

THE ANNALS  
AND  
MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 99. MARCH 1856.

---

XVI.—*On the House Ant of Madeira.* By Professor O. HEER, of Zurich. Translated from the original\* by R. T. LOWE, M.A.†

[With a Plate.]

I. *Apparition and Habits.*

AMONGST the richly varied insect-tribes the Ants stand foremost probably in point of numbers. We meet with them everywhere, in field and garden, meadows and forests, from spring to latest autumn. In general the unwinged labourers alone are seen; but in July and August the winged males and females issue from their nests, and rise in such vast swarms into the air as to attract occasionally general attention. This was especially the case in August 1849. On the 7th of August immense swarms, consisting of *Myrmica rubra*, F., *Formica fuliginosa*, F., and *F. nigra*, made their appearance in Winterthur. From two o'clock till near sunset they appeared in small clouds, glistening in the sun and reaching up into the higher regions of the atmosphere. The ground in the town and its environs was quite strewed over with these little winged creatures. On the 8th of August a whole tract in width of the Lake of the Four Cantons, between Bauen and Flüelen, was completely covered with little black, winged ants (doubtless *Formica fuliginosa*, F.), so that from forty to fifty could be taken up out of the water at one handful. Many were yet alive; others were dead: they had not therefore been immersed collectively, but must have fallen on the spot into the water. On the same evening great bodies of the *Formica fuli-*

\* An die Zurcherische Jugend auf das Jahr 1852, von der Naturforschenden Gesellschaft, LIV. Stück.

† The Translator desires thus to express his special thanks to Professor Heer for a copy of this valuable and interesting Memoir.

*ginosa*, F., were also seen in the Lake of Zurich; but it is related that at Schondorf in Wurtemberg, on the same evening, swarms like clouds (to judge from the description), of *Myrmica rubra* were moving between three and four o'clock through the country; and a like report referring to the same day was made from Soleure, Friburg, Bubendorf and Gelterkinden in the Canton of Basle: whence it is to be inferred that the swarms were moving in a southerly direction. The last great swarms (of *Myrmica rubra*, F.) we observed on the 11th of August, on the summit of the Uetliberg. Similar phænomena occur however every year, though not in these environs\*. It depends in great measure on the weather. Should this happen to be fine at the time when the winged ants are quitting the chrysalis state, they all leave their nests at the same moment, and thus form those immense great cloud-like swarms; on the other hand, should the weather be unfavourable at this epoch, the swarms are distributed over a longer period, and are not therefore so striking. This is indeed the case too with our May Chafers. Let fine May weather all at once set in after a wet April, and all at once (in years when they abound) great quantities of them make their appearance, and again after a short time disappear; but if May

\* The following account, which appeared in most of the leading journals at the time, is copied from the 'English Churchman' of Sept. 2, 1852 (No. 505, vol. x. p. 575).—Tr.

"*Extraordinary Phænomenon.*—A lover of natural history, who was in Romney Marsh on Tuesday the 17th ult., about 5 P.M., gives the following:—'I saw what appeared to be a column of smoke approaching me, about a quarter of a mile off. On the column reaching me, I found it was composed of red ant-flies. I think the column was a good quarter of a mile in length, and about from 50 to 100 yards in circumference: it quite darkened the sky. After it passed me it went over the river Rother, into which millions and millions of flies fell; and when I crossed it, the water was quite black. I watched the column for a mile and a half, and, notwithstanding the numbers left in the river, and on the trees, hedges, &c. over which it passed, the column appeared undiminished, and like a wreath of dark smoke. The extraordinary thing is, that the ant-flies throughout the whole marsh, thirty miles in length (as I hear it was so all through the marsh), should all have taken wing at the same time, and collected together in such vast numbers. A man who was collecting ant-eggs for me, informs me that he found himself covered with them, running up to the tops of the strands of grass and then taking wing. After the flight he scarcely found one ant-fly in the nests. Other persons who saw the flight, and who I do not believe intended to exaggerate, considered the length of the column to be a mile. The wind was in the east, the temperature very sultry, and there was every appearance of a thunder-storm. Had not my man observed the ant-flies rise from the ground, I should have thought that they came from the Continent. The column travelled at the rate of five or six miles an hour. Those persons fond of natural history will find an interesting account of these flights, and the reason, in the 2nd volume of Kirby and Spence, pp. 51, 52.—*Sussex Express.*"

proves rainy, their flights are spread over a much longer period, and are thus less numerous. The great ant-swarms of August 1849 lead us by no means therefore to admit, that in that year an unusually great number of ants were produced; but make it only most evident to every one, how populous the Ant-tribe must be to send out such myriads of winged individuals, from any two of which a new colony might spring. Nor must we at the same time overlook that these winged ants form but by far the smaller portion of the colony, and that an infinitely greater number of unwinged ones remain behind in the nests. These creatures not only thus abound with us in the lowlands, but are met with here and there up in the higher Alps (up to 8000 feet above the sea), as they are also found in higher northern latitudes; Lapland, for instance, even possessing thirteen kinds. Still, in warmer countries they are met with in much greater numbers and more varied forms than with us. Thus they have their home all over the world, and everywhere belong to the most numerous tribes of living creatures. The same condition existed also remarkably in the old world. We are already made acquainted with eighty-three kinds of Ants belonging to a former epoch, from the tertiary formation only; although but two localities (Æningen and Radoboj) have been more closely examined in this respect. These creatures therefore in all ages formed a very important section in the insect world. They must consequently perform a part of the highest importance in the œconomy of Nature. In Nature all is motion: unbroken continual production and destruction. Many animals, indeed, in all classes are appointed to destroy and carry away dead substances, and thus prepare again organic matter for new combinations. This office has been assigned to the ants also. They work up and destroy, with industry become proverbial, the productions of the vegetable and animal kingdoms. Though the chief bent of their activity is destructive, yet is it, through its operativeness in breaking up and clearing away, besides making preparation for new forms, of the greatest importance in Nature's collective household. And a good deal of the mischief, too, charged upon ants is very unjustly placed to their account; as when with us people maintain that they do harm to fruit-trees, and try therefore to drive them from their trees. Our species however only hurt the trees when they build their nests amongst their roots; but the trees themselves, as in general all plants, they only ascend to collect honey from the flowers, and to search for Aphides, whose sweet juices they lick off. Into our houses they seldom intrude, and the harm they do in them is, in fact, inconsiderable. In warm countries, on the other hand, the case is very different. There, ants are

found which not only cause much harm to cultivation, but also force their way in enormous companies into the dwellings of man, and thus become terrible pests of the country. One of these kinds I had opportunity last year in Madeira to become acquainted with. At first, by the ravages which it caused in my dwelling, it occasioned me many annoyances; but afterwards, when I began to pay attention to its habits, it afforded me much amusement. I communicate these observations in the hope that they will induce some of our young friends to institute similar ones themselves, for which the richness of our environs in insects affords such manifold opportunity.

In the accompanying Plate (III.) is figured the small minute Madeiran Ant. Fig. I. represents the female, fig. II. the male; figs. III. & IV. the neuters, which present two very distinct forms. The one (fig. III.) has a remarkably large head; it is larger than all the rest of the body, and gives the little creature a most extraordinary appearance; in the other, the head is much smaller and nearly circular. These small-headed ants are the working-class of the colony, and form the mass of its population; we shall therefore call them the *labourers* or *workers*. The large-headed ants can scarcely amount to  $\frac{1}{100}$ th of these, and serve partly for the defence of the nest; we shall therefore distinguish them by the name of *soldiers*, from the rest. In still smaller number appear the *females*, which not only are much larger than the labourers, but are also distinguished by their transparent glassy wings and shining brown colour. The males are not much bigger than the labourers, and of a coal-black colour. Accordingly, with these ants the family consists of four quite different-looking individuals: of workers, soldiers, males, and females. This ant-colony is consequently further developed than those of our species, in which only one form of neuters (the common wingless ants) occurs.

The house-ant lives in very numerous societies, under stones in the ground, and also under the bark of trees, and within the walls of houses. The stones serve them, in common with all ants living in the ground, in place of a roof for shelter. Their nests go down pretty deep into the earth, and are divided into a great number of passages and chambers. They have several entrances, which are sometimes covered over, and run like burrows under the stones. Not unfrequently they form their nests in flower-pots standing before the windows and on the balconies.

They are found on the whole south side of the island of Madeira, up to a height of about 1000 feet above the sea, in incalculable numbers, especially in hot sunny places. In turning over ten stones in such places, these ants are pretty sure to be

living under eight. In the city of Funchal there can scarcely be a house which does not harbour millions of these creatures, which mount up to the highest stones, issue forth in whole troops out of the chinks of the walls and floor, and in orderly regular columns traverse the room in all directions. They creep up the table legs, along their edges, upon the tables themselves, and even into chests of drawers, boxes, &c. Being extremely small, they can get in through the smallest cracks and holes. You may kill thousands on thousands, and yet perceive no decrease of them; they are continually replaced by new hosts in the rear. Only after very heavy rains, during which the water that came down in torrents made its way between the walls of our house, did we observe some sort of diminution, which we thought might indicate that a large number had been drowned. I found these ants however not only in Madeira, but also at Seville, in the rooms of our hotel in the middle of the city.

This little creature is attached to no particular kind of food; in houses it attacks all sorts of provisions laid in store, especially preferring sweet things (sugar, honey, syrup, preserved fruits); but not less also fresh fleshy fruits of all kinds. If you leave on the table a custard-apple, a lemon, or an orange, having only the smallest opening possible through the rind, you may safely reckon that in an hour's time it will be full of ants, going to and fro in whole trains. But if there be no opening in the fruit, it is then safe. It would be indeed an easy matter for the ants to gnaw through the leathery coats; but the essential oils, which they plentifully contain, appear to protect them; for all insects are known to avoid these oils. They seem to prefer flesh to vegetable substances. Raw and boiled meat is eagerly sought by them; but insects are very decidedly preferred. I had great trouble to guard my collections of insects from them. At first they made their way in numbers into the boxes, and my painfully collected treasures were grievously mutilated by them, until I found a means to make them more secure from them. They do not however seek after dead insects only, but attack also the living. Very droll it is to see how these tiny little creatures seize on flies! Let a fly settle on the table-cover near an ant, and at once the latter springs upon it, seizing it by a leg. The fly tries instantly to get free from its enemy and escape; but the ant has grappled on to the table-cover by its legs, and with its pincers holds the fly fast. Other ants soon come to help the first, and the fly is lost. This is much sooner the case when soldier-ants are near. These spring at once like cats upon the fly, and gnaw off first its wings and legs, so that it is then easily carried off by the labourers. But the soldiers never make the first seizure; they are much more cowardly than the labourers,

and often quit the fly when it makes very active exertions to shake off its assailants. I have never seen the labourers do so. Sometimes they cannot, indeed, hold the fly fast, as when it is on a smooth wall or polished table; but they do not therefore let go their hold with their pincers, but remain clinging to the fly's legs when it flies away. When it again settles, the ant tries again to hold it, and, with the help of its companions hastening up, to master it. I often shut up flies and ants together in glasses, in order to observe this battle of the ants and flies; and have frequently had opportunity to satisfy myself with what extraordinary obstinacy\* the labourers pursued the flies buzzing about, and how so insignificant a wingless little creature could master a winged one about a hundred times bigger. General Hardwicke relates, that the ants in India are the worst enemies of the Termites (the so-called White Ants); those also of Brazil are known to clear the houses of these dangerous guests. With what keenness our little ant attacks the Termites, I have more than once had occasion to observe. I had procured a great number of Termites, and had placed them, with the pieces of wood in which they lived, in a tin box, which was closed with a lid. The ants however managed to get into the box through a small chink, and within two hours the box was swarming with ants, which had destroyed nearly the whole of the Termites, amounting to a couple of hundred. But it is still much more extraordinary that even grasshoppers cannot withstand them. I had in a box half-a-dozen specimens of the Cape Grasshopper (*Gryllus capensis*, L.), which is abundant in Madeira, in order to observe their habits and their mode of chirp. To my surprise, I soon discovered that whole troops of ants had crept into the box, furnished as it was with little air-holes, and had attacked the grasshoppers. These were hopping restlessly about the box, and had also bitten and killed whole masses of ants, so that the bottom of the box was quite covered with their nibbled remnants; but at last the grasshoppers were forced to yield to hostile numbers, and, with the exception of the horny portions, were completely devoured. How should we be astonished to see an animal of the size of a mouse hunt elephants, and master them; and yet a grasshopper in proportion to our ant is bigger than an elephant! We can but be grateful to these ants for living in continual warfare with the flies, and other troublesome inmates of our houses. But they attack also useful insects. I had

\* We have observed also the same obstinacy in our own ants, which will often rather let themselves be torn in pieces than release an object into which they have once fixed their jaws. I once saw an ant (*Formica fusca*) that had seized by the leg a great courser-beetle (*Carabus hortensis*), which, in spite of all its efforts, could not free itself.

placed in front of my room, on a balcony, a Cactus (*Opuntia Ficus indica*\*, L.), with cochineal insects, in order to acquaint myself more closely with the metamorphoses of these wonderful little creatures. Soon however the ants made their appearance here also, and, by degrees, ate up all the cochineals. This is a fact very well worth noting, since our ant must do great injury to the cochineal-breeding, which for some years past has become of the greatest importance to the Canary Islands. At least I saw this ant very plentiful in cochineal-gardens, where they ought to be exterminated as much as possible.

The predaceous animals, as a rule, spare those of their own kind. Strange to say, this is not the case with our ant. In hope of becoming more closely acquainted with their œconomy, I placed four winged females, with two soldiers and six labourers, in a glass, which was stopped at top, but with a hole in the stopper just large enough to let the labourers go out and in, but not the bigger soldiers and females. These therefore were obliged to remain in the glass, in which was placed sufficient food. The glass was soon entered by other labourers from without, which presently attacked the females and tore up their wings. Since the labourers are said to tear off the females' wings to prevent their flying away from the nests, I thought at first the matter might be thus explained; but in the course of a few days the females had their antennæ and legs also torn off; and at last we found their heads pulled off, and the labourers busy in tearing them completely asunder, and in carrying away the separate pieces out of the place. Strange to say, the females did not defend themselves in the least, which would however have been easy for them to do, from their considerably larger size and stronger fangs. They bore all these attacks with the greatest, and to us incomprehensible, resignation. Nay more; even the soldiers were attacked, and one of them killed; some of the labourers took all sorts of pains to carry away the head, and get it through the little hole in the stopper; but through this it would not pass. Thus individuals of their own species are killed and eat up when they are found in circumstances in which they can be no longer profitable, as was the case with these individuals shut up in the glass. Not unfrequently I saw ants that had been hurt† carried away by labourers, to which

\* Rather *O. Tuna* (Mill.), D.C., which is the common species in Madeira, and that on which the Cochineal there usually exists. I do not recollect to have ever seen the true *O. Ficus indica*, L., in the island, though *O. vulgaris*, Mill., sometimes occurs.—R. T. LOWE.

† But apparently healthy ants also were sometimes carried off in this way. Rengger relates the same thing (Reise nach Paraguay, S. 250) of the Isau ant (*Æcodoma cephalotes*, Latr.). "The labourers are very often seen,"

they had affixed themselves by laying hold with their fangs at the abdominal pedicle. I imagined that they were carrying them to the nest to nurse them, in the same way as they treat their young with the greatest care; but the very barbarous habit above related would make it seem more probable that they were carried into the nest in order to be there fed upon, as being no more capable of work. With the ants, everything is turned to the most careful possible advantage of the common stock; and this reaches so far, that one of the same species, nay, even of the same family, is not spared, when it can no longer serve its purpose.

With this bad propensity, it must seem very strange that any different sorts of animals should be ever met with in their nests. Snails, worms, caterpillars, and such like, in general are never found under the same stone; seldom even a millepede (*Julus*), which they however attack only when the nest is disturbed, and then all the ants of every sort fall with great fury on the strangers, as if they considered these the cause of the misfortune which has befallen them. The millepedes then try, with violent contortions, to get free from the ants that cling to them. But claiming attention as animals peculiar to ants, are a Coccus, and a very curious little beetle (*Cossyphodes Wollastoni*, Westw.), which is never found elsewhere. I found it first in an ants'-nest in the country; but afterwards in the balcony of our apartment, where an ant-colony had established itself in a tub in which grew a *Diosma alba*, L.\* I have seen at different times more examples of the same insect, and always at the entrance of the nest. For what reason this very peculiar little beetle lives in these ant-colonies, I am not able to explain. We are acquainted already with a great number of minute beetles which occur in the ant-nests of our own country. Some of these (such as the little club-beetles) are regularly tended by the ants; and, as I have often satisfied myself, they are carried down into the deeper parts of the nest with the same care and anxiety as the pupæ when the nest is disturbed; but the others are probably merely tolerated, without being adopted into the family. The *Cossyphodes* seems to belong to the former class.

says he, "travelling home laden with another of themselves. These are not chance prisoners from another nest, but they belong to one and the same household; for the one carried is often bigger than its bearer. Besides, I have often observed, when two ants were returning home, that one would lay hold of the other and carry it home. If moreover its load be taken from one of these carriers and placed on the ground, both travel then along the same road quietly home." The like has been observed also amongst our own ants. (Compare Huber, 'Recherches sur les Mœurs des Fourmis,' p. 140.)

\* *Diosma ericoides* (Sims), Curt. Bot. Mag. t. 2332.—Tr.



In order to look more into our ants' manner of proceeding in their work, I placed a small wooden vessel in a tumbler of water, and stretched a thread from the vessel through the air to a ledge on the wall two feet off, and from this ledge a second thread to the ground. This thread was perpendicular, the first horizontal. The ants soon passed along the horizontal thread to the vessel in the water, on which I had laid a small piece of meat. No sooner was this discovered, than the ants set to work at it. In a short time, whole masses poured in. At first they were only labourers, but presently a few soldiers made their appearance in the train of the former. The soldiers cut up the meat into little pieces, drawing up their abdomen into an almost vertical direction, like that of their head. (Compare fig. III. 3). They presented thus a most curious appearance, when one looked down from above, and saw only the middle part of the body and the crown of the head. The meat was cut up into quite small fragments with their great hatchet-shaped pincers, being held fast at the same time by the two fore-legs. The labourers took these fragments between their pincers, and carried them away. Whole trains passed along the horizontal thread, and each of those that formed them had a fragment in its mouth. But the labourers alone were engaged in this act of transport: I never saw a soldier carrying away anything. At times, indeed, one or another went back over the thread, but always without taking anything with him. The ants soon discovered the perpendicular thread, and found out that they could get easier to the floor of the room by it than by the wall; and thenceforward the whole train always passed along this perpendicular thread down to the ground, and from thence to a corner of the room, where they disappeared through a little hole in the wall. Thus, from the vessel in the water they first passed along the horizontal thread to the wall, where they had to run along a ledge, and then arrived at the perpendicular thread, which reached down to the ground. The thread was always thickly crowded with ants, some passing downwards laden with fragments, the others empty, mounting upwards; and the up and down passers always arranged in files, so as not to disturb each other mutually in their way. More than once I placed ants, which I had fetched out of another room, in the vessel in the water. These also soon found, indeed, the thread leading to the wall; but there they dispersed themselves on all sides; whilst the others, without stopping, always ran to the perpendicular thread. This gave me a ready means of ascertaining whether ants from different nests came into my room or not. A closer investigation proved the first to be the case. It turned out that all the ants which resorted to the vessel in the water to fetch food, belonged to one colony, as well as all which appeared on the

table on which the vessel stood; and that, on the other hand, those which were destroying the fruit on the window-seat, must belong to another nest. From this, however, I could not quite draw the conclusion, that one ant-colony, when it has fallen in with a prize, excludes another from a share in it. At least I have never seen them fighting with each other, which in such a case would scarcely not have happened. Probably all provision that may be discovered is considered common property, and each party keeps as much of it as it can carry away. But if once a nest has taken entire possession of a thing, then probably the others keep aloof, and leave it altogether to the first. Here, too, it is to be considered, that ants clearly have a sort of power of communication; for let only a single labourer discover a supply, and without delay there appears a whole troop of ants to work at it. We cannot otherwise explain this circumstance to ourselves, than that the exploring labourer had gone back into the nest, and thence procured help. It would be in consequence of this circumstance that, as a rule, ants of the same nest are always collected for a common work.

That ants have memory, Huber has already pointed out; and the following observation would also confirm it:—One of my fellow-lodgers had arranged in his room a similar apparatus to that which I have described above; only in this, from the middle of the horizontal thread, which was several feet long, a second shorter thread was carried to the nearest wall. The ants soon chose this last road; thus going from the vessel in the water to the middle of the horizontal thread, and thence to the wall over the thread at right angles to it. After some time this last was removed. At first all the ants stopped suddenly, exactly at the place where, before, the thread that led sideways was fastened, and ran no farther along the horizontal thread. They had therefore observed closely for themselves the place whence the side-thread had branched off, though it had no sort of mark. At last, after having run restlessly backwards and forwards for some time, they tried to proceed further on the thread, and thus arrived at the wall, where they collected together in a cluster, having thence to seek the way for themselves. Perhaps too the fact here communicated may be explained by the faculty of tracking in ants. The dog tracks out, as is well known, the way which his master has taken to a great distance; and so the ant, perhaps, possesses a like fine "scent," which enables it to find again with certainty the way along which it has once passed. As above noticed, the larger pieces of meat placed in the vessel were torn up on the spot into scraps of pretty equal size, such as a single labourer could well transport; in like manner were grasshoppers and larger insects also dealt with; but dead flies, which were

placed in the vessel, were not divided, but carried off quite entire. To ascertain the strength of these little creatures, I tied with a thread first two, then three and four dead window-flies together, and they dragged even this load of four flies first to the perpendicular piece of wood to which the level thread was fastened, aloft, then horizontally along this, and then down the perpendicular thread till they brought it to the hole in the wall. Here the flies were first pulled in pieces, because the hole was too small to let them be carried through it entire. This carriage of the flies over the thread stretched through the air, was extremely droll to see. A single fly would sometimes be dragged away by only two ants; on the load of four flies were mostly from six to twelve labourers employed. Most of these had laid hold with their fangs in front, and pulled, going backwards, at the load; the rest had fastened on the other side, and pushed, going forwards, in a straight direction, holding on meantime by their legs to the thread. The motion forwards was always by short impulses; on each jerk there followed a longer or shorter rest. Men are well known to do the same in shoving along a great load: when several share the work, it is always managed by a cry (Yo ho), that all may lay hold at once, and so bring equally to bear the force applied. A like co-operation in these ants could not but be discerned: the hinder pushed at the same time as the front ones pulled, and at the same time they left off and rested for an instant together. But by what kind of means this unanimity in their operations was attained, I was not able to discover. The most remarkable thing moreover was, that sometimes all let go together, and a single one held the whole load in suspension. Here therefore again some agreement must have taken place, for not one fly ever fell to the ground: there was always an ant ready to hold on: but had all left loose at the same time, the load must have naturally fallen down. The load was altogether held by the fangs only; with their legs the ants clung fast to the thread, wherein the peculiar curvature of the first joint of the foot, and the remarkable claw (see fig. 1. *a b, c*) corresponding thereto, had each essentially their share. Thus a single, and that an unusually minute ant, was able, hanging to a thread, to support four flies. What immense muscular power in the fangs and legs does this display!\*

Whilst the ants were transporting this burden, they were not easily disturbed at their work; whilst otherwise they quickly run off when they are meddled with. For example, if one lifts up a fruit full of ants, or shakes it, they hurry out as fast as

\* A house-ant (dried) weighs  $\frac{1}{20}$  of a milligramme; but four window-flies (also dried)  $18\frac{8}{10}$  of a milligramme. Thus this ant was able to bear a load 376 times its own weight.

possible. They do not go back to their nest, but hide themselves in some cranny, or else under some near object; but as soon as the danger is over, they come out again, and betake themselves afresh to their work. On such occasions one may satisfy oneself that they do not see far. On taking away from an ant the morsel it is carrying, it seeks about for it for some time, running hastily in zigzags up and down; but at times stopping still, and lifting its head up in the air. When placed at the distance of some inches, the ant does not go straight up to it, as would be the case if it could see it, but runs round about in different directions, and only when at the distance of about an inch, springs forward on it, as if seeming then to have first seen it. If we examine the eye of this ant, we shall find that (as, however, generally in all ants) it is of simple structure, as in most other insects, and only consisting of a small number of lenses (Ocellen).

In order to see whether these ants would try to pass over water, I several times destroyed the connexion formed by the thread between the vessel in the water and the wall, so that the ants which happened to be in the vessel were quite cut off. If there was a scum formed over the water (which is always the case when the water has stood some time, a thin film spreading over the water from the falling dust), then they tried to run away over it; a few got quite safe over, when the film could bear them; but others broke through and were drowned. But I never saw such a number fallen into the water that a bridge was formed by the dead bodies, as is related of other sorts of ants, and that by this means they reach vessels of provisions placed in water.

The work of these little creatures goes on alike day and night; and if you look after them during the day, or in the night, or early in the morning, you see always the same stirring activity. Hence they seem to observe no fixed resting-times, at least none in connexion with the change of day and night. This is also the case with most of our own native ants, of which Pliny already relates that they work by moonlight. These however hibernate. The ants of warm countries, and so of Madeira, on the contrary, do not. One of our own kinds (*Formica fusca*, L.) is also found there, and it too continues the whole winter in activity. Our house-ant is found throughout the whole year in nearly equal abundance. The males and females probably appear at the end of summer. Of the former I found only a single example, whilst females were found in several nests till the new year. In most cases it might well be that I observed none, because they keep in the deeper parts of the nest. The females lay minute little white eggs, out of which proceed little white maggots; the pupæ are free, not enclosed in cases, as in our common ants

(*Formica*), which pupa-cases with us are falsely called ants' eggs. The soldiers are met with in the nests in proportionally greater numbers than outside; they appear therefore to be provided for the work within the nest and its defence, whilst the labourers procure food and take care of the young. At least it is these which carry away the pupæ when the nest is disturbed. That the soldiers however go out also with the labourers, and are serviceable to them in their operations on the treasures they discover, has already been mentioned. Lacordaire (Introduction à l'Entomologie, ii. 498) relates of the Train-ant\* (*Ecodoma cephalotes*, Latr.) of Bengal, that the soldiers accompany the trains, without mixing with the mass of the army. Stationed at the sides of the column, they are to be seen marching forwards, then again turning back to an earlier occupied post, halting a moment to see the train file past, and running hastily up and down, especially if a stoppage anywhere occurs, and their help be necessary. Nay, they will often, as Lacordaire relates, climb up the plants near the train, station themselves on the edges of the leaves, and from this elevated post inspect the train of their troops. In our Madeiran ants the soldiers play no such prominent part, always marching along in the same rank and file as the labourers.

All that we have said above relates to one kind of ant only, the *Ecophthora pusilla*; but in hot countries there are whole numbers of species which have similar habits, and which come into hostile collision with man. In Brazil this is so much the case, that the inhabitants there say, "The ants are the queens of Brazil, for they have the most power in the country." One of the largest and most dangerous kinds, which is spread over the whole of tropical America, continental as well as insular (*e. g.* Cuba, from whence we have specimens), is the Train-ant (*Ecodoma cephalotes*, Latr.). The female is bigger than our hive-bee; the labourers about twice as big as those of our red wood-ant. It lives in very populous colonies in the ground, into which they dig their dwellings, sometimes nine feet deep. It marches in great regular trains, and on its course strips bare of leaves, often in a short time, trees and shrubs. Rengger relates of the Isau ant (which I do not consider different from the train-ant †), that in one night many millions, inhabitants of a single nest, levelled to the ground whole plantations of manioc, maize, potatoes, melons, garden-stuff, &c. Having rapidly ascended the plants which they intend to plunder, they place themselves at the

\* Visitor-ant, Angl.—Tr.

† From specimens seen by me in Rengger's Collection.

edges of the leaves, and with their fangs cut out in a short time a piece of about half the size of a farthing, which they then directly carry home. If, as very often happens, the piece falls to the ground before they have been able to lay hold of it, they set themselves at once afresh to work, and do not go down to look after the fallen piece. It has been maintained, that the Isau throws this piece on purpose to the ground to save itself and its fellow-labourers the trouble of carrying it down. But this is by no means the case; for the ants approaching from the nest pay no heed to these pieces of leaf, though the ground is often quite strewed with them, but each for itself bites its own piece out of a leaf whilst yet attached to the plant. This communication of the close observer Rengger serves to correct earlier statements, that the Train-ant bites the leaves off at the stalk, and lets them fall to the ground, where their companions stand ready to clip up the fallen leaves and carry them home. This stripping process is often so rapidly effected, that sometimes in the morning trees look like besoms which the evening before were standing in their whole beauty of foliage; nay, Lund relates, that he has seen a tree stripped within half-an-hour. Dr. Delacour speaks of a similar species, which sometimes in New Spain robs a garden of its whole crop of plants in one night. One of his acquaintance had planted a very fine vineyard: at the end of three years the ants made their appearance, and, in the space of one night, it was despoiled of the whole of its leaves and destroyed.

The Train-ant properly lives in the open air; but sometimes it makes inroads in regular trains, like a great army, into houses, where it immediately makes chase after the flies, the spiders, cockroaches, and all vermin generally. However useful this activity, yet is it so troublesome a guest, that those who live in the house are not unfrequently obliged to leave their dwelling for some time. When these ants swarm, the females are caught in great quantities; the abdomen is cut off, fried in butter, and esteemed a delicacy. Eaten undressed, its taste, says Rengger, is like that of a hazel-nut; and when slightly toasted, or covered thick with syrup, it tastes like burnt and sugared almonds. The Train-ant does not attack people; but this is by no means the case with certain other American species. Dr. Delacour speaks of a little reddish-yellow kind, which, by its sharp bite causing inflammation, is very dangerous to little children. His own child, twenty months old, once, in the middle of the night, awakened him by a violent shriek; on examination he found it covered by a crowd of ants, which had bitten it so violently, that in the morning it was quite covered with pustules, and for forty-eight hours lay in a violent fever. The same kind is a

great enemy to young chickens, and makes it in many places very difficult to rear them. But still more dangerous, according to Dr. Delacour, are some of the wood-ants. In the year 1834, he says, a young man of respectable family, resting under a tree on the way from Tampico to Mexico, was attacked by the ants and completely eaten up. On the following day nothing was found but his skeleton, with the clothes. A similar accident he relates also to have happened in the year 1838; nay, he had once himself nearly fallen a victim to these creatures. In a forest near Turpan he had been leaning for a few minutes against the trunk of a tree, when all at once he was so violently bitten in all parts of the body, that he would have sunk down under the violence of the pain had not two of his hunting companions come up, stripped off immediately his clothes, and freed him from his enemies. In Paraguay, also, a species (*Odontomachus*) is found, which, when it makes its appearance, puts the inhabitants there into fear and terror. According to Rengger ('Reise nach Paraguay,' S. 262) it appears all at once in great companies, and attacks men as well as beasts; crickets, spiders, grasshoppers are immediately torn by them in pieces. I have, says Dr. Rengger, seen mice, covered with these insects, leave their hole in torture; young mice, which have been eaten up by them in their nest; lizards, and even snakes, flying before them. They attack people in their sleep, and gnaw them till the pain awakens them. Dr. Rengger saw a drunken mulatto whose eyebrows, partly during his own presence, as well as eyelashes, these beasts entirely eat off, and also gnawed the skin of his face to the quick. Two of his patients were attacked by these creatures in their bed, and one of them died soon after, partly in consequence of the fright.

In tropical Africa, also, certain ants occur which prove extremely troublesome to man. The most exact information we possess about them is that afforded by Mr. Savage concerning the Driver-ant (*Anomma arcens*, Westw.), which is found on the west coast of Africa. It is a little black ant, with very sharp and pointed fangs; and the neuters also present two forms, one smaller (the labourers) and another larger (the soldiers). They have no fixed dwelling, but seek their lodging in shallow hollows under roots of trees, overhanging rocks, and such like, where they find shade. The direct rays of the sun being fatal to them, they only come out on cloudy days and by night. If surprised by the sun at their work, they build over their path a vault with earth, which they glue together with their saliva. At other times the soldiers form a vault over the path for the shelter of the labourers. At the rainy season, if their places of abode are

inundated, they form themselves into a round cluster; the young, with the weaker ones, within, the stronger on the outside, and thus float about till they come to dry land. If they fall in with a broad piece of water in the way, they form, by laying hold of each other, a chain across the water, along which the rest pass as over a bridge. The Train-ant is also said to do the same. Madame Merian relates the process thus:—The first ant places itself on a little bit of wood, and holds fast on to it by its fangs; a second lays hold of the first, a third in like manner of the second, and so on. In this way they let themselves be wafted over by the wind, until the last of the chain reaches the other side, and then at once they pass over the bridge by thousands. The Driver-ant often forms similar chains from the twigs of trees to the ground. Their food consists principally of animals, and they kill large-sized ones; even the gigantic snake (*Python natalensis*) is exposed to their attacks. Their first assault is directed on the creature's eyes; and, when surprised by them, their immense numbers win the day. They make their way into houses in crowds by night, when a universal flight of rats, mice, lizards, beetles, and other vermin, announces their arrival, and the inmates are obliged to leave their beds and take to flight into the open air.

Amongst the Ants of India, the *Formica indefessa*, Sykes, is spoken of as destructive in houses; and Lieut. Sykes has furnished (Transact. of the Entomol. Soc. of London, p. 104) some interesting observations, from which we shall extract the following in particular:—A table laid out with sweets and dishes had its legs placed in a vessel of water, and the water covered with oil of turpentine, making it impossible for the ants to reach the legs of the table. The table stood however near the wall, so that the larger ants, holding on by their hind-legs to the wall, could reach the table with their fore-legs and thus get upon it. The table was therefore drawn further back; but now the ants went a foot higher up the wall than the level of the table, and jumped down upon it from the wall, never falling between the table and the wall to the ground, but always alighting on the table.

In New Holland there are in particular two kinds of *Eciton* (*E. gulosum* and *E. forficatum*, Latr.) which are much dreaded, from their appearing in great numbers, and for their violent bite. They are distinguished by their long and straight fangs.

[To be continued.]



these might even be considered as a single natural genus. But to such as study the Mollusca of a larger and more prolific district, and especially the species now contained in collections brought from various climes, such a union of genera seems to me most undesirable, particularly as it prevents that accuracy of observation and discrimination which it is the great advantage of natural history as a branch of education to establish and teach.

“From the study of the animals, shells and opercula of these Lamarckian genera, I have been induced to form the group into the following families, viz. *Rotelladæ*, *Turbinidæ*, *Liotiadæ*, *Trochidæ*, *Stomatelladæ*, *Scissurelladæ*, *Haliotidæ* and *Fissurelladæ*. I believe that *Scissurella* is very distinct from *Trochus*, and intermediate between it and the *Haliotidæ*, but more nearly related to the latter than the former; and this view of its position has been strengthened by Mr. Barrett’s description of the animal, as well as by what you say as to the operculum and structure of the shell.

“Though the family of *Scissurelladæ* only contains one, or as you have very properly proposed, two genera, yet they appear to be all that remain of a large number of fossil genera, containing together more than 300 well described and figured species.

“I never believed that *Scissurella* had any relation with *Ianthina*, and the figure and description of the animal distinctly prove that it has not any.

“*Adeorbis*, on the other hand, is clearly a genus belonging to the same great group above mentioned, and is referable, by the exquisite structure of its operculum, to the family *Liotiadæ*, characterized by its horny many-whorled operculum being ornamented with concentric spiral lines of a calcareous pearly substance.

“Ever yours sincerely,  
“J. Gwyn Jeffreys, Esq.” “J. E. GRAY.”

---

XXVII.—*On the House Ant of Madeira.* By Prof. O. HEER, of Zurich. Translated from the original by R. T. LOWE, M.A.

[Concluded from p. 224.]

## II. *Description of the House Ant.*

### ŒCOPHTHORA, Heer.

MANDIBLES very strong, in the females and soldiers with a sharp cutting edge, in the labourers toothed like a saw. Palpi of the tongue and maxillæ *very short* and *two-jointed*; the

second joint somewhat longer than the first. The pergamentaceous stalk or stipes of the maxillæ with a thin membranous, ciliated sheath (case or cover).

Antennæ in the males seventeen-jointed, the first joint thicker but not longer than the next succeeding joints; in the females, labourers, and soldiers twelve-jointed, with a rather long shaft and eleven-jointed flagellum, the three last joints of which form a slight, gradually attenuated club.

Wings with three cubital and two discoidal cells; *the middle cubital cell stipitate.*

The tibia in the females, labourers, and soldiers with a pectinate hook.

The back of the metathorax with spines.

The abdominal pedicle two-jointed, the first joint clavate.

The family consists of males, females, labourers, and large-headed soldiers.

This genus belongs to the group *Myrmicidæ*; it differs altogether from *Myrmica*, Latr., by the much shorter two-jointed palpi, by the seventeen-jointed antennæ in the males, and the venation of the wings; in this last point it approaches nearer the genus *Atta*, but in this the maxillary palpi are five-jointed, and the metathorax is unarmed with spines. In the two-jointed palpi our genus agrees with *Pheidole* and *Typhlopone*, Westw.; the latter genus belongs to the group *Poneridæ*, and cannot therefore come into consideration; the former is founded by Westwood on an Indian species, the *Atta providens*, Sykes; but from this, *Ecophthora* differs in the much longer first joint of the tarsus, the anteriorly sharper-toothed mandibles, the maxillary-case produced beneath, by the fusiform second joint of the maxillary palpi, the much less deeply notched upper lip, the differently shaped abdominal pedicle, and the marked division of the neuters into two forms, widely differing in the structure of the head.

#### *Ecophthora pusilla*, Heer.

Allied species to it are the *Myrmica omnivora*, L. Latr., *Myrmica nana*, Latr., and *Atta megacephala*, F. Latr., both the latter of which must certainly belong to the genus *Ecophthora*. The *Myrmica omnivora*, Latr., is spread over all tropical America, and also appears in Egypt as one of the pests of the country. More recently it has also spread northwards, and in Kasan as in London does great mischief in houses. From this *M. omnivora*, our Madeira kind is distinguished (over and above the generic characters) by the armed thorax, and by not having both the segments of the node or abdominal pedicle (die beiden Glieder des Knötchens) cylindrical. With the *Myrmica nana*,

Latr. (*Formica pusilla*, De Geer, from South America), it agrees in size, colour, and the armed thorax; but in that, the thorax, with the head, is shagreened with numerous little raised points, which is not the case in our species. In the form and size of the head, the soldier of the *Ecophthora* agrees with the *Atta megacephala*, Latr. (from the Isle of France); yet Latreille would surely not have overlooked the peculiar striated sculpture of the head: but since neither the description nor figure gives this, we cannot identify our species with his; and this especially as the female is said to be only a little larger than the neuters,—the difference in ours being so considerable. From this, *A. megacephala*, Latr., the ant so called by Losana (Memorie della Reale Accademia di Torino, xxxvii. p. 328), is distinct; and the description of the species which is found in the gardens of Piedmont agrees in all points of importance with the soldier of the Madeiran ant. On the other hand, the description of the labourer is quite inapplicable, for it assigns to it a larger heart-shaped head. It is also very surprising that Losana should not have remarked that the head of the labourer is quite smooth, and that labourers and soldiers present constant differences, not only in size, but also in the formation of the head.

### 1. *The Female.*

Pl. III. fig. 1. 1, the natural size; fig. 1. 2, ten times magnified; fig. 1. 3, in profile.

Whole length  $3\frac{1}{4}$  lines. Length of the head  $\frac{3}{4}$  line, breadth the same. Length of the thorax 1 line, breadth  $\frac{3}{4}$  line. Length of the abdomen  $1\frac{1}{2}$  line, breadth nearly 1 line. Length of the upper wings  $3\frac{1}{4}$  lines, breadth  $1\frac{1}{8}$  line.

The head is roundish, and of the breadth of the thorax, as long as broad, with a very slight notch at the base behind. The eyes are rather small, and composed of few lenses. The three ocelli are very distinct, and placed at the base of the head in a triangle. The clypeus is not distinct from the forehead; slightly hollowed out directly over the mouth, where the edge is furnished with a row of punctures. The antennary clefts are somewhat converging forwards, short, but broad and deep, and rather widening forwards, where the forehead, which otherwise is flat, becomes more prominent. The forehead between the antennary clefts is moderately broad, and furnished at its anterior margin with an impressed, triangular, somewhat smoother compartment, which is faintly keeled down the middle. The whole upper side of the head is traversed by fine parallel striæ longitudinally, which reach down nearly to the base of the head; behind the eyes the striæ are fainter, more irregular, and partly obsolete, or passing into

dots. The upper lip (labrum) (fig. I. 4) is very small, and depends quite perpendicularly between the mandibles; it consists of two horny plates, a very short but broad basal piece, and a second longer outer piece, which is rounded, and slightly notched anteriorly; in the middle of the notch stands a little papilla. The labrum is beset with a double row of fine bristles, one within the other upon the edge, with two longer, stouter bristles in the centre of the lip. The mandibles (fig. I. 5) are very strong and horny, becoming broader and hatchet-shaped externally; the fore-edge exactly truncate, and produced forwards into a strong tooth, furnished with a narrow horny rim or border extending at the top into a short, not prominent, tooth. This border, which, as the actual cutting-edge, forms the mandibles, is very sharp, but without teeth. The outer edge of the mandible is grooved; the upper surface, on the contrary, even. The maxilla is much smaller. The peduncle (stipes) is pergamentaceous, narrowed at the base, notched at the top, to which is affixed the extremely small two-jointed *palpus*: this is so small, that it does not reach to the point of the sheath. The first joint is cylindric, the second somewhat longer, fusiform, and produced into a fine point. The sheath extends pretty far out beyond the stipes; it consists of a stalk-like basal piece (fig. III. 5. *b*<sup>2</sup>) and a larger membranous very thin upper piece, which is rounded at top and furnished with a crown of hairs; further below the hairs cease, and the edge is naked and extremely thin; but here a border of excessively minute hairs runs obliquely over the surface of the sheath. The labium is very small, as long as the stipes of the maxilla, greatly narrowed at the base, broader outwards and bluntly rounded. The lingual palpi are two-jointed and very short; the first joint obconic, the second fusiform and somewhat longer, bearing two bristles. The mentum is corneous, and slightly hollowed out. The antennæ are moderately long; the first joint (the scape) extends a little beyond the edge of the head, and is scarcely perceptibly thickened outwards: the flagellum is eleven-jointed; its first joint is about twice as long as the next very short one; all are of equal thickness; the three last are considerably larger, though not abruptly distinct from the rest; they are together about the length of the seven preceding joints. All the joints of the flagellum are finely hairy, especially the last three.

The thorax is pretty large. The *prothorax* is very short, and not perceptible from above; laterally, however, the side-piece (Pl. III. fig. I. 3 *a*<sup>2</sup>) forms a pretty broad prominent segment; the *mesothorax* composes the chief part of the thorax (fig. I. 3 *b*); the *mesonotum* is somewhat larger than the head, rather flat above, nearly circular, but truncate behind, with a transverse impression and row of impressed punctures, and on either side a

small black tubercle. The upper side of the mesonotum is quite even, with only a faint longitudinal groove. The scutellum (fig. 1. 3 *b*<sup>2</sup>) is attached immediately to the mesonotum; it is abruptly truncate in front, bluntly rounded behind. The side-plate of the middle thoracic segment is of about the same size as that of the anterior, and receives the coxa of the middle leg. The first piece of the metanotum is extremely short (fig. 1. 3 *c*<sup>1</sup>); the second piece (its *scutellum*, fig. 1. 3 *c*<sup>2</sup>) is indeed longer, but still small and strongly attenuated backwards. On the back it is even; on each side bordered by a raised margin, on which stands a distinct prominent black spinule.

The legs are moderately long, with thick but short coxæ, small trochanters, and femora dilated in the middle. The tibia is considerably shorter than the femur. The anterior tibia is thickest in the middle, slightly rounded forwards on the inner side, where there is placed a moveable proportionably large hook, furnished on its inner side with a membranous border, which is fringed with a row of fine straight setæ (fig. 1. 6 *c*), giving it the appearance of a comb. The tarsi are long, and extremely slender and filiform. The first joint is nearly as long as the tibia, but the four following are very short. The fifth is thickened outwards, and provided with two curved very sharp claws (fig. 1. 7), between which lies a membranous flap (or lobe). The first tarsal joint in the four hinder legs is straight, but in the anterior pair is very strongly curved at the base, the curve answering to the pectiniform hook, which has a similar curvature. It is also worth notice, that on the parts of the tarsus answering to the hook, the tarsus is clothed with a thick fine felt of hairs; whilst on the other parts of the tarsus, these hairs are longer and less closely set.

The wings extend pretty far beyond the apex of the abdomen. The fore-wings are much narrowed at the base, and attain their greatest breadth at three-fourths of their length. They have a distinct, pretty large stigma. The radial cell, before it, is open, for the *vena scapularis* does not run into the margin. The cubital cells are three, of a similar form to those of the *Atta*. The inner cubital cell is polygonal and irregular; it is contiguous to the stigma: the second is also closed, somewhat bell-shaped and pedunculate; the cross vein which divides it from the third open large cubital cell is connected with the cross-vein which divides the inner cubital cell from the radial cell, and which issues from the stigma. The inner discoidal cell is rhomboidal and rather small; but the outer discoidal cell is very large and open. The *area interno-media* is divided into two cells, of which the outer one is open, the *vena interno-media* running out free. The hind-wings are considerably smaller than the fore, and the *vena scapularis* is connected already at one-third

of their length with the marginal vein; the *v. externo-media* divides very soon into two forks, the outer of which is connected by a little cross veinlet with the scapular vein, and then proceeds towards the tip of the wing. The *v. interno-media* is extremely short, and opens into the *externo-media*.

The abdomen consists of six segments, the first two of which form a proportionably long pedicle. Of this the first segment is strongly curved like a horn, and clavate. At the point of its insertion into the thorax it is quite thin, but is thickened upwards. This thin pedicle is the cause of the great mobility of the abdomen: when raised perpendicularly up, it shuts on so close to the metathorax (cf. fig. 1. 2), that from above only its nearly quadrangular head (*i. e.* the upper end) is visible; but when lowered, its head separates from the metathorax in proportion to the obliquity of its position (cf. fig. 1. 3). When the pedicle is raised, the abdomen is lifted up aloft; in the other case it is depressed. The second joint of the node\* (the second abdominal segment) is much broader, but much shorter, inserted obliquely into the first, and, seen from above, coroniform. On either side it is furnished with a small tuft of hairs. The body of the abdomen consists of four segments, and is shortly oval, somewhat broader than the head, bluntly rounded before and behind. The first segment, or third of the whole abdomen, is the largest; it is of the same length as the three following together. It is even; only furnished on the back with a faint longitudinal line, and on the hinder edge with a row of punctures and a circlet of hairs; the upper side is pretty thickly clothed with fine short pubescence. The second segment is decidedly shorter, quite smooth and naked, with only a narrow hairy band on the hinder edge, and the edge itself ciliated with longer hairs. The third and still shorter segment presents the same characters; the fourth only projects a very little.

The colour of the insect is a shining brown. The head is chestnut-brown; the fore part lighter, yellow-brown; the edge of the scutum and the fore-edge of the mandibles black. The eyes black, the ocelli whitish. The mesonotum is of the same colour as the head; the metanotum, on the contrary, lighter yellow-brown; the tibiae and femora are brown, the tarsi and antennae light yellow. The abdomen is shining; lighter in front, behind blackish-brown: the commencement of the first segment, and sometimes the (whole) first segment and fore-part of the second of the body of the abdomen are yellow-brown; the hinder segment, on the other hand, is dark brown or blackish; but the small last (segment) again lighter yellow-brown. In certain individuals, moreover, the whole body is a lighter brown

\* Knötchen—here evidently means pedicle.—Tr.

than in the majority. The wings are hyaline, whitish, with yellowish veins.

### 2. The Male.

Fig. 11. magnified ten times. As before mentioned, I found only a single example, which was moreover broken to pieces on the journey, the head and thorax only remaining perfect. In fig. 11. 1, the dotted portion (the abdomen) is sketched merely from memory.

Length of the head  $\frac{1}{4}$  of a line; of the thorax  $\frac{5}{8}$ ; breadth of the same  $\frac{1}{2}$  a line.

It is much smaller than the female, the length of the soldier, and of a coal-black colour; the legs only are light yellow, with however the coxæ and trochanters black. The head is small and nearly circular; its mandibles are small, scarcely perceptible; the palpi, on the other hand, are somewhat longer than in the female. The head is smooth, bearing in front the approximate antennæ; these are long, setaceous, and seventeen-jointed. The first joint is the thickest, the second of the same length, as also the 7-8 following; but thence they become gradually shorter, and more abruptly separated from each other; whence the last seven joints can be much more easily distinguished from one another than the first ten. All the joints (with the exception of the first and last) are cylindrical and thickly pubescent. The thorax is considerably broader than the head, bluntly rounded anteriorly; the hinder edge of the mesonotum with a row of longitudinal excavations; the scutellum subtriangular, its edge also beset with impressed punctures; the abdomen oval. In the wings, the inner discoidal cell is larger than in the females. The legs are of finer make than in the females. The femur is thinner, the tibia proportionally longer (fig. 11. 2). The hook at the fore part of the tibia (cf. fig. 11. 3) is differently formed; it is curved, and also furnished on the inner side with a row of setæ, which are not however attached to a membranous flap (hautlappen\*), and are not pectinate. The tarsus is much shorter than in the female; the first joint about the length of the second and third together; the second, third and fourth are of equal length; the fifth is thickened outwards, and with two sharp claws.

### 3. The Labourer.

Fig. 1V.—1V. 1, the size of nature; 1V. 2, magnified ten times.

Whole length  $1\frac{1}{8}$  line; length of head  $\frac{3}{8}$  line; breadth the same; length of thorax  $\frac{1}{2}$  line, of abdomen  $\frac{1}{4}$  line.

\* "Hautrande" (membranous border) before, in description of the female.—TR.

The head is somewhat larger than the abdomen ; it is altogether shining, smooth, and naked. The point of insertion of the antennæ is also marked by a pretty deep groove, and the anterior border of the forehead likewise furnished with an impression ; on the other hand, the striæ, which in the females as well as in the soldiers are perceived on the head, are wholly wanting. The mandibles (fig. iv. 3) are proportionably longer, but more attenuated at the base than in the female and soldier, acquiring thus a more slender form ; the two teeth at the point are longer and much more acute, and the whole inner edge is set with a row of little teeth, varying in number between ten and twelve. These teeth are very regularly placed, and give a serrated appearance to the edge of the mandible. The teeth of both mandibles fit into each other, and make it intelligible how these little animals can hold and carry with their mandibles such considerable loads. The other parts of the mouth are formed as in the female. The antennæ (fig. iv. 4) are much longer in proportion than in the female and soldier ; their shaft or pedicle extends conspicuously beyond the head, their base ; in other respects their structure is the same. The ocelli are wanting.

The thorax is very narrow ; the prothorax (the collar) is very finely granulated. The mesothorax is somewhat widened in the middle ; it is quite smooth and shining ; on the other hand, the scutellum and the metathorax are very finely granulated (only perceptible under the microscope), the latter furnished on each side with a small spine.

The legs are formed like those of the female, only much smaller (fig. iv. 5, 7) ; their tarsi are extremely fine, with however sharp claws, between which is seen a membranous lobe (fig. iv. 6). They are finely pubescent.

The second joint of the abdominal pedicle is proportionably longer and more slender than in the female ; the abdomen itself very small and shortly oval. The first segment is about half the length of the whole, and is also much greater than the second.

The head is sometimes lighter, sometimes darker brown ; the thorax, shaft of the antennæ, femur and tibia light yellow-brown ; the flagellum of the antennæ and the tarsi light yellow. The shining abdomen chestnut-brown, lighter at the base and tip.

#### 4. *The Soldier.*

Fig. III. 1, natural size ; fig. III. 2 & 3, magnified ten times.

Whole length 2 lines ; length of head  $\frac{3}{4}$  of a line, breadth full  $\frac{5}{8}$  line. Length of thorax  $\frac{3}{4}$  line ; of abdomen  $\frac{1}{2}$  line, breadth the same.

Distinguished from the labourers by the head being twice as



large, emarginate at the base and striated, by the shorter and stronger mandibles, which are not toothed on their inner edge, and by the somewhat larger abdomen.

The faintly pubescent head is of enormous size, and much more deeply emarginate at the base than in the female, so that it is nearly heart-shaped. A deep longitudinal furrow traverses it in the middle. The antennal clefts are pretty deep, being bordered anteriorly and towards the forehead by a rather strong prominent rim. The fore-part of the forehead has a deep impression like that of the female. The clypeus is very short, and divided from the head by a faint line. The upper side of the head is finely striated longitudinally, as in the female; these striæ become obsolete behind the middle of the head, so that its hinder part is quite smooth. The eyes are small, and the ocelli are wanting. The trophi are as in the female, as are also the mandibles, except that on their cutting edge stands a pair of very small obtuse denticles furnished with a bristle (fig. III. 4). The antennæ are as in the females; their shaft is much shorter than the head; the three last joints (fig. III. 6, 7) are distinctly separate.

The thorax is similarly formed as in the labourer, except that the mesothorax is much broader in the middle and bears on each side a little tubercle (Härchen) furnished with a bristle, by which structure it is distinguished both from the female and labourer. The scutellum is almost quadrangular; the hinder piece of the metanotum is armed on each side with a sharp spinule, and furnished in the middle with a longitudinal cleft. The whole thorax is sprinkled with scattered or distinct hairs. The legs are larger than in the labourer; otherwise they are of the same form.

The abdomen is much smaller than the head. The first joint of the pedicle is enlarged into a more prominent scale-like protuberance (furnished with a tuft of hairs) than in the labourer; the second joint, on the other hand, is shorter and thicker than in these, and approaches in form that of the female. The first segment of the abdomen is the largest; the second of about the same breadth, but shorter; the third rounded behind; the fourth is very small, and almost withdrawn into the preceding. It is quite smooth and shining, sparingly sprinkled with fine bristles, which at the hinder edge of each segment are longer and set closer together.

The head is sometimes lighter, sometimes darker brown; on the under side always lighter than on the upper. The edge of the clypeus and the anterior edge of the mandibles black; the antennæ and legs are light yellow; the thorax and abdominal pedicle somewhat lighter brown than the head; the abdomen at the base and tip of the same colour; the second and third seg-

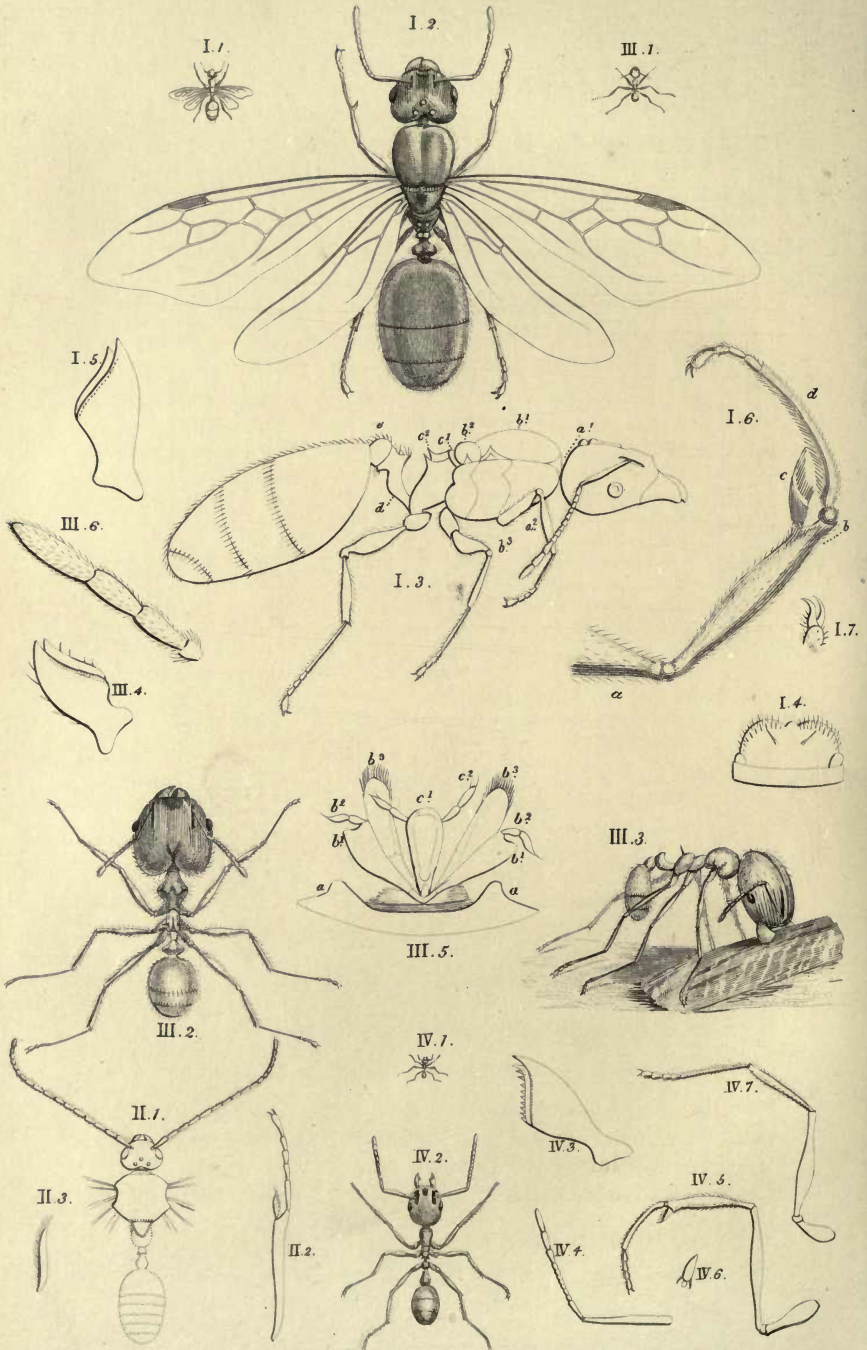
ments, on the other hand, blackish-brown. At times the dark brown extends further, over even the hinder edge of the first segment; but still more frequently it is more contracted, forming only a dark band over the hinder edge of the second and the (whole of the) third segment.

### III. Conclusion.

Comparing with each other these four different kinds which compose a colony of *Ecophthoræ*, we find that the males differ altogether from the rest in the structure of the head. The females, soldiers, and labourers approach each other closely in the structure of the parts of the mouth, in the legs, and in the equal number of the abdominal segments; yet the labourer differs much from the female, not only in being so much smaller, but by its smooth head, its serrato-dentate mandibles, different structure of the thorax, owing to the want of wings, as well as by the form of the second joint of the abdominal pedicle. In size, structure of the mandibles, and striated head, the soldier forms a middle link between the female and the labourer; but, on the other hand again, it differs much from both in its excessively large perfectly heart-shaped head, and in the shape of the mesothorax; assuming thus quite a peculiar aspect. These forms are very distinctly marked; and amongst the numberless specimens seen by me of this ant, no intermediate link between the labourer and soldier ever has occurred. In *Atta capitata*, Latr., which I have observed in great numbers on the Guadalquivir at Seville, as well as in several other places in Spain, labourers with small heads, and soldiers with large, occur also; but, between these, transitional forms are found, which is never the case with our *Ecophthora*. That the soldiers cannot possibly be slaves captured from other nests (a circumstance of known occurrence amongst the Amazon-ants), is proved as well by their very constant occurrence in the pupa and perfect state in the nests of the *Ecophthoræ*, whilst they are never found alone, as by their agreement in all essential organs (in their trophi, antennæ, and legs) with the labourers and females. Such a marked distinction between the two neuter forms as in *Ecophthora* has not elsewhere been observed. Something similar, however, seems to be the case in several species of the Southern Hemisphere, only it has not usually been rightly understood. We have seen above, that in the Train and Driver Ants two forms of neuters are found, and also in *Atta capitata*, Latr., which must not be considered as varieties, but as forms, each of which has its own special and peculiar position in the ant-æconomy. Nay, even amongst several of our own species, attentive observation points

out two forms of labourers ; for example, in *Formica herculeana*, L., and *F. pubescens*, F. ; only the difference is not so striking as in the above-cited species. The same too with the Honey-bee ; for in the same hive smaller and somewhat bigger labourers are found, of which, according to Huber, the former take care of the brood, the latter produce the wax.

At present it is generally held, that the neuters found amongst all these insects which live together in large families are imperfectly developed females ; and one would be led to this view principally by the resemblance of the working-bees to the females (the so-called queens), as well as by the fact, deduced from certain experiments carried on with bees, that in many cases they can make queens out of working-bees' eggs. When indeed a comb full of eggs is introduced from another hive into one without a queen, this last can *sometimes* rear itself a new queen out of it ; but this by no means always happens, and I have myself twice employed this method without any result, which shows that queens cannot certainly be reared from *all eggs* laid in the cells of working-bees. Amongst bees the labourer indeed is very like the queen ; but with ants the difference is very great : in these, not only are the females much larger and winged, but they have an essentially differently formed thorax ; so that it seems quite incomprehensible to me that merely the mode of nutriment should determine such different kinds of individuals, and that it should depend on the labourers whether a female or a labourer should proceed from the same egg. But the explanation is rendered still more difficult by the occurrence of a second form of neuters, differing again as much from the females as from the labourers. In this case we must therefore hold, that ants possess the means of rearing labourers out of some and soldiers out of other eggs,—which appears to us very improbable. Hence we are almost compelled to ascribe the distinction between the females, labourers, and soldiers, not to the skill of the ants in rearing them, but to an original difference ; and consequently to admit, that not only in the male and female individuals, but also in the labourers and soldiers, the difference is congenital. This is borne out by the fact that bifurmed individuals, between labourers and males (cf. *Entomologische Zeit.* 1851, p. 295), have already been discovered, in which one half exactly represents the male, the other half the labourer ; precisely like bisexual individuals in insects, between male and female. Were the neuters undeveloped females, we should not meet with forms like these, but we should rather have forms of transition between neuters and females, which however is never the case. Against this view it may be alleged, I am well aware, that in the animal kingdom only two constantly



different kinds of individuals (male and female) are produced by the parent, to which all other aberrations can be reduced. But reference may here be made to the system of alternate generations, which reaches up into the class of insects (in the Aphides and the Psychidean genus *Talæporia*); and that amongst these, individuals are produced immediately from the female parent (the so-called nurses) which are quite different from the neuters. The neuter ants are to be compared with these; from which however they again recede, in never being capable of reproduction.

## EXPLANATION OF PLATE III.

Representing the four different forms of *Æcophthora pusilla*.

- Fig. I.* The FEMALE.—1. Natural size; 2. magnified ten times; 3. side-view; *a*<sup>1</sup>. the *pronotum*; *a*<sup>2</sup>. the side-piece of the *prothorax*; *b*<sup>1</sup>. the *mesonotum*; *b*<sup>2</sup>. the *scutellum*; *b*<sup>3</sup>. the side-piece of the *mesothorax*; *c*<sup>1</sup>. the first segment of the *metanotum*; *c*<sup>2</sup>. the hinder segment of the same, with the spinules; *d*. the first joint of the abdominal pedicle; *e*. the second joint of the same; 4. the *labrum*; 5. the mandible; 6. the fore-leg; *b*. *tibia*; *c*. the pectinate hook; *d*. the tarsus; 7. the claws.
- Fig. II.* The MALE.—1. Magnified ten times; 2. fore *tibia* with *tarsus*; 3. its hook, more highly magnified.
- Fig. III.* The SOLDIER.—1. Natural size; 2. ten times magnified; 3. side-view, in the attitude of gnawing a piece of meat; 4. mandible; 5. the rest of the *trophi*; *a*. *mentum*; *b*. *maxillæ*; *b*<sup>1</sup>. the *stipes*; *b*<sup>2</sup>. the palpus; *b*<sup>3</sup>. the sheath; *c*<sup>1</sup>. the tongue; *c*<sup>2</sup>. its *palpi*; 6. the last four joints of the antennæ.
- Fig. IV.* The LABOURER.—1. Natural size; 2. magnified ten times; 3. the mandibles; 4. the antennæ; 5. the fore-leg; 6. the claw-joint of the same; 7. the middle leg.

---

XXVIII.—*Notes on Permian Fossils*:—Palliobranchiata. By WILLIAM KING, Professor of Mineralogy and Geology in Queen's University, Ireland (Q. C. Galway); Corresponding Member of the Natural History and Medical Society of Dresden, &c.

(Concluded from p. 269.)

## Family Rhynchonellidæ, Gray, 1848.

## Genus RHYNCHONELLA, Fischer de Waldheim.

IN one of Mr. Davidson's usual valuable papers lately published\*, he has been led to question the existence of the genus *Rhynchonella* during the Permian period. The query evidently has reference to the uncertainty hitherto prevailing as regards the

\* "A few Remarks on the Brachiopoda," Ann. and Mag. of Nat. Hist. Dec. 1855.