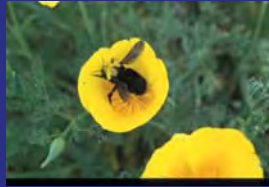


## Bees 101: Species Diversity and Behavior

Pollinator Gardening, 28 April 2012  
Robbin Thorp, UC Davis



## A “Not-A” Bee



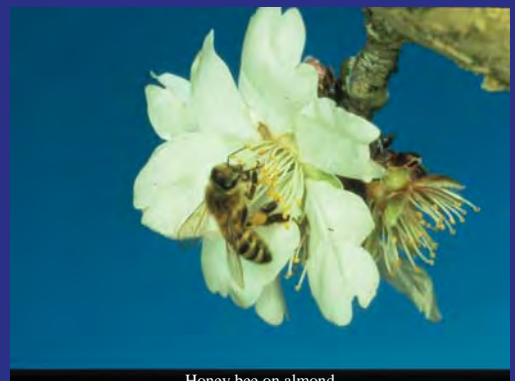
## Another “Not-A” Bee

An Apoid Wasp (“You are what you eat”)



## A Bee

The European Honey Bee, *Apis mellifera*



Honey bee on almond

## Bees 101 Quiz: Fact or Fiction?

- All bees sting.



- Fact?
- Fiction?

## Bees 101 Quiz: Fact or Fiction?

- **Fiction:**
- Boy bees do not sting
- Only female bees are capable of stinging
- Not all native bee females can or do sting



## Bees 101 Quiz: Fact or Fiction?

- All bees are social and live in hives.

- Fact?
- Fiction?



## Bees 101 Quiz: Fact or Fiction?

- All bees are social and live in hives.

- **Fiction:**
- Most bees are solitary and live in holes in the ground or tubular cavities.



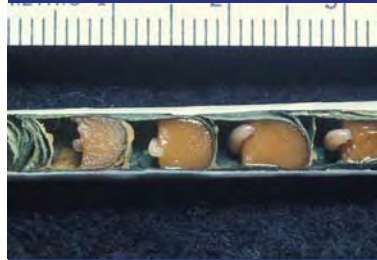
## Bees 101 Quiz: Fact or Fiction?

- All bees make honey.
- Fact?
- Fiction?



## Bees 101 Quiz: Fact or Fiction?

- All bees make honey.
- **Fiction:**
- Bees with perennial colonies (honey bees and stingless bees) produce honey to survive times of dearth
- Native bees survive winters in other ways



## What are Bees? Why are They Important?

- Derived wasps that use pollen (not animal) protein to feed their young
- They use nectar as flight fuel
- They have branched hairs, and other adaptations to gather food from flowers and transport food back to the nest
- They provide an important ecological service to flowering plants (crop and wild): Pollination

## You Are What You Eat Food gathering devices



## You Are What You Eat

Food gathering devices



## How Diverse are Bees? (Numbers)

- There are about 20,000 species (maybe 30K)
  - More diversity than all Mammals + Birds together.
- North America: 4,000 species
- California: 1,600 species
- Yolo County: More than 300 species
- Honey Bee Haven: 60+ (and counting)

## How Diverse are Bees? (Life Styles)

- Life styles
  - Solitary - 75%
  - Social - 10%
  - Cuckoos (Cleptoparasites) – 15%
- Pollen collection
  - Generalists vs. Specialists (Oligoleges)

## Bee Diversity Polyester and Masked Bees



- Polyester bee female with scopa on hind legs for pollen transport.
- Lines its burrow w/ membrane-like polymer secretion.

## Bee Diversity

### Polyester and Masked Bees



- Masked bee, Female.
- Tiny nearly naked. Transports pollen internally (in gut).

## Bee Diversity

### Mining Bees



- Mining Bee
  - Female
  - Unnamed species
  - Specialist on Sky Blue (Oligolege)
  - Some pollen deposited on “safe site” where female bee cannot remove it.

## Bee Diversity

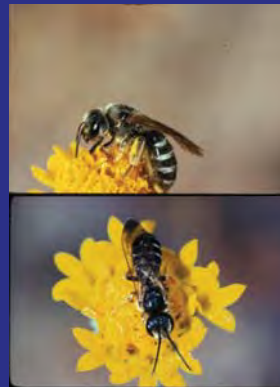
### Mining Bees



- Mining Bee
  - Female
    - Scopa on hind legs
  - Male
    - From unfertilized egg
      - Haplodiploidy
    - Sexual dimorphism

## Bee Diversity

### Sweat Bees



- Sweat Bee
  - Female
- Sweat Bee
  - Male



## Bee Diversity Sweat Bees



- Green Sweat Bee  
– Female



- Green Sweat Bee  
– Male

## Bee Diversity Leafcutting & Mason Bees



- Leafcutting Bee  
– Female collecting pollen  
– Scopa under abdomen



- Leafcutting Bee  
– Female cutting leaf

## Bee Diversity Leafcutting & Mason Bees



- Mason Bee  
– Female



- Cotton Bee  
– (Wool carder)  
– Male

## Bee Diversity Leafcutting Bee Family Cuckoo



- Female  
– Cuckoo Bee



- Male  
– Cuckoo Bee

## Bee Diversity

### Digger, Cuckoo, & Corbiculate Bees



- Cuckoo Bee
  - Female



- Cuckoo Bee
  - Female

## Bee Diversity



- Digger bees:
- Female Long-horn bee



- Male Long-horn bee

## Bee Diversity

### Digger, Cuckoo, & Corbiculate Bees



- Squash Bee
  - Female (Oligolege)
  - Visits squash flowers before dawn



- Squash Bee
  - Male Long-horn squash bee
  - Sleeps in closed flowers

## Bee Diversity



- Digger Bee
- Female



- Male

## Bee Diversity

### Digger, Cuckoo, & Corbiculate Bees



- Carpenter Bee
  - Male/Female courting
  - Female nectar robbing

## Bee Diversity



- Small Carpenter Bee
  - Female
  - Male

## Bee Diversity

### Digger, Cuckoo, & Corbiculate Bees



- Yellow Face Bumble Bee
  - Queen



- Cuckoo Bumble Bee
  - Social parasite
  - Male

## Life Styles: Nesting Habits

- Most are solitary soil nesters
  - Sand, clay, sandstone, rock
  - Flat ground, birms, vertical cliffs
  - Many have specialized habitat requirements
- Many are tubular cavity nesters
  - E. g., beetle tunnels, hollow stems
- Some excavate burrows in wood or pith
- Some social bees use large cavities



## Life Cycle of a Solitary Bee



- Female Mining Bee on Goldfields flower head in spring
- This bee specializes on Goldfields for pollen (Oligolecty)

## Life Cycle of a Solitary Bee

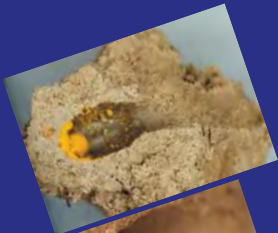


- Nest entrance:
  - open with tumulus (excavated soil) surrounding it.



- Nest architecture:
  - Vertical entry shaft
  - Lateral tunnels
  - Brood chambers:
    - 1) Completed with egg
    - 2) Under construction

## Life Cycle of a Solitary Bee



- Brood chamber with food mass being formed



- Brood chamber with food mass completed and egg laid on surface

## Life Cycle of a Solitary Bee



- Cap of brood chamber (inner view)



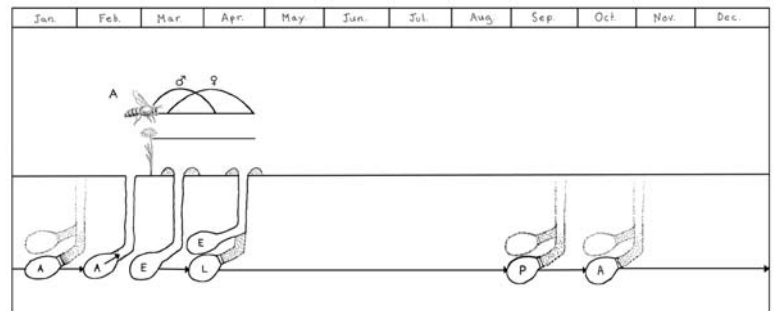
- Early larva ready to initiate feeding on pollen provisions

## Life Cycle of a Solitary Bee



- Post-feeding larva (summer phase)
- Pupa (autumnal phase)

## Annual Life Cycle Spring Bees

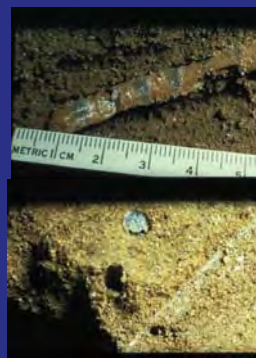


## Life Cycle of a Solitary Bee



- Early spring bloom of Goldfields and Yellow Carpet at Jepson Prairie Reserve
- Female Mining bee on pollen host, Goldfields
- Synchronized annual cycles
- [www.vernalpools.org/Thorp/](http://www.vernalpools.org/Thorp/)

## Bee Nests Polyester & Masked Bees



- Polyester Bee brood chambers
  - Cellophane-like polymer secretion
- Entrance:
  - “Doggy door”

## Bee Nests



- Alfalfa Leafcutting Bee
  - Female collecting pollen from alfalfa



- Female cutting leaf

## Bee Nests



- Alfalfa Leafcutting Bee
  - Cavity nester
  - Field domicile with bee boards



- Female into nest with leaf piece

## Bee Nests



- Alfalfa Leafcutting Bee
  - Female in with pollen



- Female laying egg on pollen provision

## Bee Nests



- Alfalfa Leafcutting Bee
- Brood chambers with pollen provisions, egg, larvae
- Fully developed larvae in cocoons

## Blue Orchard Bee (a Mason Bee)



- Blue Orchard Bee (BOB) female on almond flower



- Female with mud for nest partitions

## Blue Orchard Bee Nests



- Drilled hole with mud partitions, pollen, and larvae



- X-ray of mature BOB nests with pupae

## Carpenter Bee Nests



- Large Carpenter Bee
  - Mountain Carpenter Bee
  - Excavates nests in soft wood or pithy stems



- Small Carpenter Bee
  - Excavates nests in pithy stems

## Bumble Bee Life Cycle



- Bumble Bee
  - Corbiculate Bees
  - Annual societies
  - Queen emerging from hibernation



- Starter nest
  - Honey pot
  - Initial brood
  - Incubated by queen

## Bumble Bee Life Cycle



- Bumble Bee Nest
  - Egg cups, cocoons
  - Eggs, larvae, pupae
  - Nectar storage in old cocoons
- Bumble Bee Nest
  - Egg cup
  - Eggs exposed
  - Cocoons
  - Pupa exposed

## Bumble Bee Life Cycle



- Bumble Bees
  - Mating male/queen
- Queens entering into hibernation

## Gardening for Bees

- Bees need **habitat** not just gardens:
- Flowers for food
  - Pollen
  - Nectar
- Nesting habitat
  - Bare soil (avoid “mulch madness”)
  - Bee condos for tube nesters
  - Houses for bumble bees (below & above ground)

## Credits

- Photo Credits:
  - Dennis L. Briggs
  - Rollin Coville
  - Kathy Keatley Garvey
- Life Cycle drawing:
  - Emily Bzdyk



Questions?

