

HYMENOPTERA — FORMICIDÆ.

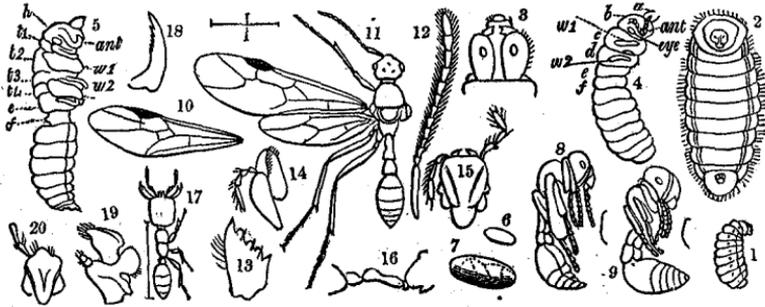
taking any part in the transport of the food: on disturbing the route and killing some of the ants, these individuals hastened to the spot, alarming the others, but gave themselves no concern with their dead companions: when order was restored, the aperture was observed to be guarded by nine of these individuals.*

Independent of the difference of habits in these two kinds of neuters, and of the modifications in their structure according therewith, their development is especially interesting as connected with that of the ordinary neuters. We can, it is true, as yet only employ analogy in considering the subject; but as we know that the neuter bee is produced from ordinary female eggs, the loss of certain characteristics taking place during its development, which the worker bees have the power to prevent, and to restore the larva, which had been destined for an imperfect female (or neuter), to its original normal character,—so in the ant, we may consider not only that the neuter is a modified female, but further, that the inhabitants of the nest have the instinct so to modify the circumstances producing this state of imperfection, that some neuters shall exhibit characters at variance with those of the common kind. It is in the consideration that such a power is possessed by the inhabitants, of thus modifying the larvæ produced from female eggs into three different kinds of individuals, that I find a confirmation of the opinion which I expressed in a preceding page, relative to the development of the different kinds of individuals composing the community of the white ants.

The transformations of *Myrmica rubra* have been carefully traced by Swammerdam (*Book of Nature*, pl. 16.); De Geer has also given very ample details and figures of the various states of different species of *Formica* and *Myrmica*, especially of *F. rufa* and *M. rubra*. (*Mém.* tom. ii. pl. 41—43.) The larvæ have the appearance of small white grubs or worms, destitute of feet; they are short, thick, and somewhat conical, being narrowest towards the head, which is bent

* M. Wesmael has just forwarded to me his notice of a singular Mexican ant, (*Myrmecocystus Mexicanus*), in which the neuters exhibit two still more remarkable modifications of form, some being of the ordinary form of neuter *Formicæ*, whilst in the others the abdomen is swollen into an immense subdiaphanous sphere, produced by the distension of the membrane connecting the abdominal segments. According to the notes of the discoverer of this species, and the observations of M. Wesmael in support thereof, the latter individuals do not quit the nest, are almost inactive, and are occupied only in elaborating a kind of honey, which they subsequently discharge into cells analogous to those of the hive. (*Bull. Acad. Roy. Bruxell.* tom. v. p. 771.)

Fig. 86.



down upon the breast (*fig. 86. 1. larva of F. rufa seen sideways; 2. ditto magnified, seen from beneath, after Ratzeburg*). The body is composed of the head and twelve segments. The head (*fig. 86. 3.*) is furnished with two small horny hook-like pieces, which, although evidently the analogues of the mandibles, are too wide apart to be used as such; below these are four small points or bristles, two on each side, and a subcylindrical, soft, fleshy lobe, which is retractile, and by the assistance of which the larva receives its food from the workers, consisting of a nutritious fluid which they have previously elaborated in their stomach, and subsequently disgorged. Honey dew, and other saccharine fluids collected from different vegetables, probably form its chief base. De Geer, however, records the circumstance, that he had observed the neuters destroy and devour the young larvæ which they had previously guarded with such great tenderness. Possibly their instinct might have inspired them with despair of ever rearing these unfortunate larvæ. A peculiar duty of the neuters consists in removing these larvæ and the pupæ, from time to time, to various parts of the nest, where a proper degree of temperature exists. Latreille has even observed that the neuters of *Myrmica Cæspitum* keep the larvæ and pupæ separate. Dr. F. T. C. Ratzeburg has made the segmental development of these insects the subject of an elaborate memoir, to which I have already alluded (in p. 79.), his chief object being to prove that the head of the pupa is composed of the head and first segment of the larva (the eyes of the pupa being visible through the skin of the hind part of such first segment of the larva), and that the fifth segment of the body of the larva (exclusive of the head) becomes the peduncle of the pupa; the metathoracic præscutum (*fig. 85. 10. t. 4.*) and the metathoracic scutellum (*85. 10. e*) respectively occupying a separate segment of the

body of the larva. My figures 86. 4. and 5. are copied from Dr. Ratzeburg's memoir, and represent the larva at different stages, but near to the period of assuming the pupa state. In *fig.* 86. 4. the eye will be seen at the back of the first segment (b) of the body; the antennæ (ant.) occupying part of this segment, but extending into the head (a); the fore wings (w. 1.) will be observed in the second segment of the body (c); the hind wings on the third segment (d); whilst the fourth and fifth segments (e and f) will be seen to be considerably constricted. In *fig.* 86. 5. the head (h), antennæ (ant.), and eyes of the pupa, are seen to be entirely withdrawn from the head of the larva, and to occupy the first segment; and as the peduncle is still more decidedly seen to occupy the fifth segment (f), it follows that the collar (t. 1.), mesothoracic scutum (t. 2.), and scutellum (t. 3.), and the metathoracic præscutum (t. 4.), and scutellum (e), must be the three intermediate segments. Without intending to express any doubt as to the correctness of Dr. Ratzeburg's actual observations, I cannot admit the theory by which he endeavours to account for the appearances he has described. As already noticed, in p. 79., the necessarily increased size of the head of the imago*, requisite for the support of organs to be employed by an insect in searching for its own food (whereas in the larva state there was no need of highly developed trophi, the insect being fed by others, and that merely with a thickened liquid), together, also, with the equally necessarily increased size of the mesothorax requisite for the support of the large pair of fore wings, and the consequent decrease in size of the prothorax and its collar, must equally necessitate a diversity of size in the segments of the pupa (although still invested in the larva skin); hence we find the head so much increased in size, that it is pushed back so as also to occupy the first segment of the larva; the prothorax (t. 1.), on the other hand, is so reduced in size, that it cannot be said to occupy a segment of itself; so that we may either consider it as forming part of the first segment with the head, in which case no anomaly will exist, the head and prothorax of the pupa occupying the head and first segment of the larva, or we may regard it as part only of the second segment, the remainder being occupied by part of the mesothorax of

* I am happy to learn from the most able entomotomist our country has yet produced, G. Newport, Esq., that my view of this subject is fully confirmed by the nervous system of the animal at the period of its undergoing these changes, in his forthcoming article, "Insect," in the *Cyclop. of Anatomy*.

the pupa, which is the proper view of the subject; but as the wing-bearing segments of the pupa are necessarily increased in size, it follows that they are also pushed backwards, so that the peduncular scale (f), instead of occupying the fourth segment of the larva, in effect occupies the fifth (exclusive of the head). It may, indeed, be asserted, that as the body of the imago possesses two or three segments fewer than exist in the body of the larva, we may suppose that the loss of one of these segments takes place, at least, in this manner, and in this part of the body. This, however, can only be done by admitting that the head and three thoracic segments of the imago are composed of five larva-segments, instead of four, an admission negatived by all analogy with pedate larvæ; but Ratzeburg does not even imply this, because *fig.* 86. 5. is that of a male, as is proved, not only by the abdomen being 7-jointed, but also by the existence of the exerted male organs of generation.

The larvæ of those species of ants which are destitute of a sting enclose themselves ordinarily in an oval cocoon, of a dirty white colour (often mistaken for the eggs of the ants), marked at one end with a black spot, which corresponds with the hinder extremity of the body of the enclosed insect; this cocoon is composed of a very slender parchment-like envelope, formed of fine threads, spun by the larva, as Leuwenhoeck expressly describes; and is sufficiently delicate, when placed in spirits, to allow the limbs of the pupa to be seen through it (*fig.* 86. 7. cocoon of ♀; *fig.* 86. 6. ditto of ♂ *Formica fusca*). The larvæ of those species which are furnished with a sting do not thus encase themselves in a cocoon, the pupa being entirely naked, and at first white, but afterwards assuming a darker colour. *Formica fusca*, our common small brown garden ant, has afforded me many opportunities of confirming Latreille's curious statement, that sometimes the pupæ are naked, and at others enclosed in a cocoon. The precise reason for this difference has still to be ascertained. The pupa exhibits all the organs of the imago, with the limbs laid along the breast; those of the neuters being, of course, destitute of rudimentary wings (*fig.* 86. 8. pupa of *Myrmica rubra* ♂; *fig.* 86. 9. ditto ♀). As the period draws nigh for the development of the imago, the workers gnaw a hole at one end of the cocoon, in order to form a passage for the pupa; which, having its various limbs enclosed in separate but very delicate pellicles, possesses the power of moving them immediately previous to casting off this pellicle, and of making its escape out of the cocoon; immediately after which it disengages its

limbs from their sheaths, its wings extend, its colours become darker, and in a very short time it assumes all the characters of the imago.

It would be impossible, and indeed out of place, in a work like the present, to enter into the details of the history, manners, and economy of these tribes, which vary in almost every species, and of which so much has been written. Those who would learn the details of these interesting subjects should consult the admirable memoir of Huber, the monograph of Latreille, or the second volume of the *Introduction to Entomology*, in which the greater portion of the seventeenth letter is devoted to this family. Herein, and in other general works, such as those of St. Fargeau, De Geer, &c. (Ray, in his *Philosophical Letters*, has also given many interesting details relative to the habits of these insects), we find detailed accounts relative to the swarming of the sexes; the duties of the impregnated females; the various labours of the neuters; the language, or mode of communicating the knowledge of various facts amongst the latter; their wars and combats*; the exceeding fondness of ants for the saccharine fluid emitted by the Aphides and Cocci, termed honey dew; and the pains which they take in securing it, by regularly milking the Aphides†, which they even imprison in their nests; the emigrations of their surplus population; the attempts of the latter, when established in their new habitations, to induce others to join them; their nocturnal labours (and

* These wars generally take place between the *neuters* of the same species inhabiting nests near each other, the individuals from each distinguishing, by some strange instinct their own companions; but occasionally between neuters of different species. T. W. Bond, however, asserts, that a battle lasting an entire day was observed between *winged* ants flying in the air, one army consisting of black and the other of red ants. (*Ent. Mag.* vol. iv. p. 221.) I apprehend, however, that this was only the ordinary swarming of a nest for the union of the sexes. (And see *Mag. Nat. Hist.* No. 18.; and Hanhart, *loc. cit. supra*, translated in *Time's Telescope*, 1829, p. 111.)

† Huber has particularly described the mode in which this is performed, observing that during the autumn and spring months many species of ants keep a brood of Aphides in their nests, guarding the eggs of the Aphides with the greatest care. (See also Gen. Hardwicke, in *Zool. Journ.* No. 13., "On the Loves of the Ants and Aphides," and *Mag. Nat. Hist.* No. 12. May 1830.) Their fondness for sweets of every kind is indeed well known, and Col. Sykes has given a remarkable case of instinct, in which an Indian species (*F. indefessa Sykes*), contrived to make its way to a sideboard of sweets by swimming over the water in which the legs of the table were immersed, and even leaping from the wall upon the table. (*Trans. Ent. Soc.* vol. i.) See further Drury's account of the ravages of ants in tropical climates, especially upon saccharine matters, chiefly from information given to him by Smcathman. (*Illustr. Exot. Ent.* vol. ii. p. 80. 2nd edit.)

see Kirby, in *Trans. Ent. Soc.* vol. i. p. xxv.) ; their singularly constructed tracts ; their great perseverance and strength * ; their repose, and diversions during their moments of relaxation, &c. : whilst in the first volume of the *Introduction* we find numerous notices of the injuries which they occasionally commit ; the devotion and behaviour of the neuters to the eggs, larvæ, and pupæ, and the various modes of formation of the nests, are also therein fully described.

The exotic species, it is true, although affording many singular forms, have been but slightly studied in respect to their habits ; indeed, on the contrary, much evidently fabulous matter has been published respecting them.

Some of these exotic species are of a comparatively large size, exceeding an inch in length ; and the forms of many of them are exceedingly singular, some having an enormously large head ; others have the jaws disproportionately long ; in some the thorax is armed with numerous spines, whilst in others this part of the body and the peduncle of the abdomen are composed of a series of elongated knots.

The species of these insects inhabiting the tropical parts of the world are not only larger, but far more numerous, both in the number of species and of individuals, than those of our countries. This is especially the case in the vast elevated plains in the interior of South America, where the largest of the species of birds and Mammalia which subsist entirely upon ants, such as the *Myrmecophaga jubata*, *Dasypus giganteus*, destroy them in inconceivable numbers. M. Lund, indeed, supposes that in these climates, from their great agency in removing obnoxious matter, they become the representatives of various other families of insects, such as the *Carabidæ*, *Necrophaga*, and other carnivorous species, which are but rarely met with. Indeed, the inhabitants of Rio Janeiro sometimes even introduce them into their dwellings, in order to rid them of the visits of the Cupion, as the *Termitidæ* are named, considering that there is a natural antipathy between these two tribes. M. Lund, however, mentions an instance in

* The pertinacity of these insects, in their attacks upon others many times exceeding them in size, is extraordinary. I have often seen large preserved beetles, &c., to which a minute ant was attached by its jaws, having chosen to die rather than let go its hold. In this manner *Formica elongata Oliv.* seizes, "et d'une manière opiniâtre," the antennæ and legs of a green *Melolontha* of *Tranquebar*, and I have myself captured a bee on the wing, to the extremity of one of the tarsi of which the head alone of an ant remained fixed by the jaws, the body of the ant having evidently been torn off, without the insect quitting its hold. W. W. Saunders has met with a similar instance.

which a colony of ants and of white ants were established in the same abode; but that, on disturbing the nest, the ants attacked the workers of the white ants, which they perhaps considered as the authors of the mischief. General Hardwicke, however, expressly mentions that the ants in India are formidable enemies to the white ants, each ant seizing and carrying off its victim whenever opportunity occurs for so doing. (*Zool. Journ.* No. xiii. p. 114.) On the other hand, however, their ravages upon the vegetable productions of those countries are far more to be dreaded; as in the instance of the attacks of *Formica saccharivora* Linn. upon the sugar canes in the island of Grenada, whereby the cultivation of that plant was entirely put a stop to, and a reward of 20,000*l.* offered for an effectual mode of destroying the ants. (Castle, in *Phil. Trans.* vol. xxx. p. 346., quoted by Kirby and Spence, vol. i. p. 186.) See also Guilding (in *Mag. Nat. Hist.* No. 27.), on the ants of the West Indies; and an article in the *Entomol. Mag.* (vol. iv. p. 108.), of the "plague of ants" in New Spain, from Herrera's *Decades*; likewise an article on the same subject in the *London Magazine*, October, 1827.

The Jesuit Dobrizhoffer, in his work (*De Abiponibus*, vol. ii. p. 375., quoted by Perty, *Delect. An. Art. Bras.* pref. p. 23., and translated in *Nat. Hist. Ins. Fam. Library*, vol. i. p. 37.), has given a detailed account of the astonishing devastations of the ants in Paraguay. The conical earthen nests of one of the species, which abounds in the plains of that country, are three or more ells high, and as hard as stone; and he adds, "Tumulos illos pyramidales prius solerter cavatos Hispani pro furno ad coquendum panem adhibent aliquando; nonnunquam eos commolunt ac in pulveres redigunt, qui rite aqua subacti ad parimentandas domos egregie valent." We cannot, unfortunately, determine the species in question. The Portuguese have an old saying, that the ants are the queens of Brazil, in order to indicate their universal powers of destruction. Pohl and Kollar also mention various obnoxious Brazilian species, especially *Atta cephalotes*; the female of which is, however, eaten by the natives. (*Vorzugl. Hist. Ins. Bras.*) Dobrizhoffer also mentions the same fact, as well as Azara (p. 198.), and also Barrère. (*Ess. Hist. Nat. France Æquin.* p. 197.) Lander also informs us that ants, stewed in butter, are eaten by the natives of Yariba, in Africa. (*Journ. Second Exped. into Interior of Africa*, 1829.) Drury also mentions the same fact. In our own country, an exceedingly minute species (*Myrmica domestica* Shk.) has re-

cently proved exceedingly troublesome, infesting the houses in some parts of London and the suburbs, Brighton, &c., to such an extent, that the inhabitants have been compelled to quit their abodes. (See Bostock, in *Trans. Ent. Soc.* vol. ii. p. 66., for various details and experiments for its destruction.)

The account given by Madame Merian of the annual visits of immense swarms of the visiting ant (*Atta cephalotes*) from house to house, in South America*, and of their habit of forming large troops, each individual carrying a piece of a leaf in its jaws, was long considered fabulous, but has since been fully confirmed by Homberg, Smeathman, Hancock, Stedman, and Lund, the two last-named authors having been eye-witnesses to the entire defoliation of a tree by this species, which is thence called the parasol ant in Tobago. Lund has particularly described their mode of operation, and has also observed these marches extended through several days.

A species of this family, sufficiently common in France (*F. rufescens* Latr., forming the genus *Polyergus*), constitutes a remarkable exception to the remainder of the family, in respect to its habits. This species, which Huber names the Amazon ant, is distinguished by the structure of its mouth, provided with slender simple jaws; whereby it is rendered incapable of constructing its nest, and attending to the duties of the community (which are in a great degree performed by the latter organs). They are therefore under the necessity of forming themselves into large armies, and of attacking the nests of *Formica fusca* and *cunicularia*, their object being to carry off the pupa; the insects hatched from the latter acting, in all respects, as their slaves; and as they are brought to the imago state within the nests of the Amazons, they do not feel the desire to quit their masters, but labour for the support of their abode as though it were their own; increasing

* M. Lund states that he never observed a species of the restricted genus *Formica* migrating, or marching in close columns, in Brazil; and that the migratory species, and those which form these compact columns, belong to the section which have the abdominal peduncle formed of two nodes, and the antennæ unconcealed.

† The fact of these Amazons carrying off only neuter pupæ seems to me to offer a more striking instance of instinct; for were they to introduce a single male or female pupa into their own nest, the consequences may be easily conceived. As it is, the proceedings of these neuter slaves, acting for their masters and their progeny with as much tenderness as they would exhibit to their own species, seems to prove that their labours are but the effect of circumstances, independent of any sense of philoprogenitiveness, as already suggested in p. 181. The situation of these slaves, toiling in a strange territory for strange masters, might at first

the size of the nest, provisioning the young, &c., whilst the Amazon ants are completely free from these duties. St. Fargeau, indeed, sees in the proceedings of these insects the perfection of instinct †; asserting that the Amazon ant is able to perform all the requisite labours itself, but, from a love of luxurious idleness, it adopts a plan for having them performed by slaves. But Huber, who discovered and closely studied the details of their history, expressly tells us that the Amazons “n’ont d’autre occupation et d’autre talent què celui de la guerre” (*Réch. Fourm.* p. 234.); and in a subsequent page he relates an experiment, in which the greater part of a number of Amazons, placed in a glass case with their pupæ, died from want; but that a single *F. fusca* introduced into the case restored order, preserved the lives of the remainder, and raised a number of the young brood. Thus these Amazon ants ought, to a great extent, to be considered as analogous to the parasite bees, &c.; and if the *habitudes morales* of the Hymenoptera are to be considered as of primary importance in the distribution of the order, these Amazons ought surely to be removed from the working species.

Huber also discovered that a species of *Formica* (*F. sanguinea*), which Stephens gives as a species found near London, larger than the *Polyergus rufescens*, makes slaves of the same two species as the latter: unlike them, however, they share the labours of the nest with their slaves; and it would even seem that both species of slaves are met with in the ant hills of the sanguine ants; and Huber even brought up *Polyergus rufescens* and *Formica sanguinea*, which are both slave-makers, with *F. fusca*, in one common dwelling.

M. Lund also observed a Brazilian species of *Myrmica* (*M. paleata Latr.*), which was assisted in the affairs of its nest by the neuters of another species of the same genus (*M. erythrothorax Lund*). He also discovered a thick column of another species, forming a new genus (*Ancylognathus lugubris L.*), loaded with the larvæ and pupæ of ants, and which he considered as a party returning from a maraud-

sight appear lamentable; but when we recollect that these slaves have been born in this state, without knowing any thing of a different state — that of freedom; that they toil not more laboriously for their masters than they would do for their own relatives if they were free; that they suffer no privations of repose or food; that they are even permitted to watch over the rearing of some of their own community; and, moreover, that the state of society dependent upon the structural peculiarities of the *Polyergus* requires their presence in the nests of the latter, — we are induced to hesitate before we exclaim with Sterne — “Still slavery; thou art a bitter draught.”

ing excursion, rather than changing their abode, because many of the ants themselves were mutilated. (*Ann. Sc. Nat.* June 1831.)

I have above alluded to the habits of our indigenous ants of obtaining a supply of honey dew from the Aphides and Cocci; but the exotic species of the family do not confine themselves to these tribes; since, in General Hardwicke's drawings of Indian zoology, now in the British Museum, I have observed several representations, in which ants are in the act of milking the larvæ of various species of Cercopidæ; and M. Lund has also noticed the same in a Brazilian species *F. (Dolichoderus Lund) attelaboides Fab.*, which thus attaches itself to the larvæ and pupæ of *Cercopis* and *Membracis*. He observes, however, that this is probably owing to the entire absence of Aphides in the interior of the country (although they are occasionally found near Rio Janeiro; where, however, they had, in all probability, been imported with plants from other parts of the world). He also once found the larva of a *Fulgora* in an ant's nest. I may here mention having repeatedly found many very young individuals of a perfectly white colour, belonging to species of *Oniscus**, in the nests both of *Formicæ* and *Myrmicæ*; and M. Lund noticed a column of *Myrmica typhlos*†, many of the specimens of which carried an *Oniscus* beneath the abdomen, the latter holding itself in that position by its short hooked legs, which gave the *Myrmica* a most singular appearance. Latreille also noticed *Onisci* creeping about at will in the nests of *Formica rufa*. On disturbing the nests of *Formica fusca*, I have almost invariably observed an extremely minute fly, belonging to the genus *Trineura Meig.*, hovering over the nest, as though it had also been disturbed, and darting at times upon the ants.

The habits of the singular Brazilian genus *Cryptocerus* are quite unlike those of the rest of the family. They are solitary idle creatures, fixing themselves all day long in the middle of a leaf, and when alarmed, retreating slowly sideways to the under side of the leaf. How far it is correct to assert, with Lund, that they are in no degree social, and the care of the young depends on the females, the neuters being entirely useless, has yet to be ascertained. Pohl and Kollar inform us that a large species of this genus emits a liquid which stains the flesh for several days.

* The same fact is also mentioned by Mr. Knapp (*Journal of a Naturalist*, p. 304.). Various Coleoptera, also (g. *Claviger*, *Batrisus*, *Myrmecixenus*, &c.), inhabit ant's nests. See Chevrolat, in *Silberm. Rev. Ent.* No. 17.

† This species is blind, a peculiarity which Lund thinks has some influence in the selection of their lucifugous companions.

whole shape, and the gradual disappearance of ocelli, no two insects can be more unlike than *Formica* and *Tenthredo*; whilst the latter, and even the true *Trichoptera*, are furnished with ocelli.

The third and last division of the subsection *Prædones* consists of the wasps, termed *DIPLOPTERYGA** by Kirby (*Diploptera* † *Latr.*), from the wings being folded throughout their entire length when at rest

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* Mr. Kirby (*Faun. Bor. Amer.* p. 263.) has altered Latreille's name, the termination *ptera* being used for orders alone.