MOTHS AND BUTTERFLIES

OF THE UNITED STATES

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East of the Rocky Mountains

By S. F. DENTON

A Limited Edition of 500 Copies, of which this is

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Upper Side

ATTACUS CYNTHIA

As Nature Shows Them

MOTHS AND BUTTERFLIES

OF THE

UNITED STATES

EAST OF THE ROCKY MOUNTAINS

With over 400 Photographic Illustrations in the Text and Many Transfers of Species from Life

BY SHERMAN F. DENTON

Part I. THE MOTHS

BOSTON:
BRADLEE WHIDDEN
1900

PREFACE.

Scientific works on butterflies are not rare in most libraries; but to the enthusiast who loves these creatures for their beauty and variety there is usually very little of interest in scientific details.

It is the aim of the present work to represent our native butterflies and moths not as dried and mutilated specimens in a cabinet, with pins stuck through them, nor as dissected fragments for scientific classification, but as one sees them in our woods and fields, fresh and lovely.

From the standpoint of the artist and the decorator, the study of the designs and color patterns on the wings of butterflies may be of valuable assistance. Such combinations of pleasing tints are rarely found in the handiworks of man. What better school could be found for the colorist than is within the reach of the humblest aspirant for fame as artist or decorator? Think of students copying the dingy works of the old masters year after year, when at their own doors the grandest combinations of colors that Nature can produce are passed by without a thought! We have close about us the best that Nature is capable of producing, if we but use our eyes to see it.

The life histories of many of the lepidoptera are replete with interest, and the knowledge of not a few is essential to man's welfare. To the gardener or the florist the study of entomology is a necessity, and the recognition of his enemies and friends in the insect world is of first importance.

To those who have, or desire to have, a cabinet of specimens, this study will be found of never-failing interest, as one may pursue his researches through all seasons of the year. Improved methods of mounting and keeping such specimens render their preservation and care a simple matter; and the collections made in one's childhood may be kept to delight one's old age. The practical hints on collecting and rearing specimens, the result of many years' experience, will be appreciated by beginners and the new methods of illustration herein used will greatly help the student in identifying and naming his specimens.

The colored plates, or Nature Prints, used in the work, are direct transfers from the insects themselves; that is to say, the scales of the wings of the insects are transferred to the paper while the bodies are printed from engravings and afterward colored by hand. The making of such transfers is not original with me, but it took a good deal of experimenting to so perfect the process as to make the transfers, on account of their fidelity to detail and their durability, fit for use as illustrations in such a work. And what magnificent illustrations they are, embodying all the beauty and perfection of the specimens themselves!

As I have had to make over fifty thousand of these transfers for the entire edition, not being able to get any one to help me who would do the work as I desired it done, and as more than half the specimens from which they were made were collected by myself, I having made many trips to different parts of the country for their capture, some idea of the labor in connection with preparing the material for the publication may be obtained.

I will say, however, that there never was laborer more in love with his work, or one whose labors took him among pleasanter scenes. In collecting such a large number of specimens, many new facts in regard to the habits of these charming creatures have been observed, and to write interestingly of their lives and to give a few examples of their marvellous beauty has been the aim of the author.

SHERMAN F. DENTON.

WELLESLEY, MASS., 1899.

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TRANSFERS FROM LIFE.

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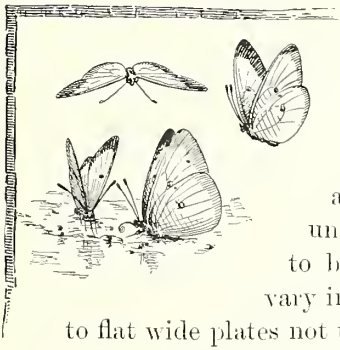
HETEROCERA

THE MOTHS

Lepidoptera; or Scale-winged Insects.

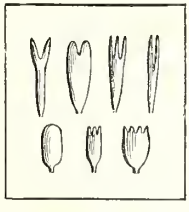
THE LIFE HISTORY.



The name *Lepidoptera* was first applied by the naturalist Linnæus to the order of insects known as butterflies and moths.

The dust which covers the wings and bodies of these insects, when placed under a microscope of low power, is seen to be composed of minute scales. These vary in form from those elongated into hairs to flat wide plates not unlike in appearance the scales of fishes.

The variety in shape and color of the scales of different species of Lepidoptera is amazing, and a number sprinkled on a microscopic slide will frequently display all the glitter and iridescence of a casket of precious jewels. To these scales the beauty of coloring of this order of insects is entirely due; for when they are removed, the



Butterfly Scales.

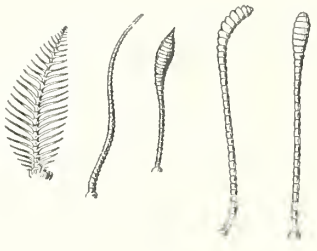
wings are seen to be composed of veins or ribs, with thin transparent membranes extending between them. Many of the scales are striated or corrugated and decompose the light in such a way as to give to our eyes those combinations of colors so pleasing to behold. They are

frequently arranged on the wings in regular order, as are the scales on reptiles or fishes, and when removed leave a slight scar on the membrane where they were attached.

In studying the structure of a butterfly, turn it underside uppermost. It will then be seen to be composed of three distinct parts: the head, which supports the antennæ (popularly known as feelers), the eyes, and the mouth parts; the thorax, to which are attached two pairs of wings and three pairs of legs; and the abdomen.

The eyes of butterflies and moths are compound, and the facets vary in different species from several hundred to many thousand. The vision of some of the higher butterflies is exceedingly acute, as one will often have reason to note when cautiously endeavoring to approach some coveted prize near enough to use the net. Many moths, on the contrary, seem to be simply able to distinguish between light and darkness, and are apparently more often guided by the sense of smell than of sight.

The antennæ have been supposed by some naturalists to be organs of smell, and there is certainly good foundation for this supposition. They vary in shape from hair-like and feather-like in many of the moths to rods with club-shaped ends in most of the butterflies.



Antennæ.

By the antennæ the beginner may most easily distinguish between butterflies and moths. The antennæ of butterflies are nearly always blunt or knobbed at the ends, while the same organs in moths are generally pointed.

The mouth parts of the lepidoptera are constructed for sucking the sweets from flowers or the juices from other substances; and while some of the moths have no way of taking nourishment in their perfect state, most of the species of this order are provided with a

long tongue which, when not in use, is coiled into a close spiral between the palpi. This reaches its greatest development in some

Tongue of Sphinx.

of the sphinx moths, enabling them while on the wing to extract the nectar from the deepest flowers.

While most of the lepidoptera have six well-developed legs, a group of butterflies, the *Nymphalidæ*, have the first pair so small and weak that they are probably of very little use to the insect. The legs are used almost wholly for clinging to substances while the insects are at rest, as very few of the lepidoptera walk or run to any extent.

The butterflies are day flyers, and in the hot sunny hours they sport through the woods and fields. The moths fly mostly by night, and are frequently more hairy and larger bodied than the butterflies, while their colors are usually softer and more blended.

The life history of one of the insects we are considering, from the egg to the fly, is most interesting. The perfect insect lays its eggs, by a wonderful faculty, which for want of a better word we call instinct, upon or near the species of plants which are to furnish the food for the future caterpillars.

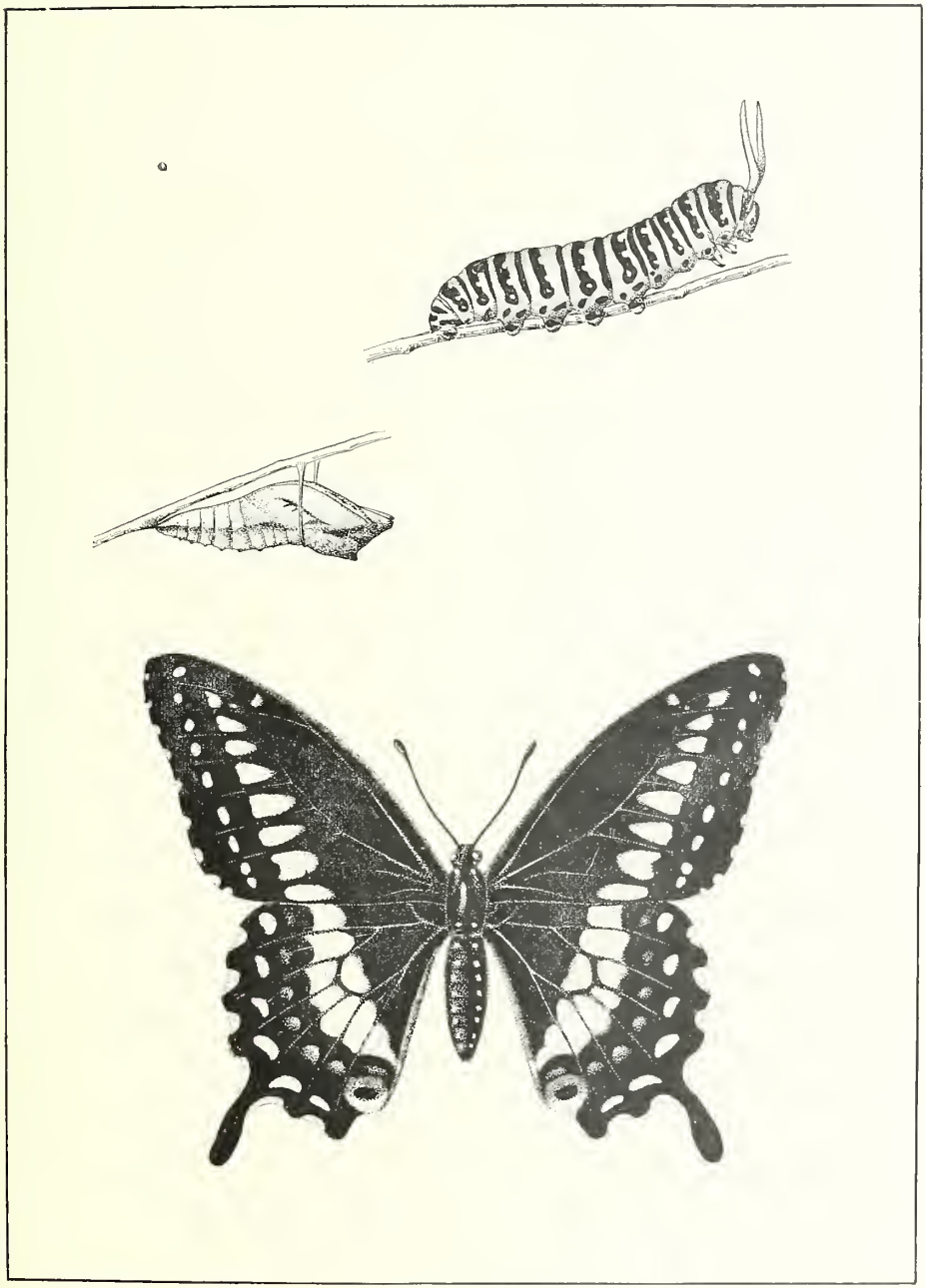
These eggs, often very minute, are of various shapes and are ornamented in a variety of ways. Some are oblong; others almost perfect spheres; others again flattened above and below, while their outlines are circular. With these shapes go smooth and sometimes highly polished surfaces. Some resemble low vases with turned-over and fluted edges, while they are adorned with raised patterns or sharply cut grooves or circular pits, or in other examples studded with nodules or even with spines. Others bear a general resemblance to a lady's work-basket in shape and reticulated ornamentation. Some have a lid or cover, which is raised by the caterpillar when about to emerge from the shell. They vary too, in color as well as in shape and ornamentation; some are white or of a pearly lustre, some blue or gray, while a large number are green, and a few brown

or black. An interesting collection may be made of these eggs alone, and an entomologist can often tell from examining an egg the species of butterfly to which it belongs.

When the larva emerges, so small and so unlike the mature insect, no one would guess what it was to be. It crawls to the tips of the tender young leaves and makes its first meal. It soon begins to grow rapidly; and as it grows its skin becomes too small for its constantly increasing bulk, and a new skin begins to form under the old one, which after a short period of rest the caterpillar casts off. This is done in the following manner: the insect first spins upon the leaf or twig upon which it rests a mat of silk to which it can hold firmly with its claws and claspers. It ceases to eat for a period and remains perfectly quiet upon the mat. It becomes so dull and sickly in appearance that one might suppose it was about to die. At length it begins to twist its head from side to side vigorously, and after a series of contortions in which the forward segments swell and shrink alternately, the skin splits down the middle of the back and the rent is further enlarged by the struggles of the insect until it can draw its head and legs out of the opening, when by securing a firm hold with its forward hooks it crawls out of its old skin looking as bright as a gold coin fresh from the mint. It is feeble and exhausted from its labors, while its skin and even its head and legs are soft and tender, and it now remains quiet until the skin dries and toughens by exposure, when it is ready once more to attack with renewed energy the tender leaves of its food plant.

The cast-off skin sometimes retains the shape and colors of the caterpillar to a surprising degree — a veritable ghost of the former insect. Some caterpillars devour their outgrown garments as a first meal after each moult; others leave them where they were cast; and one species carries in front of its head on a tuft of hairs, during its caterpillar life, the cast-off shells of its head which were shed with each change of skin, thus keeping in sight a record of its outgrown coverings from infancy. When the caterpillars are gregarious these cast-off skins in groups representing each moult of the colony may frequently be seen on one plant. The moulting period is a critical time in the life of the larva, for it is not only helpless to resist the attacks of enemies but it may die from exhaustion in the act of shedding its skin.

The larva eats ravenously (sometimes devouring twice its weight of food in twenty-four hours) after it resumes activity, with a



Development of a Butterfly.

corresponding rapid growth in size. In consequence its new coat soon becomes too small, and the moulting process is repeated several (sometimes five or six) times, with corresponding changes in the size of the larva. In many instances there are marked changes in the colors and the shape of the caterpillar after each moult. At length, in the course of several weeks, the insect arrives at its full growth. It now ceases to eat, and looks about for a suitable place in which to pass its period of inactivity, known as the pupa or chrysalis state. And here, before he spins his cocoon or changes to a pupa, we will take a last good look at him.

The larva of a lepidopterous insect is jointed or segmented into thirteen divisions. First comes the head, which is usually hard and horny: the eyes, twelve in number, are very small, and are placed near the mouth. They are simple eyes with very convex lenses, so that the range of vision must be very short: in fact, so deficient is the sight of caterpillars one may conclude that they are guided more by the sense of feeling than by sight. Place a caterpillar on a twig and watch it ascend, feeling its way and reaching out from side to side before every advance movement. When it reaches the top, it does not survey the scene below, but taking a firm hold with its last two or three pairs of claspers, it stretches its body out to the utmost, swinging first one side and then the other, in order to feel if there is anything beyond on which it can lay hold.

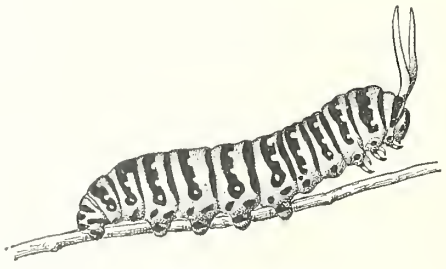
The jaws of a caterpillar move horizontally and are powerful instruments, capable in the larger species of biting through the tough ribs of leaves as the insect reaches them while feeding. Crawling down the midrib of a leaf the caterpillar advances toward the edge, and holding the leaf between one or more pairs of its horny front legs, it brings its jaws together on opposite sides, cutting out a small piece with each bite, and continuing this down with regular order, it soon cuts out a large semicircular space, taking ribs and all. A smaller caterpillar will simply eat away the soft parts of the leaf between the small ribs, leaving a skeleton; while the very minute leaf miners burrow in the substance of the leaf between the upper and lower skin.

The noise made by a large colony of larvæ while feeding has been compared to that made by a heavy shower of rain on an attic roof; and the quantity of food which they require is well-nigh appalling to a novice who has started perhaps with several hundred tiny creatures which could all make a meal on a handful of leaves, and

finds that they need bushels of fresh food daily when nearly full grown. Of course, in a state of nature the large larvæ are usually widely scattered, so that their ravages are not so noticeable; but when feeding a large number hatched from eggs one is liable to find he has an elephant on his hands.

A little protuberance under the mouth of the larva is the silk-spinning organ. This is the external opening to the silk secreting glands, which consist of two tubes or sacks, one on either side of the body, containing the viscid fluid which, by exposure to the air, dries and hardens into silk. This silk is used in a variety of ways by the different species of caterpillars. Some colonies build nests for their mutual protection; others attach a thin thread to the leaves and branches of the plants as they crawl over them, so that they are with difficulty shaken off, for they merely let themselves down on their threads a short distance and then crawl up again when the danger is past. Many species spin cocoons as silky coverings for themselves when they are about to pupate; and a good many of the butterfly larvæ not only attach the posterior extremity of the abdomen to a silken carpet but anchor themselves with a strong cable spun about the body and attached to the substance from which they are suspended.

If we examine a caterpillar, we shall notice that the first three pairs of legs, attached to the second, third and fourth segments



Caterpillar of Butterfly.

(calling the head the first), are different from the fleshy legs or claspers. These first six legs are hard and horny and provided with claws or hooks at the ends. They are the true legs and correspond to the legs of the perfect fly. The usual number of claspers is five pairs, and these are placed on the seventh, eighth, ninth, tenth and

thirteenth segments — the fifth, sixth, eleventh and twelfth segments having none. A number of caterpillars, however, have but four pairs of claspers (also called abdominal legs or prolegs), while a few have but two pairs, and these situated at the extremity of the body. The claspers are thick and fleshy, and may be extended or contracted, while their ends are surrounded with a number of minute hooks. These prolegs or claspers are absorbed into the abdomen of the insect during its transformation into a pupa.

In walking, a caterpillar advances by an undulating motion, extending and contracting its body. A few species (the geometrids) advance by bending the body up into a loop and then extending it to its full length. These are sometimes called inch-worms or measure-worms, from their mode of progression.

Insects breathe through spiracles or air-tubes in their sides: and the openings of these tubes are often plainly visible in caterpillars, especially in smooth ones. They are located on the segments, one on either side, and are often enclosed in a small circular or oval patch of color.

The variety of the shapes and colors of caterpillars is well-nigh endless, and often most wonderful, they being adapted in many instances to so resemble the plants upon which they feed that their enemies are baffled in their search for them.

Some look and act as if they were venomous, while others are by their repulsive or even terrible appearance calculated to frighten insect-devouring creatures. Some are smooth-skinned, some humped, or covered with bunches, tubercles, warts, fleshy filaments, horns, spikes, spines, bristles, hairs or down, and sometimes a combination of several of these. A few sting like the nettle, while others shed their sharp pointed hairs which work into the flesh if they are roughly handled. Some secrete strong, disagreeable odors, while some are perfumed like a dandy at a ball. Their colors are scarcely less wonderful. Some bear large spots which look like great eyes watching from the leaves. Some are striped or banded, or sprinkled with dots. They are of every imaginable color or shade, but the majority are green, and so nearly resemble the leaves among which they feed that it is difficult to see them. Some look as if made of bark and covered with lichens; others so closely resemble twigs with their minute knots as to deceive even the expert.

But with all these subterfuges for protection, the birds, toads and ichneumon flies find most of them out; thus, in spite of the countless

millions which hatch from the eggs each season, their numbers are mostly kept within bounds.

But to resume our history of the life of the caterpillar. As before mentioned, some species make for themselves cocoons; others burrow down into the soil or hide among the fallen leaves at the roots of trees; while still others have no covering, and suspend themselves by silken webs in various localities. In preparing for the pupa state a change takes place in the appearance of the caterpillar. Its colors fade; it shortens and thickens; and at length, after move-

Development of the Moth.

ments similar to those which it uses in changing its skin in moulting, a seam opens in the back, and the larval skin is worked backwards and finally off.

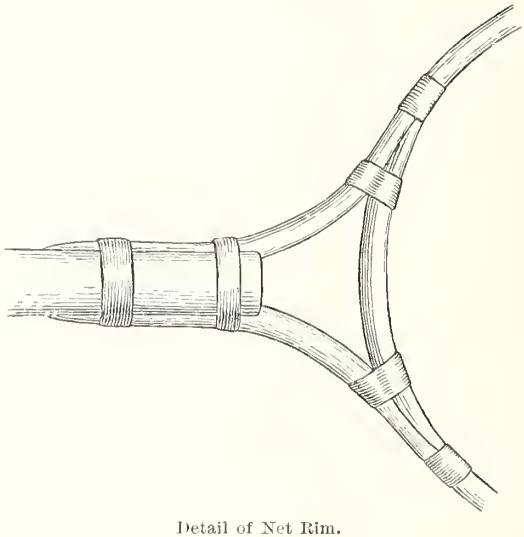
It is now a pupa or chrysalis, looking neither like the caterpillar which it was nor the fly which it is to be. By close examination the legs, wings, antennæ, etc., may be clearly made out: but how compactly they are placed together! Not a particle of room is wasted. It seems most marvellous that from this inactive, fossil-like creature,

a butterfly full of life and beauty shall emerge. Beneath this hard and usually dull-colored exterior, what wonderful changes are taking place! Simple eyes give place to compound eyes; biting jaws change to a sucking tube, with its palpi; antennæ spring from its head, wings from the sides of its body, and a delicate scale armor covers the whole. What tale from "The Arabian Nights" can equal marvels in the life history of a common butterfly? At length after weeks, in some cases months, of inactivity, through the shell of the chrysalis may be dimly seen the colors of the developing insect. A slight split opens in the back of the shelly case, and as this widens and opens the butterfly slowly crawls out, and, after finding a suitable place, hangs almost motionless. The creature is still very unlike the butterfly with which we are so familiar. Its body is soft and weak; its wings are no larger than one's finger-nail, and it looks wet and bedraggled. But watch it. Its wings begin to swell with the fluid which is pumped into them from its body. It appears to grow as we look, and in half an hour it is a glorious creature, a living jewel. Oh, how perfect and beautiful it is — not a mar on its velvety wings! We rarely see one in a wild state so fresh and flawless. It is now at its best. It has reached this grand climax after weeks of preparation, and we can but admire its wondrous beauty. With the emerging and developing of the perfect insect, its growth ceases, for a little butterfly never grows to be a big one. A part injured, a wing torn, is never mended; loosened scales are never replaced; and its life from now on sees it less bright and beautiful day after day. After depositing its eggs for the next generation it soon becomes a tattered, helpless creature, and falls an easy prey to one of its many enemies.

IMPLEMENTS FOR COLLECTING.

THE NET.

First of all and most important of all is the net. The lightest, most serviceable, and in every way the best net that I know of is made with a rim of rattan. Procure a light piece of straight-grained pine, two feet long and one inch thick. Plane it down for a net handle a little smaller at one end, and make a grove with a gouge, on either side of the smaller end, four inches long. Now, take a

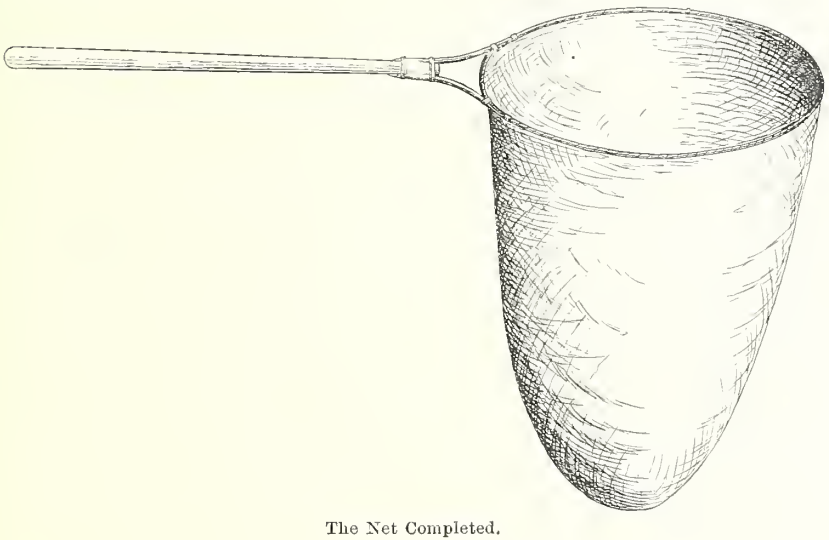


Detail of Net Rim.

piece of rattan sixty-six inches long, rather thicker than a lead-pencil, and fasten the ends to the handle with two bands of copper wire. This will make a net about eighteen inches in diameter. By now taking a short piece of rattan, twenty inches long, making a long level at both ends, grooving them out a little and wiring it to the rattan hoop, as shown in the following figure, you have a splendid rim for a net, and one that will last for years. In order to be sure

that the hoop will be symmetrical after it is completed, it is a good plan to first fasten the small piece of rattan on with twine, and when it is satisfactory in shape, wire the whole together in a substantial manner. The rattan will bend better if soaked in hot water for an hour. A coat of paint or shellac over the handle and the bands of wire is likely to make the whole more durable.

To make the net, about two yards of mosquito netting, one yard wide, are necessary. Sew the netting on the rim with strong thread (carpet thread will answer), button-hole stitch, selvage next the rim, and when round, cut off the surplus and let the net hang down. The net should be made rounded, not pointed, at the



The Net Completed.

bottom; and, in order to accomplish this nicely, pin the sides of the netting together at intervals of two or three inches, cut off the corners with scissors, and sew together with an over and over stitch. The finished net should look like the annexed figure. The netting used should be soft and fine and of some inconspicuous color, such as brown or green. New netting generally contains some starch which renders it stiff, but soaking in hot water for a few minutes after the net is made will obviate this difficulty.

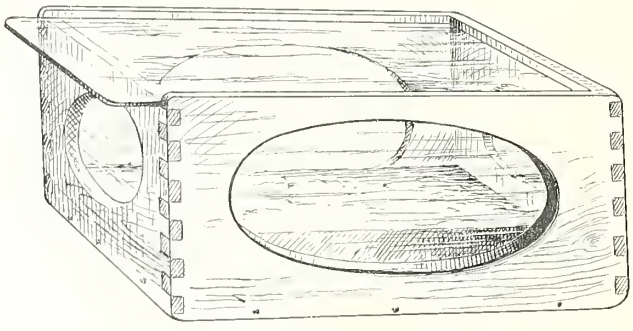
The netting will have to be renewed once or twice in a season if much collecting is done. If rattan is not easily procurable, one may

use stout iron wire such as telegraph wire, but it makes the net heavier and less flexible. A straight piece of willow, as large as one's little finger, will answer for a rim when nothing else can be obtained. Some may find that a net smaller in diameter and with a longer handle will answer their purpose better; but it is difficult to manipulate a net with one hand if the handle is longer, and the larger the net one can swing the more likely he is to capture the large and rapid flying insects which may come his way.

Where insects fly very high, as they sometimes do, a net will have to be fastened to the end of a pole. A jointed bamboo fish-pole is a very good thing to use in this case, as the short handle of the net may be fitted into the brass ferule of the rod at the second joint. But it will rarely be necessary to use a net of this description as most of our native butterflies may be easily taken with a short-handled net.

COLLECTING BOX OR JAR.

A thin glass tumbler, with a tight-fitting cork stopper, will answer for killing small specimens and an occasional large one; but it is almost too small for one who intends to do a large amount of collecting. The tumbler is prepared as follows: Put into it one



Poison Box.

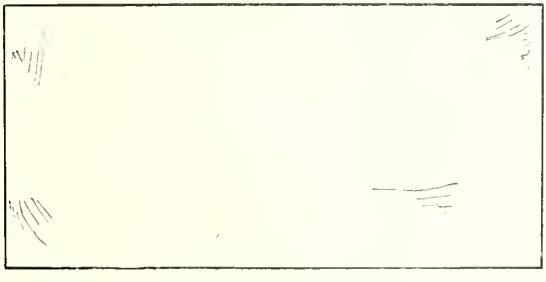
ounce of cyanide of potassium broken into fragments and cover with an inch of sawdust well pressed down. Mix a small quantity of plaster-of-Paris and water to the consistency of rich cream and pour over the sawdust to the depth of half an inch. When the plaster hardens the "bottle" is ready for use, killing in a few moments,

without injury, all insects placed in it. Great care should be used in handling the cyanide. Do not breathe the fumes of it as they are deadly poison.

A more convenient and more useful article for killing insects can be made in the following manner: Purchase at the drug store a small box with a sliding cover and dovetailed corners, six inches long, four inches wide and three inches deep. It may be difficult to get a box as shallow as this, but if the other dimensions are right, it may be cut down to the right height. This box should be taken to a glazier, and have him fit into it one piece of glass for a sliding cover and five pieces for bottom and sides. These latter pieces should be fastened on with shellac, and thin glass should be used to make the box as light as possible. When the shellac is dry, put in the cyanide as with the tumbler. This box will hold a large number of insects with papers between them, and will be found very useful when one is doing much collecting. Occasionally the cyanide becomes so dry in the collecting box or bottle that it fails to kill the insects quickly. The addition of a few drops of water will generally restore it to full strength.

A small leather satchel suspended by a strap from the shoulder is a first-class addition to the collector's outfit. Into it may be put the captured insects in their envelopes or collecting papers, with needles and thread for mending the net or the clothing, insect forceps, etc. A small light box with straps attached may be used in place of the satchel.

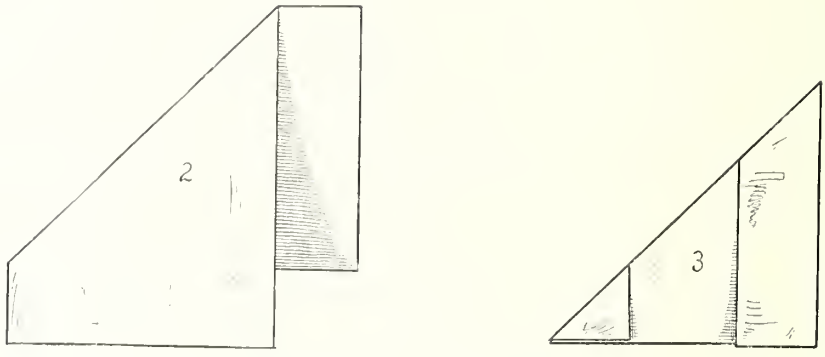
Collecting papers or envelopes are made thus: Take smooth,



Shape for Collecting Papers.

strong paper (newspapers will answer if nothing better can be procured) and cut out an oblong piece as shown in the cut. Fold the

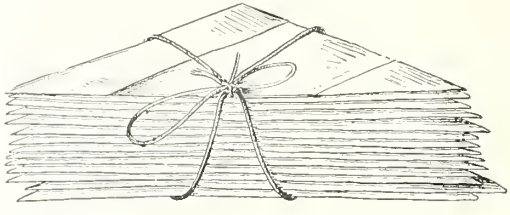
ends across at right angles to each other; after which fold one of the ends over again, put the insect in head downward, being care-



The Folding of Collecting Papers.

ful that its wings be flat; fold the other end over, and the envelope is finished. Some collectors fasten one end of the paper down with a little gum or paste; but the dried insect is not so easily taken out of such a paper. One collector whom I know uses coupon envelopes for his butterflies. They are very cheap and convenient to handle, being all one size.

Insects in their papers should be left exposed to the air for a couple of days to partly dry; then they may be tied up in bundles,

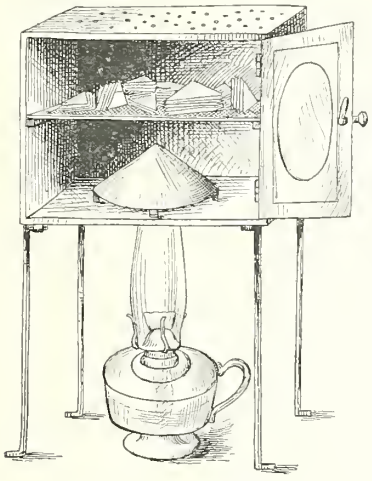


Bundle of Insects in their Envelopes.

and are ready to store away in boxes or to be sent by mail or express to their destination.

TO DRY INSECTS.

In very wet weather insects may have to be dried artificially, to insure them against mildew. A good article for this purpose is a light tin or sheet-iron oven with detachable legs so made as to be set



Oven for Drying Insects.

over a lamp. In this the insects are placed in their papers. This is very useful in tropical countries where specimens may be taken at the rate of several hundred a day; but ordinarily one can use the kitchen oven for drying his specimens in wet weather. Lay them loosely on the oven shelf, with the door slightly open and they will dry nicely in an hour or two. Some very large-bodied insects take a good while to dry; and if a slit is made in the under side of the abdomen with a sharp knife, the contents taken out and the space carefully filled with cotton gently crowded in, the body will look better when dry.

The bodies of many of the large moths, especially the males of the silk-spinning species, are filled with a natural oil which is liable to gradually ooze out and spread over the entire insect, ruining its appearance and perhaps causing the poor collector many a sigh over his lost treasure. This may be remedied by cleaning out the abdomen of all such insects and stuffing with cotton. Another method

which I have used with success is to snip off the abdomen of such an insect, cut it open on the under side, remove the contents and soak it in gasolene for twenty-four hours, after which it can be stuffed and replaced in its former position with shellac. This process, of course, does away with all liability of the insect becoming greasy.

To restore the beauty of greasy specimens, place them in gasolene in a shallow, covered pan, for twenty-four hours or longer, when they will come out bright and clean. Downy or hairy specimens may need a little blowing to restore their fluffy appearance.

The fumes of bisulphide of carbon will kill insect pests which may have found their way among unmounted specimens. Pour an ounce or two into a dish placed in the cabinet and close it up tight for forty-eight hours. Care should be exercised in its use, as it is very volatile and explosive.

PREPARATIONS FOR A CABINET.

There are several ways to prepare lepidopterous insects for the cabinet. I need mention but two: one by the ordinary method of spreading the wings and with a pin thrust through the thorax, well known and used by most collectors the world over since man began to collect and preserve the beautiful objects of nature; and the other by a new and improved method invented by the author in 1894.

After having accumulated a beautiful collection of butterflies and moths from different parts of the world, only to see it finally destroyed in spite of all the care I had bestowed upon it, and knowing my experience had been that of hundreds of other persons, the necessity of some means by which specimens might be kept safe from the many dangers which threaten them forced itself upon me. As the result of a good deal of thought and many experiments, I invented a simple, light, strong, glass-covered tablet which not only renders the destruction of the specimens impossible, but puts them in a shape at once more beautiful, and infinitely neater, than was possible by the antiquated method of impaling them on pins — a prey to insects and a refuge for dust — and liable to be broken even by a careless breath.

Some of the advantages of my invention over the old method of pinning insects are these:

They are protected against breakage, dust and museum pests, and specimens once so put up are good for hundreds of years.

A collection thus mounted needs no care whatever, neither is it necessary to have tight boxes or cabinets; and one may leave his collection indefinitely without the least danger.

There is no odor from the specimens, neither is it necessary to fumigate the cabinet at all, and the vile smells caused by the use of naphthaline and bisulphide of carbon are entirely done away with.

There are no pins to obstruct a view of the specimens, or to make them appear as if impaled alive.

There is no danger in showing the collection to *any* one, and the most valuable specimens may be handed around for a close inspection of their beauties without the least danger of breakage.

A collection of this kind occupies but half the space of a collection mounted on pins, as the drawers of the cabinet need be but one inch deep inside.

Lastly, the wings of specimens mounted in this way lie perfectly flat, as the glass rests directly on them, and they therefore cannot lop down or warp up, as pinned insects are liable to do.

Many will be surprised to see how lovely are some of our most common things mounted by this new method, making each specimen a picture.

The tablets are made of many sizes, to accommodate every variety of specimen. They are flat on the top, with a body cavity of the size and shape to fit the body of the insect; are white with a glass-like polish on the face; are hollow at the back, in order to be as light as possible, and this hollow is covered with card-board when the insects are mounted.

As my own method is in every way superior to the other, and is already being adopted by the museums not only of this country but of the world, I shall devote the most of this chapter to a detailed description of how best to put up a collection as it should be to remain indefinitely, and to show to the best advantage. I am aware that I shall encounter — in fact I have already encountered — the opposition of many of those collectors who have spent years in putting up their collections by the old methods. It is not reasonable to suppose that entomologists will welcome with open arms an invention which makes the collections of a lifetime look poor and out of date; but why, I ask, should not improvements be made in mounting butterflies as well as in making shoes or in printing newspapers?

This is an age of invention. Everything is being improved upon where the ingenuity of man can suggest improvement, and we are no longer satisfied with the moss-grown methods of our grandfathers. Go into almost any of our museums or natural history rooms, and look at the collections of butterflies. Did one ever see anywhere else such a miserable display? Wings torn and worn, bodies devoured by museum pests, and the whole so dusty that one can scarcely identify the species. Why, any able-bodied collector can make and put up in one season at very small expense a collection that will put to shame any of the exhibition collections in the museums of the country. Collections of insects can be made surpassingly beautiful and an ornament to the finest palace that man can build. It is no discredit to a museum to have the best. It is a mis-

take to suppose that a collection need be slovenly in order to be scientific. Science should be made attractive, and the beauty of which Nature is so lavish should not all be driven from our museums. Old curiosity shops for the storage of objects of natural history should give place to magnificent buildings devoted to the display of the rarest and most beautiful which Nature produces. I will make no further excuse, therefore, for introducing my invention to the reader's notice, for, outside of my personal interest in the matter, it is the only practical way known to me of mounting a collection of lepidopterous insects.

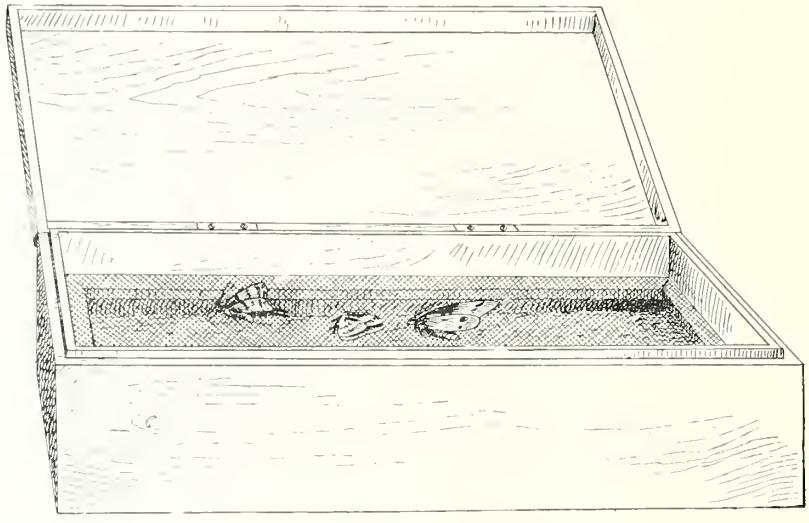
Let us suppose, then, that the collector has been out with the net and has brought in an assortment of butterflies for the beginning of a collection. These may be spread either when fresh, or, which is simpler, may be placed in collecting papers and allowed to dry, and when a number are procured, softened in the relaxing-box and then spread. This latter method is preferable in many ways, the most important being that the specimens having once been dried will dry again very quickly, twenty-four hours usually being sufficient to render them rigid, while if the insects are spread in a fresh state they may require from four days to two weeks to dry thoroughly.

THE RELAXING-BOX.

To make one, use a tight box, one foot square and five inches deep, with a hinged cover; paint it inside and out with three coats of house paint, and when thoroughly dry put into it two inches of wet sawdust pressed down flat. Make a light wooden frame to fit the inside of the box, stretch netting over it and secure it with two or three brads an inch above the sawdust. When this is all ready place the dried insects on the net, and in twenty-four hours they will be soft enough to spread without breaking. The success of this method depends on having a tight box. The net on the frame does not allow the insects to come in direct contact with the wet sawdust, but they absorb enough moisture to render them pliable and are not liable to become too wet. Silk veiling makes an excellent article to use on the frame in place of the net, as it is soft and fine. Water should be added to the sawdust whenever it becomes too dry. A small quantity of powdered alum put into the water will prevent the sawdust from becoming mouldy.

A much simpler way, although to my thinking not so safe to use with valuable specimens, is to have a plain wooden box filled with wet sawdust in which deep grooves are made and the butterflies placed body down in their papers in these grooves. One needs to be careful not to have the sawdust too wet in this case as the insects are liable to absorb too much water, which may injure their appearance.

After the insects have remained in the relaxing-box until pliable (the following method may also be used for fresh specimens), they should be spread underside uppermost on smooth pine blocks; these may be from four to six inches square and covered with smooth paper



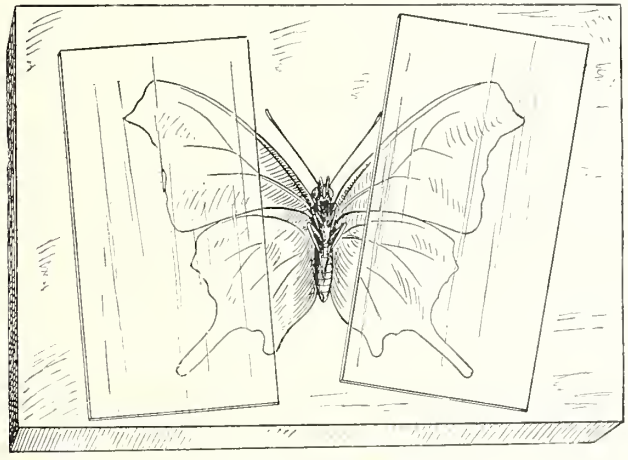
Relaxing-Box.

pasted to the face. Pin the insect to be spread through the thorax (stout insect pins will be found best for this purpose) on the block *wrong side up:* spread the wings with fine needles: lay strips of glass on them: secure the legs and antennæ in place with pins: and allow the specimen to dry, after which it will be found very flat and in the right condition for mounting. Insects may be kept in this state in a tight box until the collector is ready to mount them in the tablets.

A good many insects, especially butterflies, show a marked difference between the upper and under side of the wings. When it is desired to show the under side, the insect should be spread on the

block *right side up* and the glass strips placed on the wings not far from their tips so as not to bend the wings too much. In spreading a fresh insect the pin through the thorax must be removed at the time of spreading, otherwise it will become so firmly attached that the specimen may be broken in removing it. With an insect which has once been dried this precaution is not necessary as the pin may be removed at any time.

A smooth paper or palette knife will be found useful for opening the wings of the insects to be spread. Take the specimen in the left hand between the thumb and finger, and after inserting the knife between the wings bend them down on each side. If all the insects

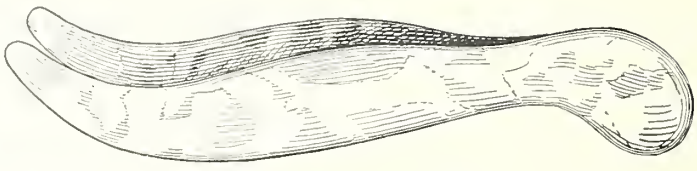


Insect Spread on Setting Block.

in a collection are spread so that the lower margins of the upper wings are at right angles to an imaginary line drawn lengthwise through the centre of the body the whole will look uniform and the beauty of the individual insects will be shown to the best advantage. The setting needles may be made more convenient to use if the ends are pushed into small wooden handles, match stubs for instance. If the needles are too long, as is apt to be the case, break them in two and use the points only. For mending broken insects and replacing detached antennæ and legs, use white shellac. The appearance of a specimen whose wings are slightly injured may be very much

improved by fastening on the back with shellac a piece of another butterfly which matches it in color.

For handling insects, use smooth broad-tipped forceps. If these cannot be purchased at a store where naturalists' supplies are kept,



Forceps for Handling Insects.

a pair may be made by an expert out of hard rubber or tortoise-shell. I have known a pair of tin candy tongs to answer for forceps after the tips were made flat and smooth.

PREPARING LARVÆ AND PUPÆ.

Collections where larvæ and pupæ are added are enhanced twofold in their value from the standpoint of the naturalist. The weird and varied forms with the remarkable coloring of some of the species makes them exceedingly interesting when taken in connection with the fully developed insect. When it is remembered that the active life of a butterfly is but a very few days at the most, and that by far the greater part of its existence is passed in the larval state, the state when it is directly injurious to man's interests, one can readily appreciate the importance of studying the insects at this stage. Larvæ are not easily prepared to look well in the cabinet, and to make them look at all natural requires painstaking labor.

One method, which has been used with considerable success, is to inflate and dry the skin of the larva after the contents have been squeezed out through the anal opening. This is done by first killing the larva in the poison jar, then laying it on soft paper or cloth and, beginning at the head, rolling it gently toward the posterior end, under a round lead-pencil wound with soft canton-flannel or blotting-paper. When the skin is quite empty, insert a straw into the opening and gently inflate the skin, at the same time turning it round over

a lighted lamp. A small spring of steel fastened to the end of the straw in such a way that it may prevent the slipping of the larva skin as it is inflated will prove useful, and a little sheet-iron oven to slip over the lamp, having small openings above and below, will prevent the burning of the specimens as they dry. Many larvæ, especially the hairy ones, will look well if carefully prepared in this way. A considerable number though look anything but like the natural caterpillar.

I have tried another method with success, which, requiring little more skill, is much more satisfactory in its results. Treat the caterpillar the same as if it were to be inflated with air, but instead, inject into it hot paraffine or beeswax, colored to resemble the contents of the natural insect. This is done as follows: Procure at the drug store a small collapsible rubber syringe (the ball and tubing connected with an atomizer for perfume will answer as well), and into the opening insert a piece of small brass tubing, having a small steel spring attached to hold the larva. Purchase a quantity of paraffine or white beeswax, put it in a tin with boiling water, and when melted add the proper coloring by mixing with it oil colors from a collapsible tube, such as are made by Winsor & Newton and procurable at any store where artist's materials are sold. Now draw boiling water up into the syringe a few times until it is thoroughly warmed, and then quickly fill it with the hot paraffine and inject the skin of the caterpillar (which should have been previously placed in warm water) to its normal size. If the larva is now put into cold water it will soon harden and will keep its shape. If the paraffine is of the right color, the resemblance to the natural insect will be very striking. Specimens treated in this way are hard but are not nearly so brittle as those inflated and dried with hot air.

Of course, either method requires some careful manipulation; but with a little practice the results, especially with the paraffine, are encouraging. The resemblance to the natural caterpillar will be still nearer if the skin can be painted wherever warts and spots occur. These are frequently red or blue, while the general surface is green. But this belongs more to the professional, and skilful painting can hardly be expected from the amateur.

The chrysalides and cocoons of different kinds are not difficult to preserve and usually look pretty well if simply dried. Some of the translucent chrysalides will be improved if the contents are taken out at the back and the space filled with colored wax or paraffine.

THE CABINET.

Cabinets may be made in a variety of ways with drawers large or small, but they need not be more than one inch deep inside. Basswood makes a nice cabinet as the wood is very light and does not warp so badly as many other woods. The front of the drawers and the front, top and sides of the case may be made of some hard wood, such as oak or cherry, which will take a handsome polish. A useful cabinet, and one which looks well, too, may be made of the following dimensions: Four feet six inches high, four feet wide, and two feet six inches deep from front to back. Two doors in front and a double row of drawers from top to bottom. However, the cabinet should correspond with the owner's taste and what it is intended to illustrate. One may have a very small cabinet and yet with room to spare which will contain the cream of the butterflies of the world. A good many, in fact nearly all butterflies will fade perceptibly if exposed to the light for years, and some of the most delicately tinted moths lose all their beauty if so exposed for a short time. Therefore they must be protected from the light.

Shallow wooden boxes answer nicely for storing the collection temporarily. These may be made very inexpensive, and look well if of uniform size. To own a handsome cabinet for his collection should be the aim of every collector.

HOW TO MAKE A COLLECTION.

COLLECTING BUTTERFLIES.

To make a successful collector of diurnal lepidoptera requires agility and a practised eye. One soon learns to manipulate the net so as to capture the specimens on the wing almost exclusively. This is preferable as the net is less liable to be torn and the insects are taken in more perfect condition than when captured while at rest. After capturing a butterfly and retaining it in a fold of the net, carefully place its wings together back to back, and give the thorax a sharp pinch between the thumb and finger. This will in most cases render the insect inactive and it may be turned out and into the poison jar without injury. It is a good plan to put the specimens in collecting papers before placing them in the poison jar if they are large and fine, as this will protect them from injury by rubbing together. Another scheme which answers admirably is to place small pieces of tissue paper over the specimens as they are put into the poison jar, so that fresh additions may not injure the ones already captured. There will be little necessity to touch the wings of specimens with the fingers when once accustomed to the work; and as more damage is likely to be done at the time of collecting than at any other, care in handling will make a marked difference in the appearance of the collection as a whole. It will rarely be necessary to run much for the insects one desires to capture, for by watching favorable opportunities they may be swept into the net with little more than a few quick steps and a rapid movement of the hand in guiding the net. Some butterflies, however, fly long distances when once on the wing, and one will sometimes get a long run and a glorious sweat in making such a capture. One soon learns to distinguish, while the insects are flying, between fresh specimens and those which are worn or torn; and this, it is scarcely necessary to say, will save the collector many needless steps. Collecting with the net may be commenced very early in the spring, as some species make their appearance before the snow is all gone and from that time on one may find new species coming out every few days.

Low, grassy meadows, with clumps of bushes, are generally favorite haunts of many butterflies. The different species of *Argynnis*,

Phyciodes tharos, *Melitæa phaeton*, *Limenitis disippus*, *Satyrus alope*, *Neonympha canthus*, with two or three species of the genus *Thecla* and many moths, are found in such localities. As the ground is frequently very wet in such places, one must go prepared or else put up with wet feet. The butterflies to be found in the upland fields are among the most common we have, *Pieris rapæ*, *Colias philodice*, *Chrysophanus americana*, *Pyrameis huntera*, *Pyrameis cardui*, *Pyrameis atalanta*, *Danais archippus*, etc., being lovers of the open fields. Fields of clover and patches of milkweeds and thistles are particularly attractive to the species named.

I well remember a neglected pasture where thistles and milkweeds grew in scattered clumps, where I have passed many an hour with good success. *Pyrameis huntera*, *P. cardui*, *P. atalanta*, *Danais archippus*, and several smaller butterflies flew from blossom to blossom, and were sometimes so intent on extracting honey that I picked them off the flowers with my fingers. The hours between ten in the morning and three in the afternoon were the most favorable, and beautiful fresh specimens were to be found there almost every day. Such a locality, if known to a collector, will furnish him with a great many splendid insects. Among such a number one need take only the most beautiful and perfect, and the duplicates can be used in exchange with foreign collectors for their treasures.

Roadways and along brooks and rivers are sometimes excellent localities for collecting. Butterflies seem to like to fly along roads and running streams, particularly the *Papilios*, *Limenitis arthemies* and *L. ursula*. They will also sometimes congregate on the muddy banks of rivers or about muddy pools in the road where a dozen or more may be taken by one sweep of the net. Several species are in the habit of visiting barnyards, and decaying sweet apples and pears are an irresistible bait for *Limenitis ursula*, *Grapta interrogationis*, *Grapta j-album*, *Vanessa antiopa*, *Pyrameis atalanta* and *Vanessa milberti*.

In the town of Mentor, O., where I passed a portion of my childhood, there was an old cider-mill, and from the time the first sweet apples arrived and were crushed until late in the fall, on every fine day, clusters of butterflies could be seen resting on the heaps of refuse and eagerly sipping the half-fermented cider. What a place that was for a boy with a net! I have seen twenty *Limenitis ursula*, resting on one heap of "apple chankins," opening and closing their purple and black wings in the sunshine, while several other

species of handsome butterflies were no less numerous. At the approach of any one they rose in a swarm, some resting on the sides of the old mill, while others continued to fly until the danger was past and then settled once more to the feast. It would be difficult to tell which occupied the greater part of my attention, the butterflies or the cider. Suffice it to say, that both I and my collecting-jar went home pretty nearly full after a few hours passed at the old cider-mill.

The tops of hills and low mountains are frequented by butterflies; and often when the sides of a hill are poor in both species and individuals, they will be found plentifully on the tops, especially if there is a cleared space in the forest occupied with shrubs and bushes where they may fly about. At such times they may be seen flying in regular circuits, and two or three will often chase each other up into the air until they are almost lost to view.

I remember such a hill near Sonora in California. Starting with a fellow-collector early in the morning of May 15th, we arrived at the top of the hill about nine o'clock. We had seen few butterflies on the way up; but on reaching the top, we found them in hundreds. The air was filled with them, they rested in dozens on every bush. There were not a great many species, perhaps not more than seven or eight kinds in all; but of these we could have taken almost any number, and I caught two cigar boxes full of perfect specimens — perhaps two hundred and fifty insects — before dinner time. A large number were imperfect; and we found a good many dead and dying ones on the rocks and ground. The lizards and ants were making great havoc among the weak and sickly ones, and the ground was littered with their wings. Why they had so congregated I cannot imagine. The gentleman with whom I went informed me that he had found them in this place several years in succession, at the same season of year.

The different species of *Parnassius* are mountain-inhabiting butterflies, and are usually found far up on the sides of high mountains. We have several mountain butterflies which are to be found upon the bare and inhospitable tops of the White Mountains in New Hampshire. Mountain valleys are usually very rich in butterflies; and on a road traversing such a valley the collector will sometimes find a veritable paradise for his labors.

Some butterflies are very combative, and will give chase to every flying object that comes in their neighborhood. They will even fol-

low to near the earth anything which is thrown into the air; and often I have captured insects which persisted in alighting far out of the reach of my net, by throwing my hat in the air and taking them as they followed it down.

When collecting in the woods where butterflies are wild and fly high, one may materially increase his captures by using a decoy, by pinning a dead specimen with its wings spread, in a conspicuous place, the top of a low bush with the leaves stripped off, for instance, and, standing ready with the net, the butterflies may be taken as they fly down and hover over the decoy. A live decoy may be used in the same manner by tying a thread around the body of the insect between the abdomen and the thorax and allowing it to flutter about where it can be readily seen. This method I have used very successfully in tropical countries to capture the superb but wild and high flying *Papilios* and the gorgeous *Ornithopteras*. I have sometimes been obliged to shoot with a shotgun the first specimen for a decoy. A piece of cardboard painted to resemble a butterfly I have seen answer for a decoy, and it has the advantage of durability.

Of some species of butterflies the males will be found to outnumber the females three to one or more in the specimens taken. That there really are so many more males than females I very much doubt, as in rearing specimens from the eggs or the larvæ the sexes seem pretty evenly divided; but possibly, on account of the males being more active and flying more in the open or being frequently more showy, the collector will almost invariably take more males than females of a given species. This discrepancy is shown in the catalogues of those who have butterflies for sale, where the females of some species are often two or three times the price of the males.

The females are usually much larger than the males, and are sometimes, though rarely, richer in their coloring. The males of some species may readily be distinguished from the females by noting the claspers on the end of the abdomen of the former. The females frequently have larger bodies than the males, their abdomens being distended with eggs. There are a good many kinds, however, where these distinctions are not readily seen and the sexes are difficult to separate. In some species the sexes very closely resemble each other, while in others they differ so much as to look like totally different insects. Take *Argynnis cybele* and *Vanessa antiopa* as examples of the former, and *Saturnia io* and *Attacus promethia* as representatives of the latter.

For a collector to capture one hundred species of butterflies in a day in some parts of Mexico, Columbia or Brazil is not an unheard-of thing; but here we have to be contented with a much smaller variety, and to take ten or twelve kinds in good condition is a good day's collecting.

WHEN BUTTERFLIES ARE MOST ABUNDANT.

June, and the latter part of August and the first of September are the best times of the year for collecting in the United States, although many kinds are to be taken at other times.

Between the latter part of June and the first of August there is generally a dearth of specimens, except of the different kinds of *Argynnis*, which are most abundant about the middle of July. This does not apply to the mountain districts, as excellent collecting may be had in the vicinity of Mt. Washington, N. H., the Berkshire Hills, Mass., the Adirondacks, N. Y., Blue Ridge, Va., and the Ozark Mountains, Ark. in July, where a dozen species of butterflies will be found in their prime at that season. The reason for this scarcity of butterflies when one might expect to find them most numerous is that the first brood has all hatched and gone, and the second is at that time still growing in the larval state. A collector may go out with his net at such a time and be well-nigh disgusted at the poverty of a locality which at former seasons has yielded him a fair harvest for his labors. How dull and uninteresting are the fields of grass and clover where not even a common yellow *Colias* or a white *Pieris* flits across the landscape to gladden his eyes. Plenty of moths may be had at this season, but the butterflies are scarce.

I am often asked by persons interested, "How long does a butterfly live?" My answer is: "Some species only a few days, or a week or two at the most; some hibernate and live in a dormant state several months, but their life of activity is very short; a butterfly is at its best only two or three days."

COLLECTING MOTHS.

ASSEMBLING.

This name is given to a method of bringing together numbers of the males of any species of insect by the aid of a virgin female of the same or an allied species.

The different species of the family *Bombyx* may be readily assembled, and a more interesting experience to an enthusiastic collector can scarcely be imagined. Some of the species assembled with little difficulty are among our largest and most handsome moths. *Saturnia io*, *Telea polyphemus*, *Actias luna*, *Attacus promethia*, *Saturnia maia*, etc., are all easily assembled, the method of procedure being as follows: Take a virgin female a few hours after she has hatched from the cocoon, and place her in a bag made of mosquito netting. Hang the bag out of doors on the limb of a tree or other suitable place, and have a light near enough so that you may see the males when they arrive. A warm, dark night with a light breeze blowing will be found most productive; and when the males begin to congregate, the collector will be busy indeed if he manages to catch and take care of half the specimens that come. Sometimes they make their appearance early in the evening, at other times later, and one must do his best when the dance begins.

An experiment which a friend of mine assured me he had tried with excellent success was on a warm afternoon to take the captive female with him on a ramble through the forests and fields, making a circuit of two or three miles about his home, and on returning hang the moth out of doors near his house as usual. He said he had very good reason to think that the males in flying about in the evening came across the scent left by the female as he carried her, and on following it up arrived at his house, where he was on the lookout for them. His success leads me to recommend this method to the collector, as my friend evidently puts a great deal of faith in it.

Attacus promethia and *Saturnia maia* are day flyers, and usually assemble best on warm afternoons, when they may sometimes be taken by dozens. It frequently happens that the first night after hatching a female will not attract the males at all, while they will come in numbers the second night. A good deal seems to depend

on the condition of the atmosphere; for on some nights the scent does not seem to travel well, and on others it must go for miles, judging by the number of specimens that follow it up. It is a fine sight and one worth losing half a night's sleep, to see these great moths, from two to a dozen at a time, circling about the trees or alighting on the grass, all eager to pay homage to the gentle lady in the net. She generally remains quiet or gives her wings a gentle tremulous motion, presumably to attract her dilatory lover, whom she has good reason to suspect has deserted her for some other fair virgin.

One particular evening when we were boys, my brother and I stayed up nearly all night capturing the moths that came to one captive female, *Telea polyphemus*. My mother came out about midnight to tell us that we must stop and go to bed; but she became so interested that she not only gave her consent to our remaining at the work, but actually got her net and joined in the excitement. We took something over two hundred perfect specimens of the males that night. It is a splendid way to capture large and fine specimens for the cabinet, and also to get series showing variety of coloring.

To see *Actias luna*, that lovely pea-green gem of the night, assemble in numbers, is an experience not soon forgotten. The female of this species should be taken to the edge of a forest containing walnut or birch trees and placed in position before dark. One must keep a constant watch over the prisoner, as birds and bats think of entomological specimens only as savory morsels for a meal, and will not scruple to tear the net open to get at the prize, as I have known them to do on several occasions much to my disgust.

But to go on with the methods for collecting: Take a lantern, a net and a poison jar, with a box or a small satchel and plenty of papers. If the night is favorable and the female in the right condition to give off the scent, a very interesting time may be expected. The moths are so light colored that they look almost white in the light of the lantern, and as they flutter down from the trees to where the female is held captive one will almost hold his breath for fear of frightening them. They are not wild, however, and do not seem to notice the collector and his net and lantern.

Cats and skunks take advantage of such chances of procuring a meal, and I remember once having left out all night a female moth in a net, and looking out in the morning to see my lawn strewn with the wings of hundreds of moths which the cats had killed and eaten.

COLLECTING WITH A LAMP.

On warm, moonless nights, especially if cloudy, moths are attracted toward a bright light, and many insects rarely seen at other times may be taken in this way. A second-story window overlooking lawns and cultivated fields, not far from forest trees, makes a good place to try. The lamp should be one which gives a large and brilliant light and be placed on the window-sill with the window wide open, so that the moths may come into the room, where they may be taken with a small net or captured in the poison jar as they rest on the walls or the ceiling. A piazza or balcony with a lamp on a table will sometimes be found to answer the purpose well. In that case place the table and lamp against the side of the house, so that the moths as they fly about will alight on the clapboards near the lamp, where they may be easily captured. The side of the house away from the wind will be found most favorable for this mode of collecting.

The good nights for taking moths in this way are not numerous, and one must make the most of them when they come. Collecting in this manner may be carried on from early May till late in October if the weather is favorable, different species making their appearance at different times. The variety thus to be collected is almost endless, and comprises moths from the minute *micro-lepidoptera* up to the giants of the race, six or seven inches in expanse of wings. One soon learns to recognize the different species by their modes of flight, as they bump their heads on the ceiling of the room in their strange bewilderment. When some much-prized moth enters, close the window, as I have known many a fine specimen to change his mind about adorning one's cabinet with his precious body and fly out of the open window much faster than he came in. To lose a rare and beautiful moth is a keen disappointment to an enthusiastic collector, and such a mishap may often be avoided if this simple precaution be taken.

One may sometimes make grand captures about electric lights, even in cities, by visiting them on warm summer evenings with the net and poison jar. Sphinx moths, which rarely come to a lamp, will often be seen flying in wide circles about the electric arc lights; they are then not very shy and may be easily taken.

While employed in Washington, D. C., I made a splendid collection of the moths of that region simply by going the rounds of a number of electric lights every evening. The lamps about the Treasury Building were sometimes very productive of fine specimens and the broad stone steps and pillars were frequently littered with moths, May flies, beetles, etc., where one could stand and pick out his desiderata with little difficulty. I captured several of the Regal Walnut moths (*Citheronia regalis*) and a number of our largest and handsomest sphinxes. Besides making the acquaintance of a number of insects new to me, I met several entomologists who, like myself, had been attracted to the lights by the abundance of specimens.

SUGARING.

A favorite manner with many collectors of taking specimens is by sugaring or smearing trees, posts, etc., with a strong mixture of rum and molasses, and taking the half-intoxicated moths with the poison jar. This method may be successfully practised during the summer and autumn and will add many new species to the collection.

The mode of proceeding is as follows: Get a pint of strong, dark molasses and boil it down until it is as thick or thicker than ordinary house-paint or gruel. To this add a quantity of rum, whiskey or other strong alcoholic liquor. Care should be taken, however, not to put in enough to make the mixture too thin or watery. After tying a rag on the end of a stick, by way of a brush, the collector is ready to sally forth. Select a locality not far from the woods, and before dark smear the trunks of trees, fence-posts, etc., with the mixture. At dusk the moths will begin to arrive, and the collector, provided with a lantern and a poison bottle, should go the rounds. If the locality is a good one and the night favorable, numbers of moths in all stages of intoxication, from "mildly hilarious" to "comfortably drunk," or even blissfully ignorant of everything about them, and too far gone to be able to wind up their extended tongues will be found about the bait. They are at these times easily taken, simply by placing the poison bottle under them and knocking them into it.

Many *Noctuidæ* and *Phalænidæ* come to such bait, and I know of no better manner of procuring the different species of the large and handsome *Catocala*. Most species of this genus may be

taken in this manner from the middle of August until cold weather. It is useless to try this bait where flowers are abundant, and moths will not come on cool or windy nights. The same trees may be smeared night after night with good results. A small box containing sheets of cotton batting cut to fit it is very useful for this mode of collecting. After a number of moths are captured in the poison jar, they may be turned out into the box and carried safely home between the sheets of cotton. It is best not to allow the moths to remain too long in the poison jar, as they are apt to rub their scales off, very much injuring their appearance.

COLLECTING ABOUT WILLOW BLOSSOMS AND GARDEN FLOWERS.

When the catkins of the willows are in bloom they attract a great many moths: and the collector provided with a bull's-eye light and a poison jar may reap a rich harvest in rare *Noctuidæ* on warm spring evenings. So intent on the repast are many of the moths that the net will seldom be needed. I have in mind one near-by locality where, after a warm day in spring, the moths may be collected by dozens on the willow catkins.

Many species of both butterflies and moths are attracted by fragrant flowers. The lilac, phlox, petunia, syringa, pink and many other common garden flowers are resorted to by butterflies and day-flying sphinx moths in the daytime, and by moths of many kinds at dusk and late into the night. A bull's-eye lantern and a net are needed for their capture after dark. Some of our largest and handsomest insects may be captured in this way, as they remain poised on the wing, tongue extended, extracting the nectar from the flowers. Some of the sphinx moths are very shy, and are liable to leave if the rays of the lantern are turned directly on them. They are apt to flutter a great deal after being captured in the net, so that they should be taken out and quieted as soon as possible, else they may ruin their appearance endeavoring to escape.

I have taken in this manner in a single evening over forty sphinx moths, representing eight species, near one bed of phlox. In some localities I have no doubt that this number can be exceeded, or even doubled, by one who understands the capture of these fine insects.

COLLECTING CATOCALA.

Catocala are sometimes found in numbers in the forest on the trunks of trees; and when a collector is fortunate enough to run across such an assemblage he should make the most of the opportunity, as it is not likely to occur very often in one's experience. The different species of *catocala* so closely resemble in color and markings the bark of certain trees, that it is next to impossible to see them. Oak groves seem to be their favorite haunt, and the tree trunks for the space of an acre or two are sometimes well peopled with them. They are so shy that one must use the greatest caution in their capture. They are best taken by placing the mouth of the poison jar over them as they lie with folded wings feeling secure in their striking adaptability in color to the moss-covered bark. Many species may sometimes be taken in one locality; but they are all wild and very rapid flyers, so that it is difficult to capture them on the wing. It is best not to undertake their capture with the net for another reason: I refer to their liability of injuring themselves in their desperate efforts to escape. A poor specimen is little better than none at all for exhibition purposes; in fact, I regard one really beautiful, perfect specimen nicely mounted, of more value than one dozen worn and mutilated ones. To view a collection of fifty fine and perfect insects will give a naturalist more pleasure than to look over a whole cabinet full of rubbish collected with no care and mounted in a slovenly manner.

The greatest care is necessary in handling the *catocala* as their scales come off with a touch, leaving bare and unsightly patches. *Catocala cara* and *C. concumbens* are often found under bridges over rivers and brooks, hanging back downwards from the boards or stones. One bridge a mile from my home has furnished me with many excellent specimens of the two species named; and I rarely go there in the season but I find from ten to thirty of these insects. It is useless to look for them in such localities before the middle of August. The same species may also be found on the underside of tree trunks which overhang the water.

The *catocala* often frequent rocky ledges and stone walls where the gray color of the upper wings of some species harmonize with their surroundings.

GATHERING CHRYSALIDES AND COCOONS.

The larvæ of many moths go into the ground to pupate, where they remain (many of them) during the winter. At the approach of warm weather they work their way to near the surface where the perfect insect can easily find its way out. At such times they are easily found by raking over the fallen leaves under the trees in close proximity to their trunks. Scattered groves of large trees are likely localities in which to hunt for chrysalides in this manner: and pines, oaks, poplars, willows, elms, etc., are reasonably sure to furnish treasure for the searching.

A stout, forked stick makes a good tool with which to work, and a box containing leaf mould answers well for a depository for the specimens, in which they may be left until the flies emerge. The cocoons of a variety of moths may be found attached to the twigs of the trees on which the larvæ feed, after the leaves have fallen in the autumn. Wild cherry and sassafras will sometimes be found with a number of cocoons attached, while oaks, elders, birches, maples, and numerous other trees and shrubs will each yield their reward for diligent search. The naked chrysalides of butterflies are often attached to fences, walls and houses besides the stems of the food plants of the larva. The chrysalides of many butterflies are exceedingly difficult to find, and with some species it is only by most diligent search that success may be attained. If one wants to make a trial, let him begin with one of our most common butterflies, *Colias philodice*, which abounds everywhere in fields and meadows in summer. See how many hours of patient exploration are necessary to find the first chrysalis; while to locate in the pupa state *Argynnis idalia*, *Melitæa phæton*, *Limenitis ursula*, *Papilio turnus* and others of our well-known butterflies may require many days of study and careful search.

TO REAR SPECIMENS FROM THE EGG OR THE LARVA.

Many species of lepidopterous insects are easily reared from the egg or the larva.

One may procure the eggs of some butterflies and moths simply by enclosing in mosquito netting a fertilized female with a branch of the plant upon which the larvæ feed. Some insects, however, cannot

be induced to lay their eggs in this manner; and sometimes it is only by watching the female at liberty depositing her eggs that they may be had at all. Many of the eggs are smaller than the head of a *doll's* pin, and are frequently attached to the underside of the leaves of the food plant, so that diligent and careful search is necessary to find them. Most of them are covered when first laid with a gum or varnish which when dry securely fastens them to the objects upon which they are deposited.

The number of eggs laid by a single female varies from one hundred to five or six hundred or more, according to the species. They are often laid singly, especially by the butterflies: but a large number of the moths deposit their eggs in a compact patch and in regular rows so close together that they touch each other on all sides.

The eggs deposited during the warm days of summer soon hatch, while those of autumn remain unchanged until the following spring.

The heat of summer and the cold of winter seems to have no injurious effect upon the eggs of butterflies and moths; and if it were not for the army of creatures whose life work it is to keep these hosts in check, every green thing in the way of vegetation on the face of the earth would be devoured.

Just before hatching, an egg frequently assumes a leaden hue, and the young larva eats his way out of his prison and escapes, often devouring before he goes the egg-shell which has sheltered him. At this stage the larva is frequently very unlike the mature caterpillar. He should now be placed in a glass jar with an inch or two of moist loam at the bottom, with young and tender leaves of the food plant. He will have a sufficiency of air if the cover is kept on, and the leaves will be kept fresh longer. Care should be taken not to place the jar where the direct rays of the sun will shine on it, as the temperature may become too great. One may introduce into the jar a small bottle of water, holding the leaves if this is desired; but the mouth should be plugged with cotton or the larva may fall into it and be drowned. The caterpillar will grow rapidly, and will require a good deal of fresh food. For this reason it is best when it is one-third grown to place it on a branch of its food plant and enclose the whole in mosquito netting.

In rearing quantities of larvæ a barrel without either head may be placed over a bush and all the branches brought up through the top. Then after enclosing the branches which protrude in mosquito netting and introducing the larvæ to be reared, fasten the

netting securely round the top of the barrel. This simplifies the rearing of larvæ and gives them conditions almost exactly the same as they enjoy in a free state. A great many specimens may be reared at one time in this simple manner.

If the insects are earth-loving species and desire to complete their transformations in the ground, they must have an opportunity to do so, and should be placed in a box with loam when fully grown.

Many will spin cocoons, others will attach their naked chrysalides to the twigs of the food plant. Great care must be taken with the larvæ to protect them from their natural enemies, the ichneumon flies, which are constantly on the watch for an opportunity to deposit their eggs in or on them. For this reason they should not be exposed out of doors unless covered with fine-meshed netting.

The cocoons may be kept in a wooden box in the cellar during the winter months. The naked pupa, including those which have transformed in the soil, may be placed in tin cans (ordinary fruit cans will answer) without any soil or loam and kept in the cellar also. These should have the covers put on to prevent the pupæ becoming too dry, as they are almost sure to do if not covered tight. In this way their preservation is a simple matter, and their loss by drying or mould is completely done away with. In the spring the cocoons may be tied on strings and hung in the attic, where they will hatch without trouble.

The naked pupæ may also be removed to the attic and allowed to remain in the tin cans until a short time before the fly should emerge, when the pupæ may be placed in a good-sized wooden box, on (not in) damp earth, with a few leaves covering them, and allowed to hatch. The box may be covered with netting to prevent the escape of the perfect insects. A few twigs placed among the chrysalides will enable the newly hatched flies to suspend themselves so that their wings will develop in the normal manner.

CLASSIFICATION.

The following order of classification, adopted mostly from that of Mr. Henry Edwards, will be used in this work.

ORDER LEPIDOPTERA. Moths and Butterflies.

Sub-order Heterocera. The Moths.

Micro-Lepidoptera.

PTEROPHORIDÆ	Plume Moths.
TINEIDÆ	True Moths.
TORTRICIDÆ	Leaf Rollers.
PYRALIDÆ	Snout Moths.

Macro-Lepidoptera.

GEOMETRIDÆ	Loopers or Spanners.
NOCTUIDÆ	Owlets or Moth Millers.
BOMBYCIDÆ	Spinners.
ZYGÆNIDÆ	Zyganids.
ÆGERIDÆ	Glass-wings.
SPHINGIDÆ	Dusk-flyers.

Sub-order Rhopalocera. The Butterflies.

HESPERIDÆ	Skippers.
LYCÆNIDÆ	Blues, Coppers, Hairstreaks.
SATYRIDÆ	Wood Nymphs, Browns.
NYMPHALIDÆ	Angle Wings, Silver Spots.
PAPILIONIDÆ	Whitelings, Yellows, Swallowtails.

HETEROCERA. *The Moths.*

In this group of insects the antennæ are of various shapes, generally terminating in a point, while the wings are usually folded roof shape over the abdomen when the insects are at rest.

Many of the species have a bristle attached to the upper edge of the hind wing near the body which fits into a loop in the lower edge of the upper wing for the purpose of holding the wings together during flight. By turning the insect upside down and spreading its wings the bristle and loop may be readily seen.

Many of the species are extremely minute, the aid of a microscope being necessary to study them, while a few are gigantic in comparison, being among the largest and grandest insects known.

Many are plain in color or their coloring is soft and blended, while a few rival the gayest and richest butterflies. Most of the species fly by night, a few love the hottest sunshine, while others prefer the dusk of morning and evening.

Their geographical range is very great. They abound in the tropics in countless myriads while species of this group have been seen in the cold and barren wastes of the most northern polar lands. They are found in every land and under all conditions of climate, either as the perfect insect or as the egg, larva or chrysalis.

Some species make cocoons in which to pupate; many burrow in the ground or hide under leaves in the forest.

Most of the caterpillars of moths feed on the leaves of plants, some in the stems and trunks of trees, while some devour fruits. The small kinds, probably best known to the thrifty housewife, devour woollens, feathers and furs.

The moths outnumber the butterflies many times and between five and six thousand species are natives of America north of Mexico.

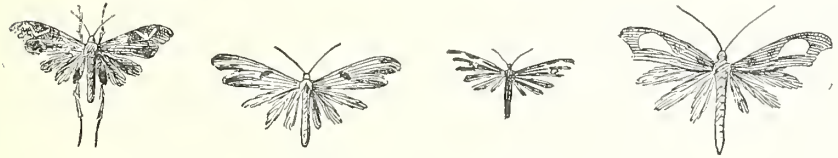
These insects are nearly all, except the silk producers, directly injurious to man's interests: the parasites and insectivorous birds and mammals keeping these vast hosts in check.

MICRO-LEPIDOPTERA.

A few only of the innumerable species belonging to the four groups representing the micro-lepidoptera will be mentioned and figured in this work. The detailed study of these minute creatures belongs to the specialist, and even he can only hope to become well acquainted with the species of a few genera.

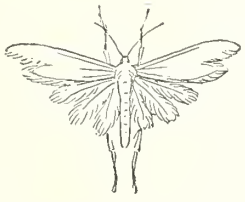
PTEROPHORIDÆ.

The *Pterophoridæ*, or plume moths, have the wings divided into plumes or feathers. Their bodies and legs are slim, and the creatures are so delicate as to be difficult to capture and preserve without injury. Most of these insects are night flyers and may be met with from early in the spring till late in the fall.



Various Forms of Plume Moths.

The caterpillars are hairy and spin no cocoon, changing to a naked chrysalis suspended from the end of the abdomen. The chrysalides of some species of these moths are also hairy.



Pterophorus pentadactylus.

The white plume moth (*Pterophorus pentadactylus*) is not a common insect in the East, but I have taken it on a few occasions with a lamp in June and July, and have seen it often in Northern Ohio and Virginia in those months. It flies slowly and is so exceedingly

fragile that the greatest care is necessary in handling it. The larva is said to feed on the tender leaves of the convolvulus; but I have never seen it and know nothing of its habits. The moth has an expanse of wing of about seven-eighths of an inch in a good-sized specimen, but is often smaller. The upper wings are two-lobed or plumed, and the hind wings three. The insect is often a pure silvery white. Sometimes, however, its wings are sprinkled with a few gray scales. The legs of the moth are so long, and it stands so high when at rest, that it bears a slight resemblance to a crane fly, and would hardly be thought to be a moth at all by the novice.

We have a number of species belonging to this family but this is one of the largest and most easily recognized.

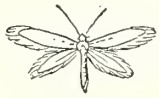
Alucita hexadactyla.

The six-plumed moth (*Alucita hexadactyla*) is a common American species, being also found in Europe. Its expanse of wing is about half an inch, and each wing is six-plumed, being yellowish-gray in color with brown markings, and a black dot at the end of each feather or lobe. The caterpillar feeds on the flowers of the honeysuckle, is of a reddish-salmon color, and, unlike most of the other species of this group, spins a silken cocoon. The moth is said to hibernate during the winter.

TINEIDÆ.

The *Tineidæ* are mostly very small moths, and the number of species belonging to the group is very large. Many of these insects are gayly, some magnificently, colored; but a microscope is needed to see their beauty. Their wings are narrow and pointed, and are fringed with long delicate hairs. The larvæ of these moths are minute creatures; and many of them are leaf miners, so called because they burrow in the leaves just below the surface, and make long and crooked passages widening as they advance. Some species bore in plant stems, some attack grain stored in houses, some mine in the roots of plants, some few produce galls, and some make sad havoc in our houses among woollen goods or feathers, if left where they can procure access to them.

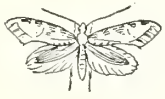
Tinea flavifrontella,—the common clothes moth, is found in our houses in summer, and may frequently be seen flying about our apartments at night. It is of a light yellowish color and has a silky appearance.



Tinea flavifrontella.

The larva is whitish and does great damage to woollens, using the material on which it feeds to make its pupa case.

Numerous moth destroyers are used to exterminate this pest. Camphor, naphthaline, benzine, snuff and corrosive sublimate may be all used with effect; but common kerosene oil is perhaps the simplest, cheapest and most effective. When woollens are to be put away for the summer, sprinkle kerosene oil profusely in the bottom of the trunk or box in which they are to be packed and after it is filled lay over the goods a paper saturated with it and close the whole up tight. When it is desired to use the clothes once more, a few hours' exposure to the air and sunshine will remove all smell of the kerosene.



Tinea granella.

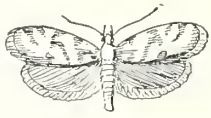
Tinea granella is a creamy-white moth with brown markings on the upper wings one-half an inch in exposure, and the larvæ live in our granaries, where they entail great loss if left undisturbed.

The female moth lays its eggs upon the grains of wheat, and the worms eat their way into the grains, reducing them to shells and binding masses of them together with their webs. The larva, according to Curtis, makes a cocoon composed of web and wood-pulp in which it hibernates during the winter, changing to a chrysalis in the spring and soon after emerging a moth.

Hyponomeuta millepunctatella.

In *Hyponomeuta millepunctatella* the larvæ are gregarious and spin cocoons. The moth is three-fourths of an inch across the

expanded wings, the fore wings being white with black dots, the hind wings dark gray.



Depressaria robiniella.

Depressaria robiniella. This moth expands three-fourths of an inch. The head and fore wings are reddish-brown spotted with yellow. The hind wings and body are gray. The green larvæ live on the leaves of the locust and spin their webs among the leaves drawing them together. They are very active creatures and in searching for them by pulling their webs apart they are very liable to wriggle away. The larvæ are said by Packard to pupate among fallen leaves on the ground.

The genus *Nepticula* contains many very minute and yet many very beautiful species. To this genus belong the smallest of all known lepidopterous insects, many of them less than an eighth of an inch in expanse of wing. The larvæ of these minute insects mine in the leaves of different species of trees.

TORTRICIDÆ.

The leaf-rollers, so called because the larvæ of most of the species of this group of moths form the ends of leaves into rolls for their protection, are a numerous family, represented by many species in this country.

The fore wings of these moths are broad and are often brilliantly colored, while the hind wings are usually sombre.

Some of the larger species are gregarious in the larval state, uniting a number of leaves by webs, among which they feed and

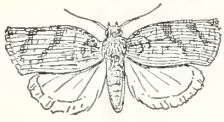
Various Forms of Leaf-rollers.

finally pupate, leaving the empty shells of their chrysalides protruding from the webs.

Lozotænia cerasiovorana is about one inch across the expanded wings, which are of an ochre-yellow color crossed by brownish markings.

The larvæ of these insects are gregarious and live on the leaves of the choke-cherry, their unsightly nests with the yellowish-brown shells of their chrysalides attached to the outside of the webs by their posterior ends may frequently be seen by the roadside. The moths often remain about or upon the nests several days after hatching.

Lozotænia cerasiovorana.



Lozotænia rosaceana.

Lozotænia rosaceana expands nearly an inch in a fine specimen. The fore wings are light brown crossed by bands of reddish-brown and the hind wings are light yellowish brown. The larva is said by Packard to bind together the leaves of the rose, apple and strawberry with a few silken threads. The insect is double brooded, one appearing in June and another in August.

Antithesia pruniana.

Antithesia pruniana is five-eighths of an inch in expanse, and the fore wings are marbled with black and lilac with white on the outer portion. The larva lives on the plum, and is a native of Europe as well as this country, doing considerable damage.

Carpocapsa pomonella.

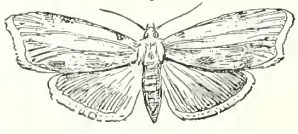
Carpocapsa pomonella is the famous coddling moth, the larvæ of which often does so much damage to the apple and pear crop, living in the interior of the fruits and causing them to drop to the ground when only partly grown. The moth is half an inch in expanse and is dark brown in color.

PYRALIDÆ.

The *Pyralidæ*, or snout moths, may be recognized by the long fore wings, their long legs and elongated bodies. Many of them also have the palpi very much elongated, from which they derive their common name. Some species are day flyers, others fly at dusk and still others fly at night and are purely nocturnal. Some of them are white and silvery in appearance, while their wings are bordered

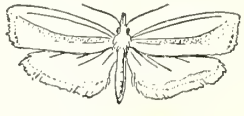
Various Forms of Snout Moths.

or streaked with bands of gold, others are gray or brown, often of a silky lustre, while some are black with white spots. While at rest many species fold their wings close to and partly around the body, giving them a tubular form. Many of the larvæ feed upon grass and clover, while some devour the leaves of the grape, and one interesting but very destructive species infests the comb of the honey-bee often ruining all the comb in a hive.



Galeria cereana

This species, *Galeria cereana*, is gray and purplish-brown in color, and the larvæ pupates among the honey-combs, where it has constructed its silken galleries. This insect is double brooded.



Crambus girandella.

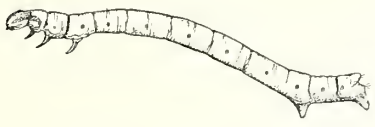
Crambus girandella is satin white with a broad gold band on the fore wings. The larva is whitish or gray, of a silky appearance and feeds upon grass or clover. This insect is sometimes very abundant, and I have seen the whole front of a house where a bright light was kept burning during the night so covered with this species as to look silvery white at a distance of a few feet.

GEOMETRIDÆ.

Loopers or Spanners.

The insects belonging to this group are easily distinguished by their slim bodies and broad thin wings, which, when the insects are at rest, are spread out flat, scarcely overlapping at the edges. The coloring is usually soft and delicate in tone, being often brown, gray-green or buff, crossed by darker wavy lines. The antennæ are often feathery (pectinated) and the legs usually slim and long.

The larvæ, from which the group derives the name of *Geometridæ*, or "earth measures," are readily distinguished from the larvæ



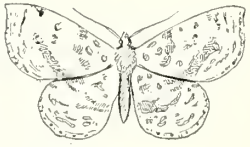
of all other moths by their peculiar mode of progression, which is by bending the body into loops, thus giving the appearance of measuring the ground over which they travel.

Larvæ of geometrid moths.

From four to six of the abdominal legs possessed by the larvæ of most lepidoptera are wanting in this group, in consequence of which the larvæ of geometrids may be recognized at a glance. Many of these larvæ spin silken threads wherever they go and are ready to quit their hold and drop from the leaves on which they may be feeding whenever danger threatens, mounting their threads and resuming operations again when it is past. Some of the caterpillars spin slight cocoons beneath leaves at the trunks of trees, while others burrow into the ground and there undergo their transformations.

The insects of this group are numerous both in species and individuals, and specimens may be taken from the first warm days in spring till late into the fall.

Angerona crocataria is a yellow moth with light brown markings, and expands from an inch and a half to two inches. The larva feeds



Angerona crocataria.

on the currant and strawberry and is yellowish or light green, with brown dots and markings. The perfect fly may be found among low bushes near cultivated fields during June, and, like many other moths of this class, it flies a good deal in the daytime.

Brephos infans.

Brephos infans is one of the first moths to appear in the spring and is a northern species, being found throughout New England and north into Labrador. It is a day flyer, and may be taken in the latter part of March or the early part of April before the snow has left the ground. It prefers low, bushy districts, where alders and willows abound, and in favorable localities may be seen in some abundance though generally shy. It is a pretty moth, about one and a quarter inches in expanse, the fore wings being brown with light gray markings, while the lower wings are red with brown margins. The caterpillar is unknown to me.

Anisopteryx vernata.

Anisopteryx autumnata.

Anisopteryx vernata and *Anisopteryx autumnata*, the spring and fall canker-worm moths, have in the larval state long been a seri-

ous pest in different parts of the country, as they frequently appear in such numbers as to completely strip the foliage from apple, elm and other trees, leaving them as if devastated by a conflagration. These moths are about one and a quarter inches in expanse of wing.

As the females of these two species of moths are wingless grub-like creatures, and can only deposit their eggs on the trees which form the food of the larvæ by climbing their trunks, it would seem that their destruction is a simple matter. Still one sees whole districts wherein fruit and shade trees have been stripped of their foliage, in spite of the precaution of encircling the trunks with bands of tar paper smeared with tar or printer's ink. The spring canker-worm moth makes its appearance early in April, and the males may then be seen in numbers fluttering against the windows of a well-lighted room. By going out with a lantern the females may be found ascending the trees to lay their eggs, the males hovering about.

The moth of the fall canker-worm emerges from its cocoon, which is spun beneath the ground, late in October. The spring canker-worm makes no cocoon, but hollows out an oval cavity in the soil in which it passes the winter as a chrysalis. These two species resemble one another closely, both in the larval state and as the perfect fly, the fully developed insects being light gray and brown with light lower wings.

Zerene catenaria.

Zerene catenaria, beautifully white, with black markings and dots, is not uncommon in our fields and among low shrubs in September and October. It is feeble in flight, and is often quite local. In expanse it will measure about one and a half inches. I have never seen the larvæ, but have found the thin, transparent cocoons attached to low shrubs, and have hatched the moths.

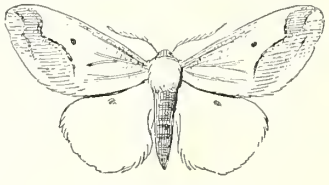
The larva of *Amphidasis cognataria* feeds on the maple and currant, and, like the full-grown moth, is thick-bodied for a geometrid.

Amphidasis cognataria.

The moth is dark gray, speckled and marked with black, and about two inches in expanse.

Rheumaptera hastata.

Rheumaptera hastata is a black-and-white moth, little more than an inch in expanse, easily recognized from the other species of this class. It may be found in June along roads in the woods, where it flies in the daytime, much like a butterfly. This insect is said to be widely distributed, being found in Europe and Asia, as well as America. The caterpillar, which is dark brown, feeds on the leaves of the birch, where it lives in colonies.



Hybernia tiliaria.

This moth, *Hybernia tiliaria*, about two inches in expanse, resembles the canker-worm moth, in that the female is wingless and that it is in the larval state destructive to fruit and shade trees. The larvæ are yellow, with black lines on the back and sides, and are sometimes so plentiful as to completely denude trees of their foliage. When

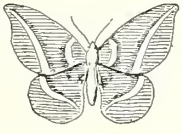
fully grown the larvæ descend into the ground, where they transform to pupæ a few inches below the surface. The perfect insect makes its appearance in October. It is light buff-yellow with orange spots, while the hind wings are nearly white.

Petrophora diversilneata.

Petrophora diversilneata is a very pretty moth, which often makes its way into our rooms at night. It is yellowish, with a slightly red or pink shade on the outer half of the fore wings; which are crossed by a number of reddish-brown lines. The lower wings are lighter near the body with a few brown lines near the lower edge. It is about an inch and a half in expanse of wings. The larva lives on the leaves of the grape, but rarely in such numbers as to do much damage.

Hæmatopis grataria.

During August the pretty little moth, *Hæmatopis grataria*, may be found in meadows, especially near streams, where it is sometimes quite abundant. It has a wide range, as I have taken it in Iowa, Ohio, Virginia, and the New England States. The moth is about one inch in expanse. It flies a good deal in the daytime, soon alighting after it has been flushed from the grass. Its colors are yellowish-red crossed by bands of pink. The larva is said to feed on chickweed.



Geometra iridaria.

An exceedingly beautiful little moth is *Geometra iridaria*. About one and a quarter inches in expanse of wings, it is of a rich

shade of green, the wings being crossed by white lines edged with purple. There are a number of green moths belonging to this group which resemble one another closely, but this is the most attractive in coloring, and were it as large would rival the beautiful *Actias luna*. I know nothing of the life history of this moth, but have often been charmed with its beauty as it flew in at the open window to my lamp.

Among the many geometrids to be found in our country I may mention the following species, as shown in the illustration.

Endropia marginata, having all wings yellowish-buff, bordered with a broad band of light brown. Expanse one and three-quarters inches. This moth may be taken with a lamp early in September. A smaller moth, *Endropia hypochraria*, has brownish-gray wings with brown markings. It expands about one and a half inches.

In *Eutrapela clematata* we have a moth with brownish-gray wings the inner part darker crossed by brown and light gray lines. It expands one and three-quarters inches. *Eutrapela transversata* is light brownish-yellow, with distinct lines and markings of brown. Expanse nearly two inches.

Acidalia ennucleata is creamy-white with brown markings near outer edge of wings. Expands one and a quarter inches.

A finely marked moth, *Therina seminudaria* is light gray with wings crossed by yellowish-brown and yellow lines. Expands one and three-quarters inches.

Before leaving this interesting class of insects, having figured and described only a small number of the more common species, a few words in regard to the wonderful protective coloring, shapes and habits of some of these moths and their larvæ may prove interesting to the student of entomology. The thin, flat wings of these moths enable them to conceal themselves, not by folding the wings up close to the body as so many other species do, but by spreading them out flat on the objects on which they rest, hugging so closely to their support as to appear to be a part of it. Some of the species closely resemble patches of lichens when flattened against the trunks of trees, the lines and bits of color on their wings helping out the resemblance to such an extent that when discovered, one is sometimes half in doubt where the insect leaves off and the bark begins. The green species, many of them, extend their wings on the green leaves, lying so close to the surface as to be scarcely distinguishable.

Eutrapela clematata.

Endropia marginata.

Therina seminudaria.

Eudropia hypochraria.

Acidalia enucleata.

Eutrapela transversata.

GEOMETRID MOTHS.

Some yellow and brown species have the habit of resting with wings extended on the upper sides of leaves so as to almost exactly resemble the brown and withered patches on half-dead foliage. One or two kinds when at rest throw their bodies into curious attitudes, at the same time bending their wings into such shapes that when seen one can hardly believe they are anything but dead fragments of leaves adhering to stems.

The larvæ of this group of insects are many of them protected both by their shape and coloring, and even by their habits in a remarkable degree. A large number closely resemble twigs, and will remain standing out straight at an angle of forty-five degrees from a branch, holding on by their posterior claspers for hours at a time. So closely do these caterpillars resemble the small stems of plants with their minute knots that one may have to pick them from the branch to be sure he is not mistaken.

One does not need to go far from home to come across examples of protective mimicry as striking and as useful to contemplate as any the world affords, and a study of the geometrids in both their larval and mature state will point as clearly to the law by which every animal is just adapted to its surroundings and protected in a degree from its enemies as any so charmingly used by the great naturalists Charles Darwin and Alfred Wallace to illustrate the law of natural selection.

NOCTUIDÆ.

Owlets, or Moth Millers.

The moths belonging to this large group are stout-bodied and rapid-flying insects, and are, as their name implies, seldom seen on the wing except at night. When at rest they fold their wings over the body, roof-shaped, in such a way that the lower wings are entirely concealed. Their antennæ are long and tapering, and their wings are always fastened together by the loop and spur already mentioned in another chapter. Most of these insects are sombre in coloring, browns and grays being the predominating colors. Many of them are thickly covered with long hair-like scales, which are easily loosened. The thorax is frequently tufted; and the legs covered with long scales are sometimes provided with spines at the joints. Most of our native species are of small or moderate size, but some of the

exotic species are gigantic, specimens of *Erebus strex* from Brazil sometimes measuring twelve inches from tip to tip of the expanded wings.

Great difficulty is experienced in identifying many of the small and plain-colored insects belonging to this group, as they are frequently very much alike both in shape and markings, and puzzling varieties in colors are common.

The larvæ are usually smooth, though some are hairy, and a few possess tubercles and warts. They are generally provided with sixteen legs. Some make cocoons in which to transform to the chrysalis state: the majority burrow into the ground and form smooth, naked chrysalides. Many of the caterpillars feed exclusively by night, hiding by day, and a number of species are among the principal insect pests with which the gardener and farmer have to deal.

Our first example is the splendid moth *Erebus odora*, which expands six or seven inches and is occasionally taken as far north as Canada. It is a rare visitor, and one may consider himself exceedingly fortunate who captures a good specimen, for it is said not to live in the United States except as a wanderer from Mexico. I have never taken a specimen, but know of several instances where they have been captured in New England and the Western States. The insect is not rare in Mexico; and one rarely sees a collection from that country which does not contain one or more specimens of this fine moth.

The predominating color is dark brown; but in certain lights, pink and metallic purple and blue are reflected from the wings.

There is frequently a good deal of variation in this species, sometimes the wavy lines running across the wings being almost white and again obscure gray or yellowish brown. This insect is a very strong flyer, as specimens are said to have been taken on board a ship, one hundred and twenty-five miles from the nearest land. I know nothing of the larva or of the life history of the insect.

In *Parthenos nubilis*, the insect looks very much like the *Catocala* and has much the same habits. The upper wings are dark brown, black, gray and creamy-white. Thorax and body light brown. Lower wings blackish-brown with four wavy and somewhat indistinct bands of yellowish-orange. Expanse of wings two and one-half inches. I have specimens of this insect from New England and the Middle and Western States. It may be taken in the company of *Catocala* and seems to have a wide range.

Erebus odora.

The genus *Catocala* is very well represented in this country, and is of more interest to the collector than any other class of the Noctuidæ, both on account of the large size of many of the species and also for their great beauty. These insects frequently measure three inches or more across the expanded wings. The upper wings are usually brown or gray with numerous zigzag lines running across them, while the lower wings are frequently crossed with broad black bars, alternating with bands of red, yellow or white. The lower wings are hidden from view when the moths are at rest. The larvæ feed on various forest trees, oak and hickory being their most common food plant. Both the larvæ and the perfect moths are protected by their resemblance in color to the bark of trees, and only careful and dilligent search will enable one to find them. There are eighty or more species of this genus native to this country, and a large number of varieties which have been given separate names. The identification of some of the species is difficult, both on account of their variation and the obscurity of their markings.

Catocala cara is one of the most common moths of this genus as well as one of the largest and finest.

It loves to fly along water-courses at night, particularly where they are bordered on either side with forests, and on this account may often be found in the daytime hiding on the underside of the boards and beams of bridges, and I have myself taken thirty-seven specimens of this fine moth under one bridge in less than an hour. If one knows of such a place, he may visit it every day from the middle of August to the last of September and be tolerably certain of finding specimens of this and sometimes one or two other species. Where trees overhang the water, too, one may look for this insect with good chances of success in finding it.

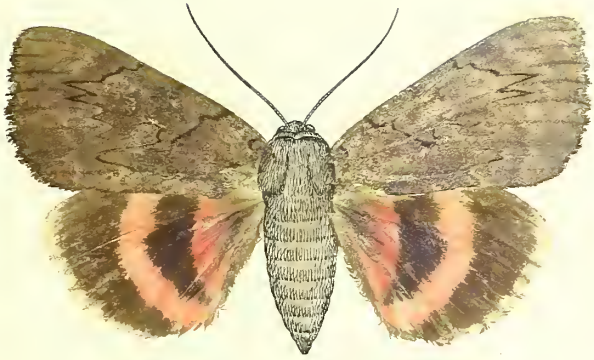
The larva of this insect lives on willow and may sometimes be found descending the trunk of a tree preparatory to burrowing under the leaves to undergo its transformations. The scales of all these moths seem to be very loosely attached, and the greatest care is necessary in handling them. I make it a rule never to touch one with my fingers for fear of injuring it. When a moth of this kind is seen on the trunk of a tree do not try to use the net for its capture but place the open end of the poison jar over it and when it flies into the trap put on the cover and the insect is safe. Each specimen should be taken out and placed in an envelope or collecting paper before another one is put into the jar. Although many of the *Cato-*

cala may be enticed into one's room on warm evenings in August, by placing a light in the window, I have never yet taken *Catocala cara* in this manner: nor does it seem to be attracted by sugaring, and if one had to depend on this mode of capture he would conclude that it was a rare insect.

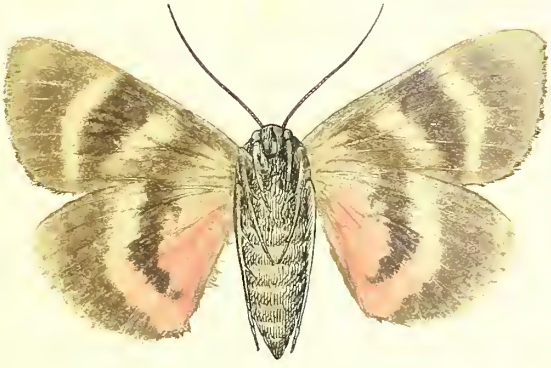
Catocala relicta.

This is one of the finest and rarest of the *Catocala*. The upper wings of the male insect are creamy-white, crossed by several indistinct bands of gray; the lower wings are black, with a white curved bar crossing just below the middle and a creamy-white fringe at the margin. The head is light: but the thorax and abdomen are dark gray, almost black. The upper wings of the female are much darker, although specimens may be found ranging from almost pure white to dark gray. A fine specimen of this rare moth will measure nearly four inches across its expanded wings, and it is enough to make one's heart jump with excitement to see one of these strikingly marked insects quietly sipping the intoxicating liquid where one has smeared a tree-trunk with rum and molasses.

Like many other species of the genus *Catocala*, this insect is local, and may sometimes be found in some abundance. One collector with whom I am acquainted has taken a dozen perfect specimens in a season, but this must be considered very unusual. I have always found it a very scarce insect. It is widely distributed, as I



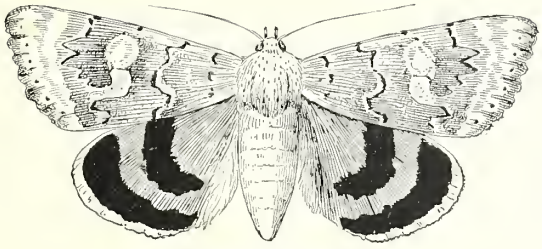
Upper Side



Under Side

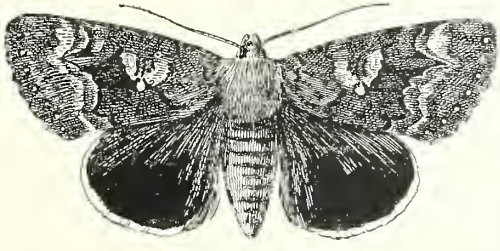
CATOCALA CARA

have had specimens from New England, Ohio, Illinois, Arkansas and Virginia.



Catocala concumbens.

Although common, *Catocala concumbens* is a very attractive insect. Its forward wings being a soft gray, while two bars of black and two of pink adorn the lower wings. This moth may be taken by sugaring, and it will also come to a light, and is a pretty creature for one to see coming in at his window fluttering its wings of black and pink just in front of his face. This insect is probably found over a large part of this country, as I have specimens from many localities. Stone walls or heaps of rocks in the woods seem to be favorite haunts of this moth; and as the bright pink lower wings are covered by the gray upper ones when at rest, it is not easily discovered. Two and three-quarters inches is the expanse of wing of a good-sized specimen. The caterpillar lives on willow.



Catocala epione.

A number of the *Catocala* have no bands of bright color on the lower wings, but these members are simply black or dark brown with a white fringe, while the upper wings are very like those insects I have been describing. The present species is one of this class, and there are a large number so closely related that their separation into species is not an easy matter.

These moths inhabit oak woods, generally in company with other kinds, and are most often to be found in the daytime hugging closely to the trunks of the trees where their gray wings marbled with dark brown and black render them difficult to see. When once alarmed they readily take to flight and are strong and rapid on the wing. This species may be taken by sugaring but rarely comes to a light. The larva lives on oak.

Catocala fratercula.

The little *Catocala fratercula*, which much resembles some of the larger kinds, is often abundant in oak woods in August, where it may be found in company with the larger species. Its fore wings are light gray, with creamy-white and brown patches and markings, and its lower wings are orange banded with black. One will often find this moth on fences and stone walls as well as tree-trunks. Half-a-dozen or more species of the same size may easily be mistaken for this and the beginner will encounter many difficulties in separating the species of *Catocala*. The larva lives on oak.

The moth *Catocala cerogama* has upper wings gray and brown, with black markings. Thorax gray. Body brown. Lower wings brown near the body, the rest being black crossed by a single narrow band of dull orange, edged with yellowish-gray. This insect expands a trifle over three inches. I have not found it a common specie, but have specimens from Arkansas, Ohio, Massachusetts and Ontario, Canada.

In *Catocala parta* the upper wings are gray, light brown and black. Thorax gray and black, body light brownish-buff. Lower wings orange-red with one narrow and one broad black band, the outer margin yellowish-gray. The insect expands three inches and a half in a fine specimen. This is not a rare insect, and I have taken it in Massachusetts, Southern Ohio and Illinois, and have specimens from Ontario, Canada.

Catocala subnata. Upper wings gray and light brown. Thorax light gray, body yellowish-brown. Lower wings ochreous-yellow

Catocala parta.

Catocala cerogama.

Catocala unijuga.

Catocala subnata.

NOCTUID MOTHS.

crossed by two bands of black. Expanse nearly three and one-half inches. I have never taken this insect, but have specimens collected in Southern Ohio.

Catocala unijuga. Upper wings dark gray and black with light gray wavy lines. Thorax dark gray. Body brown. Lower wings bright orange-red, edged with white and crossed by two intensely black bands. Expanse of wings three inches. This is a common insect in the northeastern part of the country, and I have a number of specimens from Canada.

The species, *Catocala innubens*, is a very variable one. The upper wings are usually dark brown, light brown and black. Thorax and body light brown. Lower wings reddish-orange edged with yellow and crossed by two bands of black. This insect expands two and one-half inches and is sometimes found in numbers on oak-trees. I have specimens from Iowa, Ohio, Massachusetts and Ontario.

Catocala flebilis. Upper wings dark gray and sooty black. Thorax dark gray. Body sooty brown. Lower wings black, edged with yellowish-white. Expanse two and a quarter inches. A common insect in oak woods in September and October.

Catocala desperata. Upper wings light gray and light brown and crossed by black lines. Thorax light gray. Body sooty brown. Lower wings blackish-brown, lighter near the body and edged with yellowish-white. Expanse two and three-quarters inches. Not a rare insect in New England and the Middle and Western States.

Catocala palæogama. Upper wings gray with black markings. Thorax gray. Body light brown. Lower wings orange crossed by two black bands. Expands two and one-half inches. I have specimens of this insect from Southern Ohio, but have never taken it in Massachusetts.

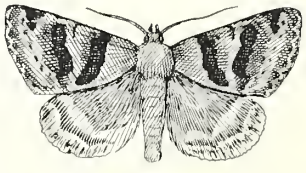
Catocala amica. Upper wings gray and black with a greenish shade. Thorax gray. Body yellowish-brown. Lower wings orange with a large brownish-black patch. Expanse of wings one and three-quarters inches. This insect is sometimes very common in autumn, and may frequently be taken in numbers on the trunks of poplar-trees. I have also found it abundantly when collecting other *Catocala* in oak forests.

Catocala antinympha. Upper wings blackish-brown, with black and brown marks. Thorax and body dark. Lower wings orange, with two black bands. Expanse, two inches. I have specimens of this insect from Ohio and Massachusetts.

Poaphila quadrifilaris is a little moth which expands about an inch. It is very dark brown, or almost black, lighter toward the

Poaphila quadrifilaris.

edges of the wings. The fore wings are crossed by two white stripes, the inner one being the narrower, while the lower wings are plain dark brown. This little insect inhabits marshy meadows and when disturbed flies so rapidly that it is difficult to follow it with the eye. Its flight is short, and it alights suddenly on a grass blade, keeping an eye on the intruder and holding itself ready for another flight. I have taken this moth rarely with a lighted lamp in Massachusetts.



Drasteria erechtea.

Drasteria erechtea is a very common insect frequenting open grassy fields and meadows. It flies rapidly when disturbed, but only for a short distance. This moth is one of the first to make its appearance in the spring, and may also be found abundantly in the late summer and autumn. In expanse about an inch and a half, it is one of the commonest visitors to the collector's lamp, sometimes becoming a great nuisance, fluttering about the lamp and even into the chimney, extinguishing the flame.

The larvæ of this moth feeds on clover and is of a reddish-brown color with darker stripes and two light gray lines on the back. The caterpillar might easily be mistaken for a Geometrid as it has but three pairs of abdominal legs and moves with a looping motion. The mature insect is grayish-brown with dark brown bands and markings disposed as shown in the illustration. The male is more

Catocala innubens.

Catocala flebilis.

Catocala desperata.

Catocala palæogama.

strongly marked than the female. This insect is found over a large part of the American continent.

Euclidia cuspidea.

A pretty species related to the preceding is *Euclidia cuspidea*. Of the same size, its wings are brown crossed by bands of light yellowish and reddish-brown and having on the upper wings several patches of very dark velvety brown or black. This insect may occasionally be seen among low bushes and shrubs, particularly about patches of sweet fern. When disturbed it flies rapidly for a short distance and drops suddenly among the low bushes and conceals itself. The larva is unknown to me.

Rhodophora florida.

One of our most beautiful Noctuids is *Rhodophora florida*. Its expanse of wing is about an inch and a quarter. The fore wings are mottled with rich pink on a yellow ground for two-thirds of their length, the outer margin being yellow, while the lower wings are very light yellow or almost white. This insect may often be seen about the evening primrose, which is the food plant of the caterpillar, and it has the habit of concealing itself among the flower petals in the daytime, the tips of the wings alone being visible. This little moth has a wide range, and I have taken it in California, Nevada, Arkansas, Virginia, Ohio and in Massachusetts, and have specimens which were taken in Canada and Florida. The larva is probably a

nocturnal feeder, as it may be found hiding in the daytime among the young leaves of the primrose. It is greenish-yellow in color.

The cotton worm, *Aletia agillacea*, and the army worm, *Hellophila unipuncta*, both belong to this group of insects, and are well known where they occur in numbers on account of their destructiveness.

The former lives on the leaves of the cotton plant, as its common name implies, and is the greatest enemy the cotton-growing industry has in the South. This caterpillar is nearly two inches long when fully grown, and is green in color with black stripes and black and yellow spots. The moth, which is very plain, expands an inch and a half, and is brownish-gray, the fore wings being crossed by faint wavy lines of a darker color. This insect is found mostly in the cotton-growing States, but has been taken in the North, where its occurrence is said to be from southern migration.

The army worm has a wider distribution than the cotton worm, being found over the whole of the eastern half of the country as well as in Europe and Australia. The moth is plain in color, being yellowish-gray and brown with a white dot in the centre of each fore wing. These caterpillars feed on grasses, and are sometimes so

Larva of Hellophila unipuncta.

abundant as to devour almost every vegetable growth within their reach. At such times they commence their march for "pastures new," and are often seen in great numbers and all marching in one direction, which gives them their common name. The caterpillar is striped with dark gray or dark brown on a greenish-yellow or grayish-yellow ground, and is an inch and a half long when fully grown. The pupa state is passed in the ground.

A genus of *Noctuidæ* having many American representatives, among which are some very beautiful species, is *Plusia*. The fore wings rather pointed, usually of different shades of brown, are frequently ornamented with a silvery or golden comma-shaped spot (in some species several spots and patches), while the thorax and upper part of the abdomen is adorned with tufts of hair-like scales. The larvæ, generally greenish in color, sometimes striped, are some of them injurious to garden vegetables, and spin their thin cocoons, through which the pupæ can be seen, among the leaves.

These moths frequent flowers in the evening, one of their favorites being the phlox, upon the blossoms of which they alight. It is amusing to watch one of these moths standing almost upon its head

Plusia simplex.

as it thrusts its tongue into the flowers in its eagerness to procure the sweets. *Plusia simplex* is a common and well-known insect, expanding an inch and a quarter or more. The fore wings are brown, in some specimens pinkish-brown, darker near the centre, where there is a silvery spot whose shape can be seen in the illustration. The lower wings are dull yellow and margined with a broad band of brown. This insect is probably double-brooded, as I have taken it in June and again in September.

Plusia putnami.

A very pleasingly colored species is *Plusia putnami*. The head, forward part of the thorax, antennæ and legs are reddish-pink, the tuft of hairs on the thorax being pinkish-brown. The abdomen is yellow with tufts of pink hairs on the sides. The fore wings are reddish-brown, deeper toward the outer margins, and adorned with patches of silver and golden colored scales. The lower wings are yellowish with a grayish band near the margins, and edged with pink, the whole making one of our most beautiful little moths. I have never found this species common, but have taken it with a

lamp in Ohio and Massachusetts in August. Some species of *Plusia* have no metallic spots but are rich in their reddish-brown shadings.

In *Plusia area* the upper wings are purplish-brown. Head and forward part of thorax yellowish, dark gray above. Body yellowish-gray. Lower wings dark brown, lighter next to body. Expanse one and one-half inches.

Eucirrædia pampina has upper wings and thorax reddish-orange with brown markings. Lower wings and body pinkish-gray. Expanse of wings one and one-half inches. This is a common little moth in autumn, and is often taken while sugaring for *Catocala*.

In the species of the genus *Gortyna* the larvæ are stalk-borers, living in the stalks of both wild and cultivated plants, and sometimes doing considerable damage to the potato, tomato, Indian corn, etc., causing the plants to wither and die.

Gortyna nitela.

In *Gortyna nitela* the fore wings are purplish-gray stippled with yellow, a light line running across them. The lower wings are light brown. The larva is pinkish-brown, darker toward the head and is marked with light yellowish-white stripes. This species is frequently destructive to the dahlia and aster, passing its larval state within the stems of these plants and devouring their substance. The insect pupates just below the surface of the ground, where it constructs a slight cocoon. The moth appears in September.

Cucullia speyeri.

Cucullia speyeri is a gray moth with slender pointed upper wings marked with brown, the lower wings being white, margined with

gray-brown. This insect has a crest on the forward part of the thorax, and from this fact is called the hooded owlet. The caterpillar feeds on golden rod.

Pyrophila pyramidoides.

Pyrophila pyramidoides is a common moth with brown fore wings crossed by wavy lines of dark brown and black, while the hind wings are copper colored and brown. The whole upper surface of the insect is very glossy. In September this insect may be found on fences and tree-trunks and I have sometimes dislodged a number of them when stripping the loosened bark from dead tree-trunks in search of beetles. The food plants of the larva are the grape and Virginia creeper.

A very interesting species in the larval state is *Bellura gortynides*, which lives in the leaf stems of the pond lily, having a communication with the air through a hole in the leaf. When feeding it descends below the surface of the water to a distance, according to Comstock, of two feet or more. The perfect insect is brownish, and expands an inch and a half.

Mamestra picta.

A beautifully marked insect in the caterpillar state is *Mamestra picta* and the larva goes by the appropriate name of the zebra worm.

This insect is frequently to be seen in the autumn on the leaves of the parsnip, carrot and cabbage, although I have never seen it abundant enough to do much harm. The smooth, naked caterpillar is

Larva of Mamestra picta.

striped longitudinally with yellow and black in conspicuous bands, these stripes being crossed with numerous fine white lines on the sides of the insect. The larva burrows into the ground and passes the winter in the pupa state, whence it emerges in the spring a moth with dark chestnut-brown fore wings and yellowish-white hind wings. The moth expands an inch and a half.

In the genus *Agrotis* the larvæ are known by the appropriate name of cut-worms. The ravages of these pests are well known to farmers, gardeners and florists. What an aggravation it is after purchasing and carefully planting a few choice pansies or sowing and diligently caring for a bed of sweet peas to see the young plants toppling over and withering in the morning sun, their stems cut off just above the roots. The eggs of the moths are laid in the ground during July and August and the infant caterpillars soon make their appearance, but are so minute while their food (the roots of succulent plants) is so abundant that their depredations are not noticed. As cold weather advances they burrow deep into the ground, where they pass the winter in smooth oval cavities in the earth in a curled position. When warm weather again awakens them to life they work their way to the surface and are then most destructive to young plants, often cutting off in a single night numbers of cabbages, beans or peas, and hiding just below the surface of the ground during the daytime, ready to renew their depredations the next night. When the larvæ arrive at maturity they again descend into the ground, where they pupate. The moths emerge in July and August. The larvæ are stout-bodied creatures, dingy in color, often striped from head to tail with light gray and brown or black. They are naked, with a horny plate on the upper part of the body near the head, and the different species so closely resemble each other as to be scarcely distinguishable. These insects are very destructive to many flowering plants as well as garden vegetables, and one or two species have been known to ascend apple and pear trees and grape vines in

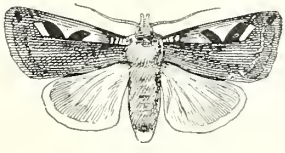
the night and devour the fruit buds, greatly diminishing their production.

Many experiments have been tried to destroy these pests, but perhaps the most effectual is to carefully remove the soil from about the infected young plants and kill the caterpillars as they lie curled up near the roots an inch or less below the surface of the ground. Small tin basins or cups placed in the ground near the plants in such a manner that their tops are on a level with the surface will be found to be excellent traps for these annoying marauders. The caterpillars in their nightly wanderings in search of food fall into the receptacles and one may wreak vengeance on them in the morning as they will be unable to climb up the smooth sides of the tin. Revenge is indeed sweet when one has seen his finest flowers and vegetables cut off in early youth by these destructive "worms." The perfect insects are mostly nocturnal in their habits, coming into our houses at night and secreting themselves behind picture frames or among clothing in our closets in the daytime. Some species are, however, day-flyers and may be seen during the sunny hours about the blossoms of the milkweed and golden-rod busily sipping their sweets.

Most of these moths are very dull in color, though a few are marked with pleasing tints of brown, gray and buff.

The following illustrations of a few typically marked species of *Agrotis* will give an idea of their general appearance.

Agrotis tassellata.



Agrotis c-nigram.

Agrotis normaniana.

Agrotis tassellata is a small moth. The color of its fore wings is dark gray with two light spots and two black spots on each. The lower wings are light brownish-gray, darker at their edges. This moth expands one inch and a quarter.

Agrotis c-nigram is a rather dark species, the fore wings being dark brown, gray and black, with a few lighter spots and markings, while the hind wings are light brown. It is one of the larger species, expanding an inch and three-quarters.

Agrotis normaniana is a prettily marked species, its fore wings being marked with gray, buff and black, with the hind wings buff and brown. The insect expands an inch and a half.

Agrotis herilis.

Agrotis venerabilis.

An exceedingly abundant species during August is *Agrotis herilis.* The fore wings are gray and black, with cream-colored marks and spots, while the hind wings are light brown. Expands about an inch and a half.

Agrotis venerabilis is a reddish-brown moth, whose hind wings are grayish-brown. Expands an inch and three-eighths.

Calocampa nupera.

A rather rare moth, and at the same time a prettily marked insect, is *Calocampa nupera.* This insect expands two inches and a half, and is marked as follows: the upper half of the fore wings is gray, darker toward the tips, light ash-gray nearest the body; an interrupted black line runs longitudinally through the middle of the wing, on which is situated a black spot; the lower half of the fore wing is chestnut-brown; the lower wings are reddish-brown, with a glossy surface; the thorax is dark brownish-purple and the abdomen reddish-brown. I have taken this insect occasionally in autumn while sugaring trees for *Catocala.* The larva of this moth is unknown to me.

Catocala antinympha.

Catocala amica.

Aputela lobeliæ.

Eucirrœdia pampina.

Parthenos nubilis.

Plusia ærea.

NOCTUID MOTHS.

Apatela americana is a gray moth, with a scalloped, light gray line near the outer margin of the fore wings edged externally with black and brown, and with a row of black dots along the outer

Apatela americana.

margin. The lower wings are yellowish-gray, and the insect expands two inches and a half. The hairy caterpillar feeds on the leaves of the maple, elm and chestnut, and is usually seen partially curled sidewise when not feeding. Its head, belly and legs are black, and its back is dull green. The hairs covering its body are yellow, with two pairs of tufts of long black hairs on the forward part of the body and a single tuft near the posterior extremity. In autumn the insect spins a cocoon composed externally of silk and hairs from its body, inside of which is another covering, composed of silk and bits of bark or chips of wood. This cocoon is usually hidden under the loosened bark of a tree and in it the pupa passes the winter.

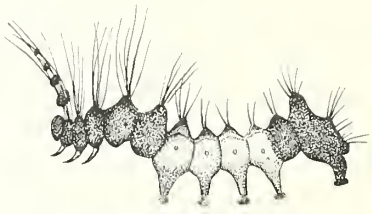
In *Apatela lobeliæ* the upper wings are gray with light gray lines and black marks. Thorax gray. Abdomen brown. Lower wings light brown. Expanse two inches.

Gramatophora trisignata.

Gramatophora trisignata is a pretty species, being of a mouldy-green color on the fore wings, marked with lines and mottlings of black, with three round reddish-brown spots on each wing, the lower wings being light yellowish-brown.

This moth I have taken on one or two occasions with a lamp in Ohio and Massachusetts. I have also received one specimen from

Toronto, Ont. It expands an inch and a half. The larva is one of those strange, weird forms in which Nature seems occasionally to delight, suggesting that she must have been in a "wondrous merry mood" in evolving a being so grotesque. The extreme of the



Larva of Gramatophora trisignata.

fantastic and the ridiculous seems to have been reached in shaping this creature. Of beauty it has none, and is withal a most venomous looking animal, for when disturbed it swings its head from side to side in a menacing manner. The tuft of hairs just back of the head usually have attached the hard black shells of the insect's head which were shed in the earlier moults of the larva, and these add a good deal to its uncanny appearance, giving one the impression that it has several heads of different sizes. The caterpillar is dark brown, with a lighter brown patch occupying several of the segments. The six front legs, head and warts from which the hairs spring are shining black. The food plant of the caterpillar is lilac.

BOMBYCIDÆ.

Spinners.

The family of Bombyx is one of great importance, as it not only includes many of the largest and finest insects in the world, but also those of greatest importance to man from an economic standpoint, as in this family belong all the principal silk-producing insects from whose cocoons such a variety of beautiful and useful fabrics are manufactured. The moths belonging to this family are mostly stout, thick-bodied insects, frequently very hairy or woolly. They have small, sunken heads, and the antennæ are often feathered, particularly in the males. The mouth parts are either rudimentary or wholly wanting, many of the species not being able to appropriate food of any kind in the perfect state. Their wings are usually broad,

and in many of the species are covered with a dense armor of scales arranged in colored patterns, frequently very gay, while in others the clothing is of more subdued tints, soft and blended. The remarkable power by which the virgin females attract the males, often from long distances (referred to in a former chapter), is, to the best of my knowledge, confined exclusively to this family of moths.

The caterpillars are stout-bodied creatures, many of them densely clothed with hairs or spines, while others are fleshy and are adorned with rows of tubercles. A few are naked and smooth.

Xyleutes robiniæ. One may find in the trunks of poplar, oak and locust trees, protruding from large circular holes, the empty shells of this moth. *Xyleutes* (the carpenter) is a very appropriate name for this genus of moths, as their larvæ mine in the solid wood of

Xyleutes robiniæ. Female.

trees, excavating long tunnels, increasing in diameter as the caterpillars grow. Their larvæ have true legs and prolegs, but are grub-like looking creatures. The present species is flesh color above and light beneath, with the head and the forward part of the body above covered with a hard shelly substance, brown in color. When fully grown the caterpillars are two or three inches long. They seem to prefer large trees and sometimes do considerable damage, riddling the trunks and carrying their tunnels out through the bark before changing to pupæ. They are said to require three years to reach maturity and make their thin silken cocoons in the burrows some distance from the opening, usually lining the tunnel with silk both front and back of their cocoons.

The pupa is yellowish-brown, and, by means of rows of short spines on the abdominal segments, works its way to the mouth of its burrow, when the moth is about to break the shell. The moth comes forth in July, and is a night-flyer. The insect is very plain. Its wings are parchment-like, resembling in some respects the coddis flies. The female is light gray, with a net-work pattern of dark brown on the fore wings. The head and thorax are gray, and the abdomen and lower wings are brownish-gray. The insect expands three inches. The male is much smaller than the female. Its

Xyleutes robiniæ. Male.

forward wings are of a greenish-gray and dark brown, its head and thorax gray, abdomen black, and its lower wings orange and black. Although not a rare insect, on account of its habits it is seldom seen.

Zeuzera pyrina. The leopard moth is a European species which has been introduced into this country. The wings are white, partly transparent, and marked with a number of dark spots and rings, from which it has derived its popular name. The caterpillar bores tunnels in the wood of various trees (elm, ash, maple, pear, apple, etc.), and is capable of doing a good deal of damage should it become very numerous. It is yellowish, with numerous black spots on the sides and back, and has a horny plate on the segment next the head. The moth may occasionally be taken about electric lights in the neighborhood where it has been introduced.

To the genus *Sthenopis* belong some rare and interesting moths. I have made the acquaintance of but two species of this genus in this country, *Sthenopis argentomaculatus* and *S. argentata*. These insects are much alike, the former being the larger, and measuring three and a half inches or more in expanse, while of the latter species, the only

specimen I ever took is two and a half inches across. Their colors are ashen gray, the fore wings being crossed by bands and rows of spots of darker gray. On the fore wings are two small silvery spots.

Sthenopis argentata.

A remarkable characteristic of these moths is their exceedingly short antennæ. I have never seen the larva, and the life history of these moths is not known to me. Professor Comstock states that "the larva are nearly naked and grub-like in appearance, although furnished with sixteen legs. They feed upon wood and are found at the roots or within the stems of plants. They transform either in their burrows or in the case of those that feed outside of roots within loose cocoons." *S. argentomaculata* I have taken in northern Ohio, while collecting with a lamp. As it circled about the room, it looked, with its long wings, a good deal like a large dragon-fly. I also found a specimen of the same species in the same locality in the daytime clinging to the under side of a blackberry leaf. *S. argentata* (the species figured) I took at dusk in July in South Sudbury, Mass. It was flying slowly along the road in a wooded district, and I easily caught up with it and knocked it down with my hat. I have seen species of this genus from Mexico and Brazil; and a very large coarse-looking insect of the same genus was lately sent me from Cooktown, in Queensland, Australia.

The *Lasiocampians* include the tent caterpillars and the lappet caterpillars. The moths belonging to this group are downy or woolly and thick-bodied, and are distinguished by the lack of the loop and bristle which holds the upper and lower wings together during flight in other moths. The caterpillars are soft-bodied creatures, almost velvety to the touch, and are clothed with short soft hairs, thickest on the sides, which do not arise from warts or tubercles. The antennæ of these moths are feathered more broadly in the

males than in the females. When at rest the wings are folded in such a way that they slant both sides of the abdomen like a roof, and the lower wings project on the sides, not being wholly covered by the upper wings. The moths are night-flyers. Some of the larvæ are gregarious, living in colonies, frequently in immense numbers. Some species feed on cultivated trees, and on account of their vast numbers sometimes do immense damage. The pupa state is passed in a cocoon composed mostly of silken threads.

A numerous and most destructive species belonging to this group in the East is *Clisiocampa americana*, the tent caterpillar, whose unsightly webs of large dimensions are to be seen almost everywhere in neglected apple orchards and by the roadside on wild cherry-trees. The eggs of the female moth are deposited in a compact mass or bunch near the end of a twig, of its chosen food plant, partly or wholly encircling it. They are cylindrical in shape and are placed on end close together often three or four hundred in a bunch and covered with a shining brown water-proof varnish which protects them from the weather. In this state they remain during the fall and winter, and hatch about the time that the leaf-buds are ready to burst in May. The young caterpillars construct in the fork of a branch a small triangular web or tent of fine silken webs in which they remain through the night and during cold or stormy weather, sallying forth in long lines, usually in single file, each caterpillar spinning its web, presumably to enable it to retrace its steps as it advances to the ends of the twigs to feed upon the opening foliage. In time these lines of silk extend to the tips of all the immediate branches about the nest, which is added to as the individuals composing the colony grow in size. As they remain in this tent at all times when not engaged in feeding or in wandering to and from their feeding grounds, it is a veritable home, and in time becomes large and strong, capable of resisting the attacks of most birds and of all parasitic insects. When the caterpillars reach maturity they are about two inches long, sparsely clothed with soft hairs thicker on the sides, with black heads, and are striped lengthwise with white, yellow and black, with a blue spot in the middle of each segment on each side. When about to pupate they abandon their tent and separately wander off in search of a suitable locality in which to spin their cocoons.

These are spun in crevices in the bark of trees, about fences and stone walls, frequently on buildings on the clapboards or under the

eaves. They are oval in form, light colored and thin, and intermixed with the threads is a yellowish-white substance which seems to give stiffness to the cocoon. About two weeks after the cocoon is finished the moth makes its escape through a hole in one end which it moistens, it is said, with a secretion from its mouth, enabling the insect to push the loosened threads aside. The moth expands from an inch

Clisiocampa americana.

to an inch and a half or over, the male being smaller than the female. The body of the insect is woolly, and is of a rusty brown color, its fore wings being crossed by a lighter band edged on either side by a narrow grayish-yellow line. The male is somewhat darker than the female.

This insect in its caterpillar state is so injurious to apple orchards that its destruction becomes a necessity to keep the trees in bearing condition. It is not a difficult insect to combat, as its clusters of eggs are easily seen during the fall and winter, and can be picked off by hand and burned. When the young larvæ first begin their operations in the spring their nests may easily be taken from the trees and each colony destroyed in its infancy. To insure success in this work the tents should be removed either early in the morning or late in the afternoon, or else on stormy days when the whole colony is at home. A piece of coarse burlap wound around the end of a pole and saturated with kerosene oil will be found well fitted for the work, as the oil will destroy the caterpillars which it touches even if they are not removed with the tent. To keep one's orchard cleared of these pests the nests should be destroyed not only on the orchard trees but also on all neglected trees in the neighborhood infested by them, especially the wild cherry-tree, which seems to be the favorite food plant of the species. Two or three neglected trees will breed moths enough to stock several orchards with the pest the following spring.

The parasites probably do more to hold these insects in check than all other agents (man included) put together. If one will

closely watch a colony of the tent caterpillars when out of their nest or a large number of larvæ of any other kind, he may see a small swarm of ichneumon flies constantly hovering about and over them. These are on the watch for a chance to deposit their eggs in or on the bodies of the caterpillars; and when one considers their numbers and persistency, one wonders that a sufficient number of the larvæ escape to propagate the species. Here is an instance which gives some idea of their ravages. One of my brothers had one hundred caterpillars of a large species he wished to raise which he placed on a young tree and enclosed the whole in mosquito netting. Under this net they remained until nearly full grown, when one day a small rent was discovered in one corner of the net presumably made by a bird: and when the larvæ were taken out and examined, of the entire number but three had escaped the ichneuman flies which had found their way into the net and laid their eggs on the caterpillars.

While a species is comparatively scarce, its chances of escape from birds and parasitic insects are fairly good; and if it is a prolific

Clisiocampa disstria.

species well adapted to its surroundings and has plenty of food, it will increase until its posterity may be reckoned by millions. It now begins to attract attention, both from the birds and the parasites, as a large amount of food going to waste. The parasites attack it, and having an abundance of food begin to increase at a rapid rate; and the birds finding an easily obtained food-supply neglect other foods and apply themselves to this. The consequence is that the demand soon equals and finally exceeds the supply, and an entire region previously infested with an injurious insect may be so depopulated in one or two seasons that a careless observer might conclude that the species was extinct or had migrated to other parts. This, in my opinion, is the explanation of the sudden disappearance of many an

insect pest which may have at one time threatened the destruction of the plants upon which it subsisted.

The forest tent caterpillar, *Clisiocampa disstria*, resembles the preceding species both in its habits and in the general appearance of the caterpillar and moth. The larva is more bluish than the common tent caterpillar, has a row of spots along the back instead of lines, is greenish on the sides and has a blue head. It lives in large colonies of three or four hundred individuals on oaks and walnuts, and makes a large tent beneath which it remains except when feeding. This insect I have seen very abundant in the White Mountain region of New Hampshire, where it not only devoured the leaves of the oak and walnut, but also apple, cherry, and when hard pressed even birch, alder and elm. The insects were nearly full grown by the middle of June. The moth is about the same size as the preceding, but is of a more reddish-tan color, and the fore wings are crossed by a broad band of a darker shade. It is an inhabitant of all the New England and Middle States.

Tolype velleda.

The lappet moth, *Tolype velleda*, is a pretty and interesting species. The larva is very much flattened beneath, and along its sides are a number of flat projections or lappets from which spring numerous hairs making a fringe around the body. When the insect is not feeding it hugs closely to the bark of the tree, the hairs on it sides lie flat against its support; and as its colors are dull greenish-gray, it looks like nothing on earth so much as a swelling on the bark. One may even gaze directly upon it without realizing that it is anything alive. The larva is orange, sometimes red beneath and has an intensely black band between two of the segments on the upper side on the forward part of the body. This band does not show when the insect is at rest. It feeds upon the apple, poplar and willow, and reaches full size during July, when it is two inches or more in length. It spins a thick gray-brown cocoon, oval in shape, convex above, flat and very thin on the under side, and spreading out on the edges like

thin paper, attached to the trunk or a limb of the tree upon which the larva fed. The chrysalis is dark brown and very smooth. The moth makes its appearance early in September and is a night-flyer, occasionally attracted to lighted lamps. Its colors are soft and blended, being white shaded with blue-gray, and its wings crossed by two broad bands of dark gray. The female moth expands two and one-half inches, but the male is smaller, expanding but one and one-half inches.

Another species, closely related to the preceding but smaller, is *Tolype laricis*, which lives on the larch. Its larva is brownish-gray in color and about an inch and a half long. Its habits are much like

Tolype laricis.

T. velleda, and it makes a similar though smaller cocoon. The moth emerges early in September and lays its eggs, which do not hatch till the following spring. The female moth resembles *T. velleda* in color, except that it is lighter near the body, and the outer gray band on the forward wings is darker and narrower. The male, which is here figured, is dark gray with clouded wings. The abdomen is sooty black. According to my experience this is a rare moth.

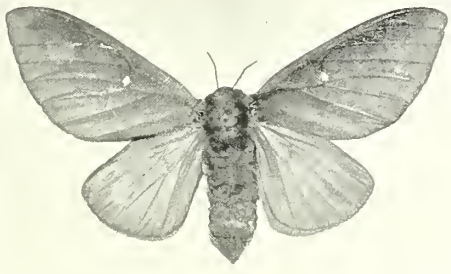
Gastropacha americana.

Gastropacha americana is a reddish-brown moth with a lighter band crossing the wings, edged with wavy dark brown lines and having the edges of the wings scalloped. There is a good deal of discrepancy in size between the male and female, a good-sized specimen of the latter spreading two inches. The larva feeds on apple, birch, maple and ash. It is flattened beneath and fringed with hairs

on the sides, like *T. velleda*. It is gray above, with irregular white spots, and striped with sooty black, having two scarlet bands crossing the forward part of the body, on each of which are three black spots. The under side is orange.

The caterpillar measures over two inches in length when fully grown, and makes a gray-brown cocoon on the tree upon which it feeds. The moth emerges in June or early in July.

To the genus *Anisota* belong several pretty native insects. They are not large, the largest spreading less than three inches. The sexes differ so much in coloring, size and shape as to scarcely be recognized as the same species. The antennæ of the females are narrow, while in the males they are pectinated for two-thirds of their length. The larvæ feed on various forest trees and are sometimes so abundant as to completely strip the trees of their leaves. These insects pupate in the ground.



Anisota senatoria.

Anisota senatoria is a common species in the eastern United States and Canada, and may be taken the latter part of June about electric lights at night or found in the daytime clinging to grass-stalks under oak-trees, where they have rested to expand their wings after leaving the chrysalis shell. The female moth deposits her eggs in clusters on the under side of the leaves of oak-trees, and the larvæ may sometimes be seen in immense numbers.

They are apparently gregarious during their entire caterpillar state and in casting their skins they congregate on the ends of the twigs leaving their wrinkled cast-off coverings where they often remain after the larvæ are full grown and have departed. When young they eat only the small and tender leaves, devouring the

larger and tougher ones as they grow in size and strength, often stripping whole acres of forests of their leaves. When not feeding, the caterpillars congregate in immense clusters, bending down the smaller twigs with their weight. They are dark brown or black in color, with dark ochreous yellow stripes on their sides and back, and are armed with short spines on each segment, and two horns on the segment next the head. They are stiff, hard and rough when fully grown, and during the early part of September crawl down the trees and burrow five or six inches into the ground, where they remain in the pupa state during the winter. The chrysalis is hard and spiny; and when the moth is about to break the shell it works its way to the surface, where the empty case may be found protruding from the ground after the insect has flown. The female moth expands two and a half inches, and is of an ochreous yellow color, with a reddish cast, tinged slightly with purple along the outer margin of the fore wings. The upper wings are stippled with faint brown spots and have a small white dot near the centre. The male is much smaller than the female. Its wings look small in proportion to its body and are purplish-brown, darker toward the tips of the fore wings, which have a white spot in the centre.

Anisota stigma is not nearly so common an insect as the preceding species, and I have never seen it abundant. The habits of the caterpillar are similar to those of *A. senatoria*; but it is much lighter in color, being a tawny orange with dark stripes on its sides and back. Its spines are also longer. The female moth very much resembles *A. senatoria*, but is richer and more reddish in coloring, with larger spots of dark brown or black on its wings. The male is more like the female in color than is the male of the other species, and has a large white spot in the centre of the fore wings. The wings are also spotted with dark brown. This insect varies a good deal in the intensity of its coloring. Especially is this the case with the male, which is sometimes almost red. The male expands an inch and three-quarters and the female nearly three inches.

In *Anisota virginiensis* the scales are thinly scattered over the wings, so that they appear almost transparent. The female is more purple than the other two species, and lacks the sprinkle of brown spots. The male is small and purple-brown in color, with a scaleless, transparent patch in the middle of each of the wings. This insect I have never found abundant. The female moth is about the size of *A. senatoria*, but the male is smaller than the male of that species.

The larva of this insect, like the two preceding, lives on the oak. It is of a dull grayish-green color, with indistinct stripes of pinkish, and is stippled with white dots. It is armed with short spines and horns, and, like the other species of the genus, is rough and hard.

Anisota rubicunda.

Anisota rubicunda is very variable in its abundance or scarcity, and is sometimes to be taken in numbers where, during the next season, it may be rare. The species is usually very abundant in Washington, D. C., where the larva lives on the maple-trees, frequently doing much damage. The trees in the Smithsonian grounds are infested with the caterpillars, and the perfect insects just out of their chrysalids may be taken by the dozen in June clinging to the grass stalks under the trees. One may even gather the live chrysalides as

Chrysalis of Anisota rubicunda.

they protrude from their burrows and have the pleasure of watching the imprisoned moth emerge in one's own room. It is a beautiful insect. The fore wings are a delicate pink with a wide yellow band crossing them diagonally, while the lower wings are yellow with the lower margin pink. The body is yellow, and very soft and downy. The males are much smaller than their mates, and their coloring is usually much stronger. The insect spreads from one and a half to two and a half inches. The larva is two inches long, is light green striped longitudinally with dark green, and is horned in front, spiny along its back and sides, and is firm and rough to the touch. It

seems to be more plentiful in the South than the North, and is, I believe, a rare insect in New England.

We now come to the two genera *Citheronia* and *Eacles*, the royal moths, both represented by large species. They are very stout-bodied moths and hairy or woolly. The antennæ of the males are broadly pectinated for two-thirds of their length, the same organs of the females being simple. Their wings are strong, but they fly only by night. The larvæ are armed with horns on the forward part of their bodies and are also somewhat hairy. They spin no cocoons, but pass the winter in the pupa state under ground. The chrysalis is spiny on the abdominal segments, doubtless to enable it to push itself up to the surface when the moth is about to break the shell.

Citheronia regalis. Male.

Citheronia regalis is a large and strikingly marked insect, and is not rare in the South and West, where the caterpillar feeds on the leaves of the walnut, hickory, butternut and persimmon. The sexes frequently differ very much in size, although similarly marked. A good-sized male will measure four inches across its expanded wings, and a female six or more. I have a grand female specimen of this insect from Gainesville, Va., which is nearly seven inches across.

The body is reddish-orange, with yellow spots and lines on the thorax. The upper wings are olive streaked with broad reddish lines which follow the veins, and a number of large yellow spots are distributed over the wings as shown in the illustration. The lower wings are reddish-orange, with a few vague olive markings between the veins, a large spot and a defused band of yellow near the upper margin, which is usually covered with the upper wings. I have taken this fine moth about the electric lights in Washington, D. C., where it is not rare, have found specimens in Illinois and Arkansas, and have no doubt but that it inhabits all the Southern and Western States as far west as Kansas; but it must be considered a rare insect in northern New England.

An insect very closely allied to this I have seen in collections from Mexico, also from Colombia and Brazil, South America.

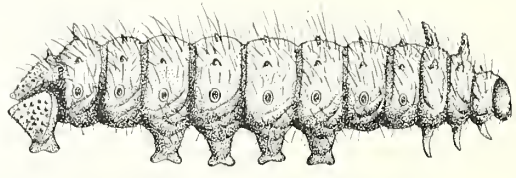
A friend living in Norwich, Conn., has succeeded in finding the larva of this moth there for several consecutive years, feeding on the leaves of the sumac, and has reared the perfect insects, of which he has sent me specimens.

The caterpillar is one of our largest, if not the very largest, being four or five inches in length, thick in proportion and very formidable in appearance, owing to a number of large curved spines with which it is armed on the forward part of the body. It is green in color, banded across the rings with blue. The head, legs, and large spines near the head are orange and the shorter spines black. Although a formidable-looking creature, it is perfectly harmless. When ready to pupate in September, the insect burrows into the ground, where it transforms into a stout brown chrysalis. This chrysalis works its way to the surface of the ground the latter part of the following June, and the fly emerging crawls to a neighboring bush, and there hangs suspended until its wings have developed and are rigid enough to support it in flight. It is a sluggish insect, and when found may be carried home on the twig to which it is attached without danger of its taking flight.

Eacles imperialis resembles the preceding, both in the larval and perfect state. Although not differing greatly in size, the males being slightly smaller than their mates, there is a marked difference in the coloring of the sexes. The ground color of both male and female is a rich yellowish-buff. In the male the forward wings are brownish-purple on the inner half, connected with a broad band of the same color extending along the outer margin. The lower wings

have an irregular wavy line of the same color crossing them with a round spot and a vague patch above. Both upper and lower wings, particularly the former, are stippled with blended spots of dark brown or black. The thorax and abdomen are mottled with yellowish-buff and brownish-purple. The female is lighter than her mate, all four wings being crossed with a band of brownish-purple, with an irregular clouded patch of the same color at the base of each wing near the body. The body is mottled and the wings stippled much the same as with the male. A good-sized specimen of this fine insect will measure five and a half inches across its expanded wings. It is not rare throughout the eastern half of the United States and Canada, and two or three closely allied species or varieties of the same species (one of them considerably larger than our own) occur throughout Mexico and temperate and tropical South America.

The eggs are deposited singly on the button-wood, oak, and the different species of pine, and the caterpillars may be found full grown in September. They are usually dark green in color, although occasionally brown or even black, three or four inches long when full grown, and are rather hairy. Each segment is armed with short rough spines, with four larger ones on the forward part of the body.



Larva of Eacles imperialis.

The spiricles are very distinctly marked on the sides. The larva burrows into the ground, where it transforms into a chrysalis, remaining in this state during the winter. The chrysalis, which is much like that of *C. regalis*, makes its way to the surface of the ground, where it emerges a moth in June, and the empty pupa case may be found partly protruding from its burrow after the moth has flown.

As the larva of this insect is a large and stout creature, it might be supposed that it would be readily seen; but as it is frequently located on the high branches of large trees and is usually of the same color as the leaves, it is not an easy insect to find. Where pine or sycamore trees overhang a road or a well-worn path the huge pellets

Male Moth.

Female Moth.

EACLES IMPERIALIS.

of excrement dropped by the caterpillar will enable one to search out its whereabouts. When found it is not an easy thing to dislodge him, as he has a tenacious grasp of the twig to which he clings. The moth is sluggish in its movements, but flies well when once on the wing, and may occasionally be taken about electric lights.

Saturnia io is a familiar insect to most persons having a slight acquaintance with our native lepidopteria, and like several other native insects belonging to this family of *Bombycidæ* is a very lovely creature. The predominating color of the male, which expands three

Saturnia io. Female.

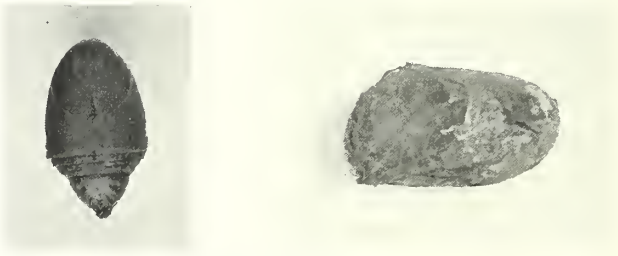
inches, is a yellowish-buff, deeper on the lower wings, the fore wings having a purple-brown spot a little above the centre of the wing, with two wavy lines near the outer margin, and one near the base of the wing, of the same color. In the middle of the lower wing is a large bluish spot with a white centre, having a broad ring of black encircling it. Outside of this is a sharp black line and then a reddish-purple line which broadens out into a wide band on the inner margin. The body is yellow, and the antennæ, which are red, are broad and pectinated. The female is considerably larger than the male. The upper wings are a deep brownish-purple crossed by darker bands edged with fine wavy lines of yellow. The lower wings are much like those of the male except that the bluish spot is larger in proportion and the colors generally darker. The thorax is purple-brown and the abdomen reddish-brown. The antennæ are narrow and slightly pectinated.

The eggs of the female are laid on the leaves of a variety of trees — oak, willow, locust, poplar, apple, etc., — and are deposited in a

compact patch of from thirty to eighty, or more, on the under side of a leaf. When the caterpillars hatch they are reddish-brown in color and covered with minute spines. They are gregarious in their habits during the earlier part of their existence, feeding, resting and moving from place to place in regular order. When half-grown they separate, and during the remainder of the caterpillar state shift for themselves. The mature larva is two and a half inches long, of a

Larva of Saturnia io.

light green color, with a white stripe edged with reddish-purple extending along the sides. It is profusely covered with branching spines which are very sharp, and when carelessly touched sting like the nettle, causing the part affected to swell into whitish pimples, smarting painfully for an hour or two. When about to pupate the larva descends to the ground, where it draws together a few dead



Chrysalis and cocoon of Saturnia io.

leaves and spins among them a thin, irregular, brown cocoon, in which it passes the winter, coming out as a moth late the following June. This insect is readily attracted with a bright light, and the males may be assembled in numbers with a captive female.

Saturnia maia. When the leaves of the oak are unfolding in the spring colonies of small, dark brown, spiny larvæ may be found on them by diligent search. These are the young of the maia moth, and they may be easily reared by enclosing a small scrub-oak in mosquito netting and allowing the larvæ to feed. As the larvæ mature they

become solitary in their habits, and when fully grown are three inches long, and, like the preceding, are covered with sharp branching spines which sting, but in a less degree than *Saturnia io*, if the insect is handled carelessly. The larva is brown in color, with reddish-brown head and legs, the tubercles at the base of the spines being also reddish-brown. When about to pupate the caterpillar crawls to the ground and, drawing a collection of leaves and sticks together, spins a loose, thin cocoon among them.

Saturnia maia. Male.

The moth emerges late in the fall, usually about the middle of October, and is one of the last of our lepidoptera which the collector may take on the wing. The maia moth is a day-flier, and may be seen on mild autumn days when the woods and fields are brown, hovering over the shrubby oaks.

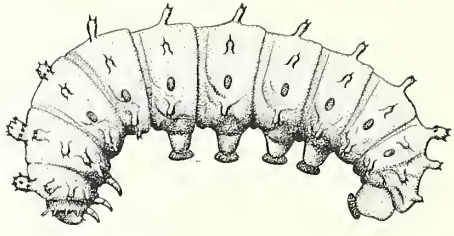
The males are easily assembled with a captive female. The sexes are readily distinguished from each other. The male has a broad feather-like antenna (while that of the female is narrow) and the end of the abdomen is adorned with a tuft of red hairs which the female does not have. The wings seem to be thinly covered with scales, and on that account are partly transparent.

This moth is often very local, and may be abundant in one locality while scarce in another, apparently as favorable to its habitation. It may be readily taken on the wing with the net, and when fresh and perfect is an exceedingly pretty insect, its colors of soft blackish-brown, creamy-white, and bright red harmonizing in a pleasing manner. The female may sometimes be found by watching the

movements of the males, who seem to scent them out, fluttering near the spot where the female rests concealed on a scrub-oak.

Next in order comes the group of moths called *Attaci*, which includes many of the largest silk-producing species.

Attacus cecropia is our largest native silk-spinning insect, and easily holds its place among the giant lepidoptera of the world. Specimens are occasionally taken six and one-half or even seven inches from tip to tip of their extended wings; and were it not so common, it would be much higher prized by collectors. When fresh from the cocoon, its wings (still soft, but fully expanded) have the appearance of being a part of some rich and heavy fabric, and a gentleman with whom I am acquainted having interests in a woollen mill, remarked, on seeing one of these grand moths for the first time, "Now if I could manufacture a piece of goods like that, I think it would sell." The subdued colors and the delicately traced patterns of many of the moths would, if imitated in fabrics, give greater variety and more artistic effects to the materials used for our adornment and comfort. The female cecropia moth, the bulk of whose enormous body is composed almost wholly of eggs (two or three hundred in number), lays them singly or at the most two or three together on the under side of the leaves of the food plant. These eggs are circular in shape, slightly flattened above and below, and



Larva of Attacus cecropia.

are creamy-white in color. The young caterpillars make their appearance in ten or twelve days and are at first dark brown or black, covered with minute tubercles and stout black spines. At each moult they change in color, and when three-quarters of an inch long are orange or deep yellow studded with black tubercles and spines. The insect assumes a greenish and finally a beautiful bluish-green color as it matures, eventually reaching a length of three or four inches and a thickness of one's thumb. It is then an imposing-look-

Upper Side

ATTACUS CECROPIA

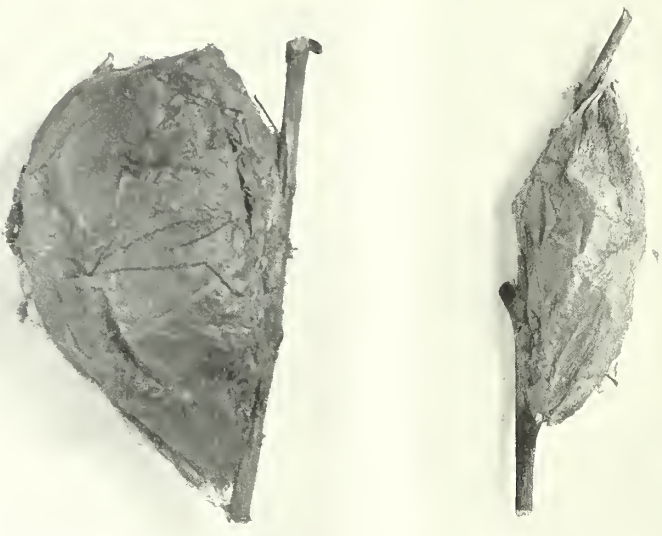
ing creature with large coral-red tubercles on the forward part of its body, yellow ones on its back, and smaller blue ones on its sides and about its head, all covered with short black bristles. It clasps the bough or twig on which it rests with a wonderful tenacity, and if placed on one's finger the grasp of its fleshy feet with their minute hooks is very noticeable. It has a peculiar odor, both in the larva and the moth state, which may be of some protection to the animal.

Toward the end of September the caterpillar constructs its coarse, brown, elongated cocoon, which is usually attached on one side to a twig or branch. This cocoon is composed of two parts, consisting of a loose, wrinkled outer covering and a well-shaped and dense inner pod, with fine floss silk separating the two, which are both loosely

Section of cocoon of Attacus cecropia.

spun at one end to enable the moth to make its escape. There is frequently a marked difference between the cocoons found on trees and shrubs on high ground and those taken from low bushes and shrubs in swampy districts. The latter are frequently two or three times as large externally as the upland variety, and have a large amount of the floss silk between the outer and inner coverings. This variation I cannot explain, and have noticed no difference in the moths emerging from the two varieties of cocoons other than that the swamp-inhabiting specimens appear larger and richer in coloring than their upland relations. Sometimes the cocoons of these species are to be found in large numbers. In the suburbs of Chicago they may be seen on the shade trees in dozens and sometimes in hundreds; and I have known two men to collect a bushel of them in

this locality in half a day. The moth emerges about the 20th of June, usually in the morning; and by evening its wings are rigid and it is ready to take flight. As these moths take no nourishment their lives are very short after reaching maturity. Resting hidden



Swamp and upland forms of cocoons of Attacus cecropia.

by day among the leaves, the males sally forth at evening in search of their mates guided by their keen sense of smell, and having insured the continuance of the species for another year, they soon perish.

This insect inhabits a large part of the continent east of the Rocky Mountains. In Colorado, Utah, California and the far West generally its place is occupied by closely allied forms, very large and heavy-bodied insects, in which red and dark brown colors predominate. Two or three species of *Attacus* from Mexico are interesting, from having a transparent almond-shaped spot in the centre of each wing. One of these, *Attacus splendens*, is a lovely creature, on whose wings pink, brown, purple, black and white are mingled, making a very pleasing combination. There is frequently great variation in the coloring of these moths.

Attacus cynthia is a species which has been introduced into this country and Europe from China, and may now be found in a wild

UNDER SIDE

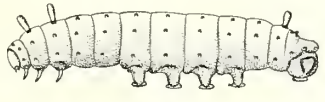
ATTACUS CYNTHIA

state in the vicinity of New York City, Philadelphia and other places where its food plant, the alanthus, has been cultivated as a shade tree. It became so common in Philadelphia and Washington, D. C., at one time as to be a pest, and threatened the destruction of the trees: but the parasites and birds seem now able to cope with it and hold it in check.

This insect is reared in Asiatic countries for its silk, which is said to be strong and very durable, but lacks the beauty of that produced by *Bombyx mori*. It was probably for its silk that it was introduced into this country, but that it has ever been successfully utilized here for the manufacture of fabrics I have yet to learn. The female lays two hundred to three hundred cream-colored eggs, and the young caterpillars are yellowish profusely adorned with black spots and tubercles. The mature caterpillar is three inches long, of a clear bluish-green color adorned with blue tubercles. The cocoon is similar in shape to that produced by the next species described, *Attacus promethia*, and is a little larger.

In some parts of the country the insect is double-brooded, the second brood remaining in its cocoons during the winter months, coming out late in June. The moth is a fine large insect, expanding, in large specimens, four or five inches. The females are usually a good deal larger, with broader wings than their mates.

Attacus promethia is a very abundant species throughout a large part of the United States and Canada, and is one of the first of the family with whose life history the amateur collector is likely to become acquainted. The female moth deposits her eggs in July on the twigs of the wild cherry, sassafras and button-bush, sometimes five or six together and at others twenty or thirty or more in a



Larva of Attacus promethia.

cluster: and toward the end of that month the minute caterpillars make their way out and mount to the top of the tree or bush, where they may be found feeding on the tender young leaves. When fully grown the caterpillar is one of the handsomest, being two inches long, half an inch thick, very smooth and plump, and of a light bluish-green color. There are four cylindrical coral-red tubercles on

the upper part of the body just back of the head and a large yellow one near the tail end. Numerous small blue warts occur in regular order on the back and sides. The head, legs and posterior part of the body are yellow. While feeding these caterpillars usually remain among the tender leaves on the new growth, and several are generally found in close proximity. On reaching maturity the caterpillar descends to the lower part of the bush and begins spinning its cocoon. After selecting a leaf suitable for its purpose, it commences by spinning a quantity of silk along the branch and down the stem of the leaf in order to make it secure for the winter.

Cocoon of Attacus promethia.

It then draws the sides of the leaf together with silk, and therein spins its tough, brownish cocoon. The silk is very strong, and the cocoons are attached so firmly to the twigs by their slender cord that they ride secure for the winter. In fact, one may often find cocoons which have weathered the blasts of several seasons still firmly attached. The upper end of the cocoon, which is double like *Attacus cecropia*, is so loosely spun that the moth has little difficulty in forcing its way out. This silk could probably be made useful in the arts, as it is very strong and durable and the caterpillars could be reared in the open air in countless thousands with little difficulty.

The moths emerge from the cocoons the latter part of June and the first of July, the females differing so much from the males as easily to be mistaken for different species. The male is a very oily

Upper Side

Under Side

ATTACUS PROMETHIA — MALE

Upper Side

Under Side

ATTACUS PROMETHIA — FEMALE

Male Moth.

Female Moth.

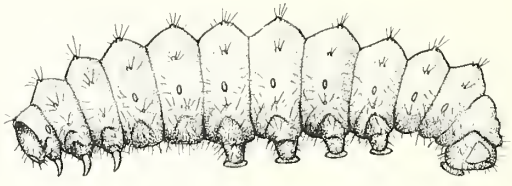
ATTACUS ANGULIFERA.

insect, and in preparing specimens for the cabinet the abdomen should be opened from the under side and its contents removed, the space being filled with cotton. *Attacus promethia* is a day-flyer: but although such a common insect, it is seldom seen on the wing unless one is assembling the males with a captive female. When following up the scent, the insects do not seem to know fear, and one may gather by hand the specimens hovering about a captive female, almost as readily as he may pick roses in a garden.

One of my brothers had an amusing experience on one of his collecting tours through the country where he carried a live female, *Attacus promethia*, fastened in a net to the frame of his bicycle. In wheeling along the road he could watch the train of eager suitors as they followed his tracks, crossing where he crossed and stopping and circling about where he stopped. Coming to a farmhouse, he went in for a drink of water leaning his wheel against a tree. As the good lady brought out the drink of water he innocently asked her if she ever saw any butterflies in that neighborhood. "No," said she, "they are pretty scarce about here; I don't know when I have seen one." By this time the train of moths began to arrive and flutter about the lawn. "Why," said the old lady, "there is one now, a big one; and there is another and another. I haven't seen so many butterflies before this summer. Why *look* at them. Did you ever see the like? I never saw so many butterflies before in all my life." Having thanked her for the water, my brother mounted his wheel and rode away, followed by the flock of "butterflies," leaving the old lady standing on the lawn and looking after him in open-mouthed wonder.

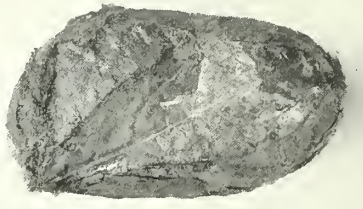
Attacus angulifera is a moth closely related to the preceding. It is a rare insect in the Northern and Eastern States, but is plentiful in some parts of the South, where the lava feeds on the leaves of the buttonwood. The cocoons spun by this caterpillar, which closely resembles *A. promethia*, also resemble those of that insect, and are attached to the stems in the same manner. They are, however, larger and less firm. The moths hatch in June, and are day-flying insects. The female is a rich tan color, with a black wavy line extending across all the wings and the eye-spot near the tip of the fore wing, similar to *A. promethia*. The male somewhat resembles the female of *A. promethia* in the color pattern of its wings, but is of a dark yellowish and ochreous-yellow stippled with dark brown or black.

The large and fine moth, *Telea polyphemus*, is a native of the eastern half of the United States, and is a familiar object to every one who has made a collection of native lepidoptera. The eggs of the moth, two or three hundred in number, are usually laid singly on the leaves of a variety of trees, oak being its favorite food plant, while maple, elm, birch, cherry, linden and other trees frequently furnish its fleshy light green larva with sustenance. The larva may easily be distinguished from the larva of *Actias luna*, which it closely resembles, by the seven oblique yellow lines on each side of its abdominal segments, while the larva of *A. luna* has a lateral yellow stripe. It is a large and handsome caterpillar, when fully grown



Larva of Telea polyphemus.

measuring three or four inches in length and thicker than one's thumb, while each of the segments is adorned with pearl-colored tubercles from which spring silvery hairs. The caterpillar spins its whitish oval cocoon in September, and passes the winter in the pupa



Cocoon of Telea polyphemus.

state. The cocoon is usually spun among the leaves still on the tree, and generally falls to the ground with the leaves. The silk is strong, nearly white and of a silvery lustre, and as it is spun in a continuous thread, it may with care be unwound after soaking in warm water in which has been dissolved a little baking soda. This

UPPER SIDE

TELEA POLYPHEMUS

Under Side

TELEA POLYPHEMUS

silk has been used for manufacturing into fabrics, and although it has not the fineness of the silk of *Bombyx mori*, it is exceedingly durable and beautiful, and a garment made from it would probably last a life-time.

Many experiments have been tried from time to time with the view of making this insect of commercial value as a silk producer, but thus far, I believe, without success. The greatest difficulty seems to be to unwind the silk from the cocoons rapidly enough and in a sufficiently large quantity to make the operation financially successful. It seems as if here was a fair field for the inventor. What clothing we might have if the silk from the cocoon of *Telea polyphemus* could be unwound, spun and woven into cloth inexpensively. Just think of the undergarments, socks, gloves, etc., we might wear, not to mention the curtains, portières, rugs and carpets that might adorn and bring comfort to our homes. I believe this will be achieved at no distant day. As the food plants of this insect abound almost everywhere where there are forests, the food supply is unlimited. The caterpillars are hardy and could be reared out of doors in innumerable millions with the simplest contrivances; and with simple and efficient methods of manufacture, silk goods should be as cheap as cotton.

It is interesting to watch one of these large caterpillars spin its cocoon. The spinneret is located just below the jaws, and as he moves his head backward and forward the silken thread is drawn out. It takes about three days continuous labor to complete the cocoon, and when it is nearly finished the caterpillar gives the whole interior a coating of waterproof varnish, which when dry makes the cocoon feel hard and firm.

When the moth is about to emerge, a liquid is discharged from a gland located where the mouth should be, if it had one, which dissolves the substance which binds the threads together, when they are pushed aside and the insect escapes from a large round hole in the end of the cocoon.

There is considerable variation in the color of the moths. Some are yellowish, some buff, while others have a decided reddish or pinkish tint. These latter are frequently very large and beautiful specimens. *Telea polyphemus* is a night-flyer and on this account although a common insect is rarely seen unless one knows just where and when to look for it. The males are easily assembled with a caged female, and when the cocoons are hatching in one's attic the males

outside will sometimes keep up such a fluttering against the windows of the house in their mad desire to get in, that sleep is out of the question.

The surpassingly beautiful *Actias luna*, with its translucent pea-green wings bordered with purple, is justly esteemed by collectors as one of the most lovely creatures the insect world affords. When fresh from the cocoon, its downy wings fully expanded and perfect in every detail, it is a delightful creature to look upon, and is familiar to most persons who have lived any time in the country, the long tails of its hind wings and green color making it easily distinguished from any other insect known to the United States or Canada. The moths emerge from their cocoons in June, and may frequently be seen on moonlight nights flying among the upper branches of the forest trees. Being very light they look almost white in the moonlight. They are difficult to catch on the wing unless one has a female with which to assemble them, as they fly so high. They usually rest quietly among the foliage in the daytime, and on account of their protective coloring are difficult to find.

The eggs of the moth are laid singly on the leaves of the walnut, hickory, birch, chestnut and other forest trees about the middle of June, and the caterpillars soon hatch. They are dark in color at this stage and covered with hairs. They reach their full size early in September, and are then two and a half to three inches long, as thick as one's thumb, and of a translucent green with a yellow stripe extending along each side, a similarly colored band running transversely across the back between each of the segments and minature pearl-colored tubercles along the back and sides, which bear many short, light yellow hairs. This larva closely resembles the *Telea polyphemus* larva in shape and size, but the latter has larger tubercles, the segments are more humped, and it lacks the continuous yellow stripe on the sides. The larvæ spin their thin, brownish cocoons among the leaves, still fresh and green, and when they fall, the cocoons fall with them and are covered up on the ground by other leaves and by the snow, which protects them from the severe frosts of winter. Many of them are found by the moles, skunks, crows and jays and help eke out the scanty rations of these animals during the months of scarcity. One may find the cocoons in autumn and early spring by searching among the fallen leaves under the walnut and birch trees. This insect is not very hardy, but may be reared with care from the egg or the caterpillar, although the moths

ACTIAS LUNA.

Male.

are apt to be small in size, as the insect does not seem to thrive well in captivity.

I am in hopes of finding a method of breeding luna moths of good size, but so far the efforts of my brothers and self have resulted in pigmies. This insect is sometimes found in great abundance, and I have seen the sidewalk under an electric lamp littered with their wings, the insects attracted to the light having probably been devoured by bats.

Cabinet specimens should be kept out of the light, or they will soon lose their beauty. A good-sized insect of this species will expand five inches. The females are generally of a bluish-green, while the males are more yellowish. The broad band along the upper margin of each fore wing, extending across the thorax, is purplish-brown. On each wing is a transparent eye-like spot surrounded by rings of maroon, ochre-yellow and black. The body is very downy and cottony-white, and the antennæ are ochre-yellow. The insect has a wide range over a large part of the country. Allied species are found in Central America and in Japan and China.

The silkworm par excellence (*Bombyx mori*), domesticated in China at a very early date, was long ago introduced into Europe and later into America, where it is still cultivated to a limited extent. The rearing of the larvæ and reeling of the silk of this species has not met with the success predicted for silk culture in this country: and although the government took up the problem in a scientific manner at their experimental station in the Agricultural Department in Washington, D. C., after a great many attempts covering several years, the enterprise was finally abandoned. One great obstacle in connection with the successful rearing of this insect in large numbers is the fact that it thrives well only on the mulberry tree (its native food plant) and the osage orange, necessitating the cultivation of these trees over large areas. It is also much less hardy than the larvæ of most of our silk-spinning moths. The insects, too, are very susceptible to several contagious diseases which sometimes carry off hundreds of thousands in a single night.

The female moth lays three hundred or more eggs, which are round and of a light yellow color, and are usually attached to the paper generally provided for this purpose by a secretion furnished by the moth. The eggs soon begin to turn dark, and the young caterpillar when it makes its escape is dark gray, clothed with long hairs

which spring from tubercles on its sides and back. With each moult the caterpillar grows lighter, and when fully grown is two inches long, dull yellowish in color, with a curved horn somewhat resembling that of the larva of a sphinx moth on the posterior end, and the first three segments next the head very much swollen and wrinkled. The interior of the body is filled largely with the silk glands, extending one on either side in a loosely-wrinkled tube. These are the glands from which, after the larva is steeped in vinegar, the silk gut so useful to the angler is manufactured. The cocoons are often very beautiful and symmetrical, usually oval, but sometimes constricted slightly about the middle. They are ordinarily light yellow, though sometimes silvery white, greenish or flesh color.

The moths emerge in about three weeks. They are cream colored with two indistinct lines across the fore wings, and as they expand only a little over an inch, are small in proportion to the size of the larva and the cocoon. Neither male nor female is able to fly, and after leaving the cocoons they pair, the females lay their eggs and soon die.

This insect has been so long under cultivation that several varieties have been produced which, if found in a wild state, would be considered distinct species. The original wild stock is not known, but may yet be found in some of the little-known interior districts of China or India.

An insect which is fast becoming well known through the United States and Canada through the efforts of the Massachusetts legislature in distributing profusely illustrated literature on the subject, is the Gypsy moth, *Ocneria* or *Porthetria dispar*, an importation from Europe. The larva of this moth, to which little in the way of vegetation seems to come amiss, is a most destructive pest, and, but for the efforts of the state, which has appropriated large sums of money for its extermination, the insect would doubtless ere this have spread over the whole of the eastern half of Massachusetts. At present it is confined to a limited extent of country within Middlesex County, and it is hoped that by persistent effort it may be entirely eradicated. The insect is attacked at every stage of its development. About the trunks of trees in infected districts bands of burlap are secured, and under these the larvæ are often found resting during the day, they being night-feeders. The pupæ concealed about stone walls, on fences and tree-trunks and like places, frequently in immense numbers, are destroyed when found. The egg clusters are

MALE

FEMALE

OCNERIA DISPAR

gathered and burned or treated with a solution which destroys their life. Whole areas of forest and scrub land have been cleared and burned over to annihilate the pest. The work of the Board for the extermination of this pest has met with a good deal of adverse criticism, but that its labor of keeping in check this foreign army of invasion has been thoroughly performed, is shown by the fact that in many places where most abundant a few years ago it is now a very scarce insect. In fact one may walk for miles through parts of the infested area and not see a sign of its presence.

The male moth is much smaller than his mate and can fly, while the female, although provided with wings, cannot use them in flight. The distribution of the insect, therefore, even if unrestricted, would be slow. The eggs are laid in clusters, usually on the bark of a tree, although the moth does not seem to be particular in this respect. The clusters are covered with hairs from the abdomen of the female and being ochre yellow in color are readily seen. The larva is brown and is thickly covered with stiff hairs, while red and blue tubercles adorn its back.

Porthesia chrysorrhœa.

Another importation from Europe which has also found a foothold in eastern Massachusetts, although not nearly so destructive as the Gypsy moth, is the Brown-tail moth, *Porthesia chrysorrhœa*. The moth is creamy white, with a white body tipped at the end of the abdomen with a tuft of brown hairs, from which the insect derives its common name. The larva is dark brown or black, with reddish hairs covering the body except on the sides, where there is a row of small tubercles from which spring white hairs. There are several small scarlet warts on the back. This insect is a good deal of a pest where abundant, as it devours the leaves of several of our fruit and shade trees and measures may have to be taken to prevent its increase and spread.

A number of the following stout-bodied, hairy moths belong to the family *Notodonta*. Some of them resemble the Noctuids, both in the pupa and perfect state, and may easily be mistaken for them. The larvæ, which often bear humps, tubercles and spines in many of the species, have but four pairs of abdominal legs used in crawling, the last pair being prolonged into tails or are held above the supporting twigs while at rest. Some of the larvæ are naked and others sparingly clothed with soft hairs. They feed on the leaves of trees and shrubs, often in great numbers, and their transformation usually takes place beneath the ground.

Cerura borealis.

Cerura borealis is a whitish moth, marked with brown bands across the upper wings, and is interesting from its peculiarly shaped

Larva of Cerura borealis.

larva, which has a forked prolongation or tail adapted from the last pair of abdominal legs. When disturbed it pushes out from the end of this forked tail two fleshy orange-colored filaments, which it bends over its back or sides as if to protect itself. This larva is naked, is green and purplish in color, and feeds on the poplar and choke-cherry; its color is protective, and it looks while feeding on a leaf a dried and withered part of it.

Clusters of a smooth, bluish, yellow and black-striped larva, with the head and a hump on the posterior end of the body, orange-red,

may often be seen hanging to the stems and leaves of the oak in September. This is the larva of *Edema albifrons* and is sometimes

Larva of Edema albifrons.

abundant enough to do considerable damage to the trees. When not feeding, and especially if disturbed, the caterpillars bend the head

Edema albifrons.

and rear end of the body over the back. The perfect insect has brown upper wings with a whitish band along the upper margin, and light yellowish-brown lower wings.

Cœlodasys unicornis.

Cœlodasys biguttata.

A curiously humped caterpillar is the larva of *Cœlodasys*, of which we have several species. *Cœlodasys unicornis* is buff-gray,

Larva of Cœlodasys.

with darker markings, and *Cœlodasys biguttata* is gray with brown markings and light brown hind wings.

A closely related species is *Nerice bidentata*, a little moth which is rather rare. The upper half of the upper wings is brown with an uneven dark brown line running from base to margin. Below this is

Nerice bidentata.

a white area gradually shading into light brown. The lower wings are light brown.

Another curiously humped caterpillar is the larva of *Œdemasia concinna*. The head and a hump on its back is red, while the body

Larva of Œdemasia concinna.

is striped with black, yellow and white lines and supports a few black spines. This caterpillar is sometimes to be seen in clusters on

Pheosia rimosa.

the apple-trees, where, if unmolested, it is capable of stripping the branches bare of leaves. It also feeds on the cherry and plum. The

cocoon is made under leaves in August or September, and the perfect insect comes forth in June or July of the following year. The moth is light brown and gray and has a dark brown band along the lower margin of the upper wings. It expands something over an inch.

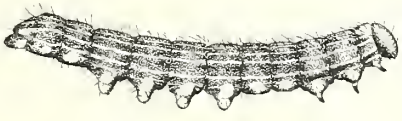
Pheosia rimosa is a gray, brown and yellowish-white moth occasionally to be seen about electric lights. It looks and flies a good deal like a noctuid.

A moth which curls its abdomen up in a curious manner when at rest is *Apatelodes torrefacta*. In this position it would scarcely be

Apatelodes torrefacta.

taken for a moth at all unless closely examined. The fore wings are gray, with a dark brown spot near the base. The lower wings are light pinkish-brown. Both sets of wings have faint lines crossing them.

Great numbers of a black and yellow-striped larva sparingly furnished with soft whitish hairs may be seen in August and September on the apple and cherry, and also the birch and other forest trees, completely stripping the branches of their leaves. So numerous are they and sometimes congregated in such masses that the branches bend with their weight. These caterpillars bend the head and tail



Larva of Datana.

up over the body when disturbed and rest on the four forward pairs of abdominal legs. They are the larvæ of *Datana*. The caterpillars

descend a few inches into the ground in the autumn, where they remain in a chrysalis state till the following July. Our best-known

Datana ministra.

species is *Datana ministra*, a tan-colored moth with buff lower wings and having a patch of reddish-brown on the thorax and several lines of the same color crossing the fore wings.

A genus of moths of medium size, interesting from their gay colors and the habits and shapes of the larvæ, is *Limacodes*. These larvæ are slug-like creatures, and would hardly be taken for caterpillars at all by the novice. The body is short and thick, high in the middle and flat beneath. The head is concealed beneath the forward part of the body, and both the true legs and prolegs are

Limacodes scapha.

scarcely discernible. The animal adhering closely to the leaf or twig upon which it rests has much of the gliding motion of the slugs. Some of these larvæ are naked, while others are adorned with branching spines or fleshy filaments. Some of the caterpillars

are gayly colored. When mature they spin a tough oval or nearly spherical cocoon attached to the twigs of the food plant, oak, walnut, birch and other forest trees furnishing them with food. The moth emerges from the cocoon by pushing off one end, leaving the side attached like a half-spherical lid.

Limacodes scapha is a prettily marked little moth expanding about an inch. The body and lower wings being cinnamon-brown, and the upper wings having a rich reddish-brown patch covering most of the upper part of the wing, edged with silver beneath. The rest of the wing is light brown. The larva is green, without spines, short, thick and high in the middle. It feeds on the oak.

Limacodes querceta.

Another prettily marked insect is *Limacodes querceta*. It is reddish-brown with a small dot of dark brown in each fore wing, and a broad, irregular patch of light green extending from near the lower margin next the body diagonally across the wings to near the tip.

Parasa fraterna.

The caterpillar lives on the oak and willow, is yellow and purple in color, and has a number of branching, pointed filaments which spring from its back and sides. The moth makes its appearance in July, and often comes into our rooms at night attracted by the light. It is a rapid flyer for so small a moth, its short wings humming with the rapidity of their motion.

Parasa fraterna is a rare and beautiful little moth, and is closely related to *Limacodes*. The upper wings have a wide, bright-green band crossing them, with a brown margin and a brown patch next the body. The abdomen and lower wings are light yellowish-brown, and the thorax is green. I have taken this insect on but two or three occasions with a lighted lamp in Massachusetts, and know nothing of its life history.

Lagoa crispata.

To the genus *Lagoa* belong some very woolly moths which go by the appropriate name of flannel moths. Our common species, *Lagoa crispata*, is of a light yellow or light buff with crinkled black and

Case of the Evergreen Bag Worm.

light brown hairs on the fore wings. The body is very downy, and when at rest with the wings folded the creature looks like a bit of wool. The larva, which is also very woolly, feeds on the blackberry, oak and apple. The head is hidden beneath the forward segments of

the body and the legs are so short as to suggest the larva of the *Limacodes*. The cocoon is formed of the hairs of the caterpillar closely woven with silk.

In *Thyridopteryx ephemeræformis* or the evergreen bag worm, the larva constructs a bag or case of silk and pieces of the leaves of its food plant, which it carries from place to place as it feeds, and in which it resides during its caterpillar state. The larva lives on the red cedar and the arbor-vitæ, and the pieces of the leaves are laid lengthwise of its case or bag. The female moth is wingless and grub-like, and never leaves the case, in which it transforms into a pupa after having closed up both ends with silk. The male is provided with wings which support it in flight. Its body is long and tapering and its antennæ are pectinated. Several species of this genus are natives of this country.

Halisidota caryæ.

An insect sometimes very common and doing considerable damage in the Eastern States to hickory, elm, beach, apple and other trees is the hickory-tussock moth, *Halisidota caryæ*. The larva is a pretty caterpillar, an inch and a half long when mature in September. The head, feet and belly are black, and the body is covered with spreading tufts of hairs, white on the sides, with a crest of black tufts along the middle of the back, and long white hairs growing forward over the head. There are also two pairs of tufts of long black hairs placed near either end of the body with a single pair of white tufts near the posterior end. The larva makes an oval gray cocoon composed largely of its own hairs held together with silken threads. This is usually hidden away beneath stones, in the chinks of bark, etc. The moth makes its appearance in June. Its wings are ochre

yellow and seem to be thinly covered with scales, rendering them semi-transparent. Several rows of whitish, silvery spots cross the fore wings and between them is a fine stipple of brown dots. We

Halisidota tessellata.

have other species of tussock moths which closely resemble the foregoing, both in the larval and perfect state.

Orgyia leucostigma is interesting from the fact that the female is a wingless, grub-like creature, looking little like her mate which, although plain grayish-brown in color, has broad wings and can fly.

Larva of Orgyia leucostigma.

The caterpillar is one of our handsomest, being striped with yellow, brown, green and lilac, sparsely clothed with white hairs on the sides with two long plumes of brown hairs next the head, a similar plume on the posterior end of the body and four short, thick, white puffs on the back. Its head is red, and there are two red warts near the tail. The insect feeds on apple, sometimes doing a good deal of damage, spins a thin cocoon frequently on the tree trunk, and upon emerging, the female lays her eggs on the top of the cocoon, cover-

ing them with a frothy substance which, on drying, makes a white crust.

Leucaretia aeræa.

Sometimes seen in numbers in June is the salt-marsh moth, *Leucaretia aeræa*. The thorax, the end of the abdomen and the upper wings of the male moth are white, while the abdomen and the lower wings are yellowish-tan color. Both sets of wings are sprinkled with black dots, and the abdomen has two rows of small dots on each side and a row of large black spots on the back. The female moth differs in color from the male in that the lower wings are white instead of tan. The larva of this moth, which is widely distributed, is frequently seen in large numbers feeding on the coarse lowland grass, not only of the sea-coast, but in the interior of the country. It will also attack other plants, and is capable of doing a great deal of damage. When full grown it is nearly two inches long, covered

Phragmatobia rubricosa.

with long dark brown hairs on the back and lighter hairs on the sides. The spiricles along the sides are white, and the skin of the caterpillar is yellowish. In the fall the caterpillar conceals itself

among the lower grass stems or under stones, and there makes its hairy brown cocoon, in which it passes the winter in a chrysalis state.

A pleasingly-tinted little moth is *Phragmatobia rubricosa*. The upper wings and thorax are pinkish-brown, the lower wings reddish-pink with brown margins, and the abdomen is red with a row of small brown dots on either side, with another row down the back. The wings are so thinly clothed with scales as to be almost transparent. The larva is unknown to me.

An insect well known to almost every one is the brown and black hairy caterpillar covered with stiff short bristles all about the

Larva of Pyrrharctia isabella.

same length, which rolls itself into a round ball when disturbed. This creature feeds on a variety of herbaceous plants, and may be seen in the fall actively engaged in seeking a suitable place for its winter hibernation; for, unlike the larvæ of most lepidopterous insects, it passes the winter in the caterpillar state and may sometimes be found on mild days in the winter crawling over the snow.

Pyrrharctia isabella.

As soon as vegetation starts in the spring it begins feeding, and makes its hairy cocoon under boards, stones and the like in April or May, whence it emerges a moth in June or July. This moth is *Pyrrharctia isabella*, and is of a tawny yellow or dull tan color, having a number of brownish spots on its wings and body.

The *Arctians* are a genus of moths represented in this country by several exceedingly beautiful forms. The species are very variable, and on this account have caused considerable confusion. The antennæ are usually feathered in the males and simple in the females. The larva is covered with stiff sharp-pointed hairs. The

Cocoon and pupa of an Arctian.

cocoon is oval, loosely constructed of the hairs of the caterpillar interwoven with a few threads of silk. The chrysalis is stout, smooth, and dark brown in color. The moths of this genus come readily to a bright light, and a collector in the country will often find them flying about his room on warm summer evenings. They have a habit of feigning death when captured. Several of the species give off a strong odor when handled, which is probably a protection to the insect from its enemies.

Aretia nais.

Arctia nais is a widely distributed insect, being found over the whole of the United States and the lower part of Canada. This insect, according to Edwards, has, on account of its variation received

no less than nine different names. The wings are usually an inch and a half in expanse and are of a pale yellow, pinkish near the base of the lower wings, and striped on the forward pair by broad bands of black with triangular black spots near the outer margin. The lower wings also have several black spots. These spots and bands sometimes cover almost the entire surface, giving the moth a very different appearance. The abdomen is usually flesh color with a band of black on each side and one on the top. The caterpillar lives on the dandelion. Its hairs are black on the back, and brown on the sides.

Arctia arge.

One of the most common species of this genus is *Arctia arge*. The general color is a flesh tint, being intensified to reddish along

Arctia phalerata.

the outer margins of the lower wings. Narrow triangular black spots and long black stripes adorn the upper wings, with several black spots on the lower wings. A row of black spots extends along each side of the abdomen and one row down the back. This insect

expands nearly two inches and makes its appearance in June and July. The caterpillar is dark gray, sometimes almost black, and is thinly clothed with clusters of spreading black hairs which spring from dark colored warts. The larvæ live on the plantain.

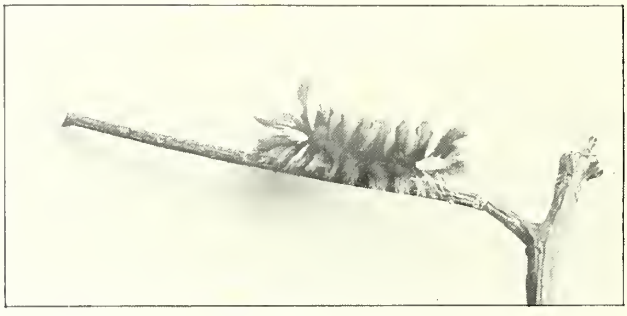
Another common species is *Arctia phalerata*. The thorax and upper wings are yellowish-buff with broad black stripes and triangular spots, and the abdomen and lower wings are reddish-pink with black spots and markings.

Arctia virgo.

Our largest and most beautiful species of this genus is *Arctia virgo*. The upper wings are flesh color marked with broad stripes of black, and the lower wings are vermilion red and deep reddish-pink at the base with large black spots. The thorax is the color of the upper wings, with three black splashes, and the abdomen is the color of the lower wings with a black band on each side and on the back. I have never found this insect abundant but have taken it in August with a lighted lamp in Massachusetts and in northern Ohio. The insect expands two and one-half inches. The caterpillar is brown, covered with brown hairs, is two and a half inches long when fully grown, and feeds on pigweed, dock and plantain.

The common snow-white miller, *Arctia virginica*, has a wide distribution. The wings are pure white with one or two small dots of black, while the abdomen has the customary black spots of the genus on the sides and back with a yellow stripe on each side. The caterpillar of this moth is the "yellow bear," which is a common pest in our vegetable gardens, devouring almost everything in the way of herbaceous plants it finds. Its body is covered with long yellow or

tan colored hairs, and it has an interrupted stripe of brown on either side and a brown band between each of the segments. The insect passes the winter in its hairy cocoon, and in the following June appears as a moth.



Larva of Cycnia egel.

On the milkweed may often be seen numbers of little caterpillars covered with tufts of black, white and orange hairs. These are the harlequin caterpillars, and are the larvæ of a plain little blue-gray moth, *Cycnia egel*, which makes its appearance the latter part of June, after having passed the winter in the pupa state in its oval hairy cocoon. The abdomen of the moth is yellow above, with a row of black dots down the back, resembling the *Arctians*.

Utetheisia bella is a very beautiful moth, and is widely distributed over this country. Its habits are similar to a following species, the soldier moth, and it is often found in low grassy districts in considerable numbers, taking to wing readily when disturbed. When handled it exudes an oily substance with a peculiar odor, and remains perfectly still, as if dead, soon, however, taking wing if not further molested. These habits, combined with a probably very bitter taste, have doubtless preserved this gayly colored little creature from extinction. The larva is one and a half inches long, and is yellow and white in color sprinkled with black dots. It feeds on herbaceous lowland plants.

The anchor moth, *Callimorpha interrupto marginata*, is a rather rare moth, and is about the same size and marked with brown similar to the soldier moth, except that it is yellowish where the other species is white.

Upper Side

Under Side

UTETHEISIA BELLA

The soldier moth, *Callimorpha lecontei*, is a common species to be found among rank grass or bushes near brooks or swamps in June and July. When disturbed it flies a short distance and quickly

Callimorpha lecontei.

hides away among the grass or shrubs. This insect is rarely seen singly, and often while walking among the grass of low land I have started half-a-dozen of these moths from their hiding places. The wings are creamy white marked with dark brown, the head is yellowish, and a brown stripe extends down the back, the rest of the body being creamy white. In some specimens the brown markings of the fore wings cover nearly the whole surface, leaving but a few white patches. The larvæ are thinly clothed with hairs, and are brown in color with yellow stripes. They are night-feeders on herbaceous plants, hiding by day.

Hypoprepia miniata.

A beautiful little moth which sometimes comes to the lamp of the collector is the striped footman, *Hypoprepia miniata*. It is deep scarlet with three dull brown stripes running lengthwise of the upper wings and a broad border of the same color along the margin of the lower wings. The dark brown spiny larva feeds upon lichens, and makes a thin silken cocoon. The moth appears early in June.

Another species closely related to the foregoing and easily mistaken for it is *Hypoprepia fucosa*. This moth is somewhat smaller than *Hypoprepia miniata* and may be distinguished from it by the color of the wings, which are yellow and red.

ZYGÆNIDÆ.

In the family *Zygænidæ*, the species have prominent heads, long narrow wings thinly covered with scales, leaving naked spots in some species. Some of the members of this family are adorned with gay colors, and a large number are diurnal in their habits, rifling the flowers of their sweets in the hot sunshine. The larva is short, thick, and usually adorned with small tubercles. Many of the species are hairy, others naked. Most of them spin silken cocoons, while others utilize the hairs of their coat for a covering for the pupa, binding them together with a few silken threads. Others again make no cocoon whatever. The pupa is usually short and stout-bodied.

Ctenucha virginica.

Ctenucha virginica may be seen on the white clusters of elder blossoms during the sunny hours. It is not timid and is slow to take flight. The head and sides of the thorax are orange, the fore wings are smoky-brown, the hind wings bluish-black, and the body is deep purplish-blue. The wings expand two inches or over. The larva is hairy and feeds on grasses. It constructs a thin hairy cocoon.

A very long and narrow-winged species is *Lycomorpha pholus*. This insect expands a little over an inch; in color the shoulder covers and base of both pairs of wings are orange, the rest of the insect being bluish-black. This moth flies only in the daytime, and may frequently be seen extracting the honey from the goldenrod by

the roadside. The hairy greenish larva feeds on lichens growing on stones, and makes a thin silken cocoon.

Lycomorpha pholus.

A prettily colored moth is *Eudryas grata*. The thorax and fore wings are white, with brown, pinkish-brown and greenish-brown markings, while the abdomen and lower wings are yellowish-buff

Eudryas grata.

with markings of brown and pinkish-brown. This insect expands about two inches. The caterpillar feeds on the leaves of the Virginia creeper and the grape. It is a peculiar looking creature, being blunt at the posterior end and crossed by numerous bluish and orange bands and fine black lines and spots. The transformations are passed in the ground.

Another species, differing greatly in the perfect insect but very similar in the larval state to the foregoing, is *Alypia octomaculata*. This insect expands something over an inch, and is black with the exception of two large yellow spots on each of the fore wings, two large white spots on each of the hind wings, the shoulder covers (which are yellow), and tufts of reddish-orange hairs on the legs. This moth is an active creature, flying about in the sunshine, sud-

denly disappearing and as suddenly returning. It is very common in some parts of the country. The larva is banded with white and orange and with narrow black lines and rows of black dots. This species has eight black lines to each segment, while the preceding

Alypia octomaculata.

has but six. It feeds on the leaves of the grape and Virginia creeper, and transforms into a pupa in an earthen cavity beneath the surface of the ground. There are usually two broods in a season, one coming forth in June and another in August and September.

Psychomorpha epimenis.

Psychomorpha epimenis I have found a rather rare little moth, although I have heard of its being abundant in some parts of the country. The insect is black, with a large yellowish-white spot on each fore wing and a large brick-red spot on each hind wing. It expands about an inch. The caterpillar feeds on the grape and Virginia creeper, drawing the ends of the young shoots together with silken threads. In shape it resembles the foregoing, but has a bluish appearance; being banded with black and white lines. It transforms in the ground.

ÆGERIDÆ.

Glass-wings.

The moths belonging to the family *Egeridæ* are rather small, and are readily distinguished from all other moths by their resemblance to bees and wasps. They have narrow, mostly transparent wings, long bodies, with a fan-shaped tuft of hairs at the posterior end, and spindle-shaped antennæ. Most of the species are gayly colored and all are diurnal in their habits. The larvæ are borers in the stems and roots of trees and shrubs, and do a great deal of damage to some of our cultivated fruit trees. They are grub-like, whitish creatures with brown heads. Some kinds are sparsely covered with fine hairs. The transformations usually take place in the excavations made by the larva, where a rude cocoon is constructed by cementing together fragments of wood. The pupa is armed with minute spines on its abdominal rings, and when about to break the shell makes its way out of the cocoon and along the passage to the opening previously made by the caterpillar. Here the moth escapes, often leaving the empty shell protruding from the hole.

Melittia cucurbitæ.

Melittia cucurbitæ is our largest native species of this group, and expands about an inch and a half. The upper wings are black, the lower ones transparent, edged with a fringe of long hair-like scales. The abdomen is orange with a few black dots, and the posterior pair of legs have long orange and black hairs. The larva infests the squash, cucumber and melon, living in the interior of the vine and devouring its substance.

Another species familiar to cultivators of peach and plum trees from the destruction caused by the larva is *Egeria exitiosa*. The male and female moths differ greatly in size and general appearance. The male has all four wings transparent, the veins and margins being steel blue. The body is also blue, with a yellow tuft at the extremity. In the female moth the fore wings are dark blue and opaque, while the hind wings are transparent, and the abdomen is

crossed by a broad band of orange. The larva feeds on the inner bark and young wood of peach and plum trees, infesting them

Ægeria exitiosa. Male.

Ægeria exitiosa. Female.

especially near the ground. So destructive is this pest in some regions as to have caused the abandonment of peach growing.

Ægeria tipuliforme.

The currant borer, *Ægeria tipuliforme*, is scarcely less destructive than the preceding, and, as its name implies, the larva bores in the stems of the currant. The larva feeds on the pith of the plants, causing the leaves to turn yellow and eventually the plant to die. The moth is smaller than the preceding, expanding about three-quarters of an inch, is blue-black in color, the wings being transparent, with a coppery colored bar at the tips of the forward pair. The shoulder covers and three lines across the abdomen are yellow. The moth makes its appearance in June.

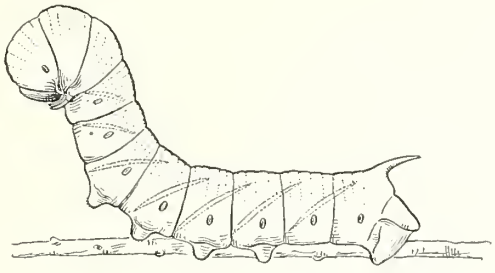
Ægeria pyri.

A small species, whose larva bores under the bark and in the young wood of the pear tree, is *Ægeria pyri*. The insect expands half an inch. Its general color is purplish-black above and yellow beneath; but the wings are transparent, with a band of copper-brown at the tips of the forward pair, and the body is crossed with two narrow lines and one broad band of yellow, while the fan-shaped tuft of hairs at the end of the abdomen is yellow.

SPHINGIDÆ.

Dusk-flyers.

The interesting group of moths that come under this head have long been favorites with collectors. Their trim, graceful shapes, the pleasing tints and large size of many of the species, combined with the grotesque attitudes assumed by the larvæ, make them objects of unusual interest. The name "Sphinx moths" was given to the group by Linnæus on account of a fanciful resemblance which the



Larva of Sphinx Moth.

larvæ bear while at rest to the fabled Sphinx. Clasping the twig with the posterior feet the caterpillar raises the forward part of the body and remains in this attitude sometimes for hours. These insects also go by the common name of Humming-bird moths, from the habit of the insects, which while poised on rapidly vibrating wings extract the honey from the flowers. Hawk moths, too, is a name given this group, probably from the strong, direct flight of the insects.

These moths have powerful, long, narrow wings, particularly the upper pair, and stout spindle-shaped bodies. The antennæ are stout, thickened in the middle and usually supplied with a curved hook at the tip. The tongue is often very long, although in some species it is short. The eyes are large and prominent. In one group the wings are transparent, resembling in this respect the *Ægeriadæ*. They have strong, well-developed legs. Most of the species fly only at dusk of morning and evening, while others fly late into the night, and a few only in the daytime in the hot sunshine. The larvæ are usually smooth, naked caterpillars, green in color, with oblique light stripes along the sides, and supplied with a sharp curved horn on the top of the next to the last segment. In some species this caudal

horn is to be found only in the young caterpillars, an eye-like tubercle taking its place in the more mature larva. That this horn is of any use to the caterpillar I have yet to learn. It may be the survival from its ancestors of a sting; but if such is the case it has entirely lost its value as a weapon of defence. The transformations usually take place a few inches beneath the surface of the ground. A few species make rude cocoons by drawing about themselves leaves and twigs on the ground under their food plant, and fastening

Pupæ of Sphinx Moths.

them together with a few silken threads. They usually pass the winter in a pupa state. The chrysalis in some species is furnished with a long tongue-case which stands out from the body and is often compared to the handle of a jug.

Among the clear-wing sphinxes, our most common species is *Hemaris thysbe*. In this insect the wings expand about two inches and are transparent, the veins and margins being reddish-brown. The head and thorax are olive-green: the upper part of the abdomen is crossed by a broad band of buff, while the lower part is rich reddish-brown or maroon, and reddish-brown beneath. The fan-like tail is black on the sides, with a yellowish-brown central tuft of hairs. The under side of the thorax and legs of the insect are light yellow. This insect is sometimes very common in June and July, and may be seen on hot summer days hovering over the flowers of the garden extracting their nectar. It looks not unlike a humming-bird in miniature while on the wing. The blue blossoms of the pickerel weed, which grows so plentifully along the margins of most ponds and

slow flowing rivers is a favorite flower with this moth. It looks as if suspended in the air while poised before the spike of blossoms, its wings moving so rapidly as to be scarcely visible. The larva, which feeds on the leaves of the snow-ball, is nearly two inches long, and is

Hemaris thysbe.

light green in color. When about to pupate it draws a few leaves and twigs about itself on the surface of the ground and makes a rude cocoon by spinning a few silken threads to hold them together. In this it passes the winter in the chrysalis state.

Hemaris diffinis.

Another species of clear-wing more common farther south than the preceding is *Hemaris diffinis*, or the bumble-bee hawk moth. It is somewhat smaller than *Hemaris thysbe*, the veins and margins of the wings are darker brown, the abdomen beneath and legs are black, while the abdomen alone is crossed by a broad band of rich reddish-brown. The top of the thorax is covered with light yellow hairs

which give it while on the wing a bee-like look. The habits of the insect are much the same as the preceding. The larva feeds on the leaves of the bush honeysuckle and it makes a clumsy cocoon of leaves and sticks on the ground under the bushes.

Deilephila chamœnerii.

Deilephila chamœnerii expands two and a half inches and is boldly and prettily marked. The body is olive-green above, with a white line along the sides of the head and thorax, and white and black spots with a pinkish shade on the sides of the abdomen. The fore wings are dark olive-green or greenish-brown, with an irregular buff stripe extending from the lower margin of the wing near the body to the tip; the outer margin is bordered by a band of gray. The lower wings are black, with a wide pink band extending across them with a white spot next the inner margin. This insect, although apparently not so common as the following species, is quite widely distributed. It may be seen early of a summer evening about the flowers of the evening primrose and the petunia, and is often so intent on its repast as to allow itself to be closely approached. The larva is unknown to me, but is described by Packard as "bronze-green, dull red beneath, with nine round cream-colored spots, pupilled with black, and having a dull red caudal horn." It feeds on the leaves of the willow herb.

Deilephila lineata expands from three and a half to four inches and is one of our prettiest sphinx moths, its close fitting scales and spindle-shaped body with the abdomen ending in a pointed tuft of hairs, giving it a trim and neat appearance. It is colored much

like the preceding species except that there are several white lines following the veins and extending diagonally across the upper wings. There are also white lines on the thorax, and the abdomen has a decided rosy tint besides the black and white markings. This insect is found from the Atlantic to the Pacific coast, and extends well up into Canada and also into the southern parts of the country, as far down as the Gulf of Mexico. It is very abundant in some parts of

Deilephila lineata.

the country, and I have taken it in numbers in Sacramento, Cal., where early on a June evening, even before sunset, it might be seen flying in wide circles over the fields of wild flowers or poised before the spikes of blossoms daintily extracting their sweets. The larva is yellowish-green in color, and feeds on the leaves of the apple, plum and currant. It is said to be double-brooded in the southern part of the country.

On the grape and Virginia creeper may often be seen during July and August the larva of *Everyx myron*. This caterpillar is about two inches long when fully grown, green in color with a whitish stripe edged with dark green along each side extending from the head to the caudal horn, and oblique markings of yellow shaded behind with dark green also on the sides. There is, too, a row of pink spots down the back. Occasionally a specimen may be found of a strong pink, brownish-pink or even reddish color. In such an

insect the stripes and lines are usually pale, pink instead of yellow or white. The two forward segments next the head are small, and those farther back much swollen, so that the head and first segments may be partly retracted and almost concealed beneath the folds of

Everyx myron.

the large fleshy parts, giving the caterpillar a humped appearance and suggesting the common name of hog caterpillar. These larvæ are often attacked by parasitic insects, whose grubs feed on the flesh and fat of the caterpillars which later may be found in an enfeebled con-

Pupa of Everyx myron.

dition crawling about with the cocoons of their destroyers clinging to their sides and back. The larva makes a poorly constructed cocoon on the surface of the ground, composed of leaves held together with a few silken threads. The chrysalis is yellowish-gray and is

sprinkled with black dots. The moth expands about two and a half inches. The body and forward wings are olive-green, the wings

Larva of Everyx myron.

being crossed by a vaguely defined band of flesh color, while the lower wings are brick-red in color with a softly shaded patch of olive-green at the lower angle. This insect is widely distributed over this country.

Everyx chærilus.

Another insect not rare in the eastern half of the country is *Everyx chærilus*. The predominating color is reddish-brown, but the fore wings are crossed by bands of yellowish-brown and pinkish-gray, while the lower wings are brick-red with a dark brown shade along the lower margins. This insect may be taken about lilacs, and may occasionally be seen flying around the electric lights in our towns.

Philampelus pandorus and the following closely allied species are grand insects, easily holding first place among our native sphinxes. The expanse of wing is from four and a half to five inches, and magnificent is the only word that seems to do justice to the size and coloring of these fine moths. The present species is olive-green and gray with dark velvety patches of greenish-brown on the upper, and

black on the lower wings. A rosy tint is diffused over the greens, grays, and olives which are softly blended and shaded into one another in a most charming manner.

A designer of good taste and refinement might evolve from this moth's velvet coat a dress of modest loveliness for a lady which would make her the envy of her fair sisters. The sight of such an insect in its perfect beauty having recently spread its wings from the narrow confines of its hard, brown chrysalis, is apt to set one wondering why

Philampelus pandorus.

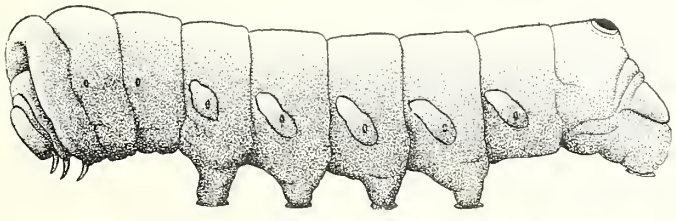
our costume makers do not go more to Nature's art school for their suggestions.

The habits of this insect are much the same as those of other long-tongued species of sphinxes, which in the dusk of morning and evening extract the nectar from the fresh opened flowers. It is sometimes to be seen flying in circles about the electric lights in cities, but I have never known it to be attracted by the light of a common kerosene lamp. This is true of most of the sphinx moths. It takes the powerful rays of the electric light to dazzle and bewilder them.

The larva of this moth is large and fleshy, and like the preceding it can, by contracting the first three segments, almost completely hide

them beneath the fleshy folds of the much swollen following segment, thus making the insect look very blunt and humped at the anterior end. It is smooth, without hairs or tubercles except an eye-like spot on the top of the posterior end of the body. The color of the larva is usually light green, although specimens are to be found of a flesh or brownish-pink color. Along the side runs a row of broad oval spots, yellowish in color, obliquely placed on the segments. The forward part of the body is covered with a fine stipple of black dots. The young of this larva is interesting from the fact that it is usually light pink, and has a curled spine on the posterior end of its body, which after two or three moults disappears, leaving only the eye-like tubercle before mentioned.

This caterpillar feeds on the leaves of the grape and Virginia creeper, and on account of its large size, often three or four inches long, and as thick as one's thumb, it consumes large quantities of the leaves, even eating the midrib down to the stem. It is rarely, however, found sufficiently abundant to do any great damage.



Larva of Philampelus pandorus.

In *Philampelus achemon* the larva very closely resembles that of the preceding species both in its habits and its shape and coloring, except that the spots arranged along the sides are much longer and narrower, are scalloped on their edges, and a long yellowish stripe extends above the spots the entire length of the caterpillar. This species also feeds on the grape and Virginia creeper, and when fully grown in the latter part of August or early in September it, like the larva of the preceding species, burrows into the earth a few inches, where it changes to a pupa without making a cocoon of any kind, simply excavating a smooth cavity or cell in the soil. The perfect insect comes forth the next July. This moth is somewhat smaller than *Philampelus pandorus*, but is very beautiful, the forward wings and the body of a light pinkish-brown with intensely dark brown patches

arranged as shown in the figure. The lower wings are rose color, being light buff next the body, and bordered externally with light brown and dark brown spots and shadings. This insect is probably less abundant than *Philampelus pandorus*. Both are widely distrib-

Philampelus achemon.

uted, being found from the Atlantic to the Pacific coasts of our country, and from Canada well into the Southern States, while allied species occur in Mexico.

The tomato-worm moth, *Macrosila quinquemaculatus*, is one of our largest sphinx moths, and although ashen gray with a few dark brown and black markings, is still a fine insect. The length of the tongue of this insect is very remarkable, and on this account it is able to extract the nectar from our largest and deepest flowers. It is interesting early on a quiet summer evening to stand beside a bunch of phlox or a bed of petunias and watch this moth hovering over the flowers. It is strong and rapid on the wing, and on account of its size and the directness of its flight looks quite bird-like.

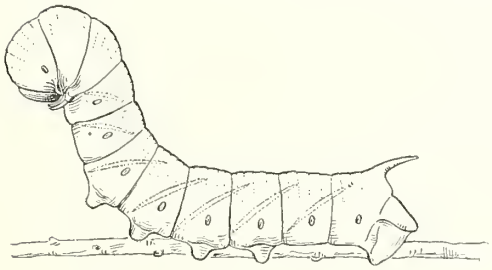
The legs of the moth are armed with sharp spines, so do not try the unpleasant experience of taking one of these muscular insects by hand. Even if through your love for collecting you manage to hold it, the specimen is liable to be ruined in the struggle to escape.

The larva of this insect feeds on the leaves and even the young

fruits of the tomato. It will also eat potato and tobacco leaves, and in some parts of the country does great injury to the tobacco crop

Macrosila quinquemaculatus.

unless men are constantly engaged in "picking worms" from the plants.



Larva of Macrosila quinquemaculatus.

The larvæ are usually green with a curved caudal spine. Specimens are occasionally found of a dark brown or black color.

One can frequently locate the larva on its food plant by shaking

the stems and listening for the snapping noise made by the jaws of the larva as it swings its head from side to side in a menacing manner. It is quite harmless, however. The pupa is interesting from its tongue case, which looks not unlike the handle of a jug. It is frequently found while spading or ploughing the garden. The pupa passes the winter several inches under ground, and works its way to the surface in spring when it is about to break the pupa case and emerge a perfect fly. (See figure on page 140.)

This insect is widely distributed over the whole of the United States and Canada.

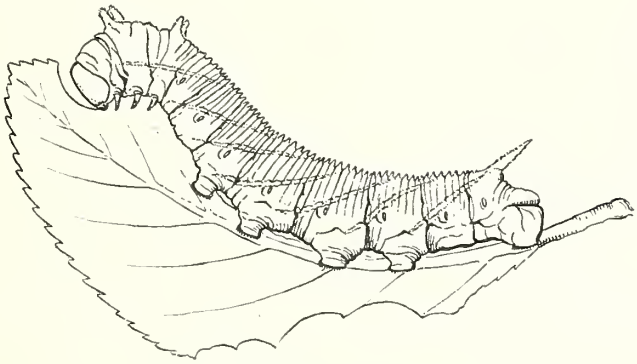
Macrosila carolina.

The Carolina sphinx, *Macrosila carolina*, very closely resembles the foregoing in all three stages of its existence, and also feeds on the same plants. It is, however, a somewhat smaller insect, and the moth is more brownish in color with less gray, while the black markings on the lower wings run more together and are not zigzag as in *quinquemaculatus*. The larva is green, stippled with white dots, with seven oblique whitish stripes, and a light longitudinal line extending along each side. The stout caudal horn is usually bluish.

They are frequently, among the country folks, considered venomous, the caudal horn probably giving rise to the idea that they can sting.

A large caterpillar, which feeds on the leaves of the elm and is

interesting from its protective mimicry, is the larva of *Ceratomia quadricornis*. This larva is green, of the exact tint of the underside of the elm leaf, and along its sides are a number of oblique light



Larva of Ceratomia quadricornis.

lines. A line down its back is serrated, and on the forward part of the body are four soft green horns, also serrated. While this insect

Ceratomia quadricornis.

is at rest clinging to the midrib on the underside of the elm leaf it is a difficult creature to see, and one may gaze directly on it and still think he is looking at a slightly curled leaf. The light line down

the back answers to the midrib of the leaf, the oblique stripes on the sides look like the main veins, and the green horns closely resemble the notched tip of the leaf. One may readily locate the creature by observing the pellets of excrement on the ground under the trees, but even when he is known to be on a certain branch he is not easily seen. The caterpillars may sometimes be seen on the trunks of trees as they are making their way down to the ground to undergo their transformations in the soil. The moth is four inches or more in expanse and is light brown in color, with lines and markings of dark brown, black and gray.

The caterpillar descends into the ground during August or September and emerges a moth the next July, when it crawls up the trunk of an elm tree, waiting until evening when its wings are sufficiently strong to enable it to take flight.

Daremma undulosa.

Daremma undulosa is a good-sized moth of a brownish-gray color, with a few light gray and dark brown or black markings distributed as shown in the figure. It is not a rare moth and will sometimes be attracted by the collector's lamp. It is rarely taken about flowers as it does not seem to be as partial to sweets as many of the sphinxes.

A small moth somewhat resembling the preceding in its markings is *Dolba hylaeus*. The upper wings are light reddish-brown and gray with many black and brown lines. The lower wings are sooty-brown

and white. The thorax is reddish-brown with white stripes on the sides, and the abdomen has several white bars on the sides with two rows of white dots down the back. This insect is common in the southern states and I have taken a few in Massachusetts and Ohio.

Dolba hylæus.

A very common sphinx moth with a wide geographical range extending over the larger part of this country and Canada is *Sphinx gordius*. This insect is dark sooty gray and light gray or white with several black bars on the sides of its body, and a few pen-like mark-

Sphinx gordius.

ings also in black on the wings. It is very partial to lilac blossoms, and when the clusters of flowers are fully expanded it may sometimes be seen at dusk on a warm quiet evening in some numbers. So intent are these moths on their feast of honey that one may approach

quite near them and watch them guide their long flexible tongues into the tiny flowers. The motion of their wings is so rapid that they make a slight whirring noise and in the half-light are almost invisible. The larva is green with light oblique stripes on the sides, and it feeds on the leaves of the apple though it is rarely sufficiently plentiful to do much damage.

Sphinx chersis.

On the ash and lilac, in September, may be found a plump, handsome green caterpillar, whitish on the back and having seven oblique light yellow stripes on its sides edged above with dark green. This is the larva of *Sphinx chersis*. The moth is ashen gray in color with several black and white bands on the sides of its body, two heavy black lines on its lower wings and a few pen-like markings in black on its forward wings. It is a large powerful moth and has a strong, rapid flight.

Sphinx drupiferarum is also a good-sized moth, being four inches or over in expanse of wing. The general color is dark sooty brown. The outer margin of all four wings is light brown while a large area along the upper margin of the upper wings and a band across the lower wings is gray. Black and white bands alternate on the sides of the body. The larva feeds on the leaves of the plum and hackberry. It is light green with white stripes edged above with purple.

Sphinx kalmiæ expands about four inches, and is buff and rust-red in color, with reddish-brown markings streaking the upper wings. It is not a rare insect, and may be taken early in the season about

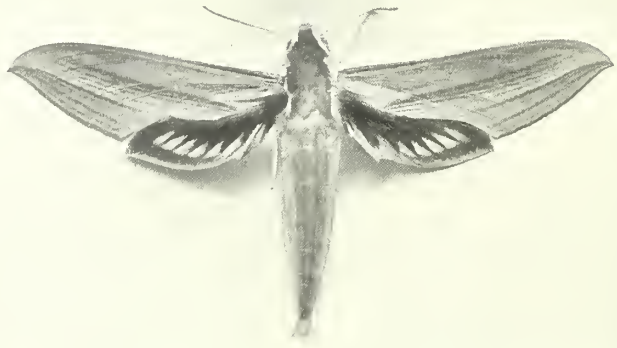
Sphinx drupiferarum.

the lilac blossoms. The larva is pale green with oblique bands of yellow on the sides, edged above with black and blue. It feeds on the leaves of the lilac and laurel.

A plainly tinted but gracefully shaped insect is *Chloerocampa tersa*. In this moth the body is long and tapering, ending in a tuft of hairs. The upper wings are long, narrow and pointed, while the lower pair is small in proportion. Its body is tan with a yellowish stripe on either side, and the thorax and head is brown with a light gray band also on the side. The upper wings are light brown crossed diagonally with numerous brown lines. The lower wings are black margined with brown, with a row of light yellow spots extending above the brown margin. This insect is more plentiful in the southern parts of the country, and is rather common in Washington, D. C., where about the electric lights they may frequently be taken in July and August.

One of our earliest sphinx moths to be seen in the spring is *Thyreus abbotii*. The lilac blossoms are very attractive to this species, and on a May evening it may be seen hovering about the clusters of flowers. It is not very shy, and may be easily taken with the net. The general color of the moth is dark purplish-brown. The fore wings are crossed by numerous black lines, while a broad band of black and

dark brown extends along the outer margin of the lower wings, the rest of the wing being yellow. The body is bluish-gray and brown, with lines and bands of black. From the sides of the body spring tufts of



Chloerocampa tersa.

hairs, and three spreading plumes of long yellowish-brown hairs adorn the end of the abdomen. These latter the insect can spread or contract

Thyreus abbotii.

at pleasure, and are no doubt of value in guiding its rapid flight. The caterpillar of this moth feeds on the leaves of the Virginia creeper, and in its markings closely resembles a section of the stem of the vine.

It is grayish or greenish brown in color, crossed by numerous darker brown markings. The under side is pink. At the posterior end is an eye-like spot or tubercle, making the insect look, as one observer worded it, "as if the worm had a head at each end." When handled the caterpillar twists its body vigorously from side to side, making at the same time a squeaking noise. The winter is passed in the chrysalis state, a few inches beneath the surface of the ground.

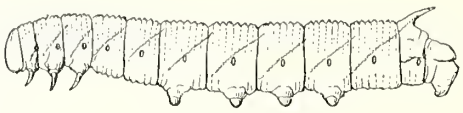
Amphion nessus.

A little jewel among the sphinx moths is *Amphion nessus*. It expands a little over two inches, and the wings are very much scalloped. The ground-color of the fore wings and thorax is purplish-brown, the wings being crossed by dark velvety brown markings and faint yellowish lines, with a spot of reddish-brown near the tip of the wing. The lower wings are margined with a broad band of brown edged with yellow, the rest of the wing being reddish-brown. The abdomen is dark reddish-brown, lighter on the sides, and is crossed by two conspicuous bright yellow bands. The end of the abdomen bears three tufts of long dark brown hairs which may be spread or contracted at the pleasure of the insect. The white lilac and syringa are favorite flowers. Its flight is not so rapid as that of other members of the family, and it may be easily taken, even by hand.

I have never found this insect abundant but have had numerous specimens sent me from Ontario, Canada, and also from Virginia.

The genus *Smerinthus* contains some large and very handsome moths. Unlike the species of sphinx moths already described, in this genus the tongue is very short, almost wanting in fact, and can be of little use to the insect. The fore wings are scalloped on their outer

edges, and the moths are sluggish in their habits, flying only by night, and then in a vague and uncertain manner, contrasting greatly in this respect with the strong, direct flight of most of the species of the



Larva of Smerinthus.

family. The larvæ are usually green in color, and their skin is rough and granular, giving it a hard sandpaper-like feeling. The transformations are passed in the ground.

Smerinthus geminatus.

Our beautiful little *Smerinthus geminatus* is not a rare insect, and may often be taken with the collector's lamp in July. The upper wings are gray with a faint rosy cast, and are crossed by lines and bands of olive and rich velvety brown. The thorax is also gray, with a large triangular patch of dark brown occupying the middle. The lower wings are rich carmine margined with gray, with a large black spot located near the inner angle of the wing, in which are two bluish-purple spots. The larva of this insect lives on the leaves of the apple, plum, willow and ash, and is green in color with yellow stripes on the sides. Its skin is covered with fine white granules, and it has a triangular head. The pupæ of this species may often be found in connection with that of the following, in the soil at the roots of ash and willow trees.

Smerinthus excæcatus is not so exquisitely colored as the preceding species, but is still, when freshly hatched from the pupa, a very pretty insect. Its general color is fawn, with lines and bands of brown and

Smerinthus excæcatus (male).

tan. In the middle of the lower wings is a rose-colored patch, and near the inner angle is a large black spot with a dim blue centre. The eggs of this moth are large in proportion to its size, are oval in shape,

Smerinthus myops.

transparent green in color, and look not unlike malaga grapes in miniature. The larva is green with yellow stripes on the sides. The caudal horn is blue. This caterpillar feeds on the leaves of apple,

wild cherry, elm, ash, etc., and may be found near the tips of the branches devouring the young and tender foliage. Young trees and bushes seem to be more subject to the attacks of the larvæ of these moths than older and larger trees. This insect is found from Canada to Virginia throughout the Atlantic States.

A dark brown insect somewhat resembling the foregoing is *Smerinthus myops*. The fore wings and body are dark purplish-brown with light purple lines and markings, and the lower wings have the eye-like spot of the preceding species, but are much darker generally. In

Triptogon modesta.

habits the two species closely resemble each other. While at rest hanging from the stem of a plant, the scalloped outline of the wings of these insects, together with their brown or tan colors and the peculiar bent attitude in which the body is held, give them a resemblance to brown and withered leaves. So complete is their mimicry that one may be obliged to touch the insect before being sure of its identity.

A fine large, but rather rare, insect having a wide range over the northern half of the country is *Smerinthus* or *Triptogon modesta*. This moth expands, in a fine specimen, from five and a half to six inches, and its colors are soft and pleasing. The outer two-thirds of

its fore wings and the outer margin of the lower wings are olive. The inner third of the upper wings and the inner margin of the lower wings are light gray. The middle of the lower wings is dull carmine, while near the inner angle is a bluish-gray patch having a curved black line over it. The body is greenish-olive. This fine moth is rarely captured by the collector, but it may be reared from its larva, which is not uncommon, and is to be found feeding on the leaves of the poplar and cottonwood in September. It is a large green caterpillar three or four inches long, and on account of the rough, white granulations with which its body is covered, it has the appearance of being sprinkled with dew or frosted. A closely allied insect or a variety of this same species is rather abundant in the western states and on the Pacific coast of this country.