Forest Health Technology
Enterprise Team

TECHNOLOGY
TRANSFER

Identification of Caterpillars

Caterpillars on the Foliage of Conifers in the Northeastern United States (revised)




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U.S. Department of Agriculture
Forest Service
Connecticut Agr. Experiment Sta.

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This identification guide is dedicated to Annette F. Braun and T.N. Freeman, who did so much to improve our understanding of tiny moths and their caterpillars.

The Forest Health Technology Enterprise Team (FHTET) was created in 1995 by the Deputy Chief for State and Private Forestry, USDA, Forest Service, to develop and deliver technologies to protect and improve the health of American forests. This book was published by FHTET as part of the technology transfer series.

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On the cover:

The caterpillars shown on the front cover are (in clockwise order, from upper left): the spruce budworm (*Choristoneura fumiferana*), the festive pine looper (*Nepytia* species [undescribed]), the Comstock's sallow (*Feralia comstocki*), and the larch silkworm (*Hyalophora columbia columbia*).

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This publication also is available on the FHTET website (http://www.fs.fed.us/foresthealth/technology)

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We thank Sandra Blackler, Tia Blevins, John Loffredo, Morgan Lowry, Jeff Lozier, Josh Pepe, Paul Perrotti, Barbara Rasch, Rita Rio, Alfonso Sabetta, Stephen Sandrey, Katrina Stewart, Adam Szewczak, Rebecca Tomlinson, Peter Trenchard, and Tracy Zarrillo, who collected or reared caterpillars mainly between 1993 and 2002. In addition, the senior author (CTM) acknowledges the considerable help of his youngest daughter, Julia, who eagerly pursued caterpillars on several field trips.

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INTRODUCTION

Coniferous forests are important features of the North American landscape. In the Northeast, balsam fir, spruces, or even pines may dominate in the more northern forests. Southward, conifers still may be prevalent, although the pines become increasingly important. In dry, sandy areas, such as Cape Cod of Massachusetts and the Pine Barrens of New Jersey, hard pines abound in forests composed of relatively small trees. Conifers are classic symbols of survival in harsh environments.

Forests of conifers provide not only beautiful scenery, but also livelihood for people. Coniferous trees are a major source of lumber for the building industry. Their wood can be processed to make paper, packing material, wood chips, fence posts, and other products. Certain conifers are cultivated for landscape plants and, of course, Christmas trees. Trees of coniferous forests also supply shelter or food for many species of vertebrates, invertebrates, and even plants. Insects that call these forests home far outnumber other animals and plants.

Because coniferous forests tend to be dominated by one to a few species of trees, they are especially susceptible to injury during outbreaks of insects such as the spruce budworm, *Choristoneura fumiferana*, the fall hemlock looper, *Lambdina fiscellaria fiscellaria*, or the pitch pine looper, *Lambdina pellucidaria*. Trees that are defoliated by insects suffer reduced growth and sometimes even death.

Trees stressed by defoliation, drought, or mechanical injury, are generally more susceptible to attack by wood-boring beetles, diseases, and other organisms. These secondary pests also may kill trees. Stress or tree death can have a negative economic impact upon forest industries. In addition, severe injury has other, often less obvious, impacts on the health and the inhabitants of forests. For example, defoliation can destroy the food and the habitat of insects and other animals, causing their decline or possibly extirpation. Defoliation and tree death also lead to elevated temperature in the soil and the water, which has additional negative ramifications.

Most caterpillars and other insects, however, are not pests. Many provide essential food for animals and plants, recycle nutrients, or destroy noxious insects and plants. Furthermore, studies of forest insects have been instrumental in developing the fields of ecology, animal behavior, and environmental health.

In this manual, we furnish descriptions and photographs of caterpillars, as well as information on life history, to assist foresters, extension agents, educators, students, conservationists, and others who wish to identify and understand the caterpillars that eat the foliage of conifers.

Life Cycles and Food Plants

Moths and butterflies (Order Lepidoptera) whose caterpillars consume the foliage of northeastern conifers have an enormous diversity of life styles. Most species have one or two generations per year. They develop through four life stages: the egg, the caterpillar or the larva, the pupa (chrysalis in butterflies), and the adult (moth or butterfly). In Lepidoptera, the caterpillar and the adult usually are markedly different in appearance and function. The caterpillar principally feeds and grows, whereas the adult mainly reproduces and disperses. The transformation from the caterpillar to the adult moth or butterfly takes place during the pupal stage. Most of the species that are restricted to conifers spend the winter as an egg, a caterpillar, or a pupa; very few species pass the winter as an adult.

Lepidoptera differ in the duration of their life stages. In the Northeast, the stage that exists during the late fall and winter typically lasts the longest because development slows or stops during periods of low temperature. Eggs that are laid during the spring and the early summer usually hatch in 1 to 3 weeks. After hatching from eggs, caterpillars feed for variable amounts of time, but most reach full size within 1 to 3 months. Most caterpillars molt or "shed their skin" four to six times. Between molts the caterpillar is considered an instar, with the number of the instar increasing with age. Caterpillars can grow because the body covering or cuticle increases in size with each successive molt. Pupae that do not delay development normally yield adults in 1 to 4 weeks.

In general, caterpillars restricted to conifers eat species in only one to a few genera. Perhaps, the most restricted in diet are the tiny caterpillars that exclusively mine needles to obtain food for development. Most of the needleminers eat trees in only one genus and sometimes in only one species of that genus. Among the larger caterpillars on pines, certain species of *Macaria* (Family Geometridae) and *Zale* (Family Erebidae) are restricted to one or more pines, *Pinus* species. A narrow diet also can be found among caterpillars that eat other types of conifers. Even among the conifer feeders, however, a few species will eat the majority of native species growing within their distributional range.

In New England, where our sampling was concentrated, there are 16 native species of conifers in three plant families. These families and species are:

Pinaceae (firs, pines, spruces, and relatives)
- Balsam fir, *Abies balsamea*
- Eastern larch, *Larix laricina*
- White spruce, *Picea glauca*
- Black spruce, *Picea mariana*
- Red spruce, *Picea rubens*
- Jack pine, *Pinus banksiana*
- Red pine, *Pinus resinosa*
- Pitch pine, *Pinus rigida*
- Eastern white pine, *Pinus strobus*
- Eastern hemlock, *Tsuga canadensis*

Taxaceae (yews)
- Canadian yew, *Taxus canadensis*

Cupressaceae (cedars, false cedars, and junipers)
- Atlantic white-cedar, *Chamaecyparis thyoides*
- Common juniper, *Juniperus communis*
- Creeping juniper, *Juniperus horizontalis*
- Eastern red-cedar, *Juniperus virginiana*
- Northern white-cedar, *Thuja occidentalis*

We generally do not list non-native food plants of caterpillars mentioned in this guide, although these exotic conifers found in plantations, in yards, or along roads may be suitable food. We did not collect caterpillars on Canadian yew or creeping juniper, and infrequently sampled those in natural stands of black spruce, jack pine, and red pine. In addition, we did not sample or list native food plants that are absent or scarce to the north of southern New Jersey or Delaware. Examples of these include shortleaf pine, *Pinus echinata*, pond pine, *P. serotina*, loblolly pine, *P. taeda*, Virginia pine, *P. virginiana* (Pinaceae), and bald cypress, *Taxodium distichum* (Cupressaceae).

MORPHOLOGY

We shall use a few specialized terms to describe the caterpillars of moths and butterflies. In this section, terms that refer to structures or areas in the illustrations are printed in boldface type at first mention. These and other specialized terms are defined in the **Glossary of Specialized Terms**.

The caterpillar (or larva) has a more or less cylindrical body composed of three main body parts: the **head**, the **thorax**, and the **abdomen** (Figures 1 and 2). The head (Figure 3) appears to be a single unit, but actually it is comprised of six fused segments that create a tough, hardened (sclerotized) head capsule. The head bears the feeding and sensory appendages. On each side of the head is a typically rounded area called a **lobe** that is above the **stemmata**, six simple light-sensitive eyes arranged in a curved row. In the middle of the front of the head is a conspicuous plate known as the **frons** or frontal triangle. Below the frons is the **clypeus**, a narrow plate that runs across the front of the lower head. Beneath it is the **labrum** or upper lip, a simple sclerotized plate that may or may not be notched. A notched labrum is used to guide food to the **mandibles**, a sturdy pair of opposable-toothed jaws that are located behind the labrum and usually extend below it. On each side of the head is a short **antenna**, which is a sensory structure that lies between the stemmata and the clypeus or labrum. The head has other structures, but most of them are visible only from the rear or are internal. Within the head are the modified salivary glands that produce silk, a proteinaceous substance used for aerial dispersal, construction of shelters (tents, feeding webs, and cocoons), escape from predators, and other things.

Each of the three thoracic segments (**T1 to T3**) has a pair of "true" **legs** with claws (Figures 1 and 2). The first thoracic segment (T1) is covered dorsally by a **prothoracic shield** or

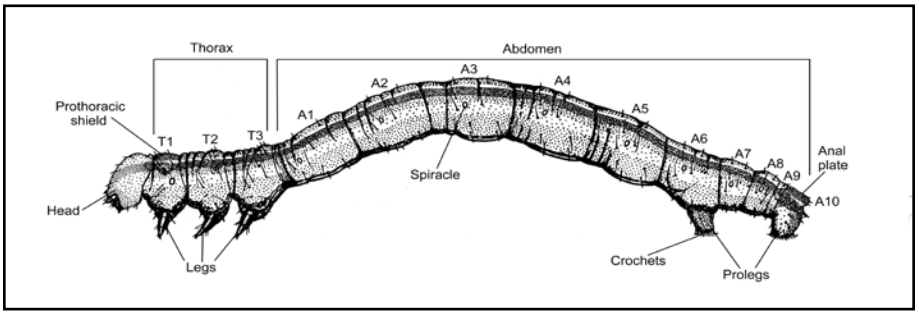

Figure 1. Side view of a caterpillar called a looper (Family Geometridae).

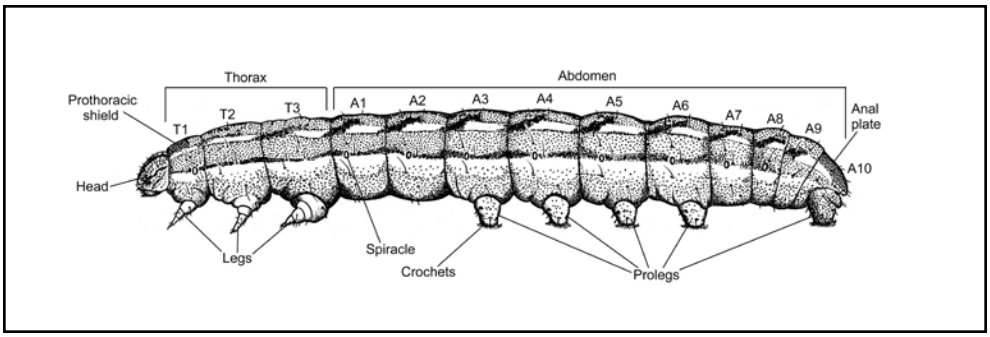

Figure 2. Side view of a caterpillar called a cutworm (Family Noctuidae).

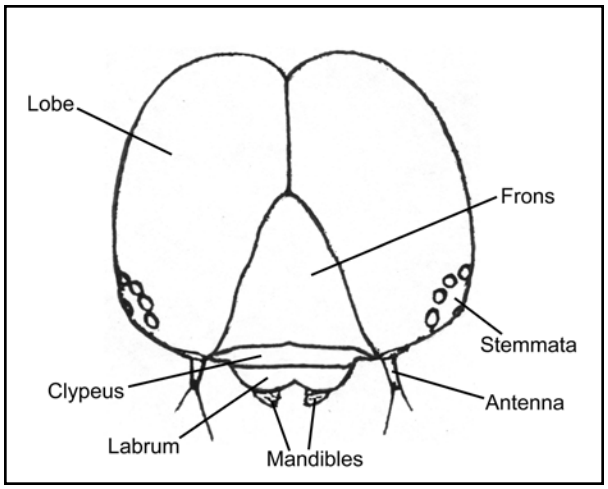

Figure 3. Front of a generalized head of a caterpillar.

plate. The color pattern of this shield is valuable for identifying species of leafrollers (Family Tortricidae) and other caterpillars.

The abdomen consists of 10 visible segments (**A1 to A10**). Most caterpillars have a single pair of **prolegs** or fleshy false legs near the bottom of segments A3 to A6 and A10 (Figures 1 and 2). In a few groups, the prolegs are reduced to two or three pairs (especially loopers and inchworms) or in size (many needleminers). The prolegs on A10 usually are well developed. The ends of the prolegs have a circular or other arrangement of **crochets** or tiny hooks that are used to cling to foliage, bark, silk, or other substances. Experts sometimes use the arrangement and the length of the crochets to identify caterpillars to the family level. Although crochets are briefly mentioned in some descriptions, they usually will not be used to identify caterpillars in this manual. Abdominal segments A1 to A8, as well as thoracic segment T1, have a **spiracle** on each side of the body. Spiracles are usually circular or oval openings to the respiratory system of insects. In some caterpillars, there is a distinct **anal plate** or sclerotized shield on the top of A10.

The body of a caterpillar may be adorned with hairs, spines, horns, warts, swellings, tubercles, and other structures that are helpful in distinguishing species. Chaetotaxy, the arrangement and the nomenclature of body hairs, is useful for separating the families of

Lepidoptera, but its use here would unduly burden the reader.

The body may have distinctive colors or patterns of color. Many caterpillars have longitudinal (lengthwise) lines or stripes on their thorax and abdomen (sometimes extending to the head). These longitudinal markings frequently allow them to blend into their background. These marks facilitate identification even though they may vary in width or color, even within a species. No standard terminology exists for the various colored streaks and patterns; however, some jargon is necessary to refer to the location where a colored mark or a structure is located. Our descriptive terms are shown in Figures 4 and 5. The areas from top to bottom are: **middorsal, subdorsal, supraspiracular, spiracular**, **subspiracular,** and **subventral**. These and additional specialized terms for markings are defined in the glossary.

Larvae of other insect groups can resemble caterpillars. For example, beetle larvae can be elongate, but they do not have abdominal prolegs. Sawflies, which also may eat the needles of conifers, have more than five pairs of abdominal prolegs, and these lack crochets.

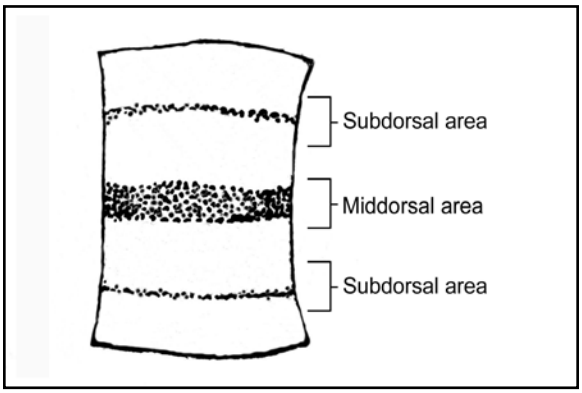

Figure 4. Top view of a generalized abdominal segment.

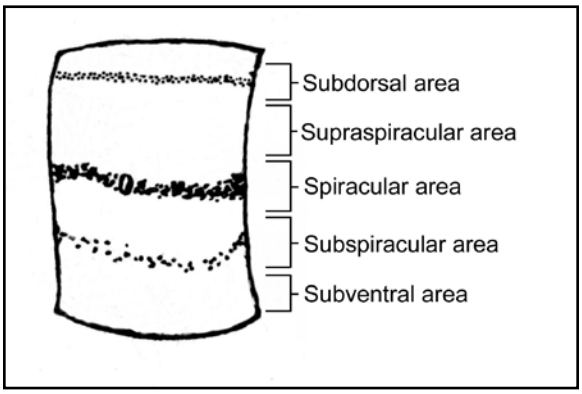

Figure 5. Side view of a generalized abdominal segment.

Collecting and Rearing

Learning about the biology and the identity of moths and butterflies can be an exciting and rewarding educational activity for the amateur or the professional. Collecting and rearing can contribute much new information about lepidopteran species because the food plants, feeding period, variation in appearance, and other biological attributes of many species are poorly known. Furthermore, new species await discovery. By rearing caterpillars to adults and by preserving specimens, even amateurs can make worthwhile contributions to entomological science. A careful observer, however, should record the locality, food plant, date of collection, rearing method, and other details for specimens raised to adults.

Caterpillars can be collected by striking or "beating" the trunk or the limbs of woody plants with a stick or baseball bat, causing them to drop onto a light-colored cloth or plastic sheet placed beneath the foliage (Figure 6). After collection, caterpillars can be enclosed singly in clear plastic cups or other suitable containers, along with the foliage of their food plant (Figure 7). Preventing desiccation, supplying fresh foliage every few days, and avoiding temperature extremes will improve the success of rearing.

Valuable information about the developmental time and number of generations per year can be obtained by rearing caterpillars outdoors under natural light. One widespread method of raising caterpillars outdoors is to confine one or more in a mesh or muslin bag

Figure 6. The senior author "beating" the foliage of eastern hemlock to dislodge caterpillars.

Figure 7. Plastic cups used to rear caterpillars in the laboratory. The cup on the far right contains a pupa that has been prepared for overwintering by placing it in sphagnum moss.

or sleeve placed over the branch of a food plant (Figure 8). The position of the rearing cage should be changed whenever the food supply dwindles.

Another technique to obtain caterpillars is to let them hatch from eggs laid by captive adults. At night, many species of moths are attracted to lights, especially ultraviolet or mercury vapor lights. Others come to bait (a fermenting mix of sugar, rotting fruit, beer, and sometimes other material) that is applied to tree trunks. After adult females are

Figure 8. Fine-mesh nylon bags used to rear caterpillars on eastern hemlock.

collected, they can be put into a container with the foliage of a known or suspected food plant. If they were mated and fed, they soon should lay eggs. An excellent adult food for most species is a solution of tap water (2 parts) and honey or maple syrup (1 part) soaked into cotton. Butterflies confined with their food plant should be exposed to bright light to stimulate the laying of eggs. Once caterpillars have hatched from eggs, they can be reared as described earlier. Rearing in bags or sleeves significantly reduces mortality from parasites and predators and usually produces larger, more normal adults.

Caterpillars that eat the needles of conifers often will form their pupae on or beneath the foliage in rearing containers, although in nature most normally change to pupae in soil or debris. Larger caterpillars may need to be supplied with moist sand, potting soil, sterile peat, or fresh sphagnum moss for pupation. When full-grown caterpillars begin to wander about their enclosures, they probably are seeking a site for pupation. At this time, they may show some color change or shrinkage. Most caterpillars will burrow into the soil or other material and quickly form their pupae. Some full-grown cutworms (Family Noctuidae) construct a chamber in the soil or the moss where they remain for a month or more before they transform to pupae. After caterpillars find a pupation site but before they actually form pupae, they continue to change color and to shrink in size.

In the fall or winter, the pupae or the caterpillars of most northern species must be exposed to low temperature before they will finish their development and produce adults. In the fall, the pupae of most species can be placed in moist, but not wet, soil, peat, or sphagnum (Figure 7, far right). If the rearing containers are then stored in a refrigerator or in an unheated garage for 3 to 5 months, the pupae (or caterpillars) usually will resume development after they are returned to room temperature or after they warm in the spring. After adults emerge, they should be allowed to age for several hours to one day before they are killed for study or released. Many books explain how to prepare adult moths and butterflies for a collection. Several books with procedures for rearing are cited at the end of this manual.

We recommend that several caterpillars of any one type be reared because similar caterpillars may well yield more than one species of adult and because some immatures are likely to be killed by handling, diseases, parasites, or predators. Data on parasites are valuable, especially if the stage (including the instar of the caterpillar) killed can be recorded. Parasitic flies and wasps that emerge also should be preserved for identification. Consult general entomology textbooks for proper techniques of preservation, but remember that the recording of data is the most crucial step.

PHOTOGRAPHY

We photographed caterpillars and foliar damage in the laboratory where lighting and background could be controlled. For most of the images of large caterpillars, we used Nikon® camera bodies (N70, N6000, N6006) with Nikon® (105 mm) or Sigma® (90 mm) macro lenses. Magnification was sometimes further increased with dual-element diopters (Nikon® 3T, 4T; Sigma® Life-size [+5]). Subjects were illuminated with a ringlight (SunPak® DX-8R) or with built-in flashes on the camera bodies. Cameras were hand-held when they were used with a flash.

To photograph small (<10 mm in length) and sometimes medium-sized (10 to 15 mm in length) caterpillars, we used Nikon® camera bodies with a 60 mm Nikon® macro lens in combination with three Kenko® extension tubes (total length, 68 mm) and a Raynox® 24X dual-element diopter. Subjects were illuminated with a dual-head fiber optic system (Fiber-Lite®, Series 180) with color correction for daylight film. The camera assembly was mounted on a heavy-duty tripod head (Bogen® 3126) equipped with a focusing rail (Velbon® Macro-slider) for stability and fine adjustment. Vibration was dampened with a cable/electronic release.

We used Fujichrome® 100 or occasionally Kodachrome® 64 film. All but a few photographs were made from the color slides developed from these films.

The principal photographer was Jeff M. Fengler, who developed many of the photographic techniques.

Most of the images in this publication are available through Forestry Images (http://www.forestryimages.org) and Invasive and Exotic Species of North America (http://www.invasive.org) websites via the numbers in the lower left-hand corner of the images.

Coverage and Use

We have illustrated and described many of the common caterpillars that eat the foliage of coniferous trees and shrubs in the northeastern United States and southeastern Canada. Although our color manual will be useful for identifying caterpillars anywhere in eastern North America, it should have its greatest utility in New England, New York, and New Jersey, where we sampled most extensively. We have included some caterpillars, especially pine feeders, only found south of Long Island, New York. Our surveys in southern and western parts of the Northeast and in the northern one-third of Maine were very limited.

We collected most of the photographed caterpillars directly from their food plants, which yielded important data about their diet and true color in nature. In this manual, we describe caterpillars that eat mainly live foliage during their lives. We have excluded most of the species that feed upon cones (*Cydia*, *Dioryctria*, *Endopiza*, *Eucosma,* and *Eupithecia* species), make pitch nodules (*Retinia* species), or exclusively bore into shoots, buds, and twigs (*Argyresthia*, *Diorcytria*, *Eucosma*, and *Rhyacionia* species). Larger caterpillars, which are more easily seen, are emphasized in the species accounts.

To assist readers in using this publication, we have included a **Glossary of Specialized Terms**, citations to **Helpful Literature**, and an **Index** to common and scientific names of caterpillars, butterflies, moths, and their families.

Family and Species Accounts

In this section, we give a summary of each family, emphasizing caterpillars, followed by descriptions of various species within the family. The families are arranged from the most primitive to the most advanced. The classification scheme generally follows Scoble (1992), although the family Argyresthiidae is retained and the new arrangement of noctuoid families outlined by Lafontaine and Schmidt (2010) is followed. Within each family, the species that have similar appearance or food plants usually are grouped, although those within the same genus are not separated. The most important feature of each species account is the photograph, because truly "one picture is worth a thousand words." As far as we know, our photographs depict mature caterpillars (last instars). To avoid confusion about the use of specialized terms for the location of colored marks or structures, most of the caterpillars are oriented horizontally with their true top or dorsal side upward; in nature, the caterpillars often position themselves differently.

The text for each species of caterpillar begins with the common name and then the scientific name, which is latinized. In the first paragraph **(Description)**, we begin by characterizing the general color, color patterns, structures, or other features that sometimes, but not always, allow a caterpillar to be identified. This initial, general description usually is followed by a more detailed characterization of the head, thorax, and abdomen. Generally, our detailed descriptions go from head to thorax to abdomen and from top to bottom within each body region. Sometimes the descriptive pattern is altered to combine several features of similar color, color pattern, or structure or to emphasize prominent features. In most cases, characteristics that occur on both sides of the caterpillar are described as if they were on only one side, because the opposite side is just a "mirror image" of the side that is visible in the photograph. Finally, we estimate the maximum length in millimeters (mm) of the full-grown or mature caterpillar.

Descriptions of small species that mine foliage or live in concealed situations often are very brief because these caterpillars have few distinguishing features that are easily seen. In these species, identification usually depends as much upon the food plant or type of damage as upon morphology. Relatively few needleminers are featured, although the ones that are shown are representative of the group as a whole. Larger caterpillars have longer, more detailed descriptions because many of their features are obvious to the naked eye. Species that have only subtle differences may not be separable. Also, bear in mind that caterpillars can change color from instar to instar and that mature ones can be highly variable in appearance. Although our photographs usually represent only one individual of one color form, other forms or variants may exist.

The next section **(Food)** typically gives the common name of known plants upon which the caterpillar feeds; sometimes we suggest how often the food is used. The third part

(Life Cycle) gives, in the following order, the number of generations during one year, the stage of the insect that passes the winter, and the estimated period when the mature caterpillar (final instar) can normally be found on foliage. Readers should be aware that many species mature about 1 month earlier in southern New Jersey than in northern New England. Additional information on appearance, damage, feeding habits, origin, economic importance, closely related species, or former scientific names is mentioned in a final section **(Comments)**. Here we often supplement the brief descriptions of tiny caterpillars by including information about their feeding damage or behavior.

Bagworms

(Family Psychidae)

The caterpillars in this small, primitive family live in silken cases into which they incorporate parts of leaves, twigs, or debris that can make them less conspicuous. These cases, which are responsible for the common name of the family, may reach a length of 50 mm. Each case has two openings, one at the top and another at the bottom. The caterpillars extend the front end of their body through the top hole to eat lichens or the foliage of woody trees and shrubs. They eject frass (pellet-like excrement) through the bottom opening.

Some of the bagworms can be identified by the shape of their cases or by the material used to construct them. Typically, the caterpillars are stout and taper posteriorly. All of them have the spiracle on T1 fused to the prothoracic shield. Bagworms usually have a single pair of prolegs on A3 to A6 and A10, but the abdominal ones are reduced in size. The crochets are arranged in a characteristic pattern.

Bagworms eat the foliage of many different woody and herbaceous plants, including even lichens. In the United States, three species can cause economically important injuries to plants. One of the three, the evergreen bagworm, *Thyridopteryx ephemeraeformis*, is the lone defoliator of conifers.

In most species, the males and the females are medium-sized moths that differ in appearance. The females typically are larva-like, with their eyes, antennae, mouthparts, wings, and legs greatly reduced or absent. They spend their entire life in the case. Females attract day-flying males with a sexual scent, mate, and then lay eggs in their case. Many of the males have drab coloration and a large scaleless area on their wings. Neither sex is known to feed.

Evergreen Bagworm (*Thyridopteryx ephemeraeformis*)

DESCRIPTION Easily identified by its large case constructed of silk and embedded with pieces of its food plant. Dark purplish brown body with lighter areas on head, thorax, and anal plate. Light gray head and thoracic dorsum marked with dark brown to black, amount of dark color increases from T1 to T3; brown (non-sclerotized) band on anterior margin of T1 to T3 and A1, most visible when head and thorax extended out of case. Dark brown anal plate with light gray usually at hind margin. Up to 35 mm.

FOOD Many trees and shrubs, including especially eastern red-cedar and northern white-cedar (arborvitae).

LIFE CYCLE One generation. Egg overwinters in case of female. Mature caterpillar present in August and September.

COMMENTS This caterpillar is a well-known pest of arborvitae, junipers, and other plants in landscaped settings. It may cause severe damage or browning of foliage that can kill the tree. The female moth, which lacks many adult characteristics, lays eggs in her case and dies there. The evergreen bagworm rarely is found north of coastal areas in southern New England.

Ermine Moths

(Family Yponomeutidae)

The caterpillars in this small family are identified by the arrangement of crochets on their prolegs and by their chaetotaxy. They have a single pair of prolegs on A3 to A6 and A10; needleminers may have the prolegs reduced in size. Yponomeutids usually have a distinct anal plate. Mature caterpillars average 15 mm in length, although some may be greater than 35 mm.

Many species have gregarious caterpillars that live in webs spun over foliage or flowers. Most caterpillars eat the leaves, the flowers, or the seeds of non-coniferous plants. After they complete their feeding, they change to pupae in their communal webs. The solitary caterpillars of *Ocnerostoma* and *Zelleria* feed upon conifers by mining or boring into the foliage of trees, especially those in the Cupressaceae and the Pinaceae.

The moths, which are small to medium in size, sometimes have their wings spotted. A few are colored brightly. The adults fly between dusk and dawn.

Red Pine Tubemaker (*Ocnerostoma* species [undescribed])

DESCRIPTION Grayish yellow body with blackish head (at least on lobes), prothoracic shield, and anal plate. Grayish thoracic legs with dark tip; deep crease where segments meet. Prolegs greatly reduced in size; grayish venter. Up to 8 mm.

FOOD Red pine.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in silk-lined tube of needles. Mature caterpillar present in April and May.

COMMENTS Early instars of this caterpillar are true needleminers. The final instar, however, constructs a feeding tube by binding four to six pine needles together with silk. Little else is known about this apparently undescribed species. The native white pine tubemaker, *Ocnerostoma strobivorum*, mines the needles of eastern white pine before it constructs its tube. The European pine tubemaker, *O. piniariella*, which is figured by Duncan (2006), has similar habits. Freeman (1960) has illustrated the mining damage of both of these described species. *Ocnerostoma* species never eat the ends of the needles that form their tubes. By contrast, the pine tube moth, *Argyrotaenia pinatubana*, and the jack pine tube moth, *A. tabulana*, routinely chew the ends of their tubes of needles.

Pine Needle Sheathminer (*Zelleria haimbachi*)

DESCRIPTION Mostly yellowish green body with rosy brown subdorsal stripe. Yellowish head, prothoracic shield, and anal plate (sometimes with rosy brown tinge). Very broad subdorsal stripe with small, light spots. Up to 14 mm.

FOOD Jack and possibly other hard pines.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in a mined needle. Mature caterpillar present from May to July.

COMMENTS After hatching, the caterpillar mines the base of a needle within the sheath and removes its frass, which typically is deposited by adjacent sheaths. The older caterpillar makes a feeding web around the bases of the needles where it feeds. Rose et al. (1999) have illustrated the feeding damage of this species.

Argyresthiids

(Family Argyresthiidae)

The caterpillars of this small family are separated from closely related caterpillars by the pattern of their hairs and by the uniform length of their crochets, which are usually arranged in a circle. They have single pairs of prolegs on A3 to A6 and A10. Most caterpillars are small, typically 5 to 16 mm in length at maturity.

These caterpillars mine foliage or bore into buds, fruit, cones, or twigs. Although many northeastern species eat conifers, a few species prefer deciduous trees and shrubs. Most species show considerable host specificity, feeding on only one or a few plants. Argyresthiid caterpillars can cause economically important injury to conifers, especially pine, juniper, and northern white-cedar (arborvitae). Most caterpillars spin a white or mottled cocoon before they change to pupae.

The small adults usually have their wings marked with yellow, brown, or white. On spring days, the moths of the arborvitae pests may fly in clouds around landscape plantings of their food plants.

Canadian Arborvitae Leafminer (*Argyresthia canadensis*)

DESCRIPTION Green body with dark brown head and with central bronwn patch on prothoracic shield and anal plate. Up to 7 mm.

FOOD Northern white-cedar.

LIFE CYCLE One generation. Nearly full-grown caterpillar overwinters in mined foliage. Mature caterpillar present from April to June.

COMMENTS The caterpillars of the brown arborvitae leafminer, *Coleotechnites thujaella*, and three species of *Argyresthia* mine the foliage of northern white-cedar; sometimes several species will infest the same tree. As its name indicates, the brown arborvitae leafminer is brown, whereas the *Argyresthia* species are mostly green. *Argyresthia aureoargentella* and *A. canadensis* make whitish, spindle-shaped cocoons that are located outside the mine on the foliage. The cocoon of the first species is white, whereas that of the second is mottled with brown (see below). The arborvitae leafminer, *A. thuiella*, forms its pupa within its foliar mine.


UGA 1178004

Arborvitae Leafminer (*Argyresthia thuiella*)

DESCRIPTION Greenish body with dark brown head, prothoracic shield, and anal plate. Up to 7 mm.

FOOD Northern white-cedar.

LIFE CYCLE One generation. Nearly full-grown caterpillar overwinters in mined foliage. Mature caterpillar present from April to June.

COMMENTS The caterpillar forms its pupa within its foliar mine, usually near the base. The green pupa is curved at the end of the abdomen. See the comments for the Canadian arborvitae leafminer, *Argyresthia canadensis*. The caterpillar and the pupa of the arborvitae leafminer are figured by Rose et al. (2000). This leafminer sometimes is a serious pest of planted northern white-cedars (arborvitae). The mined foliage typically turns brown (see below).


UGA 1178003

Casebearers and Relatives

(Family Coleophoridae)

Many of the North America caterpillars in this small family belong to the genus *Coleophora*, which includes pests of larch, fruit, nut, and other trees. The caterpillars of the first instar of *Coleophora* are true leafminers, living within the leaf. The older caterpillars reach into leaves to mine or skeletonize them while they dwell in portable cases that remain at the surface of the leaf. The cases of *Coleophora* species are constructed of foliar fragments and frass that are bound together by silk. The shape of the case varies from species to species and may be important for identification. Other caterpillars in the Coleophoridae are scavengers, plant feeders, or even predators of insects. Coleophorid caterpillars may live in the nest of other caterpillars, in the burrows of boring insects, in flowers, in or between leaves, or in other locations.

These caterpillars of *Coleophora* are modified for their case-bearing life; for example, the prolegs on A3 to A6 often are reduced to bumps. Most *Coleophora* species pass the winter as partly grown caterpillars in cases attached to the food plant. After springtime feeding, the caterpillars change to pupae within their cases. Mature coleophorid caterpillars generally are 5 to 15 mm long.

The small white moths tend to be dull white, tan, or grayish and have narrow wings with long fringes. The adults of most species are active between dusk and sunrise.

Larch Casebearer (*Coleophora laricella*)

DESCRIPTION Easily recognized by its grayish white tubular case that has longitudinal ridges. Brown body with dark brown head, prothoracic shield, spiracles, and anal plate; relatively small prolegs. Up to 6 mm.

FOOD Eastern larch.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in its case at the base of a bud. Mature caterpillar present in May and June.

COMMENTS After it becomes a second instar, this species lives in a case that is composed of two mined needles that are bound together with silk. Extensive mining by caterpillars causes the normally green needles of larch to turn brown. The larch casebearer infests not only native larches, but also several introduced species used in landscape plantings. Duncan (2006) has published several excellent images of the caterpillar and its damage. This European pest arrived in North America in the 1800s. Since then, it has spread widely in Canada and the northern United States.

Gelechiids

(Family Gelechiidae)

The caterpillars of this large and highly diverse family are not separated easily from other families of Lepidoptera. Experts use the relative positions of body hairs, a structure near the anus, and other characteristics to identify members of the family. These caterpillars have single pairs of prolegs on A3 to A6 and A10. They usually reach a length of 10 to 15 mm at maturity.

The feeding habits of gelechiid caterpillars are remarkably diverse. They feed internally or externally upon a wide variety of plants although most species are specialists, eating only one or a few plants. The caterpillars feed upon foliage, flowers, seeds, bark, twigs, and stems. While they feed, they may mine foliage, roll or tie leaves, or bore into stems. A few are gallmakers or scavengers. The caterpillars may be either solitary or gregarious. *Coleotechnites* species, the largest group of conifer feeders in the family are miners of foliage. Of these species, the miners of arborvitae and ornamental junipers are important foliar pests. Identification of the food plant is essential for correct determination of the species on conifers. Other members of the family are significant pests of cotton, stored grain, and other products.

In most adults, the ends of the relatively broad hindwings are drawn into a point or lobe that is distinct because of an indentation in the rear margin of the wings. The generally small moths are active mainly at night.

Orange Larch Tubemaker (*Coleotechnites laricis*)

DESCRIPTION Grayish green body usually with orange blush dorsally, especially at hind margin of segments. Mostly dark brown head, prothoracic shield, and anal plate; prothoracic shield with light gray anterior margin; small dark spots on body. Up to 8 mm.

FOOD Eastern larch.

LIFE CYCLE One generation. Partly grown caterpillar overwinters on twig. Mature caterpillar present in June and July.

COMMENTS After hatching, the young caterpillar mines leaves. In fall, it constructs a shelter of needles and frass along a twig. After spending the winter in its shelter, the caterpillar resumes feeding while it lives in a tube that is composed of needles tied together with silk. Finally, it changes to a pupa within the tube.


UGA 1178012

Orange Spruce Needleminer (*Coleotechnites piceaella*)

DESCRIPTION Light brown body with orange hue, especially on dorsum, and with dark brown head; variable body color. Dark brown prothoracic shield with light anterior margin; dark brown thoracic legs. Narrow orangish band where segments meet; brown anal plate. Up to 8 mm.

FOOD Spruces.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in a mined needle. Mature caterpillar present in June and July.

COMMENTS We found this species to have variable body color, suggesting it might represent a complex of several species. In summer and fall, the caterpillar mines needles that are bound loosely with silk. After spending the winter in a hollowed needle, it eats buds or mines needles formed during the previous year, again tying them with silk (see below). Rose and Lindquist (1994) also have shown the damage of the orange spruce needleminer. Several other species of *Coleotechnites* mine spruces, but their biology is not well known. Several tortricid caterpillars, which will be described later, also mine spruce needles.


UGA 1178013


UGA 1178007

Common Juniper Leafminer (*Coleotechnites gibsonella*)

DESCRIPTION Light brown body with pink tint and with orange-brown (or darker brown) head, prothoracic shield, and anal plate. Prothoracic shield with light gray anterior margin. Up to 7 mm.

FOOD Common juniper.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in bundle of mined needles. Mature caterpillar present in April and May.

COMMENTS In summer and fall, the young caterpillar mines or hollows needles at the ends of shoots and ties the dead needles together with silk. In fall, it lines the center of the bundle with silk to make a chamber where it spends the winter. In spring, the caterpillar moves to new terminal growth, again binding hollowed needles together with silk (see below). This caterpillar can be identified by its color and by its distinctive damage to terminal needles. Two other miners on common juniper are *Argyresthia annettella* and *Coleotechnites juniperella*. *Argyresthia annettella* has a green caterpillar that forms its pupa in an open-mesh cocoon located outside the mine on the foliage; the cocoon is illustrated by Rose et al (2000). Little is known about the biology of *C. juniperella*.


UGA 1178008

Red-cedar Leafminer (*Coleotechnites albicostatus*)

DESCRIPTION Greenish gray body with pinkish red bands on dorsum. Orange-brown head, greenish brown prothoracic shield and anal plate; narrow grayish band at hind margin of segments. Up to 7 mm.

FOOD Eastern red-cedar.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in its mined foliage. Mature caterpillar present in May and June.

COMMENTS In spring, the caterpillar dwells in the largest of the mined needles in its silken, feeding nest. The webbed nest includes not only mined needles, but also fragments of needles and frass (see below). The caterpillar becomes a pupa within a silk-and-frass cocoon that is located on the foliage within the web. Adults reared from the red-cedar leafminer depicted here closely match specimens of *Coleotechnites albicostatus* in the Canadian National Collection (J.-F. Landry, pers. comm.). In northeastern North America, the similar *C. juniperella* and *C. obliquistrigella* also feed upon eastern red-cedar or common juniper.Until the species of *Coleotechnites* are revised taxonomically, it will be difficult to determine which species our photograph represents. Eastern red-cedar also is the food plant of the greenish leafminers, *Argyresthia affinis* and *A. freyella*. *Argyresthia freyella* has a whitish spindle-shaped cocoon with brown spotting. Its cocoon, which is pictured by Rose et al. (2000), is attached to the outside surface of the foliage included in the web.

Brown Arborvitae Leafminer (*Coleotechnites thujaella*)

DESCRIPTION Brown body with dark brown head, prothoracic shield, and anal plate. Prothoracic shield with light brown anterior margin; narrow, light brown band at hind margin of segments. Up to 8 mm.

FOOD Northern white-cedar.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in its mine. Mature caterpillar present from May to July.

COMMENTS The brown arborvitae leafminer lives its entire life in a mine that turns dark brown (and later fades to light brown) after the inner tissue has been removed. After feeding is completed, it forms a brown pupa within the mine. This caterpillar is the only brown one that mines northern white-cedar (arborvitae). Several greenish *Argyresthia* species also infest arborvitae; see the comments for the Canadian arborvitae leafminer, *A. canadensis*. The brown arborvitae leafminer is one of the most important pests of arborvitae in the Northeast.

Brown Hemlock Leafminer (*Coleotechnites macleodi*)

DESCRIPTION Brownish body with very dark brown head and prothoracic shield, the latter with a light gray anterior margin. Up to 7 mm.

FOOD Eastern hemlock.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in hollowed needle in its feeding nest. Mature caterpillar present in May and June.

COMMENTS The young caterpillar initially mines a series of adjacent needles and ties them loosely together with silk. In the spring, the caterpillar hollows the undersides of additional needles, which also are bound together with silk (see below). The pupa is formed in a silken tube within the feeding web. This species can be distinguished from the green hemlock needleminer, *Coleotechnites apicitripunctella*, by its brown color. Freeman (1967) also has illustrated the feeding damage and webbed nest.

Green Hemlock Leafminer (*Coleotechnites apicitripunctella*)

DESCRIPTION Yellowish green body with orange-brown head and prothoracic shield. Prothoracic shield with light gray anterior margin; many small, dark green spots conspicuous on pale body segments. Up to 7 mm.

FOOD Eastern hemlock.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in hollowed needle in its feeding nest. Mature caterpillar present in May and June.

COMMENTS The feeding habits and webbed nest (see below) of this caterpillar are similar to those of the brown hemlock needleminer, *Coleotechnites macleodi*. The two needleminers can be separated by their color. Freeman (1967) and Johnson and Lyon (1991) also have illustrated the damage caused by the green hemlock needleminer. Occasionally, the green hemlock needleminer reaches outbreak levels in the northeastern United States.

Juniper Webworm (*Dichomeris marginella*)

DESCRIPTION Very light brown body with dark middorsal and subdorsal stripes. Brown head; orange-brown prothoracic shield with light anterior margin and with narrow, dark brown spot at hind margin. Brown middorsal stripe narrower than dark brown subdorsal stripe. Up to 14 mm.

FOOD Common and creeping junipers.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in a silken case in the webbed foliage. Mature caterpillar present in May and June.

COMMENTS After hatching, the young caterpillar mines foliage. The mature caterpillar hollows needles while it dwells in a communal web of dead needles and frass (see below). It forms a pupa in a silken cocoon in the webbed foliage. The juniper webworm also infests non-native junipers that are used in landscaping. This introduced species is native to Europe.

Pine Needleminer (*Exoteleia pinifoliella*)

DESCRIPTION Brown body with dark brown head and prothoracic shield. Up to 6 mm.

FOOD Jack, pitch, and other hard pines.

LIFE CYCLE One generation. Partly grown caterpillar overwinters in mined needle. Mature caterpillar present from April to June.

COMMENTS After hatching, this caterpillar mines several needles. After it has spent the winter in a mined needle, it bores into additional needles and changes into a pupa within its last mine. At least five other needleminers infest pines in northeastern North America, including the European pine bud moth, *Exoteleia dodecella*, which eats the needles of introduced pines. Needles that were mined by the pine needleminer and related species are shown by Freeman (1960) and Rose et al. (1999).

Leafrollers and Fruitworms
(Family Tortricidae)

Most of the caterpillars in this large family have a uniform body color and a variably pigmented prothoracic shield and anal plate. The color of the shield or plate often is used to identify species. The caterpillars tend to be slender if they feed externally, and stout if they feed internally. Many of the external feeders rapidly move backward when they are dislodged from their feeding sites or otherwise disturbed. Tortricid caterpillars are medium-sized, varying from 8 to 25 mm in length at maturity. They have a single pair of prolegs on A3 to A6 and A10. Above the anus, most species have an anal comb that is used to eject frass. Members of this family are best distinguished by the arrangement of hairs on their bodies.

Some caterpillars are external feeders that eat buds, leaves, flowers, and seeds. The foliage feeders often roll, crumple, or tie leaves together before eating them. Other species feed internally by mining leaves or by boring into stems, fruit, roots, or other structures. A few change from internal to external feeders during their life. Tortricids, as a whole, have a broad food range, eating most major groups of plants. This family has many economically important species, including the spruce budworm, *Choristoneura fumiferana*, the oblique-banded leafroller, *C. rosaceana*, and the codling moth, *Cydia pomonella*.

The moths of most species have dull coloration and tend to be camouflaged when they are resting. Most adults are small to medium in size. Typically, they are active at night. Chemists have duplicated the sex attractant produced by adult females of some tortricid pests. These attractants have been used in traps to monitor the flight activity of males or have been released in abnormally high concentrations to disrupt mating activity.

Larch Tubemaker (*Spilonota laricana*)

DESCRIPTION Greenish gray body with very dark brown head and prothoracic shield. Dark prothoracic shield with light anterior margin; anal plate dark, but less so than shield. Up to 12 mm.

FOOD Eastern larch.

LIFE CYCLE One generation. Partly grown caterpillar overwinters on tree. Mature caterpillar present from May to July.

COMMENTS This caterpillar lives in a characteristic feeding tube that is constructed by binding larch needles together with silk. Ultimately, it changes to a pupa in a white silken cocoon within the tube. Rose et al. (2000) have pictured the tube of this species on larch, although they consider it to be the eye-spotted bud moth, *Spilonota ocellana*, a remarkably similar caterpillar that feeds upon fruit trees and other deciduous woody plants. The larch tubemaker feeds upon not only eastern larch, but also several non-native larches used in landscape plantings. This species probably was introduced from Europe, where it is widespread.

Spruce Budworm (*Choristoneura fumiferana*)

DESCRIPTION Mostly greenish gray body with distinct, pale subdorsal spots; variable color on head and prothoracic shield. Dark brown head; yellowish brown prothoracic shield with various dark marks and with greenish gray anterior margin. Greenish gray of upper two-thirds of body contrasts with greenish yellow of lower one-third. Pair of offset, yellowish white subdorsal spots on most segments; single pale spot above and below each abdominal spiracle. Prolegs on A3 to A6 reduced in size, but those on A10 of normal size; yellowish brown anal plate. Up to 22 mm.

FOOD Balsam fir, red spruce, white spruce, and less commonly other conifers.

LIFE CYCLE Typically one generation (some populations with 2-year life cycle). Recently hatched, tiny caterpillar overwinters in silken shelter under bark or in another protected area. Mature caterpillar present from May to July.

COMMENTS This caterpillar is the most destructive insect in many northern coniferous forests. In spring, the young caterpillar mines old needles, buds, and male flowers. The final two instars eat expanding buds or new foliage as they make webs that often bind the developing shoots together. After a caterpillar consumes all of the new needles, it will eat mature foliage. Rose and Lindquist (1994) and Johnson and Lyon (1991) have pictured the foliar damage. The spruce budworm and the pitch pine budworm, *Choristoneura pinus maritima*, are variable in color and sometimes cannot be identified to species without knowledge of the food plant.

Pitch Pine Budworm (*Choristoneura pinus maritima*)

DESCRIPTION Light grayish body with pale spots in dark brown bands around body segments; variable body color. Orange-brown head, prothoracic shield, and anal plate; shield with light anterior margin and with two or more dark brown marks at hind margin; dark brown thoracic legs. Grayish upper two-thirds of body contrasts with lighter lower one-third. Pair of offset, grayish subdorsal spots on most segments; single pale spot above and below each abdominal spiracle. Prolegs on A3 to A6 reduced in size, but those on A10 of normal size. Up to 22 mm.

FOOD Jack, pitch, and other hard pines.

LIFE CYCLE One generation. Young caterpillar overwinters under bark or in another sheltered place. Mature caterpillar present in June and July.

COMMENTS This caterpillar can vary in the color of the head, the prothoracic shield, or the rest of the body. For instance, unlike the photographed specimen, the head and shield can be mostly dark brown. The jack pine budworm, *Choristoneura pinus pinus*, prefers jack and red pine. Ives and Wong (1988) and Rose et al. (1999) have illustrated the damage and the immatures of this more northern and western subspecies. Except for the food plants, the feeding habits of the two subspecies of *C. pinus* and the spruce budworm, *C. fumiferana*, are similar. For example, the pitch pine budworm usually forms a web among the developing needles and the male flowers.

White-lined Leafroller (*Amorbia humerosana*)

DESCRIPTION Grayish and yellowish green body with marked head and prothoracic shield; variable body color. Orange-brown head with broad, horizontal dark brown streak over white line. Orange-brown prothoracic shield edged laterally with dark brown. Brownish anal plate darker than body. Up to 30 mm.

FOOD Many trees and shrubs, including balsam fir, eastern hemlock, eastern larch, pines, and spruces.

LIFE CYCLE One generation. Pupa overwinters in debris on ground. Mature caterpillar present from July to September.

COMMENTS We also have seen a variety with a mainly brownish body (see below).

Eastern Blackheaded Budworm (*Acleris variana*)

DESCRIPTION Greenish body with darkly marked head and prothoracic shield. Orange-brown head with two dark brown marks on each lobe. Greenish brown prothoracic shield with dark brown border laterally and posteriorly. Up to 15 mm.

FOOD Balsam fir, eastern hemlock, and spruces.

LIFE CYCLE One generation. Egg overwinters on live needle. Mature caterpillar present from May to July.

COMMENTS Despite the common name of this caterpillar, neither the head nor the prothoracic shield is black, but mainly greenish, reddish, or dark brown. The form with a very dark brown head and prothoracic shield, which is figured by Rose and Lindquist (1994) and Duncan (2006), apparently is more common in northern areas. When the eastern blackheaded budworm approaches maturity, it lives in a shelter of webbed needles on the new shoots. During outbreaks, this species noticeably injures foliage.

Fall Spruce Needle Moth (*Argyrotaenia occultana*)

DESCRIPTION Green body with head marked faintly with orange-brown on lobes. Head also with dark brown spot near stemmata and with horizontal dark bar behind stemmata. Greenish thoracic legs with two dark brown spots near middle and with dark tip. Up to 15 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, spruces, and probably other species of Pinaceae.

LIFE CYCLE Two generations. Pupa overwinters. Mature caterpillar present in June and July and again in September and October in southern New England.

COMMENTS MacKay (1962), Ives and Wong (1988), and Duncan (2006) have illustrated the fall spruce needle moth with darker pigmentation on the lobes of the head. The mature caterpillar binds the needles of its food plant with silk to construct a shelter within which it feeds. This species resembles the red-banded leafroller, *Argyrotaenia velutinana*, which occasionally has been reported on similar conifers. The fall spruce needle moth may occur on the same trees as the eastern blackheaded budworm, *Acleris variana*. The latter, however, always has a more colored head with little or no green.


UGA 1178112

Pine Tube Moth (*Argyrotaenia pinatubana*)

DESCRIPTION Yellowish green body with orange to yellow brown head marked with dark brown on frons and lobes. Head also with dark brown spot near stemmata and with narrow, horizontal dark bar behind stemmata. Up to 15 mm.

FOOD Mainly eastern white pine.

LIFE CYCLE Two generations. Pupa overwinters in silk-lined tube of needles. Mature caterpillar present mainly in June and July and again in September and October in southern New England.

COMMENTS The mature caterpillar lives in a silk-lined tube comprised of up to 20 needles that have been webbed together (see below). This species and the jack pine tube moth, *Argyrotaenia tabulana*, characteristically eat the ends of their tubes, which distinguishes them from other tubemakers on pines. The identity of the food plant is helpful for distinguishing the pine tube moth from the jack pine tube moth.


UGA 1178113

Jack Pine Tube Moth (*Argyrotaenia tabulana*)

DESCRIPTION Green body with head marked with orange-brown on lobes. Head also with dark brown spot near stemmata and with horizontal dark brown bar behind stemmata. Greenish thoracic legs with one or two dark spots near middle and with dark tip. Up to 15 mm.

FOOD Jack, pitch, and possibly other hard pines.

LIFE CYCLE Two generations. Pupa overwinters in silk-lined tube of needles. Mature caterpillar present mainly in June and July and again in September and October in southern New England.

COMMENTS The older caterpillar resides in a silk-lined tube centered between needles (see below). The food plant and the presence of feeding tube with a chewed end can be used to distinguish this species from other tubemakers on pine. Duncan (2006) has shown additional examples of the foliar injury caused by the jack pine tube moth.

Three-streaked Sparganothis (*Sparganothis tristriata*)

DESCRIPTION Yellowish to grayish green body with mostly light orange head. Head with brown spot near stemmata; prothoracic shield with light gray anterior margin and with curved, dark brown lateral margin. Faint, dark green middorsal stripe and broader subdorsal stripe; pair of offset, pale spots above subdorsal stripe on most segments. Up to 15 mm.

FOOD Jack, pitch, and red pines; less commonly balsam fir, common juniper, eastern larch, eastern white pine, spruces, and possibly other conifers.

LIFE CYCLE Probably one generation in New England. Overwintering stage unknown. Mature caterpillar present from July to September.

COMMENTS The biology of this species is poorly known. Several other species of *Sparganothis* pass the winter as partly grown caterpillars.

Green Needleworm (*Clepsis persicana*)

DESCRIPTION Grayish green body with gray middorsal and subdorsal stripes. Yellowish green head with dark brown spot near stemmata and with small, horizontal dark line behind stemmata. Middorsal and subdorsal stripes sometimes indistinct. Up to 17 mm.

FOOD Many trees, occasionally including balsam fir, eastern hemlock, eastern larch, and spruces.

LIFE CYCLE One generation. Partly grown caterpillar probably overwinters in debris on ground. Mature caterpillar present in May and June.

COMMENTS In the past, the green needleworm was a minor pest of deciduous fruit trees in orchards that received few or no insecticidal applications. Duncan (2006) has illustrated several caterpillars of this species that are more greenish in color.

Spruce Needleminer (*Taniva albolineana*)

DESCRIPTION Green body with dark head and prothoracic shield. Dark brown head; similarly dark prothoracic shield with yellowish brown anterior and lateral margins. Narrow yellowish band at hind margin of segments. Up to 8 mm.

FOOD Spruces, especially planted ones.

LIFE CYCLE One generation. Nearly full-grown caterpillar overwinters within its feeding nest. Mature caterpillar present from May to July.

COMMENTS After hatching, the young caterpillar mines needles. It later builds a nest by tying dead, mined needles and frass together with silk (see below). The caterpillar overwinters within the nest and, after additional feeding, forms its green pupa in a gray cocoon. In spring, several caterpillars sometimes occupy the same webbed nest. Freeman (1967), Johnson and Lyon (1991), and Duncan (2006) also have illustrated the feeding damage of the spruce needleminer.

European Spruce Needleminer (*Epinotia nanana*)

DESCRIPTION Light brown body with dark brown head, prothoracic shield, and thoracic legs. Prothoracic shield with a light brown anterior margin; variably brownish anal plate. Up to 9 mm.

FOOD Red, white, and other spruces.

LIFE CYCLE One generation. Nearly full-grown caterpillar overwinters in mined needle. Mature caterpillar present in May and June.

COMMENTS In spring, the caterpillar mines needles that it attaches to twigs with silk. Unlike the spruce needleminer, *Taniva albolineana*, this species usually forms its pupa in a cocoon that is located in the debris beneath the tree. Freeman (1967), Johnson and Lyon (1991), Rose and Lindquist (1994), and Duncan (2006) have pictured the damage caused by this needleminer. As the common name suggests, this species was introduced from Europe. In North America, its preferred food is the introduced Norway spruce, *Picea abies*.


UGA 1178124

Spruce Bud Moth (*Zeiraphera canadensis*)

DESCRIPTION Plump, very light grayish brown body with orange-brown head and prothoracic shield. Head with horizontal dark brown spots or bar behind stemmata; pair of small, offset, gray or brown subdorsal spots on most segments; other small, dark spots near spiracles. Prolegs on A3 to A6 slightly reduced in size. Up to 10 mm.

FOOD White spruce, especially in exposed areas; uncommonly other spruces and balsam fir.

LIFE CYCLE One generation. Egg overwinters near base of shoot with new growth. Mature caterpillar present from May to July.

COMMENTS The caterpillar typically ties the brownish spruce bud cap to the developing shoot with silk, preventing its drop (see below), and it eats the developing foliage beneath the cap. Afterward, it may move down the developing shoot to eat other new needles. Duncan (2006) has provided excellent images of the caterpillar and its feeding habit. After it finishes its feeding, the caterpillar descends to the ground where it changes to a pupa in the litter. At times, this bud moth can be a serious pest in plantations of white spruce.


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Purple-striped Shootworm (*Zeiraphera unfortunana*)

DESCRIPTION Plump body with contrasting broad areas of purplish brown and light brown. Orange head; brownish prothoracic shield with darkest brown on posterior half and with light anterior margin; dark brown thoracic legs. Purplish brown dorsum and broad spiracular stripe, both contrasting with broad, light brown subdorsal stripe; margin of dorsum with row of light brown spots; apparent indentations in subdorsal stripe. Supraspiracular spots ringed in brown; dark brown spiracles. Up to 10 mm.

FOOD White spruce, especially in exposed areas; uncommonly other spruces and balsam fir.

LIFE CYCLE One generation. Egg overwinters near base of shoot with new growth. Mature caterpillar present from May to July.

COMMENTS Duncan (2006) has illustrated the variable color of caterpillars of this species. The feeding habits of the purple-striped budworm and the spruce bud moth, *Zeiraphera canadensis,* are similar. The former also can be a pest in plantations of white spruce.

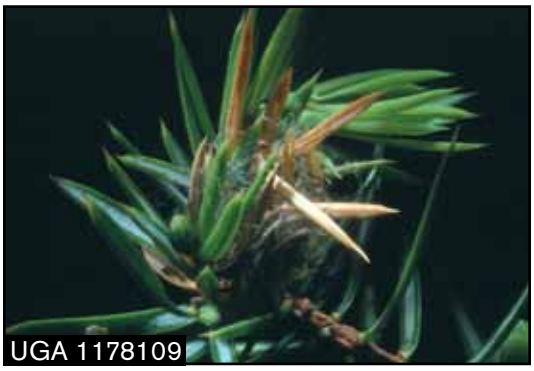
Pale Juniper Webworm (*Aethes rutilana*)

DESCRIPTION Dull yellow body with orange-brown head and prothoracic shield. Up to 11 mm.

FOOD Common juniper.

LIFE CYCLE One generation. Caterpillar overwinters in silken shelter on a twig. Mature caterpillar present from May to July.

COMMENTS After hatching, this caterpillar mines needles. It spends the winter in a silk-lined, frass-covered case that is attached to a branch. In spring, the caterpillar webs foliage where it feeds (see below). The feeding nest typically has dead, often mined needles and frass in the center. This Eurasian species sometimes infests native and non-native junipers in landscaped areas. Additional images of the caterpillar and its injury can be found in Duncan (2006).



Pyralids
(Family Pyralidae)

Most of the caterpillars in this third largest family of Lepidoptera have a cylindrical body that is tapered at each end. They have five pairs of prolegs in the normal positions, although sometimes they are reduced in size in specialized feeders. The crochets on the prolegs tend to be arranged in a circular or ellipsoidal pattern. Mature caterpillars range in length from 8 to 40 mm.

The caterpillars feed in concealed situations where they eat either living or dead plant material. Some bore into roots, stems, leaves, and seeds; others mine, fold, or web leaves as they feed. A few live in the nests of social insects, such as bees, or are predatory on scale insects. Those that eat seeds and dried, stored products probably have the greatest economic importance. Although most species are terrestrial, a few in one group are aquatic. Notable pest species include the Indian meal moth, *Plodia interpunctella*, and the European corn borer, *Ostrinia nubilalis*.

Adult moths generally are relatively small and have dull coloration. A few, however, are large or brightly colored. Many bear a striking superficial resemblance to species in other lepidopteran families. The adults of nearly all species are active during the night. The moths are readily attracted to lights or to certain flowers, but not to baits.

Pine Webworm (*Pococera robustella*)

DESCRIPTION Yellowish brown body with dark brown stripes; sometimes upper body overwhelmingly dark brown or with exceptionally broad stripes. Yellowish brown head marked with dark brown on lobes; yellowish brown prothoracic shield with several narrow, short, transverse dark lines. Broad middorsal stripe; broad subdorsal and thin supraspiracular stripes with narrow, fragmented stripe between them; thin, broken subspiracular stripe. Yellowish brown below spiracles and on venter. Up to 20 mm.

FOOD Jack, pitch, red, and other hard pines.

LIFE CYCLE One generation. Pupa overwinters in silken cocoon in soil. Mature caterpillar present from August to October.

COMMENTS The young caterpillar mines needles. After it stops its mining, the pine webworm eats needles while it dwells in a silken tube in a webbed nest of needles and frass (see below). Several caterpillars may occupy the same nest. In southern New England, we have found most of the nests near ground level on pitch pine. The pine webworm previously was known as *Tetralopha robustella*.

Inchworms, Measuringworms, and Loopers

(Family Geometridae)

The caterpillars in this large family typically have functional prolegs on only A6 and A10, and have the last four abdominal segments shorter than the preceding ones. The crochets on prolegs usually come in two lengths. Geometrid caterpillars vary from long and skinny to quite stout. Most have gray, green, or brown coloration. They commonly mimic twigs, petioles, flower parts, or foliage. Among the strangest are the species of *Nemoria*, which have fleshy projections on their body that often give them the appearance of dead leaf fragments. Geometrid caterpillars usually are 15 to 60 mm long at maturity. The common names of this family are derived from the way the caterpillars move by extending the front of their body as far as possible and then looping the rear to meet the forward part.

Geometrid caterpillars eat a wide variety of trees, shrubs, and herbaceous plants. Some, including several described in this guide, feed upon both deciduous and coniferous trees. With the possible exception of the family Gelechiidae, this family has the largest number of species normally associated with conifers. Several species are prominent pests of forests or agricultural crops.

The moths often have their wings marked with straight or angled lines. Most fly at night, but a few fly during the day. The day-fliers tend to be the more colorful species. Many species are attracted to lights, and a few can be seen at bait or flowers.

Fringed Looper (*Campaea perlata*)

DESCRIPTION Grayish body with many faint, longitudinal lines and with grayish fringe of slender, fleshy subventral tubercles; variable body color, sometimes dominated by pinkish red bands or annulations. Greenish gray head with lobes mottled with purplish brown, usually in herringbone pattern, and with dark purplish brown streak from top to stemmata. Multicolored annulations on segments; tiny, pale raised spots circle segments. Prolegs on A5, A6, and A10, with the first pair reduced in size. Up to 30 mm.

FOOD Many deciduous trees and shrubs; less commonly balsam fir, eastern hemlock, eastern larch, and pines.

LIFE CYCLE Two generations. Partly grown caterpillar overwinters. Mature caterpillar present from April to September; at any one place the generations are well separated, with the gap between them increasing southward.

COMMENTS This species is very unusual in having a pair of small prolegs on A5, in addition to the usual pairs on A6 and A10. The common name of this caterpillar describes it well. Its fringe of slender tubercles drape onto the substrate, enhancing its resemblance to a twig by covering up the shadow beneath its body.

Cleft-headed Looper (*Biston betularia*)

DESCRIPTION Gray body with depression between pointed lobes of head, with tiny speckles especially dorsally on body, and with prothoracic and abdominal tubercles; variable body color. Mainly reddish brown head; anterior edge of prothoracic shield with low transverse ridge bearing small pair of tubercles; mostly yellowish brown thoracic legs. Grayish dorsum with tiny black speckles that sometimes reach level of spiracles, particularly where segments meet. Transverse dorsal hump on A8; large tubercle before and slightly above spiracle on A5; orange-red spiracles contrast with gray body. Small, slender white filaments on prolegs and between their bases. Up to 60 mm.

FOOD Many trees and shrubs, including occasionally eastern larch and eastern white pine.

LIFE CYCLE One generation (possibly two in some areas). Pupa normally overwinters in soil or debris. Mature caterpillar present from July to November.

COMMENTS The body of the mature caterpillar can also be mainly brown or green. Rose et al. (2000), Wagner et al. (2001), and Wagner (2005) have depicted other color morphs of the cleft-headed looper. Mature caterpillars on different plants vary greatly in length, ranging from 35 to 70 mm, which is large for a geometrid. This cryptic species usually lies flat against a twig or a branch when it is not feeding.

Saddleback Looper (*Ectropis crepuscularia*)

DESCRIPTION Reddish brown and light gray body with swollen T2 and with darkened diagonal ridge that ends at dorsal tubercle on A8; highly variable body color. Light gray head with darker brown herringbone pattern on lobes and with horizontal streak at top of frons. Gray, brown, and white, broken middorsal and subdorsal stripes, usually with dark margins; middorsal stripe sometimes expanded into large light gray diamond on mid-abdominal segments. Curved, dark brown oblique line usually between middorsal and subdorsal stripes on A2 and on ridge between tubercle and subdorsal stripe (or lower) on A8. Orange spiracles, ringed in black, on pale swollen area; typically dark brown subspiracular mark behind spiracles, sometimes developed into discontinuous subspiracular stripe; lightly speckled anal plate. Up to 32 mm.

FOOD Many trees and shrubs, including balsam fir, eastern hemlock, eastern larch, northern white-cedar, spruces, and probably other conifers.

LIFE CYCLE One to three generations, with number increasing southward. Pupa overwinters in soil or debris. Mature caterpillar present mainly in July and August in New England.

COMMENTS Other color forms of the saddleback looper are shown by Rose and Lindquist (1994), Wagner et al. (2001), Wagner (2005), and Duncan (2006). This Holarctic species is a superb twig mimic that remains rigid after being disturbed.

Dash-lined Looper (*Protoboarmia porcelaria*)

DESCRIPTION Grayish and brownish body with conspicuous, broken middorsal stripe; variable body color. Purplish gray head with darker, speckled herringbone pattern on angular lobes and with dark, almost rectangular, dorsal patch where lobes meet. Broken, black middorsal stripe with each dash on anterior one-third of segments. Distinct, light brown spiracular swelling on A1 to A5; black spot behind spiracle on A1 and A2 and sometimes on A3 to A5. Up to 30 mm.

FOOD All conifers except possibly creeping juniper; also deciduous trees and shrubs, especially heaths, in spring.

LIFE CYCLE One generation in New England, and two generations in southern New Jersey. Partly grown caterpillar overwinters usually under bark or in debris. Mature caterpillar present from May to July in New England, and mainly in April and May and in July and August in southern New Jersey.

COMMENTS This variable caterpillar, which has both grayish and brownish forms, is another species that strongly resembles twigs. Duncan (2006) has nicely illustrated the color variation in the penultimate instar. The dash-lined looper is one of the most common caterpillars encountered during the spring.

White Slant (*Tetracis cachexiata*)

DESCRIPTION Brownish gray body with somewhat flattened head, swollen T2, and various, often darkened warts, tubercles, and ridges. Gray and brown head with dark brown marks and with swollen, yellowish clypeus. Thoracic segments (especially T2) with wing-like, subdorsal expansions. Grayish middorsal stripe edged with black and usually dashed until A8; transverse dorsal ridge with paired tubercles on A4, A5, and A8; additional, but smaller, tubercles on dorsum of other segments. Spiracular swelling on most segments; prominent, dark brown subspiracular tubercles before and after spiracle on A1 and A2; prolegs larger on A10 than A8. Up to 40 mm.

FOOD Many trees and shrubs, including balsam fir, eastern hemlock, eastern larch, eastern white pine, and white spruce.

LIFE CYCLE One generation. Pupa usually overwinters in soil or debris. Mature caterpillar present mainly from July to September.

COMMENTS This species is another twig mimic that becomes rigid after it has been disturbed. Wagner, et al. (2001) and Wagner (2005) have illustrated other color forms of this caterpillar. Wagner et al. (2001) have suggested that in late summer and early fall the white slant has a partial second generation in some eastern states, but we have not witnessed one. In southern New Jersey, the adults fly during May and June.

Juniper Geometer (*Patalene olyzonaria puber*)

DESCRIPTION Brownish and grayish body with dark angular lines dorsally and laterally. Brown and gray head with dark brown herringbone pattern on lobes and with narrow, curved, brownish line behind stemmata; upper frons edged with dark brown. Dark brown, intermittent, zigzag lines cross in middorsal region, outlining brown dorsal diamonds; pair of black dorsal warts on A9; whitish patches below angular lines in subdorsal area. Yellow spiracles preceded by elongate, brownish white spots with dark brown edge above and followed by fleshy, raised brownish bumps, particularly on abdomen. Up to 30 mm.

FOOD Atlantic white-cedar and eastern red-cedar; less commonly northern white-cedar and possibly other species of Cupressaceae.

LIFE CYCLE Two generations in southern New England, and apparently three in southern New Jersey. Egg probably overwinters. Mature caterpillar present from June to October in New England.

COMMENTS This caterpillar usually is cryptic when it rests on its food plant. The juniper geometer forms a green and white pupa that blends well with the foliage of its food plants.

Pine Looper (*Hypagyrtis* species)

DESCRIPTION Reddish brown body with grayish white dorsal triangles and lateral spots. Grayish white head mottled with reddish brown; lightened areas on front of head appear as four spots or as two horizontal streaks through frons. Middorsal stripe forms mainly diamond-shaped patches with their dark brown margins connected to dark subdorsal spot on each segment. Low, transverse dorsal hump on A8 marked with small white spot at each end. Dark brown spots on spiracular swellings; large grayish white spot between raised spiracular areas; narrow, wavy, greenish white subspiracular stripe. Up to 30 mm.

FOOD Balsam fir, eastern hemlock, and pines; less commonly eastern larch and other conifers.

LIFE CYCLE One generation in New England. Partly grown caterpillar overwinters usually on exposed wood or foliage of tree. Mature caterpillar present from May to July.

COMMENTS The form of *Hypagyrtis* that we collected is now the dominant one on conifers from southern Connecticut to at least southern New Hampshire. Based on adults in museum collections, this variety was uncommon in New England during the first half or more of the twentieth century. The moth is darker and more brownish than that of the typical diamond-backed looper, *H. piniata*, which during the 1990s was scarce in our sampling areas in New England. We suspect that the caterpillar pictured here is either a variant of the esther moth, *H. esther*, that has expanded its range northward, or a formerly rare, dark form of *H. piniata* that has now become dominant. Another plausible explanation is that *H. esther* and *H. piniata* may now freely hybridize. In New Jersey, the esther moth has two generations with mature caterpillars in May and early June and again in late July and August.

Gray Spruce Looper (*Caripeta divisata*)

DESCRIPTION Mostly reddish brown body with low, transverse dorsal ridges and with light-colored lateral patches; variable body color. Brownish head marked in dark brown herringbone pattern on lobes. Multicolored middorsal stripe expanded posteriorly on segments into circular or diamond-shaped area; rear of segments with dorsal ridge that has small, paired tubercles. Uneven, yellowish subdorsal stripe infused with reddish brown and edged in dark brown. Broad, discontinuous, greenish white spiracular stripe (appearing as large spots before spiracles on A1 to A6) outlined above with very dark brown. Up to 35 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, northern white-cedar, spruces, and rarely pines.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from August to October.

COMMENTS This caterpillar also has forms that are mostly brown or grayish brown. Among the various *Caripeta* species, the gray spruce looper has the broadest range of food plants. The caterpillars in this genus vary greatly in color and pattern; thus, their identification should be based upon reared adults.

Northern Pine Looper (*Caripeta piniata*)

DESCRIPTION Grayish and brownish body with distinct, but low, transverse dorsal ridges and usually with pale dorsal and lateral patches. Grayish head with purple and dark brown lobes marked in herringbone pattern. Indistinct, multicolored, broken middorsal stripe. On most segments, brownish subdorsal patch before dorsal ridge that has small, paired tubercles. Light gray spot before dark yellow spiracles topped with short, dark brown oblique line. Up to 35 mm.

FOOD Pines.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from July to October.

COMMENTS An apparently unnamed species of *Caripeta*, whose caterpillar is similar to the northern pine looper, occurs along the coast of Connecticut to New Jersey. At this time, we do not know how to separate the caterpillars of the two species, although the undescribed one apparently has a partial spring generation and a late summer to fall one. Thus, some of the early and late records for the northern pine looper may represent the unnamed species.

Brown Pine Looper (*Caripeta angustiorata*)

DESCRIPTION Reddish brown and grayish yellow body with light-colored dorsum, transverse dorsal ridges, and spiracular stripe; color variable, often darker. Yellowish head marked with white spots and shaded with reddish brown. Light yellow dorsum, sometimes invaded by brown at hind margin of segments and bisected by gray middorsal stripe. Rear of segments, especially A1 to A6, with low dorsal ridge that has brownish, raised tubercles. Broad, light yellow spiracular stripe. Up to 35 mm.

FOOD Pines and spruces; less commonly balsam fir and eastern larch.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from July to September.

COMMENTS The brown pine looper shown here apparently is the same light form that is illustrated by Duncan (2006). Wagner et al. (2001) and Duncan (2006) have figured darker more brownish forms of this polymorphic caterpillar. The stripes on the brown pine looper become increasingly obscure as it approaches pupation.

Gray Pine Looper (*Iridopsis vellivolata*)

DESCRIPTION Reddish brown and gray body with lighter patches dorsally and laterally; variable body color. Reddish brown head with small knob on top of lobes and with grayish white spots usually coalesced into horizontal streak on lower head; prothoracic shield mottled with reddish brown except in center. Low, transverse dorsal ridge (especially on A1 to A6) that has small, paired tubercles. Greenish yellow middorsal stripe trimmed with grayish white and interrupted by grayish white rectangles that connect to bands of similar color. Wide, discontinuous, grayish white spiracular stripe, often appearing as large spots. Up to 30 mm.

FOOD Pines; less commonly balsam fir, eastern larch, and spruces.

LIFE CYCLE One generation in New England, and apparently two in southern New Jersey. Pupa overwinters in soil or debris. Mature caterpillar present from June to September.

COMMENTS The gray pine looper has forms with considerably more gray (Ives and Wong 1988), which apparently accounts for the common name. Wagner et al. (2001) and Wagner (2005) have illustrated forms of this caterpillar with considerably more brown. Some color forms of this caterpillar are similar to *Caripeta* species, but the pattern of crochets of *Iridopsis* and *Caripeta* species differs. The gray pine looper has its crochets in one group, whereas species of *Caripeta* have their crochets in two groups. The gray pine looper, which was formerly was known as *Anacamptodes vellivolata*, appears to mimic the sheaths of pine needles.

Morrison's Pero (*Pero morrisonaria*)

DESCRIPTION Yellowish and brownish body with angular head, dark middorsal stripe, and scattered dark warts; variable body color. Dark brown head with transverse, light brown streak across front and with lighter brown lobes swollen and almost pointed. Dark brown middorsal stripe; inconspicuous pair of narrow, meandering dark brown subdorsal stripes. Dark brown spiracles; prominent spiracular swelling on A3 with large, dark tubercle below. Up to 35 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, pines, and spruces; records of broad-leaved trees and shrubs probably erroneous.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present mainly in July and August.

COMMENTS This caterpillar is an excellent twig mimic. Other color morphs of this caterpillar are pictured by Ives and Wong (1988), Wagner et al. (2001), and Duncan (2006).

Fall Hemlock Looper (*Lambdina fiscellaria fiscellaria*)

DESCRIPTION Brownish and grayish body with spotted head and with many longitudinal lines and stripes. Gray head with small brown and large black spots; gray prothoracic shield with yellowish patches and dark spots; grayish brown thoracic legs. Mostly brownish gray dorsum with indistinct, gray middorsal stripe trimmed in lighter gray; four black dorsal spots on each segment. Grayish white subdorsal stripe tinted with dark yellow near hind margin of segments; many grayish, brownish, or blackish longitudinal lines and stripes below subdorsal stripe. Large grayish spot above black spiracles on some segments; grayish white venter with several dark longitudinal lines. Up to 30 mm.

FOOD Balsam fir and eastern hemlock; less commonly eastern larch, pines, spruces, and other conifers; also many deciduous trees and shrubs during outbreaks.

LIFE CYCLE One generation. Egg overwinters on foliage. Mature caterpillar present in July and August.

COMMENTS This species and the spring hemlock looper, *Lambdina athasaria*, often inhabit the same trees of balsam fir and eastern hemlock. In our studies of life history in Connecticut, however, we have found that on any one date the caterpillar of the fall hemlock looper is always larger. The fall hemlock looper has outbreaks much more frequently than does the spring hemlock looper.

Spring Hemlock Looper (*Lambdina athasaria*)

DESCRIPTION Brownish and grayish body with spotted head and with light dorsum and darker, striped sides. Grayish head with small brown and large black spots; partly dark yellow prothoracic shield with dark spots; gray thoracic legs tinted with yellow. Mostly light gray dorsum spotted with brown and black; grayish white subdorsal stripe with interdispersed, brownish areas and with dark brown edges; series of grayish, brownish, or blackish longitudinal lines and stripes below subdorsal stripe. Black spiracles; light gray venter with several dark longitudinal lines. Up to 30 mm.

FOOD Eastern hemlock; less commonly balsam fir and spruces.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from August to October.

COMMENTS We consider this species to be distinct from the curve-lined looper, *Lambdina fervidaria*, which has a paler caterpillar that prefers to eat oaks, *Quercus* species. Unlike the spring hemlock looper, the curve-lined looper has two generations per year. The spring hemlock looper has an outbreak every 40 to 50 years; the last one in New England occurred during the late 1980s and early 1990s.

Pitch Pine Looper (*Lambdina pellucidaria*)

DESCRIPTION Brownish and grayish body with spotted head and with light dorsum and darker, striped sides. Grayish head with small brown and large black spots; partly dark yellow prothoracic shield with dark spots; mostly yellow legs. Light gray dorsum speckled with brown; grayish white subdorsal stripe with interdispersed, yellowish brown patches and with dark brown edges; series of grayish, brownish, or blackish longitudinal lines and stripes below subdorsal stripe; brown subspiracular stripe most uniformly colored stripe. Black spiracles; light gray venter with several dark longitudinal lines. Up to 30 mm.

FOOD Pitch, red, and other hard pines.

LIFE CYCLE One generation. Pupa overwinters mainly in soil or debris. Mature caterpillar present from August to November.

COMMENTS Some experts suspect that the pitch pine looper and the spring hemlock looper, *Lambdina athasaria*, are the same species because their adults have similar periods of activity and because their females use the same sexual attractant. Although their caterpillars have only subtle differences in color, they use different food plants. We believe that differences in the diet of caterpillars, adult color, and habitat (dry pine forests versus moist balsam fir or hemlock forests) justify the separation of the species.

False Pine Looper (*Nepytia pellucidaria*)

DESCRIPTION Flamboyant, multicolored body with spotted head and with distinct longitudinal lines and stripes. Mostly orange-brown head and prothoracic shield with large black spots; purplish to black thoracic legs. Orange-brown dorsum with faint, darker middorsal stripe; white and yellow subdorsal stripe with black longitudinal line at margins; lavender area below with two more black lines (lower one essentially supraspiracular stripe). Very broad, yellow spiracular stripe; black spiracles; prolegs and anal plate with large black spots, usually coalesced into bar on prolegs on A10. Up to 25 mm.

FOOD Pitch, red, and possibly other hard pines.

LIFE CYCLE One generation. Egg presumably overwinters. Mature caterpillar present mostly in August and September in Maine.

COMMENTS The false pine looper cannot always reliably be separated from the festive pine looper, *Nepytia* species, although the former usually has slightly darker orange on the body and thoracic legs and has larger, merged spots on the last pair of prolegs. The false pine looper was not collected anywhere in the Northeast between about 1950 and the late 1990s, but now it seems to be increasing in abundance.

Festive Pine Looper (*Nepytia* species [undescribed])

DESCRIPTION Boldly multicolored body with spotted head and prothoracic shield and with distinct longitudinal lines and stripes. Yellowish orange head and prothoracic shield with large black spots; greenish orange thoracic legs with black toward tip. Orange to greenish orange dorsum on T2 to A9, with darker, faint, middorsal stripe; white and yellow subdorsal stripe with black longitudinal line at margins; lavender area below with two more black lines (lower one essentially supraspiracular stripe); broad, yellow spiracular stripe with black longitudinal line below; black spiracles ringed with white. Yellowish orange prolegs and anal plate with small black spots. Up to 25 mm.

FOOD Pitch pine; less commonly eastern white and other pines.

LIFE CYCLE One generation. Egg overwinters. Mature caterpillar present in July and August in southern New England, and in June and July in southern New Jersey.

COMMENTS The pupa, which is formed in a flimsy cocoon among needles, is striped with dull orange to light brown and white. The festive pine looper is an undescribed species of *Nepytia* that occurs in coastal areas in southern New England and in the mid-Atlantic states to at least central Virginia. The similar false pine looper, *N. pellucidaria*, is found mainly in northern New England.

False Hemlock Looper (*Nepytia canosaria*)

DESCRIPTION Bluish green body with spotted head and prothoracic shield and with distinct pale stripes. Bluish green head and green prothoracic shield with black spots. Dark green middorsal stripe; white and yellow subdorsal stripe trimmed with dark green; black spiracles; yellow subspiracular stripe. Black spots on dorsum of A9, prolegs, and anal plate; yellow band at hind margin of segments. Up to 25 mm.

FOOD Balsam fir, eastern hemlock, spruces, and occasionally other conifers.

LIFE CYCLE One generation. Egg overwinters on foliage. Mature caterpillar present from July to September.

COMMENTS With its spotted bluish green head and distinctive stripes, this caterpillar cannot be confused with any other species on conifers. In late summer, it constructs a flimsy cocoon and transforms into a green and white pupa, which is very difficult to detect on the foliage of balsam fir and hemlock. In southern New England, the caterpillar is very common on eastern hemlock.

Yellow-lined Conifer Looper (*Cladara limitaria*)

DESCRIPTION Dark green body with pale stripes and with single yellow bands at hind margin of segments. Yellowish green head. Greenish white subdorsal and spiracular stripes, the latter about twice as wide and not extending uninterrupted to head. Prolegs smaller on A6 than A10; anal plate edged with yellow posteriorly; grayish white venter. Up to 25 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, spruces, and other conifers.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present in May and June.

COMMENTS The yellow-lined conifer looper and the angle-lined carpet, *Cladara anguilineata*, are similar in appearance and, in fact, may be the same species. The yellow-lined conifer looper superficially resembles the powder moth, *Eufidonia notataria*, and at least two species of *Macaria*, which eat similar conifers. The powder moth, however, usually has a purplish red subspiracular stripe on the thorax. The species of *Macaria* lack the reddish subspiracular stripe, but they have their heads distinctly marked with brown or reddish brown. The yellow-lined conifer looper usually tucks its head under the thorax when it is disturbed.

Pine Powder Moth (*Eufidonia convergaria*)

DESCRIPTION Green body with prominent, pale subdorsal and spiracular stripes. Yellowish green head sometimes faintly marked with brown on lobes; blue lower frons and labrum; green prothoracic shield and anal plate. Dark green middorsal stripe; yellowish subdorsal stripe less distinct than white spiracular stripe; subventral stripe margined with dark green. Up to 25 mm.

FOOD Mainly eastern white pine.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from July to September.

COMMENTS The food plant and the absence of red subspiracular stripe on the thorax distinguish this species from the powder moth, *Eufidonia notataria*. The green body with pale stripes allows both caterpillars to be inconspicuous on the foliage of their food plants. The pine powder moth also resembles species of *Macaria* on eastern white pine. The species of *Macaria* differ by having distinct reddish brown markings on the head, a whitish dorsum, conspicuous subdorsal stripes, or some combination of these characteristics.

Powder Moth (*Eufidonia notataria*)

DESCRIPTION Dark green body with conspicuous, pale spiracular stripe and purplish red subspiracular stripe. Yellowish green head spotted with dark brown on lobes; dark green prothoracic shield and anal plate, the latter speckled with brown. Dark green middorsal stripe; very faint, yellowish green subdorsal stripe; white spiracular stripe adjoins subspiracular stripe. Up to 25 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, and spruces.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from July to September.

COMMENTS This caterpillar resembles several other species that eat the same kinds of foliage. The powder moth can be separated from the others by its purplish red subspiracular stripe that usually is most evident on the thorax. The adult of the powder moth flies during both the day and the night.

Green Larch Looper (*Macaria sexmaculata sexmaculata*)

DESCRIPTION Green body with distinct pale stripes; also purplish brown form. Yellowish green head with bluish frons. Dark green middorsal stripe edged distinctly with white; broad, white subdorsal stripe; mainly white spiracular stripe with yellow near spiracles. Yellow band on hind margin of segments; prolegs usually blushed with whitish yellow. Up to 18 mm.

FOOD Eastern larch.

LIFE CYCLE One to two generations. Pupa overwinters in soil, debris, or sphagnum moss. Mature caterpillar present from July to October.

COMMENTS The final instar of this species has both a green and a purplish brown form (see below). Ferguson (1974, 2008) has reported that both forms are green or grayish until the final instar. The green caterpillar is well camouflaged on foliage, whereas the brown one is cryptic on twigs. The darker variety is mostly purplish brown, with the dark purplish brown areas on the sides alternating with the gray areas that surround the black spiracles. In our experience, the green larch looper is the most common and the smallest species of *Macaria* on eastern larch. The green larch looper and other species of *Macaria* are more likely to have a second generation in southern than northern areas of the Northeast. The green larch looper formerly was known as *Semiothisa sexmaculata sexmaculata*.

Owen's Larch Looper (*Macaria oweni*)

DESCRIPTION Green body with pale subdorsal stripe darkened below and with purplish thoracic legs and prolegs. Purplish to reddish brown head with lobes marked in dark brown herringbone pattern; dark brown streak on lobes with pinkish white margins (extensions of subdorsal and spiracular stripes). Indistinct, dark green middorsal stripe; yellowish white subdorsal stripe with two (sometimes fused) very dark green longitudinal lines immediately below. White and yellow spiracular stripe; purplish area on anal plate. Up to 20 mm.

FOOD Eastern larch.

LIFE CYCLE Probably one generation. Pupa overwinters in soil, debris, or sphagnum moss. Mature caterpillar present from July to September.

COMMENTS The purplish color of the head and prolegs of Owen's larch looper should distinguish it from the green larch looper (green form), *Macaria sexmaculata sexmaculata*, and another looper, *M. submarmorata*, on eastern larch in New England and southeastern Canada. The green larch looper (green form) has a yellowish green head and green prolegs, whereas *M. submarmorata* usually has a dull green head with a purplish stripe laterally and green and purple prolegs. Color variation in caterpillars of *M. submarmorata*, possibly induced by rearing conditions, is discussed by Ferguson (2008). Owen's larch looper formerly was known as *Semiothisa oweni*.

Jack Pine Looper (*Macaria marmorata*)

DESCRIPTION Greenish body with mostly reddish brown head and with conspicuous, pale subdorsal and spiracular stripes; also purplish form. Reddish brown head with lobes marked in dark brown herringbone pattern; yellow patch behind stemmata (extension of spiracular stripe); purplish brown thoracic legs. Dark green middorsal stripe; yellowish white subdorsal stripe with one or two wavy, purplish or dark green longitudinal lines immediately below, especially on anterior body segments. Broad, yellow spiracular stripe; green prolegs usually with purple shading near base. Up to 25 mm.

FOOD Jack pine.

LIFE CYCLE One generation in Maine. Pupa overwinters in soil and debris. Mature caterpillar present in August and September.

COMMENTS This and several other species of *Macaria* on pines have purplish or reddish forms whose color may result from crowding during rearing. In particular, Ferguson (2008) has described a more purplish form of the jack pine looper that he reared. The northern distribution and the wide, yellow spiracular stripe should help to distinguish this species from most of the other greenish species of *Macaria* that eat hard pines. In northern New England and southern Canada, however, the similar caterpillars of the jack pine looper and *M. masquerata*, a new species recently described by Ferguson (2008), both feed upon jack pine. Because of their greenish bodies and pale stripes, caterpillars of the pine-feeding species of *Macaria* are well camouflaged on needles. Those with mostly brown or purple heads further enhance the mimicry by resting with their heads against the needle sheaths of similar color. Until recent taxonomic changes, the jack pine looper was known as *Semiothisa banksianae* (Ferguson 2008).

Bicolored Angle (*Macaria bicolorata*)

DESCRIPTION Green body with marked head and with obvious, pale subdorsal stripe; also purplish form. Green head with lobes marked with brown herringbone pattern; brown streak on lobes with white margins (extensions of subdorsal and spiracular stripes); brownish green thoracic legs. Dark bluish green middorsal stripe; yellowish white subdorsal stripe; mainly dark green between subdorsal stripe and spiracles; diffuse, white and greenish yellow spiracular stripe. Mostly green prolegs; yellowish green venter. Up to 22 mm.

FOOD Pitch, red, and other hard pines.

LIFE CYCLE One to two (or possibly three) generations, with the number increasing southward. Pupa overwinters in soil or debris. Mature caterpillar especially common from August to October in southern New England, and from June to November in southern New Jersey.

COMMENTS The bicolored angle, as well as the blurry chocolate angle, *Macaria transitaria*, and the granite moth, *M. granitata*, eat the foliage of pitch and other hard pines. The first two can be distinguished because the bicolored angle has more distinct middorsal and subdorsal stripes and fewer wavy, dark longitudinal lines. The granite moth differs because it usually has a bluish green body. The bicolored angle apparently does not occur north of central New Hampshire; northern records of the bicolored angle from jack pine most likely represent *M. masquerata*, which recently was described by Ferguson (2008). Until recently, the bicolored angle was known as *Semiothisa bicolorata*.

Blurry Chocolate Angle (*Macaria transitaria*)

DESCRIPTION Dull green body with marked head, with pale subdorsal and spiracular stripes, and with many wavy, dark green longitudinal lines; also reddish form. Green head with lobes streaked with reddish brown, partly in darker herringbone pattern; streak on lobes with white margins (extensions of subdorsal and spiracular stripes); brownish green thoracic legs. Indistinct, green middorsal stripe edged with dark olive-green; grayish to yellowish white subdorsal and spiracular stripes, the latter broader; many wavy, olive-green to dark green longitudinal lines between middorsal and spiracular stripes. Up to 24 mm.

FOOD Jack, red, pitch, and other hard pines.

LIFE CYCLE One to two generations. Pupa overwinters in soil or debris. Mature caterpillar present from July to November, but mainly in July and August in southern New England.

COMMENTS Ferguson (2008) has chosen to treat some populations on different hard pines as subspecies; for example, *Macaria transitaria resinosae* is his subspecies associated with red pine. We believe that additional research is needed to justify the use of such subspecies names. The blurry chocolate angle was formerly known as *Semiothisa transitaria*.

Granite Moth (*Macaria granitata*)

DESCRIPTION Bluish green body with marked head and with mostly pale stripes; also purplish form. Greenish head with lobes streaked with brown (some greenish reticulation in brown) to reddish brown; streak on lobes with white margins (extensions of subdorsal and spiracular stripes); bluish frons; brownish thoracic legs with greenish blue base. Dark green middorsal stripe edged faintly with white; white subdorsal stripe with two wavy, dark longitudinal lines immediately below. Diffuse, white and yellowish white spiracular stripe; greenish yellow band at hind margin of segments. Up to 22 mm.

FOOD Mainly pitch pine in New England; pitch and one or more other hard pines in southern New Jersey.

LIFE CYCLE One to two generations in New England. Pupa overwinters in soil or debris. Mature caterpillar present from July to November, with latest dates in the southern part of the Northeast.

COMMENTS The bluish green body of this species usually separates it from other caterpillars on hard pines. Wagner et al. (2001) and Ferguson (2008), however, have described this caterpillar with color that we have not seen in nature. This species formerly was known as *Semiothisa granitata*.

Red-headed Inchworm (*Macaria bisignata*)

DESCRIPTION Greenish body with faintly marked head and with prominent, pale subdorsal stripe. Greenish head with lobes streaked with light brown (some light green reticulation in light brown); streak on lobes with white margins (extensions of subdorsal and spiracular stripes); greenish brown thoracic legs. Mostly yellowish green dorsum; green middorsal stripe edged with white; white subdorsal and spiracular stripes, the latter less distinct. Up to 22 mm.

FOOD Eastern white pine.

LIFE CYCLE One to two generations. Pupa overwinters in soil or debris. Mature caterpillar present from July to November.

COMMENTS In addition to this caterpillar, the white pine angle, *Macaria pinistrobata*, and the minor angle, *M. minorata*, are common on eastern white pine. Of these three species, the red-headed inchworm usually has the least amount of frosting on the dorsum. Until recently, the red-headed inchworm was known as *Semiothisa bisignata*.

White Pine Angle (*Macaria pinistrobata*)

DESCRIPTION Green body with frosted dorsum and with conspicuous, pale subdorsal and spiracular stripes. Yellowish green head with very small brown spots on outer side of lobes and with yellow streak from stemmata to T1 (extension of spiracular stripe); green thoracic legs, increasingly yellowish brown toward tip. Green middorsal stripe trimmed with mostly white; dorsum partly frosted with bluish white; white subdorsal stripe with two wavy, dark green longitudinal lines immediately below. Mainly white spiracular stripe with yellow near spiracles; yellow band on hind margin of segments. Up to 24 mm.

FOOD Eastern white pine.

LIFE CYCLE One to two generations. Pupa overwinters in soil or debris. Mature caterpillar present from July to October.

COMMENTS Unlike the other species of *Macaria* on pines, the white pine angle has very little brown color on the head. Wagner et al. (2001) and Wagner (2005) have pictured forms of this caterpillar with considerably more purple, which may be a product of laboratory rearing. We have never encountered the more purplish forms in nature. The white pine angle formerly was known as *Semiothisa pinistrobata*.

Minor Angle (*Macaria minorata*)

DESCRIPTION Green body with marked head, frosted dorsum, and obvious pale stripes. Green head with lobes streaked with dark green (with light green reticulation) and reddish brown; streak on lobes with white borders (extensions of subdorsal and spiracular stripes); greenish thoracic legs, increasingly brown toward tip. Dark green middorsal stripe; bluish white dusting on dorsum; wide, white subdorsal stripe with dark green area below. Broad, bluish white spiracular stripe. Up to 20 mm.

FOOD Eastern white pine; rarely jack, pitch, and red pines.

LIFE CYCLE One to two generations. Pupa overwinters in soil or debris. Mature caterpillar present from July to October.

COMMENTS The mature caterpillar of the minor angle is the smallest species of *Macaria* on pine. Among the species of *Macaria* on eastern white pine, the minor angle has the greatest amount of whitish dusting on the dorsum. The minor angle previously was known as *Semiothisa minorata*.

Hemlock Angle (*Macaria fissinotata*)

DESCRIPTION Green body with darkly marked head, with largely bluish white dorsum, and with pale stripes. Grayish green head with lobes streaked with brown to reddish brown; streak on lobes with dark brown herringbone pattern and with yellow margins (extensions of subdorsal and spiracular stripes); reddish to dark brown thoracic legs. Dark green middorsal stripe distinctly edged with white; bluish white frosting over most of dorsum; white subdorsal stripe with narrow, dark green longitudinal line immediately below. White spiracular stripe tinged with yellow near spiracles; narrow yellowish band at hind margin of segments. Up to 22 mm.

FOOD Eastern hemlock; uncommonly spruces.

LIFE CYCLE One to two generations. Pupa overwinters in soil or debris. Mature caterpillar present from July to November.

COMMENTS Even though the spiracular stripes usually are less distinct in this species than the spruce fir looper, *Macaria signaria*, the identification of these species should be based upon reared adults. Both caterpillars are well camouflaged on the foliage of their food plants. The hemlock angle undoubtedly prefers eastern hemlock, but we have found mature caterpillars of this species on Colorado blue spruce, *Picea pungens*, in Connecticut. The adults reared from the caterpillars were identified by the late D. Ferguson, an expert on the genus *Macaria*. The hemlock angle formerly was known as *Semiothisa fissinotata*.

Spruce Fir Looper (*Macaria signaria*)

DESCRIPTION Green body with marked head, frosted dorsum, and pale subdorsal and spiracular stripes; also purplish form. Bluish green head with lobes streaked with light purple to brown (dark brown herringbone pattern in upper purplish area); streak on lobes with white border above and yellow below (extensions of subdorsal and spiracular stripes); greenish brown thoracic legs, becoming increasingly brown toward tip. Dark green middorsal stripe bordered faintly by bluish green; dorsum mostly frosted with bluish white; white subdorsal stripe with two wavy, dark green longitudinal lines immediately below. Mostly white spiracular stripe with yellow near spiracles; narrow, yellowish band at hind margin of segments. Up to 24 mm.

FOOD Balsam fir, eastern hemlock, and spruces; less commonly eastern larch.

LIFE CYCLE One to two generations. Pupa overwinters in soil or debris. Mature caterpillar present from July to November.

COMMENTS The spruce fir looper also has a brownish purple form that is described by Ferguson (2008) and illustrated by Duncan (2006). The food plants of the spruce fir looper and the hemlock angle, *Macaria fissinotata*, are similar, but the former is much more likely to be the species found on spruces. The spruce fir looper also inhabits coniferous forests in northern Europe and northern Asia where it tends to be an uncommon species (Ferguson 1974, 2008). The North American spruce fir looper formerly was known as *Semiothisa signaria*.

Many-lined Angle (*Macaria multilineata*)

DESCRIPTION Greenish body with dark and pale stripes interrupted by spots. Dark grayish green head; greenish prothoracic shield with large, dark green spot laterally; dark green thoracic legs, becoming increasingly yellow toward tip. Broken, dark green middorsal stripe with irregular white spots in breaks; white subdorsal stripe interrupted by dark olive-green spots that are sometimes extended to form another stripe. Fragmented, white spiracular stripe with dark olive-green spots in gaps; yellowish band on hind margin of segments. Up to 25 mm.

FOOD Atlantic white-cedar and eastern red-cedar.

LIFE CYCLE One to two generations. Pupa overwinters in soil or debris. Mature caterpillar present from June to November.

COMMENTS This species and the similar curve-lined angle, *Digrammia continuata,* closely resemble the foliage of their food plants. Of the two, only the curve-lined angle has reddish marks near the spiracles. Another common caterpillar on cedars is Taylor's cedar looper, *Eupithecia intricata taylorata*. This last species has continuous subdorsal and spiracular stripes, whereas the other two have broken ones. The many-lined angle formerly was known as *Semiothisa multilineata*.

Curve-lined Angle (*Digrammia continuata*)

DESCRIPTION Green body with pale stripes and with reddish spots near spiracles. Green head marked with dark green herringbone pattern on lobes; lateral edges of frons trimmed with greenish white line and spot. Indistinct, grayish middorsal stripe with paired, offset, dark warts bearing hairs between middorsal and subdorsal stripes; wavy, yellow and white subdorsal stripe. Short, usually darkened, oblique line through spiracles; purplish red and greenish yellow on swelling below spiracles, essentially forming broken subspiracular stripe. Up to 25 mm.

FOOD Atlantic white-cedar, eastern red-cedar, and northern white-cedar.

LIFE CYCLE Two generations (at least in southern New England). Pupa overwinters in soil or debris. Mature caterpillar present from June to November.

COMMENTS Ferguson (2008) has considered *Digrammia orillata*, which also is reported from northern white-cedar, to be the same as the species pictured here. Records of *D. orillata* came from specimens collected in northern New England and southern Canada. *Digrammia* species formerly were in the genus *Semiothisa*.

Red-striped Juniper Looper (*Thera juniperata*)

DESCRIPTION Mostly green body with pale and reddish stripes. Yellowish green head with purplish red line down lobes to stemmata and with two small white dots on frons; broad, yellowish band on anterior margin of T1; purplish red thoracic legs. Light blue dorsum, particularly on abdomen; yellowish white subdorsal stripe; purplish red spiracular stripe adjoined to white and yellow subspiracular stripe. Narrow yellowish band at hind margin of segments; yellow stripe down center of venter. Up to 17 mm.

FOOD Common and creeping junipers.

LIFE CYCLE One generation. Egg overwinters on foliage. Mature caterpillar present in August and September.

COMMENTS This caterpillar, which was accidentally introduced from Europe, is cryptic on the foliage of common juniper. It eats not only native junipers, but also introduced ones used in landscape plantings. The red-striped juniper looper apparently is not found very far south of New England. Prentice (1963) has recorded eastern red-cedar as a food plant in southern Canada, but we have never found it on this conifer in New England. Although the native species, *Thera contractata*, also occurs in the Northeast, we did not encounter it in our samples. This very similar native species is illustrated by Wagner (2005).

Juniper Looper (*Eupithecia interruptofasciata*)

DESCRIPTION Slender, green body with pale spiracular stripe. Yellowish green head mottled with reddish brown on lobes; yellowish green thoracic legs. Dark green middorsal stripe; yellow and white spiracular stripe. Yellow annulations on segments; narrow yellow band at hind margin of segments; anal plate usually with brown to reddish brown in center and yellow laterally. Up to 14 mm.

FOOD Common juniper.

LIFE CYCLE One generation. Egg overwinters. Mature caterpillar present from May to July.

COMMENTS One variety of this caterpillar has an indistinct, whitish subdorsal stripe. The juniper looper also has a brownish form, which is pictured by Duncan (2006). Although the juniper looper superficially resembles the red-striped juniper looper, *Thera juniperata*, it lacks the purplish red spiracular stripe.

Taylor's Cedar Looper (*Eupithecia intricata taylorata*)

DESCRIPTION Slender, mostly dark green body with obvious, white subdorsal and spiracular stripes. Green head speckled with small brownish spots; greenish prothoracic shield, increasingly yellow anteriorly; green thoracic legs with yellowish brown near tip. Dark green middorsal stripe; faint, but large, grayish spots between subdorsal stripe and broader spiracular stripe. Usually yellow annulations; narrow yellowish band at hind margin of segments; green anal plate edged with white. Up to 18 mm.

FOOD Atlantic white-cedar, common juniper, northern white-cedar, and possibly other species of Cupressaceae.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from July to September.

COMMENTS Taylor's cedar looper is camouflaged well on the foliage of common juniper. This subspecies is worthy of additional study to determine if populations on different food plants represent the same species; see the discussion in Bolte (1990). Taylor's cedar looper includes the species formerly known as *Eupithecia gibsonata*. Other subspecies of *E. intricata* in Europe also eat plants in the Cupressaceae.

Small Pine Looper (*Eupithecia palpata*)

DESCRIPTION Slender, yellowish body with dark reddish middorsal stripe and pinkish red annulations on segments. Brownish yellow head with reddish tinge. Two or three faint, narrow, longitudinal lines between middorsal stripe and spiracles; light yellow spiracular stripe. Obvious, pinkish red band near hind margin of segments; anal plate darkened in center. Up to 15 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, pines, spruces, and possibly other conifers.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from June to October.

COMMENTS The mature caterpillar of the small pine looper can be found over a period of 5 months on many different trees. Future research may reveal that this species actually is a complex of several species.

Fir Needle Inchworm (*Eupithecia lariciata*)

DESCRIPTION Slender, yellowish brown body marked with mostly purplish stripes, middorsal one usually expanded into triangles; variable amount of purple on body. Grayish yellow head with darkly marked lobes. Middorsal stripe expanded into triangle on some segments and joined to band around A1 to A5 or A6; subdorsal stripe of varying distinctness. Broken spiracular stripe; brownish subspiracular stripe; anal plate trimmed with light yellow. Up to 14 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, spruces, and rarely other conifers.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from June to October.

COMMENTS The fir needle inchworm, which also is called the larch pug, is a Holarctic species that occurs in Eurasia and across North America. In Europe, it eats mainly larch. Because the fir needle inchworm is so variable in color and apparently has mature caterpillars over a period of 5 months, it deserves additional study to determine if it represents just one species. Other color forms are shown by Duncan (2006). In North America, it previously was known as *Eupithecia luteata*.

Fletcher's Larch Looper (*Eupithecia fletcherata*)

DESCRIPTION Slender, brownish body with dorsal diamonds and lateral oblique lines; variable body color. Dark brown head; brown middorsal stripe expanded into diamond on A1 to A5 or A6. Slightly curved, white oblique line above spiracles with purplish to dark brown areas above and below; dark brown subspiracular stripe. Anal plate edged with white posteriorly; dark brown prolegs on A10; whitish, partly speckled venter with reddish brown stripe down center. Up to 13 mm.

FOOD Eastern larch and white spruce; uncommonly red and black spruces.

LIFE CYCLE One generation. Pupa overwinters. Mature caterpillar present from July to September.

COMMENTS This looper is the species of *Eupithecia* most closely associated with larch in northeastern North America. Two other species that occasionally eat larch are the early brown looper, *E. annulata*, and the fir needle inchworm, *E. lariciata*. Both of these caterpillars, however, also feed on many other conifers. The fir needle inchworm usually has a yellowish brown body with purplish markings.

Transverse-banded Looper (*Hydriomena divisaria*)

DESCRIPTION Dull yellow body with dorsal rectangular spots and broad, broken supraspiracular stripe. Orange-brown head with light brown on lobes. Brownish and greenish gray middorsal stripe expanded posteriorly into rectangular patch, especially on A1 to A7. Pinkish brown supraspiracular stripe; narrower, indistinct subspiracular stripe of variable color; black spiracles. Up to 25 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, spruces, and doubtfully pines.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from August to November.

COMMENTS The transverse-banded looper occupies a very loose shelter of silk at its site of feeding.

White-fringed Emerald (*Nemoria mimosaria*)

DESCRIPTION Brownish body with obvious, fleshy, wing-like subdorsal processes. Brown mottled head with angular lobes; small pair of prothoracic tubercles. Dark brown, sometimes broken, middorsal and subdorsal stripes. Forward-pointing, subdorsal flaps on A2 to A4 (and sometimes other segments); each outgrowth with two spines, the first being longer; upward-pointing, paired dorsal tubercles on A8. Light brown oblique line edged with dark brown on side of some segments; light brown subspiracular stripe on abdomen. Up to 15 mm.

FOOD Many trees and shrubs, including balsam fir, eastern hemlock, eastern larch, and spruces.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from August to October.

COMMENTS No other common caterpillar on conifers can be confused with this species. Against a brown or a mottled background, such as a twig or bark, the caterpillar of the white-fringed emerald is cryptic. As the common name suggests, this species develops into a beautiful green moth with a white line through the wings.

Hairstreaks, Elfins, Blues, and Coppers

(Family Lycaenidae)

The stout caterpillars of this large butterfly family often appear slug-like and have a head that can be retracted into the thorax. They are relatively small in size, with most between 12 to 20 mm at maturity. Many have short, dense hairs covering the body. The caterpillars have variable color, although the eastern species on conifers are mainly green with white or yellow markings. This color pattern affords protection by allowing them to blend into their foliar background.

Most of the northeastern members of this family feed upon herbaceous plants, but the hairstreaks eat mainly the leaves of trees and shrubs. The species that are associated with ants have dorsal glands on A7 that produce sugary secretions to feed ants. The ants, in return, protect them.

The adults tend to be marked sharply with red, orange, or various blues, although species on conifers may have duller color. Butterflies of the conifer feeders are among the earliest fliers in the spring. Many adults prefer sunny areas where they drink nectar from blossoms.

Juniper Hairstreak (*Callophrys gryneus*)

DESCRIPTION Slug-like, densely hairy, dark green body with head usually retracted into thorax and with rows of conspicuous pale bars or spots. Dark brown head. Faint, white middorsal stripe; row of white and yellow, oblique subdorsal bars (or spots) and smaller supraspiracular spots. Indistinct, broken, yellowish to greenish white spiracular stripe; slightly fragmented, yellow and white subventral stripe. Up to 15 mm.

FOOD Eastern red-cedar and possibly Atlantic white-cedar.

LIFE CYCLE Two generations (second one is partial). Pupa overwinters in soil or debris. Mature caterpillar present from May to September.

COMMENTS The caterpillars of this species and Hessel's hairstreak, *Callophrys hesseli*, are very similar in appearance and well camouflaged on the foliage of their food plants. In New England, the two caterpillars can be separated by their food plant. In southern New Jersey, adults of the juniper hairstreak sometimes lay eggs on Atlantic white-cedar, suggesting this plant may be eaten in southern areas of the Northeast. The juniper hairstreak formerly was known as *Mitoura gryneus*.

Hessel's Hairstreak (*Callophrys hesseli*)

DESCRIPTION Slug-like, densely hairy, dark green body with head usually retracted into thorax and with rows of pale bars or spots. Yellowish white middorsal stripe; row of white and yellow oblique subdorsal bars. Indistinct, broken, greenish yellow spiracular stripe; fragmented, yellow and white subventral stripe. Up to 15 mm.

FOOD Atlantic white-cedar.

LIFE CYCLE Two generations (second one is partial). Pupa overwinters in debris. Mature caterpillar present from June to September.

COMMENTS The second generation of Hessel's hairstreak may be overlooked because it usually is small. In a coastal swamp in Connecticut, this species has a small second flight of adults every year. Hessel's hairstreak previously was known as *Mitoura hesseli*.

Eastern Pine Elfin (*Callophrys niphon*)

DESCRIPTION Slug-like, densely hairy, dark green body with head usually retracted into thorax and with prominent, pale stripes. Relatively indistinct, greenish white middorsal and spiracular stripes; yellow and white subdorsal and subventral stripes. Up to 15 mm.

FOOD Eastern white, jack, pitch, red, and other (hard) pines.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from May to July.

COMMENTS This caterpillar is very well camouflaged on the needles of pines. The similar western pine elfin, *Callophrys eryphon*, which eats pines, and the bog elfin, *C. lanoraieensis*, which eats black spruce, also are found in the upper Northeast (mainly in New Hampshire and Maine). The western pine elfin is illustrated by Duncan (2006), and the bog elfin is shown by Allen et al. (2005). The eastern pine elfin formerly was known as *Incisalia niphon*.

Tent Caterpillars and Lappet Moths

(Family Lasiocampidae)

The caterpillars in this small family are cylindrical or flattened and tend to be hairy, especially on the sides of the body. Most lasiocampid caterpillars are colorful and marked with stripes. The flattened species, including the one described in this guide, have lappets on their bodies; some mimic bark. Members of this family have a pair of prolegs on A3 to A6 and A10. They are distinguished from caterpillars of other families by the pattern of their crochets and by other subtle characteristics that can best be seen with the aid of a microscope. Most of the species have a projection that is found beneath the anus and between the prolegs on A10. Mature caterpillars are medium to large, ranging from 20 to 80 mm in length.

Lasiocampid caterpillars feed externally on the leaves of many different trees and shrubs, sometimes living gregariously in webs. In northeastern North America, a prominent member of this family is the eastern tent caterpillar, *Malacosoma americanum*, which commonly infests cherry trees. In broad-leaved forests, the forest tent caterpillar, *M. disstria*, sometimes causes severe defoliation. Lasiocampid caterpillars transform to pupae in cocoons that are hidden in leaves, bark, detritus, old webs, and other places.

The moths hold their wings roof-like over their bodies. Most adults have greatly reduced mouthparts and apparently do not feed. The females often are much larger than the males, although they are otherwise similar in appearance. The adults can be attracted to lights.

Larch Tolype (*Tolype laricis*)

DESCRIPTION Grayish, somewhat flattened, body with paired subdorsal tubercles and subspiracular lappets; variable body color. Gray head with darker reticulation; black horizontal line before spiracle on T1. Dorsum with yellowish areas, especially near tubercles, and also with irregular white patches that may extend to spiracles (particularly on A1); transverse black band on T3, revealed especially during movement. Subdorsal tubercles on T3 and A5 (the largest) larger than ones on other segments; tubercles connected with zigzag, speckled, dark gray line. Angular, speckled spiracular stripe, although almost pure black between T3 and A1, A4 and A5, and A6 and A7; black spiracles. Subspiracular row of fleshy lappets with long grayish hairs. Up to 35 mm.

FOOD Many conifers, including balsam fir, eastern hemlock, eastern larch, pines, and spruces.

LIFE CYCLE One generation. Egg overwinters. Mature caterpillar present mainly in July and August.

COMMENTS Franclemont (1973) has reported that this caterpillar is brownish; however, in southern New England, we have seen mainly the mostly grayish form. When this caterpillar rests on grayish bark, it is extremely difficult to see. The adult is known as the larch lappet moth.

Giant Silkworms
(Family Saturniidae)

Giant silkworms are large caterpillars, usually 4 to 10 cm long at maturity, that typically have branching hairs or spines mounted on tubercles, warts, or humps. Their heads are smooth and rounded, whereas in similar families the heads tend to be arched or to bear tubercles. In addition to the body outgrowths, saturniid caterpillars may have hairs elsewhere on the body. They have single pairs of fully developed prolegs on A3 to A6 and A10. Their crochets of two lengths are arranged linearly and parallel to the length of the body.

These caterpillars feed mainly on deciduous trees and shrubs, but a few are associated with conifers. They usually are gregarious when young, and then solitary when older. Giant silkworms usually produce large pellets of frass that often give away their presence. Most spin dense, silken cocoons that can be used to identify the genus, if not the species; some change to pupae in the soil. This family includes several classroom favorites: the luna moth, *Actias luna*, the cecropia moth, *Hyalophora cecropia*, and the polyphemus moth, *Antheraea polyphemus*.

The adults, like those of lasiocampids, have greatly reduced mouthparts and do not feed. They are active during the day, at night, or at dawn or dusk. Like most moths, the males locate females by following the airborne trail of a sexual scent emitted by the female. The adults of the species described here are attracted to lights.

Tuskes et al. (1996) have written a wonderful book about the natural history of the North American species in this family. Anyone who wishes to learn more about Saturniidae definitely should consult this book.

Pine Devil (*Citheronia sepulcralis*)

DESCRIPTION Large, purplish and yellowish brown body with large, paired subdorsal horns on thoracic segments and with conspicuous middorsal one on A8. Brownish head; yellowish brown subdorsal horns on T1 to T3, with pair on T1 smallest and with pair on T2 and T3 curved and mounted on transverse dorsal hump; large, black dorsal patch at juncture of T2 and T3, smaller dark spot between T3 and A1. Subdorsal horns on A1 to A9, with pair on A1 yellowish and other pairs dark brown to black; single horn on A8 equal in size to those on T2 and T3. Downward-curved, black oblique line before black spiracles; lateral area marked with various short, vertical black dashes and broken, horizontal lines; prolegs larger on A10 than on other segments. Up to 90 mm.

FOOD Eastern white, pitch, and other pines.

LIFE CYCLE Usually one generation, but a partial second one in southern New Jersey. Pupa overwinters in soil. Mature caterpillar present mainly in July and August (first generation) and in September and October (partial second generation).

COMMENTS No other caterpillar on conifers resembles this species. Although the pine devil once ranged well into Maine, it is now considered to be extirpated or exceedingly rare north of Pennsylvania and New Jersey. The photographed specimen came from Maryland.

Imperial Moth (*Eacles imperialis imperialis*)

DESCRIPTION Large, hairy, dark brown to grayish black body with many pale dorsal hairs and prominent, yellowish white spiracles; also bright green form. Brownish head with black sides; brown thoracic legs with black base. Spined, paired, dorsal tubercles on T2, T3, and sometimes first few abdominal segments; many long whitish hairs dorsally and shorter, less dense ones laterally. Spiracles ringed with black; short middorsal horn on A9 and A10; prolegs larger on A10 than on other segments. Up to 80 mm.

FOOD Pitch, red, and other hard pines; also many deciduous trees.

LIFE CYCLE One generation. Pupa overwinters in soil. Mature caterpillar present from July to October.

COMMENTS Both the brown and the green form of this caterpillar eat the foliage of deciduous and coniferous trees. Additional color forms are shown by Tuskes et al. (1996) and Wagner (2005), but some of these forms are apparently not found on pines. Like the pine devil, *Citheronia sepulcralis*, this species had disappeared from most of New England by 1960. It does still occur on Martha's Vineyard, Massachusetts. The pine imperial moth, *Eacles imperialis pini*, which usually eats pines, occurs in northern Vermont, northern New York, and southern Canada. Tuskes et al. (1996) have pictured this subspecies, which has white on its dorsal tubercles.

Larch Silkworm (*Hyalophora columbia columbia*)

DESCRIPTION Green body with prominent, paired dorsal tubercles and smaller lateral ones. Green head with bluish labrum and with short dark line at sides of frons; four small black spots in bluish anterior half of prothoracic shield. Spined, reddish and black tubercles on T2, T3, and A1; white dorsal tubercles on A2 to A7 tinged with yellow near tip; large, white middorsal tubercle on A8 with black spots and with yellow tint at tip. White supraspiracular and subspiracular tubercles with blue base; white spiracles; prolegs larger on A10 than on other segments. Up to 90 mm.

FOOD Eastern larch.

LIFE CYCLE One generation. Pupa overwinters in compact, silken cocoon on branch or trunk of tree or shrub. Mature caterpillar present from July to September.

COMMENTS The larch silkworm is a northern subspecies, occurring in the Great Lakes States, northern New York, northern New England, and southern Canada. Records of this subspecies from plants other than eastern larch probably can be attributed to caterpillars that were searching for pupation sites.

Hornworms
(Family Sphingidae)

The caterpillars of this moderate-sized family are medium to large, usually 25 to 90 mm in length at maturity. They typically have a prominent middorsal horn or sometimes a button on A8. The pine-feeding species of *Lapara* lack the horn. The hornworms typically have six to eight shallow creases around each segment. They have five pairs of prolegs, with the last pair flattened to form a triangular area below the anal plate. The crochets of two lengths are aligned parallel to the body axis. Most of the species are hairless except near the prolegs.

The hornworms eat the leaves of trees, shrubs, or herbaceous plants. They usually are cryptically colored with various shades of green or brown; sometimes they have two or more color morphs. Nonetheless, hornworms often reveal themselves to humans by causing extensive foliar damage or by producing by large fecal pellets. The tomato hornworm, *Manduca quinquemaculata*, and the tobacco hornworm, *M. sexta*, are species familiar to most gardeners.

The adults, known as hawk or sphinx moths, have narrow forewings that usually are two to three times longer than wide. The moths, which can fly like hummingbirds, are active during the day or the night, depending upon the species. Most have long mouthparts that allow them to reach deep into a flower to drink its nectar. The adults are regarded as important pollinators of crepuscular or nocturnal flowers. Species of *Lapara*, which fly at night, do not feed. Many species readily come to lights.

Tuttle (2007) recently published a very detailed account of the natural history of species in the United States and Canada. We strongly recommend this book to anyone who seriously is interested in this intriguing family.

Northern Pine Sphinx (*Lapara bombycoides*)

DESCRIPTION Green body with triangular head, mostly purplish brown dorsum, and pale stripes; variable amount of purplish brown dorsally and laterally. Head with yellow streak from top of lobes to stemmata, with inverted dark brown "V" below yellow at crest, and with green laterally. Purplish brown dorsum with yellowish stripe at outer margins; yellow and white subdorsal and subspiracular stripes; area around black spiracles (particularly toward rear of abdomen) and on prolegs with varying amounts of purple or purplish brown. Body speckled with yellow or yellowish white; horn absent. Up to 50 mm.

FOOD Pines, especially in sandy areas or upland forests.

LIFE CYCLE One generation. Pupa overwinters in soil. Mature caterpillar present in August and September.

COMMENTS The pine sphinx, *Lapara coniferarum*, also occurs in the Northeast. According to Tuttle (2007), the caterpillar of the northern pine sphinx has greenish true legs, whereas that of the pine sphinx has orangish legs. Both Wagner (2005) and Tuttle (2007) have illustrated the pine sphinx. Only the northern pine sphinx ranges north of southern Maine. Adults of *Lapara* are attracted to lights.

Northern Heath Sphinx (*Sphinx poecila*)

DESCRIPTION Greenish body with oblique lines on abdomen and with prominent middorsal horn on A8. Dark green head with adjacent greenish yellow and dark green streaks from top of lobes to stemmata. Tiny, hollow, purplish black circles concentrated on dorsum and below spiracles; white oblique lines edged above with purplish black and extending from subdorsal to subspiracular area of A1 to A7; last oblique reaches prominent, mainly dark hook on A8. Thorax and abdomen with a bluish green tint below spiracles; brownish red spiracles rimmed with light yellow. Up to 55 mm.

FOOD Several woody shrubs in heathlands; occasionally eastern larch and possibly white spruce.

LIFE CYCLE One generation. Pupa overwinters in chamber in soil. Mature caterpillar present in August and September.

COMMENTS In the past, some authorities have considered this species to be the apple sphinx, *Sphinx gordius*. Now most agree that the northern heath sphinx and the apple sphinx are distinct species. The two caterpillars can be separated because head of the northern heath sphinx is green with vertical stripes of dark green and that of the apple sphinx is dark green with stripes of light green (Tuttle 2007).

Tussock, Litter, and Underwing Moths
(Family Erebidae)

In a recent radical, but justified, reorganization of the superfamily Noctuoidea, Erebidae was recognized as a large family that included the former families Lymantriidae (tussock moths) and Arctiidae (tiger moths), as well as certain subfamilies the Noctuidae (see Lafontaine and Schmidt 2010). The caterpillars of the Erebidae are very diverse morphologically and ecologically and, thus, are not easily grouped by a single set of characteristics. The adults, however, are united by the venation pattern in their forewings (e.g., Lafontaine and Schmidt 2010) and by molecular similarities (Zahiri et al. 2011). Our discussion of the Erebidae will be limited to three dissimilar subfamilies, Lymantriinae, Herminiinae, and Erebinae, which have species represented in this manual.

Most of the caterpillars in the Lymantriinae, or tussock moths, are hairy with prominent red, yellow, gray, or black tufts of hairs. They have fully developed prolegs on A3 to A6 and A10. Their crochets of uniform length are arranged in a single row that is parallel to the body axis. When the caterpillars mature, they typically are 20 to 65 mm long. These caterpillars can be separated from similar ones by the presence of a dorsal gland on A6 and A7.

Most of the lymantriine caterpillars feed primarily or entirely upon non-coniferous trees and shrubs, but several *Dasychira* species are specialists on conifers in the Pinaceae. Lymantriine caterpillars depicted in this manual usually pupate in a loose cocoon, which is composed of body hairs and silk.

Lymantriine moths fly either during the day, the night, or both, depending upon the species. Females of the gypsy moth, *Lymantria dispar*, have fully developed wings, although they do not fly. Females of *Dasychira* do fly and come readily to lights at night. The non-flying females of *Orgyia* species are unique among North American species in the subfamily because they have their wings reduced to small pads.

The caterpillars in the Herminiinae, or litter moths, tend to be brownish with integumental modifications, including narrow furrows, granules, or other small features. They will feed upon living and dead plant material, but most probably feed upon dead leaves or the fungi upon them. The caterpillars of *Palthis* and a few *Zanclognatha* species, however, do feed primarily upon living foliage. Herminiine caterpillars often are cryptic; they move slowly, if at all, after being disturbed. Both genera that we discuss have their prolegs fully developed. Typically, herminiine species overwinter as caterpillars. Adults of most species come to either lights or bait.

The subfamily Erebinae includes the underwing moths, *Catocala* species, and the zales, *Zale* species, which have similar caterpillars, although the former do not eat conifers. The caterpillars of *Zale* are relatively long and slender, with their bodies tapering posteriorly, with the prolegs on A3 and A4 reduced in size, and with those on A10 directed backward. All of the crochets on the prolegs have the same length. Because they have reduced development of the anterior prolegs, species of *Zale* move with a looping motion, much like that exhibited by geometrid caterpillars. Wagner et al. (in press) have described the appearance and life history of most of the species in eastern North America.

Erebine caterpillars tend to feed upon the foliage of live plants, with most being highly restricted in their food choice. The *Zale* species in this guide are specialists on pines. Most species in this subfamily, including all of the specialists on pines, overwinter as pupae, often in the leaf litter or upper soil. Adults of nearly all species come to bait; some also are readily attracted to lights.

Northern Conifer Tussock Moth (*Dasychira plagiata*)

DESCRIPTION Grayish body with compact tufts of long, dark hairs on T1, A8, and A9, with brush-like, dorsal abdominal tufts, and with other tufts on tubercles. Dark brown head; compact tuft of long, somewhat flattened, black hairs before spiracle on T1, centrally on dorsum of A8, and on supraspiracular tubercle of A9. Large gray to grayish brown tuft on A1 to A4 with intermixed white hairs, especially at margin; dull red dorsal gland on A6 and A7. Subdorsal tuft of short, plumed white hairs on T2 to T3 and on A5 to A8; additional tufts of light gray and plumed, black hairs laterally on thoracic and abdominal segments. Up to 35 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, eastern white pine, spruces, and less commonly hard pines.

LIFE CYCLE One generation. Partly grown caterpillar overwinters. Mature caterpillar present in May and June.

COMMENTS The northern conifer tussock moth and the pine tussock moth, *Dasychira pinicola*, overlap slightly in distribution. The pine tussock moth, which eats hard pines, occurs in the region of Cape Cod, Massachusetts, on Long Island, New York, and in states to the south. It completely replaces the northern conifer tussock moth in southern New Jersey.

White-marked Tussock Moth (*Orgyia leucostigma intermedia*)

DESCRIPTION Hairy, blackish body with compact tufts of long, black plumed hairs on T1 and A8, with white dorsal abdominal tufts, and with colored stripes and spots. Reddish head and prothoracic shield; compact tuft of hairs before spiracle on T1 and middorsally on A8. Broad, black middorsal stripe; large, white dorsal hair tuft on A1 to A4; reddish dorsal gland on A6 and A7. Yellowish subdorsal stripe, broader after dorsal tufts; light gray supraspiracular and subspiracular hair tufts on partly or wholly yellow tubercles; yellowish subspiracular stripe reduced to yellow spots on abdomen. Up to 35 mm.

FOOD Many woody plants, including balsam fir, eastern hemlock, eastern larch, and spruces.

LIFE CYCLE Apparently two generations. Egg overwinters in egg mass usually on empty female cocoon. Mature caterpillar present from May to September, with generations well separated at any one place.

COMMENTS During outbreaks, this caterpillar has damaged balsam fir and other conifers in plantations. Another subspecies, *Orgyia leucostigma leucostigma*, occurs in the southeastern United States. The females of the white-marked tussock moth are flightless because their wings are reduced to minute pads. The males fly during the night.

Rusty Tussock Moth (*Orgyia antiqua nova*)

DESCRIPTION Blackish body with compact tufts of long, dark hair on T1, A2, and A8, with brush-like, dorsal abdominal tufts, and with other tufts on brightly colored spots. Black head; reddish prothoracic shield with black wedge in center and with yellowish and whitish hairs projecting forward from anterior margin. Mostly black dorsum bordered by grayish white, especially on A6 to A8; compact tuft of plumed, black hairs before spiracle on T1, below spiracle on A2, and middorsally on A8; large, yellowish brown dorsal tuft on A1 to A4; red dorsal gland on A6 and A7. Many segments ringed wholly or partly by low reddish tubercles with mostly yellow hairs. Up to 35 mm.

FOOD Many trees and shrubs, including balsam fir, eastern hemlock, eastern larch, pines, spruces, and probably other conifers.

LIFE CYCLE One generation. Egg overwinters usually in egg mass on empty female cocoon. Mature caterpillar present from June to August.

COMMENTS The dorsal abdominal tufts of this species sometimes are mostly white (Rose and Lindquist 1994, Wagner 2005). Another subspecies, *Orgyia antiqua antiqua*, is very widespread in Europe where it feeds upon many deciduous trees and shrubs. The females of the rusty tussock moth are essentially wingless. Unlike the males of the white-marked tussock moth, *O. leucostigma intermedia*, those of the rusty tussock moth are active during the day.

Gypsy Moth (*Lymantria dispar*)

DESCRIPTION Yellowish brown body with spines and hairs mounted on colorful tubercles and with darkly speckled dorsum. Yellowish brown head marked with dark brown except between lobes. Discontinuous, yellowish brown middorsal stripe speckled with black; black-spined, paired subdorsal tubercles that are blue from T1 to A2 and red from A3 to A8; reddish dorsal gland (in middorsal stripe) on A6 and A7. Brown and red supraspiracular tubercles with black spines and long, dull yellow hairs; brownish subspiracular tubercles with long, dull yellow hairs. Orange-brown venter with dark brown stripe down center. Up to 50 mm (male) or 55 mm (female).

FOOD More than 500 trees and shrubs, but especially oaks; eastern hemlock, eastern larch, eastern white pine, and other species of Pinaceae, particularly during outbreaks.

LIFE CYCLE One generation. Egg overwinters on bark in large egg mass embedded with female abdominal hairs. Mature caterpillar present from June to August.

COMMENTS The non-native gypsy moth is the most notorious defoliator of broad-leaved trees in the Northeast. In many northeastern areas, however, populations have not reached outbreak levels during the last 20 years because the caterpillars have suffered severe mortality from the introduced fungus, *Entomophaga maimaiga*. The early instars disperse aerially by ballooning on a strand of silk.

Spruce Harlequin (*Palthis angulalis*)

DESCRIPTION Brownish body with coarse cuticle, dark dorsal triangles, and dorsal hump on A8. Dark purplish brown head. Very dark brown middorsal stripe expanded into triangle on A1 to A6 and into hour-glass-shaped mark on A8. Prominent, white oblique line laterally on A7 and faint, widely separated, parallel pair on A1 to A6; lower oblique lines disrupt broad, dark brown spiracular stripe; dark brown subventral area. Up to 20 mm.

FOOD Balsam fir, white spruce, and less commonly other conifers; also many other woody and herbaceous plants and possibly dead plant material.

LIFE CYCLE Apparently two generations in southern New England, and two or three generations in southern New Jersey. Either caterpillar or pupa overwinters. Mature caterpillar present from June to October.

COMMENTS Additional study is needed to determine whether this caterpillar prefers conifers or other types of plants.

Early Zanclognatha (*Zanclognatha cruralis*)

DESCRIPTION Grayish body with dull yellow speckles, dull red reticulation, and dorsal rows of small dark spots. Light brown head with darker brown reticulation and sometimes with small spots. Dorsum and lower half of abdomen with small, dark brown spots; yellowish orange band at posterior margin of segments contrasts with ground color. Up to 25 mm.

FOOD Balsam fir, eastern hemlock, spruces, and other conifers.

LIFE CYCLE One generation in New England. Mature caterpillar overwinters in chamber in soil or debris. Mature caterpillar present on tree in September and October.

COMMENTS We have reared this caterpillar from the second to the last instar on the live needles of eastern hemlock. Wagner et al. (1997), Wagner (2005), and others have suggested that the caterpillar will eat lichens, dead leaves, and other organic matter.

Pine False Looper (*Zale duplicata*)

DESCRIPTION Purplish brown body with paired tubercles on A8. Gray head with purplish brown reticulation and with white chevron on each lobe. Fragmented, multicolored, wavy middorsal stripe edged with beaded white line; dark purplish brown diagonal spot on posterior half of most segments. Transverse dorsal ridge on A8 and A9 with paired tubercles; smaller tubercles on ridge on A9; spiracular swellings with tiny white spots. Prolegs on A3 and A4 reduced in size, and those on A10 directed backward and marked with dark brown line laterally. Up to 30 mm.

FOOD Eastern white pine and rarely other pines.

LIFE CYCLE One generation. Pupa overwinters in soil. Mature caterpillar present in June and July.

COMMENTS The final instar of this caterpillar and the next four species of *Zale* are bark mimics in some of their forms. Other brownish forms of the pine false looper are pictured by Duncan (2006). Species of *Zale* are notoriously difficult to separate because they are variable in pattern and sometimes color, although the pine false looper usually is the most uniformly colored and the smallest at maturity. A similar species, *Zale largera*, which eats jack pine in northern New England, apparently is a distinct species.

Washed-out Zale (*Zale metatoides*)

DESCRIPTION Speckled and mottled, brown and gray body with pale middorsal stripe expanded laterally on many segments. Gray head with dark brown reticulation, with white chevron on each lobe, and with curved, dark brown line through stemmata. Grayish white middorsal stripe expanded near hind margin of most segments and speckled with brown especially in front of expanded portion; transverse dorsal ridge on A8 with distinct, paired, brownish tubercles; smaller, paired tubercles on other segments; discontinuous subdorsal stripe appearing as series of dark brown spots. Narrow, undulating, dark brown spiracular stripe with darkest sections resembling oblique lines through spiracles. Prolegs on A3 and A4 reduced in size, and those on A10 directed backward and marked with dark brown line laterally. Up to 35 mm.

FOOD Jack, pitch, red, and other hard pines.

LIFE CYCLE One generation. Pupa overwinters in soil. Mature caterpillar present in July and August in southern New England, and mainly in June and July in southern New Jersey.

COMMENTS We have encountered several color forms of this caterpillar. The "southern" strain in the Pine Barrens of New Jersey is mostly green with pale stripes. The washed-out zale prefers to eat young pine needles. In New Jersey and Pennsylvania, the caterpillars of *Zale bethune*i and *Z. metata* also are found on hard pines.

Gray Spring Zale (*Zale submediana*)

DESCRIPTION Speckled, brown, gray, and white body with pale middorsal stripe, with dark tubercles on A8, and with light-colored and dark arched areas on side of abdomen; variable amount and shades of gray. Grayish brown head with dark brown reticulation, with white chevron on each lobe, and with curved, white line laterally. Multicolored, middorsal stripe expanded posteriorly on segments; enlarged sections of stripe surrounded by dark brown spot that extends to subdorsal region; arched, white lateral patches underlain by arched, purplish brown areas. Low, transverse dorsal ridge on A8 with paired, dark brown tubercles; much smaller ridge with tubercles on other segments. Prolegs on A3 and A4 reduced in size, and those on A10 directed backward and marked with dark brown line laterally. Up to 40 mm.

FOOD Jack, pitch, red and probably other hard pines.

LIFE CYCLE One generation. Pupa overwinters in soil. Mature caterpillar present from May to August.

COMMENTS Some caterpillars of this species are darker gray than the one pictured here. Among the bark mimics, the form described here is the most mottled. The gray spring zale prefers the young needles of pines. The photographed caterpillar was reared from an egg laid by a female captured in southern New Jersey.

Gray-banded Zale (*Zale squamularis*)

DESCRIPTION Speckled, brownish body with contrasting broad, pale and dark stripes and with distinct tubercles on A8. Light brown head with dark brown reticulation, with white chevron on each lobe, and with curved, white line laterally. Grayish white middorsal stripe expanded posteriorly on each segment and edged with wide, dark brown stripe; grayish subdorsal, brown spiracular, and grayish subspiracular stripes. Low, transverse dorsal ridge on A8 with paired tubercles; smaller tubercles on ridge on A9. Prolegs on A3 and A4 reduced in size, and those on A10 directed backward and marked with dark brown line laterally. Up to 35 mm.

FOOD Pitch and possibly other pines.

LIFE CYCLE Two to three generations (last two are partial) in southern New Jersey. Pupa overwinters in soil. Mature caterpillar present from June to October.

COMMENTS This caterpillar prefers the mature needles of pines. It apparently reaches the northern limit of its range on Long Island, New York, and in northeastern Pennsylvania. The photographed caterpillar was reared from an egg laid by a female captured in southern New Jersey.

Oblique Zale (*Zale obliqua*)

DESCRIPTION Speckled, grayish brown body with contrasting broad, pale and dark stripes. Grayish brown head with dark brown reticulation, with white chevron on each lobe, and with curved, white line laterally. White middorsal stripe expanded posteriorly on segments and broadly margined with dark brown stripe; low, transverse dorsal ridge on A8 with paired tubercles; smaller tubercles on ridge on A9; grayish subdorsal stripe. Dark brown spiracular stripe; gray subspiracular stripe; prolegs on A3 and A4 reduced in size, and those on A10 directed backward and marked with dark brown line laterally. Up to 40 mm.

FOOD Jack, pitch, and red pines.

LIFE CYCLE One generation in New England. Pupa overwinters in soil. Mature caterpillar present from July to September.

COMMENTS This caterpillar prefers the mature needles of pines. The photographed caterpillar was reared from an egg laid by a female captured in southern New Jersey.

Buchholz's Zale (*Zale buchholzi*)

DESCRIPTION Reddish brown and green body with pale longitudinal lines and stripes. Reddish brown head with white streak on each lobe (extension of subdorsal stripe) and with curved, white line behind stemmata. Mainly green middorsal stripe edged with white; white subdorsal and thin supraspiracular stripes that outline yellowish to greenish brown area; broad, brown spiracular stripe; narrow, white subspiracular stripe. Low, transverse dorsal ridge on A8 and A9 with small, paired tubercles. Prolegs on A3 and A4 reduced in size, and those on A10 directed backward and marked with indistinct brown line laterally. Up to 40 mm.

FOOD Pitch and other hard pines.

LIFE CYCLE One generation. Pupa overwinters in soil. Mature caterpillar present from May to July.

COMMENTS This caterpillar feeds mainly upon new growth; its first instar sometimes bores into small needles. Buchholz's zale reaches its northern limit in the Pine Barrens of New Jersey. The photographed caterpillar was reared from an egg laid by an adult captured in southern New Jersey.

Brown-spotted Zale (*Zale helata*)

DESCRIPTION Mostly green body with broad, dark spiracular stripe and pale middorsal and subdorsal stripes; variable body color. Greenish brown head with brownish reticulation, with white chevron on each lobe, and with curved, white line behind stemmata; greenish thoracic legs. White middorsal, subdorsal (broadest of three), and subspiracular stripes; brownish green spiracular stripe; most segments with slight spiracular swelling having tiny white spots. Very low, transverse dorsal ridge on A8 with paired tubercles; ridge on A9 with smaller tubercles. Prolegs on A3 and A4 reduced in size, and those on A10 directed backward and marked with faint, brown line laterally. Up to 35 mm.

FOOD Eastern white, pitch, red, and other pines.

LIFE CYCLE One generation. Pupa overwinters in soil. Mature caterpillar present mainly in June and July.

COMMENTS This species also has a striped, mostly brown form (Wagner 2005) and a reddish brown form (see below). The mostly green form pictured above and the northeastern pine zale, *Zale curema*, are concealed among the needles of pines. The striped, greenish species of *Zale* often rest on needles with their brownish heads near the branch, which further enhances their resemblance to the food plant. The brown-spotted zale prefers to eat young needles.

Northeastern Pine Zale (*Zale curema*)

DESCRIPTION Green body with brownish head and pale stripes. Grayish green head with brown reticulation (making the head appear brown), with white streak (extension of subdorsal stripe) on each lobe, and with curved, white line behind stemmata; mostly brown thoracic legs. Green middorsal stripe trimmed with white; broad, white subdorsal stripe; very faint, whitish supraspiracular stripe; yellowish white spiracular stripe. Low, transverse dorsal ridge on A8 with small, paired tubercles; small ridge on A9 with barely visible tubercles. Prolegs on A3 and A4 reduced in size, and those on A10 directed backward and marked with brown line laterally. Up to 35 mm.

FOOD Pitch and possibly other hard pines.

LIFE CYCLE One generation. Pupa overwinters in soil. Mature caterpillar present in June and July.

COMMENTS This caterpillar prefers to eat the young needles of pine. The photographed caterpillar was collected on pitch pine in Connecticut. This species tends to be uncommon.

Cutworms, Armyworms, and Their Kin
(Family Noctuidae)

The caterpillars in this large family display considerable diversity in their structure and life history; a single characteristic cannot be used to identify them. However, most are relatively stout, medium-sized caterpillars between 20 and 30 mm in length at maturity. The species that eat conifers usually are cryptic, generally being green, gray, or brown. Noctuid caterpillars generally lack protuberances and tufts of hairs, but the species of *Acronicta* and *Panthea* shown in this guide are relatively hairy. Most noctuid caterpillars have prolegs on A3 to A6 and A10; a few lack prolegs on A3, A4, or both (e.g., *Syngrapha*) or have their anterior prolegs reduced in size. The crochets on the prolegs tend to be arranged in a linear series.

Noctuid caterpillars eat grasses, herbs, shrubs, and broad-leaved and coniferous trees; a few eat decaying material. Some bore into the stems of grasses and other herbaceous plants. Several migratory species are significant crop pests, but no noctuid species is an important pest of trees in eastern forests. Most of the species that eat the foliage of northeastern trees specialize on new spring growth, at least in their early instars. Relatively few prefer conifers, and most that do are feeding specialists. Overwintering stages among species on conifers include caterpillars, pupae, and adults. Wagner et al. (in press) discusses the appearance and the biology of many of the noctuid caterpillars in eastern North America.

The moths typically are gray or brown, but those of some groups are brightly colored. Most have a kidney-shaped spot on their forewings. Adults of many species can be attracted to lights or bait.

Abstruse False Looper (*Syngrapha abstrusa*)

DESCRIPTION Green body with pale stripes of varying width. Yellowish green head. Wide, dark green middorsal stripe bordered by broad white stripes; narrower, white subdorsal stripe; white and yellow spiracular stripe with yellow near dark yellow spiracles. Minute black spots circle segments, but visible mainly between subdorsal and spiracular stripes; prolegs only on A5, A6, and A10. Up to 25 mm.

FOOD White spruce; possibly jack pine and other conifers.

LIFE CYCLE One generation. Partly grown caterpillar overwinters. Mature caterpillar present in May and June.

COMMENTS This species is very closely related to the spruce climbing cutworm, *Syngrapha alias*. Lafontaine and Poole (1991) have noted that the abstruse false looper is found in well-drained habitats, whereas the spruce climbing cutworm is mainly associated with wetter, often boggy, areas. In Connecticut, the abstruse false looper is commonly found in plantations of white spruce on well-drained soils.

Angulated Cutworm (*Syngrapha rectangula*)

DESCRIPTION Green body with pale stripes of varying width. Yellowish green head. Wide, dark green middorsal stripe bordered by broad white stripes of about same width; narrower, white subdorsal stripe; mostly yellowish white spiracular stripe. Minute black spots circle segments, but visible mainly between subdorsal and spiracular stripes. White spiracles; prolegs only on A5, A6, and A10. Up to 25 mm.

FOOD Balsam fir, eastern hemlock, spruces, and less commonly other conifers.

LIFE CYCLE One generation. Partly grown caterpillar overwinters. Mature caterpillar present in May and June.

COMMENTS In addition to the two species of *Syngrapha* described in this manual, the spruce climbing cutworm, *Syngrapha alias*, and the spruce false looper, *S. viridisigma*, eat conifers in the Pinaceae in the Northeast. Only subtle differences in the color and the width of stripes may separate the caterpillars of these four *Syngrapha* species. The spruce climbing cutworm and the spruce false looper are pictured by Duncan (2006).

Comstock's Sallow (*Feralia comstocki*)

DESCRIPTION Dark green body with bluish bloom on dorsum, with prominent, bicolored spiracular stripe, with pale middorsal and subdorsal stripes, and with circular subventral spots. Green head marked with dark brown at sides of frons; mostly reddish brown thoracic legs. Light yellow middorsal stripe; white subdorsal stripe; wide spiracular stripe that is red above and white and yellow below; subdorsal and spiracular stripes interrupted or constricted where segments meet. Body above spiracular stripe dusted with light blue; subventral row of yellowish spots. Up to 35 mm.

FOOD Balsam fir, eastern hemlock, spruces, and possibly other conifers.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from June to September.

COMMENTS The handsome greenish adults of this and other *Feralia* species are very effective mimics of the greenish lichens on the tree trunks of conifers. Adults of the three species of *Feralia* figured in this manual do not feed as adults.

Red-marked Caterpillar (*Feralia jocosa*)

DESCRIPTION Green body with conspicuous, bicolored spiracular stripe, with pale middorsal and subdorsal stripes, with elongate subventral spots, and with dimpled cuticle. Light bluish green head; reddish brown thoracic legs. White middorsal and subdorsal stripes; broad spiracular stripe that is red above and white and yellow below; subdorsal and spiracular stripes interrupted or constricted where segments meet. Light yellow subventral stripe broken into oblong spots. Up to 35 mm.

FOOD Balsam fir, eastern hemlock, spruces, and possibly other conifers.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from May to July.

COMMENTS This species is distinguished from Comstock's sallow, *Feralia comstocki*, by the absence of dark marks on the head, by the broken spiracular stripe, by the elongate shape of the subventral spots, and by the dimpled texture of the cuticle. The major sallow, *F. major*, occurs mainly on pine in the Northeast.

Major Sallow (*Feralia major*)

DESCRIPTION Dark green body with prominent, bicolored spiracular stripe and with pale middorsal, subdorsal, and subventral stripes. Light green head; dark reddish brown thoracic legs. White middorsal and subdorsal stripes; wide spiracular stripe that is narrowly red above and broadly white below; yellowish white subventral stripe usually broken where segments meet. Up to 35 mm.

FOOD Eastern white pine, pitch pine, and possibly other conifers.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar probably present from May to July.

COMMENTS This caterpillar can be separated from the other two *Feralia* species by the evenness of its subdorsal and spiracular stripe and by its food plant.

Lemmer's Pinion (*Lithophane lemmeri*)

DESCRIPTION Green body strikingly marked with broken, pale stripes and with light-colored spots of different sizes. Green head with small white spot near stemmata; prothorax marked with white and yellow spots. Yellowish middorsal stripe broken at middle of segment; two small white spots on each segment between middorsal and subdorsal stripes; yellow and white subdorsal stripe fused with white, almost perpendicular, bars capped in black. Fragmented, spiracular stripe composed of small white and larger yellow spots on each segment; yellow spots of stripe fused to slanted, white subspiracular bars, especially on abdomen; black spiracles; white subventral spots. Up to 30 mm.

FOOD Atlantic white-cedar and eastern red-cedar.

LIFE CYCLE One generation. Adult overwinters. Mature caterpillar present in June and July in southern New Jersey.

COMMENTS The elaborate markings of this caterpillar make it remarkably well camouflaged on the foliage of cedars. This species apparently is now absent in New England, although it once was reported from Connecticut. In northern New England, the caterpillar of *Lithophane thujae* eats northern white-cedar, and that of *L. lepida* feeds upon jack, pitch, and red pines. Another species, *L. adipel*, formerly considered a subspecies of *L. lepida*, is associated with hard pines in the Pine Barrens of New Jersey and in more southern areas.

Nameless Pinion (*Lithophane innominata*)

DESCRIPTION Brownish body with indistinct stripes and dark dorsal chevrons on most segments. Light brown head mottled with dark brown on lobes; prothoracic shield with central dark brown rectangle. Faint, light brown middorsal, subdorsal, and spiracular stripes edged in dark brown; middorsal stripe joined to thicker, diagonal dark brown bars that resemble chevrons from above (most distinct one on A8). Grayish area below spiracles with various dark linear marks; gray venter. Up to 30 mm.

FOOD Many broad-leaved trees; occasionally balsam fir, eastern hemlock, spruces, and other conifers.

LIFE CYCLE One generation. Adult overwinters usually in debris on ground. Mature caterpillar present mainly in June and July.

COMMENTS Before it molts to its final instar, this caterpillar can be grayish brown (Duncan 2006), grayish green, or green. The nameless pinion uses an exceptionally large number of food plants.

Woodgrain (*Morrisonia latex*)

DESCRIPTION Brownish body with lighter brown on dorsum and below spiracular stripe and with dorsal chevrons of variable distinctness. Light brown head with lobes marked with dark brown reticulation and with dark vertical line from top to frons; mostly dark brown prothoracic shield with white spot laterally. Broken, dark brown middorsal stripe blended with dark brown diagonal bars to form chevrons that contrast with lighter brown background. Faint, dark brown subdorsal stripe and distinct, uneven spiracular stripe; brown (or sometimes gray) below spiracular stripe much lighter than brown immediately below chevrons. Up to 30 mm.

FOOD Many broad-leaved trees and shrubs; occasionally eastern hemlock, eastern larch, eastern white pine, pitch pine, and probably other species of Pinaceae.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from June to August.

COMMENTS This caterpillar is distinguished from the confused woodgrain, *Morrisonia confusa*, by its brown color. The reticulation on the head can be used to separate the woodgrain from the nameless pinion, *Lithophane innominata*. Wagner (2005) has depicted the color of an earlier instar of the woodgrain. Until recently, the woodgrain was known as *Polia latex*.

Confused Woodgrain (*Morrisonia confusa*)

DESCRIPTION Speckled, greenish gray body with contrasting dark head and with reddish supraspiracular spots, especially on thorax. Brownish head with dark brown lobes outlined in light brown. Usually intermittent, light gray middorsal, subdorsal, and spiracular stripes, the last the most visible. Up to 30 mm.

FOOD Many broad-leaves trees and shrubs; occasionally eastern hemlock, pitch pine, and other conifers.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from June to November, perhaps not feeding during the entire period.

COMMENTS The next to last instar of this caterpillar usually has a bright orange head and conspicuous, reddish purple spots above the spiracles (Wagner et al. 1997, Wagner 2005). On broad-leaved trees and shrubs, this solitary caterpillar makes a feeding nest by webbing one or two leaves together. Its feeding habit on conifers is unknown.

White Pine Cutworm (*Xestia badicollis*)

DESCRIPTION Yellowish green body with tiny, yellowish white speckles and with dark spiracular and other pale stripes; variable body color. Greenish head. Faint, narrow middorsal stripe; white subdorsal stripe; narrow, dark green spiracular stripe over broad, speckled, yellowish white subspiracular stripe. Narrow, fragmented, white subventral stripe; green venter. Up to 25 mm.

FOOD Eastern white pine; less commonly balsam fir, eastern hemlock, eastern larch, white spruce, and probably other conifers.

LIFE CYCLE One generation. Partly to full-grown caterpillar overwinters in southern New England. Mature caterpillar usually present on tree from May to July and sometimes during late fall in New England.

COMMENTS This caterpillar also has brown, grayish brown, and grayish green forms (Wagner 2005). The variable climbing caterpillar, *Xestia elimata*, and another cutworm, *X. praevia*, also have variable color and eat some of the same conifers as the white pine cutworm. The three species have overlapping distributional ranges in New England. In addition, *X. perquiritata* is found in northern New York, New England, and southern Canada where it apparently eats balsam fir and white spruce. Duncan (2006) has figured the caterpillars of both *X. praevia* and *X. perquiritata*. Until more caterpillars are examined and reared to adults, we hesitate to suggest ways to separate the *Xestia* species. Both *Xestia* species described in this manual previously were considered to be in the genus *Anomogyna*.

Variable Climbing Caterpillar (*Xestia elimata*)

DESCRIPTION Speckled, grayish brown body with dark brown spiracular stripe; variable body color. Brown head with dark brown streak down lobes to frons (extension of subdorsal stripe) and with reticulation elsewhere. White middorsal stripe; remainder of dorsum light grayish brown with row of paired, offset, dark brown spots on each side of segments; intermittent, white subdorsal stripe trimmed with dark brown mainly above. Distinct, dark brown spiracular stripe; body lightly speckled with white laterally; light brown or grayish brown below yellowish spiracles. Up to 30 mm.

FOOD Pitch, red, and other hard pines.

LIFE CYCLE One generation. Partly grown to mature caterpillar overwinters in soil or debris. Mature caterpillar present on foliage in October and from April to June in New England, and from October to April in southern New Jersey.

COMMENTS The mature caterpillar of this species also has a common grayish brown form and a scarce green form. This species has another appropriate common name, the chameleon caterpillar. Normally, the brownish last instars of *Xestia* species feed at night. Occasionally, the last instar of the variable climbing caterpillar will climb trees to feed during exceptionally warm periods in the winter. Before forming a pupa, this caterpillar constructs a chamber in the soil where it may remain dormant for 2 to 8 months. In some areas, the last instars of *Xestia* are easily collected at sugar baits in the fall and the spring.

Fir Harlequin (*Elaphria versicolor*)

DESCRIPTION Brown and gray body with swollen T3 and A1, with light-colored abdominal patches of various sizes, and with distinctive hump on A8. Light brown head with narrow and broad, dark brown streaks on lobes and with narrow, curved line behind stemmata. White middorsal stripe expanded downward on A1, A4, and A8; broken, black spiracular stripe becoming solid and wider on A7 and A8. Up to 20 mm.

FOOD Probably algae or lichens on bark of balsam fir, eastern hemlock, eastern larch, eastern red-cedar, pines, spruces, and other conifers; also occasionally foliage of these trees.

LIFE CYCLE Apparently two generations in southern New England, and two or three generations in southern New Jersey. Pupa overwinters in soil or debris. Mature caterpillar present from June to October.

COMMENTS Although this distinctive caterpillar may not eat the foliage of conifers regularly, it will eat needles in captivity. We have included the fir harlequin in this manual because we encountered it frequently.

Tufted Spruce Caterpillar (*Panthea acronyctoides acronyctoides*)

DESCRIPTION Black and white body with pale tubercles that bear compact tufts of long hairs or less dense tufts of shorter hairs. Blackish head with some white marks. Prominent, paired, white dorsal hair tufts on T1, A1, and A8; smaller, more sparsely haired tufts on low tubercles that encircle most segments. White middorsal stripe variably expanded over anterior half of most segments; white spot near subdorsal tubercles. Faint, broken, white supraspiracular stripe; angular, white marks extend from subspiracular tubercle upward to margins of segments. Up to 35 mm.

FOOD Balsam fir, eastern hemlock, eastern larch, pines, and spruces.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present from July to September.

COMMENTS In the Northeast, this species occurs mainly in northern areas of New England and New York.

Tufted White Pine Caterpillar (*Panthea furcilla furcilla*)

DESCRIPTION Reddish brown body with four pairs of compact dorsal tufts of long hairs and with pale spots near spiracles; also black form. Grayish head mottled with dark brown. Prominent, compact dorsal tufts of mostly black hairs on T1, T2, A1, and A8, some hairs broadened toward tip; less compact tufts of shorter hairs of variable color on low tubercles in other areas. Broken, blackish subdorsal stripe speckled with white; spiracles in dark gray to black patch over white oblique mark. Up to 35 mm.

FOOD Eastern larch, pines, and spruces.

LIFE CYCLE Apparently two generations. Pupa overwinters in soil or debris. Mature caterpillar present from July to September.

COMMENTS The dark form of this species (see below) can be distinguished from the tufted spruce caterpillar, *Panthea acronyctoides acronyctoides*, by its long hair tufts on T2. Dark forms of both species have pale hairs. In the mid-Atlantic region, *P. furcilla furcilla* intergrades with *P. furcilla australis*, a more southern subspecies (Anweiler 2009).

Lanceolate Dagger Moth (*Acronicta lanceolaria*)

DESCRIPTION Light green body with black dorsum and with pale hairs on tubercles. Mostly green head. Broad black stripe on dorsum between uppermost rows of tubercles; tubercles aligned in five rows and clothed with many white hairs. Dashed, black supraspiracular and spiracular stripes; black spiracles; yellow band on hind margin of segments. Up to 35 mm.

FOOD Many woody shrubs; uncommonly eastern larch, pines, and possibly other conifers.

LIFE CYCLE One generation. Pupa overwinters in soil or debris. Mature caterpillar present in June and July.

COMMENTS Ives and Wong (1988) have illustrated a western variety of this caterpillar with mostly yellow hair. Although this species is widespread in the East, its adults are rare in collections.

Glossary of Specialized Terms

Abdomen: Last section of the body of a caterpillar that usually is composed of 10 visible segments (A1 to A10) and that follows the leg-bearing thoracic segments (see Figures 1 and 2).

Anal comb: Pronged fork generally located behind the anal plate and near the anus; comb-like structure used to eject frass.

Anal plate: Sometimes hardened area on the top of the last abdominal segment (A10), often distinctly colored in the caterpillars in the Tortricidae (see Figures 1 and 2).

Annulations: Shallow creases that ring especially the abdominal segments.

Antenna (plural: **antennae**)**:** Elongate sensory structure located between the stemmata and clypeus or labrum near the bottom of the head of a caterpillar (see Figure 3).

Anterior: Toward the front or the head of a caterpillar.

Band: Transverse, colored strip that may encircle a segment of a caterpillar.

Chevron: Pattern having the shape of a "V" or an inverted "V."

Clypeus: Area or plate on the front of the head between the frons and the labrum (see Figure 3).

Conifer: Tree or shrub (Order Coniferales) that is mostly evergreen and bears cones (deciduous larches and non-cone bearing yews are exceptions).

Crochets: Hook-like claws on the ends of the abdominal prolegs that are used by the caterpillar to cling to leaves, bark, silk, and other substances (see Figures 1 and 2).

Cryptic: Similar to the background; camouflaged.

Cuticle: Skin or integument of a caterpillar.

Dorsal: On the top or back of a caterpillar; above.

Dorsal glands: In certain species of Erebidae, eversible, probably defensive, organs usually in the center of the dorsum of A6, A7, or both of a caterpillar; in the Lycaenidae, organs on A7 that produce sugary secretions to attract ants who, in return, protect the caterpillar.

Dorsum: Upper side or back of a caterpillar.

Family: Category in animal classification that is above the genus and tribe and below the order; group of genera that share similar characteristics. (Scientific family names of insects always end in -idae).

Frass: Pellet-like excrement of a caterpillar.

Frons (or **frontal triangle**)**:** Triangular plate on the front of the head that lies above the clypeus (see Figure 3).

Hard pines: Species of pines (such as jack, pitch, and red pines) that have hard wood and have needles in bundles of two or three.

Head: Fused anterior segments that bear the mandibles, antennae, eyes, and other sensory structures (see Figures 1-3).

Herringbone: Pattern made up of rows of parallel lines in which any two adjacent rows slope in opposite directions.

Holarctic: Biogeographical region including the northern parts of the New and the Old World; the Nearctic and the Palearctic regions combined.

Horn: Rigid and pointed cuticular outgrowth, especially on the thorax or abdomen of caterpillars in the Saturniidae and the Sphingidae.

Instar: Caterpillar between two successive molts. Typically the instars are numbered in sequence from the first to the last.

Labrum: Upper lip attached dorsally to the clypeus; structure used to help a caterpillar position foliage for eating (see Figure 3).

Lappets: Body lobes or outgrowths usually in the subspiracular or subventral region.

Larva (plural: **larvae**)**:** Caterpillar stage; in Lepidoptera, the feeding stage between the egg and the pupa.

Lateral: On or toward the side of a caterpillar; used by some to describe the position of a longitudinal stripe of a caterpillar.

Line: Narrow, elongated mark that usually extends discontinuously or continuously for one to a few segments; a very narrow longitudinal mark that touches or runs near a wider longitudinal stripe.

Lobe: Typically rounded area that is above the eyes on each side of the head of a caterpillar (see Figure 3).

Looper: Caterpillar in the Geometridae or the Noctuidae with some of its prolegs reduced or absent, requiring it to move by looping its body forward.

Mandibles: Tooth-like jaws of caterpillars that are used to tear and chew foliage and other food material (see Figure 3).

Mature caterpillar: Caterpillar of the final instar; the instar that precedes pupation.

Middorsal: Along the middle of the back; usually used to describe the position of a longitudinal stripe of a caterpillar (see Figure 4).

Mine: Chamber, usually inside a needle or between the upper and lower leaf surfaces that is created by the feeding of a caterpillar and that often is occupied by it; when a caterpillar eats tissue from the inner needle or leaf while reaching below the surface or while occupying a hollow where the tissue has already been consumed.

Molt: To shed the old skin or cuticle to reveal the new, larger one below.

Oblique: Not perpendicular or parallel to the body axis; usually used to describe a slanted, lateral mark on abdominal segments, such as in many caterpillars in the Sphingidae.

Order: Category in animal classification that is above the family and below the class; group of families that share similar characteristics. (Scientific names of insect orders end in -a).

Posterior: Toward the rear of a caterpillar; behind or rear.

Prolegs: Single pairs of false legs on the bottom of two to five abdominal segments, typically on A3 to A6 and A10 (see Figures 1 and 2).

Prothoracic shield: Dorsal portion or plate of the first thoracic segment (T1), often distinctly colored in caterpillars in the Tortricidae (see Figures 1 and 2).

Pupa (plural: **pupae**)**:** Usually inactive developmental stage between the caterpillar and the adult (known as the chrysalis in butterflies).

Reticulation: Network of fine lines.

Sclerotized: Hardened; not fleshy or soft.

Spiracle: Lateral opening to the respiratory system; one pair on T1 and on A1 to A8 (see Figures 1 and 2).

Spiracular: Pertaining to or near the spiracle; usually used to describe the position of a longitudinal stripe of a caterpillar (see Figure 5).

Stemma (plural: **stemmata**)**:** Simple eye of a caterpillar, usually arranged in a group of six on each side of the head (see Figure 3).

Stripe: Broad line or streak that usually extends continuously or discontinuously for the length of the thorax and abdomen (and sometimes head) of a caterpillar.

Subdorsal: About midway between the middorsal and supraspiracular regions; usually used to describe the position of a longitudinal stripe of a caterpillar (see Figures 4 and 5).

Subfamily: Category in animal classification that is above the genus or tribe and below the family; group of related genera within a family. (Scientific subfamily names of insects end in –inae).

Subspiracular: Just above the level of the spiracles; usually used to describe the position of a longitudinal stripe of a caterpillar (see Figure 5).

Subventral: Between the subspiracular and ventral regions; usually used to describe the position of a longitudinal stripe of a caterpillar (see Figure 5).

Superfamily: Category in animal classification that is above the family and below the order; group of families that share similar characteristics. (Superfamily names of insects end in –oidea).

Supraspiracular: Just above the spiracles, or between the subdorsal and spiracular regions; usually used to describe the position of a longitudinal stripe of a caterpillar (see Figure 5).

Thorax: Body region between the head and abdomen that is composed of three segments (T1 to T3) that bear the pairs of true legs (see Figures 1 and 2).

Transverse: Across a segment, or perpendicular to the long axis of the body of a caterpillar.

Tubercle: Distinct swelling of the integument that is variable in form, sometimes being low and broad or long and narrow.

Venter: Bottom or underside of a caterpillar.

Ventral: Below or underneath a reference point; underneath.

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INDEX

The following index includes common and scientific names of caterpillars, butterflies, moths, and their families. Page numbers in **boldface** type (following the full common or current scientific names of species) indicate where the descriptions of photographed caterpillars can be found. Scientific names of genera and species are in italics.