Biology of *Sesbania punicea* seed banks and control by solarization and inundation

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Introduction

- *Sesbania punicea* is a riparian shrub originally from South America
- Invading CA rivers and floodplains, displacing native species
- Restoration flows may spread this species

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Sesbania observations over time

Documented *Sesbania punicea* locations 2001-2014 (data source: CalFlora Database)
Introduction

• Goals: non-herbicide control of Sesbania seed banks

• Field Experiments
  ▫ Solarization

• Lab Experiments
  ▫ Soil seed bank study
  ▫ Thermal tolerance
  ▫ Inundation tolerance
Study Site Locations
Sesbania Seed Banks

Dense, prolific stands lead to high seed abundance in the soil
Seed Bank Study

![Graph showing mean S. punicea seeds per m² for high and low stand density. High density has a significantly higher mean compared to low density.]

- **Mean S. punicea seeds per m²**
- **Stand density**: High, Low
Seed Bank Results

Table 1: *Sesbania punicea* seed bank one-way ANOVA results for low density vs. high density stands.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Variable</th>
<th>DF</th>
<th>DF error</th>
<th>F ratio</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stand density</td>
<td>Normal seed no.</td>
<td>1</td>
<td>84</td>
<td>20.623</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td></td>
<td>Malformed seed no.</td>
<td>1</td>
<td>29</td>
<td>3.446</td>
<td>0.074</td>
</tr>
<tr>
<td></td>
<td>% Unscarified germination</td>
<td>1</td>
<td>54</td>
<td>9.893</td>
<td>0.003*</td>
</tr>
<tr>
<td></td>
<td>% Scarified germination</td>
<td>1</td>
<td>53</td>
<td>0.789</td>
<td>0.379</td>
</tr>
</tbody>
</table>

* Significant at p < 0.05
Seedling Emergence Under Tarps
Solarization Soil Temperatures

Mean and max soil temperature (°C) (±SE) in solarization plots along the San Joaquin River north of Fresno, CA. Temperatures measured from Oct.-Dec. 2015 between 13:00–17:00 in the afternoon at 7 cm below the soil surface.
Solarization Results

Results seven months after the start of solarization
Thermal Tolerance

Mean % germination (±SE) of *Sesbania punicea* seeds under four temperature treatments and three durations. Columns without common letters differ significantly (Tukey p < 0.05).
Seed Inundation Tolerance: Germination

% (±SE) *Sesbania punicea* seed germination for inundated and control treatments
Seed Inundation Tolerance: Survivorship

\% (±SE) *Sesbania punicea* seed survivorship for inundated and control treatments
Mature *Sesbania* and Inundation

Mature stand after 5 months inundation

Development of adventitious roots at the waterline

Photo: Trevor Meadows
Conclusions

• *Sesbania* has abundant, persistent seed banks which are resistant to fall solarization

• Solarization may not be a practical control method for this species

• Future research: solarization during summer months
Conclusions

• Current control method (biomass removal and herbicide) still appears to be the most effective

• Inundation may reduce seed banks, but could also lead to seed transport downstream in riverine systems

• Future research: Inundation trials in the field