$
- Apple and ToH as single diets are less suitable, but become suitable when combined
Late-season:

Yes, similar trend was observed except for ToH as a single diet $P = .0005$
RESULTS: STAGE-SPECIFIC SURVIVORSHIP

- Low 2\textsuperscript{nd} ($P = .0453$) and 3\textsuperscript{rd} ($P < .0001$) instar survivorships on apple and ToH
- Low 5\textsuperscript{th} instar survivorship on catalpa ($P < .0001$)
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

Mixed diets

Single diets

Numbers in each bar indicate the number of individuals that reached adulthood.
RESULTS: STAGE-SPECIFIC STADIUM

- General trend: The shortest stage was 1\textsuperscript{st} instar, followed by 2\textsuperscript{nd} and 3\textsuperscript{rd}, then 4\textsuperscript{th} and 5\textsuperscript{th}.
- 5\textsuperscript{th} instar nymphs on apple and catalpa (single) required the longest time to molt.

Mixed diets

<table>
<thead>
<tr>
<th>Diet</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple + ToH + Peach + Catalpa</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Apple + ToH + Peach</td>
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</tr>
<tr>
<td>Apple + ToH</td>
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Single diets

<table>
<thead>
<tr>
<th>Tree of heaven</th>
<th>Catalpa</th>
<th>Peach</th>
<th>Apple</th>
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Mean days

\( P < .0001 \)
### RESULTS: PRONOTAL WIDTH

Numbers in each bar indicate the number of individuals that reached adulthood.

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

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th>Males</th>
<th>Tree of heaven (ToH)</th>
<th>Apple + ToH</th>
<th>Apple + ToH + Peach</th>
<th>Apple + ToH + Catalpa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pronotal width (mm)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apple</strong></td>
<td>3</td>
<td>7</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Peach</strong></td>
<td>51</td>
<td>33</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Catalpa</strong></td>
<td>2</td>
<td>55</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apple + ToH</strong></td>
<td>7</td>
<td>50</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apple + ToH + Peach</strong></td>
<td>48</td>
<td>46</td>
<td>46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apple + ToH + Peach + Catalpa</strong></td>
<td>8</td>
<td></td>
<td>46</td>
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</tr>
</tbody>
</table>

- Values in the chart are denoted by letters (a, b, c, d) for statistical analysis.
Adults reared on mixed diets and ToH (single diet) were heavier.

Numbers in each bar indicate the number of individuals that reached adulthood.
RESULTS SUMMARY

- Mixed diets proved to be optimal for nymphal survivorship and development
  - Combining 2 sub-optimal single diets (apple & ToH) resulted in increased survivorship
  - 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

- Apple and catalpa were found to be least suitable as single diets

- Tree of heaven showed higher suitability toward the latter part of the growing season
Is nymphal feeding preference influenced by host plant quality?
- Host-choice experiment

What is the pattern of nymphal dispersal throughout the growing season involving fruit tree and wild tree hosts?
- Trunk traps
THANK YOU!

SALAMAT!

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QUESTIONS & COMMENTS?