Common Pollinators and Flower Visitors

Whitney Cranshaw
Colorado State University
Primary Groups of Flower Visitors and Pollinators

- Bees
- Flies
- Beetles
- Butterflies and Moths
Most butterflies and moths commonly visit flowers to collect nectar.
Butterflies....

fly during the day.....
..attracted to flowers primarily by color (also by scent)......
...and have long mouthparts that can reach deep into flowers.
Moths

- Usually are active at night or dusk
- Locate plants primarily by smell
- Can have long mouthparts, sometimes very very long mouthparts
Hornworms and Sphinx Moths
About two dozen kinds of hornworms occur in the region.
Adult stage of the hornworm is known as a *sphinx moth* or *hawk moth*.
Most sphinx moths fly at night

The whitelined sphinx is a day flying sphinx moth, aka, a “hummingbird moth”
Hummingbird Moths
Hummingbird Moth

A type of sphinx/hawk moth that flies during the day
Whitelined sphinx

*Hyles lineata*

The most common hummingbird moth of the western US
Whitelined Sphinx
"hummingbird moth" of the West
Hummingbird clearwing sphinx
Hemaris thysbe

“Bumble Bee” Clearwing Sphinx Moths

Snowberry clearwing
Hemaris diffinis
Some plants most often visited by hummingbird moths include:

- Four o’clocks
- Evening primrose
- Larkspur
- Gentian
- Nasturtium
- Catmint
- Datura
- Winecup
- Honeysuckle
Many flies commonly visit flowers to collect nectar
Flies....

fly during the day....
are usually found on white or yellow flowers......
...usually have short mouthparts restrict them to smaller flowers.
Small, accessible flowers are most commonly used by flies as nectar sources.
…usually – but with exceptions - have short mouthparts restrict them to smaller flowers.
Flower (Syrphid) Flies
Many flies mimic bees!
There are many families of beetles that feed on pollen.
Blister Beetles
Soldier Beetles
Soldier beetle and Ambush Bug
Ambush bug – a late summer predator common at flowers
Ambush bugs with prey
Bees & Wasps: A Review of Colorado Species
What is a bee?

What is a wasp?
Features of Bees vs. Wasps

Bees
- Usually noticeably hairy
- May be carrying pollen
- Color often muted

Wasps
- Not hairy
- Never carry pollen
- Often brightly colored
Common Families of Bees and Wasps

**Bees**
- Apidae (honey bees, bumble bees, digger bees, carpenter bees)
- Megachilidae (leafcutter bees, mason bees, sower bees)
- Andrenidae (ground-nesting bees)
- Halictidae (sweat bees)
- Colletidae (plasterer bees)

**Wasps**
- Vespidae (paper wasps, yellowjackets, hornets, potter wasps)
- Sphecidae, Crabronidae (hunting wasps)
- Pompilidae (spider wasps)
- Mutillidae (velvet ants)
- ......other families of predatory Hymenoptera
- ......myriad families of parasitic Hymenoptera
- ......Gall wasps?
Habits of Bees & Wasps

• **Bees**
  – Social bees
    • Perennial colony (honey bee)
    • Annual colony (bumble bees)
  – Solitary bees (leafcutter bees, digger bees)

• **Wasps**
  – Social wasps (yellowjackets, hornets, paper wasps)
  – Solitary wasps (hunting wasps, parasitic wasps)
Hunting Wasps

Families Sphecidae, Crabronidae, Pompilidae
Hunting Wasp Habits

• Solitary wasps – no colony structure
• Young are fed paralyzed prey
• Nests are produced to rear young
  – Dug in soil, plant stems
  – Constructed of mud
  – Existing cavities
• Adults can sting, but are not aggressive
  – Sting of hunting wasps (Sphecidae) are mild
  – Sting of spider wasps (Pompilidae) are very painful
Ammophila wasp digging nest (left), carrying caterpillar prey (lower left), at nest entrance with prey (below)
Ammophila spp. at flowers
Podalonia spp.
Bembix wasp digging while holding horse fly prey
Golden Digger Wasp
– Predator of grasshoppers and katydids
Social Wasp

Western Yellowjacket

*Vespula pensylvanica*

Adults are primarily scavengers

Nesting occurs in soil
Yellowjackets as pollinators? *Marginal*, at best.
Social Wasp

European Paper Wasp

Polistes dominula

Single layer paper nests are produced above ground

Adults are predators of live insects
European Paper Wasp

Western Yellowjacket
Note trailing legs of European paper wasp.

Western yellowjacket.
Traps do not capture the European paper wasp or any other paper wasps
Social Structures of Bees

- Social Bees
  - Perennial Honey Bees
  - Annual Bumble Bees
  - Leafcutter Bees
- Solitary Bees
  - Digger Bees
  - Sweat Bees
Common Social Bees

Social Bees

Honey Bees
Apis mellifera
(Perennial Colony)

Bumble Bees
Bombus spp.
(Annual Colony)
Note on proper spelling of bee names

If it is a bee, then “bee” is a separate word!

Honey bee – Yes!
Honeybee – Not!

Bumble bee – Yes!
Bumblebee – Not!
Honey Bee

Apis mellifera
Honey bee

Nest constructed of wax
Wax flakes are produced by special glands of the thorax, then are molded into comb.
Hexagonal cells: Maximize space and minimize materials
Developmental Stages of Honey Bees
Honey bee colonies have specialized castes that include a queen (fertile female), drones (males) and numerous workers (infertile females)
Queen (fertile female)

The only thing that determines whether a honey bee differentiates into a queen or a worker is larval diet – specifically the percentage of royal jelly.
Royal Jelly

A nutrient rich glandular substance fed to larval bees that is produced by honey bee workers “tasked” with its production (nurse bees).
A small percentage of the colony are males – the drones

Males are produced from unfertilized eggs
Drone fly

Honey bee drone
The male honey bee (drone) cannot sting.

Stinger is a modified ovipositor.
Honey bees – and most bees – collect nectar as their primary energy source.
Frame Filled With Honey
One 8 fl oz “honey bear” is the result of:

ca. 1,000,000 flower visits

-The efforts of 570 honey bees making a total of 14,400 foraging trips
Honey bees – and most bees – use pollen as their primary source for proteins, fats and most other nutrients.
Honey Bees Carry Pollen in a Pollen Basket on the Legs
Honey Bees Produce a Perennial Nest
Honey Bee Colonies Produce Swarms

This may be thought of as a type of budding as a means for the colony – a superorganism – to reproduce.
Ideal Site for Wild Honey Bee Hive

- Located well above ground
- Capacity of 15L to 75L
- Small entrance, located at bottom of cavity
The stinger of a worker honey bee is **barbed**.
Honey bee stinger and poison sac detach and remain embedded in skin.

The only insect that regularly leaves a stinger in the skin is a worker honey bee.
Honey bee stinger and poison sac detach and remain embedded in skin.
Schmidt Sting Pain Index

- Attempts to rank relative painfulness of the sting by various bees, wasps, ants (Hymenoptera) – 1 to 4 ranking
- Descriptive comments may be added
- Top ranking sting – Bullet ant (4.0+)
  - “Pure, intense brilliant pain. Like fire walking over flaming charcoal with a 3-inch rusty nail in your heel”
Schmidt Sting Pain Index

Honey Bee (2.x)

“Like a match head that flips off and burns your skin”
CAUTION

Insect Mimicry in Action!
Bee Flies (Diptera: Bombyliidae)
Bee flies develop as parasites of ground nesting bees
Flower (Syrphid) Flies
Syrphid flies are excellent mimics of bees and wasps

Honey Bees

Flower (Syrphid) Flies
Flower fly larvae

Ken Gray

Brian Valentine
Bumble Bees

*Bombus* species
Bumble Bee Life History
Vacated Bird House inhabited by Bumble Bees
Bumble Bee Stages

Top Left: Capped Pupae
Above: Pupa
Left: Larva
Wax Storage Pots of Bumble Bees
Perennial Colony or Annual Colony?

Bumble bees make annual colonies
Bumble Bee Queen and Worker
Bumble Bee Life History
Bombus huntii – Overwintered queen on left
Male bumble bees
Bumble bees carry pollen in pollen sacs on the hind legs.
Bumble Bees are “buzz pollinators”

Some plants are dependent on buzz pollination
Bumble bee brushing pollen from body into pollen baskets
Some plants (e.g. the tomato) are dependent on buzz pollination.
Project Bumble Bee

A Xerces Society Citizen Science project to identify and record bumble bees found throughout North America.

http://www.xerces.org/bumblebees/
Social Structures of Bees

- Social Bees
  - Perennial Honey Bees
  - Annual Bumble Bees
- Solitary Bees
  - Leafcutter Bees
  - Digger Bees
  - Sweat Bees
Primary Groups of Solitary Bees

- **Family Apidae**
  - Digger bees, longhorned bees, squash bees, sunflower bees, carpenter bees

- **Family Megachilidae**
  - Leafcutter bees, mason bees, carder bees

- **Family Andrenidae (Mining bees)**

- **Family Halictidae (Sweat bees)**

- **Family Colletidae (Plasterer Bees)**
The life cycle of a solitary bee consists of four stages: egg, larva, pupa and adult. Solitary adult bees provision their young with a pollen-ball, illustrated above.

All photographs in this illustration are by Dennis Briggs except the photograph of the pupa, which is by Robbin Thorp.
Carpenter Bees

*Ceratina* spp., *Xylocopa* spp.
Large Carpenter Bee (Xylocopa sp.)
Large carpenter bees (*Xylocopa* spp.) are not present in most of Colorado.
Woodpeckers feed on large carpenter bees
Small Carpenter Bees  (*Ceratina* spp.)
Small carpenter bees are one of the insects that commonly nest in pith of plants. Hunting wasps are another common group of “pith nesters”.
Pollen stores of small carpenter bee in pith of ash twig
One small carpenter bee develops in each chamber.
Small carpenter bees nest in broken twigs – or pruned roses and brambles.

The cells for rearing young are provisioned with nectar and pollen.
Ground Nesting Bees – Family Apidae
Digger Bees

*Anthophora* spp.
Longhorned Bees

*Melissodes* spp.
Longhorned Bees
*Svastra* spp.
Squash Bees

Peronapis spp.
Solitary Bees

Leafcutter Bees, Mason Bees, Carder Bees

Hymenoptera: Megachilidae
Leafcutting Bee damage to rose leaves

Van Waters & Rogers
1983 division of Univar
Leafcutter Bee Excavating Rotten Porch Board
Leafcutter bee excavation in rotten garden timber
Tunnels created by nesting leafcutter bees in decayed wood
Leafcutter bees cut fragments from the edges of leaves that are suitable for nest building.
Leafcutter bee damage to rose, lilac and Virginia creeper
Leafcutter bee carrying leaf fragment
Leafcutter bee returning with leaf fragment
For nest construction:

- 3-4 rectangular pieces, crimped for the base
- Oval pieces along the sides of the cell
Leafcutter bees carry their pollen on the underside of the abdomen.
For nest construction:

- 3-4 rectangular pieces, crimped for the base
- Oval pieces along the sides of the cell
- Nearly perfect circles used to cap the cell
Leafcutter bee collecting pollen
Leafcutter bees carry their pollen on the underside of the abdomen.
Leafcutter bees often will tip up the abdomen.
Leafcutter bee working sweet pea flower.

Note how the anthers become exposed as the bee pushes the flower while nectaring.
Mason Bees
(*Osmia* species)
All members of the family Megachilidae (leafcutter, mason, carder bees) carry pollen on the underside of the abdomen.
Predrilled wood for nesting by the orchard mason bee/ Blue orchard bee
Carder Bees

*Anthidium* spp.
Nests are made in existing cavities. The nest tunnels are lined with plant hairs.
Male wool carder bees patrol and defend territories.
Andrenidae – Mining Bees
Andrenid Bee
nest site
Andrenid bee nest site
Note: *Andrena* spp. are some of the earliest bees you will see.

*Andrena* spp.

*Perdita* spp.
Colletidae – Plasterer/Polyester Bees
Colletidae

*Colletes* spp.
Colletidae

*Hylaeus* spp.

“Yellowfaced bees”
Solitary Bees

Hymenoptera: Halictidae

Sweat Bees
Sweat Bees
Sweat bee (left) and honey bee (right) in thistle flower
Halictidae (Sweat Bees)

*Agapostemon* spp.
Halictidae (Sweat Bees)

Augochlorella spp.
Halictidae (Sweat Bees)

*Halictus* spp.
Halictidae (Sweat Bees)

Lasioglossum spp.

Note: This group includes many of the tiniest bees you will see.
Pollen is collected on the femur and tibia of the hind legs.

Photograph courtesy of Tom Lethbridge, University of Florida.
Halictid bee nest sites in backyard patio area
Most sweat bees are soil nesters.
Schmidt Sting Pain Index

Sweat Bee (1.0)

“Light, ephemeral almost fruity. A tiny spark has singed a single hair on your arm”