Beetles, butterflies, moths, and other insects : a brief introduction to their collection and preservation / by A.W. Kappel and W. Egmont Kirby.

BEETLES

BUTTERF

MOTHS

AND OTHER INSE

PLATE I.

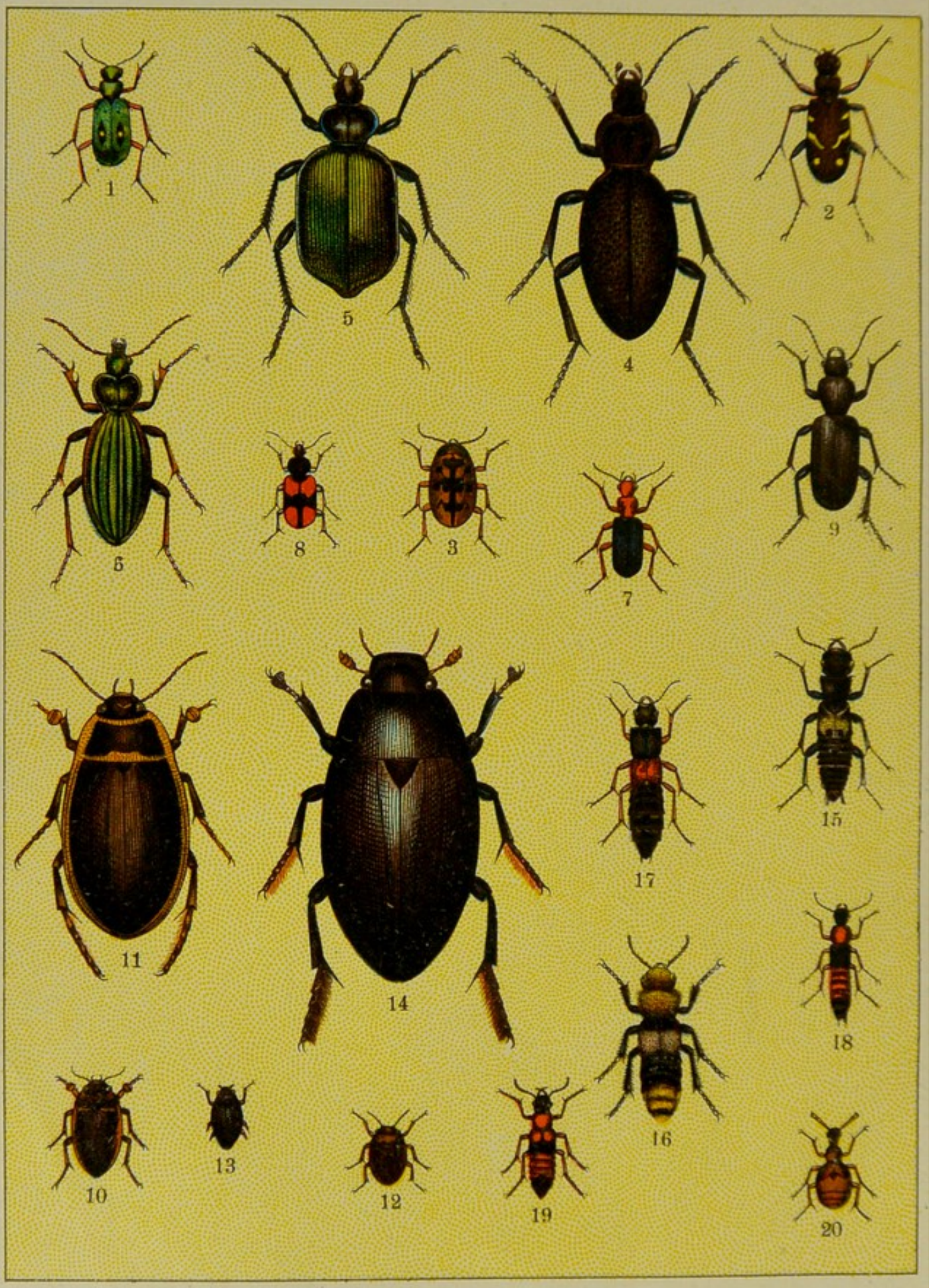

PLATE I.

COLEOPTERA.

Descriptions will be found at the pages given after the names of the insects figured.

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Beetles, Butterflies, Moths, And Other Insects.

A BRIEF INTRODUCTION TO

THEIR COLLECTION AND PRESERVATION

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WITH TWELVE COLOURED PLATES.

CASSELL & COMPANY, LIMITED:

LONDON, PARIS & MELBOURNE.

1892.

PREFACE.

The present little volume makes no pretensions to exhaust such an extensive subject as British Entomology. It is intended as an introductory work, which may be useful to young people living in the country, or spending a holiday there, who, without wishing to go deeply into the subject, yet take an interest in the natural objects with which they are surrounded. The book will be found to contain descriptions and figures of examples of the more important groups of insects. British species have, as a rule, been selected for illustration; and those which are most common and conspicuous have been most fully treated. Besides the descriptions of species, the subject of Insect Collecting and Preserving has received particular attention. Although more especially intended for young people, the work will, we hope, prove of interest also to those of more mature years who may happen to open it, and we think that those who have mastered its contents and wish to pursue the subject further will find the knowledge which they have gained from the perusal of its contents very useful to them in the study of larger works on Entomology.

THE AUTHORS.

CONTENTS.

BEETLES, BUTTERFLIES, MOTHS, AND OTHER INSECTS.

CLASSIFICATION OF INSECTS.

THE Animal Kingdom is divided into two great sections, the Vertebrata and the Invertebrata, characterised respectively by the presence or absence of a bony vertebral column, called the spine. This consists of a series of small bones connected by ligaments, and to it the other parts of the skeleton are attached. The Invertebrata are either destitute of any skeleton, *e.g.*, the Infusoria and Hydrozoa, or have an external horny or calcareous covering, as in the Crustacea and many insects.

The Insecta or Hexapoda are a class of Invertebrate animals belonging to the sub-order Articulata, or jointed animals. They are characterised, as the name Hexapoda indicates, by always having in their mature condition six legs more or less perfectly developed. The name INSECTA

alludes to the animals being divided into *segments*, and properly speaking might be applied to the whole of the Articulata.

Insects are divisible into seven orders, the principal characteristics of which are given in the following table:—

INSECTS WITH TWO WINGS.—Metamorphoses complete.

Mouth formed for suction . . . . . *Diptera.*

INSECTS WITH FOUR WINGS.

I.—*All the Wings Membranous.*

(*a*) Covered with coloured scales. Metamorphoses complete. With spirally rolled proboscis . . *Lepidoptera.*

(*b*) Wings glassy and transparent.

(1) With few veins. Metamorphoses complete. Mouth generally formed for suction . . . . . *Hymenoptera.*

(2) With a network of veins. Metamorphoses complete or incomplete. Mouth sometimes furnished with mandibles . . . . . *Neuroptera.*

II.—*Upper Wings Harder than the Lower.*

(*a*) Upper wings of uniform texture throughout.

(1) Fore-wings horny. Metamorphoses complete. Mouth furnished with mandibles . . . . *Coleoptera.*

(2) Fore-wings softer, resembling parchment. Metamorphoses incomplete. Mouth furnished with mandibles . . . . . *Orthoptera.*

(*b*) Upper wings mostly horny in front, the hinder part being membranous. Metamorphoses incomplete. Mouth formed for suction. . . . *Hemiptera.*

EXTERNAL STRUCTURE OF INSECTS.

Fully developed insects are distinctly separated into three principal parts—the head, the thorax, and the abdomen.

The head (Fig. 1 *a*) is more or less rounded, and is provided with a mouth, antennæ, and eyes. The eyes (Fig. 1 *a'*) are generally large, hemispherical, and immovable; sometimes occupying the greater part of the head. They are placed laterally, and are composed of a large number of small facets, often numbering several thousand. The facets are generally hexagonal, and each one may be regarded as a separate eye. There are frequently also from one to three accessory eyes, or ocelli, placed on the top of the head between the principal eyes. The facetted eyes are called compound eyes, but the ocelli are composed of a single facet only, and are called simple eyes.

The antennæ or feelers (Fig. 1 *b*) vary much in shape, length, and structure, and often differ in the sexes. They

are situated on the front of the head near the eyes, and are composed of a number of articulated segments. In some species, as for instance in the Dragon-flies, the antennæ are so short as to be hardly visible; but in many insects of different orders they are very long, sometimes several times as long as the body. They are defined according to the structure—as filiform, when they are thread-like and of equal thickness throughout; setiform or bristle-shaped, when they gradually taper towards the end; moniliform or bead-like, when they consist of a row of rounded joints, like a string of beads; bifid, when they are double almost from the base; clavate or clubbed, when they are thickened towards the end; and when this thickening takes place suddenly, so as to form a round or flattened knob, they are called capitate. Antennæ which are thickest near the middle and taper at both ends are called spindle-shaped or fusiform. If there are short and blunt appendages on each segment, they are called toothed or dentated; if these are pointed and longer than they are broad, serrated; if of equal length throughout, like a comb, pectinated; and if long and thread-like,

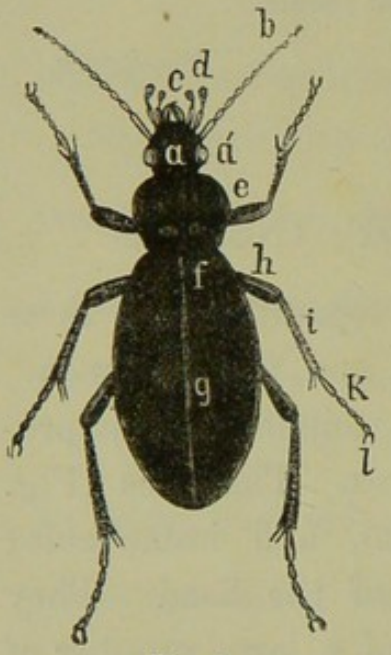


Fig. 1.

resembling a feather, they are called plumose. They are called ramose when the branches are very long from the base; fan-shaped when the terminal joints fit close together, so that they can be spread out like a fan; whilst they are called broken, angulated, or elbowed, when the antennæ form a distinct angle at the end of the basal joint, or scape.

The mouth is placed on the lower part of the head, and formed either for biting or for sucking. In the former case it is provided with jaws (Fig. 1 *c*) which move laterally, like shears, and cut the food placed between them. In many insects, *e.g.*, the Carabidæ, they also serve as an offensive weapon against their foes. Outside the jaws are usually two pairs of organs called palpi (Fig. 1 *d*). In insects which take their food by suction the mouth consists of an upper lip or labrum, and rudimentary mandibles. There is a tongue or proboscis placed under these, by means of which the insect imbibes its food. In the Lepidoptera this consists of two separable portions, which, when not in use, are rolled up in a spiral form; in other insects it is often straight, strong, and capable of inflicting a severe puncture.

The thorax consists of three portions, usually more or less fused together, known as the prothorax, mesothorax, and metathorax, each of which bears a pair of legs. The upper part of the thorax is called the pronotum (Fig. 1 *e*).

The two pairs of wings are attached to the meso- and metathorax respectively.

The legs, of which there are always three pairs, consist of the trochanter, a short joint (sometimes double) which is attached to the thorax by the coxa or hinge-plate; the femur or thigh (Fig. 1 *h*), which joins on to the trochanter; the tibia or shank (*i*), which usually has one or two spines at its end; and the tarsus or foot (*k*), consisting of from three to five short joints terminating in a pair of claws (*l*) by means of which the insect can keep its footing on rough surfaces. Between the claws we often observe a large pad or pulvillus. The joint between the femur and tibia is called the knee. The hind-femora are especially developed in insects which can jump well. In the mole-cricket the front legs are very much broadened and flattened, and adapted for burrowing in the ground, and in swimming insects the legs are generally fringed with hairs.

The wings of insects are generally arranged in two pairs, but the hind-wings are almost rudimentary in the Diptera, and are often more or less imperfectly developed in various insects of other orders, while in the females of many insects all the wings are frequently absent or rudimentary. The wings are mostly membranous, with branching veins. In the Lepidoptera they are clothed with coloured scales, and in the Trichoptera and in some of the Diptera, etc., with hair. In the Coleoptera the fore-wings are horny, and in the Orthoptera and Hemiptera Heteroptera the fore-wings are generally parch-

ment-like, their extremities in the latter group being membranous.

We will now give a further account of the structure of the wings in the various orders of insects.

In the Coleoptera the hardened fore-wings are usually called elytra or wing-cases. When at rest they lie over the abdomen, and cover the true wings almost completely. In flight they are lifted, and the wings are unfolded from beneath them. Many beetles have the wings more or less imperfectly developed, and cannot fly, and in these the wing-cases are frequently soldered together along the line of demarcation, which is called the suture (Fig. 1 *f*, *g*). In others the elytra are very short, and leave the greater part of the abdomen uncovered, although the wings, which are folded under them, are fully developed; this group is called Brachelytra or Rove Beetles. Some beetles have the elytra soft and elastic, *e.g.*, the Telephoridæ, or Soldiers-and-Sailors, which may often be seen on flowers, where they feed voraciously on other insects, in spite of their own soft integuments. There is a small, triangular space between the commencement of the suture and the pronotum, which is known as the scutellum (Fig. 1 *f*).

In the Hymenoptera the wings are membranous, and the fore and hind-wings are connected together by a row of little hooks. They are spread over a skeleton of firm hollow tubes called veins, and the fore-wings are larger than

the hind-wings, both pairs being more or less triangular in shape. The terms applied to the sides and angles of the wings are the same as those used in the Lepidoptera.

In the Lepidoptera the transparent membranous wings are covered with coloured scales. The fore-wings are generally larger than the hind-wings, and usually cover the latter to a greater or less extent when at rest. When the wings are spread out flat, they naturally exhibit an upper and an under surface. The colour of the under side is generally very dull in moths, but in some butterflies, especially among the exotic species, it is not unfrequently even more bright and showy than the upper side. In the clear-wing moths the wings are partially devoid of scales. The wings are generally of a somewhat triangular form, and in order to understand the descriptions, it is necessary to remember the names which are applied to their different sides or margins. In the fore-wings (Fig. 2 A B C) A B is the front edge or costa, A C the inner margin, and B C the hind-margin or border, lying furthest from the body of the insect. In the hind-wings (A C D)

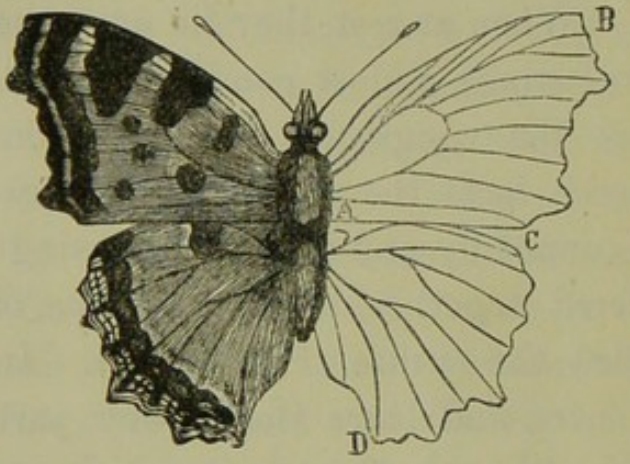


Fig. 2.

A C is the costa, A D the inner margin, and C D the hind-margin. The point A, at which the wings are attached to the sides of the thorax, is called the base; the angle formed by the costa and the hind-margin, marked B in the fore-wing and C in the hind-wing, is called the tip or apex. The angle at C in the fore-wings, formed by the inner and hind-margins, is called the hinder angle, and the corresponding angle of the hind-wings at D the anal angle. The hind-margins are in many species notched, sinuated, or indented, an instance of which may be seen in Fig. 2, which represents the Large Tortoiseshell Butterfly. Butterflies at rest hold their wings upright with the upper sides pressed together, so that only the under sides can be seen. Many moths, on the other hand, let their wings droop over the body, the fore-wings covering the hind pair, so that only the upper side of the fore-wings is visible.

The wings of the Diptera are membranous and transparent, and it is the fore-wings which are used in flight, the hind-wings being reduced to small knobs not unlike a battledore in shape; these are called halteres or poisers.

In the Neuroptera the wings are often very long, and all four are of similar texture; sometimes they are all of equal length, with the hind-wings broader than the fore-wings, as in the Dragon-flies and Ant-lions, but in the Caddis-flies and May-flies, especially in the latter family, the hind-wings are much the shorter. The wings are

transparent and membranous, and the veins form a close network.

In the Orthoptera the fore-wings are straight and parchment-like, and the hind-wings, which are much broader, are folded beneath them like a fan, except in the Earwigs and Cockroaches, in which the arrangement is somewhat different.

The Hemiptera Heteroptera have parchment-like fore-wings, membranous at the extremity, and a large scutellum, sometimes covering the greater part of the abdomen. In the Homoptera the four wings are membranous and of nearly similar structure. In females of the Coccidæ and Aphidæ the wings are usually absent.

The abdomen of insects is more or less cylindrical, and is composed of nine movable rings or segments. In some insects it is hard and horny, whilst in others it is soft, and may be covered with hair. On either side is a row of spiracles or breathing-holes. At the extremity are found the organs of reproduction, which, in the female, are often modified into an ovipositor or a sting.

METAMORPHOSES OF INSECTS.

Insects pass through several stages, called "metamorphoses" or transformations, before reaching the perfect condition. These are said to be complete or incomplete,

according to whether the insects undergo a perfect change of form after a period of inaction, or not. When the metamorphoses are complete, the insect passes through four very distinct stages, called respectively the egg, larva, pupa, and imago or perfect insect. The eggs are laid by the female, usually in large numbers, in some place where the larvæ when hatched can at once find their food. The larvæ are remarkable for their great voracity, and are of very various forms. Most larvæ have six legs on the segments corresponding to the thorax of the perfect insect. Those which are devoid of head and legs, as in the flies, are called maggots, whilst those of butterflies and moths, which have from ten to sixteen legs, are called caterpillars, and those of some saw-flies having still more legs, up to twenty-two, false caterpillars. When the larva has reached its full growth, having previously moulted several times, it enters into a third stage, the pupa, of which two kinds are distinguished. When the metamorphoses are complete, the pupa is inactive, and does not eat, being to all appearance lifeless. It is frequently enclosed in a cocoon, or covered with earth, etc., as in some Lepidoptera; in this state it is often called a chrysalis. When the metamorphoses are incomplete, the pupa has six legs, and feeds, and differs only from the larva and perfect insect in having rudiments of wings; this is called the nymph, and is the form found in grasshoppers, dragon-flies, etc. In the case of beetles, the different organs of the body are encased in

separate coverings, but the pupa is nevertheless inactive. Such a pupa is called necromorphous, or corpse-like. The pupæ of Diptera are barrel-shaped, and the insect emerges by pushing off a kind of lid.

The final transformation from the pupa to the perfect insect takes place by rupture of the outer skin, when the perfect insect emerges through the aperture. The wings are often limp, and require to be dried in the air, and expanded to their full size before they can be used. The nymphs quit their skin and develop their wings in very much the same manner.

Different insects may pass the winter in different stages, and revive on the return of fine weather. Most insects pass through all their stages in the course of a year, but some have several generations or broods in that period, whilst others, like the cockchafer, require three years or more for their development.

HABITS AND HAUNTS OF INSECTS.

These depend in a great measure on their food, which consists of various animal and vegetable substances, alive and dead. Many insects are active only by day, and others at night; whilst others again may be seen both by day and night. Some insects frequent flowers and live on honey, *e.g.*, Lepidoptera, and many Hymenoptera; while others

simply visit flowers in search of prey. Carnivorous beetles, *e.g.*, the Carabidæ, often seek their prey on the ground or in crevices, and carrion-feeding beetles also seek their food in similar places.

Strong-flying carnivorous insects, such as Dragon-flies and some of the Diptera, pursue their prey on the wing, and parasitic insects, which deposit their eggs in the bodies of living caterpillars, seek these diligently in the spots which they frequent. Many insects are very retired in their habits, especially in the larval state, and are hardly ever to be found without careful search, except at night. Some few, such as fleas, lice, sheep-ticks, bed-bugs, etc., are parasitic on warm-blooded animals.

Vegetable-feeding larvæ often live exposed on their food plants, but some gregarious species form a web on the plants, in which they live; others again feed under the surface of the ground on the roots of plants, or bore in the stems, or even in the solid wood of trees, and the larvæ of many minute moths and flies form mines or blotches in the substance of leaves. Many insects live in fresh water during at least a portion of their lives; some of these are very voracious, such as the larger water-beetles, which destroy quantities of fish-spawn and even young fishes. Many beetles live in dung or in fungi, whilst some frequent ants' nests; thus Claviger is always found in ants' nests, and is fed by the ants. The beetles inhabiting the great caves in

America and on the continent of Europe are destitute of eyes, but the senses of many insects are very acute.

Many insects are directly or indirectly injurious to man. They destroy his crops and his fabrics, or even attack himself or his flocks. On the other hand insects are very useful, by the rapidity with which they consume all kinds of decaying animal and vegetable substances, and by keeping in check the too great exuberance of vegetation; they also serve as food to birds and a variety of other insect-feeding animals, and in many countries even to man himself. Insects also furnish many useful products, such as honey, wax, silk, shell-lac, cochineal, etc.

COLLECTING INSECTS.

We now turn to a subject of great importance to the collector, namely the apparatus required for capturing and preserving insects. The best localities for collecting are generally those which have the richest and most varied vegetation, and are at some distance from human habitations. The growth of towns and the spread of cultivation exterminate many species both of plants and animals.

The apparatus required by the collector are the following:—

The *ring-net* (Fig. 3) consists of a light iron jointed ring, which can be folded up and placed in the pocket

when not in use. The ring (Fig. 4) should be about a foot in diameter; it is generally made with a screw, by means of which it can be fitted on the end of a walking-stick, a screw cap being placed in the hole at other times to keep out dirt. A net made of green gauze, sewn

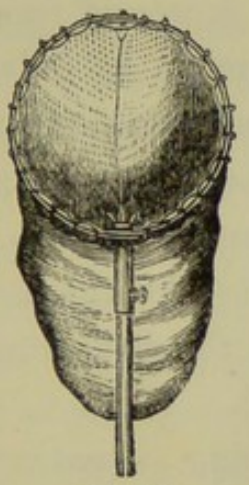


Fig. 3.

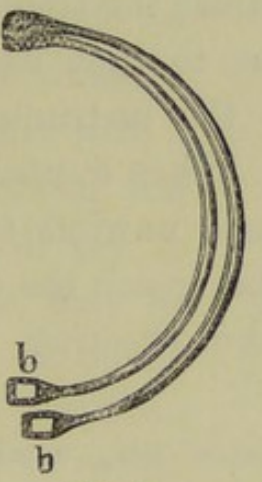


Fig. 4.

on to some strong, stiff material about two inches broad, is fixed loosely round the ring so that it can be slipped off when necessary. The shape of the net should be conical and somewhat rounded at the end, and it should be about three feet long, so that it can be twisted round the ring or stick after striking at an insect. This net is used for capturing insects on the wing, or when resting on flowers, but it is necessary in the latter case to be careful that it does not get entangled among thorns.

The *umbrella-net* is generally somewhat larger than the ring-net, and the stick passes across the opening. This is, of course, a disadvantage, as is also the fact that the stick is short. It is, however, very portable, and can be more quickly prepared for use than the ring-net. The framework is made of elastic steel, or whalebone, and when not in use lies flat against the stick. The net is wound round it and a case similar to that used for umbrellas is drawn up over it, giving the instrument the appearance of an ordinary umbrella. When wanted for use it is only necessary to draw off the case, unwind the gauze, and push up the elastic sides till they reach the catch. For beetles the net is usually made of stout sheeting, and is used for sweeping grass and bushes.

The *water-net*, used for catching aquatic insects, is similar to the sweeping-net, but the ring is made much stronger, and is best in one piece. The stick also requires to be stronger and longer. The net itself should be made of canvas, rounded, and much shorter than the sweeping-net.

The *forceps-net* (Fig. 5) is now seldom used, and is not essential. It is chiefly useful to capture small insects at rest. As is seen in the figure, it has much the shape of a curling-tongs, expanding at the end into a more or less circular framework, on which the gauze is spread.

For catching beetles which live on trees and shrubs an *umbrella* will generally be found most convenient. An

ordinary umbrella serves the purpose very well, but a light-coloured one is best, as the insects will be more readily seen on the light ground; and they can be captured more easily if the ribs are covered with stuff like the umbrella, so as not to leave any crevices. Some collectors use an umbrella the stick of which can be taken off. The mode of procedure is to hold the umbrella under a bush or tree and strike the branches with a stick, when many insects will fall down and can be picked up, though some will try to escape by flight. A cloth, or sheet, may be spread under the bush instead of an umbrella.

Fig. 5.

A good *steel pick* will be found useful in searching for insects under bark and in rotten wood, and may also be employed for digging up pupæ.

A small *forceps* (Fig. 6) is particularly useful for dislodging insects from crevices in bark, and for picking beetles out of dung, fungi, etc.

The *beetle-sieve* is a very useful instrument for catching ground-beetles. It consists of a wire sieve about a foot in diameter and of about $\frac{1}{8}$-inch mesh. In it are placed moss, fallen leaves, mould, etc. The sieve is shaken over a sheet of white paper or a white cloth, and the small beetles are caught as

Fig. 6.

they fall; or the sieve may be made with a lid under it on which to receive the beetles. This method is very productive, especially in cold seasons, when beetles live chiefly under moss, dead leaves, etc., but it is, of course, only applicable to the smaller species.

The *collecting-boxes*, of which the collector will require to take several with him on his excursions, are made of wood or stout pasteboard, and lined with cork or turf to receive the pins. The most convenient size is about six inches by three, and three inches deep, fitted with cork on both sides. A few chip boxes to receive live insects should also be taken. Some collectors employ papers, but these are chiefly useful for soft-bodied insects, such as Lepidoptera and Saw-flies. They are made by folding square pieces of paper diagonally, leaving a margin. One edge is folded over, forming a sort of triangular envelope into which the insect when caught and killed is slipped, the margin at the open end being folded over to close the envelope. Only one specimen should be put into each paper, and the papers should be proportioned to the size of the insects for which they are to be used. Papers are very portable, but unless great care be taken, the specimens are liable to become more or less damaged.

A few *wide-necked bottles* with tightly fitting stoppers, containing spirit diluted with 25 per cent. of water, are the best receptacles for beetles and bugs. The spirit soon

stupefies them, but does not kill them directly, and it is necessary to keep some of the larger species in it over-night. This is the simplest way of killing them, but should not be employed for any soft or hairy insects. Insects can be kept a long time in spirit without injury, if it be renewed as often as it becomes discoloured by the substances discharged from the bodies of the animals.

One of the best ways of collecting hard-bodied insects is to bring them home in tin boxes or small phials, taking care, however, in the case of carnivorous beetles to keep each specimen separate, and afterwards plunging them into boiling water. This kills them instantly, but they must be taken out as soon as they are dead, or they will become so much softened as to be useless.

The *pins* used for setting insects are known as entomological pins, and can be obtained from any dealer in entomological apparatus. They are of different lengths and thicknesses, and the pin used in each case must be proportioned to the size of the insect.

Sugaring will be found very useful for collecting many insects. The collector goes out a little before dusk and smears the stems of trees with some sweet sticky liquid, such as beer and sugar, to which a few drops of rum or apple flavouring should be added to render the odour more powerful. Honey will also be found very attractive, as well as slices of dried apple soaked in the sweet solution and hung up by

threads. As soon as it becomes dusk many moths and other insects will make their appearance when the weather is favourable, when they can readily be captured with the aid of a dark lantern. Flowers are also very attractive to insects, both in the daytime and at dusk, and, on the other hand, high-flying butterflies are often attracted by puddles, the sap exuding from the trunks of trees, or even by dung, carrion, strongly smelling cheese, etc.

Insects may also be attracted by a light placed at an open window.

THE CAPTURE AND REARING OF CATERPILLARS.

It is generally difficult to rear insects from the larva, except in the case of some of the larger Lepidoptera, and to these we will therefore restrict our observations on this subject. When in search of caterpillars it is necessary to take some boxes of wood, cardboard, or tin, with a wire lid or covered at the top with muslin, to admit air.

The whereabouts of caterpillars may often be detected by the ragged leaves of the plants on which they feed. Some species may be found all through the day, but others remain in their hiding-places, and only emerge to feed at certain times of the day or night. Some may be obtained by beating bushes, etc., and others by means of the sweeping-net.

Hairy caterpillars should not be handled much, as the hairs are apt to stick in the skin and sometimes produce great irritation.

When searching for caterpillars, chrysalides must not be neglected. These may be found hanging from twigs and on fences, in a web between leaves, and they may likewise be found in the chinks of bark, or dug up from the ground, especially near the roots of trees. They should be placed in the pupa-cage under conditions as nearly as possible resembling those in which they have been found.

Several cages are required for breeding caterpillars. They are square wooden frames, with a network of gauze let into three of the sides, a glass door forming the fourth side. The bottom of the cage should be covered with earth, in which the food-plant should be set: where this is not possible, small glasses of water may be placed in the cage containing shoots or branches of the food-plant, and covered at the top to prevent the caterpillars from falling in and getting drowned.

For small caterpillars, which would be liable to be lost in a large cage, smaller cardboard or wooden boxes may be used, with a covering of muslin or fine wire for the lid to admit air. Some caterpillars, *e.g.*, those of the goat-moth, feed on wood, and these must be kept in tin boxes. Caterpillars with large jaws are better avoided, or should be kept isolated, as some of them are cannibals and will devour

other caterpillars which come in their way. The first thing to be done after bringing home a caterpillar is to procure its proper food, as many species can only eat particular plants. If a caterpillar is obtained the food-plant of which is unknown, it should be offered a variety of plants, in hopes of finding the right one.

It is most important to keep the caterpillars supplied with fresh food, and if this be placed beside the old, they will pass from the one to the other of their own accord. The cages must also be kept clean and well ventilated, and fresh, moist earth put in from time to time. If these precautions are neglected, the larvæ invariably sicken and die, but the more nearly they can be kept in a state of nature the better. Sometimes a muslin bag is spread over a brood of caterpillars on a branch, and they are reared beneath it.

Caterpillars bred from eggs require even greater precautions, as they are very delicate when young, and can generally only be reared with patience and perseverance. During the last few years many persons have amused themselves by rearing some of the more conspicuous foreign Lepidoptera, such as the various large silkworms, from the eggs, and the Zoological Society of London has a house set apart in its gardens for this purpose.

When the caterpillars have passed into the chrysalis state, they had better be removed and placed in a separate cage set apart for chrysalides, if this can be done without

injuring them. Many large caterpillars form the chrysalis underground, and others will spin a cocoon against the side of the cage, and in such cases it is too dangerous to move them. When the caterpillar is about to assume the chrysalis state, it ceases to eat, loses its colour, and begins to spin threads. When these symptoms are observed, it may be removed to a separate cage to undergo its last changes.

ON PREPARING INSECTS FOR THE CABINET.

Collections may either be kept in a cabinet or in store-boxes. Entomological cabinets are generally made with from twenty to fifty drawers arranged in tiers. The drawers are lined with cork, and are covered with a glass lid which can be taken off. They have a recess let in at the side, which is covered by the framework of the lid. This is intended to hold camphor or some other preservative, and is provided with one or two round holes, about the size of a shilling, communicating with the inside of the drawer. The drawer is lined with white paper, and opposite the holes a number of perforations should be made with a pin, to allow the vapour of the camphor to pass into the drawer. All the drawers should be made interchangeable.

Well-made cabinets are always expensive, and if a good cabinet cannot be procured at first, it is better

to use store-boxes for a time than to waste money on an article of inferior workmanship. Store boxes are of various sizes, and are best made of some light wood. The bottom is lined with cork or turf covered with white paper. They are best kept set on end like books, and not laid on their sides. They are sometimes fitted with a compartment for camphor, like cabinet drawers, but if not, a piece of camphor enclosed in a small muslin bag should be pinned in one corner.

When properly taken care of, a collection of insects will last for many years, but specimens should never be placed in open glass cases, or otherwise exposed to the light, which soon spoils their colours, and, if they are not kept in close-fitting cases supplied with camphor or some other preservative, they will soon be destroyed by mites or small beetles. The camphor must be renewed from time to time as it evaporates.

Most insects, except bugs and beetles, are set with their wings expanded, and in such cases the insect should generally be pinned through the middle of the thorax. Insects must either be set before the wings become stiff, or must be placed for a short time in a closed vessel with a little damp sand, in order to soften the integuments sufficiently.

The setting-board (Fig. 7) consists of two long strips of deal, of varying width, according to the size of the insect. These are fixed to a piece of wood underneath, a

space corresponding to the size of the insect's body being left between them, which is lined with a narrow strip of turf or cork almost to the surface. The strips are generally inclined slightly downwards and outwards in English setting-boards.

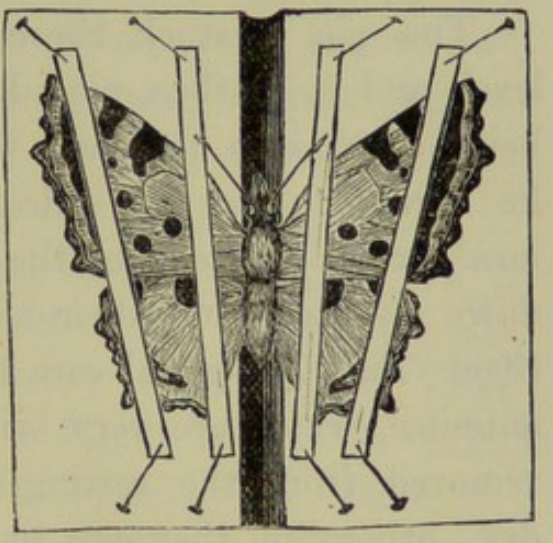


Fig. 7.

All butterflies and moths should be set at a uniform level on the pins, and this level will depend on the depth of the groove in the setting-boards. In England it is usual to set insects so low that the ends of the wings almost touch the surface of the drawer or box, but on the Continent they generally set the insects high on the pins, about an inch above the surface of the drawer. This has the advantage of placing them more out of the reach of mites, and if all are set exactly at the same height, it looks better. The setting-boards must be of different widths according to the size of the wings of the insects, and the groove between them must also vary with the size of the body. Continental entomologists sometimes regulate the width of the groove by fitting screws to the setting-boards, but there is no necessity to use such complicated apparatus. In setting,

common pins should not be used, as they are too thick and non-elastic, but entomological pins, which are about an inch long and of various thicknesses, should be employed.

The pin is stuck through the insect to the required level, and it is then placed on the setting-board, the pin being stuck into the cork in the groove, so that the wings lie evenly on the two sides of the board. The wings are now carefully placed in the proper position, and are fixed down by strips of paper or thin cardboard pinned across them (Fig. 7), special care being taken not to damage the antennæ, which are very brittle. The insect must not be removed from the setting-board till the wings are quite dry, otherwise they are liable to slip into an unnatural position. Large insects require several days to become perfectly stiff, but do not take so long in hot weather as in cold.

The preparation of beetles and bugs for the cabinet is somewhat different from that of other insects, as the wings are generally not expanded. If the specimens are in spirit, they should first be laid on blotting-paper to drain. A pin is then thrust through the right wing-case and the insect is placed in a box or on a piece of cork, and the antennæ and legs are spread out, as in walking, and kept in position by means of pins, and the insect must not be moved till it is quite dry and stiff. If it be desired to have the beetles high on the pins, a setting-board can be arranged with a piece of deal

below and a layer of turf or cork on it of the required thickness.

In pinning beetles, care must be taken that the pin does not injure the base of a leg. Some elytra are so hard that they can only be perforated by using a thick pin, and employing some degree of force. Another important point is that the pin should be exactly vertical, and all the insects should be set at the same height on the pin. Insects less than $\frac{1}{4}$-inch in length had better be mounted on cardboard, as shown in Fig. 8.

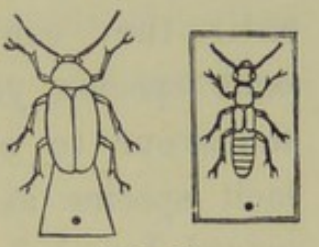


Fig. 8.

Some insects, such as grasshoppers, are so different in appearance when the wings are open and closed that specimens should be set in both positions; or, if you have only a single specimen, it is well to expand the wings on one side only, leaving those on the other side closed.

To prepare caterpillars for the collection is much more troublesome, and we do not advise the beginner to attempt it. They must be first killed with methylated spirit, and then cut open at the hinder end, and the contents of the body carefully squeezed out between blotting-paper—not a very pleasant job; a straw is then stuck through the aperture, and the empty skin is blown out with air, and at the same time held over a hot plate or a spirit-lamp to dry it. The caterpillar thus treated can be fixed on a twig or a piece

of cork through which a pin is stuck. Most caterpillars fade in the process. Chrysalides can be more easily mounted. One has only to stick a pin through the skin from which the imago has emerged, or through a dead specimen.

The value and beauty of a collection is much impaired if the specimens are damaged or in poor condition, and, although we would not advise bad specimens to be rejected until they can be replaced by better examples of the same species, yet we would recommend every collector to endeavour to obtain as perfect and well-set specimens of each species as possible. Again, much harm is often caused by wholesale and reckless collecting, and we would strongly urge upon our readers never to destroy more specimens than they *actually require* for themselves and their friends.

Insects must be arranged systematically in the cabinets or boxes under their Latin names, for English names are but little used, and many species do not possess any. The insects should be placed in columns, each column being separated by a black line or thread. The name of the group, family, and genus is written at the top, and the specific name placed underneath, or a printed list may be cut up for labels. In the case of small insects, which are difficult to identify, it is best to put them under the family or generic name till an opportunity occurs for determining them by comparison with some well-named collection, or otherwise.

A register of specimens should be kept, giving the date, place of capture, and time of day, with any other notes which the collector may think worth recording. A sufficient number of specimens should be kept to illustrate both surfaces of each sex, as well as any varieties which may be met with. When specimens are required which cannot be obtained in any other manner, they may be purchased, but the collector will always find the specimens which he has captured or reared himself more interesting and more instructive than those obtained from others.

ORDER COLEOPTERA

(*Beetles*).

There are about 3,000 species of British beetles, 15,000 European species, and fully 100,000 species are known from the tropics, where every freshly-explored locality is sure to yield a large proportion of new forms.

Our British species fall into four large groups, separated according to the number of joints of the tarsi, as follows:—

1. *Pentamera*, with five joints to all the tarsi.
2. *Heteromera*, with five joints to the tarsi of the front and middle legs, but only four to the hind pair.
3. *Tetramera*, with four joints to all the tarsi.
4. *Pseudotrimera*, which have apparently three-jointed tarsi.

PENTAMERA.

GEODEPHAGA (CARNIVOROUS LAND BEETLES).

This group includes many large and middle-sized as well as small beetles. They are mostly black, frequently with a metallic lustre. They are found running on the ground, or hiding under stones and moss, and feed on other insects, etc., for which purpose they are provided with powerful jaws.

The larger species are useful on account of the number of injurious insects which they destroy. We can only mention a few of the most important, for this is a large group.

FAMILY CICINDELIDÆ.

On warm, sunny days the species of the *Cicindelidæ* may be found running about in sandy places and rising now and then with a quick, jerky flight. They have a broad and long head, and long, slender legs. Their larvæ live in holes in the ground.

Cicindela campestris (the Green Tiger-beetle), Plate I., Fig. 1, is light green above, with several whitish spots. The larva is as voracious as the beetle itself. It is common everywhere, even near London.

Cicindela sylvatica (the Large Tiger-beetle), Plate I., Fig. 2, is the largest of our British *Cicindelidæ*. It is dark coppery brown, with a white, semilunar mark on the shoulder, an irregular streak below the middle of the wings, and a dot below it.

It is found, among other places, on the South Coast, at Bournemouth.

Cicindela hybrida (the Hybrid Tiger-beetle) resembles *C. campestris*, but its colour is more greyish brown, and the markings are more yellowish.

FAMILY CARABIDÆ.

This family includes many large and remarkable forms.

Some species are devoid of true wings, and the males have the joints of the front pair of legs expanded.

Omophron limbatum, Plate I., Fig. 3, is remarkable for its curious oval shape, quite unlike that of most of the other *Geodephaga*, and rather simulating that of the water-beetles. It lives on the banks of brooks and swamps, under the roots of plants. It is tawny, with dark green markings.

Procrustes coriaceus, Plate I., Fig. 4, is a Continental species, which is said to have been taken at Portsmouth, but is very doubtfully British. It is a large, dull black insect.

Calosoma sycophanta (the Large Gold Beetle), Plate I., Fig. 5, is a fine species. It is metallic green, reddish at the sides, with rows of fine depressed spots. It is very rare in Britain, and is supposed to be only a casual visitor.

Carabus auratus (the Gold Beetle), Plate I., Fig. 6, is metallic gold above, with three ridges on each side. Below, it is black. The legs and antennæ are reddish brown. Although common everywhere on the Continent, this insect is so rarely met with in England, except among foreign vegetables, that it is hardly considered a native species.

Carabus granulatus is black, with three rows of small raised tubercles on each wing-case. It hides itself during winter in the stumps of old trees, and is common throughout Britain.

Carabus violaceus has nearly smooth elytra. It is dull

blue-black, purplish at the sides. It is common in the South of England.

Carabus nemoralis has a purplish thorax and coppery wing-cases.

Carabus nitens, a smaller species, is bright green with reddish sides. The pronotum is punctured, and there are three ridges on each of the elytra. It is found in boggy or sandy places.

Brachinus crepitans (the Bombardier Beetle), Plate I., Fig. 7, is a slender insect with broad, truncated elytra, and a narrow, heart-shaped pronotum. It is orange with dark blue wing-cases. It lives under stones and among the roots of trees, and when disturbed, emits from its hinder extremity a pungent, acrid substance, which volatilises immediately on coming in contact with the air, and produces a slight report.

Panagæus crux-major (the Large Cross Beetle), Plate I., Fig. 8, is easily recognised by its nearly round pronotum and the black cross on its red wing-cases. It is rather local, but is common in some places.

Harpalus æneus is a very common metallic green or coppery beetle, with the legs and the base of the antennæ red.

Harpalus ruficornis is slightly larger, dull black in colour, with fine hairs on the elytra. The antennæ and legs are reddish brown. It is extremely abundant, and is frequently dug up in gardens.

Broscus cephalotes, Plate I., Fig. 9, is a rather long, shining, black insect, with a heart-shaped pronotum. It is common on the coast, but is rarely found inland. It is so voracious that it will sometimes attack and devour its own species.

Zabrus gibbus is pitchy-black, strongly convex, and the elytra are marked with lines of punctures. It is a most destructive insect, for the larvæ feed on the roots of wheat and other cereals, and the beetle feeds on the ears by night, a most remarkable fact, as the Carabidæ generally feed on animal substances.

Clivina fossor is a little, slender, pitchy brown beetle, which has the tibiæ toothed. It is common among garden refuse.

Bembidium quadrimaculatum is a small beetle with two light spots on each wing-case. It frequents the banks of streams and marshes.

Bembidium bistriatum is the smallest of the Carabidæ found in Britain. It is only $\frac{3}{4}$-line in length, and is reddish black with yellowish legs and antennæ. The wing-cases have several indistinct stripes, and two distinct ones. Like others of the genus, it lives in damp places.

Elaphrus riparius is also a semi-aquatic insect. It is about $\frac{1}{4}$-inch long, with greyish green wing-cases with some large, depressed punctures. It has short antennæ and prominent eyes, which make the head appear very broad.

Nebria brevicollis is a common insect about $\frac{2}{3}$-inch long, of a pitchy brown colour, with heart-shaped pronotum, and punctured lines on the wing-cases. It is found on the banks of streams, etc., under stones.

HYDRADEPHAGA.

These beetles and their larvæ are aquatic, and are generally met with in standing water. They live on other aquatic animals, and are good swimmers, but have to return to the surface occasionally to take in a fresh supply of air. They sometimes leave the water at night, and may therefore be occasionally met with at some distance from water. The Water-beetles generally have a smooth, oval body and filiform antennæ. The hind-tarsi are flattened and hairy, for swimming, and in the males the front tarsi are generally widened into a flat plate, with a number of raised sucking-pads. The larger species will eat small fishes and spawn, and are therefore very injurious to pisciculture.

Hydaticus transversalis, Plate I., Fig. 10, is of a long oval shape, the pronotum being rusty red in front and at the sides. The wing-cases are yellowish on the sides and have a yellowish band near the base.

Hyphydrus ovatus, Plate I., Fig. 12, is easily recognised by its globose form and rusty red colour. The upper side of the female has a silky shine. It is common in ponds and pools.

Dytiscus marginalis (the Common Water-beetle), Plate I.,

Fig. 11, is one of the largest of our British water-beetles. It is long and oval, greenish black above, yellow on the edges of the pronotum and wing-cases, and yellow beneath. The male, which is distinguished by the sucking-pads on its front tarsi, is smooth, whilst the female has the wing-cases generally deeply furrowed, although this varies in individuals, and females with almost smooth wing-cases are sometimes taken. *D. marginalis* swims with great rapidity, and is a good diver. Specimens may often be seen, tail upwards, on the surface of the water, taking in air by the spiracles on the side of their body. If the pools in which they live become dried up in summer, they take to the wing, and fly in search of a new home.

Acilius sulcatus is common in swamps. It is dark brown, with yellow spots on the sides of the abdomen, and yellow bands on the sides and middle of the pronotum. The wing-cases are smooth in the male, but deeply furrowed and hairy in the female. The under side is black.

Colymbites notatus is about the same size as *Hydaticus transversalis*. It is reddish yellow, with a black mark in the middle of the pronotum, black confluent spots on the wing-cases, and a brownish yellow line on the suture.

Gyrinus natator (the Whirligig Beetle), Plate I., Fig. 13, is of remarkable form. The antennæ are short and thick, and the middle and hind legs, which are only used for swimming, are very short. The Whirligig Beetles spin about

on the surface of slowly running or standing water. They have an air apparatus at the end of the abdomen which serves as a reservoir when they dive. They are blue-black in colour, dark and metallic beneath. The thorax has a rusty red margin, and the legs are yellowish red. If handled, they exude a bad-smelling, milky liquid, apparently from all parts of the body.

HYDROPHILIDÆ.

These differ from the Hydradephaga in being generally more convex and in having short club-shaped antennæ. The maxillary palpi are generally as long as, or longer than, the antennæ. In their mode of life they resemble the last group, but are less carnivorous.

Hydrophilus piceus (the Great Water-beetle), Plate I., Fig. 14, is our largest British water-beetle. It is elongated and oval, narrowing behind. Its colour is shining pitchy black, with rusty red antennæ. On the under side, which is dull, the hind-part of the thorax has a long spike projecting backwards. The male has flat triangular front tarsi. This beetle lives in standing water, and does not paddle along like the Hydradephaga, but moves its legs alternately, like a dog.

BRACHELYTRA (ROVE BEETLES).

This is a group with very distinctive characteristics. The wing-cases are very short, and only cover a small

portion of the abdomen, the uncovered part of which is horny. The tarsi are not always five-jointed. The *Brachelytra* or, as they are popularly called, Rove Beetles have generally a narrow and elongated form, and the larvæ bear a great resemblance to the beetles themselves, only that they are wingless. They feed on other insects and are found under stones, moss, bark, in dung and other decaying substances, in fungi, and many of them in or near ant-hills. They are mostly small, often only a small fraction of an inch in length, generally uniform black or brown, rarely with any distinctive colouring or marking. We have a great many species in Britain, and they are often so much alike that the beginner will find the greatest difficulty in distinguishing any but the largest and most conspicuous species.

Creophilus maxillosus (the Large-jawed Rove Beetle), Plate I., Fig. 15, is common on paths, near dung or dead animals. Its name is derived from its large and powerful mandibles. The head is large and somewhat square; the thorax is flat in the middle and hairy on the margins, and the wing-cases are edged with a broad, grey, felt-like band. It runs quickly, and has a powerful flight. There is a variety called *C. ciliaris*, found in Scotland, in which the pile is tawny-golden.

Emus hirtus (the Humble Bee Beetle), Plate I., Fig. 16. This very rare species is remarkable for its shaggy coat of long hair, which resembles that of the insect from which it

derives its name. The head, thorax, and three last segments of the abdomen are covered with golden-yellow hair, and the wing-cases have a yellowish grey felt-like band across them. It is found in dung-heaps, where it probably feeds on small dung-beetles.

Leistotrophus murinus is black, densely clothed with greyish brown down, and has black legs. It is common in dung-hills in many places.

Staphylinus cæsareus (the Red Rove Beetle), Plate I., Fig. 17, is the commonest of the true *Staphylini*, the other species of this genus being rare in Britain. It is dull black, with red wing-cases and legs, and has reddish yellow antennæ. The back of the pronotum and sides of the abdomen are clothed with golden-yellow hair.

Staphylinus erythropterus is found in the North of England. It differs from the last species in having the scutellum also covered with golden-yellow hair.

Staphylinus pubescens (the Downy Rove Beetle) is black above, clothed with greyish brown down. It is silvery beneath, and has a yellow ring before the end of the femora.

Ocypus olens (the Devil's Coach Horse), the best known of the group, is a large, dull black beetle, with a large head and powerful jaws. It is common on roads, and has a strong fetid smell. It has a habit of elevating its head and tail when disturbed, opening its jaws at the same time, and

snapping at anything which comes near it. The larva resembles the perfect insect, and lurks in a cell which it has constructed for itself, and watches for insects, upon which it feeds.

Pæderus riparius, Plate I., Fig. 18, is black with blue wing-cases. The pronotum, the first four segments of the abdomen, and the base of the antennæ and legs are red; the femora are black at the tips.

Stenus biguttatus is one of a large group of small beetles which are characterised by the great breadth of the head, the slender, short antennæ, which are placed on the forehead, and the narrowness of the pronotum. The present species is greyish black, with a round, reddish mark near the middle of each elytron.

Oxyporus rufus, Plate I., Fig. 19, is shining black, with the pronotum, the first four segments of the abdomen, and the legs red. There is a reddish yellow spot at the base of each elytron. It lives in fungi which grow on trees, and has powerful jaws.

Oxytelus rugosus is common on dung everywhere. It is only $2\frac{1}{4}$-lines in length, and is black, with three longitudinal furrows on the pronotum, which has small tooth-like projections at the sides.

NECROPHAGA.

The *Necrophaga* have the antennæ clavate, or knobbed, at the end. This group includes not only many useful insects

PLATE II.

COLEOPTERA.

Descriptions will be found at the pages given after the names of the insects figured.

Fig.

NECROPHAGA.

1. Necrophorus humator (the Black Burying Beetle), p. 43.
2. Necrophorus vespillo (the Common Burying Beetle), p. 43.
3. Silpha thoracica, p. 44.
4. Silpha obscura, p. 44.
5. Hister quadrinotatus, p. 45.
6. Nitidula bipustulata, p. 45.
7. Dermestes lardarius (the Bacon Beetle), p. 46.
8. Attagenus pellio, p. 46.
9. Anthrenus scrophulariæ, p. 47.
10. Byrrhus pilula (the Common Pill-Beetle), p. 47.

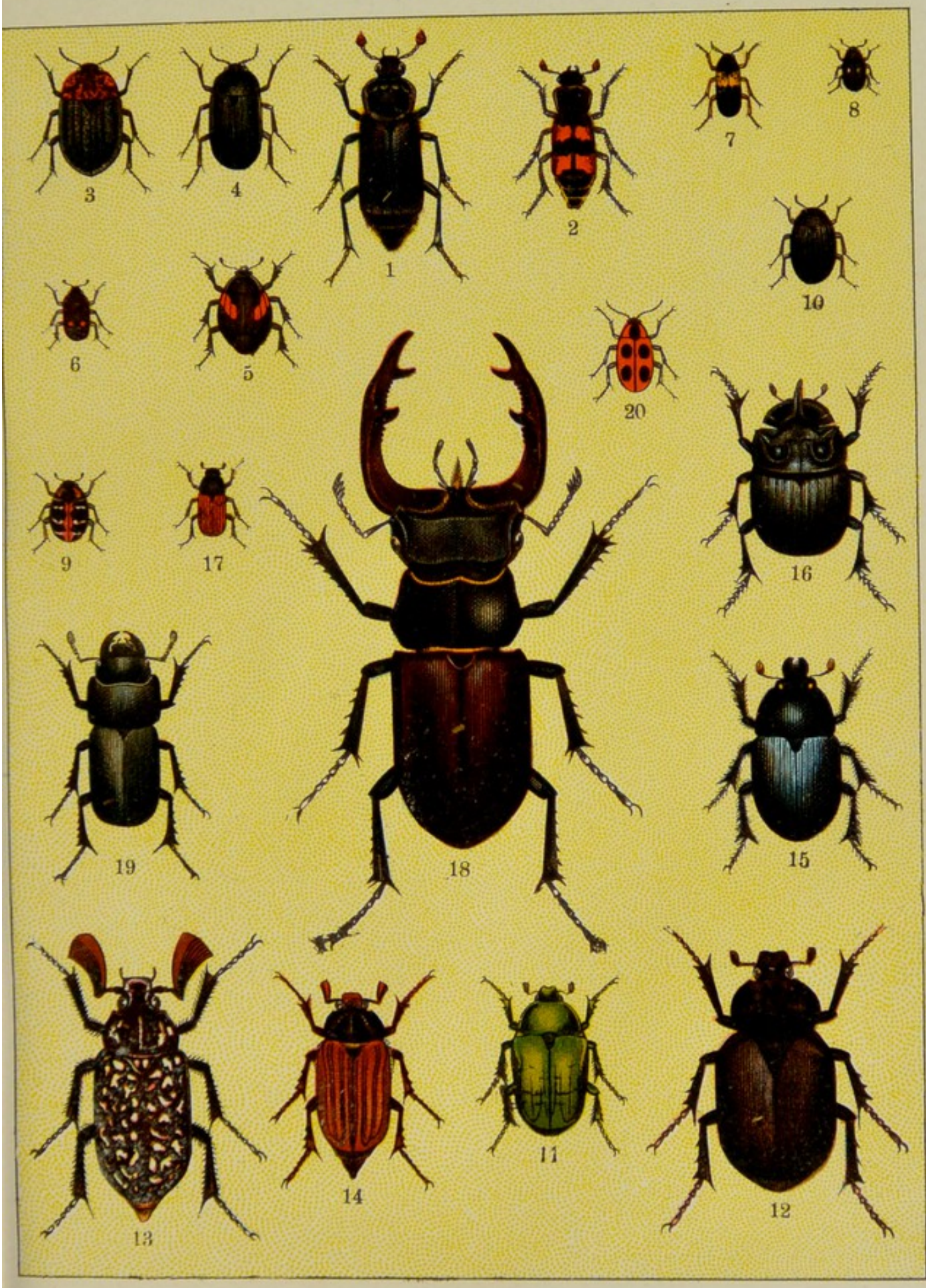
LAMELLICORNES.

11. Cetonia aurata (the Rose Chafer), p. 48.
12. Osmoderma emerita, p. 48.
13. Polyphylla fullo, p. 48.
14. Melolontha vulgaris (the Common Cockchafer), p. 49.
15. Geotrupes stercorarius (the Dor Beetle), p. 50.
16. Copris lunaris (the Lunar-headed Dung Beetle), p. 50.
17. Aphodius fimetarius (the Small Dung Beetle), p. 51.
18. Lucanus cervus (the Stag Beetle), p. 51.
19. Dorcus parallelopipedus (the Small Stag Beetle), p. 51.

COCCINELLIDÆ.

20. Endomychus coccineus, p. 80.

PLATE II.



which feed on other insects or on carrion, but also some very injurious species which destroy plants, fur, etc.

One of the most interesting families of the group is the *Necrophoridæ* or Burying Beetles, which are distinguished by their clubbed antennæ and their truncated elytra. Some of them live on dead mammals and birds, which they discover by their sense of smell, and in which they deposit their eggs. They have a slight smell of musk, and emit a fetid black fluid from the mouth.

Necrophorus germanicus (the Great Burying Beetle), our largest British species, is about an inch long, and is of a uniform black except for a red line on the margined or turned-up borders of the elytra. It does not feed on carrion, but pursues live insects, and is frequently found on dung-heaps.

Necrophorus humator (the Black Burying Beetle), Plate II., Fig. 1, is somewhat smaller than the last. It is of a uniform black colour, with the clubs of the antennæ red. It is common about carrion, fungi, etc.

Necrophorus vespillo (the Common Burying Beetle), Plate II., Fig. 2, is black, with two orange bands across the elytra. The antennæ are also orange, and the front of the pronotum is set with yellow hairs.

Necrodes littoralis is uniform black, with rust-coloured clubs to the antennæ. It resembles *Necrophorus humator*, but has a narrower and rounder pronotum, and the hind

femora of the males are sometimes much enlarged and thickened.

The *Silphidæ* or Carrion Beetles feed on carrion and insects, but many of their larvæ are injurious to turnips, etc. The antennæ are only slightly thickened at the end, and do not form a distinct club. The tarsi of the front and middle legs are thickened in the male. When touched, they emit an ill-smelling, yellowish liquid.

Silpha thoracica, Plate II., Fig. 3, is common in woods. It is oval and flat, and is readily distinguished by its red pronotum and black elytra.

Silpha opaca (the Beet Carrion Beetle) is very common and feeds on dead animals. The beetle is black, with a dense greyish brown down on the upper side. The larva is sometimes very destructive to beet, mangold, etc., on the leaves of which it feeds.

Silpha obscura, Plate II., Fig. 4, is one of the commonest of the Carrion Beetles. It is black, with punctured wing-cases, each of which has three obscure, slightly raised lines.

Silpha atrata (the Black Carrion Beetle) is somewhat smaller, and differs in having a semicircular pronotum, and in being thickly punctured, especially on the sides of the thorax, and on the elytra.

Silpha quadripunctata (the Four-spot Carrion Beetle) is pale yellow with two black spots on each wing-case. The head and pronotum are black, with the exception of the

yellow margin of the latter. It occurs on carrion in woods, and is common in spring on oaks and fruit-trees, where it feeds on caterpillars, especially those which live in a web (See p. 21).

The *Histeridæ* are small oval beetles which live in dung. Their elytra present several longitudinal lines, and are truncated, leaving the end of the abdomen uncovered. The legs have flattened femora toothed on the outer side, and can be drawn up close to the body.

Hister quadrinotatus, Plate II., Fig. 5, is rounded, broad and black, with two dark red marks and three lines on each wing-case.

Hister unicolor is glossy black, with four long and three short lines on each of the wing-cases.

Nitidula bipustulata, Plate II., Fig. 6, is brown, with two red spots on each wing-case; it feeds on carrion, and sometimes attacks meat.

Meligethes æneus (the Turnip-blossom Beetle) is a destructive species. It is a small beetle of an elongated oval shape, and is shining metallic green or bluish above. It is common throughout the summer, and is particularly destructive to rape and mustard, the buds and blossoms of which are often extensively attacked. As a preventive, it has been suggested to sow the rape in rows, whereby the plants are strengthened, for it has been noticed that these beetles seldom attack strong vigorous plants.

Ips quadripustulatus is a small beetle, about $2\frac{1}{2}$ lines long, of a shining black colour, finely punctured, and with two red spots on each wing-case. It lives under the bark of trees.

Trogosita mauritanica likewise lives under bark, but is also found in granaries. It is flat, and uniform pitchy brown, and is about 5 lines in length.

Dermestes lardarius (the Bacon Beetle), Plate II., Fig. 7, is common in houses, warehouses, etc., and has received its name from its destructiveness to cured meats, etc. It is elongate, dark brown, with a light greyish yellow transverse hairy band across the wing-cases, which are marked with three black spots on each side. The larva, which has an anal tuft of long hairs, lives not only on bacon, but on all kinds of animal substances, such as meat, hides, etc. As the larvæ moult several times, their presence is often indicated by their cast-off skins.

Attagenus pellio, Plate II., Fig. 8, is much smaller, but equally destructive to natural history specimens and furs. It is black, with a small white spot on the middle of each of the wing-cases. The larvæ may be destroyed by beating the furs, or by exposing them to moderate heat in an oven. The beetle is found in houses in the winter, but may be met with on flowers in summer.

Anthrenus museorum, which is only about 1 line long, is another very destructive insect of similar habits. It is

oval in shape and brownish black in colour, with the sides of the thorax and three transverse bands on the elytra clothed with greyish yellow scales. To destroy or drive away the hairy larvæ, it is usual to expose the furs to heat in an oven, or to use some strong-smelling substance, such as camphor or carbolic acid, as a preservative.

Anthrenus scrophulariæ, Plate II., Fig. 9, is similar in shape, but is slightly larger. It is distinguished by its bright red suture and the three white bands which cross the wing-cases. It is found on various flowers, and the larva is destructive to furs, etc., though less so than the last species. It is doubtfully British.

Byrrhus pilula (the Common Pill-beetle), Plate II., Fig. 10, is long and very convex, with the antennæ hardly clubbed. It is black, with brown downy hair above, and has four black longitudinal stripes on each wing-case, interrupted with brown. If touched, it shams death, and draws its legs up with the flat femora in the grooves of the thorax. It will also contract its legs when dropped into spirit, and may sometimes be seen in this state in collections.

LAMELLICORNES.

In this group the last joints of the antennæ are flattened, and can be spread out and closed again at the will of the animal. The antennæ are larger in the male than in the

female. These beetles are generally of considerable size and of bulky form; the front femora are toothed on the outer side. Many feed on plants, and are sometimes very destructive.

Gnorimus nobilis is bright metallic green above and coppery beneath. The elytra are transversely wrinkled, with whitish spots. There are also similar spots on the sides of the abdomen. It is found on the roots of fruit-trees, flowers, etc., and is about 7 lines long.

Trichius fasciatus is common on flowering-plants, and is about the same size as the last species. It is black, densely clothed with pale yellow hairs, and has two broad yellowish bands across the wing-cases.

Cetonia aurata (the Rose Chafer), Plate II., Fig. 11, is found on various flowering plants, such as roses, elder, thistles, etc. It is bright green with a metallic lustre, and has white markings on the elytra. The pronotum is notched in front.

Osmoderma emerita, Plate II., Fig. 12, is pitchy black, with the pronotum depressed in the middle in the male, with a raised space on either side. It occurs in old trees on the Continent, but is not British.

Phyllopertha horticola (the June Bug) is especially injurious to roses and willows. It is hairy, the elytra reddish brown, the thorax and under side dark metallic green.

Polyphylla fullo, Plate II., Fig. 13, is a handsome

Continental insect, allied to our common Cockchafer, and has been reputed British. It is a rich dark chestnut-brown, with numerous white hairy spots. The male has very large fan-shaped antennæ, but those of the female are small.

Melolontha vulgaris (the Common Cockchafer), Plate II., Fig. 14, is well known to everyone. The elytra are reddish brown, with a few longitudinal furrows and a certain amount of whitish down; the legs and antennæ are somewhat lighter, the latter being longest in the male and seven-jointed, but in the female only six-jointed; the abdomen is spotted with white on the sides, and is pointed at the end. They appear in May in large swarms, although single specimens may often be found even in winter in mild weather. The female burrows in the ground and there lays a number of eggs, from which the pale yellow larvæ emerge some four or six weeks later. These are about an inch long, and are provided with six legs and powerful jaws. They live underground for three years, feeding on the roots of grass, vegetables, and young trees, and are very destructive. After this they assume the pupa state late in the summer, and the beetle, which emerges in the spring of the following year, feeds on the leaves of various trees, and proves almost as destructive as the larva.

The complete metamorphoses require four years to accomplish. Luckily the cockchafer has many enemies, such as moles, shrews, field-mice, rooks, etc., which keep down

their numbers. When there are swarms of cockchafers on the trees, it is useful to shake them down, and to employ children to pick them up, when they may be used to feed pigs or poultry. These and other destructive insects, etc., may be destroyed in large numbers by driving pigs and poultry, especially ducks, into ploughed fields to feed.

Rhizotrogus solstitialis (the Small Cockchafer) is much smaller than the Common Cockchafer. It is brownish yellow, clothed with long hairs, and has four longitudinal furrows on the elytra. It appears in June, and its habits are very similar to those of the larger species, like which it may often be seen flying round trees in the evening.

Geotrupes stercorarius (the Dor Beetle), Plate II., Fig. 15, is a common, dung-feeding beetle. It is oval, and black or bluish black, with fourteen finely punctured lines on each wing-case. They dig holes under patches of horse-dung and there deposit their eggs.

Copris lunaris (the Lunar-headed Dung Beetle), Plate II., Fig. 16, is deep shining black, with a few reddish hairs beneath and on the sides. The male has a long, pointed horn on the head, and the female a short, blunt one. It burrows under cow-dung.

Aphodius fimetarius (the Small Dung Beetle), Plate II., Fig. 17, is black, with the front angles of the pronotum and the elytra red. It is very common in the dung of cows and other farm animals.

Lucanus cervus (the Stag Beetle), Plate II., Fig. 18, is our largest British beetle. The large, branching horns of the male, which expand in front of the broad, square head, are not used to eat with, but probably to break twigs. The beetle sucks the sap of the oak with its yellowish brown, brush-like tongue. The horns vary much in size in different individuals, and are always very small in the female. The colour is dark chestnut above, the head and thorax being generally darkest. It is commonest in oak-woods, especially in the South of England, and the larvæ, which take several years to complete their transformations, live in the wood of these trees.

Dorcus parallelopipedus (the Small Stag Beetle), Plate II., Fig. 19, is much smaller, and perfectly black. It lives in decaying oak, walnut, and beech trees. The male has short jaws, with a tooth in the middle which is curved upwards.

Sinodendron cylindricum is smaller still, cylindrical in shape, and shining black, densely punctured, with brownish wing-cases. The head of the male has a long horn bent backwards, and the female a tubercle in the same position. The larvæ live in the rotten trunks of trees, especially beech. The length of the beetle is about half an inch.

STERNOXI.

These are slender beetles with more or less distinctly serrated antennæ. They have been divided into two

sub-groups, viz., *Buprestidæ* and *Elateridæ*. Of these the latter are able to turn themselves over when placed on their back, but the former cannot.

The *Buprestidæ* have large eyes, and the head is deeply set in the thorax. Their larvæ are devoid of legs, and feed on wood.

Anthaxia nitidula is ovate, golden-green, with two depressed punctures at the base of the pronotum. It is found on various flowers, especially the rose, chrysanthemum, ranunculus, etc., and has a habit of disappearing when approached, so that it is difficult to catch.

Agrilus biguttatus is our largest British species of the *Buprestidæ*. It is about half an inch long, and is of a brilliant green colour with a small, whitish spot at the base of the elytra, and generally two indistinct spots on the sides of the abdomen. The larvæ live in the bark of fallen oak-trees, in which they make numerous galleries.

Ancylocheira rustica, Plate III., Fig. 1, is common on the Continent, but does not occur in Britain. It is of a uniform dark metallic green above, with rows of punctures.

The *Elateridæ* or Click-beetles have the prosternum provided with a short spine pointing backwards, which fits into a hollow of the mesosternum, and by means of which the beetle can spring to its feet with a click when placed on its back. The larvæ have six legs.

Lacon murinus, which is about $\frac{3}{5}$-inch long, is dark brown

PLATE III.

COLEOPTERA.

Descriptions will be found at the pages given after the names of the insects figured.

Fig.

STERNOXI.

1. Ancylocheira rustica, p. 52.
2. Elater sanguineus (the Red Click-beetle), p. 55.
3. Corymbites lineatus (the Striped Click-beetle), p. 55.
4. Corymbites signatus, p. 55.

MALACODERMI.

5. Lampyris splendidula, male, p. 56.
6. Lampyris splendidula, female, p. 56.
7. Telephorus fuscus, p. 56.
8. Malachius æneus, p. 57.
9. Clerus formicarius, p. 57.
10. Trichodes apiarius, p. 57.
11. Lymexylon navale, p. 58.
12. Ptinus fur, p. 58.
13. Ptilinus pectinicornis, p. 58.

HETEROMERA.

14. Blaps mortisaga (the Rare Cellar Beetle), p. 59.
15. Tenebrio molitor (the Meal-worm Beetle), p. 60.
16. Pyrochroa coccinea (the Cardinal Beetle), p. 60.
17. Cerocoma schæfferi, p. 60.
18. Meloe proscarabæus (the Common Oil Beetle), p. 61.
19. Cantharis vesicatoria (the Spanish Fly), p. 62.

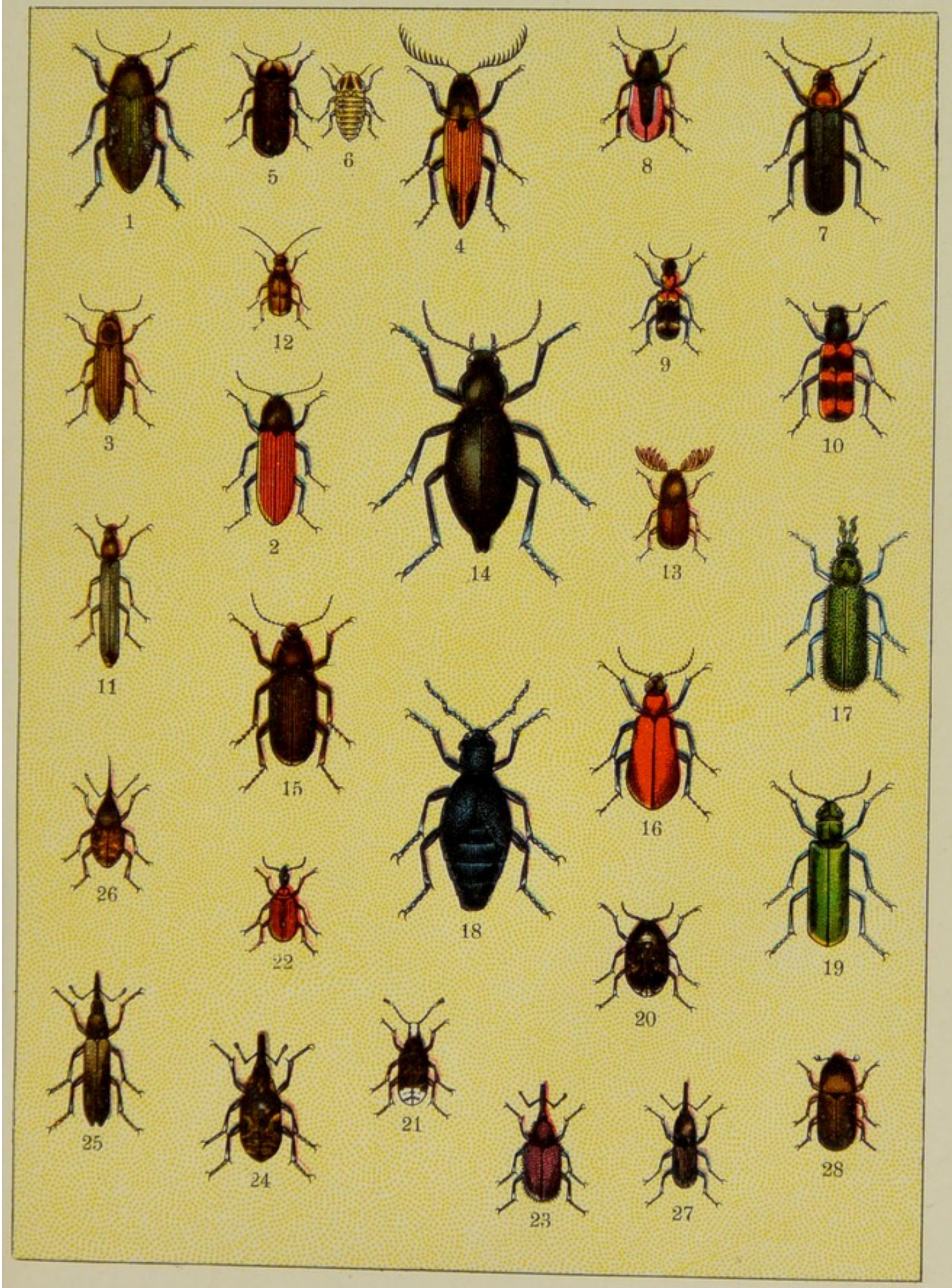
RHYNCHOPHORA.

20. Bruchus pisi (the Pea Beetle), p. 63.
21. Anthribus albinus, p. 63.
22. Apoderus coryli, p. 63.
23. Rhynchites bacchus, p. 64.
24. Hylobius abietis (the Pine Weevil), p. 65.
25. Lixus paraplecticus, p. 65.
26. Balaninus nucum (the Nut Weevil), p. 66.
27. Sitophilus granarius, p. 67.

BOSTRYCHIDÆ.

28. Tomicus stenographus, p. 68.

PLATE III.



with light, hairy spots and rusty red antennæ and tarsi. It occurs in fields and meadows, and the larvæ are destructive to field and garden produce.

Elater sanguineus (the Red Click-beetle), Plate III., Fig. 2, is characterised by having scarlet wing-cases, the head, thorax, and under side being black. It lives in the bark of decaying oak-trees.

Corymbites lineatus (the Striped Click-beetle), Plate III., Fig. 3, is brown, with striated wing-cases, the intervals between the ridges being dark. The larvæ, which are known as wireworms, are very destructive to plants. They eat their way into the stem just above the root, and sometimes find their way up, even above the surface of the ground. Their transformations occupy about five years.

Corymbites signatus, Plate III., Fig. 4, a Continental species, has ochreous wing-cases with a dark green mark at the end on each. The pronotum is metallic green, and the antennæ are pectinated.

Corymbites æneus is common in grassy places, and under stones. It is about $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in length, and is shining green or metallic blue, with strongly striated wing-cases, and reddish legs.

MALACODERMI.

These beetles have soft wing-cases and a long, slender, soft body; they live partly on animal and partly on vegetable food.

Lampyris noctiluca (the Glow-worm) has a greyish yellow pronotum, and the elytra are about three times as long as broad. This insect is the cause of the phosphorescent lights sometimes seen in the grass on summer evenings. Both the males and females are luminous, but the males only in a slight degree. The females are wingless, as are also their larvæ, which greatly resemble them. The light is emitted from the under side of the abdomen, near the extremity, and is subject to the will of the insect. Both the beetle and its larva feed on small snails and slugs, and have special organs near the end of the body to brush off the slime and dirt which adhere to them.

Lampyris splendidula, Plate III., (male) Fig. 5, (female) Fig. 6, a Continental species, is greyish brown in the male, with the elytra twice as long as broad. It has three light semi-lunar spots on the pronotum. The female is yellowish and wingless.

The *Telephoridæ*, popularly called Soldiers and Sailors, live on plants and feed upon insects, as do also their larvæ, which are found in the ground, and under stones.

Telephorus fuscus, Plate III., Fig. 7, and *T. rusticus* are both long beetles with greyish black wing-cases, reddish yellow bases to the antennæ, and a red pronotum, with a black mark upon it, which is situated on the front edge in the former species and in the middle in the latter.

Telephorus obscurus, also greyish black, is somewhat smaller, but the pronotum is black with red margins.

Telephorus melanurus is orange-red with black tips to the elytra.

The *Melyridæ* are found upon flowering plants. The larvæ are carnivorous, and live under the bark of rotten trees.

Malachius æneus, Plate III., Fig. 8, is green, with a yellow mark on the front of the head, and has the tip and sides of the wing-cases red, so that only a wedge-shaped space on the suture remains green.

Malachius bipustulatus is of a uniform green, with only a yellow mark at the mouth and a red one at the tips of the elytra. Some of the joints of the antennæ are enlarged in the male.

Dasytes niger, only two lines long, is black and hairy. The larva is found in raspberries.

Clerus formicarius, Plate III., Fig. 9, is common in newly felled pine-trees, and is useful because it feeds on various destructive insects. The head and elytra are black, with two transverse white bands on the latter; the front of the elytra, together with the pronotum, is red, and the legs are rusty red.

Trichodes apiarius, Plate III., Fig. 10, is blue and downy, with three red transverse bands on the elytra. The antennæ are somewhat thickened at the end. It lives

upon flowers, and the larva is said to be found in hives, and to destroy the bees and honey.

The *Anobiidæ* are somewhat cylindrical, with a hood-like pronotum, which laps over the head, partially covering it. The larvæ live in wood, to which they are more or less injurious.

Lymexylon navale, Plate III., Fig. 11, is a long slender beetle, which is destructive to old ships in the docks. The male is black, with the legs and fore-part of the elytra yellowish; the female is ochre-yellow, with the head and tips of the elytra darker.

Ptinus fur, Plate III., Fig. 12, is a small rusty-brown beetle with four hairy fascicles on the pronotum, and two interrupted white hairy bands on the elytra. The male is long and slender, whilst the female is oval. It is found in old houses, museums, etc., and comes out at night. The larvæ are destructive to fur, stuffed animals, dried plants, collections of insects, etc.

Ptilinus pectinicornis, Plate III., Fig. 13, is characterised by its large, deeply pectinated antennæ. It is of a uniform dark brown, with the legs and antennæ lighter, and is common in old willows.

Apate capucina, 5 lines long, is black, with a convex cowl-like pronotum. The wing-cases and abdomen are deep red.

Anobium pertinax (the Death Watch), $2\frac{1}{4}$ lines long, is a cylindrical dark brown beetle with several elevations and

hollows on the pronotum, and yellow downy hair on the hinder angles. The beetle and its larvæ are found in old willows, and also in old furniture, wainscoting, etc. It has received its popular name because the male taps against the inside of the wood with its head, making a ticking noise, which is supposed by the superstitious to presage the death of some member of the household. The beetle has also the remarkable habit, when touched, of shamming death so pertinaciously that it will allow itself to be impaled with a pin or held in a flame without showing any signs of animation.

Anobium paniceum, an allied species, is pale brown, with no elevations on the pronotum. It is found in stale bread, dried plants, etc.

HETEROMERA.

Front and middle tarsi five-jointed, hind tarsi four-jointed. They are moderately large, uniform dark brown or black beetles, with filiform antennæ. They live in dark places and are generally wingless.

Blaps mortisaga (the Rare Cellar Beetle), Plate III., Fig. 14, is uniform black, with the elytra pointed, especially in the male. It is found in cellars, out-houses, stables, and other dark places, where the larvæ feed on wood. It is very rare in Britain, and is only found in the North of England;

two other species, however, *B. mucronata* and *B. similis*, which are very like it, are common everywhere.

Opatrum sabulosum, $\frac{1}{3}$-inch long, is common on sandy roads on the South Coast. It is flat, and of an ashy-grey colour, with longitudinal ridges and shining interspaces. The front tibiæ are armed with a triangular tooth.

Tenebrio molitor (the Meal-worm Beetle), Plate III., Fig. 15, is blackish brown, with reddish brown under side and legs, and longitudinal rows of punctures on the wing-cases. This species is common in bakers' ovens and in mills, and the larva is called the meal-worm. It lives on flour, and is often very destructive. It is commonly used for feeding singing-birds.

Helops striatus is common everywhere in the summer under the bark of trees, and in the winter under moss in woods. It is shining dark reddish brown or pitchy black above, with reddish brown antennæ and legs. The pronotum and elytra are punctured.

Pyrochroa coccinea (the Cardinal Beetle), Plate III., Fig. 16, has downy scarlet pronotum and elytra, with the head, antennæ, scutellum, legs, and under side black and covered with fine downy hair. The larva lives in the bark of felled birch, walnut, and fir trees, etc.

Cerocoma schaefferi, Plate III., Fig. 17, is a brilliant green, densely punctured beetle, with yellow mouth, antennæ, and legs. The antennæ are of a curious twisted shape. It

lives on flowers, and, though common on the Continent, is not found in Britain.

Mordella fasciata, about 5 lines long, is common on umbelliferous flowers. It is black, thickly punctured, and covered with ashy downy hair. There is a whitish spot behind the middle of each of the elytra.

The genus *Meloe*, or Oil Beetles, is remarkable for being wingless and for having short, soft elytra which do not approach each other in the middle line to form a suture, but leave the greater part of the large abdomen uncovered. They are all dark blue or blackish, and soft, and exude a yellowish liquid from the joints of the legs (whence the name Oil Beetles) which in some species will raise a blister if it touches the skin. Their metamorphoses are remarkable. The female lays a large number of eggs in the ground, and the little, flea-like larvæ which emerge from them creep into flowers and attach themselves to the bees or wasps which visit them. In this way they are conveyed into the nests of these insects, where they feed upon the honey.

Meloe proscarabæus (the Common Oil Beetle), Plate III., Fig. 18, is blackish blue above with a violet shimmer, and the pronotum is roughly punctured. The antennæ of the male are bent irregularly in the middle.

Meloe violaceus is somewhat smaller and is of a brighter blue colour, with the pronotum finely punctured. The antennæ are similarly bent in the male.

Meloe variegatus is somewhat rarer and larger than the other species. It is of a dirty metallic green, with a large, bright, copper-coloured mark on each segment of the abdomen.

Cantharis vesicatoria (the Spanish Fly), Plate III., Fig. 19, is found in June on trees in the South of England. It is bright shining green, with rather long, soft elytra. These beetles contain a volatile, blistering substance, and are collected in the southern countries of Europe, where they are commonest, for pharmaceutical purposes. The persons who collect them wear masks, and thick gloves, and when the beetles swarm in the trees they shake them down, and plunge them into boiling vinegar, after which they are dried.

TETRAMERA.

With apparently four joints to all the tarsi.

RHYNCHOPHORA (WEEVILS).

In this group the head is prolonged into a more or less distinct proboscis, at the end of which is the mouth, which is very imperfectly developed. The antennæ, which are situated on the sides of this proboscis, are generally elbowed and are slightly clubbed. The larvæ are devoid of legs and eyes, and live in the interior of plants. Both the larvæ and

the perfect insects are extremely injurious to the plants on which they feed. The number of species belonging to this group is so large that we can only mention a few of the more important ones, and we may add that many of the smaller species are very difficult to determine.

Bruchus pisi (the Pea Beetle), Plate III., Fig. 20, is very destructive to peas. The female lays its eggs in the growing pod, and the larvæ feed on the peas inside, and in due course assume the pupa state. The beetle when it emerges bores its way through the pod and flies away. The infested pods may be distinguished by the presence of a small, round, semi-transparent spot. The beetle is only 2 lines long, and is of a greyish-brown colour with a short proboscis, and the antennæ not elbowed. The end of the abdomen is white with two black spots, and the pronotum and elytra are marked with several small white spots. The front legs are orange.

Anthribus albinus, Plate III., Fig. 21, has a broad proboscis and long antennæ, which are not elbowed. It is greyish brown, with the forehead and proboscis, as well as the hind part of the elytra and some of the joints of the antennæ, white; there is also a white spot in the middle of the elytra. There are three black elevations on the pronotum, and the antennæ are longer in the male than in the female. It lives in rotten bark.

Apoderus coryli, Plate III., Fig. 22, has the head, under

side, and legs black, and the pronotum and elytra bright red. The head is separated from the body by a distinct neck. This beetle lives on alder and young walnut trees; it rolls up the leaves and deposits its eggs in them.

Rhynchites bacchus, Plate III., Fig. 23, is shining coppery red, with long down and a dark blue proboscis. The female has a spine on each side of the pronotum, which is wanting in the male. With this instrument the female pierces young apples, in which it deposits its eggs.

Rhynchites betuleti is very injurious to vines and birches. It is steel-blue or golden-green, and the female has spines on the pronotum like the last species.

Rhynchites populi, which feeds on poplar, has also these spines in the female. It is coppery red or golden-green above, and blue beneath.

Apion apricans (the Purple-clover Weevil), 2 lines long, is one of a group of very injurious beetles. It is a little, black, pear-shaped insect, with a long curved proboscis, and the base of the antennæ yellowish. The wing-cases are furrowed, and the space between them is punctured. It is very destructive to clover, upon which it feeds.

Apion pomonæ, an allied species, is very injurious to fruit-trees.

Cleonus sulcirostris, nearly $\frac{3}{4}$-inch long, is sometimes very common. It is an ashy grey beetle with dark, oblique lines

on its rather long elytra, and with some longitudinal furrows on the proboscis.

Hylobius abietis (the Pine Weevil), Plate III., Fig. 24, is injurious to firs and pines. It is dark brown; the elytra have longitudinal lines of punctures and two ochreous irregular bands of hairs. Although it lays its eggs only on coniferous plants, it also attacks other trees, feeding on the tender bark of the young shoots.

Molytes germanus, about $\frac{1}{2}$-inch long, is oval and uniform black, without scales, with the exception of a few yellow, hairy spots on the pronotum and elytra.

Phytonomus polygoni, a small beetle about 2 lines long, is found on garden plants, especially on carnations. The pronotum has three white longitudinal lines; the elytra are bluish grey, with black, interrupted, longitudinal lines.

Phyllobius argentatus, 3 lines in length, is closely set with shining, metallic green scales. The antennæ, femora, and tarsi are brownish yellow, and there is a tooth on the outer side of the femora. It is sometimes injurious in orchards by gnawing young trees.

Phyllobius oblongus has rusty red elytra, antennæ, and legs. Its habits are similar to those of the last species.

Lixus paraplecticus, Plate III., Fig. 25, is peculiar for its elongated shape, and for the elytra being bidentate at the extremity. It is grey or yellowish green, and lives on water-plants.

Pissodes notatus is reddish brown with white dots on the pronotum and two yellowish bands on the elytra. It bores into pine-trees, the cones of which then turn red. The larvæ live in the stems of young trees under the bark and in the wood. There are several similar species which are equally injurious.

Anthonomus pomorum is common and destructive to apple-trees. It is only about 2 lines long, and is greyish-brown, with a white scutellum and rusty brown elytra, marked with an oblique whitish band near the middle, bordered with black. The female pierces young apple buds and inserts its eggs, when the buds stop growing and dry up as if scorched by the sun.

Balaninus nucum (the Nut Weevil), Plate III., Fig. 26, is covered with brownish yellow scales above, and has a very long proboscis, which is curved downwards and is nearly as long as the whole body. The femora have a distinct tooth near the end. The larvæ are the well-known maggots found in filberts and hazel nuts. While the nuts are still young and soft, the female pierces them with her long proboscis and lays one egg in each nut, the larva hatching in ten days.

Cryptorrhynchus lapathi, 4 lines long, is injurious to willows and alders. It is black and very convex, with elevations on the upper side, and may be recognised by the broad white ends of the elytra. This beetle has the power of concealing its proboscis in a depression under the thorax.

Ceuthorrhynchus sulcicollis (the Gall Weevil), about $\frac{1}{8}$-inch long, is black with grey scales above, and has striped elytra. The female pierces small holes in the stems or roots of cabbages and turnips, inserting an egg in each, which causes the formation of a gall. The pupæ are formed in the ground in cocoons.

Cionus scrophulariæ, only 2 lines long, together with several allied species, feeds on the upper surface of the leaves of various plants. The pronotum is covered with whitish scales, and the elytra are striped and chequered with black and white. There are two confluent black marks on the suture, bounded by a white mark in front and behind.

Sitophilus granarius, Plate III., Fig. 27, 2 lines long, is blackish brown, with the thorax nearly as long as the abdomen. The female lays her eggs in grains of corn; and the whitish legless larva devours the contents and pupates in the empty shell.

Sitophilus oryzæ, an allied species, has two dull red spots on the elytra. It feeds on rice, wheat, and maize.

BOSTRYCHIDÆ.

These beetles are particularly destructive to forest trees. They include many small species, varying from uniform pale brown to dark brown. They are of a cylindrical shape, with the head generally deeply inserted and almost hidden in the thorax. The antennæ are short and clavate. The beetles

and their legless larvæ live in the bark and wood of trees. They commonly attack trees which are already diseased, though they will sometimes attack healthy ones also. The female bores a hole in the trunk in the spring and inserts her eggs, and the larvæ when they emerge eat out straight passages or galleries in the stem. Woods may be protected from their attacks by setting traps consisting of felled trees and branches, which attract the beetles and prevent their attacking sound trees.

Tomicus stenographus, Plate III., Fig. 28, the largest of this family, is about 3 lines long, and forms galleries in pine-trees. The elytra are excavated at the apex and furnished with six teeth on each side.

Tomicus laricis is smaller, and has from three to six teeth on the margins of the concavity at the extremity of the elytra. It is not only found in the larch, but also in other coniferæ.

Tomicus bidens has no indentations at the end of the elytra. It lives in the bark of pine-trees, and forms radiating galleries.

Scolytus intricatus has the abdomen slightly raised at the extremity. It is about $1\frac{1}{2}$ line long, and makes zigzag paths in the wood of oaks.

LONGICORNES (LONG-HORNED BEETLES).

This group includes many large and beautiful species. They have elongated elytra, and very long antennæ, especially

PLATE IV.

COLEOPTERA.

Descriptions will be found at the pages given after the names of the insects figured.

Fig.

LONGICORNES.

1. Prionus coriarius, p. 71.
2. Hammaticherus heros, p. 71.
3. Aromia moschata (the Musk Beetle), p. 71.
4. Clytus arcuatus, p. 72.
5. Astynomus ædilis (the Timberman), p. 72.
6. Saperda carcharias, p. 73.
7. Molorchus minor, p. 73.
8. Rhagium mordax, p. 74.

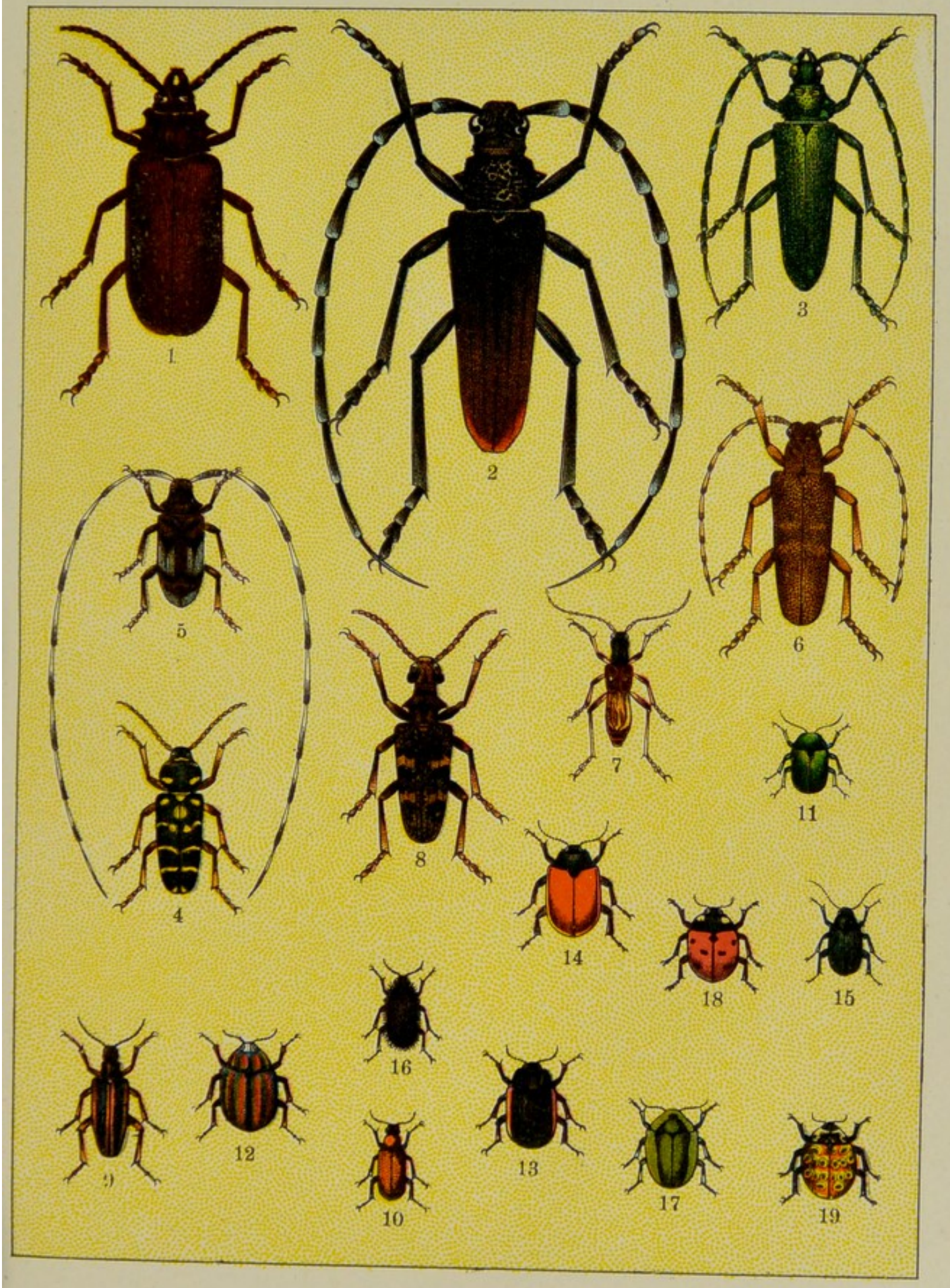
EUPODA.

9. Donacia dentipes, p. 75.
10. Crioceris lilii, p. 75.
11. Cryptocephalus sericeus, p. 76.
12. Chrysomela cerealis, p. 76.
13. Chrysomela sanguinolenta, p. 76.
14. Lina populi, p. 76.
15. Graptodera oleracea (the Common Flea Beetle), p. 77.
16. Hispa atra (the Hedgehog Beetle), p. 78.
17. Cassida equestris (the Green Shield Beetle), p. 78.

COCCINELLIDÆ.

18. Coccinella septempunctata (the 7-spot Lady Bird), p. 79.
19. Coccinella ocellata (the Eyed Lady Bird), p. 79.

PLATE IV.



in the males. Many Longicorns are able to produce a chirping noise by rubbing the thorax against the elytra. The larvæ are destitute of feet, and live in the wood of trees; the beetles generally live on plants.

Prionus coriarius, Plate IV., Fig. 1, is a large beetle which is found on trees, especially oaks, on the South Coast. It is broad and of a dark brown colour, with three spines on each side of the pronotum, and thick serrated antennæ.

Hammaticherus heros, Plate IV., Fig. 2, is one of the finest European species: it is said to have been taken in Britain, but was probably imported with timber. It is almost uniform black, with the elytra gradually tapering towards the extremity, where they are light brown. The pronotum is granulated, and has a short spine on each side; the antennæ are, in the male, nearly twice as long as the body, but are much shorter in the female. It lives in oak-woods, and is very destructive when it is numerous.

Aromia moschata (the Musk Beetle), Plate IV., Fig. 3, is so called because it emits a strong and pleasant odour. It is common on old willows, and is an elegant shining metallic green insect, often shot with coppery brown; the legs and antennæ are steel-blue.

Callidium violaceum, about an inch long, is a pretty beetle of a uniform dark violet colour, with black legs and antennæ. It is found on pines and alders in June.

Callidium variabile, another species, varies from reddish with violet elytra, to reddish brown or even dark steel-blue.

Hylotrupes bajulus is common on felled trees. It is about $\frac{3}{4}$-inch long, pitchy black, with several shining prominences on the pronotum. The elytra, in fresh specimens, have whitish downy hair.

The species of *Clytus* are elegant and handsomely-coloured beetles, with the thorax rounded.

Clytus arcuatus, Plate IV., Fig. 4, is common on fallen oak-trees. It is black, with two yellow elongated spots on the thorax, and a number of transverse lines and spots on the elytra, of the same colour. The antennæ and legs are orange.

Clytus mysticus, about $\frac{2}{5}$-inch long, is black, with fine grey hairs. The wing-cases are reddish brown with three whitish transverse lines in the middle and whitish at the extremity.

Lamia textor is a rather bulky, dull black beetle, with a spine on each side of the thorax, and with granulated wing-cases. The larvæ live in willows and aspens.

Astynomus ædilis (the Timberman), Plate IV., Fig. 5, is found on firs and pines, and occasionally makes its way into houses. It is greyish brown with four yellowish, hairy spots on the thorax, and bands of a darker colour on the elytra. The antennæ in the male are about five times the length of the body, but are much shorter in the female,

which is distinguished by its projecting ovipositor. It is common in Northern Europe, including some localities in Scotland.

Saperda carcharias, Plate IV., Fig. 6, about an inch long, has a smooth cylindrical thorax. It is clothed with dense, greyish yellow down dotted with black, and has black rings on the antennæ. It lays its eggs in the bark of poplars, on the wood of which the larvæ feed.

Saperda populnea, though only about half the size of the last species, is hardly less destructive. It is black with yellowish grey down, with two yellow, longitudinal lines on the pronotum, and a mark composed of four converging spots on each of the elytra; the antennæ have whitish rings.

Saperda scalaris, not a very common species, is somewhat larger than the last. The elytra are black with a greenish yellow suture and five transverse stripes, in addition to several spots on the margins. The pronotum is yellowish green, with a longitudinal, black line in the middle.

Molorchus minor, Plate IV., Fig. 7, is readily distinguished by its very short, brown elytra, which scarcely cover a third of the abdomen, and are crossed in the middle by an oblique, white line. The larva lives in decaying pine wood.

In the genus *Rhagium* the jaws are powerful, and the head, which is square, is distinctly separated from the

thorax by a constriction; the pronotum has a spine on each side.

Rhagium mordax, Plate IV., Fig. 8, the largest of the genus, occurs on oaks, but is not found in Britain. It is black, with dense yellowish downy hair, which forms two transverse bands on the elytra.

Rhagium bifasciatum, one of our British species, is somewhat smaller and narrower, and is not downy. The wing-cases are reddish brown on the sides and at the hinder extremity, and are crossed by two oblique yellow lines. The beetle is common in pine woods, and the larvæ eat passages into the bark.

Pachyta collaris, only $\frac{1}{3}$ of an inch long, is black with yellowish downy hair. The pronotum is very convex, and is bright red, as is also the abdomen. The elytra are greenish black or dark blue. It is common on flowers.

Leptura scutellata is black, thickly and coarsely punctured. The upper side is covered with fine grey pile, and the scutellum with close yellow downy hair. The head is separated from the thorax by a distinct neck. It is about $\frac{2}{3}$-inch long, and the elytra are narrowed behind. The larvæ live in old beech-wood.

EUPODA.

These are mostly small, oval beetles, many of them very brightly coloured; the last joint but one of the tarsi is

generally bilobed, as in most of the *Tetramera*. They and their six-legged larvæ feed on the leaves of low plants, and are often injurious in gardens.

Donacia dentipes, Plate IV., Fig. 9, is golden green above, with a longitudinal purple band on each wing-case; beneath, it is covered with fine short silky hair. The hind femora have a strong spur in the male, and a weaker one in the female. This beetle lives on water plants, and is common on rushes.

Lema melanopa has uniform bluish green elytra, a black head, antennæ, and tarsi, and red pronotum, femora, and tibiæ. It is about 2 lines long, and is common on leaves of corn, on which it feeds.

The genus *Crioceris* is characterised by an elongated body and prominent eyes. These beetles live chiefly on liliaceous plants, and have the power of making a chirping noise by rubbing the thorax against the elytra.

Crioceris lilii, Plate IV., Fig. 10, is common and very destructive to liliaceous plants on the Continent. It is scarlet above, with a black head and under side.

Crioceris duodecimpunctata (the 12-spot Asparagus Beetle), about 2 lines long, has six black spots on each of its orange elytra. Like the next species, it is found on asparagus, but is much rarer.

Crioceris asparagi (the Asparagus Beetle), about the same size, often causes great injury to asparagus by the

larvæ denuding the plants of their leaves and young shoots. It has a red pronotum and bluish green elytra with red borders and tip, and three yellow spots which are often confluent.

Clythra quadripunctata, 5 lines long, is shining black, the elytra being yellowish red with two black spots on each. It lives on willow and birch.

Cryptocephalus sericeus, Plate IV., Fig. 11, 2 lines long, is a cylindrical uniform golden-green or coppery red beetle, with long antennæ, and the head hidden under the pronotum. It is common on flowering plants in the sunshine, and, like many other beetles, has the habit of dropping down if the plant is touched.

The *Chrysomelæ* are very convex beetles, which live on bushes and low plants.

Chrysomela cerealis, Plate IV., Fig. 12, is a beautiful species which is injurious to grass. It is golden-green with a purple lustre, the pronotum and each of the wing-cases having three longitudinal blue lines.

Chrysomela graminis, 5 lines long, is uniform golden-green.

Chrysomela sanguinolenta, Plate IV., Fig. 13, has bluish black punctured wing-cases edged with red.

Lina populi, Plate IV., Fig. 14, and *L. tremulæ* are common, and destructive to poplar, aspen, etc. They are both bluish black or dark green with red elytra, the margin

of which is black in the former, but not in the latter species, which is somewhat the smaller of the two.

Gastrophysa polygoni is a common little beetle found most frequently on knot-grass. It is shining blue or green, with red legs and pronotum.

Prasocuris phellandrii, 2 lines long, is common on water plants. It is blackish green with reddish yellow margins to the pronotum, and with a reddish yellow longitudinal line on each wing-case, and the border and extremity of the same colour.

Adimonia capreæ is common, and destructive to willow and birch, in the bark of which it lays its eggs, which do not hatch till the following May, when the larva proceeds to feed on the leaves. The beetle, which is $\frac{1}{4}$-inch long, is brownish yellow above, with the head, the under side, and some small depressions on the pronotum black.

Agelastica alni, $\frac{1}{4}$-inch long, is uniform dark blue, with the elytra widened towards the extremity. It lives on alder.

The *Halticidæ* are a large family, including many small and closely allied species, which are remarkable for the development of the hind femora, which enables them to jump like fleas, whence they are called flea-beetles.

Graptodera oleracea (the Common Flea-beetle), Plate IV., Fig. 15, is one of the commonest and most destructive. It is uniform shining steel-blue or metallic green, and appears

in the spring, when it attacks the young leaves of many cultivated plants, especially vegetables, and the acacia, as well as forest trees, and lays its eggs on the leaves, upon which the larvæ feed.

Crepidodera helxines (the Buck-wheat Flea-beetle) is hardly 2 lines long. It is of a bright golden colour, with green elytra, and generally has the pronotum coppery red.

Hispa atra (the Hedgehog Beetle), Plate IV., Fig. 16, is about the same size, and is black, covered all over with prickles. It occurs on grass in sandy places, but is not common.

Phyllotreta nemorum (the Turnip Flea-beetle), which is rather smaller, is black, with a straight longitudinal yellow line on each wing-case.

In the *Cassididæ* the pronotum and elytra are extended over the body like a shield, so as to cover the head and legs completely.

Cassida equestris (the Green Shield Beetle), Plate IV., Fig. 17, is bright green above and black beneath, only the margins of the abdomen near the legs being yellowish. After death the vivid green colour disappears, and is replaced by a dirty brownish yellow.

PSEUDOTRIMERA.

With only three visible joints to all the tarsi.

FAMILY COCCINELLIDÆ (LADY BIRDS).

The Lady Birds are semi-spherical, rarely oval in form, and are generally spotted or otherwise varied; when touched they exude a yellowish liquid from different parts of the body. They live on plants and feed on Aphidæ.

Coccinella septempunctata (the 7-spot Lady Bird), Plate IV., Fig. 18, one of the commonest of our British beetles, is found in gardens, and often enters houses by the windows in the summer. It has red elytra, with three black spots on each and one on the scutellum. The pronotum is black, with yellowish white sides.

Coccinella quinquepunctata (the 5-spot Lady Bird) is very similar, but has only two spots on each wing-case.

Coccinella bipunctata (the 2-spot Lady Bird), almost, if not quite, as common as the 7-spot, has generally one spot in the middle of each wing-case, but may have a large one on the shoulder as well.

Coccinella ocellata (the Eyed Lady Bird), Plate IV., Fig. 19, our largest species, is about $4\frac{1}{2}$ lines long. The pronotum is black with white margins, and two white spots behind; the elytra are orange, with numerous black spots edged with yellow. It is found on fir-trees.

Coccinella vigintiduopunctata (the 22-spot Lady Bird), only

2 lines long, is bright shining sulphur yellow, with five black spots on the pronotum, and eleven on each wing-case. It is found on hedges, etc., near the sea coast.

Endomychus coccineus, Plate II., Fig. 20, does not strictly belong to the Lady Birds, which it nevertheless somewhat resembles. It is an oval beetle of a bright red colour, with two black spots on each wing-case. It is not uncommon on fungi and rotten wood, and the larvæ are found in the bark of willows and fir-trees.

FAMILY PSELAPHIDÆ.

This family includes a great many very small beetles, generally of uniform colouring, with long maxillary palpi, and wing-cases that do not quite cover the body. Most of the species live in ants' nests, or in rotting vegetable substances.

Claviger testaceus, Plate I., Fig. 20, is only 1 line long, and is of a reddish colour. It has neither eyes nor wings, and the tarsi terminate in a single claw. This beetle is common in ants' nests on the Continent, and both it and its larvæ are fed by the ants.

Claviger foveolatus, our sole British representative of this genus, is found in chalky districts in the South of England. It is yellow, and is very slightly smaller than the last species, which it somewhat resembles. It lives in the nest of the small yellow ant (*Formica flava*), which makes its nests under stones.

PLATE V.

HYMENOPTERA TEREBRANTIA.

Descriptions will be found at the pages given after the names of the insects figured.

Fig.

1 *a*, *b*. Cimbex lutea, with larva (*b*), p. 83.

2. Sirex gigas (the Giant Wood-wasp), p. 84.

3. Ichneumon annulator, p. 85.

4. Cynips quercus-folii (the Oak-leaf Gall-fly), p. 86.

HYMENOPTERA ACULEATA.

5 *a*, *b*, *c*. Formica rufa (the Red Ant), male (*a*), female (*b*), worker (*c*), p. 87.

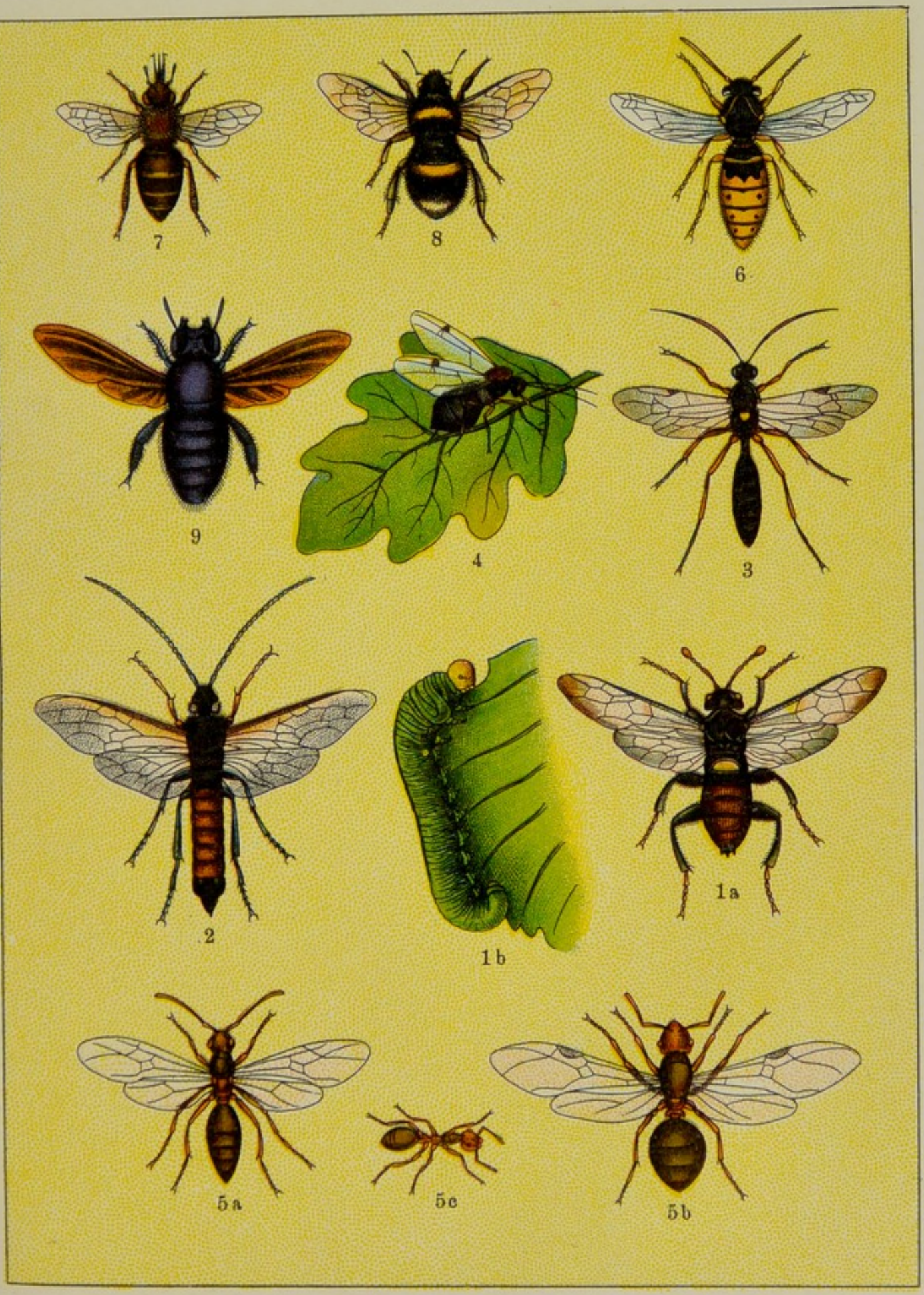
6. Vespa vulgaris (the Common Wasp), p. 88.

7. Apis mellifica (the Common Hive Bee)—worker, p. 89.

8. Bombus terrestris (the Humble Bee), p. 90.

9. Xylocopa violacea (the Carpenter Bee), p. 90.

PLATE V.



ORDER HYMENOPTERA.

The Hymenoptera have four transparent membranous wings, with only a few veins. They pass through a complete metamorphosis, and most of them have a proboscis for taking liquid food. The females either have an ovipositor at the end of the abdomen, or a sting with which they can inflict a wound. Some species live in communities and build nests. The number of British species is about 3,000. They are separated, according to the abdominal appendage of the female, into *Terebrantia,* which have an ovipositor, and *Aculeata,* which have a sting.

HYMENOPTERA TEREBRANTIA.

FAMILY TENTHREDINIDÆ (SAW-FLIES).

In these the abdomen is not distinctly separated from the thorax, and the ovipositor does not project, but is hidden in a sheath. The larvæ have from 18 to 22 legs, and feed on various plants, and many of them are very destructive.

Cimbex lutea, Plate V., Fig. 1*a*, one of our commonest species, has a black head, thorax, and legs, reddish brown abdomen, yellowish antennæ, and brownish hind-margins to the wings. The larva (Fig. 1*b*) is green and lives on birch-trees, on the branches of which it makes brown barrel-shaped

cocoons and spends the winter in them, assuming the pupa state in the spring.

Lophyrus pini (the Pine Saw-fly), is about 5 lines long. The male is black, with transparent iridescent wings; the female is whitish, with black head and thorax, and the wings are iridescent and marked with a black patch. The larvæ are very destructive to pines, feeding on the leaves as well as the bark of the young shoots.

Hylotoma rosæ (the Rose Saw-fly) lives on roses. It is black, with the abdomen yellow, and the antennæ are apparently only three-jointed, the terminal joints coalescing into a long club.

FAMILY SIRICIDÆ (WOOD-WASPS).

These have the ovipositor projecting from the abdomen.

Sirex gigas (the Giant Wood-wasp), Plate V., Fig. 2, is one of the largest of the European Hymenoptera. It is black, with a red abdomen tipped with black in the male; the female is black, with the middle of the abdomen yellow. There is a yellow mark on the head behind the eyes. The female lays her eggs in pine-trees, piercing the bark with her ovipositor. The larvæ, which have six legs, feed on the wood, and are very destructive. It is usually trees which are more or less unsound which are attacked.

Sirex juvencus (the Steel-blue Wood-wasp) is blue-black, with rusty red femora in the female, and brownish wings.

In the male the abdomen is red. Its habits are the same as those of the last species.

FAMILY ICHNEUMONIDÆ (ICHNEUMONS).

In the Ichneumons the abdomen is separated from the thorax by a constriction. The females have either a long or short ovipositor, with which they pierce the caterpillars of Lepidopterous insects and insert their eggs. Caterpillars thus treated sometimes survive to attain the chrysalis state; the butterfly or moth never emerges, but, instead, one or more Ichneumons, which have passed through all their transformations in the body of the caterpillar, come out and fly away.

Ichneumon annulator, Plate V., Fig. 3, is black, with red femora and tibiæ, and a yellow scutellum.

Microgaster glomeratus, a small species, sometimes lays as many as sixty eggs in one caterpillar of the Large Cabbage White Butterfly.

Pteromalus brassicæ, another little Ichneumon, lays its eggs on the chrysalis, and the two or three hundred larvæ which hatch, at once proceed to eat their way into it, and feed on the contents.

FAMILY CYNIPIDÆ (GALL-FLIES).

The females of these small insects pierce leaves and stalks with their ovipositor and insert the eggs. The leaf swells up where it has been pierced, forming a variously-

constructed oval or round out-growth called a gall, and in these galls the flies undergo their transformations and afterwards eat their way out.

Cynips quercus-folii (the Oak-leaf Gall-fly), Plate V., Fig. 4, is a common species. It forms green or reddish galls of about the size of a cherry on the under side of oak leaves.

Cynips gallæ-tinctoriæ (the Ink Gall-fly) is the species the galls of which are usually employed in making the gallic and tannic acids used in medicine, as well as in the arts. It is generally the principal ingredient in ink. These galls, which are found on *Quercus lusitanica*, are collected in Asia Minor and sent over in the dried state.

HYMENOPTERA ACULEATA.

These live in dwellings of their own construction, and the females have a sting.

FAMILY FORMICIDÆ (ANTS).

The ants and bees are remarkable for living in communities consisting mainly of workers or sterile females, commonly called neuters. In the case of ants these are wingless, and though the males and females are winged, the latter cast their wings after a short flight and then return to

their nests, if sufficiently fortunate to escape their numerous enemies.

Ants live in hollow trees, in the ground, or in nests of their own construction, and are remarkable for their intelligence and industry. They feed on the sweet parts of plants and also on animal substances. If a dead mouse be placed in an ants' nest, the soft parts will be devoured, and the clean skeleton left behind. The pupæ, incorrectly called ants' eggs, are much used for feeding birds, and as fish-bait; the ants themselves contain a peculiar acid, formic acid, which can be obtained by suitable methods. It is remarkable that many species of insects, especially small beetles, inhabit ants' nests, and the blind *Claviger*, which has no other abode, is fed and protected by them.

Formica rufa (the Red Ant)—Plate V., Fig. 5*a*, male; 5*b*, female; 5*c*, worker—forms large round ant-heaps out of vegetable refuse. It is a large species common in pine-woods.

Myrmica molesta (the House Ant) is a small yellow species common in houses in London, where it is very troublesome, for it attacks all sorts of provisions, especially sugar. It builds nests in warm places, which are usually difficult of access, but these may be destroyed when practicable by flooding them with boiling water. When the nests cannot be reached, the ants may be materially reduced in numbers by laying pieces of liver about, which should be dipped into boiling water as often as they become covered with ants.

FAMILY VESPIDÆ (WASPS).

Wasps build well-constructed nests in hollow trees, in the ground, or in outhouses, etc. These they make of a crisp paper-like mass, and there are, as in ants, males, females, and neuters, or workers, which, however, are always winged. The females are armed with a poisonous sting, but only attack man when molested. Wasps feed on both animal and vegetable food, and will sometimes kill bees for the sake of their honey.

Vespa vulgaris (the Common Wasp), Plate V., Fig. 6, has a black head and thorax spotted with yellow, and a yellow abdomen, black at the base and with black spots on the sides.

Vespa crabro (the Hornet) is larger and has a much severer sting. It is over an inch long and is black, with the front part of the thorax, and the middle and front part of the abdomen, reddish brown. The last segments of the abdomen are yellow with black spots.

FAMILY APIDÆ (BEES).

The bees are distinguished from the wasps by having the first joint of the hind tarsi widened and flattened. These are also fringed with hairs, to which the pollen of various plants adheres, and many plants are mainly fertilised in this manner. The body is more or less hairy. Bees are divided into social

and solitary; the former have males, females, and workers, which, like those of the wasps, are winged; but the latter consist of males and females only.

Apis mellifica (the Common Hive Bee), of which the worker is figured on Plate V., Fig. 7, is the best known and most useful. It is quite as industrious as the wasps, but feeds almost exclusively on honey. The bees build very carefully constructed nests, in boxes or baskets, called hives. In each nest there is only one female, the queen-bee; but there are several hundred males or drones, and some thousands of workers. These last are the smallest, the drones being larger and devoid of sting, whilst the queen is still larger. If several queens are hatched in one hive in the course of the summer, all but one quit the hive, accompanied by a number of workers, to form new colonies. This emigration is called swarming. If two queens encounter each other they fight till one is killed, unless prevented by the workers. When a swarm settles, it is the bee-keeper's object to transfer it to an empty hive, and if the queen is placed in it, the workers will follow. The building of cells now commences. These are small hollow hexagonal cases, placed together with great regularity, and constructed of wax prepared from the pollen which has adhered to the legs of the bees. The cells are placed close together, one above another, and thus form the comb. They are arranged in double layers open in front, but closed behind by a partition

wall. The bees employ their time, when not at work in the nest, in visiting flowers to collect honey and wax. When they return to the hive they deposit the honey in the cells and close them up till winter. The business of the queen-bee is to lay an egg in each cell, which hatches in a few days, and the larva is fed with suitable food by the bees. The drones are killed by the workers in the autumn, or driven out of the hives.

Bombus terrestris (the Humble Bee), Plate V., Fig. 8, is a gregarious species, which builds its nest in the ground, covering it with moss. It is black, the front of the thorax and a broad band on the abdomen being yellow; the end of the abdomen is white.

The solitary bees generally build their nests in the ground, but some species lay their eggs in the nests of Humble Bees.

Osmia parietina makes its nest in clayey soil. It is black, with yellowish grey downy hair, the terminal segments of the abdomen being yellowish red in the male. It appears to be restricted in Britain to Scotland and the North of England.

Xylocopa violacea (the Carpenter Bee), Plate V., Fig. 9, though not British, deserves mention on account of its peculiar habits. It is black and downy, with violet-coloured wings, and with the last joint but one of the antennæ reddish yellow in the male. The female bores a

long gallery in rotten wood, of the same width as her body. At the extremity of this she deposits some wax and honey, and lays one egg. She then closes the cell with wood dust, and lays another egg with some more honey and wax. In this way the whole gallery is filled up with a series of cells, each containing an egg, which passes through its transformations in the cell, and eventually makes its way out as the perfect insect.

ORDER LEPIDOPTERA.

RHOPALOCERA (BUTTERFLIES).

Butterflies have a slender body and broad wings, brightly coloured on both sides. When resting they raise their wings in such a manner as to show the under side. They fly only by day, and chiefly in bright sunlight. The caterpillars have eight pairs of legs, the first three pairs being horny and corresponding to the legs of the imago, whilst the others are fleshy and are called prolegs, the last pair being placed at the extremity of the body.

Caterpillars are generally covered with spines or short hairs. The chrysalides are curiously shaped, and often spotted with gold or silver. They are either suspended by a thread from the tail, head downwards, or fastened by a thread to twigs, palings, etc. The female butterfly lays her eggs singly or in clusters on the food-plant, and in the former case they are often very difficult to find. The number of British species is between sixty and seventy.

The Butterflies are divided into—

Papilionidæ . .	Swallow-tails.
Pieridæ . .	Whites.
Nymphalidæ . .	Fritillaries, etc.
Satyridæ . .	Meadow-browns.
Erycinidæ . .	Duke of Burgundy Fritillary.
Lycænidæ . .	Blues, Coppers, and Hair-streaks.
Hesperiidæ . .	Skippers.

PLATE VI.

LEPIDOPTERA RHOPALOCERA.

Descriptions will be found at the pages given after the names of the insects figured.

Fig.

1 *a*, *b*, *c*. Papilio machaon (the Swallow-tail Butterfly) with larva (*b*) and pupa (*c*), p. 95.

2. Euchloe cardamines (the Orange Tip), p. 96.

3. Gonepteryx rhamni (the Brimstone Butterfly), p. 98.

4 *a*, *b*. Vanessa io (the Peacock Butterfly) and larva (*b*), p. 100.

5. Vanessa levana (the Least Tortoiseshell Butterfly), p. 101.

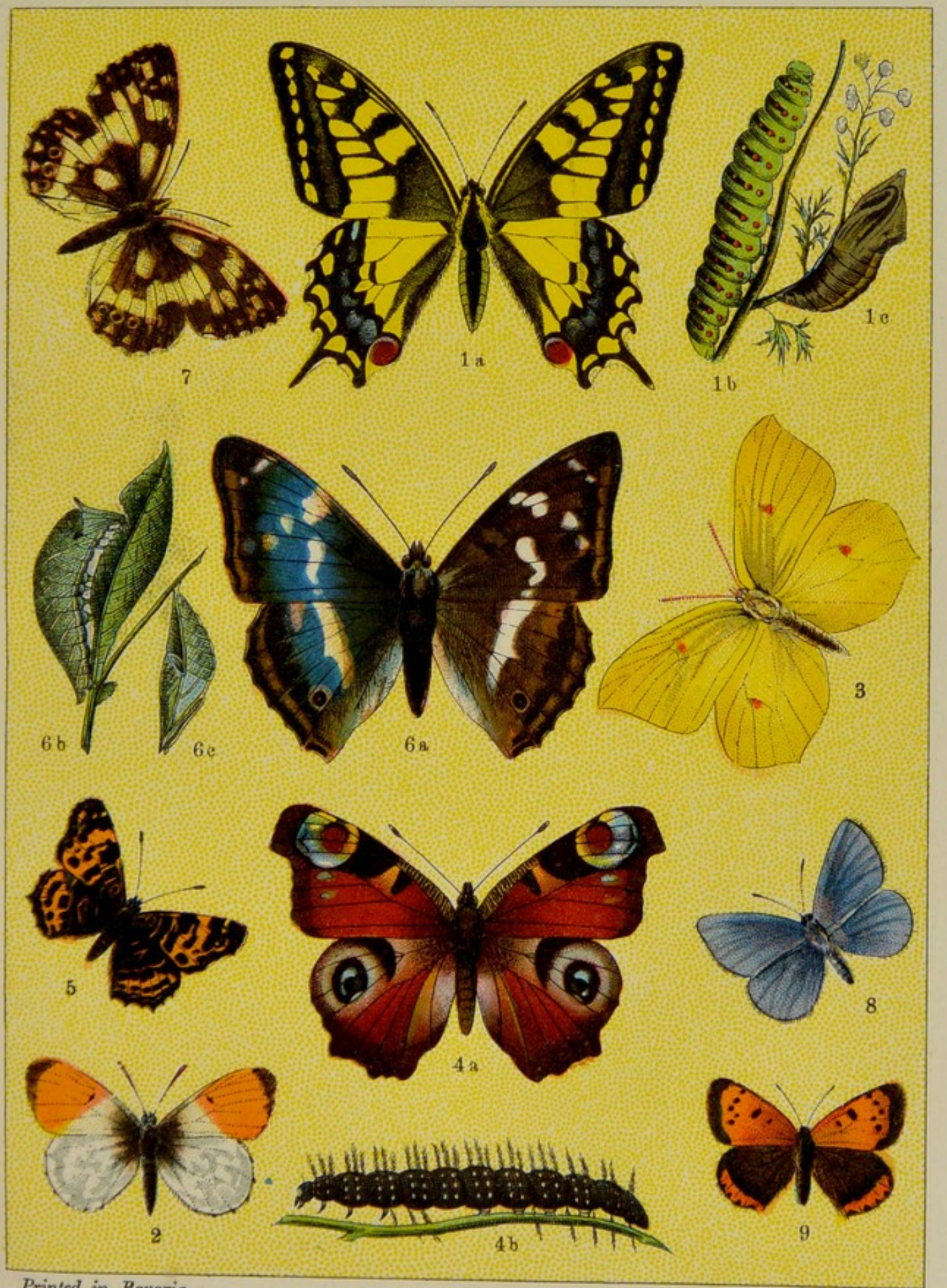
6 *a*, *b*, *c*. Apatura iris (the Purple Emperor) with larva (*b*) and pupa (*c*), p. 104.

7. Melanargia galathea (the Marbled White), p. 106.

8. Polyommatus icarus (the Common Blue), p. 110.

9. Lycæna phlæas (the Small Copper), p. 111.

PLATE VI.



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FAMILY 1.—PAPILIONIDÆ (SWALLOW-TAILS).

These have the upper wings triangular, and the lower generally terminating in a tail. The caterpillars are smooth, and have a fleshy, retractile fork at the back of the head. In Britain we have only one example of this family, which in the Tropics includes some hundreds of the largest and most richly coloured species.

Papilio machaon (the Swallow-tail Butterfly), Plate VI., Fig. 1, *a*, *b*, *c*. Wings yellow, with black markings; margin black with a line of yellow spots, like half-moons. Hind-wings tailed, with black margins dusted with blue and with a rusty red spot at the anal angle. The caterpillar is green, with black transverse stripes and reddish orange spots. It is cylindrical in shape, and is found in June and September feeding on umbelliferous plants, such as fennel, carrot, parsley, caraway, etc. The Swallow-tail Butterfly has become much scarcer in England than formerly, and is now almost confined to the fen district.

FAMILY 2.—PIERIDÆ (WHITE BUTTERFLIES).

The members of this family are white or yellow, with or without black spots, and the wings are not dentated or tailed. The caterpillars have no spines, but are covered with fine short hairs, and some of them are very destructive to farm and garden produce.

Leucophasia sinapis (the Wood White). Wings uniform white, dusted at the tip with black. Expanse of wings $1\frac{1}{2}$ inch. It flies in open glades, and is local. The caterpillar feeds on vetch and trefoil, and may be found in June and September.

Euchloe cardamines (the Orange Tip), Plate VI., Fig. 2. White with black tip to margin of fore-wings, and a black spot in the centre. There is a great difference between the sexes. The male has a broad orange bar near the extremity of the fore-wings which is not present in the female. The caterpillar is bluish green with a whitish stripe on the side. It lives on lady smock, and passes into the chrysalis in July, the butterfly emerging the following spring.

Pieris napi (the Green-veined White) is white, the fore-wings with a dusky tip, and one black spot in the middle in the male, and two or three in the female. On the under side it is yellowish, with the veins of the hind-wings broadly dusted with greyish green. The caterpillar is dull green, and lives on rape, etc., but is less destructive than the Cabbage Whites.

Pieris rapæ (the Small Cabbage White). Wings white, with a brownish spot at the tip of the fore-wings; the male with one spot in the middle, the female with two, and a blotch on the inner margin. There is a black spot on the hind-wings on the costa. The under side is yellowish. The caterpillar is greenish, with a yellow stripe along the back

and yellow spots on the sides, and is very destructive to green vegetables.

Pieris brassicæ (the Large Cabbage White) like the smaller species, which it much resembles, is one of the most common and destructive of our butterflies. It is found throughout the summer in gardens and fields, and is white with a black tip to the fore-wings, which have also in the female two black spots. The female lays its eggs on the lower side of cabbage-leaves and allied plants, to which the larvæ do much damage. The latter are yellowish green, with black spots and yellow stripes. Their numbers are kept in check by their numerous enemies, including song-birds and ichneumons (p. 85).

Aporia cratægi (the Black-veined White). Wings white, thinly scaled, with black veins. The female lays in the summer about a hundred golden-yellow eggs. These are deposited on the under side of the leaves of fruit-trees. The caterpillars emerge in August, and are black, with two orange stripes on the back. They weave a web in which they pass the winter, and assume the chrysalis state in the spring. These webs or caterpillar's nests should be destroyed before the weather becomes mild and the caterpillars have come out of their winter sleep. On emerging from the pupa the insect usually discharges a few drops of a red fluid, which has sometimes given rise to stories of a rain of blood. The Black-veined White, which used to be

common in many localities in England and Wales, is now almost extinct in Britain.

Colias hyale (the Pale Clouded Yellow). Wings sulphur-yellow in the male, paler in the female, with a blackish border. There is a black spot in the middle of the fore-wings, and a light orange spot on the hind-wings. On the under side this is replaced by a brown and silver mark. The caterpillar, which is green with yellow stripes, feeds on vetches.

Colias edusa (the Clouded Yellow) is commoner in the British Isles than the pale species, but both are much more frequently met with than formerly. It is similar in marking to the last species, but the ground colour is bright orange. The butterfly comes out in August, and frequents clover fields, where, though it flies low, it is rather difficult to catch on account of its swiftness of flight. The caterpillar is dark green with a white stripe and yellow spots on the sides, and feeds on leguminous plants.

Gonepteryx rhamni (the Brimstone Butterfly), Plate VI., Fig. 3. Antennæ reddish, short, and thick; wings with a short, broad projection, and an orange spot near the centre of each, bright sulphur-yellow in the male, yellowish white in the female. The larva is dull green, paler on the sides, and feeds on buckthorn. This insect is commonest in the South of England.

FAMILY 3.—NYMPHALIDÆ (FRITILLARIES, ETC.).

To this family belong several rather large and showy butterflies which are common in England. They have only four fully-developed legs, the fore-legs being almost rudimentary. The caterpillars have spines or fleshy excrescences on the body, or horns on the head. The chrysalides are suspended vertically by the tail.

The genus *Vanessa* includes several common and handsome species. The wings are broad, and exhibit more or less distinct angular projections and dentations. The caterpillars have sharp branching spines. The chrysalides have in many cases metallic gold or silver markings.

Vanessa atalanta (the Red Admiral) is of a rich brown-black colour, the fore-wings being crossed by a bright scarlet band, and dotted with several patches of white near the margins. There is a similar band of scarlet on the hind-margins of the hind-wings, with several black spots upon it. The caterpillar is brownish with a yellow stripe on the sides, and may be found on nettles in May and June. The butterfly is common in gardens.

Vanessa antiopa (the Camberwell Beauty) is so called from its having formerly been met with at Camberwell. The wings are rich dark chocolate with a broad cream-coloured border, within which is a row of blue spots. There are two spots of the same colour as the border on the costa of the

fore-wings. The caterpillar, which is black with reddish spots on the back, feeds indifferently on willow, poplar, and birch.

Vanessa io (the Peacock Butterfly), Plate VI., Fig. 4. Wings dark reddish brown with greyish brown borders. The fore-wings have two black patches on the costa, with yellow patches between them and some blue spots near the hind-margin. The hind-wings have a large blue spot surrounded by a black ring near the anterior angle and a triangular black patch on the costa. The caterpillar is black, dotted with white, and lives gregariously on nettle and hop.

Vanessa urticæ (the Small Tortoiseshell) is common everywhere in gardens and weedy places. Reddish orange, hind-margins with a narrow band of yellow, within which is a band of black with blue spots. The fore-wings have three large black spots on the costa and several smaller spots near the middle. The hind-wings have a large triangular patch at the base. The caterpillar is blackish with brownish stripes. It feeds on nettles.

Vanessa polychloros (the Large Tortoiseshell), somewhat larger and paler than the last species, is fairly common in the South of England. Wings light yellowish brown, margins with a narrow yellow band with a black band within it, marked with lunules on the hind-wings. There are three patches of black on the costa, and several more near the centre of the fore-wings, in addition to a spot on the costa of the

hind-wings. The caterpillar is blackish, striped with rusty yellow, and is spiny. It feeds gregariously on cherry and other trees.

Vanessa ca-lbum (the Comma). Wings reddish brown with dark brown spots and borders, the hind-margins of the wings very deeply toothed. On the under side there is a white mark like a C on the hind-wings. The caterpillar, which is brown, with the back rusty-yellow in front and white behind, lives singly on hop, elm, and other plants. It is local in England.

Vanessa cardui (the Painted Lady) is pale terra-cotta with black spots. The fore-wings are black at the hind-margin, and the tip is black with several white spots. The caterpillar is grey, striped with yellow, and is spiny, and feeds on nettle, thistle, etc.

Vanessa levana (the Least Tortoiseshell), Plate VI., Fig. 5, is not a British species; its life-history is, however, so interesting that it would be a pity not to notice it. It is the smallest species of the Vanessæ. Its colour is tawny brown with numerous black spots. *V. levana* appears in May, and from its eggs is hatched in July or August of the same year a second brood, which is quite distinct in markings, and has received another name, being known as *V. prorsa*. This form is black, with a white transverse band running across the wings, and a double yellow band beyond this on the hind-wings. What renders this insect more particularly

interesting is that the two broods appearing at different times of the year are quite unlike in their markings.

Melitæa. With this genus we commence those handsome butterflies, the Fritillaries. The Melitæas are yellowish brown or fulvous, with black spots, and have a great general resemblance. The caterpillars have fleshy spines and hibernate gregariously under a web.

Melitæa cinxia (the Glanville Fritillary) is fulvous, with a network of black lines at the base of the wings and three rows of black spots nearer the hind-margins. The hind-wings are pale yellow beneath, with two rust-coloured bands edged by zigzag black lines and spots. The larva is black with white spots, the head and feet being red. It lives gregariously on plantain, speedwell, etc. This species is very local, and is found most frequently in the Isle of Wight.

Melitæa athalia (the Pearl-bordered Likeness Fritillary) occurs locally in England and Ireland, but is common wherever it is found. The fore-wings are very like those of *M. cinxia.* The hind-wings are black, with three rows of fulvous spots near the hind-margins. They are pale yellow on the under side, with two fulvous bands and a zigzag black line on the hind-margins.

Argynnis. These are moderate-sized or large butterflies, fulvous with black spots. The fore-wings are rather paler beneath, and the hind-wings are generally more or less

marked with silver or metallic green. The caterpillars frequently hibernate, and may be found in the spring on violets and other plants; they are cylindrical, with rows of spines. These butterflies may be found in the summer flying in open glades in woods, etc.

Argynnis selene (the Small Pearl-bordered Fritillary). Under side cinnamon-brown, with dull pearly spots on the hind-wings. Towards the tip of the fore-wings is a series of black markings, which have been fantastically imagined to resemble the figures 1501.

Argynnis euphrosyne (the Pearl-bordered Fritillary) is very like *A. selene*, but the under side is varied with brick-red. The caterpillar is black, with yellow spines.

Argynnis adippe (the High Brown Fritillary) is found in woods and heaths in hilly districts. It is reddish fulvous, with black spots. The hind-wings are yellowish on the under side, with silvery spots, and have a row of small rust-coloured spots centred with silver. The caterpillar is blackish, with greyish white stripes on the back.

Argynnis aglaia (the Dark Green Fritillary). Hind-wings greenish on the under side, with large silvery spots, and a row of similar spots along the hind-margins. The caterpillar is black, with black spines; there are two whitish lines on the back, and red spots on the sides.

Argynnis lathonia (the Queen of Spain Fritillary). On the under side the hind-wings are tawny with large silvery

spots ; the fore-wings have several similar spots at the tip. The caterpillar is provided with red spines.

Argynnis paphia (the Silver-washed Fritillary) is very distinct from the other species mentioned, and is the largest of the genus found in England. Hind-wings green on the under side, with silvery bars. The male is brighter than the female and has the black veins of the fore-wings thickened. The caterpillar is dark brown with a yellow stripe on the back, and long yellow spines. It feeds on the raspberry, dog-violet, nettle, etc.

Limenitis. These are moderate-sized butterflies, black and white on the upper side, brown and white beneath.

Limenitis sibylla (the White Admiral), the only British species of this genus, much resembles the Purple Emperor in general appearance, but is more slender and has a much weaker flight. It is black, with a band of large white oval spots across the wings. The caterpillar is green, with white stripes and red spines, and feeds on honey-suckle.

The *Apaturæ* are large butterflies, black or reddish brown, with a rich blue or purple lustre in the males. The only species which is found in England is—

Apatura iris (the Purple Emperor), Plate VI., Fig. 6, *a, b, c.* Dark brown, with a rich purple lustre in the male ; fore-wings with groups of white spots, hind-wings with a white band across them and an orange ring centred with black near the anal angle. The caterpillar is green and

rough, with whitish markings, and so closely resembles its food-plant that it is difficult to distinguish it. It appears early in June, and lives on sallow, aspen, and poplar. This insect is found chiefly in the south-eastern counties, its most northerly recorded locality being Bardon Hill in Leicestershire.

FAMILY 4.—SATYRIDÆ (MEADOW BROWNS).

Brown, grey, or black butterflies with several small eyes or rings on the wings. They are generally of moderate size. The first pair of legs is aborted. The caterpillars are stout and naked, with two spines at the extremity. They live on grasses, and generally conceal themselves, which makes them difficult to find. They hibernate, and reappear in spring. The chrysalides are found hanging to blades of grass, in hollows, on the ground, or under stones.

Hipparchia semele (the Grayling) is local on heaths, especially in chalky districts. It is brown, with a tawny band beyond the middle, which is hardly marked on the fore-wings in the male. The fore-wings have two round white-centred spots; the hind-wings one, near the anal angle. The caterpillar, which is brownish with greyish green stripes, lives on grasses.

Erebia cassiope (the Mountain Ringlet). Dark brown, fore-wings with a reddish fulvous band, hind-wings with

reddish spots marked with black dots. The caterpillar is pale green, with numerous darker green longitudinal lines, and a white stripe on the sides. It is found in Scotland, some parts of Ireland, and the English Lake District.

Erebia æthiops (the Scotch Argus) occurs in Scotland and the North of England. Brown, crossed by a reddish fulvous band, with three small rings centred with white near the hind-margins of the wings. The caterpillar is green, with a brownish stripe on the back, and two white stripes on the side. It feeds on Meadow-grass.

Melanargia galathea (the Marbled White), Plate VI., Fig. 7. Brownish black, with numerous large patches of creamy white, and on the under side of the hind-wings black-ringed eyes. The caterpillar is green, with reddish stripes, and has posteriorly two short protuberances terminating in red spines. It lives on Timothy-grass.

Satyrus megæra (the Wall Brown). Fulvous, with dark markings, fore-wings with a white eye ringed with black near the tip, hind-wings with three smaller eyes near the hind-margin. The larva is green, with pale lines. It is common everywhere, and is found throughout the summer.

Satyrus ægeria (the Wood Argus) is brown, with yellowish spots. Fore-wings with one small black ring near the tip, hind-wings with three rings on the yellow spots. The larva is green, with a broad whitish stripe on the sides, and lives on grasses.

Epinephele hyperanthus (the Ringlet). Dark brown, fore-wings with two greyish rings centred with black, on both sides. Hind-wings with several yellow rings centred with black, generally with a white dot in the middle. The caterpillar is greenish grey, with a dark line on the back and paler lines on the sides.

Epinephele janira (the Meadow Brown). Brown above, with an eye near the tip of the fore-wings, which have a fulvous band in the female only. The caterpillar is pale green, with a darker line on the back, and a whitish stripe on the sides. It lives on smooth-stalked meadow-grass, and other grasses.

Epinephele tithonus (the Large Heath) is fulvous, with broad dark brown margins, and has the hind-wings also dark brown at the base. At the tip of the fore-wings, across which in the male extends a clouded brown mark, is a large black spot, marked with two white dots. The Caterpillar is greenish, with a dark reddish line on the back, and two whitish lines on each side.

Cœnonympha pamphilus (the Small Heath) is pale fulvous, with a black dot at the tip of the fore-wings. The hind-wings are greenish grey beneath, with an irregular whitish band across the middle. It is found throughout the year, there being a succession of broods.

Cœnonympha typhon (the Marsh Ringlet). Tawny, with more or less distinct yellow rings centred with black. Fore-

wings with one such ring at the tip; hind-wings with three or four near the hind-margins. The green caterpillar feeds on cotton-grass. It is found in Scotland, Ireland, and the North of England.

FAMILY 5.—ERYCINIDÆ.

The Duke of Burgundy Fritillary is the only European butterfly of a large family, almost all the species of which inhabit tropical America.

Nemeobius Lucina (the Duke of Burgundy Fritillary). Dark brown, with three rows of tawny spots on the fore-wings, hind-wings with two such rows. There are black dots on the marginal row of spots. The larva feeds on primrose and sorrel, and is olive brown, with a dark line on the back, and a paler line on the sides. The insect is common in woods in the South of England.

FAMILY 6.—LYCÆNIDÆ (BLUES, COPPERS, AND HAIR-STREAKS).

These are small butterflies, metallic blue-brown or coppery, with very few markings on the upper side, except in the coppers, the under side being, however, profusely marked with numerous eye-like spots. They are very abundant in open flowery places in bright sunshine. The caterpillars are hairy, and woodlouse-shaped.

Polyommatus arion (the Large Blue) has become very rare

and local in England. It is blue, with black hind-margins, and a spot below the middle of the costa, and a row of black spots beyond, which are sometimes almost obsolete in the male. In the female there is also a row of spots near the middle of the hind-wings. The caterpillar feeds on the blossoms of the wild thyme.

Polyommatus semiargus (the Mazarine Blue) is another species which has become almost extinct in England of late years. The male is dark purplish blue, with a dark brown margin; the female is brown. The caterpillar is covered with yellowish green hair, and has dark stripes on the back and sides.

Polyommatus minimus (the Bedford Blue) is almost confined to chalky districts. It is dull brown, slightly shot with blue in the male. The caterpillar is dull green, with an orange stripe on the back, and similar oblique stripes on the sides.

Polyommatus argiolus (the Azure Blue) lives in open woods, and is most common in the South of England. Both sexes are blue, but the hind-margins of the fore-wings and the front edges of the hind-wings are black in the female. The larva is dull green, with a dark green line on the back, and lives on the flowers of holly and ivy. It is double-brooded, the butterfly appearing in April and August.

Polyommatus corydon (the Chalk-hill Blue). The male is pale greenish blue with black hind-margins. The female is

light brown, with a row of orange spots on the hind-margins of the hind-wings. The caterpillar, which is green with yellow stripes on the sides and back, feeds on various vetches. It occurs in chalky districts in the South of England.

Polyommatus bellargus (the Clifden Blue) is found in chalky districts in the South of England, but is somewhat local. The male is bright sky blue; the female is brown, with orange spots along the hind-margins of the wings. The caterpillar is green, with a darker stripe on the back, and a yellow line on the sides.

Polyommatus icarus (the Common Blue), Plate VI., Fig. 8, is abundant everywhere in open meadows. The male is lilac blue, with a narrow black line on the margins. The female varies from lilac blue to brown, with several dark spots on the wings, and a row of orange spots on the hind-margins. The larva is green, with a dark line along the back, and a row of whitish spots and a yellow stripe on the sides. It lives on clover, bird's-foot trefoil, etc.

Polyommatus astrarche (the Brown Argus) is brown, with a marginal row of orange spots on all the wings. It is local in the South of England, and is replaced in Scotland and the North by *P. artaxerxes* (the Scotch Argus), which has a white spot near the centre of the fore-wings, and wants the orange spots in the male. The larva is green, with a dark line along the back, and a pinkish lateral line.

Polyommatus ægon (the Silver-studded Blue). Male blue; female brown, blue at the base, and with orange spots on the hind margins of the wings. Both sexes have on the under side a row of large orange spots on the hind margins of the hind-wings, and a row of greenish silver spots within them. The larvæ are brown, with a reddish line on the back, and a white streak on the sides.

Lycæna phlæas (the Small Copper), Plate VI., Fig. 9, is the only surviving British species of Lycæna; the Large and the Scarce Copper, which were once found in the fens, being now extinct. The Small Copper is common in flowery meadows on sunny days, and it has a succession of broods, being found from May or June till September. The fore-wings are metallic reddish golden, with black spots and black hind margins; the hind-wings are brownish black, with a reddish marginal band. The caterpillar, which lives on sorrel, is green, with red lines on the back and sides.

The hair-streaks (*Zephyrus* and *Thecla*) are generally uniform brown, with frequently a short tail at the anal angle. The caterpillars are shaped like a woodlouse.

Zephyrus betulæ (the Brown Hair-streak). Dark brown, uniform in the male, with a broad transverse orange band on the fore-wings in the female. Hind-wings with the tail and anal angle orange. The ochreous under side is marked with a dark band bounded with white lines. The larva is green, striped with yellow. It feeds on birch, sloe, plum, etc.

Zephyrus quercus (the Purple Hair-streak). Brownish black, in the male shot with purplish blue; in the female with a bright purple blotch on the fore-wings; under side silvery grey with a white streak. It is common in oak-woods from June to August. The larva feeds on oak, and is reddish brown, with yellow spots on the back, and a yellowish stripe on the sides.

Thecla rubi (the Green Hair-streak) is uniform brown above and green beneath, and is not tailed. The caterpillar is green, with a yellow line on the back and sides.

Thecla pruni (the Black Hair-streak) is extremely local, but occurs in large numbers wherever it is found. Brownish black, hind-wings with an orange band of spots along the hind margins. Hind-wings with a tail at the anal angle. The caterpillar is green, with a whitish line on the back, and oblique lines of the same colour on the sides. It feeds on sloe, birch, etc.

Thecla w-album (the White Letter Hair-streak). Dark brown, with short tails, and an orange spot at the anal angle. Under side crossed by a white line, which forms a mark like a W near the anal angle. The larva is green, and has two white humps on the back. This insect is local in woods.

FAMILY 7.—HESPERIIDÆ (SKIPPERS).

These are small butterflies with a rather large head, a thick body, and short antennæ. They form the transition

to the moths, to which they have almost as much resemblance as to butterflies. There are a large number of species, and they are mostly tawny or greyish brown with quadrangular white spots. They are called skippers on account of their curious jerking flight. The caterpillars are covered with fine thin hairs, and undergo their transformations in a slight cocoon.

Hesperia malvæ (the Grizzled Skipper). Common in Britain, but unknown in Ireland. Is greyish brown chequered with whitish spots. The caterpillar is brownish yellow, with reddish streaks bordered with yellow. It feeds on wild strawberry and raspberry.

Nisoniades tages (the Dingy Skipper). Dull brown, with marginal rows of pale dots. There are two indistinct dark bands on the fore-wings, and one on the hind-wings. Larva pale green, with yellow lines on the back and sides. It feeds on bird's-foot trefoil. The butterfly frequents dry places, such as roads along woods, slopes of hills, etc.

Cyclopides palæmon (the Chequered Skipper) is extremely local. Blackish brown, chequered with tawny spots, which are square on the fore-wings, but roundish on the hind-wings. The larva is greyish black, with a broad yellow stripe on the sides.

Pamphila comma (the Pearl Skipper). Fulvous, with brown margins and a broad oblique stripe across the fore-wings, which contains a narrow silvery line in the male.

The female is darker, and is marked with square tawny spots. The under side of the hind-wings is marked with large white spots. The caterpillar is blackish grey, and feeds on papilionaceous plants.

Pamphila sylvanus (the Large Skipper) is very like the last species, but the black stripe has no silvery line through it, and the margins are not so dark. The under side has no white spots. This species and the next are pretty generally distributed.

Pamphila thaumas (the Small Skipper). Uniform fulvous, with narrow brown margins. The caterpillar is green, with a double white line on the back, and a yellow line on the sides. It lives on grasses.

PLATE VII.

LEPIDOPTERA HETEROCERA.

Descriptions will be found at the pages given after the names of the insects figured.

Fig.

SPHINGES.

1 *a*, *b*, *c*. Acherontia atropos (the Death's Head Hawk-moth), with larva (*b*) and pupa (*c*), p. 118.

2 *a*, *b*. Deilephila euphorbiæ (the Spurge Hawk-moth), and larva (*b*), p. 119.

3. Chœrocampa elpenor (the Elephant Hawk-moth), p. 120.

4. Smerinthus ocellatus (the Eyed Hawk-moth), p. 121.

5. Macroglossa stellatarum (the Humming-bird Hawk-moth), p. 121.

6. Trochilium apiforme (the Hornet Clear-wing), p. 122.

7. Ino statices (the Green Forester), p. 123.

8. Zygæna filipendulæ (the Six-spot Burnet), p. 123.

9. Syntomis phegea (the Black Burnet), p. 124.

PLATE VII.

LEPIDOPTERA HETEROCERA (MOTHS).

The moths differ from the butterflies in not having a club at the end of the antennæ, which are of different forms, and often more or less feathered, especially in the male. Most moths fly in the evening or at night, and, with the exception of a few slender-bodied species, never rest with their wings vertically raised like butterflies.

SPHINGES (HAWK-MOTHS, Etc.).

This group contains the largest of our British moths, as well as many smaller species. The body is generally large and stout, the antennæ short, the fore-wings broad and narrow, and the hind-wings remarkably small. Many species have a very long proboscis, which is rolled up spirally when not in use, but which can be extended and plunged into a flower to suck the honey, whilst they hover above it without alighting. They usually fly at dusk, though some may occasionally be met with by day. The caterpillars, which are not hairy, are provided with eight pairs of legs, and there is generally a curved horn on the back near the extremity.

They are divided into the following families :—

Sphingidæ,
Sesiidæ,
Zygænidæ.

FAMILY 1.—SPHINGIDÆ (HAWK-MOTHS).

Large and powerful moths, which fly at dusk. The body is stout, and the wings long and narrow. The proboscis is long. The pupæ are found buried underground.

Acherontia atropos (the Death's Head Hawk-moth), Plate VII., Fig. 1, *a*, *b*, *c*. This has a wing-expanse of 4 or 5 inches, and is the largest British insect. It takes its name from the ochreous markings on the upper side of the thorax, which bear some resemblance to a skull. The abdomen is very large, and is orange coloured, with a number of narrow black rings at the joints, and a broad bluish-black stripe along the upper side. The fore-wings are dark brown with pale yellow and rusty markings. The hind-wings are ochreous, with two black bands on the hind margins. The live insect squeaks somewhat like a mouse when molested. The perfect insect emerges from the chrysalis in August or September. The caterpillar, which is very large and fleshy, is green with yellow and bluish oblique stripes on the sides, and has a yellow horn on the back of the last segment. It feeds on potato, thorn-apple, wild jasmine, and in some neighbourhoods on buckthorn. The caterpillar buries itself in the earth when about to change into the chrysalis, which is chestnut-brown.

Sphinx pinastri (the Pine Hawk-moth) is ashy grey, with short longitudinal black dashes on the fore-wings. The

hind-wings are dark grey, lighter at the base. The larva is green, with a reddish brown stripe on the back, and two white stripes on the sides. It feeds on pine and fir. This species is very rare in Britain, but has occasionally been taken resting on the trunks of trees in the daytime.

Sphinx convolvuli (the Convolvulus Hawk-moth) is but little smaller than the Death's Head. It is dark grey, mottled with lighter and darker markings on the fore-wings; the hind-wings are crossed by pale irregular broken bands. The abdomen is flesh coloured, with dark grey rings on the incisions of the segments, and a broad dark streak along the back. The caterpillar, which is yellowish brown, with oblique ochreous stripes on the sides, feeds on small bind-weed, etc.

Sphinx ligustri (the Privet Hawk-moth). Fore-wings brown, paler towards the costa, and with one black and several white lines near the hind margins. Hind-wings pale pink, with two black bands. Abdomen rose coloured, with dark rings, and a dark line down the back. The caterpillar is green, with oblique white and lilac stripes, and is common on privet and lilac in autumn, but frequently escapes observation, being concealed by its colour. The moths appear in May or June.

Deilephila euphorbiæ (the Spurge Hawk-moth), Plate VII., Fig. 2, *a*, *b*. Fore-wings rosy grey, with a dark olive-green triangular band near the hind margin and a

spot of the same colour at the base, and one or two spots on the costa. Hind-wings reddish, with a black band near the hind margin and at the base. Body olive green. The caterpillar is black dotted with yellow, and has a red stripe on the back and a line of alternating large red and yellow spots on the sides. It is found in autumn on spurge. This insect is very rare in England, being only found in a few localities on the South Coast.

Chœrocampa elpenor (the Elephant Hawk-moth), Plate VII., Fig. 3. Fore-wings olive green, with two oblique rose-coloured transverse bands, and a similar band along the costa. Hind-wings rose coloured, black at the base. Abdomen olive green, with rosy lines. The caterpillar is brown or green, with pale streaks at the sides near the head, and black eye-spots, and there is a horn on the back of the last segment. It feeds on vine and willow-herb.

Chœrocampa porcellus (the Small Elephant Hawk-moth) resembles *C. elpenor*, but is smaller. It is dull yellow with broad rosy spots on the costa of the fore-wings, and on the hind margins of all the wings. The caterpillar is like that of *C. elpenor*, but without the horn. It feeds on bed-straw.

Smerinthus tiliæ (the Lime Hawk-moth). Fore-wings yellowish, marked with green or reddish brown on the costa and at the base, with a band of the same colour on the hind margins; hind-wings brownish yellow. The caterpillar, which

is green with oblique yellow and red stripes on the sides, lives on elm, lime, birch, etc.

Smerinthus populi (the Poplar Hawk-moth). Brownish yellow or grey, with dark bands on the fore-wings, and a rusty-red blotch at the base of the hind-wings. The caterpillar, which feeds on poplar, willow, and aspen, is yellowish green with oblique pale lines.

Smerinthus ocellatus (the Eyed Hawk-moth), Plate VII., Fig. 4. Fore-wings brown; hind-wings rose coloured, with a large blue spot near the anal angle, encircled by a black ring. The caterpillar, which is bluish green with white oblique streaks on the sides, lives on willow, poplar, and apple.

Macroglossa stellatarum (the Humming-bird Hawk-moth), Plate VII., Fig. 5, is common in gardens and on the edges of woods, but is difficult to catch on account of its peculiar habit of hovering over flowers without settling, and darting away at the least alarm. The fore-wings are dark brown, with two black transverse lines; the hind-wings are rusty yellow, and the end of the abdomen is spotted with black and white at the sides. The caterpillar is green, with white stripes on the sides, and lives on bed-straw.

Hemaris bombyliformis (the Broad-bordered Bee Hawk-moth). Wings transparent, with the hind margins broadly bordered with reddish brown. Body olive, with a broad reddish brown belt.

Hemaris fuciformis (the Narrow-bordered Bee Hawk-moth) is very like *H. bombyliformis* but is smaller, and has narrower borders which are duller in colour. The band of the abdomen is tawny, not reddish. Both these species bear a superficial resemblance to bees, on account of their transparent wings.

FAMILY 2.—SESIIDÆ (CLEAR-WINGS).

These are rather small moths, with transparent wings almost devoid of scales, and resemble wasps and gnats. They fly by day, especially in the hot sunshine. The caterpillars live in the interior of the stems, branches, or roots of trees and shrubs, and there pass through their transformations.

Trochilium apiforme (the Hornet Clear-wing), Plate VII., Fig. 6. This is the best known and largest of the family, and its transparent wings and yellow and black ringed abdomen bear a striking resemblance to the hornet's. The caterpillar is whitish yellow, with a blackish head and a dark line on the back. It lives in the stems of poplars, and is sometimes very destructive.

Sesia tipuliformis (the Currant Clear-wing), a smaller species, which might easily be mistaken for a gnat, is very common in gardens among currant bushes, to which its larva is very injurious. It feeds on the pith of the shoots in winter and early spring. The body, including the tuft at

the end of the abdomen, is bluish black, but there are some yellow belts on the abdomen.

FAMILY 3.—ZYGÆNIDÆ (BURNETS).

These have generally metallic steel-blue fore-wings, with a few red spots or streaks, and red hind-wings edged with black. Others have green fore-wings, and whitish hind-wings. They fly in fields and meadows during the daytime. The caterpillars are woodlouse-shaped, with rows of black spots, and are covered with fine hairs. The chrysalis is enclosed in a thick paper-like cocoon.

Ino statices (the Green Forester), Plate VII., Fig. 7. Fore-wings and body uniform shining metallic green, hind-wings uniform grey. This species, which is sometimes common in meadows, is replaced in one or two chalky localities by the much more local species, *I. globulariæ* and *I. geryon*, which differ from it in the shape of the antennæ.

Zygæna minos (the Streaked Burnet). Fore-wings dark bluish grey, with three red streaks, hind-wings uniform red. The caterpillar lives on clover, trefoil, etc. This insect is restricted to the western coasts of Great Britain and Ireland.

Zygæna filipendulæ (the Six-spot Burnet), Plate VII., Fig. 8, is common in meadows, on flowery slopes, etc. Fore-wings dark metallic bluish green, with six red spots on each of the fore-wings; hind-wings red with black margins. The

caterpillar, which lives on clover and other low plants, is golden yellow, with two rows of black spots.

There are three five-spot burnets which are local, and which may be distinguished by the character of the spots :—

Zygæna loniceræ, the largest, has the five spots distinct.

Zygæna trifolii often has them more or less confluent.

Zygæna meliloti, which is only found in the New Forest, may be distinguished by its smaller size, and in having one of the middle spots much smaller than the other.

Syntomis phegea (the Black Burnet), Plate VII., Fig. 9, is a Continental species, which has been taken once or twice in the South of England. It is bluish black, with several transparent white spots on the wings, and two yellow belts on the abdomen.

BOMBYCES.

These are true night moths, which do not fly till after dark, but spend the day in retired hiding-places, with their fore-wings drooping over the hind-wings. The caterpillars spin a cocoon before undergoing their transformation, and the moth, when it emerges, softens it at one point with a fluid which it secretes, and it often squeezes through an almost incredibly small opening. The Bombyces, like the Sphinges, have a stout hairy body. The males generally have pectinated antennæ. The caterpillars have eight pairs of legs, and are often covered with long hairs. Many of them are destructive to trees.

PLATE VIII.

LEPIDOPTERA HETEROCERA.

Descriptions will be found at the pages given after the names of the insects figured.

Fig. BOMBYCES.

1 Deiopeia pulchella (the Crimson-speckled Footman), p. 127.

2. Euchelia jacobææ (the Cinnabar-moth), p. 127.

3 *a*, *b*. Arctia caja (the Common Tiger-moth), and larva (*b*), p. 128.

4 *a*, *b*. Orgyia antiqua (the Vapourer Moth), male (*a*) and female (*b*), p. 129.

5 *a*, *b*. Saturnia carpini (the Emperor Moth), and larva (*b*), p. 131.

6 *a*, *b*. Gastropacha quercifolia (the Lappet Moth), and larva (*b*), p. 132.

7. Lasiocampa pini (the Pine-tree Lappet Moth), p. 132.

8. Clisiocampa neustria (the Lackey Moth), p. 133.

9. Phalera bucephala (the Buff-tip), p. 134.

PLATE VIII.

FAMILY 1.—LITHOSIIDÆ.

Œonistis quadra (the Large Footman). Fore-wings greyish yellow in the male, with a blue mark at the base; in the female ochre yellow, with two steel blue spots. The hind-wings are pale yellowish. The caterpillar is grey, with yellow stripes and red spots, and feeds on lichens.

Lithosia lurideola (the Common Footman) has the fore-wings leaden grey, with a yellow streak on the costa; and the hind-wings yellow.

Gnophria rubricollis (the Black Footman) is dull black, with an orange red collar on the thorax and the tip of the abdomen yellow.

FAMILY 2.—ARCTIIDÆ (TIGER-MOTHS, ETC.).

These are large or middle-sized moths, most of which have bright colours and markings. The caterpillars are covered with long hairs, and are popularly known as "woolly bears." They feed on low plants, such as plantain, dandelion, etc.

Deiopeia pulchella (the Crimson-speckled Footman), Plate VIII., Fig. 1. This pretty moth is very scarce in England. The fore-wings are yellowish, variegated with red and black spots, and the hind-wings are white, with an irregular black band on the hinder margin.

Euchelia jacobææ (the Cinnabar-moth), Plate VIII., Fig. 2, is common by day in weedy places. Fore-wings black,

with a blood red stripe on the costa, and two similar spots on the hind margin; hind-wings red. The caterpillar, which feeds on ragwort, is black with orange rings.

Callimorpha dominula (the Scarlet Tiger-moth). Fore-wings greenish black with large orange and yellowish spots; hind-wings red with black spots. The caterpillar is black, with three rows of alternate yellow and white spots, and with blue warts.

Nemeophila plantaginis (the Wood Tiger-moth). Fore-wings black with whitish stripes. Hind-wings yellow in the male, red in the female, and spotted with black. The caterpillar is black, with the middle segments red.

Arctia caja (the Common Tiger-moth), Plate VIII., Fig. 3, *a*. Fore-wings chocolate brown, varied with white bands; hind-wings and abdomen red, with blue-black spots. The caterpillar (Fig. 3, *b*) is covered with long hair, which is rust coloured in front and on the sides, and black elsewhere. It is common in the autumn on various plants.

Arctia villica (the Cream-spot Tiger-moth) has the fore-wings black with large white spots, and the hind-wings yellow with black spots. It is rather local, but common where it is found.

Spilosoma lubricipeda (the Buff Ermine) is pale ochreous; the fore-wings varied with small black dots. It is very common everywhere, even in London gardens.

Spilosoma menthastri (the White Ermine) is white, with

black spots, which are most numerous on the fore-wings; the abdomen is yellow. This species is equally common with the last.

FAMILY 3.—LIPARIDÆ.

Orgyia antiqua (the Vapourer Moth), Plate VIII., Fig. 4, *a*, has brown fore-wings, with dark lines, and a white spot at the hinder angle; the hind-wings being brownish yellow. The female (Fig. 4, *b*) is thick-bodied and wingless. The caterpillar has four tufts of yellow hair on the sides, and a black tuft near the head and at the tail. It feeds on various trees, including the laurel.

Leucoma salicis (the White Satin Moth) is uniform shining white, with black legs and antennæ. The caterpillar is black, with red warts and large pale yellow spots on the back. It feeds on poplar and willow.

Ocneria monacha (the Black Arches). Fore-wings white, with black irregular transverse lines; hind-wings dark grey, with white bands on the margins; abdomen reddish, with a short ovipositor. The caterpillar is dark grey, with blue and red warts, and a blue and white spot on the second segment. It feeds on fruit and forest trees.

Porthesia chrysorrhœa (the Brown-tail Moth) is uniform snow-white, with a brown tuft at the end of the abdomen. The caterpillars are dark grey, with two red lines on the back, and some white streaks below them. They hibernate

gregariously in webs among the leaves of trees, and such nests should be destroyed before spring.

Porthesia auriflua (the Gold-tail Moth) is like the last species, but the abdominal tuft is yellow.

FAMILY 4.—COSSIDÆ.

Cossus ligniperda (the Goat Moth) is a large greyish brown moth, varied with pale grey. The caterpillar, which is large and naked, is of a dirty flesh colour, with a broad dark band on the back, interrupted at the incisions. It lives in the stems of poplars, willows, and fruit trees, to which it is sometimes very injurious. If reared, it must be kept in a metal cage, as it would eat its way through a wooden one and escape.

FAMILY 5.—HEPIALIDÆ.

Hepialus humuli (the Ghost Moth). The wings of the male are uniform white above; the fore-wings are dull yellow in the female, with two broken reddish bands near the hind margins; the hind-wings being reddish. The abdomen is yellow in both sexes. The larva feeds on the roots of grass, hops, etc.

FAMILY 6.—PSYCHIDÆ.

The males are small moths, with uniform blackish wings, often thinly scaled. The females have neither wings nor legs. The caterpillars drag about with them a small case

formed of grass stems, etc., and in this they undergo their transformations.

FAMILY 7.—SATURNIIDÆ.

These are large moths, most of which have a large eye-spot upon each of the wings. They have a thick body covered with long hair, and the antennæ are pectinated in the male. The caterpillars are naked, but have tufted excrescences on each segment. The chrysalis is enclosed in a pear-shaped cocoon.

Endromis versicolora (the Kentish Glory). Fore-wings brown, with whitish and black streaks; hind-wings rusty yellow in the male, whitish in the female, with a dark line crossing it near the hind margin, and a few spots. There are no eye-spots. The caterpillar, which is green, with oblique white stripes on the sides, feeds on birch.

Saturnia carpini (the Emperor Moth), Plate VIII., Fig. 5, *a*. Male with reddish brown fore-wings and yellow hind-wings, female with all the wings soft grey. There are zigzag dark lines and a black eye-spot in a black and white ring on all the wings. The caterpillar (Fig. 5, *b*) is green, with seven orange tubercles studded with stiff hairs on each segment. It feeds on heath, sloe, etc. Our figure represents the male insect.

FAMILY 8.—LASIOCAMPIDÆ.

These moths, when at rest, close the fore-wings over the hind-wings in such a manner that the borders of the latter

project beyond the former. The caterpillars are covered with short, soft, fur-like hair.

Gastropacha quercifolia (the Lappet Moth), Plate VIII., Fig. 6, *a*. Wings dark coppery brown, the margins being indented, something like an oak-leaf. The hind margins are slate-coloured, with several irregular dark lines. The large brown caterpillar (Fig. 6, *b*) has blue transverse spots on the third and fourth segments, and has hairy tubercles on the sides and on the last segment but one. It lives on fruit trees.

Lasiocampa pini (the Pine-tree Lappet Moth), Plate VIII., Fig. 7, is not a British species, though common in the pine forests of the Continent. Fore-wings grey, with a rusty brown band near the base and middle. They are also marked with a white spot before the middle, and several transverse wavy black lines. Hind-wings and abdomen ochre yellow. The caterpillar is greyish brown, with a blue spot on the third and fourth segments, red spots on each segment, whitish lines along the sides, and a short tuft on the last segment but one. The chrysalis is brownish black with red incisions, and rests in a loose cocoon. The female lays its eggs on firs and pines, and the caterpillars hibernate, but in spring they often strip trees of their leaves.

Lasiocampa potatoria (the Drinker Moth). Female yellow, male tinged with brown. Fore-wings with a brown line running from the tip to the inner margin, and another shorter line near the base; between these are two

silvery white spots. The caterpillar is dark brown, with yellow spots at the sides, and a black tuft of hair on the third segment, and on the last but one. It feeds on grass and is easily reared.

Lasiocampa quercus (the Oak-Eggar). The male is bright reddish brown with a broad yellow transverse band; the female is larger, and ochre yellow. The wings are thickly covered with fur-like scales, and there is a white spot in front of the middle of the fore-wings. The caterpillar, which is also densely covered with hair, is ochreous, with white stripes on the sides, and black incisions dotted with white. It feeds on trees and low plants. The insect is called the Oak-Eggar in allusion to its hard egg-shaped cocoons.

Lasiocampa rubi (the Fox Moth) is something like the Oak-Eggar, but is dull brownish grey. The caterpillars, when young, are black with orange belts, but afterwards become brown with bluish black incisions.

Clisiocampa neustria (the Lackey Moth), Plate VIII., Fig. 8, is smaller than the last species, but is often very destructive. The fore-wings are ochre yellow, with two brown transverse stripes, between which the ground colour is generally somewhat darker; the hind-wings are lighter yellow. The slender larva is bluish grey, with a blue head, and white, blue, and red longitudinal streaks on the body. The female insect lays its eggs, cemented closely together,

in a ring round a slender twig. The caterpillars emerge in April from the hibernated eggs, and live gregariously till June in a light web (caterpillar's nest), between the branches of willow and other trees. The larva assumes the chrysalis state in June, and the moths emerge a short time afterwards. The eggs should be searched for and destroyed in winter, and the caterpillars' nests in spring.

Eriogaster lanestris (the Small Eggar). The fore-wings are rusty brown, with an oblique white stripe before the hind margins, and a white spot at the base and another near the middle; the hind-wings are paler. The female has a thick woolly tuft at the end of the abdomen, which it uses to cover its eggs after they have been laid in a cluster. The caterpillar is dark blue, with two rows of orange warts and white spots between them. It feeds on fruit trees, etc.

FAMILY 9.—NOTODONTIDÆ.

Phalera bucephala (the Buff-tip), Plate VIII., Fig. 9. Fore-wings mottled silvery grey, with a large pale yellow blotch at the tip; hind-wings yellowish white. The caterpillar is brownish with yellow stripes, and a tuft of hair on the fifth and terminal segments. It feeds on lime, oak, and birch.

Cerura vinula (the Puss Moth) is a large and common moth. The fore-wings are greyish white, with numerous dark grey zigzag transverse lines. The caterpillar, from

which the insect derives its name, is of very remarkable shape, and is terminated by two long tails, which it carries erect. When young it is blackish, but afterwards becomes green; the retractile head has a red border, and there is a broad black band bordered with white on the back, which tapers in front and behind; it has only seven pairs of legs, and the fourth segment is raised into a hump. It lives, in summer and autumn, on poplars and willows, and forms a very hard case for the chrysalis.

Notodonta ziczac (the Pebble Prominent) has the fore-wings brownish, with paler transverse stripes, and a greyish white patch in the middle of the costa; there is a strong toothed projection on the inner margin. The hind-wings are whitish. The caterpillar is violet, orange towards the extremity, with two large humps on the sixth and seventh segments, and when at rest it raises its head and tail. It lives on poplar, willow, and oak in early summer, and is found again in autumn.

NOCTUÆ.

These, as their name denotes, are true night-flying moths, of which only a few are brightly coloured. They are mostly dull grey or brown on the fore-wings, with light grey or brown hind-wings. The larvæ have eight pairs of legs, are generally naked, and usually change to pupæ in the ground. The Noctuæ are a large group, and

our space will only allow us to mention a few of the com moner species.

Diloba cæruleocephala (the Figure-of-8 Moth) has the fore-wings grey with two paler marks like an 8; the hind-wings are light grey, with a blackish spot at the anal angle. The caterpillar, which is dirty white with yellow stripes and a bluish head, lives on fruit trees.

Acronycta leporina (the Miller) is white with a few black streaks on the fore-wings, one of which is on the costa.

Acronycta psi (the Common Dagger Moth) has the fore-wings ashy grey, mottled with darker, and a dagger-like mark near the border. The hind-wings are lighter.

Acronycta aceris (the Sycamore Moth). Fore-wings pale grey mottled with darker, and with some black transverse lines; hind-wings almost white. The caterpillar lives on various trees; it is yellow with long whitish hairs, and has white spots on the back bordered with black.

Panolis piniperda (the Pine Beauty), Plate IX., Fig. 1, is a moderate-sized moth with reddish brown fore-wings, varied with yellowish grey, and with a white kidney-shaped spot near the costa centred with green; the hind-wings are blackish brown. The caterpillar is green, with three white lines on the back and an orange stripe on the sides. It lives in May and August on firs and pines, and forms its chrysalis among moss. The moth appears in April.

Charæas graminis (the Antler Moth) has brownish fore-

PLATE IX.

LEPIDOPTERA HETEROCERA.

Descriptions will be found at the pages given after the names of the insects figured

Fig.

NOCTUÆ.

1. Panolis piniperda (the Pine Beauty), p. 136.
2. Scoliopteryx libatrix (the Herald Moth), p. 139.
3 *a*, *b*. Triphæna pronuba (the Yellow Underwing), and larva (*b*), p. 139.
4. Dichonia aprilina (the Marvel du Jour), p. 140.
5. Mamestra persicariæ (the Dot), p. 140.
6 *a*, *b*. Calocampa exoleta (the Sword-grass Moth), and larva (*b*), p. 141.
7. Catocala nupta (the Red Underwing), p. 141.

GEOMETRIDÆ.

8. Venilia macularia (the Speckled Yellow), p. 142.
9. Urapteryx sambucaria (the Swallow-tailed Moth), p. 142.
10 *a*, *b*. Abraxas grossulariata (the Magpie Moth), and larva (*b*), p. 143.
11. Fidonia piniaria (the Bordered White), p. 144.
12. Biston zonaria (the Belted Beauty), p. 144.
13 *a*, *b*. Amphidasis betularia (the Pepper-and-Salt Moth), and larva (*b*), p. 144.

PLATE IX.

wings with three confluent pale spots and blackish hind-wings. The caterpillar is brown with pale lines on the back. It feeds, from autumn to June, on the roots of grass, and is often very destructive.

Scoliopteryx libatrix (the Herald Moth), Plate IX., Fig. 2, has the fore-wings, which are deeply dentated, of a reddish grey colour, dusted with scarlet at the base and in the middle, and crossed by two whitish transverse lines. The thorax is reddish, but the hind-wings and abdomen are greyish brown.

Amphipyra pyramidea (the Copper Underwing) has yellowish brown fore-wings, varied with dark brown, and crossed by two light transverse stripes edged with black; the hind-wings are cinnamon.

Triphæna pronuba (the Yellow Underwing), Plate IX., Fig. 3, *a*, is common everywhere. The fore-wings are brown mottled with paler, and the hind-wings are yellow with a black band on the hind margins. The caterpillar (Fig. 3, *b*) is dirty grey with black stripes on the segments, and lives on low plants. It feeds only by night, and conceals itself during the day.

Triphæna fimbria (the Broad-bordered Yellow Underwing) is very similar to the last species, but the fore-wings are greenish grey, the hind-wings of a deeper yellow, and the black band is much broader.

Agrotis segetum (the Common Dart) is very destructive to

corn and grass, on the roots of which it feeds. The moth has brownish grey fore-wings mottled with darker, and white hind-wings.

Dichonia aprilina (the Marvel du Jour), Plate IX., Fig. 4, is readily distinguished by its pale green fore-wings with black and white markings. The hind wings are dark grey.

Mamestra brassicæ (the Cabbage Moth). Fore-wings greyish brown with black zigzag lines and a white spot near the costa, also a submarginal white line which forms a W near its lower end; hind-wings lighter brown. The caterpillar, which is greenish with yellow stripes, feeds on cabbages and other low plants in autumn. It eats into the heart of the cabbage and is often very destructive.

Mamestra persicariæ (the Dot), Plate IX., Fig. 5, is very similar, but much darker, the fore-wings being almost violet-black, and the white spot near the costa is centred with rusty brown. The caterpillar lives in autumn on low plants.

Habryntis meticulosa (the Angle-shades Moth). Fore-wings olive-brown with reddish bands, and a yellowish band on the hind margin; hind-wings yellowish white. It appears in May or June, and again late in the summer.

Mormo maura (the Old Lady) is a large dark moth of a rich brown colour, with three broad black bands on the fore-wings, and one along the hind margin on the hind-wings.

Calocampa exoleta (the Sword-grass Moth), Plate IX., Fig. 6, *a*. Fore-wings violet-grey, darker towards the costa, with two rather long kidney-shaped spots. The caterpillar (Fig. 6, *b*) is large, and bright green, with a yellow and red stripe on each side and white spots edged with black, and connected by a black blotch on the back. It lives on low plants.

Plusia chrysitis (the Burnished Brass Moth) has the fore-wings brown, with two broad transverse greenish brassy bands connected towards the middle. The caterpillar is green with a white stripe on the sides, and fine lines of the same colour on the back.

Plusia gamma (the Silver Y Moth) abounds everywhere during the summer. The fore-wings are dark greyish brown mottled with darker, and marked with a silvery spot, shaped like the letter Y, near the costa. The hind-wings are pale grey.

Catocala nupta (the Red Underwing), Plate IX., Fig. 7, is fairly common in the South of England. The fore-wings are grey varied with darker, and crossed by dark zigzag lines ; the hind-wings are red, with broad black central and marginal bands. The grey caterpillar feeds on poplar and willow.

Brephos parthenias (the Orange Underwing). Fore-wings brown with a whitish band near the margin, and another near the centre. Hind-wings rich fulvous, with

black margins, and several black lines running from the base, and broadening out towards the centre. The caterpillar, which is green striped with white, lives on birch. The moth appears in March.

GEOMETRIDÆ.

These are not unlike butterflies in general appearance, having slender bodies and broad bright-coloured wings. They fly chiefly by night, and when resting generally keep their wings spread out flat. The caterpillars have only five pairs of legs, with a long interval between the third and fourth pair. When walking they stretch out the body and fix the front legs, and then arch the body, and bring the hind pairs of legs close up to the front ones. Many of them rest grasping a branch with the last two pairs of legs, holding the body straight up, and, as their colour is like that of the bark, they resemble a small twig. Of the multitude of Geometers we can only mention the following:—

Venilia macularia (the Speckled Yellow), Plate IX., Fig. 8, is common in woods in spring. It is deep yellow with numerous brown spots on all the wings. The caterpillar feeds on dead-nettle.

Urapteryx sambucaria (the Swallow-tailed Moth), Plate IX., Fig. 9, is common in gardens after dusk, even in

London. The wings are pale yellow, with two light brown transverse lines on the fore-wings, and one on the hind-wings. The hind-wings are tailed.

Angerona prunaria (the Orange Moth). Male, orange; female, pale yellow. Both with a violet-grey spot in the centre of the wings, and densely covered with transverse dashes of the same colour.

Abraxas grossulariata (the Magpie Moth), Plate IX., Fig. 10, *a*, has white fore-wings with transverse rows of large black spots, and an orange band across the middle and at the base. The hind-wings are white, with a row of black spots across the middle, and another row along the hind margin. The caterpillar (Fig. 10, *b*) is white with black and yellow spots, and is destructive to gooseberry and currant bushes, on the leaves of which it feeds.

Hybernia defoliaria. Female wingless, yellow with black spots; male with yellowish fore-wings crossed by a reddish brown transverse band, and hind-wings pale grey speckled with brownish. The caterpillar, which is reddish brown with a yellow stripe on the sides, is often very destructive to fruit trees. They emerge in the spring from eggs laid the winter before, and feed ravenously on the leaves and young buds. They enter the chrysalis state underground, and the moths do not appear till November, when the female creeps up among the branches to lay her eggs. Fruit trees may be protected from the attacks of these and other winter moths

by painting the trunks of the trees with tar, in which the females become entangled.

Fidonia piniaria (the Bordered White), Plate IX., Fig. 11, has the wings dark brown in the male, with large ochre-yellow marks in the middle. The female is dull fulvous, with two dark transverse lines, and dark margins on the fore-wings. The caterpillar is green, with white lines on the back, and a yellow stripe on the sides. It feeds in autumn on pines and firs, and the chrysalis is concealed among moss. The moth appears in May and June.

Biston zonaria (the Belted Beauty), Plate IX., Fig. 12, has the fore-wings dark grey in the male, with white transverse lines, and the hind-wings whitish with greyish bands. The borders of the segments of the abdomen are whitish. The female is black, with very short rudiments of wings. The caterpillar feeds on yarrow.

Amphidasis betularia (the Pepper-and-Salt Moth), Plate IX., Fig. 13, *a*, is white, thickly covered with fine black dots arranged in distinct transverse lines on the hind-wings. The colour of the caterpillar (Fig 13, *b*) resembles bark. It feeds on various trees.

Geometra papilionaria (the Large Emerald Moth) has bright green wings, the fore-wings with one and the hind-wings with two whitish transverse lines. The caterpillar is green, with a yellowish streak on the sides, and has two rows of humps tipped with red.

Cheimatobia brumata (the Winter Moth). Male, dirty brownish grey, with indistinct dark zigzag lines on the fore-wings; hind-wings lighter. The wings of the female are rudimentary, and it lays its eggs among the branches of fruit trees. This is the commonest and most destructive of the winter moths with wingless females.

MICROLEPIDOPTERA.

The small moths, or *Microlepidoptera*, are almost as numerous and varied as the larger ones; but their small size renders them inconspicuous on the wing, as well as much more difficult to set and preserve. We have, therefore, given only one or two representatives of each group. The following main groups are called by the general name of *Microlepidoptera* :—

Pyrales.
Tortrices.
Tineæ.
Pterophori.
Alucitæ.

PYRALES.

Botys verticalis (the Mother of Pearl) is bright straw colour, with a pearly lustre, and greyish brown transverse markings. The pale green caterpillar is common on nettles.

Crambus tristellus (the Common Grass Moth). Fore-

wings varying from dull yellow to rusty brown, with a central pale streak, and a dark brown line near the hind margin; hind-wings whitish. Like the rest of the grass moths, it rolls its wings into a very small compass when at rest. They sit during the daytime head downwards on the stems of grass, and only fly a short distance when disturbed.

TORTRICES.

Halonota fœnella has rich chocolate-brown fore-wings, with a large and conspicuous white spot in the middle, shaped like an inverted V. The cream-coloured caterpillar lives on the root and stem of the mugwort.

TINEÆ.

Tinea pellionella (the Common Clothes Moth) has brownish grey fore-wings with three brown spots near the middle, and light grey hind-wings. The whitish larva feeds on cloth, feathers, etc.

Adela viridella (the Green Long-horn Moth) has metallic greenish fore-wings, tending to copper colour towards the costa, and dark purplish brown hind-wings. The antennæ are about three or four times as long as the body. It flies in woods by day, in the spring. The caterpillar feeds on wood anemone.

Hyponomeuta padella (the Small Ermine Moth). Fore-wings greyish white, with three rows of black spots,

hind-wings unspotted. It abounds on hedges, and is often very destructive, the caterpillars feeding gregariously under a web.

PTEROPHORI.

Pterophorus pentadactylus (the White Plume Moth) has the fore-wings cleft into three feathers, and the hind-wings into two. It is common among herbage, and may be distinguished from the other species of this group by its snow-white colour. The caterpillar feeds on bind-weed.

ALUCITÆ.

Alucita hexadactyla (the Twenty-plume Moth) has each of the wings divided into six distinct feathers. It is grey, with more or less distinct darker bands. The caterpillar is found on honeysuckle.

ORDER DIPTERA

(*Flies, etc.*).

The Diptera have only two wings, which are transparent and membranous, with only a few veins; behind these there are generally battledore-like projections called *halteres*, which represent the rudiments of the hind-wings; or they may have no true wings at all. The mouth consists of a sucking apparatus formed either of a proboscis, which is generally elbowed, as in the common house-flies, or of a long proboscis furnished with a stinging bristle, as in the gnats. These insects present a complete metamorphosis, and the larvæ are legless maggots, which live in vegetable refuse, in dung, or in water. The pupæ are generally enclosed in a firm, oval case, the upper part of which flies open, like a trap door, for the insect to emerge. On the whole, the Diptera are not very injurious, if we except those species which attack men and animals, with their sting.

The number of British Diptera is about 3,000, and they are divided into :—

Nemocera or Gnats, Crane-flies, etc.
Brachycera or Flies.
Aphaniptera or Fleas.

PLATE X.

DIPTERA.

Descriptions will be found at the pages given after the names of the insects figured

Fig.

NEMOCERA.

1 *a*, *b*. Culex pipiens (the Common Gnat) and larva (*b*), p. 151.
2. Tipula oleracea (the Common Daddy Longlegs), p 152.

BRACHYCERA.

3. Stratiomys chamæleon, p. 153.
4. Tabanus bovinus (the Gad Fly), p. 153.
5. Asilus crabroniformis, p. 153.
6. Syrphus pyrastri, p. 153.
7 *a*, *b*. Eristalis tenax and larva (*b*), p. 153.
8. Gastrophilus equi (the Horse Fly), p. 154.
9. Scatophaga stercoraria (the Dung Fly), p. 154.
10. Musca domestica (the House Fly), p. 154.
11. Chlorops tæniopus (the Ribbon-footed Corn Fly), p 155.

APHANIPTERA.

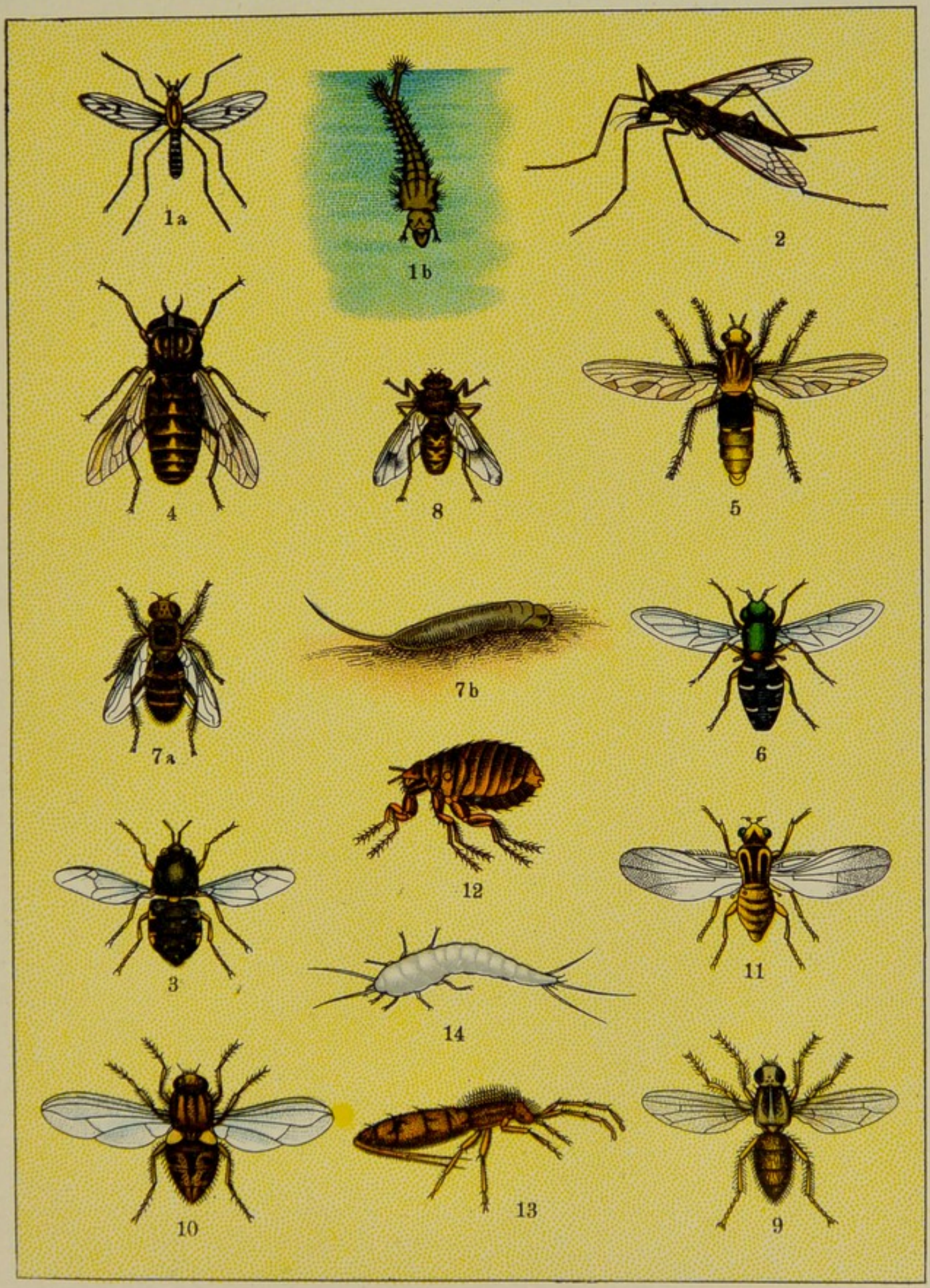
12. Pulex irritans (the Common Flea), p. 156.

NEUROPTERA.

THYSANURA.

13. Podura villosa (the Spring-tail), p. 162.
14. Lepisma saccharina (the Silver Fish), p. 162.

PLATE X.



DIPTERA NEMOCERA (GNATS, CRANE-FLIES, Etc.).

These are slender insects, with rather long antennæ composed of from six to twenty-four joints.

FAMILY CECIDOMYIIDÆ (GALL-GNATS).

Small insects, the females of which lay their eggs on plants, causing malformations of growth.

Cecidomyia destructor (the Hessian Fly) is a small yellow insect only about 2 lines long. The female lays minute reddish eggs on various kinds of corn and grass, and the larvæ, which emerge from them, feed on the juice of the plant, which becomes weakened and bends over.

Cecidomyia tritici (the Wheat Midge) is another small species, which also causes damage to corn, but is less destructive than the former species.

FAMILY CULICIDÆ (GNATS).

These are small insects, with long legs and a long proboscis. Only the female gnat stings, and in so doing it leaves a liquid in the wound, which produces swelling and irritation.

Culex pipiens (the Common Gnat), Plate X., Fig. 1, *a*, is about 3 lines long. It is often seen in large companies near water, dancing in the air. It has a grey-and-white ringed abdomen, and a brownish thorax with two dark longitudinal

lines. The hairy larvæ swim in water, head downwards, with the end of the abdomen—where the organs of respiration are situated—projecting, as seen in Fig. 1, *b*. The pupa also floats in water, but with the head upwards, as the spiracles are differently placed. These larvæ and pupæ are common in water-butts. The female gnats sting men and animals, and suck their blood. They are often very troublesome and pertinacious, but are much worse in hot climates, where they are called mosquitoes. A few of these pests in a bedroom are quite sufficient to prevent sleep.

FAMILY TIPULIDÆ (CRANE-FLIES).

The Crane-flies are much larger than the gnats, though they are very similar in general appearance. They do not sting, but live on the juices of plants, and their larvæ live in the ground.

Tipula oleracea (the Common Daddy Longlegs), Plate X., Fig. 2, is found in meadows. It has a grey thorax with brown stripes, a yellowish brown abdomen, and red front margins to the wings. The larvæ feed on the roots of grass, corn, etc., and are therefore very destructive.

DIPTERA BRACHYCERA (FLIES).

The flies are distinguished from the gnats by their short, usually three-jointed, setiform antennæ.

Stratiomys chamæleon, Plate X., Fig. 3, is a black fly with a thick body. The head is yellow in front and at the sides, as are also the scutellum, and some of the segments of the abdomen. The larvæ are aquatic.

Tabanus bovinus (the Gad Fly), Plate X., Fig. 4, which is so troublesome to cattle, is a dark brown fly, with the middle and hind-part of the segments of the abdomen yellowish. The larva lives in the ground.

Chrysops cæcutiens, a smaller species, only about 4 lines long, is black, with the fore-part of the abdomen yellow. Unlike the Gad Fly, which announces its presence by a loud humming noise, this fly makes its attacks silently. Both of them will sting men as well as animals.

Asilus crabroniformis, Plate X., Fig. 5, is reddish yellow, with the fore-part of the abdomen black. It feeds on other insects.

Anthrax semiatra is readily recognised by its black colour, and the black patches on the fore-part of the wings. It is about 4 lines long.

Syrphus pyrastri, Plate X., Fig. 6, is particularly useful to man, as its green larvæ destroy the injurious aphides. The fly has three pairs of yellowish lunules on the abdomen.

Eristalis tenax, Plate X., Fig. 7, *a*, has a loud hum, and has a superficial resemblance to a drone bee. It has transverse yellow lines on the abdomen. The larva (Fig. 7, *b*) is an ugly greyish monster with a long thin tail, and is common

in cesspools and drains. It is popularly called the rat-tailed grub.

Œstrus ovis, ½ inch long, is an almost naked fly, with a whitish abdomen, marked with numerous black spots. The forehead and thorax are covered with black excrescences. It lays its eggs on the noses of sheep. The larvæ, when they emerge, creep into the nasal cavity, producing very unpleasant effects. When mature, they fall out, and pupate in the ground.

Gastrophilus equi (the Horse Fly), Plate X., Fig. 8, is reddish yellow, with a brownish band and two spots on the wings. The larvæ live in the intestines of the horse, which they are believed to reach through the eggs being laid on the hair of the horse, and unconsciously swallowed, when he is licking himself. The larvæ are subsequently evacuated, and pupate in the ground.

Scatophaga stercoraria (the Dung Fly), Plate X., Fig. 9, is a harmless species, which is commonly found flying about dung, in which the larvæ live. This fly is about ½ inch long, and has reddish-yellow legs, and a yellow hairy abdomen.

Musca domestica (the House Fly), Plate X., Fig. 10. This well-known species, although it does not sting, is very troublesome by its abundance and its constant buzzing. It abounds in houses and stables, and lays its eggs among putrefying substances, upon which the larvæ feed. It

multiplies very fast, and is now found almost all over the world.

Musca vomitoria (the Blue-bottle Fly) does not occur in such large numbers as the last species, but is even more troublesome. It buzzes very loudly, and lays its long white eggs upon meat, which is then called fly-blown. It is about $\frac{1}{2}$ inch long, and is characterised by its shining blue abdomen ringed with black.

Sarcophaga carnaria is another common species about $\frac{1}{2}$ inch long. It is whitish grey, with a black root to the abdomen and a yellow head. Its larvæ feed on carrion, including dead insects.

Chlorops tæniopus (the Ribbon-footed Corn Fly), Plate X., Fig. 11, is only about 2 lines long. It is shining yellow, with three black longitudinal streaks on the thorax. The larva is very destructive to ears of corn.

Trypeta onopordinis (the Parsnip Fly) is another small species which is equally injurious to the leaves of the celery and parsnip plants.

DIPTERA APHANIPTERA.

FAMILY PULICIDÆ (FLEAS).

These are insects both sexes of which are apparently wingless, and provided with long legs, the hind-pair being especially developed for jumping.

Pulex irritans (the Common Flea), Plate X., Fig. 12, is a well-known brown insect which has a wonderful power of jumping. It is parasitic on warm-blooded animals, and lives by biting them and sucking their blood. It is not nearly so hurtful, however, as

Sarcopsylla penetrans (the Jigger) of South America, which fixes itself to the skin, especially under the nails, where it lays its eggs, producing dangerous ulcers.

PLATE XI.

NEUROPTERA.

Descriptions will be found at the pages given after the names of the insects figured.

Fig.

ODONATA.

1 *a*, *b*. Cordulegaster annulatus and larva (*b*), p. 159.

EPHEMERIDÆ.

2. Ephemera vulgata, p. 160.

PLANIPENNIA.

3 *a*, *b*. Myrmeleon formicarius (the Ant Lion) and larva (*b*), p. 161.

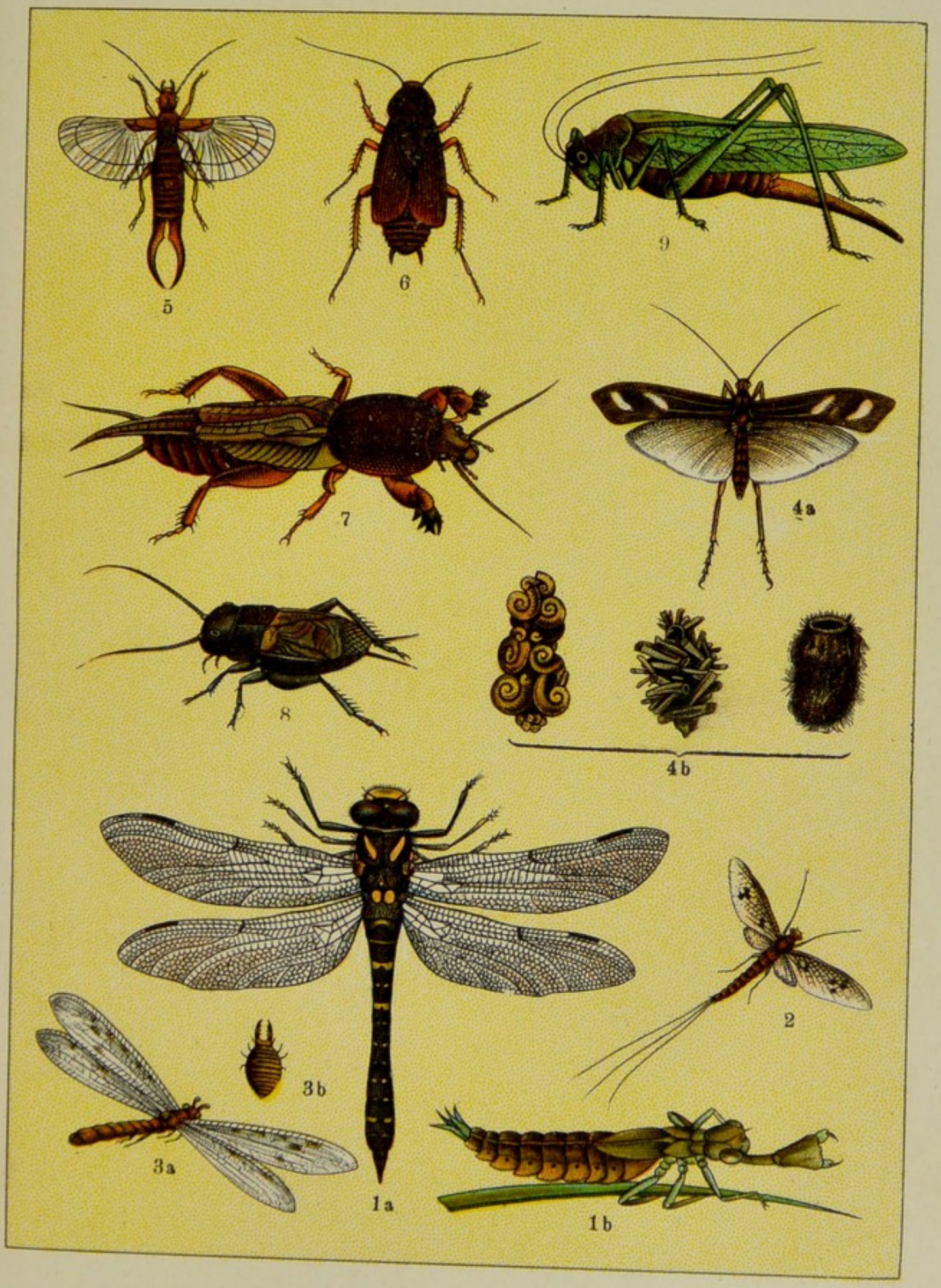
TRICHOPTERA.

4 *a*. Phryganea rhombica (the Caddis Fly), p. 161.
4 *b*. Cases of Caddis Flies, p. 161.

ORTHOPTERA.

5. Forficula auricularia (the Common Earwig), p. 163.
6 Blatta orientalis (the Cockroach), p. 163.
7. Gryllotalpa vulgaris (the Mole Cricket), p. 164.
8. Gryllus campestris (the Field Cricket), p. 164.
9. Locusta viridissima (the Great Green Grasshopper), p. 164.

PLATE XI.



ORDER NEUROPTERA.

The *Neuroptera* have mostly four transparent wings with numerous branching veins; they have well developed jaws, and some have a complete, others an incomplete, metamorphosis. Most of the species live on other insects, and the larvæ are generally aquatic. There are about 600 British species.

ODONATA (DRAGON-FLIES).

These insects are generally found flying in the neighbourhood of water. They have a broad head and large projecting eyes, and the abdomen is long and narrow. The antennæ are short, and the four equal-sized wings are situated further back than the legs. They catch their prey on the wing. The female lets its eggs fall into the water, and the larvæ live on water insects which they catch by means of their projecting under-lip. The metamorphoses are incomplete.

Æschna grandis is a very large species with the wings tinged with brown.

Cordulegaster annulatus, Plate XI., Fig. 1, *a*, *b*, is black with yellow markings, and has the eyes wider apart than in others of the largest dragon-flies. It has a powerful flight, and is often found at some distance from water.

Libellula depressa, about 1½ inch long, has a very broad and flattened abdomen, with yellow spots on the sides.

Calopteryx virgo is nearly as long as the last species, but with shorter wings and a slender abdomen. The male has a bright metallic blue body, and deep blue wings. In the female the body is metallic green, and the wings are reddish brown.

EPHEMERIDÆ.

These insects are much smaller than the Dragon-flies, and the hind-wings are much smaller than the fore-wings.

Ephemera vulgata, Plate XI., Fig. 2, is a common brown species with three rows of yellow spots on the abdomen, which terminates in three thread-like processes. The wings are brownish, densely reticulated, the fore-wings with a brown band. The perfect insect only lives a few hours, and takes no food, and, indeed, it is destitute of a mouth. The larva, on the other hand, is provided with lateral jaws, and lives for two or three years as an inhabitant of the water. The dead bodies of some species of Ephemeræ are sometimes found in such quantities, on the Continent, near water, that the people employ them as manure.

PERLIDÆ.

Perla cephalotes, 1 inch long, is brown, with black legs, and has two thread-like appendages to the abdomen. The metamorphosis is incomplete and the larva is aquatic.

PLANIPENNIA.

In these insects the antennæ are always longer than the head. The cycle of transformations is complete.

Panorpa communis is common, and easy to recognise, for the male has a pair of turned-up claws at the extremity of the abdomen, and a long head. It is rather more than an inch long, and of a brown colour, with red proboscis and claws. The wings are banded with dark brown.

Myrmeleon formicarius (the Ant Lion), Plate XI., Fig. 3, *a*, has short clubbed antennæ and long narrow wings covered with brown spots. The larva, which is the true Ant Lion (Fig. 3, *b*) is a small creature with large projecting pincers-like jaws, toothed on the inner side. It forms a large funnel-shaped burrow in the sand, and there lies in wait for any insects which may fall in, such as ants, etc. It sucks the carcass dry, and then throws it out of its burrow.

TRICHOPTERA (CADDIS FLIES).

Phryganea rhombica (the Caddis Fly), Plate XI., Fig. 4, *a*, is distinguished by the two transparent streaks on its brownish fore-wings. The larvæ may be found early in the spring on the banks of streams, dragging a cylindrical case about with them constructed out of sand, bits of rushes, or snail-shells, etc. Fig. 4, *b*, represents some of the various forms of cases.

THYSANURA (SPRING-TAILS).

Podura villosa, Plate X., Fig. 13, is about 2 lines long. It has a peculiar forked tail at the extremity of the abdomen, which it can fold under the body, and by means of which it is able to jump a considerable distance. Its colour is yellowish red with black bands, and it is very pubescent. It is found in woods.

Lepisma saccharina (the Silver Fish), Plate X., Fig. 14, is common in larders. It is a long silvery creature about 4 lines long, with quick gliding movements. It has several thread-like appendages at the end of the abdomen.

ORDER ORTHOPTERA.

The *Orthoptera* have four wings, the front-wings, which are called tegmina, being parchment-like and narrow; the hind-wings are broad and membranous, and are generally folded like a fan beneath them. The metamorphoses are incomplete. They are provided with a mouth-apparatus for biting, and the antennæ are long in some groups. The abdomen frequently ends in an ovipositor in the female, and many species are able to chirp or make various noises. There are about sixty species in Britain, some of which are injurious.

Forficula auricularia (the Common Earwig), Plate XI., Fig. 5, has very short wing-cases, under which, nevertheless, the large wings are completely folded when not in use. During the day it conceals itself under stones and bark, in flowers, etc., and comes out at night, in search of food. It is about 1 inch long and of a reddish-brown colour, with large pincers at the end of the abdomen. It lives on the juices of flowers, to which it is very destructive.

Blatta orientalis (the Cockroach), Plate XI., Fig. 6, is an unwelcome guest in our houses, and is especially common in bakeries. It originally came from Asia, and is a dark brown creature, with reddish legs and wing-cases. The wingless specimens, which are much more frequently seen than the winged ones, are the larvæ and pupæ.

Gryllotalpa vulgaris (the Mole Cricket), Plate XI., Fig. 7, is about 2 inches long. It is brown and is peculiar for its broad fore-legs, which resemble those of a mole, and with which it excavates passages under the surface of the ground. It lives on the roots of plants, and is, therefore, destructive in fields and gardens.

Gryllus campestris (the Field Cricket), Plate XI., Fig. 8, is about an inch long, and is very rare in Britain. It is blackish, with the front of the tegmina, or fore-wings, somewhat lighter, and the inside of the hind femora red. It is found in fields, and on heaths.

Gryllus domesticus (the House Cricket) is common everywhere, in houses and bakeries, where it lives on any sort of provisions which it can find. It is yellowish grey, with dark spots on the head and thorax, and chirps loudly.

The *Locustidæ* are characterised by their long hind-legs, with well developed femora for jumping. The males are provided with an apparatus for chirping.

Locusta viridissima (the Great Green Grasshopper), Plate XI., Fig. 9, is a common species, the female of which is provided with a long ovipositor. The nymph, or pupa, resembles the imago, but has only short rudiments of wings, and cannot fly. This is the case in most of the Orthoptera. It feeds on other insects as well as on plants.

Some of the large locusts are occasional visitors to our shores, but never breed here.

PLATE XII.

HEMIPTERA HETEROPTERA.

Descriptions will be found at the pages given after the names of the insects figured.

Fig.

AUROCORISA.

1. Pentatoma dissimile, p. 168.
2. Pentatoma baccarum, p. 168.
3. Coreus quadratus, p. 168.
4. Pyrrhocoris apterus (the Scarlet Bug), p. 168.
5. Phytocoris bifasciatus, p. 169.
6. Reduvius personatus (the Fly Bug), p. 169.
7. Cimex lectularius (the Bed Bug), p. 169.
8. Hydrometra paludum (the Water Measurer), p. 169.

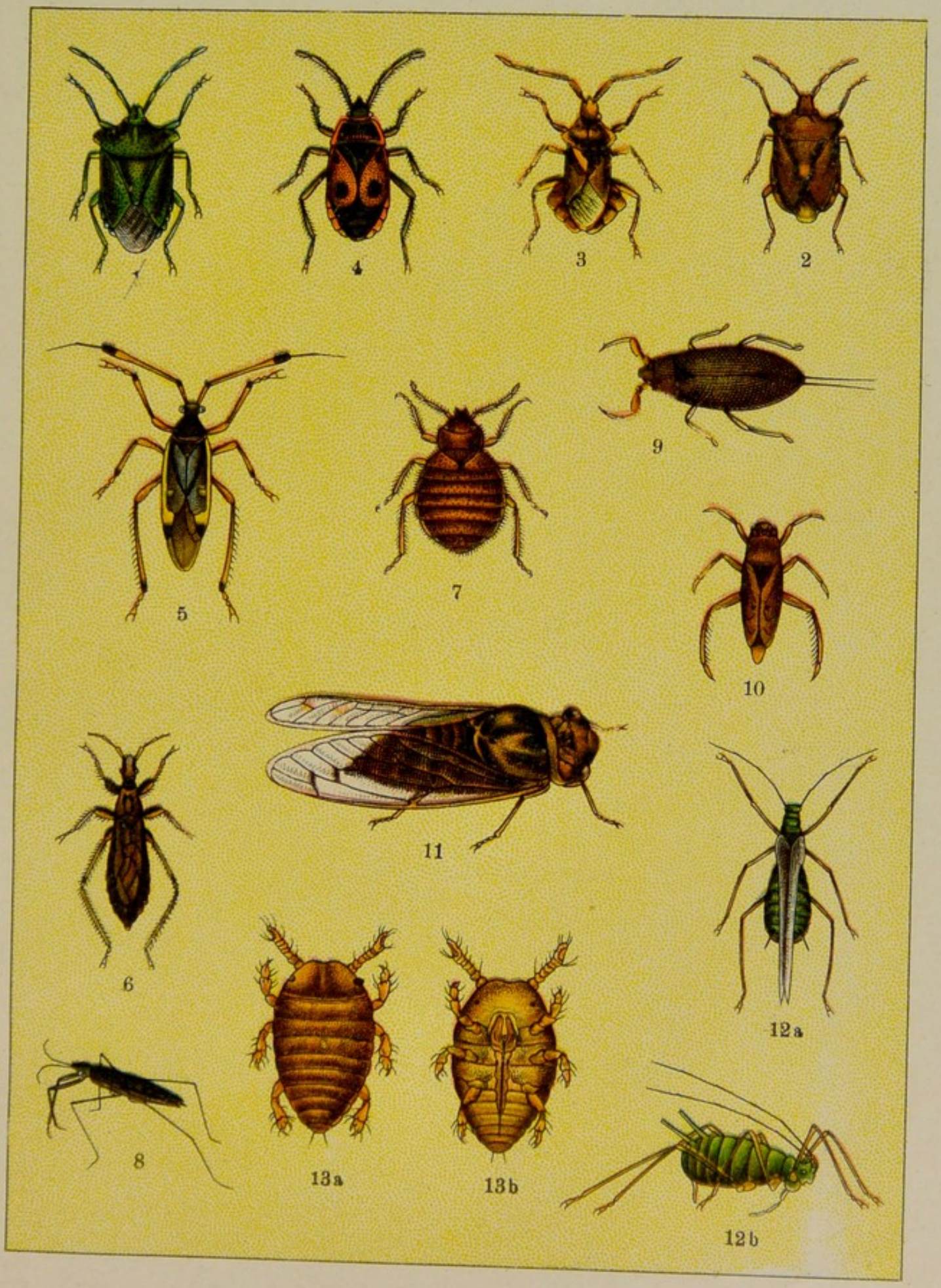
HYDROCORISA.

9. Nepa cinerea (the Water Scorpion), p. 170.
10. Notonecta glauca (the Water Boatman), p. 169.

HEMIPTERA HOMOPTERA.

11. Cicada orni, p. 171.
12. Aphis rosæ (the Rose Aphis), winged (*a*), wingless (*b*), p. 172.
13. Phylloxera vastatrix (the Vine Aphis), upper side (*a*), under side (*b*), p. 172.

PLATE XII.



ORDER HEMIPTERA.

(*Bugs, etc.*)

The *Hemiptera* are chiefly characterised by the proboscis, which bends back under the thorax, and by their incomplete metamorphosis. The wings are not formed after the same pattern in all the species, and they are divided according to the shape of the wings into *Heteroptera* and *Homoptera*. In the former division the front part of the fore-wings, except at the tip, is harder than the hind-wings, whereas the *Homoptera* have the four wings of uniform texture. We have about 900 species in Britain.

HEMIPTERA HETEROPTERA.

In these the fore-wings are hard, except at the extremity, where they are membranous, and the antennæ are composed of only a few long joints. They, mostly, emit a disagreeable odour, especially if touched. Some few species are aquatic.

AUROCORISA (AIR BUGS).

The air bugs live on the ground or on plants, and feed principally on other insects, whose juices they suck by means of their proboscis. Many of the species are brightly

coloured. The scutellum, the portion of the back behind the pronotum and between the base of the wing-cases, which is small in most insects, is very large in some bugs, being, sometimes, so large as to cover the whole of the back of the insect. This peculiarity is most marked in the *Pentatomidæ*.

Pentatoma dissimile, Plate XII., Fig. 1, is grass-green above and reddish beneath; it has the last joint of the antennæ reddish brown.

Pentatoma baccarum, Plate XII., Fig. 2, is a common brown species with white-ringed antennæ. It has a white point to the scutellum, and white spots on the sides of the abdomen.

But the European species which has the largest scutellum is—

Tetyra hottentotta, whose scutellum covers nearly the whole of the abdomen and only leaves a very small space for the wings. In colour it varies from yellow to dark brown.

Coreus quadratus, Plate XII., Fig. 3, is another interesting species. It is about $\frac{1}{2}$ inch long, of a cinnamon-brown colour, and is remarkable for its curious flattened, lozenge-shaped abdomen.

Coreus hirticornis, a similar species, has hairy antennæ, and is common on thistles.

Pyrrhocoris apterus (the Scarlet Bug), Plate XII., Fig. 4,

is local, but occurs in large numbers where found. It frequents paths, and is found among stones. It is black with bright red wing-cases, each with a large black spot, and the thorax and abdomen are margined with red.

Phytocoris bifasciatus, Plate XII., Fig. 5, is a pretty little bug only 4 lines long. It is black, with golden downy hair, and two yellow spots on the wing-cases, and the tip of the scutellum of the same colour. The second joint of the antennæ is thickened and tipped with black.

The largest air bugs are found among the *Reduviidæ*, which prey upon other insects, which they kill with their proboscis before sucking out the contents of their bodies.

Reduvius personatus (the Fly Bug), Plate XII., Fig. 6, one of the species of this family, is found, occasionally, in out-houses. It is dark brown, with reddish brown legs, and whitish femora.

Cimex lectularius (the Bed Bug), Plate XII., Fig. 7, must not be forgotten. It is a flat, broad, wingless insect about 2 lines long, of a brownish red colour, and, like most bugs, it emits a very disagreeable odour. It makes its attack at night, piercing the skin with its proboscis and then sucking the blood. Many remedies have been suggested against their attacks, but they have become much less common since iron bedsteads have come into general use. Like the common house-fly, they have followed man all over the world.

Hydrometra paludum (the Water Measurer), Plate XII.,

Fig. 8, is a dark brown species which darts about on the surface of the water with sudden jerks, and feeds on water-insects.

HYDROCORISA (WATER BUGS).

The *Hydrocorisa* live in the water and feed upon various aquatic animals; they are good swimmers. They have very small antennæ and are not so brightly coloured as the air bugs. They can inflict a severe puncture with their proboscis.

Nepa cinerea (the Water Scorpion), Plate XII., Fig. 9, is common everywhere, and may easily be recognised by its peculiar shape. It is flat, and of a dirty greyish brown colour above, and the abdomen, which is concealed by the wing-cases, is red. The front pair of legs have the femora thickened, and curved in front of the head like the claws of a scorpion, and there are two bristle-shaped appendages projecting from the abdomen.

Ranatra linearis is a similar species, with a long narrow body and the front legs bent upwards, which pursues its prey at the bottom of streams. It is more than 1 inch long, but only 2 lines wide, and is dirty grey, with the abdomen red above, and yellow on the sides. The wings are milky-white.

Notonecta glauca (the Water Boatman), Plate XII., Fig. 10, is a common species, which is remarkable for swimming

on the surface of streams, on its back. It is about $\frac{1}{2}$ inch long, and the upper surface of the body is convex, and of a greyish yellow colour, with a black scutellum. The head and thorax are light greenish. The femora and tibiæ of the hind-legs are provided with long swimming hairs, like those of water-beetles. It lays its eggs on water-plants, and is believed to destroy young fishes.

HEMIPTERA HOMOPTERA.

These have four membranous wings, the fore-wings being sometimes harder than the hind-wings, but of equal consistency throughout. They feed on the juices of plants, and some are very injurious.

Cicada orni, Plate XII., Fig. 11, is a large South European species, of a yellowish colour spotted with brown, with the fore-wings extending much beyond the body. It feeds on a kind of ash, which yields the manna of commerce.

Aphrophora spumaria (the Frog Hopper) is an insect about 5 lines long, of a yellowish grey colour, with two lighter bands on the fore-wings. This is the insect which causes the cuckoo-spit, which is seen on grass and other plants, in summer. It is produced by the larva, which exudes it as a protection from its enemies, whilst it is

developing. The perfect insect has well developed hind-legs, and can jump a considerable distance.

The *Aphidæ* are a family of small insects, which cause great injury to plants, by sucking the juice. The best known species are mostly green, with two long appendages at the end of the abdomen. These insects are remarkable for often producing living young, instead of eggs. In the spring only wingless specimens are to be found, but towards the end of the summer winged insects also appear.

Aphis rosæ (the Rose Aphis), Plate XII., Fig. 12, *a*, *b*, is the small green insect which is often found in such large numbers on roses, and is very destructive to these plants.

Phylloxera vastatrix (the Vine Aphis), Plate XII., Fig. 13, *a* and *b*, only $\frac{1}{3}$ line long, is found occasionally on vines in England, but is very destructive in vine-growing countries. It is a small wingless creature, which hibernates on the roots of vines, and is of a yellowish colour. It lays a very large number of yellow eggs, which hatch so quickly that from five to eight generations may result in a single summer. The winged specimens, which are smaller than the others, do not appear until towards the end of the summer. These creatures destroy the vines by sucking at the roots of the plants. They were first noticed in the South of France, where in a short time they destroyed one-third of the wine-crop. In England, however, they are only found in hot-houses.

In the *Coccidæ* the male has two or four wings and no proboscis in the perfect state, and undergoes a metamorphosis, whilst the female may be either winged or wingless.

Coccus cacti (the Cochineal Insect) is an inhabitant of Mexico and Central America, where it feeds on various species of Cactus. The dried female insects are used to prepare a red dye.

Coccus lacca, another species, lives on trees in the East Indies, and yields the shell-lac of commerce.

ANOPLURA.

Pediculus capitis (the Head Louse) is one of a large group of insects, the lice, which are parasitic on man and animals. The Head Louse is one of the commonest species in England, but only occurs where cleanliness has been neglected.

THE END.

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