

BRITISH INSECTS AND BUTTERFLIES.

JANUARY AND FEBRUARY.

KEEN are the winds, dark are the drifted clouds, and storms and sleet "deform the day delightless;" yet now and then the sunbeams break forth, as if in mockery, and lure the Pipistrelle Bat from its winter retreat. An hour or two in mid-day suffices for its exercise, and soon the spreading clouds warn it to retire. But not for nothing is it that it has been temporarily called into activity. The same transient gleam that roused its slumbering energies has revived hosts of gnats and suchlike insects, hibernating creatures, which issue forth from many a little nook and cranny to dance for a brief space in tepid air, and again retire. Not unmolested, however, are they in their mazy revels. The bat snaps them up and thins the phalanx.

When we speak of the torpidity of insects we do not forget that numbers of these creatures, when they have attained their perfect state, perish under the chilling blasts of the declining year; nay, the existence of many (as the *Ephemera*) terminates in the course of a few sunny hours; they deposit their eggs, and their work is done. Nevertheless, numerous species, in one condition or another, positively hibernate (of course it is to British insects that we expressly allude); and if, by a few general observations we can excite some degree of interest, our object will be gained.

Insects pass the winter in various stages of existence. First in the egg-stage. Here we think the term hibernation to be scarcely admissible; the eggs are merely in a state of quiescence, as those of a fowl before the vital principle is excited by warmth into activity. Nevertheless they endure the temperature without losing vitality, as those of the fowl would assuredly do, but this simple power of endurance cannot be called hibernation, by which term we understand the life-preserving torpor of a living and active animal. They remind us of the buds upon the tree, which develop in due season under the influence of light, air, and warmth. Nor, we may add, does it appear that the number of insects which in this primary egg-stage pass through the ordeal of winter is, proportionally, very considerable; at the same time it must be confessed that more extended and accurate researches might add greatly to the catalogue.

Several insects bury their winter-enduring eggs in the earth at a considerable depth, by means of a long and strong ovipositor; we may instance the grasshoppers—as the great spotted grasshopper of Europe (*Tettigonia vel arida verrucivora*), the green grasshopper (*Tettigonia vel arida viridissima*); as do also the crane-flies, or hairy long-legs (*Tipula*), so common in our meadows.

The aphid tribe next demands a brief notice. The aphid, of which we have many species—pests of the garden—produces living young during the spring and summer, but as summer declines it deposits eggs innumerable, which sustain without injury the severest cold of winter, but early in the spring these eggs disclose their living hosts, which swarm upon the tender shoots of the rose, and upon the sappy bark of the apple-tree, before even the buds are developed. So sudden oftentimes in early spring is the appearance of these noxious insects as to induce a general belief that they or their eggs are floated in the easterly wind, and thrown upon the plants, and shrubs, and trees of the garden and orchard. They may well be called the blight, and upon this term we need not comment.

That the eggs of many coleopterous insects, and certain aquatic species, survive the winter and become hatched in spring is almost beyond a doubt; but more delicate and frail insects than these deposit eggs which the cold season does not destroy. Most persons, perhaps, have noticed a ring round the twig of the hawthorn, the apple, and other trees, closely fitting, and composed of hundreds of small hard-shelled eggs, regularly disposed in circular rows, and glued together in compact order, so as to present a very pleasing appearance. These are the eggs of the sackey-moth (*Clisiocampa neustria*). In spring the tiny caterpillars come forth, and feed upon the leaves of the tree to the twig of which they were attached, instinct having directed the parent in her selection.

Another species of moth (*Hippogymna dispar*) glues an oval disc of eggs to the bark of a small stem or branch, but as these have only a slight shell the female covers them with a blanket, a non-conducting fabric, composed of hairs plucked from her own body, and impervious to wet. In like manner the rabbit makes a nest of its own fur for its young, and the eider duck of its down.

But we must pass to our second subject—insects in their larvæ, grub, or caterpillar state. Numerous are the insects which hibernate in this condition of existence,—some in water, as the fierce dragon-flies, the trout-attractive *Ephemera* (May flies) and the *Phryganea*. The latter, by means of a silky secretion, form for themselves a sort of sheath, to which is attached a coating, generally rough, sometimes merely granular, consisting of bits of wood, small pebbles, sand, and particles of the shells of water-snails. Protruding the fore part of their body from this singular case, they crawl about, looking like inanimate rough little nothings, self-endowed with the power of locomotion. Well does the angler know the value of the caddis worm (for such is the popular name of these larvæ) as a bait. The caddis-worm is more active on the sandy bed of the water than might be supposed. It is very voracious, and carnivorous in its appetite, devouring both dead and living prey.

Among the coleopterous insects which hibernate in the grub or larvæ state we may notice by way of example the dorbeetle (*Scarabæus stercorarius*, Linn). The grub passes the winter in a deep burrow. On its emergence from the egg this grub feeds on the store of cow-dung prepared for it by the parent. As the cold comes on (after several times changing its skin) it sinks into torpidity, and then assumes the pupa form, the perfect beetle appearing in May or June.

The chafer-beetle (*Melolontha vulgaris*) affords us another example. The female, at the latter end of summer, burrows in the earth to the depth of five or six inches. In this pit she deposits her eggs. From these eggs proceed those destructive larvæ which are the pest of the farmer, and offer to the rook, the farmer's true friend, a coveted morsel. In winter these grubs bury themselves still deeper, eating nothing; but woe to the rising wheat in spring. In this predatory state the grub continues till the fourth year, when it becomes a pupa; and in summer myriads of perfect insects make their appearance, the prey of the bat and the fern-owl, or *Caprimulgus*. Who does not know the wireworm—that is, if ever cultivated a garden. The wireworm is the larva of the elater, or springing-beetle, also called click-beetle, which leaps up when placed upon its back. The larva of one species (*Elater segetis*), which feeds on the roots of corn, and often, in conjunction with that of the chafer-beetle, lays waste whole fields, continues for four or five years before becoming transmuted into the perfect insect.

We may here notice the mealworm, the larva of a species of beetle (*Tenebrio molitor*), invaluable to those who keep soft-billed warblers in an aviary, but not advantageous to the miller. It exists in its larva condition for two years. Among the extensive tribe of moths (Lepidopterous insects), there is one, namely the goat-moth (*Cossus ligniperda*), the large, wood-boring caterpillar of which here demands attention. It is in the soft and semi-decayed wood of pollard willows, oaks, and poplars that this caterpillar makes its extensive mines, or irregular tunnels, gnawing its way, and feeding upon and digesting the ligneous particles, the rejectments of which thickly cover the floor. Voracious during the spring and summer, it becomes less so towards the close of the season, and, in anticipation of the approaching cold weather, begins to excavate for itself a snug cell, in which to sleep during the winter. But, more than this, attentive to its comforts, it lines the cell with a singular tissue composed of the comminuted particles of the wood, which has been operated upon by its powerful jaws, compacted together by means of a strong tenacious silk, which, like so many other caterpillars, it is capable of secreting in abundance. The fabric thus woven, or felted, is as thick as moderately stout broadcloth, and, being of course a nonconductor, is as efficient as a stout wrapper. In the cell thus prepared the caterpillar passes the winter, not stretched out at length, but in a doubled-up attitude, and so sleeps, taking no nutriment.

Thus, sleeping in winter, and mining and feeding in summer, the caterpillar of the goat-moth enjoys a three years' length of epicurean existence. But the spring time of its change comes; it prepares a cell, lined in the manner described, enters and becomes a pupa or chrysalis. Four or five weeks pass, and then the perfect goat-moth issues forth to enjoy a few bright months of existence, deposit its eggs, and pass away.

But we must not linger. The pupa or chrysalis stage demands attention. Thirdly, then, the pupa.—In this condition of existence so many insects pass the winter that their name is legion. Butterflies and moths (*Lepidoptera*), bees and certain wasps (*Hymenoptera*), numerous beetles (*Coleoptera*), as the chafer-beetles, the click-beetles (*Elater*), &c., to say nothing of aquatic species, pass the winter in a pupa state. Some suspend themselves against palings or under the coping of old walls; others lodge in the chinks and crannies of wood, bark, and masonry; some find a retreat under moss, or in manure-beds, or under stones. The larva of the *Hepialus humuli* (or ghost-moth) excavates, under a stone, a cavity well fitted to its size and lined with silk, in which it assumes the pupa state, and thus protected endures the cold of winter. The gold swift (*Hepiolus hectus*), the caterpillar of which is an underground feeder, assumes the pupa state under the roots of the heath. Other examples of a like mode of passing the winter underground in the pupa state might be added. For example, the caterpillars of many hawk-moths (*Sphinxæ*) descend to a considerable distance in the earth, where they excavate an oval cell, in which to assume the pupa state, the perfect insect emerging in summer. Many moths (we allude to the caterpillars) spin cocoons, often of very fine and close texture, in which the pupa remains quiescent until the final transformation is accomplished. The cocoon of the silkworm is a familiar example in point. Some weave their cocoons between withered and crumpled leaves; others roll up the leaves so as to form an envelope, as does the green silver-line moth (*Hylophila prasinana*), while others again seek a shelter in the fissures of bark, amidst matted herbage and brushwood. The female (almost wingless) of the mottled amber-moth deposits her multitudinous eggs on the twigs or branches of trees—the pear, the apple, &c. Here the caterpillars assume the pupa state, and the perfect insect emerges late in autumn. Hordes of the caterpillars of this moth often devastate whole orchards, the pear-trees especially, presenting mournful evidences of their destructiveness, for the eggs deposited in autumn are hatched in spring, and the trees then swarm with them.

We were to extend our observations upon the hibernating pupæ of beetles, moths, butterflies, &c., pages would not suffice, but we are not called upon to exhaust the subject.

Fourthly, The hibernation of perfect insects.—Here, again, an extensive field opens before us. Beetles innumerable hibernate, some under stones, some under the bark of aged trees, some under moss, and some in pits bored deeply into the earth. It is in a deep burrow that the dorbeetle ensconces itself, and, if we may trust to our personal observations, the beautiful golden-green rose-beetle, which, as we can testify, burrows like a tortoise. Water beetles, as the *Dytiscus* and *Hydropilus*, plunge into the oozy mud at the bottom of ponds, and drainage courses, and there await the return of summer; this is also the habit of the waterboatman, *Notonecta*, and the water-scorpion, *Nepa* (*Hemiptera*).

Of bees and wasps we forbear here to speak, as they will more appropriately come under our notice in subsequent papers.

We have already said that certain species of aphid, as *Aphis Rosa*, *Cardui*, &c., hibernate both in the egg and perfect state. We may add that they congregate or cluster together in millions; some, as the apple-aphid, under a delicate cotton-like exudation.

That ants form a compact phalanx in their dormitories is known to all; and it would appear that the hosts of gnats which dance for an hour in the sun, crowd together in their places of retirement. Such is the case with other dipterous insects. There are some beetles which are found collected in numbers together in their hybernacula, as a species of *Carabus*, and also the lady-bird (*Coccinella*). It may be, however, that the same place of refuge which proves attractive to one proves the same to others, and that thus they congregate without special design to do so.

Many of our butterflies, and certain of our moths, present us with an early and late brood. Of the late brood, as far at least as some species are concerned, individuals sheltered in some hospitable asylum survive the winter, and make their appearance unlooked for, but welcome harbingers of spring, even in February and March, should a gleam of warm sunshine awaken their dormant energies. Of these we may mention the brimstone butterfly (*Gonepteryx rhamni*), the painted lady (*Cynthia cardui*), and also the peacock's-eye (*Vanessa io*). Two of these butterflies, the brimstone and the painted lady, figure in our Plate. May it be the lot of those who wander down sheltered country lanes and by snug copses, towards the close of February, to be refreshed with a vision of these attractive courtiers of the sun, in some happy interval between the showers, when bright rays pierce the clouds, and a passing smile irradiates the sombre face of nature.

Our Plate represents the larva of the goat-moth exposed in its retreat by the woodman's axe; a few early lady-birds, the sulphur butterfly, the painted lady, a cloud of gnats; an ants'-nest broken open by the spade, and the chrysalis of the cabbage butterfly.

* This name is etymologically improper; it ought to be *Dytiscus*, as M. Geoffroy writes it.

BRITISH INSECTS AND BUTTERFLIES.

MARCH AND APRIL.

FEBRUARY passes into March, and March into April, but still winter has not yet fairly retreated. Yield it must at last, and will soon pass away. Already there are bees on the wing; early workers in their day and generation. How busy are they; wax, propolis, beebread, and honey are the objects of their search. Yet though the bees are on the wing, the garden snail still adheres to the wall or the palling; it refuses to unglue itself; it fears the east wind. So also do the little flat snails, which are multitudinous in our gardens; they ensconce themselves deeply under the roots of shrubby plants, and a thyme bed affords them a snug hybernaculum. The beautiful banded snail of our hedgerows still remains torpid, as also does another species confined to certain localities in our island (among which we especially notice the limepits near Dorking). This is the edible snail of the Continent—an introduced species. It is early in autumn that the edible snail begins to work out its burrow, gluing up, as it retreats into the recesses of its shell, not only the aperture, but the penetrations of its domicile; wall after wall being built up at intervals. Early it retires, late it reappears.

Let us walk forth: the fields and the drainage streams are around us. Listen! What is that hoarse murmur of strange sounds? Simply a convocation of frogs; frogs restored to animation after their winter sleep. Croak, croak, croak in various keys resounds from every pool and ditch. Return in a day or two, and gelatinous masses are floating about, soon to disappear, when in their stead myriads of tiny tadpoles, voracious little cannibals, will be found teeming in the muddy water. These gelatinous masses are replete with frog-eggs: thence issue the tadpoles, and these in due time become frogs. The toad does not yet appear; he waits in burrow or crevice, or under the roots of bushes, till the keen winds of March have retreated. Neither the snake nor the lizard have yet crept forth from their hybernacula, but the water-newt may be seen in ponds and drainage courses, having emerged from the soft mud in which, during the winter, it took its quiet siesta.

March does not rouse into activity our truly hibernating mammalia; we must except the little pipistrelle bat, which leaves its retreat for an hour or two when the warm sunrays throw a transient gleam over the landscape, and glance into the old church-tower, where it hangs suspended by the hind claws in a state of half sleep. The squirrel, too, is on the alert: it never fairly hibernates; but the dormouse, in its snug little nest, sleeps tranquilly, and the spring hedgehog has not broken asunder the mattress of leaves and dried herbage in which it has imbedded itself. But many insects are stirring. Beetles concealed under moss, grass-tuffs, and stone heaps, under dried cowdung and beneath the decayed bark of aged trees, are now active, although they do not always emerge from their places of concealment.

The sulphur butterfly (we suppose March to be progressing) is now common; the peacock's eye (*Vanessa io*), and the small tortoiseshell (*Vanessa urticae*) are by no means unfrequent. Of the latter, indeed, considerable numbers often issue from their retreats on the warm days of March; nay, even earlier in the more southern counties, and it has been noticed on the wing in the Isle of Wight on the 8th of January (*London's Magazine of Natural History*, v. p. 595). There appears to be, at least, two broods of this species annually, one in June, another in September, and we may presume that it is chiefly from among the latter that so many individuals pass the winter in concealed retreat. The caterpillar of this species feed on the nettle: for sometime after exclusion from the eggs, they live together in little family associations, but they disperse as soon as their increasing size renders a larger supply of food necessary. They are of a blackish colour, with four yellowish stripes, two along the back, and one on each side. The body is beset with strong branched spines.

March draws to a close, the apple-blossoms are unfolding, the snail has unglued itself, aphides swarm on the rose and the honeysuckle, and ants and ladybirds are feasting upon them. Flora begins to deck the garden.

Already has the great humblebee emerged from its retreat; it is exploring garden and meadow, and busy will it be through the ensuing spring, summer, and autumn, till the approach of winter. There is something so curious and yet so little known with respect to the history of the humblebee (*Bombus terrestris*) that we are bound to give a sketch of it. The humblebee is a storer of honey, but its hive, or rather cell, is an underground chamber, often in the side of a bank of about six or eight inches in diameter, to which a long winding passage leads, capable of admitting the ingress and egress of two bees at a time. The population seldom exceeds one, or at most two, hundred individuals, and consists of females, males, and workers.

Now it would appear that of the females there are two sorts; a very large, and a smaller race. The large females, far exceeding in size all the other inmates of the subterranean apiary, produce (as we are assured by Huber and other authorities) males, females, and workers, or neuters, while the small females produce only male eggs. The large females therefore may be regarded as the founders of every colony.

It is in autumn that the larvæ, both of the large and the small females, become duly transformed into perfect insects, the latter having the precedence. This is the pairing season, males as we have said being the product of the small females.

Let us follow up the history of one of the large females; on the approach of winter each, acting independently, retires to a little apartment lined with moss or bits of grass, distinct from the general vault, passing the cold season in a state of torpidity. In the spring they awake, each emerging and taking its own course, intent upon the business of founding a colony. Suppose, then, that one of these large queens has formed or enlarged a cavity—say in a bank, overgrown with briars and herbage—her next course is to construct cells: wax, pollen, and honey are the objects of her daily excursions. So rapidly is each cell built, that its construction requires little more than half an hour, and as rapidly is it stored with honey and pollen, one or two eggs being placed within the larvæ thence issuing having a store of prepared food. The brood emerging from these eggs consists almost exclusively of workers, assiduous helpers to the parent, who has yet more work to go through. Her next brood consists of large and small females, and males; these appear in August and September; but, if Huber be correct (Linn., *Trans.*, vi. 285), some male eggs are laid in the spring with those that have to produce workers.

We have now, then, large and small females, males, and workers, all the produce of this one female or queen, who began to found the establishment. The workers are by far the most numerous, and to them is intrusted the reparation of the cells, and the spreading of wax over the

roof. When in any of the cells one of the larvæ has spun its cocoon, and assumed the pupa state, it is their duty to remove the wax away from it, and after the pupa has attained to perfection, which takes place in about five days, to cut open the cocoon so that the perfect insect may emerge from its imprisonment. Their duty, moreover, is, supposing the store of honey and pollen to fail, to bring in supplies of similar food, and thus nourish the grubs, introducing it through a small hole into each cell, opened and stopped up again as occasion may demand.

As the grubs increase in size, they make breaches in their cells, which it is necessary from time to time to repair with wax, or even enlarge, as necessity may require. Hard labour for the workers. In some apiaries there are forty or fifty, sometimes even sixty, once the residence of pupæ, now active bees: these are turned into store-vessels for honey. But it must not be supposed that there is a strict similarity between the cellpits of the humblebee and that of the ordinary hive-bee. Instead of vertical combs of wax, with hexagonal cells, we see either a single cluster of cells or a few irregular horizontal combs, one above another, and supported by pillars of wax. Some are destined for the reception of eggs, some simply for honey, but of the latter most have been occupied, and are now left empty.

But what, during all this stir and bustle, is the great queen-mother doing? Let us suppose her surrounded by her worker progeny; these watch all her movements. She is about to deposit in the cells the eggs from which the second brood is to emerge as spring advances. Actuated by some unaccountable instinct, the workers endeavour to seize these eggs as soon as laid and destroy them. The female has now to exert herself to the utmost, in order to prevent them from being all devoured; and it is only after she has driven them back several times, and routed their forces that she succeeds in securing their safety. Nay, even when she has deposited her eggs, with a store of food, and closed them up in the cells with wax, she has still to keep vigilant watch over them for six or eight hours, the workers still persevering in their assaults. After this period, strange to say the disposition of the workers become changed, their propensity for devouring the eggs ceases, and the female, giving up her charge, commits them to their care. From these eggs proceed a few large females, to be at a future day the founders of new colonies, some males and some small females closely resembling the workers, but attended by the males which form their court.

And now, as Huber assures us, the whole establishment is a scene of confusion, for these recently-perfected small females begin to prepare cells for their eggs, a proceeding which rouses the anger of the queen-mother to the highest pitch. She assaults them with fury, endeavouring to drive them away; she puts her head into the cells and devours the eggs, but is herself in turn attacked and forced to retreat. There is then a contention about the possession of cells; a squabble like that of rooks in a rookery, but tranquillity soon returns. The produce of these small females consists only of males, which pair with the large females in autumn; it is then that the latter retire to their hybernaculum and take their winter siesta, but many perish from floods and other casualties. On the setting in of winter the workers, the males, and the small females all die off, and the continuance of the race depends upon the few large females, which, reposing in their dormitory, wear through the winter.

Réaumur assures us that the males are not an idle race; they work hard at repairs, and make good any damage that may befall their common habitation. They remove any rubbish that may by chance accumulate, and also the bodies of such individuals as may die; but they do not forage for provisions. These males are rather larger than the small females, and their antennæ are longer and more slender.

There is another humble bee called the carder (*Bombus muscorum*), which is now roaming over meadow and garden. This bee, agreeing much in general habits with the common humblebee, selects a shallow excavation or little pit in the ground of about five or six inches in diameter. Over this it rears a dome of moss, intertwined with fibres of dried grass, and the like, the materials being as it were felted together. This dome, four or five inches in height, is lined internally with a coating of wax, in order to render it rain-proof. The hive thus constructed is not the work only of the queen, but the conjoint work of many individuals; her progeny and their mode of procedure is curious. The bees arrange themselves with some regularity into a file, as men do supplying buckets of water to a fire-engine, and are separated by intervals from each other: those which are farthest from the chosen locality collect the moss and vegetable fibres, making up a small felted bundle, which is passed on to the next worker in succession; and so it is transferred from worker to worker, not without additions, until the nestbuilders receive it, and add it to the rising fabric, thus labouring until the edifice is reared. A covered way, excavated and moss-concealed, leads to this domed chamber; it is long, extending often to the distance of twelve or fourteen inches, but is so narrow as only to admit a single bee, whether in its ingress or egress. The colony, however, is not very numerous, as may be supposed from the contracted limits of the domicile. At the same time, as it would appear, the carder bee resembles the humblebee in its general economy and mode of procedure.

April is merging into May, and many butterflies which have not hibernated have just burst their pupa-cerements, and are now on the wing. The cabbage butterfly (*Pontia brassicae*) hovers over garden and orchard; it is on the wing throughout the whole of the summer, and its disgusting caterpillars penetrate into the heart of one of our most valuable vegetable esculents. There, too, flies the small white butterfly (*Pontia rapae*), with its yellow underwings varied by dark scales. Closely allied to the foregoing, it is yet a very distinct species, as the dissimilarity of the caterpillars proves; but they are alike devastators of our garden produce, and the same cabbage is often replete with the disgusting larvæ of both species. What a transformation from a ravenous leaf-eating, rank-scented grub to a neater sipping, aerial butterfly!

We may here allude to the pale-clouded butterfly (*Colias edusa*) figured in our Plate. This elegant species, the wings of which are of a delicate orange-yellow, broadly margined by black (with a black central dot on the anterior pair), is chiefly found along our south-eastern coast. In some years it abounds, while in others scarcely an example is to be met with. Its Continental range is very extensive. It is spread over temperate Europe generally. Mr. Burchell found it in South Africa, and Mr. Swainson states that he has seen specimens from the mountains of Nepal. Are we quite sure that the species are identical?

In April, showers and sunshine alternate, and even snow-clouds and sleet-storms have not passed away; but the joyous month of May is at hand, and returning spring treads with a firmer footstep over the enamelled greensward. Insects and flowers now crowd upon us; let us give them welcome.

BRITISH INSECTS AND BUTTERFLIES.

MAY AND JUNE.

MAY, tremulous at its incoming, is now in the fulness of its beauty, and Nature seems endued with new life: the year has renewed its youth.

The river rolls placidly at our feet with a gentle ripple; there floats the whorled *Planorbis*, the little *Physa*, and the *Limnæa*; while the limpet-like *Ancylus* adheres to masses of stone in some sequestered nook; and there expand, over a bed of broad wet-repelling leaves, the flowers of the white and the yellow water-lily.

See in that still corner what a host of merry whirlwigs (*Gyrinus natator*) weave their mazy dance on the tranquil surface! There are two water-bugs (*Gerris lacustris* and *Hydrometra stagnorum*) as active as the whirlwigs, and the shining little *Hydrophilus* goes round and round in the enjoyment of life. The water-boatman (*Notonecta*), floating with his back downwards, and stretching out his two long oars, timidly shows himself; and so does the great water-beetle (*Dytiscus*); but the water-scorpion (*Nepa*) lurks cautiously in the mud.

But what are these that cover masses of jutting stone, posts, and palings with their myriads? Clouds of them are floating in the air, and thousands fall into the water. Hark to the plunge of the trout as he leaps to seize them; mark the concentric rings he has made by his vigorous effort! These are the mayflies (ephemera), well known to the fisherman. These insects live only for a few hours, or at most for a day. They deposit their eggs, and perish; but as aquatic larvae they have enjoyed a year or two of existence, and were then voracious enough. Now, winged and mouthless, they eat nothing. One purpose only has to be accomplished, and their existence closes. Occasionally the number of these three-tailed mayflies exceeds conception. We have ourselves seen them literally fill the air.

Besides ephemera, numerous are the gauze-winged phryganeæ which hover over the water, and these also sometimes occur in numbers as astonishing as do the ephemera. The aquatic larvæ of the phryganeæ are known to the fisherman as caddis-worms; those of the ephemera being called bankbait. The caddis-worms make for themselves curious habitations, which snaillike they drag about with them as they crawl along the sandy bottom of streams or rivers. These habitations are tubular, so as to fit the body of the larvæ; and each species has its own selection in the choice of materials. Some glue particles of wood together, intermixed with gravel, and thus make a rough case; some use portions of the slender stems of rushes, and form a fluted cylinder; some agglutinate grains and sand together, and form a smooth and slightly domed; others avail themselves of fragments of river-shells, intermixed with small pebbles, making a fanciful grotto-like tenement, smoothly lined with silk. In clear shallow water these larvæ may be observed with the head and thorax protruded, crawling about in quest of food. We have seen numbers surround a crushed snail, purposely thrown in amongst them, and commence with eagerness to devour it. These caddis-worms are very careful as to the adjustment of the specific gravity of their case; it must not incumber them, but it must be submerged. Often, therefore, are alterations made, and with that precision which is the result of unerring instinct.

May is merging into June. It was on a fine warm day early in June that, while wandering along the banks of the Thames between Reading and Sunning, we were gratified by a spectacle not often witnessed. Hundreds of the great dragonfly were darting to and fro on quivering wings; while on the tall grass-stems along the water's edge and on the upper portion of semi-aquatic plants hundreds, nay, we might say thousands, of the pupæ of these fierce insects were resting—some just bursting the pupa case, some struggling to free themselves, others waiting till the crumpled wings expanded and the energy of life returned. The dragonfly, hovering over the water, commits her eggs to the fluid element, of which the larvæ are destined for so long a time to be inhabitants, fierce marauders then, as they will hereafter be in the air.

The larvæ of the dragonfly has six legs, and prowls about the stems of aquatic plants in search of prey. But it has another mode of progression in the water, which is not a little curious. Five leadlike appendages terminate the body; at the base of these is a cavity with muscular walls, and into this the larvæ during its aquatic progress perpetually takes a certain quantity of water, and instantaneously rejects it with considerable force, thus propelling itself along by a series of jerks. It is on the same principle (the force being continuous) that a rocket rises in the air, and attempts, we believe, have been made to apply this mode of propulsion to ships or boats by means of steam and machinery; but Art often fails to imitate the mechanism of Nature.

Bankbait, caddis-worms, the eggs and the minute fry of minnows, not excluding very young tadpoles, constitute the food of this voracious larvæ, and well is it provided with instruments for the seizure of its victims. The anterior part of the head is covered with a horny mask or visor in three pieces, which are capable of being opened (displaying edges armed with teeth) and of closing and securing the prey, which is thence conveyed to the true mouth. Thus furnished, the larvæ creeps upon its prey, as a cat upon a bird, and then seizes it by a sudden evolution. The pupa differs little from the larvæ, except in displaying the incased rudiments of the wings. About to undergo its final transformation, it ascends a plant or stem of grass, and there clings firmly by means of its legs. Soon the case, or indurated skin, splits down the back, and the imprisoned dragonfly slowly extricates itself, drawing its legs out of those of the pupa, as a man draws his feet out of topboots; thus it emerges, leaving its case, prehensile mask, and all, still adhering to the grass stalk. As yet the wings are soft and crumpled up, but in less than an hour they become expanded, the nervures harden, they are vibrated, as if by way of trying their strength, and then up soars the perfect insect, rejoicing in air and sunshine—an insect falcon.

Many other insects are aquatic during their incomplete stages—such, for example, are the *Culicidæ* or *Tipulidæ*, commonly called gnats. One species belonging to the latter group (*Tipula* or *Chironomus plumosus*) is often found in abundance in large rain-water tubs; we mean in its larvæ state. These larvæ are little red wriggling creatures, ever and anon ascending and descending—a restless multitude. We have said that some of the phryganeæ undergo their transformation on the surface of the water; so do the larvæ of these gnats, their exuviation forming a tiny boat, from which the perfect insect rises with unwet wings.

To the hive-bee we shall hereafter allude. We have already introduced the humble-bee; but there are many other species of bee indigenous in our island the habits of which are well deserving attention. There are many bees which are solitary in their habits, that is, they do not form communities, and among them are carpenters, which work their mines

into the soft or semi-decomposed wood of posts and palings. There are others which are called masons, because they bore into soft old brickwork, or rather into the lime between the bricks. Now, it so happens that our garden wall presents us with the pits or nests of a species of mason-bee in considerable numbers (*Megachile*). We have watched its labours, and, did space permit us, we might enter into some interesting details.

The walls of our garden present us also with another mason, not a bee, but a wasp. It is in the accidental crack or rugged cranny of the brick itself that this wasp (*Odymerus*) constructs a nidus for its progeny. Most probably it modifies this cranny, working at the substance of the brick itself by means of its powerful jaws. The receptacle being complete, it is lined with a thin coating of clay or mud, worked up into plaster; and over this, inclosing a shaft, is an outer wall of the same material, as nearly level as may be with the surface of the brick, and sharp must the eye be to detect the work of the cunning architect. Space forbids any extensive comments; nor can we do more than say that, both of bees and wasps, there are workers in wood (carpenters), the general habits of which, except that the material upon which they operate is more easily chiselled than brick, mortar, or a stiff bed of indurated or compact sandstone, are in the main not very dissimilar, allowance being made for species.

It is June. How within our limited space can we comment upon the crowd of insects which now teem around us? Glossy beetles, and other forms to which naturalists give the title of *Coleoptera*, *Lepidoptera*, *Neuroptera*, *Hemiptera*, *Diptera*, &c. force themselves upon our notice. Who can recount their numbers? Then there are moths with plumage so chaste, so delicately pencilled, as to put the powers of the artist to their utmost stretch.

Butterflies are everywhere around us, hovering over mead and garden on fanlike wings. They are the creatures of light and sunshine, feeding on the nectar of flowers. Yet were they once mere grovellers upon earth, the voracious destroyers of the vegetable produce of the garden, noxious crawlers, greedy devourers. They were then in their caterpillar state, and furnished with horny jaws well adapted for the mastication of coarse herbage, even the leaves of the nettle and thistle; but these jaws have now disappeared, a delicate tubular proboscis, wound round upon itself when not in use, is given in exchange, and through this is drawn up the nectar of opening flowers. What a change of diet—from cabbage and nettle leaves to luscious nectar! But how great has been the metamorphosis altogether! Look at the caterpillar—it is the product of an egg. At first it is small, but even then “a huge feeder;” it soon moults its skin, and increases in bulk, a new integument being formed. In a short time it again casts off its skin, a new cuticle supplying the shrivelled exuviation, and this with increase of size. The change is effected as follows:—Beneath the original skin or cuticle a new one begins to be formed, and the caterpillar also begins to swell, rending open the old integument along the dorsal line. A few struggles suffice to complete the extrication, and the caterpillar emerges, enlarged in size and brighter in colouring. At the moulting time the caterpillar is dull and sluggish, and refuses food; but as soon as the change is accomplished it recovers its appetite, accumulating internally a load of fat to serve as a supply to the pupa, for such it will soon become, which is constrained to fast. Thus do several moultings take place, until at length the caterpillar prepares for its change. Beneath the last skin the vital energies of the system have developed wings, as yet crumpled up, antennæ, a long slender proboscis, and limbs—in fact, all the organisation of a perfect butterfly or moth. But this last skin has to be cast off, and exchanged for a pupa-case, the mummy-like cement of the developing insect, and from which it will in due time, according to its species, burst forth. Some caterpillars undergo their final metamorphosis buried in the earth, often surrounded by a cocoon of silk; some in decayed timber; others surrounded by an exterior tissue of silken threads, enveloping an interior cocoon; others again, unprotected in the pupa state, hang suspended by the tail from walls and palings. The *modus operandi* by which a pendent caterpillar attaches itself by its tail to the wall is as follows:—Its position being assumed, the hinder limbs acting as graspers, and its last skin being ready for throwing off, it contorts the body, and repeatedly brings up the head to the tail, in order to spin a short but secure caudal fastening, composed of a number of silken filaments. This done, it hangs down fairly suspended. After a brief pause it again writhes itself, and jerks the whole frame, inasmuch that the dried and now easily detached skin is thrown completely off, and the contracted caterpillar in its clean pupa case—head, antennæ, wings, and limbs being plainly discernible—hangs moored to the chosen point of affixation. It has now only to wait the final change, which completes the progressive series of development. Such, then, is an outline of the progress of the butterfly from the egg to its perfect condition, from

the worm, a thing that crept
On the bare earth, then wrought a tomb and slept,

to the aerial Psyche.

Let it not be supposed that in other metabolous insects the change is not as great as in the example cited. Look at the difference between the frail Ephemera and the bankbait, the gauze-winged Phryganeæ and the caddis-worm, the *Culex* and its wriggling larvæ; nay, these are aquatic in their habits, and have to exchange that medium for the atmospheric air—which is not the case with the larvæ of moth or butterfly. Look, again, at beetles, flies, bees, &c. Here we might enlarge, but space forbids.

The butterflies which, as emblematic of this month, we have figured are:—1. The Admiral Red (*Vanessa Atalanta*), which appears on the wing from June to the end of September. Many of our butterflies, which result from successive hatches (and among them the present species), appear even as late as October, and of these many individuals survive the winter, hibernating in some sheltered spot, some nook or cranny, which protects their tender frame—caterpillar feeds on the nettle. 2. The small Tortoiseshell (*Vanessa urticae*), an elegant but common species, appearing from March to September. It abounds in the south of Europe, and may be seen in Italy on the alert during the winter. In our island it hibernates—caterpillar feeds on the nettle. 3. The Peacock Butterfly (*Vanessa io*), a most elegant species—*Omnium regina* of Ray. Is rare in Scotland, and, indeed, is far less abundant in our northern than our southern counties—caterpillar feeds on the nettle. 4. The Orange-tip Butterfly (*Pontia cardamines*). This delicately-painted butterfly, of which the female far exceeds the male in beauty, and has been called the Lady of the Woods, is common in some districts during the whole summer—caterpillar feeds on various cruciferous plants, especially *Cardamines*; also on the *Brassica campestris*, and some other species.

June is drawing to a close. The longest day of the year has passed; the longest night has yet to come. July opens upon us.

BRITISH INSECTS AND BUTTERFLIES.

JULY AND AUGUST.

THE fervid month of July opens upon us. Far too limited is our space to enable us to say much about the multitudinous larvæ, which now throng the garden, the orchard, and the woodland. Yet can we not altogether omit some notice of them. We pluck a leaf. How tortuous is the mining of a minute grub, which feeds upon the tender succulent substance between its two outer tables, leaving a transparent track as it proceeds on its devious course.

Here is a rolled-up leaf; it is the home of a caterpillar; no little toil has it occasioned the inmate, and many are the silken strings by which the leaf has been drawn into and secured in its position. It is a little bale, with a longitudinal tube for the occupation of the indweller, which comes forth to feed at stated periods. Far more delicate and curious are the tementments of other leaf-rollers. But we must hasten on.

Some are leaf-blower makers. Generally these caterpillars associate in colonies, and by their united exertions contrive to draw a number of adjacent leaves together, securing them by silken threads, so as to form a leafy tent, which they occupy for a season, migrating as pasturage fails to another locality. Curious are the habits of many species of the weevil tribe; we speak of the larvæ.

The grubs to which we particularly allude lead a solitary life; well-fed anchorites, they fare daintily and get fat. In former times some were regarded as luxuries of the table, and in the present day, both in the East and West Indies, the large larvæ of the palm weevil is reckoned an epicurean *morceau*.

In our country there is a weevil (*Balanus nucum*) which plays a sad part as far as filberts and hazelnuts are concerned. You may crack nut after nut, and meet with disappointment. But how can the egg be deposited within the hard nutshell? In this manner. While the nut is yet young, and its shell tender, the weevil, by means of its minute but sharp mandibles at the end of her long snout, perforates the shell; slight is the wound, but it suffices for the introduction of a single egg, which in due time gives birth to a grub. As the nut develops the grub grows, feeding upon the kernel, and filling the vacant space with its excreta.

Often do we find the grub of a weevil in the core of the apple: it has left a filled-up mine in its progress to the centre.

In some respects the weevils, as gall or excrescence makers, emulate the cynips tribe (the producers of the gallnuts of commerce). The cynips uses its long, flexible, keenly-pointed ovipositor; the weevil its diamond-edged jaws. In each case the puncture, whether in leaf, or bark, occasions a morbid action in the adjacent tissue, and the result is a nidus for the grub according to its species. The gallnuts of commerce, and those mossy-looking ruddy bodies (called *Belleguar*) which are conspicuous on the wild rose of the hedgerow, are due to certain species of cynips.

In like manner the weevil produces gallnuts, varying in size and other particulars, upon leaves and tender twigs; but, besides these, certain species give rise to nodes, excrescences, or tubercles, within which the maggots dwell. The roots of young cabbage plants, and those also of the hollyhock, are often deformed by the multitude of these excrescences which annoy the careful gardener.

Were a large collection of living caterpillars placed before the eye of a person not professedly an entomologist, he would gaze with astonishment upon their varied forms and their general peculiarities.

Many are tinted with the most exquisite dyes; some are grotesque, others repulsive. Not a few, as the large caterpillar of the tiger-moth (*Arctia caja*), are densely covered with long bristly hairs. These caterpillars when alarmed roll themselves up into a ball, and, hedgehog-like, will drop from a considerable height to the ground without injury. Some caterpillars deceive the eye by a combination of colouring and action. Such are the geometric caterpillars of a group of moths curious alike in their attitudes and mode of progression.

Among other singular caterpillars of the moth tribe we may notice that of the puss moth, remarkable for the odd positions which it assumes, and the changes it undergoes during its growth. We might here present to our reader a legion of similar examples; but our space is restricted.

The water presents us, in the instance of the caddis-worm (*Phryganea*) and others, the example of larvæ making unto themselves a domicile, which, snail-like, they carry about with them. Not unique are they in this practice; they are imitated by larvæ anything but aquatic in their habits. Who is not familiar with those household pests, the clothes-moths (*Tinea*)? Take one of these moths, say the *Tinea pellionella*. Abundance of eggs does the female lay, and thence issue the doers of the mischief; that is, the little grubs or larvæ. Fur, wool, woollen fabrics, hair, and feathers are the main objects of their ravages, especially if not exposed to the light. Carefully may a lady put away her muff, boa, or tippet, deeming all secure; as winter approaches the articles are unpacked; alas, in what a state! The moth has done its work. But about the larvæ. It encases itself in a felted tunic; in fact, it dresses itself, and carries on its ravages in great comfort. No shears cut closer than the jaws of this grub: it appropriates the finest underclothes, binding the filaments together with a silk secretion, till a feltlike case is made, within which it resides. As it grows it adds to the dimensions of this case, its diameter being increased by the ingrafting of a slip of such a breadth (narrow of course it must be) as to make the "fit" comfortable. Week after week does it go on, devouring the fine under fur, or the basal down of the feathers.

We might here enlarge our observations, but it is time that we turn to our Plate. We figure the Swallow-tail Butterfly (*Papilio machaon*), the great Tiger-moth (*Arctia caja*), the Death's-head Hawk-moth (*Acharontia atropos*), and a species of lace-wing fly (*Genus Hemerobius*, Linn.). From among the coleoptera we have selected the noble Stag-beetle (*Lucanus cervus*), and the fierce Tiger-beetle (*Cicindela campestris*.)

The swallowtail is rare in the more northern parts of England; indeed, it is common nowhere. It is, perhaps, more abundant in the fenny districts of Cambridgeshire than elsewhere. Essex, Middlesex, Sussex, Kent, and also Norfolk, from time to time afford us specimens; it has been taken in Yorkshire, but is not found, as it would appear, either in Scotland or Ireland. It is more common in the warmer portions of the Continent than in our island, and is said to be plentiful in Egypt and Syria. In our country it makes its appearance in June, but it continues to the close of August; such, at least, are the months in which it has been observed. The caterpillar is partial to umbelliferous plants, as the fennel and carrot, and sometimes in France, where the insect is common, produces considerable injury. It is known in France by the popular name of *Le Grand Carottier*. The death's-head hawk-moth is the largest and most remarkable of our British *Sphingide*: it often exceeds four inches in the

expanse of its wings, but we have seen many specimens from the Continent considerably larger. It is spread over Europe generally, and everywhere is regarded with superstition. It bears on the back of its thorax markings resembling those of a "death's-head," and, strange to relate, it emits when captured a shrill cry; no wonder, then, that it is regarded as a creature of evil omen. We read that sometime since, while an epidemic was raging in Brittany with great violence, these moths abounded in vast numbers, and that to their malign influence the mortality was popularly attributed.

The death's-head hawk-moth is mischievous enough, without being charged with "deeds of darkness." It is a most notorious despoiler of the hives of the honey-bee. It not only robs the combs of their nectar-stores, but scatters the terrified bees in every direction. The fact is very singular, and strange it is, that without sting or shield, and with no advantage except that of size and courage, this moth should be capable, singly and unassisted, of contending successfully with a whole horde of sting-armed insects and driving them from their fortress. By what magic spell is it protected—what is the malign influence it exerts over these industrious insects, noted for their promptitude of defence? We do not pretend to give an answer.

Among our most beautiful moths, the great tiger-moth stands conspicuous; it is by no means an uncommon species, and its great hairy caterpillar, a favourite food of the cuckoo, is a tenant of our gardens, feeding upon the lettuce and early esculent vegetables. The moth appears in July, and continues through August and the early part of September, or even later. It is strictly crepuscular or nocturnal in its habits, sluggishly reposing during the day. With respect to tone of colouring, it is subject to some variation, but the bold, abrupt markings of its wings contrast admirably with the white ground upon which they are painted.

A pretty little fly is the lace-wing. It is a four-winged fly belonging to the Linnean genus *Hemerobius*, with finely-reticulated wings. Elegant as these insects are their odour, that of the *H. Perla* for example, is most disgusting. The eggs are attached by long slender peduncles to the twigs of various plants or shrubs, as the lilac, &c. The species of *Hemerobius*, in all their stages after exclusion from the egg, feed upon small insects, especially the aphides; the larvæ have six feet, and issue from eggs deposited on the leaves in the midst of aphides, so that their food is ready for them. The lace-wing is an assiduous insect-hunter, and rivals the ladybird in the destruction of the aphid. The *H. Perla* is common in gardens.

Reverting to the moth tribe, we may here observe that, though they are generally regarded as nocturnal insects, such is not universally the case; some indeed are diurnal, preferring, however, dull and cloudy weather to a sky glowing with the fervid rays of the sun.

Again, all nocturnal moths are not strictly so. Some are crepuscular (doers of eventide); some are active chiefly during the still hours of midnight; while others come forth between the hours of midnight and early dawn. Hence the strict division of moths into diurnal and nocturnal seems to us to be rather artificial than consonant with nature.

Turn we now to the Coleoptera. The British species alone amount to thousands in number, and their exclusive study is a work of long-continued application.

There is no end to variety in the habits of the Coleoptera. To say that some groups are terrestrial, others aquatic, others arboreal, others earth-miners, wood-miners, or bark-miners, is to say but little. That some are diurnal, others nocturnal, we anticipate. Multitudes are carnivorous, vegetable and animal, upon which they feed. Multitudes are voracious, armed with jaws as efficient as those of the tiger, wolf, or hyæna. Many seize and devour living prey; others are soul feeders, relishing carrion. On the contrary, whole tribes are herbivorous, devouring grain, leaves, roots, flowers, and the honey of the nectary. Some are quicksighted, alert, and active; some are dull and sluggish; some are adorned with the most brilliant colours, and sparkle as gems; others are destitute of all brilliancy, while not a few gleam as if in armour of gold and bronze.

We represent a fine leaf-eating species, and one of tiger-like habits, viz., the stag-beetle, and the tiger-beetle.

The stag-beetle is remarkable for the staglike antlers (peculiar to the male, for in the female they are undeveloped) which ornament the head. These antlers are modifications of the anterior jaws, and can be used as very efficient pincers. Different opinions have been entertained respecting their use. It has been suggested that they are especial instruments for lacerating the leaves of trees, for the purpose of causing a flow of sap, upon which they feed; if so, why is not the female equally well armed? Let it be remembered that they are tenacious graspers and clingers, and as we believe subserv a purpose upon which, in a paper like the present, we cannot fully dilate.

The tiger-beetle (*Cicindela campestris*), as its name implies, is essentially carnivorous. It is a beautiful, active, but fierce insect, running and flying with great swiftness, and seizing its prey both on the ground and in the air. As carnivorous is the larvæ as the adult. It is generally found in dry, sandy places, often, as we have seen in Cheshire, by the side of rapid streams. It makes a perpendicular hole in the ground, and keeps its head at the entrance, so as to be ready to catch the insects that unwittingly slip into it. A relatively considerable space of ground is sometimes entirely perforated in this manner.

July has merged into August. So far through the summer have we proceeded, and not yet alluded to the glowworm, but we must not pass it by. This light-shedding insect is the wingless female of a beetle (*Lampyrus*), and is very common in many of our southern counties, continuing to give out its radiance from June to the middle or close of August. It is from the abdominal portion of the body that the phosphorescent light is emitted, and, though most brilliant in the female, it is not altogether wanting in the winged male, nor yet in the larvæ. We once in Bedfordshire, near Woburn, saw, during a warm night, the banks on each side of the road for a full mile literally bestarred with glowworms; nay, the road itself was crowded. Such a sight we had never seen before, and have never seen since. Moss-tufted banks, and the borders of woods and copses, are the favourite localities of this luminous insect.

Up is the broad harvest moon in the clear expanse of heaven. There is a murmur of insects in the air. Beetles hum past us, moths glance round oak and seycamore, and dart down the shady lane, and along the woodland glade. The long-eared bat wheels and sweeps about, and the pipistrelle in abrupt zigzag mazes gives chase to its smaller quarry. The creatures of night are all on the alert; those of the day have retreated to their lurking-places. The wearied reaper slowly wends his way homewards, ready with his sickle for the morning, when the wheatsheaves will stand in goodly array around him.

BRITISH INSECTS AND BUTTERFLIES.

SEPTEMBER AND OCTOBER.

THE fervid heat of July and August is now beginning to moderate; we say beginning, for the early part of September is often as intense as the preceding month; and as multitudinous are the insects upon the wing, and the devouring caterpillars in our garden, as they were some weeks ago. White butterflies are hovering about the fields and gardens around us, and the females are depositing their eggs by thousands upon such vegetables as are fitting food for the larva.

It is at this season that the great swarming of ants takes place. They issue forth in millions, and condense into a cloud, rising and falling, now dispersing, now uniting into columns, whirling and twisting, and ever changing their tactics. These winged ants are males and females, for the neuters (and there are neuters among ants as among bees) never assume wings—wings which, after all, are only temporary, enduring only for a few days, and then to be cast off. Sometimes, especially on the Continent, these ant-swarms are astounding, a whole district contributing to swell the phalanx, consisting of myriads upon myriads in dense array, like masses of vapour, twisting about in fantastic evolutions. It is the great pairing season. Of this horde most perish—all the males, and the majority of the females. The males, the object of their existence being accomplished, soon cease to exist; they have no sting, neither have they strong jaws for labour or the acquisition of food; but the groundling wingless neuters play a better part—they have yet a task to perform. Now, with regard to the females, which may be known by their size and the superior amplitude of their wings, many escape, and we believe that some males, which do not quit the nest, also avoid destruction. The fertile females, which survive the general fate, now settle upon stones, posts, paling, and similar objects, and it is the part of the workers, or neuters, to issue forth to their rescue, and reconduct them to the nest. Their wings now drop off, or become shrivelled and are plucked away by their own feet or mandibles. Nevertheless, certain numbers of females escape the neuters, and become the founders of new colonies, laying their eggs, and, as it would appear, attracting a few workers to participate in their toil, for they must as yet labour for themselves.

We have said that some males do not quit the nest, and the observation applies also to some females, who are, in fact, prisoners, and not allowed to depart from the original settlement. Prisoners as they are, they are kindly treated, and are each attended by one or more workers, whose duty it is to supply their wants. They exhibit (unlike the queen bees) no rivalry; crowds, however, follow in their train, and, when they lay their eggs, these are taken by the workers, and lodged in appropriate chambers. So minute are the eggs as to be scarcely perceptible to the naked eye. They occupy the express care of a body of workers. From time to time (as deposited) they are carefully collected, and duly moistened (a plan which seems necessary to their development), they are stored in separate apartments, and carried from one to another, as they may require a warmer or moister situation, or as the weather may render needful. In a few days the young grubs are disclosed, and require the most unremitting care. The devotion of the workers to the helpless larva is, indeed, extreme; they toil for them, they defend them, they die for them. During all this time the formicary has to be kept in order, its breaches repaired, its galleries cleared out, its arrangement, both internal and external, punctually and sedulously attended to. "Go to the ant, thou sluggard, consider her ways, and be wise."

It is in September that the swarming of wasps takes place. Whole vespiaries at this season turn out their irritable inhabitants, ever prompt to take offence and use their stings. The fondness of this insect for ripe fruits, such as plums and pears, is notorious. A sugar-cask is an especial attraction; but other diet is also acceptable; it enters the shop of the butcher, and uses its jaws upon the joints of beef as they hang on the hooks, or are displayed upon the board. It attacks and devours weaker insects, and will eat a juicy fly with great relish, seizing it on the wing with consummate address. We need scarcely say that wasps construct their vespiary in various situations—in the deep holes of banks, enlarged by labour, in recesses under the roof of old buildings, in the thatch of barns and outhouses, and elsewhere. Strange to say, it is from a single female, which has survived the rains and storms of winter, that the multitudinous tenants of a vespiary proceed. Of these multitudes, which we see around us, all will perish as the winter comes on—all, except certain females, now replete with eggs, on whom depends the continuance of the race. Let us enter into this matter a little more fully. A vespiary in summer contains, first, females of two sorts, a large sort producing the eggs both of workers and females, and a small sort producing only male eggs; secondly, workers or neuters; thirdly, males; fourthly, young, as eggs, larvae, and pupae. These accomplish their ultimate metamorphosis in July or August.

We have already said that on the setting in of winter all these tenants of the vespiary perish, except a certain number of females, and these are of the large sort. Survivors of the host, they betake themselves, each alone, to as secure a retreat as it can select, there remaining torpid till roused by the warm breath of spring. It is now that this lone female commences her labours—she first sets about enlarging and altering the hole or burrow in which she has hibernated, unless, indeed, the old domicile suffices for her purpose. A certain number of cells, often amounting to hundreds, are requisite; she makes the papier-mâché of which they are composed, and lays an egg in each. In a short time a brood of larvae, of the worker sort, make their appearance. These are assiduously fed, until they assume the pupa state; but in a few days they complete their change, and the queen finds herself surrounded by a crowd of obedient labourers. They begin by enlarging and perfecting the vespiary; they construct additional ranges of cells, in which the queen (as we may call her for distinction's sake) deposits her eggs of females, large and small, and also of other workers. These become in a short time larvae, and unwearied are the first set of workers in feeding and tending them—no light occupation. In due time these larvae become fully developed, as females and neuters or workers. The small females now give birth to males, these pair with the large females. Winter comes on, and the large females alone survive; but not all, for the casualties of winter thin their numbers: it is upon these survivors that the perpetuation of the race depends.

Kirby and Spence observe that the number of cells in a well-stocked vespiary sometimes amounts to more than sixteen thousand, and that the number of females amounts to several hundreds. They emerge from the pupa state in August, at the same time with the males, and fly in September, when they pair. Soon afterwards the general mortality commences.

The wasp's nest is made of paper, manufactured from the fibres of soft wood, and worked up with a salivary secretion by means of the powerful jaws. The external envelope of some wasp-nests from abroad which we have examined we have found to be composed of the whitest and finest cardboard, no writing-paper could take ink better; and thus, while the nations of antiquity were using tiles of clay, skins, parchment, or the inner bark (liber) of the papyrus and other plants, there existed from time immemorial an extensive firm of paper-manufacturers whose art was unknown in Egypt, Greece, or Rome.

Who is not acquainted with those elegantly-arranged spider-nets which during September and October are so abundant in lawns and gardens, stretching vertically, or nearly so, by means of rigging from bush to bush, or from branch to branch—they are the spinneret products of the diadem spider (*Epeira diadema*), chiefly perhaps of the female, who is now about to lay her multitude of eggs, which she envelops in a cocoon of silk, placing it in a chosen spot for security. These nests consist of lines radiating from a centre, crossed by others disposed as concentric circles—the whole fabric displaying the effects of consummate skill and quiet perseverance. In the centre, ever watchful, and so sensitive as to feel the slightest jar made by any unwary insect which may dash against it, sits the female. She is marked like a zebra, and is certainly beautiful. Around her, adhering to the glutinous threads, are the carcasses of gnats and flies, whose juices she has drained. Larger insects are not safe; we have seen her dart upon a moderate-sized beetle, rolling it round and round, and swathing it with a silken bandage till it has resembled an Egyptian mummy: her poisoned fangs finished the work; when done with it she did not let it remain, as she did the gnats and small flies, but cut it clear from the net, so as to allow it to fall to the ground; perhaps its weight strained the cordage, or it was an unsightly object. We much doubt whether she sucked its fluids, we think not; she seemed to attack it solely for the purpose of destroying and getting rid of it. On more than one occasion we have witnessed this operation, and we have purposely thrown small beetles against the net in order to gain an opportunity of watching her proceedings.

It is at this season that showers of filmy webs called gossamer fall from the atmosphere, covering stubble-fields, grass lands, bushes, and hedgerows. Marvellous did these showers appear to the naturalists of the last century, but more recent observations have solved the mystery. They are the webs of aerial spiders, and their fall is in consequence of meeting with a humid current, as in myriads they float aloft they become damp; those of many individuals coalesce. The sun sets, the night is chilly (it is in the night that the shower takes place), and, overlaid with humidity, they fall often covering a considerable area. Next morning the sun rises brightly, and the flocculent carpet spread over field and hedgerow be-gemmed up with minute dewdrops glitters in the rays.

Let us turn to our Plate. Besides wasps and the diadem spider, we have figured some butterflies appropriate to the season, and a water-beetle.

First, The Wall Butterfly or Great Argus (*Hipparchia megera*)

Secondly, The large Heath Butterfly (*Hipparchia lithonus*).

Thirdly, The Clifden Blue (*Polyommatus Adonis*), a lovely little species which we have taken, as we have the others at the latter end of August and in September, on heaths and furze-clad commons near Reading, Berkshire. The blue of its wings is pure azure. It may be observed that many species of butterfly which are abundant in autumn present us with two annual broods, one in May or June, another in August or September. We may instance the pearl-bordered fritillary (*Melitæa Euphrosyne*), a beautiful species, widely distributed over our island and the adjacent parts of the Continent. We are not aware, however, that any species of the genera *Melitæa*, *Polyommatus*, or *Hipparchia* hibernates during the winter. The action of these heath butterflies, as we may collectively call these tenants of sequestered lanes, and furze or heath lands, is very interesting. All are of comparatively small size, and they flit along before you as you proceed, taking short flights, continually settling on the herbage, and again rising. Their capture, however, by means of a net is easy, for they do not soar aloft and dart off to a distance, as is the habit of some butterflies; on the contrary, they seem as if they invited you to follow them, keeping at a tantalizing distance, secure in their address, and their zigzag evolutions. Their colours are beautiful: some are marked with belts and ocellated spots on a rich brown or orange ground; others are azure blue, with dotted or dark margins to their wings, and the under surface of these, as will be seen in the figures of *Adonis* and *Lithonus*, is as ornate as the upper. If not as showy as their race, they are as attractive from the delicate and stippled character of the pencilling of their wing-plumage, and the lightness of all their actions.

But October is advancing. The foliage of the garden and the grove shows but too plainly that the year is on the decline.

There is a stir and agitation in the insect world. Of thousands the natural termination of their existence has arrived. Caterpillars are rapidly assuming the pupa state; some rolled in leaves, some under bark, some in the ground, some in the water, some suspended against walls and posts. Where, in short, may not the entomologist look for them? Of butterflies, perhaps also of moths, and certainly of numerous dipterous insects, very many species hibernates. With respect to the two former, it is only we suspect, a favoured few, the remnants of a late autumnal brood, that find a safe hybernaculum. Early in spring they reappear, lay their eggs, and die. We do not assert that this is always the case, but believe it to obtain as a general rule at least.

Busy, too, is the beetle tribe. Of this, numbers of hibernating species are now beginning to retire, or have already retired, into their dormitory. They bore into the semi-decomposed wood of mouldering trees; nay, into sounder and harder wood. They burrow beneath the bark; they ensconce themselves under blocks of stone; under beds of moss; in the crevices of rocks or masonry. They sink deep pits in the earth. They plunge, frog-like, into the mud of pools, or streams. But enough.

We have figured a solitary water-beetle resting on the edge of a little pool. It is time for him to think of entering into his submerged hybernaculum. His voracity has left him for the present; for voracious is he during the summer, feeding upon tadpoles and the young fry of fishes, as well as upon aquatic worms, insects, and larvae. "This is positively his last appearance before the public for the present season." He is about to take a long siesta. His relations and companions, dancers and figurantes on the placid stage of the river's shady nook or the lake's tranquil margin, have already retired.

And now more decided are the golden and russet tints of the foliage. The trees wear a thinner robe. Hoarded are the gifts of Pomona and Ceres, and the brow of Flora is but sparsely garlanded. October gives place to November.

BRITISH INSECTS AND BUTTERFLIES.

NOVEMBER AND DECEMBER.

It is November. The serc and yellow leaves are falling in showers from the trees. A few hardy flowers still enliven the garden. The barberry-bush hangs out its pendent berries, waxlike and coral red. The holly and the yew look fresh, and green is the dense privet hedge, loaded with clusters of jet-like berries.

To the entomologist a fine old privet hedge is ever attractive. Numerous are the species of insects whose eggs or pupae are to be found sheltered by its compact foliage. It is there, too, that we may find the cocoons of the diadem garden spider (*Epeira diadema*), which, as we have previously stated, endure through the winter, the eggs becoming hatched in the ensuing May.

We have already noticed the elegant nets of the female of this spider in autumn; but as November advances they no longer invite our inspection. The skilful weaver has wrought her last work, her eggs are laid, the envelope of soft silk is spun around them; she has accomplished her task, and has only to die.

So generations in their turn decay,
So flourish these when those have pass'd away.

But where are the hive-bees,—those assiduous labourers which, during the months of spring, summer, and even a great portion of autumn have been toiling day after day, early and late, without intermission? We pass a row of hives, but we hear no murmur proceeding from them; we see no crowd about the entrance of their domicile; none are issuing forth, none are returning; all is silent. It would seem as if the angel of desolation had passed over a once populous and busy city, leaving its once crowded streets unthronged, untrudged.

Let us descend to a few not uninteresting particulars concerning those extraordinary insects, whose hexagonal cells and mathematical acquirements have employed the pens of the greatest philosophers.

A hive of bees in a state of tranquillity consists of eggs and larvae or pupae in different stages of advancement, and, besides these, of a dominant female, called the queen or workers (really undeveloped females); and, lastly, of weaponless males, or drones, the number of which is limited.

Dr. Bevan assures us that the average life of the drone is about four months, that of the worker being extended to about six months, or little more. On the other hand, the life of the queen bee is extended to four or even five years. (See *Mag. of Zoology and Botany* i., p. 57.) Kirby says that the queen will live for more than two years, and we suspect this to be its average duration of existence. If we call to mind that the gravid female is to be regarded as the source whence all population originates, and that in swarming the old female leads the way, and becomes the founder of several colonies in succession, the comparatively long duration of life of the female ceases to surprise. According to Reaumur, whose experiments on bees and their aparies are entitled to our fullest confidence, mere want of room is not the cause of the emigration of swarms from a given hive. No doubt the hive is cleared by such a procedure, but this is not the primary result aimed at. Other considerations apart, the migration of swarms is evidently Nature's plan for the extension of the colonies of this insect, and we cannot doubt that an instinctive feeling urges them to the accomplishment of a wise purpose.

Of a hive of bees, whose winged population amounts to twelve or twenty thousand individuals, with a dominant queen, the number of the drones amount to several hundreds, the bulk of the population consisting of workers. The tale of the drones is soon told. The eggs which produce these drones are laid in April or May. In a short time their utility ceases, and in July and August they are stung to death by the workers. A pitiless massacre is not a pleasant picture, and may serve, perhaps, to lower the character of the industrious worker in our estimation. We confess, indeed, that there is something mysterious in the whole affair. Surely their food is not grudged them; though, to speak the truth, the workers are of a saving turn, and the very structure of their elaborate cells indicates an impulse to economise space, and the means of hoarding to the fullest within that space. Can any quarrel have arisen? The drones (or males) are not litigious, and have no rapiers to draw, even had they among them Capulets or Montagues to head a faction. The motive, in fact, which actuates the conduct of the workers (or neuters) to this onslaught has been often discussed, but not thoroughly cleared up; for it appears that in hives deprived by accident of a queen they remain unmolested, and the observation also applies to those rare cases in which the queen lays only male eggs.

By way of note it may be stated that a queen who does not give promise of eggs until the twenty-eighth day of her existence is passed lays male eggs only. Under ordinary circumstances, the gravid female begins far earlier to lay eggs producing workers, and continues to lay such solely for the next several months, and afterwards she commences laying male eggs, often delaying till the spring. The female in full activity lays about 200 eggs a day, or about 12,000 (a swarm) in two months.

But what becomes of the workers? Their fate is at hand; they perish as winter sets in, leaving however a certain number of survivors (the individuals of a late brood) which take refuge in the hive, ready on the cheering warmth of spring to exert all their energies in behalf of the queen. Of 12,000 workers, the unmolested hive will contain in winter but a few hundreds. The following is Dr. Bevan's calculation:—

Number of bees forming the complement of a hive in	
February	3000
Spring-bred bees (workers)	17,000
Summer and autumn bred bees	6000
	26,000
Removed by death between February and December ..	23,000

Thus bringing the family down to the February number 3000

It would seem that bees, though confined to the hive, do not pass the winter season in a state of torpidity; there are indoor duties which devolve upon a portion at least of the workers, for the larvae, or bee grubs, with which so many cells are tenanted (each cell having its own occupants), require to be tended. It may be here observed that the workers or neuters, according to the observations of rigid investigators, are themselves divided into two classes—small nurse-bees and large wax-workers, whose duty it is during spring and summer to collect wax, honey, propolis, and bee-bread. One party modifies and assists in constructing the combs, tending and rearing the young; the other party labours in the fields and flower-gardens, bringing in stores of honey and wax, bee-bread and

propolis. Propolis is a vegetable varnish, prepared from the resinous gummy, or glutinous secretion of the leaves and buds of various trees or shrubs, such as the tacamahaca (*Populus balsamifera*), the birch, &c. It is largely employed, not only in varnishing the cells of the combs, but as a material for stopping up crevices, coating rugged or irregular portions of the hive, and also the sticks from which the combs are pendent. Sometimes it is spread over the whole or greater portion of the hive-dome, and it is necessary for tempering the wax, so as to make it work more pliantly in the mandibles of the comb-builders.

Bee-bread is the delicate pollen of flowers, and we often see it covering, like a fine powder, the body of the honey-gatherers, who have buried themselves in the deep nectary of the blossom. Carefully is this pollen brushed off the body, wings, and limbs, and kneaded up with nectar into little cakes, which are carried in curious wallets to the hive. These wallets occur on the expanded inner surface of the thighs (middle joint of the leg). A depression there is overarched by a series of elastic hairs, so arranged as to act the part of a wicker lid, and it is here that these delicate cakes are temporarily packed, to be disposed as circumstances may require. Part is eaten by the bees themselves, part is appropriated to the young brood, and the remainder is providently deposited in some empty cell, in order to serve as a future provision.

The importance of the transference of the fertilising pollen from flower to flower by means of the wandering bee is fully appreciated by the botanist.

Wax is a peculiar secretion, lodged in little receptacles beneath the overlapping scales of the abdomen, generally four on each side. We need not say that it is only in the neuters that wax-secreting pockets occur.

Honey is the nectar of flowers lapped out of the nectary by means of the tongue, and immediately transferred to the crop, or honey-bag. The alteration it here undergoes is at most but very trifling; hence the fine flavour and quality of the honey depends most materially upon the botanical character of the bee pasturage. Honey, when disgorged from the "bag o' the bee" into the cell, is so adhesive as not to run out, horizontal as this cell is; moreover, a sort of cream rises and forms a glutinous film, obliquely placed, acting as a sort of transient capsule; when, however, the cell is completely filled, it is covered with a waxen lid.

The honey of some cells is ordinarily used for food, and the cells are kept regularly supplied. Others are store-cells, and it is these that are secured, when filled, by the waxen lid. We may form some conception of the industry of the bee when we learn that it requires the contents of many honey-bags to fill a single cell.

Our hibernating insects are now hastening to their retreats. Some are later in repairing to their dormitory than others, and even then, when disturbed before the hard frost thickly sheets the water with ice, appear to be scarcely quite torpid. As our summer birds depart at various periods, so some insects retire earlier than others, and some appear earlier, even as early as March; such is the case with certain small coleoptera, with the remains of which we have found the stomachs of the earliest-arrived of our flocks of wheat-eaters completely filled.

Is it mere cold on the one hand that enforces to hibernation, and mere genial warmth that reanimates the dormant system? We think not: First, because we know that hibernating reptiles and insects revive and become active in spring at a lower temperature of the atmosphere than was the case when the dormitory was entered; and, again, as the experiments of Mangili prove, we find that while a certain degree of cold conduces to this lethargy, a greater reduction of temperature produces reviviscence as speedily as an increase of heat. Mangili placed a torpid marmot, which had been kept in a temperature of 45°, in a jar surrounded with ice and muriate of lime, so that the temperature sunk to 16°. In about half an hour a quickened respiration indicated returning animation. "In sixteen hours it was completely revived. It was trembling with cold, and made many efforts to escape." Other experiments of a similar nature have been tried, and we doubt not that the condition of the brain and nervous system in quadrupeds, and even in reptiles, exerts a potent influence over the phenomena of hibernation. Are insects, because their blood is a mere sanies, and because their nervous system is merely ganglionic, to be regarded as uninfluenced by the very same atmospheric states as are influential upon their lighter copartners of the surface of our globe? It is true, that of sensibility (we speak of the nerves) they have little; but of muscular irritability and contractility they are, so to speak, moving storehouses. Their gymnastic feats are astounding; arguslike are their powers of vision, and many are ever on the alert. Greatly, as we have said, are they under the dominance of temperature. They rejoice in a glowing sun; they endure the biting frosts of winter; they exhibit striking examples of hibernation, and also of a sort of intermediate state, a partial or semi-hibernation.

But November is passing. Let us look to our Plate. There are even moths which at this season are to be met with on the wing; they are late flyers, and some most probably hibernates.

We may enumerate, first, the humming-bird hawk-moth (*Macroglossa stellatarum*). Of this interesting species three broods appear every year—viz., April, June, and September, and specimens have been taken as late as Christmas, so that we have reason to believe that many individuals live through the winter. It frequents flower-gardens and shrubberies, flying during the day between the hours of ten and twelve in the morning, and those of two and four in the afternoon. It probes the deepest nectaries, poising itself like the humming-bird on rapidly vibrating wings, and darts from flower to flower with unimitable grace and address. Secondly, The mottled umber-moth (*Liberia desolatoria*). Of this species the female is wingless, and is ever stationary. Gardens, orchards, and woods are the localities which it frequents, but, like others of the genus *Liberia*, it only makes its appearance at the fall of the leaf. Thirdly, The sawfly (*Xanthia cerago*), common throughout Europe and the adjacent parts of the Continent. It is subject to great variety of colour, and the caterpillars are to be found on the birch and willow. The perfect insects appear in August or September, and continues on the wing till November. Each of these we have figured.

Fourthly, The December moth (*P. Populi*). The butterfly is the azure blue, female (*Polyommatus Argiolus*). It is sometimes to be seen late in the year, even as late as the first few days of November.

To these many more might be added, but space forbids.

November is passing away; it is December. The wind sweeps through the leafless trees, with a hollow moan, over wild moorland and through the rocking forest. There is no rippling music on the shingly sea-beach; a storm is brooding, the sky is lowering. Our discursive task is ended. We retreat before the wintry blast; we have no more to say about insects; life languishes. "C'est le baliser du rideau." The curtain has fallen.