

The chaff is taken out and thrown beyond the limits of the paved area.

"During protracted wet weather, it sometimes happens that the provision stores become damp, and are liable to sprout and spoil. In this case, on the first fine day the ants bring out the damp and damaged grain, and expose it to the sun till it is dry, when they carry it back and pack away all the sound seeds, leaving those that had sprouted to waste.

"In a peach-orchard not far from my house is a considerable elevation, on which is an extensive bed of rock. In the sand-beds overlying portions of this rock are fine cities of the Agricultural Ants, evidently very ancient. My observations on their manners and customs have been limited to the last twelve years, during which time the enclosure surrounding the orchard has prevented the approach of cattle to the ant-farms. The cities which are outside of the enclosure as well as those protected in it are, at the proper season, invariably planted with the ant-rice. The crop may accordingly always be seen springing up within the circle about the 1st of November every year. Of late years however, since the number of farms and cattle has greatly increased, and the latter are eating off the grass much closer than formerly, thus preventing the ripening of the seeds, I notice that the 'Agricultural Ant' is placing its cities along the turn-rows in the fields, walks in gardens, inside about the gates, &c., where they can cultivate their farms without molestation from the cattle.

"There can be no doubt of the fact, that the particular species of grain-bearing grass mentioned above is intentionally planted. In farmer-like manner the ground upon which it stands is carefully divested of all other grasses and weeds during the time it is growing. When it is ripe the grain is taken care of, the dry stubble cut away and carried off, the paved area being left unencumbered until the ensuing autumn, when the same 'ant-rice' reappears within the same circle, and receives the same agricultural attention as was bestowed upon the previous crop,—and so on year after year, as I know to be the case, in all situations where the ants' settlements are protected from graminivorous animals."

In a second letter, Dr. Lincecum in reply to an inquiry from Mr. Darwin, whether he supposed that the ants plant seeds for the ensuing crop, says, "I have not the slightest doubt of it. And my conclusions have not been arrived at from hasty or careless observation, nor from seeing the ants do something that looked a little like it, and then guessing at the results. I have at

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all seasons watched the same ant-cities during the last twelve years, and I know that what I stated in my former letter is true. I visited the same cities yesterday, and found the crop of ant-rice growing finely, and exhibiting also the signs of high cultivation, and not a blade of any other kind of grass or weed was to be seen within twelve inches of the circular row of ant-rice."

In his second letter Dr. Lincecum proceeds to give some account of what he terms the "Horticultural Ant," which appears to be identical with the "Cutting Ant," *Æcodoma mexicana*, Sm., described by Mr. S. B. Buckley in the 'Proceedings of the Academy of Natural Sciences of Philadelphia,' 1860, p. 233*; but as his account does not contain any important additional observations, it is here omitted.

Mr. Buckley also describes (*l. c.* p. 445), the "Agricultural" or "Mount-making Ant," although his account of its habits will be found to differ in several respects from that given by Dr. Lincecum.

Descriptions of some New Species of Ants from the Holy Land, with a Synonymic List of others previously described. By FREDERICK SMITH, Esq., Assistant in the Zoological Department, British Museum. Communicated by DANL. HANBURY, Esq., F.L.S.

[Read April 4, 1861.]

THE ants which form the subject of the present paper were collected in Syria and Palestine by Dr. J. D. Hooker and Mr. Daniel Hanbury, during a visit of a few weeks to those countries in September and October last. The species, though only ten in number, are part of a fauna replete with interest: all the productions, in fact, of the Holy Land are so worthy of our attention, that he who adds even the smallest number of species to the list does not work in vain.

I am not prepared to say how many, or even if any, of the species of Ants forming the present list have been recorded as indigenous to Palestine; but in one or two cases the knowledge of the geographical distribution of ants is rendered highly interesting. Not only do we here find species common to Southern Europe, but in *Formica brunnea* and *Tapinoma erraticum* we recognize insects found even in the vicinity of our own metropolis. A few observa-

* A notice of this paper will be found in the *Annals & Mag. Nat. Hist.* 3 ser. vi. p. 386.

tions on the habits of one or two species are added in the hope of contributing to the dissemination of a knowledge of the marvellous history of the economy of this most interesting family of insects.

Fam. FORMICIDÆ, *Leach.*

Gen. FORMICA, *Linn.*

FORMICA COMPRESSA. *F. nigra*, thorace compresso, antennis apice femoribusque rufis, capite maximo.

Formica compressa, *Fabr. Ent. Syst.* ii. 353. 2.; *Latr. Fourm.* p. 111.

This species is found in Egypt, in most parts of India, in China, and I have also seen examples from the Philippines. The *worker major* differs greatly in form from the *worker minor*; it is nearly seven lines in length, is black, with the base of the legs pale red, its head being larger and wider than the abdomen. The other form of the worker is smaller, the thorax and legs pale, the head oblong and narrower than the abdomen, the latter being frequently more or less pale at the base. Taken on the north shore of the Dead Sea.

FORMICA VIATICA. Sanguinea, opaca, antennis pedibusque rufobrunneo; abdomine nigro-fusco.

Formica viatica, *Fabr. Ent. Syst.* ii. 356. 27; *Syst. Piez.* p. 404. 33. ♀.

—*Formica bicolor*, *Fabr. Ent. Syst.* ii. 351. 5; *Syst. Piez.* p. 398.

♂.—*Formica megalochola*, *Foerst. Verh. d. naturh. Ver. d. Rheinl.*

vii. 485. ♀.—*Cataglyphis Fairmairei*, *Foerst. Verh. d. naturh. Ver. d.*

Rheinl. vii. 485. ♂.—*Monocombus viaticus*, *Mayr, Form. Austr.*

p. 110. 1.

This ant and the *Atta cephalotes*, according to the information that I have been able to obtain, are usually, if not always, found in the same localities; and it would appear that, in some degree, they are dependent on each other. It is now a well-ascertained fact, that other species, in the fulfilment of their economy, require the aid of a distinct race, or rather are dependent on slave-labour for the rearing of their young brood, and for the performance of many other offices connected with the duties of their formicarium.

The connexion between the *F. viatica* and *Atta cephalotes* appears to be similar to that which exists between *F. sanguinea* and *F. fusca*. The substance of the following account was communicated by M. Roussel to Dr. Nylander. M. Roussel observes that both species are common in Algeria, that they live in numerous societies, and construct their formicaria usually in banks, frequently at road-sides. It would appear that fierce combats take place occasionally between the *Formica* and the *Atta*, the former being always victorious, and carrying off captive numbers of the *Atta*, which henceforth become the nurse-slaves of *F. viatica*. M. Roussel frequently observed evidences of fierce encounters between these species of ants, having found the ground in the vicinity of the nests of the *Atta*

strewed with the mangled remains of both combatants; but he does not appear to have ascertained whether the *F. viatica* carries off the *Atta* in the pupa or perfect condition. Probably the former, since, judging from analogy, it would appear necessary that such should be the case, as under such circumstances the *F. fusca* in the nest of *F. sanguinea* appears to form, as it were, an absolutely necessary part of the community. Probably such perfect individuals as are sometimes carried off by slave-making ants, are not intended to form part of the living population. Mr. Bates, who resided several years in Brazil, communicated to me some very interesting accounts of the habits of various predaceous species of ants. Not only did he observe the slave-makers carrying off pupæ from the nests of more peaceable communities, but he also witnessed the slaughter of the defenceless species—their furious assailants tearing the larger and more weighty females limb from limb, and then carrying away the mangled remains to their own habitations. Such, probably, is the fate of such living examples as may be frequently observed vainly struggling with their more warlike invaders.

M. Roussel observed *Atta cephalotes* in great numbers, living in perfect harmony, in the nests of *F. viatica*.

FORMICA BRUNNEA. *F. fusco-nigra*, cinereo-micans; antennis pedibusque pallide testaceis; squama leviter emarginata.

Formica brunnea, Latr. *Fourm.* p. 169, pl. 6. fig. 35. ♀.—Formica timida, Foerst. *Hym. Stud. Form.* p. 35. 15.

A most widely distributed species, being found in England, France, Germany, Austria, Italy, Algeria, and also in Palestine. Specimens from North America have also been examined, which I am unable to separate from this species.

FORMICA BIPARTITA. *F. operaria*. Rufo-ferruginea; metathorace spinis duabus acutis minutis; abdomine nigerrimo nitido.

Worker. Length 2 lines. The head, thorax, and legs rufo-ferruginous, smooth and slightly shining, the eyes black; the thorax much compressed behind; the metathorax obliquely truncate, concave above; the lateral margins acute, terminating posteriorly in an acute angle, or short spine; the scale of the peduncle oblong, notched above, inclining forwards, and fitting into the oblique slightly concave truncation of the metathorax: when viewed sideways, it is wedge-shaped; the abdomen ovate, and shining black.

I at first sight mistook this very distinct, and apparently undescribed ant, for a species belonging to the genus *Myrmica*, to many of which it bears a strong resemblance. In size, general form, and more particularly its spinose metathorax, it approaches the *Myrmicidæ*; but its having a single scale, or node, at once points out its situation to be amongst the *Formicidæ*. I much regret having only workers for examination; and although upwards of thirty were captured, not one possesses an antenna. Had all the sexes been before me, I have a strong impression that this

species would have been found to form a new genus, intermediate between *Formica* and *Myrmica*. Future observation and research will probably supply the materials for deciding this interesting question.

Gen. TAPINOMA, *Foerst.*

TAPINOMA ERRATICA. *T. nigro-fusca*, nitida, glabra; pedum articulis tarsisque pallidis; squama oblonga depressa.

Formica erratica, *Latr. Hist. Nat. Fourm.* p. 182.—*Tapinoma erratica*, *Smith, Brit. Fourm.* p. 111. 1.

The collection contained a single example of this species. Its coming from so distant a locality created a doubt of the possibility of its being identical with the species found in this country and throughout Europe; but after the most attentive examination having been given to it, I acknowledge my inability to detect the slightest difference between them.

Fam. MYRMICIDÆ.

Gen. MYRMICA, *Latr.*

MYRMICA JUCUNDA. *M. fusco-nigra*, nitida; mandibulis antennis pedibusque articulis et tarsi rufo-pallescentibus.

Worker. Length $1\frac{1}{2}$ line. Brownish black, very smooth and shining; the mandibles, anterior portion of the head, the antennæ, tarsi, and articulation of the legs pale testaceous; the eyes small and placed midway at the sides of the head. Thorax narrowed posteriorly, with the division between the meso- and metathorax strongly impressed; the metathorax with two very minute spines; the first node of the abdomen, when viewed sideways, is wedge-shaped, the second globose. Abdomen subovate, widest towards the apex.

MYRMICA GRACILLIMA. *M. rufo-pallida*, lævis, nitida; abdomine nitido nigro.

Worker. Length $1\frac{1}{2}$ line. Pale rufous, smooth and shining; the head oblong, rather wider than the abdomen; the mandibles stout and armed with four black acute teeth on their inner margin; the eyes small, ovate, and placed in the middle at the sides of the head; club of the antennæ 3-jointed; the antennæ as long as the head and thorax. Thorax compressed, the division between the meso- and metathorax strongly impressed; the metathorax unarmed. Abdomen ovate, black, smooth and shining; the nodes of the peduncle pale rufous, the first elevated above the second; when viewed sideways, wedgeshaped, with the apex blunt, the second globose.

There is a certain similarity in the habit of this small ant that induces me to think it quite possible that it may be only a very diminutive form of the worker of *Atta barbara*.

MYRMICA PUNICA. *M. rufo-pallida*; capite longitudinaliter delicatule striato; metathorace parvo, acuto, dentiformi.

Worker. Length nearly $1\frac{1}{2}$ line. Pale red, the legs and antennæ palest; the flagellum of the latter with 3 joints in the club; the head wider than the abdomen, delicately striated longitudinally; the mandibles stout, striated, and furnished with 4 or 5 black teeth on their inner margin; the eyes small, black, and situated about midway at the sides of the head. Thorax, the anterior margin transverse; the division between the meso- and metathorax strongly impressed; the metathorax armed with two short acute spines. Abdomen smooth and shining; the nodes ovate and shining; the thorax and abdomen with a few erect pale hairs.

Gen. ATTA, *Fabr.*

ATTA BARBARA. (*Formica barbara*, *Linn. Syst. Nat.* i. 962. 2; *Fabr. Ent. Syst.* ii. 356. 26; *Syst. Piez.* p. 403. 30.—*Formica binodis*, *Fabr. Syst. Piez.* p. 405. 39; *Latr. Fourm.* p. 285.—*Formica juvenilis*, *Fabr. Syst. Piez.* p. 405. 38.—*Myrmica capitata*, *Losana, Form. Piem.* p. 325.—*Formica capitata*, *Latr. Fourm.* p. 234. pl. 10. fig. 66. ♀ c. ♀ a.—*Atta capitata*, *St. Farg. Hym.* i. 173. 1.)

This ant is one of the most widely distributed species; it is also one which varies greatly in colouring; hence has arisen the confusion which the above synonym exhibits. The *F. barbara* of Linnæus is a form of the species which has the head and antennæ red; the *F. juvenilis* of Fabricius is a black variety. The *A. capitata* of Europe, according to Nylander and Mayr, varies from individuals totally black to others having the head and legs red, with the thorax more or less obscurely so. These observations apply to the worker only; the male is, I believe, always black; the female is sometimes, but rarely, as highly coloured as the worker. The numerous specimens from Palestine exhibit various shades of coloration; the majority being, however, more highly coloured than any which I have seen captured in Europe. The head, thorax, legs, and in some instances, the nodes of the petiole also are entirely bright red; of those taken in Jerusalem, some are highly coloured, whilst others are quite black. The species has not been discovered in England, but it is common in many parts of France, Germany, Austria, Hungary, Dalmatia, Italy, Sardinia and Sicily; I have also received it from Portugal. The nests of this ant are frequently much infested by a myrmecophilous beetle, *Pycnidium testaceum*.

ATTA STRUCTOR. (*Formica structor*, *Latr. Fourm.* p. 236.—*Formica lapidum*, *Fabr. Syst. Piez.* p. 406. 49 ♂.—*Formica rufitarsis*, *Fabr. Syst. Piez.* p. 406. 45. ♀.—*Atta structor*, *St. Farg. Hym.* i. 174. 2.—*Myrmica structor*, *Nyland. Form. Cr. et d'Algér.* 85. 10, Div. 2.)

This species has not been found in England, but is scattered over great part of Europe, having occurred in France, Italy, Germany, Austria, Dalmatia, and Switzerland; it has also been found in Algeria.