Natural History

OF

NEW YORK.

[Division V. - Agriculture]

Vol. 5

BY AUTHORITY.

NEW YORK:
D. APPLETON & Co. AND WILEY & PUTNAM:

BOSTON:
GOULD, KENDALL & LINCOLN.

ALBANY:
CHARLES VAN BENTHUYSEN, PRINTER.

AGRICULTURE

OF

NEW-YORK:

COMPRISING

AN ACCOUNT OF THE CLASSIFICATION, COMPOSITION AND DISTRIBUTION OF THE SOILS AND ROCKS,

AND OF THE CLIMATE AND AGRICULTURAL PRODUCTIONS OF THE STATE;

TOGETHER WITH DESCRIPTIONS OF

THE MORE COMMON AND INJURIOUS SPECIES OF INSECTS.

BY E. EMMONS, M.D.

VOLUME V.

ALBANY:
PRINTED BY C. VAN BENTHUYSEN.
1854.

TO T. ROMEYN BECK, M.D., LL.D.

SIR:

THERE is more than one reason why the concluding divisions of the present work, undertaken to explore and illustrate the natural history of the State of New-York, and conducted under legislative patronage, should be dedicated to you. You were among the first to foster the enterprise, and remained its consistent advocate in times when adverse circumstances seemed to jeopardize its continuance: much more than this, your whole life has been assiduously engaged in promoting the advance of science and the spread of popular education, and the published results of your scientific and literary labors may be referred to as reflecting an honor upon your native State. Would that the merits of the present volume were such as to render it more worthy its dedication.

THE AUTHOR.

PREFACE.

I HAVE not attempted, in the preparation of this work, to place before my readers an account of all the rare and newly discovered insects of New-York and New-England, but have confined myself to those which are most common and widely distributed. The rare and the local possess an interest in the eyes of the learned; but those which are daily met with in the fields and in our walks, are the ones our interests demand us to know: the former do neither harm nor good; but a familiar acquaintance with the forms and habits of the common and widely spread, is an indispensable preliminary towards enabling the husbandman to take advantage of the services they may be made to render him, or to protect his premises and the fruits of his labor from the depredations of noxious broods. This view has mainly controlled our undertaking: as the work is designed for those who are supposed to be mere beginners in entomology, and perhaps intend to prosecute the study no farther than practical results will warrant, it was thought fit to restrict the field of investigation to such insects as are sufficiently numerous to interfere in some way with the prosperity or comforts of the dwellers in this northern portion of our country.

One part of my labor has been to collect materials in the field, and another to collect them from the researches of others, the latter item constituting doubtlessly the largest and most valuable portion of the entire work; but it is confidently believed that naturalists and authors who have contributed largely to the common stock of entomological knowledge, and thereby earned and received a high and enduring reputation, will not be disposed to object to the diffusion of information fraught with such great consequence to the welfare of community. These distinguished investigators are honored by their discoveries; but their discoveries require to be made known to all the world, to the end that their results may redound to the common good of the human family.

After saying thus much in general, it is scarcely necessary to add that this work is designed to disseminate the information collected from various periodicals in which it was first gathered, and from expensive books of the day in which a large amount is almost inaccessibly stored up, but is not expected to add much to the materials of knowledge already accumulated.

We have been poorly supplied with the means of promoting the study of entomology in this country, notwithstanding we have among us such men as the LECONTE's elder and younger, who both stand in the first rank of entomologists; but it is unfortunate that their classical works are mostly confined to the libraries of the learned.

I have made the freest use of Dr. HARRIS's excellent and practical works; and have also been very much assisted by our distinguished entomologist, Dr. ASA FITCH of Salem, Washington county, N. Y.

I have occasion also to acknowledge a further indebtedness to Mr. HALDEMAN of Columbia (Pennsylvania), who enjoys a European reputation as a naturalist, for several valuable notes on various insects; and could his assistance have been still farther procured, the value of my work would undoubtedly have been greatly enhanced.

I have figured such insects as I have seen, and know to belong to New-York and New-England; but I have not seen them in all their states, and am therefore frequently indebted to others for the figures given of the larva and pupa stages. Some are copied from ABBOTT & SMITH's work on the insects of Georgia, and some from other works of like kind. I have figured very few foreign species, and these have had some special purpose in view.

The figures have been drawn from specimens of the insects themselves, by E. EMMONS junior, and are faithful and accurate portraits of the individuals from which they were taken. It is difficult, however, to secure a finished and uniform coloring, especially for so large an edition as three thousand copies.

I do not deem it necessary to point out the faults of this volume; for the keen-sighted, and those who are disposed to look after them, will find them with little trouble. I am persuaded, however, that the general reader, as well as the student, will find in it many valuable records. E. EMMONS.

ALBANY, July 25, 1854.

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INSECTS OF NEW-YORK.

CHAPTER I.

GENERAL CONSIDERATIONS.

The common idea of an insect is, probably, sufficiently exact for all practical purposes; yet it seems proper that the scientific idea should be expressed : indeed it is always important to define clearly the limits of all departments of Natural History, by stating in determinate language the boundaries which confine them. Insects, then, are animals whose bodies are covered with a coriaceous integument; and they are divided into three distinct segments or sections, the *head*, *thorax*, and *abdomen*. The head is provided with two antennæ; the thorax, with six articulated legs; and the abdomen with many rings, and contains the digestive organs : the sexes are distinct. They have a respiratory, circulatory and nervous apparatus : the first permeates the whole body; the second consists mainly of a long vessel extending through the body, and is called a dorsal vessel, from the position it occupies; the third is a symmetrical arrangement of nervous threads in two lines, placed upon the abdominal face, and connected by knots or ganglia at every ring of the body. The breathing is performed through small openings along the sides of the abdomen, at every ring : the air admitted permeates the whole system, and acts upon the fluids as in all animals. The most interesting peculiarities, however, consist in the changes which the insect undergoes during its stages of growth, which, although the developments are not more remarkable than in other departments of the animal kingdom, yet differ from the higher in being stationary for certain periods, during which it performs the functions of a perfect animal, except indeed that which belongs to the exercise of the sexual organs. These changes are called *metamorphoses*, and consist of three stages, the *worm* or *larva*, the *pupa*, and the *perfect insect*.

Insects, as defined in the foregoing paragraph, are still very closely related to other classes of animals : thus they resemble the Myriapodes in the annular or jointed structure, and in the possession of two antennæ, but differ from them by the division of their bodies into three segments, while the Myriapodes are composed of many rings, to each of which there is provided a pair of legs, as in the family of animals called Centipedes. They resemble the spiders, or Arachnidæ, somewhat in the division of the body, but the head in spiders is soldered to the thorax : they are also destitute of antennæ ; the nervous system is condensed into fewer central ganglia, and sometimes their respiration is analogous to the pulmonary, the air being received into sacs or bags. They resemble the Crustacea in a few points, but differ essentially from them in the character of the respiratory apparatus, inasmuch as the Crustacea are provided with organs analogous to the gills of fishes. The resemblance which insects bear to the worms, Annelides, is the annulated structure : those worms have neither antennæ nor feet, and, as to sex, they are mostly hermaphrodites. In addition to the foregoing, I may add, none of the classes have wings but insects, and their metamorphoses are of a different character, consisting mainly of a casting of the integuments as in the crab and lobster.

All insects are oviparous, or spring from an egg laid before the birth of the individual. A few examples are known where the egg is retained in the body, and there hatched. These eggs are often carefully concealed, and hence are discovered with difficulty : it is owing to this circumstance that they multiply to an injurious extent, and are often capable of devastating extensive territories. They are, however, generally laid upon the bodies which are to provide the food for the young : those which subsist upon herbaceous plants, are found upon or near the foliage ; those which feed upon wood are deposited in holes, or in cracks and crevices of trees, into which the young animal immediately begins to penetrate ; or, which is equally bad, the egg is deposited in the rudiments of the fruit, and will be ready to devour it when it is mature.

Insects are extremely prolific, but the different species vary exceedingly. According to a statement in the Naturalist's Library, a certain large fly (*Mesembrina meridiana*) lays only two eggs ; while the female white ant lays probably not fewer than forty or fifty millions in a year, which are extruded at the rate of sixty in a minute when engaged in the act*. This statement embraces the extremes. Others are known to lay, as the queen bee for example, fifty thousand ; female wasp, thirty thousand, though generally only from two to three thousand. The eggs of the wheat fly are not very numerous, and probably less than one hundred ; yet even in that small number the increase will be sufficient to secure the destruction of the wheatfields in a large district. But many insects produce several broods in a season, and some of the most prolific produce several generations of young, consisting mainly of females, which are capable of laying eggs as soon as they have reached a stage

* Naturalist's Library, Introduction, pp. 72, 73.

of full development. But the law of increase seems to rest upon the supply of food : where this is sure and constant, the increase is much greater than where it is precarious or uncertain ; thus those insects which subsist on animal food are comparatively limited, while the vegetable feeders are more numerous : this is in keeping with the harmony of nature, and the original arrangements of the Creator.

The eggs of insects are made up, essentially, of the same parts as the egg of vertebrated animals. It consists of a yolk, with its germinal disc and germinal spot, which seem really to be nothing else than a cell with its nucleolus. The yolk is enveloped in a proper membrane ; and in order to defend and protect it, it is supplied with a hard outside envelope, analogous to the eggshell of the common fowl ; but the shell, the white, and its tough membrane, are not essential parts in the constitution of the egg.

The eggs of insects, like all other eggs, obey the law of temperature. The young are hatched at an earlier day if the temperature is increased, and the hatching is retarded in a medium of low temperature. It therefore happens that man is often a gainer in consequence of the warmth of spring, which brings forward insect life at an early day, only to perish by the frosts which soon succeed. The eggs of insects are endued with the power to resist, or rather withstand, wide variations of temperature. It is evident that they sustain all the ordinary changes of the climate, and that it often happens that they are exposed to a temperature equal to 20° below zero. The ability to withstand either extreme of temperature depends upon the conditions of the egg : if it has progressed considerably towards the development of an embryo, its power to withstand those extreme changes is diminished. The pupa resists but feebly those changes when it first assumes this state ; but when it has nearly reached the period of completing its metamorphosis, it is surprising that it can resist a high degree of heat. I exposed the pupæ of numerous silkworms, enclosed in a bottle, to 212°, without injuring them. I was surprised to find, not many days afterwards, that hundreds of millers of both sexes had escaped from their cocoons. The warmth of the sun, together with its light, is sufficient to destroy the vitality of the pupa when it first assumes that state ; but the eggs of insects require air, or oxygen, as much as the perfect animal : when enclosed in a vacuum, they lose their vitality. Oxygen is essential to the development of the embryo, and hence the outer covering must admit its passage.

The eggs of some insects seem to grow : they increase in size, probably by the absorption of moisture from the atmosphere, or from the surface upon which they are laid.

The covering of eggs varies exceedingly : in some it is beautifully sculptured ; in others it is smooth and shining. These different characters, if they could be fully delineated, would constitute important marks for the discrimination of species, for it is probable that they differ in the species to which they belong.

The most remarkable fact in the history of insects, is their metamorphosis. The egg, as has been observed already, is similar to the eggs produced by other classes of animals ; but it never gives birth to a perfect insect, the immediate product of the egg being really as

unlike the perfect insect as possible; for what can be more unlike than the caterpillar and butterfly? How disgusting the one, as it crawls like a reptile; and how beautiful the other, as it flits in the air like a bird!

From the egg, the first state in which the insect appears is the larva. This stage of existence is characterized by the vermiform shape and construction of their bodies; and it is a stage which attracts our attention more frequently than that of the perfect insect, and it is one in which it usually commits a greater amount of injury than in the perfect stage: it is, too, in this stage that the agriculturist can more effectually exterminate these his foes. The term *larva* is applied generally to the immature butterfly or caterpillar. Grubs are white, soft-bodied animals, which are immature beetles; while maggots are immature flies, or belong to the dipterous order of insects. All, however, are the analogous representatives of the different orders in the same stage of development, or that stage during which the insect grows and frequently casts its integuments: it devours immense quantities of food, and is often very destructive to the foliage of vegetables. When it has reached its development for the larva stage, it ceases to eat, wraps itself in a mantle, simulates death, but is really undergoing internal changes preparatory to a higher stage of development. In its mantle it casts its old skin, which it presses down into the lower part of its envelope, and soon appears in a livery peculiar to the pupa stage. The time during which it is confined to this stage varies with every insect: in some it is brief; in others, it is long.

Insects are composed of thirteen segments, including the head; but an obscurity often arises from the consolidation of segments, and often produces thereby a disproportionate development of certain parts. The three segments immediately behind the head correspond to the *prothorax*, *mesothorax*, and *metathorax* of the insect; and these bear the three pair of legs, provided the larva possesses legs. These are persistent, and hence are called *true legs*, to distinguish them from the *abdominal legs*, *prolegs* or props, which are caducous, or are never transmitted to the perfect insect: they are peculiar to the larva. The mouth-pieces or oral organs frequently differ in the different stages also. These are sometimes designed for suction in the larva, while the perfect insect is provided with jaws for mastication; hence, in such cases, the nature of the food is changed: in other cases the provisions for taking food are the same in both stages.

The larvæ grow rapidly, as a general fact, insomuch that the whole structure of the animal indicates provisions subservient to this result: they are provided with strong and efficient organs of manducation; their digestive organs are very large and capacious; the function of digestion is rapidly effected, and the consumption of food is immense in proportion to the weight of the body. It is stated that flesh-flies increase two hundred times their weight in twenty-four hours. Count Dandolo remarks that the weight of the silk-worm, when first hatched, is about one-hundredth of a grain, or it requires one hundred of them to weigh a grain: after the first moulting, one hundred weigh 15 grains; after the second, the same number weigh 94 grains; after the third, their weight is 400 grains;

after the fourth, their conjoint weight is 1628 grains; and after the fifth, when they have attained a length of three inches, they weigh 9500 grains. These changes of skin, called *moultings*, seem designed to accommodate the development of the body to its outer envelope: it is a critical period; and if any accident happens which interferes with its proper performance, the animal either perishes, or is left in an enfeebled state, and is unable to assume the form of the perfect insect. The number of moultings varies with the species, but is always alike in the same species: the same changes are repeated in each respectively. All these changes are best observed in the silkworm, in which their number is five, and require thirty days for their complete performance. In some insects the number of moultings extends to nine or ten, while in others it does not exceed three or four. The larva ceases to eat when it is undergoing this process: an internal change takes place, however, which greatly favors the casting of its envelope; it is the absorption of the fat beneath the outer skin, which becomes shrivelled, while at the same time it gives opportunity for the expansion of the internal parts. The motions are strange during this period: their bodies are curiously shaken and contorted, with jerkings of the head and posterior parts of the abdomen; these are designed to break up the attachments of the outer skin, and finally to detach it from the new skin beneath, which is bright, fresh, and moist. A rent is finally made in the old skin along the back, through which the animal now forces its way, in which process it is assisted by attaching itself to some point of support: this is managed so adroitly that the old skin remains whole, except the rent along the back, and so perfect that it might be mistaken for the perfect larva. The change is not confined to the outer envelope: the organs of respiration, though extremely delicate, as well as those of digestion, cast off also their membranes, which are ultimately expelled from the body. It is no wonder, then, that the moulting stage is one of great danger to the larva. This becomes still more hazardous to the silkworm which is placed in an artificial state, and which is increased by the numbers that are crowded into a small area. The last change is attended with circumstances somewhat peculiar. They first seek a suitable retreat, adapted to the nature of the insect itself; a crevice in the bark of trees, a shelter under the roof of a building, or a hole in the ground, in which they construct a sort of chamber, which they line and otherwise prepare in a mode suitable to their necessities. They form habitations with much skill, and the bestowment of much care, to defend their bodies from the extremes of temperature, or as a defence from their enemies. Sometimes, as in the dipterous insects, the old skin is converted into a pupa case, after becoming more rigid and stiff: in other instances a beautiful case is made, and a robe of silk is laboriously woven from a single thread, which is formed and spun from the juices of the body.

The silkworm is an admirable example to illustrate the instinctive powers of insects in perfecting their stages of development. We admire the skill by which it suspends itself in its case, and the beautiful manœuvres by which it manages to place the band of silk around

its body. The habitation of the pupa is usually called its *cocoon* ; which term, however, is more commonly applied to those silken cases or envelopes of which I have been speaking, and of which we have an example in the silkworm. This is so closely woven that it excludes water, and is often stiffened by a glutinous matter, by which it preserves its original form even after the perfect animal has escaped : it is also farther strengthened by leaves and pieces of wood, which undoubtedly serve as a better protection from its enemies. Thus this helpless state is guarded and protected by a system of means which are calculated to secure the existence of the animal in its utterly helpless state ; a state which simulates death, and which, in its ultimate triumph, resembles the resurrection of the body from the grave of real death.

All insects do not undergo the same changes ; neither are they alike in analogous states. Thus the caterpillar of our butterflies wraps itself in its mantle, where it silently undergoes its change ; but the grasshopper comes from the egg an immature insect, but with the general form of the perfect animal, and hops about with the rudiments of wings upon its back. As it grows rapidly, it outgrows its skin, which it frequently casts, like the larva of the butterfly : its wings continue to grow, and the body to increase ; the partial wings keep pace with these changes, till at last they are perfected, and the animal has reached its perfect state without having lost its activity during its period of growth. The grasshopper, then, never passes into the inactive pupa state ; and in this its metamorphosis is similar to bugs, and dissimilar to beetles and caterpillars.

There is another difference in the history of insect life, which is interesting : it is not the inhabitant of the same medium through life. It may begin its career in the water, and end it in the air : the musquito is an example. Who has not observed the wiggler in stagnant water, and in our cisterns ? It is the musquito enjoying its water-life to the full. When the time arrives for its change, it rises to the surface, bursts its mantle, thrusts up its head and spreads its wings, while with its feet it rests still upon its cast-off mantle, then rises buoyant from its sinking bark, and flies away in triumph from the element which gave it birth.

Equally remarkable are the appetites of the insect in its larva and in its perfect state. Thus the larva, or, as it is usually called, the *maggot*, sports and feeds upon the putrid mass ; but the fly, which springs from its mantle, seeks the honey of our table : so various are the forms and manners of insect life. The caterpillar, grub and maggot go through the three stages, or undergo a complete metamorphosis ; passing through the three periods which are known as the caterpillar, pupa, and imago or perfect stage. The last is the only period which is given them to continue their kind and generations : in many it is transient as the fleeting day, and seems designed only for fulfilling the law of increase ; which, when fulfilled, the insect dies.

CHAPTER II.

SKETCH OF THE ANATOMY AND PHYSIOLOGY OF INSECTS.

The parts of the insect which are employed in description are the antennæ, the segments, the wings and nervures, the eyes, the parts forming the mouth, etc.; and these it will be necessary to describe somewhat at length. The three divisions of the body are marked by deep incisions, by which the head, thorax and abdomen, or *hind-body* as it is sometimes called, are always distinct in the perfect insect; but in the larva there are only two divisions, the head and body. The middle, or thorax, supports the head and wings. The head is armed with jaws or mandibles and palpi, and ornamented or surmounted by the antennæ, which, in some insects, are much larger than their bodies, and are made up of many joints gradually tapering to a point.

The wings of beetles are composed of dissimilar pieces, lying, when at rest, one above the other. The upper or outer wing is thick, and shaped to the parietes of the abdomen, being convex above and concave below : it protects the true wing, which is delicate and studiously folded, and is only elevated in flight, in order to give play to the true wings. The upper wings are called *elytra*, to distinguish them from the reticulated wing; they are also denominated *wing-covers* or *cases*, and are often finely sculptured, punctured or ornamented : to these the insect frequently owes its beauty; upon these, too, the fine colors are impressed, which are often of a splendent hue or lustre. In other orders of insects the four wings are entirely reticulated, or composed of a fine network traversed longitudinally and obliquely by nervures which branch in the same species in a certain manner, which, from their constancy, have been employed by systematists to aid in classifying, and as characteristics of genera. The wings are still farther modified in the Lepidoptera; the network is more compact and close, and is covered with fine scales but slightly attached, which appear to the unassisted eye like meal of a pearly hue. Butterflies and moths are provided with this peculiar wing, which, though extremely delicate and always injured when slightly touched with the finger, yet always appears perfect when first captured; showing thereby their power and ability to perform the natural functions for which they were designed, without sustaining the loss of this delicate substance.

The external covering of insects is quite hard : it is called *integument*, or *crust*, and supplies the place of the internal skeleton, and is the part to which the muscles are attached. It is somewhat horny, or corneous, but varies considerably in this respect in the different species : In certain beetles it is hard and inflexible ; while in others, it is soft and quite flexible. It resembles the true skin of animals in its divisibility into three layers, an epidermis, a rete mucosum, and a leathery tunic called the *corium* or *dermis*, the true skin. This outer integument is composed chemically of phosphate of lime and magnesia ; but, what is interesting, it is found to contain a peculiar substance, termed *chitine*, which is insoluble in potash. Phosphate of iron, albumen, and a peculiar coloring matter, are also among the substances composing this integument.

The shape of the head is variable, but the spherical form predominates. The integument forms a kind of box, with an aperture in front, through which the organs of the mouth may be thrust. The posterior part furnishes a place and attachments for the muscles which move the head upon the thorax. The eyes are large, usually, and occupy the lateral parts of the head. The external parts of the head have received different names. The *epicranium* is that portion which extends from the eyes backwards. In front of the epicranium, is the forehead. The *clypeus* is the margin in front above the mouth. Sometimes the whole region in front of the eyes is called the face. The inferior parts of the box enclosing the head has also its spaces, which have received distinct names, as *gula*, or throat, which lies immediately behind the margin of the lower lip, and extends back to the prothorax. The cheeks are situated upon the sides of the head, from the eyes downwards to the mouth. The antennæ are situated between the angle of the mouth and the eyes : they have a subglobose joint at the base, upon which they move, and which is placed in a kind of socket ; this is sometimes called a *torulus*.

The mouth, as may be supposed, is constructed so as to answer the ends designed, and it is either suctorial or manducatory, masticating : if the food is fluid, it is suctorial ; if solid, it has jaws for mastication. In the mandibulate or masticating, there is perfect freedom of motion ; in the suctorial or haustellate (*haustellata*), the parts are more or less soldered together, so as to form a tube for the transmission of fluids. The terms *haustellata* and *mandibulata* apply, therefore, to two great classes of insects, one of which subsists on the juices of plants and animals, which they obtain by suction ; the others, the masticating, subsist on solid substances. Animals destined to obtain food by modes so apparently distinct, furnish many distinctive characters of importance. The *labrum* is the most anterior part seen from above ; it covers the mouth, and is united by a membranous hinge to the clypeus : it is employed in retaining the food in the mouth during mastication ; it is, therefore, a true upper lip, but of a variable form. Mastication is performed by the *mandibles*, which are two strong jaws that move laterally, and consist of wedge-shaped or triangular pieces more or less elongated, and placed immediately below the labrum. These organs are also called upper jaws : they move like the blades of scissors. Their inner edge is fre-

quently dentate or toothed, the teeth being arranged so as to shut within each other. Below the upper jaw are the feeler jaws, or maxillæ; these also move horizontally : they are smaller, and, instead of notches, their inner edges are furnished with bristles or hairs; they are articulated to the throat by a hinge (*cardo*), which places them at right angles to the stipe or stalk, which last is pretty thick and strong at its upper part. Attached to this is the feeler-bearer, so called because the maxillary palpus is inserted on its outer edge. The terminal portion of the maxilla is the maxillary lobe, which is frequently toothed at its extremity. The maxillary palpus is a filiform, jointed process, which always distinguishes the maxillæ from the mandibles. The proportion of joints is variable, and in number they never exceed six. The terminal joint is quite variable in form in the different genera, and hence becomes an important characteristic. The under lip is called a *labium*; it antagonizes the labrum : at its base is the *mentum* or chin. The anterior part bears the labial palpi : the terminal portion is the *ligula*, and is often lobed. The labial palpi are jointed, but the joints never exceed four. The tongue, in the Carabidæ, is a lining membrane of the under lip, which protrudes along its anterior angles, or in front : it is obscure among the Coleoptera, but more distinct among the Orthoptera. The mouth designed for suction is not very dissimilar to the one formed for mastication. The mandibles have undergone modifications which are referred to three types, that have received the following appellations : *promuscis*, *proboscis*, and *haustellum*. The tube is formed by the elongation of the maxilla and accessory parts : so also it is formed by the mandibles.

The thorax is the section of the insect which lies between the head and abdomen : it supports the legs. Three principal pieces enter into its composition : the anterior supports the fore-legs, and is called the *prothorax*; the next, the *mesothorax*, which supports the middle legs and fore-wings; the last, the *metathorax*, which supports the hind-legs and hind-wings. The inferior part of the thorax is covered by a plate, called the *prosternum* by Burmeister. The *scutellum* is a triangular piece of integument interposed between the elytra at their base : sometimes it is concealed by the elytra. Connected with the scutellum is the *frenum*, a membrane designed to regulate the quantity of movement belonging to the elytra : in the Fulgura it consists of cartilaginous elastic rings, which admit of tension and relaxation. The mesothorax has another important division, called the *scapulæ* : they assist in forming the articulating socket of the elytra; they pass down the sides of the second thoracic segment. The mesothorax has also its spiracle : on the under side of this segment is placed the *mesosternum*; it contains the sockets of the middle legs. The metathorax is the posterior segment of the thorax, which supports the hind-legs and the inferior wings : it is well developed in the Coleoptera and Orthoptera. The best authorities regard it as admitting of a division into seven pieces : the dorsal portion is the *metanotum*; it is quadrangular, and notched in front. The metathorax is separated from the abdomen by a parietal wall called the *metaphragma*, and from the mesothorax by the *mesophragma*. The lateral portions of the metathorax are provided with horny plates, termed by Kirby and

SPENCE *pleura* and *peripleura*; the latter supports the *halteres* or *poisers* in dipterous insects. The thorax invariably supports six legs. The wings are sometimes wanting, when the insect is said to be *apterous* : those with two wings are *dipterous;* and those with four, *tetrapterous.* The superior wings are provided with an articulating socket, which is formed in part by the organ called the *scapula* : they lie close upon the sternum; they constitute the second principal portion of the mesothorax, lying one on each side in front. Another distinct portion of the mesothorax is the *mesosternum* : it lies upon the under side, opposite the mesonotum; in its area the middle legs are articulated. The mesosternum is not equally developed in all orders of insects : it is most perfect in the Coleoptera and Orthoptera; the dorsal portion has received the name of *metanotum*, quadrangular in form, and emarginate in front.

The parts supported by the thorax are the wings and legs; and, as has been observed already, the latter are invariably six in number, and never wanting. The wings are variable in number, in form and in substance; and upon the variability in form and substance, the orders are composed. Thus those with four wings are termed *tetrapterous;* those with two, *dipterous;* and those with none, *apterous.* The anterior pair in Tetraptera is attached to the mesothorax : this pair is also sometimes called the superior pair, while the pair attached to the metathorax is called the posterior or inferior pair. The pair which is wanting in the Diptera, is the posterior pair.

It has been said that the wings differ in form and substance. Nature, however, preserves rigorously the symmetry of parts. In Coleoptera, the anterior wings differ from the posterior both in substance and form. The substance of the first is leathery, more or less rigid, and horny : their form is various, but adapted to the dorsum or back of the insect; while the posterior are membranous, flexible and elastic, and capable of being folded beneath the anterior wings. In another order of Tetraptera the wings are similar in form and substance, and of equal size : these insects have received the name of *Neuroptera.* Where, however, in tetrapterous insects, the posterior wings differ in size, but preserve the form and substance of the anterior, the order is called *Hymenoptera.* Examples of Neuroptera are the dragon-flies; of Hymenoptera, the common honey-bee, wasp, etc. In flight, the rigid anterior wing of the Coleoptera is of little use : it serves to protect the membranous wing and abdomen when at rest. Hence it is that the flight of beetles is short, and sustained evidently with much more labor than that of dragon-flies or honey-bees. The insects whose wings are four, and covered with scales, are called from this last circumstance *Lepidoptera.*

It is proper here to remark, that while there is a great dissimilarity between the anterior wing of a beetle and that of a dragon-fly, yet we are not to suppose that the difference is effected by a sudden leap : there is really a gradation in substance. We have insects whose anterior wings are intermediate in this respect, both in substance and form. Thus the common grasshopper has an anterior wing which is between leathery and membranous, and is

elongated very frequently beyond the body. This is the characteristic of the order *Orthoptera* of systematic writers; and in this order, the wing grows with the body of the insect. There is another modification of the anterior wing, which seems to arise from an arrest of development, as the organ acquires scarcely half its usual length : this modification has served to establish the order *Hemiptera* of authors.

A still more beautiful modification of the wing of the insect is found in butterflies and moths. In these the membrane and network, constituting the frame and foundation-work of the organ, are covered with a mealy substance, or what appears to the unassisted eye as such. This substance, however, is a scale of a beautiful workmanship, of a variable form and size in different insects, and in different parts of the wing of the same insect : they are beautiful objects for the microscope. Rude handling immediately destroys the beauty of the wing, by detaching these scales, and leaving the membrane beneath naked and broken.

The wing, anatomically considered, is composed of two parts : the *nervures*, and *membrane*. The former are likened unto ribs, which start from the anterior angle, and branch in various ways as they pass to the posterior margin. They give strength to the organ, and serve an important purpose in supporting and staying the outstretched membrane. The nervures are not, as might at first be supposed, solid ribs : they are traversed internally by a spiral vessel and nerve. The membrane is double, although extremely delicate : this delicacy, however, is no obstacle to the growth of appendages, such as hairs, etc., inasmuch as it is frequently densely covered with them: The wing, divided by the branching and anastomosing of the nervures, forms a network more or less fine. The spaces enclosed by the branches are called *cells* or *areolets;* and being quite constant in form and place, they are employed in the determination of groups. Three areas are particularly noticed, namely, the *costal*, *intermediate*, and *anal* areas. The wing has a base, and anterior and posterior margins : the first is the part attached to the sternum; the two others define themselves. The apex of the wing is the part opposite to the base.

Various views have been expressed by different authors on the analogical relations of the wings, many of which are certainly very fanciful. M. Audouin takes a rational common sense view of these relations, and regards the wings as organs *sui generis*, intended for the exercise of special functions.

The legs. Each segment of the thorax supports a pair of legs. The joint which unites them with the body is called the *coxa* or *hip* : it is held in its socket by a ligament. The motions of the leg are controlled more or less by the form of the coxa. The thigh is the largest portion of the leg : its form is various; it is cylindrical or flattened, it is straight or arched. If the insect leaps, the posterior thighs are thick and strong. The legs are also more or less spinous.

The *tibia* is the next part of the leg, and forms an angle with the thigh. It is more

slender than the thigh, and is connected with it by a joint similar to a knee-joint, called *ginglimus* (articulation): it is so formed that it may be closely applied to the thigh. Spines and spurs are also found upon the tibia or shank : when the spines are short, they are regarded as teeth. The spurs are articulated with the part, and possess some motion : they are commonly arranged in pairs at the extremity of each tibia.

The tibia terminates below in the *tarsus*, or foot : this consists of a series of pieces, more or less heart-shaped, and never exceeding five in number. The combined motion of these pieces is considerable, though it is such as belongs to the ginglimus articulation : they are never of equal length, and the first one is the longest of all. The terminal piece bears a bifid claw, often dentate or serrate on the edges ; and a spurious claw is frequently found between the branches. In addition to the forenamed parts, we often find cushions placed upon the bottom of the foot, which serve as sucking cups, enabling the insect to support itself in a pendant position. Hairs also clothe the sole.

The forelegs often exhibit a form more or less divergent from the others, and hence serve an additional purpose in the economy of the insect : they are employed in prehension. So it is sometimes the case that the hindlegs have a form specially adapted to a particular purpose, such as the rolling of the ball in which the eggs are enclosed, etc.

The third part of the body of an insect, which calls for our attention, is the abdomen : it has no appendage, and in this respect differs from the parts already noticed. Its external structure is not peculiar ; for, like the other parts, it is composed of a series of horny rings or segments, which are closely connected together. The rings do not exceed nine in number : if they appear to be fewer than nine, it may arise from the overlapping of adjacent ones. A section of the abdomen exhibits a triangular outline. The abdomen itself is united to the thorax, but not always in the same way : the area of junction is sometimes broad, or equal to that of the first segment ; in other cases the union is by a short stem, or petiole, consisting of a trumpet-shaped tube : the abdomen is sessile in the former case, and petiolated in the latter. The rings or segments are united to each other in two ways : by the first, the inferior and middle parts are joined or soldered together, leaving the sides and dorsal portions only free ; by the second way, there is no soldering of parts, but the rings are supported by overlapping each other, and may slide into each other like the pieces of a telescope. In the former mode, motion is restricted, while the greatest freedom exists in the latter. The segments are lined by a membrane, but it is scarcely visible except in the case of a gravid female, when it is seen distended like a bag.

The abdomen, being comparatively free, is well fitted to sustain the function of respiration. To this end, each segment or ring is furnished with an opening for the transmission of air, which penetrates thence in appropriate vessels throughout the whole body. These openings are surrounded by rings, and are usually denominated *spiracles*. As the abdomen is devoted to digestion, and is also the cavity in which the generative organs are lodged, it

is necessary that it should be well supplied with air or oxygen : hence each segment has a pair of spiracles, which are capable of inhaling a large amount of this essential element. The external orifices are often protected by hairs, which shut over them, and thus serve to exclude foreign matters, while the air permeates freely into the interior of the body.

Besides the digestive organs, and a portion of the respiratory apparatus, the abdomen contains the genital organs, the piercer and sting of females. The piercer is a flexible jointed tube, and is used to puncture trees or other bodies for the purpose of depositing the eggs. It varies in length and form, and is fitted to perform its office according to the instinct of the animal to which it belongs.

I have now described, in as few words as possible, the most essential external parts of insects; those parts which are particularly employed in the description of genera and species, as well as those used in general classification. From these parts the student will be able to form a correct notion of the extent of this class of animals; but there are yet other portions, occupying the interior of the insect's body, which are important for us to study, inasmuch as they will yield information in regard to the economy of this interesting class which will be of essential service. I refer to the *digestive*, *circulatory*, and *nervous* systems. If the external forms of insects are curious and interesting, the student will find that the apparatus for carrying on the foregoing functions is still more so. There is especially one curious fact particularly worthy of notice in relation to the digestive apparatus : it is this, that the secretory organs are reduced to the simplest form, that of tubes; from which we learn that nature requires no special form of instrument for the performance of a given function.

All the essentials of a digestive apparatus, which belong to the higher classes of animals, are found in the insect. Some interesting differences, it is true, exist; still when it is considered that the food of insects does not really differ from that of other animals, we may of course expect to find the digestive organs essentially the same in kind. As insects subsist upon various kinds of food, some upon vegetables, others upon the elaborated juices of animals or upon flesh, so we find similar variations in the form and proportion of the organs as exist among the higher animals. The vegetable feeder has a larger and more capacious digestive apparatus than the carnivorous insect, nature always adapting her means to the end.

The function of digestion in insects, as in all other animals, is performed through the instrumentality of an alimentary canal. Our first object will be to describe this apparatus. The function itself involves the existence of two kinds of apparatus : the parts through which the food must pass; and the parts which supply the special fluids essential to effect certain changes in the food before it can become aliment or nutrient matter. Beginning with the description of the first kind of apparatus, namely, the organ or organs through which the food passes during the process of digestion, we may regard this apparatus as a

canal open at each extremity, with an enlargement or dilatation more or less in its central portion; whence it is diminished, and becomes tubular and folded repeatedly upon itself, increasing thereby in length until in some instances it is many times the length of the body. Different portions of this canal have received different appellations, as is highly proper, from the fact that certain of its parts perform functions of a modified character, although all contributing to one general result. In this division of parts, comparative anatomists have employed the same names that have long been in use in the anatomy of the higher animals, as the following enumeration will show, to wit: the pharynx, œsophagus, crop, gizzard, stomach or chylific ventricle, small intestines, cæcum and rectum.

The pharynx is the anterior portion or beginning of the canal. The cavity of the mouth opens into it, and it is an aperture more or less enlarged: it is, however, better developed in those insects which masticate their food, the mandibulated class. Indeed it is regarded as having no existence except in this class; for in the suctorial insect, the next part, or esophagus, is in direct continuity with the haustella or sucking tube, which is connected with it by two distinct tubes.

The esophagus, commonly known as the *gullet*, is a tube connecting the pharynx with the crop, or first enlargement of the intestinal canal. It passes directly through the thorax and constricted part of the insect, terminating in the abdomen in the crop. It is variable in length: it may form one-half the length of the canal, while in other instances it is less than one-sixth of such length. It has a peculiarity which has already been alluded to: its bifurcation anteriorly in the lepidoptera, each spiral sucking tube extending its branch to it just behind the head.

The esophagus is connected in the first place with the crop, an enlargement having a close analogy in position and form with the crop of a bird. It is also called a *stomach* by some writers on entomology. It is sometimes placed on a line with the esophagus, when it appears as a simple enlargement of the tube; in other instances it is placed on one side, and then appears more like a sac connected with the esophagus by a short canal, and serving as a kind of reservoir; or, in other words, more analogous to the crop of birds*. In certain beetles, as the Cicindela, the organ is provided with a glandular apparatus, which secretes an abundant and active juice to soften and otherwise change the food deposited in it. In the hemiptera it is remarkably modified in function: it loses its importance as a depository of food, and becomes a part of a pumping apparatus; whence it has been called a *sucking stomach*. The insect in this case has the power of distending the sac, and thereby

* It is proper in this place to notice the fact, that while there are numerous variations in the form and length of the alimentary canal of insects, there are two modifications that should be particularly spoken of, namely: the bot-fly has no opening at all answering to the mouth and pharynx, and hence can take no nourishment; and in the larva of the wasp and bee, the rectum is closed, and hence their economy does not require the evacuation of excrementitious matter.

rarifying the air in its interior; in consequence of which, fluids rise in it as in a pump. We have in this case an instance of a modification of an organ of the simplest kind, by which, however, the entire function is changed; passing from a digestive function to a transferring one, or one more immediately subservient to the mouth.

The gizzard is the next organ, and may be distinguished from the crop by its peculiar apparatus for mastication : its internal surface is studded "with teeth or spines, or horny ridges;" the organ, therefore, is eminently fitted for performing a perfect comminution of the matters received into it. It completes, in this respect, what has been performed but imperfectly. It performs a function somewhat analogous to that of rumination in the herbivora. All the insects which feed upon hard substances, those which might be regarded as nearly indigestible, are provided with a strong muscular gizzard, furnished with a masticating apparatus.

The stomach, or that part in which we first observe the food reduced to a pulpy mass, and first exhibiting a chylous appearance, is bounded above by the gizzard, and below by a constricted portion of the canal, which receives a bundle of vessels that give it an analogy to the liver of vertebrated animals, and in fact it is strictly the hepatic organ of insects. The stomach is of an oval shape, or an elongated oval : it has been denominated the *chylific ventricle* by M. Leon Dufour. Its capacity is considerable : its surface is lined by a mucous membrane, and it is sometimes studded over with little mucous cysts or bags, which secrete a solvent fluid similar in composition and use to the gastric fluid of the higher animals. The organ, in order to increase the extent of surface, is frequently constricted, and also twisted upon itself, so as to form many circumvolutions, and hence it is quite variable in shape in the different orders of insects : its inner surface, however, is always villous.

From the stomach outwards or downward, the canal becomes narrower, or passes along with a diminished calibre; but as there are still enlargements or dilatations in its course, anatomists speak of a duodenum, ileum, cæcum, colon and rectum. But this is regarded by many as an unnecessary multiplication of names, inasmuch as it is extremely difficult to recognize the parts which are thus designated. The beginning of this part of the canal, however, is indicated by a constriction and the existence of a sphincter muscle, as well as by the junction below of the hepatic vessels. The tube is generally short, rarely exceeding the length of the body : sometimes it is inflated into an ovoid sac rather abruptly.

In following out the distinction of parts in the intestinal canal, we may recognize the existence of a colon, or what corresponds to the large intestines of the higher animals, by the character of the alimentary ball; for the food, after having passed the stomach and through the narrowed part of the canal posterior to the stomach, loses its viscidity, and becomes more or less dry and compacted into the form of an excrement, showing by its condition that the nutrient matter has been extracted from it. Here is also a valve to guard

the passage of the canal, which it closes to prevent the backward movement of the digested mass. The segment recognized as the cæcum is short, and in direct communication with the anterior tube; but in some cases it seems as if joined laterally to it, and then it has the appearance of a pouch. Fluids are supposed to be secreted by warty excrescences situated upon the mucous face of this intestine, designed to aid in the digestive process.

The rectum is that part of the large intestines which terminates the alimentary canal below: it is always short, and is furnished with a sphincter at its extremity. It is muscular, has thicker walls than the cæcum, and gives shape and form to the excrements.

The function of digestion requires, in addition to the formal tube through which the parent matter must pass, a supply of certain fluids which shall possess a solvent power upon the contained mass; and more than one kind of fluid seems to be necessary. Though these different fluids agree in use and effect with analogous ones found in the higher animals, the organs which secrete them have a very different form: indeed, the difference is so great, that a student whose views of the function of digestion have been obtained solely from the observation of the organs of a vertebrate animal would not at first recognize the parts which perform similar functions in insects.

The secretory organs, and those which are subservient to digestion, are always tubular in insects: the gland or parenchyma present in quadrupeds being entirely absent in insects, these organs are reduced to their simplest form. The kinds of tubes taking their names according to the nature of the fluid secreted, are the *salivary*, *biliary*, and *urinary*. The salivary apparatus is quite complicated: it consists of tubes, single and double, and even triple, situated around the esophagus and mouth, and provided with bags that serve as reservoirs. The tubes open into the mouth or esophagus by two or more excretory orifices. The salivary apparatus is most perfect in the haustellata or sucking insects; the tubes ascending into the abovenamed cavities in a meandering course, whereby the extent of secreting surface is much increased.

The operation of salivation is an important preliminary to digestion: mixed with the food, the saliva serves to soften its consistence, while it also carries along with it much air which appears to be necessary for some purpose in the economy. The bile is a still more important fluid than the saliva: it is secreted in long capillary tubes, more or less flexuose and folded upon themselves, which connect with the alimentary tube below the stomach, or just behind the pylorus; though they sometimes continue farther down, and enter near the cæcum. These tubes vary in number: there are usually two, especially in coleoptera, hemiptera and diptera; but in these orders they are not absolutely uniform, as in the cerambycidæ there are three, and four in some diptera, while in neuroptera there are six, and in certain neuropterous groups as many as eight. Where the number of the tubes varies, however, it operates as a compensation for their length: for example, if the simple tubes are each five or six times the length of the body, their number is less; but when

they are short, their number is proportionally increased. Although these hepatic tubes are generally quite uniform in diameter, there are some deviations from the rule; but it is perhaps unnecessary to describe particularly the few modifications that are known to occur. The function of these tubes, as has been intimated, is to secrete or prepare a fluid analogous to bile. They may be recognized in the caterpillar, when the abdomen is opened, by their position, and by their white vermiform appearance : they float apparently loosely in the cavity of the abdomen.

Among the secretions mentioned is the urinary, which seems to be far less constant than those already described. When the urinary organs are present, they terminate in the rectum : they have been found in certain carnivorous coleoptera. The fluid which has been called the *urine* in insects, is caustic and odorous : it is often discharged by the carabici, on handling them, in jets, which, when falling upon the skin, occasion a transitory burning. In connection with this secretion, may be noticed that peculiar to the bombardiers, which is discharged in explosive jets, and is supposed to be intended as a means of defence. The name of the genus possessing the power of producing explosive jets of fluid, is *Brachinus*. I am not aware of the fact, if it has been ascertained, that this fluid is similar in composition to that of the higher animals, or that it contains urea.

In concluding our remarks on digestion in insects, we may observe that the function is performed in ways quite as numerous as in the higher orders of animals, though there is no departure from the general principles which prevail in the vertebrate and molluscous types. There is always an apparatus for trituration, or mechanical separation of the food into fine parts : it is thereby prepared for the action of the several fluids which concur in the digestive process, and which exercise some peculiar chemical influence that serves to separate the nutrient matter from the useless portion of the food. These fluids are more or less acrid in their nature : thus the saliva injected into the wound made by a flea or a fly, for example, by the *tabanus*, occasions inflammation and itching; and this irritation is designed to favor the insect, inasmuch as it produces a flow of blood to the wounded part. An effect of saliva is seen upon leaves attacked by the caterpillar, which very soon suffer a loss of color; and as the morsel swallowed passes along from one receptacle to another, it is constantly undergoing changes : it is softened in the crop; in the gizzard, it becomes pulpy; and in the true stomach the chyle is formed, and is at once recognized by the globules it contains.

A controversy has been long maintained respecting the office of those tubes which have been called *hepatic* or *biliary*. Some eminent physiologists have regarded them as *urinary*, inasmuch as uric acid is sometimes found in them; but as this is not always the case, a compromise seems to have been made by regarding them as both biliary and urinary, and giving them a corresponding denomination *urino-biliary*. The circumstance that the same tubes which have since been found sometimes to contain urine were regarded as biliary

tubes by the older anatomists and physiologists, is accordant with known facts in the economy of the lower animals, among which it is common for an organ to perform a double function.

The food in the alimentary canal of insects is moved along by a peristaltic motion : the canal, therefore, is supplied with a muscular apparatus. Indeed, from the phenomena exhibited, we might infer that the apparatus has a construction and parts such as have place in quadrupeds : thus the coats of the alimentary canal are three, a mucous, a cellular, and a muscular coat ; the first being the internal one, the muscular the outside, and the cellular in the middle. The mucous coat is thin, often transparent, and difficult to detect. The muscular coat is perfectly developed : its fibres are both longitudinal and circular ; and where the constrictions peculiar to the tube exist, there it is more perfectly developed, or in greater force. These muscles serve partly as sphincters, and also to keep up a continual movement.

Circulation. Insects are furnished with a circulatory apparatus : it consists of a dorsal vessel, which, as its name indicates, is a tube running beneath the dorsal face of the external covering. This is the central organ, and is equivalent to the heart in the higher orders of animals ; and the circulation is continued from the dorsal vessel, in channels excavated in the tissues. The structure of the dorsal vessel permits the blood to flow from the posterior to the anterior part of the animal, by means of a series of valves opening forwards. The blood is transmitted to the thorax and head, the wings and legs, and returns through certain channels denominated *veins*, which open into the dorsal at different points through the valves ; but the larger portion of the returned fluid collects in the posterior chamber, and passes the whole length of the vessel. The vessel has been, and still is, regarded by some physiologists as analogous to the heart : others, however, consider it as more analogous to the aorta of quadrupeds.

It does not seem to be a matter of much importance whether we regard the so-called dorsal vessel a heart, an aorta, or an organ compounded of both, the posterior segment taking more especially the form and function of an aortic vessel. Its visible contractions, as seen through the transparent covering of many insects, furnish ostensibly valid reasons for regarding it a heart.

The fluids which circulate in the vascular system of insects are usually white, carrying along distinct corpuscules having forms like those which are found in the higher and more perfect animals.

In connection with the foregoing facts, it should also be stated that the circulation in insects is carried on in vessels having close proximity with those of another kind, namely, the air-vessels, or *trachea*. The two classes are easily distinguished from each other by the structure of the latter ; for in order that air may traverse the insect system, it is necessary

that its conducting vessels be maintained in a tubular form : this is effected by means of a spiral elastic thread wound closely upon itself. By this means the vessels are prevented from collapsing, the air enters freely at the sides of the insect, and permeates perfectly the whole system. The air, then, is constantly in contact with the thin membrane intervening between the trachea and those vessels which transmit the blood to the different parts of the insect's body and extremities. Recent observations prove, in regard to the relations of blood and air, that the former moves through the space between the outer and inner membranes, in which a spiral filament winds, so as to bathe the exterior of the air-tubes themselves*.

It would therefore seem that there is in insects a most complex system of spiral vessels or air-tubes, in connection and close relation with the vascular system, both being distributed with the greatest minuteness throughout the whole body. There is still another provision for keeping up a supply of air especially in those insects whose flight is rapid, and requires to be long sustained : it is found in the air-sacs that are distributed in different parts of the body; they serve not only to retain a due supply of air, but also to buoy up the body and render it lighter. The pulmonary system, by a combination of elastic tubes and sacs, receives an extraordinary development, so as to compensate in the most perfect manner for the deficiencies resulting from a less perfect form of circulation; for powerful muscular motion requires a rich supply of oxygen, rather than food, in order to give energy and activity to the muscular system.

From these facts, it appears that insects occupy no mean place in the scale of being, when they are ranked according to the development of their circulatory apparatus and the accompanying tracheal system. This combination, so far as the power of muscular motion is concerned in the estimate, serves to elevate the insect to a rank but little below that of the vertebrate class.

Nervous system. The nervous system consists of a pair of chords extending through the insect, upon the interior abdominal face, and connected at each segment by a ganglion. Thus disposed along the ventral face of the body, the nervous system forms a symmetrical whole. The ganglionic masses of the head, however, are more largely developed than those of the trunk : this is necessary, from the condition of the eyes and the perfection of the masticating apparatus. The cephalic centres are placed also above the esophagus. So the nervous centres which supply the wings and legs are larger than those of the abdomen. We see here again a provision for the locomotive apparatus, by which a due supply of nervous power or force is secured.

There are probably but few instances in the animal kingdom, that exhibit such minute

* See Carpenter, p. 382 of his General and Comparative Physiology.

subdivisions of matter as certain portions of the nervous system do. Thus when it is stated for the first time in our hearing, that the eye of the common house-fly is compounded of no less than 4000 single eyes, it seems impossible that a nerve, originally microscopic, can be subdivided into threads or fibres sufficiently fine to furnish a nerve to each simple eye; and when we are further informed that the eye of the dragon-fly has (24,000) six times as many subdivisions as that of the house-fly, our faith is still more severely taxed; but to suppose that a filament is wanting in an eye, is to suppose that the eye is made in vain; for the eye depends upon its nervous filament, however slender that may be, for its power of vision.

The sympathetic system of nerves in insects has been known from the days of SWAMMERDAM, who first discovered it in the rhinoceros beetle. While this system is found more or less perfect in all articulated animals, it is specially perfected in insects. The imperfection of the nervous apparatus consists in the absence of the cerebral masses, or of all that portion concerned in the formation of ideas. Nothing appears in the nervous system of the articulata, higher or above the ganglionic centres which connect together the double ventral chord. The ganglia of this system which are more particularly devoted to the purely animal functions, undergo a slight change during the passage from the larval state to that of the perfect insect; the change consisting chiefly in a concentration of nervous matter upon those ganglia which are subservient to the function of locomotion. The sympathetic system, however, undergoes no change : it is equally perfect in the larva as in the mature animal, and reaches its full development in this early stage of existence, thereby showing that it presides over the functions of vegetative life.

It is scarcely necessary to speak more particularly of the functions of the nervous system. It may, however, be observed, that it is upon this system that sensation depends, and the nervous fibrils are the channels through which the properties of external bodies become known to the individual. If we may judge of causes by effects, we are warranted in believing that impressions are received by insects from without, in the same manner as is the case with the higher animals; and that they possess all those special senses which belong to the latter, and some of them in much greater perfection.

TOUCH. The sense of touch in insects, in consequence of the hard covering of their bodies, must be confined to certain parts. Those who have watched their motions are fully convinced that the palpi are the organs in which this sense is concentrated, or in which it exists in its greatest perfection. These organs are constantly applied by the insect, after the manner of *feelers*, to the external bodies with which it comes in proximity; and they are well adapted by their structure to fulfil such a purpose, being flexible, and furnished with a soft and delicate integument.

Hearing. The phenomena which indicate the existence of the sense of hearing are perhaps more equivocal than those of touch. Still attentive observers have noticed that insects seem to place themselves in an attitude of listening, when loud sounds are emitted from any quarter in their vicinity : they erect their antennæ, and remain motionless for the time being; and when the disturbance has ceased to excite them, they resume their ordinary movements. From the position of the antennæ, then, under the circumstances alluded to, it is inferred that they are connected directly with the function of hearing. Beneath them is a nerve connected with a soft membrane, which seems to be adapted to this special end. The antennæ in themselves extending outwardly, must become sensible of the vibrations in the air, and transmit them to this delicate auditory apparatus lying immediately beneath. The organs are often long-branched, or plumose, so as to increase the extent of surface. This view of the office of the antennæ does not conflict with the one often entertained, namely, that they may also be useful and employed as organs of touch.

Taste. The existence of this sense rests more upon analogy, than upon well determined facts to support and prove its existence.

Smell. Insects are attracted to odorous bodies from a distance : hence there can be no doubt that they are possessed of the sense of smell in great perfection, although its precise location is a matter of great uncertainty. Several different parts of the insect's body have been conjecturally assumed as the seat of this sense; and it has often been assigned to parts that are variable, evanescent, or of occasional existence only. If analogical reasoning were to be our guide in this case, we should point to certain inward parts of the body that are in direct relation with the external air. In the mammalia, though the organ of smell is located in the head, yet its distinguishing characteristic is its immediate communication with the atmosphere, and the sense itself is exercised only when the air is inhaled. It is not necessary to infer, that because in the higher animal it holds this intimate relation to the head, that it must occupy the same place in the insect : it is more consistent to suppose that its closest relation is with the respiratory organs. It is highly probable, therefore, that the trachea and spiral vessels, which conduct the air inwards, constitute the channels by which this sense is furnished with the odorous particles on which the sensuous nerve is to operate. Accordingly this view is looked upon with favor by Cuvier and many other distinguished physiologists.

Sight. Of all the senses, that of sight seems to be the most perfect in insects. The organ is compound, or, in other words, consists of many eyes comparted together, each of which is perfect in itself, being furnished with the proper humors and lenses essential to the exercise of vision. In addition to the compound eye, which often occupies the largest portion of the head, they are often furnished with simple eyes upon the forehead : these

have received the names of *ocelli* and *stemmata*, and are generally three in number, and arranged in the form of a triangle; but there may be but two, or only one. Their structure qualifies them for viewing such objects only as are close at hand.

The compound eye presents a reticulated appearance under the microscope: the surface is convex or globular; but the organ is immovable, except by the motion of the head. The reticulated appearance is produced by the lines that mark the boundary of each eye or lens: these are hexagonal, and their number is almost incredibly great in some species. They vary in this respect from 50 in the ant, to 25,000 in a species of *Mordella*: the butterfly has 17,000, and the dragonfly 12,544. Each eye is furnished with an apparatus sufficiently perfect for the exercise of vision in its sphere: it has its lens for refraction, its choroid for the correction of aberration, and its retina for the reception of the images of external objects. Each single eye, however, must embrace an extremely limited field of vision, and there is no doubt that it requires the use of many of these eyes to see a single object; for only those rays of light that fall perpendicularly upon the eye can reach the optic nerve.

The eyes of predaceous insects, such as the dragonfly, are large, prominent and globular: hence they enjoy, altogether, a large field of vision. In those insects, on the other hand, which are confined in their range, or are parasitic, the field of view is diminished by a reverse of circumstances.

The nerve of each eye terminates in a common nerve: this must be regarded as the *sensorium commune*, the nervous plane upon which the image of an object is spread. Sometimes the eye is pedunculated, or placed upon a footstalk: sometimes it is semicircular, in consequence of the implantation of the antennæ, and indeed this implantation may be such as to give the semblance of four eyes. In other instances the size of the eye is a sexual mark.

We are too much in the habit of looking vaguely upon the insect tribes. While we recognize the movements of the vertebrated class as resulting from distinct acts of the will, and as controlled by internal feelings, we are little disposed to entertain the view that the apparatus of a fly or a beetle indicates similar internal motives for action; or, in other words, we do not possess so lively a sense of the perfection of the being of the insect, as of the being of the higher order. We see, however, that insects have eyes to see, ears to hear, and organs of smell; a highly developed nervous apparatus, and an active circulation: in fine, the insect moves in a world of its own, which takes no part in the sphere belonging to the mollusca or vertebrata. Its senses and organs of animal life, however, give it a wide sphere of activity, and have prepared it for fulfilling important functions, and furnished it with a capability to affect very materially the interests of man. Being widely diffused, and their life overflowing with activity, always moving as if impelled forward by important business or engaged in errands of the most momentous character, they seem to

make the most of their brief and uncertain existence. Witness the energy of the dung-beetle in finishing the ball in which it has deposited its egg : it often dies in the act of providing for the continuance of the life of its kind. To some these actions may seem less interesting, because instinctive ; but surely the faculty of instinct affords matter for deep thought to the ordinary observer, and to the philosopher it must possess an interest next to that of reason itself. Instinct urges the individual forward to the fulfilment of its destiny, but it makes no inquiry as to the cost.

Muscular motion. The insect enjoys a full development of the power of motion, especially in its perfect state : the two kinds of muscle, striated and non-striated, are always present. Every part of the system is supplied with muscular fibres ; not only are the legs and wings largely supplied with them, but also the abdomen and various parts of the trunk, head, and thorax. The most interesting fact which appears in this connexion, is the power of the insect to sustain a long and vigorous flight : thus the dragonfly darts forwards, backwards, or sideways, and is able to outstrip the swallow in its most rapid course ; and this it can do for hours together. Taking into consideration the diminutive size of insects, we readily see, that in proportionate locomotive power, they far excel the vertebrate animal. We have already observed that their joints usually admit of but two kinds of motion, forwards and backwards, or the ginglimus movement : when, however, this motion is exerted in extension and flexion, as in the leaping of the grasshopper or flea, we cannot fail to perceive that their powers in this respect, also as in flying, are far superior to those possessed by any other class of animals.

Though the larval state of insects is generally sluggish, we are not without many examples where there is a great degree of activity. We often see the caterpillar hurrying along as if it were in great haste, though the space it is able to traverse is quite limited. We observe, in all these movements, an aim to preserve life : the life of self, however, is subordinate to that of kind or progeny.

Propagation. Insects propagate their kinds from eggs laid by the female, subsequent to the act of congress with the male : the sexes are therefore distinct. Their power of multiplication is immense, especially in those insects which produce several broods in a season. But there is a remarkable exception to the foregoing rule : the aphis increases by a process of gemmation ; females being cast off at once for several generations, of which each possesses the power of multiplying its kind in the same way. Carpenter likens it to the gemmation of the polypi, "the individuals being budded off from internal stolons, instead of being developed from ova provided by the female and fertilized by the male." It has long been known, that in the aphis, this method of propagation is repeated to the seventh or ninth generation. At the end of the season, the perfect individuals, both male

and female in a winged state, are produced, by the congress of which ova are fertilized: these are preserved through the winter.

It would seem from this, that although in the articulated class budding is resorted to to multiply the number of individuals, yet it is not adequate to continue the existence of the species. Calculations have been made of the numbers which an aphis may produce in a single season, provided the individuals are not destroyed by accident. According then to calculation, based upon observed facts, the whole brood in a season from a single aphis will amount to the inconceivable number of 1,000,000,000,000,000,000! From such an ability to increase, we should at first thought be disposed to expect a result approaching the calculated numbers; but it is gratifying to observe, that where the powers of increase are extended and multiplied as in the case of the aphis, the destructive powers are equally multiplied and active: there is therefore but little reason to fear an excessively injurious multiplication in the midst of so many enemies. The aphis is extremely feeble: the touch destroys it; the winds, rains, and cold sweep off its numbers by hundreds of thousands. The excessive multiplication of individuals is only a means of supplying an increased number of consumers: hence instead of an approach to the enormous number indicated by calculation, their actual numbers will fall infinitely short of it. The balance of nature is always preserved; and wherever danger seems to point, there checks are provided, which put an effectual restraint upon inordinate increase. We may conceive of what is *possible;* but the *actual* just suffices to keep up a suitable equilibrium: at most the threatening is transient, and recurs only at wide intervals.

APPENDIX TO CHAPTER II.

DESCRIPTION AND REPRESENTATION OF PARTS OF SUCH INSECTS AS ARE REFERRED TO IN THE FOLLOWING TREATISE.

(Copied mostly from the Naturalist's Library.)

I. PARTS OF THE HEAD, MOUTH, &c.—PLATE A.

Fig. 1. Head, upper side : *a*, forehead ; *b*, vertex ; *c*, occiput ; *dd*, temples ; *ee*, eyes ; *f*, torulus, the cavity for the insertion of the antennæ ; *g*, clypeus ; *h*, labrum.

Fig. 2. Under side of the head : *k*, posterior orifice ; *l*, neck ; *m*, mentum ; *o*, eyes ; *p*, mandibles ; *s*, labial palpi.

Figs. 3, 4, 5. Forms of the labrum.

Fig. 5. Mandible of *Hydrus piceus*.

Fig. 7. Mandible of *Gœrius*.

Fig. 8. Mandible of *Calosoma sycophanta*.

Fig. 9. Maxilla of *Necrophorus germanicus* : *a*, maxillary palpus ; *b*, external lobe of the maxilla ; *c*, internal lobe.

Fig. 10. Maxilla of *Cicindela* : *a*, external maxillary palpus ; *b*, internal ditto ; *c*, interior lobe, with an articulated hook at the apex *d*.

Fig. 11. Form of the maxilla of *Hydrus piceus* : *a*, insertion or hinge ; *b*, dorsal piece ; *c*, squame-palpifers of STRAUSS : *bcd* form the stalk (stipes) ; *e*, external lobe ; *f*, internal ditto.

Fig. 12. Labium of *Cychrus rostratus* : *a*, mentum ; *b*, ligula ; *c*, labial palpi.

Fig. 13. Labium of *Carabus*, inside : *a*, mentum ; *b*, lingua ; *c*, paraglossæ.

Fig. 14. Thorax of *Scolia flavifrons*, showing in succession the prothorax, mesothorax and metathorax, also the coxæ : A, pronotum ; C, mesonotum ; F, metanotum ; HH, parapleura ; *c*, scutellum ; *dd*, patagia.

Fig. 15. Side view of the thorax of *Scolia flavifrons* : E, mesosternum ; B, prosternum ; G, metasternum ; *d*, patagium ; *c*. scutellum ; *a*, first spiracle ; *b*, second ditto.

Fig. 16. View of the same from beneath : BB, prosternum ; EE, mesosternum ; GG, metasternum.

Fig. 17. Thorax of *Cicada fraxini* : A, pronotum ; C, mesonotum ; FF, metanotum ; *c*, scutellum ; *dd*, frenum.

Fig. 18. Hindleg of *Melolontha vulgaris* : *ab*, coxa ; *d*, trochanter ; *e*, thigh ; *f*, tibia ; *h*, tarsus ; *i*, claws.

Fig. 19. Pectinated claws.

Fig. 20. Claws of *Asilus* : *o*, central filaments; *ss*, membranous expansion of the terminal joint, advanced beneath the claws.

Figs. 25, 26 : showing the upper and under side of the domestic cricket (*Acheta arachnoidea*).

Fig. 27. Maxillary palpi (*bc*) of the cricket; *b*, galea.

Fig. 28. Lower lip of the cricket : *a*, mentum; *d*, labium; *e*, additional articulations, divided into two, three, or more lobes ; *cc*, apparently 3-jointed palpi, yet the basal joint enveloped or concealed in the lip.

Fig. 29. Mandibles of the grasshopper (*Acrydium*) : *b*, molar plate.

Fig. 30. Mandibles of the cricket.

Figs. 31, 32. Forms of antennæ.

Fig. 33. Serrated antennæ.

Fig. 34. Lamelliform antennæ.

Fig. 35. Pectinated antennæ; bipectinated, if it produces two long teeth, instead of one; and flabellate, when the branches are very long, and flattened like the rays of a fan.

Fig. 41. Setaceous antennæ : filiform, when the antennæ are of unequal thickness; moniliform, as in fig. 42; ensiform, when tapering, and angulated at the sides; subulate, when short, and pointed at the tip; fusiform, when narrowed at the two extremities and thickened in the centre, as in fig. 43; clavate, when they gradually thicken at the top, as in 37 and 35; geniculate, when bent as in 39 *abc;* capitate, when terminated in a knob or head, as 36, plumose, when the lateral filaments go off from a shaft, like those of a feather; nodose, when the joints are thickened in various parts like knobs; verticillate, when whorls of hairs are placed at equal distances upon the joints; fasciculate, when the hairs are gathered in bundles upon each joint; scopiferous, when a single bundle is placed upon one joint; palmate, when the antennæ are short, broad, and divided by deep divisions; auriculate, when one of the basal joints is dilated into a shield or ear partially covering the rest; fissile, when they are terminated by a cleft knob; ramose, when several of the joints throw out branches; furcate, when there are two branches like a fork; aristate, when the antennæ are terminated by a fine bristle, as in the order MUSCA; dentate, when the joints are armed with short spines; cylindrical, when they are of equal diameter throughout; prismatic, when they resemble a prism, or are formed of three sides.

II. PARTS OF THE DIGESTIVE APPARATUS.—PLATE B.

Figs. 2, 3. *a* shows the œsophagus, beginning in fig. 3 just behind the head, and terminating in an enlargement which is the crop; or, if the crop is absent, it terminates in the gizzard *d*. The œsophagus is a simple tube, except in the lepidoptera.

Fig. 4 *c* represents the position and relation of what has been denominated a *sucking stomach*. The gizzard is shown in position, fig. 2 *c*. The true stomach, or, as called by some entomologists, the *chylific ventricle*, is seen in figs. 2 & 3 *d* : in this organ the food becomes semifluid or pulpy, and remains until chylification takes place. The intestine begins as represented in fig. 3, where the lateral tubes are inserted : it preserves a course more or less contorted, as is seen at *f;* and in some instances it is enlarged or inflated, as at *g*. The cæcum is seen at *g* fig. 2.

Fig. 3 *h* exhibits the termination of the intestinal canal in the rectum.

Fig. 5 *aa* exhibits the salivary apparatus, having fleshy organs at the base of the head, and tubes that pour saliva into the mouth during mastication.

Fig. 4 *aa*. General arrangement of the urinary organs, the secreting vessels disposed on the tops of small tranches; *cd*, the bladder; *b*, deferential canal.

Fig. 1 represents an arrangement that exists among the bombardiers : *a*, accessory bladder; *c*, principal bladder.

Fig. 6 exhibits the biliary organs *cc*, fringed as in the cockchafer.

III. CIRCULATORY SYSTEM.—PLATE B.

Fig. 13 : *aaa*, dorsal vessel; *b*, wings; *cd*, diminution in diameter towards the head.

Fig. 14 shows the interior walls of the dorsal vessel, circular fibres, arrangement of its walls, and the valves.

IV. RESPIRATORY SYSTEM.—PLATE B

Fig. 12. Spiracles or stigmata.

Fig. 9. Another form of stigmata.

Fig. 16. Stigmata of *Dytiscus marginalis*, edges of which are beset with hairs.

Fig. 15. Stigmata of the cockchafer, where there is a membrane drilled with holes.

Fig. 8. A circular membrane stretched over the valves, and ornamented with colors.

Fig. 17 shows the rows of stigmata along the sides.

Fig. 10 exhibits the system of the trachea or air-vessels : *aa*, stigmata; *bb*, ventral spiracles; *cc*, trunks closed at their extremities; *ee*, bladder-like bag, receiving the longitudinal trachea; *fff*, trachea for the wings; *gg* & *hh*, bags for air; *k*, trachea for the thorax; *ll*, trachea for the head; *o*, base of the tegmina.

V. NERVOUS SYSTEM.—PLATES B & E.

Fig. 2 (Pl. B), *ghilll*, exhibits the principal ventral chord, with its ganglia.

Fig. 2 (Pl. E). Nervous chord of the cockchafer : 1 1, lobes of the anterior cephalic ganglion; *aa*, optic nerves; *bb*, eyes; 2, posterior cephalic ganglion; 3, prothoracic ganglion; 4, mesothoracic ganglion; 5, metathoracic ganglion; 6, ganglion of the abdominal series; *dd*, mandibular nerves; *cc*, antennæ.

Fig. 1. Nervous system of the caterpillar of the *Sphinx ligustri*, a few days before it becomes a chrysalis : 1, cerebral ganglion; 2, posterior ditto; 3, 4, 5, 6, thoracic ganglia; 7, 8, 9, 10, 11, 12, abdominal ganglia; *ooo*, system of transverse nerves, more distinct in fig. 3, in which 3 4 5 represent the three thoracic ganglia; *aa*, central nervous fillet; *bbbb*, nerves furnished by the fillet; *eeee*, nervous threads separating from the preceding nerves, and which, by uniting when they reach the ganglion, constitute the central thread.

Fig. 3. Nervous system of *Sphinx ligustri* thirty days after its change, showing a greater condensation of the nervous masses : the posterior thoracic ganglia are now united into one mass.

VI. GENERATIVE APPARATUS.—PLATE E.

Fig. 8. Generative organs of *Athalia centifolia* : *aa*, ovarial tubes; *cc*, uterine cavities; *d*, separate oviducts; *e*, ejaculatory oviduct; *f*, spermatheca; *g*, poison gland; *h*, its vessel; 10, 11, terminal ganglia.

Fig. 7. Generative organs of *Ranatra linearis* : the letters correspond to the same parts as in fig. 8; *g*, supposed swimming bladder, with part of the intestine.

Fig. 5. Male organs of *Athalia centifolia* : *aa*, smaller testes; *bb*, ducts; *c*, larger testis; *dd*, vasa deferentia; *e*, vesicula seminales; *h*, ejaculatory duct; *i*, exterior valves.

Fig. 9. *Hydrus piceus* : *aa*, testes; *bb*, vasa deferentia; *cc*, principal seminal vessels; *eeee*, various accessory vessels; *f*, ejaculatory duct; *g*, copulative armature of the vagina.

Fig. 4. Testicles of *Silpha obscura*, greatly magnified.

CHAPTER III.

REMARKS ON THE CLASSIFICATION OF INSECTS.

The multiplication of species renders it necessary to resort to some kind of arrangement, by which they may be gathered into groups under one or more common characteristics. It matters not which of the kingdoms of nature we enter, if the individuals are dispersed singly or unarranged into families or groups, no one can hope to possess himself of an idea of their relations. Memory would be too much burthened in the attempt to comprehend the relations, or retain the characteristics of the species which belong to a single district of the globe. Hence the necessity for devising some scheme by which we may group together those which are alike, and to which we may apply a positive expression indicative of that likeness.

There is perhaps nothing easier than to say on what general principle such a scheme should be based; for it is plain enough that *resemblance* must be the basis of all schemes, and indeed ever has been since attempts at classification have been made. Classification is founded on resemblance; and yet there are so many points of resemblance, that it becomes necessary to make a choice. It is evident that the resemblances in the mineral kingdom are not those of the vegetable or animal, and those of the vegetable kingdom are yet inapplicable to the animal. This, however, is not the difficulty: taking each kingdom by itself, and selecting from among its individual members certain characters which belong to the many, they fail us in attempting to make a general application of them; they either cease to exist, or else possess an importance so variable or inconsiderable that they become uncertain as marks suitable to be employed in classification.

There are two kinds of resemblances in the natural world: there are morphological and teleological resemblances. In the first we seek for external forms; in the second, we look for ends. The wings of a bird, of a bat, and of an insect, possess a teleological resemblance, but not a morphological one: the end, or final cause, is the same; but the form, arising from structure, is quite different. It can be scarcely possible that final causes or teleological resemblances should be available in classification, although they may be useful in many other respects; and we may remark here that it is only by an attentive study of morphology that a true basis for classification can be found, and all the schemes that have been successfully applied belong to this kind. Availing ourselves of the principles

found in forms, we may proceed with a degree of certainty; and when forms are correctly defined, we may escape most of the graver errors in the formation of groups.

I do not propose to enter into the details of the principles of classification in this place, but shall proceed at once to the modes which have been proposed and followed by the principal English entomologists.

The first classification is that of STEPHENS, in which the first grand division of the insect kingdom is into two subclasses:

FIRST SUBCLASS: MANDIBULATA.

Order 1. STREPSIPTERA.
2. ORTHOPTERA.
3. NEUROPTERA.
4. DERMAPTERA.
5. TRICHOPTERA.
6. HYMENOPTERA.

SECOND SUBCLASS: HAUSTELLATA.

Order 1. HEMIPTERA.
2. HOMOPTERA.
3. LEPIDOPTERA.
4. DIPTERA.
5. HOMALOPTERA.
6. APHANIPTERA.
7. APTERA.

Insects are classed by WESTWOOD in the following manner:

FIRST SUBCLASS: DACNOSTOMATA.
(Mouth with jaws.)

Order 1. HYMENOPTERA.
? Osculant Order STREPSIPTERA.
Order 2. COLEOPTERA.
Osculant Order EUPLEXOPTERA.
Order 3. ORTHOPTERA.
? STREPSIPTERA?
Order 4. NEUROPTERA.
?
Order 5. TRICHOPTERA (Phryganea alone).

SECOND SUBCLASS: ANTHOSTOMATA.
(Mouth with a sucker.)

Order 1. DIPTERA.
Osculant Order HOMALOPTERA.
Osculant Order APHANIPTERA.
Order 2. HETEROPTERA (including the water-bugs).
Order 3. HOMOPTERA.
Order 4. LEPIDOPTERA.

CHAPTER IV.

ORDER I. COLEOPTERA.

THE COLEOPTERA is the order which has usually been first described, and WESTWOOD has followed the common practice in this respect in his Genera of British Insects. This order is thus characterized :

> Anterior wings horny or leathery, concealing the posterior when at rest, placed parallel and joined by a straight suture. Posterior or inferior wings membranous, longitudinally and transversely folded. Month furnished with transverse jaws. Pupa incomplete.

The insects of this order are denominated *beetles* : they constitute the most beautiful of the class, and occupy the foremost rank among the tribes. They are grouped as follows by Mr. M'LEAY :

1. GEODEPHAGA : containing those beetles which have setaceous antennæ, with the outer processes of the maxillæ palpiform.
2. HYDRADEPHAGA.

In the first division the following families are included, being the old genus CARABUS subdivided into

GEODEPHAGA :	CICINDELIDÆ. CARABIDÆ. HARPALIDÆ. SCARITIDÆ. BRACHINIDÆ.
HYDRADEPHAGA :	GYRINIDÆ. DYTICIDÆ.

The above is regarded as a normal group, and is followed by an aberrant one, characterized by clavate antennæ, or such as become gradually thickened towards the apex, and the external lobe of the maxilla losing its palpiform character. This constitutes the RYPOPHAGA of STEPHENS.

PHILHYDRIDA :	HETEROCERIDÆ? PARNIDÆ. HELOPHORIDÆ. HYDROPHILIDÆ. SPHÆRIDIIDÆ?
NECROPHAGA :	SCAPHIDIIDÆ. SILPHIDÆ. NITIDULIDÆ. ENGIDÆ. DERMESTIDÆ.
BRACHELYTRA :	STAPHYLINIDÆ. STENIDÆ. OMALIDÆ. PSELAPHIDÆ. TACHYPORIDÆ.

WESTWOOD, however, in his work on the British genera, adopts, in preference to the foregoing, the tarsal system, and hence recognizes the following subdivision :

1. PENTAMERA : tarsi with five joints ;
2. HETEROMERA : the four anterior tarsi 5-jointed, and the two posterior 4-jointed ;
3. PSEUDOTETRAMERA : tarsi 5-jointed, the fourth exceedingly minute ;
4. PSEUDOTRIMERA : tarsi 4-jointed, the third joint very diminutive and concealed.

Cicindelidæ.

THE family of beetles, which are known under this name, are among the most beautiful of the insect tribes : their colors are brilliant, and their markings add to the beauty and elegance of the colors by contrast. In size they occupy a middle ground : the largest scarcely exceed an inch in length, and the smallest are at least one-third of an inch long. Their habits are as interesting as their colors are beautiful : their watchfulness is untiring ; and though their flight is short, it is difficult to capture them. In the nature of their instincts they agree with the carnivora among the vertebrate class of animals : they are flesh-eaters ; but in order that they may capture and secure the living insect as their prey, they are qualified to give chase either on the wing or on foot, and they make war upon all insects that are not too strong for them. The cicindelidæ hunt upon sandy and arid plains, and seem to delight in the heating rays of the sun ; for in hot days they appear far more numerous, flying and alighting upon the ground before us in dry paths, and turning their heads watchfully towards us when they rest for a moment.

As the cicindelæ subsist solely upon other insects, or, in other words, are carnivorous, they cannot be regarded as injurious to the farmer : they are rather beneficial than detrimental to his interests. Their markings, together with their predacious habits, have given them the name of *tiger beetles*. It is evident, from the prominence and size of their eyes, that they are well provided with one essential power to enable them to pursue successfully the means of subsistence, namely, keenness of vision. So too their jaws or mandibles are powerful : their legs, however, are long and slender, and are adapted rather for quick movements than for the performance of feats of strength.

The larvæ of the cicindelæ are no less predacious than the perfect animal. They are represented by WESTWOOD and others as having a large head armed with powerful jaws, and capable of burrowing in the earth to the depth of a foot. At the mouth of this burrow they lie in wait for their prey, which they seize and drag to the bottom to devour at their leisure. To aid in ascending and descending these burrows, they are provided with two hooks on the back : some observers, however, suppose these hooks may assist in holding their prey, when bent in a suitable manner ; for, on entering the mouth of the burrow with their prey, they suddenly slide to the bottom.

These insects, then, in all their stages, are predacious ; and inasmuch as their numbers are less than those of many allied families, and their instincts are such as require a higher development of locomotive apparatus, they may well be regarded as occupying the highest rank in the articulated class.

The CICINDELIDÆ are in general easily distinguished : their colors are usually green or gray combined with a brassy or bronzed tint, with whitish spots for ornament in combination with brindle spots or angulated lines, which give them all a pleasing and indeed an elegant appearance. From their powers of flight, the cicindelæ have sometimes received the name of *Eupterinea*.

The family CICINDELIDÆ has been divided by Mr. HARRIS into the following groups :

1. Labrum with three teeth ; thorax contracted behind.
2. Labrum 1-toothed ; thorax quadrangular, flattened above and dilated behind.
3. Labrum one toothed ; thorax nearly cylindrical.

1. *Labrum provided with three teeth; thorax contracted behind.*

CICINDELA.

The genus CICINDELA, as defined by WESTWOOD, is described as follows : The males have their anterior tarsi elongated and dilated. The elytra are oblong-ovate and depressed. Thorax subquadrate. Internal maxillary palpi with joints nearly equal in length ; the two basal joints of the labial palpi short, the third is elongate and ciliate, and the fourth clavate and naked. Antennæ are inserted into the anterior margin of the eyes. The head

is broader than the thorax, and the forehead is excavated : the eyes are large and prominent; elytra flat; wings two.

The larvæ of the cicindelæ have nearly the same habits as the perfect insect : they construct their habitations in the ground, penetrating it to the depth of eighteen inches, which labor is performed by means of their mandibles and legs. The hooks upon their backs aid them efficiently in ascending and descending their burrows : by means of these hooks or appendages, they suspend themselves at the mouths of their holes, and await for their prey.

The larvæ are long, cylindric, soft, whitish grubs, and furnished with six feet. The head and first joint of the body are described as metallic green above and brown beneath. The head is quite large, armed with two long, sharp, and nearly vertical mandibles. Upon the back there are fleshy tubercles clothed with hairs : each of these tubercles is armed with a recurved horny spine. (See Plate xvii, figs. 9, 10, 11 : copied from Ratzberg, *Forst. Insecten.*)

Cicindela vulgaris. (Plate xvii, fig. 10.)

Labrum and base of the mandibles yellowish white. Elytra marked with three oblique lines, yellowish white and angulated : these lines are in the form of lunules; the one past the middle is double.

Length of the male $\frac{24}{40}$, of the female $\frac{20}{40}$ of an inch.

Say in the Transactions of the American Philosophical Society, New Series, I, 409; Pl. xiii, fig. 1.

This species appears early in the spring, continuing until about the first of June : It reappears in August, and continues two months, and perhaps longer if the weather is favorable.

Cicindela generosa. (Plate xvii, fig. 2.)

Color obscurely cupreous above. Elytra bright purplish or subviolaceous; lateral margin entire; humeral and terminal lunule broad and white; intermediate band bent at a right angle, and occupying nearly the centre of the elytron : at its extremity it is widened, and extends nearly to the suture.

Length varying but little from $\frac{5}{8}$ of an inch.

Head is varied with cupreous and violet : the front is supplied with prostrate ashy hair. Labrum white; anterior edge furnished with three teeth. Antennæ, or their anterior margins, cupreous. Mandibles with about $\frac{2}{3}$ of the anterior and lateral portions white, the rest black.

Trunk cupreous, varied with violet; sides hairy; thorax quadrate, and somewhat narrowed behind. Elytra bright subviolaceous, deeply punctured with green. Feet and thighs bright green, above brassy. Abdomen greenish blue, hairy; tail purplish.

This species, like the *vulgaris*, has two broods in the year; the first appearing in May, the second in August. It lives in sandy districts, frequenting the sea-beaches, and is one of our largest species.

CICINDELA REPANDIS.

The markings of the *repandis* resemble those of the *vulgaris* : the cream or yellowish white of the labrum extends to half of the mandibles, and the insert is smaller; the lunules are wider and more dilated, the middle one extending to near the suture behind.

CICINDELA PURPUREA.

Purple. Head, thorax and elytra bordered with green combined with steel-blue and brilliant green. Thorax margined with brilliant purple; legs purple. Lunule upon the elytra obsolete. There is a cream-colored dot upon the outer angle of the shoulder, an obsolete lunule behind the middle, a spot upon the outer and posterior angle, and a bar upon the margin inside of the green edge.

Length half of an inch.

SAY, Trans. Am. Phil. Society, New series, II, 55; Pl. xiii, fig. 8.

CICINDELA PATRUELA (Dj.).

Bottle-green above, steel-blue and green beneath. Outer angle of the elytra marked with two ovoidal spots, nearly united by narrow and pointed elongations; middle marked transversely by an oblique bar, posterior by a large round dot, and margin by a line inside of the purple edge. The lunules may be described as broken.

It is rather more than half an inch in length, and nearly a quarter of an inch wide.

Head is bright green with bluish, naked, and finely granulated; labrum dingy white; teeth three, with six marginal punctures. Mandibles have a white spot at base : the four basal joints of the antennæ green; terminal one rufous.

Thorax convex, narrowed behind, granulated. Beneath bluish green; legs green; trochanters purple.

It has a wide range, according to GOULD; being found in North-Carolina, and in Vermont as far north as Burlington.

CICINDELA GUTTATA.

Brilliant steel-blue and green. Labrum light buff rather than cream-color. Outer edge or surface of the mandible buff; middle and outer angle of the elytra dotted : posterior margin has a short transverse bar inside of the green edge.

Length rather less than half an inch, and $\frac{1}{5}$ in width.

SAY in Trans. Am. Phil. Society, New series, Pl. xiii, fig. 4.

CICINDELA ALBILABRIS (*White-lipped Cicindela*).

Labrum white, obsoletely tridentate, rather prominent in the middle. Elytra broadly punctured, with three marginal spots and a broken discoidal band, all white.

KIRBY : figured on Plate I in Richardson's N. A. Fauna.

Body underneath green, or golden green clouded with blue ; above, black with a purplish tint. Labrum white, prominent, armed in the middle with three short teeth, the lateral ones obtuse ; above, with an intermediate obtuse longitudinal ridge. Elytra, under a powerful magnifier, covered with innumerable minute granules, and also with numerous shallow impressions : a series of larger ones is parallel with the suture ; the angular white discoidal band reaches neither the suture, nor the lateral margin. There are also three marginal white dots, one humeral, another between it and the band, and one between the latter and the apex.

Length of the body, 6 – 6½ inches.

KIRBY remarks, that though this species is common in this country, it is not noticed by SAY, who perhaps mistook it for *C. sylvatica* (LINN.), "of which it may be regarded as the American representative, and with which it agrees in its prominent upper lip and the shallow impressions and markings of its elytra, as well as in its general color ; but it is smaller, has a white instead of a black upper lip, with an obtuse longitudinal ridge and not an acute one, terminating in three almost obtuse short teeth instead of a longer one, and likewise by the want of the silky lustre produced by granulations much more visible."

3. *Labrum with one tooth; thorax nearly cylindrical, sometimes elongated.*

CICINDELA HIRTICOLLIS.

Insect purplish gray above and brilliant green beneath. Outer anterior angle of the elytra marked with cream-colored spots : there is another just behind the middle lunule, followed by another near the inner margin ; posterior and outer margin marked by a lunule. The lunules and spots less conspicuous than in the *vulgaris* or *repandis*.

Length rather less than half an inch ; female, half an inch.

CICINDELA ALBOHIRTA. (Plate xvii, fig. 1.)

Insect, head and thorax brassy green ; hairs erect and white ; sides brilliant and cupreous. Elytra subviolaceous. Lunules and margin white, with the intermediate recurved band.

GOULD : Cicindelæ of Massachusetts, in the Boston Journal of Natural History, Vol. i, p. 49; pl. iii, fig. 1.

'The head is cupreous varied with blue and green, and densely covered with long hoary 'hairs except behind the eyes ; labrum white ; marginal punctures ten ; mandible

'long and dark green; tips and teeth black, with a white spot at base; palpi yel-
'lowish white; terminal joints green. Trunk brilliant cupreous at the sides. Thorax
'quadrate, brassy green, hairy. Elytra densely punctured.'

GOULD, Trans. Bost. Nat. Hist. Society.

Abdomen greenish blue; tail purple.

According to GOULD, it is closely allied to the *hirticollis*, with which it has been confounded.

CICINDELA PUNCTULATA.

Color obscure cupreous. Elytra purplish green and blue; beneath varied with blue and purple. An angular cream-colored line runs along the outer and posterior margin of the elytra; the anterior and outer angle marked with cream-color.

According to GOULD, it has but a single brood in a season, which appears about the middle of July and remains till September.

Common in dry places, paths in fields, etc.

CICINDELA DUODECIMGUTTATA (Dejean). (Plate xvii, fig. 3.)

Insect bronze above. Elytra with a narrow interrupted lunule, with spots near the suture replacing the termination of the lunule. Head pale and obscurely bronze; front pubescent with cinereous hairs; labrum white; mandibles dark green, with a white spot at base; palpi dark green. Trunk quadrate and rather short; feet green; thighs cupreous. Beneath metallic greenish or blue; sides of the thorax and breast cupreous.

It is a common species, and appears early.

GOULD in Trans. Bost. Nat. Hist. Society, Pl. iii, fig. 3.

CICINDELA HÆMORRHOIDALIS (Hentz). (Plate xvii, fig. 5.)

HENTZ, Trans. Am. Phil. Society, New series, III, 254; pl. ii, fig. 2.
HARRIS, New-England Farmer, VII, 91.
C. hentzii, DEJEAN, Spec. des Coléopteres, V. 1.

Color bluish black above, or obscurely cupreous. Small humeral lunule entire; posterior one subentire; intermediate one sinuate and angular, white. Marginal dot white. Abdomen ferruginous.

Length variable, not exceeding half an inch: one of the smallest of the species.

Head cupreous, with two lines between the eyes; eyes large and prominent, brown, with fine striæ around them; basal joints of the antennæ bronzed green, the others obscure brown; labrum dingy white, somewhat rounded before, with six marginal punctures bearing hairs; mandibles short, dark green; second joint of labials whitish. Thorax quadrate, as long as broad, obscure cupreous; marginal impressed lines greenish blue;

sides hairy. Elytra bluish black or obscure cupreous; humeral lunule nearly interrupted in the middle, and dilated at the extremities; intermediate band composed of two imperfect semicircles, or two crescents united at their tips; legs long, bluish green; trochanters purple. Head and thorax metallic blue beneath; breast green; sides hairy. GOULD, Trans. Nat. Hist. Soc. Boston, p. 52–3.

Discovered by Dr. T. W. HARRIS on the summit of Blue hill in Milton (Massachusetts), occupying the naked rock and the patches of mosses growing thereon. Its name is derived from the fact, that in flying, its abdomen appears like a drop of blood suspended to its tail.

APPENDIX TO CICINDELA.

CICINDELA CAMPESTRIS (Linn.). (Plate xvii, fig. 6.)

Above dull green, sometimes richly resplendent with coppery and golden reflections. Elytra very finely shagreened, green, with from three to six pale spots on each, disposed one externally on the shoulder, three on the outer edge of the elytra, one on the tip and one in the disk. Beneath green, with rich coppery red hues; legs bright copper glossed with green, especially on the tarsi; labrum whitish.
STEPHENS, p. 11, illustrations, etc.

This is a common European species, introduced here for the purpose of comparison with ours.

Carabidæ.

THE insects embraced in this natural family, or group, possess several characters in common, by which they are distinguished from the cicindelidæ, and from those which are to follow. The distinguishing characters, as given by systematic writers, are as follows:

'Anterior tibiæ without emargination on the inner side. Head narrower than the thorax; 'eyes rather prominent; palpi with the terminal joints often compressed, large, and 'somewhat triangular in shape; mandibles simple, moderately long and rather thick.'

This family is divided by WESTWOOD into five sub-families, each embracing several allied genera. With the intention of giving these sub-families a natural arrangement, WESTWOOD places first upon the list the *Brachinides*, which stand near the head of the GEODEPHAGA; and ends with the *Bembidiides*, the sub-aquatics, or the sub-family which links the GEODEPHAGA with the HYDRODEPHAGA. The order, then, in which the several sub-families stand to each other, is as follows:

I. *Anterior tibia notched on the inside.*

1. BRACHINIDES : *Bombardiers.* Elytra truncated behind. Tarsi of the males seldom dilated at the base.
2. SCARITIDES : *Burrowers.* Elytra rounded at the extremity. Abdomen pedunculated.
3. HARPALIDES : *Blackclocks.* Elytra rounded behind. Abdomen sessile.

II. *Anterior tibia without a notch near the tip.*

4. CARABIDES : *Dischargers.*
5. BEMBIDIIDES : *Subaquatics.* This sub-family is distinguished from the four preceding by its palpi being terminated by a minute conical joint, while the same organ in the former is terminated by a joint equally large with the others.

The habits of these sub-families differ from each other in many respects. The most important fact, however, which should be stated respecting the numerous species belonging to this family, is that they are friendly to the farmer. Many of them live upon refuse matter : some devour those insects that are injurious to the farmer : hence they should not be destroyed ; and not only so, but it seems even possible to employ some species of them for the very purpose of extirpating injurious insects. To exhibit the mode in which this may be accomplished, I copy the following communication from Prof. HALDEMAN, which he had translated from the fifth volume of the *Revue Zoologique.* The facts and remarks are quite important, and should be generally known, and therefore no apology is required for introducing them in this place.

'"There is," says M. BOISGIRAUD, "a numerous family, composed of carnivorous species, most of them robust and very voracious, which may be multiplied with impunity, and without fear, in our gardens. They do not, indeed, feed upon plants, which they are called to protect : on the contrary, they and their larvæ make great havoc of the herbivorous insects, and at the same time of the limaces and helices," or land-snails, with and without shells; which, in Europe, are destructive to vegetation, but cannot be considered in the light of noxious animals in America. Nevertheless we are occasionally put in possession of the means to destroy them, taken from English horticultural works; just as we are told how to protect ourselves from insects which are not found upon our side of the Atlantic. This is principally owing to the fact that the same *vulgar name* is applied to distinct objects in Europe and America.

'The insects alluded to are the carabidæ. "Well, who would believe it," continues the author, "the greater part of the cultivators crush these powerful auxiliaries with a kind of avidity; whilst the butterfly, which is to give birth to numerous caterpillars, which afterwards devour their plants, is the object of their admiration, and frequently even of their protection. A multitude of noxious insects, after having for several years committed ravages upon our property, disappeared suddenly, without our being made acquainted with

the cause. In looking more closely into these matters, one might be assured, that in most cases, an enemy of the insect which has disappeared, has produced the happy result. I can furnish some proofs in support of this opinion.

'"The thick foliage of a fine avenue of poplars was all at once attacked by an immense quantity of the caterpillars of *Bombyx dispar*. I thought of giving them the *Calosoma sycophanta* for company; as, like them, it passes its life upon the trees, feeding upon the caterpillars which it meets, and even deposits its eggs in their nest, that its voracious progeny may procure nourishment more easily and in greater abundance. Well! this insect multiplied itself with a rapidity truly astonishing; and the caterpillars disappeared, without those who were witnesses to the destruction having the least idea of the causes which produced it." The author then gives it as his opinion that the neighborhood of the city of Toulouse is so little ravaged by the *Melolontha vulgaris*, which is so destructive in other parts of France, because the *Carabus auratus* is very common in the fields, meadows and gardens. It is known, he remarks, that the *Carabus auratus* seizes and devours the *Melolontha* previous to the deposition of its eggs; and that it is more fond of these, than of any part of the insect.

'"One would be much deceived," he continues, "in believing that it is always easy to make an advantageous use of this means of destruction, a profound study of the manners of insects being often indispensable to arrive at the end proposed." Here is an example: "The most robust of our carabi, the *Procrustes coriaceus* (LINNEUS), had served me admirably in the centre of France to destroy the little insects which attack the plants in gardens: here (in the south) this insect *does not destroy the same species;* and although very common, it is unknown, or hardly ever met with. The reason is, that in the centre, the west, and probably the north of France, this *procrustes* is *diurnal*, requiring only cool and shady places: with us (in the south, under a warmer climate) it is, on the contrary, essentially *nocturnal*, and therefore destroys only such insects as are, like itself, nocturnal, or which remain within its reach during the obscurity of night."

'"In transporting into my garden twenty of the *Carabus auratus*, I had thought to destroy the collections of *Forficula* (no destructive species found in America) which had chosen it for the theatre of their ravages." To his great astonishment, the *carabi*, which will actually destroy the *forficulæ*, were either found starved to death, or left the place; and the latter continued their devastations! The reason given is, that the *forficulæ* are essentially nocturnal, and, during the day, keep themselves hidden in crevices into which the *carabi* cannot follow them: these latter, too, are only active during the middle of the day, and in the heat of the sun. But the resources of our persevering entomologist were not yet exhausted; his next expedient being to introduce a smaller carnivorous insect common in France, the *Staphylinus olens*, which, he remarks, "filled all the necessary conditions for the destruction of the *forficulæ*."

'"You see, then, gentlemen," says M. Boisgiraud, in conclusion, "that it is indispensable to study the manners and habits of destructive insects, that their instinct and address may be successfully employed for the destruction of the species able to do us injury. Then in place of barbarously crushing the useful species which have the misfortune to be not always ornamented with the rich colors of the butterfly or the *buprestis*, we will endeavor to protect them and propagate their race. We will find auxiliaries in them the more valuable, as they increase with our adversaries, and as they alone are able to rival the cunning of these ingenious enemies."'

Brachinides.

The sub-family Brachinides may be known by the shortness of the wing-covers, which are not sufficiently prolonged to cover the extremity of the abdomen. In addition to this character, the head and thorax are narrower than the abdomen. The labium is often oval or square, and is occasionally furnished with two small lateral linear lobes. The penultimate joint of the tarsi is bilobed in many of the small species : the anterior tarsi of the males are, very rarely, dilated at the base. Some species are destitute of wings (Westwood).

The most curious fact connected with the natural history of this sub-family is the means by which they defend themselves against the attack of an enemy. When pursued, they suddenly discharge from behind a highly volatile and elastic fluid, possessing considerable pungency : this sudden discharge, which is accompanied with an explosion, both irritates and confuses the pursuer, so that the intended victim has opportunity to escape. From this singular mode of defence, these insects have received the name of *bombardiers*. The fluid discharged is caustic, and stain the skin yellowish brown. They live under stones, logs or boards in fields. Several individuals are often found in the spring together, as if their habits were of a social nature.

Genus BRACHINUS (Weber).

'Body oval, convex; thorax narrow; labrum transverse; tarsi simple; palpi filiform; 'claws simple.' Westwood.

Brachinus perplexus (Dj.). (Plate xvii, fig. 7.)

Head, thorax, abdomen and legs light brick-red. Elytra bluish black, faintly grooved.

Brachinus cephalotes (Dj.). (Plate xviii, fig. 4.)

Head, thorax, abdomen and legs light brick-red. Elytra blue-green, or with a reflexion of green; the metallic hues stronger than in the *perplexus* : body also proportionally shorter, and more obtuse behind. Length about three-tenths of an inch.

BRACHINUS CONFORMIS. (Plate xviii, fig. 5.)

Head, thorax and legs brick-red. Elytra blue lustrous, or semi-metallic. Abdomen dark brown. Length one-fourth of an inch.

BRACHINUS FUMANS. (Plate xviii, fig. 6.)

Head, thorax, under and anterior part of the abdomen, and legs brick-red. Elytra purplish. Sides of the abdomen brown. Length about half an inch.

Found under stones, rails, etc. in June, July and August. Not uncommon in New-England and New-York.

GENUS CIMINDIS (LATREILLE). TARUS (Clairville).

'Body depressed; thorax cordate truncate; claws denticulated; tarsi simple; labial 'palpi of the males with the basal joint securiform' (WESTWOOD).

CIMINDIS PILOSUS. (Plate xviii, fig. 13.)

Insect dark brown, pilose; legs light brown. Head and thorax about two-thirds the length of the abdomen, which is rounded, and nearly covered by the elytra.

GENUS GALERITA (FAB.). POLYSTICHUS (Bar.).

'Body depressed; head triangular; thorax subcordate; palpi long; tarsi simple; men-'tum tooth triangular' (WESTWOOD).

GALERITA AMERICANA (L.). (Plate xviii, fig. 12.)

Head elongate, small and black or brownish black; thorax and legs bright red. Elytra blue-black, submetallic with cupreous reflexions. Length from six- to seven-tenths of an inch.

GENUS LEBIA (LATR.).

'Body depressed, broad; thorax transverse, lobed behind; penultimate joints of the tarsi 'bilobed' (WESTWOOD).

LEBIA ATRIVENTRIS (Say). (Plate xviii, fig. 2.)

Head, thorax and legs brick-red; elytra and abdomen glossy black. The lower and anterior part of the abdomen is of the same color as the thorax, and the upper surface of the tarsi is black. Length one-fourth of an inch.

LEBIA SMARAGDULA (Dj.). (Plate xviii, fig. 3.)
Head, thorax and elytra brilliant metallic blue-green; lower side glossy black. Length?

LEBIA VIRIDIS (Say). (Plate xviii, fig. 1.)
Brilliant green above, glossy black below; legs black. Length from three- to four-tenths of an inch.

L. smaragdula and *viridis* scarcely differ either in color or size.

Scaritides.

THE most remarkable peculiarity in this sub-family is the wide space between the thorax and abdomen, by which the latter appears pedunculated: the posterior angles of the former are also so rounded, that its form is lunate. The antennæ are short, moniliform, and the first joint is the longest; the head is large; the tibiæ of the anterior legs are broad and dentated, having the appearance of being palmated. The mandibles are large and powerful, and armed with broad teeth; labrum short, entire or dentate, sometimes trilobate; mentum tridentate, with the middle tooth strong; labial palpi two- and four-jointed.

The scaritides are carnivorous, and in this respect bear a close resemblance to the allied subfamilies: some living in the ground, upon other insects or their larvæ; and some frequenting the seacoast, burrowing in the sand, and living upon the dead carcases of shrimps. In this State, they burrow in the ground, or live under stones. A large species is found in decaying logs in North-Carolina, some ten or fifteen being frequently found together in one situation.

GENUS SCARITES (FAB.). TENEBRIO (Linn.).

'Oblong, subdepressed; antennæ elbowed; mandibles with strong teeth internally; 'external maxillary palpi and terminal joint of the labia nearly cylindric; mentum 'trilobate. Antennæ with the basal joint subconic; thorax broad, lunate; body 'depressed; anterior tibiæ strongly palmated, the rest simple' (STEPHENS).

SCARITES SUBTERRANEUS (Fab.). (Plate xviii, fig. 14.)
Color black; thorax marked with a fine central line. Thorax and head equal the abdomen in length, the latter supported on a short peduncle. Length eight-tenths of an inch.

The insect, in consequence of its pedunculated abdomen, appears as if bisected. It is a nocturnal feeder, and is found quite abundantly in Central New-York. Its singular form renders it easy to be distinguished.

Genus CLIVINA (Latr.).

'Labrum quadrate, transverse; mandibles short, denticulated from the base to the apex; 'terminal joint of the labial palpi nearly cylindric; basal joint of the antennæ stout, 'the second long; body elongated, subdepressed; thorax quadrate; anterior tibiæ 'palmated externally and at the tip' (Stephens).

Clivina lineolata (Say). (Plate xviii, fig. 11.)

Color light glossy brown; thorax rounded behind and narrowed before, marked by three distinct lines; elytra marked by distinctly punctate lines, of which there are about five to each elytrum. Length two- to three-tenths of a line.

Found under stones.

Genus DYSCHIRIUS (Panzer).

Body elongated, subcylindric at the tip; thorax globular or globose; tibiæ rarely palmated.

Dyschirius globulosus (Say). (Plate xviii, fig. 15.)

Insect brown, glossy; thorax globose, smooth; elytra punctated. Length scarcely two-tenths of a line.

Harpalides.

The elytra of this sub-family cover the abdomen; the extremity is rounded: they are also sessile, and not pedunculated. The anterior tibiæ are deeply notched near their tips, and, in the males, the basal joints are dilated. The mentum is emarginate, though it is occasionally entire: the centre of the emargination has generally a spine. The antennæ are filiform; labrum quadrate, rarely bilobate, but sometimes emarginate in front; mandibles generally with one or more denticulations; mentum deeply emarginate anteriorly, the emargination simple or sometimes toothed; body elongate.

These insects are not so voracious as those of the succeeding family, the Carabides. The predominant colors are black, while a few of them are adorned with brilliant metallic hues. Some are apterous, and run remarkably well. The larva, like the perfect insect, lives beneath stones, and feeds upon other insects or their larvæ. They are cylindric and elongate, but slightly flattened or depressed; and they have twelve rings, which are more or less scaly: the last ring is armed with two small processes.

The sub-family contains many genera, which, though related to each other, are not readily separable into groups. Stephens divides them into three groups, viz:

A. Mentum emarginate, and without a tooth.
B. Mentum emarginate : emargination furnished with a bifid tooth.
C. Mentum emarginate, and furnished with a simple tooth.

Genus AGONUM. Carabus (Lin.).

'Anterior tarsi with elongated joints; mentum tooth simple; thorax rounded' (Westwood).

Agonum octopunctatum. (Plate xviii, fig. 8.)

Head, thorax and elytra brilliant green above, and traversed through the middle by a bronze belt; greenish bronze below. Elytra marked with four punctures each towards their inner margins.

Agonum cupripenne. (Plate xviii, fig. 9.)

Body and thorax brilliant green; elytra brilliant bronze or green, as the light favors the reflexions. Elytra faintly lined, and punctured upon the marginal line.

Genus HARPALUS (Latr.).

'Palpi, external maxillary and labial with the terminal joint fusiform and truncate, and 'of equal length with the preceding, which is clavate; labrum subquadrate, slightly 'emarginate; mandibles short; mentum deeply notched, with an obtuse simple 'lobe in the centre; antennæ with two basal joints, naked; thorax transverse, sub-'quadrate. Anterior and intermediate tarsi of the males with three dilated joints' (Stephens).

Harpalus pleuriticus (Raf.). (Plate xix, fig. 16.)

Chestnut-brown; sides, both of the elytra and thorax, nearly straight, obtuse behind. Length half an inch. The thorax is smooth, and without punctures upon the angles, and the male is darker than the female.

Harpalus bicolor. (Plate xix, fig. 15.)

Color dark chestnut-brown. Sides rather curved, and posterior angles of the abdomen and elytra rounded. Length six-tenths of an inch.

The thorax is marked by a central line, which extends to the posterior margin : posteriorly it is indented by two impressions, and sculptured like the *faunus*.

Harpalus faunus (Say). (Plate xix, fig. 14.)

Color reddish brown, nearly uniform. The thorax is longer than in the *pleuriticus*, and

the bases of the elytra touch the sternum. The head is smaller than in the preceding species. Length five-tenths of an inch.

The head is without punctures, except on the posterior and lateral angles, and the thoracic line does not extend to either margin. Color beneath of a light fawn.

HARPALUS ERRATICUS. (Plate xix, fig. 13.)

Color light brown or rufous, narrow, elongate; thorax wider in front than posteriorly; elytra slightly truncate, exposing the point of the abdomen. Length six-tenths of an inch.

The male is furnished with strong mandibles, and, in both sexes, the brown elytra are darker than the glossy head and thorax.

GENUS PANGUS (ZEIGL.). HARPALUS (Stephens).

'Palpi with the terminal joint subcylindric: thorax narrowed behind; angles rounded; 'antennæ rather short' (WESTWOOD).

PANGUS CALIGINOSUS. (Plate x, fig. 7.)

Color black and rather dull, rather glossy beneath: the thorax has a broad transverse elevation. Elytra marked by about eight impunctate lines; outer border obscurely punctate: legs furnished with rows of reddish spines and cilia. Length eight-tenths of an inch.

Pangus caliginosus is found sometimes upon the seedbearing tops of tall grass; but it is not apparent whether the vegetable, or an insect inhabitant, was the object of pursuit.

This insect is about an inch long, robust, broad, of a black color, with a large head and quadrate prothorax which is wider than long; the elytra with eight impressed striæ.

GENUS AMARA (BN.).

'Oblong oval, broad, subdepressed; head ovate; thorax as broad as the elytra; wings 'two; mentum-tooth bifid; last joint of the palpi ovate; labrum quadrate, slightly 'emarginate; mandibles short, denticulated at base; elytra somewhat emarginate at 'the tip. Anterior tarsi of the males with three dilated joints' (STEPHENS).

AMARA IMPUNCTICOLLIS (Say). (Plate xix, fig. 11.)

Color black with a strong purplish hue, or a cupreous lustre nearly uniform in tint. Length about four-tenths of an inch.

The genus AMARA is said to have been observed in Europe eating the seeds of immature grain; but the damage that insects of carnivorous families are likely to do, are trifling in comparison to the benefits they confer.

Genus AGONODERUS (Dj.).

Head subquadrate; thorax subquadrate, slightly narrowed behind, elongate : the thorax equals in width the base of the elytra.

Agonoderus pallipes. (Plate xix, fig. 5.)

Head black or very dark brown; thorax, elytra and legs brown : middle of the thorax darker. Inner margins of the elytra darker than the outer and posterior margins.

Genus ANISODACTYLUS (Dj.). Harpalus (Steph.).

'First tarsal joint of the male small, the fourth largest; mentum-tooth obsolete; thorax 'subquadrate or trapezoid' (Westwood).

Anisodactylus agricollis. (Plate xix, fig. 9.)

Color dark brown or black; thorax about as wide as the base of the elytra; sides slightly curved. Length five-tenths of an inch.

Anisodactylus rusticus. (Plate xix, fig. 10.)

Color brown; the thorax rather wider than the base of the elytra. Length nearly half an inch.

Anisodactylus baltimorius.

Head and thorax dark brown; elytra, legs and antennæ much lighter, or light chestnut-color. Length rather less than half an inch.

Genus CHLŒNIUS (Bon.). Carabus (Lin.).

'Palpi with the last joint ovate truncate; mentum-tooth bifid : thorax, in the centre, 'truncate subcordate, broadest behind or subquadrate' (Westwood).

Chlœnius emarginatus. (Plate xx, fig. 6.)

Head black, with green submetallic hues; thorax bronze, submetallic; elytra blue-black, brilliant : beneath black, punctate, sculptured, but confined mostly to the thorax and anterior of the abdomen; thorax and head above finely punctate; legs, palpi and feelers light reddish brown. Length half an inch.

CHLŒNIUS NEMORALIS. (Plate xx, fig. 5.)

Head and thorax metallic green; elytra blue-black, rather brilliant; legs, palpi and antennæ brown. Length half an inch.

This species is rather broader than the foregoing.

CHLŒNIUS SERICEUS. (Plate xx, fig. 7.)

Head, thorax and elytra brilliant green above, glossy black below, punctate; legs, palpi and antennæ brown. Length from six- to seven-tenths of an inch.

CHLŒNIUS TOMENTOSUS. (Plate xx, fig. 2.)

Head black, dark bronze, punctate; elytra dark, bronzed and faint greenish hue, tomentose.

CHLŒNIUS LITHOPHILUS. (Plate xx, fig. 8.)

Head, thorax and elytra green, brilliant black beneath; legs, palpi and antennæ brown. Length four-tenths of an inch.

GENUS TRECHUS (CLAIRV.).

Mentum transverse, tridentate anteriorly; central tooth shortest; head ovate; thorax cordate truncate; angles mostly rounded.

TRECHUS CINCTUS. (Plate xix, fig. 8.)

Small, shining brown; head darker; elytra rather lighter on the outer than the inner margin. Length two-tenths of an inch.

TRECHUS CONJUNCTUS. (Plate xix, fig. 7.)

Small, shining brown; head black or dark brown. Length rather more than two-tenths of an inch.

GENUS CALATHUS (BON). CARABUS (LIN.).

Tarsal claws toothed; palpi simple and rather long; labial nearly filiform, the terminal joint truncate; labrum transverse, a little emarginate; mandibles denticulated at the base; mentum with a bifid tooth in the centre of the notch; elytra elliptic; thorax subquadrate or trapeziform; head angular.

CALATHUS GREGARIUS. (Plate xviii, fig. 16.)

Form ovate; antennæ long filiform: head, thorax and elytra of a glossy brown color; margin lighter; legs brown. Length about four-tenths of an inch.

GENUS ANCHOMENUS (BON.). CARABUS (Fab.).

'Mentum-tooth entire; thorax cordate, posterior angles acute; elytra oblong, subconvex; 'head as broad as the thorax; third joint of the antennæ twice as long as the second. 'Elytra rather sinuate at the apex. Anterior tarsi of the males with three dilated 'joints' (WEST. & STEPH.*).

ANCHOMENUS EXTENSICOLLIS (Steph.). (Plate xviii, fig. 10.)

Head and thorax green, submetallic; elytra purplish bronze, submetallic; legs light brown. Length about four-tenths of an inch.

DICŒLUS DILATATUS (Say). (Plate xxi, fig. 13.)

Insect large; thorax nearly as wide as the abdomen. Head black, smooth; thorax purple, indented before and behind. Elytra purple, strongly marked by eight plain lines: one begins in the acute upper and outer angle, running rather obliquely, and joins the fifth from the inner margin, the two enclosing one line: outer line next the margin depressed, and imperfectly punctured. Length about eight-tenths of an inch.

DICŒLUS ELONGATUS (Say). (Plate xxi, fig. 9.)

Insect narrowed; margin of the thorax and elytra nearly upon the same line, black; head and thorax smooth. Elytra marked with plain lines: line commencing at the outer and anterior angle, rather oblique, and becoming more so at the posterior extremity, where it coalesces with the other lines, and all together terminate in the posterior and inner angle; the dotted line of the margin obsolete. Length about seven-tenths of an inch.

SPHÆRODERUS STENOSTOMUS (Dj.). (Plate xxi, fig. 10.)

Insect dilated behind, narrowed before; head smooth, shining black; thorax smooth, brilliant steel-blue, punctured behind. Elytra dark purplish upon their disks, bordered by rich steel-blue, punctured and lined; lines interrupted posteriorly. Glossy black and punctured laterally beneath. Length from five- to six-tenths of an inch.

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* Mr. STEPHENS remarks that the ANCHOMENUS may be distinguished from CALLISTUS by the elongate form of the thorax, and its not being punctate throughout; and from PLATINUS, by its acute simple notch in the centre of the mentum.

Carabides

Constitute the fourth sub-family of the Carabidæ. They are distinguished from the other subfamilies by the absence of the notch, which, in the allied species, is situated near the extremity of the anterior tibiæ : the only approach made to it, is by the presence of a slight groove in the place of the notch at the extremity of the tibia. The elytra are entire, and cover the extremity of the abdomen : antennæ setaceous; labrum may be simple, bilobate or trilobate; mandibles simple or merely one-toothed, rarely tridentate; maxillæ ciliated internally, and furnished with a claw at the tip; labial palpi four-jointed; mentum large, broad, and generally produced in the centre; anterior tarsi greatly dilated in the males.

This subfamily contains many large showy insects : they are mostly apterous, and their elytra are often elegantly marked with metallic spots, or set off with splendid metallic hues.

The carabides run fast, and are very carnivorous in their habits : hence they should be preserved, as they are friendly to the farmer. Some of them discharge a powerful odor when taken, which is exhaled from a fluid ejected from the abdomen, and remains a long time.

The Genus Carabus, the typical one of the family, contains, according to Mr. Westwood, notwithstanding the restrictions to which it has been subjected, nearly 200 species. By far the greater number of these species are confined to northern climes.

Genus CYCHRUS (Fab.). Tenebrio (Lin.).

Head long and narrow; palpi with the last joint large and spoonshaped; labrum strongly bilobate; mandibles bidentate at the tip; antennæ setaceous; mentum quadrate, toothless; thorax truncate; wings none.

Cychrus viduus (Dj.). (Plate xxi, fig. 14.)

Insect large, dilated behind and narrowed before : head and thorax bluish purple, sculptured on the borders. Elytra purple, marked by about fifteen strong dotted lines each, which are somewhat interrupted behind and partially broken, giving them an approach to a zigzag form; beneath, purplish, inclining to brown or cupreous. Length from one to one and a quarter inches.

This insect may be known by its remarkable elongation of the head and thorax, and its dilated elytra and abdomen, the former of which are reflected over the latter.

Genus CARABUS.

Labrum bilobate; mandibles furnished with a tooth in the middle; mentum-tooth entire; thorax subcordate, emarginate behind; palpi with the last joint securiform; antennæ linear, second joint shortest, third cylindric; wings rudimentary or none. Anterior tarsi of males dilated.

Carabus vinctus (Weber); *C. interruptus* (Say). (Plate xxi, fig. 11.)

Head and thorax smooth, blue-black. Elytra black, faintly bronzed, and marked with punctured lines: the three interrupted lines are sharply elevated, and the metallic points are reflected from these interruptions. Length eight- to nine-tenths of an inch.

Carabus serratus (Say). (Plate xxi, fig. 12.)

Color black, with blue and purplish hues which are reflected from the margins of the elytra and thorax: head and thorax plain and glossy black; margins of the thorax elevated and punctured. Elytra thickly punctured in about twelve rows: if taken in threes, there are three rows of ovoidal parallel impressions without punctures. Length seven- to eight-tenths of an inch.

Carabus limbatus (Say). (Plate xxi, fig. 16.)

Color black: head and thorax smooth and glossy black. Elytra purplish black, bordered with blue and purplish hues, and marked by seventeen or eighteen punctured lines: three of these lines are broken by stellate or cruciform markings. Length nine-tenths of an inch.

Genus CALOSOMA (Web.). Carabus (Lin.).

Labrum bilobed; thorax transverse, shorter than wide; abdomen subquadrate, wider behind than before; wings large; palpi with the last joint ovate, truncate; labium short broad, the upper margin setose acuminated; mentum sublinear, rounded laterally, unidentate in the middle. Antennæ, second joint shortest; third longest, compressed.

Calosoma scrutator. (Plate x, fig. 8.)

Head blue-black: thorax blue-black, surrounded with golden green. Elytra green with purplish reflexion and bordered with cupreous, marked with punctured lines: the ridges between are transversely marked with numerous lines; each elytrum is also ornamented with three rows of distant green dots, which are not very conspicuous. The whole body beneath is green, with steel-blue reflections: legs steel-blue, and the thighs are punctured with four or five rows of dots; tarsi and tibiæ dusky. Length exceeds an inch: about $1\frac{1}{4}$ inches.

CALOSOMA CALIDUM. (Plate xxi, fig. 15.)

Head and thorax black, finely punctured. Elytra ornamented by three rows of metallic spots placed upon thick lines, crossed by obscure punctures. Length nine-tenths of an inch.

Both species of CALOSOMA are abundant in the United States; both feed upon other insects, and are useful by diminishing the number of insects injurious to the farmer. They are furnished with wings, are found upon trees, and feed upon the larvæ of lepidopterous insects: their larvæ also have the habits of the perfect insect.

GENUS NOTIOPHILUS (DUN.). ELAPHRUS (Fabr.).

Head as broad as the thorax; eyes large; thorax quadrate, flattened; labrum large, rounded; palpi robust.

NOTIOPHILUS PORRECTUS. (Plate xx, fig. 13.)

Insect brown, with a uniform bronze hue. Length from two to three lines.

This insect is wider in front than posteriorly: the great size of the eyes makes the head as prominent as the thorax.

GENUS ELAPHRUS (FABR.). CICINDELA (Lin.).

'Antennæ short; eyes very prominent; thorax convex; labrum slightly trilobed; palpi 'slender' (WESTWOOD).

ELAPHRUS RUSCARIUS (Lin.). (Plate xx, fig. 1.)

Head, thorax and elytra bronze tinted with green, and singularly marked by dark round spots encircled with green, which give the insect a tuberculate appearance; beneath green and metallic.

The insect's body is short, but it has the general appearance of a CICINDELA.

OMOPHRON LABIATUM (Fab.). (Plate xx, figs. 11, 12.)

Head with a deeply notched patch of green at the base, and partially surrounding the eyes: thorax black, with green metallic hues bordered with light brown. Elytra variegated with black-green metallic hues, and bordered with light brown, traversed with many punctate lines; beneath brown.

Var. *tessellatus*, Say (fig. 12). Obscurely banded; the elytra traversed on their inner margins with black: the brown is more conspicuous, and occupies a larger portion of the elytra.

Length about one-fourth of an inch.

Bembidiides.

The maxillary and labial palpi in this subfamily are terminated by a very minute joint. The anterior tibiæ are always notched on their insides, near their tips. The insects are small, and run with considerable speed : they are adorned with metallic colors. They live under stones in damp places, or in crevices in the ground ; and they are carnivorous, feeding upon the larvæ of other insects, and also upon dead animal matter.

Genus BEMBIDIUM (Illiger). Cicindela (Lin.).

Thorax truncate cordate ; elytra tubercled ; eyes very prominent.

Bembidium sigillare. (Plate xx, fig. 3.)

Head, eyes, thorax and elytra above metallic gray, bronzed with a faint purplish in some lights ; beneath, brilliant green : legs darker above. Length rather more than one-fourth of an inch.

Sometimes very abundant on the leaves of water plants.

Bembidium honestum. (Plate xx, fig. 4.)

Head and elytra gray bronze, duller than the preceding ; thorax blue-black ; beneath, black with a greenish hue. Length about a quarter of an inch.

Bembidium inequale (Say).

Eyes very large ; head, thorax and abdomen gray, metallic and bronze, uniform.

Bembidium inornatum. (Plate xx, fig. 9.)

Head, thorax and elytra brown. Length about one-tenth of an inch.

Bembidium tripunctatum. (Plate xx, fig. 10.)

Head, thorax and elytra brown ; metallic hues absent. Length one-tenth of an inch.

Bembidium variegatum. (Plate xx, fig. 14.)

Head, thorax and elytra metallic green above, when seen in some directions ; below, black and brownish : legs brown. The elytra are variegated with paler patches of brown, and they appear of a glossy brown when seen by direct light. Length two-tenths of an inch.

HYDRADEPHAGA.

The insects included in this section reside in water, and hence their legs are transformed into organs suitable for moving in this element. In addition to the transformation of the legs into swimming organs, the body undergoes a change of form, becoming oval or boat-shaped : in fine they are thoroughly fitted for the element in which they are to move, being endowed with the means of pursuing their prey, and furnished with all the conveniences which their congeners upon the land possess. Although they subsist in water, yet they are not provided in their perfect state for obtaining a supply of air from the element in which they move : they are air-consumers, and are obliged to rise occasionally to the surface to obtain a supply of air for respiration.

The Hydradephaga are predacious beetles; and although it is not important to the farmer to know them in an economical point of view, still some of the larger kinds prey upon the ova of fish, and even upon their young; and in this respect, they are not entirely destitute of interest to the owners of fish-ponds. Regarded as animals which live by the chase, they are truly more greedy and gluttonous than the predacious land beetles : they are pre-eminently voracious and destructive. Their larvæ, of course, are aquatic; and they too feed voraciously upon other aquatic insects. The perfect animal, though fitted for the water, is not confined to it : it may take wing at evening, and enter dwellings, like moths, being allured by the dazzling light of lamps near a window. They obtain air by resting upon the surface, and raising their elytra : this brings the air more immediately into contact with the spiracles of the insect.

Stephens divides the Hydradephaga into two families, viz :

Antennæ { long, setaceous : embracing the Dyticidæ ;
short, clavate : embracing the Gyrinidæ.

1. The Dyticidæ are furnished with rather long setaceous antennæ; their bodies are oval, being rounded anteriorly and posteriorly; their thorax is short and transverse, and their legs are formed for swimming : the posterior ones, however, are especially adapted to this end, by their great length, and by being furnished with two rows of dense cilia arranged along the edges, with the view of increasing the width of the oar; the tarsi are also flat in the males, and the anterior ones are more dilated than in the females. The mandibles of the larva are much bent, and are pierced for the purpose of extracting the juices from the animals upon which they subsist. Their respiratory organs are situated behind, and consist of two segments fringed with hairs and terminating in two conical appendages, between which are two cylindric perforated tubes : these communicate with the respiratory organs. The larva, as well as the imago, is obliged to rise to the surface to obtain a supply of air.

2. The GYRINIDÆ are provided with short clavate antennæ : body oval and convex, as in the DYTICIDÆ, but more glossy. The legs are unequal in this family : the anterior ones are long, and the four posterior are short, compressed, and formed for swimming. The larvæ differ also from those of the DYTICIDÆ, by having on each side of the fourth and seven following segments a membranous conical appendage, which is flexible and bearded at the sides : these appendages are subordinate to the respiratory organs, with which they communicate by a small tube.

Dyticidæ.

Halipides.

Antennæ ten-jointed ; posterior coxæ dilated into a large shield, covering the base of the legs.

GENUS HALIPLUS (CLAIRV.). CNEMIDOTUS (Ill.).

Maxillary palpi with the last joint very minute and subulate.

HALIPLUS 12-PUNCTATUS. (Plate xx, fig. 15.)

Head, thorax and elytra buff-colored. Elytra with twelve black spots, some of which are confluent ; inner margin and anal extremely black ; thorax with a lunate black or brown spot on its anterior margin ; eyes black.

HALIPLUS IMMACULATICOLLIS. (Plate xx, fig. 16.)

Insect buff-color : elytra with ten black spots, the central comparatively large, and common to both elytra ; thorax brown, immaculate.

GENUS DYTICUS. DYTISCUS (Linn.)

'Anterior male tarsi patellated ; claws didactyle ; maxillary palpi with the second and third joints equal' (WESTWOOD).

DYTICUS HARRISII. (Plate v, fig. 10.)

Color black softened into olive ; front or forehead luteous ; lateral margins of the thorax luteous : upon the latter it diminishes posteriorly, and extends to the under side of the same ; beneath, the thorax and first pair of legs are luteous : posterior legs long, and furnished with two dense rows of brown cilia. Length one inch.

This species is rather common in small ponds of water, where the bottom is clear and sandy : a locality where it may always be found, is at the head springs which supply the city of Albany with water.

Parnides.

This subfamily is composed of insects which frequent water : their tibiæ are unarmed and narrow, and their legs are formed for walking. They have an oval body, more or less convex, and the posterior part of the thorax is as wide as the abdomen or base of the elytra. The antennæ are short ; mandibles robust and notched at the tip, with their inner surface ciliated. As they frequent the water, their entire surface, as in Parnus, is covered with cilia to retain air ; or, as in Elmis, in part ciliated, for the same object. This arrangement gives them oxygen when immersed in water.

The two genera Parnus and Elmis are regarded as belonging to two subfamilies ; but being closely related, it is sufficient for our purpose to place them in juxtaposition.

Parnus fastigiatus. (Plate xxiii, fig. 7.)

Body oval convex ; head retracted : color a drab brown ; thorax and elytra covered with a coat of fine appressed hair ; legs reddish on their outer sides.

Elmis crenatis ? (Plate xxiii, fig. 9.)

Body convex, angulated, punctate, acute behind ; thorax and elytra marked with four black dots, and a faint reddish stripe upon each ; legs reddish.

Silphides.

The wide depressed or flat form of body is a reliable characteristic of a part of this group. They are always present in putrescent animal matter : wherever a carcase of an animal is decaying, or even a bone not perfectly bleached, there we find numbers of the silphides. The Necrophorus, however, is much less depressed or flattened than the genus Silpha, and seems at first sight to constitute a distinct group by itself. The latter are sometimes called *sexton beetles*, from their habit of burying all the small dead animals which they meet with. In this labor, they exhibit a great amount of industry and perseverance, as well as a high grade of instinct in seemingly devising means to accomplish an end.

The anatomical characters of these beetles, as given by Westwood and others, are : Antennæ thickened at the tips ; palpi filiform and slender ; labrum transverse and emarginate ; maxillæ bilobed, the inner armed with a hook ; mandibles strong and exsert, especially in Necrophorus ; thorax orbicular or semicircular, forming a kind of shield for the head ; tarsi five-jointed, the fourth nearly equalling the others.

Genus NECROPHORUS (Fab., Leach, Oliv.).

'Body oblong ; elytra truncate ; club of the antennæ large, round, four-jointed, perfoliate ; 'maxillæ unarmed' (Westwood).

NECROPHORUS AMERICANUS (Ol.). (Plate xxii, fig. 8.)

Head, thorax and elytra black, shining; forehead marked with a cordate yellowish brown spot; thorax brown, except a black dentate border : elytra marked with four irregular yellowish brown spots, the anterior prolonged upon the anterior margin; margin grooved, and of the same color as the spots : club of the antennæ yellowish brown, black beneath : anterior tarsi ciliate; cilia yellowish brown.

This large conspicuous beetle presents certain variations of color and marking, which indicate a difference either in sex or species. The yellowish brown spots described above are much darker in some individuals, while the forehead mark is rounded behind, square in front, and behind and between the eyes there is a rufous spot which does not exist in all. The thorax is curiously indented upon its border. Length $1\frac{1}{4}$ inch.

NECROPHORUS TOMENTOSUS (Wb.). (Plate x, fig. 2.)

Black : elytra crossed by two rufous bands, black beneath; thorax and sides pilose; club of the antennæ black. Length about three-fourths of an inch.

This species is quite hairy, especially upon the thoracic plate : hairs greenish.

Common in July in New-England and New-York.

NECROPHORUS PYGMEUS (Rich.). (Plate xxii, fig. 5.)

Black : elytra marked with four angular bright red spots. Length rather more than half an inch.

The NECROPHAGA perform the part of scavengers in destroying and burying carrion. *N. tomentosus* takes its trivial name from the yellow hair upon the prothorax. The family DERMISTIDÆ is also destructive to animal matter : they deposit their eggs in it; and when they are hatched, they feed upon it; but the dermestes attack and devour any animal food, whether in a state of decay or not. It is supposed that the perfect animal, however, prefers flowers to meat, though we always find it busy in the latter.

GENUS SILPHA (LINN.).

'Broadly oval, slightly convex; antennæ gradually thickened, club four-jointed; thorax 'often truncate anteriorly' (WESTWOOD).

SILPHA CAUDATA (Say). (Plate xxii, figs. 3, 7)

Black. Elytra subquadrate, papillated; papillæ in about four rows, placed between sharp ridges; inner and posterior angle slightly prolonged; outer angle rounded : thorax tomentose. Length half an inch.

SILPHA INEQUALIS. (Plate xxii, fig. 6.)

Insect depressed, black : elytra finely punctured, and traversed by three or four sharp slightly raised ridges. Length half an inch.

SILPHA NOVEBORACENSIS. (Plate xxii, fig. 9.)

Body depressed : elytra rufous ; outer margin of the thorax light and rather bright red, black beneath.

SILPHA AMERICANA. (Plate xx, fig. 3.)

Depressed, black : thorax yellow, with a subquadrangular black spot in the centre ; elytra knobby, black or brownish black tipped with yellowish ; outer angles truncate, or rounded from the middle, and slightly notched at their inner and posterior angles, forming a notch when at rest : they are marked by four rather irregular ridges.

GENUS NECRODES (WILKIN). SILPHA (Linn.).

'Body oblong ; elytra truncate ; club of the antennæ gradually thickened ; maxillæ 'without a claw' (WESTWOOD).

NECRODES SURINAMENSIS. (Plate xx, fig. 4.)

Depressed, black : thorax smooth and shining ; elytra marked posteriorly with a short rufous band, and traversed by three strongly marked sharp ridges, black beneath.

Nitidulidæ.

THIS family has the habits in part of the silphidæ, as some of them are found in putrid animal matter, or feeding upon mushrooms ; others, however, frequent flowers. They are oval, broad, and much depressed ; and they have filiform antennæ, terminating in a short club of two or three joints. The thorax is transverse and emarginate : in some, the elytra are short, leaving the abdomen exposed. They are small insects.

GENUS NITIDULA.

'Body oval, subdepressed ; thorax margined ; tibia compressed ; fourth tarsal joint bi-'lobed ; third joint of antenna longer than the fourth' (WESTWOOD).

NITIDULA BIPUSTULATA. (Plate xviii, fig. 1.)

Color of the body and thorax dull brown : central part of the elytra marked by a patch of lighter brown ; margin light brown. Length about two-tenths of an inch.

Engidæ.

The insects of this family are allied to the Nitidulidæ and Dermestidæ : from the former, they differ by their elongate form and simple tarsi ; and from the latter, by their highly polished bodies, and more developed form of their mandibles (Westwood).

The Engidæ subsist upon wood in a state of decay, or upon fungi, in some species of which many individuals may be found. I procured a large number of individuals belonging to this family, in the gelatinous sap which was slowly oozing from a wound in the trunk of a yellow birch : they are also found under the bark of trees, and never feed upon living or dead animal matters.

The anatomical characters, as given for the Engidæ proper, are : Antennæ short, clavate, ten- or eleven-jointed ; maxillary palpi equalling the lobes of the maxillæ ; labium advanced in front of the mentum ; labrum transverse ; mandibles bifid at the tip ; tarsi in some four-jointed, in others five.

Genus ENGIS (Latr.).

' Body long ovate, subconvex ; tarsi five-jointed, the fourth joint short ; maxillæ bilobed ; ' club of the antennæ short, broad, flattened, three-jointed ' (Westwood).

Engis fasciata. (Plate xxiii, fig. 2.)

Thorax black : elytra brick-red, traversed by a broad black belt ; posterior extremity black ; inner angles of the elytra black, terminating in a partial crossbar. The proportion of black and red upon the elytra is nearly equal.

These insects inhabit fungi, or decaying wood under the bark of trees : they are not, however, specially injurious to trees.

Genus IPS (Herbst).

The body is oblong and subdepressed ; tibia broad and serrated ; tarsi five-jointed ; lobe of the maxilla broad.

Ips fasciatus. (Plate xxiii, fig. 4.)

Body oblong, subdepressed ; thorax and head black ; elytra black, with two yellow angular spots upon each ; legs short ; tibia broad, subserrated ; tarsi pilose. Length two-tenths of an inch.

Ips sanguinolenta. (Plate xxiii, fig. 3.)

Head and thorax black : elytra yellow, with a single round black spot near the middle ; terminal extremity black ; outer and anterior angles black. Insect shining.

IPS QUADRISIGNATA. (Plate xxiii, fig. 6.)

Head and thorax black : elytra black, with two yellow spots on each elytrum, shining; the posterior spot is somewhat oval; upper and outer angles black.

IPS BIPUSTULATUS. (Plate xxiii, fig. 8.)

Color brown, dull : elytra marked with two large yellow dots. Length about two and a half lines.

Cucujides.

GENUS CUCUJUS. COLYDIUM (Herbst).

Antennæ short, moniliform or elavate; basal joint short.

CUCUJUS CLAVIPES. (Plate xxii, fig. 2.)

Depressed, flat or compressed : color uniform, inclining to brick-red; abdomen below dark, and nearly black upon the margins. Length about half an inch.

DERMESTES LARDARIUS. (Plate xxii, fig. 5.)

Body oval, subconvex, black, with a gray bar passing across the anterior part of the elytra, in which are three dots on each elytrum.

The genus DERMESTES is named from *derma*, a skin, with which the larvæ make great ravages, eating the surface so as to cause the hair to fall off. The *Dermestes lardarius* commits its depredations in houses, usually in furs, meat, pork, bacon (whence it is sometimes called *bacon bug*), collections of insects, etc. when stored away without protection. It is about one-fourth of an inch long, nearly black; the base of the elytra ash-color, with three small black spots.

This species is active in attacking all animal collections of natural history : from this depredator, they are best protected by arsenic. Articles of domestic consumption should be preserved by preventative measures, such as enclosing hams in canvass and white-washing them.

The *Dermestes vulpinus* is distinguished from the *lardarius*, by having the elytra entirely black, and the under sides and under parts covered with white scales. It is very destructive to hides, in which it is imported. In France, it has been observed to perforate walls built of stone soft enough to be broken by the nail. It is found in America, Europe and Asia.

There are several other insects which are destructive to skins, and to anatomical and natural history collections : one of them is the *Anthrenus museorum* (*Byrr. museorum*, Linn.). It is not a native of this country : it is, however, replaced by the *A. destructor*,

Melsh., which is a short oval insect about one-eighth of an inch in length, of a fuscous color, and marked by several waved whitish fasciæ. The larva of another small and much narrower insect, *Dermophagus tarsale* of MELSHEIMER, is also very destructive to entomological collections.

Staphylinidæ.

THE characteristics of the insects belonging to this family are, their long, narrow, and depressed form; the shortness of their elytra, and hence the great exposure of the abdominal segments. Their true wings are closely folded beneath the curtailed elytra, although they are large when expanded. Their heads too are remarkably large; and when set out by their projecting mandibles, it is no easy matter to persuade oneself that it is safe to catch them. Their antennæ are not very conspicuous, but are sometimes enlarged towards the extremity. The thorax is strong, and as wide as the first segment of the abdomen. From the shortness of the wing-covers, the abdomen is equally hard above as beneath, and is not confined by them: it therefore admits of free motion, and is employed as an instrument to assist in folding and unfolding the wings. When the insect is captured, a curious organ protrudes from the extremity of the abdomen, consisting of two vesicles, which are extruded at the will of the insect, and from which it is not uncommon to perceive that a peculiar vapor escapes that is by no means pleasant.

WESTWOOD regards this family equal in rank to the CARABIDÆ, and susceptible of subdivisions of the same value: the name BRACHYELYTRA has been generally employed in denoting it.

GENUS STAPHYLINUS (LINN.).

'Body nearly glabrous; antennæ subfiliform, with the fourth and tenth joints subequal; 'thorax subquadrate' (WESTWOOD).

STAPHYLINUS VILLOSUS.

Head and thorax black and glossy: back, sides, and abdomen beneath villose, or covered with a dense coat of hair; abdomen banded with greenish buff. Length six-tenths of an inch.

STAPHYLINUS CYANIPENNIS. (Plate xxxi, fig. 6.)

Head and thorax black and glossy; elytra steel-blue; abdomen hairy and black.

STAPHYLINUS CHRYSURUS. (Plate xxxi, fig. 3.)

Above an olive brown, clothed with short yellow hair; sides and extremity of the abdomen golden yellow; thighs black, except at their tips, and a dorsal line.

CHAPTER V.

ORDER I. COLEOPTERA (Continued).

PENTAMERA.

Distinguished entomologists have made two grand divisions of the pentamerous insects. Some of the families of the first division have been noticed : the second is equally important with the first, and admits of subdivision into natural groups or families ; but there is some diversity of opinion where the lines bounding these families shall be drawn, and also respecting the best terms for designating them.

A plain and comprehensive subdivision into groups has been made by Stephens : 1, the Clavicornes, which are characterized by the antennæ terminating in a solid ball, or a perforated one ; 2, the Lamellicornes, with the antennæ terminating in a leafy or lamellated mass ; and, 3, the Serricornes, having the antennæ constructed so that their whole length is toothed somewhat like a saw. The Clavicornes are divided into two families : the first contains those insects which resemble the Linnean Genus Byrrhus, having straight claviform antennæ, and called the Family Byrrhidæ, Leach. The second family have also claviform antennæ, but each with a distinct elbow or angle.

The Byrrhidæ are small beetles with short oval convex bodies, and generally pilose or hairy : the elytra cover the body, and the legs can be folded up ; when alarmed, it folds them together under its body, and then remains motionless, appearing like a seed, until the danger is past. In this family the antennæ become gradually clavate, and the club is not solid.

The second family of clavicornes takes its name from the Genus Hister : hence the family name Histeridæ, Leach. In these, the antennæ, instead of being straight, have a sudden or short angle in them, or are said to be elbowed. They are small insects, hard and shining or highly polished, and usually black : their forms are somewhat square, but still possess considerable convexity ; their legs are more or less dentate, and the two hind ones are set widely apart ; the elytra are short, and hence leave a portion of the abdomen exposed. Their elbowed antennæ, their polished surface and short elytra, clearly distinguish them from the byrrhidæ.

The LAMELLICORNES received their name from the structure of their antennæ; the extremity being a laminated knob, composed of three or more leaflike laminæ, which open and shut somewhat like the leaves of a book. The first division of this group consists of the SCARABIDES, the first section of which are named *Coprophagi*, from the kind of food on which they subsist : they feed upon and live in ordure, or excrements of all kinds. The ancients gave the name *pillularia* to certain species which have the curious instinct of rolling the excrement into balls with their hind feet, and in which they have deposited their eggs : when the ball has acquired a sufficient degree of solidity, it is pushed into a hole previously prepared for its reception.

A foreign species, the *Ateuchus sacer*, was an object of religious veneration and worship among the ancient Egyptians. With them it was symbolical of the world, the sun, and the warrior : of the world, from the globular shape of its balls, and perhaps also from the progeny they contained; of the sun, from the angular projections from its head in the form of rays : the six legs have five tarsi each, and hence they represented the days of the month. The idea of the courageous warrior was imbibed from the supposition that the species were all males. The Roman soldiers wore its image on their signets; and it is said that it is still a custom with the Egyptian women to eat them, to render themselves prolific : as the sun is the source of all fertility, so the eating of this symbol would impart to them the same desirable quality. When we reflect a moment upon the attention which these curious insects pay to their offspring, and the intense emotion they exhibit in rolling their balls, a work which they prosecute until overcome by exhaustion, it is not at all surprising that the ancients should have made them symbolical of the highest order of qualities.

The *Copris carolina* closely resembles the symbolical beetle of the ancients, just referred to. The Genus COPRIS makes its abode beneath the fresh excrement of the cow; and hence its hills of dirt are common in pastures, by roadsides, and other places where the cow is kept. This insect, however, never rolls a regular ball, but collects a quantity into an irregularly shaped mass. The true *pillularia* belong to the Genus GEOTRUPES, and a few other allied genera.

The larva of the GEOTRUPES resembles that of the MELOLONTHA, being of a dirty white color, soft, and, when not engaged in feeding, it lies coiled in a semicircle : they have six scaly feet and a scaly head. Subsisting at first upon the magazine of food which the mother has provided in the offal in which they are enveloped, they afterwards penetrate into the earth, and feed upon roots. It requires a year or two for their perfection : they are then transformed into nymphs; and another year passes, before they are ready to become perfect insects.

The LAMELLICORNES consist of ten families, each presenting some peculiarity in the antennæ, mandibles or maxillæ, by due attention to which the student will be able to determine the position an unknown insect may occupy. The first of these ten families is

the LUCANIDÆ, taking the family name as usual from one of the most important genera it contains : in this instance it is the *Lucanus dama*, an elongated stout insect, and furnished with strong and projecting mandibles, especially in the males. Their antennæ are elbowed, and the terminal knob is constructed after the fashion of the teeth of a comb, or is pectinate: they consist of only three terminal teeth, somewhat separated from each other, but near enough to come within the definition of *lamellicorn beetles* (See Plate xii, fig. 7, *n*, *o*).

The second division of the LAMELLICORNES embraces all those beetles whose antennæ terminate in leaves or lamellæ, consisting usually of three pieces, which fold together or lie in contact like the leaves of a book. This division received the name of *Petalocera* from DUMERIL : it contains many insects which belonged to the genus *Scarabæus* of LINNEUS. The antennæ differ from those of the insects of the Family LUCANIDÆ, inasmuch as they are not elbowed ; and the number of joints is variable, eight, nine or ten. In some groups, the males are remarkable for their appendages upon the head or thorax, either in the form of horns or protuberances. Some of the largest insects belong to this division.

The habits of the insects of this division are various : some, and probably the majority, feed upon refuse matter, some upon excrement, some upon leaves, and others upon flowers. Their larvæ are conspicuous for their size : they are of a soft consistence, of a whitish color, and furnished with strong mandibles. We find them in the vegetable mould, usually coiled, or in decaying logs. They have fourteen rings, including the head, and the rings or segments are transversely grooved.

From the diversity of character which exists in this great division, it has been subdivided into ten families. The first is the GEOTRUPIDÆ : their maxillary lobes are membranous, the mandibles are porrected, and the elytra cover the abdomen (Plate xii, figs. 1, 2, 3, 5, 8). Their antennæ have ten or eleven joints ; and their bodies are globose, or thick and more or less rounded and full. Their habits are peculiar : they feed upon excrement, though some are said to feed upon roots.

The SCARABÆIDÆ constitute the second family of this great division. They are furnished with a shieldlike extension in front, the *clypeus*, which extends over the mouth ; and their antennæ are eight- or nine-jointed, with the end terminating in a three-leaved club. The middle legs are inserted more widely apart than the others : the posterior legs are far behind ; the scutellum is not present ; and the elytra are shortened behind, leaving the abdomen exposed. The claws are minute, and the anterior tibiæ are expanded and tridentate externally, armed with a single spur. The insects feed upon excrement, and the the greater proportion of the family reside in warm climates. They are many of them ball-rollers ; and to aid them in this work, their hindlegs are long and inserted far behind, which gives them a grotesque appearance when walking. They fly mostly by day. (Plate xii, figs. 5, 7.)

The third family of MACLEAY is called APHODIIDÆ. They too are excrement-eaters : they are oval and rounded at the posterior extremity. In this family we find the minute instead

of the large beetles, and they belong to temperate climates : the legs are placed at equal distances apart; the scutellum is distinct; the clypeus is entire, and the antennæ are nine-jointed. The body is more elongated than in the former family.

The fourth family is small, or of a moderate extent : it is the TROGIDÆ of MACLEAY. The insects are of a medium size, ovate or gibbous, and the elytra are inflexed at their sides. The scutellum is distinct, and the anterior tibiæ are imperfectly toothed. The head is deflexed; thorax short, posteriorly situated, and the anterior angles are advanced : the elytra are rugose. (Plate xxiv, figs. 1 & 3.)

The fifth family is the DYNASTIDÆ of MACLEAY. The insects of the family are gigantic, and the males are very strongly identified by prominences and horns upon their heads or thoraces. The jaws are powerful, horny and prominent, and furnished with two teeth; the scutellum is distinct; the antennæ are ten-jointed, and the elytra are shortened behind, leaving the abdomen exposed : the color is a rich chestnut-brown. The insects reside in rich vegetable matter and in putrid offal, and the family belongs to tropical regions.

The RUTILIDÆ constitute the sixth family, which, for the most part, are brilliantly colored. The males are destitute of horns, in which respect they differ from the preceding family. The antennæ are ten-jointed, club three-jointed : the mandibles are short, but project more or less from beneath the coriaceous labrum; they are also notched on the outside near the tip. The elytra do not cover the abdomen.

The seventh family is allied to the preceding : it has received the name of ANOPLOGNATHIDÆ, and is composed, like the DYNASTIDÆ, of foreign species.

The eighth family, the MELOLONTHIDÆ, constitute a well-known group, which contains numerous indigenous species, with forms as delineated on Plate x, figs. 4 – 6, 9. They are ovate thin beetles, sometimes scarcely thicker behind than before. The labrum is divided into two lobes transversely; the mandibles are strong and horny, the internal margin acute at the apex. The clypeus is separated by a transverse suture, which runs just before the eyes : antennæ 9 – 10-jointed, terminated by a knob composed of a variable number of laminæ (from 3 – 7), variable also in form. The anterior margin of the mentum is notched or emarginate. Some of the species are large; but the colors are not brilliant, the surface being often pubescent and dull. The common *horn beetle*, or the *goldsmith beetle*, which fly about in the evening in the months of June and July, may well represent this family : they feed upon flowers or leaves, and are sometimes injurious in this way.

Passing the GLAPHYRIDÆ, the ninth family, which are all foreign to us, we reach the tenth and last family, the CETONIDÆ, a group which holds about the same place in the scale of importance as the MELOLONTHIDÆ. The antennæ are ten-jointed : the labrum is concealed beneath an emarginate clypeus; the mandibles are comparatively slender, lanceolate; the mentum is pitcher-shaped, and conceals the labium; the scutellum distinct: the elytra do not cover all the abdomen. The insects feed upon flowers, and hence do considerable mischief : their forms are delineated on Plate xii, figs. 4 – 6.

CLAVICORNES.

Byrrhidæ.

No species of this family have been found in this State.

Histeridæ.

HISTER CONFORMIS. (Plate xxxi, fig. 8.)

Color black : thorax bluish black, smooth, polished ; elytra without punctures, striate ; striæ obsolete. Length one-tenth of an inch.

LAMELLICORNES.

Lucanidæ.

GENUS LUCANUS (LINN.).

'Depressed mandibles of the male very large ; female moderate : club of the antennæ 'four-jointed, pectinated' (WESTWOOD).

LUCANUS DAMA (Fab.). *L. capriolus* (Linn.). (Plate xii, fig. 7.)

The insect is large, dark chestnut-brown, smooth and plain ; thighs lighter : mandibles of the male long and powerful ; female less powerful than the male. Length about $1\frac{1}{4}$ or $1\frac{1}{8}$ inch.

The male *Lucanus* may be recognized by its large and toothed mandibles, which stand out so prominently in front. The female differs from the male in the smallness of its head, which is partially concealed beneath the labrum and the oblique truncation of the lateral margin of the thorax. There is a considerable variation in the size of the individuals. It is not an uncommon species in New-York and New-England. The larvæ inhabit the trunks of decaying trees, or in wood.

PLATYCERAS PICEUS. (Plate xii, figs. 10, 11.)

The Genus PLATYCERAS belongs to this group. The mandibles are shorter than those of the LUCANUS, in both sexes : it is also a much smaller insect.

Color brown ; elytra distinctly punctate ; mandibles exsert, and each shows a strong curved subcentral tooth : in the female, the mandibles are shorter and less conspicuous. Length from one-half to six-tenths of an inch.

Fig. 10, male ; 11, female, with mandibles, antennæ and an elytrum.

Geotrupidæ.

GEOTRUPES ——. (Plate xii, fig. 2.)

Color brilliant steel-blue; beneath, clothed with yellowish brown hairs. Clypeus rough, with a central pointed tubercle (the thin edge of the clypeus is turned up in front); thorax smooth and shining upon its top, but confluently punctured at the margins; elytra marked with numerous punctate ridges. Length five-tenths of an inch.

This species I have been unable to refer to its proper name. "The *G. microphagus* is dark piceous above and beneath, and the legs are violaceous."

GEOTRUPES SPLENDIDUS. (Plate xii, fig. 3.)

Splendent green; purplish beneath. Thorax rather thickly punctured, and confluent on the sides; scutellum smooth, or with two or more punctures; elytra subtuberculated near the outer basal angle, angle somewhat rounded, and their surfaces are marked by rounded ridges punctate in the grooves: body beneath clothed with brown hairs. Length six-tenths of an inch.

GENUS COPROBIUS (LATR.).

Body ovoid; thorax dilated in the middle; scutellum none; abdomen nearly square; clypeus bidenticulated.

COPROBIUS LÆVIS.

Medium size: color dull black, finely punctured; elytral lines obsolete. The insect has a submetallic hue in some lights, but is generally dull. There are about eight obscure lines upon each elytrum: beneath, the body is naked, or destitute of hairs.

This insect is more common here than the *Geotrupes*. Common in June and July, when they may be seen engaged in rolling a ball of dung containing their ova, and which they finally bury.

ATEUCHUS SACER is a much larger insect, belonging to an allied genus, and is the sacred *Scarabæus* which entered so largely into the mythology of Egypt.

All these species fulfil an important place in the economy of creation; a fact which is more obvious in tropical regions than in the north.

Scarabæidæ.

Genus ONTHOPHAGUS (Latr.). Copris (Ill.).

Body broadly ovate, short, depressed : last joint of labial palpi evanescent; clypeus wider than long, emarginate; scutellum none.

Onthophagus hecate. (Plate xxxi, fig. 4.)

Small : dark brown, covered with white hairs, which give it a hoary appearance. Shield rather pointed and turned up; thorax terminated in a prominent plate, turned up at the angles; legs ciliated.

Onthophagus ovatus.

Rather small, ovoid, brown, smooth above; hairs sparse upon the legs and beneath. Shield marked with two parallel sharp transverse ridges.

Genus PHANÆUS (Mc.).

Basal articulation of the labial palpi larger than the others, and dilated at its internal edge : scutellum none, but its place is occupied by a small triangular extension of the thorax. Males furnished with tubercles or horns upon the clypeus, and prominences upon the thorax.

Phanæus carnifex. (Plate xii, fig. 5.)

Rather short, wide : elytra shorter than the head and thorax; shield with a single or double prominence behind; thorax rich purple green, and strongly sculptured; elytra rich purple-green, punctated and ridged; beneath green; upper surface of the legs purple.

The males are smaller than the females, and the clypeus is armed with a long and strong horn pointing backwards : in females, it is merely a tubercle, or may be two close together. The thorax of the male presents a broad, flat, nearly semilunar punctate disk. Length seven-tenths of an inch.

Occurs rarely in the vicinity of Albany : common in Maryland.

Genus APHODIUS (Ill.). Copris (Ol.); Scarabæus (Linn.).

Terminal articulation of the palpi cylindrical; mandibles destitute of a corneous tooth or lobe; form of the body gibbous.

All the species of the genus Aphodius live in the excrements of animals, where they occur often in great numbers. They are small insects, about one-fourth of an inch in length,

of a cylindrical form : some of the species are spotted, or variously colored. During the days of autumn they take wing in great numbers, flying sluggishly through the air. In Europe, *Lethrus cephalotus* is said to devour the tender shoots of plants, particularly of vines; but this seems to be an exception to the habits common to the family.

APHODIUS BICOLOR (S.).

Quite small, brown or black-brown; legs and beneath light fuscous : head and thorax finely punctured; edges of the elytral ridges finely notched; clypeus widely emarginate. Length one-fifth of an inch.

APHODIUS STRIGATUS.

Small : head and thorax very finely punctured, black, smaller than the preceding, obtuse at both extremities; clypeus convex; feet dark piceous; posterior angles of the thorax rounded.

APHODIUS TERMINALIS (S.).

Small, brown or blackish brown, shining : forelegs hairy; tips of the elytra and feet rufous; clypeus trituberculate and emarginate before; thorax marked with subequal punctures; elytra marked with punctured striæ.

APHODIUS COPRONIMUS (M.).

Quite small, light brown, shining : thorax rather mottled with darker brown, very finely punctured.

APHODIUS FEMORALIS (S.).

Blackish brown : edges of the thorax dilated and light brown; elytra fuscous and lighter in front; thighs light and translucent. Scarcely one-fifth of an inch in length.

APHODIUS ATERRIMUS (M.).

Small : thorax black; elytra dark brown; brown beneath.

APHODIUS SERVAL.

Brown : head finely punctured; thorax dark brown; elytra light brown and spotted, three in front, banded in the middle.

GENUS COPRIS (GEOFF.). SCARABÆUS (LINN.).

Body ovate, thick and convex; knob of the antennæ terminating in three leaves; four hindlegs dilated and truncated; scutellum none; articulations of the labial palpi three : the first joint is cylindrical, and not dilated at the internal side.

COPRIS CAROLINUS. (Plate xii, fig. 8.)

Body thick, obtuse behind : clypeus round and entire before, but furnished with a single notch in front of the eye, from which there is a depressed line running backwards, and terminating at the base of the tubercles, the middle of which is much the most prominent and pointed. The front of the thorax rises into a strong serrated ridge, and there are two lateral rounded depressions : the puncta are fine, and the posterior part is smooth, and marked with a slight central furrow which does not reach the elytra. Elytra strongly furrowed, and punctate. The abdomen appears as if truncated. The color is dark chestnut-brown : body beneath clothed with reddish brown hairs ; the margin of the thorax is ciliate. The dilatations of the tibiæ are similar to flattened funnels : the tibiæ of the forelegs are thick, and have four strong notches upon their outer edges. Length one inch.

This beetle is common in Virginia and Maryland, but I have not observed it in New-York, though *Cetonia* and *Phanæus*, which accompany it there, are not uncommon here.

This insect does not roll up a ball, but makes a collection or heap of soft and fresh manure, in which the eggs are deposited. It penetrates quite deeply into the ground beneath the droppings in pastures and by the roadsides.

Trogidae.

THIS is a family embracing but a few genera : they are ovate and gibbose, with inflex elytra. The head is deflexed, the thorax short and transverse, and the surface of the elytra rough. The antennæ are nine- or ten-jointed, and the extremity is formed of three leaves somewhat distant from each other : the labrum is coriaceous and exserted ; the labium is concealed by the mentum ; the mandibles are horny, and sometimes toothed.

This family is allied to the GEOTRUPIDÆ. The most reliable information is that they feed upon carrion, or decaying animal matter, being found in the carcases of dead animals : they have also been found in rotten wood, and at the same time they are known to inhabit sandy places under ground. Some of the family are apterous.

GENUS TROX (FABR.). SCARABÆUS (Linn.)

Antennæ ten-jointed ; body subovate, convex ; thorax rugous.

TROX FORCATUS. (Plate xxiv, fig. iii.)

Dull brown : clypeus rounded in front, and marked by a shallow transverse groove, angulated in the middle, with small pointed tubercles on the line of flexure ; thorax widely grooved in the middle ; elytra traversed by a series of reticulated lines, forming a species of network upon their surfaces and angles behind. Length half an inch.

TROX CAPILLARIS. (Plate xxiv, fig. 1.)

Brown, dull : elytra traversed by several rows of pointed or sharpened tubercles, standing between the fine parallel lines. Length two-fifths of an inch.

Dynastidae.

THIS family embraces the most gigantic beetles known : the genera are also numerous. The antennæ are ten-jointed : the first is robust, conic and hairy ; the second, subglobose ; the next five are short, and the head is composed of three laminæ in contact. The clypeus is frequently horned, as well as the thorax : head subtrigonal ; elytra truncate, leaving the end of the abdomen bare. The body is large and thick, the legs strong ; tibiæ broad and dentate.

This singular family have some of the habits of the GEOTRUPIDÆ : that of subsisting upon and in the excrement of animals, and decaying refuse matter from the vegetable kingdom.

Melolonthidae.

GENUS SERICA (MACLEAY). SCARABÆUS (Linn.).

'Form ovate. Antennæ ten-jointed : basal joint the largest ; the second the next, and the 'claws bifid : last joint of the palpi subacute' (WESTWOOD).

SERICA VESPERTINA. (Plate xxiv, fig. 9.)

Color light chestnut-brown, uniform : body small ; wider behind.

TRICHINUS (TRICHIUS) VIRIDANS. (Plate xxiv, fig. 5.)

Color of the head and thorax green : elytra obscurely striped ; margins marked with dark spots ; disk ferruginous, truncate, exposing the abdomen, punctured and marked by longitudinal lines ; abdomen hairy.

TRICHINUS ASSIMILIS.

Color black, hairy and glossy. Elytra marked near their bases with a light brownish patch, from each outer angle of which proceed two white oblique lines that nearly reach the margins ; and from the inner angles, two other white lines arise, which run parallel with the suture, and do not quite reach the truncated extremity : there is also an obscure line parallel with the last, and about half as long, which may not be constant. Posterior segment of the abdomen clothed with a dense coat of yellowish white hairs : abdomen below shining, and less hairy than the breast. Length rather more than one fourth of an inch.

Found in Western Massachusetts.

Genus PHYLLOPHAGA (Harris).

First joint of the antennæ largest and clavate; the fifth and sixth larger than the second, third and fourth; terminal leaves three or seven: maxillary palpi four-jointed, the fourth long and ovate: clypeus divided by a transverse suture before the eyes: thorax subquadrate: tibiæ somewhat dilated; claws equal, and armed with a nearly central tooth.

Phyllophaga quercina. (Plate x, fig. 9.)

Large: color chestnut brown, uniform; beneath covered with brown hairs. Abdomen naked; labrum rounded before, and punctured; elytra punctured, and their tips separated behind. Length about eight-tenths of an inch.

Phyllophaga drakii.

Large: color rather lighter brown than the preceding. Labrum traversed by a line dividing it into two unequal parts: rings of the abdomen finely punctured.

This species is rather larger than the *quercina*: length about nine-tenths of an inch.

Phyllophaga hirticula,

Noticed by Dr. Harris, is of a bay brown color, with punctures larger and more distinct than those upon the *quercina*, and, on each wing-cover, the hairs are arranged in three lines. Length seven-tenths of an inch.

Appears in June and July.

Phyllophaga georgicana.

Surface covered with short grayish yellow hairs. Length seven-tenths of an inch.

It occurs in New-York.

Phyllophaga pilosicollis. (Plate xxiii, fig. 7.)

Color pale reddish brown: hairs longest upon the thorax and base of the elytra. Anterior edge of the head entire, rounded and deflected, puncture dilated and shallow; lateral edge of the thorax dilated in the middle; elytra pale, testaceous, densely and equally punctured, and covered with short procumbent hairs. Length half an inch. Say.

Phyllophaga variolosa (Knoch.). *Melolontha variolosa* (Hentz).

This species differs essentially from the foregoing in the form and structure of the antennæ, the knob consisting of seven curved elongate leaves. Its color is light brown, with irregular depressions upon the elytra, which appear like accidental flexures or indentations made by some external force: it is clothed with long yellow hairs upon the breast. The clypeus is extended and reflexed, and the sutural line is before its middle.

The hairs, both upon the thorax and elytra, are arranged in four rather interrupted longitudinal belts. Length eight- to nine-tenths of an inch.

This species I had not observed in the vicinity of Albany till this year, 1853 : many individuals have been taken.

It may be remarked that most of the species of this genus are much alike, although generally smaller than that figured. The color varies from yellowish brown to chestnut, according to the species. The breast is more or less hairy, and the elytra are in some cases sparsely furnished with erect hairs. In the larva state they feed upon the roots of grass, and probably of grain, and thus they commit great havoc upon pastures, whilst the adult insects live upon the foliage of various plants.

These beetles are well known in the country by the name of *hornbugs*, and become troublesome by flying into the open windows where a lamp is burning. Their proper name is *May beetle*, a designation implying the time of their appearance among us. They are injurious both in their larva and perfect states : in the former, by their depredations upon the roots of grass and other herbage ; and in the latter, by the destruction of the young and tender leaves of fruit and other trees. They are supplied with strong jaws for cutting the leaves of plants, for which they are admirably fitted ; and their feet are strong, and fitted for digging in the soil after their transformations are effected. They were formerly included in the Genus Melolontha.

Maybugs have rarely been sufficiently numerous to inflict serious injury upon the farmer : the Hon. Mr. Barlow, however, records an instance where they did much damage in Madison county, in 1849 and 50 ; they ate the leaves of the cherry, elm, apple, butternut, etc., showing that they are by no means restricted to our cultivated fruit trees. The most effectual method of destroying them was to kindle fires at night in the immediate neighborhood of the trees they were injuring : attracted by the light of the blaze, thousands were destroyed with little difficulty, or at a trifling cost. Shaking the trees to dislodge them, was an effectual means of turning their attention to the light. They appeared the last of May and first of June, and continued from eight to twelve days.

Another instance is related by Dr. Fitch in the Journal of the New-York State Agricultural Society, where the *Phyllophaga quercina* appeared in great numbers and suddenly. He states that on the farm of Milo Ingalsbe, an orchard, consisting of about seventy plum together with many cherry trees, had their limbs stripped of leaves, buds, etc. while they were in bloom : the bugs were hatched out in the course of two nights, and completely destroyed all hopes of fruit for the season, even if the trees themselves survived defoliation.

The duration of the individual life of this insect is short, a week or two being the term during which it lives : there is, however, a succession of individuals of the species, so that the period which they remain is more than a month. After the pairing of the sexes,

the male soon dies, and the female perforates the soil to the depth of a foot, where she deposits her eggs : they are then abandoned, and she returns to the surface to remain a short time, when she also perishes. The eggs are said to hatch in about fourteen days. The grubs are whitish, and provided with six legs situated near the head, and a pair of strong jaws : their heads are brown. These are the grubs that are frequently ploughed up in old fields, of a grayish white color, an inch or more in length and a quarter of an inch thick : they lie flexed in the form of a circle. They live during the summer near the surface, subsisting upon the roots of plants, which they devour in large quantities : as winter approaches, they descend below the reach of frost, where they become torpid. Three or four seasons are spent in this way, till finally they form a ball of an oval shape, in which they enclose themselves and undergo their transformation.

The ravages of this grub may be much diminished by allowing crows and jays to frequent the grounds infested by them : indeed it is the most feasible way of getting rid of them ; and although most farmers and gardeners carry on an exterminating war with crows and blackbirds, yet these blackcoated vagabonds, as WILSON calls them, are by no means such great rascals as they are represented : they have redeeming qualities, and the destruction of grubs and wireworms are real benefits which they confer upon the farmer. The beetles themselves are devoured by skunks.

The beetles of this genus have been very abundant at distant intervals : almost incredible accounts are given of their numbers, especially of the European species.

Among the numerous remedies recommended for destroying the larva, ploughing, no doubt, would have the effect of throwing many of them within the reach of frost ; but if done too early, they would have time to bury themselves again. The larvæ and perfect insects are frequently seen when the ground is broken up in the spring ; and many are then destroyed by crows and blackbirds, which follow the ploughman to gather whatever may be exposed suitable for their sustenance : they are also destroyed by foxes, weasels, owls, and, according to Dr. HARRIS, the skunk.

The following extracts are from LOUDON's Magazine of Natural History, Vol. vi, p. 142 – 4 : the rook is a species of crow.

'A strong prejudice is felt by many persons against rooks, on account of their destroying grain and potatoes ; and so far is this carried, that I know persons who offer a reward for every rook that is killed on their land ; yet so mistaken do I deem them, as to consider that no living creature is so serviceable to the farmer, except the live stock he keeps on his farm, as the rook. In the neighborhood of my native place is a rookery in which it is estimated there are ten thousand rooks ; that 1 lb. of food a week is a very moderate allowance for each bird ; and that nine-tenths of their food consist of worms, insects, and their larvæ : for although they do considerable damage for a few weeks in seedtime and a few weeks in harvest, particularly in backward seasons, yet a very large proportion of their food, even at these seasons, consists of insects and worms, which (if we except a few

acorns in autumn) form at all other times the whole of their subsistence. Here, then, if my data be correct, there is the enormous quantity of 480000 lbs. or 209 tons of worms, insects and their larvæ, destroyed by the birds of a single rookery; and to every one who knows how very destructive to vegetation are the larvæ of the tribes of insects (as well as worms) fed upon by rooks, some slight idea may be formed of the devastation which rooks are the means of preventing. I have understood that in Suffolk, and in some of the southern counties, the larvæ [of insects allied to *Lachnosterna*] are so exceedingly abundant that the crops [of grain] are almost destroyed by them, and that their ravages do not cease even when they have attained to a winged state. Various plans have been proposed to put a stop to their depredations; but I have little doubt that their abundance is to be attributed to the scarcity of rooks, as I have somewhere seen an account that rooks in those counties are not numerous.

'A flight of grasshoppers visited Craven, and they were so numerous as to create considerable alarm among the farmers: they were, however, soon relieved from their anxiety; for the rooks flocked in from all quarters by thousands and tens of thousands, and devoured them so greedily that they were destroyed in a short time.

'It was stated in a newspaper a year or two back, that there was such an enormous quantity of caterpillars upon Skiddaw, that they devoured all the vegetation on the mountain, and people were apprehensive that they would attack the crops in the enclosed lands; but the rooks, having discovered them, in a very short time put a stop to their ravages.

'An extensive experiment appears to have been made, the result of which has been the opinion that farmers do wrong in destroying rooks, jays, sparrows, and indeed birds in general, on their farms, particularly where there are orchards. That birds do mischief occasionally, there can be no doubt; but the harm they do in autumn is amply compensated by the good they do in spring, by the destructive havoc they make among the insect tribes. The quantity of grubs destroyed by rooks, and of caterpillars and their grubs by the various small birds, must be annually immense. Other tribes of birds, which feed on the wing, as swallows and martins, destroy millions of winged insects. Even some, usually supposed to be so mischievous in gardens, have actually been proved only to destroy those buds which contain a destructive insect. Ornithologists have of late determined these facts to be true; and officers would do well to consider them, before they waste the public money in paying rewards to idle boys and girls for the heads of dead birds, which only encourages children and other idle persons in the mischievous employment of fowling. On some very large farms in Devonshire, the proprietors determined, a few years ago, to try the result of offering a great reward for the heads of rooks; but the issue proved destructive to the farms, for nearly the whole of the crops failed for three succeeding years, *and they have since been forced to import rooks and other birds to re-stock their farms with.*'

AREODA LANIGERA. (Plate x, fig. 4.)

Large, golden yellow and immaculate : scutellum and thorax give a green reflexion, brassy in certain lights. Elytra terminated by a rounded ridge, terminating in a prominence behind, densely haired beneath.

It is one of the most common and beautiful beetles of this country. It takes its specific name *lanigera*, wool-bearing, from the dense woolly coating with which its abdomen and parts beneath are supplied : it is also called the *goldsmith beetle*, from its beautiful color above ; though this name is likewise applied to the *Gymnetis nitida*, which is about the same size, and of a greenish color margined and varied with fulvous. It may be recognized by wanting the triangular scutellum at the inner base of the elytra, this portion having no apparent juncture with the prothorax.

The *Areoda* is about nine-tenths of an inch long, broad oval in shape, of a lemon-yellow color above, burnished like gold on the top of the head and thorax : the underside of the body is copper-colored, and thickly covered with whitish wool ; and the legs are brownish yellow, or brassy, shaded with green.

'These fine beetles begin to appear in Massachusetts about the middle of May, and continue generally till the twentieth of June. In the morning and evening twilight they come forth from their retreats, and fly about with a humming and rustling sound among the branches of trees, the tender leaves of which they devour. Pear-trees are particularly subject to their attacks ; but the elm, hickory, poplar, oak, and probably also other kinds of trees are frequented and injured by them. During the middle of the day they remain at rest upon the trees, clinging to the underside of the leaves ; and endeavor to conceal themselves by drawing two or three leaves together, and holding them in this position with their long unequal claws. In some seasons they occur in profusion, and then may be obtained in great quantities by shaking the young trees on which they are lodged in the daytime, as they do not attempt to fly when thus disturbed, but fall at once to the ground. The larvæ of these insects are not known : probably they live in the ground, upon the roots of plants.' HARRIS's Report, p. 22 – 3.

This insect seems to be local in its distribution, as it occurs plentifully in the public squares of Philadelphia, whilst it is rare in the interior of Pennsylvania.

PELIDNOTA PUNCTATA. (Plate x, fig. 6.)

Large, fuscous brown and uniform : head greenish behind, extending along the sides. Sides of the insect marked with four black spots, one upon the thorax, and three upon the elytra and standing in a line ; beneath, the color is green, glossy or submetallic. The rings of the abdomen are marked each with a single row of punctures.

The *P. punctata* is a fine beetle, with elytra of a pale brown or tile-color, and marked as described above : the thorax is darker than the elytra ; beneath, the body is brassy green. They fly by day, and feed almost exclusively on the leaves of the grape, and hence

may prove injurious to the vine : still their numbers are rarely such as to render them a formidable foe. The only mode of destroying them, which is recommended, is to pick them off and crush them under the foot. The larvæ are scarcely injurious, inasmuch as they live in rotten wood, as stumps of trees, and such trunks as are decaying upon the ground : they may be regarded rather as beneficial, by aiding the entire destruction of that which only cumbers the ground.

The perfect insect prevails during the months of July and August.

P. MACULATA, an allied species or variety, has the legs and extremity of the abdomen of the same color as the upper parts. 'These beetles fly by day, but may also be seen at the same time on the leaves of the grape, which are their only food : they sometimes prove very injurious to the vine. The only method of destroying them, is to pick them off by hand, and crush them under foot. The larvæ live in rotten wood, such as the stumps and roots of dead trees, and do not differ essentially from those of other scarabæans' (HARRIS, p. 23). In the variety which Dr. MELSHEIMER has designated *impunctata*, the spots are absent.

GENUS CREMASTOCHEILUS (KNOCH).

Thorax quadrangular, anterior angles prolonged; first joint of the antennæ dilated : mandibles terminating in a strong curved or scythe-like tooth, and furnished with small spines in place of the internal lobe; last articulation of the palpi long and cylindrical : mentum a reversed heart in form; upper angles rounded, without emargination (*Règne Animal*).

CREMASTOCHEILUS HENTZII. (Plate xxvi, fig. 2.)

Color black; form quadrate, sides parallel; upper surface punctured : elytra ridged and coarsely punctured. The whole surface is clothed with procumbent hairs; beneath, they are stiff, or somewht spinous. Length one-half of an inch.

OSMODERMA SCABER. *Gymnotus s.* (Kirby); *Trichius s.* (Palisot de Beauv.). (Plate xii, fig. 9; and plate xxv, fig. 5.)

Color black, or very dark brown and brassy. Body ovate, flattened; thorax round, dilated transversely, purplish, strongly punctured, and marked by two rounded ridges before; elytra deflexed at the shoulders and behind; surface sculptured, and rather rough than punctured; scutellum very acute : beneath dark brown, smooth and glossy; legs long, purplish; tibiæ trispinous upon their outer edges.

The female is larger than the male, and measures an inch in length; the male, about eight-tenths of an inch. The name *Osmoderma*, given by the French naturalists, is indicative of the odor the insect imparts to the hands when handled. They fly by night, and are common in New-England and New-York in the month of July.

Mr. Harris mentions another species, called the *O. ercnicola* : its color is deep mahogany brown, smooth, polished ; the male has a deeper tint before the middle of the thorax.

Genus DICHELONYCHA (Harris).

Labrum transverse, lanceolate ; mandibles short, trigonal, incurved, acute and toothless ; maxillæ minute, linear, bidentate, teeth short ; first joint of the palpi minute, the second longer than the third : antennæ nine-jointed.

It is more quadrangular and elongated than the Genus Macrodactylus.

Dichelonycha elongata. (Plate xxv, fig. 1.)

Color light brown : body quadrate, or with parallel sides, and the head extremity equalling the base ; elytra punctured, and marked with a greenish stripe. Length rather more than one-fourth of an inch.

Genus EUCHLORA (Macleay). Anomala (Mergerle).

Euchlora cœlebs (Gr.). (Plate xxiv, fig. 6.)

Yellowish brown ; back part of the head, and central part of the thorax, shaded with darker brown ; elytra bordered with brown.

Var. *atrata*. Darker brown, nearly black (fig. 8).

Genus HOPLIA (Illig.).

'Antennæ ten-jointed ; claws simple, but unequal' (Westwood).

Hoplia trifasciata (S.). (Plate xxiv, fig. 4.)

Rufous : surface thickly covered with scale-like grains, with downy hairs ; beneath silvery, or rather brassy. Elytra traversed transversely by three paler bars, confluent with the darker : post-abdomen covered with brassy granules, similar to the abdomen ; legs very long. Female darker than the male. Length one-fourth of an inch.

Macrodactylus subspinosa (Latr.). *Melolontha s.* (Fab.). (Pl. v, fig. 13.)

Color yellow or ashen or drab, and clothed with a short dense down. It is slender before, but comparatively thick, full and obtuse behind, but tapers gently from the base of the elytra to the extremity of the abdomen, the point of which is exposed : labrum projecting over the mouth ; thorax protuberant laterally, becoming spinous ; elytra covered closely with drab-colored hairs, nearly covering the extremity of the abdomen : beneath, the abdomen protuberant and greenish ; legs long, rufous, and but sparsely hairy ; joints of the tarsi dark brown, and surrounded with small spines : this is more conspicuous upon the hindlegs.

The *rosebug*, or *cherrybug*, as it is called, is very destructive. Its generic name *Macrodactylus*, is derived from the length of the feet; and its specific or trivial name *subspinosus*, from an incipient spine or swelling upon the sides of the prothorax. It is of a dull yellow color, about three-eighths of an inch long, and appears in great abundance in the spring, destroying roses and the blossoms of various plants, as well as the foliage of fruit trees, including the apple, cherry, plum, and that of the grape.

Dr. Harris has the credit of being the first to give a satisfactory history of this insect, as published in his Report.

I have been in the habit of destroying this insect, as well as the *Ericsoma mali*, or the *appletree blight*, by hand-crushing. When there is little or no grass beneath the trees, they may be beaten down and crushed with the foot; the best time being the morning, when they are somewhat torpid. They may be collected upon sheets, or in vessels with a little water to prevent their escape; to be subsequently burned or scalded. Plants infested should be visited once or twice a day, and every effort made, by destruction of the present brood, to diminish that of the next season.

Genus CETONIA (Fab.).

Antennæ short, the basal joint largest and robust, glabrous; the head three-leaved, elongated: palpi short; last joint cylindric tapering; mandibles short; clypeus quadrate, entire in front; thorax subtrigonal; elytra sinuate at the outer margin near the base; scutellum elongate and acute; sternum produced and rounded anteriorly.

Cetonia inda. *Scarabæus indus* (Lin.). (Plate xii, fig. 6.)

Body ovate and rather depressed, pilose above and beneath. Clypeus deflexed and truncate: thorax subtriangular, sinuate before, centre of the sinus subdentate, broadly sinuate behind for the reception of the scutel; scutel an isosceles triangle; elytra light brown with black spots scattered over their disks and sides, margins sinuate, behind truncate, exposing the abdomen; legs hairy and brown; abdomen brown, glossy.

The thorax is more densely clothed with hairs than the elytra; the latter are sprinkled with spots and dots which are nearly black, some angular, and others sinuate. Color of the abdomen and legs nearly uniform: the thorax is also spotted beneath the hairs; the sinuated base is naked and fuscous. Length six-tenths of an inch.

This insect appears twice in the season; first in March or April, and last in September: the latter, as Dr. Harris supposes, is a newly hatched brood, as at no time during the summer is an individual to be found.

These insects appear upon various autumnal flowers, as the goldenrod, in search of pollen and honey, and are fond of the sap and sweet juices of trees and plants. They are

charged, however, with frequenting orchards and feeding upon the ripening fruits : particularly do they select the best peaches, which, if they do not entirely devour, they greatly injure by biting them. The distinguished naturalist last above named mentions that he has taken a dozen from a single peach.

When cold weather approaches, they are supposed to secure themselves in some sheltered place, and pass the winter. The March brood, as I have often observed, appear to issue directly from the ground; and at numerous places they may be seen in numbers, flying low, and hovering over the ground like humblebees, upon which they alight and are lost in the dead grass and leaves, or penetrate again into the earth.

The genera of this family are numerous, and are known as *flower beetles*. The European species *Cetonia* (*Epicometis*) *hirta* is said to destroy apricot blossoms in Malta; and another, *Cetonia cardui*, visits beehives, and destroys the wax and honey (*Revue Zoologique*, vii, 96). Plates of lead, with small perforations for the bees, were put over the place of ingress; but the cetoniæ soon enlarged them : zinc was then substituted, and found to answer as a protection.

CETONIA FULGIDA (Fab.). (Plate xii, fig. 4.)

Body depressed, ovate. Head small, green above : thorax triangular and brilliant green, margined with luteous; its sides are also slightly dilated; base slightly sinuous for the reception of the scutel, which is an isosceles triangle and green. Elytra luteous, sometimes they show a greenish tint, truncate and deflexed behind : at the deflexure they are prominent; the prominence terminates an obscure ridge which runs from the shoulders of the elytra; the suture is also elevated, so as to form a central ridge. Behind, the abdomen is marked with four triangular mouldy spots : spots similar to these extend along the sides of the abdomen; legs luteous, glossy; sides of the breast hairy; tarsi and base of the cubits brown, nearly black. Length six-tenths of an inch.

This insect, which is very common in Maryland, is not very numerous, as I have observed, in New-England and New-York : it is more common in the paths in groves than elsewhere.

CHAPTER VI.

ORDER I. COLEOPTERA (Continued).

PRIOCERATA.

The next subtribe of pentamerous beetles is named Priocerata by Mr. Westwood (*Serricornes*, Latr.). They comprise those families whose antennæ are short, or only of a moderate length, with an equal thickness throughout, and generally attenuated at the tip rather than thickened : they are eleven-jointed, but their peculiar characteristic consists in being serrated upon their inside ; hence the name *serricornes* by Latreille : in the males, they are sometimes pectinated. The insect has two short robust maxillary and labial palpi : body elongate and narrow ; elytra narrowed behind, covering the abdomen.

The Priocerata are divided into two sections, the *Macrosterni* and the *Aprosterni*, by Westwood. The first comprises the old genera Buprestis and Elater, the consistence of whose bodies is firm, and their forms elliptic and elongate, but narrowed behind : their legs are short, and either partially or wholly retractile ; and their heads are short, and are received into a cylindrical excavation in the prothorax, or in front up to their eyes. The pectus advances beneath the mouth, and is also produced behind to a point.

These beetles, for beauty and splendor of coloring, are among the finest of the class of insects : they are rich in the metallic hues which ornament their bodies and elytra. They fly swiftly, but walk slowly, from the shortness of their legs. They make their escape, when in danger of being captured, by falling suddenly into the grass and weeds.

The Buprestidæ, or *bupestrians*, have an oval form, being widest behind the thorax and obtuse before, but narrower behind and frequently acute : their bodies are also wider than deep, with a thorax wider behind than before. The head, according to the typical character of the family, is sunk into the thorax up to the eyes : the antennæ are short, and serrate on the inside. The thorax is widest behind, and fits very closely to the base of the elytra. The legs are set widely apart, and are short, and hence their stand is firm : the soles of the fourth joints of the feet are furnished with spongy cushions, and the foot terminated with two claws : the scutel is small. The insects are rarely seen, except in hot sunny days, when they may be found on fences, limbs of trees, or sides of houses, basking in the sun : they never fly in the night.

Although the buprestidæ are among the most elegant and beautiful of the coleoptera, yet their larvæ are one and all more or less injurious to fruit and forest trees. The eggs of the female are deposited upon the trunks and limbs of trees, and, when hatched, the young grubs penetrate slowly through the bark; and as they are often many years in coming to maturity, time and opportunity is given for extensive injury: it is here they undergo their transformation.

The larvæ of this natural family of insects have a very close resemblance to each other, and hence a brief description of a single species will be sufficient to convey an idea of their general characteristics. These larvæ, then, are white or yellowish white, rather long, narrow and somewhat flattened, and furnished each with a small brown head sunk into a suddenly and abruptly widened out thorax, conveying at first view the impression that the head is very large, whereas it is only two or three of the last rings that are thus suddenly widened out and enlarged: the upper jaws are supplied with three black teeth. There are no legs or other apparatus for locomotion, except two tubercles placed on the under side of the second from the thorax. When drawn out of its burrow, the larva progresses by a kind of wriggling motion, frequently rolling over, though not so often as the more cylindrical larva of the boring coleoptera. They are found both beneath the bark and in the wood: under the bark, they lie partly coiled, or in the form of a semicircle. The pupa bears a very close resemblance to the perfect insect: it is found very near the outer surface of the bark, so that when the transformation is complete, the insect has only to perforate a thin scale of bark to escape from its prison into open day.

The oaks, hickories and pines are the kinds of trees most usually infected with the bupestrian larvæ; and, unfortunately, our knowledge of the ways and means by which these larvæ may be destroyed are few and uncertain: the knife and wire are the only infallible means to remove them, when once they are in possession of the premises. Our preventive means, however, in the case of fruit, are more effectual; such as scraping and washing the trunk and large limbs, at those seasons of the year when they are known to deposit their eggs. This kind of care and attention is rarely bestowed except in the spring, which, so far as the family of borers is concerned, is perfectly ineffectual, as their eggs are laid in the months of June, July and August. The perfect insect, though it may feed on leaves, is comparatively harmless. There is, however, no provision which is so important to keep in check the ravages of these and all other insects, as the preservation and protection of birds. The woodpecker in particular deserves the protection of the farmer, inasmuch as it is eminently successful in detecting the presence of the larvæ of the borers, as well as very expert in dragging them from their burrows.

Buprestidæ.

Genus BUPRESTIS (Linn.).

Antennæ subfiliform, serrated in both sexes; basal joint elongate, subclavated; terminal one small. Palpi, maxillary subfiliform, the terminal joint slightly tumid; labial, minute, the labrum attenuated and slightly emarginated in front. Mandibles slightly bifid at the apex: maxillæ small, somewhat bilobed at the tip. Head deflexed, short, retuse: thorax with the posterior margin closely applied to the base of the elytra; the latter elongated, trigonate, entire or serrated: legs slender; tarsi with the penultimate joint bilobed (Stephens).

A. *Elytra dentate, and serrate at the apex.*

Buprestis (Chalcophora) virginica (Drury). (Plate v, fig. 5.)

Form oval: color dark brown and sometimes almost black, with brassy metallic reflections, more distinct beneath. Surfaces, above and beneath punctured; above, sculptured in interrupted parallel lines. Top of the head deeply indented longitudinally; indentation linear, and extending to the front. Thorax marked by three distinct eminences, one of which is central. Elytra margined, sculptured or interruptedly ridged; base coarsely plicated; outer angle rounded and serrate; inner angle terminated by a very short spine: the under side is furnished with a short whitish down. It is nearly an inch in length, and quite robust.

The larvæ inhabit pine trees, to which they are very injurious. The perfect insect appears in June.

Buprestis fulvo-guttata (Harris). *B. americana* (Kirby).

Above black bronze; underneath metallic, glossy, punctured. Scutellum very small. Thorax marked by waving transverse lines. Elytra granulated and ornamented with six yellowish spots, but variable in number; tops rounded: underside of the abdomen, near the extremity, thickly punctured. Length 3- to 4-tenths of an inch.

The forelegs in this species are without teeth. It is the *B. drummondi* of the fourth volume of the *Fauna Boreali Americanæ*.

Found upon trunks of the white pine in June.

Buprestis (Anoplis) fasciata (Fab.). (Plate v, fig. 1.)

Flattened above. Color fine brilliant green, nearly of one uniform tint, punctured above and beneath. Mandibles stout and black: eyes black, ovate: thorax has four slight depressions: scutellum small and triangular. Elytra finely lined, and marked by transverse yellow bands: the first is a mere oblong transverse spot, near the middle;

the largest, is an undulating band extending nearly across the elytrum, and the last is a spot near the apex : the spots are surrounded with a black glossy border. The apex has a steel-blue reflexion, and is bidentate.

This is one of the finest beetles belonging to this family : it varies in length from four to six-tenths of an inch. The bands are variable in number : they are found some with three, others with two, which is the most common, and still another variety has only one.

[I have observed, in some of the plates, the color of the figure is too black, and the green too indistinct.]

BUPRESTIS ——. (Plate xxxi, fig. 11.)

Slightly depressed, widened posteriorly and punctured. Mandibles narrow, black ; beneath purplish green : eyes black : antennæ green : head and thorax green, cupreous and metallic. Elytra bordered with metallic purple ; disk green, forming a middle longitudinal band ; also marked with four elevated lines, truncate, and terminated at the inner angle with a minute spine.

This beautiful species was found at Albany : its elytra are finely bordered with purple ; the sutural line is divided into two near the base, and is dotted between. It appears to be rare, as it is the only one I have seen in any of our collections.

BUPRESTIS (CHRYSOBOTHRIS) DENTIPES (Germar). (Plate v, fig. 2.)

Depressed or flattened, oblong oval, purplish copper-color above ; beneath copper-colored, finely punctured. Surface covered in patches with a kind of shagreen. Thorax marked with two elevated lines : elytra rounded behind.

This species is still less convex than the *divaricata* : its metallic hues are less distinct, it is destitute of denticles at the apex of the wing-covers, its eyes are much smaller, and its mouth differently constructed. It inhabits the different species of oaks, and is not found about our fruit orchards or gardens. It is the *B. characteristica* of HARRIS (New-England Farmer, Vol. viii, p. 2).

BUPRESTIS (CHRYSOBOTHRIS) FEMORATA (Fab.). (Plate v, fig. 3.)

Rather depressed. Color black and bronzed above, glossy and metallic beneath : upper side the abdomen is green, punctured above and underneath. Eyes gray. Head is marked with an elevated line, and covered with short whitish hairs in front. Elytra rounded ; the posterior edge subserrate, or scarcely serrated.

This species is smaller than the *dentipes*. It has a well marked tooth inside of the thigh of the forelegs. The elytra are rather shorter than the abdomen, and have an approach to three pair of impressed gray transverse spots. It varies in size ; not exceeding, however, half an inch in length.

I took many individuals of this species in Canandaigua several years since, in June, upon a black oak. The foregoing species appear to be widely distributed.

B. *Margin without serratures.*

BUPRESTIS DIVARICATA (Say). *Cherrytree Buprestis.* (Plate v, fig 4.)

Convex; greenish cupreous above, purplish and metallic beneath, confluently punctured above and beneath. Elytra attenuate, divaricate or divergent at their tips: thorax indented before the scutel; scutel small and indented: elytra marked with lines and with abbreviated elevations; tips narrowed and prolonged beyond the abdomen, and truncate and submucronate on the inner side. Length seven-tenths of an inch.

According to SAY, it resembles the *lurida* of FABRICIUS in general appearance.

BUPRESTIS LURIDA (Fab.).

Above dull brassy; beneath brassy with purplish hues and bright, confluently punctured above and beneath. Mandibles black: eyes dark brown or black: thorax dilated before its middle, coarsely sculptured, and impressed with grooves rather than lines. Elytra coarsely sculptured, marked with wider abbreviated lines, and connected by branching ridges; behind they are slightly attenuate, projecting just beyond the pointed abdomen, and terminated with two submucronate points.

This species differs from the former, in being destitute of lines, having fewer confluent punctures, coarseness of the markings, less attenuated tips of the elytra, and their termination in two short spines instead of one. The larva is described by Mr. HARRIS as destructive to the pignut hickory: it is of a yellowish white; long, narrow, depressed in form, and abruptly widened at the anterior extremity: head brown, small, and deeply sunk in the forepart of the first segment; jaws three-toothed, black: no legs, nor substitutes except two small warts on the underside of the second segment of the thorax.

These grubs exist in the wood and beneath the bark, sometimes in great numbers: the pupa resembles the perfect insect.

AGRILUS RUFICOLLIS, a member of the Family BUPRESTIDÆ, was described by Professor HALDEMAN in the American Quarterly Journal of Agriculture and Science, Vol. iv, p. 200, fig. 1, as follows: 'This little insect, so hurtful to the raspberry, is about three lines long; black, minutely punctured, thorax and front brassy; front with a vertical impression: a wide shallow impression across the thorax posteriorly, and another at the base of the elytra. In this particular case, the knowledge of the appearance of the insect is not essential, as far as the means of preventing its depredations are concerned, although it is always interesting to know whence an injury proceeds.

'In its larva state, *Agrilus ruficollis* lives at the expense of the cultivated *Rubus* (raspberry), in the heart of which the pupa may be found in the month of May, the imago appearing in June. The larva bores between the wood and bark, injuring the plant, and causing a wide unsightly excrescence: it next penetrates to the pith, which it traverses for two or three feet, finally excavating a cavity in which it undergoes its transformations.'

Elateridæ.

The most distinct characters of this family are found in the form and structure of the posterior part of the thorax and sternum : the sides of the former are prolonged into a tooth, and the latter is produced into a spine which fits into a groove of the abdomen. This arrangement of parts enables the insect, when upon its back, to spring upwards and alight upon its feet : this is the only mode by which it can recover its standing, when accidentally upset ; and from this circumstance these insects are called *spring beetles*, or *snapbugs*. Their antennæ are short and filiform, and either serrate or pectinate ; the palpi terminate with a triangular or reniform joint ; the mandibles are bifid at the apex : body linear and depressed : thorax with the hinder and lateral angles produced into a point ; the margin is also grooved for the reception of the short antennæ. The sternum is produced behind into a spine, which fits into a groove in the base of the abdomen. The females are furnished with a tripartite ovipositor.

In this family, as in the preceding, the head is received into the thorax deeply, and the legs and antennæ are short and slender.

The larvæ live upon the roots of vegetables, wood, etc., and are very injurious to corn and herbaceous roots. They are known in New-York and New-England by the name of *wireworms*, from their form and hardness : they resemble, however, a species of Iulus, which belongs to the Class Myriapoda, and should therefore not be confounded with it ; a mistake which it is quite unnecessary to commit, as the myriapod has many feet, while the wireworm has only six.

Although the elateridæ, in their perfect state, are closely allied to the buprestidæ, yet their larvæ have feet, while the larvæ of the latter family are destitute of them : so the enlargement or dilatation near their heads is equally distinctive ; but there is one kind of resemblance common to both, for they both live several years in the larval state, and hence have abundance of time to do much injury. When a field becomes infested with wireworms, the indian corn and other cultivated crops are often entirely destroyed, and many times require replanting. The larva eats either through the kernel after it is swollen, or else through the young shoot. I have seen two wireworms in the same swollen kernel. They attack grass, and all the cereals ; and in consequence of their long continuance in this state, the soil becomes infested with them.

Soils which are the most infested with these larvæ are usually poor ; and one of the most effective modes that can be adopted in the cultivation of such land, is to enrich it. Another mode which aids very materially in the extirpation of the wireworm, is to plough late in the fall : it is supposed that by exposing the ground freely to the action of frost, the larvæ must perish from cold.

Much has been said in the agricultural journals about the use of substances supposed to be noxious to this insect, still there is no proof that any such remedy has been effectual. Salt is usually relied on, but experience does not sustain its use. So far as salt contributes to the amount of fertilizing matter, it will prove useful : beyond that, it is useless.

In gardens where these larvæ are common, Mr. Harris recommends the English mode of extirpating them : this mode consists in baiting them with slices of potatoes or turnips, which are scattered over the ground at night. Early in the morning the larvæ are found above ground feeding upon the bait, when they are collected and destroyed.

Genus ELATER.

This genus is characterized by the shortness of the antennæ, which have a short robust basal joint, the second and third joints small and subglobose, and with their margins serrate upon their outer sides. Head small and retracted ; eyes small : thorax generally elongate, with the posterior angles produced : body only slightly convex, linear elongate, sometimes subovate : legs short ; tarsi simple.

Elater (Alaus) oculatus (Fab.). (Plate v, fig. 6.)

Form elongate, depressed. Color black, sprinkled with gray. Head small : thorax large, quadrangular, and marked by two ovate black velvety spots situated rather in advance of the middle. Elytra are marked with slender lines ; posterior angles rounded. The underside of the body, and of the legs, is covered with a gray mealy substance.

This singular beetle is found in midsummer upon walls and fences. It is one of our largest beetles ; varying, however, from $1\frac{1}{4}$ to $1\frac{3}{4}$ inches in length : the largest specimens are nearly half an inch wide. It is glossy black, powdered with white specks. The head has a deep wide impression ; the prothorax is an oblong parallelogram, and the eyelike spots are surrounded by a white ring. It is widely distributed, as I have found it south and north. It appears, therefore, at different times in different latitudes : in North-Carolina, the last of May ; in Pennsylvania, in June ; and in New-York and New-England, in July and August.

Mr. Haldeman has found the larva of this beetle in ash trees in an incipient decay : it is of various sizes. Mr. Harris has found the larva in old apple trees : it is not, therefore, confined to a single species of trees. In old trees infested with them, it is recommended to remove and burn them.

The larvæ are of a yellowish white color, or reddish ; and, when fully grown, the largest individuals measure two and a half inches in length. The head is rough, brown and broad ; the mandibles are strong and curved : they have six legs, and the last segment of the body is furnished with a prop foot ; and the sides are armed with hooks and short spines.

ELATER (PYROPHORUS) NOCTILUCUS.

This species is noticed merely to state the fact that some of the spines are phosphorescent : they constitute the *fire beetles* of the West Indies, and feed upon the sugar cane. They resemble the *oculatus* in form and size, but the eyelike spots give out a strong light; so also it is emitted from the segments of the body.

ELATER (MELANOTUS) COMMUNIS (Schönherr).

Color light brown, hairy, subacute behind : thorax furrowed in the middle : elytra, at their bases, are marked with about five sulci. Length half an inch.

It is common during the spring and summer months.

ELATER (MELANOTUS) GLANDICOLOR. (Plate v, fig. 9.)

Color brown : head small ; head, thorax, elytra and abdomen covered with white or ash gray hairs. Elytra narrowed behind; anterior margin or base marked with 3 short sulci.

ELATER (MELANOTUS) CINEREUS.

Color brown; hairy. Thorax punctured, and marked by about ten obsolete cross lines : they give the appearance of a reticulated structure. Length about half an inch, and is found in April, May and June.

ELATER (LUDIUS) APPRESSIFRONS (Say).

Color chestnut-brown, but hoary from being clothed with short yellow close-pressed hairs; cylindrical, slender. Angles of the thorax prolonged : elytra finely punctured, and also marked by slender lines. Length about half an inch.

According to Dr. HARRIS, the females are more robust and larger than the males, and the *brevicornis* of SAY is identical with this species. The elytra are marked by about ten distinct lines each : the legs are lighter colored than the elytra, and clothed with hairs; and the prolonged outer angles of the thorax are excurved.

ELATER (AGRIOTES) OBESUS (Say).

Color reddish brown : body somewhat dilated and short : scutel rounded and hairy. The elytra are punctured, and clothed in much the same manner as the foregoing. Length less than half an inch. The lines of the elytra are only about seven in number, and the hairs upon the upper side are arranged in lines or stripes.

It is found in the spring among the roots of grass, and it is observed by Mr. HARRIS that its grub resembles the wireworm of Europe.

ELATER ——. (Plate v, fig. 7.)

This species was found dead : it is much larger than the *appressifrons*, and of a light brown color. I believe now that though it may not be a common species, still, as it is faded, it will probably be a matter of doubt to what species it really belongs, and therefore I omit further allusion to it.

Lampyridæ.

The glowworms and fireflies constitute a part of this interesting family of insects. Their bodies are elongated and greatly depressed, and soft : the elongation affects the abdomen, the thorax and head being very short, and the latter concealed in the former. The females are sometimes destitute of wings. Their colors are dull, though a considerable variety exists, and the markings of the thorax are very peculiar, the ornamental colors consisting of red and yellow combined with black. They are said to be voracious, and feeders upon flesh, subsisting upon snails, etc. When alarmed, they fold up their antennæ and feet, and remain motionless : if disturbed, they fall into the grass or leaves. They are common on fences and walls during the summer and spring. Some species fly into the windows at night, being attracted by the light of the candle.

The family is characterized anatomically by the different authors as having filiform or serrated antennæ, with compressed joints ; the penultimate joint of the tarsi bilobed ; the parts of the mouth small : mandible small, acute and curved.

Genus LAMPYRIS (Lin.).

'Head not rostrated, covered by thorax : females apterous : mandibles entire' (Westwood).

Lampyris nigricans (Knoch). (Plate xxi, fig. 3.)

'Brownish black : thorax with a rufous spot each side within the margin' (Say).

The margin of the thorax appears wetted, and the thorax is edged with brownish.

Lampyris scintillans. (Plate xxi, fig. 5.)

Disk of the thorax rufous, with an angular brown spot in the centre ; border yellow : elytra brown, bordered with yellow.

Lampyris angulata. (Plate xxi, fig. 4.)

Color pale fuscous, the darker indistinctly defined. Thorax marked with an angular and pointed patch of brown on its posterior part, and surrounded with rufous : sides of the brown anterior part furnished with a pair of oval yellowish spots. Elytra brown, bordered with yellow.

Lampyris laticornis. (Plate xxi, fig. 2.)

Antennæ conspicuous and compressed. Thorax ornamented with an oval central black spot, pointed before, and bordered with rufous ; margin pale yellow : beneath, the colors correspond to those above. Elytra plain dull black, black beneath. Length one-fourth of an inch.

LAMPYRIS CORRUSCA. (Plate xxi, fig. 1.)

Thorax with a black spot, rounded at the sides, and prolonged to the anterior extremity of the thorax, bordered with rufous and yellowish; margin with a black narrow border. Elytra black or dark brown.

LAMPYRIS VERSICOLOR. (Plate xxi, fig. 6.)

Body long. Thorax lined with black in the centre and posteriorly, and with oval rufous spots on each side; margin yellow. Elytra dark brown, margined with yellow, and with an acute band behind, running from the anterior and outer angle to the opposite interior angle. Length rather more than one-fourth of an inch.

GENUS DICTYOPTERA (LT.). LYCUS (Stph.).

'Head short : females winged : mandibles entire' (WESTWOOD).

DICTYOPTERA TERMINALIS. (Plate xxi, fig. 8.)

Thorax black in the middle, bordered with reddish yellow : antennæ, legs and abdomen black : elytra pale orange, terminated with blue-black, and longitudinally veined; inosculating transverse veinlets between and uniting them; wings bordered with pale orange, shaded at their extremity. Length?

DICTYOPTERA RETICULATA. (Plate xxi, fig. 7.)

Thorax with a central black spot, bordered with orange : antennæ, legs and abdomen black : elytra orange, with two large blue-black oval spots; veins six, alternately thick and thin : wings black at their tips, and shaded blackish. Length?

Both species are furnished with conspicuous antennæ.

Telephoridæ.

TELEPHORUS? ——. (Plate xxvi, fig. 1.)

Body soft, elongate, linear : elytra covering the abdomen; terminal joint of the labial palpi securiform; eyes prominent. Color of the body, head, and middle of the thorax black or dark brown; middle of the elytra brown, edges rufous; labrum and outer margins of the thorax thin and rufous. Length half an inch.

OMALISUS COCCINATUS (Say).

Thorax indented : elytra orange, reticulated with longitudinal veins and a transverse network of veinlets : antennæ slightly rufous, and bordering upon brown or black.

Cleridæ.

Antennæ subclavate, the three or four last joints being thickened : the head is more or less retractile; and the anterior parts, head and thorax, appear elongated, while the abdomen is short. The thorax and body are both subrotund; the last joint but one of the tarsi, bifid.

The family is composed of small but beautiful insects : they live in wood, and sometimes in the dried remains of animals, in which respect they seem to resemble the dermestidæ. Others frequent beehives, and feed upon the larvæ of the bee.

Genus CLERUS (Geoff.). Trichodes (Fab.).

'Tarsi with the basal joints scarcely visible; labial palpi terminated by a large hatchet-'shaped joint; terminal joint of the antennæ acutely produced within' (Westwood).

Clerus apiarius. (Plate ii, fig. 8.)

Color steel-blue, pubescent : elytra vermilion, with three transverse bands of deep violet.

Genus THANASIMUS (Latr.).

Antennæ gradually clavate : maxillary palpi small; labial palpi terminated by a hatchet-shaped joint; basal tarsi joint small.

Thanasimus dubius (Latr.). (Plate viii, fig. 7.)

Color brown and fuscous, pubescent; madibles and eyes black; head, thorax and base of the elytra fuscous. Neck surrounded with a collar : thorax emarginate before, deeply grooved transversely behind, and exserted. Elytra fuscous and strongly punctured at base, banded with rufous white and dark brown or black; thighs fuscous; tibia and first joints of the tarsi dark brown.

One-third of the basal portion of the elytra is pubescent; the remainder, or banded portion, is clothed with close-pressed short hairs : on the undulating whitish bands, the hair is dirty white. Length one-fourth of an inch.

This species of *Thanasimus* is found upon the pine, both in the living and decayed state of the tree.

The larva of one of the English species of Clerus, *C. apiarius*, is found in beehives, and is highly injurious to the community, as it feeds upon the grubs of the bees. It is an European insect, and is not known in this country; but as other members of the family may have the same habits, it is important that they should be found out.

Ptinidae.

The family Ptinidæ is composed of a number of small insects, which are sufficiently abundant at times to cause considerable damage : they are found in the woodwork of old houses ; in furniture and books, dried plants, ship biscuit, wafers, grain, etc. The Genus Anobium is one of these, and has acquired the name of *deathwatch*, from the noise it makes.

Genus PTINUS.

'Antennæ long, slender and simple, inserted close together; eyes prominent; elytra 'separated; body oblong' (Westwood).

Ptinus fur (Linn.).

This is a small oval insect of a reddish brown color, one-eighth of an inch in length, with the head and prothorax small and the feet and antennæ long and slender. The elytra are covered with hairs, and have a longitudinal stria filled with punctures. It is very destructive when numerous, and is common to Europe and America : in Europe, it destroys stored wheat. Dr. Haldeman remarks that he has found it feeding upon the cornstalks used to line cases of insects in an entomological collection, in the month of February. It seems to be a general feeder.

Lymexylonidae.

The destruction of ship-timber collected in dockyards, which so often happens, is frequently effected by the *Lymexylon navale*, a species of insect belonging to this family, and found in Europe. The cause of the damage was investigated by Linneus, at the request of the King of Sweden; and when he discovered it, he recommended immersing the timber in water during the period when the female insect would be engaged in depositing her eggs. Dr. Harris describes an American species, or one belonging to the allied genus Hylecœtus.

Cupes capitata.

Color black : head red or ferruginous, strongly ridged and transversely grooved, and furnished with two prominent tubercles : thorax with three longitudinal ridges : elytra strongly ridged, with two rows of punctures upon the back, and three between the lateral ridges.

Bostrichidæ.

This family is distinguished by the cylindrical form of the insect, and by the front of the prothorax, which is obliquely truncate. In this climate these insects are small, but within the tropics there are some large species. They all infest forest trees, burrowing either beneath the bark or into the wood. The power they possess of penetrating hard substances is quite remarkable : seasoned timber is easily cut by them, and the lead of the roofs of houses scarcely presents an obstruction. At Turin, cartridges stored in barrels were eaten through, and the leaden balls gnawed an eighth of an inch in depth. The *Bostrichus capucinus*, the species on which the genus was first established by Geoffroy, has been found gnawing type metal, which is considerably harder than lead. Their bodies are hard, and generally black or of a dark rusty brown : the thorax is dilated before ; the antennæ short, and terminate in three large serrated joints. The larvæ are wood-eaters also, of a whitish color, wrinkled above, and furnished with six legs.

Genus APATE. Bostrichus (Oliv.).

Elytra spinose and retuse posteriorly : antennæ with the second joint elongate, cylindric ; terminal joints forming a perfoliated club.

Apate basilaris.

Color black or dark brown : prothorax rough and punctured ; base of the elytra red, punctured, and the posterior extremity obliquely truncate and furnished with three teeth on each side. Length rather more than one-fourth of an inch.

This species is found as far south as Carolina. It perforates the shagbark hickory diametrically through the trunk to the very heart, where it undergoes its transformations at the bottom of its burrow (Harris on injurious insects).

In Italy, the branches of the *Morus multicaulis* are perforated by the *Apate sexdentata*. Many other species commit great havoc in forests, perforating the wood and burrowing beneath the bark, by which the circulation of the sap is cut off.

Dr. Haldeman remarks in a manuscript note, that some strips of hickory which he had employed to confine rose plants were destroyed in two years. The hickory is a tree that suffers much from the attacks of boring insects ; and hoop-poles made of hickory saplings are frequently destroyed, or rendered useless in a few months. Barrel hoops, made of this excellent material, are often attacked, so that much inconvenience, if not actual loss, may be the result. The proper remedy seems to be the immersion of the poles in water, or storing them in cellars, during the deposition of the eggs. The latter mode is sometimes adopted, but the former would have the advantage of destroying young grubs already deposited.

From the great and increasing value of the forests in New-York and Pennsylvania, it becomes necessary to direct attention to these destroyers, that proper care may be taken to prevent their increase. Although living trees are subject to attack, these insects have the peculiarity of flocking to recently cut timber. On this account, infected trees should be cut down and the bark subsequently removed and burnt, and the wood cut up and applied as fuel, turned into charcoal, or immersed in water. Some European authors contend that healthy trees are not attacked by these insects; and that when the attack has been commenced, it is an indication that the tree is in a state of incipient decline.

CHAPTER VII.

ORDER I. COLEOPTERA (Continued).

HETEROMERA.

This division comprehends those insects in which the four anterior tarsi are five-jointed, while the posterior pair are only four-jointed. They are mostly vegetable feeders, some preferring leaves, others flowers, and others farinaceous matters. There is great diversity in their color and habitat : some are beautifully ornamented, others dark and gloomy : some prefer the light of day, and are found upon the wing sporting in the beams of the sun; others inhabit dark and gloomy places, retiring from day, and abiding in obscure and unfrequented situations. In these respects, however, we find elsewhere similar arrangements and diversities.

The Heteromera are subdivided by Westwood into two sections or tribes, the first of which he calls Trachelia. The head in this tribe is considerably dilated behind the eyes, and then narrowed again, so that the thorax does not equal the broadest part of the head. The body of the insect is also of a soft consistence, and the elytra are flexible, and folded or overlapped on their inner margin. The Cantharis is an example of this subdivision, as to the character of the elytra and the softness of body and gay color of the insect.

The other great tribe or subdivision is the Atrachelia. In this tribe the thorax has the width of the head, the posterior part of which is often concealed by the thorax. The habits of the insects also serve to distinguish them from the first subdivision : they appear in dull colors, rarely fly by day, and seek concealment in darkness. Among the Atrachelia we find the Genera Blaps and Tenebrio.

The Trachelia comprise the Notoxidæ, Pyrochroidæ, Lagriidæ, Horiidæ, Mordellidæ, Cantharidæ, Salpingidæ, Œdemeridæ, and Melandryidæ ; in all nine families.

The Atrachelia embrace only six families, namely, the Cistelidæ, Helopidæ, Tenebrionidæ, Diaperidæ, Blapsidæ and Pimeliidæ.

Pyrochroidae.

Body narrowed in front, and flattened; neck distinct; thorax suborbicular; antennæ rather longer than the head and thorax, pectinated in the males.

Dendroides canadensis (Lt.). (Plate xxv, fig. 2.)

Eyes very large, nearly meeting above and below, terminating sharply beneath and rounded above: thorax rufous and punctured: elytra chestnut brown, glossy, beautifully punctured and long, and larger than the abdomen; antennæ distantly pectinated.

Genus PYROCHROA (Fab.). Cantharis (Lin.).

Antennæ rather longer than the head and thorax, pectinated in the males: eyes distant.

Pyrochroa flabellata. (Plate xxv, fig. 4.)

Eyes in the males distant, but large: antennæ pectinated: head and thorax rufous: elytra black or dark brown, finely punctured, and extending beyond the abdomen; thighs banded with rufous at both extremities; antennæ black, rufous at base; last segment of the abdomen brownish.

Cantharidae.

The *cantharides*, or blistering flies used in medicine, are represented amongst us by the allied genus Epicauta, having the same property of raising blisters. They are slender soft-bodied insects, with slender legs, the prothorax narrowed before, and the head large. They are at times abundant upon potato vines, whence they have acquired the name of *potato fly*, particularly the *Epicauta vittata*: it attacks the potato, convolvulus, and other plants, from June to September. It may, with the other species, be collected with a muslin bag having the mouth attached to a hoop; thrown into water to prevent escape, and subsequently scalded and dried for the use of the druggist.

Epicauta vittata. (Plate v, fig. 14.)

Color black: third joint of the antennæ longest: front of the head marked by two black kidneyform spots: thorax furnished with a small labial tubercle, and marked with three fuscous strips, the two lateral ones obscure; the middle of the thorax prominent. Elytra margined all around with fuscous border, and marked in the middle with a stripe of the same color: thighs fuscous at the articulation; lower extremities and tibiæ and tarsi black. Length six-tenths of an inch.

GENUS CANTHARIS (GEOFF.). LYTTA (Fab.).

Body narrow; wings two; elytra elongate; last joint of the maxillary palpi subovate.

CANTHARIS CINEREA.

Insect elongated, narrow, cinereous, and covered with short close-pressed hairs: antennæ dark brown.

The whole insect has a hoary appearance.

CANTHARIS ATRATA. (Plate XXV, fig. 6.)

Insect jet black: legs, body and thorax shining: elytra rather dull.

Sometimes I have found great numbers of this insect devouring the flowers of the china aster, in the months of August and September.

GENUS MELOE (LINN.).

Wings none: elytra short, lapping within; antennæ various.

MELOE ANGUSTICOLLIS.

Insect steel-blue: head and thorax punctured; two ovoid spaces on each side of the thorax, smooth. Elytra sculptured: the two last and part of the third ring of the abdomen naked.

Cistelidae.

GENUS CISTELA (FAB.). CHRYSOMELA (Linn.).

'Ovate: thorax semicircular; mandibles bifid; maxillary palpi subsecuriform' (WESTWOOD).

CISTELA BREVIS (Say).

Brown, widest near the middle: thorax terminated behind and laterally by a sharp angle: elytra punctured and slightly ridged; legs rather long, and paler than the body.

Diaperidae.

GENUS BOLETOPHAGUS (FAB.). ELEDONA (Lat.).

Obtuse, ovate, convex: thorax crenated; antennæ curved, clubbed and serrated.

BOLETOPHAGUS CORNUTUS. (Plate v, fig. 12.)

Brown, scabrous : elytra furnished with three rows of tubercles. Male thorax furnished with two curled horns leaning forward, yellow, villose on their under sides ; labrum furnished with two pointed upright horns, or pointed tubercles : thorax of the female furnished with two short notched tubercles ; margin of the thorax dilated, tuberculate and serrate.

Helopidae.

THE colors of this family of insects are rather lively : their elytra are free, and the wings are usually simple. The larvæ are found in wood or under the bark of trees : some, in the perfect state, frequent umbelliferous flowers.

PITHO AMERICANUS (Knoch). (Plate xxv, fig. 9.)

Brown, darker above, and slightly brassy or submetallic ; head and thorax darker than the elytra.

Tenebrionidae, Blapsidae, and Pimeliidae.

ANATOMICAL CHARACTERISTICS. Tarsi and tarsal claws entire ; sides of the head parallel ; antennæ rather short, moniliform, and inserted beneath the widened margins of the head ; mandibles short, triangular, tips bifid ; internal lobe of the maxilla often armed with a corneous tooth ; eyes oblong, and only slightly elevated.

GENERAL HABITS. These families possess many similar habits : they avoid the light, and live in damp places in cellars, basements, stables, etc., or upon the ground and under stones in sandy places. The term *tenebrio* is derived from the latin, signifying darkness (WESTWOOD). The colors are all dark brown or black.

In the TENEBRIONIDÆ, the body is oblong ovate and depressed, or supplied with short legs ; elytra free ; thorax square, and the head as broad behind as the base of the elytra : the palpi are enlarged at the tip ; mentum narrowed at the base.

In the BLAPSIDÆ : Elytra soldered together ; wings obsolete ; legs of moderate length, hence the body is less depressed than in the former family ; palpi three-jointed ; mandibles bifid ; internal lobe of the maxilla armed with a claw.

In the PIMELIIDÆ, the palpi filiform, and terminal joint rather dilated than hatchet-shaped as in the two preceding families ; maxilla concealed in a large mentum, which is as wide behind as before.

Genus TENEBRIO.

Body narrow elongate; thorax quadrate; antennæ filiform and eleven-jointed, basal joint ovate, second small; palpi unequal; legs slender; anterior tibiæ curved, minutely spurred at the apex; tarsi with entire joints heteromerous.

The Tenebrio resides in mills, granaries, meal-tubs, etc., upon the contents of which it subsists.

Tenebrio molitor. (Plate xxxi, fig. 10.)

Color black or brown: thorax darker than the elytra; beneath dark fuscous. Head thickly punctured; thorax impressed on each side of the median line; elytra obscurely streaked and punctured; legs shining reddish.

Common in bakehouses, meal-tubs, etc.

Tenebrio obscurus.

Color black, or dark brown and dull; beneath brown.

Tenebrio curvipes.

Color black or very dark brown; lighter beneath. Tibiæ much curved.

The *mealworm* is a hard smooth shining cylindrical larva about an inch long, which lives upon flour, meal or bran, and is frequently very destructive to biscuits on shipboard. It is said to pass two years in the larva state, when it appears as the *Tenebrio molitor* found in Europe and America, and probably exported to other countries. In Europe, the larvæ are raised in quantities to feed nightingales and other cage-birds. It is usually abundant in grain-mills and granaries.

Upis pennsylvanica (Dj.). (Plate xxv, fig. 8.)

Dark brown. Elytra finely punctured in nine equal lines.

CHAPTER VIII.

ORDER I. COLEOPTERA (Continued).

PSEUDOTETRAMERA.

Bruchidæ.

Genus BRUCHUS (Linn.).

Antennæ filiform, slightly and gradually thickened at the tips : elytra oblong quadrate.

Bruchus pisi. (Plate ii, fig. 3.)

Insect small and hairy, ovoid, gray : head black ; thorax gray or mottled, with a central posterior whitish spot ; elytra gray or mottled, with small inconspicuous dots or spots posteriorly ; posterior abdomen with two black oval spots, and two just beneath the ends of the wings ; scales black.

The female *peabug* deposits its eggs in the tender peapod, when the pea is soft and immature ; and when the larva is hatched, it feeds upon the matter with which it is surrounded, until it has attained its full growth, when it bores a gallery to the surface, merely leaving the surface skin untouched, ready to be pushed off by the head of the perfect insect when ready to make its exit in April. An infinity of the young grubs are destroyed in preparing green peas for the table ; but whether the epicure finds any difference in the taste of pure and infected vegetables, we are not informed.

Seed peas more than a year old do not retain the living insects, and should therefore be preferred in planting new districts : if these cannot be had, the seed may be immersed in scalding water for a short time ; a process which does not appear to destroy the germinating power of leguminous vegetables, if carefully performed. This is proved by the fact that seeds of the locust tree will grow in a single season, if boiling water be poured over them and allowed to stand until it has become cold.

GENUS CALANDRA.

'Antennæ geniculated and nine-jointed, inserted near the base of the rostrum : the club is biarticulate; rostrum elongate, rounded, slightly deflexed and bent; thorax elongate, narrowed in front, depressed, the base and apex truncate; elytra shorter than the abdomen; body subdepressed; legs rather short; tibiæ armed with an acute spur; tarsi reflexed, the penultimate joint slightly bilobed' (STEPHENS).

CALANDRA GRANARIA (Clairv.). (Plate ii, fig. 1.)

Color pale ferruginous : head finely punctate; thorax strongly punctate; elytra deeply striate and punctate; legs ferruginous.

This insect is an European species, but has been introduced here in samples of wheat received from France. Many bottles of sample wheat were entirely destroyed, although perfectly closed so that nothing could get in from without. It is called the *Corn weevil.*

I suppose this introduction of this insect, which was accompanied with another, the *Silvanus surinamensis*, is only a single instance of its occurrence in this way. When it was observed that the specimen grain was destroyed by these imported insects, Mr. J. E. GAVIT volunteered to describe and illustrate the insects for publication in the Transactions of the Agricultural Society of this State. I am permitted to republish this valuable account, furnished by the gentleman referred to; as too much publicity cannot be given to a matter so interesting to the wheat-growers of this country.

Mr. GAVIT, in his communication to the Secretary of the Society, states, that 'in the specimens of wheat furnished me, I find two beetles : one the true corn weevil of Europe, *Calandra granaria* (CLAIRVILLE); the other, *Silvanus surinamensis*, the weevil most commonly found infesting the granaries of this State.

'The former of these received the name of *Curculio granarius* from LINNÆUS, but is now called *Calandra granaria.* It is somewhat depressed, and varies in color from a deep pitch to a chesnut tint. The head is semi-globose, produced anteriorly into a longish smooth cylindrical snout, which is shortest and stoutest in the males : it is slightly curved, and sparingly punctured with two lines extending almost from the base of the head to the apex, forming two deep channels before the eyes, where the rostrum is dilated. Eyes black, vertical, ovate, finely granulated and depressed. The antennæ are nine-jointed : the basal joint being long, stout and clavate, it forms an angle with the remainder; the terminal ones forming an oval, conical, little shining club, pubescent at the tip. Thorax twice as broad as the head, oval, a little truncated : the surface is coarsely punctured with oval points. Scutellum minute and oval. Wing-covers exactly equal to the thorax and head, being ovate-truncate, and not covering the apex of the abdomen : there are nine deep punctured channels down each, producing short pale bristles; and the two raised furrows on each side of the suture have a line of long punctures. The six legs are punctured,

strong and stout, especially the anterior and posterior pairs. The thighs are stout : they all have a hook or claw at their extremities. The tarsi are reflexed and four-jointed, spongy beneath, basal joint subclavate, second ovate, third broader and slightly bilobed, fourth clavate and furnished with two minute claws. Length nearly two lines.

'This insect seems early to have attracted the attention of naturalists. LEUWENHOEK closely observed its economy, and his observations were published as far back as 1687; but to OLIVIER, however, are we indebted for the most accurate and full account of its habits published in the *Encyclopédie Méthodique*. All subsequent writers appear to have based their descriptions on his observations. No insect is more formidable to man than this little pest, since it attacks the principal basis of his food; and they are sometimes so numerous in a heap of grain, that they destroy it altogether, leaving nothing but the chaff. After the sexes have paired, the female makes a hole in the grain of wheat with her rostrum, and deposits an egg. These holes are not perpendicular to the surface of the grains, but oblique, or even parallel, and are stopped with a species of gluten of the same color as the corn. OLIVIER says there is but one to each grain : I, however, have repeatedly found two, one in each lobe, and these larvæ as plump and well conditioned as those who had the good fortune of a kernel to themselves. From the egg is hatched in due time a small footless grub (fig. *b*), which, during its growth, eats out the entire contents of the grain, and, when lodged in the grain, is perfectly sheltered from all injuries from the air, because its excrements serve to close the aperture; so there is no use in stirring the grain, as nothing can incommode it. It is very white; has the form of an elongated soft worm, and the body is composed of nine prominent rounded rings : it is nearly a line in length, with a yellow rounded head provided with organs (fig. *c*) proper for gnawing the grain. When the larva has eaten all the flour, and is arrived at its full growth, it remains in the envelope of the grain, where it is metamorphosed into a nymph (fig. *a*), of a clear white, and transparent : the proboscis and antennæ can readily be distinguished; but it gives no sign of life, except when disturbed, and then but a slight movement of the abdomen. Eight or ten days after, the perfect insect eats its way out. In general, that which serves as nutriment to insects in their larva state is unsuited to the perfect form. To this the calandra is an exception; for scarcely has it issued from its nymph state, than it proceeds to pierce the envelope of the grain, to establish itself anew therein. I have frequently watched the perfect insect feeding upon the farina of the grain, having pierced the skin and buried the proboscis to the base. It is often found, however, lodged in the interior of the grain (fig. *e*); and its black color does not announce its recent issuing from its state of nymph, since it is of a straw color at the time when it has just left its sheath : nevertheless we must doubtless believe that it occasions much less injury in this state, than in that of the larva.

'The *Calandra* has no sooner issued from its envelope of nymph, than, like the majority of insects, it is in a state of pairing for the reproduction of its species, and this act ever

bears strict relation to a certain degree of heat : if it be under 50° Fahr., it is insufficient to afford them force or vigor to desire copulation : if the weather be cold, they remain in a lethargic state, and are incapable of injury ; if warm, they pair very frequently. The deposition of eggs commences sooner or later, according to the season or climate : the female deposits them in all months, when the temperature is up to a suitable degree, ceasing to lay when the mornings grow cold.

'From the moment of pairing to the appearing of the perfect calandra, there is an interval of forty or forty-five days. By this we may see that a year must produce many generations, which multiply still more in very hot climates. According to a table for the calculation of their increase, it results that the sum total of each generation added together is 6045, proceeding from a single pair during five months, from the end of April until the middle of September, while the mercury continues above 65° Fahr. We are therefore no longer astonished if enormous heaps of grain are destroyed by these insects. The injured kernels may be known by a very simple process : if several handfuls of the grain be thrown into water, those will swim upon the surface which have been robbed of their farinaceous substance by the destroyer.

'It is not upon the surface of corn heaps, but some inches beneath, that we find these insects ; and there, unless dislodged by shaking with a shovel or sieve, they will remain so long as the weather continues warm, living, pairing, and depositing their eggs. When the mornings begin to freshen, all, both young and old, retire to clefts of walls and the flaws of wood and floors. They are sometimes found behind tapestry, chimnies, in fine every place affording a warm retreat.

'It has been supposed seriously that these insects remain lethargic during the whole winter, and return in spring to their abandoned grain-heaps, recommencing the deposition of their eggs ; the cold incapacitating them for the exercise of the functions necessary for the multiplication and preservation of their species. Based upon the knowledge of this fact, is the substitution of cold as a remedy. It has therefore been proposed to have a ventilator, the effect of which would be to keep in a granary a degree of air sufficiently cold to reduce these insects to the above lethargic state. A general and constant rule among insects is, that those which have paired perish shortly after, and do not pass the winter except in the egg or larva state. It is doubtless rare that even those which have not been exhausted by fulfilling the intentions of nature, can survive the winter rigors. Mr. Gaylord, however, in his prize essay published in the Society's Transactions for the year 1843, says, of some specimens of wheat that he had received from the Patent Office, in which he found weevils, that "selecting some pure flint wheat kernels, all perfectly sound, we enclosed a dozen of these weevils with the wheat in a large phial to prevent their escape. The phial was wrapped in paper, and placed where it would not be disturbed except for examination. Opening it occasionally for more than a year and a half, I found my weevils, with the exception of one or two, all living, and appearing to enjoy themselves much on

the wheat, a large portion of the kernels of which they had hollowed out." This would imply that they survive two seasons at least, and those I have in my possession sustain this assumption.

'Many and various modes of exterminating this foe to man have been tried. We first hear of fumigations with herbs of strong and disagreeable odor; but this seems useless, as it does not incommode the insect, while the grain receives a fetid and disgusting scent. The fumes of sulphur are pronounced equally inefficient. All these fumigations are still less adapted to the destruction of the larvæ, as the smoke cannot penetrate among the grain, and their perfectly closed envelope secures them from all such annoyance. OLIVIER recommends the following, as one of the most effectual and least expensive modes of destroying them. At the return of spring, when the calandræ are observed to spread in the heaps of winter-stored grain, it will be necessary to form small heaps of five and six measures, and place them at a suitable distance from the large heap: this stir with a shovel. The insects, who are singularly fond of tranquility, seek to escape, and, seeing another heap of grain alongside, they take refuge therein. When all are thus collected, boiling water is brought and poured over them, stirring it from time to time with the shovel to secure its penetration through the grain while hot. All these insects then die, being burned or suffocated at the moment. The grain is then spread for the purpose of drying, and afterwards sifted to separate the dead insects.

'It is necessary to perform this operation early in the spring before the deposition of eggs, the generation existing being only dangerous in giving birth to its successors. This method may be performed on a large scale as well as a small one, without occasioning any considerable expense.

'Other experiments have proved that a sudden heat of 75° Fahr. is sufficient to destroy these insects, without burning them; and a simple efficacious method is mentioned in the Tennessee Agriculturist, quoted by Mr. GAYLORD in his essay. "If a hogshead, with one head removed, be inverted over a fire until thoroughly heated, and then immediately filled with wheat and reheaded, all weevils in the grain will be killed, and the grain may be kept in safety till wanted for use."

'A gentleman in Madeira has established a heated room, with hot water pipes, in which he receives as many as eight hundred bags of grain at a time: these become heated through at about 135° Fahr.; and the wheat, when resifted, is perfectly cleaned, making quite as good bread as before, the seed also losing nothing of its vitality by this process.*

'The French "lay upon the grain, fleeces of wool which have not been scoured: the oily matter attracts the insects among the wool, when they soon die, from what cause is not exactly known."†

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* Transactions of the Entomological Society of London, Vol. 1. † London Lit. Gazette, July 1, 1825.

'One essential point in all storehouses for grain is, undoubtedly, frequent whitewashing and thorough ventilation, as there appears to be much testimony corroborative of this great preventive to the ravages of this minute destroyer.

'A correspondent of the London Mark-lane Express, in speaking of the corn weevil says : "Some years ago, we found a house overrun with weevils : after numberless attempts to destroy them, we were led to observe that they were almost entirely on the south wall (our rainy side), and that they appeared to breed in incredible numbers in an unusually damp spot or corner. Taking the hint, we cased the wall on the outside with slate, and made the house in every respect perfectly dry, and in a short time the weevils died off and disappeared. Since adopting this precaution, we have not the least trouble, and have only been reminded that such an insect exists when an accidental spot of damp has appeared to generate them again. We think ourselves, therefore, entitled to say, that these insects require moisture ; and that if the grain and granary, as both ought always to be, are dry and healthy, weevils will not long remain. This plan bears the merit of costing less than nothing, because the injury that wheat sustains directly from damp is more than equivalent to the expense of keeping premises dry, leaving its indirect influence in the generation of weevils out of the question." '

SILVANUS SURINAMENSIS. (Plate ii, fig. 3.)

The following is Mr. GAVIT's account of this insect :

'The insect accompanying the *Calandra*, and usually found in granaries in this country, is named *Silvanus surinamensis*, the *corn silvanus*. This insect was named by LINNÆUS, being sent to him from Surinam by one of his pupils. FABRICIUS, from its infesting stores and warehouses, called it *Anobium frumentarium*, and subsequently *Dermestes sexdentatum*, from the spines on the side of the thorax. LINNÆUS's name, however, has the right of priority.

'*S. surinamensis* is only one line and a quarter long, and very narrow : it is flat, of a rusty brown color, thickly and coarsely punctured, and sparingly clothed with short depressed yellow hairs. The head is large and subtrigonate : the nose appears truncated, but it is semicircular in front, and conceals the mouth, which is composed of an upper and under lip, and two little horny jaws, maxillæ and palpi. The antennæ stout, straight and pubescent, nearly as long as the head and thorax, and eleven-jointed ; the basal joint stoutish, the terminal ones forming an elongated club (fig. *f*). The eyes are black, small, and coarsely granulated. The thorax is perfectly oval, and a little wider than the head at the middle. There are three ridges down the back, forming two broad channels, and on each margin are six teeth. Scutellum minute ; the wing-covers long, elliptical, and broader than the thorax, with four slightly elevated lines down each : between them are double rows of punctures, and a series of little shining yellow bristles : beneath are two ample

wings. Legs short; thighs stout; shanks elavate; tarsi five-jointed, three first joints short, fourth exceedingly minute, fifth clavate and terminated by two small claws.

'The larva (fig. *g*) is a little depressed yellowish white worm: it is composed of a tolerably large head, with two pointed jaws and two little horns, and of twelve transverse segments; the tail is somewhat conical, and it has six conical articulated legs.

'The pupa (fig. *h*) is of the same color; the head is bent down; the thorax is suborbicular, with three ridges; the elytra wrapped over the sides, and striated: abdomen with distinct segments.

'Mr. Curtis, from whom the above description is derived, says that "this insect appears to be naturalized in England and Scotland, lying under the bark of trees*." I have found it in sugar, and in boxes containing dried figs in great numbers. It appears to be spread all over the habitable globe, probably carried in vessels with grain and dried fruits.

'This is the insect, as I am informed by that excellent entomologist, Dr. Fitch, that infested the mill of Mr. Rich of Shoreham (Vermont), mentioned in the Cultivator of December 1846, on which Mr. R. tried various experiments of fumigation, but found nothing so satisfactory as hot water, whitewashing, and general cleanliness. A correspondent of the same journal, in noticing Mr. Rich's experiments, speaks of a remedy he never found to fail: placing sassafras root among the grain infested by them. He is evidently dealing with the rice weevil, *Calandra oryzæ* (Linnæus), an insect exceedingly like the grain weevil in habits and appearances.'

Attelabidæ.

Brenthides.

Genus BRENTHUS (Fab.).

Thorax ovoid; body rounded or subcylindrical; antennæ inserted at the base of the snout, just before the eyes. In the males the mandibles are strong and prominent: the female is provided with a gently curved snout, terminated with a much smaller pair. Thorax and head as long as the body or abdominal portion.

Brenthus septentrionis (Hb.). (Plate ii, fig. 4.)

Males with distinct mandibles: females provided with an elongated snout. Color brown, polished. Head small; eyes prominent; elytra ridged and punctured in lines, and marked with yellowish patches of lighter brown. Length seven-tenths of an inch.

The whole insect is highly polished. A few years ago, I found great numbers of them upon a recently felled black oak in Canandaigua.

* 'I have since met with them in the same situation.'

Attelabides.

GENUS ATTELABUS (LIN.).

Broad : elytra subquadrate; antennæ eleven-jointed; head not narrowed behind the eyes.

ATTELABUS PUBESCENS (Say).

Yellowish brown, pubescent : body short.

ATTELABUS SIMILIS (Kirby).

Head and legs steel-blue : body cylindrical; thorax conical, rufous; elytra rufous, punctured.

ATTELABUS ANILIS.

Small : head, thorax, abdomen, and extremity of the elytra steel-blue; elytra with rufous upon the shoulders.

Curculionidæ.

Phyllobides.

GENUS PHYLLOBIUS (SCHÖN.). CURCULIO (Lin.).

Oblong-ovate, squamose : tibia rounded; rostrum short; two and three joints of the antennæ elongate.

PHYLLOBIUS TÆNIATUS (Say).

Gray or hoary, acute behind, widest near the extremity : elytra punctured, with four darker lines, and darker upon the top of the thorax.

GENUS HYLOBIUS (GERM.). CURCULIO (Lin.).

Oblong-ovate, winged : rostrum much longer than the head; second antennal joint elongate.

HYLOBIUS PALES (Hb.). (Plate ii, fig. 6.)

Brown, covered with close-pressed hairs; hairs gray, in imperfect oblique bands across the elytra; punctures of the elytra parallel; antennæ angulated; rostrum furnished with an antennal groove.

Genus PISSODES (Germ.).

Antennæ situated a little in advance of the middle of the rostrum.

Pissodes strobi.

Brown, with two hoary patches on the posterior extremity of the elytra and upon the middle of the thighs; somewhat hoary beneath.

The Rhyncophora, as they are termed, constitute a very extensive group of coleopterous insects; some of which, as already seen, have acquired the popular name of *weevil*. Many species are destructive to grain and the seeds of leguminous plants. The larva of the large *Sphenophorus palmarum* of the tropics lives in the trunk of palm trees; and the palmetto (*Chamærops palmetto*) of our Southern States is inhabited by an allied species, the *Sphenophorus zimmermanni* of Schœnherr, which is the largest member of the family known to inhabit the United States.

Hylobius pales is a common member of a genus which destroys pine trees, by burrowing beneath and loosening the bark. In April and May, it may be seen in considerable numbers upon wooden fences: it is brown, marked irregularly with small whitish spots. Towards the south, this species and *Hylobius picivorus*, which is larger and more robust, destroy pine forests entirely, leaving the dead standing or fallen trees as monuments of the mischief which a small insect can commit when sufficiently multiplied.

The female of *Pissodes nemorensis* of Germar, according to Dr. Harris, pierces the leading shoot of the white pine for the purpose of depositing its eggs; and although a pine tree may recover by sending up a lateral branch in the vertical direction, it will require three or four years to pass through this process, and the growth in consequence be retarded. This insect is named *Pissodes strobi* by Dr. Harris, on the strength of a name given to it by a Mr. Peck in an agricultural journal; which of course can have no weight, because such publications are unknown or inaccessible to naturalists who are not farmers, and seldom circulate beyond the boundaries of the district in which they are printed. It is too much to expect an entomologist in London, Calcutta, Berlin, Paris, or the city of New-York, to purchase an extensive series of expensive volumes to enable him to find descriptions of half a dozen insects said to be contained in them, and which should have been made known through some other channel.

Genus BALANINUS (Germ.). Curculio (Lin.).

'Rostrum nearly as long as the body, which is subtriangular: anterior tibiæ minutely 'hooked: antennæ inserted behind the rostrum' (Stephens).

BALANINUS RECTUS (Say). (Plate ii, fig. 5.)

Color brown, mottled with lighter patches upon the thorax and elytra. Snout longer somewhat than the body, and curved at the extremity, slender, elbowed : antennæ inserted below the middle, very slender. Rather less than $\frac{1}{4}$ inch in length.

This *nut weevil* inhabits the chinquapin nut, and renders useless almost the whole crop: the nuts, after being kept a week, are always wormy. It may be the *nascicus* of SAY, but seems to be smaller.

RHYNCHÆNUS (CONOTRACHELUS) NENUPHAR. *Plum Weevil.* (Plate ii, fig. 7.)

Color brown, usually dark and somewhat variegated, and variable in individuals, rough and warty : thorax uneven; elytra interceptedly ridged, arranged transversely in three rows, the most prominent in the middle; abdomen thick, deep but short; thighs toothed.

It appears from the numerous accounts that have been published, that the mature insect may appear as early as the last of March, and continue until the first of August; remaining, therefore, for a longer period than most of the injurious beetles.

The habits of this species are peculiar and interesting. It deposits its ova in most fruits, as the plum, cherry, apple, quince, and even in the fruit of the hickory. It is also suspected of inserting its eggs into the tender limbs of plum and cherry trees : it is not known, however, whether those black excrescences are caused in this way, although it is not improbable. I have found some three or four different grubs in these excrescences, some of which belonged to a dipterous insect.

The plum weevil inserts in each fruit a single egg, having in the first place bitten a spot upon its surface; and although there may be scores of the insect upon the tree, it is very rare to find more than one wound upon a plum or cherry. The grub produced from the egg is small, and destitute of feet; and when mature, it falls to the ground and immediately buries itself in the soil : the next spring it appears in the perfect form at the usual time, when the different kinds of stone fruit are setting.

Among the remedies which have been proposed for diminishing the numbers of the plum weevil, there is none so promising as the practice of shaking them from the tree early in the morning and late in the evening, collecting them upon sheets, and committing them to the fire : the fallen fruit should also be subjected to the same treatment. When the tree is suddenly jarred, the insect folds up its legs, falls to the ground, and simulates death. It is easily captured, especially in the morning and evening, when it is stiff, and indisposed to take flight or attempt to escape. Strong-scented odors seem also to be disagreeable to this insect, as it is rarely found upon trees situated near the hogpen.

For a full history of this insect and the remedies proposed against it, see HARRIS's Massachusetts Report on injurious insects, pp. 65 – 70.

Genus ITHYCERUS (Schœnherr).

Ithycerus noveboracensis (Schœnherr). (Plate xxxiii, fig. 1.)

Curculio noveboracensis (Forster);
Rhynchites curculionides (Herbst);
Pachyrhynchus schœnherri (Kirby).

According to Kirby, this species belongs to the Family Pachyrhynchidæ: its characters, as given by this distinguished entomologist, are:

'Labrum subemarginate; mandibles armed with two teeth at the apex; labium nearly square; palpi conical; antennæ short, inserted into a roundish lateral cavity near the apex of the rostrum; joints eleven, scape short, etc. Body oblong pear-shaped. Rostrum nearly as wide as the head, subcylindrical, a little wider at the tip, ridged between the eyes and antennæ: eyes round, prominent; prothorax subcylindrical, rather narrowest anteriorly; antepectus not emarginate, nor lobed. Coleoptera oblong, depressed at the apex: thighs clubbed, unarmed; tibiæ unarmed; penultimate joint of the tarsi bipartite. Its antennæ are straight, or only curved, not elbowed.

'Color gray, covered with a whitish pile; ground black: knob of the antennæ brown. Rostrum rather thick, widened anteriorly, having three ridges between the eyes and termination: two divergent, from an impressed angular line between the eyes; and the other proceeding directly from that line upon its middle, and which terminates anteriorly in a short fork, or near the emargination of the labrum, though it is separated from this fork by a slight interception, which is just beyond two hyphen-like lines by its sides. Anterior part of the rostrum naked, and impressed with coalescent dots. Eyes brown. Thorax subcylindrical, marked with three rather obscure whitish longitudinal bands: punctures coarse and coalescent. Elytra have nine rows of punctures, and at the base a part of a tenth row. The alternate spaces between the dotted lines have small black quadrate spots: on the sutural space, or ridge, they are smaller and more obscure than upon the others. These quadrate black spots are placed upon the four whitish longitudinal stripes, which are quite obscure. Beneath gray: legs gray. Length of the female, five-eighths of an inch; of the male, half an inch.'

This Curculio has the habit of many of the species of this family. It devours the tender leaves and blossoms of fruit trees, and has been known to do great injury to the apple and pear. It sometimes attacks the base of a young shoot, and eats it to the pith: at other times, it feeds upon the leaves of the cherry and plum. Its strong notched mandible fits it admirably for work of this kind.

The only way to rid a tree infested with this insect, is to shake it suddenly in the morning or evening while the insects are stiff and cold, and collect them upon sheets spread beneath: the insects, and the fruit that fall, should be put into boiling water.

This species has a wide range : it is found in Canada, Northern New-York, Wisconsin, and Massachusetts.

The following remarks of Prof. HALDEMAN are highly appropriate in this place :

'Among rhyncophorous coleoptera, the Genus BALANINUS is remarkable for having a very long slender snout, frequently exceeding the body in length, and bearing a pair of antennæ as slender as a hair. Chesnuts are frequently found infested with a fleshy grub, which feeds upon the interior, and fills the cavity with its castings in the shape of dust. This is the larva of *Balaninus nascicus* (SAY). It is densely clothed with short hair mottled with ferruginous. An allied but smaller species is found in the larva state in the nut of the *Castanea pumila*, or chinquapin. These larvæ are very difficult to raise to the perfect state when the attempt is made, and it is probable that many perish from various contingencies.

'*Conotrachelus nenuphar* (HERBST), subsequently named *Rhynchænus argula* by FABRICIUS, is very destructive to the fruit of the plum, which the larvæ inhabit, and cause to fall prematurely. This damage is so great in some sections, that not a single plum can be raised to maturity. When the fruit falls, the grubs penetrate into the ground ; so that to check their increase, it is advisable to collect and destroy these (as by boiling and feeding them to hogs), including such upon the trees as present a dwarfed, imperfect, or gummy appearance. Paving the ground around the trees is said to answer an excellent purpose, and it is well known that plum trees flourish well when planted in pavements. This is a small rough insect of a brown color, irregularly marked with white, black and yellow ; and the snout is held upon or near the breast. It is said by Dr. HARRIS to have been raised from the black warty excrescences found upon the smaller branches of plum and cherry trees. The Rev. D. ZIEGLER of York (Pennsylvania) has shown me specimens of the butterfly which destroys the peach-tree (*Egeria exitiosa*), raised from these excrescences, which differ from those taken from about the root of the tree in being considerably smaller : the two forms have not, however, been rigidly compared.

'The Genus SITOPHILUS includes a number of small insects called weevil, which are destructive to stored grain, as wheat, rice and corn ; and under circumstances favorable to their increase, great quantities are destroyed or depreciated in value. The use of salt, and kiln-drying, have been recommended as preventatives. The latter process may be performed in an economical manner by erecting a stove with a vertical pipe fifteen or twenty feet in height : around this pipe, and about three inches from it on every side, a second one of wood is to be placed ; and whilst the heat from the fire passes through the inner one, the grain is to be passed through the cavity between the pipes, and at such a rate as to prevent it from being injured by too high a temperature. The moisture will be more effectually driven off if the outer pipe is made with open joints, because otherwise it must rise through the whole column before it can escape, and much of it will condense and be

carried down the pipe again. The corn weevil is named *Sitophilus oryzæ* from having been first discovered in rice, a vegetable which it seems to have accompanied to distant portions of the globe. Infested grain may be detected by its loss of weight, which renders it easy to separate and boil or grind as feed upon the farm. Mills and barns sometimes swarm with these insects; and in this case multitudes may be collected and destroyed by sweeping them from the posts, walls and floors.

'*Phyllobius tæniatus* may be taken as an example of a leaf-inhabiting rhyncophorous insect. SCHŒNHERR, the great authority upon these insects, removes it into a new genus of which it is the only representative. It is found upon the leaves of the *Anona triloba*, or papaw, and is perfectly harmless.'

Scolytidæ.

THE SCOLYTIDÆ are small obscure insects, inhabiting wood : they have a short rostrum; the head is globular, and is concealed in the thorax; the body is oblong or cylindric : their colors are dull. Among these destructive wood-eaters is the

GENUS HYLURGUS (LAT.).

Body cylindrical, obtuse before and behind : head concealed in the thorax; antennæ terminated in a clubform mass, consisting of three or four joints : the tibiæ are armed with a tooth.

HYLURGUS TEREBRANS (Oliv.).

Pubescent : head rounded, and sunk in the thorax; antennæ short.

GENUS TOMICUS (LAT.). BOSTRICHUS (Erichs.).

Funiculus five-jointed; club four-jointed, tunicate; labium triangular.

Of this genus, several species have been described by Mr. SAY and Dr. HARRIS. They are small brownish beetles, with the elytra toothed at their apices, appearing as if a piece was bitten out.

TOMICUS EXESUS.

Color dark chestnut brown, and somewhat hairy : thorax ovate, rough before; elytra strongly punctured in rows; apices excavated, the edges toothed on the outer side. Length between one-fourth and one-fifth of an inch.

This small and obscure insect is found under the bark of the pitch pine tree, where it excavates numerous zigzag and parallel roads. It greatly injures forests in this way; cutting off the circulation of the sap, which ultimately causes the bark to become loosened, when the tree dies.

TOMICUS PINI.

This species differs from the former in having only three or four teeth at the extremity of the elytra, and in being a smaller insect. Its habits are much the same as those of the *exesus*, in living beneath the bark of the white and pitch pine. The grubs of both species accomplish more injury to forests than the perfect insect. I have taken the last species the first of September. Autumn, or late in the summer, is the period when the perfect insect goes abroad.

Miss MORRIS describes the *T. liminaris* in the Horticulturist, Vol. iv, p. 502. This distinguished entomologist suggests that this insect may be some way or other connected with the yellows in the peach tree, as it is found under the bark. Its color is brown : thorax punctured, and the elytra both punctured and furrowed, and beset with short hairs. Length one-eighth to one-tenth of an inch.

SCOLYTUS (TOMICUS) PYRI (Peck). *Pear-blight Beetle* (Harris).

'Color brown : antennæ and legs light ferruginous; elytra punctured in rows, very 'sloping behind; tibia flattened at the tarsal end, toothed, and terminated with a 'small hook' (HARRIS).

This insect has been highly injurious to the pear tree in New-England, and especially in the eastern part of Massachusetts. It was first described by Prof. PECK. The larva first eats its way inward into the wood, making its entrance just at the root of a bud : it reaches the pith, and, by its irritation, appears somehow to poison that portion of the limb above the bud where it first entered. We say *poisoned;* because there seems to be something more sudden and effectual in causing death, than a slight interruption in the circulation : the limb or twig looks as if it had perished from gangrene.

The remedy proposed is to cut the limb and burn it, destroying the insect before it is matured. A careful examination of the pear in June, in order to detect the first appearance of the approach of the insect, is one of the first steps to be taken.

CHAPTER IX.

ORDER I. COLEOPTERA (Continued).

LONGICORNES.

The Longicornes of Latreille (Eucerata of Westwood) deserve a special notice, in consequence of their habits, and the singular prolongation of their antennæ, which is one of the most obvious characters of the group. The antennæ are filiform or setaceous, and frequently considerably longer than the whole body. The eyes are peculiar, in consequence of the position of the antennæ, which often appear to have been implanted within them: the eye is therefore said to be emarginate, though not strictly so; and it has a reniform shape, when considered independently of the base of the antenna. The body is elongated and cylindrical. The elytra are broader than the thorax, which they more perfectly encase by their sudden flexure at the shoulder, than is common in other groups. The head is short, and driven into the thorax up or nearly to the eyes: their jaws are powerful. The legs are long, and frequently the longest in front. The thorax is cylindrical, and in some species the sides are armed with a short pointed tubercle. The three basal joints of the tarsi are cushioned beneath: the fifth is long and slender; the fourth, small.

The insects of this group come out from various kinds of wood in their perfect state, having inhabited it from the first, or from the time of the deposition of the egg: they are therefore usually found in the vicinity of wood and dock yards, or where timber is stored. It may well be inferred from these facts that the larva is injurious to the tree it occupies; and the more so, as it is known to remain in this state for many years.

The larvæ are provided with six scaly articulated legs; but they are of little use as organs for locomotion, by reason of their small size: their movements are rather effected by means of the warts or fleshy tubercles situated along the sides of their bodies. Their bodies are soft, and of a dirty white color. The head is only moderate in size, flat and wide.

In consequence of the long time the larvæ are resident in various kinds of wood, there is, through commercial intercourse, a tendency to distribute in all countries the beetles of this large group. A piece of wood from South America is brought by a ship and thrown out upon some island in the West Indies, or is transported to one of our southern ports, Savannah, Charleston, or even New-York: the insects contained in the wood are liberated

in a new and distant land; and in this way, this or any other country may become stocked with new species of insects. In the long run, and with the ever extending intercouse between the different nations of the earth, it is no visionary imagination that the time will come when these beetles will be found in every country where the climate is not decidedly unfavorable to their propagation and existence.

This group of beetles is divided into three families: 1, the PRIONIDÆ, embracing the largest of the group, and provided with very prominent jaws and very long bodies; 2, the CERAMBYCIDÆ, containing beetles of moderate dimensions, ornamented with a variety of colors; and, 3, the LEPTURIDÆ, containing insects of a yet smaller size, with bodies dilated before and narrowed behind, and with antennæ of a moderate length.

Prionidæ.

PRIONUS PENNSYLVANICUS (Fab.). (Plate xxxiv, fig. 10.)
CERAMBIX UNICOLOR (Drury);
C. BRUNNEUS (Forster);
C. CYLINDRICUS (Linn.).

Insect chestnut brown; head dark chestnut brown. Antennæ stout, and two-thirds the length of the insect: elytra lighter than the head, extending beyond the abdomen, and nearly three times as long as the thorax and head together; sides parallel; abdomen, thighs, and tibiæ red chestnut.

The whole animal is some shade of chestnut brown, but the head and thorax are darker than the elytra.

PRIONUS LATICOLLIS. (Plate xxvi, fig. 5.)
CERAMBIX LATICOLLIS (Drury);
PRIONUS BREVICORNIS (Fab.).

Insect dark chestnut brown; head and thorax nearly black. Antennæ very stout, consisting of twelve joints: tibiæ armed internally with two short spines; tarsi beneath yellowish.

The insects of both species are light and dark chestnut brown; almost black in the latter species. Their jaws are stout, and project; and their bodies are longer in proportion to the anterior parts, the elytra extending a little beyond the abdomen. They belong to the large tribe of *capricorn beetles*, and form a family called *Prionidæ*, so termed from the structure of the antennæ, which are jointed, and give the general appearance of a saw. Some of the tropical species are very large.

Drury gives a long account of the grubs of this family : he states that they, together with several other wood-eaters, constitute a delicate eating ; and that in the torrid zone, a man may supply himself with animal food of this description, provided he has a knife or other cutting tool strong enough to penetrate the decaying trees.

Cerambycidæ.

Antennæ slender, tapering and pointed, often elongated ; eyes kidney-shaped, the concavity of which receives the base of the antennæ ; thorax rounded and convex.

Stenocorus cinctus. (Plate xxvi, fig. 2.)

Cerambix balteatus (Degeer) ;
C. cinctus (Drury) ;
Stenochorus garganicus (Fab.).

Color grayish hazle : surface covered with a short gray nap. Thorax armed in the middle with a short spine : elytra ornamented with an oblique ochre-yellow bar near the thorax. Extreme length $1\frac{1}{4}$ inch. Antennæ of the males more than twice as long as the body : scutellum is triangular, and yellowish in color ; while the elytra are margined, and tipped with two small spines.

This inhabits the hickory : its larvæ form galleries in the trunk of the tree, which run parallel to the grain of the wood.

Cerambix? ——. (Plate xxvi, fig. 9.)

Color black. Antennæ ten-jointed ; basal joint oval and short, tuberculated, tubercles minute ; last joint long, slender ; second joint nearly equal the last ; the remainder nearly equal in length. Head with a prominence over each eye and a prolongation at the base of each antenna, making upon the front a deep longitudinal groove. Thorax appears to be transversely rugose, cylindrical, without tubercles or spines, but rather thickened behind, differing in that respect from the thorax of a *Saperda*, and slightly constricted near the elytra. Elytra thickly punctured, but scarcely confluent. The lower part of the tibiæ and tarsi hairy, but confined to the forelegs ; the others being only slightly hairy, if at all.

This insect would make a very good *saperda*, were it not for the extreme length of the antennæ and the form and character of the basal joint. I am not entirely satisfied with its reference to the Genus Cerambix, still its characters do not materially disagree with those given by Mr. Westwood. Length rather more than $\frac{1}{4}$ of an inch.

GENUS CLYTUS. LEPTURA (Linn.).

Thorax globose, unarmed; antennæ setaceous, and shorter than the body; elytra entire at the tip; hindlegs clavate.

CLYTUS SPECIOSUS (Say). *Beautiful Clytus.* (Plate xvi, fig. 10.)

Head yellow, with an obscure black circle between the antennæ, enclosing a yellow dot: collar encircled with a yellow band: base of the mandible yellow; lip black; eyes black; antennæ black: scutellum marked with an oval spot. Thorax black, with two yellow transverse lines on each side: beneath, there is a yellow spot before the insertion of the forelegs. Elytra black: outer angles marked with three yellow elongated spots, separated by obscure black lines. Upon the anterior part the letter W is inscribed; and the same above, with the inner lines reversed or inverted. Behind, there is an oblique narrow band running backward from the lower margin: the terminal third is yellow, with two dots of black. Beneath yellow, except at the insertion of the legs: legs yellow; tarsi of the forelegs dark brown or black, the others a shade of brown.

CLYTUS NOBILIS. (Plate viii, fig. 2.)

Black or dark brown: head black, clothed with yellow hairs; eyes black; thorax black immaculate. Elytra marked with three yellow spots upon their basal third, and, below the middle, with two transverse lines, and four dots near the apices. Legs black upon their upper sides; yellow beneath.

CLYTUS CAPREA (Say). *Callidium caprea* (Knoch). (Plate xvi, fig. 11.)

Color fuscous. Anterior edge of the thorax margined with yellow. Elytra marked by four yellow bands; tip yellow: front depressed or grooved between the antennæ. Thorax subcarinate: first and second bands unite so as to enclose a large spot; the others transverse and undulatory, and wider upon the suture.

SAY remarks that the bands are sometimes white.

CLYTUS PICTUS. *C. flexuosus* (Fab.). (Plate xvi, fig. 9.)

Color black, ornamented profusely with yellow figures and yellow bands somewhat after the pattern of the *speciosus*. The head is marked with three transverse yellow stripes. On the elytra the first and second stripes are nearly straight, the third forms a W, the fourth is angled, the fifth is broken by a longitudinal elevated line, and the sixth consists of dots arranged in the form of an arch. Length variable, but about six-tenths of an inch.

CLYTUS UNDATUS. (Plate viii, fig. 4.)

Head anteriorly hairy; parts about the front part of the head rufous; base and apex of the interrupted band, of yellow hairs: scutellum dark brown. Elytra marked with yellow upon their margins; the basal third is marked with an oblique line, succeeded by two yellow wavy bands: posterior angles of the elytra rounded off so as to show the last segment of the abdomen. Beneath, upon the breast, are three yellow spots, and also at the top of the ventral segments of the abdomen. Length about eight lines.

CLYTUS CAMPESTRIS (Oliv.).

This is a small species, from four- to six-tenths of an inch long. Its color is brown, marked with two waved bands across the elytra and tips. The pronotum has four yellow dots arranged in a square, and the under parts are marked with the same color.

The larva is injurious to fallen chestnut timber, damaging it for rails: they burrow between the bark and wood, and also penetrate into the wood. The perfect insect appears in May and June. It inhabits the Northern States, New-York and New-England, and extends as far south as Carolina (HALDEMAN, Am. Phil. Transactions, x, 40).

CLYTUS HAMATUS. (Plate viii, fig. 7.)

Color brown: head banded with yellow; scutel yellow. Elytra marked with two bars and a dash; a yellow dash near the base, two curved lines opening towards the shoulders, the inner leg extending along the suture to the scutel, and a yellow transverse curve opening downwards and situated below the middle: legs brown. Length half an inch.

CLYTUS ——. (Plate viii, fig. 6.)

Color brown. Head much concealed in the thorax, rather dilated, immaculate. Elytra marked with three transverse curved bars at equal distances; outer angle of the apex pointed: legs long, brown. Length nearly half an inch.

CLYTUS? (Plate viii, fig. 3.)

Antennæ shorter than the body, setaceous; second joint the longest: thorax globose, unarmed: elytra entire at the tip. Color black, somewhat yellowish gray from the presence of a yellowish nap. Head black, impressed with a sutural line with a transverse prominence or ridge at its base. Thorax marked with black oculate spots on the top and centre; sides grayish, with a rectangular spot: below it is black. Elytra clothed with a short nap, marked by about three narrow grayish zigzag lines, and dashes of the same about the shoulders: towards the apex they are slightly separated; and upon the apex, running up the suture, there is an obscure oblong gray spot. Beneath, black and glossy: legs black.

This species I found in many parts of this State in June, and supposed it common. Although very peculiarly marked, I have been unable to satisfy myself as yet what name it has received.

CLYTUS ——. (Plate viii, fig. 1.)

Color rufescent, covered with prostrate hair : head black ; thorax grayish, from the lighter colored hair : elytra purplish brown, with three bands of lighter, the basal obscure, the apicial ones confluent on the elytral suture. All the thighs dilated and robust.

This *Clytus* is obscurely marked ; and though it may be described, it differs much from those in my possession, and from accessible descriptions. The bands spoken of are brought out more distinctly in the figure than they appear in the specimens : the same remark will apply to the round black spot upon the base of the elytra ; and, besides, I may add that the side of the trunk is marked by a distinct luteous spot, and another smaller one at the base of the middle legs.

GENUS SAPERDA (FAB.).

Head vertical, as broad as the thorax, slightly compressed at the sides or cylindrical, destitute of lateral spines : antennæ filiform, and terminating in an elongated joint.

The Genus SAPERDA contains several species known to be injurious to the interests of husbandry. Most of them are rather sluggish in their mature state, manifest far less activity than many other insects, and rarely attempt to escape when in danger of being captured. Some of them frequent flowers, but I belive all deposit their eggs upon trees or shrubs. When the eggs are hatched, the young larvæ penetrate the bark and wood, and injure very materially the growth of the tree in which they reside ; and as they are generally two or more years in coming to maturity, their hurtful effects are proportionally augmented. The larvæ feed upon the wood as they penetrate it, and derive their nutriment from the juices it contains. Their excrement appears like sawdust ; retaining in fact the color of the wood, after it has sufficed to nourish them, and has passed through their bodies. Their form is that which is common to the tribe, the rings near the head being wider than those of the rest of the animal. The head is usually scaly, and is retractile in part within the first ring : it is supplied necessarily with strong jaws, in order that the insect may eat its way into the wood. Their food is constantly before them in their path ; and it is a very curious fact, that though they may make their way into the wood, yet they usually direct their course towards the outside when about to change from the larva to the imago state. The larvæ are without legs, soft, white or yellowish white, elongated, and more or less flattened.

One of the most destructive of these species is the larva of the *Saperda candida*. This

species, like many other insects, seems to be much more abundant some years or periods than others, and also more common in some districts than others. In illustration of this fact, I may refer to the existence of this species in the neighborhood of Troy in 1825. This was first made known to the public by the late Judge Buel, in one of the numbers of the Albany Cultivator. He says that 'he was sent for by Mr. Heartt of Troy, to witness the devastation made in a fine young orchard by a grub hitherto unknown to the farmers of the vicinity, and which to know and guard against was a great public interest.' It appears from the letter that the orchard was injured to the extent of two thousand dollars, according to the estimate of Mr. Heartt.

The larva of this species penetrates the young tree just above, or it may be just below, the surface. In its progress, it cuts its way in a winding direction upward; and as it is three years in coming to maturity, it continues to mine onward, cuts off the circulation of the sap, and deprives the tree of its necessary nutriment. One borer is sufficient to stop the growth of a young appletree; and if several are mining at the same time, the tree is inevitably destroyed. All the workings being near the root, the tree is after a while so perfectly riddled with holes that it has no strength to stand. The circumstances that favor these results, are, first, a poor soil, containing but little nutriment; the second is the growth of sprouts or suckers from the root, and of grass, which protects the base of the tree from sunshine, and conceals from the view of the owner the work which is going on. Hence all young trees should be kept free from these incumbrances at the root: this is one of the preventives of a fatal result, and should not be neglected.

It is needless to dwell upon the injurious effects of the *appletree borer*. I would take the liberty to caution the owners of orchards of fruit trees not to trust to uncertain measures, as the surrounding of the roots and base of the tree with tanbark or any other material of the kind. A judicious use of the knife and a good stiff wire are the only certain means of getting rid of these customers, when they have once got possession of the premises.

The perfect insect, according to Dr. Harris, comes forth in June: this, at any rate, is the month during which I have found them. They come out at night: in the daytime they are engaged in feeding upon the leaves of the tree, or remain quietly at rest, very rarely flying during the day.

That carelessness and inattention to young and old orchards is the great cause of the prevalence of this insect among us, is true; and so long as so many neglect the means for ridding their trees of this pest, so long it will continue to harass those who are on the watch, and who intend and wish to raise good fruit. A remedy, consisting of a solution of camphor in chloroform, may be tried, by inserting in the borings a plug of cotton wool soaked in it: it is worthy of trial, and may save cutting away the sound wood of the tree. Or perhaps camphor alone, or ammonia formed by rubbing together sal ammoniac and an alkali, either lime or potash, reduced to powder, and introduced into a burrow where it is dangerous to follow the larva, may be worth the experiment.

The larvæ of the *Saperda calcarata* infest lombardy poplars. They are yellowish white, and, when full grown or mature, are nearly two inches long : the body is thick, dilated before, and consists of twelve segments separated from each other by deep transverse furrows. In August and September, the beetle may be found on the different species of poplar : it flies by night. It is harmless in comparison to the appletree saperda ; but one of our finest shade trees is the aspen, which is often destroyed by this borer. Their presence may be known by their castings, which lodge on some part of the tree.

The *Saperda* (*Oberea*) *tripunctata* seems to be equally destructive with the two former to forest and shade trees. It is about the size of the *candida*, but quite different in its markings, as will be seen by a reference to the description. It attacks the linden, and, by burrowing beneath the bark, destroys the vitality of the tree, large flakes of which fall off gradually and drop to the ground as their attachments are broken.

SAPERDA VESTITA. (Plate xxvi, fig. 4.)

Color olive or light drab, nearly uniform : surface beneath the close-pressed nap, black. Head and thorax immaculate. Elytra dotted, each dot giving origin to a small pencil of black hairs : dot-punctures in lines at the base and along the sides, and marked with four black dots a little above the middle of the elytra ; and sometimes there are other dots, owing to the denuded nap upon little elevated points of the elytra. Length seven-tenths of an inch.

This species attacks the linden : the larvæ, by their burrows beneath the bark and within the wood, effectually destroy the tree in a few years.

SAPERDA CANDIDA (Fab.). *S. bivittata* (Say). (Plate xvi, fig. 3.)

Color light brown, marked upon the upper side with two white stripes extending the whole length of the insect : face, antennæ, underside of the body and legs white. The white is due to the clothing, which consists of a white close-pressed short nap : where rubbed off, the surface is black. The white stripes decussate from the forehead, leaving the grey-brown stripe on the top of the thorax passing down the sutural line. Length six- to seven-tenths of an inch.

SAPERDA (ANÆREA) CALCARATA. (Plate xvi, fig. 1.)

Color gray or ashen, and covered with a short dense close nap : surface covered with raised points or dots : thorax marked with three pale ochreous stripes, which decussate from the forehead. The elytra are also marked by partial stripes and bands of the same color : apex terminating in a straight short spine ; beneath pale gray ochreous. Beneath the nap, the surface is black. Length nine-tenths of an inch.

SAPERDA TRIDENTA. (Plate xxvi, fig. 6.)

Antennæ slender, shorter than the body, second longest. Color rusty brown, approaching to an olive : sutural line passing through the head and thorax. Insect ornamented with pale brick-red stripes : face margined, and eyes surrounded with the colored stripe referred to. Stripes nearly unite between the antennæ : from thence they diverge abruptly, and form lateral stripes upon the thorax ; thence they proceed to the prominent or angular shoulders, run down upon the sides of the elytra, and meet the outer angle of the apex, and then pass round on the inside a short distance upon the sutural line. These stripes send off three diverging ones : the first is arched ; the second or middle is straight, but passes obliquely downwards near the suture ; the last, or apical one is short, and arched. The sides of the thorax are marked by four oval spots. The two spots on the top of the thorax are obscure ; but in some species there seem to be four, though the two near the head may be produced by loss of the drab-colored nap. Beneath hoary, the whitish nap covering a black ground. Extremity of the abdomen truncate. Outer angle of the elytra rounded.

SAPERDA ——.

Color yellowish drab, uniform : head, thorax and elytra covered with a close-pressed short nap. Thorax longitudinally marked with pale yellow stripes alternating with deeper. Elytra punctured, and marked with about seven obscure yellowish spots on each.

SAPERDA (OBEREA) TRIPUNCTATA. *Raspberry Saperda.* (Plate xvi, fig. 7.)

'Color black : breast and top of the thorax rusty yellow. There are usually two elevated black dots on the middle of the thorax, and a third on the hinder edge. Antennæ of a moderate length, and scarcely taper. Wing-covers coarsely punctured : punctures in rows on the top, but irregular on the sides and tips. Length from three-tenths to half an inch' (HARRIS). There is also a black spot on the sides of the thorax.

Dr. HARRIS observes that this insect completes its transformations near the end of July, and lays its eggs early in August on the stems of the blackberry or raspberry. The grubs burrow into the pith of the stem, and destroy it by the end of summer.

The grubs are cylindrical in the middle, and thickened at each end. The first three rings are short, and each is provided beneath with imperfect legs in the form of minute pointed warts : the rest of the rings are smooth.

GENUS MONOCHAMUS.

Elytra somewhat parallel ; antennæ glabrous ; anterior male tarsi hairy ; forelegs longest ; thorax laterally spined*.

* KIRBY, in his generic characters in the Fauna Boreali, says this genus has eleven joints in the antennæ. I believe it has only ten, and the last joint is the longest, or equal to the second.

MONOCHAMUS TITILLATOR. (Plate xvi, fig. 5.)

Brownish, mottled with gray spots. Elytra tufted with patches of dark brown hairs : antennæ, in the male, twice as long as the body ; in the female, they equal it in length. Length one inch and more.

The middle leg has a protuberance on the upper side. The mottlings are somewhat variable, owing in part to the removal of the short close nap that covers the insect.

MONOCHAMUS MACULOSUS.

Color blackish brown. Elytra mottled and furnished with small patches of raised spots tufted with hair, rather coarsely punctured : apex, on the inner side, armed with a spine ; outer angle rounded : protuberance of the tibiæ one-third the length from the tarsi. It is rather smaller than the *titillator*.

The two foregoing species are rather common in Albany county : indeed, common to New-York and New-England.

MONOCHAMUS SCUTELLATUS.

Color dark brown, darker upon the base of the elytra. Scutel white, hairy, strongly punctured : punctures confluent at the base. Antennæ and legs dark brown.

MONOCHAMUS PULCHER.

Color lighter brown than the *scutellatus*. Thorax and elytra variegated with patches of white nap.

ONCIDERES CINGULATUS (Serv.). (Plate xxii, fig. 1.)

Ash-gray, banded : head inclining to brown : thorax ash, together with the middle of the elytra ; base and terminal extremity darker, and somewhat mottled. Length six-tenths of an inch.

Dr. HALDEMAN remarks*, that 'this insect appears in Pennsylvania during the last two weeks in August and first week in September. It feeds upon the bark of the walnut (*Carya alba*). The ova are a line and a half long, and are deposited in excavations in the small limbs. After the ova are deposited, the female gnaws a groove around the limb, which consequently dies in a short time : this seems to be intended for the future progeny, as the larvæ are found feeding upon the dead wood. When the insect is abundant, much damage may be done to the young growth of the hickory, when it is of the size suitable for hoop-poles.' When the main stem is girdled by the insect, a lateral shoot appears, that may be attacked the next year, to be in its turn amputated after undergoing the same operation : in a few years, the tree presents a curious appearance.

* Jour. Acad. Nat. Sci. Philadelphia; HALDEMAN, Am. Phil. Transactions, x, 52.

LAMIA ——. (Plate xxvi, fig. 9.)

Color gray, and banded. Thorax spined at the sides : face marked with an impressed line, depressed between the antennæ ; antennæ ten-jointed, first joint narrowed at base, second joint slightly longest, the upper half of each very black, the lower half gray. Front of the thorax is marked by a black transverse line, in the rear of which there are two small black spots : posterior part of the thorax is punctured with black, especially the transverse groove. Elytra thickly and coarsely punctured with black, and traversed by four belts, the two front ones incomplete : they are zigzag in form, and interrupted by gray spaces. Abdomen narrowed somewhat behind, and terminated by a black ovipositor. Femora thickened, and clavate at the tibial end, gray : tibiæ marked by black rings ; tarsi black. Post-pectus deeply emarginate and gray.

The foregoing is a rare species in this vicinity. Its ovipositor shows that its eggs are deposited in wood, and hence it is an injurious insect to timber. Length, including the ovipositor, seven-eighths of an inch.

TETRAOPES TETROPHTHALMA (Forster). *M. ternator* (Fab.). (Pl. v, fig. 11.)

Color brick-red. Thorax marked with four black dots arranged in the form of a square. Elytra marked with four black dots ; two near the basal angles, and two placed longitudinally upon the middle. Antennæ black : body beneath and legs black.

This insect is common on the silkweed (*Asclepias syriaca*) in June and July, and is extensively distributed, extending from Massachusetts to Carolina (HALDEMAN's Mat. Hist. Long. Am. Phil. Soc. x, 53). It is a harmless insect in its mature state.

ELAPHIDION VILLOSUM (Fab.). *E. putator* (Peck). (Plate xvi, fig. 8.)

Color brown, gray or hoary from patches and stripes of grayish down : thorax more villose than the elytra. Antennæ spinous : the second joint armed with a spine as long, or nearly as long as the third joint ; the spine of the third joint, one-third as long as the fourth joint ; on the fourth joint, the spine is shorter still. Elytra punctured, and apex spined. Beneath, the same color as above : legs villous ; hindlegs armed with a short spine.

Although about a dozen species of this genus have been discovered in the United States, the habits of this one only are known. The larva feeds upon the wood of whiteoak or blackoak, and more rarely of hickory and chesnut ; and on one occasion I reared a specimen, apparently of this species, from a larva taken from the dead trunk of a small spruce tree. The insect is half an inch or more in length, and may be distinguished by its chesnut color, varied with yellowish spots of down ; the small spine upon some of the joints of the antennæ, and two upon the tip of each elytron ; and by the smooth raised medial line, and tubercle, upon each side of the pronotum above.

When the larva attains its full growth in the branch, which is about half an inch thick, it cuts it off transversely from the inside, leaving the bark alone untouched; and this slender hold is severed by the storms of autumn, when the branch and larva fall together. The larva does not leave its shelter until the next spring, when it appears as a perfect insect in May and June.

ELAPHIDION? ——. (Plate viii, fig. 9.)

Head small : thorax somewhat flattened, dilated at the sides. Antennæ ten-jointed : the tenth longest; the second, third, fourth and fifth spinous upon the inside. Thorax marked by two sharp impressed lines : legs equal or subequal. Color of the body luteous, from the close pressed hair or nap : thorax brownish, without tubercles or armature : elytra luteous, mottled somewhat by darker spots, narrowed somewhat behind, and terminated by two spines concealed in the hair. Beneath slightly brownish, and clothed with appressed hair, especially upon the breast.

I refer this insect to the Genus ELAPHIDION, though its generic character may not entirely warrant it.

Lepturidæ.

THE insects under the name of LEPTURIDÆ, or *Lepturians*, constitute a third family of the capricorn beetles. The body is narrowed behind : eyes rounded, oval, and rather prominent; and the antennæ are situated farther from them than in the other species, and are implanted near the middle of the forehead : thorax widened behind : head connected with the thorax by a narrow neck. Colors bright.

GENUS DESMOCERUS (Dej.). CERAMBYX (Forster); STENOCORUS (Fab.).

Eyes lunated, surrounding the base of the antennæ : head sloped before; palpi terminated by a large joint in the form of an elongated compressed cone : thorax subquadrate or subcylindrical : antennæ setaceous.

DESMOCERUS PALLIATUS. (Plate xvi, fig. 6.)

Color deep violet or prussian blue : nearly one half of the elytra orange yellow.

The larvæ live in the stem of the white elder, and feed upon its pith. This year (1853) this insect has been very numerous in the vicinity of Albany.

GENUS RHAGIUM (FAB.). LEPTURA (Lin.).

'Body broad, depressed : thorax with spines on each side; antennæ short' (WESTWOOD).

RHAGIUM LINEATUM (Oliv.).

Antennæ short. Thorax narrow, cylindrical before and behind : middle of the thorax is furnished with a pointed wart on each side. Elytra wide at the shoulders, and tapering, convex above, with punctures between the smooth elevated lines, and ornamented with black and reddish ash colors, the former arranged in transverse bands. Underside variegated with dull red, gray and black.

The grubs of this beetle burrow under the bark of the pitch pine; in consequence of which, it is loosened, and falls off, when the tree dies. The grubs are often numerous: when about to become pupæ, each one forms for itself an oval ring of woody fibres. The beetle is matured before the close of winter, but remains till the spring opens (HARRIS, Injurious Insects of Massachusetts, pp. 92 – 93).

I have found the larva under the bark of the yellow pine and white pine, where it is readily recognized by forming, at the period of its transformation, an oval cavity, the border of which is made of woody fibres. The habits of the European *Rhagium indagator* (Fabr.), are similar. This insect is usually about seven-tenths of an inch long, although it is sometimes found no longer than four-tenths. Its color is gray, marked with black: the surface is somewhat downy; the antennæ are short; the elytra wide at the base, and having several raised lines; and the prothorax has a tubercle on each side. The perfect insect appears in May (HALDEMAN, MS. Notes).

PURPURICENUS HUMERALIS (Fab.). (Plate xvi, fig. 4.)

Black. Elytra marked with a rightangled triangular scarlet spot situated upon the base of the elytron, the hypothenuse passing by the side of the scutel. Thorax, neck sculptured and rugose, and furnished with a lateral pointed tubercle and two elevated roughened ridges or eminences on the median line. Length variable: female, six-tenths of an inch; male, less than half an inch.

This insect seems to be rare in the vicinity of Albany, as not more than three or four specimens have been taken in the last three or four years.

GENUS LEPTURA.

Antennæ elongate, basal joint robust, second minute; eyes narrowed above. Head exserted: thorax convex, unarmed. Insect narrowed behind from the base of the elytra to the extremity of the abdomen: legs elongate, slender.

LEPTURA VITTATA (Oliv.). (Plate viii, fig. 13.)

Color black or very dark brown: head, thorax and legs black: elytra punctured black, and marked with a rufous stripe extending from their base to two-thirds of their length, and occupying the middle of the elytrum. Beneath, the insect is clothed with short gray appressed hairs.

LEPTURA RUBRICA.

Color black : head and thorax black, pubescent; four first joints of the antennæ black, the remainder luteous at base. Elytra ferruginous, punctured; apex of the outer angle pointed, and longer than the inner, divaricate : legs black.

I refer this to fig. 10, pl. viii : the apex of the elytra in that figure is truncate.

LEPTURA MALACHITICUS.

Splendent green, with steel-blue reflections : punctures dilated deep, imparting a rough appearance. Antennæ and scutel black : thighs rufous, and lower half of tarsi dark brown or black : prothorax with a lateral tubercle, occupying nearly a central position.

This beautiful insect is quite rare in the vicinity of Albany, a single specimen only having been observed.

LEPTURA OCTOPUNCTATA (Say).

Elytra marked with eight irregular-shaped spots or dots, smallest upon the apex.

LEPTURA ——. (Plate xxvi, fig. 11.)

Color black (the light color is due to a close gray nap). Antennæ ten-jointed : first somewhat turbinate, third shortest, second the next shortest; the three first black or dark brown, the remainder rufous. Pectus and thighs brown, and a stripe beneath the shoulders. The posterior part of the thorax surrounded by a sharp ridge, which extends down the sides : this ridge is bounded by grooves; and before it, and near the middle, are two elevations, scarcely tubercles : anteriorly it is surrounded by a broad groove. Behind the antennæ, there is a deep depression upon the median line of the head. Length three quarters of an inch.

LEPTURA SUBPUBESCENS. (Plate viii, fig. 11.)

Color black, thinly covered with luteous hairs, punctured : head and neck roughened, covered with hairs. Antennæ black; third joint shorter than the fourth. Elytra punctured, rufous or dull brick-red, terminated by a black belt extending up the outer margin, divergent towards the apex; apex truncate. Point of abdomen exposed : beneath black, submetallic.

GENUS PACHYTA (SERV.).

'Body robust : thorax subconical, with an obsolete obtuse tubercle on each side; elytra short, nearly parallel; humeral angles not very prominent' (WESTWOOD).

PACHYTA CORDIFERA (Oliv.). (Plate viii, fig. 12.)

'Front clothed with yellow hair; frontal line impressed. Prothorax much widened and biarcuate posteriorly, covered with yellow hair, and having the median line obsolete. Elytra divaricate, and separately pointed at the tip: a minute black spot at the basal angle, and another (sometimes double) between it and the large median macula. Length nearly half an inch' (HALDEMAN, *Longicornia*, Trans. Am. Phil. Soc. x, 59).

A variety, *lunaris*, also described in the same work, is black, tomentose: venter dull rufous; elytra yellow; apex, and a semicircular macula behind the middle on the anterior margin, black.

GRAMMOPTERA ——. (Plate xxvi, fig. 3.)

Body black: eyes black, and slightly emarginate on the inner side; color of the upper side luteous. Apex of the elytra black, and the spot toothed on the basal side. Length half an inch.

CHAPTER X.

ORDER I. COLEOPTERA (Continued).

PHYTOPHAGA.

This division (Eupoda of Latreille) embraces a group of insects whose bodies are short, oval, thick, and hemispherical (for an example, see Pl. xiv, 11). The thorax is sometimes angular, uniting closely with the base of the elytra, and forming with them a circle or a broad oval. The head is short, and concealed; the antennæ shorter than the body, filiform. The insects are usually small, but their colors are lively and brilliant, though only a few are metallic in this climate: the *Eumolpus* is one of the brightest. They are vegetable feeders in the larva and perfect states, and some of them are highly injurious; the *Haltica* destroying the turnip crop, and the *Crioceris* the asparagus plant.

Crioceridæ.

The body is oblong in this family, and the hindlegs are often thickened for leaping. The head and thorax are narrower than the abdomen. The antennæ are filiform, or only slightly thickened at the tips: they are inserted before the eyes, which are prominent. Found upon leaves and stems of trees.

Crioceris (or *Lema*) *trilineata* (Oliv.), is a yellow insect about one-fourth of an inch long; the elytra with three black lines, one along the middle of the back, and one on each side. It belongs to an extensive division which contains many species that are destructive to garden vegetation, generally devouring the leaves, both in the larva and the perfect state. The species here cited attacks the foliage of the potato, and Dr. Harris recommends brushing them into shallow vessels of salt and water, or vinegar.

Crioceris duodecimpunctata.

Color yellow: thorax and head brownish; beneath, yellow. Elytra punctate in many rows, and marked with six black spots: each side of the thorax has also a black stripe. Tibial extremity of the femur black, as well as the tarsi. Length rather less than a quarter of an inch.

Cassididæ.

Genus CASSIDA.

Body flattened and depressed : shield or elytra dilated on all sides, concealing the head and body.

Cassida clavata. *Tortoise Beetle.* (Plate xiv, fig. 11.)

Head, body beneath, legs, and antennæ luteous : eyes black : middle of the elytra, with the four angles black or dark brown ; spaces between, together with the extended clypeus luteous and translucent.

Odontota scutellaris (Oliv.), *Hispa scutellaris* (Fab.). This insect has, in conjunction with *Cecidomyia robiniæ* (Hald.), become so abundant in Eastern Pennsylvania during the last few years, that the foliage of the locust trees is killed towards the end of August, as if by dry weather. It is nearly one-fourth of an inch long, of a tawny color, and marked along the back with a black line.

Chrysomelidæ.

Genus EUMOLPUS.

'Head vertical : antennæ as long as the body, thickened at the tips' (Westwood).

Eumolpus auratus (Fab.).

Head, thorax, body beneath, and legs brilliant blue-green : elytra golden green. The feet and antennæ incline more to black, yet exhibit the coloring described.

It inhabits in great abundance the *Apocynum androsæmifolium*, and is found in July and August.

Genus CHRYSOMELA.

Chrysomela philadelphica. (Plate xiv, fig. 12.)

Color of the body dark green, oblong, naked. Palpi, legs and antennæ rufous : labrum hairy. Front and margins of the thorax and elytra cream-color : lines and spots of the elytra, posterior segment of the thorax, and scutel green : inner margin of the elytra traversed by two lines ; marginal line widened towards the scutel ; the proximate line widened also, and both slightly divergent. Lines punctured in rows surrounding the entire thickened border. The shoulders of the elytra marked by two

green spots which converge to each other, the outer the largest : parallel with the marginal line there are three large spots; the remainder are scattered and smaller. The dots are distributed somewhat irregularly, but there is a tendency to arrangement in rows, as at the base of the elytra and along the lines and larger spots.

The insect from which the description is drawn is rather common, but it does not agree with the description of the *philadelphica* by KIRBY, who makes no allusion to the markings upon the thorax. The differences I regard as sexual.

In a few plates, I observe that the ground color is too green : it should be pale, or cream-color.

CHRYSOMELA DECIPIENS.

Head, thorax, body and scutel dark green : elytra silvery white or white. Sutural line thickened, and divergent near the scutel : the parallel and proximate lines wide, divergent before, and narrowed towards the apex; the second is shorter, and united to it; and the third is similar to two heavy dashes united at their points, but instead of being straight, they form a curve divergent from the other lines : these lines are dotted. The shoulders are marked by a heavy dash or oblong spot : two other spots are situated between the shoulder spot and marginal line; the upper roundish, and the lower oblong. There are thirteen spots on each elytrum, besides those already described, each of which is enclosed by a row of dots. Antennæ, palpi and legs rufous.

This species differs from the preceding, in having the thorax entirely of a dark green, and also in the distribution and form of the lines and markings upon the elytra.

CHRYSOMELA SCALARIS. (Plate xiv, fig. 10.)

Head, thorax, body and scutel dark green : elytra silvery white. Sutural line green, and extending to the base : a coalescing line falls into it just below the scutel, and forms with it an unequal stripe. There are two oblique dashes, which do not meet, on each elytrum. The spot upon the shoulder is double, and prolonged in the form of a curve, and there is another curved spot between the shoulder spots and sutural line. There are three coalescing spots upon the posterior flexure of the elytra. The other spots are arranged somewhat in two lines, parallel with the outer margin of the elytra; and there is a solitary dot near the middle, and upon the outer margin of the elytra. The dots are so arranged that they follow the boundaries of the spots. Antennæ, palpi and legs rust-brown.

In the specimen figured, a brownish color predominated instead of the silvery white : it may be a distinct species from the *scalaris*, and is found in the autumn upon various plants.

CHRYSOMELA TRIMACULATA. (Plate xiv, fig. 16.)

Head, thorax, body, antennæ and legs steel-blue. Elytra orange, marked with a broad black band extending nearly across the base, and two large triangular black spots near the apices : scutel and sutural line black. The margins of the black spots are undulating. The punctures of the elytra are arranged in lines. Length three-eighths of an inch.

Found in great abundance in Western Massachusetts and New-York.

CHRYSOMELA PULCHER.

Head, thorax and legs purple : antennæ, body and palpi brownish. Elytra luteous, marked by a wide black longitudinal stripe along the middle. Sutural line double and punctured : margins marked by two narrow black punctate lines, which coalesce just below the middle.

CHRYSOMELA ——.

Head, thorax, body and legs reddish brown. Elytra yellow, marked by a broad double longitudinal brown band; the inner separated from the outer by a curve, leaving between them a line of yellow, acute at each end. Sutural line wide, and dilated at the base. Scutel reddish brown : punctures arranged in lines parallel with the markings. Length nearly one-fourth of an inch.

Inhabits and feeds upon the *Solidago*. It is not uncommon in Western Massachusetts, but I have not succeeded in finding a description of it.

CHRYSOMELA CÆRULIPENNIS.

Color of the head, elytra and body beneath, dark blue; thorax and legs dull orange; antennæ and feet blackish. The females are often seen walking with difficulty, on account of the great distension of the abdomen.

CHRYSOMELA ——. (Plate xiv, fig. 1.)

Head, thorax, antennæ and body steel-blue. Elytra luteous, minutely punctured : punctures on the margins linear. There is a very obscure line of spots or dots along the suture, scarcely visible without the aid of a glass : the tips of the elytra are also dark brown. Autumn, and feeds upon the *Solidago*.

CHRYSOMELA ——. (Plate xiv, fig. 2.)

Head, body and thorax reddish brown; eyes black : elytra yellowish brown, and striped with reddish brown or ferruginous. The punctured lines are also reddish, of which there are about ten to each elytrum, running parallel to the margins. Length one-fourth of an inch.

I am unable to determine whether it is a described species or not.

CHRYSOMELA TREMULA. (Plate xiv, figs. 5, 6 & 7 : larva and pupa.)
Head, thorax, body, antennæ and legs blue : elytra brown, finely punctured.
Foreign : its larvæ feed upon the leaves of the poplar.

CHRYSOMELA BANKSII.
Immaculate, obtusely ovate : head very small; antennæ luteous; thorax with the lateral edges thickened. Color dark brown, glossy, impunctate. Elytra of the same color as the thorax, punctated : beneath, the same color as above; soles of the tarsi cream-colored. Length nearly one-fourth of an inch.

CHRYSOMELA AMERICANA.
Form ovate. Color brown, glossy : eyes black; thorax and head impunctate. Elytra punctate in four double rows, besides the sutural one : between the rows the surface is flat, impunctured, and of a brassy bronze reflection; the punctured lines are purplish. Length one-eighth of an inch.

Galerucidae.

THIS family is exemplified by those very common striped beetles which infest and destroy the cucumber plant. They are oblong, and are furnished with a small head and a narrow thorax. Their antennæ are about half as long as their bodies, of a uniform thickness, and inserted near together and near the mouth. Their legs are of an equal size, though in some the thighs are formed for leaping. They are small insects and vegetable feeders, and often do considerable damage in gardens.

The family is divided by WESTWOOD into two subfamilies : 1. GALERUCIDES; 2. HALTICIDES.

Galerucides.

GENUS ADIMONIA (SCHRANK).

Antennæ eleven-jointed, filiform throughout, and nearly equaling the body in length : joints mostly cylindric; the last acute, and pointed outwards; the second the shortest, obconic; the third next in length, the two equaling the first or fourth; the remainder equaling the first or fourth : labrum entire : palpi indeterminate. Head small, exsert : eyes prominent : body ovate, elongate : legs rather long, equal or subequal; posterior thighs only moderately incrassate.

ADIMONIA ——. (Plate xiv, fig. 4.)

Color yellowish green : head and its appendages black. A depression and two eminences behind the antennæ. The three first antennæ yellowish green; on the outer side, brown; the remainder dark brown or black : pectus black : abdomen yellowish green. Thorax greenish yellow predominating, immaculate : two slight indentations on each side, with a slight lateral ridge or dilatation. Elytra pale green, marked with eleven black rather quadrangular spots : most of them have their angles rounded, so as to approach an oval form; the basal spot is common to both elytra. Legs black : upper half of the thighs greenish. Length one-fourth of an inch.

It will be evident from the above generic and specific descriptions, that this insect is neither a *Galeruca*, *Lema* or *Haltica*, and probably not an *Adimonia* : it belongs, however, to the vast family GALERUCIDÆ. It is rather common in September and October on the asters and solidagos. Either the descriptions within my reach are faulty, or else it has not been described.

LEMA TRIVITTATA.

Rufous : thorax and head rufous; the former punctured transversely at its base, and marked with two black dots. Elytra marked with longitudinal black stripes, the middle sutural : punctures arranged in lines. Antennæ black; first joint rufous : lower tibia and tarsi black. One variety more rufous, and marked with wider stripes and larger dots upon the thorax : sometimes the dots are absent.

Resembles the *striped cucumber-bug*.

GALERUCA VITTATA.

Color yellow : head black. Elytra marked with three black longitudinal stripes, including the sutural one : abdomen black; forelegs mostly of that color : knees and feet o the other legs black.

This insect is troublesome to various vines, and especially to young cucumber vines when not of a vigorous growth. The best remedy is to secure a strong and rapid growth : other remedies, which are more or less successful, are, washing the plant with offensive liquors, or sprinkling them with strong-scented powders. Tobacco in its various forms, whale-oil soap, etc. are all more or less useful.

GALERUCA CALMARIENSIS (Lin.). (Plate xii, fig. 12.)

This is a European insect, which has been introduced into this country about Baltimore. It is destructive to the foliage of the elm. It is about one-fourth of an inch long, and is described by Mr. STEPHENS as follows : 'Oblong-ovate; above testaceous, deeply punctured : crown, furrow on the thorax, scutellum, a dash on the elytra, breast and base of abdomen, black; apex of the abdomen and base of the antennæ testaceous.

ŒDIONYCHUS THORACICA.

Color of the elytra blue purplish, immaculate : thorax luteous, marked with eight black dots; outer margin luteous. The outer half of the tarsal joints and antennæ luteous; the rest purplish.

Halticides.

GENUS HALTICA.

'Form oblong-ovate : thorax narrower than the elytra; posterior tarsi short' (WESTWOOD).

This genus comprises many species, all of which are small, and whose posterior legs are formed for leaping. They feed upon the leaves of vegetables, more especially upon the cruciform plants, as mustard, radish and turnip; the latter of which often suffers exceedingly, in consequence of the insects eating the young and succulent leaves, perforating them like a sieve. Their colors are often brilliant.

HALTICA CHALYBEA.

Body oblong oval : thorax marked with a transverse furrow. Color steel-blue, but variable and passing into greenish blue : underside green; antennæ and feet black. Length from one-sixth to one-fifth of an inch.

DAVID THOMAS, of Cayuga county, has given in Silliman's Journal an account of this species of HALTICA. This excellent observer noticed that his vine leaves were infested with a small smooth chestnut-colored larva; and on feeding them in a tumbler partly filled with earth, they came to maturity and buried themselves, and in two weeks afterwards came out the perfect insect, after having undergone their transformation. The larva feeds upon the tender fruit buds while in a growing state, and hence destroys the fruit for the season. The use of a solution of whale-oil soap would undoubtedly protect the vine, and drive away the insects.

The cucumber is infested with another species of HALTICA, which has received the name of *H. cucumeris* from Dr. HARRIS. It is black, one-sixteenth of an inch long, with clay yellow antennæ and legs, except the hindmost, which is brown : the thorax is marked by a deep transverse furrow (HARRIS).

Another is the wavy striped beetle, *Haltica striolata*, and feeds upon the horse-radish, mustard and turnip; in which respect it resembles the European species, which feeds upon and destroys the turnip crop.

CHAPTER XI.

ORDER I. COLEOPTERA (Continued).

PSEUDOTRIMERA.

This division of coleopterous insects constitutes the Trimera of Latreille. Taking the number of joints in the tarsi, the division would be represented by insects supplied with only three tarsal joints : on close inspection, however, it is found that there is a small joint in the lobes of the second. The form of the insect is oval, sometimes hemispherical : the elytra cover the abdomen. They often feed upon the *Aphis*, and thus perform a useful service to gardeners and farmers. Their colors are often bright, and their thorax and elytra marked in various places by dots and spots (See Plate xi, all the figures ; and letters *a*, *b*, *c*, *d*, larva and pupa state of the *Coccinella*).

Coccinellidæ.

Coccinella borealis (Lin.). (Plate xi, fig 8.)

Color luteous : eyes black. Thorax marked with four black dots, the largest behind upon the central line, and pointed backwards. Elytra marked with seven black dots each, the largest situated towards the apex, and two upon the sutural line. Beneath luteous : breast black.

Coccinella incarnata. (Plate xi, fig. 7.)

Flesh-colored above. Thorax marked with two large transverse black spots ; elytra with seven black spots each, or eleven as they appear when closed, three being common to each (Rich. Faun. Bor.).

Coccinella quinquemaculata. (Plate xi, fig. 5.)

Body black : thorax black ; anterior angles white : elytra tawny ; base banded, and marked with four black spots, the middle spots quadrangular. Length about three lines.

COCCINELLA 20-MACULATA. (Plate xi, fig. 4.)

Color pale honey-yellow, marked with twenty black spots somewhat confluent on the middle of the elytra. Insect quite small.

In some of the plates the green coloring is too deep. There is a variable state of the ground color : sometimes it is entirely pale honey-yellow ; in other instances, there is a grayish green tinge.

COCCINELLA NOVEMNOTATA. (Plate xi, fig. 6.)

Color luteous and reddish, marked with nine black spots ; one common to each elytrum, situated near the base. Thorax black, margined in front with pale honey-yellow : the black portion extends in front towards the head : body black. The color of the elytra is somewhat variable, yellow and reddish predominating each in different individuals.

COCCINELLA IMMACULATA. (Plate xi, fig. 9.)

Color luteous : thorax black, margined with pale honey-yellow or whitish : elytra immaculate : body black. The flank of the thorax is quadridentate.

This insect does not agree with Mr. SAY's description in every particular, still it is not so different as to preclude the idea that it is a variety.

COCCINELLA BIMACULATA. (Plate xi, figs. 10, 11.)

Color ferruginous, verging into luteous. Thorax varied with black and white ; the white dilated margins being marked with a black dot, the black arranged in the form of two decussating wide lines. Head marked with a central black line, which divaricates posteriorly, or sends off branches to the eyes. Elytra marked usually with a single black dot : body black beneath.

COCCINELLA TRIOCULATA.

The black spot upon the elytra is larger than in the preceding species, and the dilated white margins of the thorax are immaculate : the color of the insect is paler. The abdomen is black, bordered with rufous.

COCCINELLA DUODECIMNOTATA.

Body black : head black and quadridentate in front, margined with luteous : thorax black, marked with two oblique rectangular spots, and margined with luteous. Spots of the elytra twelve, and none of them sutural.

COCCINELLA ABBREVIATA.

Elytra ferruginous, marked with eight black dots situated between the middle and the apices. Thorax black, with fuscous angular spots, and margined with fuscous.

COCCINELLA TRANSVERSOGUTTATA.

Elytra marked with four black dots arranged in a line across the middle.

COCCINELLA BINOTATA.

Color black, with two brown-red spots in the centre of each elytrum. Margin of the thorax white.

COCCINELLA DECIMMACULATA. (Plate xi, fig. 4.)

Color red, deep flesh-red and purple. Head and thorax marked with two black spots; elytra with ten, one common to both at or near the scutellum, and another below the middle upon the suture: body and legs black. Length about two lines.

CHAPTER XII.

ORDER II. EUPLEXOPTERA (WESTWOOD).

THIS order of insects (the DERMAPTERA of LEACH) is extremely small as to numbers, but the individual species are widely distributed. It bears a relationship to the orders COLEOPTERA and ORTHOPTERA, having by different naturalists been placed in each : it is, however, regarded as having a closer affinity with the latter than with the former, in consequence of the peculiar structure and foldings of the wings. In the structure of the mouth, and the transformation of the insect, it corresponds to the orthopter, but to the coleoptera in the folding of the wings. The order is characterized thus by WESTWOOD :

'Anterior wings leathery, very small and uniting in a straight suture, horizontal, partially covering the wings. Posterior wings large with radiating nerves, and with numerous transverse and longitudinal folds. Mouth with transversely movable jaws, the posterior pair being galeated. Anus forcipated. Pupa semicomplete, active, resembling the imago, but with rudimental wings.'

The type of this order of insects is the common *earwig*, an insect far more notorious in other countries than in this. It will be readily recognized by its elongated form, its short wings like the *Staphylinus*, and the forked armature of its abdomen, which forms an organ of offence as well as defence. Its habits are somewhat peculiar : it is nocturnal, and goes abroad for its food by night; but with the appearance of light, it seeks to hide itself in holes and crevices where it can escape observation. Tradition affirms that it creeps into the ear, but it does not appear that there any facts to sustain the assertion.

The *Forficula* is a vegetable feeder, subsisting upon flowers, fruits, etc., and is regarded as an injurious insect. Hence the English gardeners take advantage of its propensities, by placing in proximity to the flowers and vegetables they wish to protect, crab's claws, or narrow reeds closed at one end, into which the insect takes shelter, where it is readily captured and destroyed.

CHAPTER XIII.

ORDER III. ORTHOPTERA (Olivier).

This order (the Hemiptera of Linnæus) embraces those insects whose wings, when at rest, are folded longitudinally upon the body, and present a straight outline : for this reason they have received the designation *orthoptera*, which literally means *straight-winged*. In this name, then, we perceive one of the distinguishing characteristics of the order. In addition, however, to this single character, we find their wings folded like a fan : they have also a pair corresponding to the elytra in beetles, which are of a leathery consistence, and perform the same office, that of protecting the delicate wing beneath. Their wings and wing-covers are deflected upon the sides of the body, forming an angle with the top, and, besides these peculiarities, they overlap each other upon the back. By this arrangement, the males are furnished with organs wherewith to produce different sounds, while a particular modification of the organ enables each species to form its peculiar note.

Orthopterous insects are provided with jaws which move transversely, similar to beetles, and hence the name *mandibulata* applies to them.

Another and still more important characteristic is found in the kind of metamorphosis they undergo. In this respect, they differ greatly from beetles and the butterflies : their metamorphoses or transformations are incomplete ; their young, in the early stages of life, resemble the parents in miniature, their wings being the most imperfect parts ; they eat and move about like the adult, and, like the young in other classes, they grow until they reach the perfect state. From these comparisons, we see why they should be separated from the beetles, and placed by themselves in an order expressive of the characteristics that belong to them.

The order has been divided into four sections, formed from differences of habit due to the peculiar construction of the organs of locomotion. The sections have received their names from the modes in which these organs are used : the first embraces the runners, *Orthoptera cursoria* ; the second, the graspers, *Orthoptera raptoria* ; the third, the walkers, *Orthoptera ambulatoria* ; and the fourth, the jumpers, *Orthoptera saltatoria*.

In the section comprising the runners, we find the cockroaches ; in that of the graspers, the mantis, whose forelegs are used as arms and hands ; in that of the walkers, the walkingsticks ; and in the section of jumpers, the grasshoppers and locusts.

The arrangement seems to be clear and satisfactory, and yet it will be seen, as in most other arrangements, that the lines of demarkation are imperfectly drawn; for in the section containing the cockroaches and earwigs, the insect possesses the power of flight: still it is probably sufficient for all practical purposes.

Some of the species of orthopterous insects are extremely prolific: thus cockroaches become innumerable, and locusts appear in clouds that darken the sky; and, even in our own more favored country, who has not seen the red-legged grasshopper multiply to such an extent as to devour all the herbage of hundreds of acres!

Blattidæ.

This family (*Cursoria*, the runners) is represented by the well-known and troublesome cockroach. The body is oval, flattened: wings coriaceous, with their inner margins overlapping each other. The thorax is large, often concealing the head: antennæ long, simple and setaceous, being formed of from fifty to one hundred and fifty joints; mandibles short, strong, and toothed at the tip; upper lip entire; labium bifid; eyes kidney-shaped; legs long, formed for running; tarsi five-jointed; abdomen furnished with two articulated processes. The males are smaller than the females.

We have several species of cockroach, which either inhabit fields or woody places. The common domestic one (*Blatta orientalis*) is an imported kind, and is very troublesome in basements, cellars, etc.; while the former, or indigenous species, never comes into our dwellings.

The methods that have been proposed for destroying the domestic cockroach are numerous: they consist in the use of substances which are generally poisonous, and therefore should be used with due precaution. Arsenic, red lead, or other mineral poisons may be mixed with mashed potatoes or meal, and set upon the shelves, floors, etc. frequented by the insects; and as they are fond of almost every kind of vegetable mixture, they greedily devour the mess, and are speedily poisoned.

These insects penetrate the most hidden parts of a building, even into the brick work of walls, where their young are frequently produced. They sometimes disappear from the premises without any known cause: at other times, their numbers greatly diminish in a short period of time.

Blatta nivea. (Plate xlvi, fig. 7.)

'Head and antennæ yellow; thorax and abdomen pale green; wings and wing-covers white and transparent; legs and underside of the abdomen pale yellowish green' (Drury, Vol. ii, p. 39, f. 1).

Mantidæ.

This family, which succeeds the CURSORES or *runners* in the natural arrangement, consists of insects technically called RAPTORES or *graspers*. The larger and more remarkable species, of which the *Mantis* is one, are not found in New-York or New-England, but smaller kinds are occasionally met with. Plate vii, fig. 4, exhibits the structure of an insect similar to the mantis, which takes its prey by grasping or seizing it with its forelegs. Its habits, too, are much like those of the mantis : it remains motionless upon a twig or limb of a bush, in a sitting posture with its front parts elevated, until a desirable object comes within its reach. The family are all carnivorous, and hence aid in diminishing the number of vegetable feeders.

Phasmidæ.

The insects of this family (*Ambulatoria*, the walkers) are distinguished by the undeveloped state of the wings, or by their total absence. One or two of these remarkable animals are found in New-England and New-York : they are commonly called *walkingsticks*, and the most common species is the

SPECTRUM FEMORATUM (Say). (Plate vii, figs. 1, 2.)

Apterous : intermediate thighs dilated, and furnished with a spine near the tip ; posterior also spinous.

The color of the male is greenish with a mixture of brown, especially on the forelegs and the tibia and tarsi of the others : abdomen equalling the body, and furnished with nine segments, terminated with two curved appendages. Female brownish, thick, with the trunk and abdomen nearly twice their size in the male : legs greenish, but less so than in the male ; the thighs less dilated.

This species is rather common, in the months of August and September, in the vicinity of Albany and in Western Massachusetts.

Saltatores.

This section (*Saltatoria*, the jumpers) is represented by the common cricket, and embraces those insects whose tarsi are three-jointed, antennæ setaceous, head large, with a convex crown, and inserted deeply into the thorax ; with ovate eyes, and two or three ocelli. The thorax is truncated in front ; elytra horizontal ; body elongate ; wings folded longitudinally ; abdomen cylindric ; legs stout and short ; tarsi without foot-cushions between the claws.

Achetidae.

ACHETA ABBREVIATA.

Color black : elytra turgid, brownish posteriorly; abdominal appendages elongated and pilose; posterior tarsi armed with a double row of spines.

Crickets are nocturnal in their habits, and hence seek their food and their mates in the evening. If numerous, they become injurious in gardens; feeding upon the different kinds of fruit, melons, tomatoes, potatoes, beets, etc.: when in fields, they eat the tender grass. They are not, however, confined to a vegetable diet, but they kill and devour such insects as they can overpower. The insect lays its eggs in autumn : they hatch in the spring, and the young are three years in coming to maturity.

To diminish the number of crickets in gardens, arsenic may be resorted to.

The mole cricket, *Grillotalpa brevipennis*, differs from the common cricket in the dilated form of the tibia, the lower side of which is strongly notched to fit them for burrowing. These notches have a distant resemblance to fingers, and they give to the organ the power of a hand. From the construction of the forelegs, then, and the use to which they are applied, the species has received the name of *mole cricket*. They are fawn-colored, and covered with short velvety down : they reside in soft moist soil, and throw up ridges of loose earth; they feed upon roots, and, if numerous, might do considerable damage : they are, however, rarely seen, and the effect of their feeding is scarcely perceptible. Length about one-fourth of an inch.

No one, who takes much notice of the habits of insects, but must have observed the extreme timidity of the cricket. This is especially true of the field crickets : when they issue from their dwellings, it is with extreme caution; and when the slightest approach of danger is visible, they seek at once their asylum, and do not again appear abroad until all their suspicions are allayed.

It is well known that the black cricket flies well; but it has been observed by naturalists upon whom we may place confidence, that field crickets never use their wings. This I believe is mainly true; but yet frequently when they are pursued, they spread their wings, and make a more extended leap by their use. Their wings are not defective in construction, but seem to be well organized and fitted for flying. The males, it is said, carry on a destructive warfare upon each other during the breeding season.

In some crickets the wings are undeveloped : some species prefer damp and even wet places; others, dry and stony.

Crickets have been destroyed in great numbers by placing in their way vials half-filled with beer, into which they crowd and are drowned.

Gryllidæ.

This family (the *Grasshoppers*) is characterized by the possession of four jointed tarsi, long setaceous antennæ, a large vertical head and convex forehead, vertical prominent eyes, a thorax flat above, and its sides suddenly deflexed and rounded behind : body more or less compressed; the breast furnished with two oval foliated plates; elytra coriaceous, descending the sides; abdomen compressed slightly, and furnished in the male with two processes, and in the female with an ovipositor. The legs are long behind, with thickened thighs and spines.

Platyphyllum concavum (Harris). *Katydid.* (Plate ix, fig. 1.)

Color of the body pale brown; elytra and wings, grass-green. Antennæ long, setaceous, yellowish, dilated at the base; eyes prominent, hemispherical; head greenish, brownish on the top, front ridged, terminating between the antennæ in a triangular apex : thorax greenish, rough, its integument saddle-shaped. In males the musical apparatus occupies a triangular space, covered with a dense parchment-like membrane. Elytra narrowed before, dilated behind and laterally widest near the extremity of the abdomen, and longer than the wings : nervures consist of one principal trunk, sending off numerous branches below at right angles to it. Wings narrower and shorter than the wing-covers; branches of the nervures two. Legs green : tibiæ quadrate; each corner serrate or short spinous. Body of the male over one inch long. The female is furnished with a curved ovipositor (see the figure) about one fourth of an inch long, and both sexes with two projections between the forelegs. The wing-covers, in their natural position, form a convex covering extending in the female far enough to cover the ovipositor.

The katydid is in its state of perfection in September : the female, about this time, deposits her eggs in a row upon the twigs of the tree she inhabits. Dr. Harris describes the musical instrument as consisting of a pair of taborets : they are formed of the membrane already spoken of, which is situated at the base of the wing-covers. This parchment-like membrane is stretched upon a strong, half oval frame, fitted into the space at the base of the thorax. Their notes are emitted during the evening and night, and sometimes in dark lowering weather in the afterpart of the day. It is not common, neither is it easy to discover the retreats of this singular insect : the color of their wing-covers favors their concealment among the foliage of the trees.

The katydid feeds upon leaves; but it would not comport with the truth, to charge it with doing much damage to the farmer.

PHYLLOPTERA OBLONGIFOLIA.

This species differs from the preceding in having the wing-covers narrower, flat and not concave, the true wings extending beyond them, and they are deflected down the sides abruptly. The most distinctive characteristic is the absence of the projecting integuments between the forelegs.

PHANEROPTERA ANGUSTIFOLIA (Harris). (Plate ix, fig. 1.)

Color brownish green : wings and wing-covers green, the former narrow, their upper and lower edges being nearly parallel, forming an organ equal in width except at and towards the base, shorter than the wings and rounded behind. Abdomen terminated in the male by a short projection, which curves upward. The wings do not conceal the body. Length of the body, three-fourths of an inch ; the whole length, about the same as the katydid.

The habits of the three foregoing species are much the same, each kind coming to perfection in September ; but the sounds they emit are different.

Locustidae.

THE name *locust* is applied usually in this country to our harvest-fly, which is commonly called *the seventeen-year locust*. The term *locust*, however, is here improperly applied, inasmuch as the insects which have been known from time immemorial as locusts belong to a different order from the harvest-flies. The rule of priority should be regarded in this instance ; and, besides, the name *harvest-fly* is sufficiently appropriate. The true locusts, on the other hand, have been called *grasshoppers ;* a term which, by better usage, belongs to the green insects of which the katydid is an example. The true locusts possess the following characters : their antennæ are shorter, and usually filiform ; the elytra longer than the body, though, in forms removed from the typical, they become abbreviated and distorted. The ovipositor of females is not exserted.

GENUS LOCUSTA.

Antennæ filiform, inserted into a slight depression between the eyes : head large ; eyes ovate ; thorax furnished with a central sharp ridge ; elytra longer than the abdomen : four anterior legs subequal, short ; posterior long, and formed for leaping ; tibiæ all furnished with a double row of spines.

LOCUSTA CAROLINA. (Plate ix, fig. 9.)

Color brown, variegated with darker spots : wings black, margined with yellow ; apex spotted with brown or blackish. Length an inch and a half ; breadth, or expansion of wings, nearly three inches. Common by roadsides.

LOCUSTA CORALLINA.

Color light brown, sometimes dark. The wing-covers are marked towards their tips with a triangular yellowish spot, and two or three others on the same line more or less obscure. Anterior border of the wings brown and variegated : the base is vermilion, and widely bordered with brown or dusky and nebulous; the inner portion of the border darker than the outer, and the apex is still darker or more dusky.

Appears early in the spring : is rather smaller than the preceding, and more active.

LOCUSTA SULPHUREA.

Color brown, rather uniform in this respect, the wing-covers rather lighter at the apex; base of the wings sulphur-yellow, varying in brightness in different individuals; margin broadly bordered with dusky, which extends in a sharp triangular patch upon the three nervures towards the base; wing translucent, darker at the apex: abdomen yellowish.

This is subequal to the *corallina*, appears rather later in the season, and frequents dry places.

LOCUSTA NEBULOSA? (Harris). (Plate ix, fig. 7.)

Color brown : thorax ridged, or furnished with a keel-like elevation, and divided in the middle by a transverse fissure; wings transparent, with a duskiness of the anterior margin; thighs banded transversely with yellowish and brown; tibiæ brown.

This species, though very common in Western Massachusetts, is described in part from the figure, the original specimen being lost. So far as I can determine under the circumstances, it is the *nebulosa* of HARRIS, and yet he does not speak of the banded markings of the thighs : in other respects, it agrees with his description of that species.

GENUS ACRYDIUM.

This genus differs from LOCUSTA, in having a spine beneath, between the forelegs : the ridge upon the top of the thorax is wanting or obsolete; and the antennæ are generally longer, in consequence of the joints being more elongated, consisting of 24 or 25 joints.

ACRYDIUM FEMORRUBRUM. (Plate ix, fig. 4.)

Color olive-brown above, yellowish green beneath : antennæ pale yellow or olive, darker at the tips; face green or yellowish green; thorax marked with two yellowish lines extending between and along two outer angles, olive-brown upon the top; also another triangular area extending backward from each eye, the base resting upon it. Wing-covers olive-brown, lighter upon the angles. Lower end of the femur surrounded by a black belt, and the upper end of the tibia marked in the same way. Yellow predominates upon the thighs beneath and inside; top brown and reddish brown; tibiæ and tarsi bright red, terminated by four spines : beneath yellowish.

ACRYDIUM FLAVOVITTATUM.

This common species is larger than the former, and is marked with a yellowish stripe on each side from the forehead to the tips of the wing-covers. Length $1\frac{1}{4}$ – 2 inches.

Very common in haying time, and often found in barns among the newly gathered hay.

GENUS TETRIX.

This genus differs from LOCUSTA and ACRYDIUM, by the long and sharp triangular outline when seen from above, or rather the double triangular form of the body of the insect, the base or widest part being between the middle legs, from which it tapers each way; the head being smaller than in the former genera. The insect is small, with small wing-covers; but the wings are large in proportion to the size of the body, and scollopped on the edge. The females have four boring appendages, which are notched on their edges.

Dr. HARRIS divides the genus into two groups : first group, antennæ 13- or 14-jointed; second group, 22-jointed, with additional characters not necessary to be noted here.

For a very full account of these three genera, see HARRIS's Treatise on Insects, 2d ed.

CHAPTER XIV.

ORDER IV. APHANIPTERA (Kirby)

SUCTORIA (Degeer). APTERA (Lamarck).

To avoid incongruities in classification, all that family of insects known as *fleas*, have been separated from their associates, and made an order under the name above given: the order therefore consists of the single family of the Pulicidæ, of which the common flea, *Pulex irritans*, is the leading type. The body of this insect is covered with a firm integument, somewhat shining, and more or less covered with bristles arranged in rows. Its mouth is suctorial, and is composed of a complete apparatus both for inflicting wounds, and for sucking the blood or juices into the stomach.

The Pulicidæ are all small insects, yet their anatomy is well known, as made out in a very elaborate manner by Curtis, Westwood, and M. Duges. The mouth is composed of seven pieces: it has two round eyes situated upon the sides of the head, and antennæ placed behind them in a small cavity which is usually closed with a lid or scale. The thorax has three segments: the abdomen is large; the wings are represented by small scales; the legs are long, but muscular, and hence are capable of performing wonderful feats in leaping.

The flea appears to have a choice among the animals it selects for its prey: the pig and dog seem to enjoy a preference; and for its favorite haunts it selects filthy straw, shavings, litter of most kinds, and dry sandy spots. In these places, under favorable conditions, fleas increase enormously; and the surface of sand where hogs have been littered during the winter is often black with them, especially in southern countries.

The chigre, or jigger, *Pulex penetrans*, of the West Indies, belongs to this family: indeed the species of Pulex are quite numerous; thus the dog, bat, hedgehog, mole, mouse, and cat have each their peculiar species. So even birds are infested with parasites belonging to this genus.

It is in warm climates that the pests of this family most particularly abound, and their torments are most felt and dreaded, rendering a residence there extremely uncomfortable. In our own country, cleanliness is the antidote to fleas. The dooryard is frequently the nursery for them, especially where chips and decaying wood are allowed to accumulate, mixed with straw, the refuse of the kitchen, and the blood of domestic animals that have been killed for food.

An infusion of tobacco is an effectual remedy for domestic animals against fleas, and the heaps of filth in which they are engendered should be removed and burnt.

CHAPTER XV.

ORDER V. HOMOPTERA.

OMOPTERA (LEACH). HEMIPTERA (LATREILLE).

THE insects of this order are provided with a suctorial mouth, resembling in this respect the HETEROPTERA, but with the mouth placed nearer the sternum. Notwithstanding this resemblance, the two orders are quite distinct, and the lines of demarkation well defined. The wings of the HOMOPTERA, in the first place, are entirely membranous, and do not overlap when at rest; the antennæ are short and setiform, and the tarsi number three joints. The metamorposis is of that kind called *semicomplete*, and the pupa is therefore active.

In this order are found insects of very remarkable forms : it is true, such a remark is often made respecting other orders, yet probably no insect shows more grotesqueness of outline than the leafhopper. Some subdivisions of the order contain insects which singly are perfectly insignificant; yet as they increase to an enormous extent during a single season, they become, from numbers alone, a formidable foe to the interests of the farmer.

The HOMOPTERA are divided into three families : 1. The HARVEST-FLIES, called in systematic arrangement *Cicadidæ*, or *cicadians ;* 2. The PLANT-LICE, *Aphididæ ;* and, 3. The BARK-LICE, *Coccidæ*.

Cicadidae.

ANTENNÆ short, awl-shaped, and terminated with a bristleform point : eyelets three; wings and wing-covers inclined at the sides of the body, transparent and reticulated; feet three-jointed; integument of the body hard and firm. Females furnished with an ovipositor lodged in a furrow beneath the abdomen. Insects walk and fly.

The harvest-flies are so called from the circumstance that they make their appearance about the time of harvest. They possess some remarkable characters which have served to give certain species a great notoriety, particularly the seventeen-year locust, which makes its visits only at intervals of seventeen years, and then in great numbers : hence its systematic name, *Cicada septendecim*.

CICADA SEPTENDECIM.

The males are distinguished from the females by the possession of an apparatus for the production of a rather sharp and rattling sound, which may be heard unto the distance of a mile. The females are destitute of this apparatus, and may be known from the males by the ovipositor before alluded to. The musical or sounding organs are situated on the sides of the insect, just behind the wings. They consist of plaited convex membranes, of a texture somewhat like thin parchment, and lodged in small cavities in the sides : these membranes emit their peculiar sound by means of muscles attached to their insides, which serve alternately to increase and diminish their tension with a rapidity almost inconceivable, while other accessory members assist in augmenting the loudness of the tone thus produced by the vibrating membranes.

The *Cicada septendecim* is black or dusky : anterior margin of the wing-covers, and larger veins or nervures orange red; eyes, rings of the body, and legs of the same color. Expansion of wings from $2\frac{1}{2} - 3\frac{1}{4}$ inches. The figure near the tip of the wing-cover resembles the letter W.

The most interesting fact connected with the history of the seventeen-year locust, is the mode in which the species deposits eggs and makes provision for its future progeny. The insect, in this climate, issues from the ground about the middle of June. As soon as the wings of the perfect insect are in a condition for flying, it selects a tree for the scene of its future operations. The sexes pair, and, soon after, the female prepares to deposit her eggs. She selects the extremity of a limb for this purpose, and applies the ovipositor, which is fitted both for perforating the branch, and for sawing it in such a way as to separate and detach the fibres, which are afterwards made to serve as a surrounding protection to the eggs. The eggs are deposited along a line in which some ten or fifteen perforations are made, some of which receive two eggs apiece. Soon after her labor is accomplished, the insect dies of exhaustion. The limb or twig, which has received its burthen, speedily perishes, and, being nearly severed from its supporting branch, falls to the ground, bearing with it the eggs; or, if the twig be not detached, the eggs are hatched in place, and the young fall or precipitate themselves to the ground. Whether hatched above or upon the ground, they soon penetrate the earth, descending among the deeper roots, where they attach themselves; and there they remain, extracting the juices of the roots by means of the sucker with which they are provided.

Miss MARGARETTA H. MORRIS has the credit of having first observed the fact that the larvæ of the cicadidæ were injurious to fruit trees, by wounding the roots with their suckers, and drawing therefrom their sustenance. It would seem that in consequence of these wounds, and the drainage of sap by the numerous individuals thus attached, the root becomes unhealthy, and incompetent to supply the tree with its requisite amount of nutriment. Under some circumstances, therefore, where a fruit-tree becomes sickly without an apparent cause, a search about the roots may disclose the fact observed by Miss MORRIS;

but the long-settled districts of the State, those which were reclaimed from the forest fifty years ago, will not be so much subject to attacks of the kind. Observation at the time of the appearance of these insects will tend to throw some light upon the question, whether, for instance, a certain tree was known to have been infested by them.

The *Cicada* lays between four and five hundred eggs; and hence the provision for the continuance of the species, it would seem, is ample : in consequence, however, of the accidents to which it is subjected in its larva and pupa state, its increase is by no means great, and in the older sections of New-York and New-England it certainly does not hold its own in numbers.

The larva does not necessarily descend deep into the earth : never beyond the reach of the roots of the trees on which it feeds; and in some places where I have seen it issue from the earth, it could not have penetrated directly more than six inches, in consequence of the underlying rock. It is hardly necessary to repeat the old notion respecting them, that they continue to descend for eight and a half years, and then begin their return to the surface; yet it is well established that they appear only at intervals of seventeen years, making some allowance for the irregular appearance of a few which may precede or succeed the main brood a year or two earlier or later than the rule allows. For a similar reason, probably, the cicada does not appear the same year in different parts of the country*.

Mr. Harris has given, in his treatise on insects injurious to vegetation, a long list of the times when and places where the seventeen-year locust has made its visits, together with an interesting history of the economy and habits of this singular animal. The insect, according to the author referred to, does not select any particular species of tree in preference upon which to deposit its eggs : most, if not all kinds of trees except the pine and fir, have been found with their limbs pierced by it.

The eggs, according to the observations of Miss Morris, are hatched in forty-two days: others say in less time; but however this may be, prior to the time of hatching, most of the wounded branches which have received eggs are detached, and have fallen to the ground : at least this was the case when they appeared in the vicinity of Troy about the year 1830. The twigs perish much sooner when wounded by this insect, than if a wound of equal magnitude were inflicted upon them with a knife : indeed, in a very few hours after receiving a deposit of eggs, the twig is perfectly dead.

The extent of injury inflicted by the these locusts upon forest and fruit trees does not seem to be very serious : it amounts to only a foreshortening of the limbs; and if the tree is injured at all, it speedily recovers. The injury is far less than that which often follows when the wound is made in the axis of growth. No remedy seems to be required,

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* Harris : Insects injurious vegetation, p. 183. The *septendecim* appeared in Madison county (New-York) in 1815.

unless when a fruit-tree becomes infested, in which case all the dead branches may be removed and burned.

CICADA CANICULARIS. *Dogday Harvestfly.* (Plate ix, fig. 3.)

Body black : the head beneath, breast and sides mealy; top of the head and thorax ornamented with olive-green lines connected together so as to form characters, one of which upon the thorax resembles the letter W. Legs, front of the principal veins of the wing-covers and wings edged with green. The body of this species is thicker and proportionally shorter than the *septendecim* : abdomen of the male tapers rapidly. Appears late in July, and continues into September.

According to the observations of Mr. HARRIS, this species is very regular in the time of its appearance : for many years in succession, it has been heard for the first time at Cambridge on the twenty-fifth day of July, between the hours of ten in the forenoon and two in the afternoon. It is therefore an annual visitor, in which respect it differs widely from the preceding species, while its other habits are much the same. It deposits its eggs in the extremities of the branches of various trees. It is not particularly injurious to fruit trees, nor indeed to any other species of vegetation; besides, it never has appeared in sufficient numbers to excite any apprehension of injury.

CICADA NOVEBORACENSIS. (Plate ix, fig. 2.)

Body black : veins of wing-covers and wings, thorax and abdominal rings edged or ornamented with orange.

This species is smaller than either of the preceding; but it appears annually, and has the same habits as to the mode of depositing its eggs. It is never in sufficient numbers to inflict serious injury to forest or fruit trees.

Tree-hoppers, Leaf-hoppers, etc.

Form triangular, but variable in the different genera : eyelets two; musical instruments none; locomotion by leaps aided by wings.

These grotesque insects inhabit the trunks, limbs and leaves of trees : they are small; colors green, gray, with spots or cloudiness of the wings; faces often vertical or nearly so, with the thorax and anterior parts thick, whence they taper rapidly to the extreme points of the wings; legs furnished with spines. The species are very numerous, each tree and shrub being inhabited by its own peculiar kind.

As this group of insects have habits much the same as the cicadians, and obtain their nutriment by sucking the juices of plants, it is supposed that in some cases they may be detrimental to vegetation : they cannot, however, injure the farmer very materially, though as a class they are quite numerous.

The following species are among the most interesting, and deserve attention as much, if not more, from their peculiar forms and habits, as from their infliction of injury upon the products of the farm*.

Membracidae.

Genus ENTILIA (Germar). (Plate xiii.)

Back more or less notched or sinuate : thorax foliaceous.

Entilia sinuata (Fab.). (Plate xiii, fig. 11.)

Back deeply sinuate-notched, or slightly angulated. Color brown : wings variegated with a patch of grayish white, broad upon the lower margin, and becoming narrow upon the superior.

Entilia emarginata. (Plate xiii, fig. 13.)

Back deeply notched or sinuate. Color brown : proportionately shorter than the *sinuata*.

Entilia concava (Say). (Plate xiii, fig. 10.)

Back simply sinuate, more depressed than in either of the preceding species. Color brown : wings obscurely banded with gray posteriorly.

The preceding species differ but little in size : they are about a quarter of an inch in length, and inhabit the Canada thistle and other herbs and trees, but are not known to injure any of the cultivated plants.

Genus SMILIA (Germar). (Plate iii.)

Back rounded ; the front sometimes overhanging the head, and higher than the back.

Smilia auriculata (Fitch). (Plate iii, fig. 23.)

Back rounded, high and arched anteriorly : color green ; front projecting along the median line.

Smilia guttata. (Plate iii, figs. 21, 22.)

Back slightly arched, nearly straight, fuliginous : oblique anterior band narrow and obscure ; posterior is a large greenish spot, extending nearly to the inferior margin of the wing-covers : a still more obscure grayish marking posteriorly.

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* For specimens and names of the following genera and species, I am indebted to our distinguished entomologist, Dr. Asa Fitch, of Washington county.

SMILIA VIRIDIS. (Plate iii, fig. 25.)

Arch of the back sloping towards the head; the projection over the face wanting; face rounded. Color of the sides green, dusky along the back : wings ornamented with a transverse gray patch near their extremities.

SMILIA VITTATA. (Plate iii, figs. 27, 28.)

Back only slightly arched; middle rather concave. Color brownish, ornamented with a greenish band which extends diagonally from the front to the lower margin of the wing-covers; also two transverse green spots, one on the middle, the other upon the posterior part of the wing-covers.

GENUS CYRTOSIA (FITCH). (Plate xiii.)

Humeral angles rounded, not salient : dorsum compressed, foliaceous, forming a regularly arched keel highest near its middle, and at most with a slight concavity posteriorly; apical cellule triangular, its end rounded (FITCH).

CYRTOSIA ARCUATA. (Plate xiii, fig. 14.)

Body regularly arched, highest about the centre of the back. Color light yellowish, marbled with fuscous : a shade of fuscous passes transversely across the sides, back of the middle.

CYRTOSIA FULIGINOSA. (Plate xiii, fig. 15.)

Back regularly arched. Color dark fuscous or brown, variegated with lighter anterior to the middle.

GENUS TELAMONA. (Plate iii.)

Body or back surmounted by an angular foliaceous protuberance or crest.

TELAMONA AMPELOPSIDIS (Har.). *Woodbine Telamona.* (Plate iii, fig. 17.)

Crest or protuberance rather concave in front, sloping moderately on its dorsum, and forming with the steep posterior slope an obtuse angle. Color light fuscous, traversed by a darker clouded line from the concavity of the crest to the middle of the inferior margin. Inhabits the woodbine.

TELAMONA FAGI (Fitch). (Plate iii, fig. 19.)

Dorsal crest notched posteriorly. Color dark fuscous : sides of the head light; wing posteriorly light, terminated with a darker shade.

TELAMONA UNICOLOR. (Plate iii, figs. 5, 5.)

Dorsal crest rounded. Color yellow, or only slightly tinged with fuscous.

TELAMONA CORYLI. (Plate iii, fig. 11.)

Crest straight upon the superior edge, which inclines slightly backwards; posteriorly it is concave. Color dirty yellow : margins of the crest fuscous. There is a semicircular spot on the sides beneath : apex of the wing-covers also marked with fuscous.

TELAMONA CRATÆGI. (Plate iii, figs. 3, 4.)

Dorsal crest narrow at base, high and slightly concave behind and convex before, placed in advance upon the thorax. Color of the crest black or very dark brown, which is prolonged upon the sides to the inferior margin of the wing-covers; wing-covers tipped also with black : sides anteriorly light, and with a light band between the two dark bands. Inhabits the different species of thornapple.

TELAMONA ORNATA. (Plate iii, figs. 15, 16.)

Crest wide, rounded anteriorly, sharply angulated behind : color fuscous. The pattern of the ornamental markings resembles those of *T. cratægi*, only they are lighter and the proportions somewhat different.

TELAMONA ACCLIVATA. (Plate iii, figs. 9, 10.)

Dorsal crest twice as wide at the base as at the summit, the posterior half rising only half as high as the anterior half.

TELAMONA RECLIVATA.

Anterior edge of the crest forming a straight line with the head; superior line nearly straight; posterior margin large, concave. Color fuscous, lighter before than behind.

TELAMONA QUERCI. (Plate iii, figs. 7, 8.)

Dorsal crest wide at the base, bounded by a large concavity before and behind, convex or rounded above, and about half as wide at the summit as at the base.

TELAMONA TURRICULATA. (Plate iii, figs. 1, 2.)

Thorax surmounted by a high narrow crest, rising somewhat in advance of the face; posteriorly the concavity is large, and continuous with the entire back.

GENUS CERESA (AMY & SERV.). (Plate iii.)

CERESA DICEROS (Say). (Plate iii, figs. 33, 34.)

Brown : sides of the wing-covers ornamented with two dark and pointed patches of brown.

CERESA BUBALUS (Fab.).

Wing-covers and thorax greenish : sides mottled with fuscous.

GENUS THELIA (AMY & SERV.). (Plate iii.)

Dorsal protuberance horn-like, advancing in front, rising high obliquely upwards and forwards.

THELIA BIMACULATA (Fab.). (Plate iii, figs. 31, 32.)

Color dark fuscous along the back and sides : inferior part of the sides marked with an elongate patch of yellowish (male).

THELIA LUTIPES. (Plate iii, fig. 18.)

Crest advanced beyond the front : posterior margin forms a straight line with the back.

THELIA BINOTATA. (Plate iii, fig. 17.)

Crest arched anteriorly, narrow, concave behind. Color light brown : back lighter, and marked by two brownish spots.

GARGARA CINEREUM. (Plate xiii, fig. 3.)

Color brown, punctured : towards the front it is traversed by a pretty broad belt of lighter, in form and shape like an arrowhead, with its point towards the head, and resting upon the median ridge; posteriorly it is traversed by a narrow belt, which runs directly across the back. Length two-tenths of an inch.

GARGARA MACULIFRONTIS. (Plate xiii, fig. 1.)

Color light brown and lightly mottled : front marked by an oblong dark brown spot, situated nearly between the eyes; posteriorly it is traversed by two faint or lighter bands directly across the back.

GARGARA MAJUS. (Plate xiii, fig. 6.)

Color blackish, punctured. Apex of the wing-covers black or blackish brown, extending farther upon the sides than upon the ridge, nearly meeting another transverse broad band of the same color, and leaving an oval or roundish lighter space between them : the dark anterior band does not cross the sharp ridge of the back, but leaves a continuation of the same color as the anterior and middle parts. Thighs dark brown. Length one-fourth of an inch, and sometimes rather exceeding that measure.

This species has the regular rounded outline somewhat broken by the sudden falling off of the ridge posteriorly.

GARGARA QUERCI. (Plate xiii, fig. 8.)

Color brown, and dark brown upon the middle of the sides : middle of the back marked by a long oval yellow patch. Near the apex of the hemelytra there is a small roundish patch of yellow : legs yellow. Length two lines.

GARGARA DISCOIDALIS.

Color brown, and traversed by two light bands; the front band pointing forward, its edges undulating, with a much darker space behind it, and crossing the back. The posterior band crosses the back directly, and is also bordered behind by a darker belt: legs brown. Length rather more than two-tenths of an inch.

It resembles the *cinereum*, but is more elevated at the centre of the back, and the distribution of the colors is rather different.

GARGARA PUBESCENS. (Plate xiii, fig. 3.)

Color dark brown: sides marked by a light punctured band enclosing a half-oval black space, or very dark brown; posteriorly it is traversed by a light band directly across it. Wings terminated by a dusky patch, before which there is a large patch of white.

This species is rather depressed, and flat upon the top of its back. Length two-tenths of an inch.

GARGARA INERMIS. (Plate xiii, fig. 7.)

Back rounded. Color yellow bordering upon green, punctured: punctures and color distributed very uniformly over the individual.

GARGARA PECTORALIS. (Plate xiii, fig. 12.)

Color greenish yellow, dotted with green: there is a patch of yellowish and greenish white above the eyes. The wings are traversed transversely by narrow belts of light green and white, when they are uncovered by the hemelytra: legs obscurely banded with brown. Length nearly two-tenths of an inch.

GARGARA NIGRICEPHALA.

Elevated in front. Color very dark olive brown, banded transversely in front, directly behind the eyes: sides banded transversely, which bands meet in the front band behind the eyes; head black; legs yellowish. Length two-tenths of an inch.

The general reader will be able, from the figures which are given of a few of the genera and species belonging to this subdivision of the HOMOPTERA (or HEMIPTERA), to distinguish them from other insects. It is true they are small in number, or at least less numerous than the plant-lice, *aphidæ*: still their forms and habits, as well as consistence, will always serve as diagnostic marks. So far as their food is concerned, as well as their mode of obtaining it, they resemble plant-lice: they wound the plant by puncturing it with their beaks, and suck the juices. When they are few in number, they do but little mischief: on the contrary, where they are numerous, the wounds they inflict, and the diversion of sap they occasion, have quite an injurious effect upon the health and perfection of the plant. Among the plants most liable to be injured by them, the vine probably suffers the most; for it abounds in sap, and hence offers support to large colonies of these insects.

In the eighth volume of the Encyclopædia Americana, Dr. Harris has described the leafhopper, *Tettigonia vitis*. It is about the tenth of an inch long, and arrives at maturity in the month of August : it is of a pale straw-color, and inhabits both the native and foreign grape vines, and, in some seasons, is so numerous as to affect seriously the vines and fruit. They adhere to the underside of the leaves, and hence the remedy proposed, which consists in fumigation with tobacco, will be more effectual than if they inhabited the upper side. For the purpose of fumigation, the vine or its trellis should be covered with a tent, and the process may be persisted in until the insect is thoroughly routed or destroyed.

Rosebushes sometimes become infested with a kind of leafhopper, the *Tettigonia rosæ*, which may be treated in the same way.

As the insects of this family hop briskly, they cannot be dislodged from the vines by shaking, nor is it practicable to catch them : it hence becomes necessary to destroy them by fumigation, or by the application to the leaves and vines of some substance destructive to the insects, but which will not injure the plant. Whale-oil soap in solution is another remedy whose application has been followed with success.

As these insects take refuge among the fallen leaves and underlying grass, where they survive the winter, the leaves and grass should be carefully removed and burned, either after the weather has become cold in the autumn, or in the spring before vegetation has put forth. All these methods should be resorted to, where vines suffer from too great an abundance of these insects.

Aphididae.

The aphidians (plant-lice) are a group of insects with soft bodies of an oval form, and furnished posteriorly with two tufts or pores. The females are generally wingless, though not always. The upper pair, answering to the wing-covers in the Hemiptera proper, are larger, and are used for the purpose of flight, or to assist in leaping.

The leaping plant-lice belong to the Genus Psylla : the young are covered with a cottony substance, and are found upon the alder and some other plants in the spring.

The genus to which the name Aphis has been given, from which the name of the family is derived, and which signifies *to exhaust*, is one of the most remarkable in the class of insects : feeble and entirely unprotected, the insect is crushed by a touch, or swept away by a breath. It is, however, provided with the means of increase to an immense extent; and, hence, in consequence of this extraordinary power, in virtue of its numbers alone it is competent to inflict the most serious injury upon the plants it inhabits. Most plants are infested with them; and each particular kind of plant, shrub and tree, supports its own peculiar species, though it does not seem to be proved that the juices of many plants may

not furnish wholesome nutriment to several different species of insects. Indeed the same plant may bear two or more kinds of lice, and they may occupy the root, leaf, stem, or bud.

I have alluded to the greatness of the number of aphides. Considerable attention has been paid to this part of their natural history. Reaumur has probably investigated the mode and rate in which they increase, better than any other naturalist : he ascertained that a single individual may be the progenitor of six thousand millions of individuals during the life of five generations. The eggs are laid in the autumn upon the buds of the plant, and are hatched in the spring : this takes place when the leaf is just expanding and tender, to which the delicate aphis is attached by its sucker, and from which it sucks the juice. They grow rapidly, and speedily come to maturity. The most remarkable fact connected with this first brood, which is hatched from the egg, is, that the individuals, however numerous, are all wingless females, which present this anomaly, that they are competent, without intercourse with the male, to beget another generation of females, and this another, and so on to the seventh generation. After these generations have succeeded each other, another generation, consisting of males and females, is produced in the autumn : pairing takes place, and the eggs are laid upon the buds as has been stated, and in due time are hatched ; and thus the broods are produced in the successive seasons after the same fashion. The generations all perish in the autumn, and the subsequent continuation of the race is committed to the egg. The males have wings.

A young leaf that curls, or looks unhealthy, is probably infested with aphides : they will often be found clustered together, engaged in sucking the juices of the leaf; and as they are voracious feeders, nature has provided them with the means of ejecting their food in an uncommon way. This is done through the two posterior tubes : the ejected matter appears first in the form of a pellucid fluid, which is sweet, and has received the name of *honeydew*. Ants, being fond of sweet fluids, are in the habit of frequenting plants infested with aphides, which they treat in a very gentle and tender manner, feeding merely upon the fluid without inflicting the slightest injury upon the insects that draw it from the plant. Another insect, however, the *lacewing*, unceremoniously thrusts its curved beak into the sides of the aphis, and sucks the insect dry, leaving nothing but an empty skin. The presence of ants upon a plant indicates also the presence of aphides.

The aphis, as already stated, infests most plants : the rose, the asters, apple, peach, pear, cabbage, etc. etc. are only a few among many upon which we may find it to an injurious extent. Besides it is not unfrequently the case that they exist beneath the soil and upon the roots, where they cluster together in vast numbers, and extract the ascending nutriment : these are usually white.

The peach-tree is known to suffer extremely from the aphis, which, when numerous, affects it in a way that prevents its bearing fruit. My own trees suffered for three succes-

sive seasons from this insect : the young leaves of the first product curled, thickened, became red or brown, and most of them perished. The trees afterwards put forth a new crop of leaves, and all survived, though the fruit was destroyed in the blossom. (For a delineation of the peachtree aphis, see Plate xxix, fig. 7.)

It is evident from the foregoing remarks, that plant-lice are injurious, both through the wounds they inflict upon the parts of the plant they inhabit, and from the fluids or nutriment they abstract from the circulation. As a family, their habits are the same, but some species or kinds appear to be more injurious than others; and it seems difficult to account for all the effects they produce, unless they possess a poisonous principle. In support of this observation, I may state that the pear is infested with a kind that kills the tree when young. Of this fact, I was informed by Dr. Ovid Plumb of Salisbury (Connecticut) : the limbs or twigs which he showed me were brown and dry in patches. Afterwards Mr. Harris of Cambridge investigated the matter, the results of which he has communicated in his work on insects injurious to vegetation. Dr. Plumb, who was the first to notice these minute parasites of the pear-tree, entered with much zeal and spirit into the investigation of their effects, and of the remedies to destroy them.

The genus to which this insect belongs is Psylla, one of the jumping plant-lice, but destitute of the cotton-like covering. From the observations of Dr. Plumb, it appears to give birth to two or more broods during the year, being found upon the pear from May to October. They first appeared upon imported trees. My own trees, which were obtained from Rochester, and were also imported, had many limbs that appeared rusty and dry; and though these limbs were lost, the trees survived. The appearances of the limbs were similar to those of the branches preserved by Dr. Plumb; but I was unable to find the aphis, although I sought for it diligently.

This insect is described as of a dull orange color, and one-tenth of an inch long when perfect : the thorax is brownish orange. The female is more pointed behind than the male. According to Mr. Harris, it may prove to be the *Psylla pyri* of Europe. It may be well to remark, that when the branches of a pear-tree become dark and dry in patches, it is advisable to search for this insect. The remedies recommended are, first, rubbing off the lice with a brush. Mr. Harris advises the application of strong soapsuds with sulphur, by means of a brush, before the buds expand : so also the use of whale-oil soap*.

The insects of the Genus Thrips, likewise belonging to the Family Aphididæ, are also injurious. Their wings, instead of lying obliquely upon their backs as in the Genus Aphis, lie flat, and are fringed. They are supposed to poison plants by their puncture, producing thereby curls and a thickening of the tissues of the leaf. They may be treated with soap and water, or whale-oil soap dissolved in water : a strong decoction of tansy may serve.

* Harris on Insects injurious to vegetation, p. 202.

A species of THRIPS infests the kernel of wheat while in its milk state; and it is quite doubtful whether this one can be destroyed by the application of fine slaked lime, as has been recommended : still, when the dew is on the plant, a free sprinkling may be tried, which, if not successful in the way designed, will at least benefit the soil.

The disease called *appletree blight* is due to another genus of aphides, the ERIOSOMA. It is a woolly insect, destitute of wings, but is wafted from tree to tree by the buoyancy of its woolly envelope. The eggs, only visible under a microscope, are enveloped in a cotton-like substance found in crotches of the tree and chinks of the bark; and if there are suckers standing around the tree, it may be found on them also. The full-grown insect is one-tenth of an inch long, emits a sticky juice from its extremity, and is covered with flakes of down : when this is removed, the color of the antennæ, head, sucker, and spines is blackish; abdomen honey-yellow (HARRIS). It feeds upon the sap of the alburnum of the apple-tree; and the wounds it inflicts give origin to warts, excrescences, and inequalities upon the bark : the final result of its attack is the death of the tree.

It appears from the accounts which have been published of the ravages of this aphis in England and in this country, that the only hope of arresting the evil lies in beginning at once, or as soon as the insect makes its appearance. After it has extended itself far and wide upon the large trees of an orchard, it becomes exceedingly difficult to arrest its progress, and this probably only happens in cases when the weather becomes unfavorable to the life and propagation of the insect. The rational way to go to work, will be to scrape thoroughly all the trunks and larger limbs, and then to scrub the surface with strong soapsuds, or whitewash them. When the trunk beneath the soil and the roots are infested, extend the treatment to these parts also. Mr. HARRIS recommends a solution of potash, and to protect all the wounded parts by grafting wax, and also the removal of all refuse from and about the tree that may contain the eggs or the living animals : cut off, likewise, and burn all the smaller limbs. It seems that all strongly scented solutions, such as tobacco water, ammonia, etc. are more or less effectual remedies against the depredations of the various kinds of aphides.

Another interesting and important fact in natural history is that plant-lice have numerous foes, that prey upon and destroy them in great numbers : among these foes we may rank the numerous species of *Coccinella*, or *ladybirds* (See Plate xi, where several of the most common kinds are figured). A person unacquainted with these small and beautiful insects, on seeing them upon an infected plant, might mistake their characters and office, and attribute to their presence the sickly state of the plant. He could not well commit a greater mistake; and to convince himself of this, he would only need to watch the movements of the little beetle for a short time, when he would find that its errand was one of kindness to him and his plant, for he would soon observe it feeding upon the plant-lice : these constitute its food, both in the larva and mature states, so that its services in re-

moving the plant-lice are by no means inconsiderable. He might, indeed, advantageously stock his house-plants with the *coccinella*, for the purpose of keeping them clear of lice.

I have already adverted to the lacewing : in its larva state, it is probably one of the most sanguinary enemies of plant-lice. Where these abound, the eggs of the lacewing may be seen each supported on the end of a slender thread.The larva or grub is provided with a large pair of curved pointed hollow jaws, with which he seizes the aphis, and sucks all the fluid contents of its body, leaving nothing but a collapsed skin.

Mr. Kirby states the fact, which is also now well known to many, that a fly belonging to the Genus Syrphus is equally effective in exterminating the aphis; their larvæ or maggots having completely exterminated a colony which had a week before infested his currant-bushes.

Coccidae.

The bark-lice form a third division of singular insects, from which, judging from the appearance of a few individuals among them, we should never expect serious injury to trees or plants. They vary in form : sometimes they are kidney-shaped scabs, beneath which, at some period or other, may be found a brood of minute lice : others are oval, quite large and globular, of a dark gray color, and are fixed to the surface of the bark, or have lost the power of locomotion ; these are females.

As an illustration of the character of the *Coccidæ*, I may state that the matter of the cochineal of commerce, brought to us from Mexico, is an insect of this family.

These insects are usually known under the name of *bark-lice*, of which the kind that inhabits the branches of the appletree is probably the most common. They differ in structure from the aphides, their feet consisting of a single joint terminating in a claw. The male is quite small in comparison with the female, and, like that of the aphis, is provided with wings, which are two in number, and lie flat upon the body as in the Genus Thrips. The female, after she has become fixed to the limb or bark of the tree, having lost the power of locomotion, brings forth beneath her a brood of young, which, when able to run about, escape from the dry skin of the parent, and fix themselves by their beaks to the bark, where they grow and become mature upon the sap of the tree.

A maple at my door in Hudson-street, Albany, is infested with thousands of individuals of a species of *Coccus*, about the twentieth of an inch in length, and covered with the woolly matter peculiar to the family, which imparts to the limbs a snowy appearance. On the first of September, the back of the leaf supports some twenty individual females of a green color, beneath which are the young.

Trees suffer from the minute punctures of bark-lice ; the apple-tree particularly, which is infested with a kind that resembles a dry scale, having the color of the cuticle of the bark on which it rests. The remedies for these depredators are the same as have been re

commended against aphides, particularly the brush, soap and water, and scraping the bark with a suitable instrument. Several sorts of birds, such as wrens, chickadees, creepers, etc. feed upon the larger coccidæ.

A large brown coccus, the tenth of an inch in length, inhabiting the chestnut and black-oak, gives origin to one kind of honeydew. These trees, in Warren county (New-York), were teeming with a species of coccus in 1838; and from their bodies drops of a sweet fluid were cast, which, on falling to the ground, were formed into minute threads. These appeared in sunlight like the threads issuing from the gossamer spider. The leaves and grass were covered with this substance. The insect had an oval form, about the size of half a marrowfat pea, with a brown, wrinkled, naked skin; that is, it was destitute of a woolly or cottony covering.

The currant-bush at present suffers from the attacks of an aphis, which has been increasing in numbers for three or four years past. The insect occupies, as usual, the under surface of the leaves. The female is uniformly green, and provided with antennæ longer than the body, and three rows of bristles along the back: body ovate, thicker behind, with the honey-tubes near or along the outer row of bristles. It produces a thickening and reddening of the leaf, and the crisped condition that comes from punctured wounds of the parenchyma. This valuable plant should receive a timely attention, before the insect has increased much in numbers; and as a remedy, whale-oil soap is undoubtedly the best.

The snowball (*Viburnum*) has been infested for years with a peculiar aphis, which effectually destroys the beauty of the shrub. In some cases the leaves are all crisped and rolled, and the consequence is the total loss of the beautiful and ornamental flowers peculiar to this species of *Viburnum*. The insect makes its appearance with the expansion of the first leaves, and continues through the season. The usual applications which have been recommended, should be employed upon this plant.

The black cherry, also, is infested with an aphis in July. The community consists of males and females. Males: antennæ black and equal to the body in length, pointed forward; head and thorax black or greenish black; abdomen green; wings twice the length of the body; thighs and tarsi black. Females green; antennæ two-thirds the length of the body, turned over the back or pointed backwards; tarsi black; wings rudimentary. This aphis lives upon the uppermost leaves of the young virginian cherrytree, where the females produce their usual effects, the curling, thickening, reddening, and finally the death of the leaves.

For fruit trees, it appears to me that the best remedies against insects are those of a preventative character. Trees that are kept in a thrifty growing condition by the application of manures, ard the use of means to keep the bark clean and smooth, rarely suffer from lice. Among both plants and animals, the feeble are generally those which suffer from parasites. It is not, I believe, because the tree has become weakened in the first place by them, but, on the contrary, the plant (and so also with the animal) first suffers for the

want of proper nutriment, or by other neglect. It is true that a vigorous plant or animal may become infested with parasites; but these cases are exceptions, and not the rule. We have therefore every motive to induce us to protect and nourish our plants and animals, both for the greater profit they will render us, and as a security against disease and the attacks of parasitic animals.

Atmospheric Blight.

There is a disease among cultivated herbaceous plants, the origin of which is not determined. The plant, as the june pea, for example, begins to dry and whiten below : this dryness extends upwards, and sometimes so rapidly that the crop of pease is lost; but whether this be the case or not, the crop will be greatly diminished, and the early death of the whole plant is the consequence. The disease may be said to be a premature decay and death of the plant : it is equivalent to a blight, or to the potato disease. The question that arises respecting it, is, Is it due to an insect, or to atmospheric causes? The answer to this question is neither definitely negative nor positive. No insects have yet been detected upon the pea; and yet its root, which has not perhaps been sufficiently examined, may disclose some insect that brings on this decay. As to the atmosphere, physiologists may well differ : we ascribe to changes of the weather, those diseases and injuries that cannot be referred to the attacks of insects. Remedies have not been proposed; but it is suggested that a change of seed may divert the calamity, or perhaps soaking the seeds in muriate of ammonia or a weak solution of copperas, and then rolling them in plaster.

The *lychnidea* becomes sometimes affected with a white mouldiness, which makes its appearance upon the leaves early in July, and destroys the beauty of the plant, beginning upon the lowermost part of the leaf, and extending upwards until the whole is coated with a fibrous matted mucor. It does not appear to be of animal origin : under a single lens, I have not been able to discover any thing that looks like the work of an insect. The question is, Whether this fungus is the consequence of a too feeble vital action; or, to speak more cautiously, whether what we call *vital actions* are enfeebled by any causes other than those which may be attributed to wounds by insects? The parenchyma of the leaf is not destroyed, but the surface is covered with a white fibrous fungus, analogous to the coverng of the gooseberry when affected with mildew.

In undertaking to assign a cause for effects of the foregoing kind, it should not be forgotten that a minute puncture may result in the production of a fungous growth : the juice exuding from a wound, whether poisoned or not, undergoes a change that fits it for the growth of fungi, which may be in some instances small and invisible, while in others they extend over large surfaces, and, as in the lychnidea and gooseberry, occupy in time the whole leaf, or the whole surface of the fruit; so that a puncture, to us invisible, and which may be made by an insect, can yet be detected in its consequences. The greater

effect may be the fungous growth; the lesser, the exudation of sap from the puncture, so that in these cases the effect might be mistaken for the cause. The effect of remedies may aid us materially in arriving at a correct determination of the cause.

There is still another affection of the leaf, which results in the injury if not the death of the plant. The elm, maple, chestnut, and several other trees are affected in the way about to be described. Their leaves dry at the apex or on the edge, become brown, and curl up. This affection may appear upon a small part of the leaf only, or it may cover the whole surface of a part or all of the leaves upon a branch: if only a few leaves are diseased, the branch will live; if all, it dies simultaneously with the leaves; and in some instances the disease affects so many limbs, that the life of the tree is imminently threatened. An elm standing before my door in Hudson-street has lost a part of its branches every year for many years in succession. Another thrifty elm was extensively affected, and most of its large branches died in the course of two weeks. The disease is the same in both cases, and, I think, in all the instances which begin by the drying of the apex or margin of the leaf, whatever may be the species of the tree. In no case could I find an insect to which the effects could be attributed, but the affection seems to prevail most under the influence of certain peculiar states of the weather; and I have also observed, that when the potato rot has been prevalent in its worst form, the trees have been most severely affected with this disease.

This disease constitutes a form of blight, which, on a close examination of the leaves and limb, proves itself to be independent of the cause that sometimes produces the pear blight, and which Dr. Harris ascribes to the *Scolytus pyri* (Peck). The external appearances in the two cases are identical, and yet the causes of the blight are different: in the one case, it may originate in the wounds of the insect alluded to; but in the other, there can be no doubt that it is produced by atmospheric changes resulting from heat and moisture combined. Some of our elms are affected every season; and when the cause operates intensely, several kinds of trees suffer in the same way: sometimes an entire limb wilts and blackens in the course of two or three days; and then again the disease is confined to a few leaves, which fall off, and the limb lives; while in yet others the edges of the leaves dry and blacken, or one half of a leaf, the other half remaining unaffected. I am of opinion that we should not attribute to insects a disease that runs the course above described; and as it occurs only in certain states of the atmosphere, it is more agreeable to analogy to assign the cause to which I have referred it.

CHAPTER XVI.

ORDER VI. HETEROPTERA.

This order embraces those insects whose forewings or wing-covers are coriaceous at the base and membranous at the apex : the body is depressed ; antennæ elongated and filiform ; and the mouth, which is placed on the inferior part of the head, is promuscidate. Metamorphosis semicomplete, with an active pupa state.

It is the Hemiptera of most American and English authors ; but Heteroptera is the designation preferred by Westwood, for reasons which make it appear to be the more appropriate name of the two.

The order is divided into two sections : 1. Hydrocorisa, the residents of water ; 2. Aurocorisa, those which breathe air.

We have three families at least under the first section, the Notonectidæ, Nepidæ, and Galgulidæ.

The Genus Notonectus is not uncommon in the springs that furnish the city of Albany with water, and which rise in a high sandy plain some four miles west of the city.

Notonectus ——.

Body much depressed ; mouth promuscidate, short, and composed of two joints ; antennæ lost in the specimen ; eyes ovate : the forelegs advanced, and the tarsi armed with a single two-jointed claw ; the middle and posterior three-jointed ; the third minute, and the last armed with two claws. Color brown or olive brown ; beneath lighter than above, uniform, and without ornaments or spots. Thorax in the form of a segment of a triangle ; middle impressed with a longitudinal line, crossed by a transverse groove ; margin of the thorax ciliate. Scutellum large ; base rather greater than the height : the posterior pair of legs obscurely barred with brown ; forelegs raptorial, and without bars. Length an inch and a quarter. Swims rapidly upon its back, and is carnivorous.

The damage which the *Notonectus* occasions, consists in the destruction of young fish, or *fry* : in this respect it is as voracious as the *Dyticus*.

Genus GALGULUS.

Body short, dilated; antennæ short, terminated with a round knob, and placed in a cavity beneath the eyes; eyes subpedicellate; mouth promuscidate; head triangular; arm or humerus dilated; tarsi single-jointed, armed with two claws: on the hindlegs, the tarsi are two-jointed, and armed with a double claw.

Galgulus oculatus.

Color brown or dark brown: head vertical, appears truncated before; eyes somewhat kidney-form, elevated, with their front and sides formed for vision. Head and thorax rough or warty; posterior edge of the thorax thickened, and edge luteous, emarginate. Scutellum large, traversed by a ridge, and impressed with a line upon its middle; sides tuberculated: the whole appears rough. Wing-covers rough, with two or three rows of small tubercles running parallel with the sides. Forelegs placed in front, raptorial, and with a large dilated humerus: thighs of the middle legs somewhat dilated; hindlegs long and slender, the two last pair are banded. Length rather less than a quarter of an inch.

Resembles a small toad, and inhabits muddy places, where it may be seen running, and sometimes leaping. I have found it in great numbers in the latter part of May, running and hopping upon the mud beside streams of water.

Hydrometridae.

The habits of the Hydrometridæ are peculiar. Though they have wings, they scarcely ever use them. They do not live in water, nor upon the land. In the spring, summer and autumn, almost every running stream, and pool connected with it, will furnish many individuals of this family, which, from their mode of progression over the surface of the water, have been called *skippers*. Their legs are long and angulated, and their bodies are raised considerably above the surface over which they glide. The antennæ are long and slender, and the surface of their bodies is protected from the wetting action of water as perfectly as if varnished: a skipper, immersed in water, comes out as dry as if it had been protected by an india-rubber coat. The surface of the insect, examined under the simple lens, is bright and glossy or lustrous, from the presence of a close nap, which is doubtless the means whereby the water is repelled.

The antennæ are four-jointed; the first longest, and in the Gerris they are placed directly before the eyes. The forelegs are very much advanced, and seem to belong to the head, but are still attached to the breast; the tarsi are two-jointed.

The appearance of the *Gerris* is not very much unlike that of *Reduvius*, and the forelegs might be used for grasping. *Gerris marginatus* is the most common species. Dr. Harris

enumerates only three species. The insect lives upon other small animals, which it can capture, and never upon the juices of plants : it is not known how it provides for its security during winter. It moves upon the water by a kind of rowing motion, but without immersing its feet.

Reduviidae.

One of the obvious characters of this family is the constriction behind the head, which makes it appear to be prolonged or extended behind into a narrow neck. The eyes are each accompanisd by a single ocellus. The antennæ are sometimes prolonged and slender ; in other cases, short. The thorax is often armed with a lateral spine. The legs are long, and the forelegs rather stouter and raptorial : tarsi three, and sometimes quite minute.

Reduvius ——. (Plate vii, fig. 3.)

Basal joint very short ; second joint longer than the head and neck, two-thirds as long as the whole organ ; fourth longest, slender : proboscis as long as the head and neck, stout : tarsi three-jointed ; joints minute. Body elongated, narrow : thorax armed with two lateral spines, and in front transversely ridged : wings large : legs long and hairy.

Reduvius ——. (Plate xxix, fig. 8.)

Color brown. Body elongated, oval or dilated behind : humerus dilated and banded, and forelegs raptorial : eyes prominent : thorax faintly striped longitudinally : abdomen ovate ; its edges spotted with red, brown and white, the brown oblong spots occupying the greater part of the margin : legs brown.

This species is rather common upon low bushes during the month of September, in the vicinity of Albany.

Hammatocerus purcis. (Plate xxx, fig. 6.)

Cimex purcis (Drury). Reduvius myathemerus (Illiger).

Head, eyes, thorax, abdomen, and legs black : antennæ setaceous, with numerous joints : scutellum large, triangular, black ; corium white, terminal membrane black : wings white and transparent : edges of the abdomen marked with scarlet spots : rostrum black and short : thighs of the hindlegs scarlet (Drury, Vol. iii, pl. xlv, f. 4).

This is not an uncommon species : it is frequently met with in autumn upon plants growing in shady places.

Lygæidæ.

ANTENNÆ are four-jointed, inserted directly on a line drawn from the eyes to the base of the rostrum. The body is narrow. The membranous portion of the hemelytra is furnished with about five nervures : tarsi three-jointed.

The species are small in size, and resemble the COREIDÆ in form : some are marked with bright colors.

To this family belongs the *chinch-bug*, which figured so largely in Wisconsin in 1845, and was described in the Prairie Farmer. According to Dr. HARRIS, it is the

LYGÆUS LEUCOPTERUS (Say). *Whitewinged Lygeus.*

This insect I have not seen. Its wing-covers are white, marked with an oval black spot on a central line. The body is black and downy; the beak, legs, antennæ at the base, and hinder edge of the thorax reddish yellow. Length three-twentieths of an inch.

The young and immature are bright red, but change to brown and then to black, and always marked with a white band across the back (HARRIS).

It appears that the wheat and cornfields of the West have suffered severely from this insect.

Cimicidæ.

THE next family has received the name CIMICIDÆ, and contains the *bedbug*, an insect too well known to require any very minute description for its identification.

CIMEX LECTULARIUS (Linnæus).

Body depressed or flat : antennæ four-jointed; thorax sublunate; abdomen circular; wings rudimentary, scale-like; tarsi three-jointed.

The history of this bug is not uninteresting, and it is not yet decided what country is entitled to the honor of having first given it birth. The English entomologists say that it was unknown in London, or in England, until after the great fire of 1666; and it is asserted by some that it was about this time introduced into England from America, in the fir timber imported to rebuild the city. This is partly sustained by the fact that it is still unknown in some of the remoter parts of the kingdom. It is further proved that SHAKESPEARE was unacquainted with it, as no mention is made of it in his writings. Whether this fact is decisive of the question, I leave it for others to say; only I would observe that it seems to me that none of its habits are calculated to awaken poetical associations. On the other hand, according to the statement of WESTWOOD, it appears to have been known as early as 1503.

The cheapest, cleanliest, and best way to get rid of the bedbug, is to employ a saturated solution of salt in water. The free use of salt will drive them from the bedstead to the covering, and to chinks in the wall or floor; whither the solution must follow them, or the remedy will fail, as often happens with others that have been recommended, and for the same reason.

If all is true that is affirmed of this bug, we cannot deny that its instincts are of a high order. If, for instance, it is unable to mount the bedposts, it climbs the walls and gains the ceiling, and, when it has reached a position immediately above the sleeping individual, drops down upon him. This devising of means to accomplish an end, shows the insect to possess a high instinctive power. It is also a curious fact, and one worthy of note, that the bedbug is only found in a domesticated, never in a wild state.

The favorite food of this insect is blood, but it is not confined to this diet: hence it subsists, and continues to perform the common functions of life when deprived of blood. Any albuminous matters either in a wet or dry state, juices of wood, etc. etc. suffice it when its favorite source of food is inaccessible. It is, however, said, upon high authority, that mahogany, walnut, oak, and cedar are fatal to these bugs; and that when enclosed in a box made of either of these woods, they speedily perish.

Their powers of increase are considerable: a female lays at four different periods during the year, and produces about fifty young bugs at each litter; so that at this rate, if she is fortunate in escaping the persecution of the housekeeper, she will rear two hundred a year. The young attain their full growth in eleven weeks. It requires, therefore, considerable diligence and activity to get ahead of this little foe to quiet and comfortable repose.

Fumigation with sulphur is an effectual remedy against bugs when they infest the entries, woodwork, or crevices of old houses, or when intolerably numerous in the cabins of vessels.

Coreidæ.

The Coreidæ resemble very closely the Reduviidæ; but it requires only a slight comparison of the families, to be satisfied that they are essentially different. The species of the first named family are characterized by the last joint of the antennæ, which is either thicker or longer than the others. The joints are still four in number, and are inserted near a line running from the eye to the base of the rostrum. The rostrum is three-jointed, and the middle joint is the longest: in some of our species, it extends to the base of the hindlegs. There is an ocellus near each round eye. The hemelytra terminate as usual in a membrane more or less diaphanous, and in this family they show numerous longitudinal nerves. The margins of the abdomen are not concealed or covered by these organs, and hence they may often be seen slightly projecting in the form of a sharp edge. The tarsi are three-jointed.

We have many species belonging to this family. Probably no one, who has ever been engaged in gathering our small fruits, but has observed these narrow or rather elongated bugs, some of them ornamented very elaborately with bright colors, as for instance the red and yellow that border their elytra and superior surface.

Genus COREUS.

'Antennæ four-jointed : second and third longest; the fourth rather enlarged or thickened, and shorter than the second or third. Sides of the thorax not dilated' (Westwood).

Coreus tristis. *Squashbug.* (Plate vii, fig. 1.)

Color dark brown, rusty brown, yellowish beneath : head marked with a red line extending to the front of the thorax; two others, parallel with the former, pass by the side of the eyes. Thorax roughened with elevated black points, concealing the red ground beneath : lateral edges also reddish; posterior angles rounded, and base broadly grooved transversely. Membranous part of the hemelytra black, and showing numerous longitudinal nervures. Beneath rusty ochre-yellow, and each segment of the abdomen marked with a row of black points near the outer edge, and a parallel row of small black spots, the latter rather obscure.

The *squashbug* is a common insect in gardens and fields, and is found not only on squash leaves, but upon those of the pumpkin also. It is injurious by inflicting numerous punctures upon the leaves, which cause them to wither and dry, and, if the plant is feeble, will destroy it. The first remedy for the effects of minute wounds of this kind, is to cultivate highly, so as to impart to the plant sufficient health and vigor to resist injuries by a rapid growth. If this does not answer, it will be necessary to find the insects and destroy them under foot, before their eggs are deposited for the new brood. The eggs are laid about the last of June, by the insects that have survived the winter. During the summer, it will frequently happen that the young appear at different times, and they may be found collected together in little groups.

Scutelleridae.

This family is perhaps better known through some of its species than others. The disagreeable smelling bugs that frequent berry bushes and strawberry vines belong here. They are depressed and of an oval form, and are furnished with a very large scutellum. The rostrum is composed of four joints, instead of three; and the antenna sometimes has five joints, but not always. Two ocelli are always present, and the tarsus is three-jointed.

Of this family, the Genus Pentatoma is one of the most common, and feeds upon the juices of plants (Plate vii, fig. 2). Sometimes it has only to pass over a fruit, to impart to it its offensive odor.

CHAPTER XVII.

ORDER VII. DIPTERA (Aristotle).

ANTLIATA (Fabricius). HALTERIPTERA (Clairville).

The obvious characteristic of this order is the possession of two wings only, and a pair of small knobbed appendages just behind them, which are called *halteres* or *poisers*, as in the common fly. The wings are membranous and placed upon the mesothorax, and, when at rest, remain expanded as in the Hymenoptera; that is, they are never folded upon themselves. The tarsi are five-jointed. The mouth has a fleshy proboscis, which is merely a modified labium. This proboscis encloses several lancet-like organs, capable of penetrating flesh or the softer parts of vegetables: the mouth is therefore suctorial. In a few genera, as the Œstrus, the mouth is closed. The thorax is compact, and the prothorax is reduced to a collar. The wings, which represent the fore pair in other four-winged insects, are membranous, naked, or rather clothed with scales. The disc is divided into a moderate number of areolets, by the inosculation or junction of the nervures or veins.

This order of insects is clearly separated from each of the other orders: where some species belonging to the Order Neuroptera are deprived of a pair of wings, they may still be distinguished by the absence of *halteres* or balancers. The jaws of the diptera are never formed for biting or nipping: so the neuration of the wings of the diptera are quite different from that in the other orders.

The size of the individuals composing this order may be called small; but what is lacking in this respect is more than made up in numbers, and this whether we take into consideration the number of species, or the vast number of individuals that sometimes swarm together.

Some of the diptera have domesticated themselves in our dwellings, to the great annoyance of all good housekeepers; and notwithstanding the brush and the broom is freely used to drive them away, they seem to entertain no fears of the consequences of returning to their old quarters. Arsenic fly-powder, and all the various traps that the ingenuity of man has yet devised, have not thinned the ranks of the housefly. Wherever man goes, the fly follows in his steps, and makes a free use of his dwelling whenever the weather without becomes uncomfortable.

It is scarcely necessary to say that many of the diptera, though small in size, are great annoyances to man and animals : the *œstridæ* are perpetual torments to our domestic animals; and musquitoes, in the warmer regions especially, are so troublesome as to require special means of protection from their stings.

The transformations in this order are incomplete. The larvæ are white and fleshy, cylindric, and without feet : they are usually called *maggots*.

Tipulidae.

Genus CECIDOMYIA.

It is a very curious fact in natural history, that the most serious injuries the crops of the husbandman receive are inflicted by insects the most minute and insignificant in size : the very weakest among the tribes of animals are the greatest destroyers of the products of man's industry. The whirlwind or the hailstorm, it is true, sometimes sweeps over his fields of wheat and corn, or a flood of water may pass over them, and leave desolation in its track; but these terrific visitants are harmless in comparison to the tiny fly that sports and dances over his grain-fields. With all our wisdom, we have not yet devised a weapon to extirpate this foe, nor a defence to secure us from its ravages : our most successful efforts have been but failures; and were it not for the aid of the elements, or the secret influence of an unseen but benignant hand, the foe would maintain the field in the face of him who has subjected to his will the proud warhorse and the colossal elephant.

Cecidomyia is the generic name of these destroyers : they are flies, each with two wings, antennæ, poisers, etc. Several species have been described, one of the most prominent of which is the *C. destructor* of Say, the *hessian fly*. The genus is characterized by the joints of the antennæ being variable from fourteen to seventeen : the form of the joints in the female also differ from their form in the male; the former being oval, and the latter globular, but both are furnished with hairs issuing from the joints in the form of a whorl (See Plate iv, fig. 1). Wings three-nerved, ciliate or fringed : joints of the tarsus short.

Cecidomyia destructor. *Hessian-fly.* (Plate iv.)

This species is black, except that the abdomen is only tawny, though each ring is more or less black : legs pale red or brownish, with black feet. Length of the body one-tenth of an inch : the expansion of wing rather exceeds the length of the fly. See fig. 1 *c*, which represents the natural size of the *Cecidomyia destructor*.

The *hessian-fly* has occasioned as much controversy as any species in the insect kingdom. I published in the American Journal of Science in 1846 – 47 an article furnished by Dr. Fitch, which contains all the important facts in its history. I deem it, therefore, unnecessary here to go over all of the ground occupied by that paper.

As regards its origin, it appears from the numerous accounts published at different times during the last half century, that the hessian-fly is not indigenous to this country, but was imported in straw from Europe by the Hessians in the employ of the English government about the year 1776. The facts which go to sustain this view of the question are, that an insect had appeared in Germany, and committed ravages upon the wheat crop prior to its appearance in this country; and that the habits and characters of this german insect agree with those of the one named in this article. It is farther shown by the history of its progress in this country, that it was first observed upon the western extremity of Long Island, and on Staten Island, in the immediate neighborhood of the grounds occupied by this branch of the English army; and that from this centre it spread in all directions, travelling slowly over the cultivated parts of the country, and destroying the wheat crop in its course. Its march, and the consequent destruction of the wheat crop, was marked by an increase in its numbers, and in the amount of its injury for an uncertain number of years, when it gradually disappeared from the country it had occupied and wasted. After long intervals of freedom from the ravages of this fly, it gradually returns and renews its attacks upon the wheat crop, running about the same course in its second as in its first visitation. It has very recently passed over parts of Maryland and Virginia. I observed it in the former State in 1849. I think we may infer from its history and progress, that in all parts of the United States where wheat is cultivated as a staple product, it will continue its injurious career hereafter as in times past.

The species of fly which has received the name *Cecidomyia destructor* from the distinguished entomologist Say, possesses the following specific characters: Female, head black, flattened, globular; antennæ about half the length of the body, and composed of sixteen oval joints furnished with a whorl of minute hairs, the two basal joints close and globular, terminal joint the longest; palpi three-jointed, hairy; thorax black, oval, broadest behind the wing-sockets; scutel black; poisers only dusky; abdomen black above; sutures tawny fulvous, elongate ovate, scarcely equalling the thorax in width; ovipositor rose-red; wings dusky, fulvous at their base; legs equal, pallid brown; tarsi black, equalling the legs in length. Male: antennæ three-fourths the length of the body; joints globular, and furnished with hairs as those of the female; filaments separating the joints, about as long as the joints: abdomen brownish black, cylindric, seven-jointed and slightly tapering, the extremity armed with two robust processes having incurved hooks at their tips.

It appears from Dr. Fitch's statement, that in the spring the perfect insect remains but about a week, during which time it deposits its eggs for the summer brood. The first brood appears about the first of May in Northern New-York, and of course is hatched from eggs that were laid the preceding autumn; the insect having subsisted upon the juices of the herbage, or lain in a dormant state from that time. Early in May, then, the fly deposits its eggs, in the same field, upon the more succulent leaves, near their insertion with the stem of the plant, which it may readily reach after being hatched. After a time the worm

is found attached to the stem, near or upon the first and second joints. Dr. Fitch remarks that the second brood is less injurious than the first, in consequence of the more advanced state of the grain and the firmer consistence of the stalk. The worm, by its irritation, diverts the current of flowing sap to itself, and produces an enlargement of the stem at the place where it is attached. The culm is weakened by the change of structure that has taken place in consequence of the numerous worms usually congregated near its base. By the first of June, the worm has changed into its flaccid state; and about the last of July, or early in August, the mature insect, the fly, appears for the second time. This last brood of flies is now ready for the young wheat that may be sowed, upon the leaves of which they deposit their eggs, and there finish their transformations so as to appear in New-York the last of April.

Thus careful observation has proved that but two broods appear during the year, though it has been maintained by some observers that there are three. This latter opinion seems to have arisen from the fact that an entire brood does not appear at once, or on the same day, but the fly may and does continue to come forth for as many as ten or twelve days after the first of the brood are hatched.

The most important question which stands connected with the hessian-fly, is, By what means shall the farmer protect himself from its ravages? Now we have very slight grounds for expecting, or even for hoping that a remedy will ever be found that shall meet our wishes in this respect. The evil is rather to be warded off by a judicious use of means that are related to the habits of the fly, and to the habitudes of the wheat plant itself. When a district, however, is extensively affected, the true course undoubtedly is to cease cultivating wheat, and perhaps barley also, until the fly has disappeared.

Recurring to the habits of the insect, the most significant are the time of its appearance, and the time it continues in its perfect state, during which it is engaged in laying its eggs, an operation, the exact time of which it is essential for us to know in this case; and it is a law of nature in the insect class, that when swarms are produced, they come forth at regular periods of time. The habits alluded to are well known in the case of the hessian-fly. As to the time when the insect appears, it is established by observation that about the first of May, or at time in the spring when the earliest trees and plants are flowering, this fly is maturing, and comes forth near the time specified; and the first brood is hatched from eggs laid in autumn. These two facts unite to suggest the same precautionary measure to be taken for the eradication of the fly from both the winter and the spring crop, namely, to delay sowing the grain until the fly has disappeared, or to that period when the plant will come up too late for the deposit of eggs upon it. Experience has proved the efficacy of late sowing in both kinds of wheat.

Another remedy is connected with the place where the eggs are deposited, and where the transformations are undergone. It seems established that the real hessian-fly deposits its eggs upon the young leaf, near the stem, and near the base of the stem. The consequence

is, that in reaping or harvesting the grain, the straw is cut above the place where the larvæ or eggs are usually found; and it would be well, in all cases where the fly is found, to cut the straw higher than customary. Now if the stubble is turned under for the next crop, a large proportion of the eggs will mature, and the succeeding wheat-plants will form a habitation for the forthcoming August brood; but if the stubble is first burned, the eggs will be destroyed, or but few will escape. The objection to this summary remedy is, that it also destroys those little insects that prey upon the hessian-fly. I deem this a very light objection, for the fire will destroy hundreds of eggs where the enemy of the fly would devour one. Burning off the stubble, then, must be ranked among the best palliative means for saving the wheat-crop.

There are also two remedies having relation to the habitudes of the wheat itself, and to its varieties. It appears to be established by observation that some varieties are less subject to injury than others, or indeed that some are nearly *fly-proof*: this is one of the earliest facts on record, and all experience hitherto has fully sustained it; the straw of these varieties being too siliceous to allow of a ready lodgment and home for the larva of the fly. The other remedy here alluded to, rests on the practicability to push forward and mature the plant sufficiently to give it strength to resist effectually the injuries the stem receives from the maggot in its flaccid state. High cultivation should be called to our aid here, and it undoubtedly will prove a very efficient safeguard: its effects are twofold, as exhibited in an augmentation of the power of the plant to resist injury, and in the production of a better crop; so that the remedy is not entirely lost, even if it does not succeed in the way we wish.

Objections have been made to the first two remedies above proposed: for instance, by late sowing, the grain is liable to be winter-killed; but would not this risk be greatly diminished, or even obviated entirely, by drilling in the grain? The burning of the stubble is objected to, because it destroys the parasites of the fly; but this, as I have said before, is scarcely an objection; while for the utility of the remedy, we have the testimony of Harris, Herrick and Hanaus, the latter of whom originally proposed it, and the two former are entitled to the highest consideration as observers and men of science.

Of the numerous applications to the grain crop, for the purpose of killing the insect directly, I have no faith. Rolling the seed in plaster; steeping it in various salts; sowing lime, etc. over the field of young wheat, are beneficial remedies in an indirect way: they give vigor and strength to the plant, and hence are useful as palliatives.

Cecidomyia tritici. *Wheat-fly.*

This species is very distinct from the hessian-fly: its habits sufficiently show this difference; and the remedies which are in some degree palliative in the case of the hessian-fly, are valueless against the *Cecidomyia tritici*. Among its peculiarities, some of the most remarkable are that it deposits its eggs in the wheat-head, and undergoes its metamorphoses

in the soil; and that the mature animal is engaged longer in the work of depositing its eggs, than is the hessian-fly. These distinctions must govern our attempts to guard against the attacks of these insects.

The wheat-fly possesses the following characteristics : Body orange; wings transparent, rounded at the tip, ciliate, or fringed with minute hairs. FEMALE, the antennæ are beaded; joints twelve, whorled with hairs; eyes black : length about one-tenth of an inch. MALES, the antennæ with twenty-four joints, globular, and whorled with hair as in the female : size somewhat variable, but less than the female. Its general appearance is that of an orange-colored gnat.

The first account of this insect was given by Mr. JEWETT, in the nineteenth volume of the New-England Farmer, 1820. According to Judge BUEL, it was observed here in 1828. Its first appearance in this country was in the eastern part of the United States : several of the Eastern States, and the Canadian provinces, have been visited by it. The cultivation of wheat was suspended for many years, in consequence of its injurious attacks.

The time of the appearance of this fly varies according to the situation of the country, being in some places early in June, and in others as late as August; indeed, according to Mr. HARRIS's Report, as late as the 20th of August. The first half of July, however, is the period when the largest number of eggs is deposited; a period which, in New-England, would find the spring and winter grains in the best state for receiving their eggs. The insects are active in the morning and evening, and appear in swarms; but during the day, when the sky is cloudless, they conceal themselves among the grain and grass. After about eight days, the eggs that have been deposited in the heads of the grain are hatched. The maggots are orange-yellow, and, according to the observations of Mrs. GAGE of New-Hampshire, they attain their growth in about twelve or fourteen days : they are then about an eighth of an inch in length, but their size is not uniform. Their number is also variable, as many as forty being sometimes found on a single plant, and at other times two or three only. They seem to be influenced by exposure; for in hilly places, where the grain is exposed to the wind, they are much less numerous than in sheltered spots.

The injury that wheat sustains from the presence of this fly depends upon its state of forwardness. As the worm is unprovided with boring instruments, it is principally during the soft state of the grain that it has the power to do the most hurt. If the egg is deposited so as to be hatched when the plant is in blossom, it is then capable of inflicting the greatest amount of injury; for at this time it is supposed to subsist on the pollen, and may therefore prevent the fertilization of many kernels in the same head; and then also it obtains the milky fluid that begins to be formed at this period, and is now accessible through the softness of the skin or epidermis of the grain. But if the time of deposition of the egg is such that it becomes hatched after the plant has flowered, and the kernel has acquired some considerable hardness, the worm is incapable of absorbing nutriment, and perishes for want of food.

The worms acquire their full size and perfection, cast their skins, and descend to the ground early in August, or perhaps as late as the middle of the month. They bury themselves in the soil at the depth of about an inch, where they remain through the winter. There is therefore but one brood in a season. The worm is speedily changed into a pupa, in which state it remains until ready to issue from the ground in June or July of the next year, in the imago state, or the perfect fly.

The means that have been proposed to destroy this kind of wheat-fly are numerous : if any of them are to be effectual, it is evident they should be resorted to over the whole district infested by the insect.

Among the remedies which seem to have been at least partially successful, is that of the abandonment of the cultivation of winter wheat for the substitution of the spring variety, and late sowing. The remedy operates on the principle of starvation, and would probably be completely successful, were it not that grasses and other grains, as oats, rye and barley, offer suitable recipients for the eggs of the insect, and furnish nutriment for its progeny.

It is recommended to smoke them out. To carry on this plan of warfare, the flies must be attacked in the evening, when they rise from their lurking places in the depths of the grain. Brimstone, mingled with other combustible matter, should be burned in a position to give them the full benefit of the smoke and vapor when they rise upon the wing, and hover over the grain.

Another recommendation is to sow fine quicklime over the field when the heads of the grain are moist : this may be repeated several times.

It is recommended by Dr. Fitch to first catch, and then kill them. The method of doing this is sufficiently simple and easy, and deserves a trial. Take a long rope, attached to a wide open tight bag ; and let two men, one at each end of the rope, pass through the field, dragging the open wide-mouthed net over the heads of wheat. Go over the whole field in this way, and millions of the fly will be caught if the net or bag is properly managed.

Deep ploughing is also a remedy that deserves trial, and indeed has been tried and followed with success. This, of course, is to be resorted to after harvest : the object is to bury the insects so deep that they will be unable to find their way out of the ground the next season.

The *Cecidomyia* which has appeared in this country is now regarded as identical with the *C. tritici* of Europe, which has been known in England and Scotland for two-thirds of a century, and was described at an early period. In this country, especially in the vicinity of Albany and in the county of Berkshire in Massachusetts, it has been disappearing gradually for the last ten years, and the wheat crop has again become a profitable one ; and the probability is, that with our present knowledge of its habits, and of the means for its extirpation or for avoiding its worst injuries, we may hereafter escape its depredations.

CECIDOMYIA ROBINIA (Haldeman). (Plate iv, figs. 3, 4, 5, 6.)

Color of the fly orange red; antennæ and wings dusky; thorax marked by three dark lines: two dusky spots on the sides of the body. Length three-twentieths of an inch. The larva is a maggot of a whitish color, faintly tinged with orange, rather deeper towards the head: pupa or chrysalis naked, or destitute of a cocoon.

This species inhabits the locust-tree, and was first described by Prof. HALDEMAN*. The leaf becomes thickened on its edge, and rolled over; and thus a cavity is formed, which contains two or three larvæ of this species.

CECIDOMYIA SALICIS (Fitch). *Willow Cecidomyia*†.

Color of the fly black above, paler beneath and downy; wings smoky; legs gray. Length of the body, one-fifth of an inch; expansion of wing, three-tenths.

Inhabits a reddish gall upon the low willow bushes of wet places: it is of an oval form, three-fourths of an inch long, and is terminated by a conical beak. Within a silken lined cavity, early in the spring, there will be found a single orange-colored maggot one-fifth of an inch long. Soon it changes to a pupa, but without moulting; and in a very few days it passes from its prison, after casting the pupa skin, and takes the winged form. Its size, together with the rapidity of its changes, renders the species an interesting object of study. Its damage to the basket willow is but slight.

CECIDOMYIA CULMICOLA (Morris).

The *C. culmicola* is a provisional species, whose habits have been investigated by Miss MARGARETTA H. MORRIS, by whom also it was discovered. Its habits are quite different from those of either of the foregoing species. The fly lays its eggs upon the grain, in or over the germ, where they remain unhatched until the grain germinates; but when the plant is three or four inches high, the worm may be seen, by the aid of a glass, feeding above the top of the joint in the centre of the culm, until it is ready to become a perfect insect. It is said that the pupa resembles that of the *C. destructor*.

As the fly deposits its eggs early in June, it is difficult to understand why they should remain unhatched so long, or until the future germination of the same ripened grain after it is sown, and then to feed upon the culm; for it is the usual habit of flies to deposit their eggs near or upon the magazine of food on which the larvæ are to subsist.

It is an interesting fact that most, if not all of the species of *Cecidomyia* are preyed upon by some one or other of the family of ICHNEUMONIDES while in the larva or pupa state. These parasites deposit their eggs within the body of their victim, where they are hatched in due time, and the larvæ subsist upon and destroy the body before its change into the

* American Journal of Agriculture and Science, Vol. vi, p. 193. † Idem, Vol. 1, p. 263.

imago state. In this way the increase of several species of destructive flies is kept in check, and their excessive multiplication prevented. No doubt, also, unfavorable seasons operate as a still greater means for preserving a balance between excessive multiplication and entire extirpation.

Dr. Eights, of Albany, has furnished me with the following communication respecting the *platygaster*, a minute ichneumon fly. His remarks, and the facts stated, illustrate in a striking manner one of the most important features in the insect world, the checks which are interposed to the excessive multiplication of the injurious kinds.

Platygaster tipulæ (Kirby). *Wheat-midge Parasite.*

This insect, though exceedingly small in size, has claims to our consideration, which should justly entitle it to an exalted station in the rank of public benefactors; for it has had assigned to it the peculiar and important duty of keeping in proper subjection that unrivalled pest of our fields, the wheat midge (*Cecidomyia tritici*).

The female fly of this parasite bears some considerable resemblance to the winged ant, and may frequently be seen in our neighborhood during the months of July, August and September, in the greatest profusion, when our pernicious devastator is most numerous; flying about the grasses, or running over the grains of wheat in search of the midge larva, for the purpose of depositing in each a single egg, and by this means preventing an immense number of them from developing themselves into a perfect state; although when seen thus abundantly, they have often been unjustly accused of being themselves the authors of the mischief.

This insect expands to only one line and a half in breadth. The female is of a shining pitch black color, with long, ten-jointed, flail-shaped antennæ or horns, slightly clubbed at the ends. The head is round or globose, with the eyes conspicuously placed on the sides. The trunk is oval, and bears a scutel terminated by a strong rusty spine. The body or abdomen is obovate, small, and narrowed at the base, with a long curved oviduct, concealed, when unemployed, in the abdomen. It has four transparent wings without nervures, the superior pair very large; and the legs are strong, and of a bright ochreous color, with the thighs and shanks clubbed: the feet are long, slender, and five-jointed.

We regret that some means have not yet been discovered to multiply this interesting little insect, and thus effectually preserve our wheatfields from the fearful depredations of the midge. James Eights.

Muscidae.

The character of the mouth and its organs restricts and defines this natural family : it is formed by a distinct proboscis, which is thick and membranous, retractile, and terminated by lateral lobes; and it encloses two setiform organs and a pair of palpi. The antennæ have but three joints, the third of which is the largest, and is prolonged into a seta or long slender bristle, sometimes articulated with its base. The nervures of the wings are few, and extend to the margin.

The true flies feed upon both vegetable and animal substances. The common housefly is typical of the family, and its habits in some respects are very well known. They are all small : their larvæ are white, soft, and without feet, and are usually called *maggots*. Meigen, it is said, has described 1700 European species; from which we may infer that it is a large family.

Sarcophaga georgina.

Color grayish, hairy; eyes copper-colored; face silvery white; thorax striped with gray and black; abdomen lustrous, and checked with white and black; legs black. It is common during most of the summer. Length about half an inch.

Musca vomitoria?

Body thick, steel-blue, especially the abdomen, hairy and mixed with bristles : antennæ pilose; thorax bluish black; legs black. Length about half an inch.

Genus LEPTIDA.

Leptis ——. (Plate xxix, fig. 1.)

Eyes brownish : antennæ four-jointed, small, porrect, approximate, standing a little below the crown, the last setiform pubescent; thorax semiglobose, striped, hairy; wings diverging; anal areolet open; abdomen with seven rings, tapering, and marked with clay-colored rings, somewhat silvery. Metallic points are scattered upon the sides of the thorax.

Leptis? ——. (Plate xxix, fig. 4.)

The eyes are brown, and larger than in the foregoing species : rings of the abdomen seven : top of the thorax less prominent.

Leptis ——. (Plate xxix, fig. 10.)

Color brown : thorax bordered with an ochreous line; abdomen tapering and pointed, the three last rings being attenuate, and all of them bordered with yellowish.

Neither of the foregoing species are figured or described in SAY's American Entomology, but there is very little doubt that they belong to the Genus LEPTIDA. The flies are found in thickets in the summer : they feed on other small insects, and their larvæ live in offal or on decaying wood.

Tabanidae.

TABANUS PLUMBEUS (Linnæus). *Gad-fly. Horsefly.*

TABANUS PLUMBEUS (Drury). T. RUFICORNIS (Fabricius). T. LIMBATUS (Pal. de Beauvois).

'Head ash-colored ; eyes black ; antennæ reddish brown ; ocellus one ; thorax greenish, 'with a white spot at the base of each wing ; abdomen dark brown, each segment of 'which on the underside is margined with gray ; wings transparent, anterior edges 'brown and opake ; legs dark brown, the middle ones being armed with two spines 'at the tip of each tibia : the ungues have two small brown scales under them. 'Breast hairy ; back colored, but white on the sides' (WESTWOOD, Illustrations of DRURY, Vol. 1, p. 97).

This species appears in New-York in July, and is most common in woody places, but is often in open pastures, and frequents roadsides, alighting on horses and cattle. In New-York and New-England they are too few in number to occasion much trouble, though their probosces are armed with lancets sufficiently long and sharp to wound cattle severely. Were they as numerous as the smaller kinds of flies, our pastures could not be occupied during the months of July and August.

TABANUS AMERICANUS (Drury).

TABANUS ATRATUS (Fabricius). T. NIGER (Pal. de Beauvois).

Head, antennæ, sheath of the proboscis, extremity of the abdomen, breast and legs black ; thorax brownish black ; wings dark brownish, scarcely opake ; anterior part of the abdomen dark plumbeous ; spines of the middle legs two ; breast hairy.

The lighter part of the abdomen appears as if covered with a whitish bloom. The eyes are very large, and meet at their lower edges, but are separated above by a narrow yellowish space : their color is black and bronzed. Length seven-eighths of an inch, or nearly one inch ; expansion of wings, nearly two inches.

This species is rather smaller than the *plumbeus*, with wings less robust and strong : it appears at the same time, and attacks cattle and horses in the same savage way. Both are found as far south as Maryland.

TABANUS ——.

Sooty black. In some lights, the abdomen above is glaucous; beneath, it has a shade of greenish blue : eyes faintly bronzed. Face obsolete, in consequence of the great extension of the eyes, which meet on the top, divaricating only just above the base of the antennæ, leaving a small triangular area through which the median line passes, and which is also traversed transversely by two grooves : this area is occupied by six or eight little glossy eminences. Legs and breast covered with a jet black pubescence.

The form of the eye is remarkable; the top of the head being capped, as it were, with the organ, which projects directly in front. The insect differs entirely from the two preceding species, and has not probably received a specific name.

Xylophagidae.

MIDAS FILATUS. (Plate xxviii, fig. 11.)

MUSCA CLAVATUS (Drury).

Black : second abdominal segment yellow upon the superior parts; wings copper-brown and submetallic, scarcely transparent. Length $1\frac{1}{4}$ inch; expansion of wings, $2\frac{1}{4}$.

This species, so far as my observations extend, is a rare insect in New-York. It is easily distinguished by the yellow segment of the abdomen referred to, which extends only to the sides, the inferior part preserving the black color of the remainder of the organs. Its larva is a white maggot, and exists in decaying stumps and logs. It is usually found in the forests in its perfect state in midsummer, and is one of the largest dipterous insects of New-York.

Syrphidae.

MILESIA VIRGINIENSIS. (Plate xxviii, fig. 3.)

MUSCA VIRGINIENSIS (Drury). MILESIA ORNATA (Fabricius).

Eyes black; front of the head cream-color; antennæ like short hairs; thorax yellow, with two black rings; abdomen black, ornamented with yellow rings, every alternate one of which is interrupted in the middle : it is marked with a yellow dot at the base, and terminated with yellow. Legs yellow; wings dusky. Underside, breast black, with yellow spots : ocelli distinct.

It is rather more than three-fourths of an inch long; expansion of wings, $1\frac{1}{8}$.

CHAPTER XVIII.

ORDER VIII. NEUROPTERA.

The wings, in this order of insects, are made up of a fine network, membranous, and usually naked and without down or scales : they are subequal or equal. Sometimes the lower wings are broader than the upper; but, if narrower, they are longer. The mouth is fitted in some families for mastication, particularly in the libellulidæ, which are furnished with transversely movable jaws. The abdomen is usually long, but is destitute of a sting. The antennæ are not uniform in the different families : in some they are long; in others, short. They have two or three simple eyes. The trunk is formed of three segments closely united : the abdomen is sessile. The larva has six feet. The metamorphosis is not always complete.

The order contains several well-known families, as the dragonflies, mayflies, white ants, and the ant-lion flies. In all these families, as well as in those not yet mentioned, the wings are formed of a fine network of nervures, so arranged in the minute details of structure as to constitute a great number of areolets of much beauty.

In this order there is one family, the *termitides*, which are extremely interesting in their economy and habits, as well as an instance of a remarkable development of the faculty of instinct : they are social, and live in large communities; while most of the other families are solitary, and do not construct habitations for the common convenience and defence.

Libellulidae.

Libellulidæ is the family name of the *dragonflies* : they are insects which become familiar to every body, and are frequently called *darningneedles* or *devil's-needles*. Their heads and eyes, especially the latter, are always large : their bodies are long; the thorax is thick and strong, and the abdomen long and rather slender, though not always so, and is terminated by two inarticulated appendages. The antennæ are short. They have three ocelli : two lateral ones, and one seated in the median line. The mouth is well formed, and the mandibles are strong and horny. They have four wings, which, when at rest, are extended horizontally or carried over the abdomen.

The libellulæ are widely extended in their distribution : they are voracious in their habits, of strong muscular powers, and able to remain long upon the wing. Their larvæ are quite as voracious as the perfect insect. The female deposits her eggs on the water, while upon the wing. They may be regarded as serviceable to man, especially in their perfect state, by feeding upon insects that are annoying, as musquitoes and the like.

The family has been subdivided into three genera by FABRICIUS : 1. LIBELLULA proper, with wings horizontal when at rest, eyes large and approximate, and having also the three ocelli; the middle division of the lip is the smallest, and the abdomen is ensiform. The second genus is ÆSHNA, having two ocelli situated on a transverse keel-formed elevation; the intermediate lobe of the labium larger than the lateral, and armed with a strong tooth and a spinous appendage; abdomen narrow and elongated. The third genus is AGRION : it carries its wings perpendicularly when at rest; the middle lobe of the labium divided in two; the antennæ with four articulations : there is no vesicle upon the forehead; the ocelli are equal, and the abdomen filiform.

LIBELLULA PULCHELLA. (Plate xv, fig. 5.)

Color black. Abdomen sometimes wholly black both above and below, and sometimes light slate above and black below, or partly slate color : individuals seem to vary in this respect without regard to sex. Wings marked by three black or dark brown spots or bars : the basal is confined to the costa, and does not extend to the posterior edge; the external covers the apical area, and sweeps around so as to form a circular curving edge towards the base.

Fig. 4 is closely allied in its habits and appearance to the *pulchella*, and its abdomen presents in different individuals the same varieties of color.

Fig. *f*. Larva of the *Libellula*.

Myrmeleonidae.

(Plate xxxiii, figs. 4, 5, 6, 7.)

A FAMILY of insects familiarly known under the name of *ant-lions*, while in the larva state. The insect has always arrested the attention of the curious, from its peculiar habits, the singular form of its larva, and the ingenuity it displays in making traps or pitfalls to catch the prey that must serve for its sustenance. In its perfect state, it resembles a LIBELLULA; but when it is in its larval form, we would by no means suspect that it belongs to, or is the embryo of one of the most beautiful of the insect tribes. There is always, however, a wide difference between insects in these two states.

In the family of the LIBELLULIDÆ, the larva is aquatic, and is provided with the necessary form of mouth and mandible to seize and devour other insects : it is in fact a voracious animal, and carries on its depredations in the water; while in the MYRMELEO-

NIDÆ, the larvæ are terrestrial, and the parent insects select for their habitations the places farthest removed from water, the driest sand being the only material suited to their habits and mode of life, or adapted to their essential wants.

The ant-lion, which is the common name of the insect about to be described, is a spider-looking animal, having a thick, short, and full abdomen, and narrow and elongated front, which is terminated by two long or exsert mandibles, strongly toothed upon their inside edges, and also perforated, so that the insect may suck the juices from its victims (See Plate xxxiii, fig. 2 : larva). The mandibles have three teeth each, and a row of stiff bristles below them, probably used partly for supporting their prey, when engaged in the act of suction. The mandibles are curved, and as sharp as a needle; and in this respect are well adapted to the office they are designed to fulfil, the piercing or transfixing the ant, which seems to constitute their favorite food. The three teeth are slender, and but slightly thickened at the point of junction with the jaw. The body is clothed with a few bristle-like hairs, but in other respects it may be said to be naked. But what is quite peculiar and interesting in the construction and habits of our species of ant-lion, is the position and structure of its legs : they only permit it to move with its abdomen in front, or, in other words, it is obliged to walk backwards.

To obtain a supply of food, the larva forms a conical depression in dry sand under a shelving rock, where the surface will remain undisturbed; the depression being over half an inch in depth. At the bottom, the owner places itself concealed in the sand, with only its mandibles standing a little above the apex of the depression. Now as sheltered places of this kind, which the ant-lion selects, are also excellent highways for all small animals to travel, and especially suited to the habits of the ant, if the ant is not cautious in his passage through these dry and shelving grounds, it will probably fall into some one of these sand-traps : this happening, there is little chance of its escaping from the jaws of the lion, which are always open and ready to seize the unfortunate traveller. If, however, the ant does at first escape the clutches of the lion, and attempts to clamber up the side of the pit, it is sure to be overwhelmed with a shower of sand cast up by its cunning foe, and most certainly precipitated again to the bottom.

Notwitstanding this lion is furnished with strong mandibles, they are not for the purpose of chewing or biting its food, but are so constructed as to hold its prey securely, and to extract its fluids by suction. When this is finished, the lion tosses the empty skin from its pitfall, by means of its long mandibles and the free and extended motion of the head in its thorax.

Like other larvæ, the larva of the ant-lion changes its skin. When about to undergo its transformation, it glues together a portion of sand by mixing it with a kind of mucilaginous and fibrous or silky secretion, which it forms into a perfectly round ball having a sufficient consistency to bear handling freely. At the time of the final change, which occurs about twenty days after the ball is rolled, the pupa pierces a round hole in the side

of its globular envelope, and comes forth, casting off its pupa skin, which is left partly adhering to the orifice as represented in fig. 4.

The myrmelion is a four-winged insect, at first view resembling a libellula; but it will be perceived that its antennæ are peculiar, and quite different from those of that family: they are larger at the extremity than at the base, generally curved, and sometimes appear like a hook. The eyes are wide apart, and do not touch upon the upper and posterior parts. The wings are extremely delicate, like the finest gauze; and the abdomen is rather slender, and tapers each way. The color of the insect is brown. The wings are transparent, and all the nervures are spotted with brown and white. The rings of the abdomen are brownish, but much the darkest on their posterior half: the abdomen is also clothed with short hairs. The wings are attached to the thorax at a distance apart, and the thorax is divided into two parts, the first supporting the forewings, the last the hindwings: the first has rounded eminences, separated by oblique fissures; the last has properly only two, which are separated by oblique ridges, that begin at the sides and nearly meet in the middle. The abdomen has five rings. The feet are black. Length of the larva, about $\frac{1}{2}$ an inch: length of the perfect insect, $1\frac{1}{4}$ inch; expanse of wing, $2\frac{1}{2}$ inches.

The species above described and figured were furnished me by Mr. J. Gebhard, Curator of the State Museum, and were procured under the limestone ledges at Schoharie. I have also found the larva of the ant-lion beneath the limestone ledges near Burlington (Vermont): almost every suitable place furnished specimens of the insect.

I am unable to determine whether this American species has been described or not.

Ephemeridae.

Mayfly is the common name for the insects of this family. If not characterized by the shortness of their lives, it is a well-known feature in their economy: they live but three or four hours in their perfect state; hence the modifications of their mouth are quite different from those of the libellulidæ, which have a much more prolonged existence, and are therefore provided with ample means for taking sustenance. Their antennæ are minute and three-jointed, and their four wings are of an unequal size. The mouth is nearly obsolete or wanting, and the extremity of the body is furnished with articulated setæ. Their bodies are rather long, slender, and soft; the eyes rather large, and there are also three ocelli placed in a triangle between the eyes. In some species the clypeus shuts over the mouth.

The name of this family is derived from the greek *ephemeros*, *diurnal*, in allusion to the shortness of their lives. The only function they perform is to couple and deposit their eggs in the water. Their larvæ live in the water, and their existence in this state is prolonged for two or three years. They take refuge under stones, or in the earth or mud. They feed upon the slimy mud that contains decomposing particles of organic matter, and which suffices for their nourishment.

CHAPTER XIX.

ORDER IX. TRICHOPTERA (Kirby).

The English have given the name *caddiceflies* to the insects of this order. The consistence of the body of the perfect insect is considerable, and besides they are thickly clothed with hair. Their eyes are rather prominent and large, and they are provided with three ocelli. Their antennæ are variable in length, being sometimes much longer than the body; at others, shorter. They have four membranous wings; the front ones are fibrous, and the nerves are branching: the posterior wings are the largest, and folded when at rest. The mouth is imperfect and unfitted for mastication, the mandibles being only rudimental. The maxillary palpi are long, and almost setaceous. The larva has six legs: it resides in a case in water, which it forms of little fragments of shells, or of sand or sawdust. The mature insect is often employed as a fish-bait.

Phryganea semifasciata (Say). (Plate xxxii, figs. 9 & 10.)

Color brownish or ferruginous. Wings ferruginous, marked with irregular black lines and a distinct point near the inner and basal angle: inferior wings light ferruginous or yellowish; the hindwings have a dilated mark near the inner margin.

CHAPTER XX.

ORDER X. HYMENOPTERA (Linnæus).

This order resembles the Neuroptera in the number, texture, and organization of the wings; but they have a fewer number of nervures, and are less delicate in their construction: the forewings, too, are larger than the hind ones, and their foldings are horizontally disposed upon the back. The mouth is provided with horny jaws, and the maxillæ are metamorphosed into a sheath for the membranous tongue. The eyes are large. The thorax is composed of three consolidated segments, and the abdomen is attached to it by a pedicle or thread, provided with a sting in the females, or terminated with a multivalved saw or ovipositor. The tarsi are five-jointed. The larva is without feet, except in one group; and the pupa is inactive and incomplete.

This order probably furnishes the most remarkable families for the development of social qualities and instinctive powers; and if instinctive endowments have claims for consideration, the hymenoptera should rank first and foremost among the insect tribes. Some of these remarkable qualities appear in the bee, the ichneumon, the wasp, and the gallfly.

This is the most populous of all the orders in the insect world, unless we except the Coleoptera; its estimated numbers embracing one-fourth of the insect population.

Mr. Westwood adopts the following divisions for this order:

Section I. Terebrantia (Latreille): the abdomen of the female being furnished with an ovipositor, which combines the characters of a saw and a perforator or borer for depositing its eggs.

Section II. Aculeata (Latreille), embraces those whose abdomens in the females are provided with a sting connected with a poison reservoir. The antennæ of the males have thirteen, and those of the females twelve joints.

The first section has two subsections, the second containing two divisions :

Subsection I. PHYTIPHAGA : Abdomen sessile : larvæ feeding upon vegetable matter. This contains the families *Tenthredinidæ* and *Uroceridæ*.

Subsection II. ENTOMOPHAGA : Abdomen attached by a portion of its transverse diameter : larvæ with slightly developed trophi, and for the most part feed parasitically upon other living insects.

Division 1. SPICULIFERA : Abdomen with an elongated plurivalve oviduct : larvæ for the most part feeding upon other living insects. This division contains, as at present constituted, the *Cynipidæ*, *Evaniidæ*, *Ichneumonidæ*, *Chalcididæ* and *Proctotrupidæ*.

Division 2. TUBULIFERA : Extremity of the abdomen tubular, retractile, and furnished with a minute sting : larvæ feeding upon the larvæ of other hymenopterous insects, or upon dead insects deposited by the parent with her eggs for the support of the young when hatched. The *Chrysididæ*.

The second section has two subsections :

Subsection I. PRÆDONES (Latreille) : The basal joint of the tarsi cylindrical : larvæ feeding upon stored insects, or animal fluids provided by neuters. Families *Crabronidæ*, *Larridæ*, *Bembecidæ*, *Sphegidæ*, *Scoliidæ*, *Mutillidæ*, *Formicidæ*, *Vespidæ*.

Subsection II. MELLIFERA (Latreille) : Basal joint of the posterior tarsi dilated for pollen-bearers : larvæ feed upon honey or pollen-paste deposited by the neuters. Families *Andrenidæ*, *Apidæ*.

Tenthredinidae.

THIS family comprehends those hymenoptera usually called *sawflies*. The antennæ are more variable as to the number of joints, than in most of the insects of other families. The families of the order are formed from considerations that relate to the number and form of the joints of the antennæ, and the number and form of the cells of the wings.

The insects of this family are less active than the wasps or ichneumon-flies : they fly sluggishly, and do not appear anxious to escape when about to be captured. The wings fold horizontally upon the body when at rest. The female is provided with an instrument resembling a saw, or rather a double saw, which is lodged in a fissure beneath the abdomen, and covered by two narrow pieces that perform the office of a scabbard. The two blades of the saw are placed side by side, and so skilfully articulated that when withdrawn from the scabbard they move up and down. This saw, however, has different forms in different sawflies : it has, moreover, one advantage over the carpenter's saw, which only cuts in one direction, and therefore is liable to pinch if it is not well set, especially when employed in sawing green wood ; but the saw of the fly has teeth upon the sides, so that it can move easily by cutting a free groove. It might perhaps be called a *rasp* or *file*, as its teeth have the form of the teeth of these instruments. When in use, the saw moves in a

grooved piece that serves as a back to keep the instrument sufficiently supported : the edge, upon which the teeth are cut, is circular. The use of this singular instrument is to prepare a place for the insect's eggs : slits are made in the stems and leaves of plants, into which the eggs are dropped. Some of the species, after depositing their eggs, girdle the branch, which consequently dies, when it forms a suitable kind of food for the young. In other instances, protuberances are formed which become highly charged with sap, in consequence of which the quantity of food is greatly increased.

CIMBEX ULMI (Peck), AMERICANA (Leach). (Plate xxvi, fig. 11.)

The generic characters of CIMBEX are :

Body obscurely villose : first joint of the abdomen strongly emarginate above : joints of the antennæ before the club, five ; club two-jointed, and soldered together.

The insect I have figured is the CIMBEX of authors ; but the antennæ are properly only three-jointed before the club, leaving out of the number the basal support, which is fixed. The first joint is the longest, and is equal to the second and third together. If the support is a joint, then the antennæ are only four-jointed.

DESCRIPTION (female). Head black, shining ; antennæ luteous ; thorax black, margined in front by a circular brownish ridge similar to a collar : abdomen bluish black with brownish, marked upon the sides by four ovate yellowish white spots, and anteriorly there is a whitish space between the rings similar to a belt. The substance or membrane resembles fine parchment or paper. Wings smoke-brown, semitransparent and shining ; thighs blue-black ; tibiæ pale brown, and armed with blunt spurs ; tarsi yellowish or pale yellow. Length $\frac{3}{4}$ of an inch : expanse of wing, $1\frac{3}{4}$ inch.

The body of this *tenthredo* or sawfly is thick and large. According to Dr. HARRIS, Prof. PECK had called this insect *C. ulmi*, because it inhabits the elm.

The male is more slender, and the spots are wanting on the abdomen : length about one inch ; breadth, two inches. The larvæ feed upon the leaves of the elm.

The foregoing species is one of the largest of the family of the TENTHREDINIDÆ. It does not appear to be very common in the vicinity of Albany, inasmuch as but few are found in our collections.

Uroceridae.

WOOD-WASPS : HORNTAILS.

THE head of these insects is large, convex before and flat behind : antennæ filiform ; wings long, and overlap each other upon the back ; body long and cylindrical ; rings of the abdomen close and compact. Females are provided with an ovipositor in the form of a slender horn projecting from the extremity of the abdomen, or from beneath it, the sheath of which is attached to the inferior side of the abdomen by a hinge. In the male the horn is short compared with that of the female, and is either conical or triangular.

The sexes differ considerably both in markings and size. The borer of the female consists of five pieces : the two outside pieces are grooved for the reception and support of the inner pieces, forming a hollow tube when closed together; the inner pieces are needles, with which the trunks of trees are pierced for the purpose of depositing the eggs. Their young are grub-like larvæ which are wood-eaters, and destroy forest trees by extensive burrowing in the green solid matter. Pines, elms, maples, buttonwood and fruit trees are all subject to attacks of the uroceridæ.

UROCERUS ALBICORNIS (Fabricius). (Plate xxxii, fig. 3.)

FEMALE : Color deep blue-black : stemmata three, situated behind the antennæ in a triangular form; head confluently punctured; antennæ rather long, white, the base and extremity dark brown or black. Behind the eyes there are two oval cream-colored spots. Thorax pubescent, punctured, and deeply impressed with a fissure running in a circular manner from the base of one forewing to the other, and also extending down the base of the wings, leaving an elevation with its point directed backwards. Abdomen cylindrical, smooth, shining, marked by a lateral oval white spot, and terminated by a lanceform appendage. Legs black, with white joints. Length one inch : ovipositor, nearly three-fourths of an inch; expanse of wing, nearly 2 inches.

This insect resembles the female sirex, but may be distinguished at once by its white markings.

TREMEX COLUMBA. (Plate xxxii, figs. 1, 2.)

TREMEX (Jurine). SIREX (Linnæus, Drury). S. CINCTUS (Drury). S. PENNSYLVANICUS (Degeer). *Pigeon Tremex* (Harris).

Head and thorax yellowish brown, thick : antennæ of the length of the thorax, and made up of sixteen joints : abdomen bluish black, cylindric, ornamented by six rings, the last interrupted at the median line of the body; extremity yellow : ovipositor short and stout : wings opake brown and clouded : legs and feet yellowish; tibia armed with a spur.

This insect is common in Albany county. In company with the *Pimpla lunator*, multitudes resorted to a half-grown maple tree in the back yard of the Old State Hall for the purpose of depositing their eggs. So completely was this tree riddled with holes when the insects escaped after transformation, that it died in a few years, when it was found to be perfectly mined through and through.

I have taken this species also in Maryland, so that it appears to be widely distributed. The ovipositor is nearly half an inch in length; the body, an inch and a half; the male less, but it frequently happens that the female is small also : expansion of wings, two and a quarter inches. Their wants are not confined to the maple tree : they bore or pierce the elm and buttonwood, which are thus killed in process of time. When a tree is resorted to for the deposition of their eggs, it furnishes the larvæ during every season of the year.

Ichneumonidae.

THE characters of this family, as given by WESTWOOD, are : The abdomen is attached to the hinder extremity of the thorax, and between the base of the coxæ. The anterior pair of wings exhibit perfect cells upon their disc. The ovipositor is straight, and often exserted. Antennæ setaceous or filiform, not elbowed, and composed of more than sixteen joints, except in a few minute *adsciti*. The pupa is enclosed in a cocoon. The head is small and free : eyes lateral ; mandibles slender and bidentate ; maxillary palpi five- or six-jointed, pendulous : wings moderate in length and size : legs formed for running. When the ovipositor is retracted, the abdomen terminates in a point.

The larvæ are parasitic upon other insects.

Plate I. illustrates some of the characters of the family.

The antennæ are in constant vibratory motion. The insects themselves are exceedingly active, and exhibit a remarkable degree of instinct in depositing their eggs where their progeny will be provided for. They are very important in the economy of nature, especially in keeping in check other species which would be highly injurious to man. They are particularly useful in reducing the numbers of the lepidoptera, scarcely a species of which are exempt from the attacks of ichneumon-flies. These deposit their eggs in the back of the larva, through a puncture so minute as not to interrupt its growth and perfection : the larva winds itself up as usual ; but in its pupa state, the eggs of the ichneumon hatch, and the progeny feed upon it : it is consequently destroyed ; and instead of the butterfly, there comes forth a brood of ichneumons. Before this subject was understood, the singular fact here stated was accounted for on the supposition that certain animals were susceptible of transformation into others.

The ichneumons have been divided into *Ichneumones genuini* and *adsciti* : the forewings of the former have two, of the latter, one recurrent nerve.

ICHNEUMON BREVICINCTOR ? (Plate xxvii, fig. 10.)

Color black. Antennæ with joints twenty and more : yellowish white annulus beginning at about the ninth joint, and ending at the seventeenth from the base. Wings light smoky brown. Scutel pale yellow : a sharp well defined ridge extends from each anterior angle of the scutel, to the middle of the ridge surrounding the base of the wing. Knees and tibia of the anterior feet rufous.

This individual differs from the *brevicinctor* described by SAY, in the beginning of the pale annulus, which, in his account, commences at the seventeenth joint, and extends only to the twenty-first. The cellules of the wing agree with his figure, and also the opake costal spots.

ICHNEUMON ——. (Plate xxvii, fig. 7.)

Color black. Scutel yellowish, with a sharp ridge extending from the anterior angle to the base of the wing. Second and third abdominal rings orange, with the posterior part of the second black upon the top : beneath, the orange color covers the entire rings. Face and legs orange ; the face pale. Antennæ entirely black. Wings transparent, and only slightly smoky.

ICHNEUMON ——. (Plate xxvii, fig. 9.)

Color black. Wings smoky brown. Antennæ with a white annulus beginning about the sixth ring from the base.

PIMPLA LUNATOR. (Plate i, figs. 1, 2, 3, 4, 5, 6.)

Antennæ brown, darker at base. Eyes black. Head brown, encircled with a ring of two yellow bands, and one of a pale brown : front yellow, with a brown band extending from one eye to the other. Thorax brown, marked upon the top by a trident, or a longitudinal band terminating before in three divaricating lines. Laterally there are two broad brown bands parallel with the first : between the wings, the middle band divides and forms a circle, the inside of which is yellow. Abdomen compressed, sabre-form and narrowed before. The seven rings of the abdomen are marked by semilunate bands at their posterior margin, and succeeded by a black ring : the lateral parts of the rings form an acute arch in the female, which enables her to flex the abdomen as represented in fig. 4. Abdomen greatly dilated at its extremity in the female, and terminated by a greatly elongated ovipositor. Wings transparent, and marked by a brown patch. In the male, the abdomen is slender. Legs yellow and light brown. The female is sometimes 1½ inch long, with an ovipositor some three inches long.

Fig. 4 : Female in the act of introducing its ovipositor into the trunk of a maple tree.
Figs. 1 & 6 : Males.
Fig. 5 : Female at rest.

The yellow bands represented as lunate, are probably too sharply arched to admit strictly of the appellation.

This insect formerly frequented a half-grown maple in the yard of the State House in this city. I supposed at first that the *pimpla* was attracted to this tree, in consequence of the *sirex* having also made it the place for depositing its eggs. The larvæ of both insects were found in great numbers in different stages of growth ; but it did not appear that the larvæ of the former fed upon those of the latter, for they were both in many instances full grown and separate. In some cases the pimpla passed her ovipositor very near to a larva of the sirex ; but it could not be ascertained, after a very careful examination, that the object of the first was to pierce the larvæ which infested the tree, after the manner of ichneumon-flies. Still the habits of the family favor the view that the larvæ of the pimpla

feed upon the larvæ of the sirex. The tree was perfectly riddled with holes and burrows, and was undoubtedly selected on account of its sheltered position. As happens with some other species, the females sometimes perished from inability to withdraw their ovipositor; and this does not seem at all strange, for they frequently succeeded in introducing it into the wood to the depth of three inches, slender as it is.

Sphegidae.

The collar is dilated laterally, and extends to the base of the wings. The legs are long, the posterior being more than twice as long as the head and thorax. The antennæ are filiform or subsetaceous, long, and composed of elongated joints. The body is long, and the abdomen is attached by a long peduncle. Mandibles elongate, curved, narrow, and notched on the outside at the base : eyes entire : legs fossorial.

These insects appear like wasps, except in their pedunculated abdomen : they are exceedingly active, restless, and difficult to capture.

Sphex pennsylvanica. (Plate xxvi, fig. 9.)

Color steel-blue and purplish : margins of the wings fading into brownish, scarcely observable. Head transverse, short : eyes prominent; hindwings dilated behind. Abdomen greenish steel-blue, oval, acute, and attached to the thorax by a slender thread. Antennæ brownish : thorax and head pubescent : tarsi black.

Vespidae.

Vespa fraterna. (Plate xxvi, fig. 6.)

Color brown. Surface without puncture and smooth. Antennæ paler on the under side. Wings smoke-brown, translucent. First ring of the abdomen marked with a yellow ring. Legs brown, except the joints, and a short stripe of lustrous upon the upper side of the femora : tarsi luteous.

The wasp and hornet exhibit skill and patience in preparing their habitations : they are natural paper-makers, and fabricate an article that is impervious to water.

The wasps form their habitation beneath stones, fixing it to the inferior surface. They feed their young upon vegetable juices, and the softer parts of other insects which they capture. They are fond of the juices of our domestic fruits, and seem to have a preference for the expressed juice of the apple, as they are observed to abound about cider-mills and in apple-yards.

Evaniidae ?

PELECINUS POLITURATOR. *P. policerator* (Fabr.). (Plate xxvi, fig. 7.)

Antennæ black, long and filiform, marked with two yellow bands at the extremities: ocelli distinct. Head, eyes, thorax, abdomen, and legs black. Palpi four, slender, two long and two short. Legs slender, but the hind-tibiæ are thick and strong. Abdomen elongated, consisting of six joints; the elongated rings long oval. Wings pellucid and brown.

This singular insect is not uncommon in New-England and New-York in autumn. By the roadsides, in September and October, it is seen flying slowly, as if borne down by its long abdomen. When caught, it attempts to sting, and is capable of inflicting a slight wound.

OPHION MACRURUM (Fabr.); ICHNEUMON (Drury). (Plate xxvii, fig. 5.)

Head small, dark orange: eyes large, black, oblong; ocelli shining black. Antennæ nearly the length of the insect, brown orange and thread-like. Color of all the other parts of the insect brown orange, except the wings, which are transparent. Thorax short. Abdomen arched, three times as long as the thorax, and attached to it by a very narrow or thread-like base, widening in depth, but compressed laterally: extremity obliquely truncate. Legs slender; hind ones the longest: tips of the fore-tibiæ single, the others double-spined. Length of body one inch.

This is one of the most remarkable of our ichneumon-flies, and appears during the latter part of summer and early in autumn, when it is observed busily hovering over places where there are thickets of brambles, solidagos, asters, etc. in search of caterpillars or other suitable objects for the deposition of its eggs. It is common in Massachusetts and New-York.

OPHION MUNDUS. (Plate xxvii, fig. 4.)

Color black: antennæ, tibiæ and tarsi yellow: antennal nasus, anterior orbits, and front greenish yellow; the antennæ are black or brownish black at base. Thorax clothed with hairs. Abdomen compressed: basal joint cylindrical; second joint as long and rather longer than the first. Forelegs fulvous yellow, except a brown stripe on the under side: tibiæ of the hindlegs fulvous yellow, except the tips, which are brown; feet all yellow, except the middle, which is brownish above. Length one inch.

OPHION GLABRATUS. (Plate xxvii, fig. 3.)

Antennæ shorter than the body. Color dull honey-yellow: head and orbits yellow; wings hyaline, transparent, with an oval longitudinal glabrous spot on the large cubital cell just beyond its middle; eyes dusky or brownish. Metathorax with a transverse ridge near the articulation of the abdomen. Length four-fifths of an inch.

OPHION PURGATUS? (Plate xxvii, fig. 6.)

Antennæ nearly as long as the body. Color honey-yellow, somewhat brownish : orbits yellow; wings hyaline, with two opake dots in the first cubital cellule.

This insect, though not longer than the foregoing, is rather thicker and stouter. Length about four-fifths of an inch.

XYLOCARPA VIRGINICA. (Plate xxvii, fig. 1.)

Body thick, pubescent and hirsute; thorax globular; abdomen ovate; eyes brown; antennæ short, slightly thickened at the extremities. Thorax and adjacent part of the abdomen clothed with yellow hair : two-thirds of the posterior part of the abdomen black. Wings hyaline, yellowish, tipped with a dull ochre-yellow. Beneath the body and legs hairy, black inclining to brown.

This insect attacks the dry woodwork of porticos, ceilings, etc. and completely burrows the inside, leaving a mere shell to support the framework. It always makes its entrance on the lower side of the railing, whence its operations are not readily detected.

CŒLIOXIS ANNULARIS. (Plate xxvii, fig. 2.)

Color black : face yellow : antennæ black : thorax black; margins lighter, and the disc black : abdomen black; rings annulated with yellowish white, pointed. Beneath the body and legs, black.

Scoliidæ.

SCOLIA FOSSILANA. (Plate xxvi, fig. 10.)

SCOLIA FOSSILANA (Fabricius). SPHEX PLUMIPES (Drury).

Head pale yellow in front, black on the top and hairy : antennæ black, shorter than the thorax : neck hairy, lemon-colored : thorax black, and covered with yellow hairs : wings dark brown, translucent : abdomen lemon-colored above, crossed by three black lines, dark beneath : breast and arms black : legs hairy and black; hinder ones furnished with two remarkable long spines at the tips of the tibiæ : tarsi furnished with strong pale yellow hairs.

SCOLIA OCTOMACULATA.

Thorax black : scutel marked with a yellow line. Back of the abdomen dusky rufous, and marked with eight yellow spots, four on each side of the median line : the middle spots are oval, the first and last linear. The head is black; the anterior margin of the clypeus and base of the antennæ, dull rufous : thorax black, and feet rufous.

The *scoliæ* are fond of dry sandy places, and feed on the honey of flowers.

CHAPTER XXI.

ORDER XI. LEPIDOPTERA (LINNÆUS).

GLOSSATA (FABRICIUS).

THE insects that flit before us in our daily walks, and are known under the common name of *butterflies*, are representatives of this order, to which also belong the numerous winged visitants around our lamps during the summer evenings. Those which are observed flying in the daytime, never enter our windows by night; and neither are the moths, so common at night, ever seen sporting by day, or flying abroad by the light of the sun.

Our first inquiry is, In what respect do the insects of this order differ from those already described? They have four membranous wings, clothed with minute scales: their bodies are soft and covered with hair, and their mouth consists of a tubular filamentous organ designed for sucking the juices of flowers, and which, when not in use, is rolled into a compact coil; and, lastly, their metamorphosis is complete. We cannot fail to see how widely they differ from the COLEOPTERA or ORTHOPTERA; although could all the species of the different orders be spread out before us at once, we should find that they are all connected by intermediate links.

The lepidoptera exist in three states: *the caterpillar*, *the pupa*, and *the imago* or perfect state, in the last of which the insect propagates its kind. In the first or caterpillar state it grows, or increases in size; and it is during this state that it is necessitated to change or cast off its outer integument, in order that this process may be perfected. It changes its skin four times, and it frequently happens also that its colors and markings undergo a succession of changes. Each insect is invariably furnished with sixteen feet. The mandibles and maxillæ do not differ materially from those of the insects of other orders. The true legs are borne by the first three segments of the body: the other legs are called *false*, or sometimes *prop-legs*.

As it is in this state that the insect grows, it becomes necessary that it should take a large quantity of food, which it mostly derives from the vegetable kingdom, feeding upon roots and leaves, and sometimes upon wood. When the larva has acquired its proper size, it ceases to eat, and proceeds to form for itself some kind of case, impervious to water, and

in this it undergoes a change. It is then inactive and defenceless, and appears dead; and as if aware that it is about to assume a condition in which it cannot protect itself, it seeks a secret place where it may be secure from the attacks of foes. The transformations of the lepidoptera are of the most complete kind : in some other orders, the pupa is active; here it is inactive.

The Lepidoptera are divided into three great sections. The first section contains the *Butterflies* proper, Papiliones : their antennæ are thread-like, and bear a knob. The second contains the Sphinges, or *Hawkmoths* : their antennæ are thick in the middle, and often hooked at the tip. The third contains those familiarly called *Moths* : their antennæ are neither knobbed at the end nor thickened in the middle, but somewhat naked, tapering or bristleform, or else feathered on each side. The order has also been otherwise divided into two sections : the *Diurnal lepidoptera*, which fly by day; and the *Nocturnal*, or those which fly only during the night.

Papilionidae.

The distinguishing characters of this interesting family are taken from the feet, all of which are perfect, formed for walking, and furnished with simple or bifid claws. The antennæ, which have a distinct club, have no appendage as a hook at its extremity. The hinder wings have a slice cut out of the inner margin, for the accommodation of the body, or else are grooved to receive it.

The larvæ of this family are naked, and the pupa is supported by threads of silk passed around the middle of the body: they are both angulated and smooth in the different genera.

The butterflies of this family are among the largest and most splendid of American insects : examples are the *Papilio asterias*, *philenor* and *turnus*. The family is advantageously subdivided into Papilionides and Pierides. In the former, the anal angle of the posterior wing is concave or folded, and the middle longitudinal nervure of the forewing emits four branches, while no other species have more than three; and the palpi are short. From their size and beauty, Linnæus gave them the name *Equites*.

The subfamily Pierides have a gutter in the inner margin of the hindwings, for the reception of the abdomen. The caterpillars are finely pubescent, and taper towards the extremities. The pupæ or chrysalides are angular, slightly compressed, and terminate in a point at each extremity : they are supported by a thread of silk passed around the pupa-case. Some of the common butterflies belonging to this subfamily, the white and yellow ones that flit about our walks, are less beautiful than those of the first subfamily, but still deserve our admiration.

The genera of the family have the following characters :

In PAPILIO, the antennæ are long, but the club is not flattened : posterior wings angulated.
In GONIAPTERIX, the wings angulated ; antennæ short.
In COLIAS : club of the antenna not compressed ; posterior wings rounded, and covered with scales.
In PIERIS, the club of the antenna is compressed : wings naked.
In PONTIA, the club is compressed : forewings trigonate, and both covered with scales.

The COLIAS is the genus that contains our common sulphur-yellow butterfly bordered with black : the GONIAPTERIX and PORTIA are white, and our PIERIS is orange with a black border.

Papiliones.

PAPILIONES (WESTWOOD). EQUITES & HELICONII (LINNÆUS).

PAPILIO ASTERIAS (Cramer). P. TROILUS (Drury, Abbott & Smith). *Butterflies.*

Antennæ long. Head black, marked with four yellow dots ; eyes blue : body black, marked with four rows of yellow. Wings black : beneath there is a reflection of olive green ; nervures strong. Forewings marked by two rows of yellow spots, about eight in each row : inner row, the spots are large and triangular, with apices directed towards the insertion of the wing ; outer row, smaller and nearly round. Outer edge of the wing spotted with pale yellow : near the anterior margin, there is a single spot of yellow within the rows. Posterior wings tailed : upper side marked by a continuation of the yellow spots, the inner row being rounded and the outer lunate ; between which rows, there is a row of large blue spots placed betwixt the nervures. There is an eyelet upon the inner margin, the ring of which is orange with a black centre : the hindwings are margined like the forewings. Beneath, the yellow spots are converted into orange, except those of the outer row upon the forewings, and some of the orange spots are margined with yellow : the blue spots have become lunate, and softened into-olive-green. Expansion of wing, three to four inches.

The caterpillar is found in the month of June, feeding upon umbelliferous plants, as the parsley and carrot. When perfect, it is smooth, and of an apple-green color ; each segment or ring being marked by transverse alternating bands of black and yellow spots. When first hatched, it is black, and banded across the middle : it undergoes a succession of changes during its moulting. It has a peculiar mode of defending itself from the attack of flies ; as when touched, it protrudes from the first segment of the body a pair of orange-colored horns, which exhale a disagreeable odor. The pupa is of an ochre-yellow or pale green.

PAPILIO PHILENOR (Fabricius). P. ASTINOUS (Drury).

Head, thorax and abdomen black; the breast marked with two rows of yellowish dots: antennæ and eyes brown or brownish black. UPPER SIDE: Forewings black with a green lustre; apical area brownish; outer margin marked with five spots, and edge trimmed with black and white: hindwings polished green, silky, darker at the base; posterior margin marked with five white lunules; anal angle excavated and edged with white; tail rounded, its angles trimmed with black and white, the crenæ being white. UNDER SIDE: Forewings black; apical area olive; margin marked with five yellowish spots; edge black and yellowish white: hindwings highly polished, green and lustrous, with the outer and inner margins marked with large fuscous spots surrounded with a velvety black ring, with a single spot of yellowish white on the outer side; edge trimmed with black and yellowish white; tail dilated. Legs and feet black.

PAPILIO TURNUS (Linnæus). P. ALCIDAMAS (Cramer). (Plate xxxviii, fig. 3.)

Antennæ black: body black above, marked with a yellow stripe beginning at the neck, and passing over the insertion of the wings and along the sides of the abdomen: sides of the breast striped with yellow; palpi yellow. UPPER SIDE: Wings yellow, marked by five subcostal bands: the first is a marginal one, extending from the shoulder to a yellow lunule at the anal angle; the second extends as far, but grows thinner and terminates in a point, and the other three are abbreviated and confined to the forewing: costal edge black. The outer marginal band is wide, black, and common to both pair of wings, and is ornamented with six lunules, larger and more perfect in the hind- than in the forewings, the first and last fulvous. Hindwings scollopped and tailed: tail rather long and narrow; anal angle fulvous, edged with white, and ornamented with three lunules, yellow, black and blue, and a ferruginous one below. The hindwing edges are trimmed with yellow; the forewings with white. BENEATH, the yellow is pale; the subcostal bands are less black and velvety, and bordered with greenish. Outer margin, the edge is black: there is a dusky yellow band, succeeded by a broader and more dusky one, showing greenish yellow, and bounded on the inside with a strong black line of scollops. Hindwings, the edge is yellow, succeeded by black and yellow lunules: the black line within is bordered with blue. Expanse of wing four inches. Length from the head to the extremity of the tail, $2\frac{1}{4}$ inches.

This is one of our common butterflies, and resembles the MACHAON of Europe, but its markings and form are more like those of the PODALIRIUS. Its larvæ are not known as injurious to the cultivated vegetables.

Heliconiidae.

Genus DANAUS.

The generic characters of the Danaus, as drawn up by Mr. Say, are as follows :

'Anterior feet spurious in both sexes : antennæ terminated by a club ; palpi distant, sub-
'cylindric, short : inferior wings rounded, not forming a groove for the reception of
'the abdomen : nails of the tarsi simple.'

Danaus plexippus. (Plate xxxviii, fig. 1.)

Head and body black, marked with two rows of white dots : sides also marked with many white dots : five posterior rings of the abdomen edged with white, with two rows of dots beneath. Wings entire, fulvous red varying in depth in different individuals : nervures and costæ black ; lateral and posterior margins trimmed with a black border, and two rows of white spots with a black and white edge : apical area black, and marked with elongate and subquadrate spots of the ground-color of the wings, with smaller spots of white extending along the costa. Beneath, paler : hind- paler than the forewings ; in other respects, the markings are not dissimilar to those of the upper surface. Eyes and legs steel-blue : tarsi velvet-black. Expanse of wing, four and a quarter inches.

Common, and widely distributed. The larvæ are harmless, feeding on useless plants, as the asclepias, etc. : they are annulated with white ; the pupa is green, and dotted with golden spots.

Limenitis dissippus. (Plate xlvii, figs. 1, 2.)

Ground-color of the wings precisely the same as in the *Danaus plexippus*. In the apical area, a somewhat triangular spot of black extends from the apex to the outer angle, within which there are four oblong spots of the color of the wing, and a small one at the junction with the marginal border : this black spot is marked with three white spots, and sometimes four in the row ; the lower one is a mere dot. Between these white spots and the apex, there is an elongate white lunule, or an elongate pointed spot. Beneath the costa, there is sometimes a white spot towards the base of the wing. The hindwing is marked by a narrow black belt, extending from near the middle of the costa, across the wing to the anal angle. Beneath, paler : upon the forewing there are two subcostal bluish white spots, and a dash of white on the costa near the black triangular spot. In the apical area, the fulvous spots are five in number, and more distinct than those above. Hindwings, the black belt is bordered on its basal side with three or more bluish white spots placed between the nervures. The border in both pair of wings is trimmed with black, upon which the inner row of spots forms

a distinct lunule, succeeded on the outside by interrupted curved blue lines : edge trimmed with black and white.

Head and body black : the back of the head is marked with four white spots, the first pair placed at the base of the antennæ. Antennæ black, tipped with rufous : palpi black, striped with white on the outside. Eyes blue, with a white spot posteriorly. Each side of the thorax is marked with three large white spots : coxæ white ; the ventral portion of five rings, white, and an abbreviated lateral white line. Legs black : tarsi of the forelegs striped with white in front. Expanse of wing varies from two and a half to three inches.

This species is found accompanying the *D. plexippus* in the vicinity of Albany, and is usually regarded as a mere variety of the same ; but the many differences in the markings, taken in connection with the constancy in size of the numerous individuals I have examined, leave no doubt of its distinct character.

LIMENITIS URSULA. (Plate xxxiii, figs. 1 & 2.)

Color black above, black and brownish beneath : antennæ black ; knob rather slender : eyes brown : head black. Behind the antennæ there are two white triangular spots, and a white line beneath and outside of each eye. Thorax and abdomen black above : sides of the former marked with three white spots ; on the latter, the edges of the rings of the venter white, and sides marked with a wide white stripe. Outside palpi white : upperside of the imperfect forefeet white. Forewings subfalcate ; outer margin slightly sinuate ; nervures of the wings with four branches : posterior wings slightly angulated, without tail, subtrigonal. UPPER SIDE, velvety black : forewings marked with submarginal bluish and rather obsolete lunules ; apical area marked with two white triangular spots ; edge trimmed with white and black : hindwings marked with two rows of pale blue quadrangular spots, the third upon the inner row from the anal angle being a lunate spot. Outside of these there are two rows of sublunate spots, the outer white, the inner blue ; the former are placed upon the edge. BENEATH, the apical area is brownish, and marked with white spots, which become obsolete as they extend towards the outer angle. Base of the wing bluish in some lights, and marked with two brown and four blue subcostal spots : the blue spots are small, and stand two and two ; the margin is trimmed with two rows of lunules, and the edge with white and black. Behind the disk is brownish, similar to the apical area, and the base is marked with a cluster of rufous and blue spots. The margin inside has five rufous spots surrounded with black, and two rows of lunules parallel with the edge, which is trimmed with white and black.

This species is found as far south as Georgia, yet does not appear to be common any where : it feeds on the gooseberry leaf and wild cherry, and is figured in ABBOTT and SMITH's Lepidoptera.

Pierides.

PIERIDES (WESTWOOD). DANAI (LINNÆUS).

COLIAS PHILODICE (Godart). *Clouded-sulphur Butterfly.* (Plate XXXV, figs. 1, 2, 4 & 9.)

PAPILIO PALÆNO? (Linnæus). COLIAS EUROPOME (Swainson).

MALE : Antennæ ferruginous; knob blackish above, ferruginous beneath, tipped with ferruginous or rosy color : palpi yellow, clothed with long hairs, greenish at base : eyes brown. Head blackish above; tips of the hairs often reddish. Trunk and abdomen blackish above, or rather greenish; beneath, yellow. Wings yellow, broadly bordered with black. Anterior wings above marked with a central diamond-shaped black spot, which is matched by a faint yellowish spot upon the posterior wing : beneath yellow, with a greenish tinge, especially beneath the black border of the forewings. Posterior wings of a deeper tint of sulphur-yellow than the anterior, and marked with two brownish spots each : the first is near the middle of the wing, and coalesces with a smaller spot towards the anterior margin, and both are ornamented in the centre with a spangle of silver; the other, a reddish oblong brown spot, is placed directly midway upon the anterior margin of the wing, pointing to the coalescing central spots. Wings ciliate : ciliæ rosy red.

FEMALE : The colors of the wings are much like those of the male. The border is rather paler, and shows six spots of the ground-color of the wings, placed two and two : four of the spots are nearer the apical angle. The posterior wings show obsoletely the marks placed beneath : the black border is fainter and narrower than in the male. Beneath, the anterior wings scarcely differ from those of the male; the posterior are paler, and, if any thing, show a faint rosy tint, with three or four small dots. Expanse of wing, about two inches.

The females differ as to depth of coloring : some are nearly as yellow as the male; in others, the yellow is pale and whitish. The caterpillar is described as pubescent, green, with yellow lines and black dots.

Fig. 1, male; 9, upper side female; 2, lower side female; 4, lower side male.

PONTIA OLERACEA (Harris). *Potherb Pontia.*

Knob of the antennæ flattened, black, and tipped with ferruginous; setaceous part, white beneath; above black, with the lower margin of the rings white. Head white, with a black spot upon the back of it. Thorax and body black, with the ends of many hairs and scales white : the sides of the abdomen are striped with white. Anterior wings

white, and tips and base dusky, which color extends outward along the nervures. Posterior wings white above, slightly yellowish green beneath.

Dr. Harris has given a minute description of the eggs and caterpillar of this species, from which it appears that the female lays its yellowish eggs upon the leaves of cabbages, radishes or turnips, about the first of June; that they are hatched in about a week, and that the caterpillar attains its full size in three weeks : it measures an inch and a half in length, is of a pale green color, and feeds indiscriminately upon any part of the leaf, perforating it in many places. The pupa state lasts about eleven days.

This butterfly, as may be supposed from its habits above described, is injurious to garden plants. There is no other way to save cabbages, etc. when attacked by the caterpillar, than to crush it under foot. It is common, but less so than the *Colias*. Neither inflict very extensive injury upon the farmer; and if the birds could have their own way so far as to inhabit the trees about the garden without molestation, they would always keep these minor evils in check : the indviduals of any species of insect would never increase to an extent such as to call the husbandman or gardener from his other duties.

The *Pontia oleracea* has a resemblance to species of the Genus Apterix : in all these, however, the antennæ are shorter, not flattened, but clavate, and the wings are angulated; and finally the individuals are all larger than the *P. oleracea*.

Pieris nicippe? (Plate xxxv, fig. 7.)

Head and body black above, but crossed at the back of the head and thorax with yellowish; beneath, yellow and orange along the sides. Antennæ rather short : knob yellowish. Wings yellow or orange : border wide, black, and edged with orange about the middle : below the anterior edge there is a short black line; the anterior border rather greenish. Beneath yellow, with a few splashes of red particularly on the hind-wings. Forewings, the outer border is yellow, while the basal part is a deeper yellow: the outer edge of the forewing is dotted with brown; and the fore-edge of the hind-wing shows many sharp dark lines, but frequently obscure.

Though this species does not agree in every particular of coloring with the *nicippe*, it is not so far removed as to admit much doubt of its being the same. It has a wide range, being found in Pennsylvania and Virginia as well as in New-York; but here it is far from being common.

Some of the figures have been colored of a deeper orange than the specimens ordinarily exhibit : indeed some individuals scarcely partake of this color at all, bearing mostly upon yellow.

Fig. 7, upper side; 6, lower side.

Nymphalidae.

The distinguishing characteristics of this family are found in the forelegs, the antennæ, the posterior groove of the hindwings, and the peculiar manner in which the pupa is suspended. The anterior legs are defective, being short and unfitted for walking : the antennæ have a distinct club, it may be compressed or somewhat prolonged below, but never hooked at the tip : the two hind pair of legs are furnished with bifid claws, the hinder tibia with a single pair of spurs ; and the posterior wings receive and protect the abdomen in a groove. The larvæ bear spines or else tubercles, and are cylindric : the pupa is angulated, and suspended by the tail.

This family embraces the beautiful species that have received the common names of *red* and *white admirals*, *painted-ladies*, *fritterlaries*, etc. Their flight is strong, and more than makes up for the imperfection of their feet.

The genera may be known by the following characters :

The Vanessæ have angulated wings ; antennæ rather abruptly clavate ; eyes pubescent.

The Cynthiæ have rather rounded wings, or only subangulated : in other respects, they closely resemble the vanessæ.

In the Limenites, the wings are more or less rounded ; the antennæ are straight ; the club gradually thickens : eyes pubescent.

In the Hipparchiæ, the club of the antennæ gradually thickens, and is more or less curved.

The Argynnes have the antennæ rather abruptly clavate, and club short ; eyes naked ; wings broad, and the head large.

Nymphalides.

Vanessa antiopa. *Willow Butterfly.* (Plate vi, figs. 5, 6, 7.)

Papilio antiopa (Linnæus, Donovan).

Above the medium size. Wings angulated : upper sides deep purplish brown ; surface appearing like velvet, bordered with a broad wavy belt of black, in which there are angular violet-blue spots : outer margins cream-colored, sprinkled with dots arranged somewhat in lines ; the salient angles of the border more distinctly marked. The anterior margin of the primary wings has cream-colored spots beyond the middle, towards the outer edge : the underside of the wings darker brown, terminating in the scollopped mottled gray border, in which there is a row of darker angular spots. The secondary wings are prolonged slightly into tails.

The caterpillar is black, with a series of spots along the back, and each joint armed with spines. It consumes the leaves of the poplar, willow, etc., but injures more especially the

elm, from the branches of which it often hangs in clusters; and when once stripped of its foliage by the larvæ of this species, which are more numerous some years than others, the tree rarely recovers.

The pupa is suspended by its tail from the underside of a stone or rail, and is pointed and armed with a double row of spines upon its ventral surface.

The *antiope* or *willow butterfly* survives the winter: it seeks a warm secluded place, and hence in the spring it appears early. The young butterfly comes forth from the chrysalis state in July; and in August a second brood of caterpillars appear, which pass through their changes before winter.

In consideration of the extensive injury these caterpillars inflict upon some of our best kinds of shade trees, it is very desirable that they should be destroyed, by shaking them from the limbs on which they congregate, and crushing them under the foot. It is only by taking this advantage of its larval state, that the increase of the species can be effectually checked.

VANESSA INTERROGATIONIS. *Semicolon Butterfly* (Harris). (Plate XXXV, fig. 5.)

Head and body brown, hairy. Anterior wings angulated and reddish or dark reddish orange, with their borders broadly shaded with black and obscurely marked with reddish spots, of which the longest is situated at the superior and outer angle, and dotted or marked within with black: middle spotted with seven angular black spots. Posterior wings all black except their bases, but the black is not sufficient to conceal rows of reddish spots: posterior and lateral margin edged with a black line, within which there is a reddish white line extending and spreading over the short tails. Underside of both pairs of wings the color is rust-red or marbled: the border of the hindwing is also ornamented with faint bluish green lunate spots. The centre has the pale silvery comma. Expansion of wing, $2\frac{1}{2} - 2\frac{3}{4}$ inches.

The caterpillar is spinous, brownish and variegated with yellow and brown, and lives upon the hop.

There seems to be some variety in the markings of this butterfly, though the general pattern is much the same.

VANESSA PROGNE (Fabricius). *Progne Butterfly.*

Antennæ brown: knob dark brown, tipped with lighter; outside spotted with black and white; beneath light brown. Head with a black spot at the base of the palpi. Body brown, light beneath and black above. Wings angulated, brown, and spotted with black. ANTERIOR WINGS: Outer margin black, marked near the centre with five round spots placed in a right angle: above and near the margin there is an oblong

larger spot than either of the five; beyond, a dusky patch with the apex black. POSTERIOR WINGS, mostly dusky black, but brownish towards the base : tails and margins powdered with reddish white : beneath grayish, mottled reddish or orange, and with obscure spots of lighter and darker color partaking more or less of brown. Hindwings marked with a silvery ¢ opening outwards.

This species furnishes considerable variation in the markings, as well as in expansion of wings. It is a common species, generally smaller than the *red admiral* and *comma butterfly*.

Dr. HARRIS regards this species and *V. argentea*, described by the late Rev. W. KIRBY in the *Fauna Boreali Americanæ*, as the same.

VANESSA COMMA (Harris).

Dr. HARRIS has recently described an American comma butterfly, which had been regarded as identical with the European : although closely resembling the latter, the hinder wings are not so deeply indented, which feature may serve to distinguish the two. For description, see HARRIS's Injurious Insects, 2d edition, p. 241.

VANESSA POLYCHLOROS? *Comma Butterfly.*

ANTERIOR WINGS, dusky orange, darker at base, marked with four large subquadrate spots upon the disk, of which three are in a line, and the other is placed below the middle spot of the three : costal margin with three large abbreviated fasciæ, the middle one the largest, the apical one smallest and whiter : outer margin dusky, and marked with an irregular pale line. POSTERIOR WINGS have a large black or dark brown costal spot : outer margin marked with crescents, which are not sufficiently distinct to warrant insertion in this description, owing to injury : a slender pale line is visible running parallel with the edge. Beneath the wings are clouded, the basal portion much the darkest; the higher portion, or broad band is striated transversely by numerous darker interrupted lines. In the middle of the posterior wing there is a silvery curved line.

The individual above described differs about as much from the English *polychloros*, as our *Vanessa atalanta* or *Cynthia cardui* from theirs. The most important point not made out, relates to the bluish lunules upon the outer margin; but on applying our *polychloros* to the English figure, I find it fits in length and breadth, and also the angulated and scollopped edges. There is a close correspondence in the patterns above and beneath, and the general resemblance is so near that it will not be safe to treat our species as distinct from the English.

VANESSA URTICÆ? *Tortoise-shell Butterfly.* (Plate xlvi, figs. 8, 9, 10.)

PAPILIO URTICÆ (Linnæus).

Upper sides of both pair of wings bright red-orange, dark at the base, and covered with long olive-brown hairs. Costal margin of the forewings marked with three large black subquadrate spots : between these spots, pale orange, with a whitish figure towards the apex, but within the border. Under the three black spots mentioned, there are three quadrangular spots upon the disk : the one nearest the base, rectangular and largest, and bordered on the outer edge with yellowish; above which are the two smaller spots. Exterior margin of both pair of wings black, and ornamented all around with blue lunules : beneath, the basal half of the hind-pair is nearly black; outside of which there is a belt of brown marked transversely by darker lines, and then the blackish border ornamented with obscure or black lunules. On the forewings there is a large pale orange patch, corresponding to the reddish orange markings above.

ANTENNÆ : rings marked with white and brown; knob brown, terminated with pale orange; palpi gray, from an intermixture of white and brown hairs. Expanse of wing, $1\frac{3}{4}$ – 3 inches.

I am unable to say whether this is a common species in this State, or not : it has been taken in the vicinity of Albany this season (1853), and I believe frequently. It resembles SAY's *V. furcellata*, obtained in the Northwest Territory; but in the latter there are two subquadrate yellow and reddish spots near the costa upon the black ground, and the broad belt is orange, bearing upon the costa a large black spot.

VANESSA ATALANTA (Fabricius, Curtis, Stephens). *Papilio atalanta* (Stephens).

Base of the anterior wings rich brown; of the apical half, brownish black with a tinge of blue, in which there is a series of white spots arranged in a curved line, the two largest spots separated by the two smallest. Between the broad orange fasciæ and the series of white spots, there is a large white spot upon the costa. The orange fascia crosses the wing, but does not quit the posterior angle : the scollopped edges are trimmed with white. Posterior wing, two-thirds of the basal part rich velvety brown, ornamented with a broad border similar in color to the fascia of the forewing, and dotted through its middle with black, besides the two confluent blue spots of the anal angle. BENEATH, the forewings are black; and between the middle orange band and base, there are red and blue lines : apex ashy brown. The hindwings are brown, black and grayish, traversed transversely by black narrow interrupted wavy bands : beneath the orange belt the color is ashen, marked with black angular lines. On the costal margin there is an ashen patch, with a darker middle.

CYNTIA CARDUI. *Vanessa cardui* (Godart). (Plate xlvi, figs. 1, 2.)

ANTERIOR WING : Disk reddish orange, extending near the base ; apical part nearly black, marked with quadrangular spots, the two smallest placed just to the right of the other two : the large costal spot within the four spots spoken of, is divided into three parts by the nervures : margin and edges trimmed with white brown, and an interrupted line which reaches the costa between the white spots and apex. POSTERIOR WINGS reddish orange, their inner margin covered with long brown hair : upon the disk of orange there are four regular round black spots, an imperfectly formed bar within, with two rows of black spots without, placed with long diameters at right angles to each other ; the edge is trimmed with white. The hindwing is orange, spotted all over with black spots : the costal margin, which is connected under the forewings, is white. BENEATH, the coloring is brighter on the forewings, but the pattern is much the same as above. The hindwings are ornamented with four distinct eyes, the two smallest in the middle : the centre is black ; then a partial ray of blue, then of black, then a distinct one of buff margined with black. Towards the outer angle there is often a fifth much smaller eye, arranged on a line with the others. The whole of the portion within the eyes, and the nerves, are all white, with numerous large and small white and light brown angulated spots and bars.

CYNTHIA HUNTERA (Kirby).

PAPILIO CARDUI VIRGINIENSIS (Drury). P. IOLE (Cramer). VANESSA HUNTERA (Dalè, Stephens).

Edges of the wings rounded, or only subangulated. Disk of both pair of wings orange red, brown at base, and darker at the apex ; disk broken by black irregular transverse bars connected by delicate lines : apical part marked with four silvery white spots ; the two smallest are outside of the larger, and the costal one is divided by the black nervure into two parts. There is also a large subquadrangular spot resting on the costa : outer margin trimmed with parallel scollops of white, brown and orange. On the posterior wing the ornaments consist of two black circles with blue centres, between which are two black spots. The margin does not differ much from that of the forewing, except that the scollops take the form of lunate spots : upon the anal angle, these spots have blue discs. BENEATH, there is much greater complexity as well as beauty of coloring. The principal and characteristic ornaments are the eyes on the apical angle of the forewings, and two large eyes surrounded with black upon the hindwings : the disk is a patch of white composed of mealy scollopped lines. The margin below resembles that above.

The caterpillar is said by DRURY to be green, with black rings around the body, and feeds on *balsam* or *lady's-jewels*.

LIMENITIS ARTHEMIS. *Nymphalis arthemis* (Drury). (Plate xliii, figs. 2 – 9.)

Wings black, marked by a broad white band common to both pair, reaching very nearly to the margins : apical portion marked with three white spots, to which a fourth is sometimes added. Beneath, the basal portion is black, perhaps greenish, and ornamented with a cluster of brown spots and bluish green bars situated near the base : at the apex there are three white spots. Posterior wings beneath are marked with six or seven brown spots outside of the white band : margin trimmed with white, black and blue. The last-mentioned spots are in two parallel lines, and bear the form somewhat of lunules.

The anterior pair of feet are white before : abdomen black, and the venter has a yellow stripe on the specimen before me.

This species seems to have a wide range ; being found as far north as Lake Winnepec, and south into Virginia.

ARGYNNIS APHRODITE.

Stipe of the antennæ long, buff-brown ; knob black. Head and body buff, with black upon the thorax and upper side of the abdomen. Color of the wings bright buff-yellow or fulvous : forewings spotted and banded with black, and both pair darker at base as well as hairy. In front there are six or seven black subcostal bands : the four from the base are connected with a zigzag band which extends across the wing ; or they may be regarded as a connected series of lunules, having in front of their concavities a row of six round black spots, beyond which is a regular row of seven lunules smaller than the former : margin trimmed and edged with two black lines, which are dilated where they cross a nervure. Hindwings marked with distant rows of lunules, between which there is a row of roundish spots : they are trimmed and edged like the forewings. BENEATH paler, and the subcostal bands are more distinct : there is a double row of lunules, with three spots between. At the apex, the black spots and lunules of the upper sides are replaced by silvery ones. Hindwings, base deeper colored than the wide margins, and ornamented with three parallel rows of bright silvery spots, and several more which cluster at the base : among the rows; there are small silvery spots scattered about without order : margin trimmed with a plain brown band edged with black. The silvery spots are surrounded with a black ring wholly or in part ; and there is a straight line also on the forewings, between the third and fourth subcostal bands. Expanse of wing, $2\frac{3}{4}$ inches.

This species si very common in the western part of Massachusetts and Eastern New-York.

ARGYNNIS IDEALIA.

Antennæ brown, tipped with rufous. Forewings a buff brown : costa and margin black, marked by five subcostal bands, besides the straight band which forms a delta with the fourth : apex black, marked with four white elongated subcostal spots : disk marked by a row of five round spots, besides which there are two lunules in reversed position with respect to each other, and two rather quadrangular spots; the outer margin is trimmed with black, bearing a row of eight or nine white spots. Hindwings dark or very dark brown, but lighter at the base, and marked with two rows of large white spots. BENEATH, the forewings present much the same pattern, except that the white border spots are more distinctly in the form of short arrowheads bordered with black. Hindwings very uniformly dark brown, and spotted with large white spots : there are three parallel rows, and the basal cluster might be called a fourth; the shoulders have also a white stripe running along the edge of the wing. Expanse of wing, four inches.

This species is far less common in the vicinity of Albany than the *aphrodite*.

MELITÆA PHÆTON. (Plate xliii, figs. 4, 7.)

Stipe of the antennæ ringed with black and white : knob, base fulvous, middle black, tip gray : palpi, eyes and feet rufous. Head black, with a ring of white around the eyes, and a row of white spots passing around the head just behind the antennæ. Thorax and upper side of the abdomen black, with a few white dots along the top, and two rows along the sides. Beneath the abdomen is marked with a rufous red series of largish spots on each side, and the venter with a row of yellowish white spots. UPPER SIDE : Wings black : outer margins ornamented with four rows of spots; the outer row rufous, resting on the nervures, and divided; the three inner, yellowish white; the innermost row short : beyond the rows there are two or three dashes of red, parallel with the costa. Hind- marked like the forewings, except the short row of spots is wanting. BENEATH, the surface of both pairs is marked with four rows of yellow spots between two of brown, except the inner brown row of the forewing is replaced by two large brown subcostal spots : on the hindwings, there is a cluster of brown and yellow spots at the base. It should be noted that the yellow spots of the outer row are all lunules opening outwards. Expanse of wing, 2 inches.

This season (1853) this butterfly is quite common, while in former years it was scarce.

MELITÆA PHAROS. (Plate xliii, figs. 5 & 6.)

Head, body and wings black, marked with numerous red and yellow spots. Hindwings marked with six orange-colored spots extending across the wing, the concavities turned towards the base of the wing. Outside of these spots, there is a row of six

ocellate spots with black centres : these ocelli stand between the nervures. Near the base there is a lunule, with a round spot in its concavity. Underside reddish clay-colored, mottled and clouded. Forewing the red is deeper, and the outer angle or apex has a dark triangular space dotted with red : outer margin clouded with reddish of different hues. Spread of wing, about one and a half inches.

This beautiful species is less common here than the preceding.

Hipparchiides.

HIPPARCHIIDES (Westwood). SATYRIDES (Boisduval).

The palpi of this subfamily are three-jointed and elongated, and their antennæ thickened very gradually at the tips. The insects are not robust, but rather feeble in flight. Their colors, though frequently beautiful, belong rather to the neutral tints : they are brown and yellow, with ocelli for ornaments. The larvæ feed upon the grasses during the night season : their bodies are widest in the middle : some of them undergo their transformations in the earth, and others suspend themselves by their tails.

Hipparchia alope. (Plate xxxiii, figs. 5, 6.)

Brown; paler beneath. Antennæ slender and arcuate : knob a mere dilatation of the upper end; stipe annulated with white. Upper side : Forewings marked with a broad luteous band, or rather oblong spot placed upon the outer half of the wing, and ornamented with two eyelets with a black iris and bluish pupil. Hindwings more distinctly crenate than the forewings, and marked towards the posterior margin with a single small eyelet with a black iris and blue pupil. Beneath, the eyelets are rather more distinct than above. Wings barred transversely by darker lines : posterior are marked by six small eyelets arranged in two lines, three in each; the largest in the middle, and each surrounded with a perfect brown ring outside of the black iris. The margins of the wings are traversed by black and brown lines running parallel with the edge, which is densely ciliate. Legs ashen. Common.

Hipparchia nephele. *Clouded Hipparchia.* (Plate xxxiii, figs. 3, 4.)

Color brown above and beneath, but paler beneath. Antennæ annulated with white; knob slender. Upper side is marked with an obsolete but broad submarginal band, in which there are two eyelets with a clouded white or bluish white pupil, and a black iris with a very indistinct brown ring. The posterior wings are crenate, and marked with a minute or obsolete black spot. Under side, the belt of the anterior wings is much more distinct, the eyelets bright, and the outer ring of brown plain : margin of the wing traversed with two or three lines parallel to the edge. Outer half of the hindwing paler, and marked with six small eyelets, which form three rows, the largest

eyelet being in the middle : the anal angles divaricate, leaving a wide triangular space.

This species was first described, I believe, by the Rev. Mr. KIRBY in the *Fauna Boreali Americanæ.*

Lycænidae.

LYCÆNIDÆ (LEACH). POLYOMMATIDÆ (SWAINSON).

THE insects of this family are small and weak, but finely and delicately colored and marked. The forelegs are fitted for walking, and the last joint of the palpi is small and naked. The caterpillar has a small head nearly concealed under the first ring, and secures itself, when about to undergo transformation, by the hindfeet and a loop about the body. The chrysalis is flat on the underside ; its ends are round : the imago six-footed. Social, and often collected into groups upon sweet-scented flowers.

THECLA ACIS. (Plate xliii, figs. 2, 3.)

POLYOMMATUS (Latreille & Godart). PAPILIO ACIS (Drury). P. IXION (Fabricius).

Superior wings immaculate and dark brown above, paler beneath : posterior, bicaudate; the two inner the longest, and immediately above are two red spots, and two more upon the anal angle. UNDER SIDE, the wings are lead-colored, crossed by a narrow white and black line running parallel to the external edges; the posterior are crossed by an indented irregular line : the four long reddish spots stand above four black ones.

THECLA HUMULI (Harris).

Anterior or primary wings dusky brown on their upper sides, tinted with bluish gray; and, in the males, they are also marked with an oval spot on the front edge. The posterior wings are slenderly tailed, but, unlike those of the *acis*, they are tipped with white ; and the margin posteriorly is also marked by a row of pale blue spots, among which is a crescent of orange marked in the centre with a black dot. It is a little larger also than the *acis ;* expanding about an inch and a tenth, while the *acis* is only about an inch.

In its caterpillar state, the *T. humuli* feeds upon the heads of the hop, as is implied by its specific name : its color is green, and its skin is downy. Described by HARRIS in his work on insects injurious to vegetation, p. 235, 2d edition.

Hesperiidae.

SKIPPERS.

HEAD large, with large and prominent eyes : bodies short and thick ; feelers short, hairy, and ends square or angular. Antennæ short and distant from each other, ending in a knob prolonged and bent into a hook, and pointed. Legs six, and the four hindshanks furnished with two pairs of spurs.

LARVA : Head large : body tapering from a cylindric middle, spineless, and generally naked. Solitary, concealed within a rolled leaf; their transformations taking place in envelopes of leaves and fragments of straws bound together by a few silken threads. Chrysalids taper from one end, and are rounded : they make imperfect cocoons, which are formed of rolled leaves and threads.

EUDAMUS TITYRUS. *Tityrus Skipper.* (Plate xxxviii, figs. 4, 5.)

Antennæ brown : eyes brown, with a white spot beneath. UPPER SIDE : Head, body and wings brown, lighter at base. The middle is crossed with a wide yellow band, narrowing towards the posterior angle : between it and the apex there are two yellow dots or spots. Hindwings tailed, rounded upon their anal angle : beneath they are marked by a large oval and central white spot; the edges trimmed with yellow or yellowish brown. Expanse of wings, 2 – 2½ inches. The larva is pale green, and striped transversely with darker green and dotted : head and neck red and tuberculated (fig. *e*); fig. *f*, pupa.

The *tityrus* inhabits the locust-tree, making its habitation of the leaves drawn and kept together by threads of silk, which serve also for its transformation : it feeds on the leaves, and sometimes nearly strips the tree of foliage.

This season (1853), which has furnished many other rare insects, this skipper has not been common.

PAMPHILA PHYLŒUS.

UPPER SIDE : Thorax and abdomen yellowish olive. Superior wings tawny yellow, margined with a black toothed border : three dark brown spots traverse the wing, the outer corner one coalescing with the border. Inferior wings yellow, subangulated : margin with a dark brown border, sharply indented : anal angle truncate. BENEATH, the wings are paler, marked with brown somewhat triangular and lined spots : one elongated spot near the shoulders. Expansion of wing, 1½ inches. The caterpillar feeds upon the panic and buffalo grasses.

This is a very common butterfly in Western Massachusetts, in August, in meadows.

CHRYSOPHANUS PHILEAS. *Copper Butterfly.* (Plate xlvi, fig. 4.)

Color copper-red above. Forewings margined with black : area of the disc marked with six or seven oblong black spots. Hindwings, disc and base dusky black : posterior margin red, trimmed with about six black spots, and furnished with short tails. BENEATH : Forewings, the disc is orange or cupreous orange, spotted with black, and margined with ash. Hindwings, base and disc ash, spotted or dotted with black, and bordered with faint copper-red.

Common at midsummer in the vicinity of Albany and Western Massachusetts.

HESPERIA PECKIUS (Kirby). *Peck's Hesperia.* (Plate xxxii, fig. 8.)

Color brown, paler beneath. Both pair of wings widely bordered with brown : area of the discs bright yellow, with a band of brown extending outwards from the base, ciliate; ciliæ fuscous. BENEATH, the area of the discs is occupied with yellow patches, irregular in form ; that upon the hindwing is usually double. The body is clothed with long yellowish brown hairs, especially upon the breast.

There is considerable diversity in the form or shape of the yellow patches on the discs : in some, the whole area of the disc of the forewings is yellow. It is very probable, however, that this may prove a species distinct from the *peckius*. The latter is common in fields in Western Massachusetts and Eastern New-York, in July.

Sphingidae.

HAWKMOTHS.

THIS family of LEPIDOPTERA has received the special attention of naturalists from LINNÆUS down to the present time. They fly with great strength and vigor, with a bird-like motion of their wings ; and are capable of sustaining their flight for a long time, and of poising themselves in the air like the hummingbird while sucking the nectar of flowers. The tongue is coiled compactly when not in use, and frequently exceeds the body in length. The antennæ are prismatic, presenting in a cross section the segment of a circle on one side, while others are formed by two curved lines meeting in such a way as to make an edge on the opposite side : it often terminates in a feather-like tuft. The labial palpi are broad and compressed ; but the labrum and mandibles are rudimentary, as they are not required for taking food.

The larvæ are naked, cylindrical, and supplied with sixteen feet, and ordinarily a horn is placed on the eleventh segment of the body : they are commonly ornamented with oblique stripes on the sides. They usually descend into the earth when their transformation

is about to take place. The pupa too will be found naked, and sometimes an appendage exists in the form of a bent hook, like the handle of a pitcher : this is a distinct case, and contains the tongue. Where this organ is short, the appendage is absent. The wings are generally covered with scales ; but in some cases they are transparent, as in the SESIA, from the absence of scales.

Many of the larvæ, when not engaged in feeding, fix themselves by the hindlegs, and, elevating their bodies at a considerable angle, remain stiffly fixed in that position for hours : in color and position, they then resemble a broken twig of the bush upon which they have been feeding (See Plate xxxvi, fig. *a*).

The hummingbird moths, or sphinges, fly in the early morning, or in the dusk of the evening, when they visit the garden or the wild flowers of hedges, flitting rapidly from one blossom to another, and poising themselves with the utmost ease by the rapid motion of their wings, which are long and pointed, but of unequal expanse, the forewing being the longest. Their bodies are thick and robust, and frequently pointed behind ; or else they terminate in a fan-like tail, as in the SESIÆ.

There is a diversity in habit in this family, as in all others : while some fly swift, others are slow and sluggish in their flight ; and while some prefer the twilight of the morning or evening, others take the wing only during the day. The *Smerinthus* has a slow heavy flight, and flies only in the night ; and it is doubtful whether it takes food in the imago state, as its tongue is too short to be useful for that purpose. When at rest, the wings are horizontal or a little inclined ; and the posterior have an apparatus consisting of a setiform process at its base, which passes through a hook to the anterior, for the purpose of regulating the extent of their motion.

This family contains but few genera, which may be indicated by observing the following characters :

1. SMERINTHUS : Wings more or less angulated ; flight heavy : tongue very short : antennæ in the males biciliate beneath.
2. SPHINX : Tongue long : wings entire, acute : labial palpi robust : antennæ not clavate.
3. DEILEPHILA : Antennæ clavate.
4. SESIA : Wings partially clear and transparent : abdomen terminates in a short flat brush.
5. PHILAMPILUS : Wings subfalcate ; inner margin sinuous.
6. CHŒROCAMPA : Antennæ short, arcuated, terminating in a long slender hook : margins of the wings sinuate ; hind-angle angulated.
7. CERATOCAMPA : Antennæ in the males with distinct joints, doubly bipectinated : wings entire. Larva with horns upon the shoulders.

SPHINX BRONTES (Drury). (Plate xl, fig. 1.)

Antennæ white within and brown on the outside, and tapering to a hooked bristleform point. UPPER SIDE, fuscous and clouded, but traversed transversely by two or three sets of black crinkled lines, the outer one forked at the outer angle of the anterior wing, having the shape of the letter U : disc of the wing dirty yellow, and marked with a white spot. Posterior wings, outer half brown ; base gray : the brown part is traversed obliquely by a curved gray line. Head and neck dark brown ; thorax and abdomen gray : the rings marked on each side of the median line by narrow black bars. UNDER SIDE : Breast white ; abdomen white, marked by four reddish spots placed along the middle ; posterior wings dark gray brown, but gray upon the corners and abdominal edges ; ciliæ white and brown (DRURY, Plate xxix, fig. 4).

SPHINX OCTOMACULATUS. (Plate xxxviii, fig. 2.)

Color black. Forewings marked with two oblong yellow spots ; hindwings with white spots : thorax has also yellow spots. Rings on the upper side of the abdomen white ; extremity black.

This insect makes its appearance very early, and feeds upon the tender leaves of the rape-vine : its larva goes into the ground, where its transformations are completed.

SPHINX CAROLINUS. (Plate xlii, fig. 10.)

Color gray, grayish brown. Forewings marked with narrow zigzag bands, and with white spots, one at the base, and a small central one : hindwings banded. Abdomen marked with two rows of orange-yellow spots, five in each row. Expanse of wing from three to four inches.

SPHINX CONVOLVULI. *Potato Hawkmoth.*

This species has eight transverse bands upon the abdomen : the ground-color is reddish. Its posterior wings are marked with oblique black bands. The larva feeds upon the sweet-potato vine.

SPHINX CHIONANTHI. *Fringetree Moth.*

This moth has three yellowish round spots on each side of the abdomen. The larva is greenish yellow, and is marked obliquely with black and yellow on the sides.

SPHINX VITIS. *Vine Hawkmoth.*

Wings margined with red, and marked with yellow stripes : two interrupted stripes on the back, and several transverse on the abdomen.

SPHINX ——? (Plate xlv, fig. 9.)

Forewings subfalcate, and sinuate upon the anal margin. Color of body and wings buff of various shades. Antennæ strongly and doubly pectinated. Forewings banded; inner margin marked with a quadrate brown spot. Beneath banded: middle of the hindwing marked transversely with a light ferruginous band.

This species I obtained at Williamstown (Massachusetts). It is closely allied to the *Philampelus* in the form of the forewing: the abdomen, however, is terminated by a short brush as represented in the figure. I have been unable to refer it to a described species.

SPHINX CINEREA.

Wings greatly elongated and narrow. Color gray, and the forewings dashed with black lines: there is a black spot at the base. Hindwings gray, and banded with black; the bands are broad, transverse, and towards the outer margin. Margin of the abdomen marked with alternate bands of black and white: abdomen more pointed than in the 5-*maculatus*. Back gray, without spots, but marked with a longitudinal line along the middle.

SPHINX QUINQUEMACULATUS.

Forewings gray: area of the disc darker than the margin. Hindwings gray, and marked with four black zigzag lines, the outer broadest; the next is a zigzag line: the basal is scarcely more than a spot. Abdomen broad at the base, upon which there are black and white bands: margins ornamented with four or five yellow spots, alternating with black bands and square spots. Expanse of wing, 3 – 3½ inches.

The pupa-case is brown, and furnished with a long curved handle which encloses the tongue. This is the common *potato-moth*, the larva of which descends into the earth to transform, where it forms a rounded smooth chamber with its sides. The larva is green, and marked with oblique whitish stripes upon the body: it is also furnished with a horn placed posteriorly.

PHILAMPELUS SATELLITIA. (Plate xlv, fig. 5.)

Color above light, and marked with spots of dark olive. Head light olive, with two spots of light olive on the front of the thorax; below which is a large angular spot of dark olive, which extends to the base of the forewing, and forms an abbreviated band. Back of the thorax there is a transverse band, which connects itself with a dark hairy olive spot upon the base of the hindwings. The basal half of the margin of the forewings light olive, clouded, and extending itself to near the posterior margin, where it meets a darker submarginal band, the latter extending to the apex, and banded

inwardly by wavy lines of olive and flesh-color : outer half olive, but marked with transverse abbreviated lines of darker. Apical area has a patch of flesh-color, but branched so as to include a costal spot of olive : posterior margin olive, and the olive marked with wavy bands. Hindwings marked with a row of submarginal olive spots. The conspicuous dark olive spot near the body has been noticed : there are also alternating abbreviated transverse lines of olive and flesh-color near the inner margin. Beneath buff or fuscous, traversed by narrow bands or lines : posterior margin darker. Expanse of wing about four inches.

This is not an uncommon species in New-York and Western Massachusetts. The larvæ feed upn the grapevine, and hence Dr. Harris has given the generic name *Philampelus*, 'I love the vine.' They also feed upon the *Ampelopsis*.

The larva may be known by the recurved slender horn of the back when immature, but which is lost at the last moulting, leaving a smooth cyclike spot. Color pale green : sides marked with oval cream-colored spots. The head is retractile, which makes the insect appear shortened and blunt before.

When mature, the insects are three inches in length : they are great feeders, and, when in numbers, injure vines in proportion to the leaves consumed.

Philampelus —— (Harris). *Sphinx pampinatrix?* (Plate xliv, fig. 2.)

Color olive. Head olive, from which proceeds divaricating bands along the angles of the thorax, lighter between the forks. Antennæ light buff. Forewings banded : at the base olive, marked with a costal spot of flesh-color : middle band broad and flesh-color, with a dot of olive : external band olive, wide, subbanded or marked with a stripe of flesh ; edge brownish. Hindwings flesh-colored, with an olive spot or imperfect band upon the anal angle. Beneath, buff : basal part of the forewings slightly ferruginous ; the apical area buff ; margin light olive. Hindwings, base light buff ; outer half darker buff, marked with a wavy line parallel to the edge ; edge lighter. Body beneath buff : thorax colored like the base of the hindwings, and the abdomen like the outer half, without spots.

Supposed to be a female. The general appearance is much like the *satellitia*, but smaller. Obtained in the early part of August, but does not appear to be common. Its larva not observed. Expanse of wing, $2\frac{1}{4}$ inches.

Genus SMERINTHUS.

Wings angulated, entire. Antennæ biciliated in the males.

SMERINTHUS ASTYLUS. (Plate xl, fig. 4.)

SMERINTHUS (Latreille). SPHINX ASTYLUS (Drury).

Head, thorax and abdomen rusty gray-brown. Wings cinnamon-brown : anterior, ornamented upon their outer margin by three curved yellowish stripes, situated between brown stripes; margin brown : posterior wings reddish or cinnamon at the bases, and marked centrally by a round black spot, the centre of which is yellow. This spot is placed upon an oblique yellowish belt running from the base to the lower and outer angle of the wing. UNDER SIDE : Breast, abdomen and wings cinnamon-brown, and marked as upon the upper side; legs black : black spots absent. Expanse of wing, 2½ inches.

GENUS SESIA.

In this genus of the sphinges, the antennæ are gradually thickened towards their ends, and terminate in a minute feathered style.

SESIA PELASGUS (Cramer). (Plate xxxii, fig. 9.)

Color brown, with all the wings transparent in the middle, terminated with a plain brown border. Antennæ brown, if viewed from their tips towards their base; steel-blue or blue-black, if viewed from their base towards their tips : breast and underside of the palpi cream-white : legs and tarsi brownish. ABOVE, the thorax is clothed with olive-colored hairs. Base of the hindwings purplish brown : two first segments or rings of the abdomen light purple-brown; third and fourth, deep purple-brown; fifth and sixth, purplish upon the top, lighter upon the sides terminating in tufts, purplish brown in the middle and black outside : the fifth and sixth segments have one side or patch of yellowish hairs. BENEATH, abdomen brown.

SESIA FUCIFORMIS? (Abbot & Smith). (Plate xxxii, fig. 10.)

Wings with large transparent discs, trimmed upon the margins with dusky brown or nearly black, with apical area rusty red. Antennæ black above, brown below. Thorax and breast with the palpi clothed with pale yellow hairs, and marked by a black stripe running from the insertion of the forelegs through the eyes. Four first segments of the abdomen black, with steel-blue reflections where the scales are thin; sixth and seventh clothed laterally with a patch of yellowish hairs : the terminal tufts are mostly black, with brownish yellow hairs upon the middle. Expands two inches.

Less common here than the foregoing.

Aegeridae.

(See Plate xxvi, figs. 1, 3.)

THE peculiarities of the insects of this family are, the translucency of their wings, elongate form of body, and the absence or rather deficiency of scaly covering when compared with the SPHINGIDÆ. They bear some resemblance to the HYMENOPTERA : their antennæ are simple, and often terminated by a small pencil of hairs. The insects are interesting, from the fact that they are highly injurious to trees, especially fruit trees. They are fleshy grubs of a cylindrical shape (fig. 4), with brown heads and strong jaws ; but unlike many of the larvæ of this order of insects, they have no caudal horn. They have the ordinary true six legs, eight ventral feet, and two feet at the extremity of the abdomen.

The different species feed upon different kinds of trees ; some upon the currant, mountain ash, etc. The most destructive one is the *Ægeria exitiosa* of SAY, which preys upon the peach-tree. The egg is deposited upon the bark near the root, and, when hatched, the young penetrates to the wood, when it either continues its course into the wood, or burrows between the wood and bark : usually, however, it proceeds into the soft wood, sometimes just below the surface of the soil, at other times above. In either case, such is the extent of the injury inflicted, if allowed to maintain possession, that the tree is killed. Probably the peach-trees in this country have suffered more from the *Ægeria*, than from all other insects put together.

ÆGERIA EXITIOSA. (Plate xxvi, figs. 1 – 5.)

Fig. 5, female ; 1, male ; 4, larva ; 2 & 3, cocoon and pupa.

Color steel-blue. Wings of the male transparent, and bordered behind with steel-blue : palpi, feelers, edges of the collar, and shoulders yellow ; smaller than the female. FEMALE, steel-blue : wings steel-blue ; hindwings transparent : middle of the abdomen marked with an orange-colored ring or belt. Expanse of wing, $1\frac{1}{2}$ inch.

Mr. HARRIS remarks that the ægeria does not confine its attacks to the peach-tree, but may be found also on the cherry, its larvæ being developed in the black knotty branches of the tree. It does not always locate itself at the base of the trunk of the peach-tree, but frequently bores into the limbs, in which case much less injury is done to the whole tree. The infested tree may be discovered by the presence of the dust and cuttings which the larvæ throw out around the roots ; but it is often necessary to remove the surface soil, in order to detect their presence.

The mode that is most successfully pursued for extirpating these insects, is to cut them out with the knife, avoiding the sound parts of the tree as much as possible. A wire thrust into the burrows may destroy the larvæ, without cutting the tree.

The cocoon is constructed partly out of the castings of the larvæ, which, by means of gum and silk, is formed into a common oval shell surrounding the pupa : these may be destroyed at once.

To protect a tree, Dr. HARRIS long ago recommended the use of sheathing paper, secured by strings and matting to the neck of the tree after removing the earth. This paper should be cut in strips eight or nine inches wide, and fixed below the soil by means of mortar and fresh loam. The application requires renewal every spring; but whatever means may be adopted, careful examination during the months of June and July should not be neglected. Wounds that may be made in the removal of living bark and wood, should be covered with grafting wax, or something to protect the surface from water.

The currant-bush is injured by the *Ægeria tipuliformis*, which is not a native of this country, but is of European origin. The eggs are laid near the buds, and, when hatched, the larvæ penetrate the bark and wood, and even into the pith : the stems become brittle; but, before this, they show marks of disease by yielding an inferior fruit.

Dr. HARRIS describes another insect allied to the ÆGERIA, the *Trochilium denudatum* (HARRIS) : the color is brown; the edges of the collar and of the abdominal rings, the shins, the feet, and the underside of the antennæ are yellowish; the forewings opake, and the hindwings transparent. It attacks the ash : this tree, especially the english mountain ash, when planted for ornamental purposes, seems to be quite as liable to the attacks of these borers, as the peach; and hence it requires the same attention and treatment.

GLAUCOPIS PHOLUS. (Plate xl, fig. 3.)

GLAUCOPIS (Fabricius). SPHINX PHOLUS (Drury).

Antennæ black, and thickest in the middle. Upper side black : basal half of the wings orange. Beneath the color is paler, but after the same pattern.

The larva feeds on lichens growing upon stones, and hence is more common in bleak stony places.

CHAPTER XXII.

ORDER XI. LEPIDOPTERA (Continued).

BOMBYCIDES.

PHALÆNÆ (LINNÆUS). MOTHS.

THE antenna of moths, as has already been observed, tapers from the base to the apex : it may be simple, or plumed like a feather; but the organ differs much according to sex, the pectinated antenna being more strongly marked in the males, who are also provided with a sucking tube which takes the place of a tongue, and is rolled up very compactly, being sometimes very long, in other cases very short. The palpi grow from the upper lip, curve upwards, and cover the face, the tongue being coiled up between them.

The larvæ of the moths differ much among themselves. The number of legs is usually sixteen, but some have only ten, and some are obscure and incomplete. They differ too as to their clothing, some being very hairy, others nearly or quite destitute of hairs; some are smooth, others warty or spinous : some go into the earth to transform, others remain above ground.

In treating this division of the LEPIDOPTERA, I shall follow very nearly the arrangement of Dr. HARRIS. By LINNÆUS, the moths or spinners were divided into eight groups, viz: 1, *Attaci* ; 2, *Bombyces* ; 3, *Noctuæ* ; 4, *Geometræ* ; 5, *Tortrices* ; 6, *Pyralides* ; 7, *Tineæ* ; 8, *Alucitæ*.

Lithosiidae.

THE moths of this family have slender bodies, are never very large, and their wings when at rest lie flat upon their bodies. The antennæ are bristleform and rather long, and but slightly feathered in some of the genera; in others, in the males, there is a double row of short hairs on the under side. The tongue is distinct, but only moderately long. The back is not woolly, and the thorax is not crested. The wings are often beautifully spotted or

speckled upon a white or yellow ground. The larvæ dwell in stony places, and many of them feed upon the lichens that grow on the stones : some feed upon grass.

DEIOPEIA BELLA. *Beautiful Deiopeia.* (Plate xlvi, fig. 5.)

Color of the forewings yellow, traversed by five or six white bands : bands dotted in row with black. Posterior wings scarlet, though pale, and bordered irregularly with dusky black or dark brown. Body white : thorax spotted with black. Expanse of wing, nearly 2 inches, or $1\frac{3}{4}$ inch.

It is found in Albany county in midsummer.

Arctiidae.

THE feelers and tongue mostly short and thick. Antennæ doubly feathered : feathering narrow on the inner or upper side, and less distinct in females. Wings inclined : thorax thick. Both the caterpillars and moths hairy or downy, especially the thorax and head of the moths. They are more or less white, and ornamented with black or dark-colored spots upon a white or buff-colored ground. They are nocturnal, or fly only by night.

The caterpillars move rapidly, and are covered with hairs that spread out in tufts from warts. They make, in clefts of rocks and sheltered places, rough cocoons of the hair of their own bodies, interwoven with some fibres of silk. The chrysalis is smooth, and its joints movable.

SPILOSOMA ACRÆA. *Saltmarsh Caterpillar.* (Plate xli, figs. 2 – 5.)

SPILOSOMA (Stephens). PHALÆNA (BOMBYX) ACREA (Drury). BOMBYX ACRIA (Fabricius). ARCTIA PSEUDERMINEA (Peck).

MALE, *upper side* : Head and thorax white on the upper side; lower side yellow buff, embracing the wings, abdomen and thorax. Forewings cream-colored, marked and margined with many black spots : hindwings buff, and marked with six somewhat angular spots ; the lower side is deeper colored. Antennæ and eyes black.

MALE, *lower side*, buff-colored. Forewings margined with five or six elongate black spots, the posterior margin dotted with black : the other black spots upon the disc show through the wing, and appear to belong to the upper side. Hindwings marked with seven or eight spots somewhat lunate in form ; one of which is quite prominently so, near the middle and outer margin of the wing, but stands in reverse position to one upon the margin. Abdomen of a buff upon the upper and inferior sides ; the sides being marked with a white line, which also extends to the tip of the abdomen : upper side ornamented with a row of black spots, and two rows that stand upon the margin of the white lateral line, and another line upon the lower and central part or face of the abdomen.

Female : Head, thorax, wings, and lower abdomen white or faint cream-color : upper part of the abdomen, and lower part of the thorax except extremity, buff. Wings spotted with black : hindwings prominently marked with a black lunate spot near the centre. Abdomen marked with black spots as in the male.

The caterpillars appear in the salt marshes in the vicinity of Boston, according to Mr. Harris, towards the end of June, and grow rapidly till the first of August, when they attain their size, which is about 1¾ inch long, and clothed with hairs. They then retreat to the uplands, in order to undergo their transformation : for this end, they seek a sheltered place, and construct of silk and the hairs of their bodies a coarse cocoon, and soon change to a chrysalid ; in which state, in the latitude of Boston, they continue until the next year, when they are transformed into moths. The caterpillar is clothed with long tufts of hairs, which grow from warts, either brown or black, or of various shades of brown : the skin is yellow, though shaded at the sides with black ; the back is also marked with a blackish line*.

This insect not only inhabits the coast or saltmarshes, but is found abundantly inland in Berkshire county, and in Albany and vicinity. It is destructive of the grass of salt-meadows ; and when it retreats from them to undergo its transformation, it devours the more valuable vegetables, as corn, beans, and garden plants. The remedy proposed by Mr. Harris is to mow the marshes early, while the caterpillar is immature : it is thereby destroyed.

Spilosoma arge. (Plate xli, fig. 3.)

Antennæ doubly pectinated : teeth short on the upper side. Color at the base whitish, or cream-colored ; extremities dark brown.

Moth : Upper side cream-colored, somewhat variable in its shades. Collar marked by two black lines ; upper side of the thorax by three black lines, widely separated. Anterior wings cream-colored, and marked with many triangular spots : the inner margin has a wide line running parallel with it ; the other spots are small acute triangles : margin beneath pale fuscous. Posterior wings marked mostly on the posterior margin by four black spots, sometimes only dusky. Posterior margins of both pair ciliated ; and just within this border there is a fuscous or reddish line. Inferior surface dusky cream-colored, and marked like the superior, except that the anterior margin of the anterior wings is bordered with fuscous. Neck covered with vermilion red hairs ; throat black. The cream-colored abdomen is ornamented with five rows of black spots ; two upon the sides, and one upon the centre of the back. Femora red anteriorly : joints and tibiæ black in front ; tarsi black. Expansion of wing, nearly two inches, but variable.

* Harris : Insects injurious to vegetation, p. 269, 2d edition. See also 7 vol. Mass. Agr. Rep. & Jour. 1823.

The flight and habits of this moth are much the same as those of the *S. acræa*, which it also resembles in figure, but is smaller. The caterpillar is brown, with five pale longitudinal lines, and covered with long hairs growing from fulvous tubercles : it feeds upon plantain, leaves of indian corn, peas, etc., and is frequently quite injurious.

The moth appears in the vicinity of Albany, and in Western Massachusetts, in June; perhaps earlier. While they are said to be occasionally injurious to corn in the Southern States, the insect is too rare here to give rise to much apprehension.

EUCHÆTES EGLE. (Plate xli, fig. 11.)

PHALÆNA EGLE (Drury). SPILOSOMA EGLE (Westwood). EUCHÆTES* (Harris).

Antennæ slightly pectinated. Head, thorax, underside of the body, and legs gray. Wings thin, bluish gray, paler on the front edge, immature. Neck cream-colored : top of the abdomen indian yellow, and marked with three rows of black spots, one on the top and two on the sides, each row consisting of about seven spots. UNDER SIDE : Tongue spiral, a little longer than the head : abdomen pale yellow : wings gray; margins entire.

CATERPILLAR : Head, body and legs black, and marked with a light-colored line on each side, hairy; hairs grow in short tufts from warts. The first and second rings support four long pencils or tufts, which bend over the head.

The caterpillars feed upon the milkweed (*Asclepias syriaca*), and may be regarded as harmless : they are social, and, when feeding, their heads are turned to the edge of the leaf.

CALLIMORPHA VIRGUNCULA (Kirby). (Plate xlvii, fig. 5.)

Color black. Head and thorax striped with black and orange. Forewings, ramifications of the nervures orange : hindwings orange marked with black, roundish. Abdomen orange above, marked along the middle with triangular black spots : beneath paler. Lateral portions of the abdominal rings marked by a double row of angular spots placed close together : venter pale orange. Expansion of wing, 1½ inch.

This is a common species in the vicinity of Albany : found in meadows in August.

Figured in RICHARDSON'S *Fauna Boreali Americanæ.*

CALLIMORPHA PARTHENICE. (Plate xlvii, fig. 6.)

Body beneath black. Head and thorax pale orange, marked with five oblong spots, two before and three behind. Forewings black and orange : the orange follows mostly the nerves, but transverse bands are sent off so as to form many triangular spots. Hindwings red, marked with large black patches surrounded by narrow luteous rings; beneath paler and more dusky. Beneath, the rings of the abdomen are black, and the

* EUCHÆTES, meaning *fine flowing mane*; a name applicable to caterpillars.

extremity pale and pointed. On the top there is a row of triangular spots, the apices of which point towards the thorax. Expanse of wing, $2\frac{1}{4} - 2\frac{1}{2}$ inches.

The markings of the forewings are quite similar to those of the *virguncula* found in the vicinity of Albany.

CALLIMORPHA EPIMENIS. *Phalæna epimenis* (Drury). (Plate xliii, fig. 10.)

UPPER SIDE, black. "Anterior wings ornamented with a single large yellow spot just outside the middle of the wings. Posterior wing ornamented with a large single red spot, whose outer margin is nearly parallel with the posterior margin of the wing. UNDER SIDE, black, and similar to the upper, except two additional straw-colored spots between the large ones and shoulders." DRURY, Vol. iii, p. 40; pl. 29, f. 3.

CALLIMORPHA PHYLLIRA (Latreille). (Plate xliii, fig. 8.)

PHALÆNA PHYLLIRA & BOMBYX (Drury). HYPERCAMPA (Stephens).

UPPER SIDE: Anterior wings black. Ciliæ cream-colored. The margin next to the body marked with cream-color: the outer half is marked with a B. The posterior wings are scarlet, marked with four angular spots, and margined with black. The under side is like the upper, but with fainter colors.

The caterpillar is marked with small diamond-shaped yellow spots upon its back and sides, emitting fascicles of hairs: it feeds on corn, peas and wheat, and breeds most of the summer.

SPILOSOMA NAIS (Stephens). *Phalæna* (Drury). (Plate xli, fig. 9.)

Antennæ black and pectinated. Head and body light yellowish brown. The thorax has three black longitudinal marks, and several spots upon the abdomen. Anterior wings black, marked with broad ochre-yellow lines: ciliæ light yellowish brown. Posterior wings light yellowish or ochre-brown, marked with a faint black spot on each, and having a broad irregular border of a dusky black running along the external edges, but very narrow in the middle: wings entire. Under side marked like the upper, but paler. (WESTWOOD: Illustrations of DRURY, Vol. i, pp. 15, 16.)

SPILOSOMA CUNEA (Drury). (Plate xlvii, fig. 7.)

"Antennæ pectinated, black: no tongue: head white; back and abdomen ash-color. Anterior wings white: spots numerous, of many forms, and of a sooty black: external margin marked with five spots; those nearest the tips, triangular. Posterior wings white, with dark spot near the external edge, and faintly marked near the external angle. Expansion of wing, one inch and five lines." DRURY.

This moth has not fallen under my notice either in the vicinity of Albany, or in Western Massachusetts.

ARCTIA ISABELLA (Harris). *Isabella Tiger-moth.*

Antennæ filiform, tawny yellow. Thorax tawny and brownish. Abdomen tawny, deeper color beneath, and marked with three rows of black spots, about six or seven in each row running upon the back and middle of the sides. Forewings tawny, and marked with a few black scattering spots. Hindwings nearly transparent, slightly tawny, and marked with six tawny spots. Legs black or dark brown.

I have found this moth in Williamstown, though it does not seem to be very common, as only a few individuals are taken by the different collectors here. The caterpillar, however, is common, and is frequently seen travelling across our paths in autumn, always moving as if in great haste. It is brown, and thickly clothed with hairs of a uniform length, stiff and short : the hairs are black on the first four and two last rings. On being taken up or touched, it rolls itself up. It feeds upon sundry kinds of herbs, but it is not to be ranked among the decidedly injurious insects.

ARCTIA VIRGINICA. *White Miller*, or *Virginia Ermine-moth.*

Color white. Forewings marked with a black point, and two black dots on the hindwings. Abdomen marked with three rows of black dots, one on the top of the head, the two others upon the sides, between which there is a yellow stripe. Thighs of the forelegs ochre-yellow.

ARCTIA (*var.* of VIRGINICA).

The wings of this moth are entirely white, except that the hindwings have two black dots upon the underside, and one at the base of the forewings. The abdomen is ochreous, with the three rows of black dots, and a broad belt of ochre-yellow between.

The *Arctia* figured on Plate xlv, fig. 4, may also be a variety of the *virginica*, but its abdomen is white.

ARCTIA VIRGO. *American Tiger-moth.* (Plate xli, figs. 3 & 4.)

Wings deflexed : color pink-red, with two central triangular black spots; spots above and below, angular, oblong : near the posterior margin, a thick black mark extending nearly its whole length; outer margin bordered with a fine black line. There are twelve black angular spots in each wing, the smallest upon the upper and outer angle. Secondaries yellow and red : in the male, the black dots large, and arranged somewhat in the form of a triangle. The spots near the anterior margin have quite a small one between them. The female has about nine black spots on the posterior and middle half of the wing.

CATERPILLAR brown, with four yellow or yellowish white and green stripes, interrupted with paler brown, upon each bulging ring, and ornamented with a double row of round dots; below which, upon the sides, there springs a heavy brush of brown hairs arranged in a thick pencil.

This insect feeds upon corn and a variety of other plants, as the plantain, peas, etc. : when the corn is young, its feeding is injurious to the plant.

Liparidae.

Antennæ doubly pectinate, short, and bent. In the males, the teeth are longer than those of the females, which are also narrow. Feelers hairy, like those of the *arctiidæ*, but longer. Tongue short and invisible. Females : Body thick, and furnished with only rudiments of wings. Males : Body slender ; wings broad.

These singular moths are hairy like the *arctians ;* but the female, being wingless, is always found upon or near the cocoon from which she has escaped, and hovering around her is the male or mate. When at rest, the forelegs are extended considerably forward ; while the wings, sloping but little, are folded together over the back.

Some of the females of this family are provided with wings, though only imperfectly, as they fly but sluggishly. The males are diurnal, and fly during the day in search of the females.

The caterpillars are also peculiar, being half naked ; and the covering of the remaining portion consists of long tufts of hairs growing from the sides of the body, and from warts, of which there are some six or eight. Some have four or five thick tufts of hair upon the back, cut short and even ; and from the extremities, or from the first ring, two beautiful tufts of long hair project forward in the form of feelers.

These caterpillars are called *tussocks*, from the tufts upon their backs. They resort to trees and vines of different kinds, and feed upon their leaves. Their cocoons are oval, thin, and made of silk interwoven with the hair of their bodies. They are more or less injurious to vegetation : indeed some of them inflict fatal injuries upon fruit-trees.

Orgyia leucostigma. *Pale Emperor Moth.* (Plate xxxvii, figs. 1 & *a*, *b*, *c* : female.)

Antennæ of the males brown upon two-thirds of the posterior part, whitish upon their anterior margin. The markings are two transverse waved lines and one white towards the base, with four thick dashes towards the outer angle : there is also a white angular spot upon the middle of the posterior margin. Secondaries brown and black upon the nervures, and margined with a lighter shade of brown.

Female wingless, or with only rudiments of wings : color ash or brownish ash : abdomen large.

Caterpillar cream-colored, longitudinally banded with brown, and black upon the back. Head red, with two large jointed pencil-shaped tufts of hairs upon the posterior part

of the head, and one of equal length upon the posterior extremity. It is also ornamented with four equal cut brushes of hair upon its back, situated upon the anterior half of the body, and is fringed along its abdomen and extremities with long hairs.

This caterpillar is common here in the spring, and feeds upon the leaves of the oak and the horse-chestnut.

Saturniadae.

BOMBYCIDÆ (Stephens).

THE caterpillars of this family are naked, cylindrical, and, as Mr. HARRIS describes them, have hunched backs. They are furnished with warts, which are often bristled, and may be either simple or compound in form. They construct a cocoon of silk, which is placed within a single leaf, or else within several drawn together so as to form a partial protection against the outside; or sometimes they are fastened longitudinally to a twig by gummy matter. They are unlike the pupa-cases of the PAPILIONES, which are angular, spinous, and suspended by a short thread with the head downwards.

The antennæ of the moths are strongly and doubly pectinated, especially in the males, and their bodies are thickly covered with a dense mat of hairs or wool. The tongue is rarely visible. The wings, when the moth is at rest, are extended horizontally so as to exhibit both pair : they are also destitute of hooks. The wings are commonly ornamented by one or more conspicuous eyelike spots.

The insects shun the broad daylight : their eggs are large and numerous : their cocoons are composed of a strong silk, which might possibly be converted to use; and they offer this advantage, that they feed on the leaves of the common forest-trees, and hence there would be no danger of the loss of silkworms from an accidental scarcity of food, occasioned by untimely frosts, etc.

The SATURNIADÆ may not be regarded as specially injurious to the farmer, or to forest or fruit-trees : at least the injury they produce is small, compared with that inflicted by cankerworms, leaf-rollers, etc. which are far less conspicuous in themselves.

The males of this family, according to Mr. STEPHENS, fly well, and go abroad in the after part of the day. The females fly sluggishly, probably from the weight of the abdomen. The wings are gray or drab, usually of a neutral tint; and the ornaments consist of ocellate spots, some of which exhibit the brightest of colors.

SATURNIA MAIA. *Corn Emperor Moth.* (Plate xxxix, figs. 2, 3, & *c*, *d*, *e*.)

Wings black, with a broad band of pale yellow traversing the middle, translucent and thin. Forewings marked by a yellow lunar spot near the margin of the inner black part of the base of the wings : lunar spot also upon the middle of the yellow of the pos-

terior wings; the wide black border margined interiorly with dark gray. Antennæ brown, pectinated in both sexes. Front of the thorax yellow, hairy; hairs of a rust-color posteriorly. Abdomen black, marked with three reddish rings, and the male has the last ring of the same color.

The male and female have a very close resemblance: the male, however, is a little smaller, and has two tufts of reddish hair upon the lateral parts of the thorax; while the females are marked with forked reddish lines upon the anterior wings, which terminate in the yellow stripe across the thorax. Pupa-case black.

The caterpillars of this species are of two kinds, or rather are marked after two different patterns. The head and feet are red, and each ring is ornamented with three pair of reddish compound spines. These spines sting sharply; and though not at all common, they have been found in an oak and hickory grove three miles south of the city of Albany, together with the larva or cocoon of the insect. The figures were copied from Abbott & Smith's Insects of Georgia.

Fig. 2, female; 3, male; *c* and *d*, varieties of caterpillar; *e*, pupa.

Saturnia io. *Corn Emperor Moth.*

Antennæ pectinate: head and thorax purplish brown: abdomen ochre-yellow.

Upper side, male: Color indian yellow. The anterior wings are marked with two oblique wavy lines towards the hinder margin, a zigzag line near the same, and several spots arranged so as to form the letters A H, all of a purplish red color. Posterior wings hairy and purplish, red at the base: on the posterior margin there is also a curved band of the same color; and within this band is a curved black line, and on the middle of the wing a black spot with a bluish centre, upon which there is a silver-white line or dash pointing to the inner and posterior angle.

Female: Anterior wings purplish brown or cream-color when faded, and marked in the middle with a brownish spot. Thorax and legs purple brown. Abdomen same as male.

Greatest expanse of wing about three and a half inches.

The caterpillar measures two and a half inches when fully grown: its color is pea-green, marked on the sides by a brown stripe edged with white, the stripe beginning at the fourth ring. The surface is covered with stinging prickles, standing and spreading in clusters and terminating in black.

The moth is hatched in July from the pupa, in which state it has remained through the winter.

These caterpillars feed upon the leaves of the elm, poplar, dogwood and sassafras, and also upon clover and indian corn. During a part of their lives they are social, and, when they move, they march in regular files.

ATTACUS LUNA. *Green Emperor Moth.* (Plate xxiv, fig. 1.)

ACTIAS (Leach). PHALÆNA LUNA (Linnæus.)

Head small, white, encircled with a faint brown and narrow ring. Antennæ brown, pectinated. Thorax pale yellow and woolly, ornamented with a stripe in front continuous with that upon the front margin of the wings. Wings pea-green, marked with eyelike spots near the middle : outer margin bordered with purple brown. Posterior wings prolonged into long narrow tails bending outwards. Body covered with a white woolly substance, and rather close-pressed : legs purple brown. Expansion of wing about five inches.

The caterpillar is fully grown about the first of August. It is of a bluish green color [wrongly colored in the figure], striped with yellow on the sides, and transversely also between the rings : rings marked by about six small reddish or purple warts. Length, when in motion, nearly three inches ; but when at rest, only about two inches.

In feeding, it prefers the leaf of the hickory, though it may be kept upon the leaves of several of our forest-trees. In North-Carolina it feeds upon the leaves of the liquidambar or sweet gum, as also upon the persimmon.

N. B. In some of the figures I have observed that the body and abdomen are colored a light brown, the thorax and neck being yellowish white or cream-color in the animal.

HYDROCAMPA? NIVALIS (Harris). *Delta-moth.*

UPPER SIDE : Antennæ filiform and brown. Wings pearly white, ciliated, and cilia brown. UNDER SIDE white pearly immaculate. Expanse of wing $1\frac{1}{8}$ inch.

DRYOCAMPA IMPERIALIS (Harris). (Plate xl, fig. 7.)

PHALÆNA IMPERIALIS (Drury) ; P. IMPERATORIA (Abbott & Smith, *Insects of Georgia*) ; CERATOCAMPA (Harris, *Catalogue of Insects of Massachusetts*) ; CEROCAMPA, Kirby & Spence) ; LASIOCAMPA (Latreille, Schrank.) ; BOMBYX (Fabricius) ; ODONESTIS (Germar, Stephens); BOMBYX DIDYMA (Pal. de Beauv. *Ins. Lep.* pl. 20).

MALE, *upper side* : Antennæ broad in the middle, pectinated, filiform, naked, and curved at the extremities ; in the females, filiform, naked. Color reddish and yellow. Thorax yellow, clouded by five brownish spots, the anterior one placed upon the median line. Abdomen yellow, each ring of which is marked with broad heartform bands. Wings yellow, sprinkled with brown purplish linear dots ; the outer edge broadly margined with brown, which connects itself from its middle by a curved band with the basal curved band : the connecting band curves and extends to the anterior margin below the middle, and borders it to the base : the basal band extends along the posterior margin beyond its middle, where it expands and encloses a yellow dot-

ted patch. The posterior wing is marked by a round spot with a yellow centre, below which there is a distinct transverse brown band : the base is also marked with four roundish spots, or which appear to have become confluent.

Inferior surface yellow, sprinkled with elongate dots as above. Upper wings marked with two round spots, the smaller above the other : anterior margin bordered with brown half its length; outer margined with a broad reddish band, and scollopped upon its interior margin. The posterior wings are marked with a single central spot, bordered with purplish brown.

The male expands nearly five inches, and the female six inches.

The species is said to breed twice in the year : its caterpillar feeds upon the buttonwood (*Platanus occidentalis*, Linnæus), oak, and sweetgum. The caterpillar is greenish, tawny green or orange green : body spinous, hairy, and the second and third segments armed with two pair of short rugose horns.

Almost every season, I have seen a few specimens of the *Dryocampa* : it is, however, a rare insect in the vicinity of Albany, or in the western part of Massachusetts.

Mr. Harris has removed the foregoing species from the Genus Ceratocampa, where he had placed it in his Catalogue of the Insects of Massachusetts; and refers it, though with some hesitation, to the Genus Dryocampa*.

Lasiocampadae.

The caterpillars of this family are hatched from eggs glued into a gummy substance insoluble in water : the substance entirely surrounds a small limb, forming thus a thick protuberance, in which are contained some three or four hundred eggs. These eggs are hatched as early as April or the beginning of May, or with the development of the leaves. They immediately spin from their mouths a tent like a spider's web, into which they retire at midday and evening, and where they remain until the sun has warmed the air the next morning.

The caterpillars are sparingly hairy, and free from warts : they are social in their habits, and congregate by hundreds in their impervious tents. They travel with considerable speed.

The moths are woolly, and their wings are without hooks ; but the anterior edge of the hindwings is turned up, and laps upon the forewings; and when at rest, they are inclined and cover the back of the insect like a steep roof. The under wings project beyond the upper, when closed upon the body. The moth flies only by night.

The *lasiocampians* are among the most injurious insects the farmer has to contend with : they are, however, easily managed, and only require attention and industry when they first

* Harris : Injurious Insects of Massachusetts, p. 309, 2d edition.

appear in April or May. Their habits enable us to take advantage of them, and destroy whole broods at once : numbers of them retire in a body to their tents at stated times of the day, when both houses and inhabitants may be destroyed by one sweep with a pole properly armed.

CLISIOCAMPA AMERICANA (Harris). *American Tent Caterpillar.* (Plate xlv, fig. 1.)

(Plate xlvii, fig. 6 : eggs.)

Color rust-brown or reddish brown, variegated with gray especially on the middle and base of the forewings. Anterior wings crossed obliquely by two dingy white parallel lines : margin ciliate and whitish. Hindwings without lines or spots : a portion of the costal margin whitish. Beneath darker.

The caterpillar has a black head, and its back is marked by a whitish line. On each side of this white line there is a broad longitudinal stripe, formed by a yellowish ground marked by crinkled lines coalescing below, so as to make a row of spots upon each ring of the body, in the middle of which is a small blue spot : below is a narrow wavy yellow line ; and lower still, the sides are variegated with black and yellow lines. Underside of the hody dusky. The eleventh ring bears a small blackish hairy wart, and the body is sparingly clothed with hairs.

The caterpillars come to maturity and begin to leave the trees by the middle of June ; or, in other words, they then break up their encampment, and each seeks some suitable crevice in which to make its cocoon.

This is one of the most injurious caterpillars known to infest gardens and orchards. As the eggs are deposited upon the trees, they are enabled, as soon as hatched, to begin their depredations upon the young and tender leaves. We cannot, as in some other instances, prevent the ascent of the young caterpillars up the trees, for they are already there ; but we may, after the fall of the leaves, search for the eggs, which are deposited in quite conspicuous rings around the twigs, and remove them by hand, whereby an entire brood will be totally extirpated ; and if a general attention be given at this period, an orchard need never suffer from the operations of this insect.

The damage that trees occasionally suffer by neglect is very great ; for the tree, when deprived of its leaves, will die, or else must put forth a new crop, an alternative that seems always to produce a state of great exhaustion, and from which the tree scarcely ever entirely recovers. From this cause, when a tree has been neglected for several seasons, and consequently has become stocked with these devourers, it barely sustains itself, and soon shows marks of old age and premature decay : many limbs actually die the first season, and the whole tree wears the appearance of poverty and distress.

The direct means to be instituted for ridding an orchard of these destructive visitors, must be such as can act upon the whole brood while sheltered in their tents. These means

are various. Some farmers blow and burn off the tents, and all their inhabitants, with a small charge of gunpowder : others twist off the tents with a forked stick, or a pole with a stiff brush fastened to its end, and trample the dislodged insects under foot ; others still employ a swab charged with whale-oil soap, a very little of which article will kill many of the insects, and compel others to disperse. Whichever of these means is resorted to, it must be put in requisition either late in the day, or at noon, or early in the morning before the insects go out to feed. It is also advisable to begin early in the season, with the first appearance of the caterpillars : their tents are then small, and a whole community may be destroyed with the greatest ease.

To eradicate completely the tent caterpillar, it will be necessary to give attention to the wild cherrytrees that are scattered over the farm and by the sides of fences : the cherry, it will be seen, is a favorite tree with this insect, and scarcely passes a season with entire freedom from it.

It will be observed, that if the foregoing remarks are true, the farmer has no need of receipts to heal the ravages of these insects ; for, to ensure freedom from their attacks, he has only to examine his trees after the fall of the leaves in autumn, for the rings of eggs on the small branches, which may be removed by the hand or a knife ; or if this has been neglected, then search for the tents of the young caterpillars when the buds begin to open in the spring.

As the caterpillar grows, the tent is enlarged by the construction of an additional web over and around the first, enclosing thereby a space large enough to meet the demands arising from increased size ; and so it continues to add successively new webs over the old, which have become filthy, and unfit and unhealthy as dwelling-places, though a few of the weak and more indolent remain still within them.

ATTACUS POLYPHEMUS. (Plate xliv, fig. 1.)

Color dull ochre-yellow, somewhat clouded with black. Wings ornamented with an eyelike spot : adjoining their margins there are two parallel belts, the outer one reddish and the inner black. Outer angle of the superior wings marked with a black spot, divided by a reddish white line. Eyelike spots round outer narrow border black ; inner ochre yellow, surrounding a white centre. Posterior wings are ornamented with a similar eyelike spot, but surrounded by a large bluish black spot extending upward towards the base of the wings : inner posterior angle truncate. Thorax traversed in front by a narrow grayish belt, and connecting itself with a similar border on the front edge of the wing. The wings expand to six inches.

The caterpillar inhabits the oak and elm, and may be found in August and September.

The absence of yellow stripes on the sides and transverse bands on the back, and the presence of a mark of the shape of the letter V, will serve to distinguish these caterpillars from those of the *luna* moth.

ATTACUS CECROPIA. (Plate xliv, fig. 4.)

Color dusky brown, reddish brown. The pattern of both pairs of wings is nearly alike. The base is reddish, bordered with white. The broad middle is dusky brown, in the centre of which are lunate spots, centrally white, but bordered with light brown. The middle of the wings is traversed by a narrow reddish white band, beyond which there is another broad dusky brown band; in the outer and upper corner of which, there is a black velvety eyelike spot, marked by a narrow lunate line placed upon the inner edge : this outer border is bounded by a distinct black waving line, beyond which is a white border edged with brownish. The posterior wings, however, instead of the black waving line, have a row of black spots amounting to twelve or more, placed by a dusky brown waving belt : margin dusky white. Expansion of wing, six inches.

This moth appears early in the summer, in sheltered warm places : it is out as early as the middle of May.

The caterpillar is of a fine light green color. The second and third rings bear two red globular warts, around which are numerous bristles : the seven succeeding rings bear oval yellow warts; and upon the eleventh ring, there is only one large wart. The sides are ornamented with two rows of elongated blue warts, and the five first rings have an additional row below.

The young is yellow, and marked with rows of small warts upon its back. It fastens its cocoon longitudinally to the side of a twig : the cocoon is usually three inches long, tapers from the middle, and is constructed of double walls of silk separated by loose fibres of the same, and has a resemblance to brown paper.

The caterpillar is found upon several of our fruit-trees and shrubs, but I have never been able to discover that its injuries were very serious. It is not very common : some seasons, however, furnish more than others.

ATTACUS PROMETHEUS. (Plate vi, figs. 1, 2, 3, 4.)

MALE, *upper side* : Color deep smoky brown; the shoulders and basal parts deeper than the borders, succeeded by a central band of lighter color : this is terminated towards the border by a wavy line, beyond which is the clay-colored border, ornamented on the anterior wings by a wavy line, and on the posterior by black oblong spots between the line and middle band. Outer angle of the superior wings is ornamented also by a black eyelike spot, upon which there is a lunate line or crescent.

FEMALE, color brown, deepest upon the basal parts, which are marked by a curved whitish line. Each wing bears spots, sharply lunate on the anterior wings, and bordered by black : besides which, the anterior wings are marked by an eyelike spot at their angles, within a bluish white crescent. The moth expands about four inches.

The eggs are deposited on the twigs of trees in clusters, and are hatched in July. By the first of September, or as late as the middle, the caterpillar acquires its full size, when it measures about two and a quarter inches : it is naked, of a green color, and marked by six or eight small dark warts, and is furnished with a pair of simple coral-red spines for the second and third rings. There is a short spine upon the last ring but one, and the last is furnished with about six short black bristles.

The lilac seems to be the favorite shrub to which the *prometheus* attaches its cocoon, which is about an inch long, and gray like paper : it is attached longitudinally to a leaf, that serves to protect and conceal it.

This moth is one of the most common in and about Albany, some lilacs furnishing as many as a dozen cocoons. The caterpillar, though not perhaps entirely harmless, yet in this respect scarcely deserves attention. The large moths, appearing late in the season, after the leaves are fully grown, do not seem as injurious as they might be if they arrived when the leaves were expanding and tender; and trees do not suffer so much from the loss of foliage in the early autumn, as in the spring.

CERATOCAMPA REGALIS (Harris). *Regal Walnut-moth.*

"Antennæ short, and, in the males, pectinated on both sides; in the females, thread-like. Wings without hooks : forewings olive-colored, ornamented with several yellow spots, and veined with broad red lines."

This insect I have not yet seen : it is fully described by Mr. HARRIS, and, according to his description, it is one of the finest and largest of our moths, having an expanse of wing equal to six inches. The larvæ are spinous, but harmless; that is, they do not sting when handled. When fully grown, it is four or five inches long and three-fourths of an inch in diameter, and of a green color banded with pale blue transversely*. It feeds on the walnut.

The moth is said to appear in June, and is more rare than the *Dryocampa imperialis.*

From the old family of BOMBYCIDÆ or *Saturnians*, Dr. HARRIS has separated the *Ceratocampa* and *Dryocampa*, and a few others, and has constituted a new family under the name of CERATOCAMPADÆ, after the name of the chief genus contained in it : the name signifies *horned caterpillars.* On the second, and sometimes also on the third ring, these horns are stiffer, more rigid and curved, agreeing more perfectly with their definition as *horns.*

All the species here referred to feed upon the leaves of forest-trees : they go into the ground where they undergo their transformations, and this without making cocoons. The chrysalides are notched or toothed, with the design of assisting their ascent from the ground at the time just prior to their final and last change.

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* HARRIS : Injurious Insects of Massachusetts, p. 307 – 8, 2d edition.

DRYOCAMPA PELLUCIDA. (Plate xxxvi, fig. 1 – 3.)

a. Pupa : *c.* Larva (ABBOTT & SMITH).

MALE, *upper side and forewings* : Color of the costal margin and base brown, reddish and purplish ; in the angle of this marginal and basal part there is a white spot : central part clear ; posterior margin reddish or purplish. Posterior wings buff, similar to the antennæ, head, thorax and abdomen.

FEMALE, buff with a white central spot ; outer margin paler. Beneath buff and uniform.

I have a specimen of the male, the color of which is purplish buff without any variation of tint, but preserves the pellucid wing with its white central spot. The wing is abraded, but still has a close agreement with Mr. HARRIS's description of the *pellucida*, which certainly does not agree with ABBOTT & SMITH's figure.

DRYOCAMPA VIRGINIENSIS. (Plate xl, fig. 5.)

PHALÆNA VIRGINIENSIS (Drury). P. PELLUCIDA (Abbott & Smith).

UPPER SIDE : Antennæ, basal half doubly pectinated. Wings pellucid, brown. One half of the anterior wings darker upon the upper part, in the middle of which there is a single white dot : lower margin of the posterior wings lighter brown than the basal parts.

UNDER SIDE, the legs, sides, thorax and abdomen are dark orange. Wings divided into two unequal parts by a bar : above the bar, the color is reddish yellow ; below, the same as the upper side.

I have taken a single pair of this species in Albany county, and it is of rare occurrence in this State, although during the present season (1853) it has been somewhat more numerous, so that specimens have been obtained and placed in several collections.

The larva is described as being naked, striped, rigid, and supplied with acute tubercles : the second ring has two threadlike horns. It subsists on the leaves of forest-trees : the moths were found in a young forest of oaks and hickory.

The spring of 1853 has been unfavorable to the growth and perfection of this caterpillar : at an early day they were quite numerous, but the subsequent cold weather seems to have killed many in their tents. I have numerous balls consisting of dead dried caterpillars inside of their habitations, which appear to have all perished from excess of cold when about half-grown.

CLISIOCAMPA SYLVATICA (Harris). *Tent Caterpillar of the Forest.*

Head blue. First ring marked with two yellow spots and four black dots : the next eleven rings are marked upon their tops by a row of white spots, and also two small elevated

black hairy dots, except that on the eleventh ring there is only one large dot. Sides of the back marked by a reddish stripe, which is bordered by slender black lines: they have also a yellow stripe between two black lines. Belly blue-black. HARRIS.

This caterpillar inhabits oaks and walnuts: less common on the cherry and apple. It attains its full size in June, and is then two inches long. It is also social in its habits, and constructs tents like the *C. americana.*

The moth appears early in September, and is of a light drab, brownish or yellowish color. The anterior wings are marked by two oblique, brown, straight, and parallel lines. The greatest expansion of wing is a little less than two inches.

The trees upon which the caterpillars of these moths feed are injured in the manner represented in the foregoing sketch; and though few persons are so patriotic as to give their services to the public for the purpose of destroying noxious insects, much private benefit would accrue from the extermination of these forest caterpillars. To this end, our special friends the birds come in aid, and rid us of thousands of them: the cuckoo, catbird, robin, jay, and many others feed upon them, and thus diminish their numbers very materially. The murderous gun should therefore never be pointed at birds who make it their business to serve us so effectually, especially as we seem little disposed to do any thing this way for ourselves; and even were the disposition not lacking on our part, the birds are certainly better adapted to do the work, and, no doubt, if spared by the fowler, would be competent, from their consequent increase of numbers, to hold the increase of insects so much in check as to save us from serious danger from that source. Indeed any man has a perfect right to prevent the destruction of birds, on the same ground that he has a right to protect himself from personal harm.

The direct means for destroying the forest tent caterpillar are the same as required in the case of the *C. americana*, namely, destruction of the webs and their contents at the proper time, that is, when the inhabitants are at home.

CLISIOCAMPA NEUSTORIA. (Plate XXXVII, fig. 2 – 4, and *a*, *g*, pupa and larva.)

Primaries of the male pale sulphur-yellow, marked with two distinct dark brown bands: the outer margin banded with brown, interrupted with two oblong sulphur-yellow spots near the outer angle. Secondaries dull brown, with a deeper marginal stripe parallel to the posterior margin, and marked with deeper brown also on the nervures running from the base to the posterior margin. FEMALE yellow, inclining to orange on the primaries, with the same distribution of brown and brown stripes as in the male.

CATERPILLAR green, with a row of oblong white spots on the back, enclosed in rectangular markings of yellow, which are formed by two yellow parallel stripes upon the sides of the back, connected regularly with serrated cross bands: enclosed rectangles shaded with black. Head brown. Body furnished laterally with greenish and yellow

hairs, and brushes on each side of the head; when mature, two inches long. The tail is terminated by an oval spot surrounded by yellow enclosing green and white, the white in the form of a stripe.

Cocoon bluish, oval, tapering, with eight rings, and dotted along the sides; less than one inch in length.

This insect feeds upon oak leaves, and does considerable damage to the white oak by nearly defoliating it. The caterpillar appears as early as the first of May. It is regarded by Abbott and Smith as identical with the European insect of the same name. (See Abbott and Smith's History of the Insects of Georgia, pa. 117, pl. 59; and the figures I have given are those of Abbott and Smith, from which it will appear, on reference to plate xlv, that they differ from those of our common orchard moth named by Dr. Harris *Clisiocampa americana.*)

Hepialidae.

The antennæ of the insects of this family become gradually attenuated at the tip: they are short and filiform, but never feathered at the tip; but those of the males are sometimes doubly pectinated at the base. The tongue is either very short or obsolete. The abdomen is elongated, and provided with an ovipositor. The thorax is never crested. The wings are narrow, but complicated and strengthened by numerous nervures. The larvæ have sixteen feet: they are white or reddish, soft and naked, only slightly downy, and furnished with brown heads: they feed upon wood, and construct their cocoons of bits of the wood upon which they have been feeding. The chrysalids are ridged transversely, and notched.

This family does not appear to contain many species in this country. Dr. Harris has described the *Hepiolus argenteomaculatus* belonging to the same genus as the European *hopvine hepiolus*, and figured the same in the Lake Superior Expedition conducted by Prof. Agassiz, plate vii, fig. 7.

Notodontidae.

The wings of the moths of this family are folded, and slope like the roof of a house over their backs: they are held by bristles and hooks. The antennæ are rather long, usually doubly pectinated in the males, and become narrow and short towards the tip. The feelers and tongue are small and short: the body is long.

The larvæ are provided with toothlike prominences upon their hunched backs: they are usually naked, or only downy. The posterior appendages used for feet are sometimes

modified so as to exhibit a forked shape, upon which the soles of the feet only are seen. The cocoons are formed of silk intermixed with fragments of wood and bark. The chrysalids are not notched upon the back. The larvæ feed upon leaves.

PYGÆRA ALBIFRONS. (Plate xxxvii, fig. 3 – 5.)

Wings deflexed : primaries clouded; anterior margin marked with an elongated spot of cream-color terminating in the outer angle and dotted slightly with brown, transversely banded with white, black or dark brown : secondaries brown, margined with a lighter shade. Thorax of the male banded with two distinct black lines joined by two short parallel connecting lines, between which there is a square yellow or cream-colored or light buff spot. The thorax of the female is ornamented with three cross-bars : antennæ setaceous, with a terminal enlargement. Antennæ of the male ?

CATERPILLAR striped upon its back with yellow and brown; underside lake, and furnished with three pair of legs and four pair of proplegs : it is half an inch long. It spins a thin white web between the leaves late in autumn, and appears early in the spring in perfect state, feeding upon the leaves of the white and other oak trees. They are gregarious when young. The cocoon is ¾ inch long, and has eight or nine segments.

The larvæ of this species feed at times upon the leaves of the oak, and sometimes nearly defoliate a tree when they are numerous. An instance has fallen under my observation, in which a tree of this kind was well nigh deprived of leaves by these insects for two or three years in succession.

EUDRYAS GRATA. *Woodnymph.* (Plate xlvii, fig. 8.)

Forewings pearly white; basal half trimmed with purplish brown : outer margin widely bordered with purplish brown, the inner edge of which is banded with olive, which extends and widens upon the posterior border, forming near the middle a large patch : exteriorly, upon the border and near the edge, it is ornamented with a delicate bluish line. Hindwings a yellow buff, bordered behind with purplish brown, which does not reach the outer angle, but extends along the inner edge : it is trimmed with silver-gray ciliæ. BENEATH, the forewings are pale buff, marked upon the basal half with brown, but confined to the costa, which terminates in two roundish spots. Hindwings paler yellow buff, and marked in the middle with a single brown spot. Abdomen buff brown, silky; the rings are banded with lighter, and terminated with a zone of the lighter buff.

This beautiful moth is rare here. I have taken it only in Berkshire (Massachusetts), but it exists in collections in Washington and Albany counties in this State.

Nonagriadae.

The body of the moths of this family is long; the thorax is smooth; the colors are yellowish or clay-colored, and the forewings are faintly streaked or banded. The larvæ are naked, long and slender, and taper at each end : they live within the stems of reeds, and feed upon the pith and upon the inside of roots, and hence are destructive. When about to transform, they gnaw through the stem to the cuticle, which is left entire, but is easily broken through afterwards by the nymph. They are known by the common name of *spindleworms*. Some attack corn, to which they do great injury; others, the stems of garden flowers, such as the dahlia, etc.

The *Gortynia zea* of Harris belongs to this family, and is described by him as having its forewings of a rusty red, and mottled with gray almost in bands : there is also an irregular tawny spot near the tip, and on the veins a few black dots. Expanse of wing, an inch and a half.

Another *Gortynia* attacks the roots of columbine, and has been named by Dr. Harris *leucostigma*. The forewings are tawny yellow, sprinkled with purple brown dots. (See Harris, Insects injurious to vegetation, p. 341, 2d edition.)

Agrotidae.

The larvæ of this family are subterranean, and come forth from the soil to feed in the night, and return to their burrows before morning : they are called *cutworms*, and are exceedingly troublesome in cornfields. The moths are usually brown, and sometimes fly by day, and feed upon the honey of wild plants : their wings are nearly horizontal when at rest, and the forewings completely conceal the hind ones when closed. The thorax is not crested. The antennæ of the males are sometimes pectinated at the base, but taper to slender filaments. The forelegs are spiny.

The larvæ are smooth, cylindrical, dirty white, and rather thick bodies, naked or furnished with only a few scattering hairs : their rings are dotted. They change to chrysalids in the ground.

The attacks of these larvæ extend to many of our most useful cultivated plants, corn, cabbages, wheat, buckwheat, grasses, together with cultivated flowers. In the maize-fields, however, about the middle of July, they seem all at once to cease their injurious work to the corn plants.

It appears from Dr. Harris's researches that we have many different species of this family, all of which have the similar habit of feeding upon young and tender plants, and of cutting off their stems just above the soil.

AGROTIS ——. (Plate xlv, fig. 11.)

Color dusky brown. Forewings dusky or blackish, especially along the costal edge : one half of the subcostal base is blackish ; and, beyond the middle, this dusky subcostal band extends towards the inner margin, forming a partial transverse band : apical and marginal area light brown and silky, of the same color as the area of the disc. Hindwings white with a pinkish hue in certain lights, silky and ciliate : beneath, quite pale, and without markings. Body dusky, and as dark as the forewings : the venter is slightly ferruginous, and terminates in a short brush. Expanse of wing, two inches.

This is one of the common species of *Agrotis* in Western Massachusetts and Eastern New-York.

AGROTIS ——. (Plate xlv, fig. 2.)

Color mottled gray : thorax and head brown. Forewings gray at the base : in the middle, resting upon the inner margin, is a large quadrangular spot of a cinnamon-brown, beyond which is a broad transverse grayish green band ; margin brown : costal margin mottled with gray and brown, with an intermixture of short slender transverse lines. Hindwings smoky, especially upon the posterior and inner margin : costa pearly and yellowish white, beneath smoky and pearly. Hindwing beneath marked with a central black dot. Expanse of wing, two inches.

A common species in Western Massachusetts.

AGROTIS? ——. (Plate xlv, fig. 10.)

Color of the thorax black, from which a longitudinal band extends upon the forewing, reaching its middle ; the extreme end, however, is separated from it by a small space of gray. Costa black in front : outer margin banded transversely by two dusky white bands, between which are broader bands of dusky brown. Hindwings pearly white. Abdomen whitish, or of the color of the hindwings.

Noctuidae.

THE antennæ of the insects of this large family are mostly simple : the bodies are thick, stout and strong ; their wings are of a moderate length, and strengthed by their nervures, and their tongues are long. The wings, when not in use, are deflexed upon their sides, and the body is clothed with scales rather than wool or hair. The majority of the larvæ of the different genera are naked, and have sixteen feet, though in some the second ventral pair, in others the first ventral pair, are wanting : they undergo transformation under ground, and form cocoons of silk in which particles of sand are often glued. The moth

flies by night, and conceals itself during the day : its thorax is crested. The larvæ are solitary. The colors of the perfect insect are not bright, but often have a silky lustre.

NOCTUA SQUAMULARIS. (Plate xlii, fig. 1.)

Antennæ filiform, brown. Superior surface, basal portion chocolate, outer portion slate-colored; the junction of the two colors deepest. The anterior wings are traversed by two scollopped lines; the inner running entirely across, the outer only across the inferior half. Posterior wings traversed by a chocolate band, apparently between two black parallel bands; the slate on the posterior half shaded into chocolate, or paler : margin slate, and slightly dentated. Expansion one inch and nine lines.

NOCTUA UNDULARIS. *Phalæna undularis* (Drury). (Plate xlii, fig. 4.)

Antennæ filiform, brown, slightly toothed. Insect very dark brown, bordering upon black. Wings slightly dentated, and obscurely marked by five or six narrow transverse bands of black, imparting a very black hue to the whole animal : both pair of wings marked and colored alike. Inferior surface lighter, exhibiting the same kind of markings.

NOCTUA MARGARITATA (Drury). (Plate xlii, fig. 9.)

UPPER SIDE : Antennæ setaceous, brown. Thorax and abdomen silvery white. Anterior wings silvery white at the shoulders, the remainder being of a shining red-brown; edges fringed with white : there is also a large silvery marginal spot on the outer half of the anterior wing. Posterior wings silvery white at the base, and extending over one half of the wing; the remainder brownish, but margin silvery.

UNDER SIDE : Breast, legs and abdomen white. Anterior wings silver gray, but fringed with yellow. Posterior wings colored as on the upper side, without markings. DRURY, Vol. iii, pl. 21, fig. 6.

PHALÆNA QUERCARIA. *American Oak-beauty.* (Plate xxxvi, figs. 2 & 4, *b – k.*)

(ABBOTT & SMITH, pa. 205, pl. 103.)

Antennæ of the male pectinated : wings brown. MALE : Primaries banded parallel to the outer edges; marginal black, succeeded by a waved cream-colored band, which is bordered with black : towards the base there is a parallel shorter band shaded with brown. There are two black central spots encircled with light brown, extending towards the posterior margin, and also dashes of black lines from the base outwards. Secondaries banded with black upon the margin and central part, with a lunate black

line towards the base; broad radiating dashes of brown upon the nervures from the base backwards, and reaching the posterior margin: posterior edge slightly scolloped.

Female: Primaries mottled and dotted with cream-color, centrally banded with brown and cream-color, which has a cream-colored oblong spot towards the upper margin; below, it has waved black coalescing spots: upon the margin, two large brown spots with cream-colored spots. The secondaries exhibit a similar pattern; the brown is placed upon the base and posterior margin, with cream and black angular spots within. Body brown, with a row of spots down the abdomen: the posterior third of the abdomen has the sides cream-colored, and spotted with buff or brown.

Caterpillar a looper, brown ringed with black at each joint, the last with yellow, and striped on the side with white. It is two inches long, and has the habit of fixing itself in an oblique position. Feeds upon the black oak: it spins its cocoon on the ground in May or June.

Cocoon brown, and about one inch in length.

Noctua (Acontia) nundina. (Plate xlii, fig. 7.)

Antennæ filiform, reddish brown: tongue coiled spirally: head and thorax ash-color. Anterior wings greenish, faintly marked with brownish, and with a darker angular mark placed towards the outer angle. Posterior wings silvery white, marked with faint discoidal spots, and bordered with a light brown.

Beneath, the anterior wings are silvery white, indistinctly bordered with brown, with two dark spots just opposite the single dark spot on the upper side. Posterior wings silvery white: oblong brown spots appear as on the upper side.

Erebus edusa (Latreille). *Phalæna* (Drury). (Plate xlii, fig. 3.)

Upper side: Antennæ filiform, sandy brown, deeper color towards the margin. Anterior wings ornamented with two large bluish white spots upon the outer margin, and several crooked spots on or near the basal part. Posterior wings marked with one large oval spot on the posterior half, and margined with brown dots: edges crenate.

Under side brown; but the anterior wings are marked with two whitish spots placed upon the external edges, one near the tip, the other at the lower angle: they are also crossed by a whitish bar one-fourth of an inch from the body, and a small white spot appears next the shoulders. Posterior wings brown, marked by a whitish oblong spot placed along the external edges: cilia brown. Underside, paler beneath, and marked with obscure dark spots.

CATOCALA ——. (Plate xliv, fig. 3.)

Color grayish brown. Head marked with a white spot between the eyes. Thorax black, marked by three transverse reddish bands. Abdomen dusky, with a reddish hue. Forewings brown, marked with pale cinnamon bands. Hindwings black, marked with two carmine zigzag bands, and a submarginal one more or less interrupted : edge dressed with carmine.

CATOCALA EPIONE. (Plate xlii, fig. 8.)

Thorax and abdomen sooty ash-color. Wings crenate; the anterior ones dark chocolate, marked with an undulating dark ferruginous line running from the anterior to the posterior edge : another line of the same color crosses the wing near its articulation; a broad dark patch occupying one-third of the wing's surface, showing within two oval lighter spots. The whole appearance of the wing is nebulous, exhibiting broad belts and dark and ferruginous lines arranged transversely. Posterior wing dark or black, lighter along the abdominal border : cilia white.

INFERIOR SIDE, the anterior wings are dark ashy at the base, and become black towards the outer edges, but the tips are soot-colored : external margin ornamented with seven whitish spots, above which there is a white line running from the anterior to the posterior margin, and narrowing as it goes. There is a large oblong whitish spot between the line and shoulders. Posterior wings, upon their abdominal margin, ash-color, deepening to black : a faint white streak runs a short distance down the wing from the anterior margin. Spread of the wings 2 inches 6 lines.

CATOCALA AFFINIS. *Painted Catocalla.* (Plate xlii, fig. 5.)

PHALÆNA (Linnæus). CATOCALA (Schrank).

Antennæ filiform, obscurely serrate upon the inferior side : tongue coiled, of a moderate length : feelers thick, hairy and pointed. Anterior wings ashy gray, marked by a wide line or narrow belt of a chocolate color, running from near the base of the anterior margin towards the outer posterior angle, when it becomes a zigzag line terminating in the anterior margin towards the outer angle : outer margin marked by obscure short lines of a chocolate-color. Posterior wings orange, marked by black or dusky belts parallel with each other; the outer belt parallel with the posterior margin, leaving an orange patch upon the outer angle, and dots posteriorly : a black line runs parallel with the inner margin, terminating at its base. Inferior side marked by alternating belts of orange and fuscous; margin and base lighter colored : the colors are all dull and faded below. Head and thorax dusky. Abdomen dusky above and light below. Expanse of wing $1\frac{3}{4}$ inches.

There seems to be considerable variation in the size and colors of this painted moth, possibly due in part to sex. In the figure of DRURY, the anterior wings are dark, with yellow marginal dots. A *Catocala* found in Western Massachusetts has the dark anterior wings and dotted margin; while the moth is larger, the red belts of the hindwings are brighter, and the posterior margin is almost ciliate and yellowish gray. But another, nearly as large, is pale and ashen, and the inferior wings have yellow instead of vermilion red. Another still is small, about 1½ inch in expansion, with yellow also; but has the angular spot, and other markings similar in fashion to DRURY's figure.

There seem to be gradations both in size and depth of coloring, which are not sufficient to distinguish species, but may establish varieties; but as I have before me only six individuals, I may be mistaken in my estimate of the importance of their differences.

Geometridae.

SPANWORMS, LOOPERS, &c.

THE insects of this family move over the ground, or along the branches of trees, in distinct steps, as if measuring their progress, by alternately flexing and extending their bodies from point to point. The manœuvre is performed by first extending the anterior extremity of the body as far ahead as it will reach, and then bringing forward the posterior extremity by elevating the middle portion of the body, so that the extremes are brought into contact, and the whole takes the form of a loop; and thus by successive steps they measure their route according to the length of their bodies. Their legs, which are usually ten on each worm, are employed rather in fixing the body at its successive points of rest, than in independent movements of the feet. They necessarily move slow; and as they occupy bushes and trees in feeding, and must seek the ground to undergo transformation, they are provided with the apparatus and means of spinning a thread, by which they are enabled to let themselves quickly down to the ground; and in cases of alarm they frequently do this, remaining suspended until the danger is past, when they return to their feeding by aid of mouth and feet, seizing the thread above with the jaws, and then drawing up the body by doubling it as before described. They are destitute of hairs.

When the spanworm goes to rest, it fixes itself by the posterior feet, and lifts its body up and sustains it stiffly in an angular and motionless posture, thereby counterfeiting the appearance of a short broken dead twig of the branch on which it reposes, with the instinct of eluding if possible the searching eyes and devouring beaks of hungry birds.

To the Family GEOMETRIDÆ belong some of the most destructive moths, particularly the cankerworms. Those which are injurious to fruit-trees have usually thin angulated wings; but they are wanting in the female, or merely rudimentary, and hence are very unequal in this respect: this fact gave origin to the name *aniscpterix*, 'unequal-wings.'

GEOMETRA TRANSVERSATA. (Plate xlii, fig. 2.)

Antennæ filiform, orange brown. Wings angulated, dashed with short darker lines, and shaded with about three dark parallel stripes. Anterior and posterior wings marked with a waving continuous line, beginning at the acute outer angle of the former, and terminating a little below the middle of the latter : they are also bordered with a narrow belt of a similar color. Underside of the wings similar in color and markings, except in the brown waving line. Expansion of wing, two inches. (WESTWOOD's Illustrations of DRURY, plate viii, fig. 2.)

GEOMETRA SERRATA. (Plate xl, fig. 6.)

Antennæ setaceous or filiform. Head reddish buff-color. Thorax, abdomen and wings yellowish buff. Both pair of wings scollopped, and broadly bordered with brownish or deeper buff : also the same color is found at the base of the forewings, but paler; and a transverse band upon the posterior, with dashes of the same over the yellow part. The border of the forewings is forked near the outer angle, and the anterior edge is ornamented with brown and white oblong spots. (WESTWOOD, Illustrations of DRURY, plate xx, fig. 4.)

GEOMETRA CATENARIA (Drury). *Chain-dotted Geometer.* (Plate xli, fig. 10.)

PHALÆNA CATENARIA. BUPALUS CATENARIUS (Leach).

Antennæ in the male doubly pectinated, slender. Head orange. Thorax, abdomen and wings white : the former is marked with three orange-colored spots, and each ring of the abdomen with dots or black transverse lines; the wings are also marked by two parallel denticulated lines running across them. The wings are rounded behind, and margined with a black dotted line having some resemblance to a chain. (See WESTWOOD, Illustrations of DRURY, plate viii, fig. 3.)

GEOMETRA? ——. (Plate xlv, fig. 3.)

Wings subangulated, subcrenate on the outer margin.

This moth I am disposed to refer to the Genus GEOMETRA, relying upon the form of the wings and the pattern of their ornamental marking. The color is cinnamon-brown, and the white transverse band near the middle is bordered by a deeper brown on the basal side. The costa is darker, being connected with the transverse band already referred to. Hind-wing lighter colored at the base than the outer half.

I have been unable to obtain the larva, and hence it cannot be determined whether it has the progression peculiar to the geometridæ. There is some doubt as to the genus to which it should be referred.

Tortricidae.

LEAF-ROLLERS.

The insects of this family mostly have the habit of rolling up the young leaves of trees, either one or more in a single roll, and confining them with silken threads. They are small, seldom in the larval state exceeding an inch in length. The moth is nocturnal, small, usually gray and obscurely banded, rarely ornamented with bright colors. The larvæ have sixteen legs each, and their bodies are naked, or only clothed with a few hairs in tufts: they spin a thread of silk from the mouth, with which, when disturbed, they let themselves partly down to the ground, where they remain suspended until the danger is past. The moth, though small, is broader across the forepart than in those of other families. They inflict serious injuries upon trees, by feeding on the buds and blossoms.

Loxotænia rosaceana? *Rose Leaf-roller.* (Plate vi, figs. 8 – 11.)

Color light brown, grayish brown, light cinnamon-brown. Forewings traversed by two or three narrow brown bands: when the wings are closed, the bands form a quadrangular figure on the back; these bands are variable, as well as the colors of the moth. Hindwings yellowish white or grayish yellow. Expanse of wing about one inch.

The larva is green, naked: head brownish, smooth, glossy: rings of the integument sheathing the head, yellowish white: six true legs, eight middle and two prop-legs. At the extremity of the abdomen, two or three small greenish warts, which give origin to a few hairs. Feeds upon plum, rose, and other leaves and flowers. Largest, three quarters of an inch long; sometimes one inch, but usually a little less: the figure is smaller than common.

The pupa is brown, enclosed in the rolled leaves, and suspended by the tail.

This is a very troublesome insect. In my garden, the larvæ every year destroy most of the plums on a fine tree, besides checking the regular growth of the young limbs, which, when the buds are destroyed, never grow more than an inch or two in the spring; and the effects of the insects are also seen in the knotty condition of the young shoots. The eggs are laid in patches upon the bark in the month of June or July, where they remain until the tree begins to put forth its leaves, when the larvæ make their appearance, and almost every twig has been for some years infested with them.

The best way to deal with this species of *Tortrix*, is to rub the bark of the trunk and limbs of the tree with a knife or some other proper instrument, by which means the eggs will be destroyed; and then wash the bark thoroughly with an alkaline solution, or with whale-oil soap: or if the trunk and limbs are whitewashed in the autumn or spring, just

as the eggs are about to hatch, it will mostly destroy the eggs; and if any escape, the use of a syringe with soap and water, will probably finish the work.

This leafroller attacks the rose, and several other plants belonging to the different orders : it is not, therefore, particular as to its food ; but it effectually puts a stop to the expanding blossoms, whenever it makes its habitation in the leaves that surround the bud.

I have referred this insect to the species *rosaceana*, although it does not agree in every respect with the descriptions within my reach. It is variable in its markings and size, in both the larval and perfect states. It does not spin a cocoon, unless one is constituted by the few threads of silk it employs to bind up the rolled leaves with, in which its transformation takes place.

CARPOCAPSA POMONELLA. (Plate xlvii, fig. 4.)

This insect is a native of Europe : it was brought to this country with the apple, and has become naturalized. The moth is gray, but lustrous like satin, and is delicately streaked and dotted. The posterior border of the forewing is marked with a reddish brown spot, which is surrounded by a golden mark in the form of a horseshoe. The hindwings are brownish inclining to yellow, and surrounded by a fringe : they are sparkling and brilliant. The thorax and abdomen are yellow and brownish gray.

The moth appears in the evening, having been secreted in a secure place during the day. It may then be seen busy about branches of apple and pear-trees, selecting the fruit for a depository of its eggs : in a few days, if the weather be warm, they are hatched. It requires three or four weeks to come to perfection, when it is reddish or flesh-color, with a brown head and collar. Before it changes to a pupa, it leaves the fruit, and seeks a secure place in the cracks of the bark, where it spins its cocoon.

According to KOLLAR and other authorities, two broods are produced in a single season. The first pupa changes to a perfect insect in a short time, and, by the last of August, much fruit will be injured. If the weather and season be favorable, numerous insects of this kind will come to perfection, and the quantity of fruit injured will be in proportion to the number of insects hatched from the eggs of the first brood.

The means to be adopted for diminishing the numbers of this moth, are mostly of the palliative kind. It is evident that all infected fruit should be immediately gathered and destroyed. The tree should be shaken, that all diseased fruit may fall as soon as possible, and before the larva leaves it to change into the pupa state. The defective fruit may be picked, removed and scalded, and fed to swine. It is obvious that the nearest approach to the extirpation of this injurious insect will happen when cultivators of apples and pears shall unite their efforts in the use of the remedies proposed.

Yponomeutidae.

A FAMILY of the LEPIDOPTERA, made up of very small moths, whose labial palpi are long and slender, and still but slightly developed : it is allied to the TORTRICIDÆ and TINEIDÆ; but from the former it differs in the length of the palpi, and from the latter in their non-development.

The body of the insect is slender, and somewhat elongated and depressed. The antennæ are very long and simple in both sexes. Wings also long, or a long oval and acute : they are entire, but often ciliate or fringed. The colors are white or slate, marked by a few bands of black : some, however, are ornamented with brilliant metallic colors.

The larvæ are often highly injurious to fruit-trees, especially those living in communities, which inhabit a common tent after the manner of the American tent caterpillars. They have sixteen feet, and form cocoons in the midst of their webs.

Plate xlvii, fig. 7, represents the typical form of the family : it is the *Adela degeerella*, from WESTWOOD. The species have not always the long antennæ of this one.

Tineidae.

THIS family contains some of the smallest of the LEPIDOPTERA. Their wings are narrow, in which respect they differ from the TORTRICIDÆ; and their palpi are well developed. The head is often densely clothed with scales in front : the antennæ are only moderately long; the spiral tongue is short; and the wings are entire, but convoluted when at rest.

The larvæ are very destructive to woollens and household furniture, carpets, clothing, furs, etc.; and when once they have taken possession of a house, it is difficult to dislodge them. They are usually of a dirty white, sometimes of a brown color, with long hairs from the posterior extremity; but sometimes also naked, or furnished with a few hairs scattered over the body. They form cocoons, which they frequently carry about with them; and their depredations consist in gnawing holes through the woollens, and other goods, when they get possession of them; so that when unfolded and held up to the light, the articles are often found to be perfectly riddled. They undergo transformation in the little cases or cocoons they have formed, and which may often be found in great numbers adhering to spots where they were fixed by the larvæ when about to undergo transformation.

One of the most effectual modes of preserving woollens, furs, etc. from the depredations of the moth, is to expose them to sunlight, and subject them to frequent examinations. When such articles are kept in dark closets, and left undisturbed during the months of June and July, they will suffer more or less from moths. Tobacco leaves, camphor, turpentine, are poisonous to the moth, and may be employed as protectives against it.

TINEA CERELLA (Fabricius). *Honeycomb Moth.*

This moth is notorious for its depredations in the beehive : its larva feeds upon the honeycomb, or *beeswax*.

KOLLAR, in his treatise on injurious insects, describes this moth in detail ; and from the matter he has furnished, I have derived the following facts :

The color of the male is yellowish ; the antennæ, head and back clay-yellow ; the abdomen yellowish brown, and feet yellowish gray with lighter spots. Upon the back and behind the scutellum there is a blackish brown tuft of hair, the point of which is white. The upper wings are broad, short and obtuse, of a dusty ash-gray, banded from the base to the middle, and dotted with brown : the fringes are brownish white and jagged. The hindwings are light ash-gray, marked by a yellowish spot on their inner boundary.

The female is larger than the male : her color is of a dark rusty brown on the head and back ; the forewings are darker, obtuse and straight, while the hindwings are much lighter. Length of the male, six lines : expanse of wing, one inch.

The caterpillar is cylindrical and spindle-shaped, and, when fully grown, is nearly an inch long : it is of a dirty white color, and has sixteen feet of a cream-color.

Following its singular instincts, the larva, immediately after it is hatched, forms its web of silk, which becomes for it a covered way and protecting screen, wherewith it boldly enters the hive if hatched without, and establishes its home in the midst of enemies. When the bees are at work, however, it does not appear abroad ; but when they are at rest during the night, it feeds voraciously upon the wax. It increases rapidly, and comes to its full size in about three weeks : it then makes its web stronger, and is transformed to a pupa. If it is late in the season, it remains till spring before it changes to an imago.

The effect of these intruders is first to diminish the wax of the bee-cells, which occasions the loss of the honey ; and when this takes place extensively from the presence of numerous larvæ, the bees cease working.

There are two generations of moths in a season, according to KOLLAR ; the first appearing early in the spring, and the second in July. The female lays her eggs in the cracks of the lower part of the hive, in the night, and the larvæ feed at first upon the young comb ; but they afterwards ascend to the upper part of the hive, where the older kind is deposited.

Many inventions have been proposed and resorted to, to secure the bees from these intruders : none, it is said, succeed perfectly ; and so far from requiring no attention, it is maintained by KOLLAR that the only sure method of cleansing beehives from this moth is to look after and destroy them, both larvæ and pupæ. The moth is fond of sweets, and may therefore be attracted to dishes of sweetened water and vinegar in the night, and by that means may be drowned : some other kinds of obnoxious moths may be destroyed in the same manner.

RHINOSIA POMETELLA. *Chætochelus pometellus* (Stephens).

A moth has been described by Drs. HARRIS and FITCH, belonging to the family TINEIDÆ, which has done considerable damage to the apple orchards in the vallies of the Hudson and Housatonic during the spring of 1853. Dr. HARRIS has called it *Rhinosia pometella*, and furnishes the following description :

'Forewings ash-gray, sprinkled with blackish dots, three of which are larger than the rest, 'and placed triangularly near the middle : a dusky transverse band near the tips, 'and a curved row of seven black dots at the origin of the terminal fringe. Hind-'wings dusky, with a leaden lustre, black veins, and very long black fringes. Body 'and legs beneath yellowish white, with the lustre of satin. Expansion of wing, five 'eighths of an inch' (Journal of the N. Y. S. A. Society, September). The markings, however, according to Dr. FITCH, are somewhat variable.

The larva is cylindrical, has a pale greenish color, sixteen feet, and a dusky stripe on the back : above this is a narrower whitish stripe, which runs along the middle of the back. The head is yellowish and polished. Length about half an inch. Its marks and colors are variable.

This larva has inflicted considerable injury upon orchards during the past season (1853). It eats not only the leaves, but also the apples. Like the *tortrix*, it sometimes rolls up a leaf for a habitation ; and when the tree is shaken, many let themselves down by threads of silk.

Whale-oil soap, dissolved in water and thrown freely upon the trees, is found to be an effectual remedy against this insect.

BUTALIS CEREALELLA. *Angoumois Grainmoth.*

Color pale cinnamon-brown ; lustre silky : hindwings ashy or dusky lead-color : feelers blackish near the tip ; second joint blackish on the outside : body pale brownish gray. The head is smooth : antennæ threadlike, jointed : feelers long and curved upwards, with the terminal joint naked and acute ; basal joint hairy and short : tongue about half an inch long, and spirally coiled. Forewings rather long and narrow, pointed at the end, and fringed : surface sprinkled with blackish dots, especially near the tips. Hindwings blackish with a leaden lustre, narrow, and obliquely contracted to a point at the tips : fringe blackish, widest on the inner margin. Forelegs blackish ; hind ones fringed on the inner side with long hairs.

The caterpillar, when fully grown, is whitish with a brown head : legs six, with ten wart-like proplegs. Chrysalis is obtuse at both ends : rings of the body smooth : wing-cases extending nearly to the hinder extremity. The skin of the chrysalis remains in the kernel of grain upon which the larva has fed. The insect hatches from June till August.

The community is greatly indebted to Mr. Harris, for his discoveries in relation to the *Angoumois grainmoth.* He had expressed his conviction, in the first edition of his treatise on insects injurious to the farmer and to vegetation, that a certain grainmoth would prove to be the true European angoumois grainmoth, and it seems that this prediction is fully sustained by farther discoveries of our indefatigable and distinguished entomologist.

This insect, in its perfect state, is known to lay from sixty to ninety eggs in clusters of twenty or more upon each grain : these hatch in about five or six days into threadlike worms, which disperse themselves about the grain-bin. After selecting a kernel by fixing upon its tender part, the worm burrows into it, and there remains feeding until it arrives at maturity : it then spins a web, dividing its cavity longitudinally into two unequal parts by a silky partition, where it undergoes its transformation, the larger cavity serving the purpose of a cocoon.

It appears that infected wheat, when sown, may germinate, but the plumule will be weak and small : the insect, however, still remains in the grain, feeding upon the starchy matter, till it is ready to undergo its changes. These take place while the grain is still in the field, and the mature insects may be found flying about the fields in the night, and are ready in due time to deposit their eggs in the growing grain.

It appears that the angoumois moth not only attacks wheat, but also indian corn. Mr. Richard Owen, of New-Harmony, first called the attention of the public to this fact in a communication to the Cultivator in 1846. In indian corn it attains a rather larger size than in wheat, the wings expanding to about six-tenths of an inch.

The method that has been found most effectual in destroying this grain-worm, consists in exposing the grain to a temperature of 167° Fahr. for twelve hours ; or if the heat is only 104 or 5°, it is sufficient to destroy the worms, provided it be continued for forty-eight hours. Fumigation is another remedy which has been successfully employed. Exposure to cold destroys both the larva and its eggs : if the grain, for example, in New-York and New-England, is housed when it will be exposed to a cold at zero, the insect will be destroyed.

In addition to the foregoing, it is recommended to thresh the grain at an early day ; inasmuch as by that operation the insect is destroyed to a great extent, after which the grain may be preserved in bulk. Grain, however, should not be exposed in open casks when it is liable to become infested : the insect may be excluded by keeping the grain in closed boxes or hogsheads after threshing. Corn in the husk, too, is less exposed to depredation than when husked, especially when it remains standing in the field.

TINEA GRANELLA. *European Grainmoth.*

Forewings marbled with white or gray, light brown and dark brown spots, and one square dark spot near the middle of the outer edge. Hindwings blackish. Head tufted. Length three- to four-tenths of an inch. HARRIS.

Moths appear in May, June and August : they breed twice a year.

The caterpillar of this grainworm, instead of burrowing in the grain like that of the angoumois grainworm, feeds upon the external surface only, and spins a web in which it entangles several grains for that purpose. When the period for transformation arrives, it leaves this web, and seeks a crevice in which to spin its cocoon. Altogether they occupy about six weeks in feeding on the grain, which they soil and otherwise injure by covering it with their webs and excrements.

Such are the characters of the European grainmoth. It appears from the observations of our distinguished entomologist, Dr. A. FITCH of Salem, that he observed many years ago that grain in some of the mills in his neighborhood was affected much in the way described above, only the caterpillar formed its cocoon within its web.

Although the habits of the foregoing grain insects differ somewhat, the remedies that have been successful in destroying one are equally efficacious against the other, to wit : fumigation with carbonic acid ; exposure in close vessels to heat of 130 to 140° Fahr.

ADDITIONS AND CORRECTIONS.

BARBARUS ANNULATUS, Plate vii, fig. 3 (FITCH'S Catalogue).
Antennæ, mandibles, legs, thorax, rudimentary wings, green ; eyes prominent, black ; posterior part of the head, and all the upper parts reddish ; sides greenish : legs long. Inhabits bushes in meadows and borders of woods in September.

CANTHARIS ATRATA, refer to Pl. iv.
CALIMORPHA PARTHENICE, refer to fig. 3.
CREMASTOCHEILUS HENTZII, refer to Pl. xxiv, fig. 2.
CERAMBIX, refer to Pl. xxxiv, fig. 9.
LAMIA, Pl. xxvi, refer to Pl. xxxiv, fig. 8.
LEPTURA, Pl. xxvi, refer to Pl. xxxiv, fig. 11.
PRIONUS LATICOLLIS, refer to Pl. xxxiv.
STENOCORUS CINCTUS, refer to Pl. xxxiv.
SAPERDA TRIDENTATA, refer to Pl. xxxiv, fig. 6.
RHAGIUM LINEATUM, refer to Pl. x, fig. 1.
LEPTURA MALACHITICA, refer to Pl. xxxi, fig. 7.
SAPERDA VESTITA, refer to Pl. xxxiv, fig. 4.
SAPERDA ——, page 122, refer to Pl. xxxiv, fig. 7.
Refer THECLA ACIS to figs. 1 & 3.
Page 232, for Pl. xxiv, refer to Pl. xxxix, fig. 1.
PHRYGANEA FASCIATA, refer to Pl. xxxii, figs. 7 & 9.
Correct GRAMMOPTERA, p. 128, and read TELEPHORUS, Pl. xxxiv, fig. 3.
TELEPHORUS, refer to Pl. xxxiv, fig. 3.
PODABRUS MODESTUS, instead of TELEPHORUS, Pl. xxxiv, fig. 1.
MEGACEPHALA VIRGINICA (Fab.), Pl. xvii, fig. 15.
CLYTUS NOTATUS ? p. 118, Pl. viii, fig. 3.
LYGÆUS TURCICUS, Pl. xxx, fig. 9, *var. α* (FITCH'S Catalogue).
PHYTOCORIS LINEOLARIS, Pl. xxx, fig. 7.
PHYTOCORIS COCCINEUS, Pl. xxx, fig. 2 (FITCH'S Catalogue).

PHYTOCORIS BELLUS, Pl. xxx, fig. 1.

PENTATOMA CARNIFEX, Pl. xxx, fig. 3.

PENTATOMA PENNSYLVANICA, Pl. xxx, fig. 4; young (undetermined), fig. 8.

Page 168, for REDUVIUS, read SINEA STIMULATRIX, Pl. xxix, fig. 8 (FITCH'S Catalogue).

LAPHIRA TERGISSA, Pl. xxviii, fig. 6.

LAPHIRA THORACICA, Pl. xxviii, fig. 5.

LAPHIRA SERICEA, Pl. xxviii, fig. 8.

LAPHIRA (undescribed), Pl. xxix, fig. 3.

SYRPHUS PHILADELPHICUS, Pl. xxviii, fig. 1.

SYRPHUS? Pl. xxix, fig. 6.

CTENOPHORA TRIMACULATA, Pl. xxix, fig. 5 (FITCH'S Catalogue).

For GRILLUS, substitute ORCHELLIMUM GRACILE (Harris), Pl. ix, fig. 1 (female).

Color green shaded with brown, especially on the back and wings; wing-covers and legs green, faintly tinged with brown; ovipositor brown, and cimetar-shaped: ¾ inch in length. This grasshopper is common in meadows in August.

LEPTIS ORNATA? Pl. xxix, fig. 1.

LEPTIS QUADRATA? Pl. xxix, fig. 4.

LEPTIS (undescribed], Pl. xxix, fig. 10.

Page 195, for VESPA FRATERNA (Pl. xxvi, fig. 6), read POLISTES ANNULARIS.

VESPA, Pl. xxvi, fig. 8.

Plate x, fig. 5, appears to be closely allied to the Genus SINODENDRON? (Fab.). Antennæ 10-jointed, shorter than the thorax; second short: club 3-jointed. It agrees better with the Genus SINODENDRON, than with either of the genera of the LUCANIDÆ. Referred in the description of the plate, erroneously, to the Genus SCARITES. The specimen from which the drawing was made is lost; but the insect is very common, especially south, in decaying wood and trees.

ARCTIA AMERICANA. *Great American Tiger-moth.*

MALE. Back of the antennæ white, tipped with brown; pectina brown. Head and thorax brown, covered with long hairs : front, at the base of the hairs, ornamented with a white band, surmounted with a crest of hairs trimmed with crimson, and which extends around the thoracic part. Forewings buff-brown : base of the wings marked with white branching spots, which resemble somewhat a cross : wing beyond the middle also marked with a white irregular cross something like an X, extending entirely across the wing, except to that portion which is directed towards the apex : anterior margin has two white spots, a large and a small, between the two crosses : inner margin has an oblong patch of brown parallel with its edge. Hindwings orange, marked with three round blue-black spots; between them is a lunule : on the under side, the margin has two brown patches. Abdomen orange, marked in the middle with four transverse lines; beneath brown, except at the extremity. Thighs crimson; legs brown.

In the female the markings resemble the male, but the white is more conspicuous.

Expanse of wing of the female, 2½ inches.

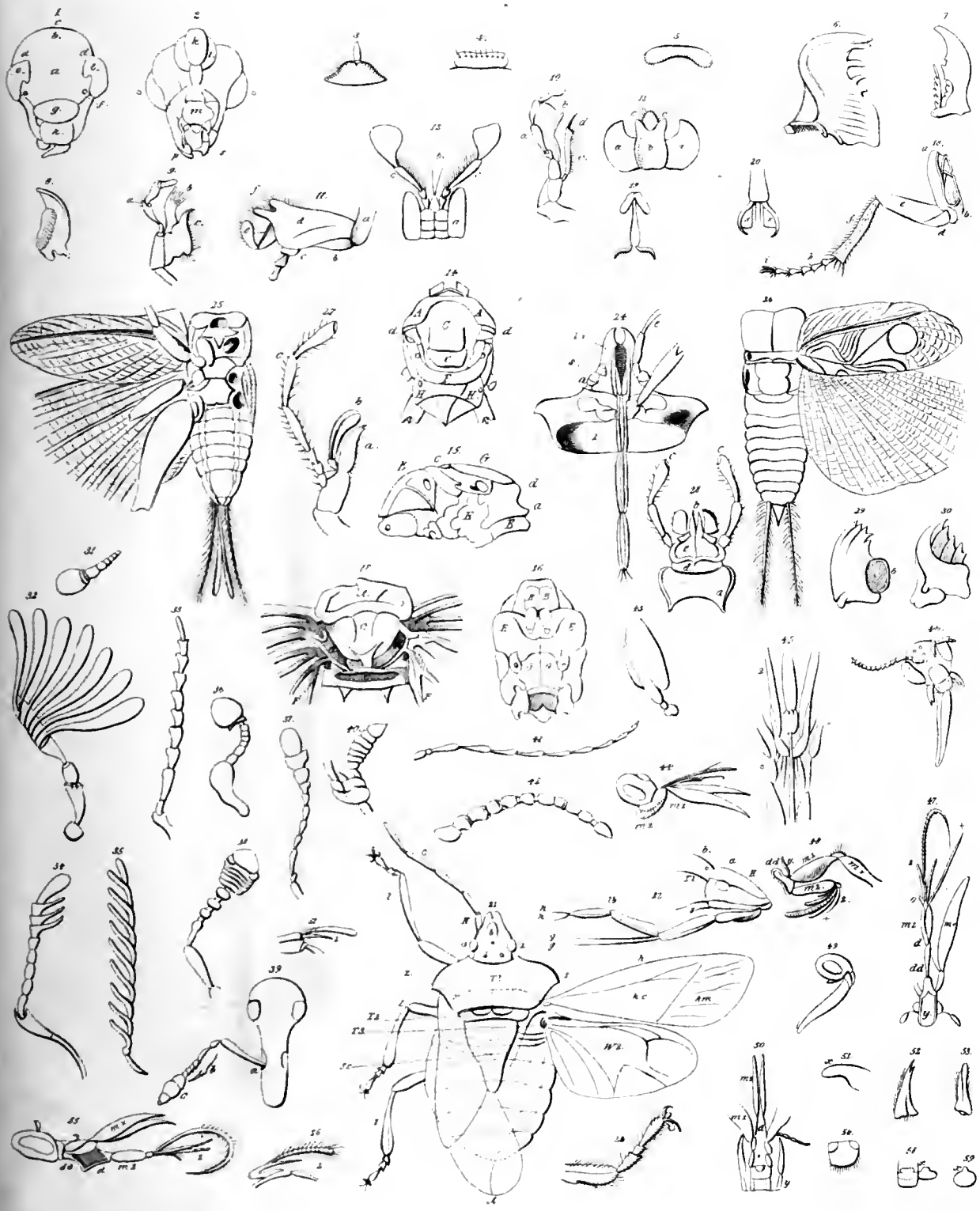
Captured near Albany.

This moth closely resembles the English *Caja*, or *Great Tiger-moth*. It is rare in New-York, or rather but few have been taken to my knowledge. Dr. HARRIS received a specimen from Trenton-falls, of which he has given a description in his Treatise on Insects, p. 267, 1852. It is easily distinguished from all our moths by its peculiar markings.

INDEX OF SPECIES.

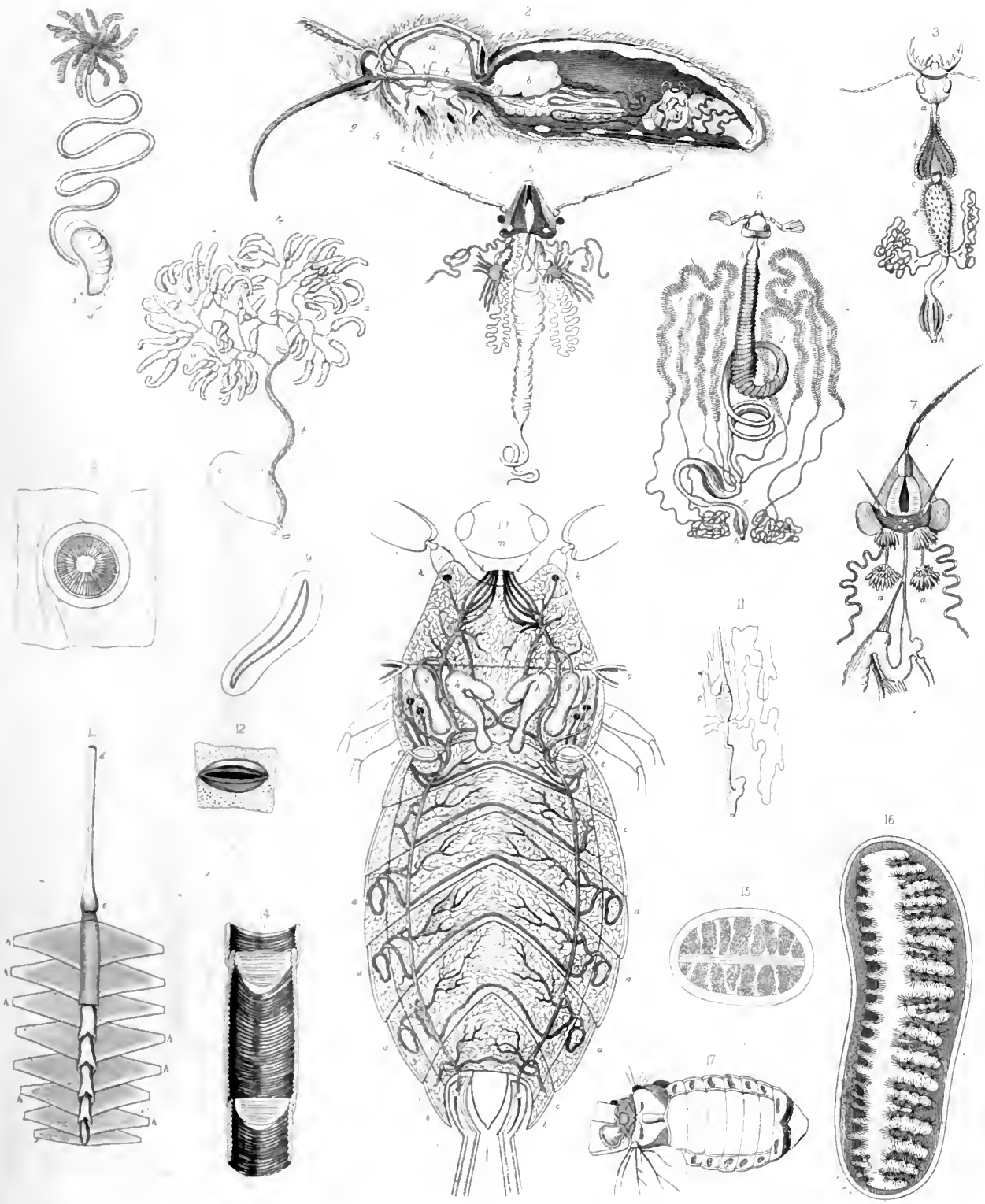
ENGLISH INDEX.

INDEX OF ANGLICISED NAMES.



E. Emmons Jr. Del.

Lith. of Richd H. Pease



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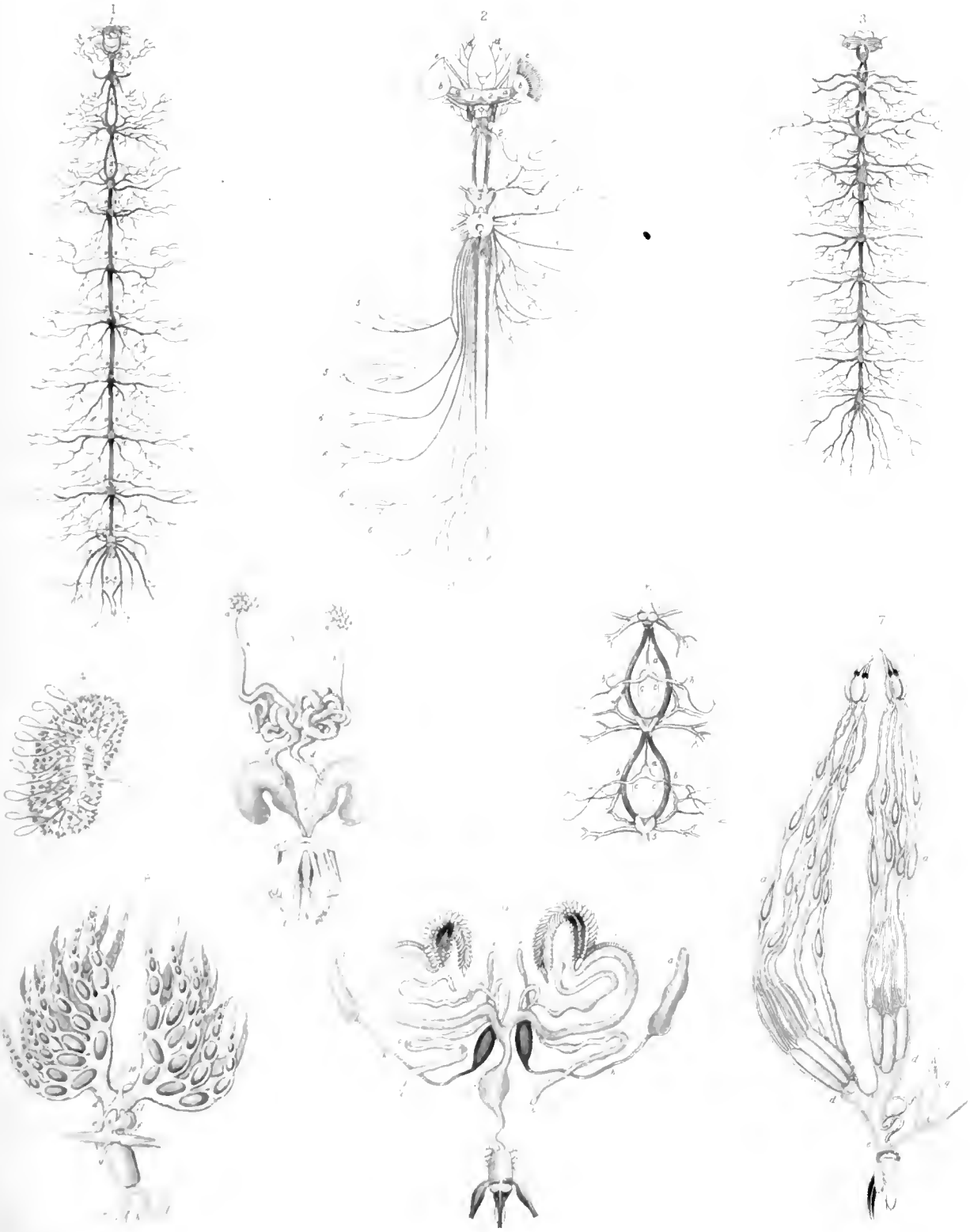
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PLATE 1.

Fig. 1. PIMPLA LUNATOR (male).

2. Female perforating the trunk of a tree.

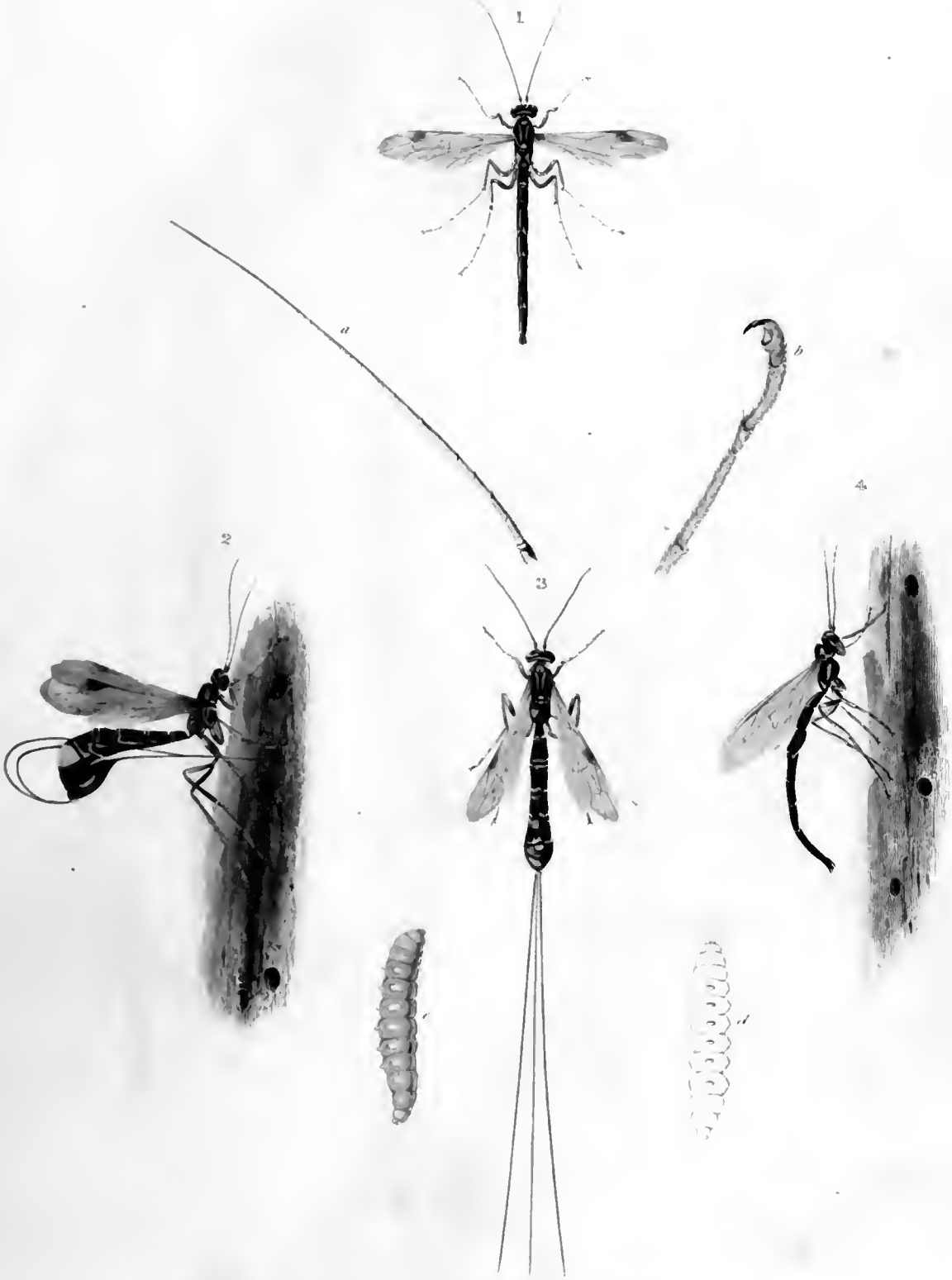
3. Female at rest.

4. Male at rest.

a. Antennæ magnified.

b. Tarsi magnified.

c, d. Larvæ, natural size.



1–4. PIMPLA, lunator (male) 2 3, PIMPLA, lunator (female)

a. Antenna, mag.ᵗ b. Tarsi, mag.ᵗ c.d. Larvæ, nat.

Drawn by F. Bowman Jr.

Published & Pr. by Hodges Smith & Co. Dublin.

PLATE 2.

Fig. 1. CALANDRA GRANARIA.

2, 2 *a*, 2 *b*, 2 *c*. SYLVANUS SURINAMENSIS.

3, 3 *a*, 3 *b*, 3 *c*. BRUCHUS PISI.

4, 4 *a*. BRENTHUS SEPTENTRIONALIS (male and female).

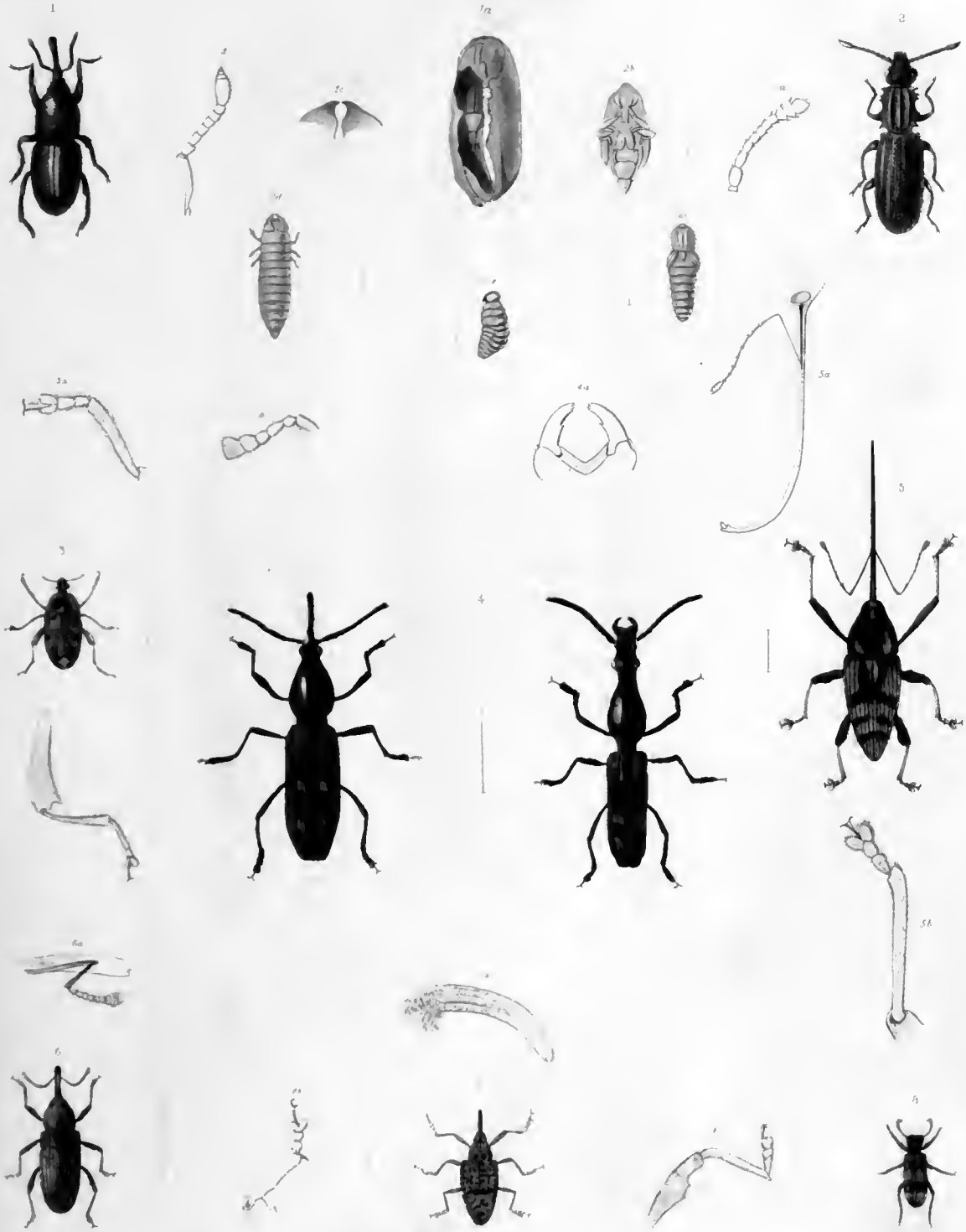
5, 5 *a*, 5 *b*. BALANINUS RECTUS.

6, 6 *a*, 6 *b*. HYLOBIUS PALES.

7, 7 *a*, 7 *b*. CONOTRACHELUS NENUPHAR.

8. CLERUS APIARIUS.

Pl. 2.



1 [illegible] Blondia granaria

2 [illegible] Eleanus [illegible]

[illegible]

PLATE 3.

Fig. 1. Telemona turriculata.
2. Telemona cratægi.
3. Telemona unicolor.
4. Telemona querci.
5. Telemona acclivata.
6. Telemona coryli.
7. Telemona reclivata.
8. Telemona ornata.
9. Telemona ampelopsidis.
10. Telemona fagi.
11. Smilia guttata.
12. Smilia auriculata.
13. Smilia viridis.
14. Smilia vittata.
15. Thelia bimaculata.
16. Ceresa diceros.
17. Ceresa bubalus.

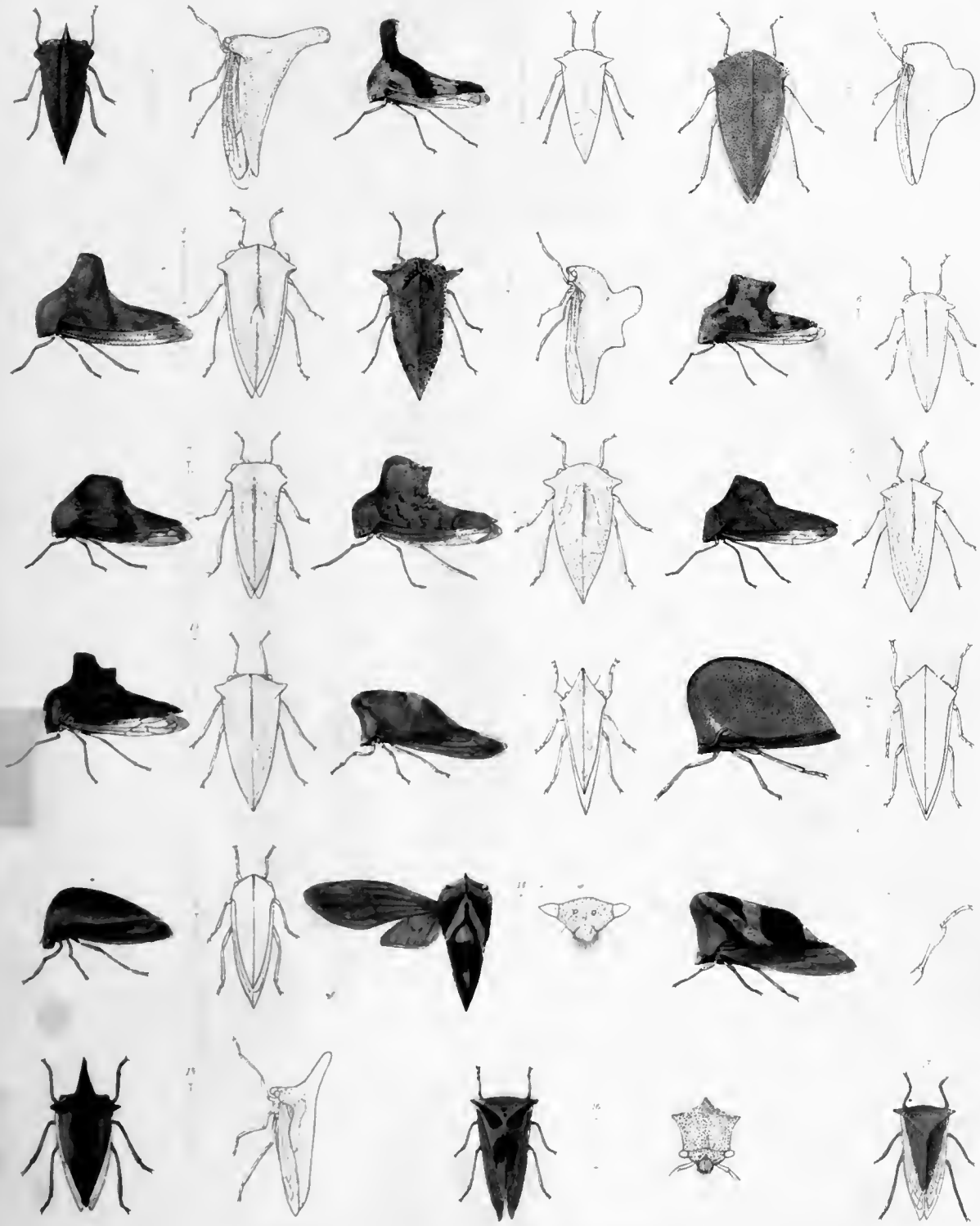


Fig. 1. Telamonia turrentulata
2. [illegible]
3. [illegible]
4. [illegible]

Fig. 5. Telamonia [illegible]
6. [illegible]
7. [illegible]
8. [illegible]

Fig. 9. Telamonia [illegible]
10. [illegible]
[illegible]
[illegible]
[illegible]

PLATE 4.

Figs. 1 & 2. *Geoponera* [illegible] female and [illegible].

a. Segments of the abdomen.

b. c. *Antennæ magnified.*

d. The same, lateral view.

e. Profile view of the head, palpi, and origin of the [illegible].

f. Dorsal view of the [illegible].

g. Of the thoracic [illegible].

h. Ventral view of the [illegible].

i. Tarsal claw.

k. Dorsal view of the [illegible] leg.

l. Ventral view of the [illegible].

m. Mandible [illegible] with the [illegible].

n. Mandible [illegible], showing the [illegible].

3. *Dorylus* [illegible] (Type [illegible]). 4. Male.

5. Larva. 6. Wing.

PLATE 4.

Figs. 1 & 2. CECIDOMYIA DESTRUCTOR (male and female).

a. Segments of the abdomen.

b, c. Antennæ magnified.

d, e. The same, natural size.

f. Profile view of the head, palpi, and origin of the antennæ.

g. Dorsal view of the worm.

h. Of the flaxseed state.

i. Ventral view of the same.

j. Lateral ditto.

k. Dorsal view of the dormant larva.

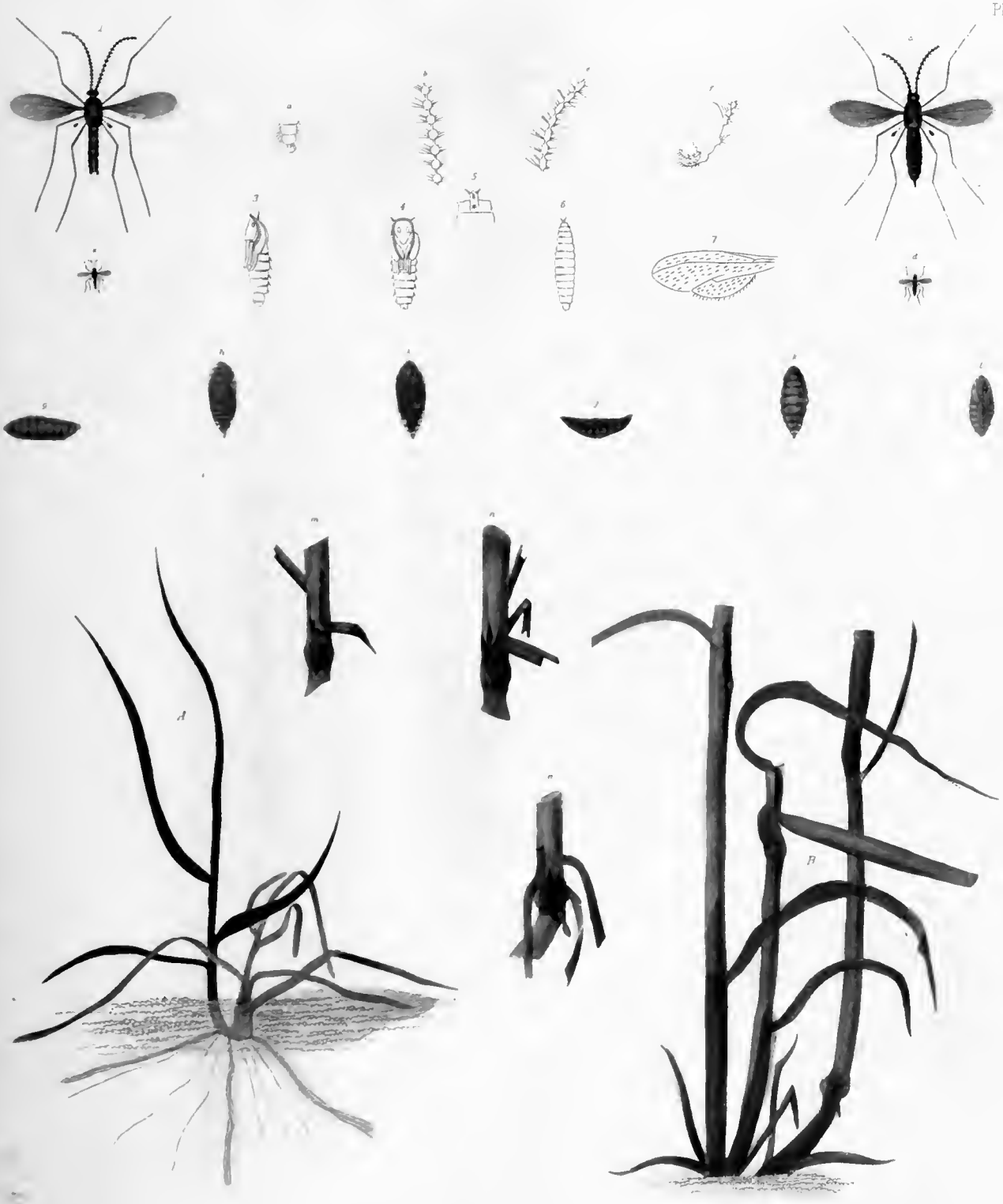
l. Ventral view of the pupa.

A, B. Wheatstalks infested with the insect.

m. Wheatstalk broken away, showing the young worms.

3, 4. CECIDOMYIA ROBINIA (pupa enlarged). 5. Mouth.

6. Larva. 7. Wing.



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Engd. H. Penzi

1 Cecidomyia destructor (male)
2 (female)
3 4 Cecidomyia vastatrix (pupa)
5 Head and mouth
6 larva
7 wing

PLATE 5.

Fig. 1. BUPRESTIS FASCIATA.

a. Antennæ magnified.

b. Tarsi magnified.

2. BUPRESTIS DENTIPES.

3. BUPRESTIS FEMORATA.

4. BUPRESTIS DIVARICATA.

5. BUPRESTIS VIRGINICUS.

6. ALAUS OCULATUS.

7. ELATER ?

8. BUPRESTIS.

9. ELATER GLANDICOLOR.

10. DYTICUS HARRISII.

k. Anterior tarsus, showing the sucking disks.

11. TETRAOPES TETROPHTHALMA.

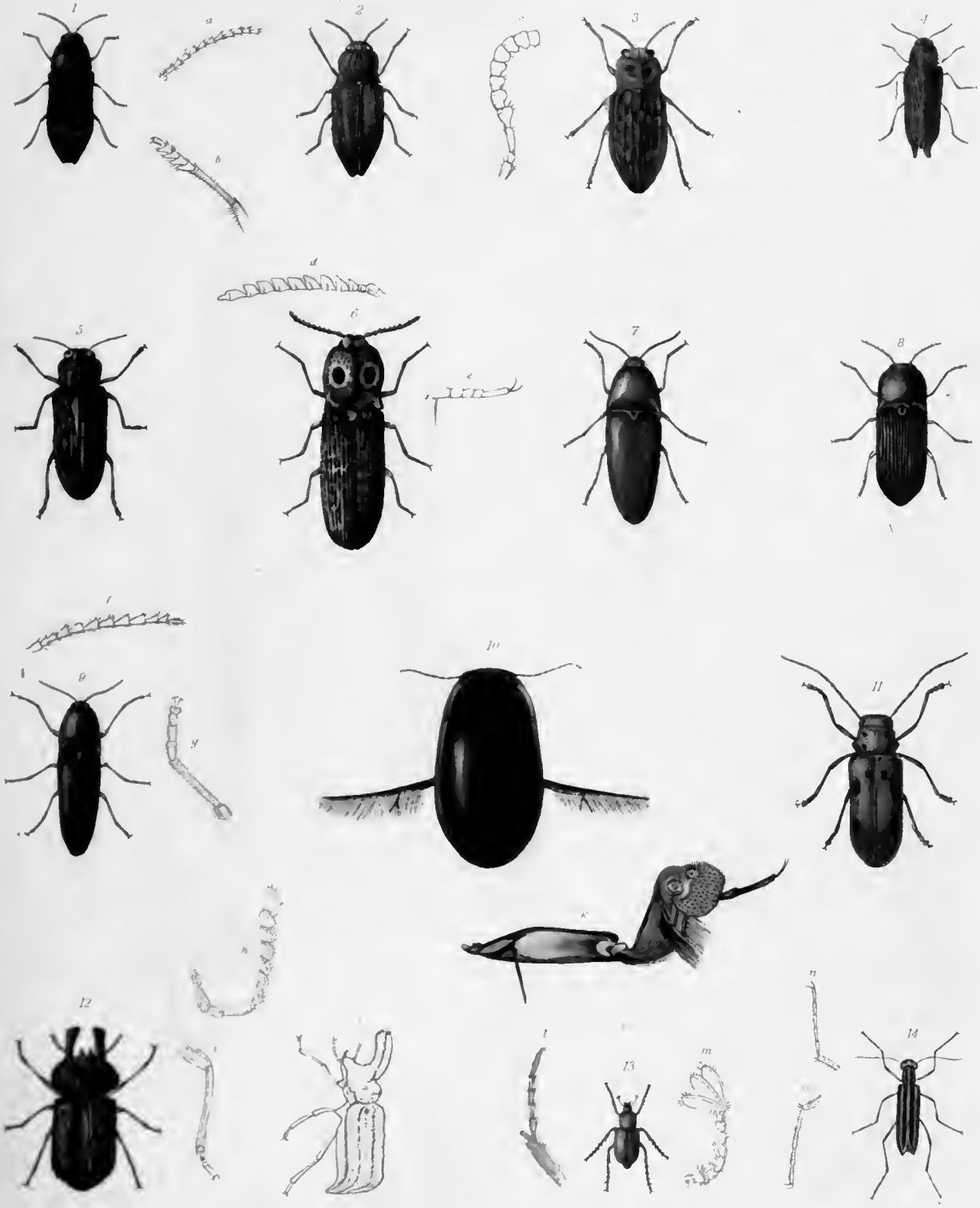
12. BOLETOPHAGUS CORNUTUS (male).

13. MACRODACTYLUS SUBSPINOSA (rosebug).

m. Antennæ.

l. Tarsus magnified.

14. EPICAUTA VITTATA.



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Rich.d H. Pease

PLATE 6.

Figs. 1 & 2. ATTACUS PROMETHEUS (male and female).

3. Larva.

4. Cocoons.

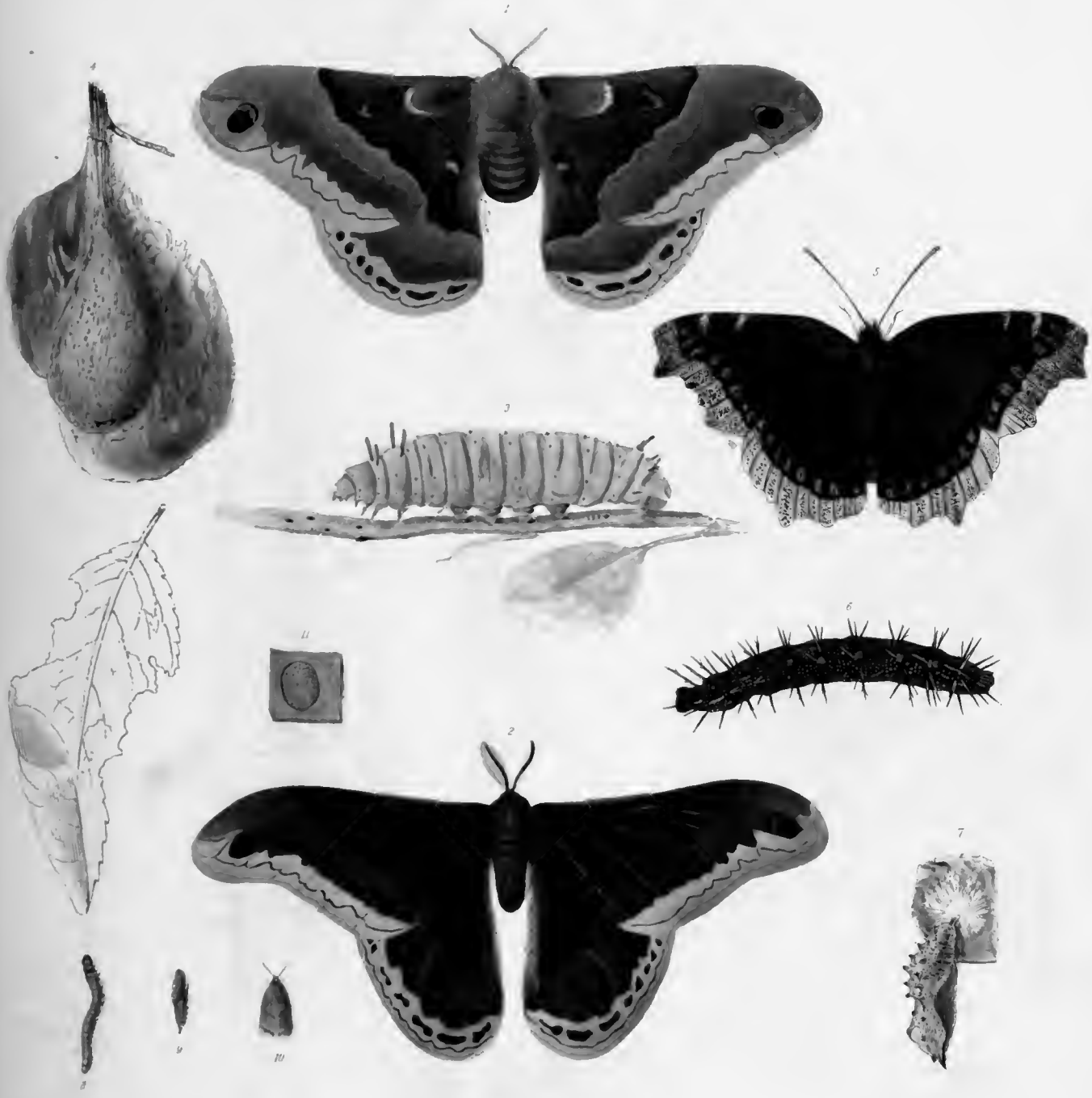
5. VANESSA ANTIOPEA.

6. Larva.

7. Pupa.

8, 9, 10. LOXOTÆNIA ROSACEANA (*the leafroller*), in the perfect, pupa and larval states.

11. Eggs deposited upon bark.



Richd H Pease

PLATE 5.

Fig. 1. *Gonyaulax polyedra*. × 1000.

2. *Peridinium* — —

3. *Hemicyclia* × 1000.

4. *Ceratium macroceros* (male and female).

5. Caudal appendages of the male.

6. Shell of the female.

PLATE 7.

Fig. 1. Coreus tristis. *a.* Proboscis.

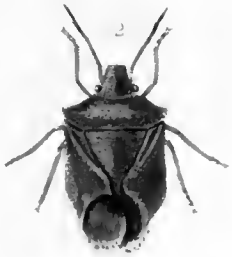
2. Pentamona ——.

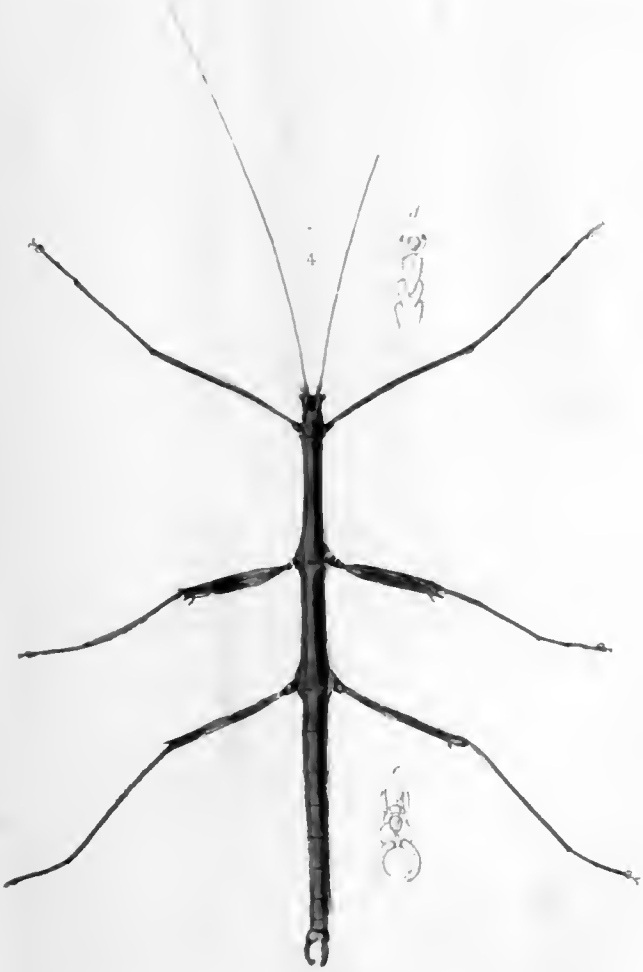
3. Reduvius? *b.* Proboscis. *c.* Tarsi.

4, 5. Spectrum femoratum (male and female).

e. Caudal appendages of the male.

f. Ditto of the female.





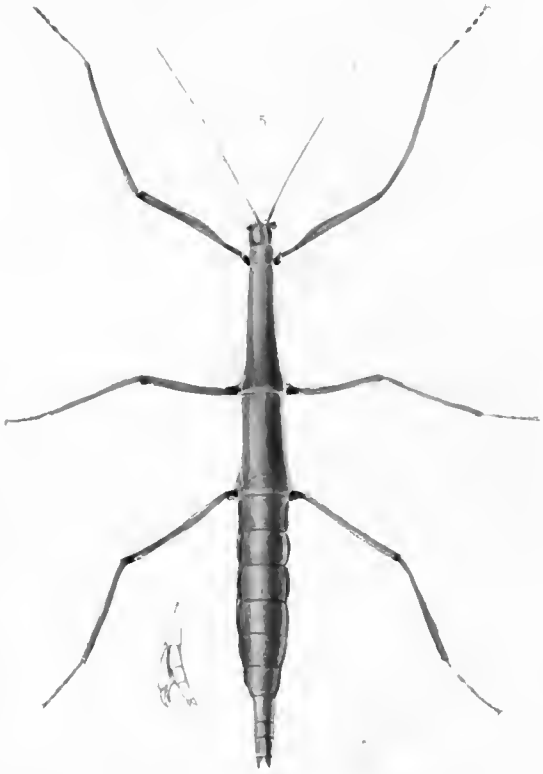


PLATE 3.

Fig. 1. Cicuta maculata.
2. Cicuta bulbifera.
3. Cicuta?
4. Cicuta bulbifera.
5. Cicuta ——.
6. Cicuta?
7. Cicuta maculata.
8. Tragoselinum prolixum.
9. Selinum?
10. Lactuca hirsuta.
11. Lactuca canadensis.
12. Pachyrrhizus erosus.
13. Lactuca pilosa.

PLATE 8.

Fig. 1. Clytus colonus?
2. Clytus nobilis.
3. Clytus?
4. Clytus undatus.
5. Clytus ——.
6. Clytus?
7. Clytus hamatus.
8. Thanasimus dubius.
9. Elaphidion?
10. Leptura rubrica.
11. Leptura subpubescens.
12. Pachyta cordifera.
13. Leptura vittata.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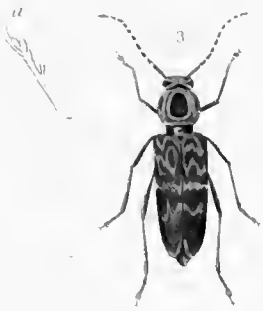
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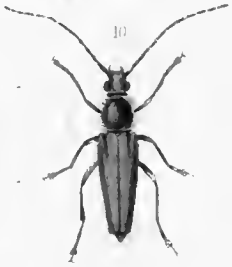
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PLATE 9.

Fig. 1. GRYLLUS ——? (female).
2. PHANEROPTERA ANGUSTIFOLIUM.
3. CICADA SEPTENDECIM.
4. ACRYDIUM FEMORRUBRUM.
5. CICADA CANICULARIS.
6. CICADA NOVEBORACENSIS.
7. LOCUSTA NEBULOSA?
8. PLATYPHYLLUM CONCAVUM.
9. LOCUSTA CAROLINA.

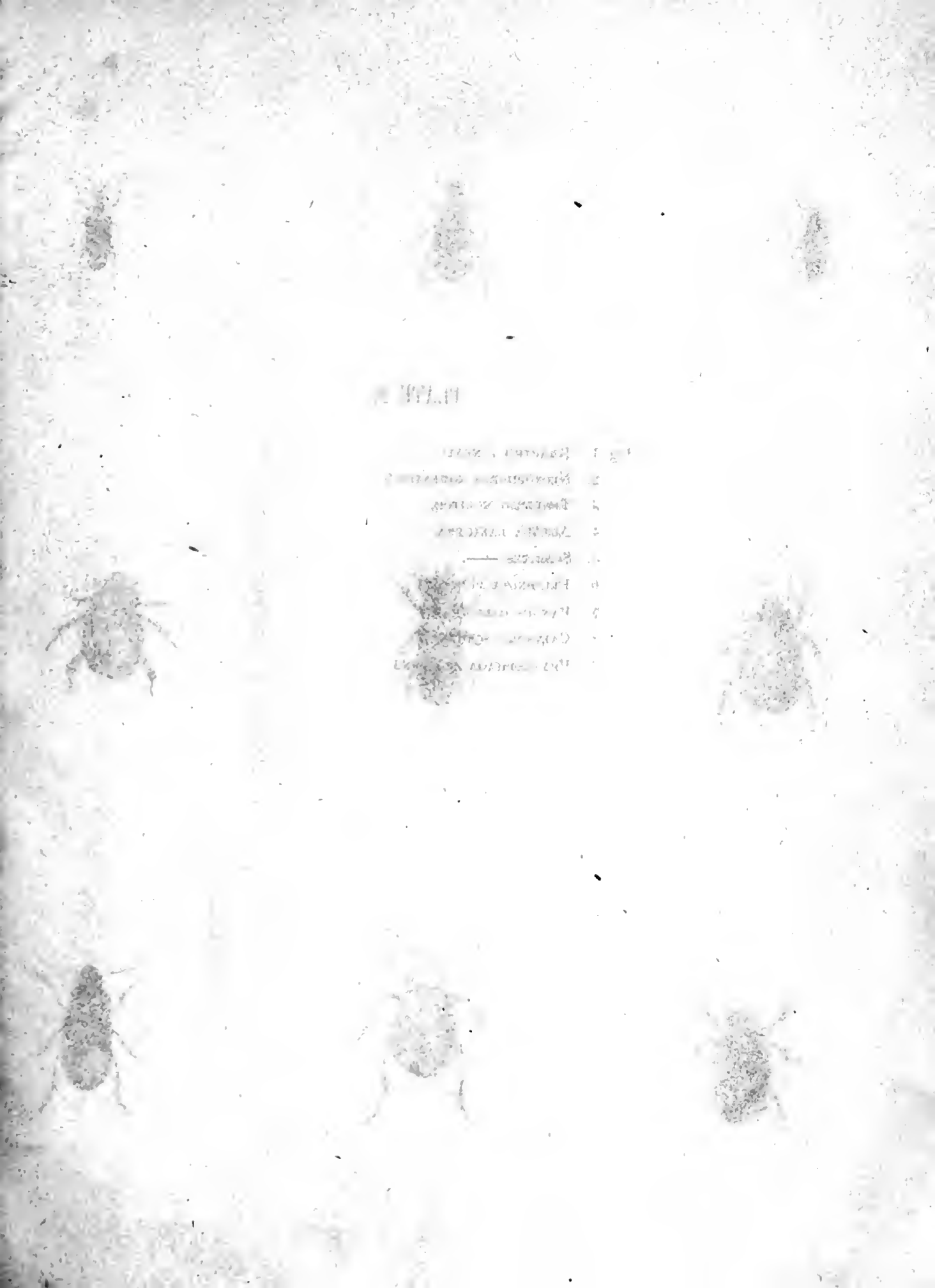

PLATE 10.

Fig. 1. Rhagium lineatum.
2. Necrophorus tomentosus.
3. Tenebrio molitor.
4. Areoda lanigera.
5. Scarites ——.
6. Pelidnota punctata.
7. Pangus caliginosus.
8. Calosoma scrutator.
9. Phyllophaga quercina.

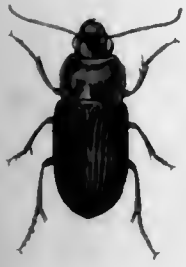

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PLATE II.

Fig. 1. Coccinella 10-maculata.
a. Imago magnified.
b. Pupa magnified.
c, d. Larva and pupa.

2. Coccinella ——.

3. Coccinella 12-notata.

4. Coccinella 20-maculata.

5. Coccinella 5-bimata.

6. Coccinella 9-notata.

7. Coccinella 13-punctata.

8. Coccinella borealis.

9. Coccinella 14-maculata.

10. Coccinella 11-maculata.

11. Coccinella 11-maculata.

PLATE 11.

Fig. 1. COCCINELLA 10-MACULATA.
a. Antennæ magnified.
b. Tarsus magnified.
c, d. Larva and pupa.

2. COCCINELLA ——.

3. COCCINELLA 12-NOTATA.

4. COCCINELLA 20-MACULATA.

5. COCCINELLA 5-SIGNATA.

6. COCCINELLA 9-NOTATA.

7. COCCINELLA INCARNATA.

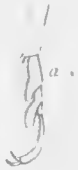
8. COCCINELLA BOREALIS.

9. COCCINELLA IMMACULATA.

10. COCCINELLA BIMACULATA.

11. COCCINELLA BINOCULATA.


b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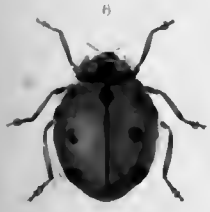
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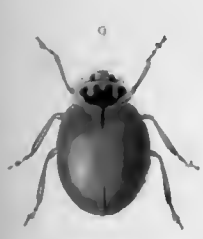
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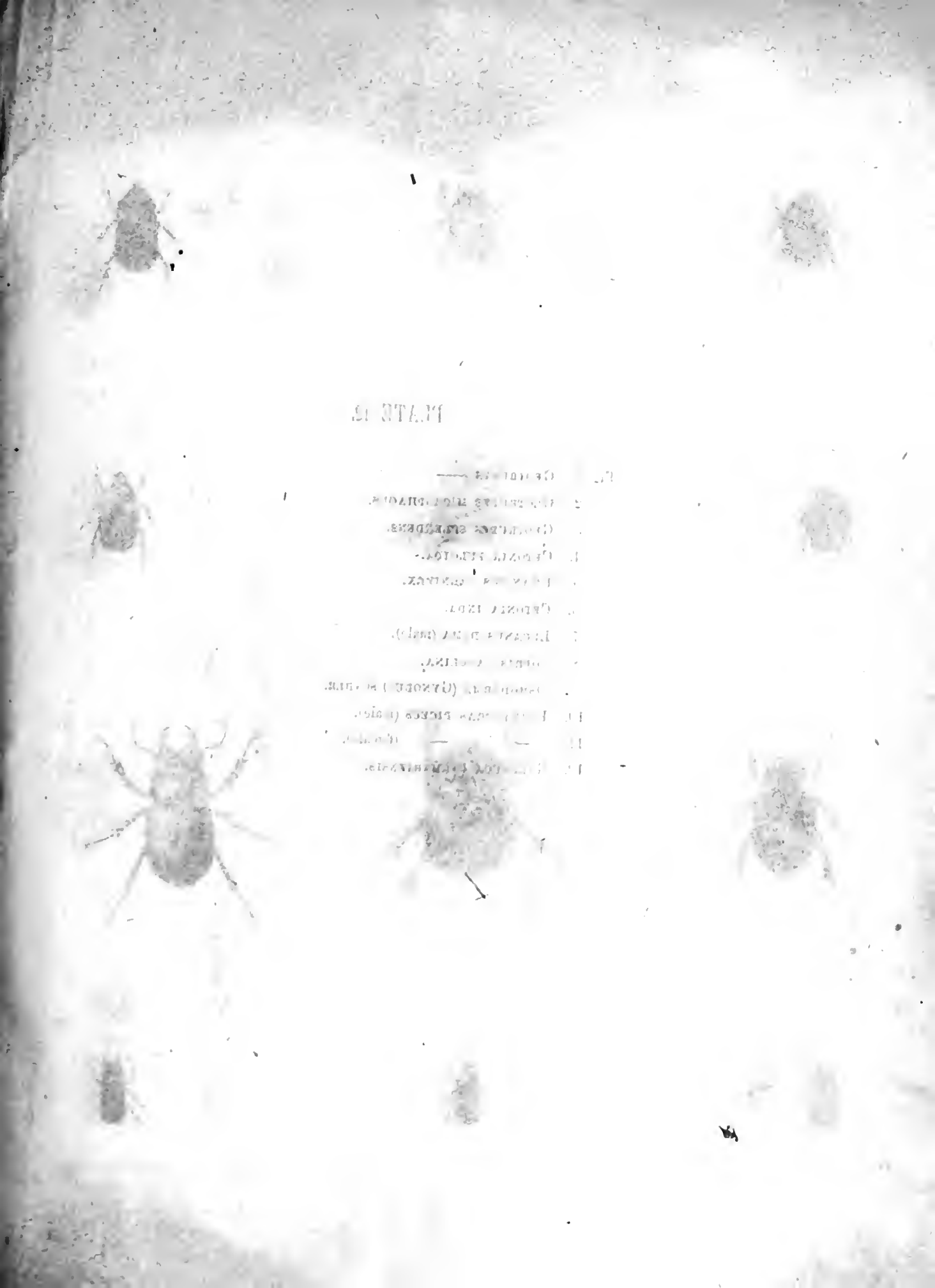

PLATE 12.

Fig. 1. GEOTRUPES ——.
2. GEOTRUPES MICROPHAGUS.
3. GEOTRUPES SPLENDENS.
4. CETONIA FULGIDA.
5. PHANÆUS CARNIFEX.
6. CETONIA INDA.
7. LUCANUS DAMA (male).
8. COPRIS CAROLINA.
9. OSMODERMA (GYNODUS) SCABER.
10. PLATYCERAS PICEUS (male).
11. — — (female).
12. GALERUCA CALMARIENSIS.

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Richd H. Pease

PLATE IX.

Fig. 1. Sphinx ——.

2. Sphinx ——.

3. Gardena perspicua.

4. Gardena dorothalis.

5. Gardena sinuosicornis.

6. Gardena maya.

7. Gardena palliderufotria.

8. Gardena quinta.

9. Gardena inexacta.

10. Nytiga lactata.

11. Nytiga signata.

12. Gardena pectoralis.

13. Nytiga maculata.

14. Cyrtosia sucata.

15. Cyrtosia pulchrinalis.

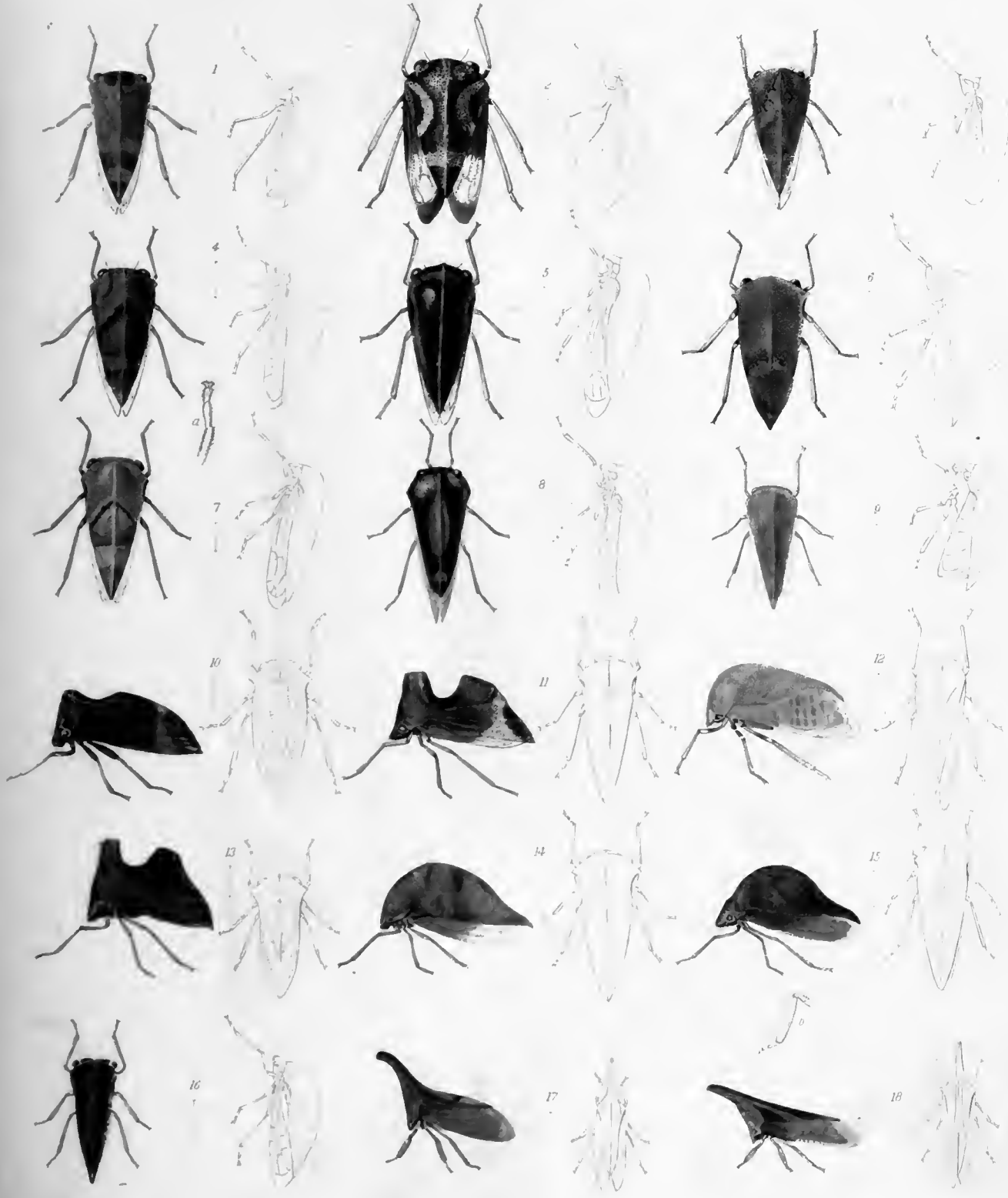
16. Cyrtosia intermedia.

17. Nycteoliteles minuta.

18. Nycteoliteles latipes.

PLATE 13.

Fig. 1. SMILIA ——.
2. SMILIA ——.
3. GARGARA PUBESCENS.
4. GARGARA DISCOIDALIS.
5. GARGARA NIGRICEPHALA.
6. GARGARA MAJUS.
7. GARGARA PALLIDIFRONTIS.
8. GARGARA QUERCI.
9. GARGARA INERMIS.
10. ENTILIA CONCAVA.
11. ENTILIA SINUATA.
12. GARGARA PECTORALIS.
13. ENTILIA EMARGINATA.
14. CYRTOSIA ARCUATA.
15. CYRTOSIA FULIGINOSA.
16. CYRTOSIA INTERMEDIA.
17. ENCHOPHYLLUM BINOTATA.
18. ENCHOPHYLLUM LATIPES.



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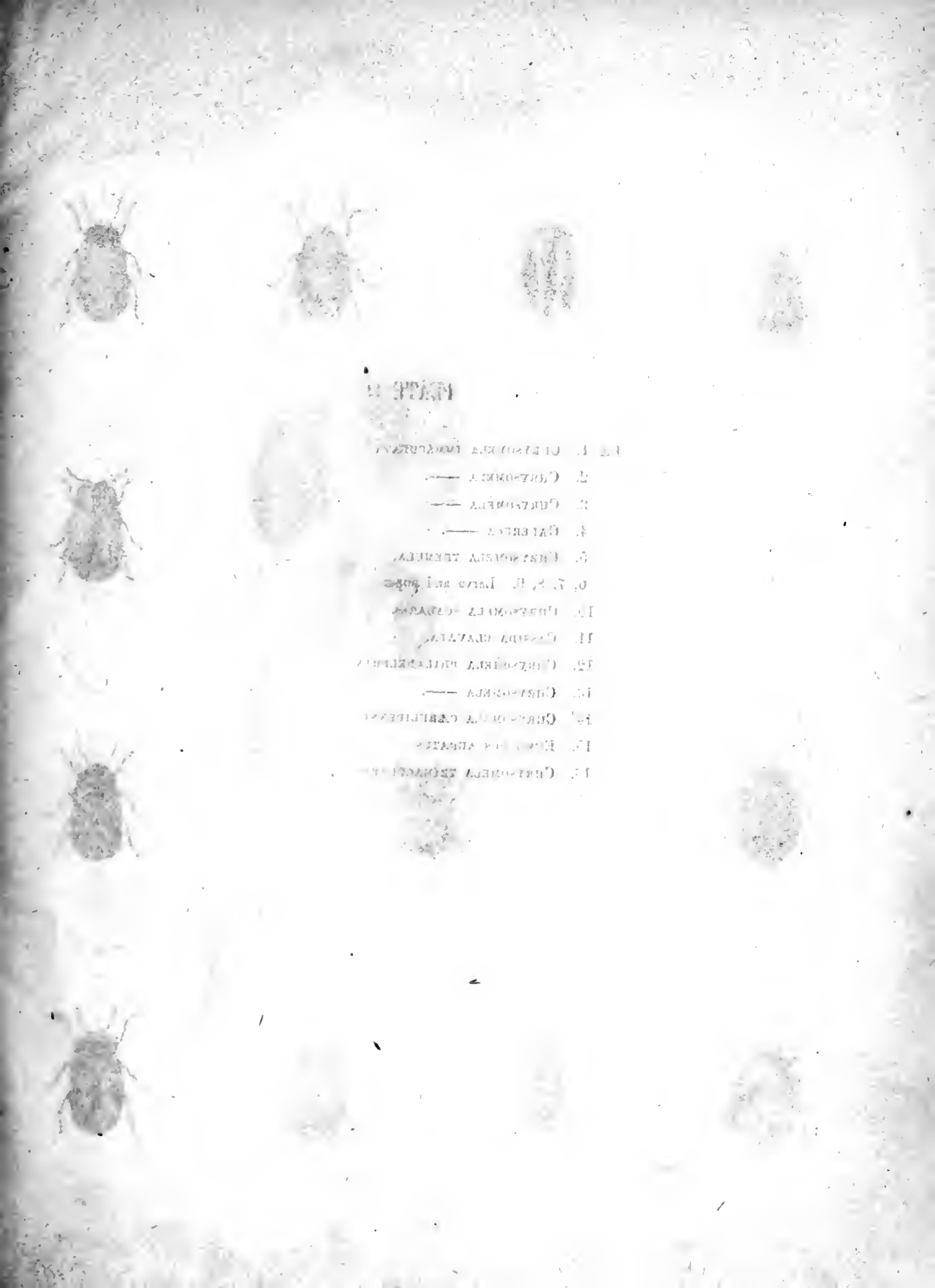

PLATE 14.

Fig. 1. CHRYSOMELA IMMACULATA?

2. CHRYSOMELA ——.

3. CHRYSOMELA ——.

4. GALERUCA ——.

5. CHRYSOMELA TREMULA.

6, 7, 8, 9. Larva and pupa.

10. CHRYSOMELA SCALARIS.

11. CASSIDA CLAVATA.

12. CHRYSOMELA PHILADELPHIA.

13. CHRYSOMELA ——.

14. CHRYSOMELA CÆRULIPENNIS.

15. EUMOLPUS AURATUS.

16. CHRYSOMELA TRIMACULARIS.


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PLATE 15.

Fig. 1. LIBELLULA?

2. LIBELLULA?

3. ÆSHNA ——.

4. LIBELLULA, *var.?* PULCHELLA.

5. LIBELLULA PULCHELLA. *f.* Larva.

E. Burnham Jr Del

Richd H. Pease

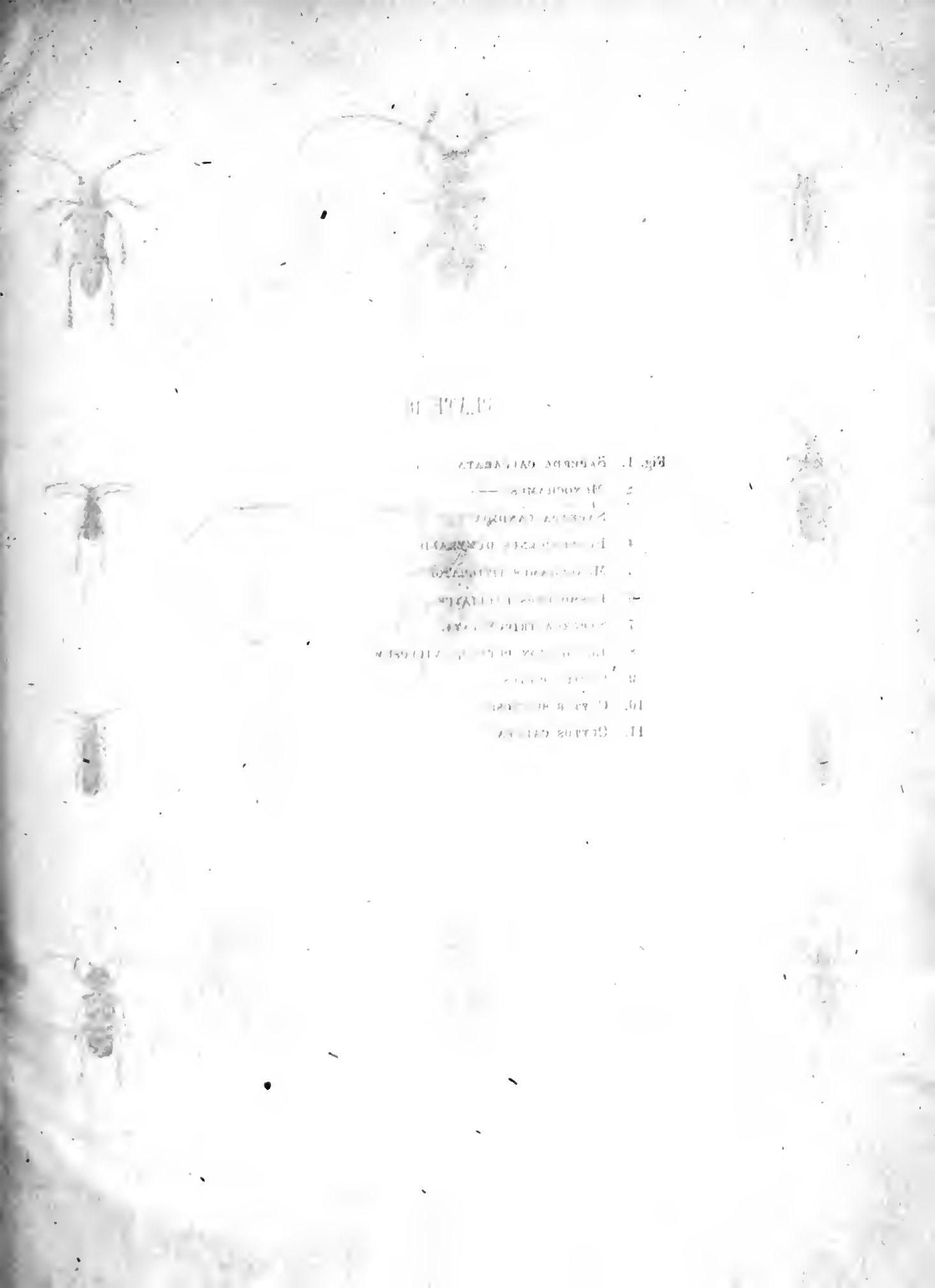
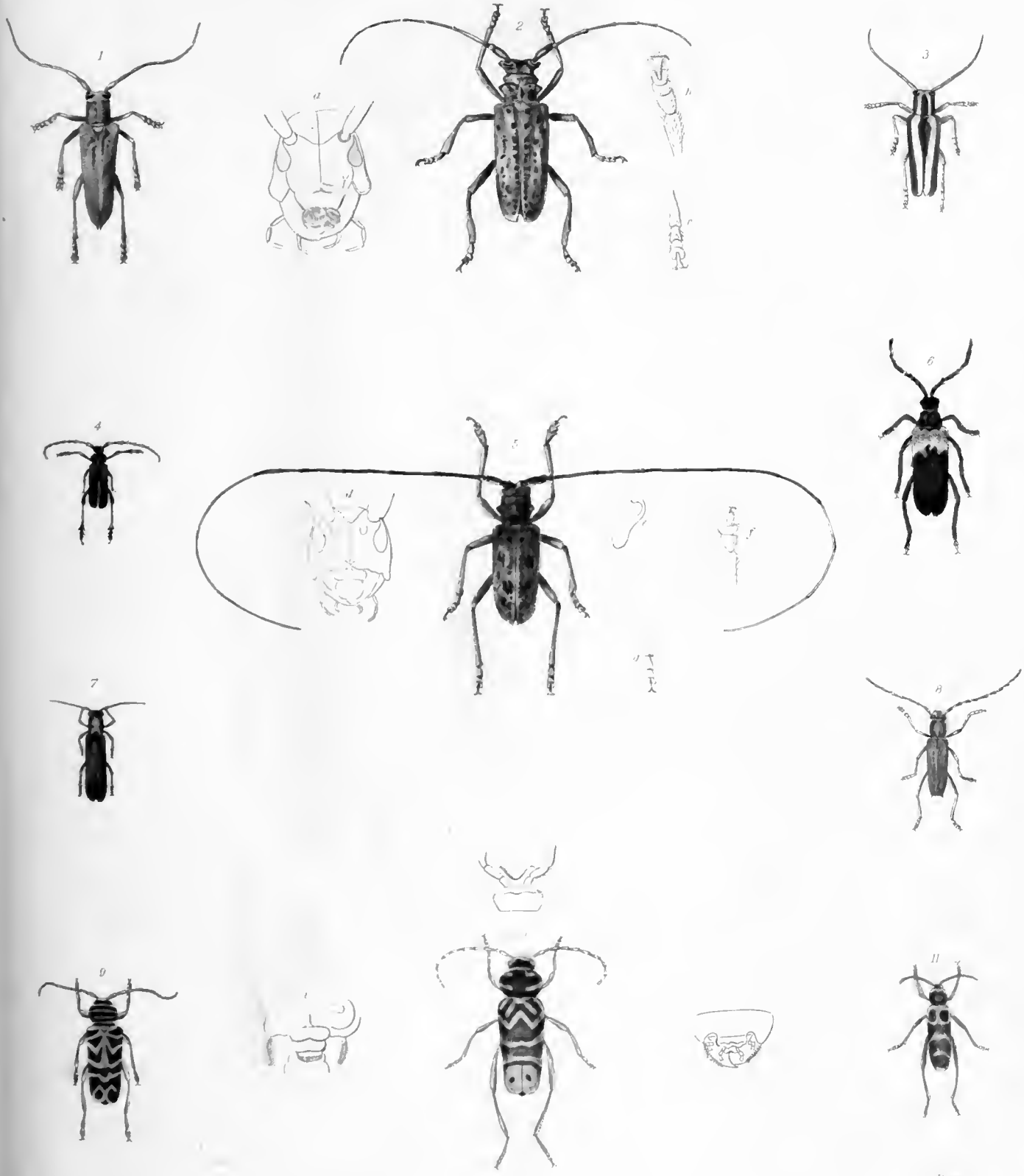


PLATE 16.

Fig. 1. Saperda calcarata.
2. Monochamus ——.
3. Saperda candida.
4. Purpuricenus humeralis.
5. Monochamus titillator.
6. Desmocerus palliatus.
7. Saperda tripunctata.
8. Elaphidion putator (villosum).
9. Clytus pictus.
10. Clytus speciosus.
11. Clytus caprea.



F. Emmerich lit. Del.

Pl. 10

PLATE 17.

Fig. 1. CICINDELA ALBOHIRTA.

2. CICINDELA GENEROSA.

3. CICINDELA 12-GUTTATA.

4. CICINDELA PATRUELA.

5. CICINDELA HÆMORRHOIDALIS.

6. CICINDELA CAMPESTRIS.

7. CICINDELA GUTTATA.

8. Mouth and appendages of *C. campestris*.

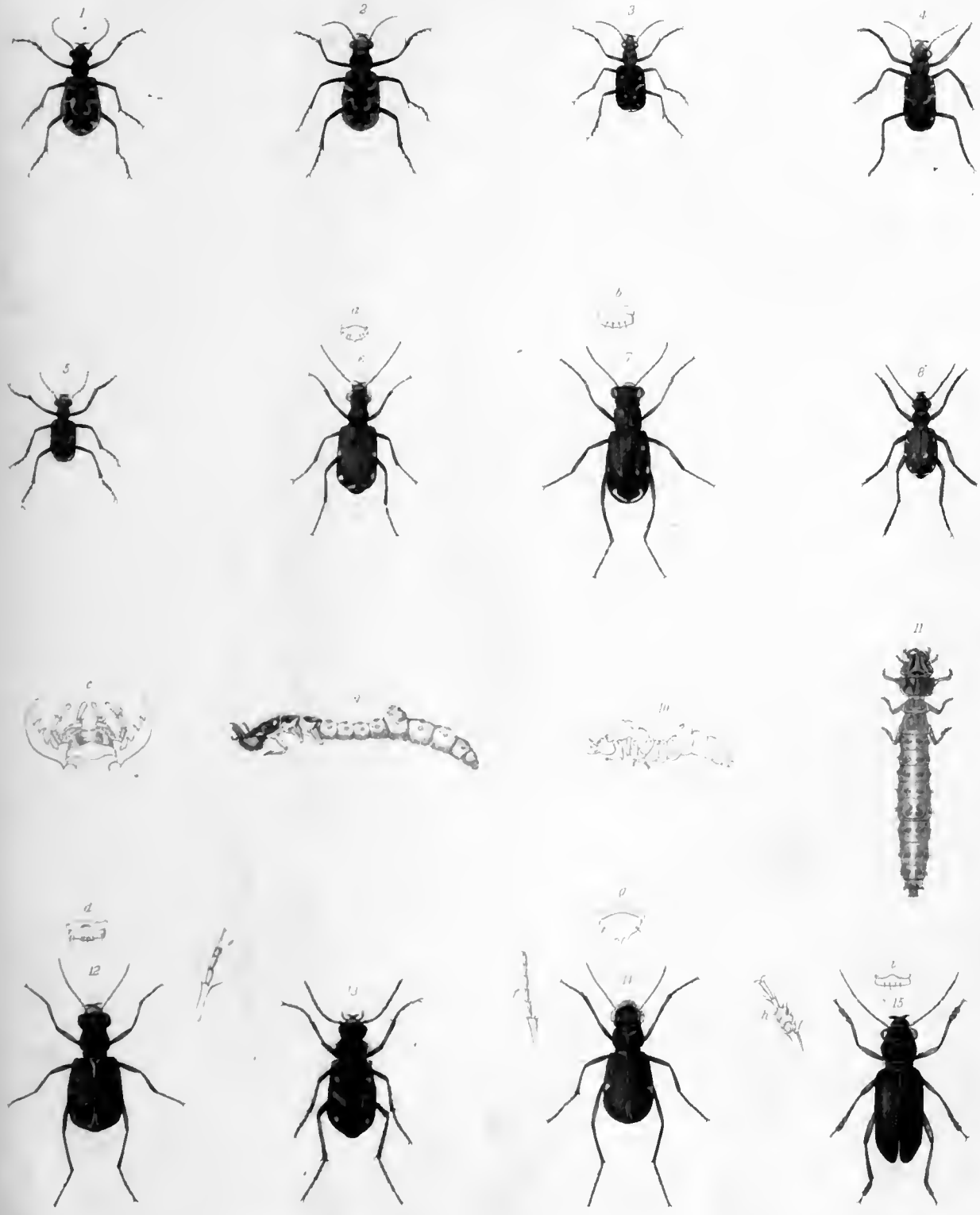
9, 10, 11. Larva and pupa of ditto (European).

12. CICINDELA VULGARIS.

13. CICINDELA ALBILABRIS.

14. CICINDELA ——.

15. CICINDELA ? (Maryland).

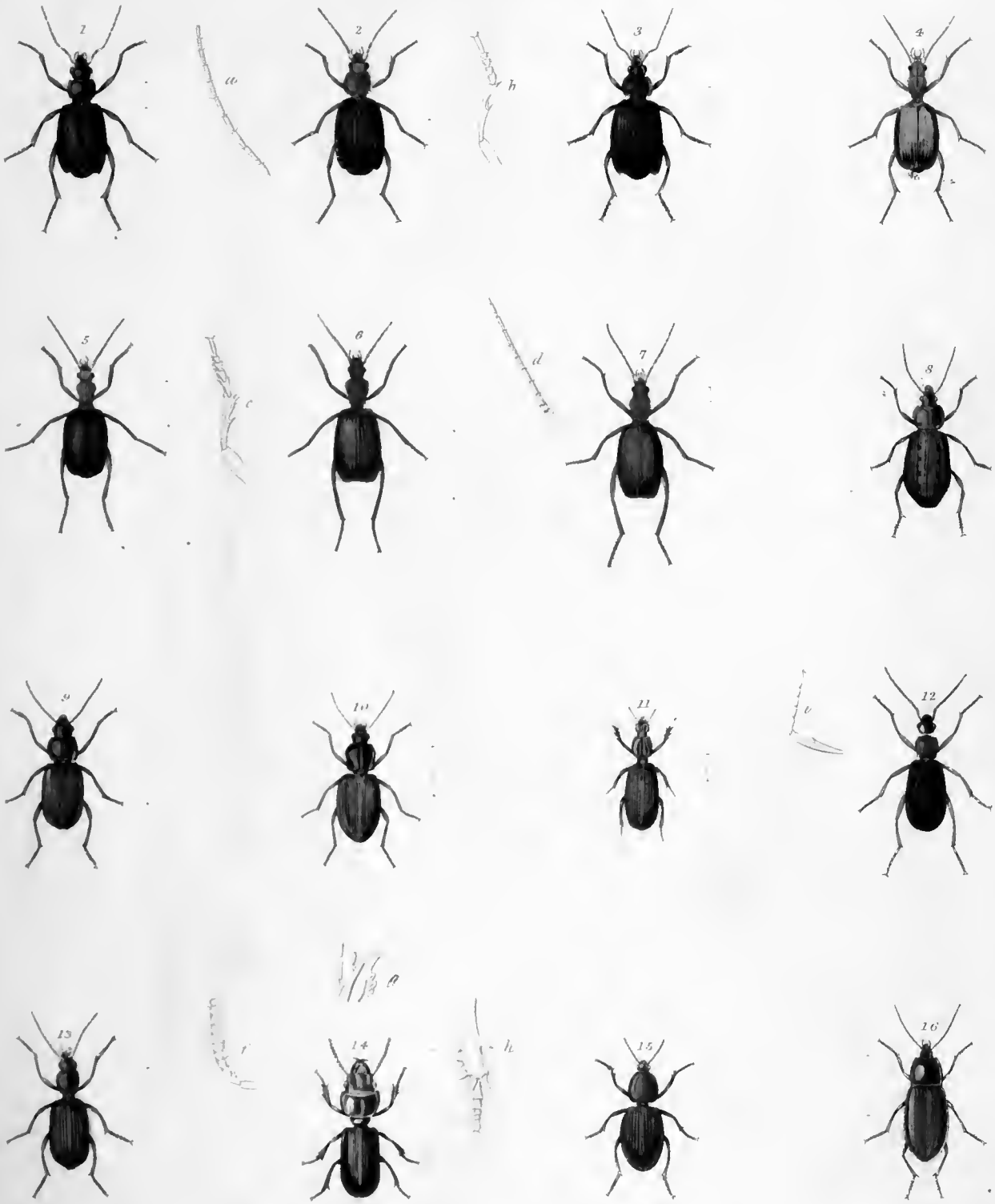


Emmons dr. Del.

Schell Prog.

PLATE 18.

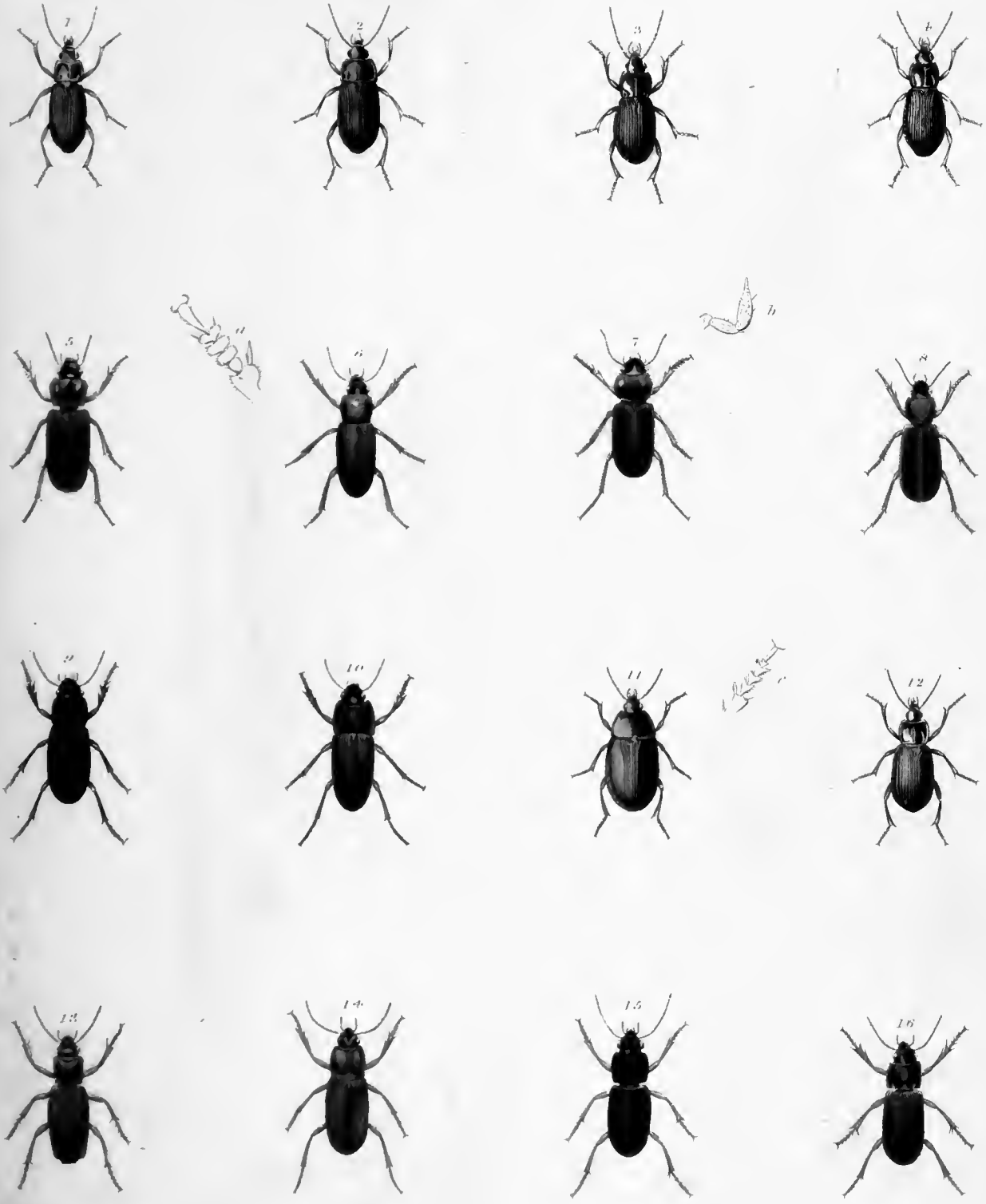
Fig. 1. Lebia viridis.
2. Lebia atrivirens.
3. Lebia smaragdula.
4. Brachinus cephalotes.
5. Brachinus conformis.
6. Brachinus fumans.
7. Brachinus perplexus.
8. Agonum octopunctata.
9. Agonum cupripenne.
10. Anchomenus extensicollis.
11. Clivina lineolata.
12. Galerita americana.
13. Cimindis pilosa.
14. Scarites subterraneus.
15. Dyschirius globulosus.
16. Calathus gregarius.



E. Emmons Junr Del

PLATE 19.

Fig. 1. Pœcillus chalcites.
2. Pœcillus lucublanda.
3. Feronia stygica.
4. Feronia adoxa.
5. Agoniderus pallipes.
6. Anisodactylus baltimorius.
7. Trechus conjunctus.
8. Trechus cinctus.
9. Anisodactylus agricollis.
10. Anisodactylus rusticus.
11. Amara impuncticollis.
12. Adelosia muta.
13. Harpalus erraticus.
14. Harpalus faunus.
15. Harpalus bicolor.
16. Harpalus pleuriticus.



E. Blanchard Gravé par

PLATE 20.

Fig. 1. ELAPHRUS RUSCARIUS.
2. CHLŒNIUS TOMENTOSUS.
3. BEMBIDIUM SIGILLARE.
4. BEMBIDIUM HONESTUM.
5. CHLŒNIUS NEMORALIS.
6. CHLŒNIUS EMARGINATUS.
7. CHLŒNIUS SERICEUS.
8. CHLŒNIUS LITHOPHILUS.
9. BEMBIDIUM INORNATUM.
10. BEMBIDIUM TRIPUNCTATUM.
11. OMOPHRON LABRATUM.
12. — — *var.* TESSELLATUS.
13. NOTIOPHILUS PORRECTUS.
14. BEMBIDIUM VARIEGATUM.
15. HALIPLUS 12-PUNCTATUS.
16. HALIPLUS IMMACULATICOLLIS.

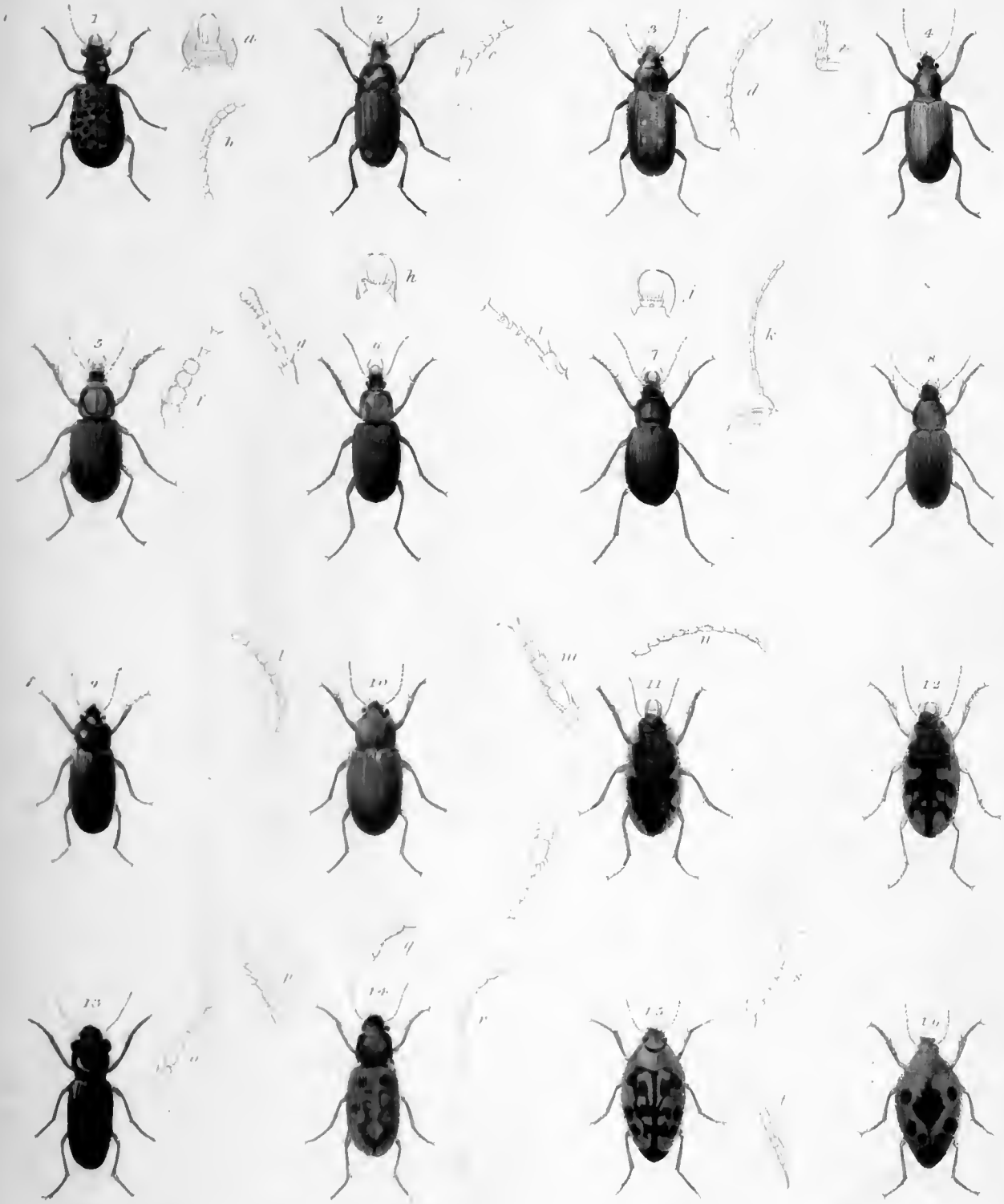

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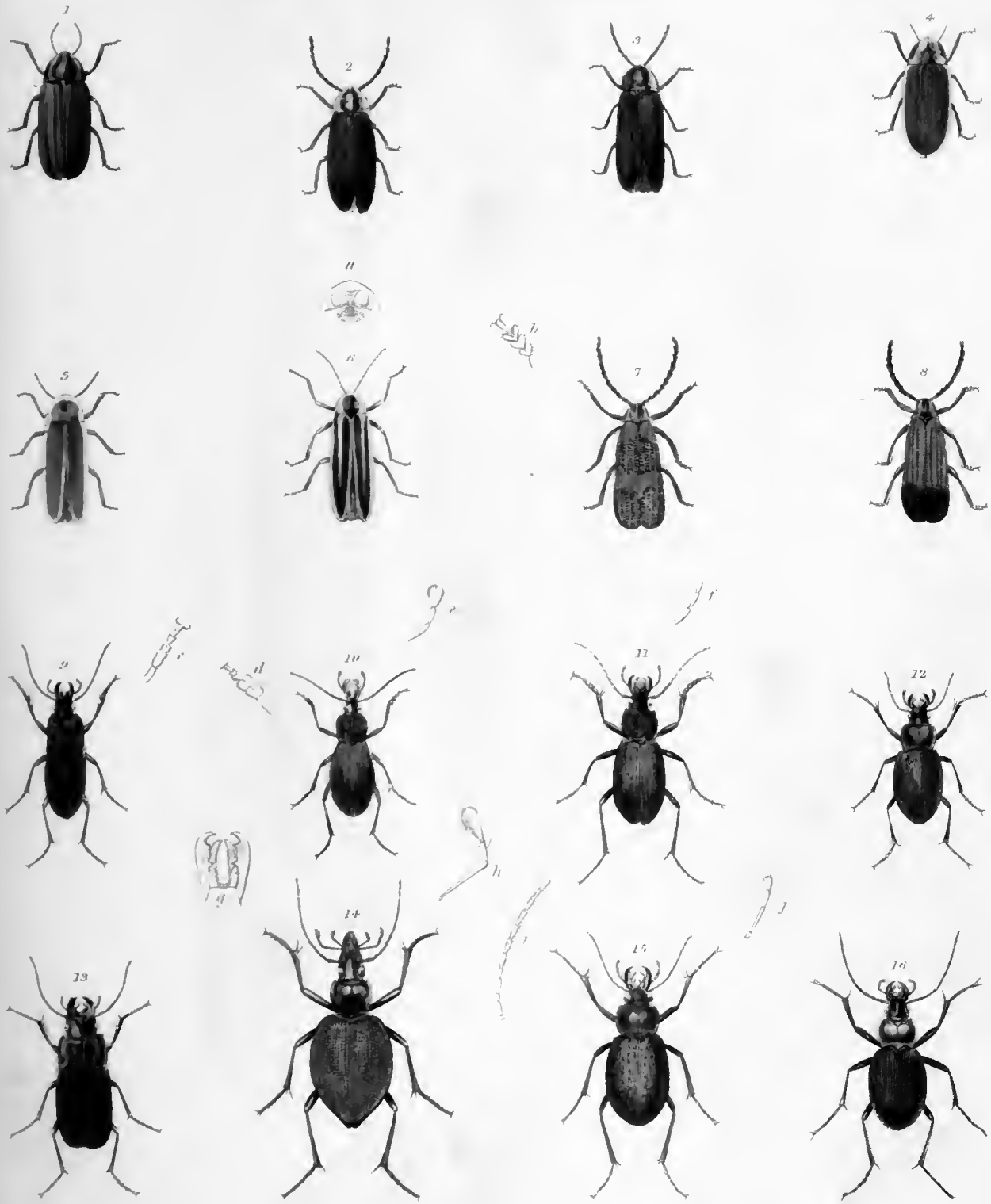
PLATE 21.

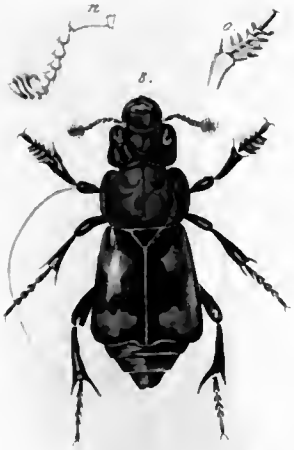
Fig. 1. LAMPYRIS CORRUSCA.
2. LAMPYRIS LATICORNIS.
3. LAMPYRIS NIGRICANS.
4. LAMPYRIS UNGULATA.
5. LAMPYRIS SCINTILLARIS.
6. LAMPYRIS VERSICOLOR.
7. DICTYOPTERA RETICULATA.
8. DICTYOPTERA TERMINALIS.
9. DICŒLUS DILATATUS.
10. SPHÆRODERUS STENOSTOMUS.
11. CARABUS VINCTUS.
12. CARABUS SERVATUS.
13. DICŒLUS ELONGATUS.
14. CYCHRUS VIDUUS.
15. CALOSOMA CALIDUM.
16. CARABUS LIMBATUS.



E Emmons Jun' Del

PLATE 22.

Fig. 1. ONCIDERUS CINGULATUS.
2. CUCUJUS CLAVIPES.
3. SILPHA AMERICANA.
4. NECRODES SURINAMENSIS.
5. NECROPHAGUS PYGMEUS.
6. SILPHA INEQUALIS.
7. SILPHA CAUDATA.
8. NECROPHAGUS AMERICANUS.
9. SILPHA NOVEBORACENSIS.



E. Lummons, Del.

Richd H. Pease, Lith.

PLATE 23.

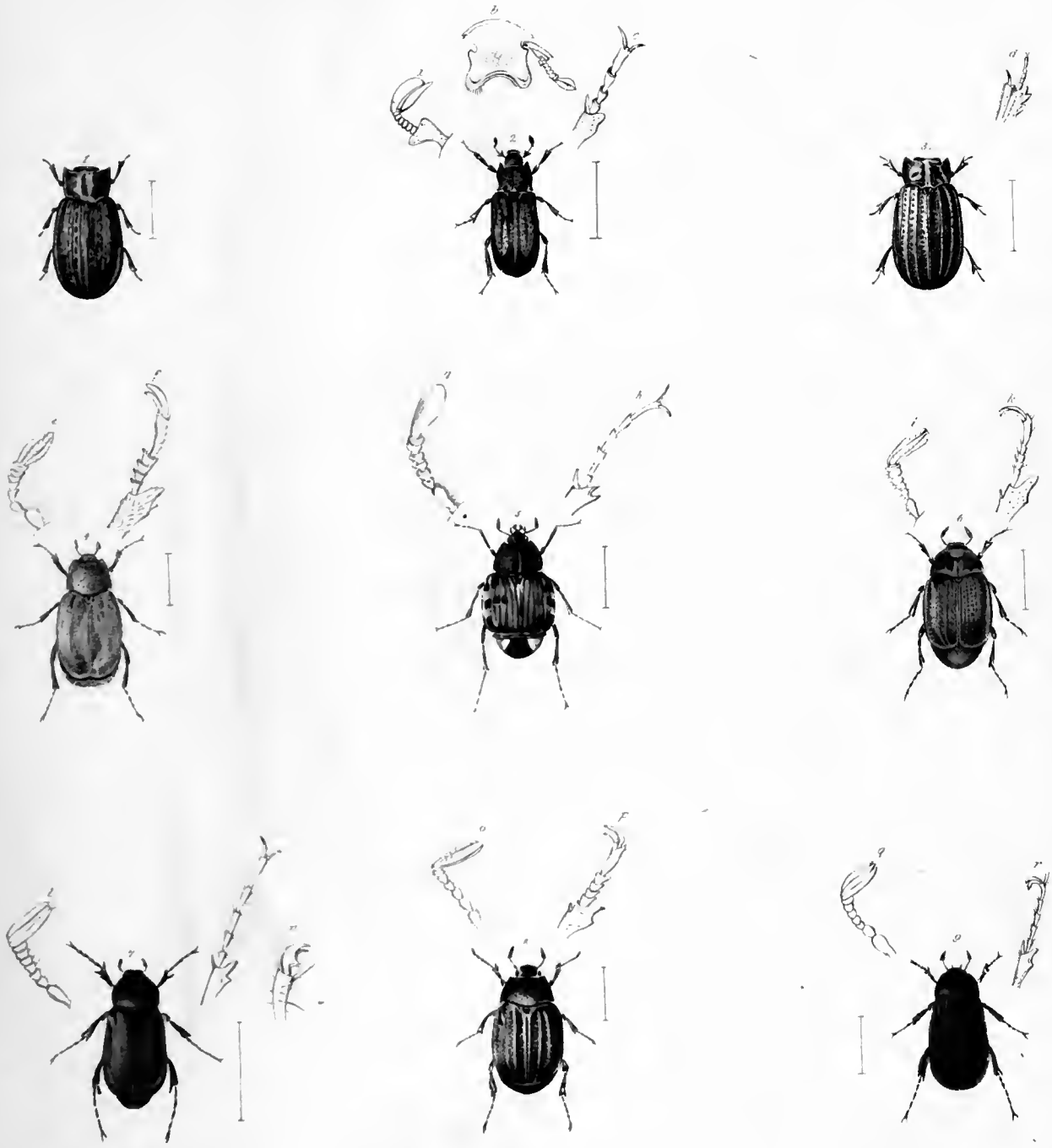
Fig. 1. Nitidula bipustulata.
2. Engis fasciata.
3. Ips sanguinolenta.
4. Ips fasciata.
5. Dermestes lardarius.
6. Ips quadrisignata.
7. Parnus fastigiatus.
8. Ips bipustulatus.
9. Elmis crenatis.

E. Emmons, Jr. Del.

Lith. of Rich.d H. Pease, Albany, N.Y.

PLATE 24.

Fig. 1. TROX CAPILLARIS.
2. CREMASTOCHEILUS HENTZII.
3. TROX PORCATUS.
4. HOPLIA TRIFASCIATA.
5. TRICHINUS VIRIDANS.
6. EUCHLORA CŒLEBS.
7. RHISOTROGUS GEORGIANICA.
8. EUCHLORA ATRATUS.
9. SERICA VESPERTINA.



E. Emmons, Jr. del.

Lith. of P. H. Peaco, Albany, N.Y.

PLATE 35.

Fig. 1. Dicrelosyrinx monoceras.

2. Dendrodus canaliculus.

3. Platycerus picus.

4. Cassidaria [illegible]

5. Oncoceras [illegible]

6. Pyrodomus [illegible]

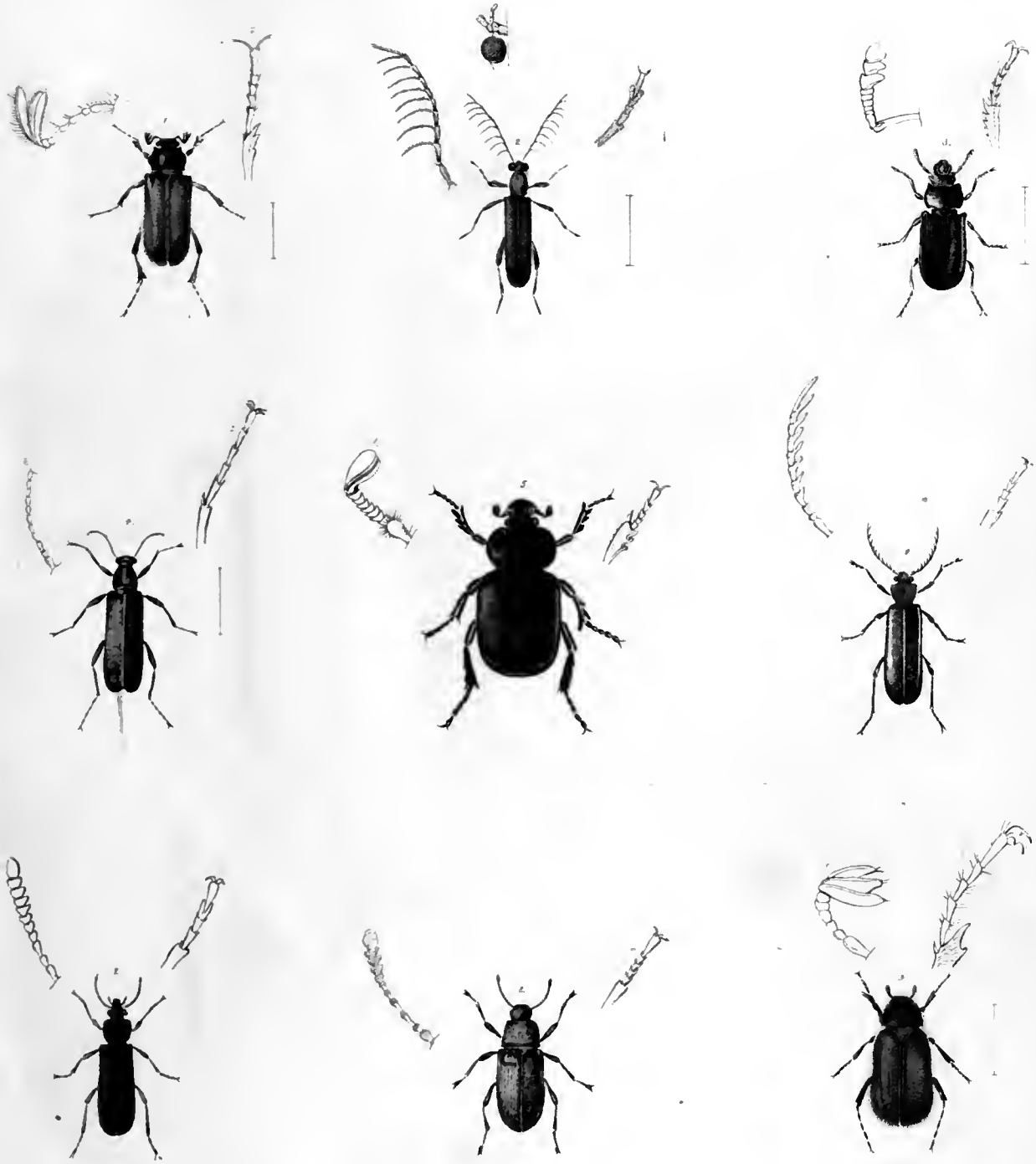
7. Pteropus [illegible]

8. Ilyes [illegible]

9. Bisomoceras [illegible]

PLATE 25.

Fig. 1. Dichelonycha elongata.
2. Dendroides canadensis.
3. Platyceras piceus.
4. Cantharis atrata.
5. Osmoderma scaber.
6. Pyrochroa flabellata.
7. Pitho americanus.
8. Upis pennsylvanicus.
9. Rhisotrogus pilosicollis.

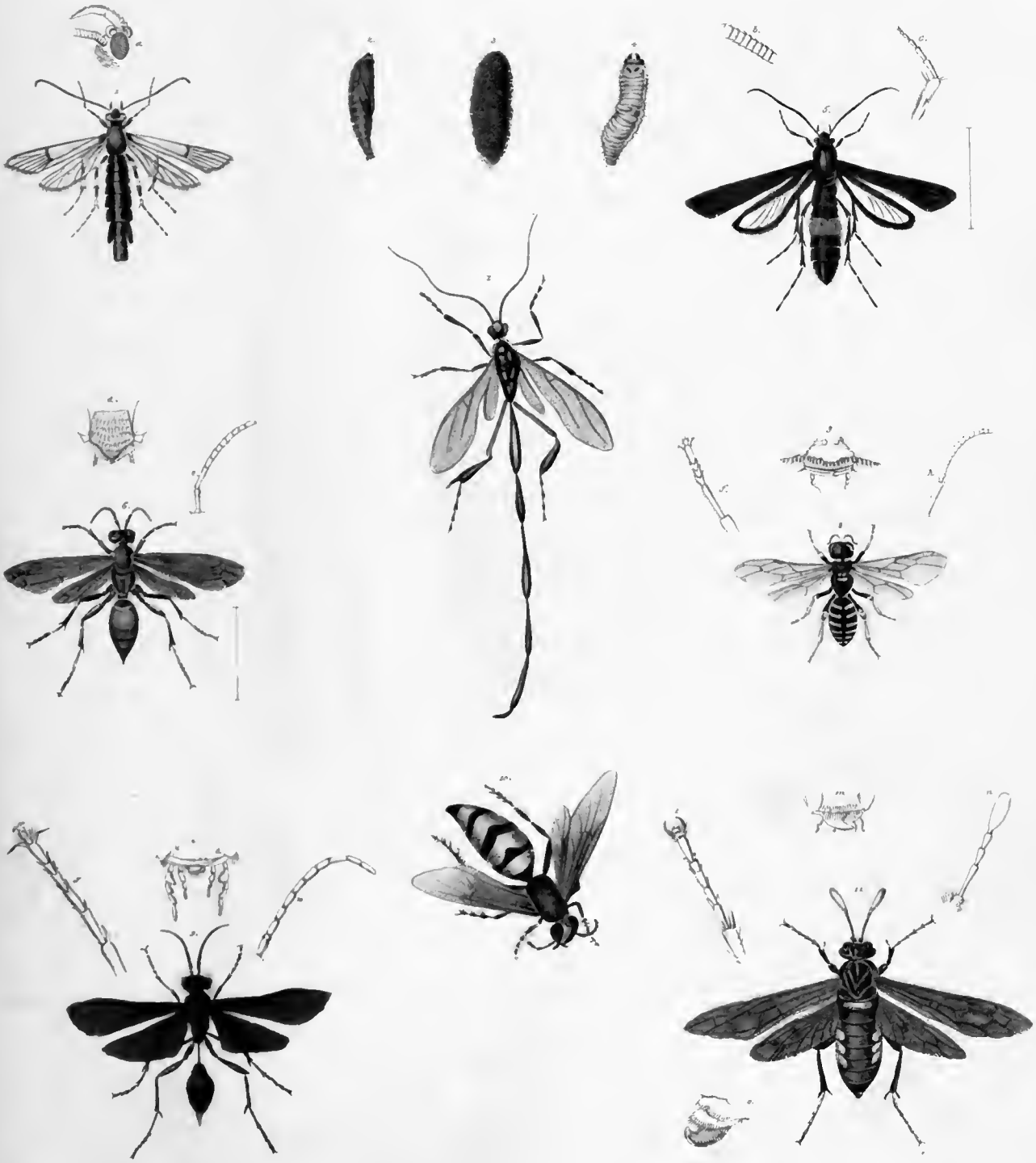


E. Emmons Jr. Del.

Lith. of Richd. H. Pease Albany

PLATE 26.

Fig. 1. ÆGERIA EXITIOSA (male).
2. Pupa of the same.
3. Coecoon.
4. Larva.
5. ÆGERIA EXITIOSA (female).
6. VESPA FRATERNA.
7. PELECINUS POLITURATOR.
8. Undescribed ?
9. SPHEX PENNSYLVANICA.
10. SCOLIA FOSSILANA.
11. CIMBEX ULMI.

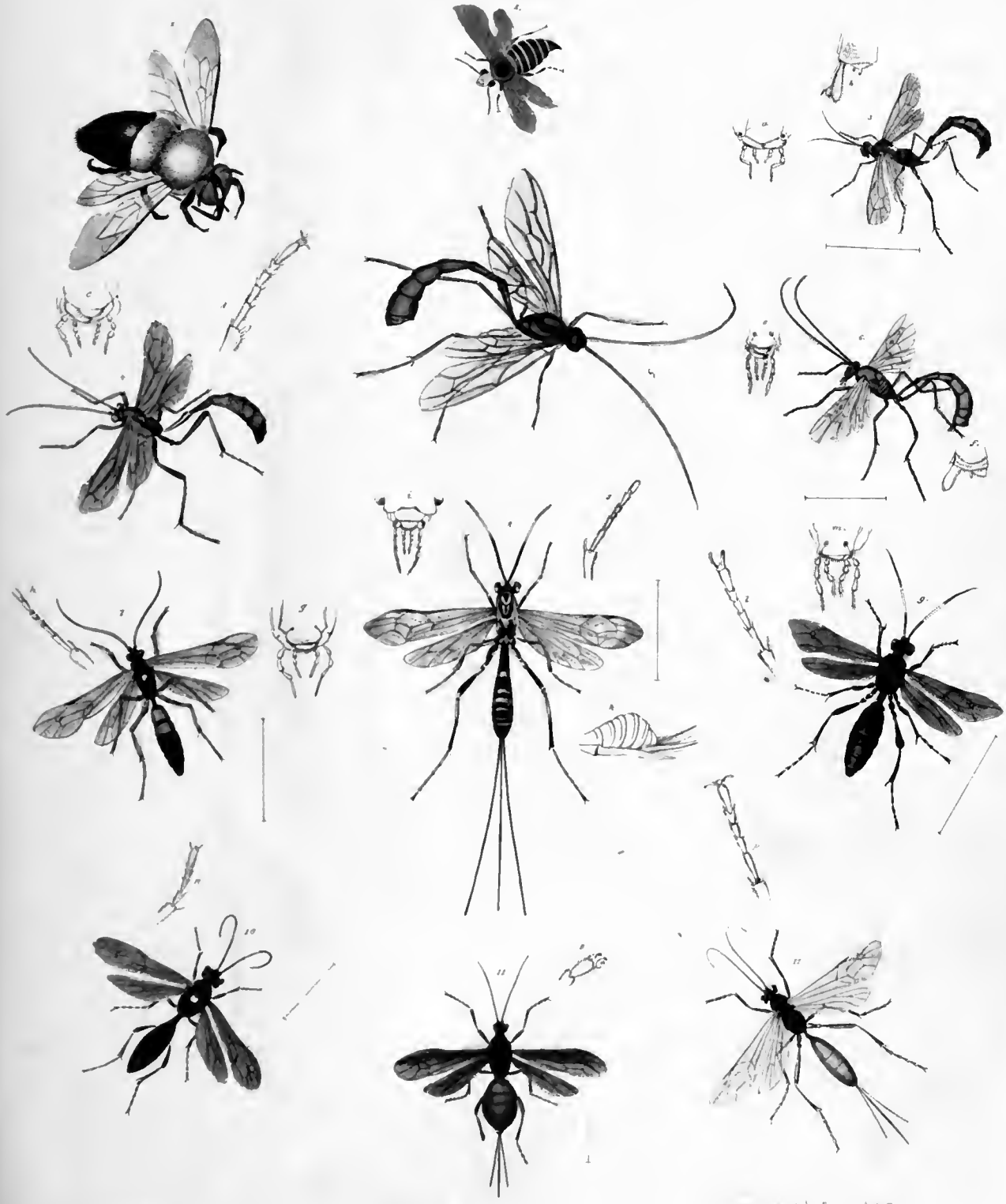


E. Emmons, Jr. Del.

Lith. of Richd H. Pease Albany.

PLATE 27.

Fig. 1. Xylocarpa virginica.
2. Cœlioxis annularis.
3. Ophion glabratus.
4. Ophion mundus.
5. Ophion macrurum.
6. Ophion purgatus.
7. Ichneumon ——.
8. Pimpla ——.
9. Ichneumon.
10. Ichneumon brevicinctor.
11. Undescribed.
12. Undescribed.



A. Fitzmorice Jr Del.

PLATE 28.

Fig. 1. SYRPHUS PHILADELPHICUS.
2. Undescribed ?
3. MILESIA VIRGINIENSIS.
4. Undescribed ?
5. LAPHIRA THORACICA.
6. LAPHIRA TERGISSA.
7. MUSCA (CALIPHORA) VOMITORIA.
8. LAPHIRA? SERICEA.
9. SARCOPHAGA GEORGINA.
10. TABANUS PLUMBEUS.
11. MIDAS FILATUS.
12. TABANUS AMERICANUS.

E. Emmons, Jr. Del.

Lith. of Richd. H. Pease, Albany.

PLATE 29.

Fig. 1. LEPTIS ORNATA ?

2. TABANUS LINEOLA ?

3. LAPHIRA (undescribed ?).

4. LEPTIS QUADRATA.

5. CTENOPHORA TRIMACULATA (female).

6. SYRPHUS ——.

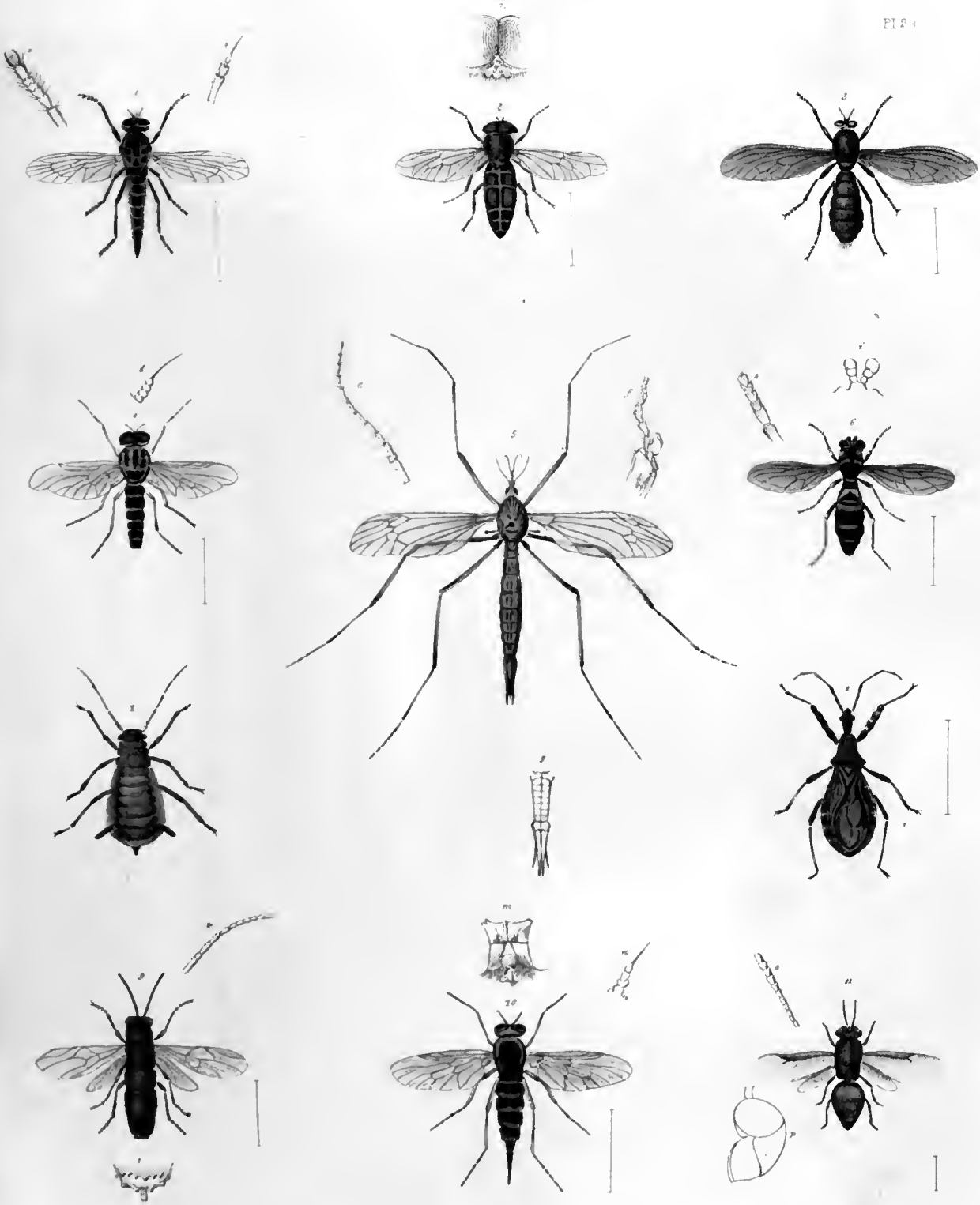
7. APHIS of the Peach leaf.

8. SINEA STIMULATRIX.

9. CHRYSIDIDÆ (family).

10. LEPTIS ——.

11. PROCTOTRUPIDÆ (family).

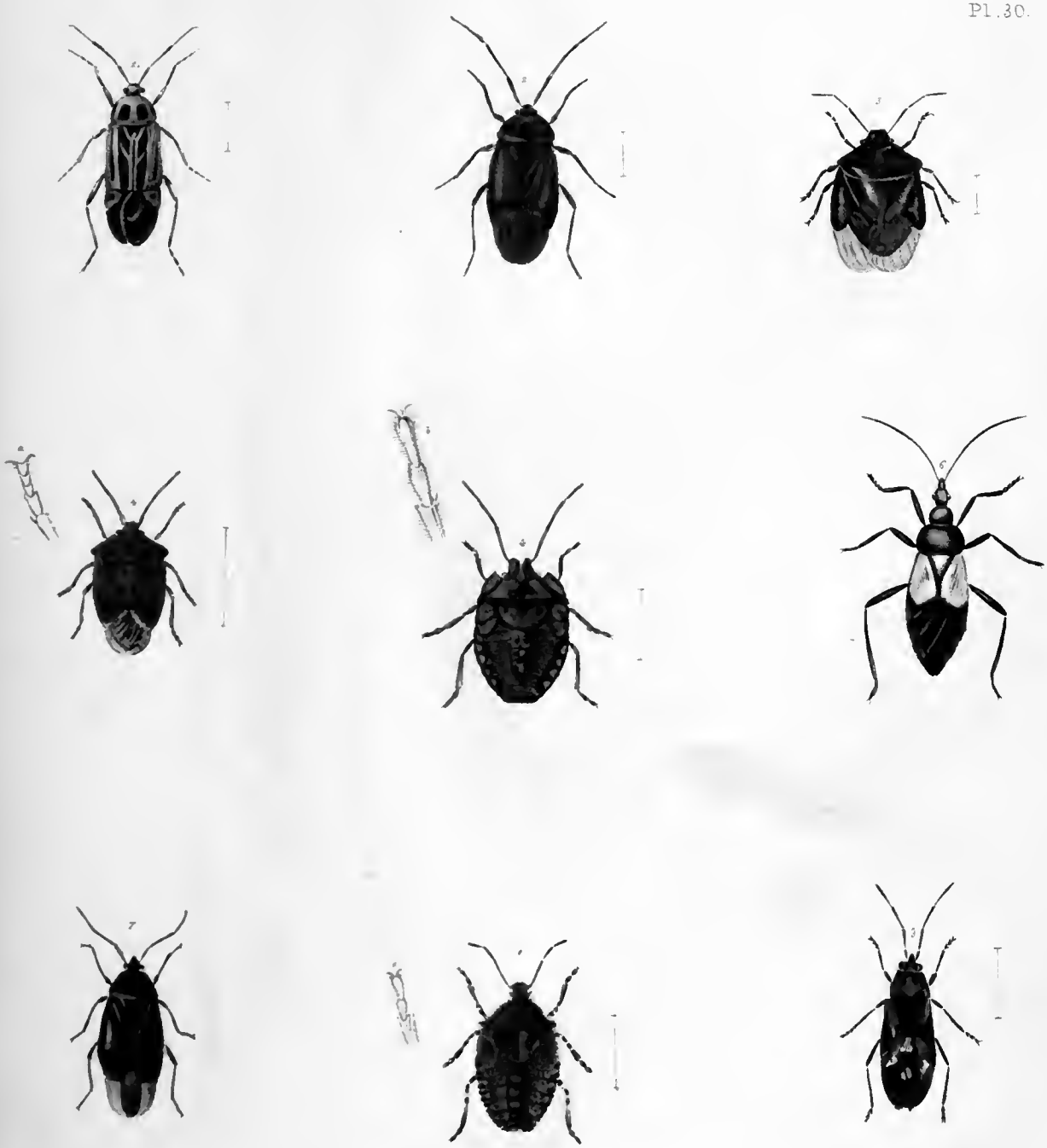


T. Emmons, Jr Del

Lith of Rich^d H Pease, Albany.

PLATE 30.

Fig. 1. PHYTOCORIS BELLUS.
2. PHYTOCORIS COCCINEUS.
3. PENTATOMA CARNIFEX.
4. ACANTHECOMA SPINOSA (young).
5. PENTATOMA PENNSYLVANICA (young).
6. HAMMATOCERUS PURCIS.
7. PHYTOCORIS LINEOLATUS.
8. PENTATOMA (young).
9. LYGÆUS TURCICUS, *var. α.*



E. Emmons Jr. Del.

Lith. of Richd. H. Pease, Albany.

PLATE 31.

Fig. 1. CANTHARIS ATRATA (bis).
2. ELATER (ATHOUS)? ——.
3. STAPHYLINUS CHRYSURUS.
4. ONTHOPHAGUS HECATE.
5. CYCLOUS AMERICANA.
6. STAPHYLINUS CYANNIPENNIS.
7. LEPTURA MALACHITICA.
8. HISTER CONFORMIS.
9. FERONIA ——.
10. TENEBRIO MOLITOR.
11. BUPRESTIS (ANCYLOCHEIRA) STRIATA.
12. COPRIS ——.

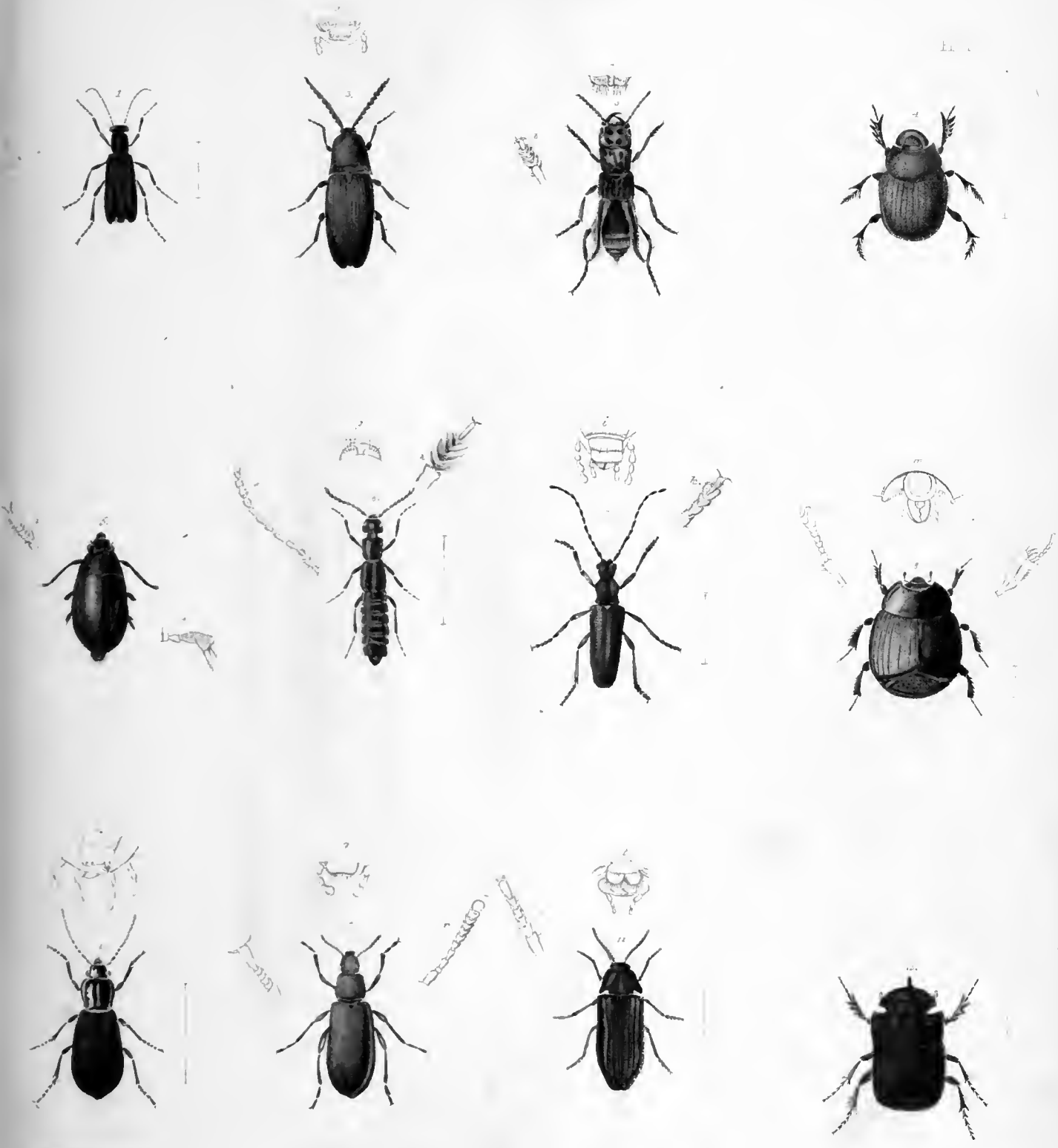


PLATE 32.

Fig. 1. *Lucoex cuculus* (female).

2. *Tetrax* (male).

3. *Hypotænia angolensis*.

4. *Micromelanox* (yellow).

5. Larva of the yellow, [illegible]

6. Larva of the yellow, [illegible]

a. Pupa case of the [illegible]

b. Sand-tunnel, or trap.

7. *Pimelocoris insignipennis*.

8. *Ilex aura monstrosa*.

9. *Sterna* [illegible].

10. *Lucoex* [illegible] *cuculus*.

11. *Sterna* [illegible].

PLATE 32.

Fig. 1. TREMEX COLUMBA (female).

2. TREMEX (male).

3. UROCERUS ALBICORNIS.

4. MYRMELEON (antlion).

5. Larva of the antlion, upperside.

6. Larva of the antlion, underside.

b. Pupa case of the same.

a. Sand-funnel, or trap.

7. PHRYGANEA SEMIFASCIATA.

8. HESPERIA PECKIUS.

9. SESIA PELASGUS.

9 *a.* PHRYGANEA SEMIFASCIATA.

10. SESIA FUCIFORMIS.

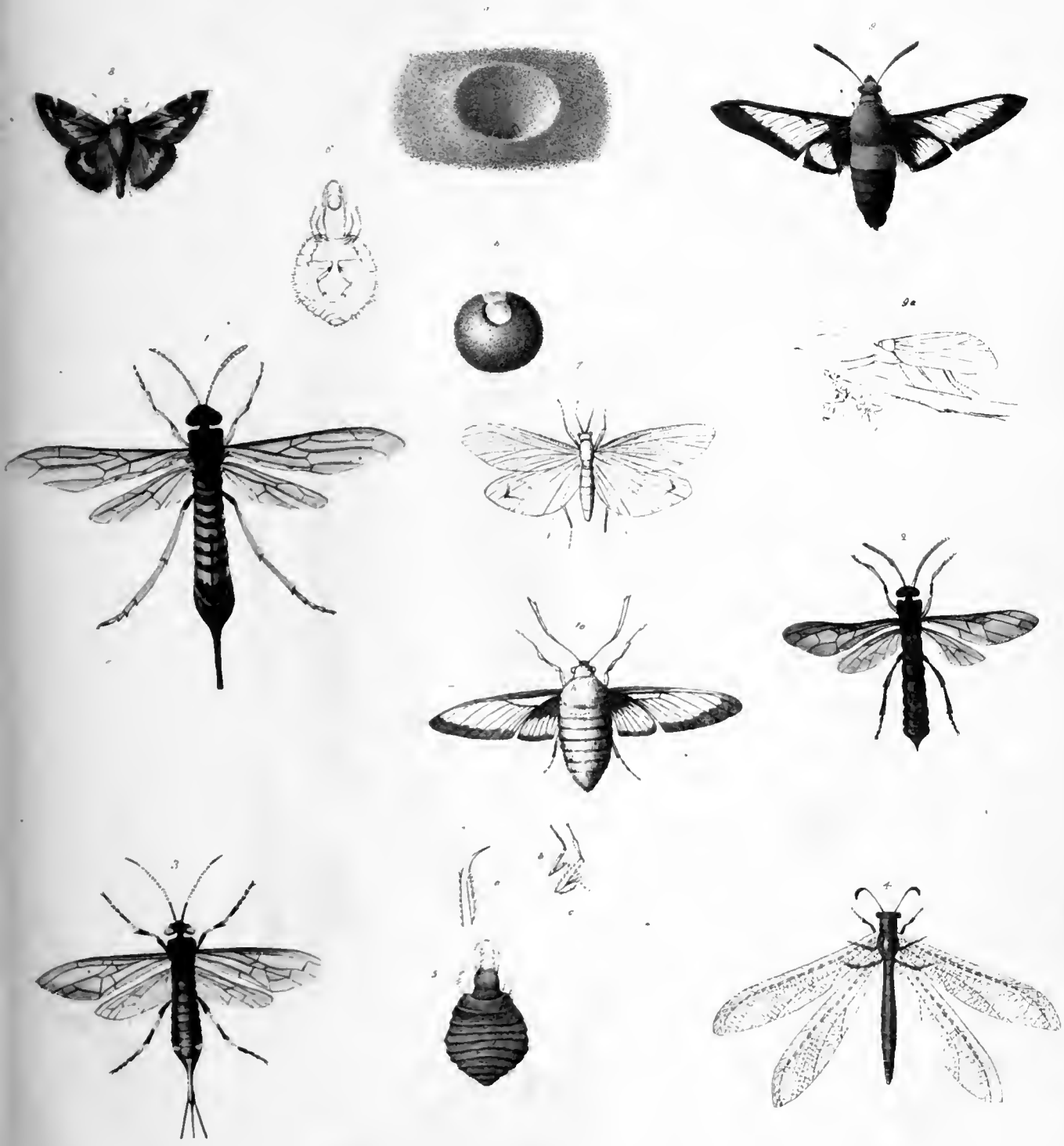


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PLATE 33.

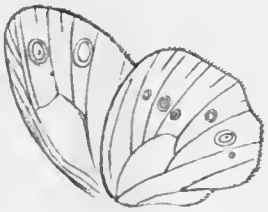
Fig. 1. LIMENITIS URSULA.

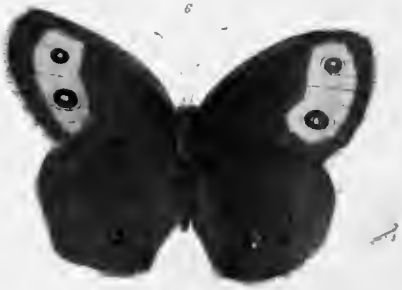
2. Underside of the same.

3, 5, 6. HIPPARCHIA NEPHELE.

4, 7. HIPPARCHIA ALOPE.

8. ITHYCERUS NOVEBORACENSIS.



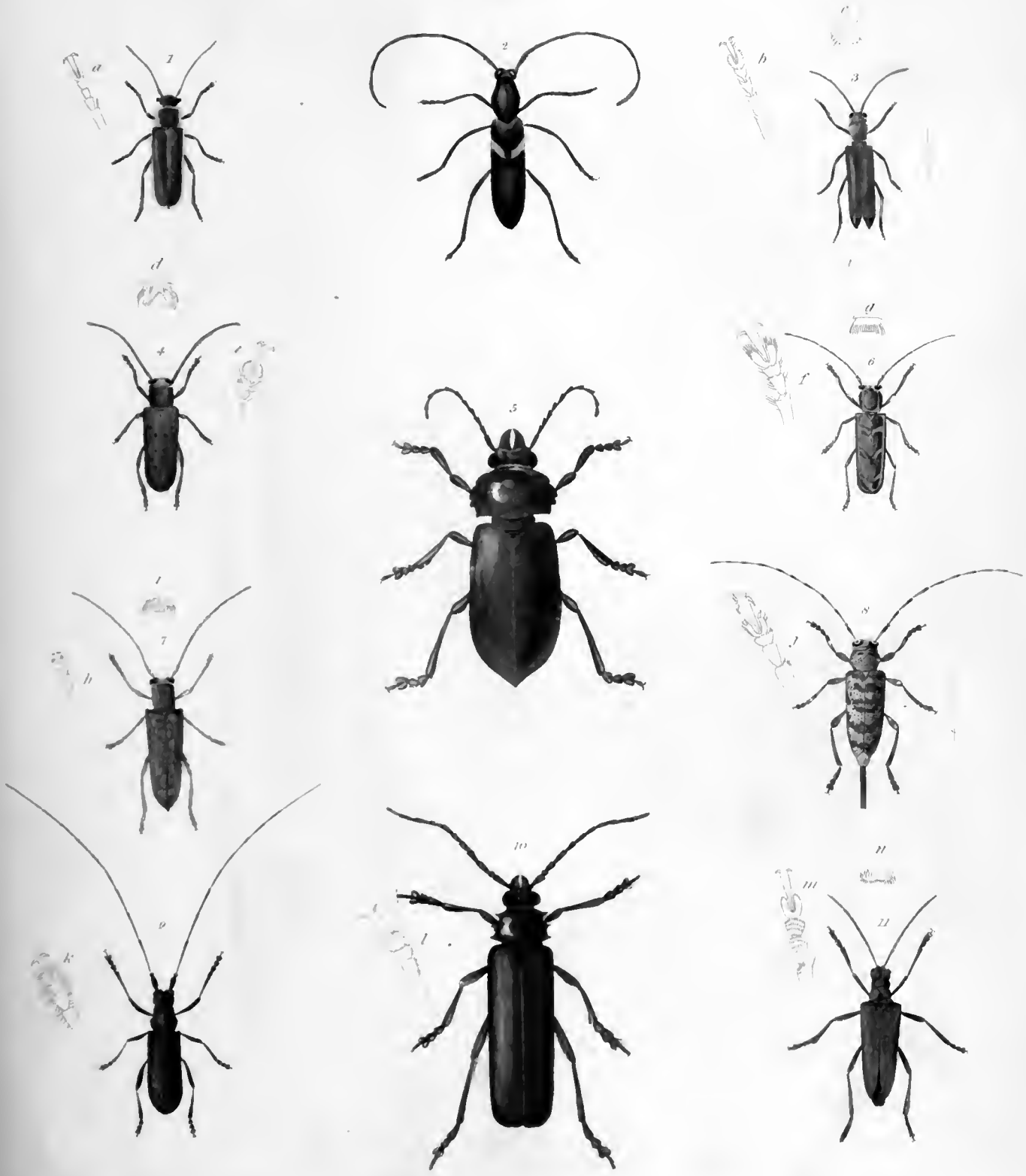


F. Emmons, Jr del

Lith of Rich^d H Pease, Albany

PLATE 34.

Fig. 1. Podabrus modestus.
2. Stenocorus cinctus.
3. Telephorus ——.
4. Saperda vestita.
5. Prionus laticollis.
6. Saperda tridenta.
7. Saperda ——.
8. Monochamus pusillus.
9. Cerambix (undescribed?).
10. Prionus pennsylvanicus.
11. Leptura ——.



L. Fuscone Jun' Del

Engraved & Printed by J. E. Gavit.

PLATE 35.

Fig. 1. COLIAS PHILODICE.

2. Ditto, lower side (female).

3. VANESSA INTERROGATIONIS.

4. COLIAS PHILODICE (male).

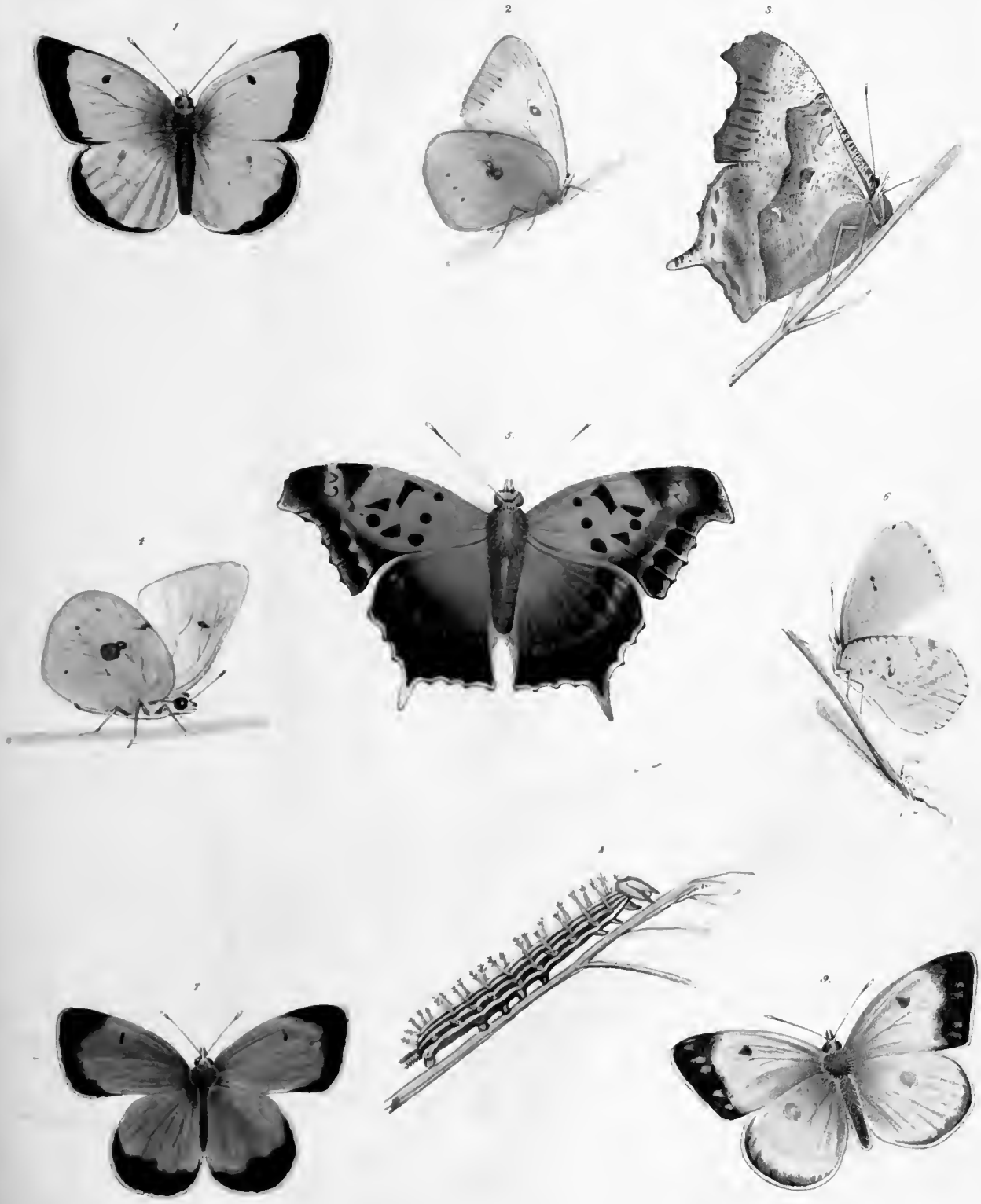
5. VANESSA INTERROGATIONIS.

6. PIERIS NICIPPE (under side).

7. PIERIS NICIPPE (upper side).

8. Caterpillar of VANESSA INTERROGATIONIS.

9. COLIAS PHILODICE (upper side, female).



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Lith. of Richd. H. Pease, Albany.

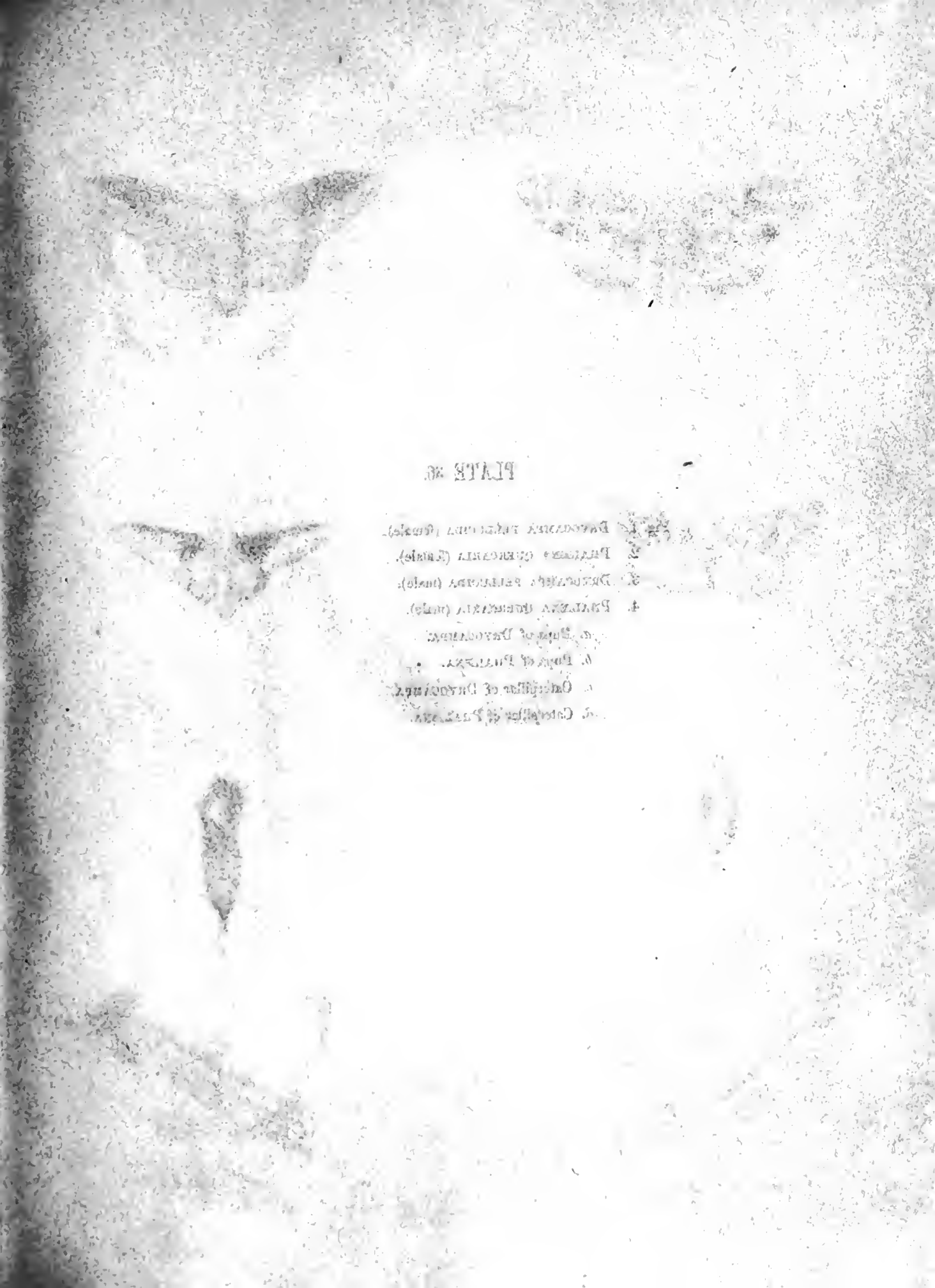
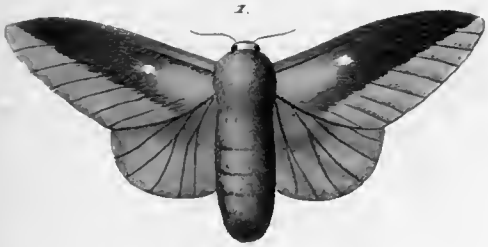


PLATE 36.

Fig. 1. DRYOCAMPA PELLUCIDA (female).
2. PHALÆNA QUERCARIA (female).
3. DRYOCAMPA PELLUCIDA (male).
4. PHALÆNA QUERCARIA (male).
a. Pupa of DRYOCAMPA.
b. Pupa of PHALÆNA.
c. Caterpillar of DRYOCAMPA.
d. Caterpillar of PHALÆNA.

1.



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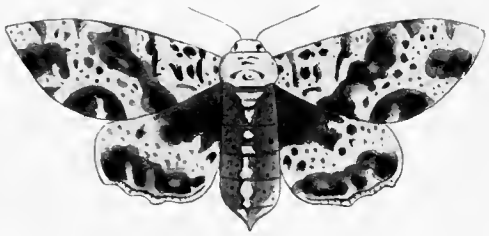

3.

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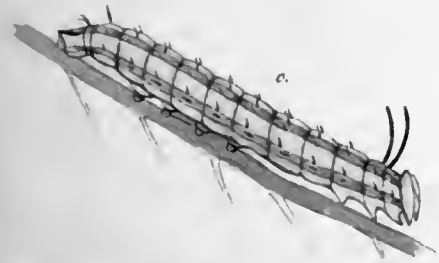
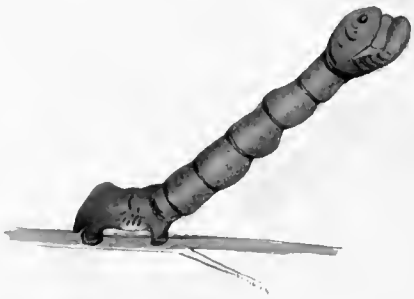
a.

b.

c.



d.



E. Emmons, Jr. Del.

Lith. of Rich. H Pease Albany.

PLATE 37.

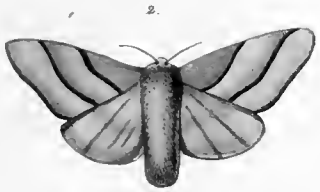
Fig. 1. PHALÆNA (ORGYIA) LEUCOSTIGMA (male).
a, *b*. Pupa.
c. Female.
f. Caterpillar.

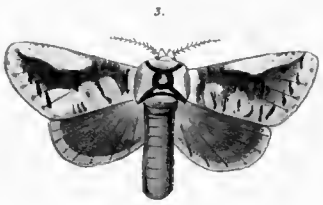
2. PHALÆNA NEUSTRIA (female).

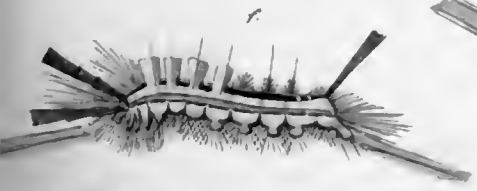
3. PHALÆNA (PYGÆRA) ALBIFRONS (male).

4. PHALÆNA NEUSTRIA (male).
d. Pupa.
g. Caterpillar.

5. PHALÆNA ALBIFRONS.
e. Pupa.
h. Caterpillar.







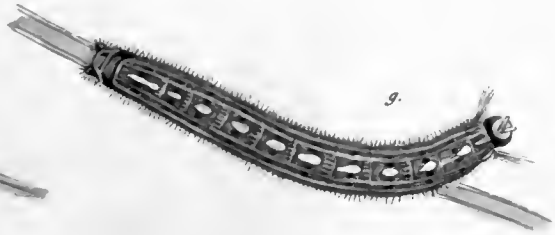


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PLATE 38.

Fig. 1. DANAUS PLEXIPPUS.
c. Caterpillar.
d. Pupa.

2. SPHINX OCTOMACULATUS.
a. Caterpillar.
b. Pupa.

3. PAPILIO TURNUS.

4. ENDOMIS TITYRUS.
e. Caterpillar.
f. Pupa.

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PLATE 39.

Fig. 1. ATTACUS LUNA.
a. Pupa.
b. Caterpillar.

2. SATURNIA MAIA (male and female).
c, d. Caterpillar.
e. Pupa.

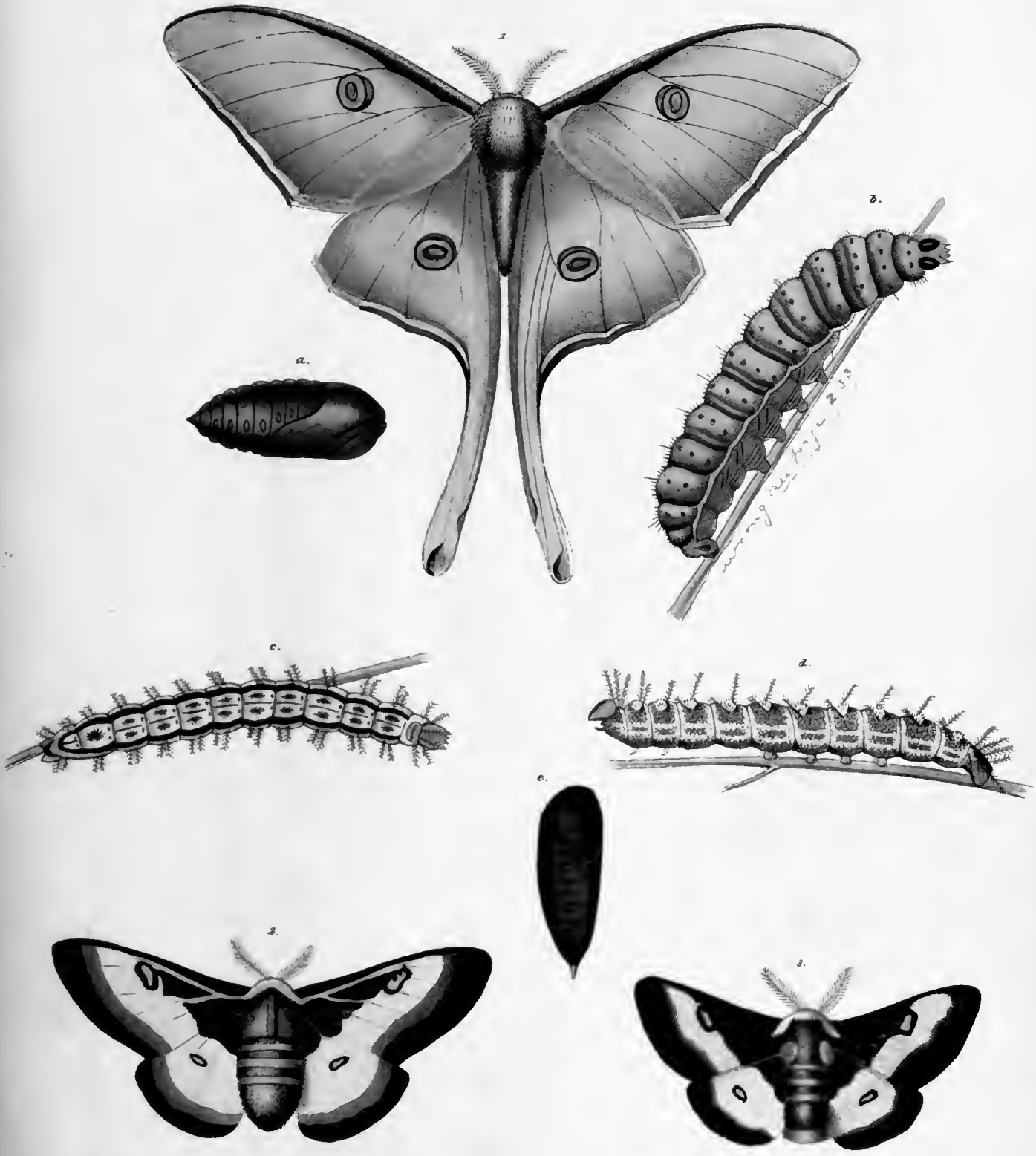

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PLATE 40.

Fig. 1. SPHINX BRONTES.

2. GEOMETRA ARGENTATA.

3. GLAUCOPIS PHOLUS.

4. SMERINTHUS ASTYLUS.

5. DRYOCAMPA VIRGINIENSIS (*vel* PELLUCIDA?).

6. GEOMETRA SERRATA.

7. DRYOCAMPA IMPERIALIS.

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PLATE II.

Fig. 1 PHALÆNA DIONÆ.

2. SPILOSOMA ACRÆA (male).

3. SPILOSOMA ARGE.

4. PHALÆNA DIONÆ (of ARCTIA VIRGO).

5. SPILOSOMA ACRÆA (female).

6. Caterpillar of PHALÆNA DIONÆ.

7. SPILOSOMA OCHRA.

8. Pupa of PHALÆNA DIONÆ.

9. SPILOSOMA ZAIRA.

10. BOMBYX CYNAMERIA.

11. SPILOSOMA LUBRICA.

12. SPILOSOMA LUTEA.

PLATE 41.

Fig. 1. PHALÆNA DIONE.
2. SPILOSOMA ACRÆA (male).
3. SPILOSOMA ARGE.
4. PHALÆNA DIONE (*vel* ARCTIA VIRGO).
5. SPILOSOMA ACRÆA (female).
6. Caterpillar of PHALÆNA DIONE.
7. SPILOSOMA CUNEA.
8. Pupa of PHALÆNA DIONE.
9. SPILOSOMA NAIS.
10. BUPALUS CATENARIUS.
11. SPILOSOMA EGLE.
do. EUCHÆTES EGLE.

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PLATE 42.

Fig. 1. Noctua squamularis.
2. Geometra transversalis.
3. Erebus edusa.
4. Noctua undularis.
5. Catocala affinis.
6. Noctua lunata.
7. Noctua (Acontia) nundina.
8. Catocala epione.
9. Noctua (Acontia) margaritata.
10. Sphinx carolina.

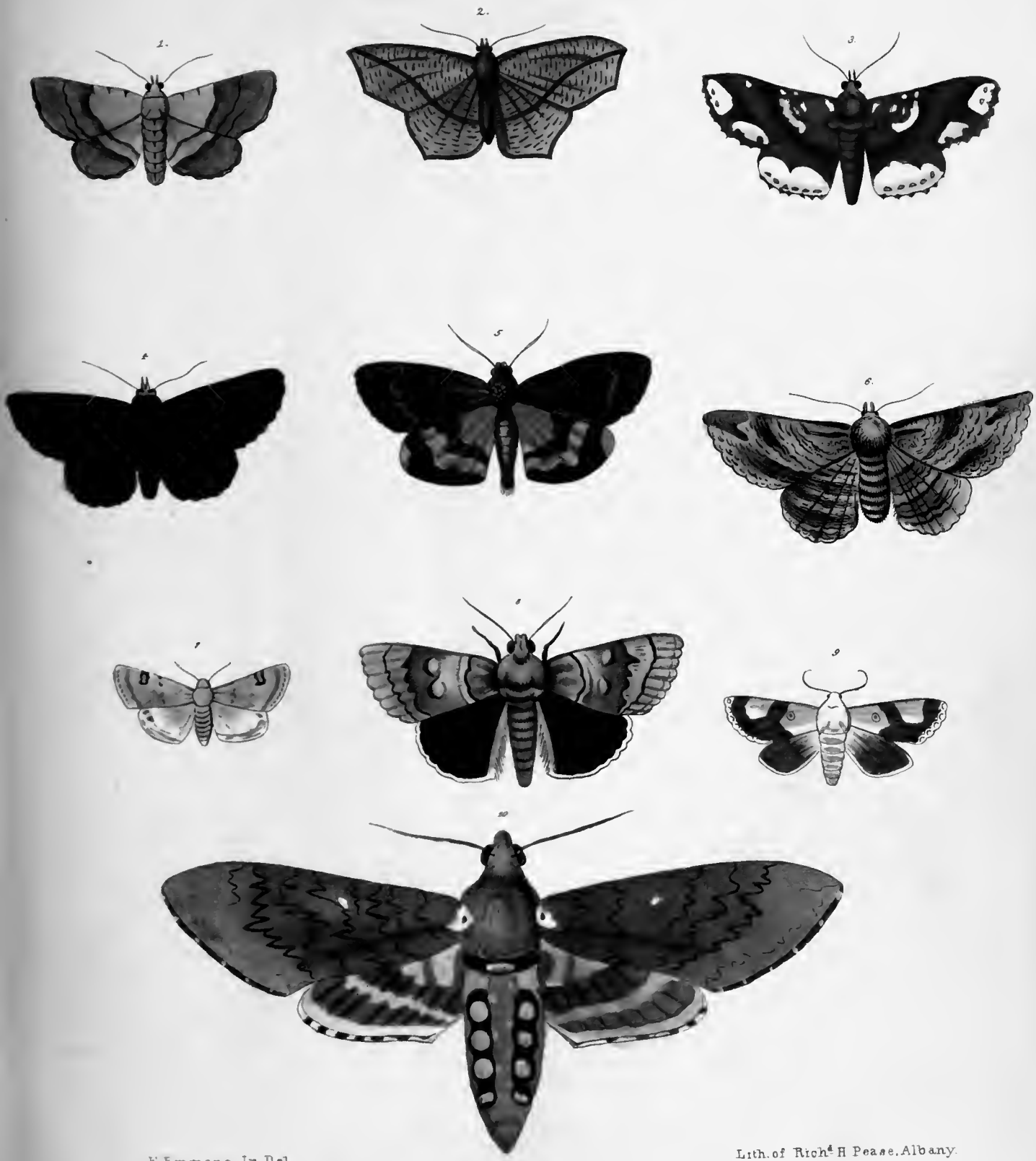

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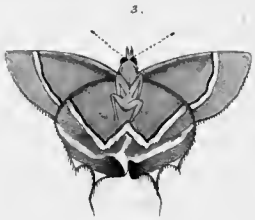
PLATE 43.

Fig. 1, 3. THECLA ACIS.
2. LIMENITIS ARTHEMIS.
4, 7. MELITÆA PHÆTON.
5, 6. MELITÆA PHAROS.
8. PHALÆNA PHYLLIRA.
9. LIMENITIS ARTHEMIS.
10. CALLIMORPHA EPIMENIS.



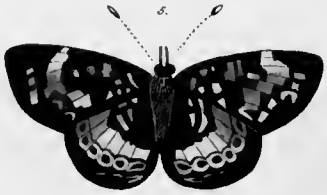


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PLATE 44.

Fig. 1. ATTACUS POLYPHEMUS.

2. SPHINX (PHILAMPILUS?) PAMPINATRIX.

3. CATOCALA AMASIA.

4. ATTACUS CECROPIA.

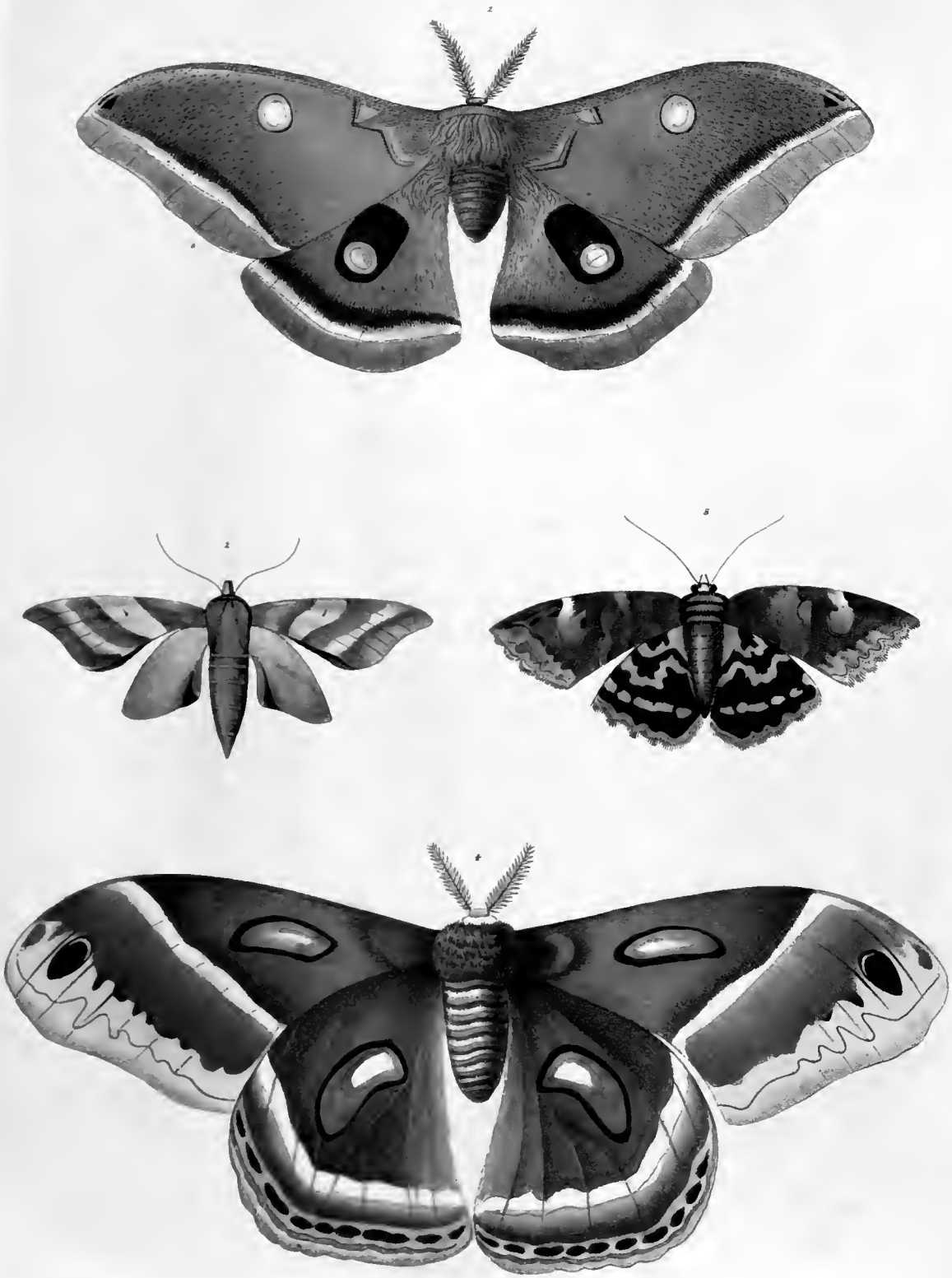

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PLATE 45.

Fig. 1. CLISIOCAMPA AMERICANA.

2. AGROTIS ——.

3. GEOMETRA ——.

4. ARCTIA VIRGINICA.

5. PHILAMPELUS SATELLITIA.

6, 7, 8. Undescribed?

9. BOMBYX? (undescribed).

10. AGROTIS ——.

11. AGROTIS ——.

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PLATE 16

Fig. 1, 2. CYNTHIA CARDUI.

a. Pupa.

b. Caterpillar.

3. 4. VANESSA ATALANTA.

a. Pupa.

b. Caterpillar.

4. CHRYSOMELAENA PULLA.

5. DIRIOPEIA BELLA.

6. Unidentified.

7. DIAPTA ANTEA.

PLATE 46.

Fig. 1, 2. CYNTHIA CARDUI.
a. Pupa.
b. Caterpillar.

3, 8. VANESSA URTICÆ?
a. Pupa.
b. Caterpillar.

4. CHRYSOPHANUS PHLEAS.

5. DEIOPEIA BELLA.

6. Undescribed?

7. BLATTA NIVEA.

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PLATE 47.

Fig. 1, 2. LIMENITIS DISSIPPUS.

3. CALLIMORPHA PARTHENICE.

4. CARPOCAPSA POMONELLA.

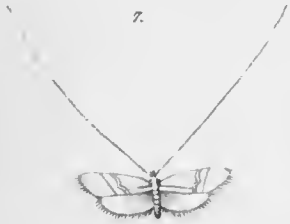
5. CALLIMORPHA VIRGUNCULA.

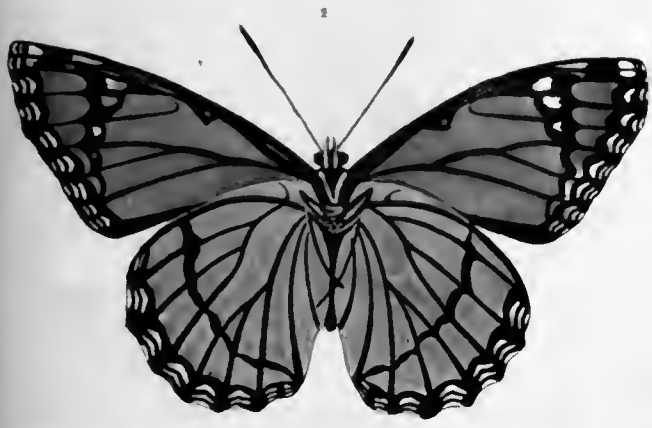
6. Eggs of the American tent-caterpillar (CLISIOCAMPA AMERICANA).

7. ADELA DEGEERELLA.

8. EUDRYAS GRATA.

Pl. 47.





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