THE ABBEY NATURE BOOKS

Edited by W. PERCIVAL WESTELL, F.L.S.

BRITISH INSECTS

(General)

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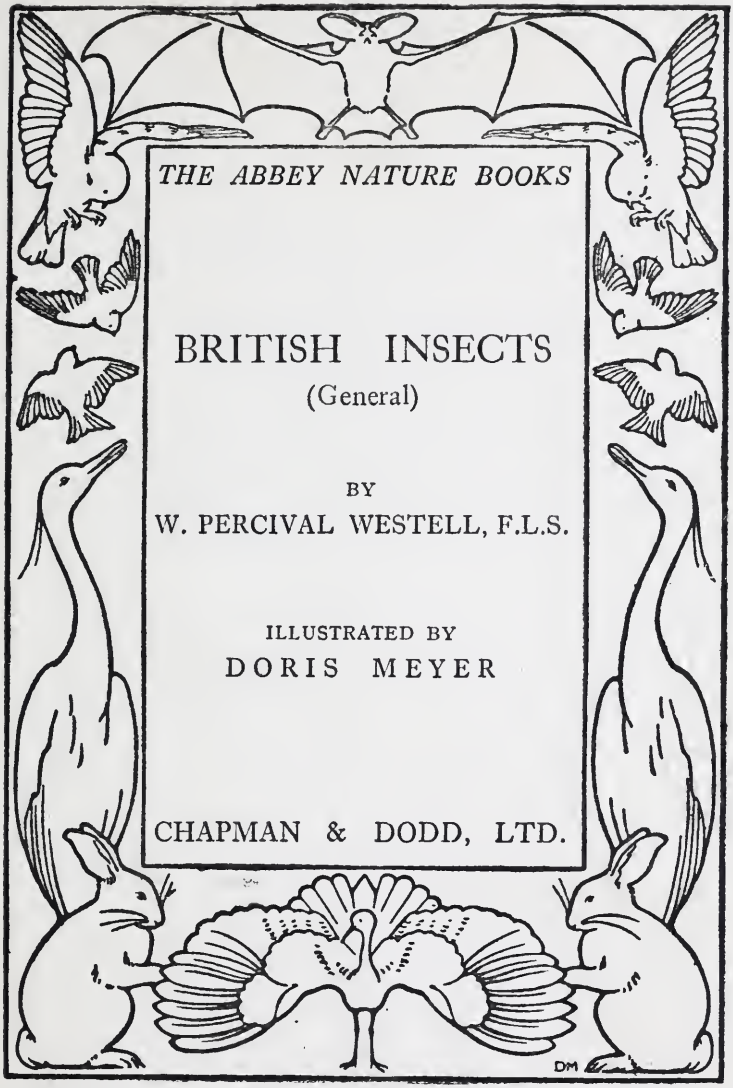
1. Soldier Beetle. 2. Demoiselle Dragon Fly. 3. Rose Chafer Beetle.



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(General)

BY

W. PERCIVAL WESTELL, F.L.S.

ILLUSTRATED BY

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CHAPMAN & DODD, LTD.

Cahill & Co., Ltd., London, Dublin and Drogheda.

INTRODUCTORY NOTE

When it is pointed out that there are over one hundred and seventy different species of Caddis Flies in Britain alone, and several thousands of species of Ichneumons, the difficulty of compressing into one modest volume even a brief survey of British Insect Life will be realised. Whilst the members of the Order *Lepidoptera* (Butterflies and Moths) have been accorded a volume of their own,* and thus relieved the congestion somewhat, there remained a mighty host to contend with in the general insecta, and it is with representatives of these that this fifth volume is concerned. It has been the author's aim to treat his subject more or less scientifically, and yet not be dry-as-dust, as a book on insect-life must, to be of any useful service, include scientific names, orders, families, and the rest. Popular books on these insect-marvels, whilst eminently readable, are of little use for identification or reference, and the idea has been to strike a happy medium by producing a tome that shall make a direct appeal to all Nature lovers, and yet have some value from the point of view already mentioned. As it stands, it is claimed to be the most comprehensive little volume yet published on British Insects

* Volume IV, of " The Abbey Nature Books."

—a multum-in-parvo—and it is hoped that, as a result, these myriads of creatures will receive a greater share of attention than has heretofore been accorded them. It should be pointed out that the classification of Insects is being constantly altered, and whilst to-day the Orders herein included are mostly accepted, to-morrow may see the Fleas, for example, taken out of the Diptera, and placed elsewhere. There seems no finality, partly because we are only gradually acquiring sufficient information for dealing with them, and many puzzles still exist. The aim has been to take the ten chief Orders of Insects represented in Britain, and to deal with them accordingly. The Author has largely followed the " Guide to the Exhibited Series of Insects in the Department of Entomology " at the British Museum (Natural History), and he has to acknowledge the courtesy of the Trustees of that wonderful Institution in loaning blocks of Figs. 1, 2, 3, 4, 11, 12, 13, 24, 27, 31, 33, 34, 35, 36, and 38, and to Mr. Ray Palmer, F.E.S., of Letchworth Museum, for helpful assistance in classification. Acknowledgment is also made of the use, as a work of reference, of the Author's recently published collaborative treatise : " Pests of the Garden and Orchard, Farm and Forest " (Palmer and Westell, Drane, Nov. 1922).

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CONTENTS

(These are only included here so as to complete the ten chief Orders of British Insects, the Butterflies and Moths having been accorded a separate Volume to themselves in Book IV.)

LIST OF ILLUSTRATIONS

BRITISH INSECTS

(General)

Introduction.—The classification of the Insecta—even if attention is restricted to British species—is so often changed, and various methods adopted, by different systematists, that it is difficult to set out with any degree of certainty a general rule that can be safely followed. For the purpose of this volume, however, it will be sufficient if we classify the insects with which we are here concerned under Ten Orders, commencing with the Bristle-Tails and Spring-Tails included in the *Order Aptera*, and concluding with the highly-organised Ants, Bees, and Wasps, which find a place in the *Order Hymenoptera*.

In the ten Orders of Insects which are represented in this, and its companion volume: "British Butterflies and Moths," it is safe to assert that over seventeen thousand species are inhabitants of our own country, and whilst it is quite impossible to include more than a fraction of these in our present survey, it will perhaps afford interest if we set out the estimated number of British species in each Order, thus :—*Aptera* 200 species ;

Coleoptera 3,265 species ; *Diptera* 4,000 species ; *Hymenoptera* 5,000 species ; *Lepidoptera* 2,060 species ; *Mallophaga* 150 species ; *Neuroptera* 228 species ; *Orthoptera* 42 species ; *Rhynchota* 1,500 species ; and *Trichoptera* 174 species, or, approximately, some 17,000 species in all. I have purposely arranged the foregoing in alphabetical order, but to carry out one of the aims of this series of Abbey Nature Books further, namely, to convey some idea of the classification of British Animal Life, it will be as well to follow up the alphabetical sequence above given with the scientific one, indicating briefly the kinds of insects each of the Ten Orders contains, thus :—

Order I (*Aptera*) is made up of the Bristle-Tails and Spring-Tails, which are wingless insects passing through no metamorphoses, the young (as in Spiders) resembling the adult except in size. Other characteristics are referred to later, where we consider more fully the general life-histories of the different species accorded a place in this introductory handbook.

Order II (*Mallophaga*) consists of Bird and Biting Lice, which, to say the least, are not likely to be very popularly regarded. These also are wingless creatures which, as in the *Aptera*, undergo very little change in the progress to maturity.

Order III (*Orthoptera*) includes Cockroaches (so often erroneously referred to as " Black Beetles "), Crickets, Earwigs, and Grasshoppers, and it may here be mentioned that the curious Praying Mantis which adopts

such a reverential attitude, and the ravenous Mosquito of other lands than ours, also belong to this important Order.

Order IV (*Rhynchota*) has among its members the detestable Bed Bug (*Cimex lectularius*); those familiar little tenants of our ponds and streams, the Water Boatman and Water Scorpion; the active little Frog Hopper whose frothy secretion is such a feature of our countryside when Summer returns again; the amazing Aphis, or Green Fly; the Apple Sucker, and the Scale Insects. All these undergo an incomplete metamorphosis, and it may be mentioned that the Cicadas, whose stridulating music is such a feature of the regions they inhabit abroad, and the Lantern Flies, also find a place in this fourth Order, although unrepresented in Britain.

Order V (*Coleoptera*) is made up of Sheath-Winged Insects, or Beetles, some large (as in the Great Water and Stag Beetles), others so small as almost to escape detection, and yet of perfect mechanism throughout, and all undergoing a complete metamorphosis. The useful Ladybirds are included among these coleopterous insects, and there are several other familiar representatives of which we have something to relate hereafter.

Order VI (*Neuroptera*) may be conveniently divided into six Sub-Orders as follows:—

1. *Corrodentia*, (Book Lice.)
2. *Plecoptera*, (Stone Flies.)
3. *Sialida*, (Alder Flies.)

4. *Planipennia*, (Lacewing, Scorpion, and Snake Flies.)
5. *Ephemeroptera*, (Mayflies.)
6. *Odonata*, (Dragon Flies).

Order VII (*Trichoptera*) includes the Caddis Flies whose larvæ were used by us as bait for angling in some silvern stream, or favourite wayside pond, "when we were boys together."

Order VIII (*Lepidoptera*), as those who possess the fourth volume in this Series will know, embraces the Butterflies and Moths specially dealt with in the preceding book.

Order IX (*Diptera*) is made up of Fleas, Flies, Midges, and Mosquitoes, and is an Order capable of almost indefinite extension, in so far as adding to the number of species is concerned, owing to the fewness of the students who concentrate attention upon this highly important branch of Entomology, and

Order X (*Hymenoptera*) has, as its representatives, Ants, Bees, Wasps, Saw Flies, Ichneumons, and Gall-Wasps.

The many interesting phases through which these tenants of the world of insect-life pass is impossible of lengthy consideration, and they are more conveniently dealt with under their respective headings in the pages which follow. A passing reference need only be made to the beauty of some, and the repulsive appearance of others. Some species among these insect-folk live more or less an active aquatic life, others tenant the air, others again are ground-surface dwellers, and others pursue

their life buried beneath the soil. And there are others again which, being parasites, pass their existence within the body of another animal. Some are obnoxious pests to plant or other forms of life, many are of distinct service in the economy of Nature. Some are indispensable agents in the pollination and fertilisation of flowers, others are detestable disseminators of disease. There are those which perform useful work as scavengers and sanitary-inspectors, removers (and consumers !) of filth, there are others whose palate is best suited to sweet and tasty provender. There are represented among insects both solitary and social workers. Those coming under the last-named head exhibit wonderful traits of co-partnership and co-operation, founding colonies whose laws and regulations are a striking testimony as to the intelligence these silent folk possess. Some perform their change from egg to perfect insect without much loss of time, others are well content to allow the operation to drag on almost indefinitely, until the hour when the all-important period of final emergence can be no longer delayed, and it is highly essential that the future destiny of the race shall be assured. Some, as has already been shown, are wingless, others possess the necessary organs of flight as soon as the adult state is reached, and there are others again who only enjoy the possession of flight-appendages for a short time, so as to enable them to travel from one place to another and there enjoy their little day. Some burrow, crawl, creep, fly, hop or jump, others swim with ease and facility, feathering their

" oars " in such a way as would make an Oxford or Cambridge freshman green with envy. Some love the muddy bottom of a sunlit pond, others revel in the thyme-covered slopes of a dry hillside. Some are fond of the warmth of the life-giving sun, others, like Diogenes of old, pass their time lurking in cold, dark places. The quick movements of some of these gay little creatures will, without much effort, be known to all, the laborious progression of others, and their consequent attendant devices for protection, will be equally familiar to the veriest tyro. The abnormal number of eggs produced, so as to allow for waste, accident, loss through enemies and other causes, is not the least feature of interest, and the clever ruses that are adopted for hiding their productions in a suitable environment need only be mentioned in passing. This great world of insect-life which populates earth, air, and water, invading all the elements, inimical to the interests of human existence here, carrying out all unconsciously important missions there, is full of interest and wonder. If all that were born came to maturity, if the wonderful law of give-and-take, if the intricate and yet delicate balance of Nature was not properly adjusted, this very world of insect-life would, in a short time, make human life well-nigh, if not quite, impossible. Every green thing would soon disappear, all, all would be lost, and in a way the super-wonder of the whole fabric of this branch of Natural Science may be stated to be, not so much perhaps the fascinating life-stories that are unfolded, but

the marvellous provisions that have been made for keeping at bay those species whose misdeeds, unless thus checked, would spell disaster not only for ourselves, but for other earth-creatures who share with us all a common heritage in the wonder-world through which we are destined to pass and play no unimportant part.

Of the remote ancestry of these insect-folk their fossil remains testify, and in the course of a most illuminating discourse on the age of insects, Professor G. H. Carpenter writes :—" We often take mountains as emblems of age, and speak of the ' everlasting hills.' The most advanced orders of insects are older than the chalk of the southern English downs, while the early winged insects flitted by the shores of the lakes wherein the grits and sandstones of the Kerry Rocks gathered fragment by fragment. For the primitive wingless insects we must look at least to the time when by accumulation of coral, and the ash and lava of old volcanos, the rocks of Snowdon were being slowly formed on the bed of the Primary Sea, and the oldest rocks of the Western Highlands of Scotland will hardly carry us back to the primeval arthropods. We walk over the hills rousing the Bee from the flower, or the Dragon Fly from the rushes. The life of each individual insect lasts but for a few days, or months, or years. Yet these creatures are the latest links in a long chain of life which reaches back to a time before the mountain whereon they dwell was brought forth. To unobservant eyes the landscape

seems enduring, but study of its features shows that it changes from age to age, changes even more rapidly than the insect-types which adorn it. Yet through the long periods of the earth's history the insects have been changing too; and the form of their bodies, and the history of their growth, teach us how to trace in some degree the wondrous unfolding of their branch of the great tree of life." (*Insects, their Structure and Life.*)

We may now proceed to consider the various species of insects included in each of the ten Orders already scheduled, concentrating chief attention upon those which are most likely to come under the reader's survey.

ORDER I. APTERA, OR SPRING-TAILS AND BRISTLE-TAILS

Although, as has already been stated, there are some two hundred British species in the first order of insects with which we are here concerned, only the specialist is interested in the more intimate details connected with them, as, in the great world of insect-life, it is necessary to specialise in certain groups in order to work out the life-histories of the different species to any advantage. It need only be mentioned, therefore, that, as a rule, the *Aptera* are divided into two sub-orders, known as *Col-*

lembola and *Thysanura*, the former containing the Spring-Tails, and the latter the Bristle-Tails.

The Spring-Tails (Fig. 1) are often discovered in

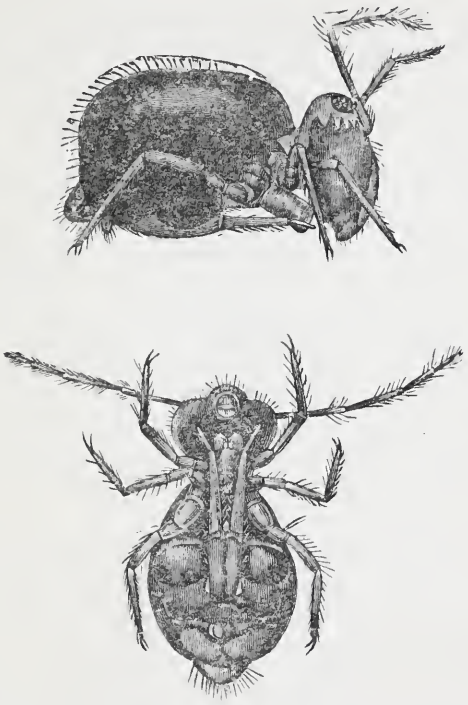


Fig. 1, Spring-Tail. (Greatly Enlarged.)

decaying vegetable matter, by the banks of ponds, on the surface of stagnant water, and on herbage by hedge-

row or wayside. They have small, soft bodies, and many of the species possess scales which, it is interesting to note, closely resemble those found upon the wings of butterflies. The species shown in the illustration is *Papirius*. There is at least one species, known by the scientific name of *Isotoma fimetaria*, which is constructed in such a way that it can adapt itself so as to live on land, as well as on the surface of, and under, water. The popular name of Spring-Tail has been acquired by reason of the springing, or leaping, powers these creatures possess, the feat being carried out by means of a forked apparatus situate upon the under part of the body as shown in the lower specimen illustrated in Fig. 1. Not all have this habit, or power, but those that do will doubtless attract attention when discovered. We are now employing insects to help in the work of the world, and Sewage Works are kept in order by the aid of one of these Spring-Tails, as it feeds on decaying matter which is, it is said, consumed at the rate of four pounds per week per individual insect.

The sewage filters become choked with a jelly-like matter, and large sums of money have been spent in clearing them, but now the Spring-Tail does the job for us, and incidentally saves the ratepayers.

We are now learning that the best way of fighting insect pests is to set other insects to eat them. Indeed, if insects ceased destroying one another, they would multiply so rapidly that the world would soon become unfit for human habitation.

But by employing insect labour we may eventually get the upper hand of all these devastating pests, and also be spared many unpleasant tasks.

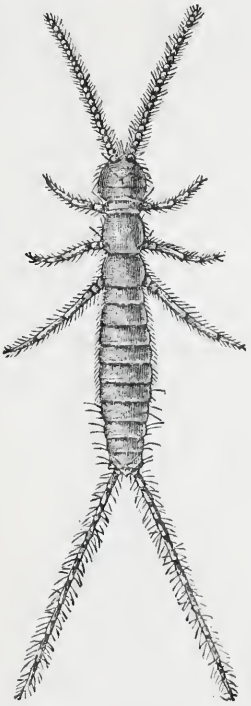


Fig. 2, Bristle-Tail. (Enlarged seven times.)

The *Thysanura*, or **Bristle-Tails,** (Fig. 2) are apparently so-called because of the bristly appendages borne upon

the extremity of the body. The long, outward-spread antennæ protruding from the head, and the double "tail" at the other end, together with the prominent segments of the body, go to make up a most interesting creature, though, truth to tell, it is seen to best advantage when examined under a lens, being by no means of large proportions as has already been hinted earlier on. These Bristle-Tails are split up into four families, and although they differ a great deal in appearance and structure, we need not pursue the matter here, except to point out that in *Campodea staphylinus* (see Fig. 2, the species we had in mind when giving a general description above), we meet with what is stated to be "perhaps the most primitive of all insects." It is of small size, being about a quarter of an inch in length, almost white in colour, and of very active disposition. It may be found in garden and other refuse.

A representative of another family, namely, *Japyx solifugus*, more or less resembles the species just described, except that the "bristle-tail" is replaced with incurved forceps, or pincers, which strikingly remind one of those possessed by the more familiar Earwig. A member of another family of the Sub-Order *Thysanura*, is *Lepisma saccharina*, commonly known as the **Fish Insect** because it is covered with silvery-grey scales (Fig. 3). In spite of its fanciful association with aquatic life, the Fish Insect is a tenant of much drier situations than are affected by members of the finny tribe, as it resorts to warehouses, clothes presses, libraries, and

other " dry " places, and, on occasions, perpetrates a

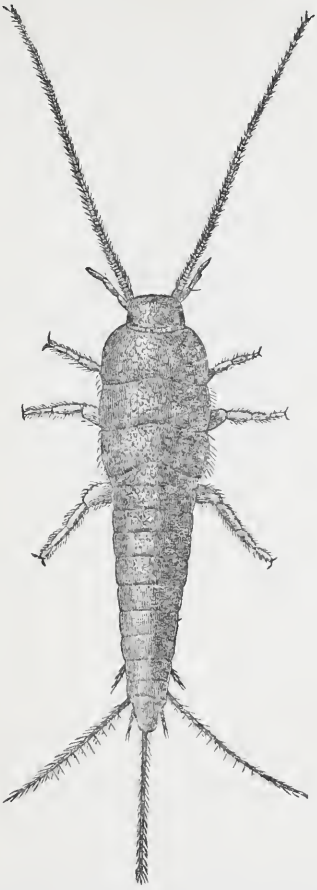


Fig. 3, Fish-Insect. (Enlarged six times.)

good deal of harm by gnawing the surface of old prints, books, and other papers. It is of larger size than the first species selected for mention (*Campodea*), having a broader, three-segmented thorax, much longer antennæ, and, in addition to a pair of appendages on either side of the extremity of the abdomen, *Lepisma* has a centre piece to its " tail " which completes a trident, and also four smaller bristles towards the extremity, two placed on either side.

We may conclude our brief reference to the members of this first Order of insects by drawing attention to an allied species which is really of an ornamental description, being biscuit colour, attractively marked with black and grey scales. It measures about half an inch in length, and although of retiring habits it does sometimes occur in very large numbers in warm places, such as a bakehouse. So much so, indeed, that, although to the scientist this creature is known as *Thermophila furnorum*, to those who are brought into contact with it in bakeries, it goes by the name of " Baker's Brat."

ORDER II. MALLOPHAGA, OR BIRD AND BITING LICE

The average individual will doubtless be somewhat alarmed to know that there are at least one hundred and

fifty species of these insects on the British list, but will heave a sigh of relief when told that, if cleanliness is established, he is not likely to be brought into too intimate terms of acquaintance with any of them! As with the *Aptera*, these wingless insects (Fig. 4) are of

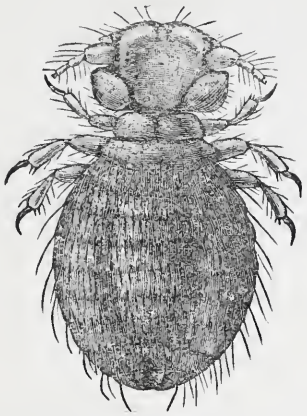


Fig. 4, Dog Louse. (Enlarged thirty-six times.)

small proportions, having a flat, hairy body, with a large free head. The powerful mandibles with which the obnoxious little "beast" is armed, are situate in a cavity underneath the head, and the legs are attached to the sides of the body-segments. There may be one, or even two claws, on the extremity of the two-jointed legs. The species shown in Fig. 4 is *Trichodectes latus* (Dog Louse). Fortunately for human beings the greater

number of these Lice devote their chief attention to birds, and it used to be a common supposition in Gilbert White's time that the possession of a supply of these parasites was helpful to such birds as Martins and Swallows, so that, when pressed for food during migration, these familiar harbingers of Summer would find an abundant food-supply close at hand. Dogs, sheep, and other mammals are also troubled with representatives of these distressing parasites, and a large number which we have examined under a microscope, secure from carrying out their distasteful practises, have caused intense interest by reason of their curious facial expressions, to say nothing of their wonder of form and structure.

ORDER III. ORTHOPTERA, OR EARWIGS, COCKROACHES, CRICKETS AND GRASSHOPPERS

The interesting series of insects included in the *Order Orthoptera* are divided into several families, the members of which have distinguishing characteristics, such as three, four, or five-jointed legs ; legs formed for jumping, leaping, running, seizing, or walking, and long, or not very long, antennæ.

The Common Earwig (*Forficula auricularia*) represents the *Family Forficulidæ*, and is one of five species found in Britain, another species, known as *Labia minor*, or Lesser Earwig, being much less noticeable than the more familiar insect known to everyone. The smaller species appears to resort to manure heaps. Three of the chief features connected with the Earwig—and hereafter reference is only made to *F. auricularia*—are the quick power of movement, the possession of incurved appendages attached to the hind part of the body, and the manner in which—unlike the majority of insects—the young are cared for, the rule among the inhabitants of the insect-world being to produce a large number of eggs, and to leave their hatching and future welfare to chance, though provision is often, if not always made, with regard to a suitable environment in which the larvæ may find themselves when hatched, and a good food-supply near at hand. Mother Earwig, as a matter of fact, is quite a model parent, and sets a remarkable example to others of the insect-race who, as has been stated, seem content with their efforts to perpetuate their species when once the eggs have been deposited. The female Earwig actually sits upon and helps to incubate her eggs, and when hatched the young closely resemble their parents. Her strong jaws at one end and formidable pincers at the other, are excellent weapons of defence should an enemy approach. The young soon require guidance and protection, and this the Mother Earwig patiently, if not lovingly, bestows. It

is one of the most interesting maternal instincts to witness this solicitude of the Earwig for her young, especially in this great world of insect-life where the inexperienced person would least expect to find it. The Earwig, too, is notorious because of its supposed habit of creeping into the human ear, and the formidable use to which it is said to put its fearsome-looking forceps. Let it be said that this insect is far too particular as to its retreat to allow itself, unless by accident or unforseen circumstance, to enter one's ear, and the scorpion-like act of turning up its "tail," as if to strike or nip, is only carried out so as to enable the creature to fold away its small, delicate wings. Some species of Earwigs do not have wings, but our familiar garden tenant has these appendages, the front pair, as a rule, being modified into elytra, or wing-cases, leathery in texture, and the softer hind pair being folded beneath, or just overlapping, the former. The name *Earwig* should, as a matter of fact, be *Earwing*, and it was so-called in days gone by because of the resemblance of the shape of the wing to our own aural orifice. The small spherical eggs are semi-transparent, and of hard texture. Being so small, they are rarely discovered, but they may be found in little groups buried beneath the ground or under a stone. Most Earwigs are brown, red, or yellow in colour, our own common species having, as is well known, a coat of mail of the former when in the adult state. During its transformation stage, it is first white, then perhaps piebald, as the stronger colour appears

and fuller development takes place, and finally chocolate-brown. When disturbed below ground in early Spring, the lighter-coloured, immature specimens may be seen. The forceps of the male are more fully developed than in his mate, and he has nine segments, instead of seven, on the abdomen. That the Earwig is a garden enemy is undoubted, and in some years the large numbers that appear are such that a battle-royal must be waged against them. It is largely a vegetarian, and has a habit of eating away the blossoms of our favourite flowers and other plant-parts, but it is said, on good authority, to be of some service in feeding upon the larva and pupa of insects, and thus helping to keep in check other obnoxious pests. The infallible habit of running to cover results in the easy capture of these garden tenants by placing an inverted flower-pot, hollow rod, bunch of hay or straw, or other trap of this kind near the plants visited, and dealing with the insects captured the succeeding morning, as they appear to carry out their chief depredations at dark, and may be trapped during the silence of the midnight-watch. They do not like *paraffin*, and we have known a ring of this oil, smeared on the ground all round a house, to effectually keep at bay a plague of these insects which previously had a habit of invading the homestead, and being found in hair brushes, beds, and other unlikely and unwelcome places. We pass by those very remarkable creatures popularly known as Stick-Insects (*Family Phasmidæ*), but which can be

highly recommended as "pets," and the Mantids (*Family Mantidæ*), and this brings us to the Cockroaches, which constitute the *Family Blattidæ*. Some species of Cockroaches have wings, others are wingless in both sexes. In others again, as in our own **Common Cockroach** (*Blatta orientalis*, Fig. 5) only the male has

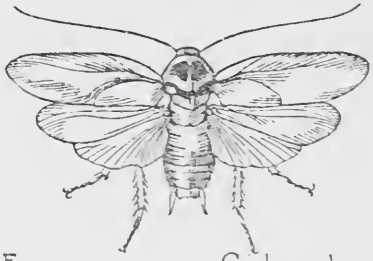


Fig 5. Cockroach

flight appendages. The flat, dark, chocolate-coloured body and the long antennæ of this so-called "Black Beetle" are well known. It resorts to houses (especially bakehouses and similar warm places), and comes from its hiding at night. Other kinds are found along the countryside far removed from habitations, but are much smaller in size. It need hardly be pointed out that, belonging to the *Orthoptera*, they are not Beetles (*Coleoptera*) and although some bear a strong resemblance to the latter, it is incorrect to classify, or refer to them as such. The female Cockroach has a capsule, or purse, on the extremity of her body, and in this recep-

tacle she carries her eggs, these being wonderfully arranged and protected. In at least one foreign species (*Panesthia javanica*), it is believed that the young are actually produced alive, and in another, the insect has the habit of rolling into a tight-fitting ball similar to the well-known Wood Louse. Young Cockroaches are at first whitish in colour, and, although resembling their parents, they do not come to maturity until, as with true larvæ, they have cast their skins several times. This insect was originally introduced into Britain from Asia and the Levant, probably brought over on some homeward-bound vessel, and it has found the conditions admirably suited to its requirements. In the household the Cockroach is not a desirable inmate as, when it comes into contact with food—its diet is omnivorous and nothing comes amiss to it—it taints it with a peculiar fœtid odour. It will even devour leather, and whilst a great deal cannot be said in its favour, it is, perhaps, one of Nature's scavengers, and as a native of countries less sanitary than our own, it is likely that it fulfils no unimportant place where humans fail to act. It is said that, when the conditions become unsuitable, these creatures will all leave one house for another in a body. The Hedgehog is stated to be a good Cockroach-catcher, but I have never put this to the test, not having as lodgers any of the insects with which to experiment. I best remember these unwelcome guests as tenanting my old home at St. Albans (one of the old coaching inns), as they do not seem to care for new

houses as for old. So far we have been concerned with members of the *Order Orthoptera* which move quickly by a crawling or running movement, but in the *Family Gryllidæ*, or **Crickets**, we come to the first section of those which resort to hopping, jumping, or leaping. These insects have long, thin antennæ, or feelers, and two, or at most three-jointed, legs. Almost all the Crickets are dressed in a sober coat of brownish, or horn colour, and the majority of them resort to burrowing, or hiding under, or in, any favourable places. The

Fig 6. Mole Cricket

rarer **Mole Cricket** (*Gryllotalpa*, Fig. 6), has acquired its English Christian name because of its front pair of legs being used for the same purpose as those of the

better-known fur-clad mammal (the Mole), namely, for burrowing. This species is largely carnivorous. The curious clicking, or chirping, noise made by the familiar **House Cricket** (*Gryllus domesticus*), is caused by the male rubbing one wing over the other in the same way as its cousin, the Grasshopper. It is said to be a signal to the female. When at rest, the wings are held in a horizontal position, and protrude beyond the body in the male. On the end of the female's body there is an ovipositor, with which a hole is drilled, and then an egg is laid. This happens about midsummer, and as many as 200 to 300 eggs are deposited by one female. The succeeding Winter is passed in the larval state, the adult form not being attained until the first year's birthday. Where there are fires in old buildings and other places the House Cricket delights to dwell, and the manner in which it contrives to get behind walls, skirting, and similar retreats is remarkable to notice. New houses are not exempt from its presence, and whilst its curious love-song does not recommend itself to some listeners, by others it is regarded with even veneration, and evidently Leigh Hunt was impressed with it, for in his lines to " The Grasshopper and The Cricket," he writes :—

" O sweet and tiny cousins that belong,
  One to the fields, the other to the hearth,
Both have your sunshine ; both though small are strong,
To sing in thoughtful ears this natural song—
  Indoors and out, Summer and Winter, mirth."

The House Cricket (Fig. 7) revels in heat, and it is wonderful what a high temperature it can stand, but we are told, and not without surprise, that it often gets thirsty, and must have somewhere at hand where it can drink. Damp wool seems to be a favourite diet

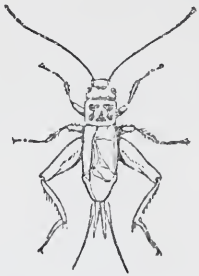


Fig 7. House Cricket

of this species, but there must surely be other ingredients upon which it feeds of which we are not cognisant Clothes, placed to air or dry by the fire overnight, or in an airing cupboard, have been found to be riddled by these household inmates, reminding one of the ravages of the larva of the Clothes Moth, of whose unkind attention my expensive boxcloth gaiters bear ample evidence at the present time. The Cricket is attracted by light, if the latter is extinguished in the room, and an electric torch is held at its entrance hole. In Summer one can often hear Crickets out-of-doors. These need not necessarily be Field Crickets, as the House Cricket will forsake its indoor retreat in Summer, and take a lengthy airing

outside. Some old folks say it is lucky to have these insects on the premises, and one writer has given his testimony thus: "Personally, I like the music (of the Cricket), and spare the annoyance of having my socks made into mince meat by keeping them out of Mr. Cricket's way."

The Field Cricket (*Gryllus campestris*) is larger and darker than its household cousin, and remains underground by day, stealing forth at night to secure its food. The male is most persistent in his efforts to call, or soothe, his mate, and will remain at the entrance to his burrow love-calling for hours on end. The larva closely resembles the imago minus wings, and lives in a burrow of its own making.

The Grasshoppers are classed under two distinct Families, those known as the Long-Horned being included in the *Phasgonuridæ*, and the Short-Horned are relegated to the *Family Locustidæ*, which also embraces the Locusts. The former are distinguished from the Crickets by having four-jointed legs, and the presence of soft pads to assist them to obtain a foothold upon the leaves and stems of plants. They have—as the Long-Horned name implies—very long antennæ made up of a large number of joints (see coloured frontispiece), and as many as 480 joints have been counted on the antennæ of one individual. These larger, long-horned species resort to bushes, shrubs, and trees, and whilst some feed upon leaves, others are carnivorous. The stridulating noise—cleverly likened by a boy

acquaintance of mine to a Fairy's sewing machine—is produced in the same way as that of the Cricket, the drum being situate at the base of the right wing, and the file, or bow, on the left one. Whilst the male only is capable of producing this familiar country sound in the majority of winged species, there are allied insects in which both sexes are equally favoured in this respect.

The Great Green Grasshopper (*Phasgonura viridissima*) is our largest British species, and resorts to bushes, grassy lanes, and hedgerows. It appears in August and September. I have found it very plentiful in Devon and Cornwall. Miss Meyer's coloured illustration will convey a much better idea than a lengthy description of this beautiful insect. It is at least two to three inches in length, has very long hind legs, with a knob-like joint at the knee, and large eyes. It is worthy of close scrutiny under a powerful glass.

The cheery little tenant of our grassy commons and waysides, the **Common Grasshopper** (*Stenobothrus bicolor*) fitly represents the Short-Horned species of the *Family Locustidæ*. As already indicated, this family includes the Locusts, but the visits of the latter to this country are so infrequent that the bare mention of their name must suffice. The Short-Horned Grasshoppers have, as their name implies, much shorter antennæ than their larger cousins, and they have three, instead of four-jointed legs. Some species are almost, if not quite, wingless, and whilst the hearing organs of Crickets, Grasshoppers, and Locusts are very perfect, and the

ears of *Phasgonuridæ* are situate upon the front pair of legs, those of the *Locustidæ* are placed on each side of the base of the abdomen. The happy-go-lucky life passed by this cheerful little tenant of the countryside will be known to all those who revel in the joys of the outdoor world. As a general rule, it appears to be a vegetarian, but its numbers do not ever attain the proportions of its cousin, the Locust, and it does not perpetrate any appreciable damage. It appears to vary in colour, brown, green, red, yellow, and other varieties being forthcoming. The long, narrow, and elliptical eggs are deposited in batches in the ground, a hole being made by the short, stout ovipositor at the extremity of the female's body. It is much shorter and less prominent than that of the Long-Horned Grasshopper, which is a very conspicuous appendage. The eggs are covered over with a sticky secretion, which hardens and affords them protection. The eggs remain as such until early Spring, and when the larva appears it passes through successive moults until it is eventually ready to take up its appointed place in the great world of life.

ORDER IV. RHYNCHOTA, OR BUGS, FROTH-FLIES, APHIDS, AND SCALE-INSECTS

This unpopular order of insects—many, if not most, of the species included therein being pests of mankind—is divided into two Sub-Orders in which the Bugs (including the Water Boatman and Water Scorpion), find a place among the *Hemiptera*, and the Frog Hopper (or Froth Fly), Green Fly, Apple Sucker, and Scale Insects constitute the *Homoptera*. All these creatures have an incomplete metamorphosis, the mouth part is formed into a long proboscis for piercing or sucking (hence name of Order from *Rhyncos*=a beak), and, when not in use, it is hidden beneath the body, and is directed backwards. In the *Hemiptera* the base of the front wings is of leathery texture, and the wings are held crossed when at rest. For the most part these creatures are vegetarians, as they live by sucking juices from plants; others, however, do not restrict their attention to plants, but attack and obtain blood from various animals, including man. Fortunately, the worst offenders are found in other countries than our own. We may now consider a few typical representatives of the *Hemiptera*, and for this purpose we may first dispose of the Land Bugs, as we may call them, and then devote attention to two familiar aquatic species.

The Shield Bugs are so-called because they have a shield, or plate, covering the wings, and our British species are of small size. Then there are their cousins, the **Pentagonal Shield Bugs,** which have been thus named because the wing-shield does not wholly cover the flight-appendages, and is so placed that it forms a triangle, which is sometimes incomplete at the sides, so that it forms a five-sided plate situate above the bases of the wings. These Bugs haunt plants of various kinds for the purpose of extracting the juices, but they also feed upon soft-bodied insects. In colour they are brown or green, and measure about half an inch long. Other species are much smaller and narrower. Others again, possess almost transparent wings (such as the Lace-Winged Bug), and whilst all are enemies of plants, the worst offender as regards human beings is the **Bed Bug** (*Cimex lectularius*). It is reddish-brown in colour, flattish in form, and emits a most offensive odour, in addition to forcing its distasteful presence upon a household or, worse still, upon one's person. As with the Crickets, there seems some doubt as to the original home of this insect, but it is thought to have come from Africa. One rather wishes that it had stayed there! Cleanliness is essential to combat the attention of this detestable household pest, but even this is not always successful as I have known more than one house, the tenants of which were scrupulously clean, to be troubled with them. Incidentally, it may be stated that the Cockroach is an enemy of the Bug

so that, if both kinds of insects are found taking lodgings in a household, the owner must decide for himself which, if either, of the two he will decide to harbour. We would not, in any case, advise the introduction of the Cockroach to combat the Bug. In addition to *Cimex lectularius*, there are three others of the same genus which seem to restrict attention to Bats, Pigeons, and Swallows, and have, in consequence, been accorded the specific names of *C. pipistrelli*, *C. colombarius*, and *C. hirundinis*, respectively. There is one more species which deserves mention, that is the **Masked Bug** which somewhat resembles the Water Scorpion described later on. It measures almost an inch in length, and has black wings. The larva and adult both prey upon other insects (including the Bed Bug), and presumably the popular name has been acquired because the larva has the habit of camouflaging its body with some substance, so as to stalk its prey unobserved. The long-legged **Water Measurers** (*Hydrometra*), and also the **Pond Skaters** (*Gerridæ*), are close relatives of the Land Bugs. They will be known by sight to almost everyone who visits a pond or stream, and their movements (the Measurer's slow, the Skater's quick) rarely fail to excite interest. This introduces us to two further pond-dwellers in the persons of the **Water Boatman** and **Water Scorpion**. The first-named insect (*Notonecta glauca*) (Fig. 8), has a smooth, flattish, yellowish-brown body about half an inch long, but its chief appeal to the popular mind is its habit of floating upside down, and propelling

itself by its long, hairy hind legs. Its resemblance to a miniature boat is very remarkable. It is at once sluggish and active, that is, it exerts itself strenuously when it wishes to move, or change its position, but soon afterwards takes up a " mark-time " attitude as if its efforts were too much for it, and it required a rest from its labours. It is a capital tenant for an aquarium, and like its relative next claiming attention, rarely fails to excite interest, especially among those (and they are legion) who have little, or no, knowledge of the

Fig 8
Water Boatman.

wonderful variety of life in the nearest pond or stream. The Water Boatman is a rapid flier, and whilst the outer pair of wings resemble those of the *Coleoptera* (or Beetles), serving for protection rather than locomotion, the delicate inner wings are objects of great beauty. It has a powerful beak capable of inflicting a nasty puncture. Small wonder, therefore, that it often preys upon larger creatures than itself, and having once secured a meal, shows considerable reluctance to " let go." The eggs are laid singly on various kinds of water-plants, each egg being deposited in a hole made

by the female's ovipositor. The larva is very similar to the adult, excepting for the absence of wings, but in the pupal state rudimentary wings are present.

The Water Scorpion (*Nepa cinerea*, Figs. 9 and 9*a*),

Fig 9.
Water Scorpion

Fig 9a. Larva of
Water Scorpion.

is first-cousin of the last-mentioned species, and it has acquired its popular (or unpopular !) name because the front pair of legs bear a resemblance to the forceps of the true Scorpion. This familiar aquatic insect is dull brown in colour, marked with some red. It has a broad, flat, bug-like body, which measures about an inch in length, and about half as much across. It inhabits both clear-running streams as well as ponds, and perhaps the most conspicuous feature is the apparatus by which the creature takes in free air. This double tube is attached to the abdomen, and when this water-dweller requires a fresh supply of air, it rises to the surface and protrudes its " tail." This accomplished, it dives below

again to renew its operations. When secreted upon the bed of its environment, or among aquatic plants, it is difficult to detect, and as it is not of very active habits, it secures protection in this way. As a matter of fact, it is not a tempting morsel for other creatures to prey upon, and seems mostly immune from attack. But its protective resemblance does enable the Water Scorpion to lie in wait for its own prey, and this, together with the power of the front pair of legs, serve it to great advantage. Having secured its victim, the short sharp beak soon gets to work on the former's body. The clawed forelegs are beautifully fashioned, so as to be closed like a pocket-knife when not in use. When the membranous under-wings are fully extended, the insect is more presentable, and is likely to make a stronger appeal, as there is not only a bright red streak across part of the wings, but the upper surface of the abdomen is also edged with the same colour. It hibernates in Winter, and can, if needs be, remain under water for a great length of time without approaching the surface. The oval-shaped eggs are deposited in a string, and the larva closely resembles the mature insect. The longer and more slender breathing tube of the adult is replaced with a much shorter and thicker apparatus in the immature form.

We now come to smaller fry included in the Sub-Order *Homoptera*, members of which possess wings having the same texture throughout, and these (where they do occur) are held roof-like when the insect is at

rest. There are several families of *Homoptera* which are unrepresented in Britain—such as the Cicadas (notorious for the sounds that they are capable of producing), the Lantern Flies (*Fulgoridæ*), which in some species have curiously developed heads, and, in addition, secrete wax which is used by the Chinese for making candles. This brings us to the *Cercopidæ*, or **Froth Flies,** the commonest and best known being the so-called **Cuckoo Spit,** or **Frog Hopper** (*Philænus spumarius*). The blobs of froth which may be seen attached to garden and wild plants in early Summer will be well known, but few people seem aware that the soft green larva of the Frog Hopper is responsible for this, and that the little tenant of the froth may easily be found by searching. This substance is an obvious protection for this familiar country dweller, until such time that its development enables it to dispense with the frothy covering. By this time, it has become a hard, dark-coloured, jumpy little beast, capable of prodigious hops for so small a creature. If man could, in comparison with his size, cover similar ground, the speed at which we live would be even more pronounced than it is to-day. When hidden in the froth apparently little harm is perpetrated. It is just a question of " wait and see " as, when mature, the Frog Hopper is a great lover of the juice of plants, and is constantly puncturing young leaves in order to extract the juice. This causes the leaves to wither and decay. Of the amazing **Aphides** or **Green-Fly,** much might be written. Green-Fly is rather a mis-

nomer, as there is a sooty-coloured pest belonging to this family which affects beans, and another species is a great enemy of hops. Roses, apple-trees, and other garden produce are preyed upon by these hosts of small plant-lice who, by sheer force of numbers and power of multiplication, are difficult to deal with successfully. Certain kinds of birds—and also, be it noted, the larva of the Ladybird Beetle—perform useful work in reducing the plagues that infest our gardens, but spraying and hand-picking are alike necessary. Even then, it is difficult to cope with the pests, as their method of propagation is such that, in double-quick time, another host soon appears, and one's work seems never done when the invading Aphides are at their height. Of the species which affect agriculture, horticulture, and forestry mention may be made by name only of the Apple, Bean, Cabbage, Carrot, Cherry, Currant, Gooseberry, Hop, Larch, Peach, Plum, Raspberry, Rose, Rosy Apple, Turnip, and Woolly Aphides. The variety of plants attacked is indicated by the popular name. Spraying with extract of quassia may be recommended (see "Pests of the Garden and Orchard, Farm and Forest," by Ray Palmer, F.E.S., and the Author), and it is very evident that, to be successful in the cultivation of plants, it is essential to have an intimate knowledge of one's friends and foes, and the best method to employ in dealing with those inimical to the interests of mankind. I venture to recommend the work above referred to in this respect. Perhaps the detestable **Woolly**

Aphis (*Schizoneura lanigera*) is one of the worst enemies of all. It is incorrectly called American Blight as it is of European origin. It is a great enemy of apple trees all over the world, and is soon recognised by the soft white mildew-like substance which covers both the adult females and young. The wingless females are purplish-brown in colour, and these are constantly giving birth to *living* young, and the latter, in due course, commence to perform a like operation. The eggs are deposited by wingless oviparous females, and these hatch the succeeding Spring, but adult insects also hibernate in cracks, crevices, and elsewhere. The whole story cannot here be told, though it is as fascinating in interest as a fairy tale, but has a much less pleasant ending. As the Woolly Aphis attacks the roots, as well as the parts above ground, remedies must be applied for combating both sets of enemies. The best method is to paint the patches on the branches with methylated spirit, and below ground it is essential that carbon bisulphide should be injected into the soil around the roots in Winter. Grease banding—as carried out for the destructive Winter Moth—is also a preventive, and can be recommended. Another serious pest belonging to the same Sub Order *Homoptera* is the **Apple Sucker** (*Psylla mali*). It attacks buds, blossoms, and leaves of apples, and the eggs may be found in Winter and early Spring on the twigs, especially around the buds. They are pale yellow, and curiously shaped. Larval and nymphal stages are passed through, and eventually

the adult appears. It is unfortunate that such a good-looking insect should be so destructive in its larval state, as its greenish colour and transparent wings are of an attractive description. Spraying with a nicotine soap-wash, paraffin emulsion, etc., is recommended, but it would be wise to consult the work on " Pests " already referred to, as it is outside the scope of this popular treatise to do more than draw the reader's attention to the matter. The *Coccidæ*, or **Scale Insects,** next call for notice by way of concluding our studies of the *Order Rhynchota*. These have acquired their name from the scale-like appearance of the females of many of the species. The males are delicate looking creatures, and only possess one pair of wings. These Scale-Insects attack such plants as apple, apricot, ash, beech, currant, elm, gooseberry, peach, pear, plum, vine, and willow. One species is so-called because it resembles a mussel, another is somewhat like a small oyster-shell. Spraying with a caustic alkali wash is an effective remedy. It is only within recent years that close study has been made of these and other enemies of the husbandman, and any young naturalist, desirous of aiding the food-production of his country, would do well to specialise in some branch of pest-study, so as to help complete the full life-histories of these minute creatures, and others might equally well concentrate their efforts upon the best remedies that can be employed for dealing with them.

ORDER V. COLEOPTERA, OR BEETLES

The very large number of species included in this important Order of Insects, the largest British Order we have after the *Hymenoptera* and *Diptera*, has already been alluded to, but it is necessary to emphasise it again here as the possibility of dealing with more than a few representatives of the principal families cannot be entertained. The Sheath-Winged Insects, or Beetles, undergo a complete metamorphosis. The front pair of wings are called *elytra*, and these serve the purpose of protecting the hind ones, and are not of use for flight. The flight appendages are folded beneath the elytra, and, when at rest, they meet in a straight line along the back, and do not cross one another. It is by reason of the elytra hiding the soft hind wings that surprise is so often expressed by the unobservant as to the possession of " wings " by even the more familiar kinds of Beetles. The *Coleoptera* are, as a rule, divided into twelve Sub-Orders, each of course with certain characters by which they are classified. These need not detain us here as the chief points of interest are pointed out as we proceed.

The Green Tiger Beetle (*Cicindella campestris*), is the first to occupy pride of place as representing the *Cicindelidæ*, which are active, predaceous beetles whose larvæ make perpendicular shafts in dry soil, and lie

in ambush for their prey. The species under review is fond of sandy, or gravelly, soil, and revels in hot sunshine. It is adorned with a bright green dress, spotted with yellow. Both as a larva and imago it partakes of an insectivorous diet, and may be regarded as a friend of the gardener. Of the larger number of Carnivorous Ground Beetles, Family *Carabidæ*, whose clean bodies are so often commented upon when one suddenly disturbs a specimen from beneath the soil, we may select the **Violet Ground Beetle** (*Carabus violaceous*, see Frontispiece), and the **Bombardier** (*Brachinus crepitans*). These, too, are of predaceous habits, the majority feeding at dark, and hiding under stones, logs, and elsewhere by day. It is always a good idea when in the country to turn over stones, logs, fallen tree-stumps, old sacks, and other debris so as to ascertain if any creatures are in hiding underneath. The searcher is more often than not rewarded. The Violet Ground Beetle should not be killed as, being carnivorous, it does good in feeding upon soft-bodied insects and grubs contained in the soil. The popular name of "Slug Killer" given by gardeners to the larva of *C. violaceous* is sufficient testimony of its usefulness. The adult is, as its name implies, dark violet-blue, and as proving that there are exceptions to every rule, this species has its elytra fastened together, and the under wings are not developed. Therefore it *cannot* fly.

The Bombardier Beetle (*Brachinus crepitans*), is chiefly notorious because it has the habit of discharging from

the extremity of its body a volatile fluid which vaporises with a slight explosion when coming into contact with the air. When being pursued by an enemy, and the Bombardier fires a "shot," the effect on the former can be better imagined than described. If the first "shot" fails, quite a little cannonade is kept up until the ammunition gives out.

The Devil's Coach-Horse, or **Cocktail Beetle** (*Ocypus olens*, Fig. 10), is a familiar tenant of the garden, and its mourning attire, and threatening attitude as it turns up its head and "tail," are well known. It has quick powers of movement, is about an inch in length, and has very short wing-cases. It produces the largest egg of any British insect. It is a useful species, the larva and adult feeding upon slugs and the larvæ of other insects. It is called by the specific name of *olens*= stinking, because of the odour it gives off.

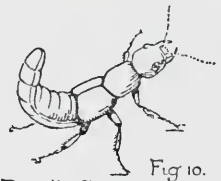


Fig 10.
Devil's Coach Horse.

The ceaseless gyrations of the **Whirligig Beetle** (*Gyrinus natator*) as, joined by numerous companions, it rushes round and round the surface of pond or stream, is another common water-dweller. As it pursues its

evolutions, it seems to have solved the problem of perpetual motion, and as the sun lights up the body-covering, the little round fellows remind one of globules of quicksilver, and as equally elusive ! It belongs to the Family *Gyrinidæ*, the larvæ living below the surface, but the adults, as indicated, are surface-skimmers, rushing here, there, and everywhere by means of their paddle-shaped middle and hind legs. The front pair are used for seizing and holding prey.

We again make the acquaintance of further predaceous insects among the *Dytiscidæ*, the representative selected for this family being *Dytiscus marginalis*, or **Great Brown Water Beetle,** (Figs. 11, 12 and 13). This fine insect is a terror of the pond or stream in which it dwells, both in the larval and adult states. It is one of the " sharks " of insect-life, and woe betide any creature which it is able to tackle successfully. Once it secures a hold, there is no leaving go. The tapered larva is prominently segmented, and bears a pair of strong jaws, and breathing tubes at the opposite extremity. It may be mistaken for the larva of the Dragon Fly by the inexperienced. The pupa is thicker, and bears more evidence of the creature that-is-to-be, and the imago is dark olive-brown, with large wing-cases, and strong jaws. This beetle is free of all the elements, as it can crawl, fly, and swim, and will, on occasions, leave one sheet of water for another. It is a fine diver and swimmer, the hind pair of limbs being flat-like, and fringed with hairs, specially adapted for the purpose

for which they are required. It measures about 1½ inches in length, and about ½ an inch across. It has two sharp spines near the hind legs which are of obvious

Fig. 11.

Fig. 12.

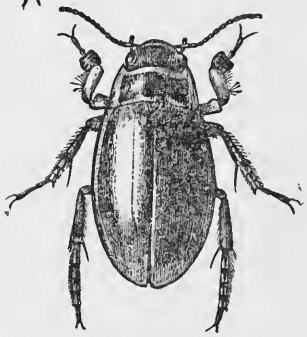


Fig. 13.

Fig.11, Larva. Fig. 12, Pupa. Fig. 13, Image of Great Brown Water Beetle.

service for defence, and also discharges an evil-smelling fluid when irritated. When the larva is ready to pupate,

it leaves the water-margin, and excavates a small oval-shaped cell in which to remain concealed. Under normal conditions it doesn't take long for the perfect beetle to emerge, but there are times when it remains in the pupal state throughout the Winter. The adult extrudes its hind quarters above the surface of the water so as to take in a fresh supply of air bubbles.

The Great Black Water Beetle (*Hydrous piceus*), must not be confused with the last-mentioned, as, in the adult state, *H. piceus* appears to be a vegetarian. It is the largest member of the *Coleoptera* in Britain, with the sole exception of the handsome Stag Beetle. The female deposits a number of eggs in an oval cocoon which she cleverly attaches to an aquatic plant. The larva feeds upon animal food until such time that, for some reason, it decides to become a vegetarian ! This species is harmless in an aquarium and may much more safely be recommended than *Dytiscus marginalis*. It belongs to the Family *Hydrophilidæ*. The *Staphylinidæ*, or Rove Beetles, are next in order of merit as regards the family tree, but must be summarily dismissed with the statement that they include a very large assembly of small species which, although good fliers, fold their wings into a very small space, and have very short wing-covers. Those with which the reader is most likely to come into contact are the annoying little insects which have such an obnoxious habit of getting into one's eye, and causing painful irritation until removed. These unwelcome visitors are all popularly dubbed " Flies "

by the unfortunate recipient. Carrion-feeding beetles next engage attention, and these belong to the *Silphidæ*, which includes *Necrophorus vespillo*, or the **Burying Beetle** (Fig. 14). This species, and its kindred, have the

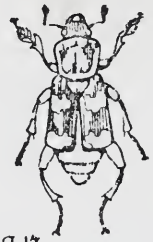


Fig 14
Burying Beetle

curious habit of burying dead birds, mice, shrews, voles, and other animals by digging the earth away beneath them. This accomplished, the beetle deposits her eggs upon the dead carcase, and when the larvæ, or grubs, hatch they find an abundant food-supply near at hand. These insect-scavengers perform useful work, and it is largely owing to their efforts that so few dead bodies of wild creatures are discovered. These Carrion Beetles also devour some of the decomposing flesh of the carcase, and seem to relish the bad odour that is given off. They may be known by the possession of a knob at the tip of the antenna. The Burying Beetle is rarely seen, unless close watch is kept over a dead rodent, bird, or other animal, and they seem to fly about on their

scavenging expeditions in pairs, being attracted to the spot by scent. The commonest species is brownish-black, with bands and spots of orange-yellow.

The *Coccinellidæ* includes the useful **Ladybird Beetles,** and these are popularly named according to the number of spots which they bear upon the wing-cases. The usual form is quite familiar, as the Ladybird is almost as highly regarded in the world of insect life as the Robin is among birds. Yet it is distressing to notice how this beneficent insect is destroyed when in the larval state by even experienced gardeners, to some of whom *all* animal life spells "foe"! During a large invasion of these beetles on the South Devon Coast a year or two ago, I also witnessed a small child just able to toddle busily occupied crushing dozens of these creatures by way of amusement. The larva may frequently be discovered among plant-lice on the under surface of curled apple leaves. It is smoke-grey in colour, with yellow or white dots, and is very slow-moving. It does good by feeding upon the lice, and should at all times be encouraged. The rounded convex form, short legs and antennæ, black and red, or black and yellow elytra, and the number of the spots, are features of interest. Two of the most familiar species are known as the Two-Spot and Seven-Spot respectively, but there is another called the Eyed Ladybird, having eight black spots, which perform useful service in clearing off green fly from hop plants. The creamy-white eggs of Ladybirds are deposited on plants during Spring, and the

black and creamy-white pupa is short and stumpy. The only defence this insect has is by ejecting an orange-coloured fluid of an acrid nature. It feigns death in a very clever way, but takes to wing when it considers the coast is clear.

The Raspberry Beetle (*Byturus tomentosus*) is a very destructive insect belonging to the family *Byturidæ*. The larva eats the tasty berries, but the adult devotes attention to the buds and blossoms. The brown under-coat is more or less concealed by yellowish-grey down. The yellowish larva has a brown head, and is about half an inch in length. Eggs are laid in raspberry blossoms, and doubtless the reader has encountered the larva when eating some of the luscious fruit. When full-fed, a cocoon is made in a crack of the cane, or elsewhere, and the beetle does not emerge until the succeeding April or May.

What are called the *Lamellicorns* include not only many large and striking insects, but a number of them are to be regarded as pests to crops and trees. We may here include the Cockchafer, three of its cousins, and the Dor Beetle, of the Family *Scarabæidæ*.

The Cockchafer (*Melolontha vulgaris*, Fig. 15), feeds upon the leaves of elm, oak, and other trees, but it is the fat larva which does most damage, as it devotes attention to roots of cultivated crops, and passes three years beneath the soil before completing its development The adult beetle has a black head and abdomen, with reddish-brown elytra, and fan-shaped antennæ, the

latter worthy of examination under a lens. The creamy-white eggs are deposited in batches in the ground, and the soft fleshy grubs are greyish-white, with hard brown heads, and long legs. When brought above ground, the grub is inactive, and curls its body inwards. It is

Fig 15. Cockchafer

the **Summer Chafer** (*Rhizotrogus solstitialis*), a smaller species than the foregoing, that occurs more or less regularly every season, as its life cycle only takes a year to complete. It is mostly on the wing in July.

The Garden Chafer (*Phyllopertha horticola*), is a day-flier, and often in large numbers. It is the smallest of the four, and is green and reddish-brown in colour. The larva does harm to grass land, and the adults pay attention to the foliage of beans, peas, roses, turnips, etc.

The pretty **Rose Chafer** (*Cetonia aurata*), is bright green, marked with white on the wing-cases. It flies during May and June on bright days, and unfortunately does damage to the flowers and foliage of raspberries,

roses, strawberries, and turnips. The larvæ live in the ground for two or three years, and are similar to those of *M. vulgaris*.

Many species of *Scarabæidæ*, like the one which follows, are dung-feeders, but the most famous is the so-called Sacred Scarab of the Egyptian desert about which Henri Fabre has written so arrestingly. This, and others of its kin, roll excrement into round balls with the hind legs until a suitable spot is reached where the curious meal can be partaken of at leisure.

The Dor Beetle (*Geotrupes stercorarius* Fig. 16), is

Fig 16. Dor Beetle

the all-black fellow with droning flight met with of a Summer evening when twilight shadows fall. It whizzes past on unerring wings, singing cheerfully as it pursues its airy course. On the underside of the body the adult is steel-blue, with a green or purple gloss. The eggs are laid in manure heaps, and in this warm retreat the larva passes the Winter. The latter is not a harmful creature, and acts as one of the sanitary agents of Nature.

The handsome **Stag Beetle** (*Lucanus cervus*, Fig. 17),

fitly represents the family *Lucanidæ*, the males of which have such a large head and jaws that they have been likened to the antlers of the monarch of the glen, and perpetuated in the common English name. Most species feed during the larval state on rotten wood. The shining chocolate-black armour of the Stag Beetle

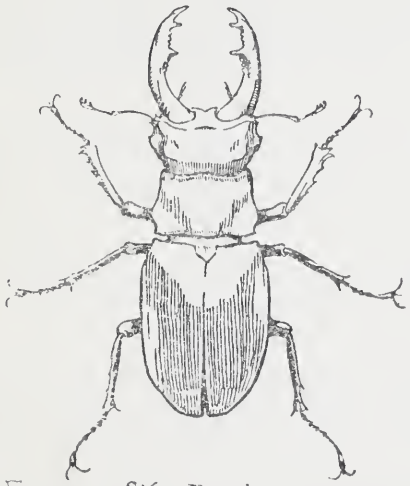


Fig 17 Stag Beetle.

sets off to advantage this large, fine creature, and whilst the antlered male is the larger of the sexes, the female has more powerful jaws than her husband. I have known the female to be picked up by the male and carried away triumphant, after the latter had fought for

possession with a rival. This insect presents an engaging sight when seen flying, and often ascends to a considerable height. The small antlers of the female enable her to pierce a hole in a tree-trunk, and in this she deposits her egg. The resultant grub feeds upon the wood but, when full-fed, crawls to the ground, and pupates in a cocoon. It appears to emerge in late Autumn, but is not ready to become a free-agent until the next Summer. The adult lives on the juices of plants, being provided with a brush-like organ admirably suited for this purpose.

The *Anobiidæ* includes a number of species which are very destructive to dry timber, woodwork, and furniture, this being the work of the larva as it tunnels and eats its way along. Valuable furniture may be utterly ruined in this way by the larva of the well-known **Death-Watch Beetle** (*Xestobium rufovillosum*), and four-post bedsteads, bookcases, and other articles specially suffer. One of my own walnut bookcases was reduced almost to matchwood by the incursions of these larvæ, and at the time of writing very large cavities have been made by them in the roof of the historic Westminster Hall, which has made it quite unsafe, and needing immediate attention. The curious ticking noise which has given rise to so many superstitions and beliefs, is caused by the beetle striking the jaws in regular motion against resounding wood. When wainscoting was more used than to-day, the " supernatural " sound often came from its vicinity, this being a favourite re-

treat for this interesting, but destructive, creature. The noise is said to be made as a signal to attract each other. It is a brown-coloured species, and one can hardly credit that so small a creature is capable of perpetrating such damage. Other species also attack furniture and similar articles, and still another is a mark on books, boots, and leather goods, if these have not been used for any length of time and the larvæ allowed to carry out their depredations undisturbed.

The Glow-Worm Beetle (*Lampyris noctiluca* Fig. 18),

Fig 18.
Glow Worm
Female.

comes next, and belongs, like the Fire-Flies, to the *Lampyridæ*. The males always have wings, but the females are very unlike their mates, being grub-like. Even the eggs are luminous, and, as is well known, the adults are expert "lamplighters." Sometimes a walk of a warm Summer's evening is reminiscent of fairyland, so prettily is the herbage lit up with the soft green lights of this species. Nearly all of them are useful, as the prey mostly consists of slugs and snails. Glow-Worms, it should be noted, are not the only

creatures in Britain which bear a phosphorescent light, as certain kinds of Centipedes also bear a trail of light, and one should not be mistaken for the other. The adult female Glow Worm is flat in form, with prominent segments, and a sombre grey dress. She is wingless, and the winged male is much more rarely discovered. Both are of nocturnal habits.

When Summer is at its height large numbers of small, red-coloured insects may be found on such wild plants as yellow parsnip (the ancestor of the garden parsnip), hogweed, and other flowers. This is the **Soldier Beetle** (*Telephorus fuscus*), and represents the Soldiers and Sailors (red and blue) of the insect-world. The family is known as the *Telephoridæ*. It is not only the colour that entitles them to represent the Army and Navy, as they are great fighters, and if some of each are kept in confinement they will fight and devour each other. They may easily be captured when found on flower-heads, but will sometimes take to flight. Presumably the nectar secreted by certain umbelliferous plants (such as yellow parsnip) attracts them. If so, it is interesting to observe that such a bloodthirsty creature has, at least, a sweet "tooth."

The *Elateridæ* includes the **Skipjack,** or **Click Beetle,** (*Agriotes lineatus*), the larvæ of which—called Wireworms—are so very injurious to crops. This species has acquired its popular name from its habit of throwing itself into the air with a jerk when placed on its back. As it does this, it makes a sudden clicking noise. There

are several species, but the one mentioned is a very able representative of its fellows. It is a small, long, narrow insect, and the yellow larva is nearly an inch long when full-grown. It has a hard cylindrical and polished body, with a few short hairs, a hard, dark-coloured head, and strong jaws. The three pairs of legs are placed on the first three segments, and on the last segment there is a lump, or swelling. As the larval state is assumed for at least three years, the amount of damage perpetrated is enormous. Nothing comes amiss to them, and only the efforts of some kinds of birds (such as Jackdaws, Rooks, and Starlings) save us from a plague of these plant-pests. The well-known form of the **Oil Beetle** (*Meloë proscarabæus*, Fig. 19), is more often seen in

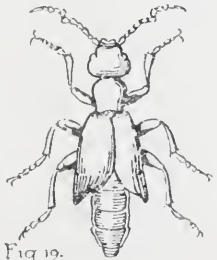


Fig 19.
Oil Beetle

early Spring, when the slow-moving creature crawls from its hiding place for the purpose of feeding, mating, and depositing eggs. On St. Bees Head, Cumberland, I once counted several hundreds of these beetles in

various sizes, all congregated on the slopes of that fine grassy headland. Many were in the act of mating, but why such a large number happened to meet in such a confined area I have never been able to understand. Was it a regular meeting-place of the clans? This is a parasite when in the larval state, as it feeds upon the eggs, young, or stored-up food of other insects. Before it reaches the pupal state it undergoes several changes of form, but the adult may always be known by its dull black body, and the female in particular by the length of her clearly ringed abdomen, and very short elytra. When handled, it exudes a caustic secretion for protective purposes, and this, when extracted, is used medicinally as cantharidine. The eggs of at least one species of Meloë Beetle are laid in the ground, and the larva crawls into the heart of a wayside flower and contrives to attach itself to a bee's body when the latter is pursuing its sweet pillage. As a result, it is carried to the bee's home where, becoming detached after its exhilarating joy-ride, it slips into one of the cells, and soon consumes the egg, or grub, of the rightful owner, and gobbles up the food placed there for the bee's own young! It then pupates, and eventually crawls forth as the creature known by sight to almost every country-dweller who has eyes to see. The Oil Beetle belongs to the Family *Meloidæ*.

The *Curculionidæ*, or Weevils, are a very large family of vegetarians, and from these we may select the **Apple Blossom Weevil** (*Anthonomus pomorum*), and **Nut Weevil**

(*Balaninus nucum*). The former kills the flower buds of apples and pears, the result of an egg deposited in each bud, and the consequent ravages of the larva, but there are others which produce excrescences upon turnips, or disembowel oak leaves, and a whole plantation of Austrian pines has been destroyed by *Pissodes notatus*. Others resort to beans, peas, plums, raspberries, and vines. The Apple Blossom Weevil has a snout, or rostrum, about half as long as its body. It is blackish, with a greyish down, and is of nocturnal habits. The larva feeds on the vital organs of the flower—the stamens and pistil—and the adult eats the leaves. The egg hatches in a few days after being laid, the larva appearing as a white maggot. It only feeds for a week or two, and then pupates. But the harm is already done by then. Fruit trees should be sprayed in February with Winter spray fluid, or caustic alkali, or with arsenate of lead just before the buds open.

The circular holes so often seen in hazel-nuts are caused by the larva of the Nut Weevil which feeds upon the tasty interior. The little round hole gives away the secret where the creature made good its escape after having had its fill by eating away its "home." We have still to consider another destructive family of beetles in the *Scolytidæ*, among which may be mentioned the **Elm Bark Beetle** (*Scolytus destructor*, Fig. 20). Although these are only small insects, they do a great deal of damage, as the larvæ feed on the layer of wood just underneath the bark. If a dead piece of bark is

ripped off, doubtless the observer will see the curious markings made by this beetle as a result of its ravages. The female *Scolytus* bores a hole under the bark of the living tree, and then inserts her eggs. In due course, the eggs hatch, and the larvæ commence their depreda-

Fig. 20.
Elm Bark Beetle.
3 times enlarged.

tions. Egg-laying takes place in June, pupation in July, and emergence in August, so that no time is lost. Some, however, hibernate and appear as perfect insects the succeeding May. This species has a black polished head and thorax, with dark brown elytra. The larva is a white, fleshy, legless grub.

The Pine Beetle (*Hylurgus piniperda*), belongs to the same family, and is a forest pest. It attacks young shoots of Scots pine trees. The adult is bronze-black, with a blunt head, short clubbed antennæ (characteristic of the *Scolytidæ*), and rough wing-cases.

Of the *Cerambycidæ*, which are wood-eaters and do much damage among forest trees, we may select the **Musk Beetle** (*Aromia moschata*, Fig. 21), which has very long and slender antennæ. It has acquired its popular name because of the pleasant odour it emits, and in some

districts is called the Squeaker as it produces a shrill sound by friction. It is green in colour, and is not of very active disposition. The larva is the wood-feeder.

Fig 21. Musk Beetle

One more British Longicorn should be mentioned before passing on, and that is the **Timberman Beetle** (*Astinomus ædilis*). It has extraordinarily long antennæ, and is resident in the north country where the larvæ burrow into pine trees, and thus commit a good deal of damage.

The Pea and Bean Beetles belong to the family *Bruchidæ*, and both are to be regarded as pests. The **Pea Beetle** (*Bruchus pisi*), is black, with greyish-brown down. The wing-cases are rather short, and the uncovered portion of the abdomen is whitish, with dark spots. To distinguish the Pea from the **Bean Beetle** (*B. rufimanus*), the latter has the front legs all-red, and

the abdomen tip does not bear any spots. The thighs of the Pea Beetle are black. The eggs of the one species are laid on young pea pods, and the other confines itself to the bean. A round hole shows the place of emergence after pupation. The fat, yellowish-white larva is wrinkled. At first it has three pairs of very small legs, but these eventually disappear.

The *Chrysomelidæ* mostly includes leaf-feeders, and some of these are regarded as very serious pests. They protect themselves by exuding an obnoxious juice, and a Foreign species is so poisonous that the natives of Ngamiland use it for poisoning their arrows.

The Mustard Beetle (*Phædon cochleariæ*), is a common British species which destroys the leaves of mustard, and the **Asparagus Beetle** (*Crioceris asparagi*), is injurious to the plant after which it is named. It has bluish-green wing-cases bordered with red, and three yellow spots on each, with a red thorax, and is about a quarter of an inch in length. It eats, both as a larva and adult, all parts of the asparagus plant, both above and below ground. The brownish, oval eggs are laid in large numbers during June on the plant attacked, and the larvæ are actually ready to pupate in about a fortnight. By then, of course, great damage has been done. The adult hibernates among soil, or dead leaves, during Winter.

The family *Tenebrionidæ* includes the **Mealworm Beetle** (*Tenebrio molitor*), which is a well-known pest in mills and granaries. It is a long, narrow rust-coloured

insect, bearing a small head, pointed at the back. It has three pairs of short legs on the thorax, and there are two small appendages on the last segment. Captive birds are very fond of the larvæ (called mealworms) of this species, and any boy smitten with a desire to add to his pocket money might do well to breed them, as there is a good demand, and the supply seems to be limited. I hand on the suggestion for what it may be worth.

The Cellar Beetle (*Blaps mucronata* Fig. 22), belongs

Fig 22.
Cellar Beetle.

to the *Blaptidæ*, and is so-called because of its fondness for damp, underground haunts. It is dull dead-black in colour, of sluggish habits, and gives off an unpleasant odour. Its wings are not developed, and the elytra are fastened together. A cousin of this species, known as the **Churchyard Beetle** (*Blaps mortisaga*) is not so common as the first-mentioned, and is less familiar in the Southern Counties.

The Tortoise-Beetle (*Cassia viridis*), belongs to the *Cassididæ*, and is an interesting insect because the elytra, or wing-cases, remind one of the carapace, or shield, of the four-legged creature after which it has been popularly named. The egg is deposited in a cell of remarkable honeycomb pattern, and is manufactured by the female from a sticky substance obtained from her own body. The larva has a pair of long tails which are carried over the back, and it is rayed all round with curious feathery appendages, and has dots on the sides. The pupa has feathery appendages on the head, and others protrude from the sides.

ORDER VI. NEUROPTERA, OR NERVE-WINGED INSECTS

So-called because their wings are covered with a network of nerves—thus Nerve-Winged—the insects belonging to this Order may be divided into six Sub-Orders thus :—1. *Corrodentia* (Book Lice), 2. *Plecoptera* (Stone Flies), 3. *Sialida* (Alder Flies), 4. *Planipennia* (Scorpion Flies and Lacewing), 5. *Ephemeroptera* (May-Flies), and 6. *Odonata* (Dragon Flies). Outside Britain there are the wonderful White-Ants, or Termites, which come under the Sub-Order *Isoptera*, but with these

1. Yellow-banded Humble Bee. 2. Lacewing Fly. 3. Hornet.
4. Giant-tailed Sawfly.

remarkable creatures and others we are not here concerned. We now have to consider the chief characteristics of each Sub-Order mentioned, and to select representative forms of each.

1. Sub-Order Corrodentia (Book Lice)

These are small, soft-bodied insects which have an incomplete metamorphosis. As a rule, the head is somewhat large, and bears conspicuous eyes. The long antennæ are made up of about a dozen joints. When wings are present, there are two pairs, those at the rear being smaller than the front pair. When at rest, the latter are held in a roof-like position. Some species are altogether wingless. A favourite haunt is a trunk, or branch, of a tree, others are fond of dead wood.

A common species that may serve as an example to represent this Sub-Order is known as *Atropos divinatoria*. I do not know its English name. It is often found in damp houses, and is a nuisance in Museums where there are specimens of plants and insects. Like the Death-Watch Beetle already dealt with, this insect makes a tapping, or ticking, noise, which is probably a love-signal as in the former case.

2. Sub-Order Plecoptera (Stone Flies)

The Stone Flies belong to the family *Perlidæ*, and they also have an incomplete metamorphosis. They are fair-sized insects, with long slender antennæ. It should be noted that the hind wings are larger than the front pair. The larvæ are water-dwellers, and they subsist upon both decayed vegetable substances and animal food. When the larva is full-grown it crawls to land, the skin splits along the back, and the perfect insect emerges. This latter frequents trees, and is very active.

3. Sub-Order Sialida (Alder Flies)

The Alder Fly (*Sialis lutaria*, Figs. 23 and 24), is included in this Sub-Order, and unlike the foregoing, it has complete metamorphoses. The adult has the head embedded in the prothorax, and it has long and slender antennæ. The two pairs of wings are of different shape. As a rule the eggs are laid on various plants near water, and as soon as the larva hatches, it makes for the liquid element, where it spends its time in the mud feeding upon small aquatic creatures. The body

of the larva tapers almost to a point. It is prominently segmented, and bears feathery appendages on each side, in addition to the legs. When ready to leave the water, the larva crawls to land and conceals itself in the ground.

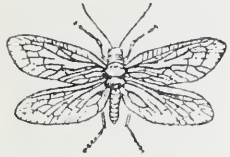


Fig 23. Alder Fly.

Fig. 24.

Alder Fly Larva.
(Enlarged.)

There it pupates, and eventually emerges as the perfect insect. It has a heavy flight, and in appearance is not unlike the well-known Caddis Fly. But it does not fold its wings longitudinally, and may thus be distinguished.

4. Sub-Order Planipennia (Scorpion Flies and Lace-wings)

This large Sub-Order contains a great many different families both at home and abroad, but we can only hope to give place here to a few of these.

The Scorpion Fly (*Panorpa communis*, Fig. 25), belongs

Fig 25 Scorpion Fly

to the family *Panorpidæ*, which scientific name has been accorded because of the curious end of the abdomen in the male. The eggs are laid under ground, and the larva feeds upon decaying vegetable matter, or rotten wood. When full-fed, it burrows deeper in the soil, and emerges after about a fortnight in the pupal state. It is then polished black, with yellow legs, and transparent wings having brown spots. Although an active species, and perhaps fearsome-looking, the Scorpion Fly is immune from harm to human folk.

The Snake Fly (*Raphidia cognata*), next claims attention, and is sometimes known as the Camel Fly. It belongs to the *Raphidiidæ*. Between the head and thorax there is a long " neck " which affords the insect much freedom of movement. The popular name is derived from the snake-like motion of the head and neck. The adult haunts water, but the larva makes its home under the bark of trees. The latter, as well as the former, is somewhat of a contortionist, as it throws its body into very curious attitudes.

The *Osmylidæ* are delicate and beautiful insects of wide distribution, one species of which (*Osmylus chrysops*) may be discovered in the New Forest, but we must pass on to a closely allied family, the *Chrysopidæ*, our choice of species being the **Lacewing Fly** (*Chrysopa perla*) (Fig. 26). The delicate green colour, and equally

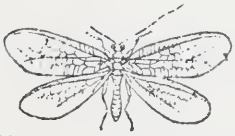


Fig. 26. Lacewing Fly.

delicate structure, of the gauzy wings of this really beautiful creature help to make it one of the loveliest objects in Nature. Small wonder the names of Lacewing and Golden-Eyes should be conferred, as the wonderful wings and bright golden, or coppery, eyes

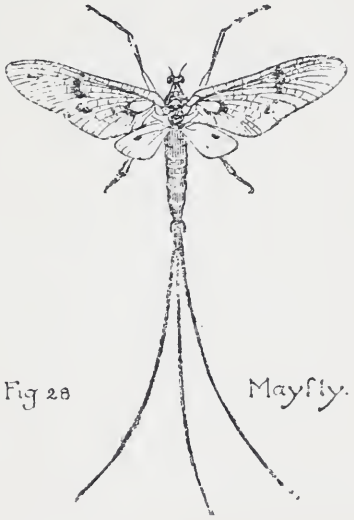
deserve all the praise that can be bestowed. The wings, when at rest, are held longitudinally, and the thin tapering body, and frail constitution, of the Lacewing will at once be patent to the lucky discoverer. It is a frequent visitor to our gardens, and to be suddenly confronted with a specimen at rest reveals "a thing of beauty and joy for ever." It is curious that such a lovely insect should give off an offensive smell when handled. The white eggs are laid in batches, and each one is attached to a leaf, or other object, by a long thread. The larva is a mark on green-fly, and should be highly encouraged. After having its fill, the larva spins a round cocoon in which it passes the pupal stage of its existence, finally emerging as the beautiful and useful creature we have discovered it to be.

5. Sub-Order Ephemeroptera (Mayflies)

Also of delicate structure, the **Mayfly** (*Ephemera vulgaris*, Figs. 27 and 28), has the hind wings much smaller than the front pair, very short antennæ, and two or three long streamers, or tails, at the extremity of the body. But it is the life-history, rather than the anatomy, of the insect that is so wonderful. Shortly stated, this is as follows. The eggs are dropped into

the water by the short-lived adult female, and those that are not devoured by creatures who lie in wait for such tasty provender, sink to the bottom of the pond, or stream. In due course the egg hatches into a larva

Fig. 27, Mayfly. (Nymph.)



which passes its days in a circular hole in the bank of the water. Thereafter the nymph emerges, and this has feathery antennæ, and a triple " tail," with a number of short bristles on either side of the abdomen. The

nymph crawls out of the water when full-grown, the skin enveloping it at once splits asunder, and the winged insect comes forth. This all happens very quickly, and when the rise of the Mayfly takes place, the observer is able to watch at close quarters this magic transformation. All is not complete even when the insect is clear of its watery home, as another skin has to be discarded before the perfect state is reached. For a few brief moments the winged form pursues its airy course downstream. Many fall by the way, to be devoured by trout and other fish, and those that do succeed in keeping on the wing soon live their little day and cease to be. But some, at least, are spared long enough to mate and deposit their eggs, so that the future of the race is assured. The fully-developed Mayfly has greenish-yellow wings, with dark spots. The body is pale yellow, with some dark lemon streaks on the lower part, and an almost black thorax. It is interesting to notice that, although it takes at least two years to acquire the adult state, the perfect insect only enjoys a brief flight in the sunshine, and then passes away. The larva feeds mostly upon vegetable matter, but some species are partly carnivorous. When the "rise" does occur, large numbers may be observed emerging if the right moment is struck. I have seen the air, ground, and water thickly populated with the insects and their old nymphal shrouds, and perhaps of all the amazing episodes associated with these forms of life, the rise and fall of the Mayfly is one of the most entrancing in the whole realm of Nature.

6. Sub-Order Odonata (Dragon Flies)

Dragon Flies, either because of the forepart of their English name, or their so-called fearsome appearance, are not at all well liked, in addition to which they are popularly supposed to "sting," indeed at least one British species is dubbed "Horse-Stinger" (Fig. 29).

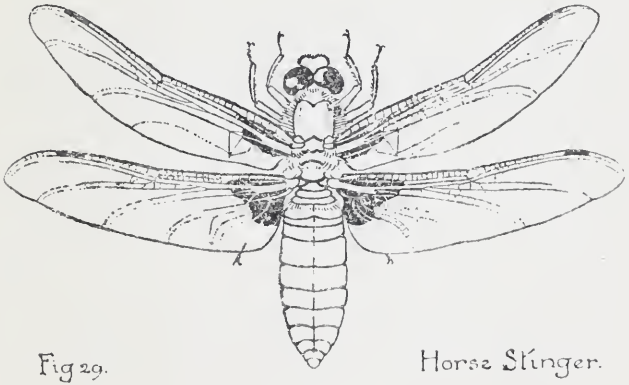


Fig 29. Horse Stinger.

To those who know them, however, and are acquainted with their wonderful life-histories, these remarkable creatures of water and air make a strong appeal. That Dragon Flies are of ancient lineage is proved by fossil remains that have been discovered, and both the larval

and adult forms have been found in a fossil state. Remains of an insect allied to the present creatures has also been recorded from carboniferous strata, which actually measured two feet in expanse of wings, so that since that far-off time insects have greatly decreased in size. The oval-shaped eggs are deposited in the water, and in due course the hungry and voracious larva makes its appearance. It is one of the terrors of the pond, or stream, in which it resides, and is dull grey, or brownish-green, in colour. It is the possessor of a curious two-jointed " mask," which can be tucked away, or extended, at will. On the outer joint a pair of strong jaws are situate, and these are capable of great execution upon the body of a victim. Woe betide any unwary creature upon whom the predatory larva decides to prey. Although it crawls sluggishly on the bed of the water, the larva has the power of forcing its way through the liquid element by means of a remarkable contrivance which runs through the centre of its body. The larva is very unlike the adult, and when the nymphal state is reached only the presence of rudimentary wings distinguishes it from the larva. When ready to emerge, the nymph leaves its watery home, climbs up the stem of an adjacent plant, rail, or post by the water-side, and waits for the greatest event of its mysterious life. The skin splits, and after a series of efforts and gymnastic performances, the perfect insect emerges. During these evolutions it turns, at least, one complete somersault, and only those who have been fortunate enough to

witness the transformation can have any idea of its romantic interest and fascination. At last the Dragon Fly frees itself from inside the cuticle, or old skin, but clings tightly to it for anchorage and support, whilst its body and wings lengthen almost before one's eyes. Gradually the body and wings attain their full extent, the outer covering and the wings harden on contact with the air, the latter are then spread cross-wise for

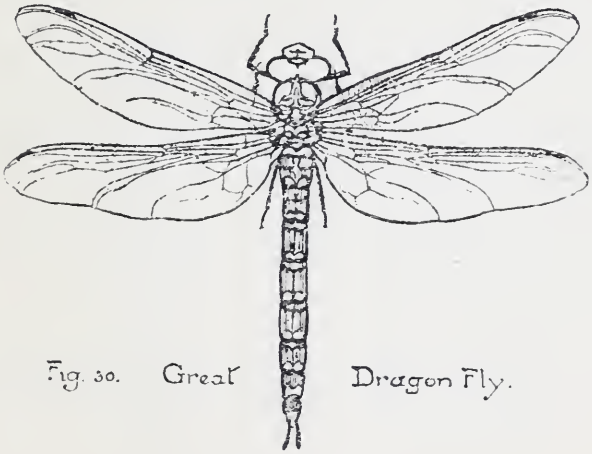


Fig. 30. Great Dragon Fly.

the first time, in readiness for flight, and away goes this insect-dragon of the air upon its initial voyage through space (Fig. 30). It is a dramatic moment to witness, and worth going a long way to see. Some species are slow fliers, others possess ease, speed, and facility. To

see them hovering, skimming, somersaulting, or planing down is quite a delightful occupation, as also to watch them in nuptial flight around the margins, or over the surface of a favourite pond. Both in the larval and adult states a carnivorous diet is partaken of, and mention should also be made of the large goggle eyes made up of a large number of separate lenses or facets, and of the beautiful colours some of the species display. Some have thick bodies, others very slim. In some species both pairs of wings are more or less similar, in others the wings are alike. In the former, the hind wings are *enlarged* near the base, in the latter both pairs are equally *narrowed* at the base. The delicacy of the wings is not the least remarkable feature, and certainly not the least attractive.

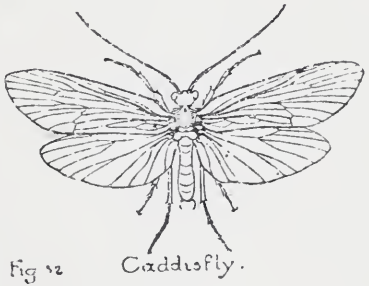
There are over forty British species, and of these the more familiar that may be mentioned are the following :—

Libellula depressa, *Anax imperator*, *Æschna xyanea*, *Calopteryx virgo*, *Pyrrhosoma nymphula*, *Enallagma cyathigerum*.

ORDER VII. TRICHOPTERA, OR CADDIS FLIES

These insects are divided into seven different families, but it will serve our purpose to set out a few salient features, and illustrate our remarks by a consideration

Fig. 31, Caddis Fly Larva.
(Twice natural size.)



of the life-story of the familiar **Caddis Fly** (*Phryganea grandis*, Figs. 31 and 32) known by sight to all those whose country expeditions in Summer take them to

pond or stream where this insect-denizen loves to dwell. There are more than 170 British species. The adult has long, slender antennæ and legs, the front wings are more or less covered with hair, and held roof-like when at rest. The hind wings are less leathery, and are held pleated when at rest. *Trichoptera* means "hairy-winged," from the Greek *trichos*=hair, and *pteron*=a wing. The eggs are laid in water, and the larva, soon after hatching, prepares for itself a case, or tube, in which its soft, grub-like body can be protected. Sometimes these cases are made of small pieces of sticks or leaves, at others they are composed of fine grains of sand glued together. Others bear upon them small water-snails in which their owners are also contained. The tube nicely fits the larva, and is just a little longer each end than the creature's own body. The tail end appears to be sealed up, but the front door remains open until such time as the larva is ready to pupate. The reason for this is that the latter is thus able to protrude its head and legs so as to crawl about and procure food. It fastens itself to stones, submerged posts, piles, and other objects. To dislodge one from its habitation requires some force, as it has two strong hooks which enable it to secure a firm grip inside. It pupates within the case, taking the precaution to close the front entrance before this takes place, and when the almost complete creature is ready to emerge, it swims to the surface by means of its two middle legs, which are fashioned like oars. This accomplished, the skin splits down the

back, and the imago is free. After emergence, the flies may be found clinging to herbage surrounding water, and Swallows and Martins have a rare old feast picking them off in double-quick time. It has a somewhat laboured flight, and this in spite of the strong wings. The larva is a vegetarian in diet.

ORDER VIII. LEPIDOPTERA, OR BUTTERFLIES AND MOTHS

This large order of scale-winged insects has already been dealt with in a separate volume of " The Abbey Nature Books," and is merely included here to show the place occupied in the classification adopted. The reader desirous of obtaining information concerning our British Butterflies and Moths is, therefore, referred to the fourth volume in this Series, where a large number of commoner species are dealt with and fully illustrated in both colour and black and white.

ORDER IX. DIPTERA, OR FLIES, MOSQUITOES, MIDGES, AND FLEAS

Comparatively few entomologists specialise in the insects contained in this important Order, and there are any number of new species to be found for the searching. Many are very small, and only the industrious collector is likely to discover them. One indefatigable worker in our own district—Mr. F. W. Edwards, B.A., F.E.S.—has not only added a large number of new species to our Hertfordshire fauna, but has also put on record several kinds new to Britain. Flies and Fleas, as we may popularly call them, are not alluring in their attractiveness, but are rather despised creatures into whose domestic affairs the average individual takes precious good care not to intrude. Howbeit, we must include them here, so as to carry out our scheme of treatment satisfactorily. They pass through a complete change from egg to imago, the adult has a slender attachment between the head and thorax, and the thorax and abdomen are fused together. The larva is, as a rule, legless, and bears a small head, but this does not hold good with regard to that of the Gnat, which has a large head and well-developed mouth, and other parts of quite a different character.

The Common Flea (*Pulex irritans*, Figs. 33 to 36),

is a fit representative of the *Pulicidæ*, and the illustrations set out below will convey a better idea of its metamorphoses than a detailed description. It breeds in neglected dirty houses, and its general appearance is only too well known. Professor J. Arthur Thomson

Fig. 33.

Fig. 34. Fig. 36. Fig. 35.

Fig. 33, Egg. Fig. 34, Larva. Fig. 35, Pupa. Fig. 36, Imago of Common Flea.

facetiously calls it "The Nimble Flea," and tells us that, of the 500 known species, nearly one-tenth of these (50) are found in Britain. In structure, activity, mode of existence, piercing and sucking apparatus, and the rest this energetic little insect is of extreme interest,

even if possessed of most obnoxious habits. It even excited the attention of one of the world's greatest men, Socrates, who stopped to enquire how far it could jump. As a matter of fact, we are told it can jump four inches *into the air* and about a foot *on the level.* As Prof. Thomson says : " It is quite far enough." *Pulex irritans* is found tenanting the wily old Badger, as well as humankind, the eggs being laid among the animal's fur, or in dusty cracks and crevices of houses. The active larva—a small legless grub which moves by the aid of bristles—lives on organic matter, and after twice casting its skin, the pupal state is reached. In due course the perfect Flea is ready to emerge from the cocoon-envelope, but it often waits until someone, or something, " pulls the trigger of activity," and thus releases it. Minus wings, the Flea must certainly be regarded as a bit of a masterpiece, and its " muscular explosiveness verges on the miraculous." Nevertheless, it is a great nuisance and a serious pest, for, between 1896 and 1911, upwards of seven million people died in India from Bubonic Plague, mainly through the bite of a Rat-Flea (*Xenopsylla cheopsis*) which transfers the virulent microbe from rat to rat, and from rat to man. Flea-control and Rat-control are essential, especially in our ports, harbours, congested cities, and other places. But we must not be tempted to pursue the subject further, and a mere list of names and usual hosts would occupy more space than we have at disposal.

The *Cecidomyiidæ* consist of a family of very small

and delicate insects known as Gall Midges. The larva of a number of them are gall-makers, producing swellings in the stems of plants, and another species—*Contarinia tritici*, or **Corn Midge**—does much harm to oats and barley. It has a cousin called the **Hessian Fly** (*Cecidomyia destructor*), which is also a grain destroyer, but being subject in England to various parasites, its numbers are kept within respectable limits.

Of the *Bibionidæ*—or Dung Flies—whose larvæ live on decaying vegetable matter, and also consume living roots—the **St. Mark's Fly** (*Bibio Marci*) occurs in large numbers in Spring. It is all-black, and has long hairy legs.

Gnats belong to the *Culicidæ*, and the Spanish word Mosquito is frequently used instead. Much attention has been devoted to these insects, because of their unwelcome habit of drawing blood from the human body, and as carriers of the fatal germ of malaria. Mosquito brigades have had to be organised to combat their energies, and stirring tales might be told of how man has eventually conquered. The making of the Panama Canal was only made possible after ways and means had been discovered for dealing with these small, but death-dealing parasites.

The Common Gnat (*Culex pipiens*, Fig. 37), passes its early life in still water, and the filthier the better. Hence, all standing water should, as far as possible, be done away with, and the breeding quarters reduced to a minimum. The larva floats on the surface with

the head held downwards and the tail extruded. It moves about by jerky motions, sweeps into its mouth microscopic food by means of a profusion of hairs, and maintains itself at the surface (the creature itself being heavier than water) by floating on the surface-film with which the pond, or other water, is covered. The pupa is quite unlike the larva, being almost a fully-formed adult, though shrouded in a transparent skin. It now

Fig 27. Gnat

extrudes its head instead of the tail, as the air-tubes have become exactly reversed. Very soon the pupal skin splits along the back, and the perfect insect makes good its escape. The adult male may be known by its bushy feelers, and it is only the female which possesses a piercing apparatus. She deposits her eggs in the water, and these, being sticky, adhere to one another. Two to three hundred of these will be laid at a "sitting," and when all are fastened together, a little raft is formed

which is then set free on its adventurous voyage. The wing of one of these insects is a very beautiful object for the microscope, but the creature is an inveterate enemy of mankind, and must be dealt with as such, no matter how much its wonder of form and life are regarded.

Our old friend the **Crane Fly,** or Daddy Longlegs, (*Tipula oleracea*) finds a place among the *Tipulidæ*. The tapering body, large gauzy wings, and long legs, as well as the blundering gait, are familiar enough to all country dwellers. It affects grassy districts in particular, the female laying her eggs among the roots of this, and other plants. The hard larva is called a Leather-jacket, and he it is who does the mischief. The female may be known from her mate by having a pointed extremity (the ovipositor) at the end of her body.

Hover-Flies (*Syrphidæ*) are both beneficial and destructive. Some of their larvæ feed upon aphids, or green-fly, and are stated to be leech-like in form. Two common species that may be mentioned are *Syrphus albostriatus* and *S. ribesii*. The habit of the adult in hovering, or hawking, in the air with rapidly vibrating wings accounts for the popular name. I have noticed that, day after day, in Summer, a certain Hover Fly may be seen in more or less the same place—its happy hunting ground apparently—and its quick movements and marvellous wing-vibrations never fail to excite my interest, admiration, and wonder. There are other

species whose larvæ live in filthy water, on excrement, and other insanitary places. There are others (*Volucella*) which prefer taking up their abode in the nests of humble-bees and wasps, and others again (*Merodon*) which feed upon narcissus bulbs, and perpetrate considerable damage. There are a number of dipterous flies belonging to the *Family Tachinidæ*, many of the larvæ of which are, like the very large family of Ichneumons, parasitic in caterpillars. There is, however, this difference that whereas the female Ichneumon Fly pierces the skin of the caterpillar, and at once deposits her eggs inside the host, the *Tachinidæ* have no ovipositor with which to make the puncture, and thus deposit their eggs on the outside. The larva, on hatching, however, soon eats through the skin, and works its way to the interior upon which it feeds.

Of the **House Fly** (*Musca domestica*), and **Blow Fly** (*Musca corvina*)—both of which belong to the *Family Muscidæ*—it is only necessary to say that, whereas they and their numerous congeners act as scavengers and sanitary-agents, there is another side to the picture as, feeding very often in distasteful places and then visiting our own food-stuffs, they are not altogether friends worthy of encouragement. They do some good, they also perpetrate much harm. Decaying matter soon attracts females to the spot, eggs are laid, grubs soon hatch, and thrive upon the filth that is provided. The general appearance of these familiar creatures does not call for mention.

Although the *Family Œstridæ*, or Bot Flies, is not extensive, it is too important to be overlooked as it includes at least three species which are parasitic upon the horse, ox, and sheep. These are the **Horse Bot Fly** (*Gastrophilus equi*), **Ox Warble Fly** (*Hypoderma bovis and lineatum*), and **Sheep Nostril Fly** (*Œstrus ovis*). The larva, which is a parasite upon the horse, finds its way into the stomach, those on the backs of oxen are found under the skin, and the one that attacks the placid sheep is discovered around the nostrils of the fleecy-clad animal.

The Horse Bot somewhat resembles a bee in appearance. It is brownish in colour and hairy, and has a stout body. The larvæ feed upon the membrane of the horse's stomach, and attach themselves by hooks. As many as a thousand larvæ have been found in a single horse.

The Ox Bot is black, with white hairs on the head, thorax, and tip of abdomen. It also is very hairy. Having no mouth, the adult insect takes no food. It is the larva which does the damage. The mature insect only flies in sunshine, and may then be seen attacking the legs of cattle, whereon the eggs are chiefly laid. The larva is licked into the mouth by the beast attacked, but eventually makes its way through the flesh of its host to the back.

The Sheep Nostril Fly is yellowish-brown, with black and silvery-white hairs on the abdomen. The female may produce either eggs or living larvæ, and these

are deposited in the nostrils of the sheep, and cause much suffering to the poor inoffensive animal. Great irritation is caused, and the symptom of attack is continuous sneezing. There are still more parasites upon mammals and birds in the group of dipterous insects known as the *Hippoboscidæ*. It is only possible to give the names of four species by way of illustration, and

Fig. 38, Biting Midge. (Greatly Enlarged.)

these are the **Forest Fly** (*Hippobosca equina*) found on horses; *Lipoptena cervi* on deer; **Sheep Ked** (*Melophagus ovinus*) on sheep, and *Stenopteryx hirundinis* which attaches itself to the gentle House Martin that warbles so pleasantly when on its nest under the eaves.

Midges, especially towards sundown and near water, are a great nuisance. Small they may be, but capable,

nevertheless, of great irritation as they attack the face or hands of the wayfarer. I have often been tormented with this obnoxious little irritant in Scotland where, of course, it is as difficult to get away from water as from a motor car along the nearest highway. One of the commonest species is *Culicoides pulicaris*, which is shown greatly enlarged in Fig. 38. It is only one of a number of True Midges belonging to the *Family Chironomidæ*, whose unwelcome attentions are known to almost everyone.

Of the *Tabanidæ*, or **Gad Flies,** we may select for brief reference the **Blinding Breeze Fly** (*Chrysops coecutiens*), **Rain Breeze Fly,** or **Clegg** (*Hæmatopota pluvialis*), and the **Autumnal Breeze Fly** (*Tabanus autumnalis*, Fig. 39). The first named is so-called because it attacks

Fig 39
Autumnal Breeze Fly

cattle and horses around the eyes. It has a broad band of brown across the centre of the wings, and a dull green abdomen which, instead of being rounded, or pointed, ends abruptly. The **Clegg** is a grey insect with mottled wings, which, when one is in the vicinity of water, will sometimes settle on one's clothing, or exposed part of

the body. It is a great blood-sucker, and should be studiously avoided. The third species mentioned above is a close relative of the **Gad Fly** (*Tabanus bovinus*), and both are the source of much annoyance to cattle and horses. *T. autumnalis* is co-called because it appears in Autumn. It is dark brown in colour, and has a more pointed abdomen than the other two Breeze Flies already referred to.

The Humble Bee Fly (*Bombylius major*, Fig. 40), is

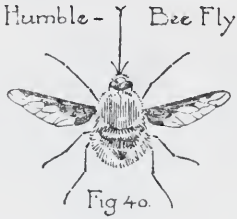


Fig 40.

worthy of brief mention. It is a bee-like insect belonging to the Family *Bombylidæ*, and seems to be fond of haunting shady woodsides and similar places, where it pursues an energetic life, darting hither and thither with its long tongue fully extended, as shown in our illustration of this species. The larva lives in the nests of humble bees, and the likeness of the adult to the host is probably of much assistance to it.

ORDER X. HYMENOPTERA, OR ANTS, BEES, WASPS, SAWFLIES, ICHNEUMONS, AND OTHERS

We now reach the last Order of British Insects, the *Hymenoptera*, and perhaps the most important of all. More than one half of those with which we are concerned belong to the Group *Aculeata*, commencing with the Ants, and ending with the Bees. All these insects are *Stingers*, and the remainder (from the Ruby Wasp to the Ichneumons) are *Non-Stingers*.

Of the communal instincts of some of these hymenopterous insects, and the solitary habits of others, as also the economic uses of several of them, we have something to record later, and may at once concentrate attention upon the *Heterogyna* which embraces the Social Ants, of which there are over two thousand known species. The **Red Meadow Ant** (*Myrmica rubra*) is the first representative which calls for notice. Its name tells of its colour, and it is one of the most familiar. Ants are social creatures, living in communities, but as an individual the Ant is probably not highly-organised in intelligence. Yet, all work together co-operatively for the benefit of the whole, the welfare of the community being the impelling motive. The labour is divided, each one has its allotted task, and the concern with which invasion, or distur-

bance, is regarded will be known to all those who watch these insects at work and play. With few exceptions, there are three kinds of individuals in each community, made up of male, female, and worker. The latter is an imperfect female. This last-named has not altogether lost the power of egg-production, but she cannot be fertilised, and only produces males. The male has wings, so also has the female during the nuptial flight, after which they are cast or bitten off, but the worker is wingless. The small white larva is legless, the eggs are of microscopic size, and the pupa is the so-called "ant-egg." It may, or may not, be enclosed in a cocoon, according to the species. The food of Ants mostly consists of insects, fruit, nectar from plants, and the honey-dew secreted by aphids. Where one finds the latter there, sure enough, Ants will be in attendance. The worker seeks assiduously for food, and has the power of regurgitating a part to feed the inmates of the Ant-hill. These inmates need not all be Ants, as slaves and guests are both given apartments in the busy City. Ants are of some service in fertilising flowers, but not nearly to the same extent as Bees, as they do not travel so far afield, and more often restrict attention to a small area. Cross-fertilisation is, therefore, infrequent. The present species constructs large hillocks of earth, and the freshly-worked soil is plainly visible near the summit in early Spring. In Winter the inhabitants work their way well below ground, but at the call of the sun they approach nearer the surface. When the community

becomes overpopulated, a swarm will leave the hillock, the females become mated, and a fresh colony is founded. The Green Woodpecker is a great enemy of this species, and its cousin of the wood, and by means of his long sticky tongue he soon levies toll upon them.

The **Black, or Garden, Ant** (*Lasius niger*), **House Ant** (*Myrmica molesta*), and **Yellow Ant** (*Lasius flavus*), are other common species, and mention must also be made of the **Wood Ant** (*Formica rufa*, Fig. 41) which

Fig 41
Wood Ant, male.

inhabits fir and other woods, and constructs a large hillock consisting of soil, pieces of twigs, and other material. When the community is at its height, and its citizens are all busily occupied, a wonderful sight is presented when one examines the countless numbers of which the hillock, or home, is made up.

The aforementioned are, it is almost unnecessary to point out, social creatures, but in the *Fossores* we make acquaintance with their solitary cousins. The **Solitary Ant** (*Mutilla europæa*), and **Digger, or Sand Wasp** (*Amonophila campestris*), are two of these, and there are only two kinds of individuals (male and female) in each

species. The male only has wings, and these are not folded. The Digger Wasp preys upon grasshoppers.

The *Diploptera*, or Wasps, includes several unpopular insects, of which the **Hornet** (*Vespa crabro*, Fig. 42)

Fig 42. Hornet.

may fitly be chosen as first representative. This fine insect is our largest British Wasp, and it should be remembered that, in addition to preying upon other insects, it does *not* damage fruit. Of course it is killed at sight, and whilst it is a formidable creature to encounter if exasperated, the fact remains that it occupies an important place in the scale of life, and need not be altogether condemned. The body is handsomely banded with black and yellow, and the large size at once distinguishes it. It places its large nest in hollow trees or buildings, and seems to be restricted to the Southern Counties. The nest is made of rotten wood, and is much yellower in colour than the more familiar grey ones of the smaller and commoner species.

What may be termed the **Larger Common Wasp** is

Vespa germanica. It is so well known by sight that familiarity breeds contempt, and whilst most books will probably say that its life-history is well known, we often doubt the veracity of this statement. The building of a nest by the Queen in early Spring, the founding of a colony, the industry of the workers, the use of the drone, and the amazing structure of the completed home, are all very wonderful. The tiers of cells one above the other containing the eggs, grubs, or pupæ, the little pedestals which are placed in position so as to separate one tier from another, the lightness in weight, yet strength and stability of the nest, are all of absorbing interest. Then, too, there is the collecting of food by the workers and the feeding of the hungry grubs, the aeration of the entrance hole by the drones, who seem told off for this special purpose, and the great industry and cleverness displayed in finding, tearing off, and carrying building material which consists of vegetable fibre. When the Queen Wasp first completes her nest unaided it is only about the size of an egg-cup, but she soon deposits some eggs, and when these have hatched, and the larvæ pupated and emerged, she at once receives assistance from her own children in the gathering of further material, and subsequent enlargement of the home. A piece of Wasp comb containing grubs and pupæ was brought to my room at Letchworth Museum one day, and I placed it on a window-ledge inside the room. Next day I found that one or two Wasps were emerging from the cells, and it was interest-

ing to watch their struggles to be free. They bit away the sealed-up portion at the top, and then crawled out as liberated prisoners. They soon showed signs of great restlessness, so that I was tempted to open the window and let them fly away. Out of the window they flew, but to my amazement they returned in double-quick time, and commenced to feed the fat white grubs who seemed to anticipate their coming! As others emerged, so the interesting development proceeded under my own eyes. I opened the window each day and the workers flew to and fro during the day, and returned each night. If, by chance, any had not returned at dusk, I found them outside the window next morning *waiting to be admitted*. Eventually all were reared, and the little colony left the fragment of comb emptied of all its contents as a memento of a thrilling episode of insect-life. Although watched at close quarters, the Wasps were far too occupied to attempt to sting anyone, and a great many visitors to my room witnessed the little episode described. The grubs are fed on insect-food, but the adults appear to possess a sweet " tooth," and do a good deal of harm in the season to ripe fruit. This species makes its nest underground, hidden away from vulgar gaze. Hence its domestic affairs are little understood, or appreciated. Only the entrance hole can be seen from outside, and if destruction is desired the best method is to use cyanide of potassium, either in solid state or solution.

The Wood Wasp (*Vespa sylvestris*) usually suspends

its nest from the branch of a bush or tree. We had one in Letchworth Museum which was built in a gooseberry bush at the time the fruit was on the branch, and this created a great deal of interest. But the most attractive example of an exposed Wasp's nest I have ever seen was suspended in a birch bush over water along the west bank of the pretty Crinan Canal, near Ardrishaig, Argyllshire, in September, 1922. I observed the beautiful tapered structure when sailing up the canal to Crinan on board S.S. *Linnet*, and several passengers whose attention I called to it remarked that it was like a small Chinese-lantern. When I walked back along the waterway later in the day, I had a closer inspection of my treasure. I found it was most cleverly suspended from a pliant branch right over the water, and that the occupants were busily going in and out through a hole at the base. I was much tempted to dislodge the nest, but hardly cared to venture without first dealing with the owners, and I had reluctantly to leave it behind.

The Tree Wasp (*Vespa norvegica*) always suspends its nest from the branches of trees and bushes, but the **Mud Wasp** (*Odynerus parietum*) which, as will be seen, belongs to a different genus, adopts entirely different methods. The cell walls are built of mud, and the nest, as a rule, is placed in any suitable hole. I know of three curious places, one in the centre of a reel of cotton, a second in a blind-tassel, and a third was placed in a roll of canvas, the group of cells being attached

together on the flat surface of the material. The mud had hardened like cement, and each cell was well calculated to stand considerable pressure.

The *Anthophila*, or Flower-Lovers (Bees), next claim attention, and the first of these is the **Leaf-Cutter Bee** (*Megachile centuncularis*, Fig. 43). There are a very

Fig 43. Leaf-cutter Bee.

large number of species, and all of them burrow in earth, or soft wood, and line same with the leaves, or petals, of flowers. The Leaf-Cutter Bee is a small black insect relieved with white down, and the circular pieces of leaves cut from rose and other trees will probably have been noticed. This is the work of this species. The pieces are neatly cut off by the aid of the Bee's long, four-toothed mandibles, and are collected as soon as a burrow has been excavated ready to receive them. Piece after piece is carried to the burrow or tunnel, and a series of thimble-like cells are eventually formed, each cell fitting into another until there is a row of them. In each cell an egg is laid, with a small cake of honey and pollen for the larva to feed upon when hatched. There may be eight or ten of these

thimble-cells all fitting into one another, and when seen for the first time the observer may well be puzzled as to the identity of the maker. This is a solitary species of Wild Bee.

Of Humble Bees there are many and various. They are a characteristic feature of the English country-side, and although often discovered in a semi-stupified condition (due to a super-abundance of nectar), there is something about this gay and fussy insect-reveller which is particularly attractive.

The Yellow-Banded Humble Bee (*Bombus terrestris*, see Coloured Plate II.), may be chosen to represent its useful race, as the *Genus Bombus* is of prime necessity in the fertilisation of flowers which require visits from long-tongued insects such as these. Clover depends entirely upon fertilisation by these indispensable agents, of which there are at least eighteen British species. The droning flight, fussy mannerisms, great industry, love of gardens (especially in Autumn when the Michaelmas daisies are in blossom), and variety of dress, are obvious features of interest. The present species usually makes its nest below ground, and the cone-shaped cells are massed together in a very different manner to those of the insects recently described. The male Humble Bee does not possess a sting.

Disused birds' nests are sometimes resorted to as a nesting site by some kinds of Humble Bees, and I have known of one (and also that of a Wasp) which was placed in a bird-nesting box. The last of the stinging insects

to find a place in this volume is one of the most familiar and beloved of all. This is the **Hive,** or **Honey Bee,** (*Apis mellifica*, Figs. 44, 45, and 46). Of the usefulness

Fig 44. Queen

Fig 45. Drone.

Fig 46 Worker.

The Honey Bee.

of this species in fertilising flowers, and producing honey, little need be added. Of its industry, and wonderful communal and homing instincts, much might be written. Highly intelligent, and of great industrial importance, the Hive Bee has for centuries made a direct appeal to those who, in other directions, exhibit precious little interest in the world of insect-life. It is probable that, as a result, more is known about these little busy-bodies than any other insect, and if, as a one-time neighbour of mine has well said (the late Professor L. C. Miall, F.R.S.), there are still problems to

be solved concerning *Apis mellifica*, it is because its life-history and economy are of unparalleled complexity. The colony consists of Queen (Female), Drone (Male), and Worker (Imperfect Female), as shown in Figs. 44, 45, and 46. The Queen deposits her eggs in the honey-comb, the egg being long and oval in shape. The grub, as in the Wasp, is fed by the Worker-Bee with a tasty sweetmeat-mixture of honey and pollen. Upon this, supplied in profusion, the grubs fatten and wax exceedingly, changing their skins as occasion demands, and becoming full-fed in about a week. The cell is then sealed up with a porous cap capable of admitting air, a cocoon is spun by the larva, or grub, and in due course pupation takes place and eventually emergence is signalled. The Queen may be known by her longer body, the Drone by its stout body and large compound eyes, and the Worker is the smallest of the three. The last-named has pollen-baskets upon its legs, and these will have been noticed laden with goods ready for delivery as the energetic little creature has been seen making its sweet pillage among the flowers. Only the Queen and Worker possess a sting. Flowers are visited for pollen and nectar, and, according to those in season, so are visits made to them. Much might be written from this point of view, such as the attractive properties of heather and lime flowers, of crocuses in early Spring, of apple and other fruit blossom. The wax from which the cells are so cleverly made is secreted by the Hive Bee in a " pocket," situate on the under side of the

abdomen, and the more the workers gorge themselves with food, the greater the supply of wax that ensues. The commencement of a comb is started by a single individual, but very soon other helpers are near at hand. Some cells are used as storehouses for pollen, others are utilised for storing honey. The former are left open, the latter are sealed up. Drone cells are larger than the Worker ones, Queen cells are large and clumsy. There is no waste of room or material. Economy is practised in all departments, except that of food-supply. The Queen, unlike many of her human prototypes, is retiring and shy. She is just a Queen in her own right. She dislikes pomp and ceremony, hates the light, and keeps, for preference, to her own select apartment. As a matter of fact, the Workers, as is fit and proper, control the Bee-Community, and the Queen herself is largely under their domain. Twice in her life the latter is roused to great activity. Mated she must be, and after she has been produced, she takes a flight in the air, and having met a husband, returns fertilised. Thereafter, she does not again forsake her faithful subjects until, or unless, she leaves the hive accompanied by a swarm of followers. If a second Queen makes her appearance there is a desperate conflict, and the weaker goes under. Sometimes the Workers consider it necessary to rear further Queens. If this happens, the old Queen asserts her rights, and much difficulty is experienced in restraining her. If the Workers produce eggs, as they are able to and sometimes do, they always

yield Drones, but the Queen's eggs, when allowed to be fertilised by her, produce Workers, or Queens, and unfertilised eggs produce Drones. If food is scarce, owing to a wet, or cold, season, or other causes, the Drones are put to death, but in any case the latter are either driven from home after Mid-Summer, or the Workers nip off their wings. There may be a population of as many as 40,000 to 50,000 inhabitants in a thriving hive at the height of its prosperity.

We now come to the Non-Stingers among these insect-folk, and in the Group *Chrysidæ* the **Ruby Wasp** (*Chrysis ignita*, Fig. 47) may here be mentioned. Al-

Fig 47 Ruby Wasp.

though this insect is a non-stinger it can, as a matter of fact, puncture the skin, but it does not inject poison in the wound as with its stinging relatives which are possessed of poison-fang as well as a stiletto. It is a beautiful little insect, and may at once be identified by the brilliant ruby-red abdomen which has a pronounced metallic sheen. The inexperienced might well be excused if possessed of the belief that the **Giant-Tailed Saw-Fly** (*Sirex gigas*, Fig. 48) was capable of stinging, but this

is not so, in spite of the curious pointed object attached to the abdomen of the female. This is her borer, or augur, with which she makes a hole in a tree, and thereafter lays her egg. It is a tool and ovipositor combined,

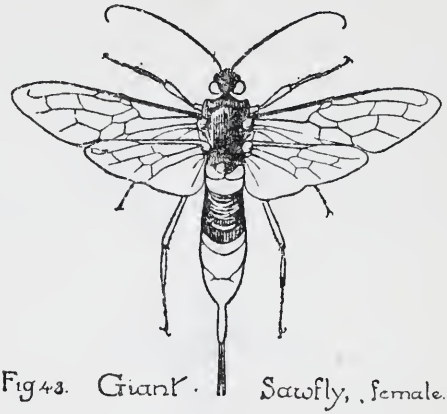


Fig 43. Giant Sawfly, female.

and this fine large insect is incapable of inflicting pain. It is sometimes called the Giant-Tailed Wasp, but it is a Sawfly, and only a distant relative of the more familiar insect. The larva eats its way into the wood of coniferous trees, and, as a rule, the latter are not in a healthy condition when attacked so that not much harm is perpetrated. The female measures about two inches in length, and has an expanse across the wings of two and a quarter inches. She and her mate are boldly banded with black and yellow. It is commoner in the fir and pine forests of the North than elsewhere,

but is not indigenous, having probably been introduced into Britain with timber from Norway.

There is, however, a common representative of this *Family Tenthredinidæ* in the South Country in the person of the **Gooseberry Saw-Fly** (*Pteronidea ribesii*, Fig. 49). The gregarious larvæ will strip a currant or

Fig 49
Gooseberry Sawfly.

gooseberry bush of all its leaves, and have a habit of hiding their bodies on the edges of, or underneath, the leaves. The adult occurs in April or May, and the female deposits her greenish eggs on the leaves. The larva feeds for about a month, and if not discovered in time, much harm will have been perpetrated. After having had its fill, the larva reaches the ground, spins a cocoon, and pupates. The perfect insect, or imago, emerges in about twenty-one days, and there are three generations in a season. It is interesting to notice that parthenogenesis occurs in this species, that is, unfertilised females can produce fertile eggs. The full-fed larva is light green, with orange colour on the first and last segments, and a very large pale coloured head, but at first it is profusely spotted all over with black. It has three pairs of true legs, and seven pairs

of claspers, twenty in all, and thus differs from a lepidopterous insect by having two extra pairs. The adult female has a brownish body, with a dark head, yellowish legs, and black feet. The male is black on the thorax and abdomen.

We are nearing the end of our story as we reach the *Cynipidæ*, or Gall-Wasps, and, as a familiar example, we may select the species which produces the well-known oak-apple. We can popularly term it the **Oak Apple Gall-Wasp,** and the insect responsible for the production of this curious formation upon the oak is *Biorrhiza pallida*. The full story is a fascinating one, and can only be briefly related. It is a story of alternation of generation, that is, a term applied to the breeding of certain insects (such as Gall-Flies and Aphides, for example) when sexual and asexual generations are produced alternately, these generations usually being quite different in appearance and habits. In the case of the Oak Apple Gall-Wasp, one generation appears above ground (resulting in the production of the oak apple), the other occurs upon the roots hidden beneath the soil. The wingless female insect which emerges from the hard round galls upon the roots makes her way above ground early in the year, climbs the bole of the tree, finds the Winter buds, punctures them, and deposits an egg in each incision made. She then dies. In due course the eggs hatch. The producer of these eggs had never been fertilised for, in her generation, there is no male issue, but from the eggs deposited by her, a

virgin-female, male and female insects are brought forth. The male of this generation has wings, the female is wingless. Mating takes place, and when this is over, the wingless female crawls *down* the bole of the tree *up* which her mother ascended before her, and makes her way below ground to the roots. Having safely found her way there, she proceeds to puncture the roots, lays an egg in each hole she makes, and then dies. These eggs eventually hatch into wingless females as already described, and there is no male issue in what we may call the root-gall-generation. The larvæ in both forms of gall are well shielded inside their snug retreat, and do not emerge until such time as the hour has arrived when it is best, or most essential, for them so to do. The adult in both generations is a small insect very rarely seen, but in spite of its stature, the results produced on oak trees are often prominently displayed during early Summer when the spongy excrescences are to be seen. With the exception of the author's old friend, the late Edward Connold of never-to-be-forgotten memory, and Mr. E. W. Swanton, few British Entomologists have specialised in galls and their producers. There is ample scope and a wide field here for the young worker, as the many other galls upon the oak, the curious fibrous growth upon the wild rose, and a great many others are at present imperfectly described, and deserve far more attention than they have received. The prominent bird-like " nests " upon birches, commonly called witche's-brooms, may have

been noticed by the reader, and wonder expressed as to the cause of them. In a way these are galls, caused by a fungus (*Exoascus turgidus*), but this does not come within our province to deal with here, and is only mentioned as a matter of interest in passing. Of the *Ichneumonidæ*, their parasitism, and usefulness in keeping other forms of insect-life in check, much might be written, but as there are several thousand British species, the task is an impossible one on the present occasion. Perhaps one of the commonest **Ichneumons** is *Ophion luteus*. It does not possess an English name. Some Ichneumons are very small, almost microscopic, others are two inches across the wings. As a rule, they have long thin bodies, and very long legs and antennæ. The female Ichneumon Fly has a sharp-pointed ovipositor, and with this she punctures a hole in the larva of some other insect, and deposits an egg. The smaller Ichneumons lay several eggs in the body of the larva, the larger species only place one egg in the body. In a few days the Ichneumon larva hatches, and commences to feed upon the body of its host, leaving the vital parts until last. Meanwhile, the doomed host goes on feeding, until the inside tenant is ready to consume the remainder. This it does, and having become full-fed, and its host eaten up, it finds its way out of the larval skin (all that is now left of its host), and at once spins a yellow cocoon on the outside skin, and pupates. The perfect insect eventually emerges, ready to carry on the work of its ancestors, and it is perhaps of interest to note that, in

the great world of insect-life, final consideration should be given to such important creatures as these Ichneumons, without whose useful aid human life would be far less pleasant, and the balance of Nature much more difficult to keep in check.

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(To facilitate easy reference, the scientific names are all printed in *italics*, the remainder being in ordinary type.)

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