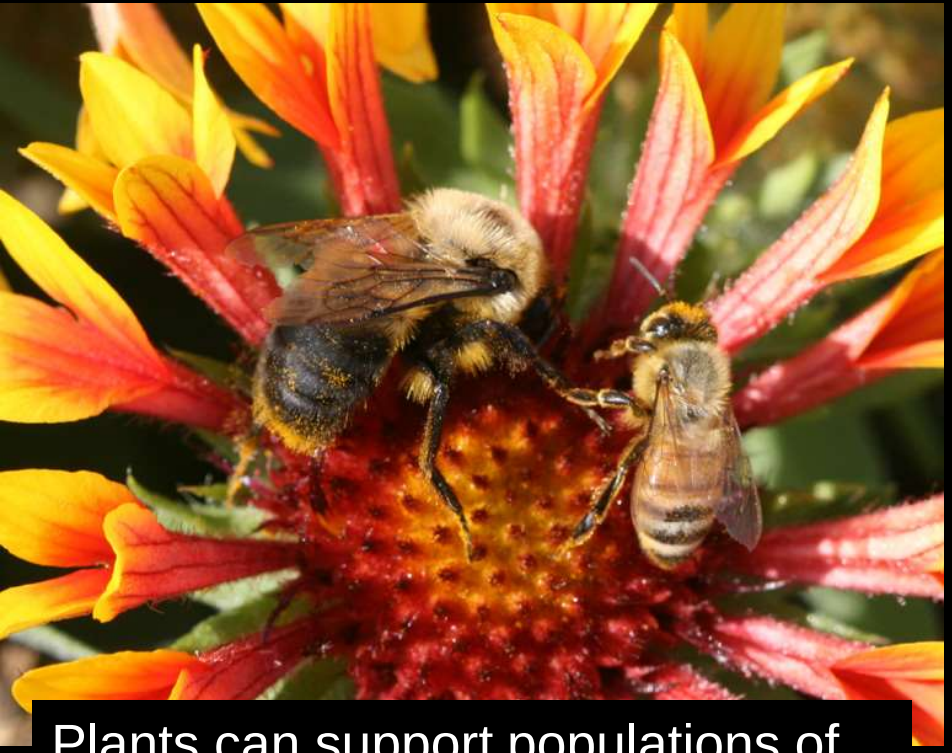
Landscaping for Insects

…. *or not!*

How Planting Selection Can Impact Insect Populations in Your Landscape



Plants can support populations of desirable insect species

Plants may be contribute to incidence of pests that limit plant value

Garden plantings can affect incidence of….

- Butterflies
- Hummingbird moths
- “Miller” moths
- Honey bees
- Bumble bees
- Various solitary bees
- Natural enemies of insect pests
- Nuisance invaders of buildings
- “Double or Nothing” species

……

Insect Needs

- Food for their young
- Food for the adults
- Shelter (some species)

Insect Needs

Food for the young

Larval Food Example:
Painted Lady

Larval host plants are thistles, hollyhock, mallow, occasionally legumes and some other plants

Insect Needs

Food for the adults

Adult Food Example:

Many predators of garden pests (biological controls)

Insect Needs (for some species)

Shelter/Nest Sites

Shelter Example: Nest cavities for leafcutter and mason bees

In the beginning there was….

Butterfly Gardening

Parsleyworm – my Gateway Bug to butterfly gardening

Susan Ellis photograph

Eggs on dill

Young larva

Parsleyworms are interesting caterpillars to find in the garden

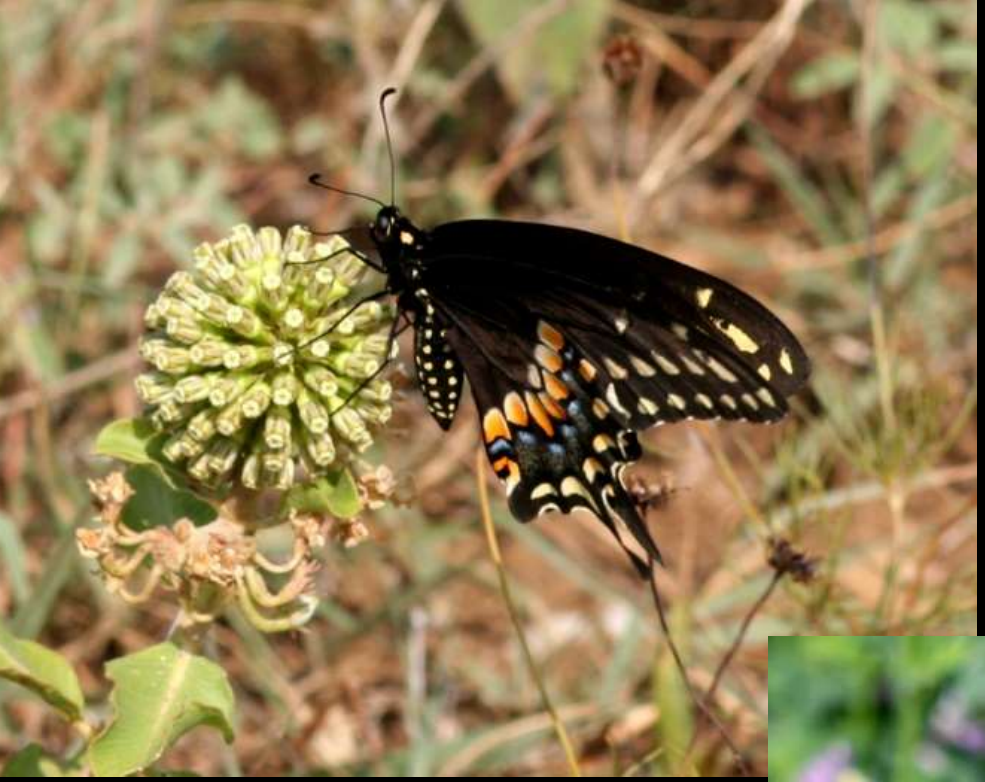
When disturbed the parsleyworm everts a scent gland (osmeterium) from behind the head

Bill and Sam checking out a parsleyworm

When full grown, the caterpillars retreat to a sheltered area and prepare for the next stage – the pupa (chrysalis or chrysalid)

Chrysalid (pupal form) of the parsleyworm

The adult form of the parsleyworm is known as…



Black Swallowtail

Papilio polyxenes

Butterfly Gardening

Principles of Butterfly Gardening

- Provide for food needs of adults
- Provide for food needs of larvae (caterpillar)
- Avoid use of harmful insecticides
- Provide mud puddling habitat?

Foods Used by Butterflies:

Nectar, **fruit juices, oozing sap….**

Some *Annual Plants* Commonly Used by Butterflies

- Zinnia
- Larkspur
- Cosmos
- Verbena
- Sunflowers
- Asters
- Coreopsis
- *Some* marigolds

Some *Perennial Plants* Commonly Used by Butterflies

- Butterfly Bush
- Milkweeds
- Sedums
- Lilac
- Purple coneflower
- Thistles
- Monarda
- New England aster

Massed plantings are most often visited by butterflies

Foods Used by Butterflies:

Nectar, fruit juices, oozing sap….

Brushfooted butterflies (Nymphalidae) will visit a variety of foods, in addition to nectar-bearing flowers…..

Hackberry butterfly on a dead raccoon

Butterfly and honey bee visiting wild hog dropping

Ripe fruit is visited and used for food by many brushfooted butterflies

Foods Used by Caterpillars:

Leaves of their host plant

Colorado State University
Extension

Attracting Butterflies to the Garden

Fact Sheet No. 5.504 | Insect Series | Home and Garden

by P.A. Opler and W.S. Cranshaw*

Quick Facts

Dozens of butterfly species are commonly found along the Front Range and East Colorado and are a welcome garden for many people. Butterflies often appear be just passing through, occasionally for a drink of nectar. You can prolong of these colorful insects and draw in providing the food and shelter they n

Providing the necessary food plants

Planning the Butterfly Garden

Make a yard more attractive to bu by providing the proper environment where can be food plants used by the immature stages (various caterpillars) sources used by the adult butterflies, physical environment.

Most butterflies prefer some shelt

Resource used for promotion of butterfly gardening in Colorado since the mid 1980s

Table 2: Food used by common Eastern Colorado butterflies and skippers.

Butterfly	Flight period	Caterpillar food	Common nectar plants, adult food
Black swallowtail (*Papilio polyxenes*)	April-September	Dill, parsley, fennel, carrot	Butterfly weed, alfalfa, thistle
Checkered skipper (*Pyrgus communis*)	April-October	Mallow, hollyhock	Verbena, dandelion, Canada thistle, aster
Checkered white (*Pontia protodice*)	April-November	Tumble mustard	Alfalfa, mustards, bee balm
Clouded sulfur (*Colias philodice*)	April-November	Alfalfa, clover	Alfalfa, phlox, rabbitbrush, aster, marigold
Edwards fritillary (*Speyeria edwardsii*)	June-September	Nuttall's violet	Rabbitbrush, gaillardia, bee balm
European cabbage butterfly (*Pieris rapae*)	April-October	Broccoli, cabbage (mustard family)	Many
Gorgone checkerspot (*Charidryas gorgone*)	May-September	Sunflowers	White clover, dandelion, Canada thistle
Gray hairstreak (*Strymon melinus*)	May-October	Many	Many
Hackberry butterfly (*Asterocampa celtis*)	May-September	Hackberry	Rotting fruit, sap flows
Melissa blue (*Lycaeides melissa*)	April-October	Wild licorice, alfalfa, etc.	Bee balm, sweet clover
Monarch (*Danaus plexippus*)	June-October	Milkweed	Cosmos, Canada thistle, rabbitbrush, etc.
Mourning cloak (*Nymphalis antiopa*)	February-November	Willow, aspen, cottonwood, elm	Rabbitbrush, milkweed, sap
Orange sulfur (*Colias eurytheme*)	April-October	Alfalfa, vetch, pea	Alfalfa, marigold, zinnia
Painted lady (*Vanessa cardui*)	April-October	Thistle, hollyhock, sunflower	Grape hyacinth, cosmos, zinnia, alfalfa, many flowers
Silver-spotted skipper (*Epargyreus clarus*)	May-July	Wild licorice, locust, etc.	Lilac, dogbane, zinnia, sweet pea, Canada thistle
Two-tailed swallowtail (*Papilio multicaudatus*)	April-August	Green ash, chokecherry	Geranium, thistle, milkweed
Variegated fritillary (*Euptoieta claudia*)	April-October	Various, including pansy	Rabbitbrush, Canada thistle
Weidemeyer's admiral (*Limentitis weidemeyerii*)	June-September	Willow, aspen, cottonwood	Sap flows, snowberry, dung
Western tiger swallowtail (*Papilio rutulus*)	May-July	Willow, cottonwood, chokecherry	Zinnia, lilac, butterfly bush, thistle, milkweed

Black Swallowtail butterfly

Twotailed Swallowtail

Papilio multicaudata

Twotailed Swallowtail

Eggs are laid on ash, chokecherry, hoptree

Hosts of the related western tiger swallowtail include chokecherry, ash, aspen, and willow

Late stage caterpillars have a different appearance

Twotailed swallowtail caterpillar everting osmeteria (repellent scent glands)

Monarch

Danaus plexippus

Good milkweed hosts of monarch caterpillars

Asclepias tuberosa

Asclepias incarnata

Photos courtesy of Monarch Watch

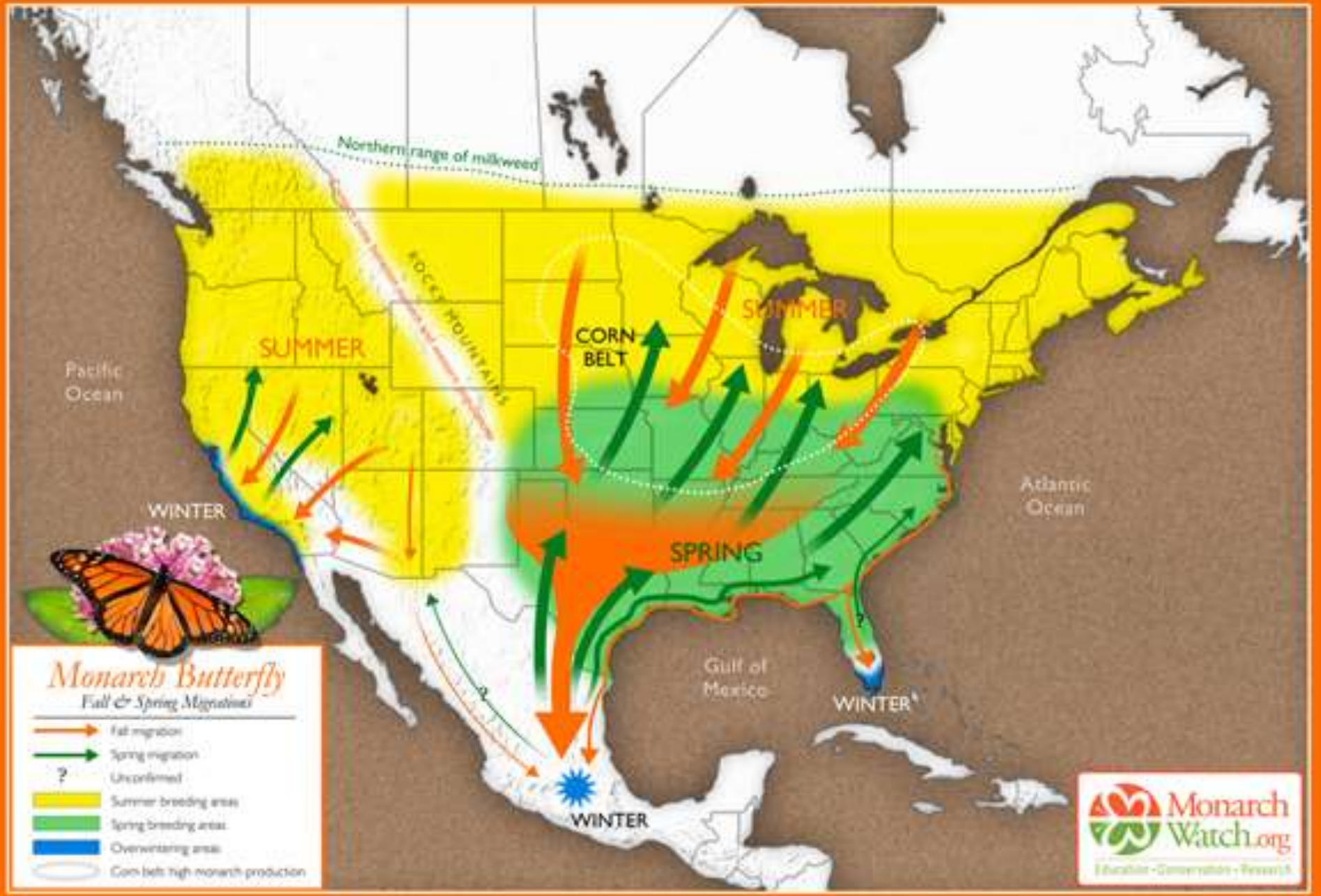
Asclepias syrica

Asclepias currasavica

Monarch Watch

Missouri Botanical Garden

Wyoming is at the edge of where the Monarch butterfly ranges in summer



Painted Lady

An annual migrant that originates from areas of NW Mexico

Larval host plants are thistles, hollyhock, mallow, occasionally legumes and some other plants

Variegated fritillary

Photo courtesy of Johnny N. Dell

Photo courtesy of Jerry Payne

Larval host plants are pansies, purslane, some *Passiflora*, some *Sedum*, others

Melissa blue
develops on various legumes

Ruddy copper
develops on dock and other plants in the buckwheat family (Polygonaceaeae)

Photographs by Robert Hammon

State Insect of Wyoming

Sheridan's Green Hairstreak

Callophrys sheridani

Larval host plants are various **wild buckwheats (*Eriogonum* spp.)**

Butterfly Houses – Do they provide benefits to butterflies?

Butterfly Houses – Do they provide benefits to butterflies?

Very dubious value

European paper wasp

Polistes dominula

European paper wasp was first found in eastern Colorado in 2001

Paper wasps feed their young freshly killed insects (mostly caterpillars) that they capture and chew

Impacts on yard/garden Lepidoptera

Common garden caterpillars, such as the cabbageworm and tomato hornworm, are well controlled by paper wasps

The European paper wasp has also impacted butterfly gardening at residential sites

Quality pollinator habitat?

Butterfly houses

Soil well covered by mulch

Gardening for Hummingbird Moths

Hummingbird Moth

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

Hornworms, Sphinx Moths (and Hummingbird Moths)

Lepidoptera: Sphingidae

Hornworms are large caterpillars. Most have a "horn" on the end of the body.

Two species can be damaging pests of tomatoes – the tomato hornworm and the tobacco hornworm

Caterpillars of the tomato hornworm and tobacco hornworm feed on leaves on tomato and other nightshade family plants

Hornworms turn into……Sphinx moths.

Conflict?

You like this….

..but not this.

Colorado has about two dozen kinds of hornworms

Most hornworms are not “pest” insects

Hummingbird Moth

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

Most sphinx moths fly only at night – and thus are not "hummingbird moths"

This includes the two species that damage garden crops

Whitelined sphinx

Hyles lineata

The most common hummingbird moth of the western US – and common throughout North America

Whitelined Sphinx
”hummingbird moth” of the West

Hummingbird clearwing sphinx
Hemaris thysbe

“Bumble Bee” Clearwing Sphinx Moths

Snowberry clearwing
Hemeris diffinis

Some plants most often visited by hummingbird moths include:

Four o’clocks

Evening primrose

Larkspur

Gentian

Nasturtium

Catmint

Datura

Wild bergamot

Many *Agastache* spp.

Honeysuckle…

Army cutworm

Euxoa auxiliaris

The predominant cutworm of the High Plains/Rocky Mountain region

…..and the common “Miller Moth” of the west

Army cutworm larva – the most common spring feeding cutworm in the region

Army cutworm pupa

Pupae are present from March through late May

Adult form of the army cutworm – the ’Miller Moth’

Miller Moth

Term applied to any species of moth that is locally abundant

Term refers to the scales on moth wings that dislodge – like flour on the smock of a miller

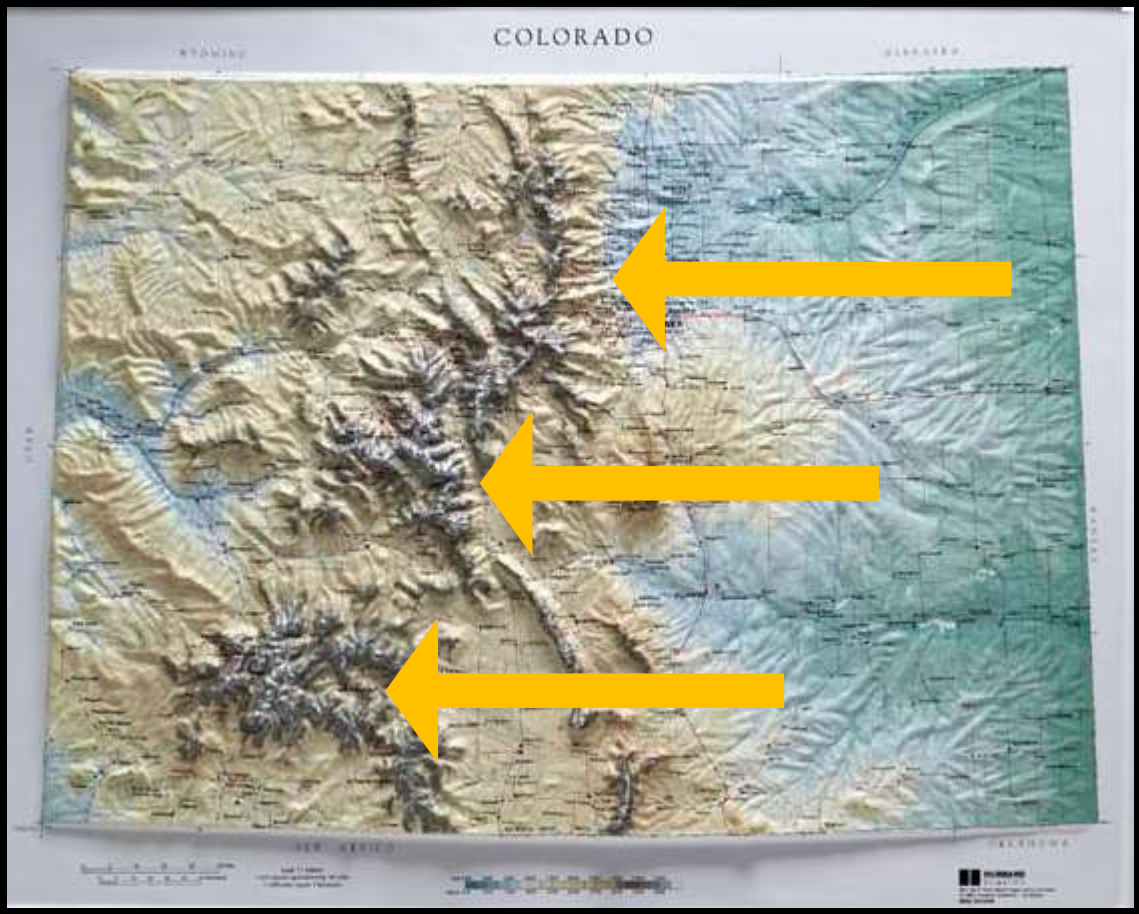
Army cutworm moths have variable wing patterning

Next Task….

Follow the flowers and stay cool

The Annual Migration

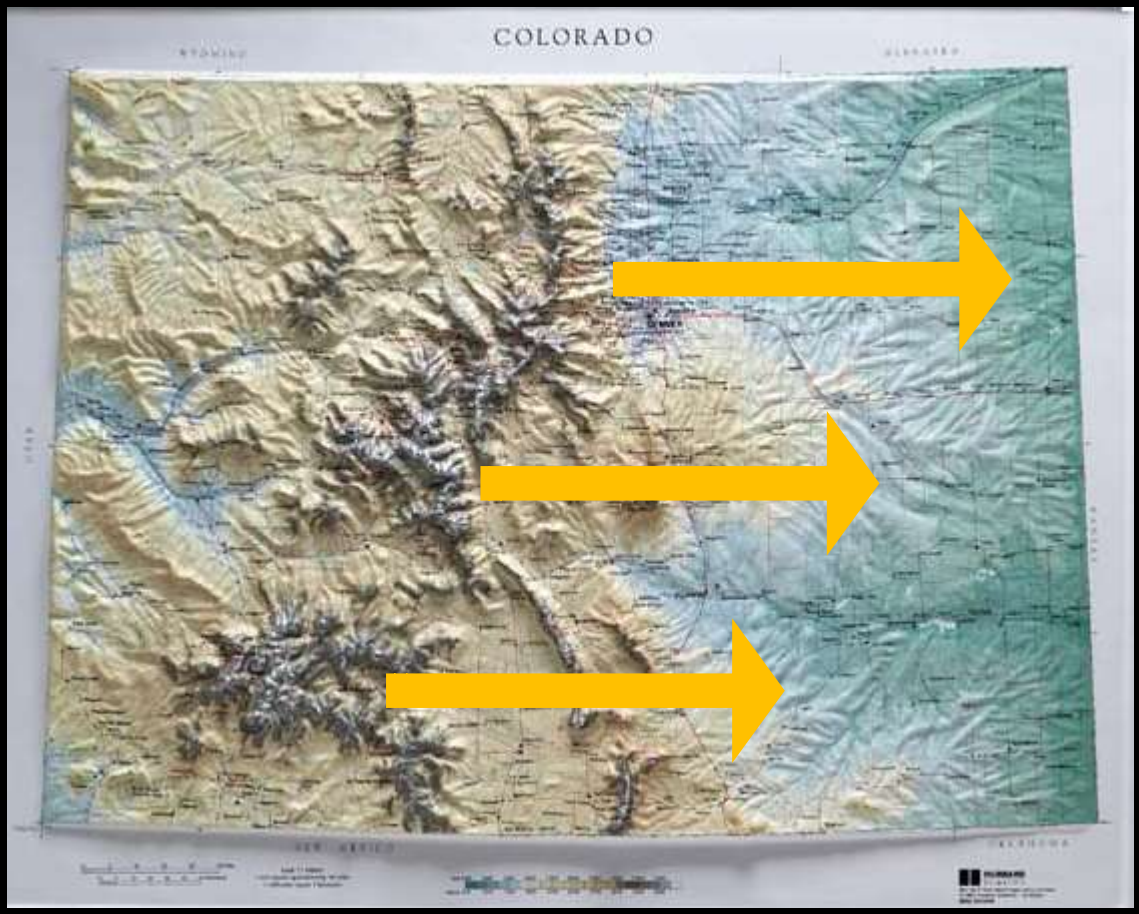
Move from the Plains to the mountains in May-June



The Annual Migration

Move from the Plains to the mountains in May-June

Return to the Plains in September and early October



Swallows at the intersections?

Its Miller Time!

Plants Commonly Used as Miller Moth Nectar Sources

- **Lilac, Chokecherry and other *Prunus***
- **Spirea**
- **Euonymus**
- **Cotoneaster**
- **Russian olive**

Plants commonly used as daytime shelter areas for miller moths

- Densely growing pines
- Spruce
- Dense evergreen deciduous shrubs (e.g., cotoneaster)

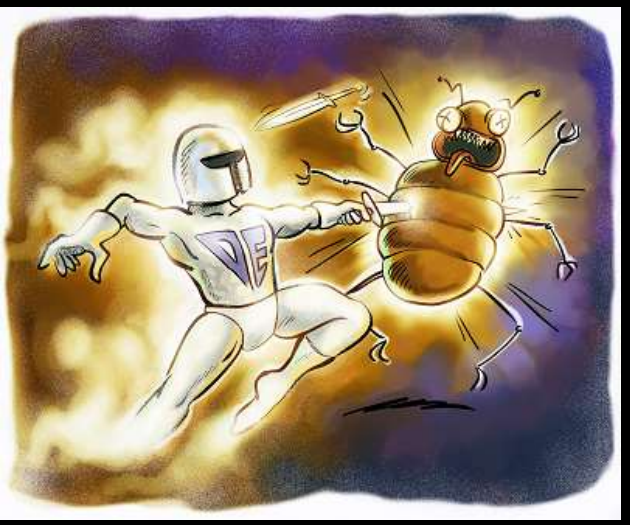
Landscaping for Biological Control Agents

Principles of Gardening for Natural Enemy/Bio-Control Insects

- Learn to recognize them – and don’t kill them
- Provide for food needs of adults
- Provide for food needs of immature stages
- Provide nest sites, if required

Principles of Gardening for Natural Enemies of Insect Pests

- **Learn to recognize them – and don't kill them**
  - **Provide for food needs of adults**
  - **Provide for food needs of immature stages**
  - **Provide nest sites, if required**



LADY BEETLE

Lady Beetle Life Stages

Lady beetles lay masses of eggs near sources of food for their young

Lady Beetle Larvae

Principles of Gardening for Natural Enemies of Insect Pests

- Learn to recognize them – and don't kill them
- **Provide for food needs of adults**
- Provide for food needs of immature stages
- Provide nest sites, if required

Lady beetles

(“Lady bugs”, “Lady birds”….)

Lady beetle adults feed on nectar and pollen

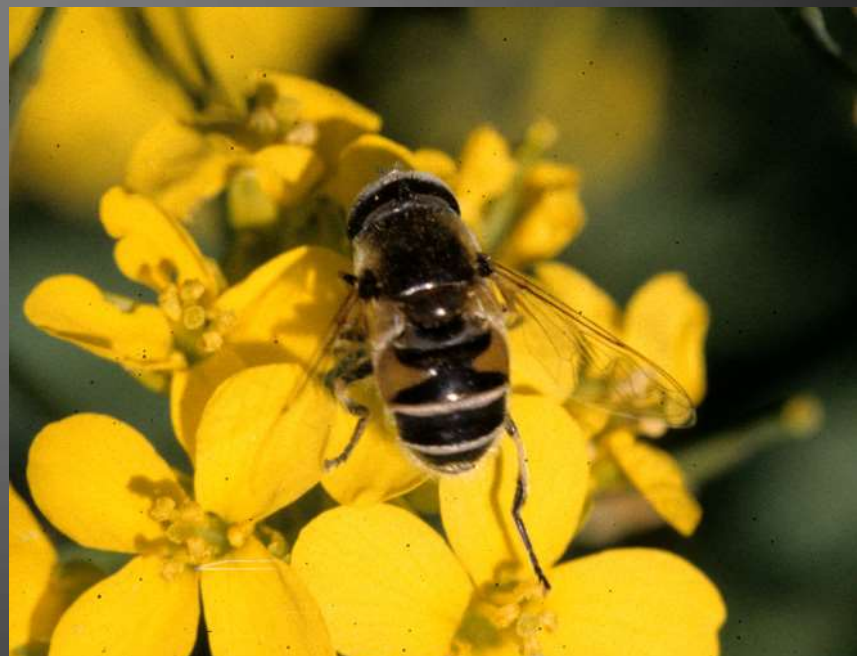
Green Lacewings

Neuroptera: Chrysopidae

Photograph courtesy of Brian Valentine

Most adult green lacewings maintain themselves on nectar and pollen

Flower (Syrphid) Flies



Flower fly larvae

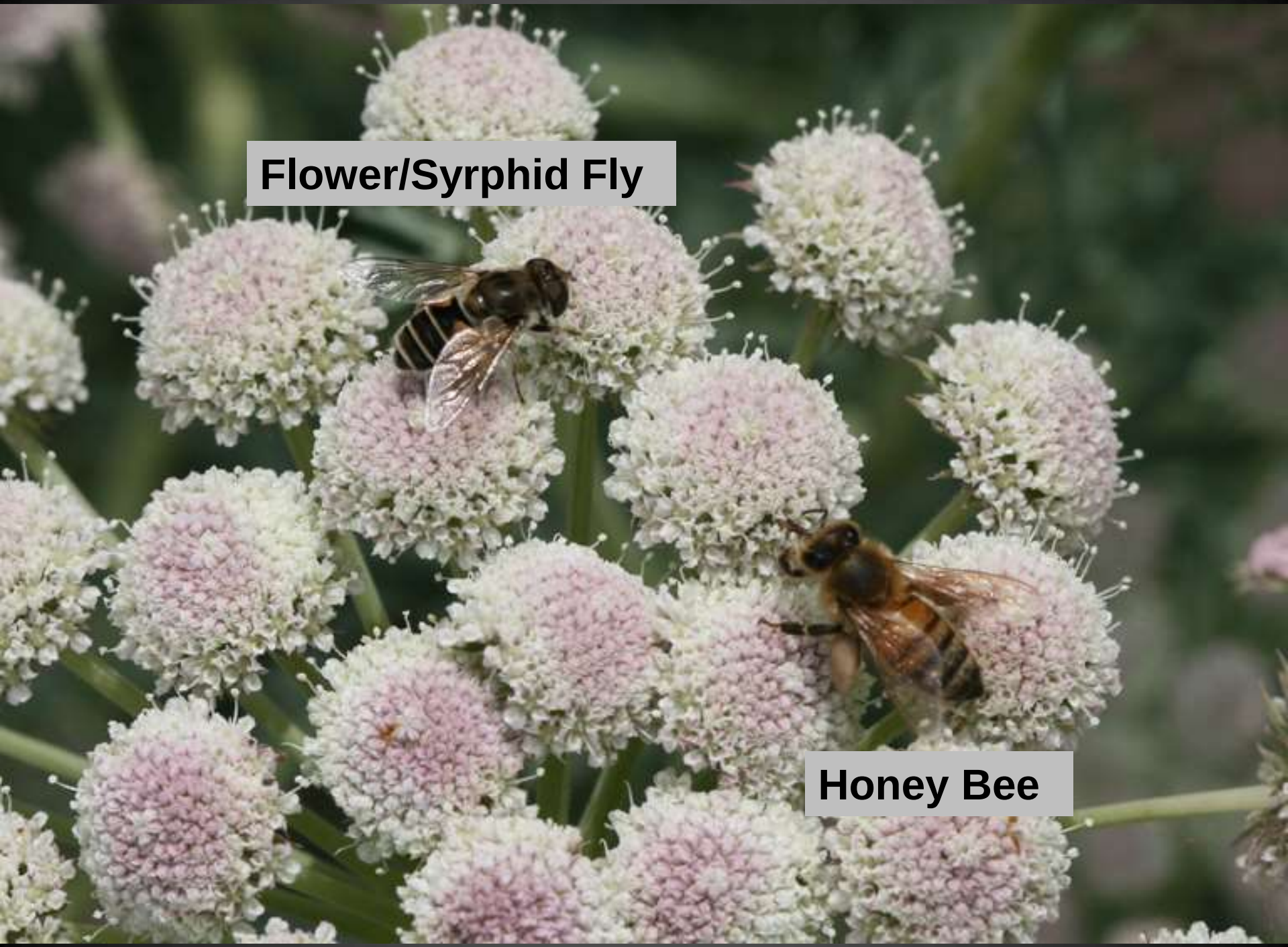
CAUTION

Insect Mimicry in Action!

Flower (Syrphid) Flies

Syrphid flies are excellent mimics of bees and wasps

Honey Bees


Flower/Syrphid Fly
Honey Bee

Adult flower flies sustain themselves on nectar and pollen

Adults of many predators use flowers (nectar, pollen) for sustenance

Parasitoid wasps maintain themselves on nectar and pollen

Tachinid fly adults sustain themselves on nectar and pollen

Larvae develop within and kill other insects

Natural Enemies of Japanese Beetle for Potential Introduction into Colorado?

Istocheta aldrichi – tachinid fly parasitoid of Japanese beetle adults

A female *Centeter cinerea* in the act of ovipositing upon *Popillia japonica* female

Istocheta aldrichii requires accessible nectar/pollen resources when the adults are active

– late June-July

Small, accessible flowers are most commonly used by natural enemies of garden pest insects

Some plants useful for providing food for adult stages of insect natural enemies

- Most Apiaceae - (dill, fennel, coriander, Ammi, Queen Anne's lace, etc.)
- Yarrow (some)
- Many sedums
- Spurges
- Sweet alyssum
- Basket-of-gold
- Thyme, several herbs

Mooncarrot

Two personal favorites for good insect action

Ammi (white cultivars)

Principles of Gardening for Insect Natural Enemies

- Learn to recognize them – and don't kill them
- Provide for food needs of adults
- **Provide for food needs of immature stages**
- Provide nest sites, if required

Spirea aphids on my bridal wreath spirea shrub – A pest??

Bridal wreath spirea

Rubber rabbitbrush

Perennial plants that consistently provide predator food sources in my garden

Principles of Gardening for Insect Natural Enemies

- Learn to recognize them – and don't kill them
- Provide for food needs of adults
- Provide for food needs of immature stages
- **Provide nest sites, if required**

Hunting Wasps

Families Sphecidae, Crabronidae, Pompilidae

Hunting Wasp Habits

- Mother (usually) prepares some nest cell for rearing young
- Mother hunts specific prey, paralyzes it and returns it to the nest cell
- Larvae of the hunting wasp consume the paralyze prey provided by the mother

Ammophila wasp digging nest (left), carrying caterpillar prey (lower left), at nest entrance with prey (below)

Bembix wasp digging while holding horse fly prey

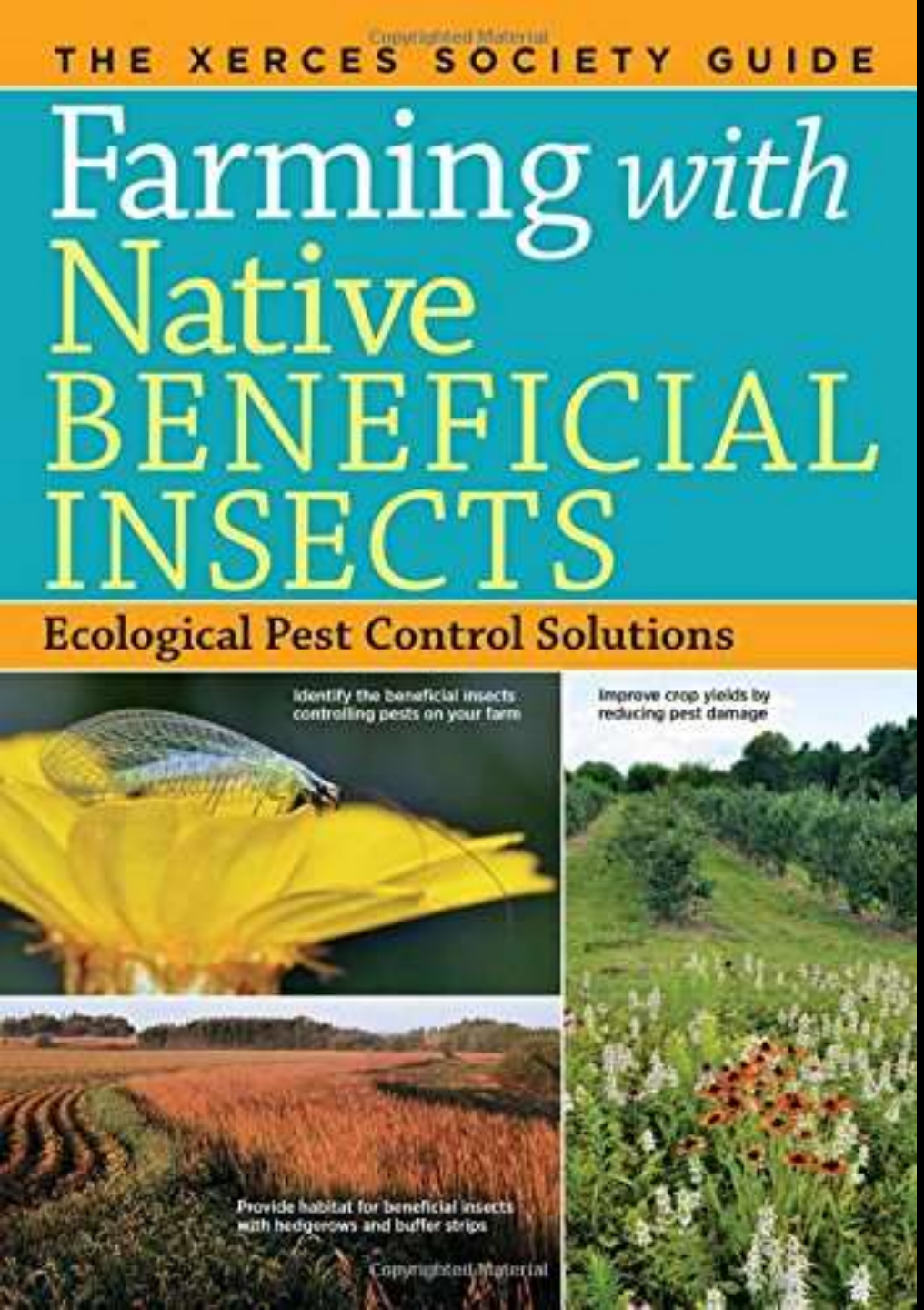
Howard Ensign Evans

Golden Digger Wasp –
Predator of longhorned grasshoppers/katydids

***Pemphredon* wasps nest in plant stems and hunt small insects**

Pemphredon **wasps nest in plant stems and hunt small insects**

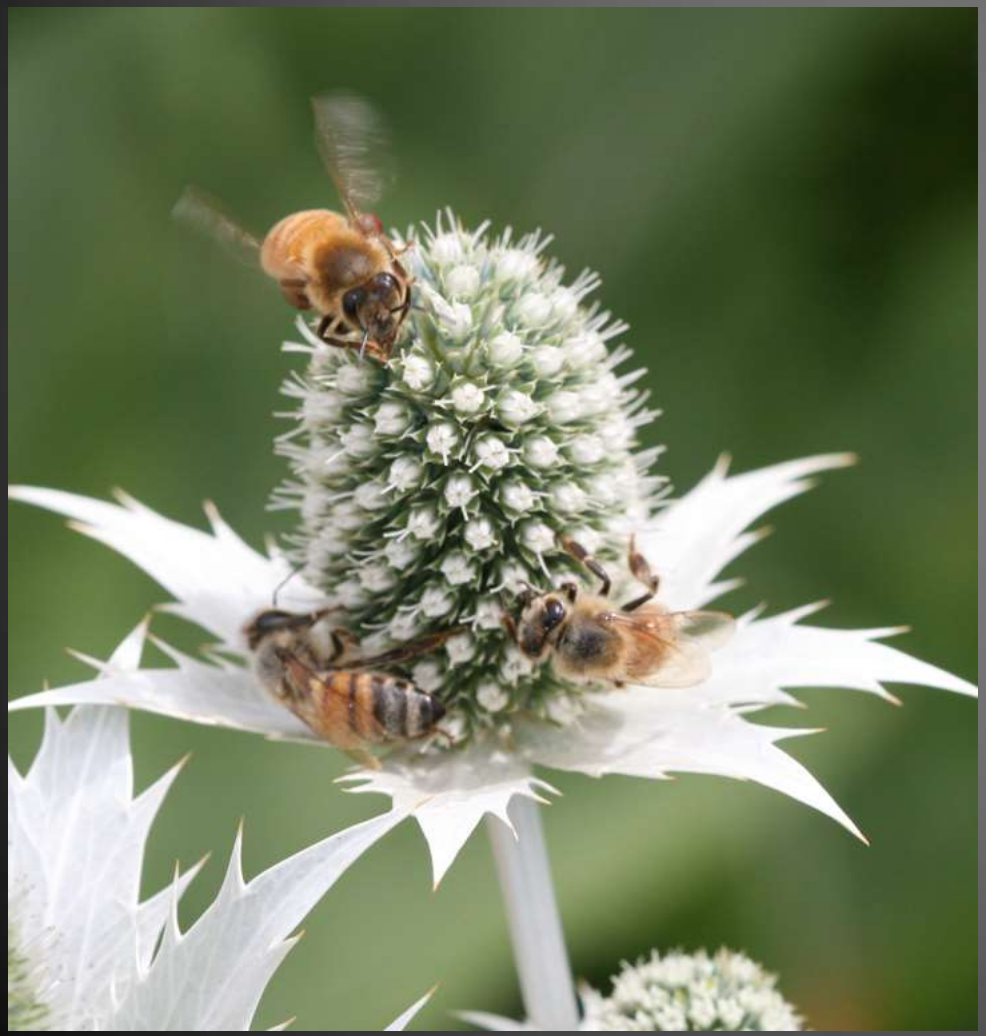
Condominium Project for Pith Nesting Pempredon Wasps



An excellent publication by the Xerces Society on improving habitat for natural enemies of insect pests

Search **conservation biological control** for other sources on this subject

Landscaping and Pollinators



Primary Groups of Flower Visitors and Pollinators

Bees (**946** CO species)

- Rear young on nectar an pollen
  - Often seen carrying pollen on their body
- Have a hairy body
- Some produce wax
- Capable of stinging
  - Social bees have painful sting
  - Solitary bees have mild sting

Gardeners can help various species of bees by expanded use of high value flowering plants

Honey Bee *Apis mellifera*

Gardening for Honey Bees – *or Not*

Honey bees – and most bees – collect nectar as their primary energy source.

Honey bees – and most bees – use pollen as their primary source for proteins, fats and most other nutrients

Pollen carried in pollen sac on hind legs

Principles of Gardening for Bees

- Provision of high quality sources of nectar
- Provision of high quality sources of pollen
- Provision of nesting sites

Principles of Gardening for Bees

- Provision of high quality sources of nectar
- Provision of high quality sources of pollen
- **Provision of nesting sites**

Top Ornamental Plants Visited by Honey Bees in CO include:

- Blue mist spirea
- *Cleome* (bee plant)
- *Agastache foeniculum*
- *Penstemon eatonii*
- *Ocimum (basil)*
- *Nepeta*
- *Salvia*
- Linden
- *Aster novae-angliae*
- *Sedum spectabile*
- *Cotoneaster*
- *Allium tangitucum*

My top three ornamental plants for providing consistent sources of nectar and/or pollen

Principles of Gardening for Bees

- **Provision of high quality sources of nectar**
  - **Sources need to be available throughout the growing season!**
- **Provision of high quality sources of pollen**
  - **Sources need to be available throughout the growing season!**
- **Provision of nesting sites**

Some important pollinator resource plants early in the season

Salix spp. (willow)

Some early season, predominantly trees and shrubs can be very important early season pollen sources for honey bees

Acer spp. (maple, boxelder)

Alnus spp. (alder)

Several very early flowering bulbs in Iridaceae, Amaryllidaceae and Liliaceae *were important early season pollen sources.*

Maples are an exceptionally important early season source of pollen

Some plants heavily visited plants by honey bees late in the season

Hemp can provide a major, late summer pollen resource for bees in agricultural areas

Lawns can be an important resource site from many pollinating insects!

J Insect Conserv
DOI 10.1007/s10841-014-9694-9

ORIGINAL PAPER

Pollinator assemblages on dandelions and white clover in urban and suburban lawns

Jonathan L. Larson · Adam J. Kesheimer · Daniel A. Potter

Received: 30 January 2014 / Accepted: 30 August 2014

Abstract Flowering weeds, though often deemed undesirable in turfgrass lawns, provide food resources for declining pollinator populations in urbanized landscapes. We sampled bees and other pollinators directly from flowering common dandelion (*Taraxacum officinale*) and white clover (*Trifolium repens*) in lawns of similar characterpercentage of hardscape in surrounding areas. Fostering public awareness of the diversity of bees and other pollinators that visit flowering lawn weeds might help nurture a sociocultural shift toward more pollinator-friendly lawn care practices.

UNIVERSITY OF KENTUCKY
College of Agriculture, Food and Environment

>50 total species collected

Some discretion can be important when siting plants highly favored by honey bees

To the left:
Sedum spectabile

To the right:
Caryopteris x candonensis


2121

Plants *not favored* by honey bees include:

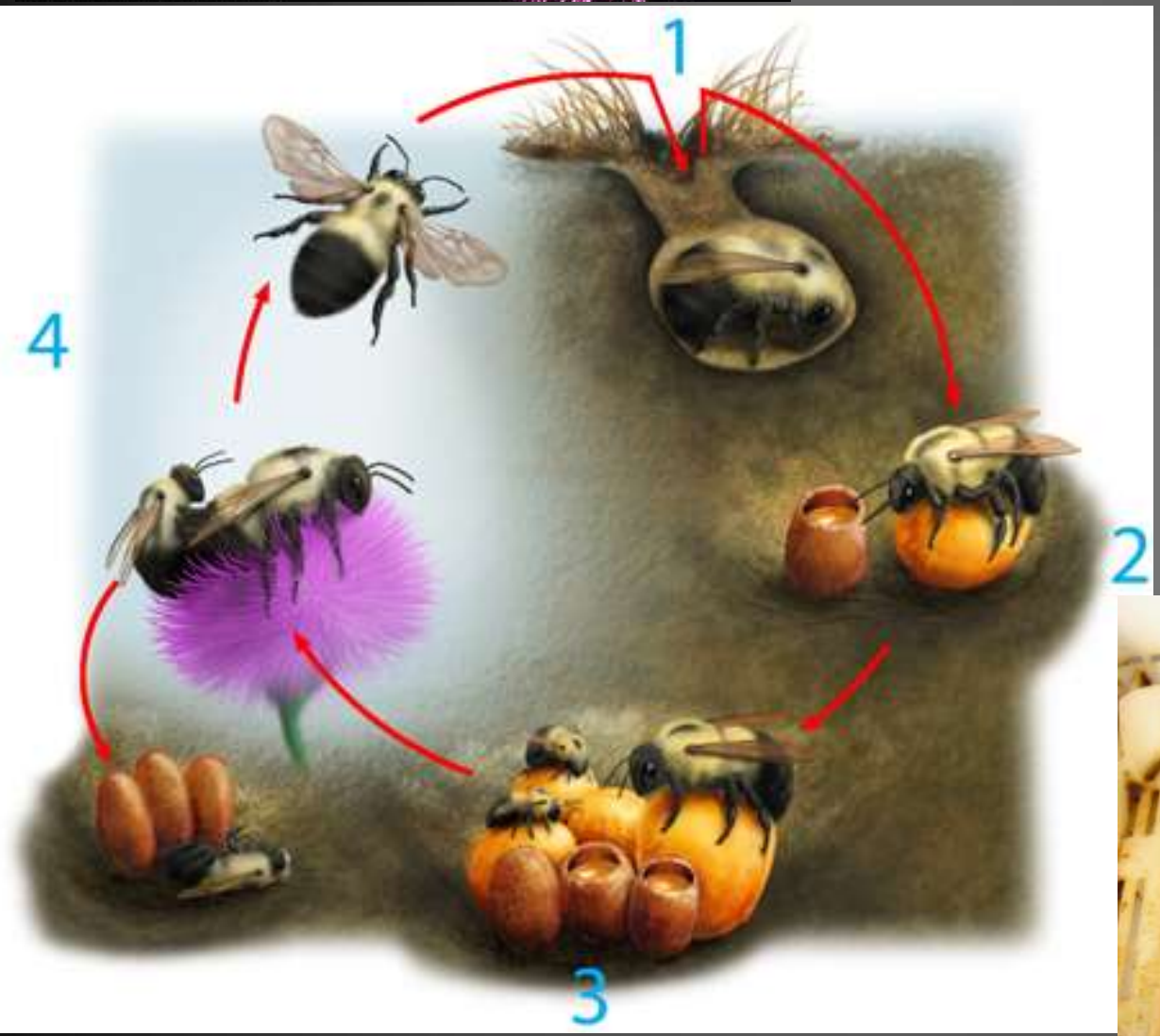
- Doubled flower cultivars
- Flowers with long corollas
- Many common bedding plants
  - Viola
  - Phlox
  - Vinca
  - Petunia

Bumble Bees

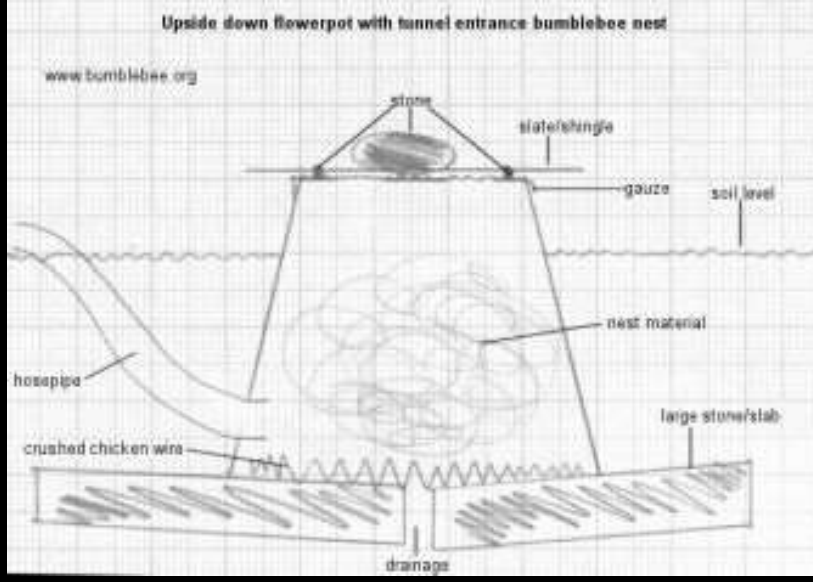
Bombus species

FROM:

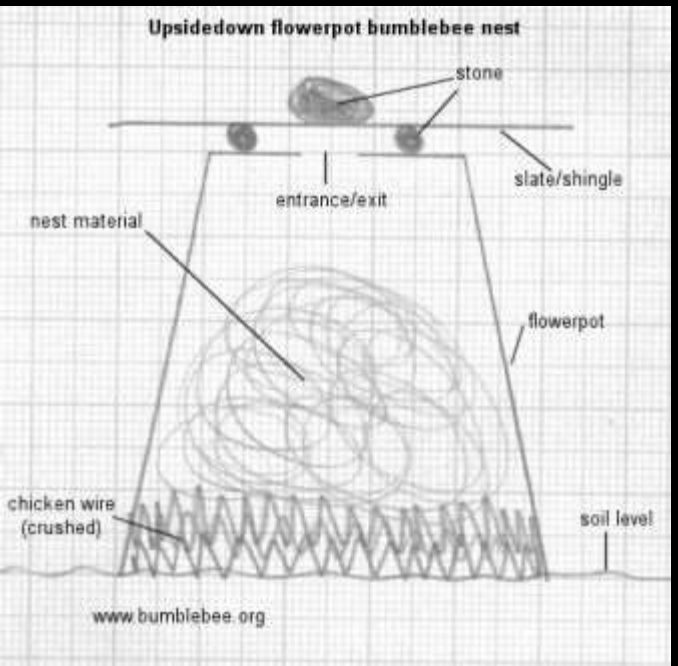
Bumble Bee Life History

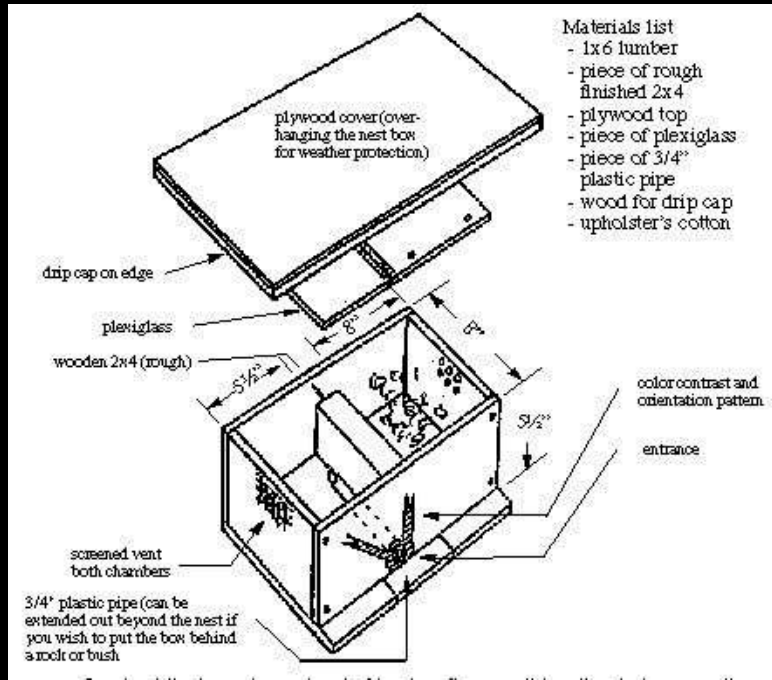


Providing nesting sites for bumble bees?



Various plans exist to construct bumble bee nests





Bumble bee colonies are sold for the pollination of certain crops

Giant Greenhouses Mean Flavorful Tomatoes All Year

Stacey Cramp for The New York Times

Some plants (e.g. the tomato) are dependent on buzz pollination

Providing nesting sites for bumble bees?

Plants heavily visited by bumble bees include:

- Most Penstemons
- *Agastache rupestris*
- *Campanula*

- *Echinacea*
- *Echinops*
- Russian sage
- *Hypericum frondosum*
- *Cleome*
- *Caragana*
- Foxgloves

Cultivar differences can be great, depending on features such as flower color

Highly favored by bumble bees – and painted lady butterflies

“Kudos Silver Blue”

Cultivar differences can be great, depending on features such as flower color

Favored but less visited – Rosie Posie

Very little visitation – Kudo's Gold

Little visited – Kudo's Ambrosia

The greatest number of kinds of bees are solitary bees

Solitary Bee Life Stages

adult

egg

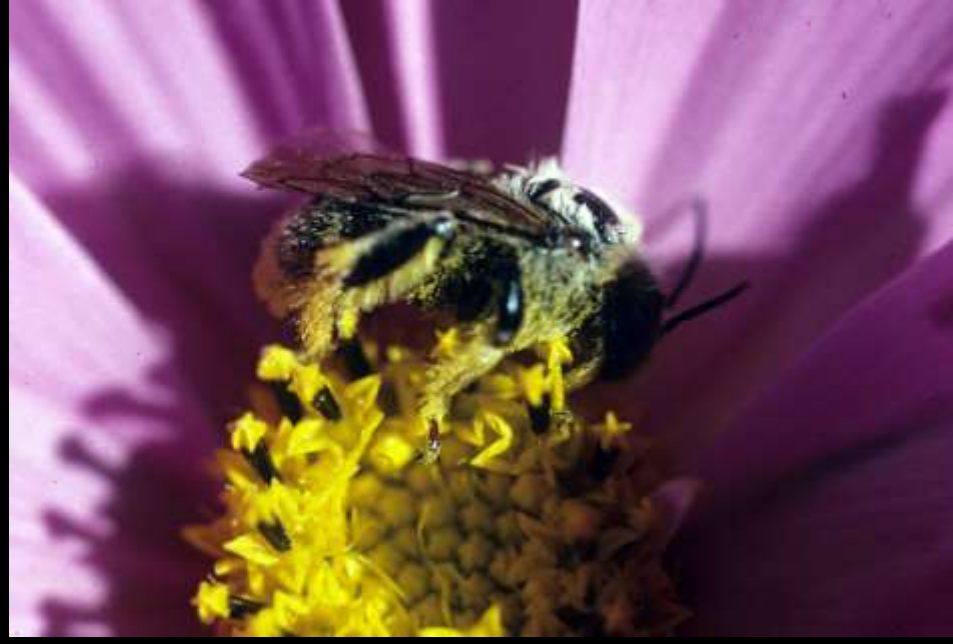
larva

pupa

Most solitary bees are ground nesters

Some ground nesting bees nest in open sites of bare ground

Some ground nesting bees nest in a patch of soil near the base of a plant.



Digger Bees

Favorable digger bee nesting site

Digger bee nesting site near Purgatoire River (Otero County)

Andrenidae – Mining Bees

Andrenid bee nest site

Sweat Bees

Halictid bee nest sites in backyard patio area

Some ground nesting bees nest in open sites of bare ground

Some ground nesting bees nest in a patch of soil near the base of a plant.

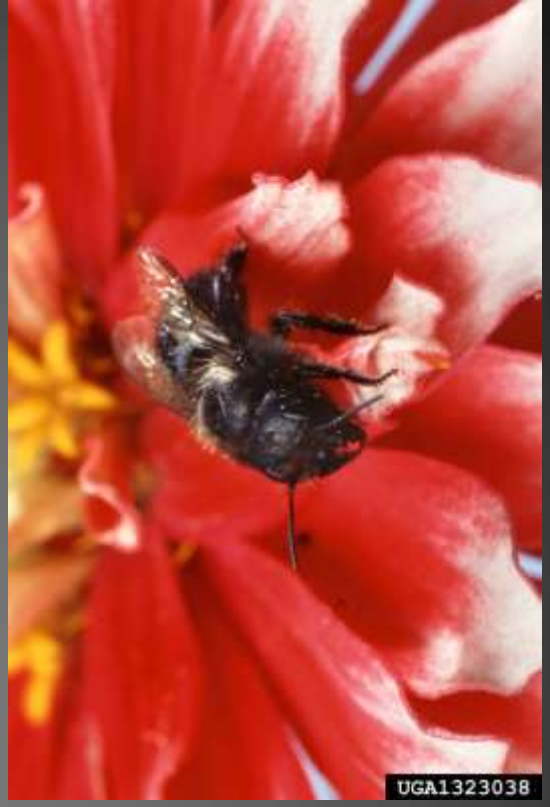
Very few – if any – will nest in a site that has a thick mulch layer

Very few ground nesting solitary bees will be able to establish nests at sites with heavy mulch

Quality pollinator habitat?

Butterfly houses

Soil well covered by mulch



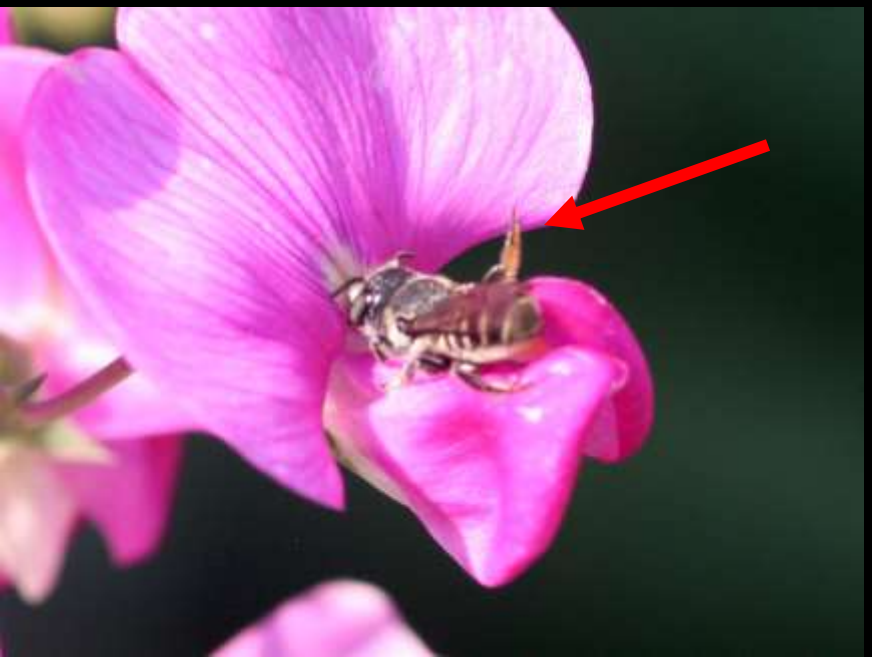
Other bees use aboveground cavities for nest sites

Family Megachilidae

Leafcutter, mason, carder bees

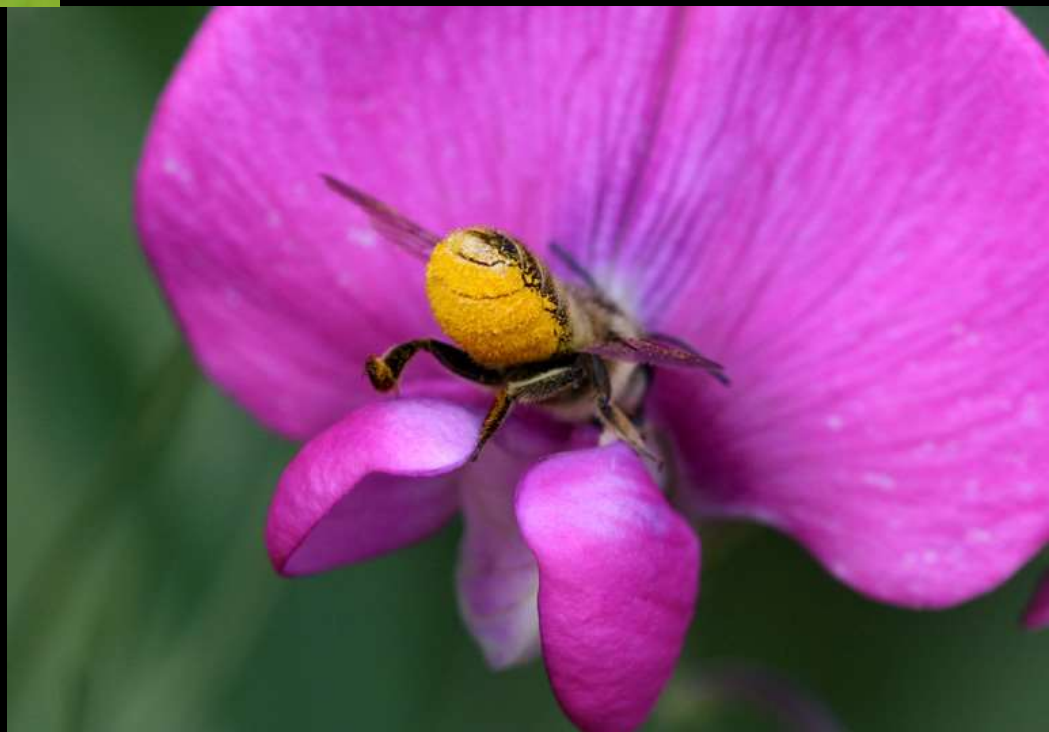
Leafcutter bee working sweet pea flower.

Note how the anthers become exposed as the bee pushes the flower while nectaring



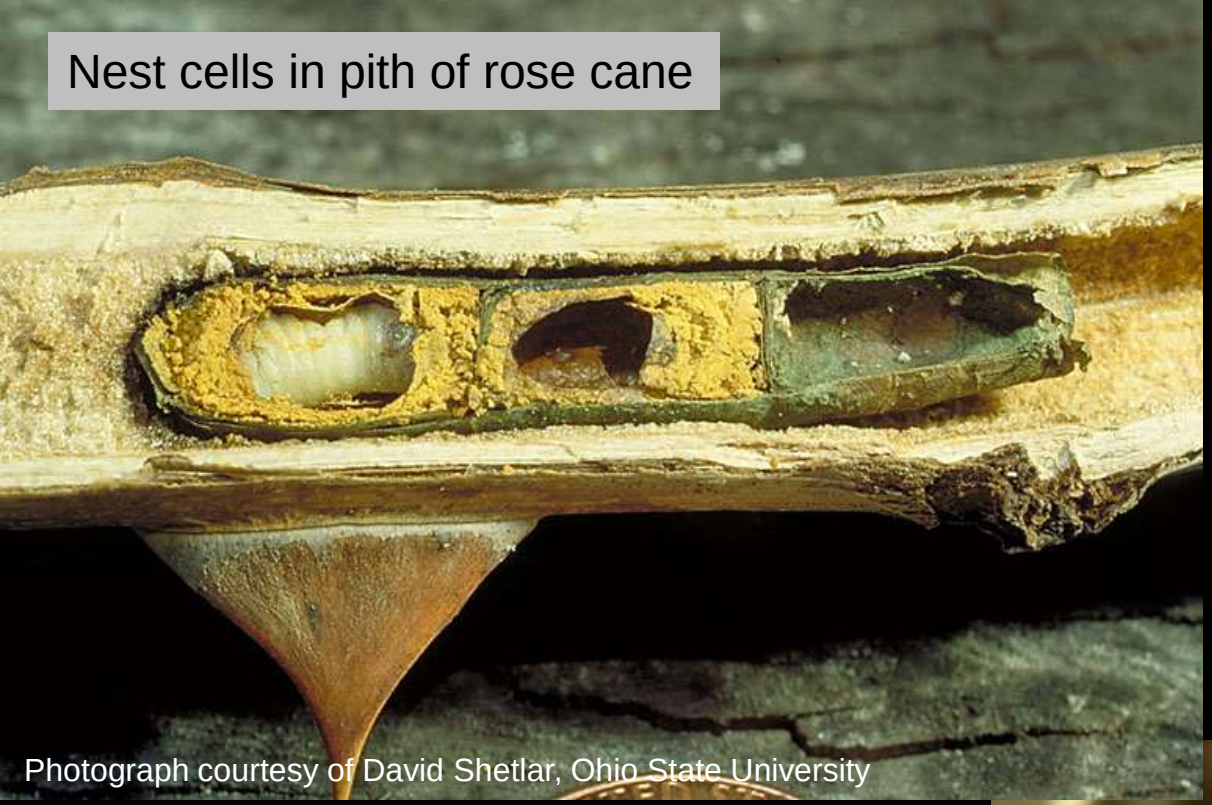
Leafcutter bee collecting pollen

All members of the family Megachilidae (leafcutter, mason, carder bees) carry pollen on the underside of the abdomen



Leafcutter Bees

Pith Nesting by Leafcutter Bees



Nest cells in pith of rose cane

Photograph courtesy of David Shetlar, Ohio State University

Nest cells with pollen in stem of weed

Photograph courtesy of David Shetlar, Ohio State University

Leafcutter bee nest sites

Soft, rotting wood is often excavated for nest sites

Leafcutter bee excavation in rotten garden timber

Leafcutter bees cut fragments from the edges of leaves that are suitable for nest building

Rose, lilac and Virginia creeper are among the plants most favored by leafcutter bees for nest materials

Leafcutter bee carrying leaf fragment

Leafcutter bee returning with leaf fragment

Cut leaves are used for nest construction

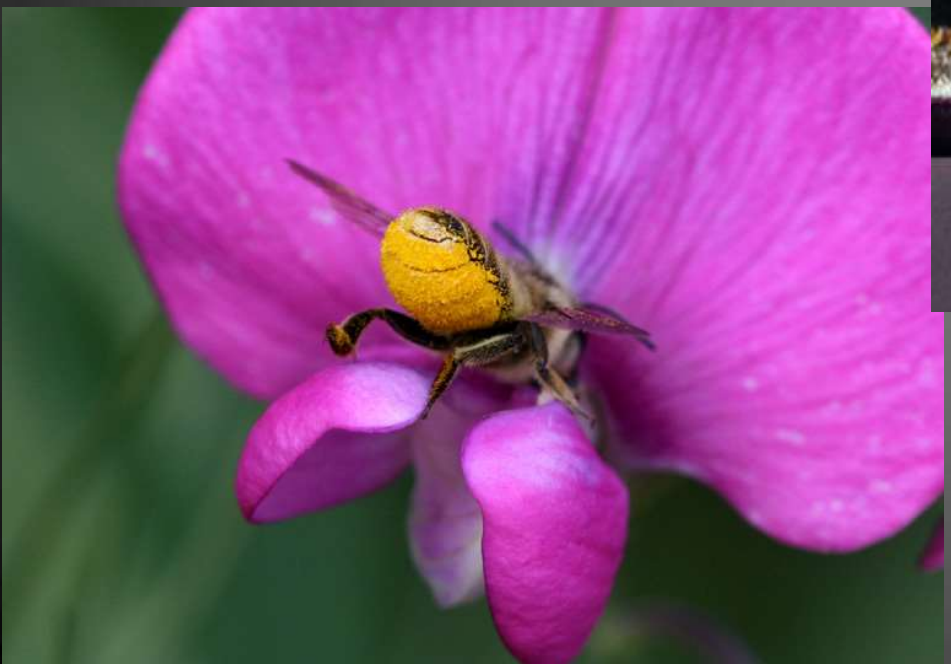
All leaf fragments are oriented with the smooth side inwards

For nest construction:

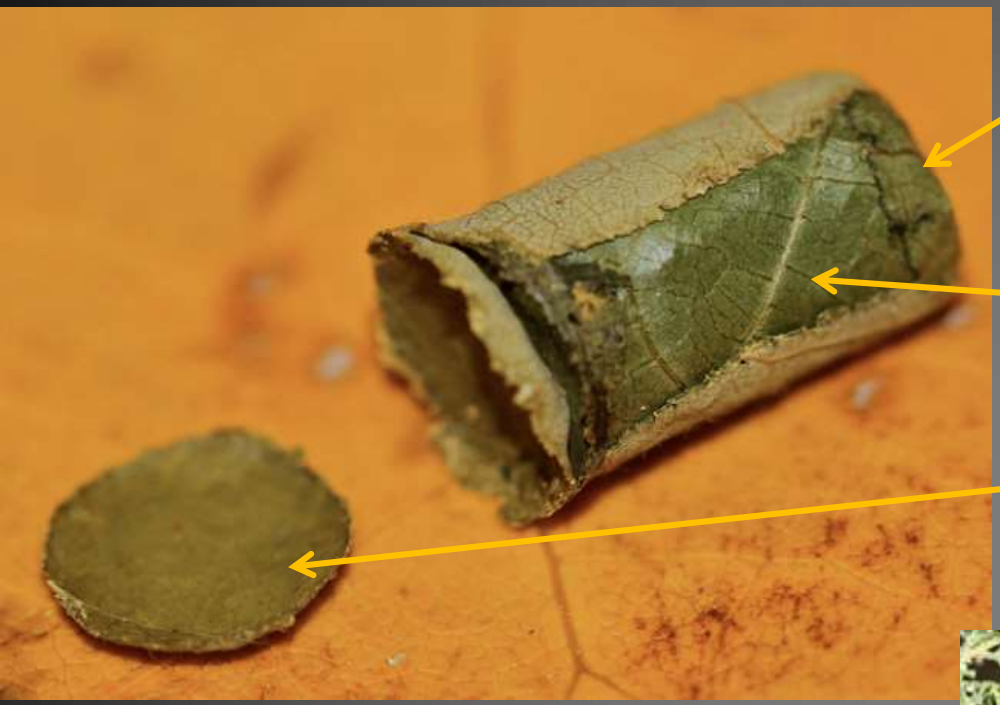
3-4 rectangular pieces, crimped for the base

Oval pieces along the sides of the cell

Leafcutter bees collect pollen and nectar, carry it to the nest site, and use it to fill a leaf-lined nest cell.



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

Nesting sites for leafcutter bees

Mason Bees
(*Osmia* species)

Predrilled wood for nesting by mason bees

Nest cells produced by mason bees in hollowed plant stems

Nesting habitat may be limiting activity of many native bees (leafcutter bees, mason bees, carder bees, carpenter bees)

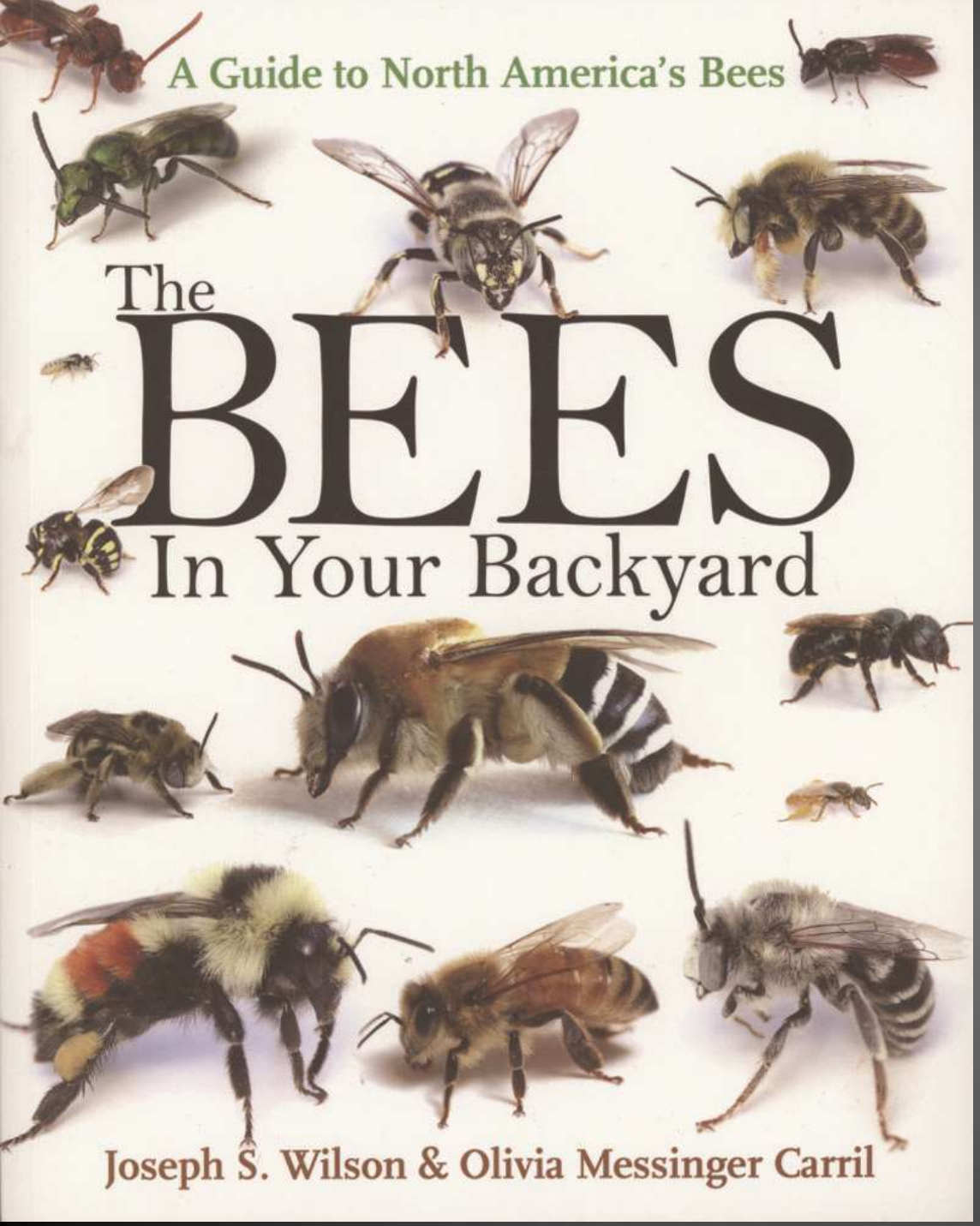
A variety of hole sizes can be used to attract a variety of species

Start at **about 5/8-inch**, then go up and down for hole width

Make the holes deep, 6-inches is good


INSEKTENHOTEL

Too much of a good thing?



Excellent publication on the subject of North American bees!

UTAH PESTS fact sheet

UtahState University COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-133-09 January 2013

Gardening for Native Bees in Utah and Beyond

James H. Cane
Research Entomologist, USDA ARS
Pollinating Insect-Biology, Management, Systematics Research

Linda Kervin
Logan, UT

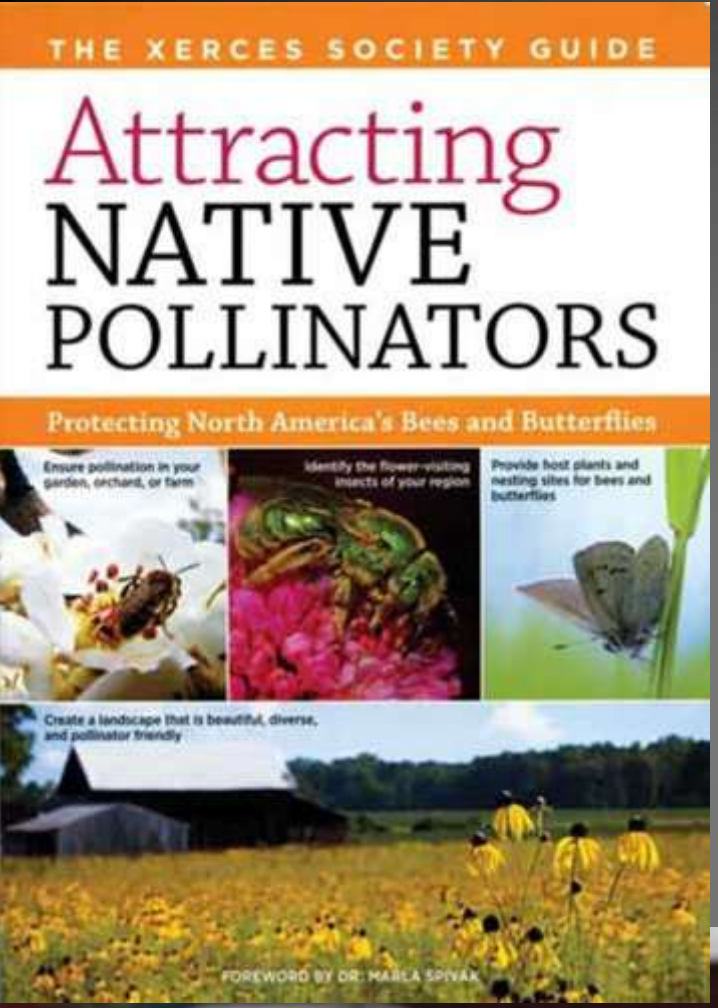
Do You Know?

- 900 species of native bees reside in Utah.
- Some wild bees are superb pollinators of Utah's tree fruits, raspberries, squashes, melons and cucumbers.
- Few of our native bees have much venom or any inclination to sting.
- Our native bees use hundreds of varieties of garden flowers, many of them water-wise.
- A garden plant need not be native to attract and feed native bees.

An outstanding – *and free* – publiccation from Utah State University

Fig. 1. Carder bee *(Anthidium)* foraging at lavender *(Lavendula:* Lamiaceae).[1]

Utah is home to more than 20 percent of the 4,000+ named species of wild bees that are native to North America. Except for bumblebees and some sweat bees, our native bees are solitary, not social, many with just one annual generation that coincides with bloom by their favorite floral hosts. In contrast, the familiar honey-



Excellent publication on how to improve habitat for native pollinators

Two Books at the Silent Auction!

Check them out!