



# Pollinators

NOT JUST BEES AND BUTTERFLIES!

# Topics

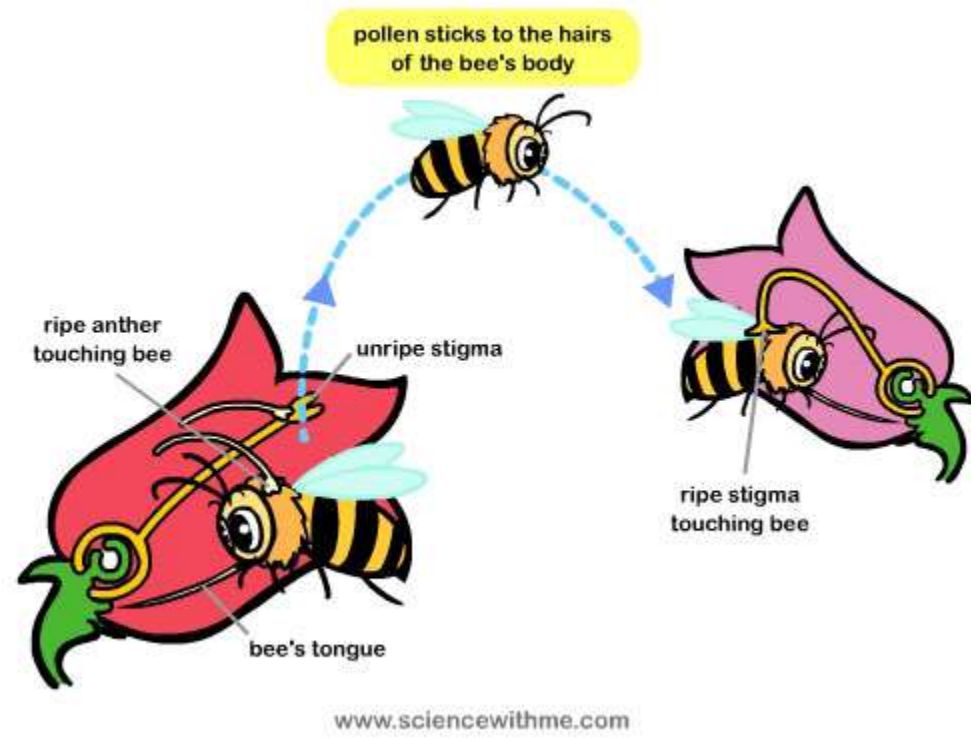
- ▶ Why the concern?
- ▶ Pollination Basics
- ▶ Groups of Pollinators
- ▶ Providing for Pollinators
- ▶ Practices to Avoid

# Role of Pollinators and Their Decline

- ▶ Pollinators are responsible for 1 out of every 3 bites of food you eat!
- ▶ Animals:
  - ▶ Pollinate 80% of flowering plants in the US
  - ▶ Pollinate 75% of fruits, nuts, and veggies grown in the US
- ▶ Pollinator decline:
  - ▶ Monarch decline
  - ▶ Bumble bee decline
  - ▶ Honey bee decline

# Pollinator Basics

- ▶ Pollination occurs when pollen is moved to the female part of a flower and fertilizes the flower, allowing for the production of fruits and seeds.
- ▶ Abiotic Pollination vs. Biotic Pollination
- ▶ Intentional vs. Incidental pollination by animals



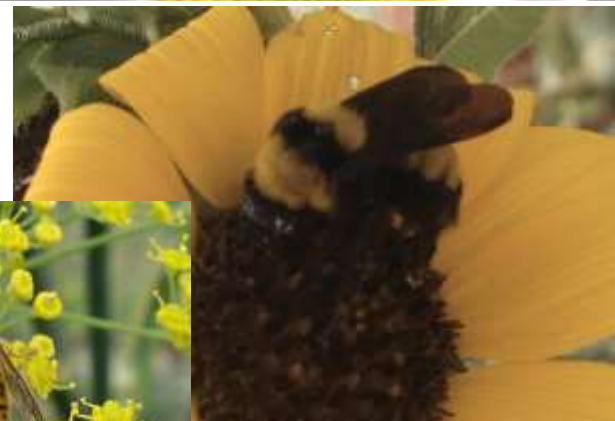
# Pollinator Syndrome Traits

Pollinator Syndrome Traits Table

Trait	Pollinator							
	Bats	Bees	Beetles	Birds	Butterflies	Flies	Moths	Wind
<b>Color</b>	Dull white, green or purple	Bright white, yellow, blue, or UV	Dull white or green	Scarlet, orange, red or white	Bright, including red and purple	Pale and dull to dark brown or purple; flecked with translucent patches	Pale and dull red, purple, pink or white	Dull green, brown, or colorless; petals absent or reduced
<b>Nectar guides</b>	Absent	Present	Absent	Absent	Present	Absent	Absent	Absent
<b>Odor</b>	Strong musty; emitted at night	Fresh, mild, pleasant	None to strongly fruity or fetid	None	Faint but fresh	Putrid	Strong sweet; emitted at night	None
<b>Nectar</b>	Abundant; somewhat hidden	Usually present	Sometimes present; not hidden	Ample; deeply hidden	Ample; deeply hidden	Usually absent	Ample; deeply hidden	None
<b>Pollen</b>	Ample	Limited; often sticky and scented	Ample	Modest	Limited	Modest in amount	Limited	Abundant; small, smooth, and not sticky
<b>Flower Shape</b>	Regular; bowl shaped – closed during day	Shallow; have landing platform; tubular, c	Large bowl-like, Magnolia	Large funnel like; cups, strong perch support	Narrow tube with spur; wide landing pad	Shallow; funnel like or complex and trap-like	Regular; tubular without a lip	Regular: small and stigmas exerted

# Pollinator Groups

- ▶ Moths
- ▶ Wasps and Velvet Ants
- ▶ Spiders
- ▶ Flies & Mosquitoes
- ▶ Ants
- ▶ True bugs
- ▶ Beetles
- ▶ Hummingbirds
- ▶ Bats
- ▶ Butterflies
- ▶ Bees



# Moths Vs Butterflies

Moths	Butterflies
Grey or brown	Brightly colored
Fold wings flat while at rest	Hold wings partially open or closed vertically over their bodies
Fatter and hairier	Slender and sleek
Antennae are broad, complex and feathery	Antennae are simple with clubbed ends
Generally fly at night	Fly during the day
Some can hover	Don't truly hover
Keen sense of smell	Keen sense of vision
Caterpillars metamorphose in cocoons	Caterpillars metamorphose in a chrysalis

# Moths

- ▶ Sphinx moth = hawkmoth
- ▶ Yucca moth
- ▶ tomato and tobacco hornworms





# Moth Flowers

- ▶ Flowers visited by moths are typically:
  - ▶ In clusters and provide landing platforms
  - ▶ White or dull colors
  - ▶ Open late afternoon or night
  - ▶ Ample nectar producers, with nectar deeply hidden such as morning glory, tobacco, yucca, and gardenia

*After dark moths take over the night shift, visiting pale blooms heavy with fragrance and large amounts of dilute nectar.*



# Flies and Mosquitoes

- ▶ Bee flies
- ▶ Syrphid flies
- ▶ Tachnid flies
- ▶ Blow flies
- ▶ Mosquitoes



# Fly Flowers

Flowers visited by flies are typically:

- ▶ Pale and dull to dark brown or purple
- ▶ Sometimes flecked with translucent patches
- ▶ Putrid odor, like rotting meat, carrion, dung, humus, sap and blood
- ▶ Produce pollen
- ▶ Flowers can be funnel like or complex traps



*Flies are attracted to blossoms  
that smell putrid.*

# Ants

- ▶ Social insects that love nectar
- ▶ Wingless so must crawl into each flower
- ▶ Not as effective at cross-pollinating flowers.



# Ant Flowers

Flowers visited by ants are typically:

- ▶ Low growing
- ▶ Have small inconspicuous flowers
- ▶ Have flowers that are close to the stem



# Bats

- ▶ Insectivorous bats in the Verde Valley
- ▶ Nectivorous bats in Sonoran desert



# Bat Flowers

Flowers that are visited by bats are typically:

- ▶ Open at night
- ▶ Large in size
- ▶ Pale or white in color
- ▶ Very fragrant –fermenting or fruit-like odor
- ▶ Copious dilute nectar



*After dark moths and bats take over the night shift, visiting nocturnal blooms heavy with fragrance and large amounts of dilute nectar.*

# Beetles

- ▶ Crossidius
- ▶ Blister
- ▶ Buprestids
- ▶ Clerids
- ▶ Jewel
- ▶ Long-horned
- ▶ Checkered
- ▶ Tumbling flower
- ▶ Soft-winged Flower
- ▶ Scarab
- ▶ Sap
- ▶ False blister
- ▶ Rove
- ▶ Soldier





# Beetle Flowers

Flowers that are visited by beetles are typically:

- ▶ Bowl shaped with sexual organs exposed
- ▶ White to dull white or green
- ▶ Strongly fruited
- ▶ Give off spicy or fermented scents
- ▶ Moderate nectar producers
- ▶ May be large solitary flowers
- ▶ May be clusters of small flowers (like goldenrods)
- ▶ Some plants are thermogenic and offer reward of heat

Beetle-pollinated flowers are very large and fragrant.



# Wasps and Velvet Ants

- ▶ Pollen Wasps
- ▶ Paper Wasps
- ▶ Yellow Jackets
- ▶ Sphecid Wasps
- ▶ Potter Wasps
- ▶ Velvet Ants



*Wasps are yet another group of pollinators.*

# Spiders

► Crab spiders



# True Bugs

- ▶ Wheel bug
- ▶ Ambush bug



# Birds

- ▶ Hummingbirds
- ▶ Orioles
- ▶ Tanagers (in other countries)



# Bird Flowers

Flowers visited by birds are typically:

- ▶ Tubular and have petals that are recurved to be out of the way
- ▶ Have tubes, funnels, cups
- ▶ Strong supports for perching
- ▶ Brightly colored (red yellow or orange)
- ▶ Odorless (birds have a poor sense of smell)
- ▶ Open during the day
- ▶ Prolific nectar produces with nectar deeply hidden
- ▶ Modest pollen producers that are designed to dust the bird's head/back with pollen as the bird forages for nectar.



*Hummingbirds visit flowers with tubular red, yellow, or orange flowers.*

# Butterflies

- ▶ Active during the day
- ▶ Not as efficient pollinators as bees and moths
- ▶ Have good vision but weak sense of smell



# Butterfly Flowers

Flowers that attract butterflies are typically:

- ▶ In clusters and with good (flat) landing platforms
- ▶ Brightly colored (red, yellow, orange)
- ▶ Open during the day
- ▶ Ample nectar producers, with nectar deeply hidden
- ▶ May be clusters of small flowers (goldenrods)
- ▶ Nectar guides are present

*Butterflies select flowers based on shape. Since they can't hover, they need a good place to land.*





# Nectar Guides

- ▶ The region of low ultraviolet reflectance near the center of each petal that guides butterflies and bees directly to the center of the flower.



**As humans view it!**



**As bees view it!**

# Bees are the master pollinators!

- ▶ Your grocery store with and without bees!



# Honey Bees Vs. Native Bees

## ▶ **Non-native Honey bees**

- ▶ Most from Europe (European honey bee)
- ▶ Now Brazilian bees that have been Africanized
- ▶ Have escaped domestication
- ▶ Don't know how to pollinate certain native plants

## ▶ **Native bees**

- ▶ Pollinate 80% of flowering plants in the US
- ▶ Pollinate 75% of fruits, nuts, and veggies grown in the US
- ▶ There are all kinds of native bees
- ▶ Arizona has the highest diversity of native bees in the US!

# A Bee, Fly, or Wasp?

Native Bees	European Honey Bees	Wasp	Fly
Two sets of wings			One set of wings
Diverse in shape and size – will go over each group	Triangular head, black eyes, dark legs, golden brown hairs, orange abdomen with black stripes Hair on eyes	Narrow waists	Huge eyes that meet at the top of head
Hairier and more robust than wasps		No pollen carrying hairs on legs or abdomen	
Medium antennae (except long-horned bees)	Medium length antennae	Long antennae	Short, stubby antennae

# Different types of Native Bees

- ▶ Bumble
- ▶ Carpenter
- ▶ Squash
- ▶ Cuckoo
- ▶ Mason & Leaf-cutters
- ▶ Sweat
- ▶ Miner
- ▶ Cellophane
- ▶ Long-horned



# Colony Collapse Disorder

- ▶ Honey Bee CCD
  - ▶ Due to a combination of factors:
    - ▶ Diseases
    - ▶ Mites
    - ▶ Nutrition
    - ▶ Stress
    - ▶ Pesticides

# Bee Flowers

- ▶ Flowers visited by bees are typically:
  - ▶ Full of nectar and have nectar guides
  - ▶ Brightly colored with petals that are usually blue or yellow or a mixture (bees can't see red)
  - ▶ Sweetly aromatic or have a minty fragrance
  - ▶ Open in daytime
  - ▶ Provide landing platforms
  - ▶ Often bilaterally symmetrical (one side is a mirror image of other)
  - ▶ Flowers are often tubular with nectar at the base of the tube



*Bees are the most efficient pollinators. There are over 4,000 species of bees in the U.S.!*

# Native Bee Nests

- ▶ Most bees excavate nest tunnels in sunny patches of bare ground
- ▶ These two groups nest in already existing holes:
  - ▶ Mason bees construct partition walls and plugs from mud
  - ▶ Leafcutter bees cut perfectly round circles from leaves and use these to line the inner walls of a nest.
- ▶ Carpenter bees harvest plant fibers and excavate their own holes for nesting.
- ▶ Cuckoo bees don't make a nest!
- ▶ Others nest in beetle burrows in dead wood
- ▶ Some nest in pithy or hollow, dry stems





# Bee mimickers

- ▶ Honey bees
- ▶ Bee Flies
- ▶ Drone Fly
- ▶ Flower flies (Syrphids)
- ▶ Yellow jackets



(possibly bumble  
bee mimic) flower fly  
(*Mallota posticata*).

# Providing for Pollinators

- ▶ Provide a variety of tree, shrub, vines, and wildflowers
- ▶ Include native plants in your garden
- ▶ Include larval host plants as butterflies you have to grow caterpillars eat.
- ▶ Choose species so plants are available throughout the growing season
- ▶ Plant big patches for better success
- ▶ Provide pesticide-free water and mud
- ▶ Create a damp salt lick for butterflies and bees by mixing a small bit of sea salt or wood ashes in an area with wet soil.



# Providing for Pollinators

- ▶ Nature is messy! In your garden, allow for other forms of structure:
  - ▶ Small piles of branches
  - ▶ Hollow twigs – leave 12 inches of roses when pruning and dried stems of sumac, Russian sage, flowering stalks of goldenrod, Echinacea and *Iris reticulata*, forsythia,
  - ▶ Rotting logs and stumps
  - ▶ Rodent burrows
  - ▶ Fallen plant material

# Providing for Pollinators

- ▶ Provide nesting habitat:
  - ▶ Allow for bare spots of soil and/or sand here and there
  - ▶ Leave 12 inches of stem when pruning shrubs
  - ▶ Drill holes ( $\frac{3}{32}$  to  $\frac{3}{8}$ " diameter and 4-5 inches deep) on post or tree trunk
  - ▶ Build a nesting block



# Providing for Pollinators

- ▶ Provide Nectar Corridor or Feeding Waystations:
  - ▶ 0.5 ac minimum
  - ▶ Include one early, mid, and late season flowering plant
  - ▶ Must be undisturbed throughout growing season
  - ▶ Avoid toxic plants poisonous to pollinators
  - ▶ Herbicides and insecticides should not be used in corridor
  - ▶ Control invasive species



# Providing for Pollinators

- ▶ Provide wintering habitat:
  - ▶ Leave areas of bare, loose soil exposed and protected from compaction
  - ▶ Leave areas of leaf litter
  - ▶ Woodpiles and rock walls
  - ▶ Sheds

# Practices to Avoid

- ▶ Avoid chemicals – pesticides and herbicides kills pollinators
- ▶ Avoid using weed barrier cloth
- ▶ Avoid thick mulch or gravel (thin layer is OK)
- ▶ Avoid sprinkler irrigation during the daylight hours
- ▶ Avoid planting modern hybrids; they have no pollen, nectar, and/or fragrance and don't benefit pollinators.

# Take Home Points

- ▶ Native pollinator species are declining, not just European honey bees.
- ▶ There are so many other groups of pollinators
- ▶ Pollinators use all kinds of flower types
- ▶ Complex mutualistic adaptations and relationships
- ▶ The best pollinators in our area are native bees, flies, moths, and hummingbirds
- ▶ Some plants only have one pollinator making both vulnerable to extinction.
- ▶ Besides plantings, other practices can benefit pollinators



Questions?

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