



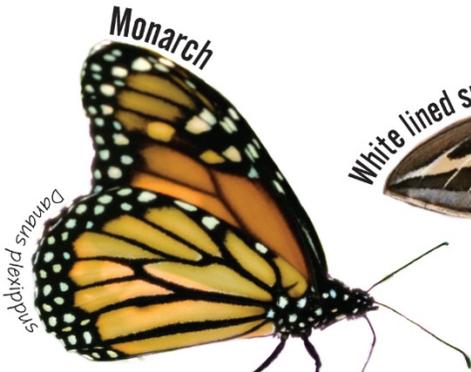
Small orange sulphur
Colias eurytheme



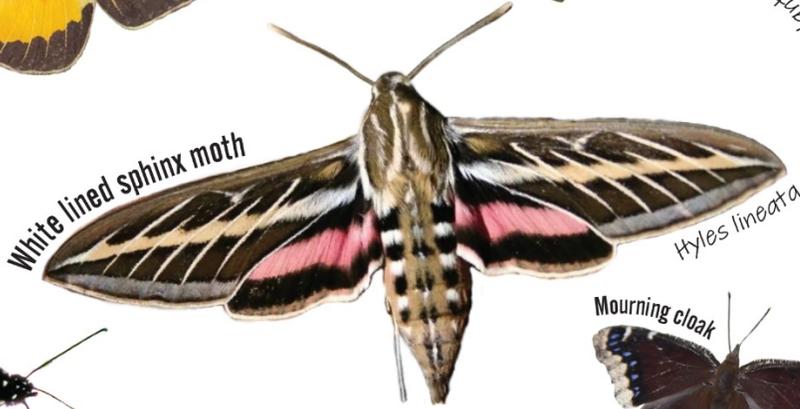
Painted lady
Vanessa cardui



Red admiral
Vanessa atalanta



Monarch
Danaus plexippus



White lined sphinx moth
Hyles lineata



Mourning cloak
Nymphalis antiopa

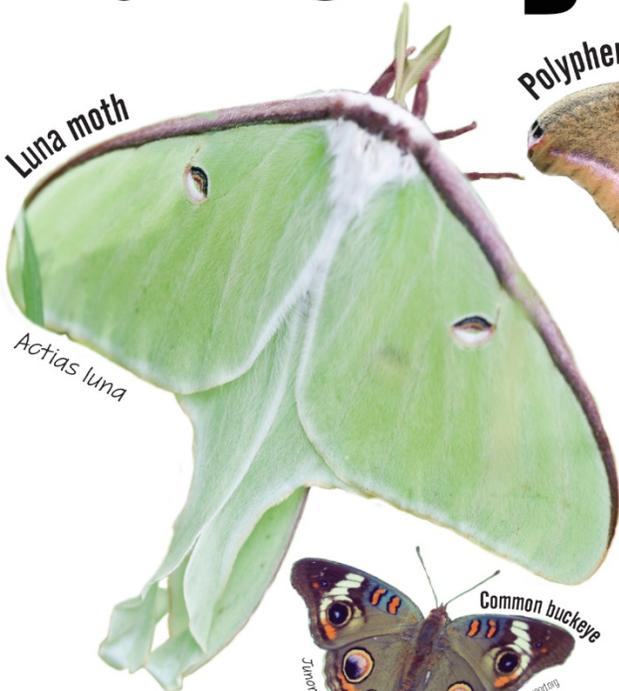


Eastern tailed blue
Glycyphana borealis

Lepidoptera

by Dr. Vera Krischik, University of Minnesota, Entomology Center for Urban Ecology & Sustainability, CUES, 2020

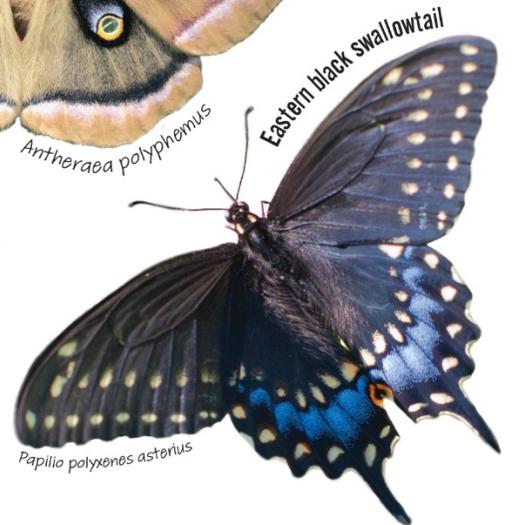
Butterfly Gardening



Luna moth
Actias luna



Polyphemus moth
Antheraea polyphemus



Eastern black swallowtail
Papilio polyxenes asterius



Common buckeye
Lunania leucaea



Cabbage white
Pieris rapae

Butterfly Gardening



Residential development, commercial agriculture, pesticide use and climate change is destroying natural wildlife habitat. Wherever possible, we need to encourage habitat restoration in order to encourage butterfly and songbird populations.

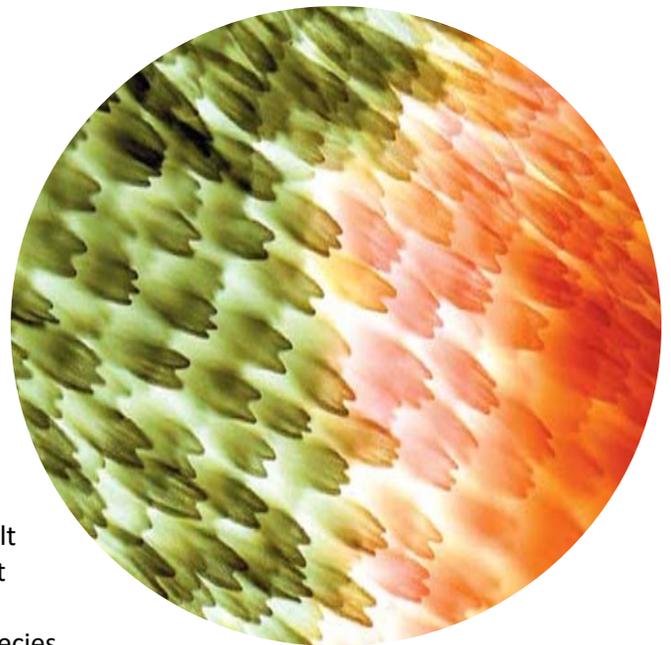
Butterfly gardening retrofits landscapes with nectar and larval host plants for butterflies. Butterfly gardening can be easy, and as simple as providing the appropriate variety of host plants for larval

(caterpillar) growth and adult (butterfly) feeding. Plants used in butterfly gardening include native plants as well as horticultural heirlooms of annuals and perennials. Different species of butterflies sip nectar from flowers on specific types of plants. They also search for specific species of plants upon which to lay their eggs. Caterpillars feed on their host plants for their entire life cycle. By choosing certain plants for adult and larval feeding, we encourage the establishment of butterfly populations which return year after year. As we manage our urban landscapes, our efforts in environmental stewardship assure the presence of butterflies and the sharing of our personal backyard edens with these beautiful, colorful, soaring insects.

What a Butterfly is

The insect order Lepidoptera consists of butterflies, skippers and moths. The name refers to the tiny scales covering the adult insect's wings.

Scales in butterflies, typically, come in a variety of colors, while those of moths, as a rule, do not. There are exceptions to the rule, for instance moths that fly by day are colorful like butterflies. Lepidopteran wings are used in flight and in various behaviors associated with the life history, such as searching for specific larval hosts for egg laying and flowers with nectar for adult feeding. Butterflies account for only 8% of the lepidopteran insect species. Moths are far more common, accounting for 92% of lepidopteran species. Approximately 150 butterfly and skipper species are estimated in Minnesota.



Good butterfly habitat provides plants for all life stages: host plants (for egg laying and caterpillar food), nectar (food for adult butterflies) and protected areas (to pupate, rest, overwinter and hide from predation).

Butterflies visit plants for several reasons. Butterflies need nectar to provide energy for flying and reproduction. It is in the process of drinking nectar that they pollinate plants.

In fact, the evolution of flowers is considered to be a result of a mutualism between pollinators and plants. Plants provide nectar in flowers and butterflies transport pollen to ensure reproduction with unrelated individuals. Insect feeding results in pollen transportation and is more reliable than the alternative form of pollen transport, wind.

Look closely at a lepidoptera and you will notice large eyes for finding flowers and larval host plants and a coiled mouthpart called a proboscis used for probing and sucking nectar from flowers. (see photo)



White lined sphinx moth (*Hyles lineata*) on thistle, photo: Greg Lasley

Butterflies are brightly colored as a way to advertise their distastefulness to predators. Throughout evolution, butterfly species evolved mechanisms to isolate and concentrate noxious host plant chemicals in their caterpillar bodies. Female butterflies, searching for host plants upon which to lay their eggs, are attracted to plants which provide these specifically noxious chemicals to their caterpillars. This is why caterpillars of a butterfly species only feed on specific plants providing the correct chemical for storage or sequestration. During pupation, when caterpillars reorganize their bodies and metamorphose (change into adults), these chemicals are conserved and distributed into the body and wings of the butterflies. These chemicals then make the butterflies distasteful to birds.



Photo: cryptic coloration typical to moths let them blend into their surroundings, lessening exposure to predators.

Moths, by contrast, are often dully colored and lack functional mouthparts. Many moth species feed on a wide range of hosts since sequestration of chemicals is not usually done. Consequently, most moths are not distinctive. They tend to be cryptic, meaning they match and blend into the background colors of their native habitat.

As a consequence of not having the plant chemical protection of butterflies, moths are highly palatable to birds. This is why they usually fly at night, to avoid bird predation. A few moth species are large and showy, but it is difficult to garden for their benefit. Most moth species lack mouthparts as adults, but the tomato hornworm (Sphingidae: *Manduca sexta*) is an example of the exception. The tomato hornworm is a species of sphinx moth active at dusk and often mistaken for hummingbirds. They prefer to feed on deep-lobed flowers such as trumpet vine and nasturtium. Other large moths such as the luna moth (Saturniidae: *Actias luna*), cecropia moth (*Hyalophora cecropia*), and polyphemus moth (*Callosamia promethea*) are very beautiful, but lack mouthparts as an adult. They cannot be lured to feed or reproduce in the garden as can butterflies. Saturniid moths also have specific host plants like lilac and azalea plus trees including ash, poplar, oak, hickory, elm, linden, willow and tulip trees.



Photo top to bottom: cecropia moth, luna moth, polyphemus moth.

Butterfly Identification

Although exceptions exist, several key characteristics or traits, typically used to separate and identify butterflies from moths, are illustrated in these drawings.

Antennae

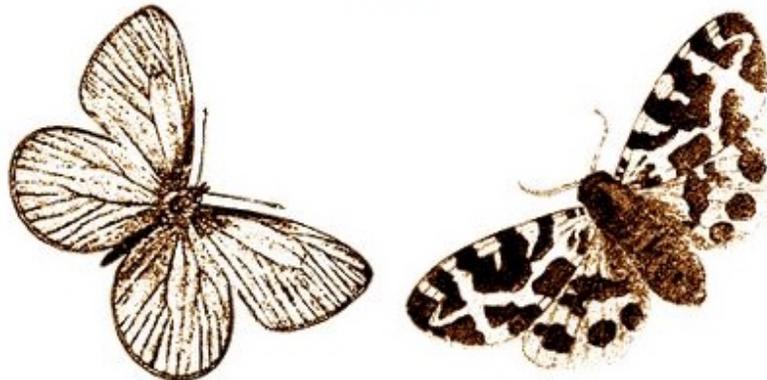


clubbed
(Nymphalidae: Monarch butterfly)

plumose
(Saturniidae: Luna moth)

slender
(Sphingidae: Sphinx moth)

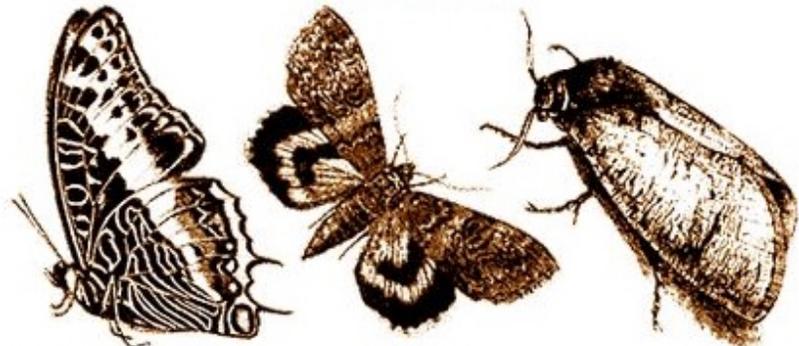
Body



slender, smooth
(Pieridae: Sulphur butterfly)

thick, furry
(Arctiidae: Tiger moth)

Wings at rest



usually held upright
(Lycaenidae: Hairstreak butterfly)

held flat
(Noctuidae: Underwing moth)

rooflike
(Geometridae: Goat moth)



Most butterfly species lay their eggs singly, one egg per leaf. Eggs hatch in a week or two. Newly hatched caterpillars are tiny and can grow for days unnoticed. Most caterpillars are selective about what they eat. They feed on only one or two host plant species. Throughout their development, almost all butterfly caterpillars remain on the plant where their eggs were laid or move only short distances to feed on other suitable host plants.

Larger, more visible caterpillars also may display characteristics designed to protect them from birds and other enemies. Monarch larvae feed heavily on milkweed and accumulate toxins called cardiac glycosides in their wings and bodies. The bright and distinctive markings of these colorful butterflies tell potential predators that their taste is bitter and the predator would be better off leaving them alone. Predators quickly learn this message.

As caterpillars grow, each size stage is called an instar. Caterpillars shed their skins four or five times as they grow, in a process called molting. You may notice their shed skins on the host plant. After the caterpillar has molted a number of times, it wanders from the feeding site and searches for a place to dangle from and pupate. After attaching its posterior end to an object, the caterpillar molts again, revealing a different skin, which hardens into a pupa. It reorganizes its body plan inside the pupa, called a chrysalis, then emerges as a butterfly. Generally, butterflies that stay and overwinter in Minnesota do so in the pupal stage and emerge in spring as adult butterflies.



Monarch (*Danaus plexippus*). Butterfly caterpillars grow substantially in size as they mature. Commonly they are at 4 instar size stage when they shed their skin in a process called molting.

Life History of a Few Butterflies

We can learn much about butterfly gardening by examining the life history of some specific butterflies. For instance, black swallowtail (*Papilio polyxenes*) caterpillars feed on dill, parsley and a few related species in the plant family *Umbelliferae*. Their larvae accumulate toxins from the host plants in their bodies and these chemicals are found in the adult butterfly as well. Caterpillars and adults are strikingly colored as a way to advertise their toxicity and distastefulness to birds. Some butterflies have only one generation a year. The pupa overwinters and the butterfly emerges in the spring. Only a few, such as mourning cloaks (*Nymphalis antiopa*) overwinter as adults. Mourning cloaks are the first butterflies seen in the spring, feeding on nectar from shrubs such as serviceberry (*Amelanchier*). Their caterpillars feed on a variety of common trees, such as willows, poplars and elms. They overwinter in barns, tree holes or other protected areas.



Left to right: painted lady (*Vanessa cardui*) eggs on host plant (mallow); eastern black swallowtail (*Papilio polyxenes*) larvae on host plant (dill) and adult butterfly on nectar plant (clover), photos: Laurie Schneider.

The tiger swallowtail (left) and zebra swallowtail (right), in the same family (Papilionidae) as the black swallowtail, are similarly characterized by a tail on each hind wing which is reminiscent of a swallow's feathers.



Overwintering | Migration



The monarch butterfly (*Danaus plexipus*) migrates far south in groups for the winter. After overwintering in the wooded highlands of Mexico, the overwintering generation flies north to the latitude of Texas and lays eggs. These eggs hatch and the larvae feed until they pupate and turn into adult monarch butterflies in 10 to 14 days. It is this generation that arrives in Minnesota in May to June. During summer, the migrated adults lay eggs that produce another generation of monarchs that return to Mexico the following fall.

Some butterflies do not migrate.

The mourning cloaks (Nymphalidae) overwinter as adults and are one of the very first to appear in spring. Most species of swallowtails (Papilionidae) and the giant silk moths (Saturniidae)

overwinter as pupae inside a chrysalis. The American painted lady (*Vanessa virginiensis*) and the painted lady (*Vanessa cardui*) migrate to the south and Texas over winter and return in the late spring. Painted ladies are attracted to open areas with low vegetation and a variety of flowers. The larvae feed on everlastings (*Anaphalis* spp.) as well as thistles. The adults prefer pussytoes (*Antennaria* spp.) and other composites such as black-eyed susan and sunflowers.



Left to right: mourning cloak (*Numphalis antiopa*), polyphemus moth cocoon, American painted lady (*Vanessa virginiensis*), photos: Laurie Schneider.

Feeding

Most species of local northern butterflies use flower nectar as their primary food source. This sugar-rich material is required for energy used in flight. Very long-lived tropical butterflies in Florida, of the family *Heliconiidae*, also feed on pollen. Some will only eat plants in a specific genus. Others may enjoy a broader selection but still limit their diet to plants in a certain taxonomic family. Butterflies prefer to feed in areas sheltered from the wind and protected from predators.

*Some butterflies, such as the mourning cloak (*Nymphalis antiopa*) and hackberry (*Asterocampa celtis*) feed on rotting fruit, sap that oozes from trees and even dung.*



Mourning cloak (*Numphalis antiopa*) on orange, photo: gardeninacity.wordpress.com



Tawny emperor (*Asterocampa clyton*) feeding on tree sap, photo: Phillip Harpootlian



White admiral (*Limentis arthemis arthemis*) on dung, photo: Wisconsinbutterflies.org

Basking

Butterflies are cold-blooded creatures. They need the sun to warm their wing muscles so they can fly. They fly best in temperatures from 75-90 degrees; so when it's cooler, they bask using the sun's heat to warm their bodies. A large, flat rock in the butterfly garden provides a warm spot for basking when the temperatures are cool. When temperatures get too warm, butterflies seek shade at the base of tall grasses or under shrubs and trees.



Fiery skipper (*Hylephila phyleus*) basking on aster, photo: Laurie Schneider

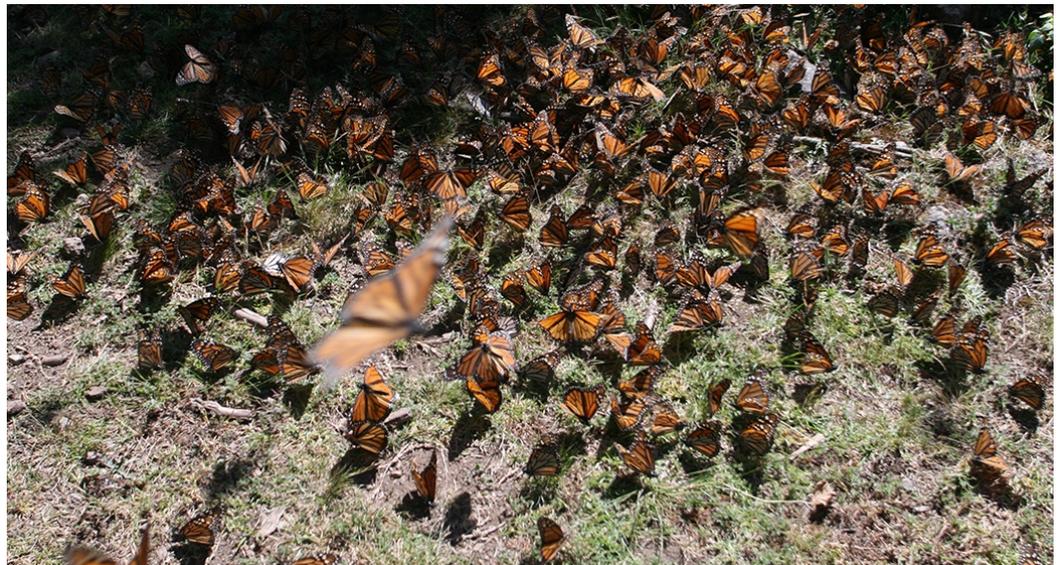
The most common basking position is with the wings positioned flat, facing the sun.

Butterflies that bask this way often have black bodies and dark colored areas on their wings. Most common among Satyrs (*Satyridae*) and Sulphurs (*Pieridae*) is lateral basking with wings folded and facing the sun. This is because the undersides of their wings are darker than the topsides, or the bases of the wings are darker than the edges. In a third type of basking, called reflectance, the wings are used to reflect the sunlight to the butterfly's body rather than absorb it. Butterflies that use reflectance basking, such as whites, have lighter colored wing ends.

Puddling

Butterflies require extra salts and other nutrients to mate successfully. Typically, more males than females puddle. Males pass the nutrients on with their sperm and these nutrients are used by the females for reproduction. Nutrients gained from puddling also help in producing pheromone. This is the chemical sexual attractant released by males to attract females to mate.

Butterflies congregate at the wet edge of mud puddles or wet sandy areas, where they imbibe fluids rich in salts and nutrients.

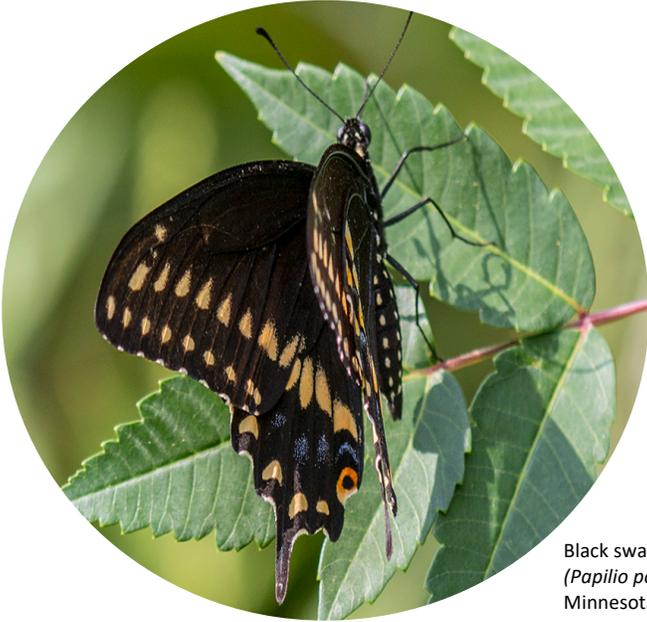


Monarch butterflies puddling in Michoacán, Mexico, photo: Laurie Schneider

Patrolling and Perching

For the purpose of mating, male butterflies search out females in two ways, by patrolling and perching. In patrolling, the male butterflies fly over areas where the female butterflies may be feeding or egg-laying. Some butterflies that commonly use a patrolling strategy include monarchs, sulphurs and whites. When butterflies fly upward next to one another, they are either males combating one another for territory, or males trying to convince females to mate with them. Instead of patrolling, butterfly species such as the mourning cloak (*Nymphalidae: Nymphalis antiopa*), black swallowtail (*Papilionidae: Papilio polyxenes*) and red admiral (*Nymphalidae: Vanessa atalanta*) will perch on tall plants in areas along streams or ridges where the females are likely to visit. Butterflies do not, however, have sharp vision; so once they spot something that might be a female, they will fly in to explore it closely. If they have found a female of their same species, they will begin courtship. If the intruder turns out to be a male, the original male will give chase. Generally, they will fly vertically for a few feet after which the original male returns to his perch.

With some butterfly species, males will perch on tall plants on the lookout for mates.



Black swallowtail
(*Papilio polyxenes*), photo:
Minnesotaseasons.com

Flight patterns used in courtship differ among the butterfly species. He may release pheromones from his body or wings. If the female is interested, she'll alight on plants or on the ground. Sometimes courtship continues with the male touching the female's antennae or legs and with different wing movements. They copulate by joining the tips of their abdomens.

Sometimes they even take flight during copulation while still joined. The mated female may try to avoid the advances of other courting males. With many species, the female physically avoids contact either by positioning her abdomen tip or spreading her wings in a manner to make contact impossible, or by releasing anti-aphrodisiacs. Still other species, such as sulphurs, fly upward in a spiral until the male gives up the chase.



Fiery skippers mating (*Hylephila phyleus*), photo: John Cole



Monarch (*Danaus plexippus*) female and male, Photo: Kim Smith

The male monarch butterfly (right) has a small black pheromone spot on the top surface of the hindwings and slightly thinner wing veins.



Butterflies lay single eggs; moths lay many eggs. Left: the monarch (*Danaus plexippus*) female lays single eggs on milkweed, a larval host for the species. Right: gypsy moths lay many eggs on tree hosts.

Photo left: Rob Wood, right: bugguide.net

If you notice a butterfly flying over plants, then touching down briefly, you are watching a female searching for egg-laying sites. Female butterflies recognize host plants through visual cues, such as leaf shape and color. Plant scent further identifies a potential host. Female butterflies also often drum on the leaf surface with their feet. Drumming scratches the leaf surface, releasing chemicals enabling the butterfly to identify the correct plant on which to lay her eggs. Monarchs are specialists for their larval host plant (only milkweed) but are generalists for adult nectar plants.

Creating a Butterfly Garden

Butterfly gardening retrofits landscapes with nectar and larval host plants for butterflies. Flowers of similar colors grouped together are more attractive to both butterflies and the gardener. You should select a variety of nectar-producing plants with the aim of providing flowers in bloom throughout growing seasons. This will entice a continuous succession of new visitors to a yard. It is especially important to have flowers in mid to late summer, when most butterflies are active. Flowers with multiple florets that produce abundant nectar are ideal. Be sure to source plants that have NOT been treated with pesticides. A list of host and nectar plants follow.

Annuals are wonderful butterfly plants because they bloom continuously through the season, providing a steady supply of nectar. Perennial plants, such as coneflowers, lilac, butterfly weed, and asters, are visited regularly by butterflies. Most plants in the mint family are also good nectar sources for butterflies. Avoid double flowers because they are often bred for showiness, not nectar production. Avoid hybrids and cultivars that are bred for their size, as they usually have less nectar in their flowers. Some cultivars will actually lose their ability to produce nectar or pollen.

Some supposedly good butterfly plants might not attract butterflies in your garden. It may be that a particular plant is not the preferred food of native butterflies local to your area.

You can supplement the garden's flower nectar with a home-made feeder made from an inverted baby food or other small jar, such a feeder can be attractive to butterflies. Drill a small hole in the center of the lid and plug it with cotton. Fill the jar with a solution of one part sugar (not honey) to nine parts water. Attach brightly-colored fabric petals to the lid to make the feeder more appealing to butterflies. Hang your feeder in a tree near your garden.

For successful butterfly gardening, you need to provide food for more than the adult butterflies. You need to provide for their caterpillar larval forms as well. Butterfly caterpillars have a limited host range. Most caterpillars feed on leaves, although some develop on the reproductive parts of flowers or seeds. A list of host plants follow.

Host and Nectar Plants

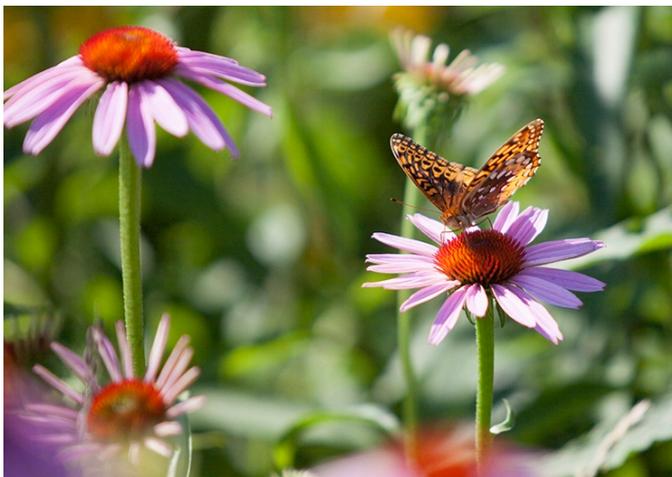
Plantings of host plants preferred by butterflies do not require any sacrifice of flowers and colors. Plants such as **yellow** sunflower, black-eyed susans and goldenrods, **pink** joe-pye weed and fireweed, **red** bee balm/bergamot, and Mexican sunflower, **purple** coneflower, verbena, wild asters, ironweed and tall buddleia provide plentiful color. (photos: Laurie Schneider)



Banded hairstreak butterfly on common milkweed



Painted lady butterfly on joe pye weed



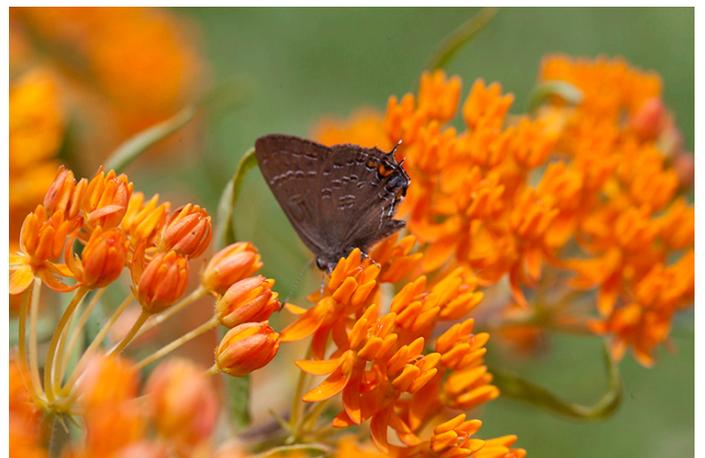
Great spangled fritillary butterfly on Echinacea



Monarch butterfly on prairie blazingstar



Southern dogface butterfly on New England aster



Banded hairstreak butterfly on butterfly weed

Host and Nectar Plants for Lepidoptera



<u>Common Name (Annual)</u>	<u>Scientific Name</u>	<u>Flower Color</u>	<u>Nectar</u>	<u>Host</u>
American marigold	Tagetes erecta	Yellow	N	H
American vetch	Vicia	Purple	N	H
Anise hyssop	Hyssopus officinalis	Purple	N	
Autumn joy sedum	Hylotelephium telephium	Pink	N	H
Black-eyed susan	Rudbeckia hirta	Yellow	N	
Blanketflower	Gaillardia aristata	Yellow/orange/red	N	H
Bottle gentian	Gentiana andrewsii	Blue	N	
Butterfly weed	Asclepias tuberosa	orange	N	
Calendula	Calendula officinalis	Yellow	N	
Common boneset	Eupatorium perfoliatum	White	N**	
Common evening primrose	Oenothera biennis	Yellow	N	
Common milkweed	Asclepias syriaca	Pink	N	H
Dill	Anethum graveolens	Yellow		H
Eastern purple coneflower	Echinacea purpurea	Pink	N	H
Silver pussytoes	Antennaria argentea	White		H
Field thistle	Cirsium discolor	Pink/purple	N	H
Flowering tobacco	Nicotiana glauca	Pink-red-white varieties	N	
Fireweed	Epilobium angustifolium	Pink/purple	N**	
Golden alexander	Zizia aurea	Yellow	N	H
Hoary vervain	Verbena stricta	Purple	N	H
Hollyhock	Alcea rosea	Pink-red-white varieties	N	
Lance leaved goldenrod	Euthamia graminifolia	Yellow	N**	
Maximilian sunflower	Helianthus maximiliana	Yellow	N	H
Meadow blazing star	Liatris ligulistylis	Purple	N**	
Mexican sunflower	Tithonia rotundifolia	Yellow	N	
Milkweeds	Genus: Asclepias	Pink/purple/orange	N	H
Mountain mint	Pycnanthemum virginianum	White/purple	N	
Nasturtium	Tropaeolum majus	Orange/red	N	H
New England aster	Symphotrichum novae-angliae	Pink/purple	N**	H
Parsley	Petroselinum crispum	Green		H
Petunia	Petunia hybrida	Pink/purple	N	
Purple coneflower	Echinacea purpurea	Pink/purple	N	
Rough blazing star	Liatris aspera	Purple	N**	
Sawtooth sunflower	Helianthus grosseserratus	Yellow	N**	
Showy sunflower	Helianthus laetiflorus	Yellow	N**	
Showy goldenrod	Solidago speciose	Yellow	N**	
Smooth oxeye	Heliopsis helianthoides	Yellow	N	
Spotted bee balm	Monarda punctata	White/pink/yellow	N	
Spotted joe pye weed	Eutrochium maculatum	Pink	N	
Stiff goldenrod	Oligoneuron rigidum	Yellow	N**	
Swamp thistle	Cirsium muticum	Pink/purple	N	H
Tickseed Sunflower	Bidens aristosa	Yellow	N**	
Verbena	Verbena spp.	Purple	N	
Violets	Viola spp.	Purple	N	H
Wild bergamot	Monarda fistulosa	Purple	N	
Wild lupine	Lupinus perennis	Blue	N	H
Zinnia	Zinnia elegans	Pink-yellow varieties	N	

** Fall blooms for monarch and painted lady migration.

Trees and Shrubs for Lepidoptera



<u>Shrub/Tree Common Name</u>	<u>Scientific Name</u>	<u>Host for Lepidoptera Family(s)</u>	<u>Shrub or Tree</u>
American Basswood	Tilia Americana		T
Birch	Betula spp.	Papilionidae	T
Black cherry	Prunus serotina	Papilionidae	T
Black willow	Salix nigra	Nymphalidae, Lycaenidae, Riodinidae, Papilioinidae,	T
Broadleaf meadowsweet	Spiraea latifolia	Saturniidae Lycaenidae	S
Buttonbush	Cephalanthus occidentalis	Sphingidae, Saturniidae, Tortricidae	S
Common lilac	Syringa vulgaris	Papilionidae	S
Cockspur hawthorn	Crataegus crus-galli	Lycaenidae, Riodinidae, Nymphalidae	S
Cranberry	Vaccinium oxycoccos	Lycaenidae	S
Currants	Ribes	Lycaenidae	S
Downy hawthorn	Crataegus mollis	Lycaenidae, Riodinidae	T
Dutchman's pipe	Aristolochia macrophylla	Papilionidae	S
Eastern redbud	Cercis canadensis	Lycaenidae	T
Ohio buckeye	Aesculus glabra	Nymphalidae	T
Gray dogwood	Cornus racemosa	Lycaenidae,	S
Hackberry	Cornus racemosa	Nymphalidae, Lycaenidae	T
Aspen	Populus tremuloides	Nymphalidae, Saturniidae	T
Honey Locust	Gleditsia triacanthos		T
Laurel willow	Salix pentandra	Nymphalidae, Saturniidae	T
Leadplant	Amorpha canescens		S
Lilac	Syringa vulgaris		S
Meadowsweet	Filipendula ulmaria		S
Nannyberry	Viburnum lentago		S
Ninebark	Physocarpus opulifolius		S
Oaks	Genus: Beech	Lycaenidae, Hesperidae, Saturniidae	T
Poplar	Genus: Populus		T
Prickly ash	Zanthoxylum americanum	Papilionidae	T
American pussy willow	Salix discolor	Saturniidae, Papilionidae, Nymphalidae	S
Red maple	Acer rubrum		T
Red osier dogwood	Cornus sericea	Lycaenidae	S
Downy serviceberry	Amelanchier arborea	Lycaenidae	T
Silky dogwood	Cornus amomum		S
Smooth sumac	Rhus glabra		S
Snowberry	Symphoricarpos		S
Spicebush	Lindera benzoin	Papilionidae	S
Stagehorn sumac	Rhus typhina		S
Stone fruits: plum, apple, cherry, peach, apricot	Genus: Prunus	Nymphalidae, Papilionidae, Lycaenidae, Pieridae,	T
Sugar maple	Acer saccharum	Nymphalidae	T
Flowering ash	Fraxinus ornus	Papilionidae	T
Weigela	Genus: Weigela		S
Wild blackberry	Rubus fruticosus		S
Wolfberry	Symphoricarpos occidentalis		S

Remember to source plants and trees that have NOT been treated with pesticides. Pesticides harm butterflies, moths, pollinators and other non-target beneficial insects.

Habitats

Successful butterfly gardening includes more than providing host plants and nectar sources. It includes planning appropriate habitats for these useful and beautiful creatures. For instance, shelter is important to butterflies for a number of reasons. Butterflies prefer to feed and lay eggs in sheltered areas, where they can find nearby warm areas to sunbath, and shelter from predators and wind gusts.

A row of shrubs or trees can make a dual-purpose windbreak if plants that also provide food for moths or butterflies are selected. Place tall plants at the back and the sides of the butterfly garden for additional protection. Consider keeping a bowl of wet sand or creating a mud puddle in your garden to encourage butterfly puddling. Use biodiversity as a guide to include a variety of water, protection, sun, flowers, grasses, shrubs and trees.



Reduce or Cease Use of Pesticides

One of the most important conservation decisions we can make is to avoid the use of pesticides. Instead, accept some plant damage, build biodiversity and soil health for natural pest control. If pesticides are necessary, use more benign spot treatments and alternative control methods such as oils, soaps, and microbial insecticides such as *Bacillus thuringiensis* (Bt). Remember that oils and soaps still kill caterpillars if sprayed directly on them and caterpillars also will die if they feed on plants treated with a Bt formulation that is toxic to them.

Most butterfly species, such as the tiger swallowtail (*Papilio glaucus*), lay only a few eggs at a time. This low level of insect population will not kill shrubs or trees. However, black swallowtail (Papilionidae: *Papilio polyxenes*) larvae, for example, can completely consume herbaceous plants such as dill. To avoid killing a beautiful guest, you should be sure of your identification of an insect before using any pesticide.

A good side effect of reducing pesticide use is the increase of natural enemies such as spiders, lacewings, ladybird beetles, and ground beetles that actually help to control unwanted pests. It's important to be able to identify the caterpillars that will grow into the butterflies you want in your garden, and to distinguish them from pests you may wish to remove.



Left: mourning cloak, photo: Steven Katovich.



Right: gypsy moth, photo: bugguide.net.

The caterpillar of a desirable butterfly such as the mourning cloak, *Nymphalidae: Nymphalis antiopa* (left) can be mistaken for less desirable or more destructive relatives such as the gypsy moth, *Lymantriidae: Lymantria dispar* (right).

Integrated Pest Management (IPM) is an ecosystem-based approach that employs long-term prevention of pests and pest damage through monitoring of plants, pests and weather to project ahead and plan. IPM addresses the source of the pest problems, whereas pesticides simply respond to pests. IPM minimizes the use of chemicals harmful to pollinators and beneficial insects, and toxic to the environment. The recommended best practice is to use cultural controls to reduce pest populations such as compost, bio fertilizers and aeration instead of pesticides.

Integrated pest management practices include:

- 1. Inspection and monitoring:** Regular and close examination of plants is essential to diagnose pest problems. Monitoring includes devices such as traps, and practices such as observation and recordkeeping.
- 2. Forecasting:** Weather and plant growth cycles (called plant phenology) help predict potential pest outbreaks. Properly timed pesticide applications will be more effective and reduce need for re-application.
- 3. Thresholds:** Set thresholds for pest populations and plant damage. Use hardy plants that are naturally resistant to pests to avoid exceeding pest thresholds. Accept some plant damage.
- 4. Education:** Regularly update the IPM plan and pesticide/treatment list so it remains effective. Stay educated and updated on IPM and best management practices.
- 5. Recordkeeping:** Keep updated records to compare year to year and for decision-making. Track data including weather patterns, when pests appear, number of pests, plant damage, and practices that work and don't work.

Minnesota Threatened and Endangered Species

Excerpt from *Environmental Quality Board, Minnesota State Agency Pollinator Report 2018*.

Federally endangered		
 Poweshiek skipperling <small>Cale Nordmeyer</small>	 Karner blue butterfly <small>JK Hollingsworth</small>	 Rusty-patched bumble bee <small>Marcie Forsberg</small>
Federally threatened	Under review for federal listing	
 Dakota skipper <small>Bryan Reynolds</small>	 Yellow-banded bumble bee <small>Bill Keim</small>	 Monarch butterfly <small>Laurie Schneider</small>

Endangered: Persius duskywing, Ottoe skipper, Dakota skipper, Assiniboia skipper, Uncas skipper, Karner blue, Poweshiek skipperling, Uhler's artic.

Threatened: Garita skipperling.

Special Concern: Arogos skipper, Disa alpine, Leonard's skipper, Nabokov's blue, Grizzled skipper, Regal fritillary.

In addition to federally-listed species, Minnesota has **8** state-listed endangered pollinator species, **1** threatened, **10** species of special concern, and an additional **19** non-listed species in greatest conservation need.

Minnesota Butterfly List

Family HesperIIDae

Subfamily Pyrginae

Silver-spotted Skipper

Epargyreus clarus

Hoary Edge

Achalarus lyciades

Southern Cloudy Wing

Thorybes bathyllus

Northern Cloudy Wing

Thorybes pylades

Dreamy Dusky Wing

Erynnis icelus

Sleepy Dusky Wing

Erynnis brizo

Juvenal's Dusky Wing

Erynnis juvenalis

Horace's Dusky Wing

Erynnis horatius

Mottled Dusky Wing

Erynnis martialis

Columbine Dusky Wing

Erynnis lucilius

Wild Indigo Dusky Wing

Erynnis baptisiae

Persius Dusky Wing

Erynnis persius

Grizzled Skipper

Pyrgus centaureae

Checkered Skipper

Pyrgus communis

Common Sooty Wing

Pholisora catullus

Subfamily Hesperinae

Arctic Skipper

Carterocephalus palaemon

Least Skipper

Ancyloxypha numitor

Powershiek Skipperling

Oarisma poweshiek

Garita Skipperling

Oarisma garita

European Skipper

Thymelicus lineola

Fiery Skipper

Hylephila phyleus

Uncas Skipper

Hesperia uncas

Common Banded Skipper

Hesperia comma assiniboia

Laurentian Skipper

Hesperia comma laurentina

Ottoe Skipper

Hesperia ottoe

Leonard's Skipper

Hesperia leonardus

Pawnee Skipper

Hesperia leonardus pawnee

Pahaska Skipper

Hesperia pahaska

Cobweb Skipper

Hesperia metea

Dakota Skipper

Hesperia dacotae

Indian Skipper

Hesperia sassacus

Peck's Skipper

Polites peckius

Tawny-edged Skipper

Polites themistocles

Crossline Skipper

Polites origenes origenes

Long Dash

Polites mystic

Northern Broken Dash

Wallengrenia egeremet

Little Glassywing

Pompeius verna

Sachem

Atalopedes campestris

Arogos Skipper

Atrytone arogos

Delaware Skipper

Atrytone logan

Mulberry Wing

Poanes massasoit

Hobomok Skipper

Poanes hobomok

Broad-winged Skipper

Poanes viator

Dion Skipper

Euphyes dion

Black Dash

Euphyes conspicuus

Two-spotted Skipper

Euphyes bimacula

Dun Skipper

Euphyes vestris

Dusted Skipper

Atrytonopsis hianna

Pepper and Salt Skipper

Amblyscirtes hegon

Roadside Skipper

Amblyscirtes vialis

Family Papilionidae

Subfamily Papilioninae

Pipevine Swallowtail

Battus philenor

Zebra Swallowtail

Eurytides marcellus

Black Swallowtail

Papilio polyxenes

Giant Swallowtail

Papilio cressphontes

Family Pieridae

Subfamily Pierinae

Pine White

Neophasia menapia

Checkered White

Pontia protodice

Western Checkered White

Pontia occidentalis

Mustard White

Pieris napi

Subfamily Anthocharinae

Large Marble

Euchloe ausonides

Olympian Marble

Euchole olympia

Subfamily Coliadinae

Common (clouded) Sulphur

Colias philodice

Alfalfa Butterfly

Colias eurytheme

Giant Sulphur

Colias gigantea

Pink-edged Sulphur

Colias interior

Dogface

Colias cesonia

Cloudless Sulphur

Phoebis sennae

Orange-barred Sulphur

Phoebis philea

Mexican Sulphur

Eurema mexicana

Little Sulphur

Eurema lisa

Dainty Sulphur

Nathalis iole

Family Lycaenidae

Subfamily Miletinae

Harvester

Feiseca tarquinius

Subfamily Lycaeninae

American Copper

Lycaena phlaeas

Great Copper

Lycaena dione

Bronze Copper

Lycaena hyllus

Bog Copper

Lycaena epixanthe

Dorcas Copper

Lycaena dorcas

Purplish Copper

Lycaena helloides

Subfamily Theclinae

Coral Hairstreak

Satyrium titus

Acadian Hairstreak

Satyrium acadicum

Edwards' Hairstreak

Satyrium edwardsii

Banded Hairstreak

Satyrium calanus

Hickory Hairstreak

Satyrium caryaeavorum

Striped Hairstreak

Satyrium liparops

Olive Hairstreak

Mitoura grynea

Brown Elfin

Incisalia augustinus

Hoary Elfin

Incisalia polia

Frosted Elfin

Incisalia irus

Henry's Elfin

Incisalia henrici

Eastern Pine Elfin

Incisalia niphon

Minnesota Butterfly List

Subfamily Theclinae

Western Pine Elfin
Incisalia eryphon

Gray Hairstreak
Strymon melinus

Subfamily Pollyommatainae

Marine Blue
Leptotes marina

Reakirt's Blue
Hemiargus isola

Eastern Tailed Blue
Everes comyntas

Western Tailed Blue
Everes amyntula

Spring Azure
Celastrina argiolus

Silvery Blue
Glaucopsyche lygdamus

Northern Blue
Lycaeides idas

Karner Blue
Lycaeides melissa samuelis

Melissa Blue
Lycaeides melissa melissa

Greenish Blue
Plebejus saepiolus

Acmon Blue
Plebejus acmon

Family Riodinidae

Swamp Metalmark
Calephelis mutica

Family Nymphalidae

Snout Butterfly
Libytheana carinenta

Gulf Fritillary
Agraulis vanillae

Subfamily Heliconiinae

Variegated Fritillary
Euptoieta claudia

Great Spangled Fritillary
Speyeria cybele

Aphrodite
Speyeria aphrodite

Regal Fritillary
Speyeria idalia

Atlantis Fritillary
Speyeria atlantis

Mormon Fritillary
Speyeria mormonia

Bog Fritillary
Boloria eunomia

Silver-bordered Fritillary
Boloria selene

Meadow Fritillary
Boloria bellona

Frigga Fritillary
Boloria frigga

Freija Fritillary
Boloria freija

Titiania Fritillary
Boloria titania

Subfamily Nymphalinae

Bordered Patch
Chlosyne lacinia adjustrix

Gorgone Checkerspot
Chlosyne gorgone

Silvery Checkerspot
Chlosyne nycteis

Harris' Checkerspot
Chlosyne harrisii

Texas Crescent
Phyciodes texana

Pearl Crescent
Phyciodes tharos

Tawny Crescent
Phyciodes batesii

Northern Crescent
Phyciodes cocyta

Anicia Checkerspot
Euphydryas anicia

Baltimore Checkerspot
Euphydryas phaeton

Question Mark
Polygonia interrogationis

Hop Merchant or Comma
Polygonia comma

Satyr Anglewing
Polygonia satyrus

Green Comma
Polygonia faunus

Hoary Comma
Polygonia gracilis

Gray Comma
Polygonia progne

Compton's Tortoise Shell
Nymphalis vau-album

Mourning Cloak
Nymphalis antiopa

Milbert's Tortoise Shell
Nymphalis milberti

American Painted Lady
Vanessa virginiensis

Painted Lady
Vanessa cardui

Red Admiral
Vanessa atalanta

Buckeye
Junonia coenia

Subfamily Limenitidinae
White Admiral
Limenitis arthemis

Banded Purple
Limenitis arthemis X proserpinus

Red-spotted Purple
Limenitis arthemis astynax

Viceroy
Limenitis archippus

Amymone
Mestra amymone

Subfamily Danainae

Monarch

Subfamily Apaturinae

Hackberry Emperor
Asterocampa celtis

Tawny Emperor
Asterocampa clyton

Subfamily Satyrinae

Northern Pearly Eye
Enodia anethedon

Eyed Brown
Satyrodes eurydice

Appalachian Eyed Brown
Satyrodes appalachia

Little Wood Satyr
Megisto cymela

Common Ringlet
Coenonympha tullia

Common Wood Nymph
Cercyonis pegala

Disa Alpine
Erebia disa

Red-disked Alpine
Erebia discoidalis

Macoun's Artic
Oeneis macouni

Uhler's Arctic
Oeneis uhleri

Jutta Artic
Oeneis jutta

Meet a few Lepidoptera: adult, larvae and host plants



Pipevine swallowtail (*Battus philenor*)



Larval host plants: pipevines
Nectar plants: thistles, bergamot, lilac, phlox, teasel, lantana, petunias, verbenas, lupines
Photo: Danny Mims



Zebra longwing (*Heliconius charithonia*)



Larval host plants: passionflowers
Nectar plants: lantana, shepherd's needle, firebush, tropical sage, blue porterweed
Photo: Roar, bugwood.org



Fiery skipper (*Hylephila phyleus*)



Larval host plants: weedy grasses
Nectar plants: red clover, alfalfa, asters
thistle, knapweed, sneezeweed, milkweed
Photo: L. Schneider



Rosy maple moth (*Dryocampa rubicunda*)



Larval host plants: maple and oak trees
Caterpillars can become pests by defoliating trees
Adults moths do not feed
Photo: Lynette Elliott



Isabella tiger moth (wooly bear) (*Pyrrharctia isabella*)



Larval host plants: leaves of many wild plants such as violets, clover, burdock, lamb's quarters and sunflowers
Adult moths do not feed
Photo: Robert Marcotte



Dogwood clearwing borer (*Synanthedon scitula*)



Larval host plants: dogwood, lilac hawthorn, alder, ash, birch, sycamore, maple, oak, pine, poplar, willow
Caterpillars bore into wood of trees
Photo: Robert Lord Zimlich