Snug as a Bug in the Leaf Litter

HOW BENEFICIAL INSECTS SPEND THE WINTER

Bethany Abrahamson, Agriculture Agent

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Benefits of Bugs!

- Pollinating
  - Generalists
  - Specialists
  - Flower visiting
- Pest predation
- Weed herbivory
- Disease suppression
- Food source
- Biodiversity

Photo credit: Bethany Abrahamson

What keeps bugs up at night?

- Loss of habitat
  - Monoculture
  - Fragmentation
  - Exotic habitat, climate change
- Pests and disease
  - Invasive species/competition
- Irresponsible pesticide use
- All the things they had to deal with before

Winter is tough on bugs

TEMPERATURE
WATER
FOOD
PREDATORS

WHERE THEY ARE | WHAT THEY DO | HOW TO HELP

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Bees!

Egg – Larva – Pupa - Adult

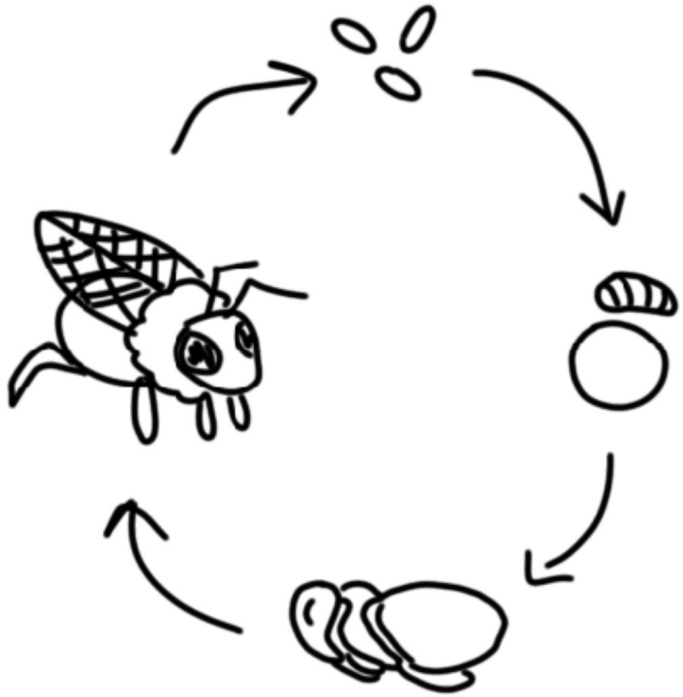


Photo credit: Bethany Abrahamson

Honey Bees

- Non-native
- Generalists
- NM: Alfalfa, melon, apple, pear, peach, plum, onion
- Regularly provide food for young

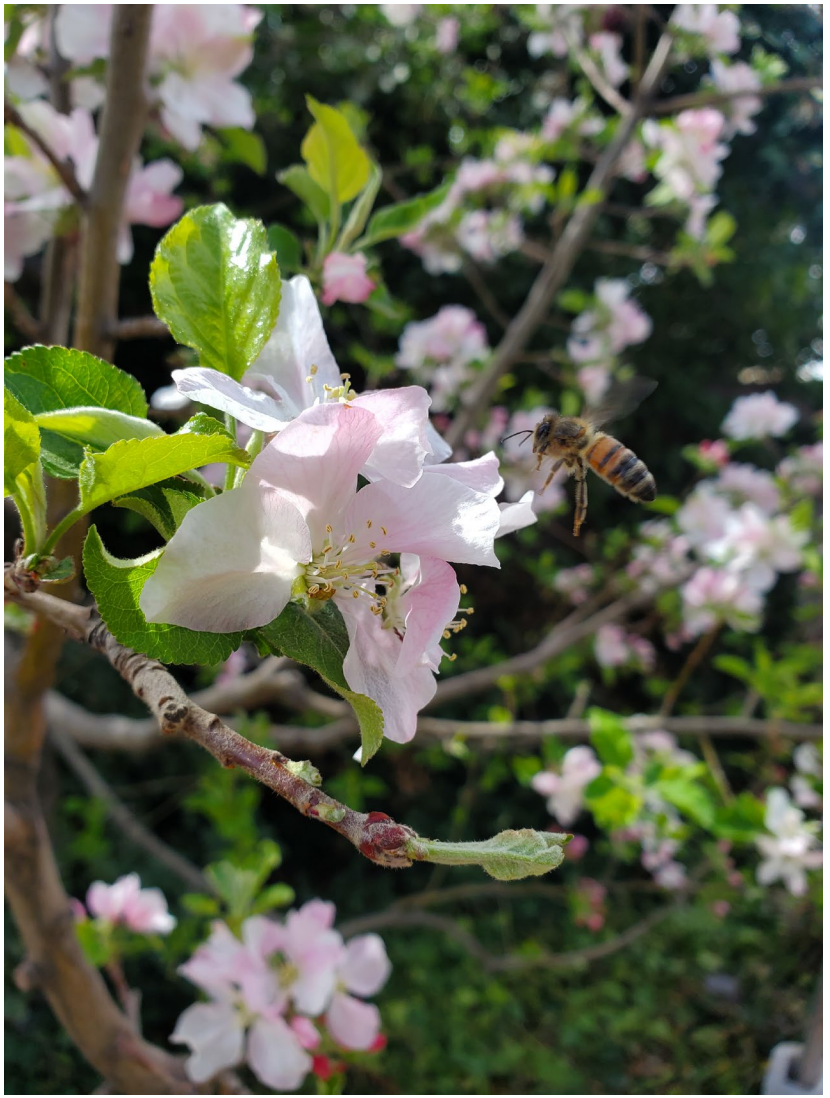


Photo credit: Bethany Abrahamson

Identifying Honey Bees

Photo credit: [Allan Smith-Pardo, Exotic Bee ID, USDA APHIS PPQ, Bugwood.org](), [CC BY-NC 3.0 US]()

Photo credit: Bethany Abrahamson

From Bennett and Kersten 2019

Honey Bee vs. Bumble Bee (Figures 4A and 4B)

Identification Tips	
Honey Bee	**Bumble Bee**
Medium- to large-sized bee	Large robust bee
Banded abdomen that is tan to amber	Typically yellow and black hair patterns
Abdomen less hairy than bumble bees	Very hairy bodies, including abdomen
Hairy eyes	Banding pattern on abdomen will vary

Honey bees in winter

- Adults huddle and shiver
- 40-100 pounds of honey → heat and insulation → winter survival
  - Total weight: 50-70 pounds
- “Cleansing flights”
- Provision of new queens, adequate honey or food stores
  - Fall sugar syrup recipe: 2 parts sugar, 1 part water, or plain sugar/fondant
- Protection from extreme weather, mice
  - 5/16 or 3/18 inch screen over bottom entrance

Photo credit: John via Flickr, CC BY-NC SA 2.0

Native bees

- 4k species in US, 1k+ in NM
- Pollinate native crops
  - Bumblebees: Tomatoes, eggplant, asters, peas, mint
- Eggs laid in soil, cavities, stems, wood with “pollen ball” to form nest

Photo credit: Charles Ray, Auburn University, Bugwood.org , CC BY-NC 3.0 US

Photo credit: **Bethany Abrahamson**

Photo credit: **Bethany Abrahamson**

Photo credit: Grasswitz and Dreesen

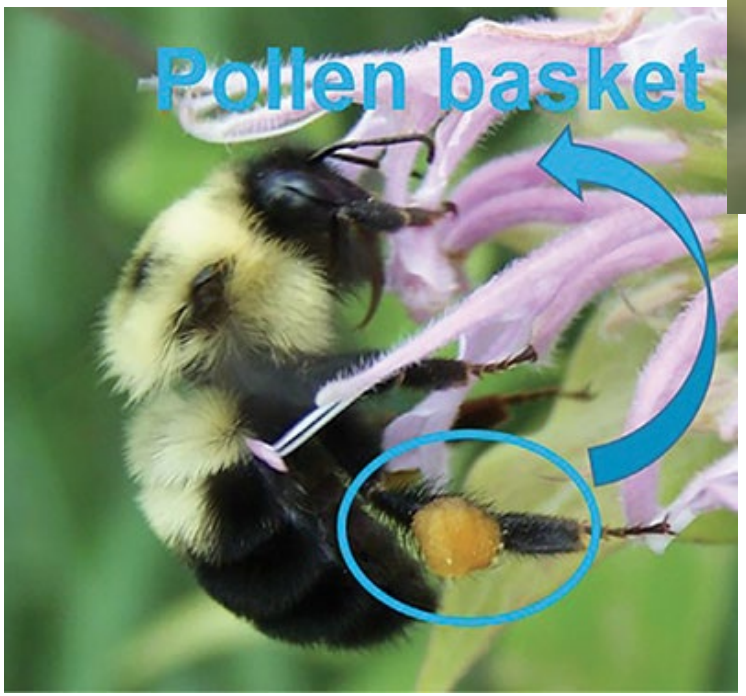


Figure 8A, 7A from Bennett and Kersten 2019

Photo credits: Bethany Abrahamson

Soil-nesting bees

- 70% of species in U.S.
- Bumble, miner, longhorned, mallow, digger, sweat, squash bees
- May overwinter as larvae or adults

Photo credit: Elsa Youngsteadt CC BY-NC 4.0

Soil nest diversity (Antoine et al. 2021)

- Location
  - Soil texture, compaction, moisture, temperature, surface features, depth
  - Natural enemies, conspecifics, resources
- Nesting shape, size, number of larvae
- Lining
- Commitment
  - Building, protection, inspection
- Time
- Poorly-studied

Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org, CC BY-NC 3.0 US

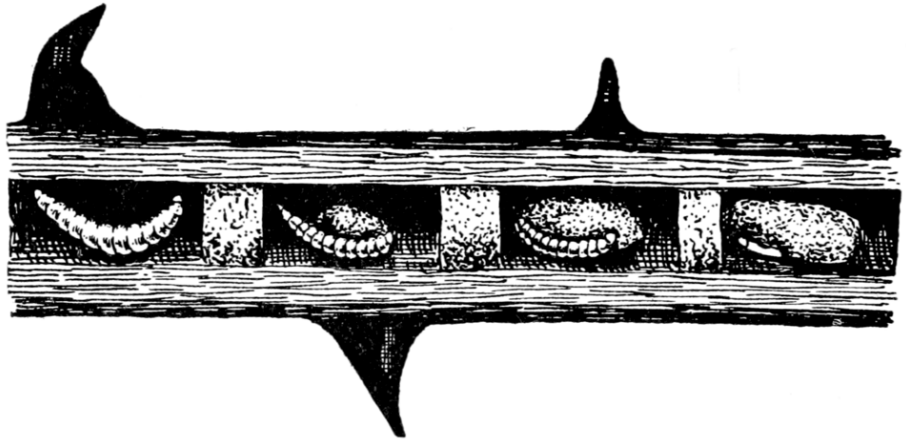
Bumble bee life cycle

- WINTER
  - Mated queens in diapause inside cavity ‘hibernacula’ (6-9 months)
- SPRING/SUMMER
  - Emerge in spring to start colony of new queens in pre-existing cavities
  - Social phase with female workers, queen moves into the colony to lay more eggs while workers forage
- FALL
  - Colonies grow, produce males
  - New queens mate and gather pollen for the ‘fat body’

Photo credit: Bethany Abrahamson

Stem-nesting bees

- “Cavity nesters”
- Leafcutter, mason, carpenter, resin, carder bees, yellow-faced bees
- May overwinter in stems as larvae or adults
  - Carpenter bee: adult
- Males emerge first
- Bee balm, rose, desert willow, yucca, agave

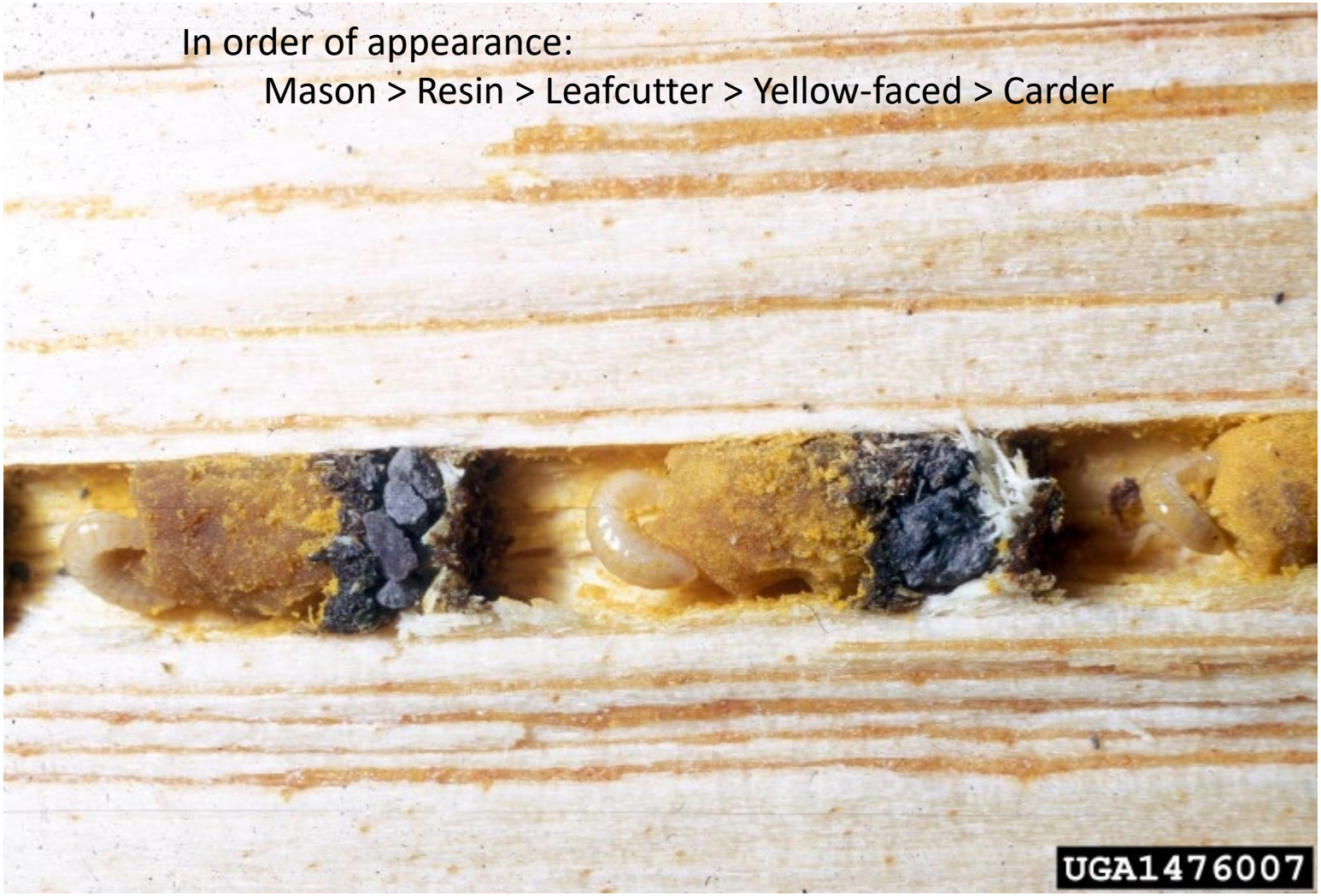


Carpenter bee nest. Photo credit: Arthur Everett Shipley via Wikimedia Commons, Public domain

Photo credit: Bethany Abrahamson

In order of appearance:

Mason > Resin > Leafcutter > Yellow-faced > Carder



Ceratina bee nests. Photo credit: Howard Ensign Evans, Colorado State University, Bugwood.org. CC BY-NC 3.0 US.

Leafcutter bee nests in insulation foam. Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org . CC BY-NC 3.0 US.

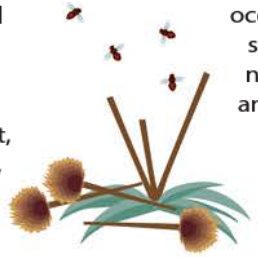
How to Create Habitat for Stem-Nesting Bees

WINTER

Leave dead flower stalks intact over the winter

SPRING

Cut back dead flower stalks leaving stem stubble of varying height, 8 to 24 inches, to provide nest cavities.

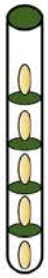


Female bees find cut or naturally occuring open stems, start a nest, then lay an egg on the pollen balls. Larvae eat the pollen.

SUMMER

New growth of the perennial hides the stem stubble.

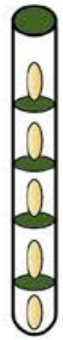
Bee larvae develop in cut dead stems during the growing season.



FALL

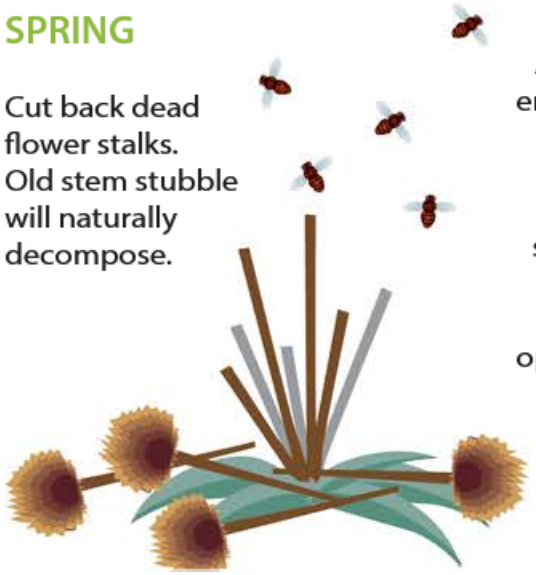
WINTER

Bees hibernate in stems during the winter



SPRING

Cut back dead flower stalks. Old stem stubble will naturally decompose.



Adult bees emerge and start nests in newly cut dead stems or in naturally occurring open stems.

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Butterflies and Moths

Egg – Larva – Pupa - Adult

Butterflies and moths

- 300+ species in NM (in top 3 for diversity in the US)
- Not as good at pollinating as bees
- Require host plants for larval development
- May overwinter in any life stage in “protected areas”
  - Leaf litter
  - Trees and plants
  - Soil

Nymphalidae: Mourning cloaks

- *Nymphalis antiopa*
- Adults overwinter under bark/in crevices
- Long-lived
- Tree sap, rotting fruit, water
- Fly on warm days: often seen first in spring!

Photo credit: Brandt Magic, iNaturalist, CC BY-NC

Nymphalidae: Checkerspots and Fritillary Butterflies

- Checkerspots
  - Bordered patch (*Chlosyne lacinia*)
  - Sunflowers are hosts
  - Overwinters as larvae
- Fritillaries
  - Mormon fritillary: Larvae overwinter in curled leaves of host leaf plants
- Painted Lady
  - Migratory
  - American and West Coast Ladies may overwinter

Photo credit: Brandt Magic, iNaturalist, CC BY-NC

Papilionidae: Swallowtails

- Feed on members of the parsley family (umbellifers), trees and shrubs, depending on species
- Western tiger swallowtail benefits from urban native ash
- Mostly pupae overwinter, sometimes eggs or larvae

Two tailed swallowtail. Photo credit: Brandt Magic, iNaturalist, CC BY-NC

Black swallowtail pupa. Photo credit: Joe Culin, Clemson University, Bugwood.org , CC BY-NC 3.0 US

Two tailed tiger swallowtail. Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org, CC BY-NC 3.0 US

Hairstreaks and Blues

- Mostly pupae overwinter
- Gray hairstreak (*Strymon melinus)*
  - Larvae have many hosts
- Sandia Hairstreak
  - Host specific: Texas beargrass
- Western Pygmy-blue (*Brephidium exilis)*
  - Smallest butterfly!
  - 2-3 generations a year

Photo credit: Brandt Magic, iNaturalist, CC BY-NC

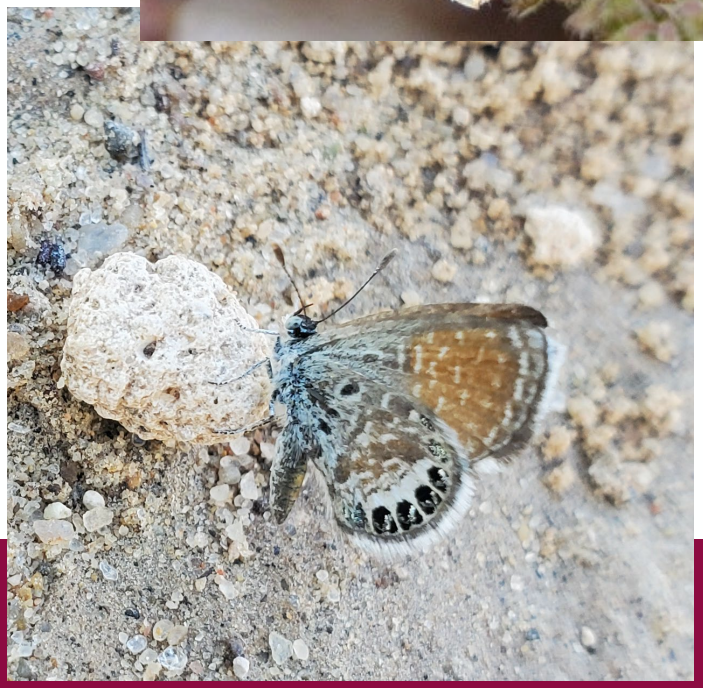

Photo credit: Bethany Abrahamson

Tomato hornworm

- *Manduca quinquemaculata*
- Horn shaped flowers *(Columbines, morning glories)*
- Overwinter as pupae in the soil

Photo credit: Whitney Cranshaw, Colorado State University, Bugwood.org, CC BY 3.0 US

Photo credit: **Mark Dreiling, Bugwood.org**, CC BY-NC 3.0 US

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How about other beneficial insects?

Beetles as Predators

- Egg – Larvae – Pupa – Adult
- Larvae and adults may be predatory
- Ladybugs
  - Aphids, scale insects, mites, thrips, eggs
- Ground beetles
  - Soft-bodied insects, catterpillers, grasshoppers, beetles, aphids, flies, snails

Figure 12H from Bennett and Kersten 2019

Predatory vs. plant-eating

Photo credit: Alexander Derunkov, Diabrotica ID, USDA APHIS PPQ, Bugwood.org, CC BY-NC 3.0 US

Photo credit: Marko Kostanjevec, Biotechnical Faculty, Bugwood.org , CC BY 3.0 US

Beetles as flower visitors

- Ancient pollinators
  - “Mess and soil”
  - Bowl-shaped, white, daytime flowers, spicy, fruity, fermented, sweet
  - Large and solitary or small and clustered
- Checkered beetle
  - Grasshopper eggs, aphids, small insects, pollen
- Ladybug
  - Adults and larvae may feed on nectar
- Melyrid beetles
  - Eggs, aphids, mites, catterpillars, flowers

Figure 10A from Bennett and Kersten 2019

Figure 13 from Bennett and Kersten 2019

Wasps

- Egg – Larva – Pupa - Adult
- Large predatory wasps
  - Ex. Paper wasps
  - Adults/larvae predaceous
  - Feed on nectar
- Small parasitic wasps
  - Flower-visiting for nectar
  - Won't sting
  - Host-specific

Figure 20A from Bennett and Kersten 2019

Figure 21E from Bennett and Kersten 2019

Flies

- Egg – Larva – Pupa - Adult
- Pollen feeders, predators, pollinators
- Pollinate apples, pepper; visit carrots, parsley
- Robber flies
  - Adults and larvae predatory
- Syrphid flies
  - Larvae predaceous
- Tachinid flies
  - Adults flower-visiting
  - Larvae parasitic

Figure 15B from Bennett and Kersten 2019

Figure 15D from Bennett and Kersten 2019

Figure 14A from Bennett and Kersten 2019

Figure 16 from Bennett and Kersten 2019

True Bugs

- Egg – Nymph - Adult
- Adults and immatures predaceous
- Predatory vs. plant-eating
- Assassin bugs, minute pirate bugs, soldier bugs, damsel bugs

Photo credit: Bethany Abrahamson

Photo credit: Figure 19, Bennett and Kersten 2019

Other Beneficials

- Praying mantises
- Spiders
- Ants

Photo credit: Bethany Abrahamson

Other bugs in winter

- Beetles
  - Often overwinter in soil as adults
  - Ground beetles: in soil or grassy clumps
- Wasps
  - Overwinter in brush or grass piles
- Flies
  - Robber flies overwinter in soil, feed on other larvae
  - Syrphid flies overwinter in soil as eggs, larvae or pupae
  - Tachinid flies overwinter in leaf litter or within host

Other bugs in winter

- True bugs
  - Often as adults in leaf litter
- Spiders
  - Jumping spider: most hide in silk retreat as young adults
  - Orb weaver: adults die in winter, egg sacs overwinter
  - Black widow: immature or mature, in protected areas under cover, may move indoors to continue life cycle
- Praying mantises: egg stage
- Ants
  - Colony stops laying eggs, retreats underground or into warmer areas

Black widow egg sac. Sturgis McKeever, Georgia Southern University, Bugwood.org, CC BY-NC 3.0 US

Carolina mantid eggs. Whitney Cranshaw, Colorado State University, Bugwood.org, **CC BY-NC 3.0 US**

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Supporting Overwintering Bugs

ADULTS THAT SURVIVE THE WINTER

LARVAE THAT NEED PROVISIONS

NM STATE

BE BOLD. Shape the Future.®

Location: Providing Habitat in Winter

- Clean thoughtfully
  - Leave/organize the leaves, grass, stems (free mulch!)
  - Avoid digging
  - Human vs. wildlife areas
  - Pest prevention (removal of annuals, weeds)
- Provide rocks, logs/snags, and bare ground, cover crop
- Bee hotels?
- Seal your home appropriately
- Provide water sources on warm days
  - Damp leaves
- Take care with found bumble queens

Photo credit: Ansel Oommen, Bugwood.org, **CC BY-NC 3.0 US**

https://content.ces.ncsu.edu/how-to-manage-a-successful-bee-hotel

Save an orphan hive!

- https://www.abqbeeks.org/report-a-swarm

Photo credit: Bethany Abrahamson

Resources: Plan for the new year

Photo credit: Grasswitz and Dreesen

- Give beneficials early/late season boost
- Choose the right plants
  - Diversity (color, shape, size, bloom time, family)
  - Native or climate ready
  - Non-crop host plants
- Consider low-till or no-till gardening
- Clean up stems thoughtfully
- Space plants appropriately
- Increase tolerance for mess, pests
- Try adding a water source
- Start a nature/garden journal
  - Ground Nesting Bees on iNaturalist
- Be patient

Early Blooming	Late Blooming
Copper globemallow	Butterfly milkweed
Engelmann's Daisy	MacDougal verbena
Upright prairie coneflower	Riddell's ragwort
Red dome blanketflower	Englemann's Daisy
Desert penstemon	Red dome blanketflower
	Upright prairie coneflower
	Blue sage

Scouting for Beneficials

- Date
- Time
- Location
- Species
- Number
- Tools

Photo credit: Bethany Abrahamson

Evidence of Beneficials

Photo credit: Grasswitz and Dreesen

Photo credit: Figure 27 A Bennett and Kersten 2019

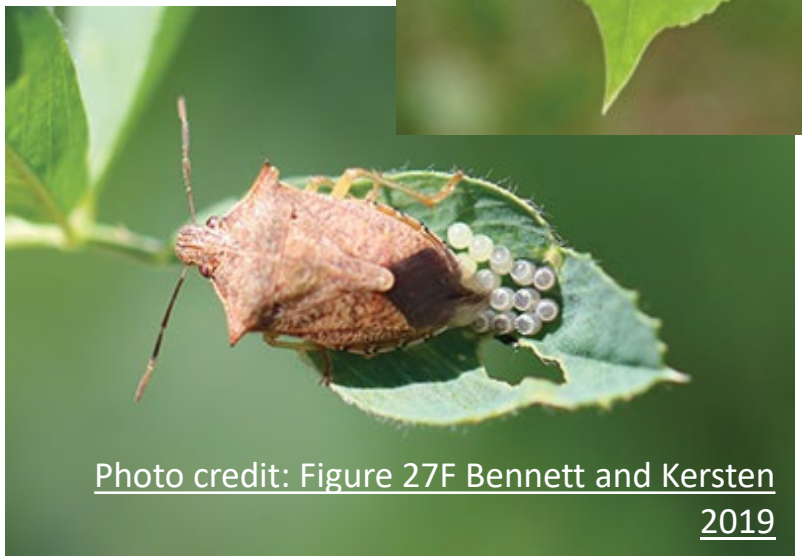
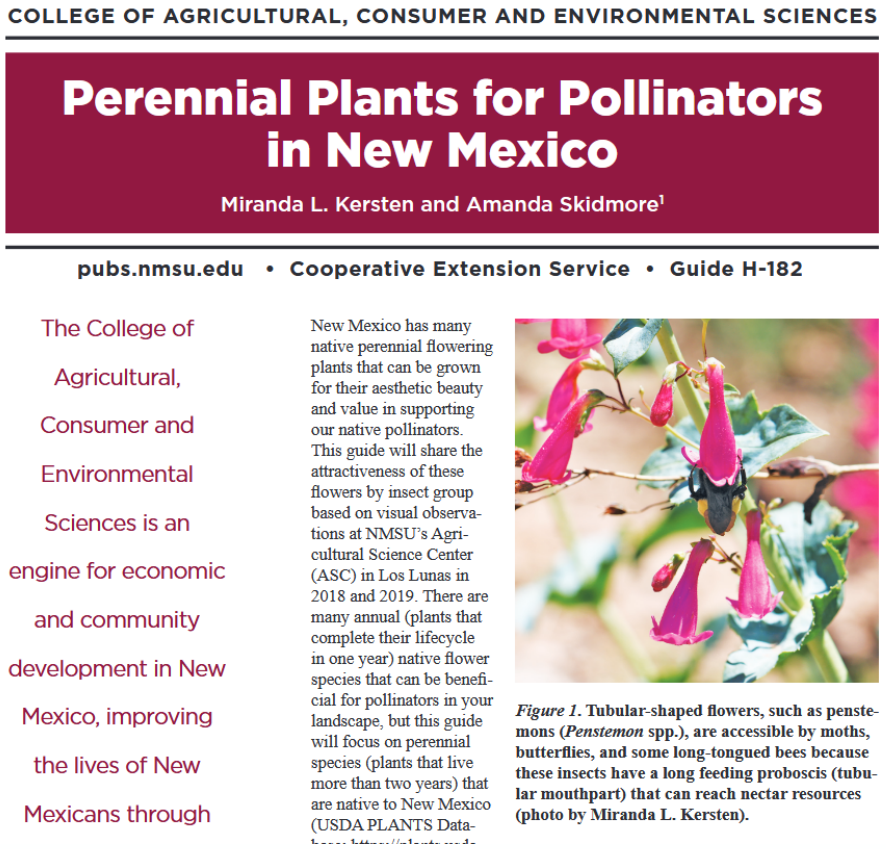


Photo credit: Figure 27F Bennett and Kersten 2019

Photo credit: Figure 27D Bennett and Kersten 2019

Plant Lists

- Xerces Society Plant Lists
  - SW AZ/CO/NM Plateaus
  - SW Arizona/NM Mountains
  - SW Chihuahuan Desert
- Native vs. climate ready
  - Future habitat
  - EMNRD Climate Ready Trees
- NMSU Publications



COLLEGE OF AGRICULTURAL, CONSUMER AND ENVIRONMENTAL SCIENCES

Perennial Plants for Pollinators in New Mexico

Miranda L. Kersten and Amanda Skidmore[1]

pubs.nmsu.edu • Cooperative Extension Service • Guide H-182

The College of Agricultural, Consumer and Environmental Sciences is an engine for economic and community development in New Mexico, improving the lives of New Mexicans through

New Mexico has many native perennial flowering plants that can be grown for their aesthetic beauty and value in supporting our native pollinators. This guide will share the attractiveness of these flowers by insect group based on visual observations at NMSU's Agricultural Science Center (ASC) in Los Lunas in 2018 and 2019. There are many annual (plants that complete their lifecycle in one year) native flower species that can be beneficial for pollinators in your landscape, but this guide will focus on perennial species (plants that live more than two years) that are native to New Mexico (USDA PLANTS Data-

Figure 1. **Tubular-shaped flowers, such as penstemons (*Penstemon* spp.), are accessible by moths, butterflies, and some long-tongued bees because these insects have a long feeding proboscis (tubular mouthpart) that can reach nectar resources (photo by Miranda L. Kersten).**

Integrated Pest Management

- Are pesticides the “easy” solution?
- Health and safety
- Efficacy and efficiency
- The farm/garden as a system

Photo credit: Dan Keck via Flickr, CC0 1.0

Photo credit: Bethany Abrahamson

Integrated Pest Management

1. Determine needs
2. Monitor
3. Identify
4. Prevent
   - Cultural
   - Mechanical
   - Biological
5. Treat
   - Low risk -> High risk
   - Follow the label
   - PPE
   - Climactic factors

General IPM Tips

Get to know your garden
Develop an IPM strategy early
Consider pest action thresholds
Scout often, keep records
Provide for beneficial insects
Keep plants healthy

Photo credit: Bethany Abrahamson

Pesticide Best Practices for Pollinators

- Identify pest correctly
- Plan location
- Consider timing
  - Time of day
  - Residual time
- Choose wisely
- Follow the label

THE NEW EPA BEE ADVISORY BOX

On EPA's new and strengthened pesticide label to protect pollinators

PROTECTION OF POLLINATORS

APPLICATION RESTRICTIONS EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

This product can kill bees and other insect pollinators.

Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.

Bees and other insect pollinators can be exposed to this pesticide from:

- Direct contact during foliar applications, or contact with residues on plant surfaces after foliar applications
- Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar applications.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives can result in bee kills.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at:
http://pesticidestewardship.org/pollinatorprotection/Pages/default.aspx

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state/tribe, go to: www.aapco.org. Pesticide incidents can also be reported to the National Pesticide Information Center at: www.npic.orst.edu or directly to EPA at: beekill@epa.gov

Alerts users to separate restrictions on the label. These prohibit certain pesticide use when bees are present.

The new bee icon helps signal the pesticide's potential hazard to bees.

Makes clear that pesticide products can kill bees and pollinators.

Bees are often present and foraging when plants and trees flower. EPA's new label makes it clear that pesticides cannot be applied until all petals have fallen.

Warns users that direct contact and ingestion could harm pollinators. EPA is working with beekeepers, growers, pesticide companies, and others to advance pesticide management practices.

Highlights the importance of avoiding drift. Sometimes, wind can cause pesticides to drift to new areas and can cause bee kills.

The science says that there are many causes for a decline in pollinator health, including pesticide exposure. EPA's new label will help protect pollinators.

EPA

Read EPA's new and strengthened label requirements: http://go.usa.gov/jHH4

[New labeling for Neonicotinoid pesticides, EPA]

Resources

- Extension Master Gardeners
- Sandoval County Cooperative Extension
- NM Dept. of Agriculture
- Licensed pesticide applicators
- National Pesticide Information Center
- NPIC Product Research Online

"When you kill a beneficial insect, you inherit its work!"

–Virgine Link-New, WSU Extension

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Beneficial Bugs in Your Area!

- Museum Databases
- Organizations like Xerces Society, iNaturalist

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Thank You!

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