





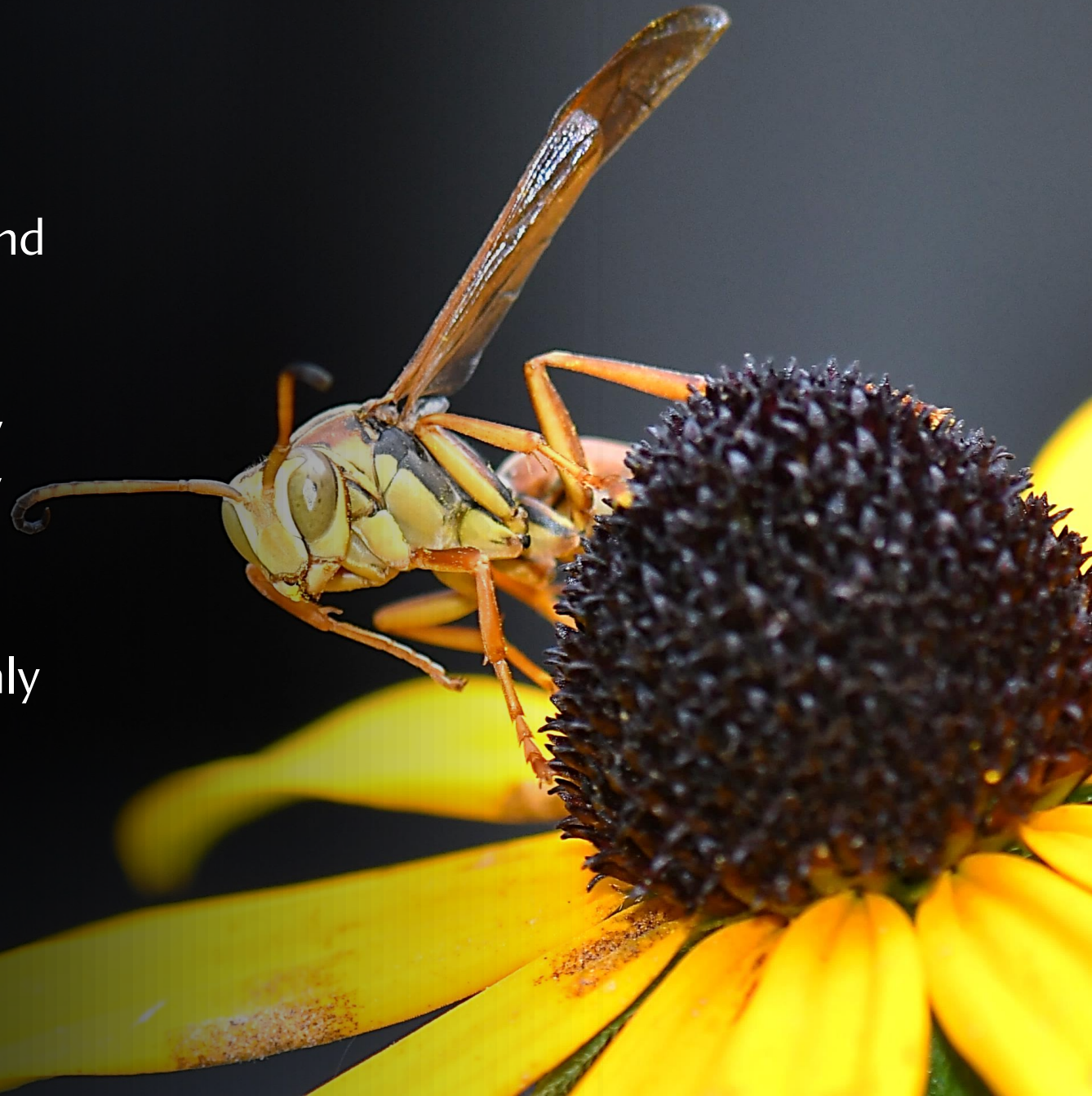
Predatory Insects and Spiders of Central PA

— Objectives

Describe predatory insects and spiders and their importance in the ecosystem

Provide a brief overview of the predatory insects and spiders I have observed in my garden in Harrisburg, PA

Show species that might not be commonly recognized as predators



What are predatory insects and spiders?

Animals that eat other animals

Specialist vs. generalist

Different stages of life

- Larval and adult stages (lady bird beetles)
- Only larval (hover flies)

Commonly identified insect and arachnid garden predators:

- Wasps*
- Assassin bugs*
- Ambush bugs*
- Hover flies*
- Lady beetles*
- Dragonflies*
- Flies*
- Mantids*
- Spiders*
- Lacewings
- Predaceous ground beetles
- Soldier beetles
- Parasitoid wasps

*These predators will be discussed.



Why are predatory insects and spiders important?

Eat many pest insects

- Key to integrated pest management program
- Critical to natural biological control

Increasing the ecological diversity of the garden will ensure a more balanced ecosystem.

Encourage natural enemies of insect pests in the following ways:

- Avoid pesticides
- Provide a water source
- Choose plants that provide pollen, nectar, and shelter
- Provide a suitable habitat with a variety of vegetation
- Avoid night time lighting
- Keep ants out of pest-infested plants

Potential drawback: predators are indiscriminate and may eat desired insects.



Wasps, Including Hornets*

Order: Hymenoptera

- Can be social (family Vespidae) or solitary; most species are solitary
- Diet varies between species
- *All hornets are wasps, but not all wasps are hornets. Hornet is the name for 22 specific, social wasps
- Hornet
 - Name commonly misused for wasps that nest above ground, including bald-faced hornets (aerial yellowjacket)
 - Construct paper nests
 - Sting is more painful than other wasps
 - More aggressive than other wasps
 - Eusocial: live together in a nest with an egg-laying queen and non-reproducing workers

Most common social wasps in Pennsylvania: paper wasps, yellow jackets (Eastern, German), bald-faced hornets, and European hornets



Paper wasp with insect prey to feed larvae.



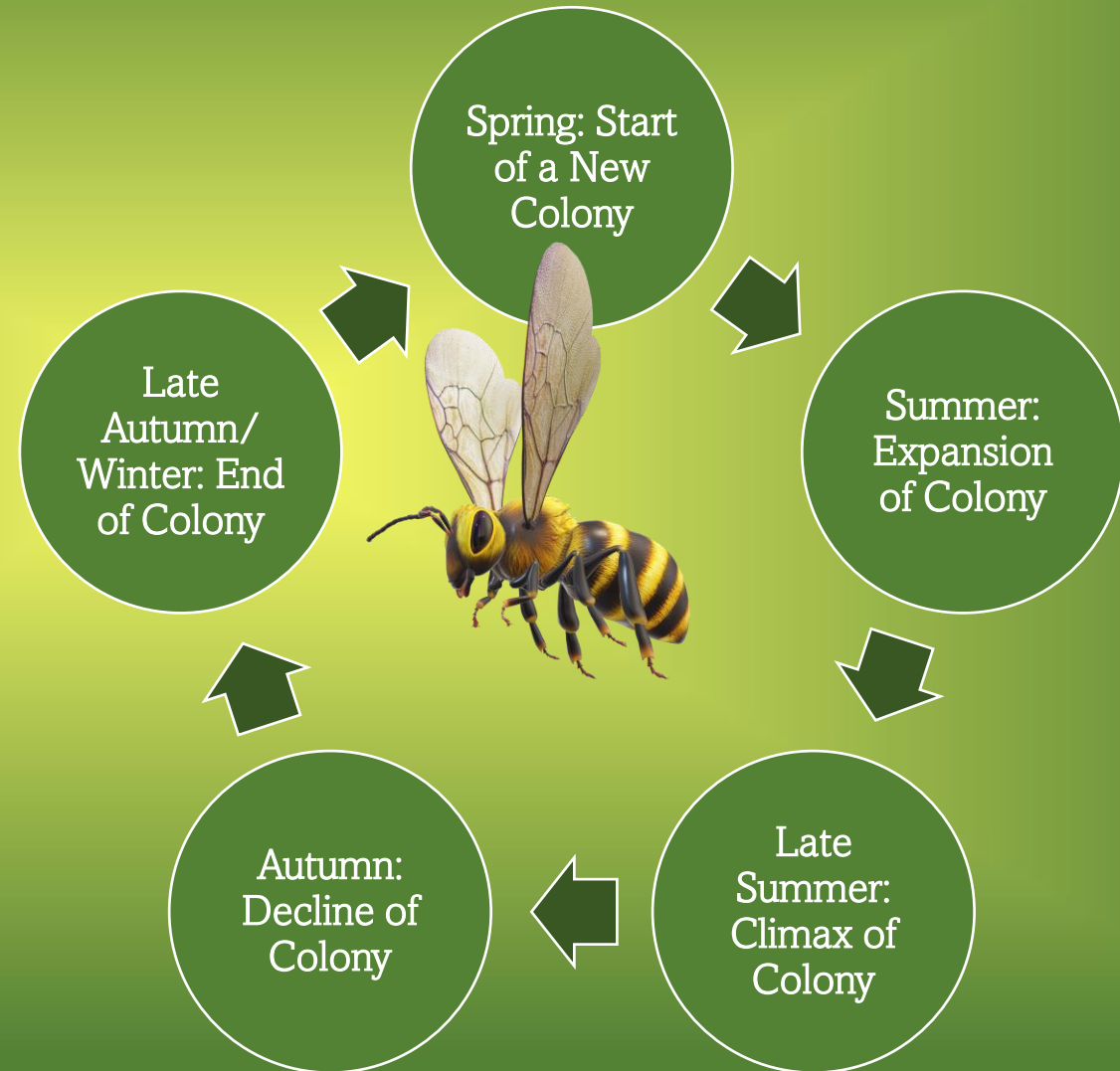


SOCIAL WASPS



Life Cycle of Social Wasps¹

Each wasp colony has the same caste system: one egg-laying queen, sterile female workers, and males.



Nests of Social Wasps

Social wasps make nests by a process called maceration: chew fibers of wood, bark, and cloth, which breaks down and forms a paper-like product.



Closed Architecture

Larger: Nest surrounded by an envelope -- outer layer with only one small opening at the bottom



Open Architecture

Smaller: Hexagonal cells on display at the bottom

Yellow jackets build nests underground. Mud daubers make nests of mud on sides of bridges and buildings.



Open architecture nest of paper wasp.

Entrance to ground nest of yellow jackets.





European Hornet, *Vespa crabro*

- Introduced from central Europe into North America; first detected in the 1840s
- Widespread and well established in the eastern United States, including all of Pennsylvania
- Only true hornet found in North America
- Feeds on the nectar of flowers and fruiting trees
- Workers dispose of eggs that are not laid by their queen in a behavior called “worker policing”
 - Unique because in most species, queens control the colony with pheromones



Solitary Wasps

- Most nest in the ground, hollow plant stems, cavities in wood, or build nests of mud
- One female wasp for each nest and one generation each year²
- Some species gregarious -- many nests in a small area
- Adults feed on nectar but feed their larvae insects or spiders
 - Many are a specialist predators
- Blue winged wasp, *Scolia dubia* →, is a common predator, parasitoid, and pollinator
 - Females attach eggs to grubs, often Japanese beetles or June bugs
- Species in families Sphecidae (thread-waisted wasps) and Crabronidae (sand wasps) also frequently seen in mid to late summer





Great Golden (Sand) Digger Wasp, *Sphex ichneumoneus*

Order: Hymenoptera

Family: Sphecidae (thread-waisted wasp)

- Native to Western hemisphere
- Provisions young with paralyzed grasshoppers, locusts, crickets, etc.
- Pulls prey into the nest burrow by the antennae







Brown-legged grass-carrier, *Isodontia auripes*

- Thread-waisted wasp that uses old nests of carpenter or mining bees
- Larvae eat for three days and then spend two forming pupae
- Crickets are common prey





Great black wasp, *Sphex pensylvanicus*

- Digger wasp that lives across most of North America
- Can grow to more than 1 inch (larger than the great golden digger)
- Larvae feed on living insects that the females paralyze and carry to the underground nest
- Important pollinator, including for species of milkweed³

Predators in the Family Crabronidae



Four-banded stink bug hunter wasp, *Bicyrtes quadrifasciatus*

- Large, solitary, digger wasp common in the United States
- Females may attack different types of true bugs, but they tend to select stink bug nymphs
- Provisions burrow with several nymphs, lays a single egg, leaves the burrow, seals the entrance



Cicada killer wasp, *Sphecius speciosus*

- Large, solitary, digger wasp common in the United States
- Females sting to paralyze prey (cicadas) rather than to defend their nests
- Provisions nest with cicadas and may directly benefit the deciduous trees upon which cicadas feed

Orange Assassin Bug, *Pselioopus barberi*

Order: Hemiptera

Family: Reduviidae (assassin bugs)

Nearly 200 species of assassin bugs in North America

- About ½ inch long
- It is golden orange
 - Black-banded legs, abdomen, and antennae
- In summer, adults typically seen on various plants where they hunt insect prey
- Attacks prey with sharp beak, injects saliva that softens the prey's innards (external digestion), and slurps out the liquefied tissue
- Bite is painful to humans





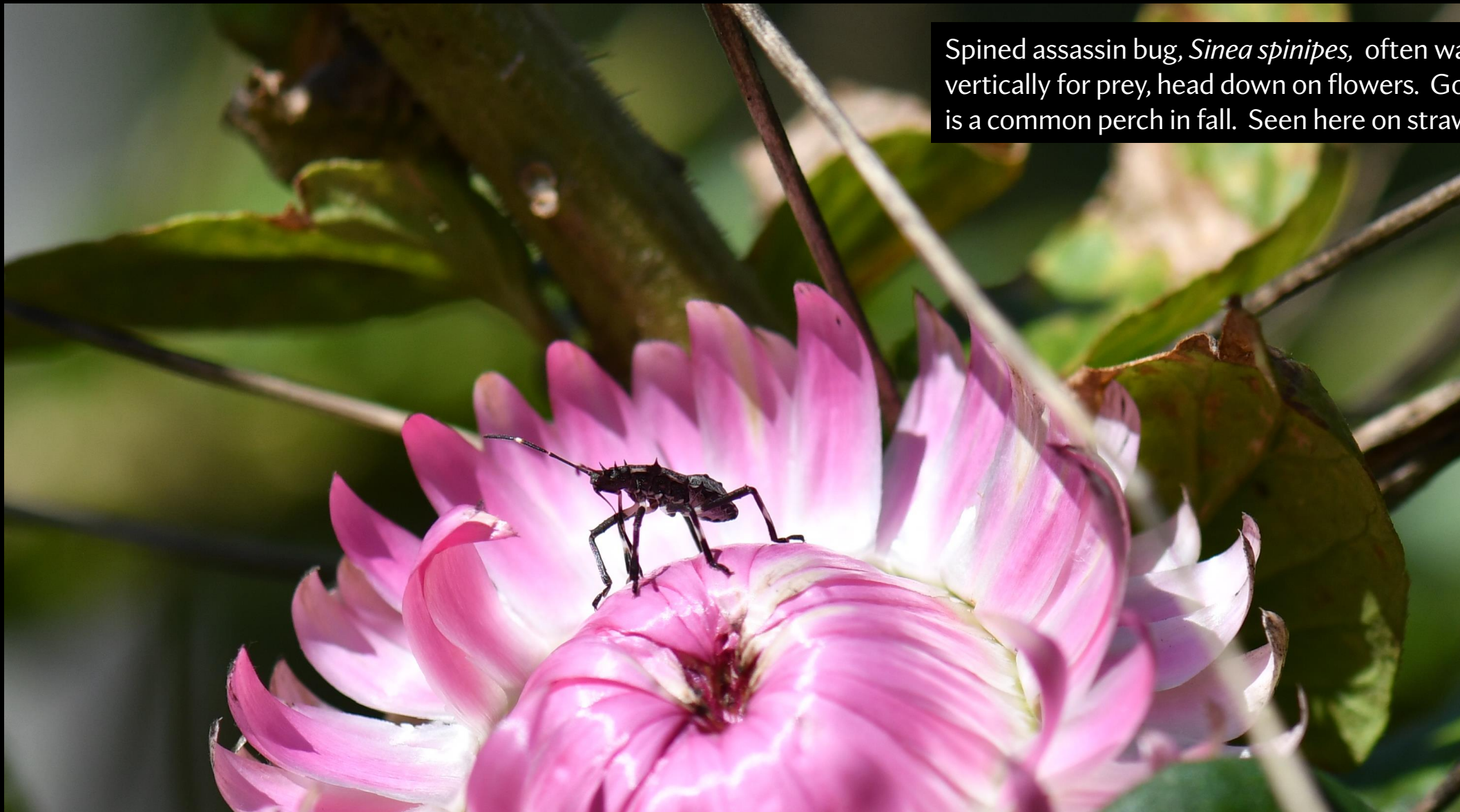






Assassin bug catches wasp and black fly moves in for spoils.

Spined assassin bug, *Sinea spinipes*, often waits vertically for prey, head down on flowers. Goldenrod is a common perch in fall. Seen here on straw flower.





Ambush Bug

Order: Hemiptera

Family: Reduviidae (assassin bugs)

Subfamily of assassin bugs distinguished by hooked forelegs, widened femur sections, clubbed antennae, and widened back portion of the abdomen. Most have jagged body contours that help them blend in with the textured background of flower heads.

- Most are gold, yellow, leaf-green, tan, brown, or white, often with dark mottled patches or bands.
 - It's not clear whether individual ambush bugs change color to match the plants they're resting on, or if they simply move to (or survive on) plants whose colors happen to match their bodies.
- Waits motionless on a plant or flower, grabs the prey, injects immobilizing and digestive fluid, then slurps the contents from the prey's body.⁴

Hover Flies

Order: Diptera

Family: Syrphidae

- Adults of many species feed mainly on nectar and pollen
- Larvae (maggots) eat a wide range of foods depending on species. They may be
 - **Insectivores** that prey on aphids, thrips, and other plant-sucking insects,
 - Herbivores that eat plants, or
 - Detritivores that eat decaying plant and animal matter in the soil, ponds, and streams





← Hover fly larva wrapped around the stem of an eryngium.

- Hover flies are attracted to flowers as adults, but some feed on aphids as larvae, and these larvae can be effective in suppressing aphid populations in gardens and mixed plots.
- Most noticeable in the later half of the growing season, usually after aphid infestations are established.

In this garden bed, larvae of hover flies and lady beetles fed on oleander aphids.



Multicolored Asian Lady Beetle, *Harmonia axyridis*

Order: Coleoptera

Family: Coccinellidae

Lady beetles (ladybugs or lady bird beetles) are familiar insects in many parts of the United States.

- Native to Asia -- introduced into the United States by the U.S. Department of Agriculture as a biological control agent
- Generally beneficial predators -- consume aphids, scale insects, and many other pests
- Adults can live as long as 2 to 3 years
- Nymphs strictly carnivores
- Adults may eat pollen, nectar, and mildew in addition to other insects



Larva of the multicolored Asian lady beetle.



Common Whitetail Dragonfly, *Plathemis lydia*

Order: Odonata (dragonflies and damselflies)

Family: Libellulidae (skimmers)

- Widespread across much of North America
- Males and females look very different
 - Immature male here will eventually have a white abdomen
 - Wings of the males have only one dark band ; female have three evenly spaced dark blotches
- Dragonflies undergo incomplete metamorphosis:
 - No pupal stage -- transition from a larva to an adult
 - Final molt takes place out of water
- Adult dragonflies hunt through “hawking”
 - Hold legs in basket shape to grab mosquitoes and other small flying insects. ⁵



Long Legged Fly

Order: Diptera

Family: Dolichopodidae

Genus: Condylostylus

- Beneficial predators as adults and larvae
- They feed on a variety of small, soft-bodied arthropods
 - Other flies, thrips, aphids, spider mites, springtails, leafhoppers, whiteflies, small caterpillars, and even termites
- Larvae of some long-legged flies eat other small arthropods in soil -- others are scavengers
- Adults can be seen carrying prey during flight
- Secrete digestive juices into prey and feed on liquefied contents⁶
- Stance to the right with legs extended is used when stalking prey





Praying Mantis

Order: Mantodea

Family: Mantidae

Shown here: Chinese mantis, *Tenodera sinensis*

- Native to Asia and the nearby islands
- Accidentally introduced by a nursery tender at Mt. Airy near Philadelphia, 1896
- Typically larger than native mantis species
- Outcompetes the Carolina mantis for food sources and even preys on the Carolina mantis
- Some sources recommend that to keep populations in check, the egg cases of the Chinese and European species should be destroyed before the eggs hatch.⁷

Oothecae (Egg Cases) of Chinese, European, and Carolina Mantis⁸



Shown from left to right, ootheca of the Chinese mantis (*Tenodera sinensis*), ootheca of the European mantis (*Mantis religiosa*), and ootheca of the Carolina mantis (*Stagmomantis carolina*). Photos © Colin Purrington. Used with permission.



This Chinese mantis can easily be distinguished from the native Carolina mantis by the distinct vertical stripes between the eyes.

Spiders

Spiders are the gardener's friend and consume huge numbers of insects:

- 400 to 800 million metric tons of insects each year⁹

Many of those insects are herbivores or granivores (seed eaters) or other insects that adversely affect humans.¹⁰

By consuming these pests, spiders help to keep their populations in check and reduce the need for harmful chemical pesticides.

In addition to pest control, spiders perform other vital functions:

- Pollination
- Soil fertility
- Biomonitoring¹¹



Jumping Spiders

Order: Araneae (spiders)

Family: Salticidae (jumping spiders)

Jumping spiders represent the largest known spider family worldwide

- More than 4,000 species -- this family makes up roughly 10% of the order Araneae
- Can leap for relatively long distances
- Excellent eyesight
- Pounce on unsuspecting insect prey or position themselves in range for a quick chase

Emerald Jumping Spider,
Paraphidippus aurantius →

- Male: black with a white stripe on each side of its head; female: brown with orange details; both: spots of iridescent green







Zebra spider, *Salticus scenicus*

Order: Araneae (spiders)

Family: Salticidae (jumping spiders)

- Zebra spiders widespread across Europe, North America, and North Asia
- Usually found in open habitats -- rock faces or trunks of trees
- Hunt other arthropods and smaller spiders but have been observed feeding on prey as many as three times their own length
- Use large front eyes to locate and stalk prey

Orbweaver Spiders

- Araneids are one of the most successful spider families; more than 2,500 species
- Three-clawed builders of flat webs with sticky spiral capture silk
- Third claw is used to walk on the nonsticky part of the web
- Many build a new web each day
- Most are active during the evening hours and hide for most of the day





Orchard Orbweaver, *Leucauge venusta*

Order: Araneae (spiders)

Family: Tetragnathidae (long-jawed orbweavers)

- Found from southern Canada as far Georgia along the East coast ¹²
- Web is often oriented horizontally; spider hangs down in the center
- Males and females virtually indistinguishable







Basilica Orbweaver, *Mecynogea lemniscate*

Order: Araneae (spiders)

Family: Araneidae (orbweavers)

- Removes web at the start of each day but wraps the old web around egg masses
- Egg masses resemble strings of beads
- Have eight tiny eyes with poor vision
- Locate their prey by vibrations



Spined Micrathena, *Micrathena gracilis*

Order: Araneae (spiders)

Family: Araneidae (orbweavers)

- Commonly known as the spined micrathena or castleback orbweaver
- Found in wooded locations and landscaped residential and suburban areas in most states east of the Rocky Mountains
- Frequently overlooked because of its small size
- Creates strong silk dragline at about eye level
- Spins a moderately large and very tightly coiled web
- Venom harmless to humans





Spined Micrathena



Order: Araneae (spiders)

Family: Linyphiidae (sheet-web weavers)

- Eats small insects: mosquitoes and gnats
- Web is positioned horizontally; spider rests on underside
- Commonly found in woodlands; woodland edges; and dense, low vegetation around houses

Filmy Dome Spider,
Neriene radiata

Potter's Grass Spider, *Agelenopsis potteri*

Order: Araneae (spiders)

Family: Agelenidae (funnel weavers)

- Medium-sized; native to North America
- Builds web on lawns, taller grasses, low shrubs, stone fences, corners of buildings, basements
- Web is a flat sheet with a funnel on one side and a barrier above
 - Funnel is small and allows the spider to escape
 - Flying insect hits the barrier, drops to sheet, becomes entangled
 - Spider rushes out, bites the insect to, drags it back to the retreat





Potter's Grass Spider



Potter's Grass Spider

Garden predators are indicative of a healthy ecosystem and are critical for successful integrated pest management!





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