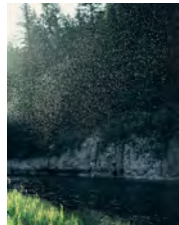


Courtship & Mating



Reproduction in Insects

- How do the sexes find each other?
 - Light
 - Swarming (male only/ female only)
 - Leks (male aggregations)
 - Defend territory against males
 - Court arriving females
 - Pheromones



What do they do once they find each other?

Courtship

- Close range intersexual behavior that induces sexual receptivity before and during mating.
- Allows mate choice among and within species.



Types of Courtship

- Visual displays



Types of Courtship

- Visual displays
- Ritualized movements
 - 'Dancing' induces copulation in receptive females.
 - Often VERY stereotyped and species-specific.
- Tactile stimulation



Ritualized courtship in *Nasonia* parasitic wasps

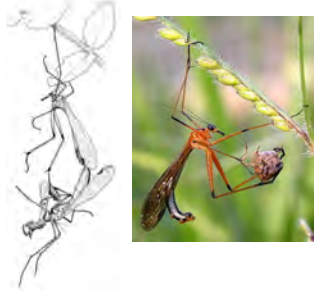
Types of Courtship

- Visual displays
- Ritualized movements
- Tactile stimulation
- Sound production



Types of Courtship

- Visual displays
- Ritualized movements
- Tactile stimulation
- Sound production
- Nuptial gifts



Nuptial Gifts

- 3 forms
 - Cannibalization of males
 - Glandular product
 - Nuptial gift
 - Prey
 - Salt, nutrients



Evolution of nuptial feeding

- Female advantages
 - Nutritional benefit
 - Mate choice (mate with good provider)
- Male advantages
 - Helping provision/produce his offspring
 - Female receives sperm while feeding rather than mating with someone else
- Male costs
 - Capturing food costs energy and incurs predation risk
 - Prey can be stolen and used by another male.

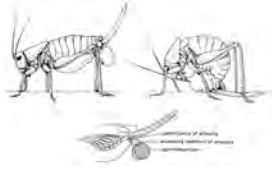
Sexual Cannibalization

- Rather extreme
- Male actually does not willingly give himself up...
 - Where would its potential reproductive benefit be?
- Do females have increased reproductive success?

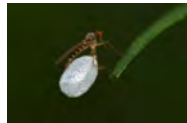


Glandular gifts

- Often part of the spermatophore (sperm transfer unit)
 - Occupy female while sperm is being transferred
 - Parental investment by male



Nuptial gifts



- Generally a food item (usually prey)
- Also regurgitations (some flies)
- But beware the Cubic Zirconia, ladies

Sexual selection



- Occurs when a trait evolves that is costly for survival, but...
- Confers greater mating success
- May explain sexual dimorphism
 - Males larger than females: rare in insects
 - Exaggerated traits in males

Types of sexual selection

- Intrasexual selection
 - Contest competition
 - Scramble competition
 - Sperm competition
- Intersexual selection
 - Male has exaggerated trait
 - Females choose males depending on trait value
 - Sex roles reversed if males perform more parental care than females

Contest competition

- Frequent fights over territory or access to females
- Males monopolize females
- Often exaggerated traits in male

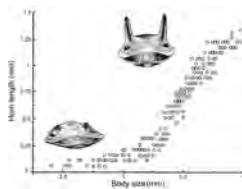


Scramble competition

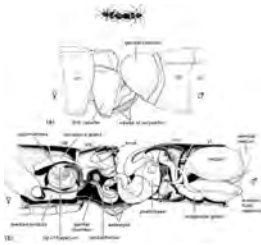
- Scramble to be first to mate
- Little monopolization of females
- No consistent body size effect
 - Small size may be better for maneuverability
 - Large size may have advantages if it relates to speed

Mixed strategy with dung beetles

- **Contest:** larged-horned males monopolize tunnels in which females live
- **Scramble:** Small-horned males sneak around large males or dig a side tunnel.



Copulation and sexual selection



- Copulation often prolonged in insects
 - Female may try to break off sooner if male is less desirable
 - Male may try to prolong copulation to maximize fertilization
- Male accessory gland secretion may...
 - Repress female receptivity to mating by others
 - Stimulate female oviposition

Sperm competition



- What really counts
 - Male: number of offspring fathered
 - Female: highest quality mates
 - Intersexual conflict may occur over which sperm fertilize eggs

Sperm competition



- Last-in-first-out systems
 - Spermatophore closest to oviduct most successful
 - Males push previous sperm higher into spermatheca
- Sperm removal
 - Scoop out previous sperm
 - Flush out previous sperm.

Dragonflies








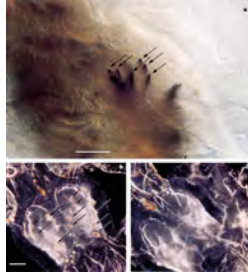
Sexual Conflict of Interest

- Particularly common in promiscuous mating systems
- Absent in monogamous mating systems. Why?
- Taken to extremes in males with genitalic armature



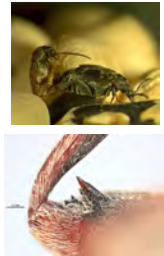
Sexual Conflict of Interest

- Particularly common in promiscuous mating systems
- Absent in monogamous mating systems. Why?
- Taken to extremes in males with genitalic armature



Sexual Conflict of Interest

- Particularly common in promiscuous mating systems
- Absent in monogamous mating systems. Why?
- Taken to extremes in males with genitalic armature



Outcomes of sexual selection

- Rapid evolution of genitalia
- High variation within and among species, more than needed for copulation



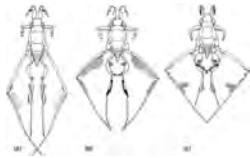
Variation in female reproductive tract

- Can prevent interspecies mating
- Can also result from intersexual conflict over control of sperm



Morphological evolution in males

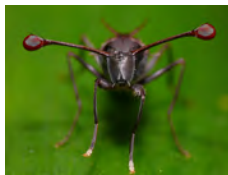
- Morphological evolution in males often much more rapid than in females
 - Especially characters related to secondary sexual traits
 - Females of different species often morphologically indistinguishable.



e.g. *Rheumatobates*
water striders

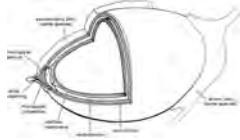
Results of sexual selection

- Further exaggeration of trait until balance between cost and benefit established
- May result in new species.



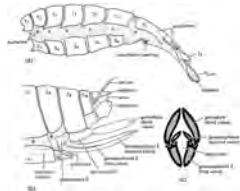
What's the result of all of these shenanigans?

- Reproduction!
- Successful fertilization will result in fertilized egg and egg-laying: oviparity.



What's the result of all of these shenanigans?

- Egg-laying accomplished through ovipositor
 - Formed from abdominal appendages (plesiomorphic), or
 - Formed from posterior segments (substitutional)



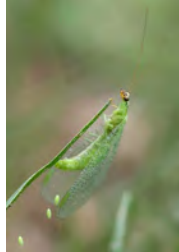
Ovipositor

- Variously modified to insert eggs into appropriate substrate.



Insect Reproduction

- Means of producing offspring
 - Oviparity: egg-laying initiates egg development.
 - Ovoviviparity
 - Viviparity



Insect Reproduction

- Means of producing offspring
 - Oviparity
 - Ovoviviparity
 - Allows offspring to take advantage of highly ephemeral resource
 - Viviparity



Insect Reproduction

- Means of producing offspring
 - Oviparity
 - Ovoviviparity
 - Viviparity
 - Pseudoplacental
 - Egg/larvae nourished in reproductive tract
 - Hemocoelous
 - Larvae free in hemocoel
 - Adenotrophic
 - Milk glands, larva pupates immediately on deposition.



OR DISPENSE WITH THE SHENANIGANS

- Parthenogenesis
- Females produce viable unfertilized eggs
- Found in nearly all insect orders



Types of parthenogenesis

- Production of females from unfertilized eggs:
Thelytokous parthenogenesis
 - Can occur via **automixis**: meiosis occurs, two products of meiosis refuse to form diploid female.
 - Can occur via **apomixis**: no meiosis, diploid egg is produced via mitosis.
- Production of males from unfertilized eggs:
Arrhenotokous parthenogenesis
 - Always produced via automixis

Types of parthenogenesis

- Obligatory
- Facultative
 - Seasonal in aphids
 - Asexual reproduction during summer
 - Sexual reproduction in spring and fall



Parthenogenesis in Hymenoptera and Thysanoptera (and some others)

- **Haplodiploidy**
- Females (queen & workers) produced from fertilized eggs or (occasionally) from automictic thelytokous parthenogenesis: **diploid**
- Male drones always produced from unfertilized eggs through arrhenotokous parthenogenesis: **haploid**.



Hermaphroditism

- What is it?
- Exceedingly rare in insects (given that every other bizarre genetic system exists).
- Only one genus of scale insect: *Icerya*

