# BUGS, BEAKS & BALLOONS

## Evolution in Response to Invasion

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**ECOLOGICAL IMPACTS** ON SPECIES & COMMUNITIES

**CHARACTERISTICS** OF INVADERS

**INVASIVE ALIEN SPECIES**

**CHARACTERISTICS** OF RECIPENT COMMUNITY

**INVASIONS AS DRIVERS OF EVOLUTION ?**

**ROLE OF +VE INTERACTIONS**

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## Introducing…..The Native Soapberry Bug

*Leptocoris tagalicus* (Family Rhopalidae)

Carroll et al., 2008 Ecology Letters 8:544-551

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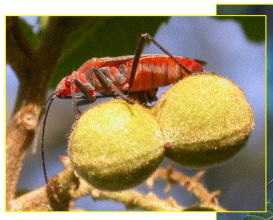
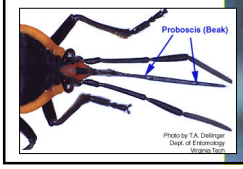
## …..and its native host, the Woolly Rambutan

*Alectryon tomentosus* (Sapindaceae)



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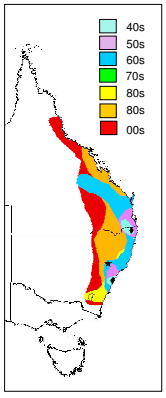
## The Invasive Alien….Balloon Vine

*Cardiospermum grandiflorum* (Sapindaceae)

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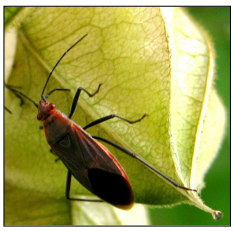
## NATIVE BUG on ALIEN BALLOON VINE

Critical Bug Trait: **Beak Length**

Selective Pressure: **Distance from fruit exterior to centre of seed**

**Woolly Rambutan**

**4.26 ± 0.23 mm**



**Balloon Vine**

**10.70 ± 1.61 mm**

Carroll et al. 2005 Ecology Letters 8:944-951

## PATTERN

Bug beaks are significantly longer on adult females collected from the alien host Balloon Vine

| Trait (females only) | Native | Alien |
|---|---|---|
| Beak length (mm) | 7.11 | 7.43*** |
| Thorax width (mm) | 3.36 | 3.42 |
| Body length (mm) | 13.39 | 13.71* |

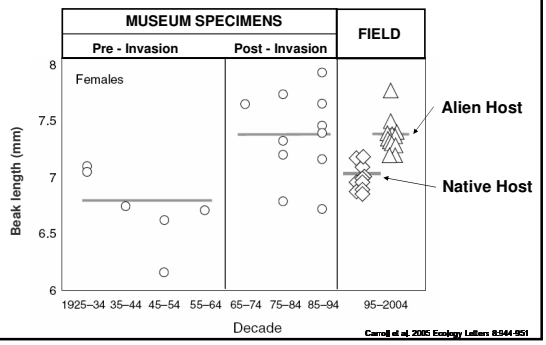
Carroll et al. 2005 Ecology Letters 8:944-951

# HYPOTHESIS

That differences in beak length between populations on native and alien hosts are the result of evolution

## TEST 1

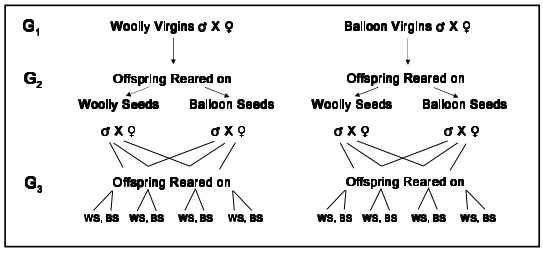
Bug beaks 'should' be longer after Balloon Vine became common (1965)




Carroll et al. 2005 Ecology Letters 8:944-951

## TEST 2

Beak length 'should' be a heritable genetic trait, not driven by host type during ontogeny

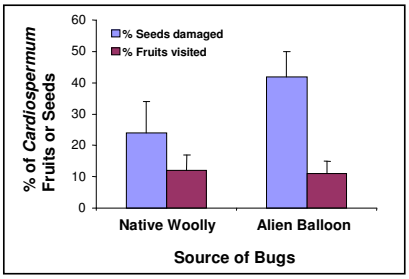



**KEY RESULT:** Host-associated differences in beak length are genetically based

Carroll et al. 2005 Ecology Letters 8:944-951

## TEST 3

Longer beaks 'should' increase feeding rate on seeds of Balloon Vine




**Experimental feeding damage to *Cardiospermum* is greatest when bugs are from that host**

## SUMMARY & CONCLUSIONS

- Native Australian soapberry bug has extended its host range to included a phylogenetically related Neotropical alien
- Since 1965 has evolved a genetically distinct beak length morph (c. 100 generations)
- Longer-beaked race is better at attacking invader's seeds
- Potential for longer-beaked race to limit spread of the alien (arms race?)
- Parallels with Cane Toads and Red-Bellied Black Snakes
- **Example of a poorly explored response to invasion**