

HYMENOPTERA.



NOTES ON VARIOUS SPECIES OF APIDÆ, FORMICIDÆ,
FOSSORES AND VESPIDÆ; WITH OBSERVATIONS ON
SOME OF THE PARASITES ON THE LATTER.

BY FREDERICK SMITH.

NOT a single species has, to my knowledge, been added to our indigenous Bees, Wasps, or Formicidæ, during the present season of 1870; it is true that I shall announce the discovery of an additional species of Ant, but that was captured in the year 1866. I have myself, and no doubt other entomologists have been congratulated upon the fine season we have enjoyed; our friends, who so kindly expressed their pleasure, did so in the certain assurance that a fine season ensured an abundant entomological harvest; but we, who have been blessed by the enjoyment of many fine summers, have ascertained by repeated experiences, that what is generally understood of a fine season, by no means ensures a prolific entomological one.

Having visited the Suffolk coast at, and in the neighbourhood of Lowestoft; paid several visits to Southend; spent five weeks on the coast of North Devon; and made an excursion to Tenby, on the coast of South Wales; also, in the month of June, having had an opportunity of entomologizing in Warwickshire, I have perhaps had a more extensive range, during a single season, than I ever previously enjoyed. Notwithstanding these facilities, I have experienced

the most unsuccessful campaign that ever fell to my lot; the results will, however, add a few crumbs to our entomological banquet.

In the neighbourhood of Warwick I did not meet with a single Hymenopterous insect that is not common in the London district; but I am led to the belief, that the Coleopterist would fare better, the district being beautifully wooded and in many respects a charming locality.

My visit to Lowestoft yielded nothing that has not been recorded as occurring there in former volumes of the Entomological Annual. I had, however, a particular purpose in visiting this locality, but my hopes were doomed to disappointment. I have recorded my endeavours in former years to discover, by rearing the insect from the caterpillar, the male of the Tenthredo, *Eriocampa ovata*; an insect found throughout Europe, described by Linnæus, very plentiful occasionally in this country as well as on the continent; but of which no one has been successful in discovering the male. I have usually taken the insect about the latter part of July and during the month of August, at which period the larvæ are abundant, feeding upon the alder. I have twice reared a considerable number of *Eriocampa* from the caterpillar; on one occasion about fifty, and subsequently upwards of a hundred, the whole of which have proved to be females. I therefore thought I would visit the locality a few weeks earlier; I did so, but I found only the female sex. The male has, therefore, yet to be discovered, and I still think the most likely way for doing so is by rearing large numbers from the caterpillar state.

My visit to North Devon enables me to add three species of *Apidæ* to the list published in last year's Annual, *Andrena spinigera*, *Megachile maritima* and *Celiowys vectis*. The first species was taken near to Ilfracombe; the *Megachile*

and its parasite were both captured at Woolacombe Sands, in Morte Bay, in August last. And I may incidentally mention that I picked up on these sands, in the month of October, two specimens of *Aphodius lividus*; at the same time thousands of the *A. contaminatus* were scattered there by a strong land breeze.

I can only add one species, *Ceropales maculata*, to my last year's list of N. Devon *Fossiores*, this was found in the same locality as the former insects.

To the list of *Vespidæ* I can add the Hornet, *Vespa crabro*; I saw numbers of the workers busy capturing flies on the flowers of the ivy in the month of October.

Last year I recorded the capture of many specimens of the local insect, *Tiphia femorata*, and I observed that they were all of a much larger size than any I had found in Surrey or Kent; this season I found the species equally abundant, but they were uniformly one-third smaller than last year's captures; these smaller examples occurred at Ilfracombe, the larger ones were found at Woolacombe Sands.

I do not know with certainty, but observation has led me to believe, that *Tiphia* is a parasite upon *Aphodius*. Every entomologist knows that the *Aphodius* is found commonly in the droppings of horses and cows, and I have repeatedly found *Tiphia* under those of cows, when the heat has dried up the moisture and when the droppings may be turned over as if they were pieces of bark or turf. It may be argued that the *Tiphia* merely resorted to such a situation for shelter from the sun's heat, but this fossorial insect appears to revel in the most intense heat, and is found active, and apparently enjoying itself most, when the heat is greatest; at such times it sometimes swarms on the flowers of the wild carrot (*Daucus carota*), or on those of the samphire (*Crithmum maritimum*). I have never had the means of digging beneath the

dried-up droppings when I have observed *Tiphia* under them, neither have I ever seen *Tiphia* enter the holes down which the larvæ of *Aphodius* had burrowed when full fed and about to undergo their change to the pupa state; but I have seen *Tiphia* just within the holes, and, having done so on several occasions, I am led to think it highly probable that it will some day be found that *Tiphia* is the parasite of *Aphodius*. I am otherwise totally ignorant of its habits.

I remarked that the specimens of *Tiphia* taken at Ilfracombe were uniformly much smaller than those taken at Woolacombe; this circumstance I believe to be attributable to a more scanty supply of food; probably at Woolacombe the larvæ had fed upon that of a large species of *Aphodius*, those at Ilfracombe having been nourished upon a smaller one.

I have a species of ant to add to the British Formicidæ; and when I call to mind that, limited as my opportunities of research have been for some years past, yet notwithstanding I have added *Formica congerens* and *F. sanguinea*, for in old collections the latter species was represented by varieties of *F. rufa*, the true *F. sanguinea* being discovered by myself at Blackwater in Hampshire; I have also added *F. exsecta* and *F. umbrata*, *Ponera punctatissima*, *Myrmica lippula* and *M. fugax* to our list;—this convinces me that, if entomologists were to collect the Formicidæ, particularly in the more northern parts, our list of British ants would soon be materially increased.

I have failed to discover the common wood ant near Ilfracombe, although I still think it must inhabit some of the woods in that district; probably those at Lee, which I have not visited. At Lynmouth the species is common enough in the woods leading up to Water's Meet; at this latter spot I may notice that *Formica fusca* is extremely abundant under

the large flat stones that lay about just at that point; but what is most worthy of notice is the fact that about the middle of August, the time I visited the spot, none of the larvæ of this ant had enclosed themselves in cocoons, a similar circumstance I never observed in the London district. I have before found the pupæ naked in the Isle of Wight, in which instance the nest was also under a stone. At Water's Meet this was the case in every instance.

This circumstance would appear to indicate the habit of a species distinct from the universally distributed *Formica fusca*; it was, however, undoubtedly the latter insect, well known as one that usually encloses itself in a silken cocoon, when the larva becomes full grown and about to change into the nymph state. I am therefore led to ask the question, were the larvæ, reared under stones, destitute of the fluid necessary for spinning the cocoons? or, being protected by the flat stones from vicissitudes of the weather, therefore the cocoon became unnecessary, and they desisted from spinning one? now, if so, would it be necessary that these larvæ should discharge this fluid before changing to the nymph state? Larvæ and pupæ were mixed together in every stage of development. These nests of *F. fusca* swarmed with the Myrmecophilous beetle, *Atemeles emarginatus*; they were also equally abundant in nests of *Myrmica ruginodis* and *M. lævinodis*.

The presence of these parasitic *Coleoptera* in ant's nests still requires investigation; what is their mission? Many species found in such situations are undoubtedly intruders, the situation either furnishing some kind of sustenance or a comfortable habitat in which to take up their abode; but there are others, such as *Lomechusa*, *Myrmedonia*, *Dinarda*, *Atemeles* and *Claviger*, that must in some way contribute to the economic uses of the ants; all these are carried by them

into their nests, and are also borne off by them when their nest is disturbed; this, I think, conclusively determines their being advantageous inmates in some way or other, and probably all of them in the same way as *Claviger* has been observed to be by P. W. J. Müller, who, in "Germar's Magazin der Entomologie," states that he observed the ants imbibing a secretion emitted by *Claviger* from orifices situated at the sides of the abdomen where the little tufts of hair are observable; the ants, Müller informs us, nourish the *Claviger* with honey extracted from flowers. I have repeatedly found *Claviger testaceus* in nests of *Formica flava*, most abundantly so in the month of April, at which time I have also noticed in the same nests quantities of oblong black eggs. After several failures, I at length succeeded in breeding from these a species of *Aphis*, with mottled wings; the specific name I was unable to ascertain. I succeeded in rearing this *Aphis* by covering the bottom of a small tin box with mould pressed down, upon which I placed the eggs and covered them with damp moss; by placing this in the sun for warmth, taking care never to allow it to become dry, I succeeded in rearing the *Aphis*.

The species of *Myrmica*, new to the British list, which I have now to add to our Fauna, is *M. Kollari*, the *Tetramorium Kollari* of Mayr. Dr. Roger, in his Catalogue of Genera and Species of Ants, published in the "Berlin. Ent. Zeitschrift" (1863), reduces Dr. Mayr's species to a synonym of the *Formica guineensis* of Fabricius, of course an African insect; at the same time he also reduces a species which I described, from Panama, under the name *Myrmica reticulata*. I know nothing of Fabricius's insect, but think it highly improbable that a species common in Austria should be the same as that from Guinea; but I am quite satisfied that the Panama species is distinct, although very

similar, but when placed side by side the distinctions are obvious.

The British specimens of *Myrmica Kollari* were taken by Mr. J. Brewer at Sheerness in 1866. These specimens I had lost, as I believed, but a few weeks ago they were sent to me to name by Mr. Nicholas Cooke, to whom I had sent them inadvertently when forwarding other insects. *Tetramorium Kollari* is of the same size as the common *Leptothorax acervorum*, and at first sight looks very like it; but it has 4-jointed maxillary palpi; *Leptothorax* has them 5-jointed; in both the labial palpi are 3-jointed. The most obvious distinctions, those indeed which will at once serve to separate the species, are, first, the colour of the head; in *L. acervorum* it is black or dark brown, in *T. Kollari* it is palish red, the same colour as the thorax. Another distinction is, that the former insect has the head very delicately striated longitudinally, whilst in the latter it has a number of longitudinal carinæ, between which it is coarsely punctured; the thorax is also rugosely punctured; the antennæ are entirely pale, the club in *L. acervorum* is blackish.

This addition increases the number of our British ants to thirty-three; for we regard *Pheidole levigata* and *Myrmica domestica*, both species found in houses, as imported insects; this will make the number of undoubted British ants thirty-one.

Cynips lignicola.—The male sex of this gall-fly has yet to be discovered; I had hoped to have announced it as a discovery this season, having had the first chance of breeding it that has ever occurred to me.

It is generally known among entomologists, that the late Mr. Benj. Walsh succeeded in obtaining males of an American species, *Cynips spongifica*; specimens of both the sexes

he kindly forwarded to me, at the same time giving an account of the course to be pursued in order to secure a chance of obtaining males. It is necessary, in the first place, to obtain a large quantity of the galls just at the time when they are becoming hard and woody, before a single fly has arrived at maturity—certainly before any have escaped from the galls. For three successive years I have searched for such an opportunity, and this summer it fortunately occurred to me. Last summer I visited Ilfracombe, and, in a wood about two miles from that place, I found a part that had been cleared of the trees and underwood; I observed many stumps of oaks, from which vigorous shoots were springing, but not a single gall was to be found on them at that time. This summer I visited the wood again, and was delighted to see an abundance of galls; when I first saw them they were green and pulpy—this was at the beginning of August. As I intended remaining the entire month at Ilfracombe, I felt assured that I had dropt upon a golden opportunity for investigation. I watched the galls occasionally, until I found, on opening a few, that the perfect insects might shortly be expected to issue from them. I then commenced collecting and securing them in a number of fine net bags—in all, I collected 4,410 galls. During the third week of August the flies began to appear, and from that time up to the beginning of November they continued to do so, in greater or less numbers, this being accelerated or retarded by the warmth or coolness of the temperature. Out of the 4,410 galls only 1,562 gall-flies have been developed, the whole being of the female sex.

Mr. Walsh informed me, that he had some seasons bred as many as 2,000 flies, all of which proved to be females; for, he added, males do not appear to be developed every season—such had been the result of his own expe-

rience. I have, on previous occasions, bred many hundreds of these gall-flies, but always from galls collected either in September, October, or in early spring, and from such it appears there is not the slightest chance of obtaining males. I own to being greatly disappointed this season, but the failure, in my own case, may perhaps stimulate others to follow up the subject, and I hope with better results.

In breeding a large number of these gall-flies certain phenomena present themselves, without offering, at the same time, any obvious explanation; at the same time, it is not easy to suggest any probable cause for such circumstances. In cutting open a number of galls, I found flies, one in about a hundred, that were only half the normal size of the species; these are not examples from which a gradual scale of dimension can be traced up to the largest specimens; this diminution of size might reasonably have been expected to occur in such flies as were developed from the smallest galls—but such was not the case—several were found in full-sized galls. Unless we seek for a solution of this circumstance in a supposition that the larvæ in such cases were arrested, whilst feeding, through falling into an unhealthy condition, I am at a loss to offer any other suggestion. When I first found a minute fly of this kind, I certainly thought I had discovered the male *Cynips* at last. I have still upwards of 2,000 galls containing *Cynips*, that is to say, exclusive of such as have been attacked by parasites, of which I have found two—the *Callimome Devoniensis*, and an apparently undescribed species of *Decatoma*—but none of the remaining galls will produce males. Mr. Walsh informs us, that he has bred thousands of flies from these old galls, which always develop females; such has always been my own experience, and others have recorded similar results.

Having alluded to parasitic Hymenopterous insects, it will

probably prove interesting to pursue the subject a little further, by a few observations on the various species of insects that are parasitic on the *Vespidæ*. The parasites on the *Vespidæ* are numerous, and may be subdivided into three sections: first, vegetable parasites; secondly, parasites that live internally in both the larval and perfect conditions; and, thirdly, such as are nourished by feeding upon, and destroying the wasp, in its larval state.

Not any species of wasp indigenous to this country has been observed to be subject to the attack of vegetable parasites, but several exotic species commonly suffer thereby; the *Polistes crinita*, from Cayenne, is frequently found to be so much infested by a fungus, which shoots out its spores so luxuriantly into hair-like threads, as to have caused the species to receive several names indicative of the circumstance, such as *P. crinita*, *P. vegetans*, &c.; this species is best known to science as the *Polistes americanus* of Fabricius. There are other species belonging to this genus, as well as to the genera *Icaria* and *Polybia*, subject to this disease of fungoid growth.

Internal parasites are not uncommonly found in the bodies of our native wasps belonging to the genus *Vespa*. The hornet is infested by a species of *Entozoa*, *Gordius Vespe crabronis*; another species belonging to the genus *Sphærolaria*, *S. Vespe vulgaris*, infests the common wasp; and Dr. Ormerod, in his excellent work on the "Natural History of British Social Wasps," found a species of *Gordius* infesting it also.

These attacks, both from fungoid growth and also from the presence of *Entozoa*, there can be little doubt, render the queen wasps incapable of carrying on the business of their economy.

The next internal parasite to which I have occasion to

allude has been assigned by several modern entomologists to the order Coleoptera; it is the *Xenos vesparum* of Rossi, who first discovered this class of parasites; it is closely allied, generically, to that of *Stylops*, the well-known parasite of the *Andrenidæ*. This parasite commonly infests the *Polistes gallica*, and also *Polistes biglumis*, both abundant on the continent, but not found in this country. An allied species, *Xenos Peckii*, is found commonly in North America.

I will now proceed to notice such parasites as attack the various species of the genus *Vespa* inhabiting this country. *Vespa crabro*, the common hornet, is attacked by a Coleopterous insect belonging to the family *Staphylinidæ*, *Quedius dilatatus*, an insect of great rarity hitherto, but probably only so because the habitat it frequents is rather dangerous of access under ordinary circumstances; and, as hornets are active by night as well as by day, not even to be approached with impunity, unless the person is clad in an impenetrable garb. The larva of *Quedius dilatatus* is said to feed upon that of the hornet, and on one occasion I saw a considerable number of dead larvæ, doubtless of that species, found in a hornet's nest. I think it very probable that various other parasites infest the nests of this wasp; for, as we shall see in the case of the common wasp, *Vespa vulgaris*, whose economy we are more familiar with, its parasites are numerous.

Vespa vulgaris is subject to the attacks of insects belonging to the orders Diptera, Hymenoptera and Coleoptera. Belonging to the Diptera may be mentioned two species of the genus *Volucella*, *V. pellucida* and *V. bombylans*; in some nests I have found larvæ of both these species very abundantly. When the colony of this wasp is attacked, as I have occasionally observed them to be, by a kind of epidemic dysentery, larvæ of some species of *Silpha* is commonly

found feeding upon the dead larvæ of the wasp, but these attacks cannot be classed among the parasitic ones.

Another dipterous insect, *Phora floralis*, attacks the larvæ, and also the pupæ of *Vespa vulgaris*, as many as eight or ten feeding upon a single larva or pupa. In a piece of comb, lately sent to me, I observed that these parasites so completely devoured the pupa, as to leave only the thin outer integument remaining; more than half the wasps were devoured in this manner. I do not imagine that wasps are very frequently attacked by *Phora*; the first instance that has come to my notice having been discovered by a friend during the present season.

The Hymenopterous parasites of *Vespa vulgaris* are an ichneumon, *Chyrimonon vesparum*, and *Chrysis ignita*; the latter parasite does not confine its attacks to the genus *Vespa*, it also attacks species of the genus *Odynerus*, solitary wasps. I have bred it also from nests of bees, such as *Osmia bicornis* and *Osmia aurulenta*; others have found it parasitic upon the larvæ of species of fossorial Hymenoptera.

The only Coleopterous parasite on *Vespa vulgaris* that I am acquainted with is *Rhipiphorus paradoxus*, and, as the nature of its parasitism has lately been the subject of considerable difference of opinion, but which direct observation has during the present season happily set at rest, I will briefly endeavour to trace the history of this very interesting parasite.

The parasitical connexion existing between *Rhipiphorus* and *Vespa vulgaris* appears to have been first recorded by Germar in the year 1813, in the "Magazin der Entomologie," but the nature of its connection was conjectural, the perfect insect only having been observed by him. Many entomologists have subsequently found the perfect beetle in the nest. Mr. MacLeay, as recorded by Mr. Curtis, must

have met with the parasite shortly after Germar's discovery. The Rev. F. W. Hope found it plentifully, not only in the nest of *Vespa vulgaris* but also in that of *V. rufa*. The first notice that I can trace of the true nature of its parasitism is that of Mr. Denison, who says that it "devours the grub of the wasp entirely." He does not enter into particulars of the observations made which warranted him in making this statement, but it is just to assume that he did make such, and this view is, I think, confirmed by the observation of Mr. Bigg, who records the discovery, and who states that Mr. Denison found the parasite in several instances, and observed it in all the stages of its growth. This was some time previous to the year 1835.

Nothing further respecting the habits of *Rhipiphorus* is recorded until 1865, when the late Mr. Stone published his observations in the twenty-third volume of the "Zoologist." He there records the fact of finding in a nest of *Vespa vulgaris* "several pupæ of the parasite and numbers of the perfect insect, males and females, but could not detect the presence of a larva." Three days later he was more fortunate, for on taking a nest of the wasp, and proceeding to open the closed-up cells, he found "a larva of the parasite firmly attached to the full-grown larva of the wasp, the mouth of the former buried in the body of the latter just below the head." The larva, he tells us, was of minute size, and appeared to have only very recently fastened upon its victim; but so rapid was its growth, that in the course of the following forty-eight hours it attained its full size, having consumed every particle of its prey with the exception of the skin and mandibles. Mr. Stone tells us that from subsequent observations he was enabled to make—clearly implying that he observed more than one larva of the parasite devouring its victim—that these parasitic larvæ, when they

once fasten upon the larva of the wasp, scarcely appear to cease feeding until they become full grown.

To my mind, these records satisfactorily trace the precise nature of the parasitism of *Rhipiphorus*. Latreille, it is true, had previously published his opinion that *Rhipiphorus* was a guest in the wasp's nest, that is, deposited its eggs in the cells, and that the wasp nourished its larva as if it was one of its own offspring; this opinion, I believe, had only conjecture for its foundation. Mr. Curtis adopted the same view, although he was acquainted with the observations of Mr. Denison; but I am inclined to think he only did so because he could not believe in the possibility of Latreille being in error.

It has been a matter of surprise to many entomologists, having these records before them, that a naturalist of the standing of Mr. Murray should have endeavoured to rebuild, as it were, the fallen fabric erected by Latreille; but Mr. Murray had possessed himself of an amount of material which he no doubt considered amply sufficient for the purpose; in fact, he considered that it substantiated Latreille's hypothesis. The article published in support of this view appeared in the *Annals and Magazine of Natural History* for November, 1869.

It is not necessary to follow the details recorded in the paper alluded to; suffice it to say, that nothing was observed which affected the correctness of Mr. Stone's observations; on the contrary, there was much that was really confirmatory of it; but Mr. Murray, from his point of view, was induced to consider them proofs of the correctness of the Latreillian hypothesis; so the matter rested until the present season.

In the month of August last, most fortunately, Mr. Murray was the first to discover the unstable foundation he had built upon, and was the first to write, "I have solved the *Rhipi-*

phorus question, and have to haul down my flag; the *Rhipiphorus* is a true parasite; I have traced it from the egg to the perfect insect." Nothing could be more satisfactory than that he himself should have traced it, and nothing more graceful than the candid acknowledgment of his own erroneous conclusions. Mr. Murray was only a few days in advance of another and a more fortunate observer; Dr. Algenon Chapman was working in the same field; he also obtained a nest of *Vespa vulgaris*, and, as he informs us in his admirable paper published in the *Annals and Magazine* for October last, that he easily ascertained that the larva of *Rhipiphorus* eats that of the wasp after the latter has spun up.

Mr. Chapman tells us that he failed to find any eggs of the parasite, and it will be seen from what follows that where the eggs are deposited is not known. He ascertained, however, a point in the history of *Rhipiphorus* that had never previously even been conjectured; he discovered the first stage of the young parasite after leaving the egg, which proved that the history of *Rhipiphorus* is parallel to that of *Meloë* and *Stylops* in its earliest stage; the larva is then a little black hexapod, exceedingly minute, and having a triangular head with a pair of three-jointed antennæ, with legs very like those of the larva of *Meloë*, the tibiæ ending in two or three claws; each abdominal segment has a short lateral spine, pointing backwards, the last segment terminating in a large double sucker. This little larva finds a wasp grub, and piercing a hole in its skin makes its way into its interior.

At what precise period of the growth of the wasp grub that of the parasite enters it has not been observed; it was however ascertained that it remains there until the larva of the wasp is full grown and has spun itself up in the cell; Mr. Chapman discovered it in such a full grown larva. At

the side and in front of the third and fourth segments of the wasp grub, the *Rhipiphorus* was observed shining through the skin; the *Rhipiphorus* larva was also observed when emerging from the wasp grub; at the time of so doing it casts a skin, together with the black head, legs, plates, &c.; it then moves onward to the anterior surface of the second segment of the wasp, where it at once seizes hold, and, thus situated, it feeds upon its victim until full grown, when it changes to the pupa state and thence into its perfect condition. All the parasites, the wasps of course also, emerge from the cells during the autumn, and probably all of them quit the nest, and, as Mr. Chapman is led to believe, the parasites hibernate during the winter. The point therefore that requires investigation is the place and manner of oviposition of *Rhipiphorus*; this point once obtained, the history of the parasite will have been pretty fully ascertained. Another season's research will probably enable Mr. Chapman to complete this link still wanting in the life-history of *Rhipiphorus*.