



<http://www.biodiversitylibrary.org/>

An introduction to the modern classification of insects; founded on the natural habits and corresponding organisation of the different families. By J. O. Westwood.

London, Longman, Orme, Brown, Green, and Longmans, 1839-1840.

<http://www.biodiversitylibrary.org/bibliography/12455>

v. 2: <http://www.biodiversitylibrary.org/item/45812>

Page(s): Title Page, Page 216, Page 217, Page 218, Page 219, Page 220, Page 221, Page 222, Page 223, Page 224, Page 225, Page 226, Page 227, Page 228, Page 229, Page 230, Page 231, Page 232, Page 233, Page 234, Page 235, Page 236

Contributed by: Smithsonian Institution Libraries
Sponsored by: Smithsonian

Generated 29 March 2012 9:51 AM

<http://www.biodiversitylibrary.org/pdf3/010170300045812>

This page intentionally left blank.

QL
468
W53X
V12
ENT

AN
INTRODUCTION
TO
THE MODERN CLASSIFICATION
OF
INSECTS;

FOUNDED ON
THE NATURAL HABITS AND CORRESPONDING ORGANISATION
OF
THE DIFFERENT FAMILIES.

By **J. O. WESTWOOD, F.L.S.**

HON. MEM. LIT. HIST. SOC. QUEBEC ; MEM. SOC. CÆS. NAT. MOSCOW ; PHYSIOGR. SOC. LUND ;
SOC. ROY. SCIENC. LILLE ; SOC. HIST. NAT. MAURITIUS ; SOC. CUVIER. PARIS ;
PLIN. SOC. EDINBURGH ; LIT. PHIL. NAT. HIST. SOC. BELFAST, RICHMOND, SHEFFIELD ;
MEM. SOC. ENTOMOL. DE FRANCE ; SECRETARY ENT. SOC. LONDON, ETC.

“ Empirici, *formicæ* more, congerunt tantum et utuntur : rationales, *aranearum* more, telas ex se conficiunt : *apis* vero ratio media est, quæ materiam ex floribus horti et agri elicit ; sed tamen eam propria facultate vertit et digerit.” — BACON, *Nov. Org.* lib. i. aph. 95.

IN TWO VOLUMES.

VOL. II.

LONDON:
LONGMAN, ORME, BROWN, GREEN, AND LONGMANS,
PATERNOSTER-ROW.

1840.

Griffin, F. J.
see: Proc. Roy. Ent. Soc. London,
6(3): 83-84 (1932) for
dates of parts

rylus *Fab.* and Labidus *Jur.*, consisting of insects of which males only have yet been observed, but differing from the remainder of the family in the antennæ being inserted close to the mouth, the head small, and the abdomen long and nearly cylindric. Saint Fargeau appears to regard them as more nearly related to the ants.* (*Hist. Nat. Hym.* p. 225.) The basal segment forms a strong knot. The maxillæ and labium, undescribed by Latreille and St. Fargeau, are extremely minute. Mr. Burchell has informed me that the African species of Dorylus is nocturnal in its habits.

The second division† of the predatory Aculeata corresponds with the genus Formica of Linnæus, and the HETEROGYNA of St. Fargeau ;

* Such also is the opinion of Mr. Kirby. (*Monogr. Apum Angliæ*, vol. i. p. 224.)

† BIBLIOGR. REFER. TO THE FORMICIDÆ.

Latreille. Essai sur l'Hist. des Fourmis de France, 1 fasc. 12mo. Brives, An. 6. (1798.) — Ditto, Observ. sur la Fourmi fongueuse *Fabr.*, in Bull. Soc. Philomat. tom. ii. 1799. — Ditto, Hist. Nat. des Fourmis, 8vo. Paris, An. 10. (1802.) — Ditto, Descript. d'une Nouv. Esp. de Fourmi, Bull. Soc. Philomat. tom. iii. (*F. coarctata.*) — Ditto, on Insects living in society, in Mém. du Muséum, tom. iii. — Ditto, in Humboldt's Work on South America. (*F. bellicosa*, with details, pl. 36.)

Leach. Descriptions of 13 sp. Formicidæ, Zool. Journal, vol. ii.

Huber (P.). Recherches sur les Mœurs des Fourmis indigènes, 1 vol. 8vo. Paris, 1810. (English Translation, 8vo. London, 1820.)

Bosc. Rapport sur l'Ouvrage de Huber, 8vo. Paris, 1813.

*Losana.*¹ Saggio sopra le Formiche indigène de Piemonte, in Mém. Acad. Royal Sc. Turin, tom. xxxvii. 1834; and in Guérin, Bulletin Zool. p. 50.

Lund, in Annales Sci. Nat. June, 1831. (Habits of Brazilian Ants.)

Sykes, in Trans. Ent. Soc. vol. i. (Habits of Indian Ants.)

Klug, in Entomol. Monogr. (10 sp. *Cryptocerus.*)

Carri and Soninere. Gesch. der Ameisen. (Naturk. Verh. Amsterdam, 1 Thl.)

Needham. Obs. Hist. Nat. de la Fourmi, Mém. Acad. Bruxelles, tom. ii.

Lochner. Sciagraphia Myrmecologiæ Medicæ, in Ephem. Nat. Curios. Dec. 11. An. 8.

¹ The first part only of this memoir, containing the Piedmontese ants (27 in number, 6 being *new*), described after the neuters alone, is here published. The author proposed to publish a more extended memoir; but his recent death will, in all probability, prevent this intention from being realised. I may here mention, that M. Brullé proposes to publish a monograph upon this family.

but, as Latreille, who proposed the latter name, also introduced the Mutillidæ into the group, I have thought it more correct to give it a distinct name, SODALES (or PHILOPONA *K.*), founded upon the circumstance, not only that the insects are social in their habits, but also because the larvæ are not enclosed in separate hexagonal cells as in the wasps and typical bees.

The single family, FORMICIDÆ, is composed of the well known and singularly interesting tribes of ants (which must not however be confounded with the Termitidæ or white ants), and which are distinguished by their habit of residing in more or less numerous societies underground; whence arises the necessity for a great number of individuals having the sexual organs and instincts rendered abortive, whereby, being freed from the latter, they are the better fitted to perform the labours of the community, for which purpose they are moreover destitute of wings; whilst the males and females are much less numerous, possessing wings, and being produced only for the propagation of their species.

The males have the body small, with the antennæ and legs long and slender (*fig.* 85.* 1. *F. fusca* ♂ 2—5. details of this sex); the females, on the other hand, far exceed their partners in size, with the antennæ and legs shorter and thicker (*fig.* 85. 6. *F. fusca* ♀ 7—10. details of this sex). Both these kinds of individuals are furnished with wings

Gould. Account of English Ants. 12mo. London, 1747.

Wilde. De Formicâ. Rome, 1612. pp. 100.

King. Observations concerning Emmets or Ants, their Eggs, &c. (Philos. Trans. 1767.)

Dorthes. Notice sur un phénomène occas. par une Espèce de Fourmi, Journal de Physique, tom. xxxvii.

Hanhart. On the Combats of Ants, in Zeitschrift de Basler Hochschule, 1825, and, in Bulletin de Ferussac, May, 1826.

Hardwicke. Observations on the Loves of the Ants and Aphides. Zool. Journal, vol. iv.

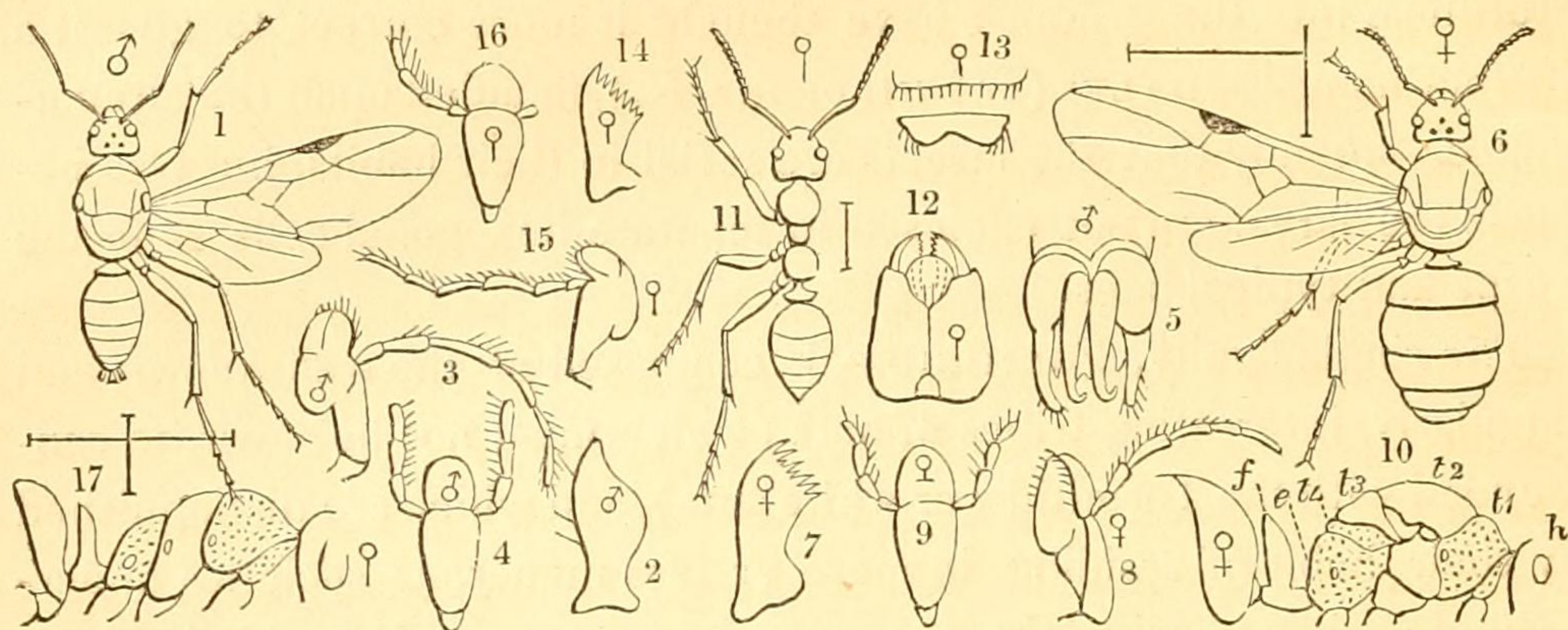
Bostock, in Trans. Ent. Soc. vol. ii. p. 65. (*Myrmica domestica* *Shk.*)

Shuckard, in Mag. Nat. Hist. Nov. 1838. (n.sp. *Myrmicæ*.)

Dryander. Cat. Bibl. Banks. (Ants, Emmets, *Formicæ*.)

Fabricius, Jurine, Rossi, Spinola, Saint Fargeau. (Hist. Nat. Hymén.)

* In the various figures upon this block (85.), I have given a comparative representation of the different organs, particularly of the trophi, of the three kinds of individuals of which each species is composed. No similar comparative details have been given by previous authors. The individuals figured were from the same nest.

Fig. 85.

and ocelli, and the thorax is continuous, *i. e.*, not exhibiting any contraction in the middle; the workers or neuters are somewhat smaller than the males, with antennæ resembling those of the females, being thickened to the tips; but they are destitute of ocelli: the thorax is more or less contracted in the middle (*fig. 85. 11. F. fusca* ♀ — 12—17. details of this kind of individual).

The head, including the mandibles, is more or less triangular, broader behind than the thorax in the neuters, but somewhat narrower in the males and females; the antennæ have the basal joint greatly elongated, sometimes equalling half the length of the antennæ, these organs being strongly elbowed at the extremity of this joint; they are very slender, and 13-jointed, in the males (*fig. 86. 12.*). The eyes are lateral*, not reaching to the posterior margin of the head, and rounded; the ocelli are more distinct and larger in the males than in the females; the mouth occupies a semi-oval incision on the front of the under side of the head (*fig. 85. 12.*); the labrum of the

* Latreille has described a minute species (which I was the first to discover as an indigenous insect), *Ponera contracta*, the neuters of which are to all appearance entirely destitute of eyes; Latreille having examined many specimens, both dead and alive, without being able to discover these organs; only twice, with a strong lens, he fancied he saw a darker coloured spot in the place of the eyes. It is found under stones, and at the roots of plants; its little assembly not consisting of more than six or seven individuals, being incapable of undertaking those measures which its more gifted brethren perform. (*Mém. Fourm.* p. 43. 197. 270.) Rennie mentions some particulars respecting this species (*Insect Miscell.* p. 118.); Latreille also described another blind species from South America, having a large head, with two knots in the abdominal peduncle. My *fig. 86. 17.* represents another species (*Typhlopone fulva* ♀ *Westwood*), in which I cannot detect the slightest vestige of an eye. It was found dead in sugar, by C. C. Babington, M. A., &c.: another blind species was observed by Lund, in Brazil, which he thence named *Myrmica typhlos*.

neuters is horny, strongly emarginate, and introduced perpendicularly between the mandibles (*fig.* 85. 13.); the mandibles are horny, large, and powerful, varying in the sexes as well as in the different species: in many they are somewhat spoon-shaped, but obliquely truncate at the tip, and multidentate. Such is their character in the females (*fig.* 85. 7.) and neuters (*fig.* 85. 14.) of *F. fusca*; but in the males of this species they are not toothed, but produced into a terminal point (*fig.* 85. 2.). In some males, however, they are also toothed, as in the other sex (*fig.* 86. 13. mand. of *Stenamma* (*W.*) *Westwoodii* (*Steph. Cat.*); whilst in the neuters of *Typhlopone fulva* *W.* they are somewhat sickle-shaped and serrated on the inner edge (*fig.* 86. 18.). In the neuters of others they are very long, linear, and deflexed at the tip.* In *Myrmecina*, they are said by Curtis to be wanting in the males. The maxillæ are coriaceous, small, and terminated by a broad, rounded, thin lobe, which defends the sides of the labium; the maxillary palpi vary in the number of their joints from six to two. In *Myrmica* and *Formica* they are 6-jointed and of considerable length, scarcely varying in the sexes (*fig.* 85. 3. max. ♂, 85. 8. max. ♀, 85. 15. max. ♀ *F. fusca*). In *Atta* and *Cryptocerus* they are scarcely as long as the maxillæ, and 5-jointed (*Hist. N. Fourm.* p. 33.). In *Polyergus* and *Ponera* there are five or four joints, and in *Myrmecina Latreillei* and *Stenamma Westwoodii*, four (*fig.* 86. 14.). In *Pheidole providens* *Westw.* (*Atta* p. *Sykes, Trans. Ent. Soc.* vol. i. pl. 13. f. 5.), and *Typhlopone fulva* *W.* (*fig.* 86. 19.), I have only been able to detect two joints in the maxillary palpi. The mentum is small, corneous, and cup-shaped; the labium membranous and rounded, but often, especially in dried specimens, it shrinks into the mentum. In the three kinds of individuals of *F. fusca* (*fig.* 85. 4. labium ♂, 85. 9. ♀, 85. 16. ♀), there is no material difference in these parts, nor in the labial palpi, which in that genus are 4-jointed: in *Polyergus rufescens*, *Myrmecina Latreillei*, and *Stenamma Westwoodii*, they are 3-jointed (*fig.* 86. 15.); whilst in *Atta cephalotes*, *Pheidole providens*,

* From the important share which these organs take in performing the duties of the individuals, especially of the neuters, it is evident that their various forms imply a diversity of habits with which we are, however, unfortunately, in many cases ignorant: thus, in *Polyergus*, which does not labour, but compels the species which it has made its slaves to perform its work, the mandibles are slender and destitute of teeth; and *Latreille* mentions two kinds of neuters in *Eciton hamata*, with different shaped mandibles, adding — “forte horum neutrorum officia pariter diversa.” (*Gen. Crust. &c.* vol. iv. p. 129.)

and *Typhlopone fulva* *W.*, they are only 2-jointed (*fig.* 86. 20.). The thorax is very variable in its shape, especially in the neuters; its composition differs also according to the presence or absence of wings; in the winged individuals the collar is large (*fig.* 85.* 10. ♀, h the head, t 1 collar), the mesothoracic scutum (t 2) and its scutellum (t 3) distinct from each other; the metathoracic præscutum (t 4) and its scutellum (e) also distinct, the collar and the metathorax exhibiting a spiracle on each side. In the neuters, however (*fig.* 85. 17.), the composition of the thorax is quite simple, consisting of the three segments quite distinct from each other, and each provided with a spiracle on each side.

The abdomen of the males is composed of seven segments, but in the females and neuters of only six; the first, and in some genera also the second (as in *fig.* 86. 16.), forms a lenticular scale or knot, varying in form, and serving as a peduncle to the abdomen. Some of these species, especially those which have only a single scale, are destitute of a sting†, and in such case the abdomen is larger in the females than in those species which are armed with that instrument, which exists invariably in those species which have the peduncle formed of two knots. The males of the former species have the abdomen more trigonate, whilst in the latter it scarcely differs in form from that of the females. The external sexual organs of the males of *Formica fusca* are represented in *fig.* 85. 5. The wings are of large size, and of a delicate texture; they exist only in the males and females; they are furnished with much fewer cells than in the wasps, &c., and the veins of the wings are often irregular: thus, in the wing of *Myrmica* (*fig.* 86. 10.), a vein will be perceived to terminate abruptly in the middle of the first submarginal cell. The legs are of moderate or considerable length; they are generally simple, unfurnished with fossorial ciliæ, with the tarsi 5-jointed.

* In figures 85. 10. & 17. the prothorax and metathorax are dotted, to distinguish them from the mesothorax. A comparative examination of these two figures with those given in previous pages of the composition of the thorax of other Hymenoptera will, I think, most satisfactorily prove that the hind part of the thorax is not, as asserted by Audouin and Latreille, the anterior segments of the abdomen soldered to the real thorax.

† Those species which are destitute of a sting are provided with glands placed near the anus, which secrete and discharge a peculiar fluid, which has been termed formic acid, the composition of which, according to Berzelius, is as follows: — hydrogen, 2.84; carbon, 32.40; oxygen, 64.76 = 100.

See also Blot, in *Mém. Soc. Linn. Calvados*, vol. i.; and *Zool. Journ.* No. 4.

These insects have attracted the attention of the observers of Nature from the earliest time ; and their untiring exertions for the welfare of the community, their devotion to the young, and their carefulness in the collection and storing up of various materials, have led to their being regarded as examples of surprising instinctive foresight : thus Virgil says —

“ — parcum genus est, patiensque laboris
Quæsitique tenax et quod quæsitæ reservet.”

Solomon, however, more explicitly informs us of the reason for this solicitous accumulation ; teaching at the same time a profound moral lesson : “ Go to the ant, thou sluggard, consider her ways, and be wise ; which having no guide, overseer, or ruler, provideth her *meat* in the summer and gathereth her food in the harvest.”* (Proverbs vi. 6, 7, 8.). By various commentators and naturalists, however, who considered this passage with reference only to the proceedings of our northern species of ants, (the males and females of which perish towards the end of the autumn, and the neuters remain in a torpid state through the winter,) it has been contended that there were no real grounds for considering that these insects do lay up food for consumption during the winter (the supposed grains of corn having been shown by Gould to be the grain-like cocoons of the insect) ; whilst others have endeavoured to reconcile the statement with the habits of our indigenous species : thus Kirby and Spence (*Introd.* vol. ii. p. 47.) contend that the words do not imply a storing up of food for future use, but merely that the ant gathers the food most suited for its use during the most plentiful season. Latreille, on the other hand, considers that this foresight has for its object the augmentation and defence of the nest against the storms of winter, the stores consisting merely of building materials, and not of food.

I would, however, adopt, in preference to either of these views, that previously given by the former authors ; namely, that the observation can only apply to the species of a warm climate, the habits of which are probably different from those of a cold one. St. Fargeau, indeed, states that in mild winters he had seen ants at large in every month ; and Colonel Sykes, in his history of *Pheidole providens* *W.*

* This ancient opinion was supposed to be confirmed by the instinct asserted to be possessed by the insects of preventing the grain stored up from vegetating, by depriving it of its corculum ; but more careful observers discovered that the gnawing open of one end of the grain-like cocoon had been mistaken for the former operation.

(*Trans. Ent. Soc.* vol. i. p. 103., *Atta* p. *S.*), has clearly proved that this Indian species collects so large a store of grass seeds as to last from January and February, the time of their ripening, till October; having observed, on the 13th of the latter month, these insects engaged in bringing up their stores of seed to dry it after the closing thunderstorms* of the monsoon; and M. Lund observes, that the species of ants in Brazil, instead of disappearing during the three months of winter, appear rather to augment in their numbers in consequence of the great migrations which take place during those months. *Dolichoderus attelaboides* *L.*, however, which subsists upon the saccharine fluid secreted by the *Cercopidæ*, retires to its nests during those months, evidently in consequence of there being none of the last-named insects during that season from which it might obtain a supply of food.

There are many peculiarities in the history and development of these insects, which require a more careful investigation than has hitherto been given to them. Our countryman Gould, and the Swiss naturalist Huber, have indeed made us acquainted with many of the secrets of the formicary, to which I can but very slightly allude. The nests are generally made underground, but they differ considerably as to their construction: some species (*F. fusca*, &c.) merely remove the particles of earth, thereby forming large chambers and tunnels, to which our railway-tunnels offer but a poor comparison; others (*F. rufa*, &c.) collect great quantities of materials, consisting of bits of straws, sticks, &c., heaped up into a conical mass, well known under the name of ant hills, the interior of which, notwithstanding its rough outside, exhibits an admirable arrangement: others, again, construct them of earth, similarly elevated, many of the cells being above, and others below, the surface of the earth: others, again (*F. fuliginosa*), construct them in the trunks of old trees, which they gnaw into numberless stories; and others use sawdust in forming their buildings, stiffening it into a kind of *papier maché*. *F. flava* (*Formica bispinosa* *Oliv.* *fungosa* *Fab.*), an inhabitant of Cayenne, constructs its nests of the cottony matter enclosed in the capsules of *Bombax*, forming it into a spongy mass (*Latr., Hist. Nat. Fourm.* p. 134.; *Lescalier, Tabl. Cayenne* p. 151.), very serviceable as *amadou*, or as a material for stopping the most

* It may, however, be observed, first, that a very large quantity of grain remained after the season of dearth was over (leading to the supposition that it had not been employed for food); and, second, that the known nutriment of ants consists of animal and vegetable *fluids*, and not of grain.

violent discharges of blood. M. Lund has described a species of *Formica* (*F. merdicola* *L.*), which constructs its nest upon the stems of reeds at some distance from the ground, or upon the spiny trunks of some kind of palm trees, using in its construction the dried excrement of horses and mules. Colonel Sykes also describes a species (*Myrmica Kirbii* *S.*, *Trans. Ent. Soc.* vol. i.), which attaches its nest to the branches of trees and shrubs, composed of a multitude of thin folia of cowdung imbricated like the tiles upon a house, the upper folium covering the whole upper part like a skull-cap. The neuters throw the abdomen over the back, or, when alarmed, carry it in an upward situation: such is also the case with *Formica elata* *Lund*, which builds its nests on the trunks of trees, of earth mixed with leaves. Spix and Martius (*Reise*, vol. iii. p. 1283.) mention a species of ant which forms its nest of minute hairs of the leaves of one of the melastomaceous trees; and also that *F. molestans* *Latr.* (*nana* *D. G.*) makes a small globose nest of very minute hairs of plants in the oblong vesicles of *Marieta*, and in the inflated petiole of *Tococa*.

A green ant, which inhabits New South Wales, was observed in Captain Cook's voyage, which form their nests sometimes as large as a man's head, in trees, by bending down the leaves and gluing the tips together (*Hawkesworth, Account of Cook's First Voyage*); and in the *Saturday Magazine* (No. 330. Aug. 26. 1837.), in an anonymous account of the habits of the ants of New South Wales, it is stated that a very small ant in the Bungo Forest builds nests of indurated clay, eight or ten feet high, whilst the large red and black ants (evidently species of *Myrmecia* *Fab.*) reside in nests scarcely raised above the surface of the ground. They are able, however, to bite and sting with great violence.

Throughout the greater portion of the year the community consists only of neuters, but during the summer the males and females are produced in considerable numbers: these are detained prisoners in the nest for a certain time, until a favourable day, or more commonly a warm still afternoon, when they make their escape, and take flight in great swarms, flying into the air, where the union of the sexes takes place: soon after this the males perish, but the females, descending to the earth, immediately tear off their own wings and commence the establishment of a new colony, or are seized and forcibly detained by the neuters for the maintenance of the old habitation. They then commence laying their eggs, which are very minute (but increase in size previous to the bursting forth of the larva); and, according to

Gould (p. 35.), those which are destined for the necessary supply of future females, males, and neuters, are deposited at three different periods. We are ignorant, however, of the peculiar circumstances by which the abortiveness of the neuters is effected. In the hive bee this is known to be produced by the female larvæ being fed with a less nourishing kind of diet than that which is given to the larvæ which are to produce fruitful females or queens; but the differences which exist between the female and neuter ant are far more striking than those between the queen and worker bees. In the ants, for instance, not only are the organs of sex obliterated in the workers, but they have a thorax of a totally different form from that of the females, and are moreover destitute of wings; the period when this loss of the wings and modification in the form of the thorax takes place, is probably simultaneous with that when the sexual organs are rendered abortive; but the circumstances connected therewith, although of great physiological interest, have not been yet observed. Another peculiarity also exists; namely, that certain individuals, few in number, amongst the neuters, are of a larger size, and furnished with much larger heads than the ordinary workers.* These individuals were first observed by Gould, and subsequently by Latreille; and they appeared to the former to be equally employed in the labours of the nest with the ordinary workers, although Huber could not ascertain their office in the nests of *F. rufescens*. According to M. De la Cordaire, these specimens (at least in a South American species allied to *Atta cephalotes*) appeared to be employed as defenders of the nests, and in capturing in their excursions. I have already also alluded to the existence of two kinds of workers belonging to the *Eciton hamata*; and Latreille has noticed other species in which he has found this “variété constante,” especially in *F. structor*, the difference in size between the two kinds of neuters of the latter being so great that they would be mistaken for different species. We are, however, indebted to M. Lund for a more precise notice of the employment of these few large-headed neuters in a Brazilian species of *Myrmica*. Having observed a column of ordinary neuters issuing from an aperture in the ground, each loaded with food, he perceived that the aperture was guarded by four of these large-headed individuals, a few of which were also noticed in the column, but not

* A similar circumstance also occurs amongst the neuters of the hive bees. Huber has named the smaller individuals “abeilles nourrices,” and the larger ones, which secrete wax, “abeilles cirières.”

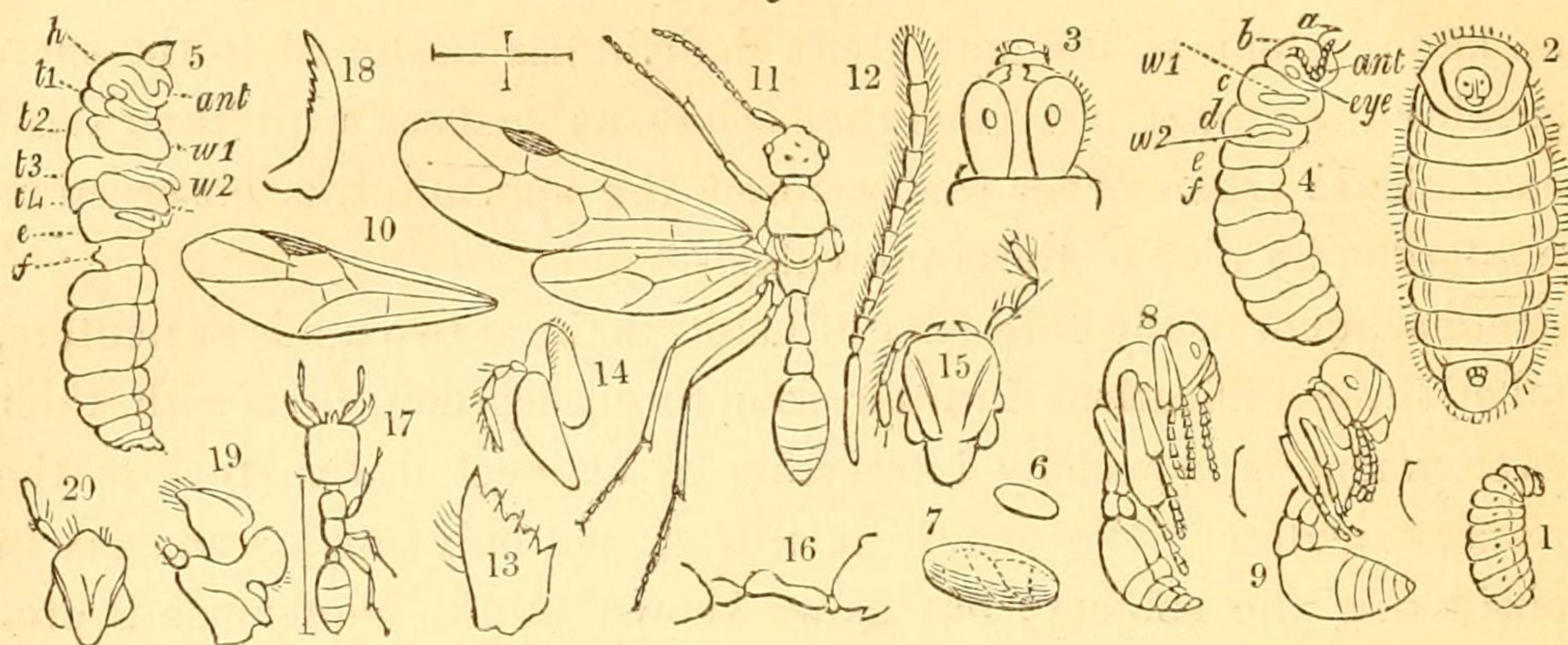
taking any part in the transport of the food: on disturbing the route and killing some of the ants, these individuals hastened to the spot, alarming the others, but gave themselves no concern with their dead companions: when order was restored, the aperture was observed to be guarded by nine of these 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. 85. 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 Smeathman. (*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 que 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.

M. Lund concludes his exceedingly interesting memoir by describing a singular genus, which he considers should be placed at the end of this family, and of which he had detected five or six species, neuters only having been observed with the antennæ elbowed, and with the abdominal peduncle formed into two nodes; but differing from all the known ants in the eyes, which occupy nearly the whole of the head. They are solitary, creeping upon the trunks and leaves of trees; they sting sharply. Latreille proposed for them the generic name of *Pseudomyrmex*.

This family of insects constitutes an exceedingly natural and isolated group amongst the Hymenoptera, &c., of which the natural affinities are very difficult to determine. Latreille, as above stated, considered them as nearest allied to *Mutilla*; and if we regard the structural peculiarities alone of the apterous individuals of these two groups, we certainly find many characters in common. Compare, for instance, *Methoca* ♀ with *Formica* ♀; the latter, in its want of wings, ocelli, and sting (three of the great characters of the order), being a far less perfect animal than the former. But when we examine the true nature of the ants, and especially the characters of the females, together with their social economy, we must award to the ants a relation with the more typical Hymenoptera, as the bees and wasps. It is true that, comparatively speaking, they do not exhibit so elaborate a species of economy as is shown by the type of those groups; but their habits are quite as elaborate, for instance, as those of *Bombus*. In placing them between the true Fossores and the solitary Fossorial wasps, I am aware that I am apparently violating nature, and such is the opinion of St. Fargeau; but until the difficult question as to the precise importance to be given to the *habitudes morales* of these insects over their *general structure* is determined, I have preferred adopting the arrangement of Latreille's most valuable work. As to the relations of the ants with the beetles and Tenthredinidæ amongst the Trichoptera, as suggested by Mr. MacLeay (*Horæ Ent.* p. 370.), I cannot conceive them to be entitled to any weight; indeed, that author has himself shown his opinion of the former relation, by stating, in a subsequent page, that *Stylops* (which he thinks nearest allied to the Chalcididæ) is the link between the Coleoptera and Hymenoptera; and as to the latter, suggested with the view of proving that the true Hymenoptera are allied to the Trichoptera (amongst which he places the Tenthredinidæ), and founded on the supposed similarity of their

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

* BIBLIOGR. REFER. TO THE *DIPLOPTERYGA* IN GENERAL.

- Réaumur.* Hist. des Guêpes, Mém. Acad. Sc. Paris, 1779., and in his *Mémoires*.
Latreille. Observ. sur quelques Guêpes, Ann. Mus. d'Hist. Nat. tom. i. 1802. — Ditto, in Mém. du Mus. tom. xi. 1824. (*Vespa Licheguana*.) (Abstracts of ditto, in Zool. Journal, No. 5. ; and in Ann. Sci. Nat. vol. iv.)
Müller (P. W. J.). Beytr. zur Naturg. der grossen Hornisse (*V. Crabro*), in Germar's Mag. d. Ent. vol. iii.
Garvie. On the great brown Hornet of New South Wales, Edinb. New Philos. Journal, April 1828 ; and in Bulletin de Ferussac, June 1829 ; and Mag. Nat. Hist. No. 2. (with Observations on the hexagonal form of the cells.)
Wesmael. Monogr. des Odynères de la Belgique, 8vo. Bruxelles, 1833. — Ditto, Premier Supplément, 1836. — Ditto, Deuxième Supplément, 1837. (Extracted from the 4th vol. Bull. Acad. Royale de Bruxelles.)
Guérin. Iconographie du Règ. Anim. ; and in Voyage de Coquille et de Belanger.
Shuckard, in Mag. Nat. Hist. Sept. 1837. (*Odynerus lævipes*.) — Ditto, Trans. Ent. Soc. vol. ii. pl. 8. (*Paragia*.)
Klug, in Entomol. Monograph. (Monogr. *Ceramius*.) — Ditto, in Weber and Mohr's Beitrage, vol. i. (*Pterocheilus*.)
Fonscolombe, in Ann. Soc. Ent. France, 1835. (*Ceramius Fonscolombei*.)
Cuvier, in Bull. Soc. Philomat. tom. i. 1797. (*Vespa nidulans* and *tatua*.)
Felton, in Phil. Trans. 1764. (n. sp. wasp.)
Bartram, in Philos. Trans. No. 493. (Great black wasp from Pennsylvania.) — Ditto, in ditto, vol. liii. (Yellowish wasp of Pennsylvania.)
Steiglitz. Abh. von Raubbienen. (Berl. Wochenb. Rel. 1775.)
Cloquet. Sur les Guêpes. (*V. vulgaris*, *Crabro*, et *gallica*, Extrait de la Faune des Medecins, 8vo.)
Ricord Madiana. De la Guêpe végétante de la Guadeloupe. (Journal de Pharm. Mars, 1829.)
Watson. Relatio de Ins. quod Musca vegetabilis dicitur (in Philosoph. Trans. vol. xiii.).
Schmid. Naturgesch. der Hornisse, &c., in Gemein Nutz. Arb. der Bienenges. in der Oberl. b. i. 5. 84.

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