

# Lifetime Learning Institute, May 28, 2020

**SUPPORT NATIVE BEES** NATIVE PLANTS FOR SUN AND CLAY SOILS



|   |   |   |  |  |   |
|---|---|---|--|--|---|
| <br>NODDING ONION<br><i>Allium cernuum</i>    | <br>WILD QUININE<br><i>Parthenium integrifolium</i>  | <br>PRAIRIE CLOVER<br><i>Dalea spp.</i>            | <br>STIFF GOLDENROD<br><i>Solidago rigida</i>         | <br>WILD BERGAMOT<br><i>Monarda fistulosa</i>         | <br>GOLDEN ALEXANDERS<br><i>Zizia spp.</i>       |
| <br>BLACK-EYED SUSAN<br><i>Rudbeckia spp.</i> | <br>OHIO SPIDERWORT<br><i>Tradescantia ohioensis</i> | <br>PURPLE CONEFLOWER<br><i>Echinacea purpurea</i> | <br>CANADA MILK VETCH<br><i>Astragalus canadensis</i> | <br>CANADA TICK TREFOIL<br><i>Desmodium canadense</i> | <br>YELLOW CONEFLOWER<br><i>Ratibida pinnata</i> |

PollinatorsNativePlants.com  
facebook: PollinatorNativePlants  
© Heather Holm

**PLANT NATIVE PLANTS**



**ENDANGERED POLLINATORS AND THEIR HABITATS**



**POLLINATOR PARTNERSHIP**



## The World of Pollinators

**Larry Cartwright**

**prowarbler@verizon.net**

# What is Pollination?

- ❑ **Pollination is a form of plant sexual reproduction that occurs**
  - ✓ When pollen is transferred from the stamen (male part) of a flower to the stigma (female part) of another flower
  - ✓ Resulting in fertilization and production of fruits, vegetables, and seeds
- ❑ **While some flowering plant species rely on wind for pollen transfer**
  - ✓ The majority depend on insects and other animals to do it for them





# Why are Insect and Animal Pollinators Important?

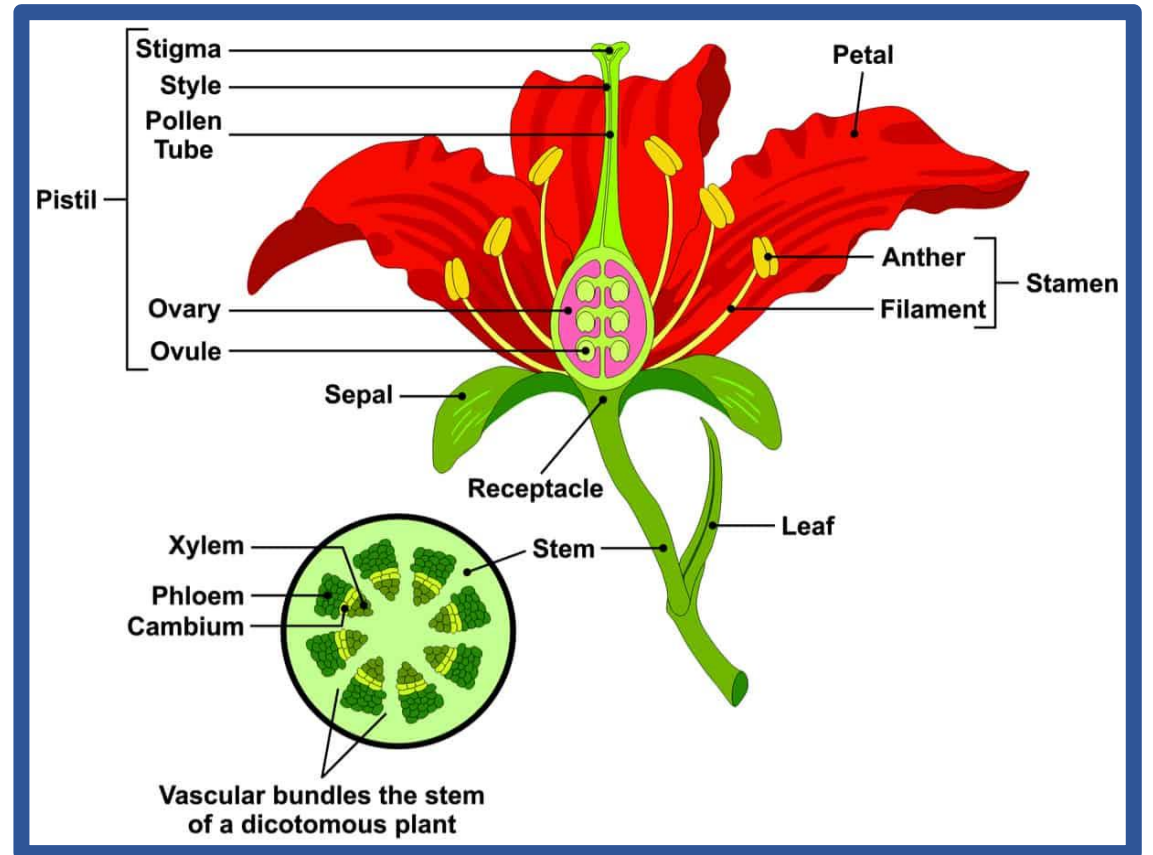
- ❑ **The U.S. Department of Agriculture estimates that**
  - ✓ 75% of the world's flowering plants
  - ✓ And 25% of the world's food crops
  - ✓ Depend on insect and animal pollination for reproduction
- ❑ **Flowering plants and their pollinator partners co-evolved over time**
  - ✓ Resulting in morphological adaptations that have increased interdependency
  - ✓ Flowering plants have developed visual cues, scent, and food to attract pollinators



Hummingbird pollinators find the bright red color of the flowers and the nectar provided by the Red Lobelia irresistible

# Parts of a Flower

- ❑ The stamen is the male fertilizing organ of a flower
  - ✓ That typically consists of a pollen-containing anther supported by a filament
- ❑ The female stigma is the part of the pistil that receives pollen during pollination
- ❑ The pollen is sent from the stigma down through the pollen tube
  - ✓ To the ovary where it fertilizes the ovules that become seeds



# Meet the Pollinators



**INSECTS**



**BIRDS**



**MAMMALS**



# Insect Pollinators: Bees

- ❑ **There are some 5,000 bee species native to North America**
  - ✓ But the colonial nesting Honeybee is not one of them
  - ✓ The only known native North American Honeybee went extinct 14 million years ago
- ❑ **Today's Honeybees were introduced to Virginia by European colonists in 1622**
- ❑ **They are good pollinators but are not as efficient at foraging as native bees, according to several sources**



**Honeybees possibly were introduced to Virginia more for the honey they produced than for their pollination services**

# The Mason Bee

- ❑ **Most native North American bees live solitary lives**
  - ✓ With no hive, queen, or honey production
- ❑ **One example are Mason Bees that nest in preexisting holes in wood**
- ❑ **The male dies soon after mating and the female tends to her nest alone**
  - ✓ But she prefers to have other nesting Mason Bee females as neighbors
- ❑ **Mason Bees pollinate an assortment of flowers, including apple blossoms**



Mason Bee females, like this Red Mason Bee, live less than a year. Some experts claim that 300 to 500 Mason Bees surpassed the pollination efforts of a hive of 25,000 Honeybees in a one-acre apple orchard



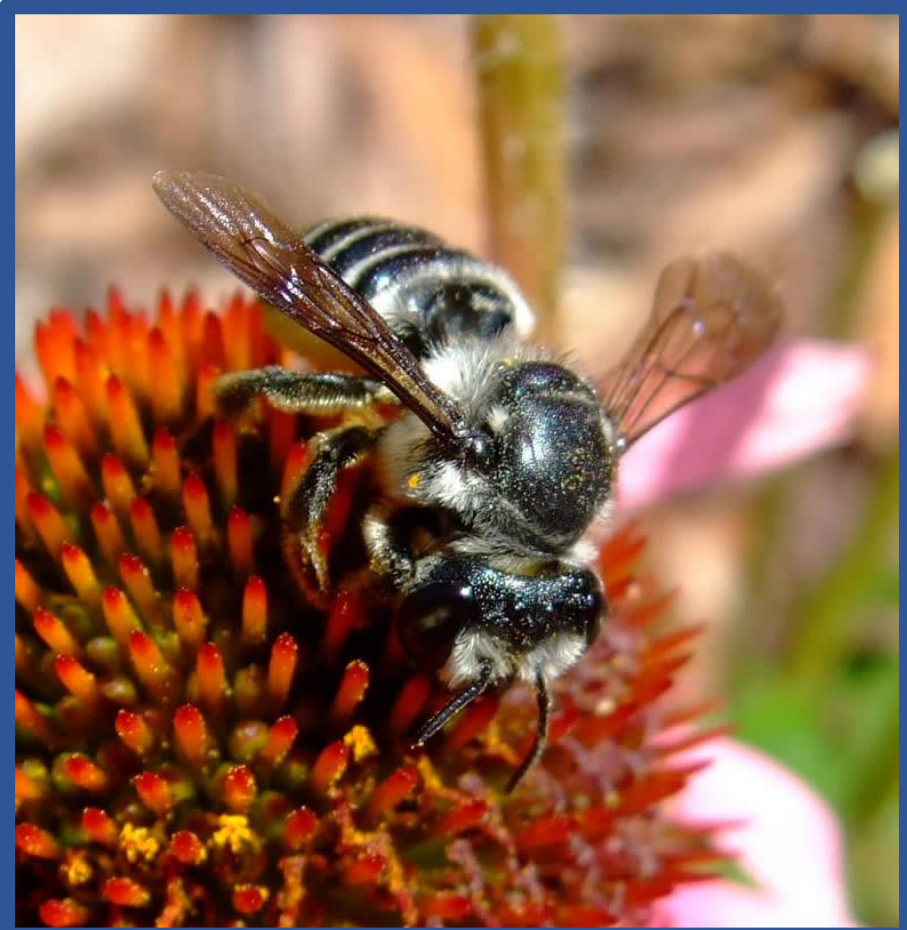
# There Are Even Mason Bee Nest Houses Available





# Leafcutter Bees

- ❑ Another efficient pollinator of numerous plants are Leafcutter Bees
- ❑ They have an almost identical lifestyle as Mason Bees
  - ✓ The female nests in holes in wood
  - ✓ In the company of other females
  - ✓ And dies at the end of summer
- ❑ But unlike her Mason Bee counterpart that uses mud for nest construction
- ❑ The female Leafcutter Bee uses leaves



A Megachile Leafcutter Bee gathers nectar and pollen from a Purple Coneflower

# The Leafcutter Bee at Work

- The Leafcutter Bee cuts leaves into almost perfect circles

- And brings the cuttings to her nest hole to be made into chambers for her eggs





# Mining Bees

- ❑ The solitary female Mining Bee builds her nest in underground tunnels
- ❑ Males perform display flights above the tunnel entrance
  - ✓ And once mating occurs, the female begins laying eggs inside the tunnel
- ❑ Mining Bees time their spring emergence
  - ✓ To pollinate the earliest blooming flowers, including blueberries
- ❑ Some species are generalists and others specialize on one or a few types of plants



An Ashy Mining Bee emerges from her nest tunnel

# Bumblebees

- ❑ Bumblebees may be the most recognizable of our native bees
- ❑ They are also one of the few North American bees that live in social groups
- ❑ A queen and her daughters maintain a colony in an old rodent's nest, but make no honey
  - ✓ All the bees die at the end of summer except a new queen who hibernates
  - ✓ And emerges the following spring to start a new colony
- ❑ Bumblebees are generalist foragers and pollinate a wide range of plants



© bill reynolds

A Common Eastern Bumblebee  
pollinates a flower



# Pity the Poor Male Bumblebee

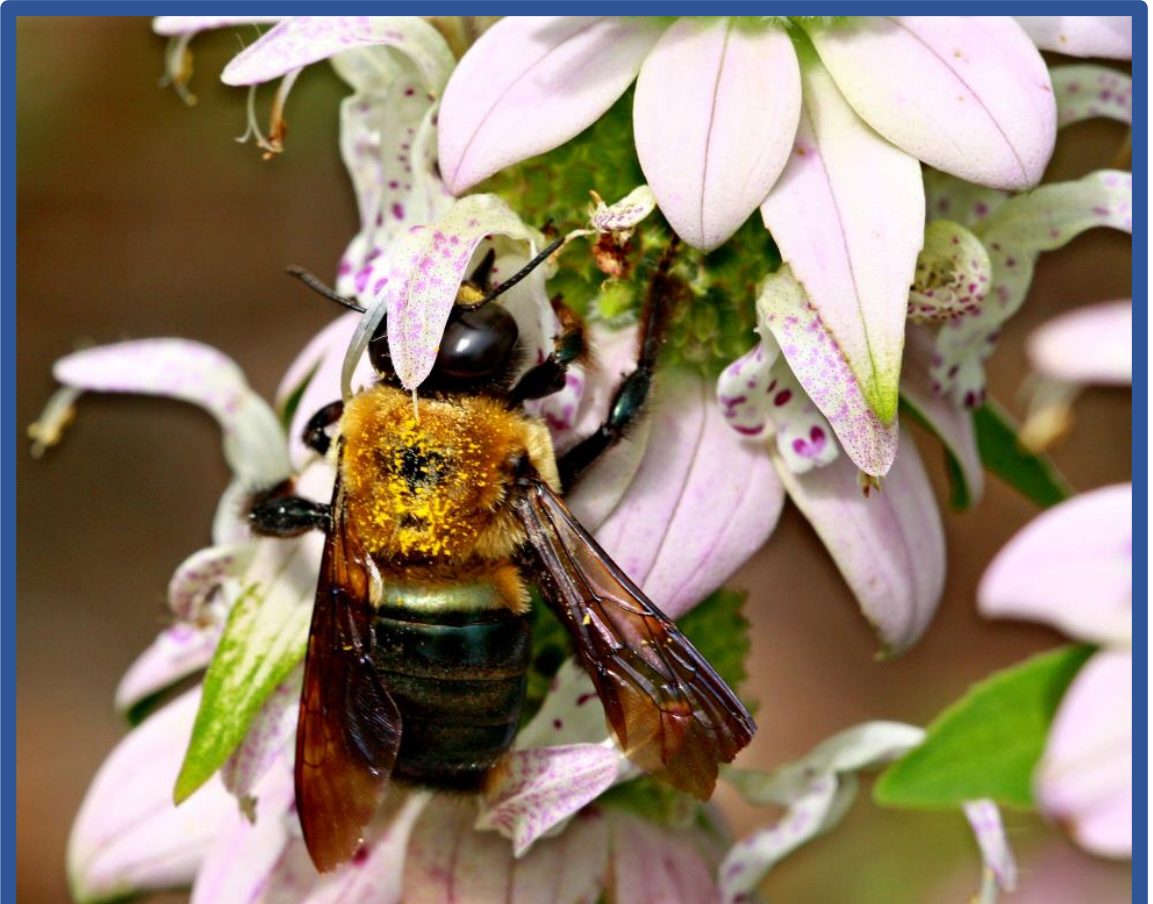
- ❑ My research shows that most, if not all, male bees die soon after mating
  - ✓ But the male bumblebee seems to suffer a particularly nasty fate
- ❑ His testicles rupture and his penis separates after mating
  - ✓ And blocks the female's genital opening so that other males can not mate with her
- ❑ So his death may be unpleasant
  - ✓ But he can be assured that his genes will be passed on to the next generation
  - ✓ What a great consolation prize!



Common Eastern Bumblebees mating. Notice that the female is much bigger than the male.

## And Finally, the Carpenter Bee

- ❑ **Carpenter Bees look like Bumblebees**
  - ✓ But the Bumblebee gives the appearance of being hairy all over
  - ✓ While the abdomen of the Carpenter Bee gives a smooth appearance
- ❑ **Carpenter Bees are generalists and visit many different types of flowers**
- ❑ **Most are solitary nesters**
  - ✓ Although some newly hatched females share the nest with their mothers
- ❑ **Carpenter Bees drill holes into dead wood, including unpainted decks**



An Eastern Carpenter Bee on Spotted Beebalm



# And I have Proof From my Own Home

A Carpenter Bee drilled a hole into the underside of our deck to build a nest

And I believe some lucky woodpecker found the larvae and had a nice meal



# Flies

- ❑ Flies are in the group **Diptera**, meaning “two wings”
  - ✓ While bees have four wings
- ❑ Among the most important fly pollinators are **Flower Flies**
  - ✓ Also called **Hoverflies**
  - ✓ And many of them look like bees
- ❑ **Flower Flies** pollinate both wild and agricultural plants
  - ✓ Including carrots and avocados

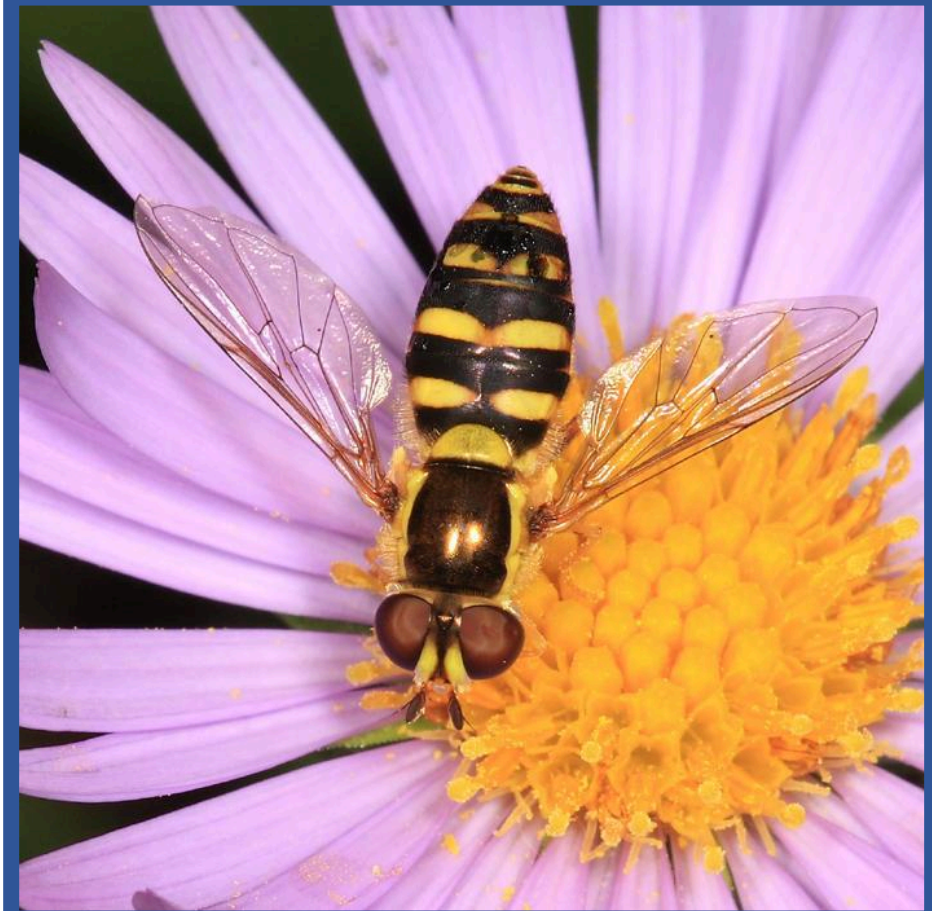


This Syrphid Flower Fly can be distinguished from a bee by its larger protruding eyes, short antenna, and its single pair of wings.



# Flower Fly Life Cycle

- ❑ Flower Flies do not make a nest for their young as do colonial or solitary bees
- Instead the flies lay eggs on a plant or even a flower
  - Perhaps one a female just pollinated
- In some species the hatched larvae go underground to feed on decaying plant or animal material
- While the larvae of other Flower Fly species consume the living larvae or pupae of other insects



A Syrphid Flower Fly feeds on Nectar

Here a Transparent Flower Fly Larva Has Consumed a Wasp Pupa





# No Flies: No Chocolate: No Lie

- ❑ **The Cacao Tree is native to northwestern South America**
  - ✓ Growing along waterways in lowland rain forests under heavy canopy cover.
- ❑ **The seeds are encased in fruit pods**
  - ✓ And are used to make chocolate
- ❑ **Cacao Tree flowers grow directly from the trunk**
  - ✓ And rely on a group of splendid little flies called Chocolate Midges for pollination



The Cacao Tree can produce many bunches of flowers simultaneously

# Enter the Chocolate Midge

- ❑ Various species of Chocolate Midge have coevolved with the Cacao Flower
- ❑ These amazing little pollinators are no bigger than a pinhead
  - ✓ But are entirely responsible for pollinating the Cacao Tree
  - ✓ Because their small size allows them to navigate the narrow intricate parts of the flower
- ❑ Cacao delivers a multitude of scents to attract the Chocolate Midge
  - ✓ And the flowers bloom right before dawn when the midge is most active

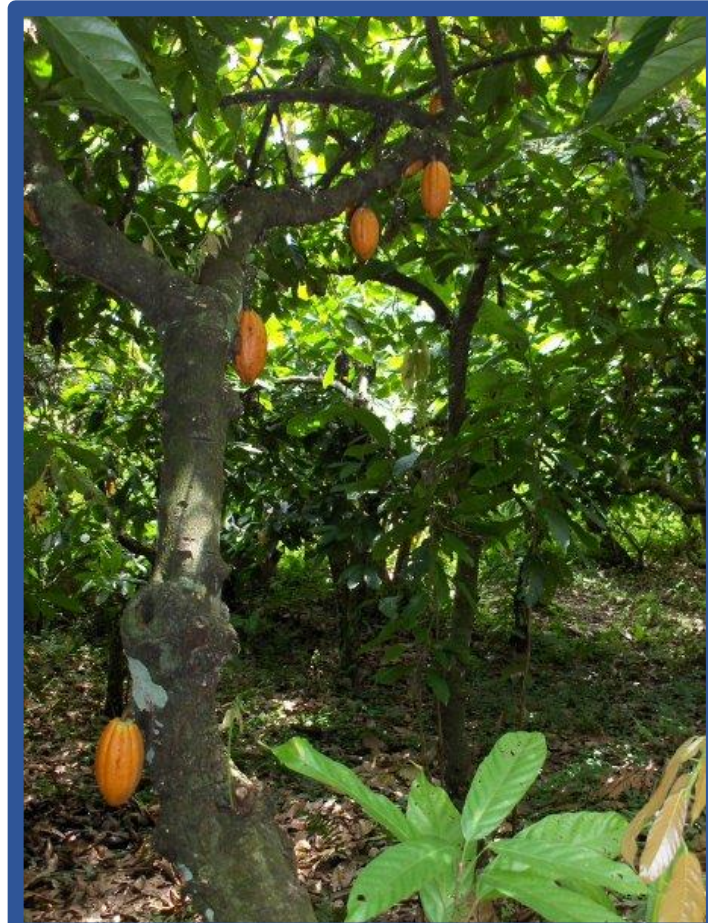


The Chocolate Midge is tiny in stature but huge in importance



# Current Problems But Future Hopes

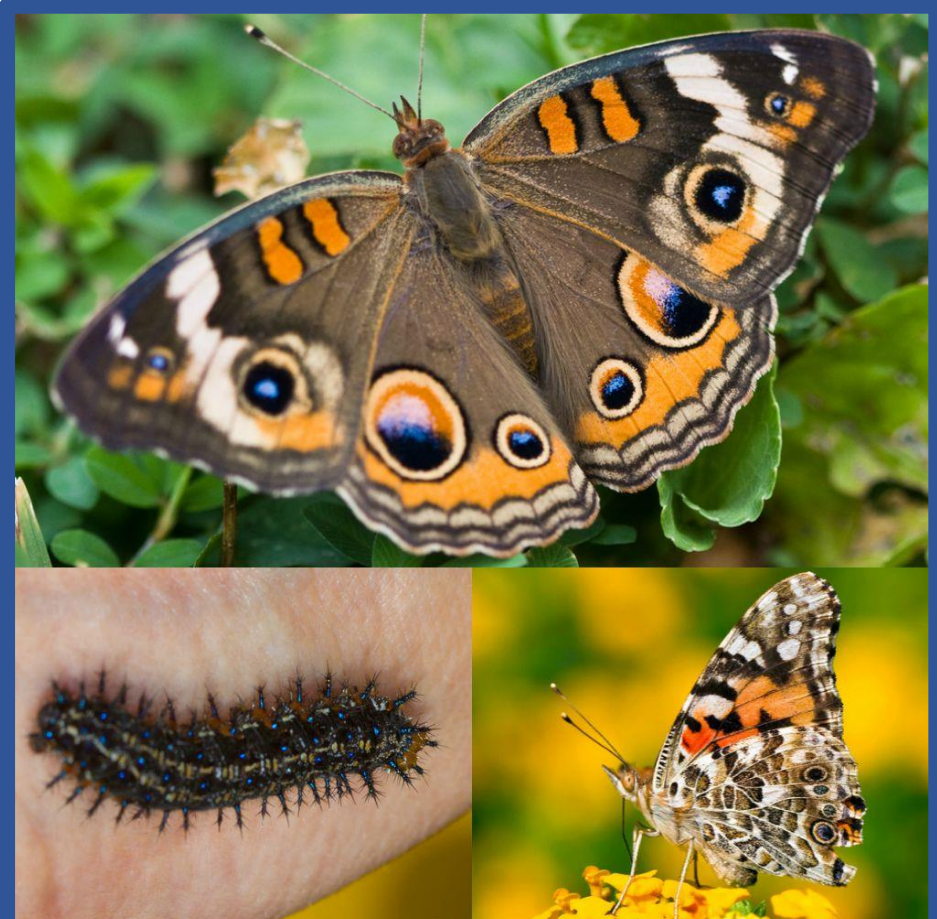
- ❑ Cacao Trees are now grown in large open plantations in many areas
- ❑ The Chocolate Midge is reluctant to traverse open areas to pollinate the flowers
  - ✓ Plus the variety of scents produced by cultivated Cacao has been greatly reduced
- ❑ The result is that only a small fraction of Cacao flowers on plantations get fertilized by the midge
  - ✓ And the options are to artificially pollinate
  - ✓ Or return to tending to smaller plots under the rain forest canopy



The Cacao Tree with seed pods

# Butterflies

- ❑ **Butterflies are undeniably our most beautiful insect pollinators**
  - ✓ Although less efficient at moving pollen between plants as bees and flies
- ❑ **Their legs and proboscises are further away from the pollen source when feeding**
  - ✓ And their bodies lack specialized structures for collecting pollen
- ❑ **Despite the reduced efficiency, butterflies can pollinate a wide range of flowers**
  - ✓ And the larvae can dine on one or many host plants depending on the butterfly species



**Aster and Sunflower are favorite nectar sources of adult Buckeyes while a variety of snapdragons and plantains host the larvae**

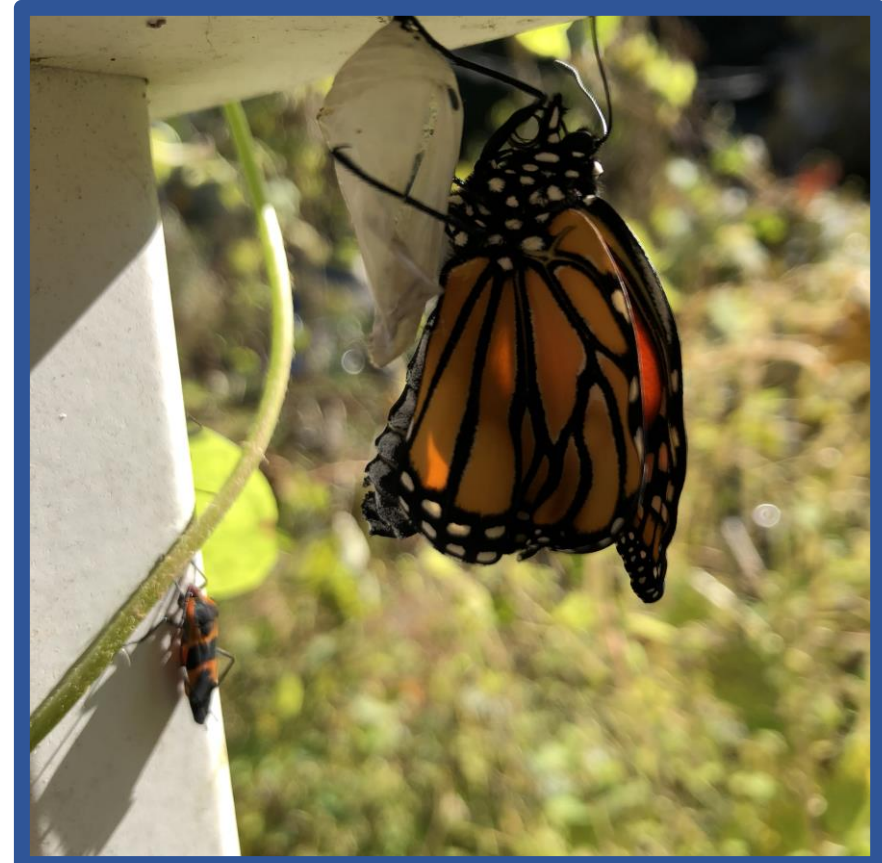


# The Monarch: King of Butterflies

- A Monarch Butterfly larva dines on its host plant, Common Milkweed, in our garden



- And a new adult emerges from its chrysalis under a railing on our porch

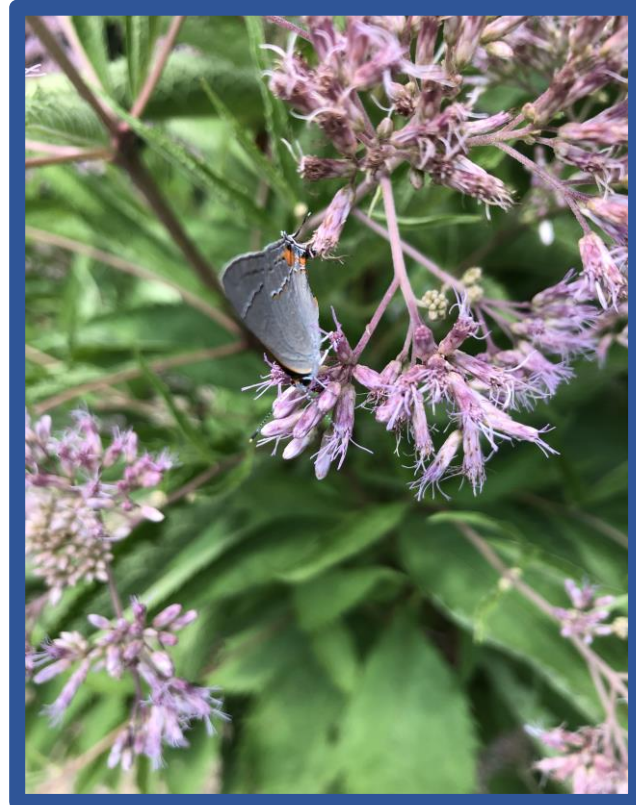


# And Even More Butterflies in Our Garden

A Clouded Sulphur feeds on a brightly colored Zinnia



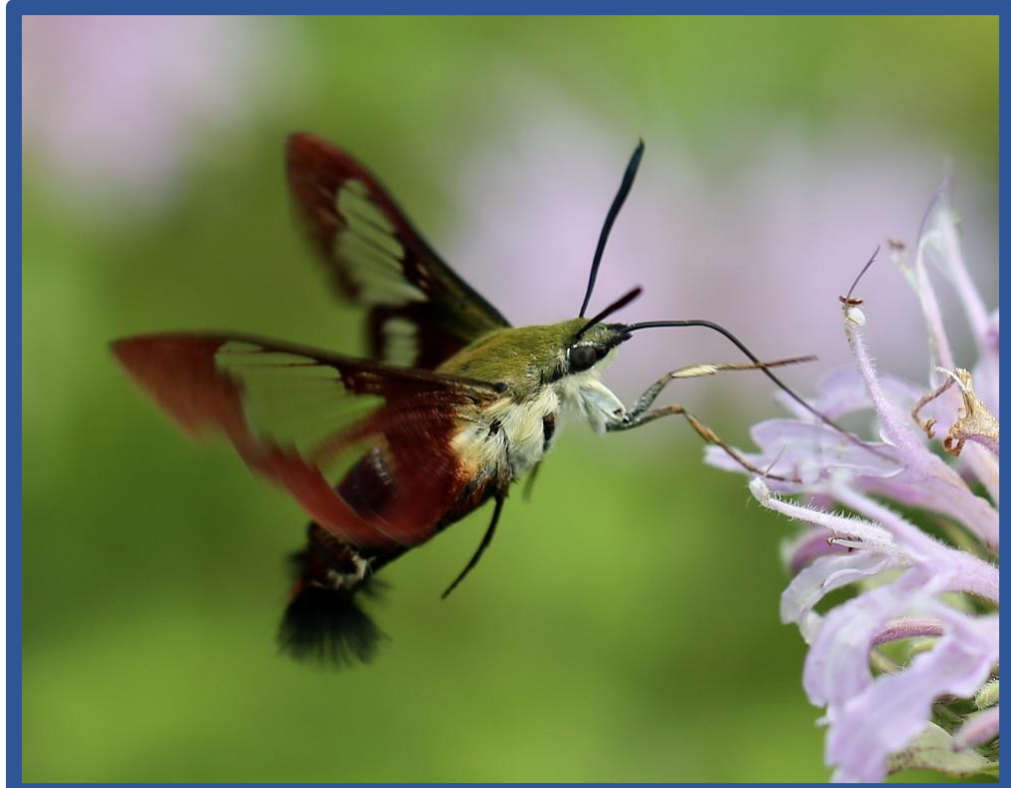
While a Gray Hairstreak dines on Joe Pye Weed





# There Are Even Pollinator Moths

- ❑ Perhaps the best known are the Hummingbird or Sphinx Moths
- ❑ They forage on flowers in similar fashion to hummingbirds
  - ✓ By hovering around tubular-shaped flowers that they prefer
- ❑ It is not uncommon for people to mistake Hummingbird Moths for actual hummingbirds
  - ✓ But remember that the moths have antennae and are smaller



A Hummingbird Clearwing Moth takes nectar from a flower

# Avian Pollinators: Hummingbirds

- ❑ Hummingbirds are specialized nectar-feeding birds found only in the Western Hemisphere
- ❑ They comprise some 340 species
  - ✓ With the heaviest concentration in Central and South America
- ❑ Hummingbirds can be generalists, accessing a wide variety of flowers
- ❑ Or they can be specialists, relying on one or a few unique flowers with which they co-evolved



The Buff-tailed Sicklebill, a hummingbird with a sharply decurved bill, depends on this uniquely shaped flower found in the South American lowlands that both species inhabit



# Hummingbirds as Pollinators

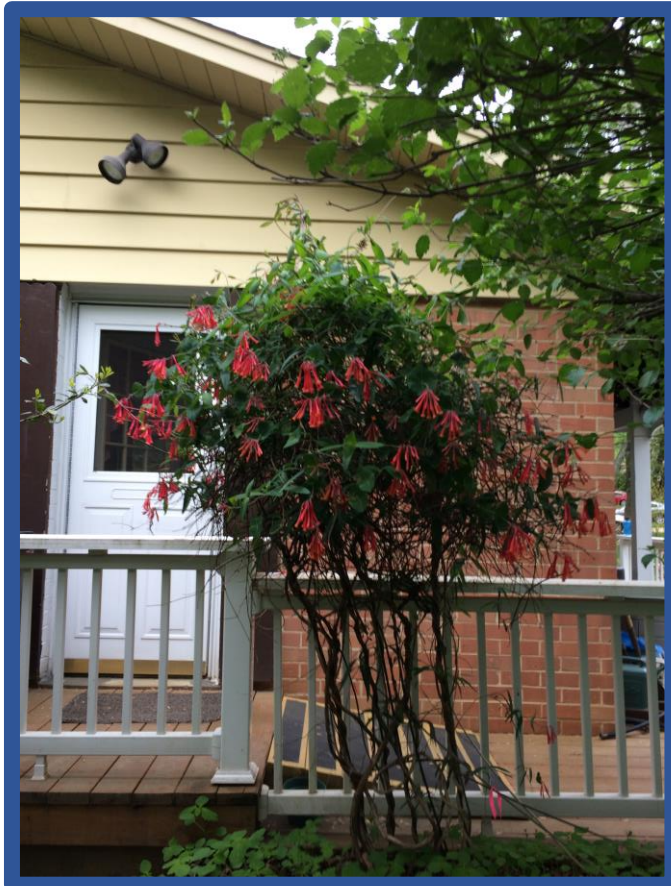
- ❑ **Hummingbirds are efficient pollinators**
  - ✓ Although they don't target the variety of flowers as do bees or flies
- ❑ **The flowers to which hummingbirds are primarily attracted**
  - ✓ Are quite colorful, especially in shades of red, pink, yellow, and orange
  - ✓ Have little scent, as hummingbirds do not depend on fragrance as do bees and flies
  - ✓ Are tubular shaped, making it easy to penetrate the flower with their long bills
  - ✓ Have a long blooming season and are high in nectar production



**A Ruby-throated Hummingbird feeds on Red Lobelia,  
aka Cardinal Flower**

# Other Hummingbird Favorites

Trumpet Vine Honeysuckle awaits hummingbirds in our garden



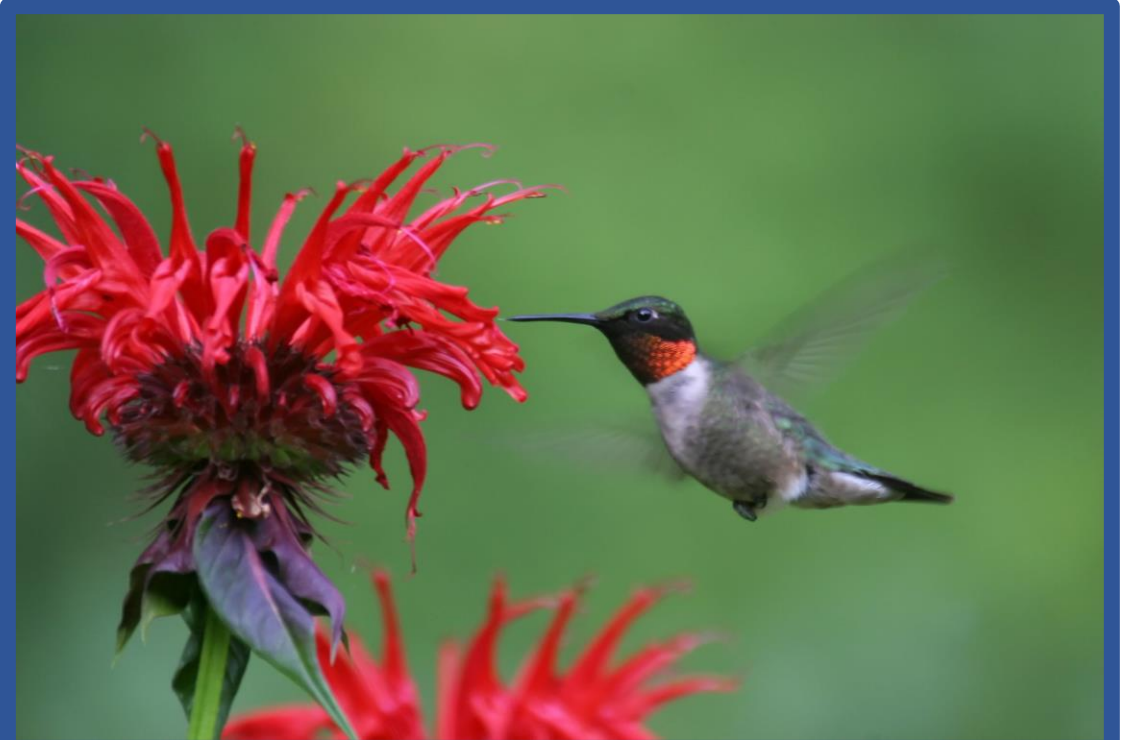
Eastern Red Columbine gets frequent visits from hummingbirds





# The Ruby-throated Hummingbird

- ❑ The Ruby-throated Hummingbird is the only breeding hummingbird native to the eastern United States and Canada
- ❑ It arrives in northern Virginia by mid-April during spring migration
  - ✓ And begins its fall migration in September
- ❑ Although relying heavily on small insects for needed protein
  - ✓ Especially females when feeding young
  - ✓ Nectar is a significant part of the Ruby-throated Hummingbird's diet



A Ruby-throated Hummingbird visits another of its favorites, a Monarda, aka Bee Balm

# Hawaiian Honeycreepers

- ❑ **There is a wide diversity of avian pollinators**
  - ✓ And my trip to Hawaii in 2019 gave me first-hand experience with some of them
- ❑ **Hawaiian Honeycreepers are not genetically related to hummingbirds**
  - ✓ And evolved from a group of vagrant finches that arrived on the islands some 5.8 to 7 million years ago
- ✓ **As new honeycreeper species evolved, they filled a variety of empty niches**
  - ✓ And some became nectar specialists



Genetic testing indicates that this Common Rosefinch and the Hawaiian Honeycreepers share the same common ancestor



# The liwi

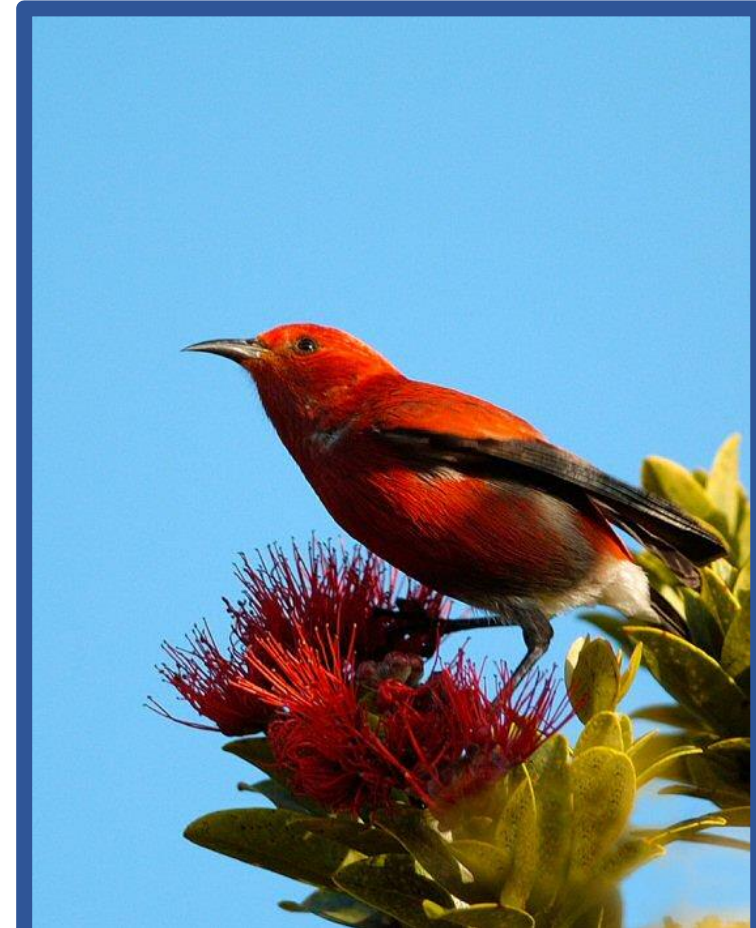
- ❑ The liwi is common on Kauai, Maui, and the Big Island of Hawaii
- ❑ Both male and female display a brilliant red plumage
- ❑ The liwi relies on a variety of nectar sources
  - ✓ But the long pink bill is perfect for pollinating the curved blossoms of native Hawaiian lobelias
  - ✓ Making the liwi and the lobelias dependent on each other for survival



This liwi prepares to feed on the curved blossoms of a native Hawaiian lobelia

# The Apapane

- ❑ The Apapane is the most common honeycreeper on the Hawaiian islands
- ❑ Both male and female are red with a white patch under the tail
- ❑ The Apapane is a nectar specialist
  - ✓ But note the smaller bill in comparison with the liwi
- ❑ The Apapane feasts primarily on the red lehua flowers of the Ohia Tree
  - ✓ That lack the peculiar shape of lobelia blossoms
  - ✓ Making a large decurved bill unnecessary



An Ohia Tree with blooming lehua flowers attracts an Apapane



# Mammals: Bats

- ❑ **Although bats are generally known as voracious insectivores**
  - ✓ Some species rely on nectar and pollen as significant parts of their diet
- ❑ **There are a variety of flowers that depend on bats for pollination**
  - ✓ In habitats as different as rain forests and deserts
- ❑ **My introduction to pollinator bats was in the desert of southeastern Arizona**
  - ✓ A truly memorable experience



# The Lesser Long-nosed Bat

- ❑ The Lesser Long-nosed Bat is a summer resident of Arizona
- ❑ Here one prepares to feed on nectar from a Saguaro Cactus flower
- ❑ The flower blooms only at night
  - ✓ Indicating how dependent the Saguaro is on night-time pollinators
- ❑ The Long-nosed Bat is listed as endangered in the U.S.
  - ✓ And the bat's extinction could lead to the decline or extinction of the Saguaro



# The Mexican Long-tongued Bat

- ❑ The Mexican Long-tongued Bat also is a summer Arizona resident
- ❑ Notice the long snout and extremely long tongue
  - ✓ That permits easy penetration into elongated flowers to access nectar
- ❑ Also take notice of the pollen encrusted head
  - ✓ That allows the bat to transfer pollen from one flower to the next
  - ✓ To easily achieve pollination





# Pollinator Decline

- ❑ **Indications of pollinator declines began after 2000 with Honeybee Colony Collapse Disorder**
  - ✓ When beekeepers noticed that worker bees were disappearing from the hive
- ❑ **An insect study conducted in Germany in 2017 collected samples from 63 sites**
  - ✓ And concluded that insect biomass in Germany had declined by 75% over 25 years
- ❑ **A British study estimated a flying insect biomass decline of 6% per year.**



**Hans de Kroon of Radboud University in the Netherlands led the 2017 study on insect decline**

# Pollinator Declines are a Global Issue

- ❑ **Initial studies were conducted on total insect density and diversity in Europe**
  - ✓ But these studies also revealed that insect pollinators were declining
  - ✓ And the situation is not confined to Europe or restricted to insects
- ❑ **There are many pollinator species in existence, especially insects**
  - ✓ So it is difficult to determine the percentage of decline for individual species
  - ✓ Some U.S. estimates are 30 to 50% for some species of insect pollinators



# Reasons For Pollinator Declines

- ❑ **There are multiple reasons why pollinators are declining**
  - ✓ And one cause often contributes to another
- ❑ **Some issues may impact insect pollinators**
  - ✓ But not birds or bats
- ❑ **Let's explore some of these causes in the remaining slides**



©Warren Photographic

**A healthy Mason Bee female carries mud to her nest**



# Habitat Loss and Urbanization

- **Conversion of natural areas to other uses can negatively impact wildlife**
  - including pollinators that depend on a plentiful supply of flowers
- **Agricultural monocultures lack the variety of flowers pollinators need**
  - As well as host plants that developing fly and butterfly larvae depend on for food
- **Studies suggest that urban pollution disrupts the ability of bees and flies to find flowers through fragrance**



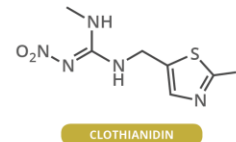
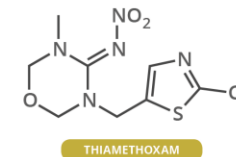
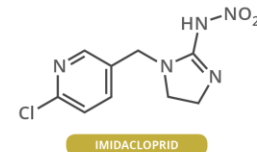
Despite offering many flowers, extensive agricultural monocultures like this offer little for the nutritional needs of insect pollinators or hummingbirds

# Pesticides

- ❑ Neonicotinoid pesticides seem particularly harmful to insect pollinators
- ❑ They contain a chemical like nicotine
  - ✓ That is drawn up through the vascular system of plants
  - ✓ And expresses itself in the nectar and pollen
- ❑ Neonicotinoids when used as instructed do not kill insect pollinators outright
  - ✓ But may impact the ability of bees to navigate back to the hive or nest
  - ✓ And make it difficult for those that overwinter as adults to survive

## NEONICOTINOID PESTICIDES - THE FACTS

The use of neonicotinoid pesticides has been a contentious issue in recent years. They account for around 25% of the global agrochemical market, but have also been linked with negative environmental effects. This graphic looks at how they work, and the nature of the concerns surrounding them.



### HOW DO NEONICOTINOIDS WORK?



Can be added to irrigation water, then taken up & spread through plant tissues. Also used in seed treatments.



Bind to nicotinic receptors for the neurotransmitter acetylcholine in the insect central nervous system.



This leads to overstimulation and blocking of the receptors, leading to paralysis and eventual death.

Neonicotinoid pesticides are effective against a wide range of crop pests. They are the most widely used insecticides in the world, accounting for roughly 25% of all insecticide use. Median lethal doses vary depending on the size of the insect, ranging from less than 1 nanogram to almost 90 nanograms per insect. Mammals also have the receptors neonicotinoids bind to, but they bind to them less strongly than in insects, so neonicotinoid mammalian toxicity is much lower.

### ENVIRONMENTAL CONCERNS



- Can accumulate in soil; low concentrations found in nectar of treated crops.
- Linked as contributors to honey bee colony decline. However, this is still inconclusive, and subject to continued research and conflicting interpretations.
- Increasing evidence of effects on non-target organisms. Negative impacts on monarch butterfly populations in the USA have recently been suggested.
- Use has been partially restricted in the EU since 2013. However, some have suggested this has merely led to increased use of older, harsher pesticides.

© COMPOUND INTEREST 2015 - WWW.COMPOUNDCHEM.COM | Twitter: @compoundchem | Facebook: www.facebook.com/compoundchem  
Creative Commons Attribution-NonCommercial-NoDerivatives licence. Image: Karunakar Rayker, <https://www.flickr.com/photos/krayker/4312985916/>

A fact sheet published on Neonicotinoid pesticides

# Diseases

- ❑ **Nature** reported in 2014 that many diseases from commercial honeybee hives were spilling over to wild populations
  - ✓ And were especially impacting Bumblebees
- ❑ One notable disease is deformed wing syndrome
  - ✓ Caused by a virus transmitted by a mite
  - ✓ Honeybees emerging in this condition are generally ejected from the hive and soon die



Note the deformed wings on this honeybee from a commercial hive



# Invasive Species

- ❑ **Native pollinators co-evolved with the flowers they feed on**
  - ✓ And with some exceptions, introduced plants do not provide the nutritional needs that native pollinators require
  - ✓ Also, invasive introduced plants lack the natural control mechanisms of natives, permitting them to run amok
- ❑ **Invasive insects and animals also have caused declines in native pollinators**
  - ✓ One notable example is the decline of ground-nesting bees like Mining Bees, caused by fire ants in the southern U.S.



**Purple Loosestrife from Europe and temperate Asia may look beautiful, but in North American it can quickly overrun native vegetation and create an unproductive monoculture**

# Finally, a Word on Climate Change

- ❑ In 2014, the UN Intergovernmental Panel on Climate Change warned of increased threats to insect pollinators
  - ✓ Because of the altered seasonal behavior of some species due to climate change
- ❑ Bees and butterflies were emerging at times of the year when flowering plants were unavailable
- ❑ Some predict that flowering plants moving north to escape warming may not move in sync with their pollinators



Migratory pollinator species like hummingbirds might become more susceptible to climate change if their seasonal migrations fall out of sync with the flowering and nectar availability in their breeding habitat

# Questions or Comments?



Bibliography available by emailing: [barry.centini@Verizon.net](mailto:barry.centini@Verizon.net)