

## Degrees of Sociality

- **Solitary**— only seek out each other for mating
- **Subsocial**—shows one of three social characteristics
- Quasisocial— members of the same generation use the same nest with cooperative brood care
- Semisocial— quasisocial, plus reproductive division of labor
- **Eusocial**— cooperative brood care, overlapping generations, reproductive division of labor

## Is it ... subsocial?

(sub = below)

If it ...

1. Aggregates

or

2. Has a division of labor

or

3. Cares for eggs or young after egg laying

... It is subsocial

## Degrees of Sociality

- Solitary, e.g. some Halictid bees



Sean McCann

## Subsocial – Parental Care Without Nesting

Giant Water Bugs

- Female oviposits on male dorsum
- Male tends eggs



Assassin Bugs

- Adults guard early instar nymphs



Result: Decrease in parasitism

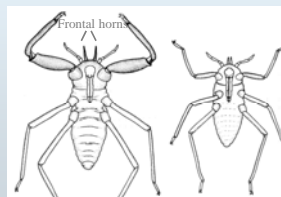
## Aggregations of Insects

- Some bees build nest entrances close together, otherwise solitary
- Common among Aposematic insects
  - Examples
    - Monarchs
    - Gregarious larvae
- Share protection



## Subsocial Aphids - Division of Labor

Soldier Morphs (Approx. 20 Species of aphids)



(Hemiptera: Aphididae)



Sterile soldier caste, but do not have overlapping generations that contribute to colony labor

Why are these soldiers apparently altruistic?



### Eusociality

- Primitively eusocial include bumblebees
- Highly eusocial include ants, some wasps, and many bees

### Why be nonreproductive??

### Bumblebees

### Why be nonreproductive??


Inclusive fitness  
leads to  
↓  
Kin selection




### What is a Eusocial insect?

(eu = true)

- Cooperative brood care
- Overlapping generations
- Reproductive division of labor (castes allow for multiple tasks: food foraging, queen and brood care, nest maintenance simultaneously)



## Hymenoptera

### Haplodiploidy

- Males are haploid (unfertilized egg)  
One set of chromosomes
- Females diploid (fertilized egg)  
Two sets of chromosomes

### Haplodiploid insects share with their full sisters

$$\begin{array}{ccc}
 \text{From Dad} & & \text{From Mom} \\
 50\% \times 100\% & & 50\% \times 50\% \\
 \downarrow & & \downarrow \\
 50\% & + & 25\% = 75\% (3/4)
 \end{array}$$

### Why Haplodiploidy encourages eusociality

- Parent and offspring normally share only 1/2 of their genes
- Haplodiploid sisters share 3/4 of their genes

### Bottom Line

They have more genes in common with FULL sisters than they would with their own daughters, so workers should invest more in their sisters than in the production of their own young.

Genetic predisposition for eusocial behavior

Coefficients of relationship (r)

	sister	brother	own son	own daughter
worker	0.75	0.25	0.50	0.50

### Diploid insects share with their sisters & brothers

$$\begin{array}{ccc}
 \text{From Dad} & & \text{From Mom} \\
 50\% \times 50\% & & 50\% \times 50\% \\
 \downarrow & & \downarrow \\
 25\% & + & 25\% = 50\% (1/2)
 \end{array}$$

Yet, the evolution of eusociality does NOT require that sisters be more closely related to one another than to their brothers or their offspring





**Different species of termites, different types of termite mounds**

