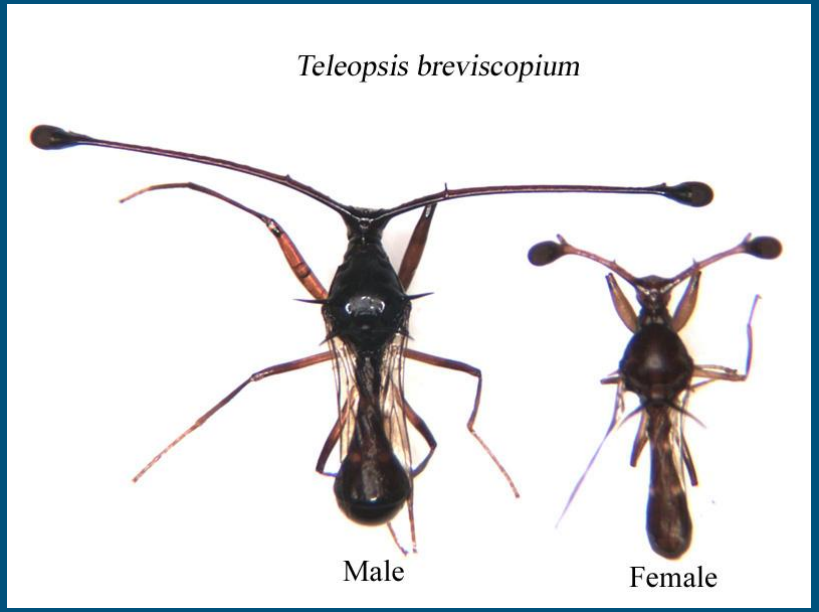
Sexual Selection in Insects

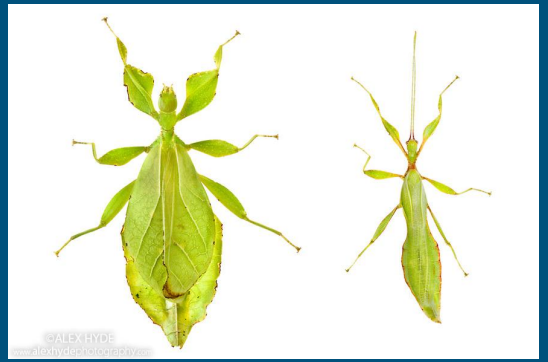
Sophie Dunkelberger and
Kelsey Testman

Sexual selection occurs in insects to obtain a higher success in mating

- Often times the morphological trait is costly for survival
  - Why do insects still expend energy on having these traits?



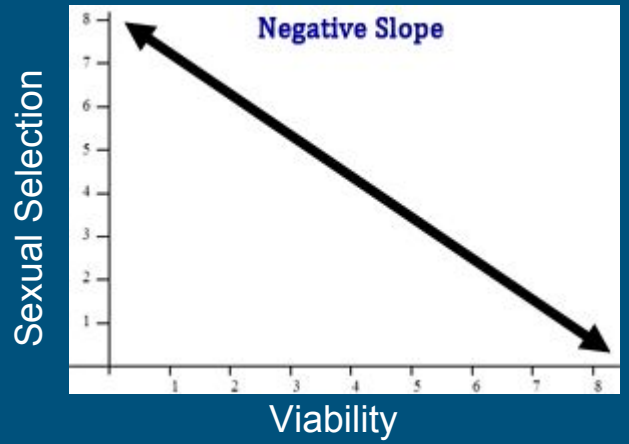
Sexual Dimorphism: Difference in size or appearance in sexes -> often relates to sexual selection



Sexual Selection vs Viability

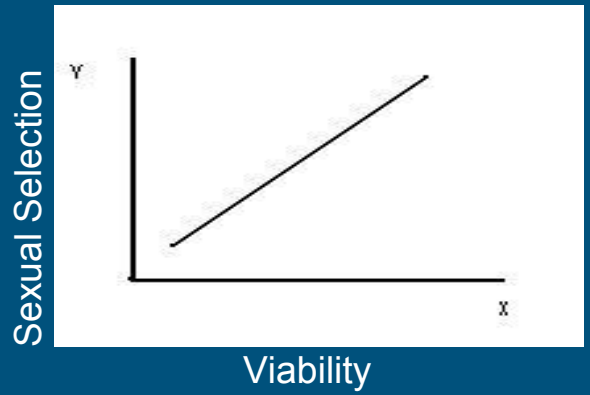
Darwin-Fisher Model- costly traits persist because of female desire for attractive offspring

- Sexual selection and viability will oppose each other until the traits reflect a balance



"Indicator Mechanism Model"- exaggerated traits indicate that a male is a good survivor, despite possessing that handicap trait

- Have the costly or ornament traits because you have good genes and are a good male/ survivor
- Sexual selection and viability will go in the same direction for that trait



Oecanthus nigricornis: Gryllidae

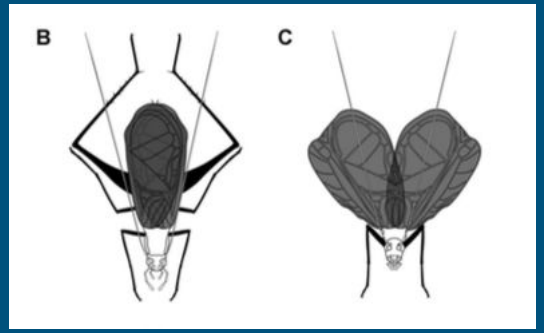
- Tree cricket

Question:

- Compared the morphological traits for mating vs solitary males (sexual selection) and the traits of males who were prey of *Isodonita mexicana* (parasitic wasp) vs survived (viability).

Methods

- Marked adult males with fluorescent powder to help the recapturing
  - Why was further investigation into this step needed?



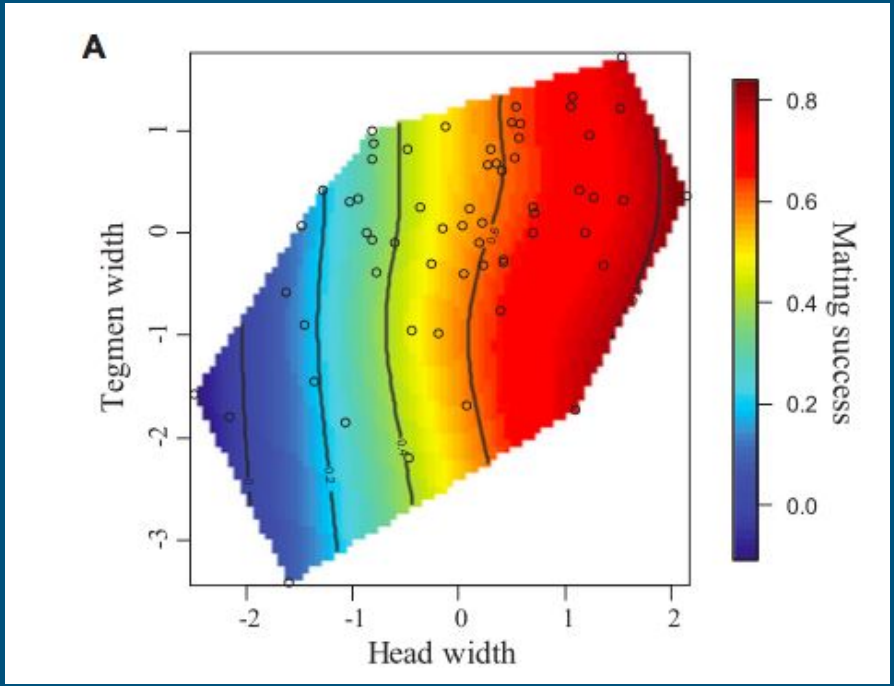
- Sexual Selection:
  - Located males by listening to courtship song and captured the males if he was mounted with a female
  - The closest non mating singleton adult male was captured for comparison

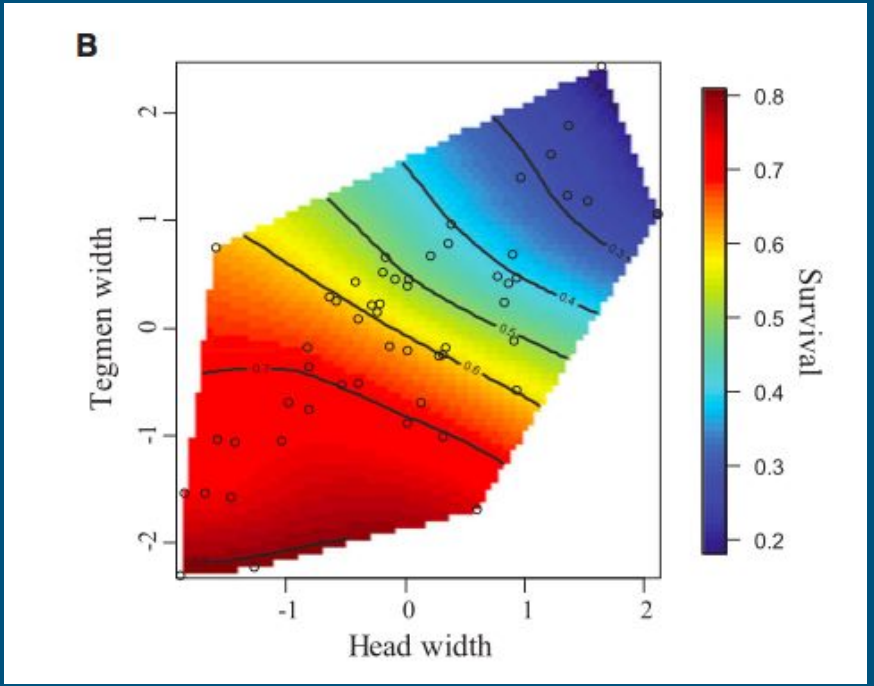
- Viability:
  - Sampled the *Isodontia mexicana* artificial trap nests for male tree cricket prey
  - Net sweeps for the surviving males

- Tree crickets were killed with freezing and preserved in 70% ethanol
- Traits measured: tegmina width, head width, pronotum length, and size of hind jumping legs

Results

Which Model does this support and why do you think these are the findings?





Supports Darwin-Fisher Model

- Directional sexual selection for wider heads and tegmen
  - Little evidence of combat in male crickets: female choice
  - Head width might not be under direct selection -> larger head -> larger mandibles or greater nuptial gift
  - Wide forewings = greater song production

Supports Darwin-Fisher Model

- Viability selection for narrower heads and tegmen
  - Most male prey were coupled to their mate
  - The wasps are attracted to males during calling, courting and contests
  - Larger, mobile males = decreased survival

Is this result similar to what is found in other species?

- No
- Usually sexually attractive traits have higher survival

Ex. Jennions, M.D. et al. (2001)
- studied 40 species of bird, insect, spider and fish
- Found that males with larger ornaments or weapons, greater body size, or higher rates of courtship showed greater survivorship

How does the presence/absence of male-male combat affect the Darwin-Fisher model?

Presence of male-male combat could create a more positive relationship for viability and sexual selection, pushing toward the indicator mechanism model, because the better competitor will mate with the female and have traits better equipped for survival.

There have been no previous studies on intrasexual selection of male tree crickets, this study was based solely on female choice.

However, many insects such as the stag beetles are known to engage in male competition. These insects should be studied to understand if male combat plays a large role in these models.

Two types of sexual selection:

- Intrasexual selection- members of the same sex competing for a mate

- Intersexual selection- members of one sex chooses a member of the opposite sex to mate with

The Maritime Earwig (*Anisolabis maritima*)

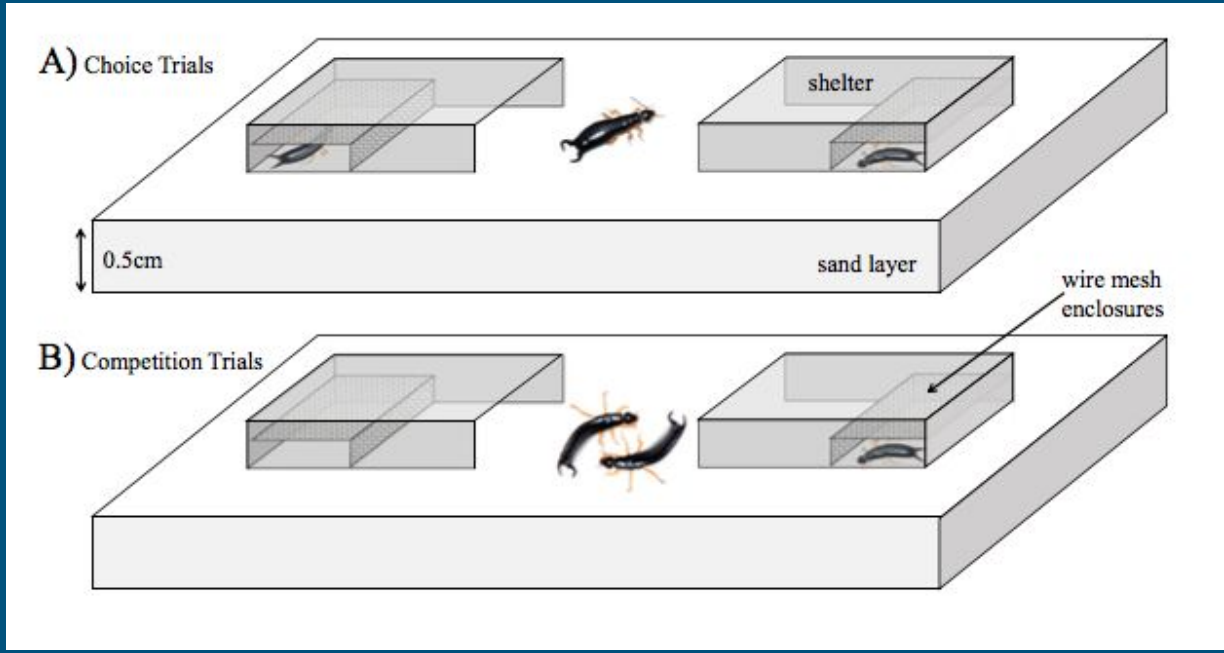
Why were these organisms chosen for an experiment involving inter- vs intrasexual selection?

- Both males and females posses weaponry
  - Intrasexual selection probably happening
- Male and Female body size differs
  - Intersexual selection probably happening too...

Methods

Trials:

1. Female choice
2. Male choice
3. Female competition
4. Male competition



Results

1. Female Choice
    a. No preference based on forcep asymmetry
    b. Initially (12h) females cohabitate with larger males and then (24h) switch to smaller male
2. Male Choice
    a. Small males: did not exhibit any obvious preference, but picked large female less often than large male
    b. Large males: No preference after 12h but after 24h picked larger female

Results

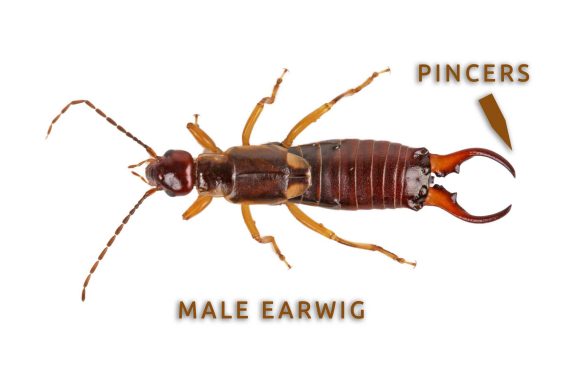
1. Male competition
    a. Forceps play no role
    b. Large males cohabitate with females more often
2. Female Competition
    a. Large females almost always won
    b. Large female wants small male more often than empty shelter
    c. Large Female wanted empty shelter over large male

What seems to be a large factor in these results? Are they surprising?

- Females demonstrated a preference for smaller males, even though the larger males were better competitors
  - Researchers thought smaller males might be less intimidating
  - The experimental conditions allowed researchers to see the inter- vs intrasexual selection

What seems to be a large factor in these results? Are they surprising?

- Forceps played no role in inter- or intrasexual selection
  - The researchers hypothesized that the forceps asymmetry would play a large role in male competition, especially in smaller males, because when competing for food this is the case
  - However this study found that the degree of asymmetry made no difference in either competition or female choice



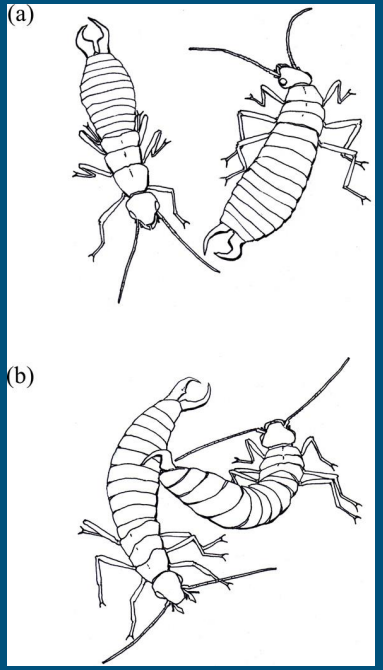
What function does the extreme curvature of the forceps serve? Why only the right forcep?

Adult earwigs use forceps for:

- Defense by twisting abdomen forward over head or sideways to engage an enemy
- Capture prey

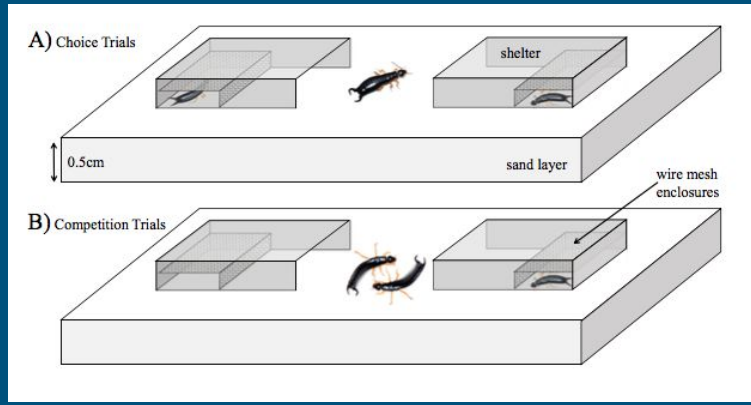
Munoz et al. 2012 - Observed that in competition for food between small males of similar size, the earwig (*A. maritima*) with greater asymmetry in the forceps usually won.

The asymmetry of the male earwigs forceps is unusual, and in nature, asymmetry rarely has any benefit in mating. In general, the curvature of the right forcep requires more research in its role, and whether it has one.



How might the design of the shelter allow researchers to see inter- vs intrasexual selection?

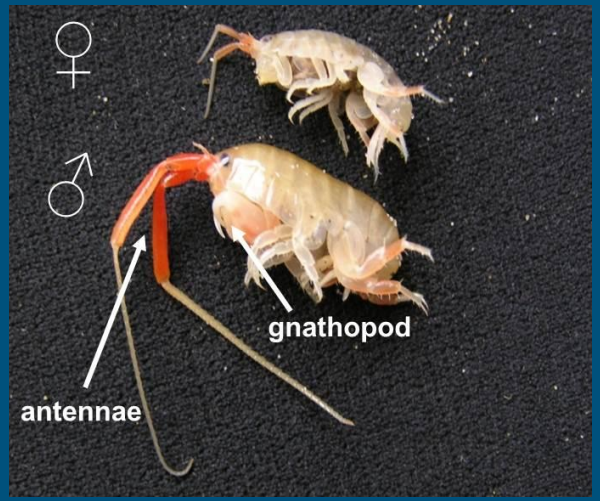
- The mesh gives the female full choice of a mate, without male actions influencing that choice
- Without mesh the female might not switched to the smaller male after 24h
- In nature the larger males would most likely win, so you might not observe the female preference for smaller males after 24h
- However, female selection still plays a large role in nature due to position required for copulation



Just depends on the species...

Iyengar et al. 2008 found that in Harems, male competition played a larger role in sexual selection than female choice. Larger males were able to hold and guard females prior to mating, limiting female choice.

* These are amphipods, not insects



Do you see a theme between the two papers? In earwigs, did the trait that was most commonly sexually selected for provide any benefit in survival/combat?

- Ultimately females were more attracted to smaller males, even though smaller males were less likely to win in combat
  - you might go as far to say that a trait that aids in combat would also aid in survival
- Forceps also played no role in intersexual selection even though they have been seen to aid in competition for resources and food
- Similar to first paper where the traits that helped with survival against predation were not sexually selected for

Why are these studies important?

- In the end insects primary goal is to have a successful reproduction
  - These studies explain natural selection and the different techniques insects use to ensure their genes are passed down to the next generation

References

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