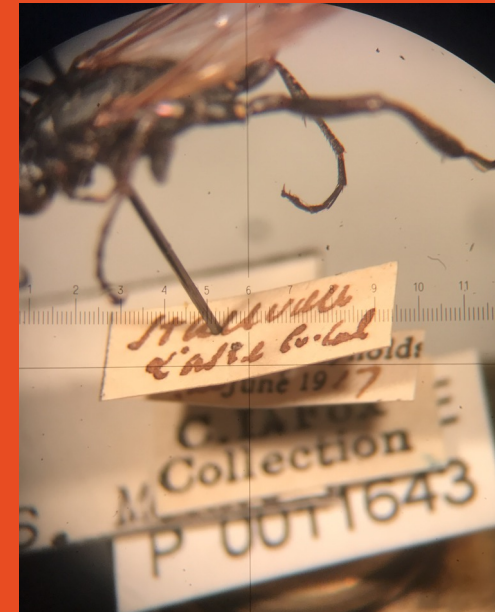
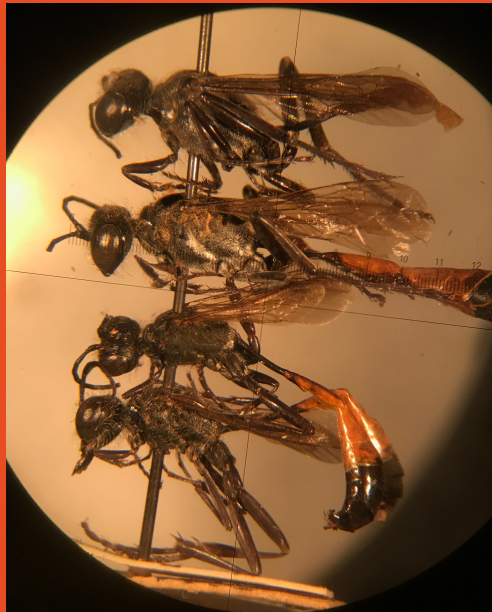


Parental care and the risk of maternally-vectored pathogens: Examining the host-parasite relationship between *Ammophila* spp. and *Paraxenos lugubris*

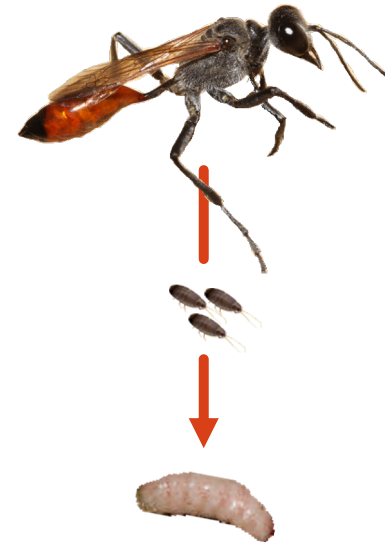
RJ MILLENA, JAY ROSENHEIM

DEPARTMENT OF ENTOMOLOGY AND NEMATOTOLOGY, UNIVERSITY OF CALIFORNIA, DAVIS



BACKGROUND

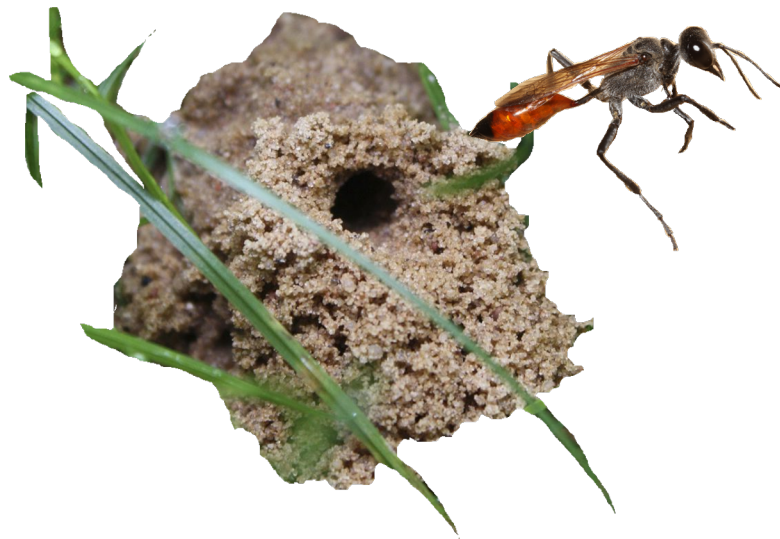
- Extended parental/maternal care is thought to be favored evolutionary due to enhanced ability to protect offspring...
- ...but vertical transmission may flip the script
 - Mechanisms: transplacental, transmammary, **contact**
 - Seen in humans: HIV, Zika, Lyme disease, trypanosomes
 - In animals: hookworms in pinnipeds



AMMOPHILA WASPS: PROVISIONING BEHAVIOR

Ammophila nesting behavior

- ① female wasp digs a single-cell nest



- ② wasp leaves nest to hunt for prey caterpillars



AMMOPHILA WASPS: PROVISIONING BEHAVIOR

Ammophila nesting behavior

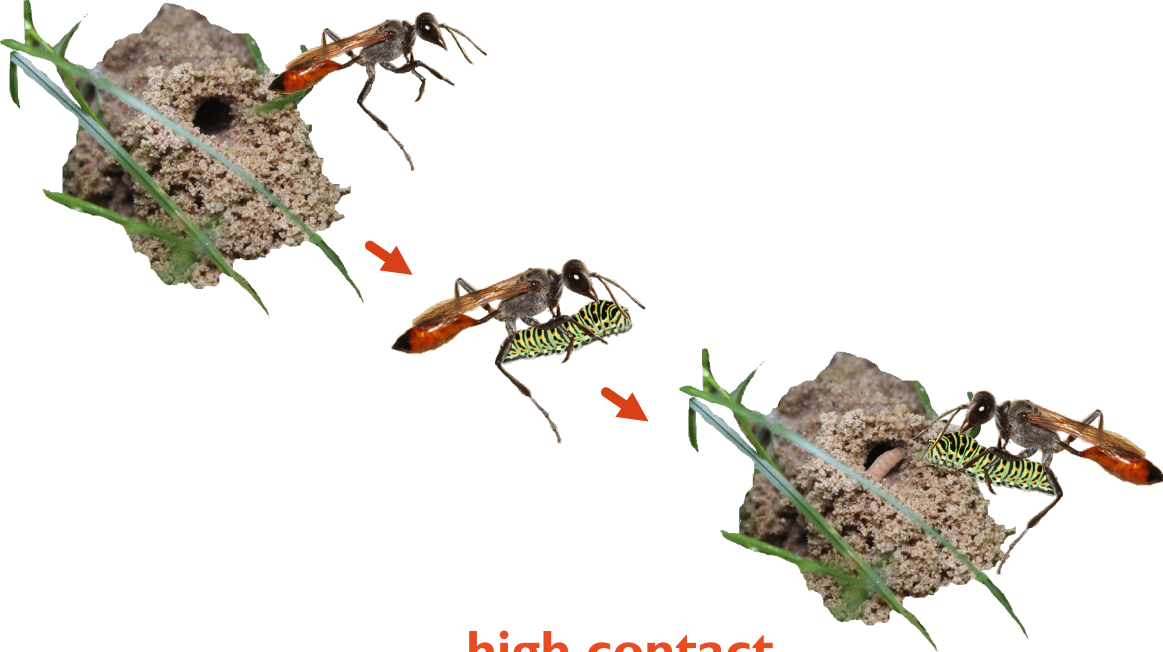
③ nest is closed up after single prey item has been placed within



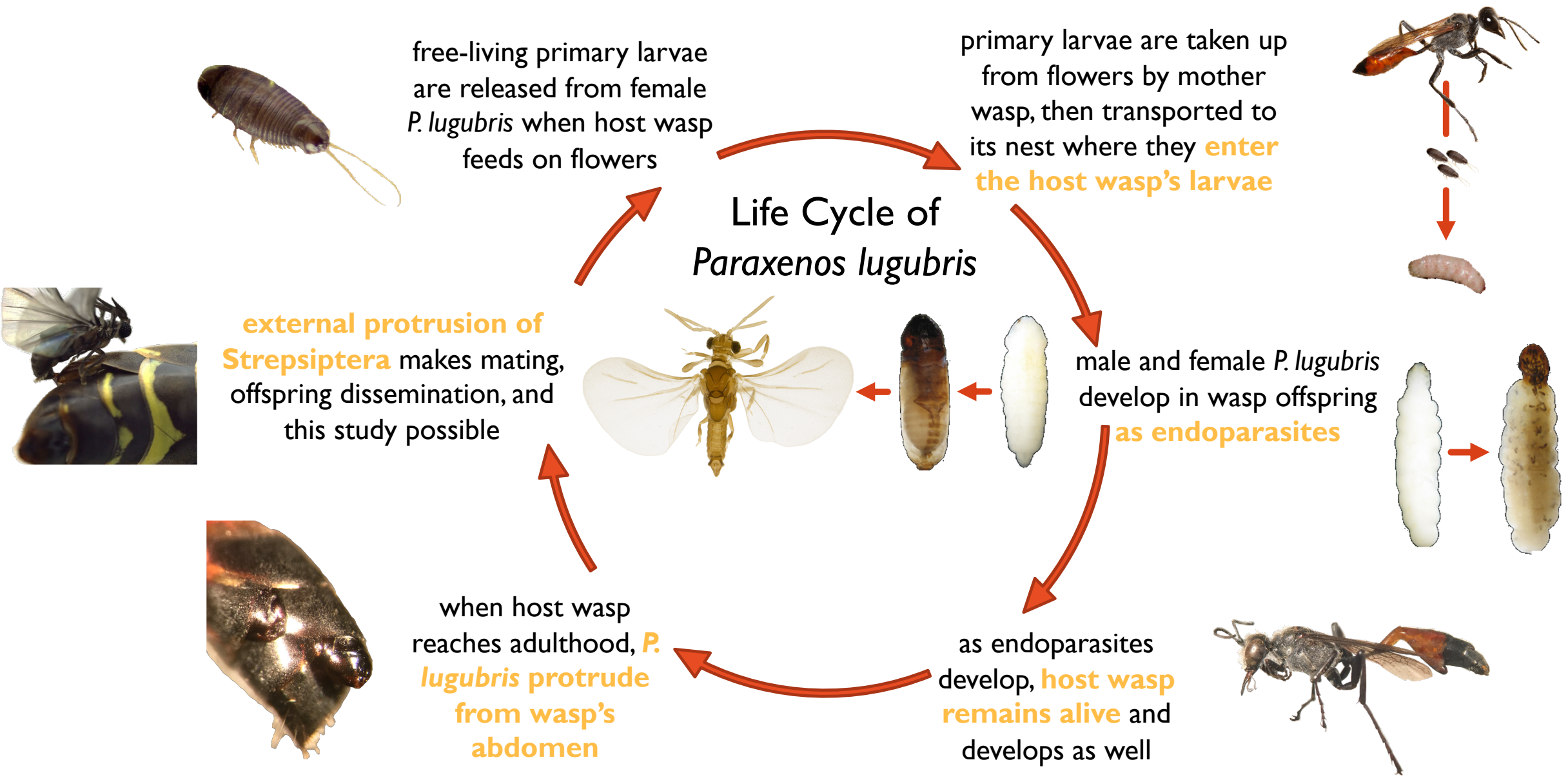
low contact

or

mother wasp leaves again to find prey with which to continue provisioning offspring



high contact



AIMS/HYPOTHESIS

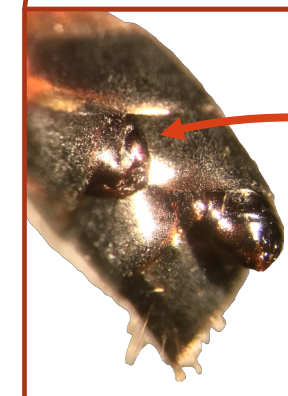
- *Ammophila* wasps show great variation in offspring provisioning, or number of prey taken to nest
- *Ammophila* are attacked by vertically transmitted endoparasite *Paraxenos lugubris* (Strepsiptera)
- ***Ammophila* spp. that provision their nests with more prey (more extensive mother-offspring contact) will have greater parasitism risk**

parasitized *Ammophila azteca* Cameron



Image captured by RJ Millena on iPhone through microscope lens, 2 Aug 2019

close-up of abdomen



female Strepsiptera

unemerged male Strepsiptera

Image captured by RJ Millena on iPhone through microscope lens, 3 Jul 2019

METHODS

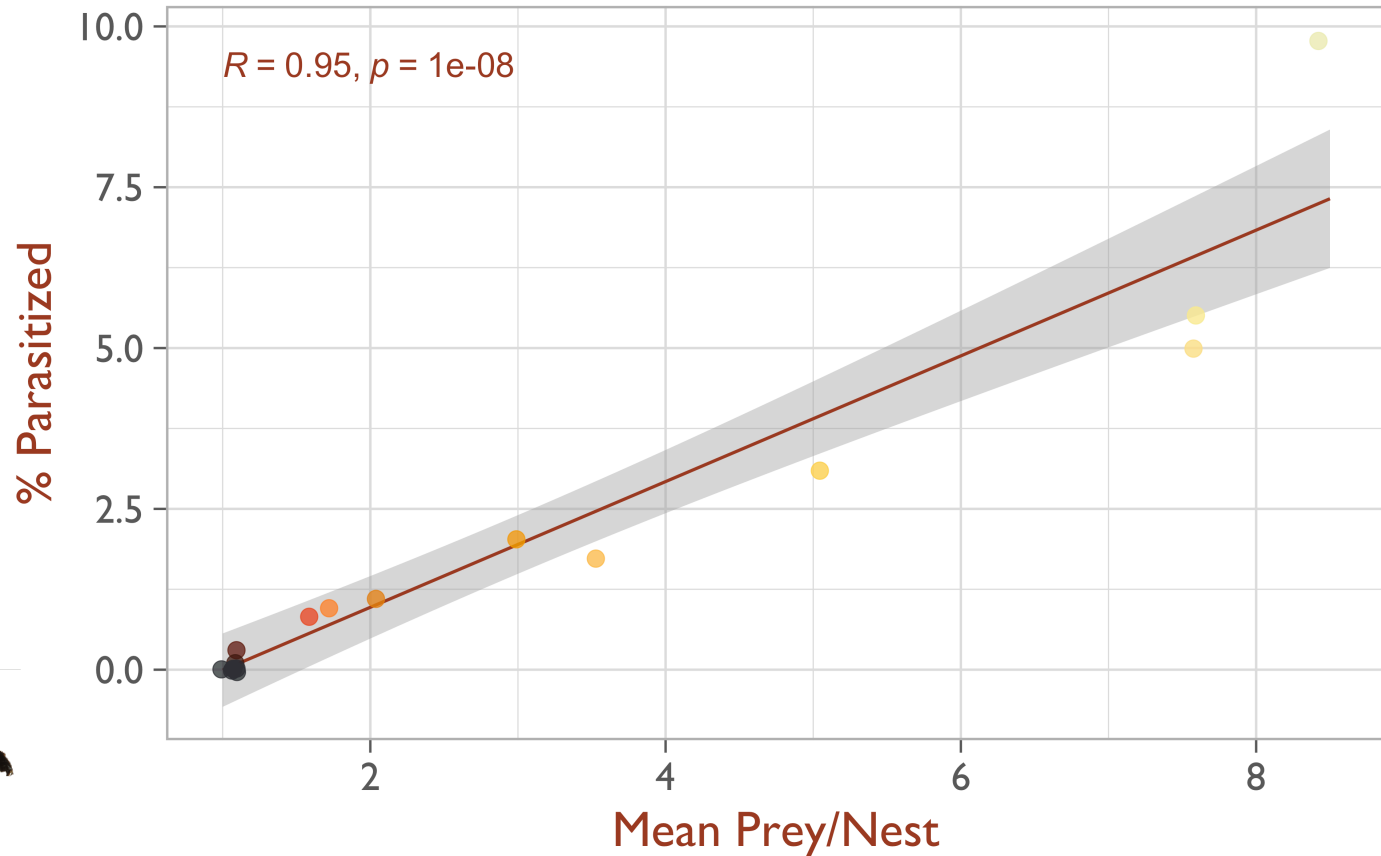


Image captured by RJ Millena on iPhone, 8 Jul 2019

- Determine provisioning behavior for *Ammophila* spp.
- Examine all available pinned specimens for *Ammophila* spp. under microscope
- Score for parasitism by *Paraxenos lugubris*
- Record all label information, measure wing length for each specimen
- Estimate rate of parasitism
- Analysis with R

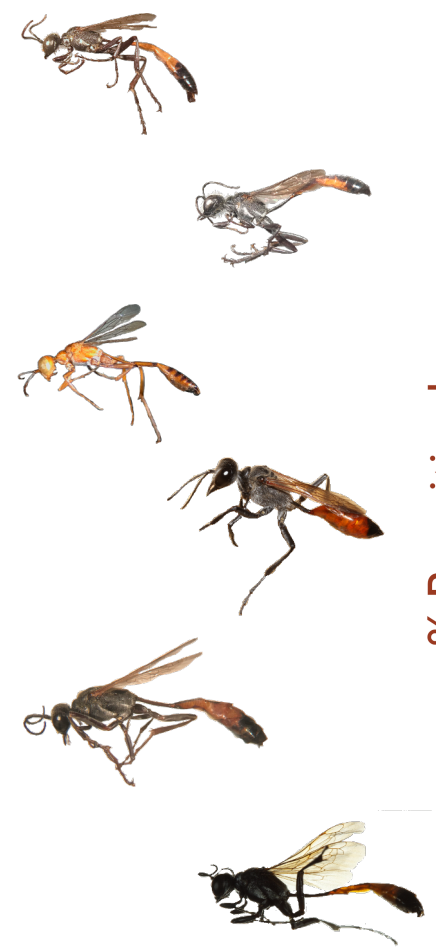
DATA

Relationship Between Mean Prey/Nest and Rate of Parasitism



Species

- aberti
- pruinosa
- azteca
- harti
- urnaria
- placida
- femurrubra
- dysmica
- juncea
- boharti
- procera
- wrightii
- marshi
- stangei
- nigricans
- zanthoptera



DATA ANALYSIS

- Linear regression support
- Generalized linear model (GLM)
 - controls for species and seasonal effects; variation
- Mean number of prey provisioned exerts dominant influence on parasitism risk
 - coefficient: 0.405 ± 0.100 (SE), $P < 0.0001$
 - highly significant predictor

DISCUSSION

- Parasitism quantified via museum specimens for 16 North American *Ammophila* species, ~ 9000 wasps
- Positive relationship between mean prey provisioned and parasitism rates in linear regression, GLM support
 - Repeated visits by mother *Ammophila* increase parasitism risk to offspring
- Demonstrates potential costs of extended parental care
 - Contrast to most studies of this phenomenon

FURTHER DIRECTIONS

- Generalized additive model (GAM) in R
 - Spatial autocorrelation
 - Wasp size; sexual dimorphism
- Complete phylogeny for NA *Ammophila*
 - Phylogenomic approach using UCEs
- Implications for Strepsiptera—museum specimen approach

Phylogeny of 25 species of *Ammophila*, with 9 of the 16 examined species present and highlighted. Taken from Fig. 2 of Field et. al (2011).



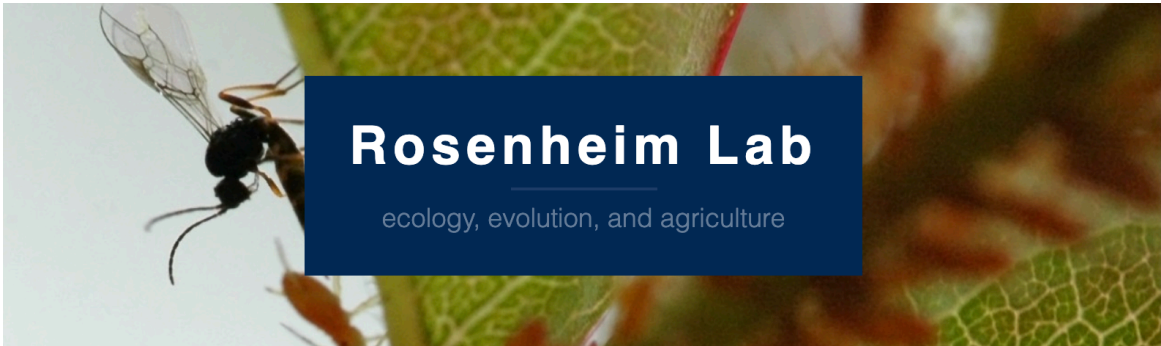
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Leadership Excellence
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Degrees (UC LEADS)



BOHART
Museum of Entomology
University of California, Davis



Rosenheim Lab

ecology, evolution, and agriculture



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