with the terminal, and the posterior with the basal joints longest.

This genus partakes of the characters of two groups: by its depressed form, lunate vertex, and slightly spiny intermediate tibiæ it approaches that to which Professor Germar has restricted the name of *Iassus*, (*Phrynomorphus*, Curt.), &c.; but the position of the antennæ, ocelli, &c. evidently allies it to *Bythoscopus*, Germ., from which its depressed form will at once distinguish it. There is but one British species, which appears to be undescribed.

Sp. 1. *B. irroratus*. Flavo-viridis; alis superioribus fusco-punctatis.

Long. corp. $2\frac{1}{4}$ lin., lat. corp. $1\frac{1}{4}$ lin.

Yellowish green; superior wings finely sprinkled with minute fuscous punctures.

Three specimens were taken by Mr. Waterhouse near London, to whom I am indebted for the specimen I possess. A specimen will be found in the Museum of this Society, presented by that gentleman.

XII. *A few Observations upon the Habits of the Indigenous Aculeate Hymenoptera, suggested by M. de St. Far-gau's Paper upon the Genus Gorytes in the first Number of the 'Annales de la Société Entomologique de France.'*
By W. E. SHUCKARD, Esq., M.E.S.

[Read March 3, 1834.]

It is rather a remarkable circumstance, that entomologists in general, in this country, have hitherto paid but little attention to the Aculeate Hymenoptera; a tribe so peculiarly interesting from its œconomy and habits, that we might reasonably have expected that some portion of the attention which has been lavished upon several other orders should have turned upon this. We might easily account for this neglect, were there much difficulty in observing or collecting these insects; but when we remember that every sunny bank and sandy spot will furnish them, I am induced to attribute this general indifference, partially, to the deficiency of an easily accessible and collective work upon the subject. But it is far from being thus satisfactorily answered, for we possess a work upon a portion of this tribe,—the Bees of Great Britain,—which, I conceive, has never been

surpassed in the annals of entomology for accuracy or acumen,—it will be readily understood that I allude to our esteemed Honorary President's 'Monographia Apum Angliæ;' a book to which (although published thirty years ago) but very few additions could as yet be made, and which is, perhaps, the most beautiful model of an entomological monograph extant. And yet this work, which should be the canon of practical writers, has stimulated but few to attend to our bees, and the majority of collections are either very deficient in them, or in great confusion. We must therefore seek elsewhere for the true cause of this neglect, and shall perhaps find it in the predominant taste of the more influential entomologists, whose zeal excited a spirit of competition, which directed attention solely to those orders to which they themselves had been almost exclusively devoted.

The insects I chiefly allude to in these observations, and particularly where I complain of the indifference shown to them, are comprised in a subsection of the Aculeate Hymenoptera, and are what are generally called *Sand-wasps*. They form Latreille's second family, of the second section of the order, to which he has given the name of *Fossores*, or 'burrowers,' from the circumstance of the majority of the family forming little burrows in sand or earth, for the purpose of depositing their eggs therein, with a sufficiency of food, consisting of other insects, either in their undeveloped or their perfect state, for the nurture of the larva upon the hatching of the egg. In their second, or larva state, they are consequently all carnivorous, as well as the true wasps, or *Diploptera*; thus differing from the *Melliferae*, or bees, which supply their larvæ with an admixture of honey and the pollen of flowers made into a kind of paste. Into these two divisions of Bees and Wasps, the Aculeate Hymenoptera are thus readily separated by the very nature of the pabulum upon which the larva is fed; the wasps (I take the term in its broadest signification,) forming a tribe which, although much fewer in numbers than the bees, may, I think, certainly vie with them in the interesting nature of their œconomy and in their personal history, for their habits are decidedly as varied as the habits of the solitary bees; and the social bees may find competitors for attentive and interesting observation in the œconomy of the true wasps, and the family of ants, if we institute the comparison without reference to their uses to man.

But the chief object of my present address (admitting, however, my earnest wish to call the attention of practical entomologists to this very interesting tribe,) consists in my anxiety to stop, as early as possible, the diffusion of error which might ensue from the generalization of a fact discovered by a very eminent French Hymenopterist,

Le Pelletier de St. Fargeau, unless previously restricted within certain limits,—which, I hope, I am enabled to do with precision, from the knowledge obtained from that only safe source, the patient and attentive observation of nature ; truth, and not theory, being the object of my quest.

The study of structure frequently either leads to the corroboration of observations upon the œconomy of insects, or throws out suggestions which experience confirms. This has been remarkably the case with the Aculeate Hymenoptera. The Rev. Mr. Kirby, whose work I so recently mentioned, was induced to surmise, from the absence of polliniferous instruments in the genus *Melecta*, one of the bees, that it might be a parasite upon another of the family ; and this supposition derived additional strength from its being found by Mr. Trimmer in the nest of *Anthophora retusa*, which subsequent observation ascertained to be the insect whereon it was parasitic. Several other genera of bees are in the same predicament ; but no investigations hitherto made will enable us to ascribe these cuckoo bees to their relative fosterers. (See Note 1.) But the term parasite must be here understood in a different acceptation to which it is received in reference to the *Ichneumones* and the *Chalcididæ*, these being strictly internal parasites ; whereas the larva of the parasitic bee or wasp is supported at the expense of the larva of the insect which collected the food, by consuming what she had laid up for the use of her own progeny. This naturally suggests the idea that the egg of the parasite may possibly be disclosed more rapidly than that of the insect which laid up the store ; but of this we have no certain knowledge, nor indeed of anything that takes place within the nest : but that the larva of the parasite is carnivorous, may, I think, be absolutely negatived with respect to the bees ; and, therefore, although the food is consumed, the larva itself is left untouched, but is starved to death in consequence of the failure of its supplies : but with respect to the wasps, I have not the least doubt that the heir is consumed as well as his inheritance.

M. de St. Fargeau followed up this hint upon perceiving, in his examination of the structure of the Fossorial Hymenoptera, that some possessed the anterior tarsi ciliated on the outside ; and when thus armed, the posterior tibiæ were likewise furnished, through their whole length, also on the outside, with spines or teeth : but in others the cilia were wanting, and, that, always when thus formed, their concomitant, the spines of the hinder tibiæ, were either deficient or obsolete. Well acquainted with the burrowing habit of the majority of these insects, he was induced to infer that the cilia of the tarsi were employed to facilitate the insect in forming its burrows, and that the

spines of the posterior tibiæ (not the calcaria which arm the apex of the limb,) assisted it to carry its prey; and consequently such as were unfurnished with these auxiliaries were unable to burrow or convey a prey, and must therefore be parasitic. This theory he has stated in several articles of the tenth volume of the 'Encyclopédie Méthodique,' in an early number of Guérin's 'Magazin d'Entomologie,' and has made practical use of it in an analysis and subdivision of Latreille's genus *Gorytes*, in the first Number of the 'Annales de la Société Entomologique de France.' I was highly gratified when I first heard of this, and considered it a discovery of an analogous value to that made by Mr. Kirby, of the males of the Aculeate Hymenoptera having one joint in the antennæ, and one segment in the abdomen, more than the females. But my pleasure was much decreased, upon inspecting my collection, to find that it furnished me with a negative to the general application of the rule. For chance led me to apply it, in the first place, to the genus *Crabro*, and here I found *C. cephalotes* with simple tarsi, but with the posterior tibiæ spinose; an anomaly that I could not account for at the time, as I have taken it repeatedly with its prey, and watched it while employing its mandibles in forming a cylindrical cell in decaying trees: thus the application of St. Fargeau's theory here would treat as a parasite one of the most ferocious and predatory of this tribe. This is precisely the case also with several other species of the same genus. I next took the genera in regular sequence, and found the genus *Sapyga* simple in both tarsi and tibiæ, and this genus, by St. Fargeau's own admission in his remarks upon it in the 'Encyclopédie Méthodique,' is certainly predatorial, as he states having captured *Sap. punctata* with its prey, which it dropt when caught, but which he detected to be a larva. (Note 2.) We may therefore safely treat it as a true *Fossor*, although from the nature of the material in which it nidificate it would certainly use its mandibles instead of its tarsi, in excavating its little cylindrical cells, and we accordingly find that Nature has provided it with the former excessively strong, and the latter very slender and simple. These instances induced me to suspect that I had detected a clue to the probable cause of this apparent anomaly (Note 3.); for, knowing that these insects nidificate in wood, I surmised that their habit was a consequence of their structure, and that therefore the theory must be limited to such as are strictly burrowers in sand or earth; and which subsequent investigation has tended to confirm; for I have invariably found such as nidificate in wood, deficient in the ciliæ of the anterior tarsi, although having the posterior tibiæ occasionally spinose, which seems to support St. Fargeau's opinion, that they are used to assist in conveying

their prey, an opinion however that I cannot coincide in for reasons which I shall presently state. In the genus *Pompilus*, some, as the *P. bifasciatus* of Fabricius and the *P. petiolatus* of Van der Linden, are simple in the tarsi and posterior tibiæ; but I suspect they nidificate in wood. The black species of *Psen*, as I have observed, nidificate in wood, although their tarsi and tibiæ are simple; hence the species of this genus cannot be placed in the class of Parasites. With respect to *Trypoxylon*, I think there can be no doubt as to its being a parasite, as it is a very common insect, and constant opportunities occur for detecting it with its prey, were it predatory. In the genus *Pemphredon*, I suspect that only *P. insignis* is parasitic,—the majority of them nidificate in wood; but the *P. minutus* I have taken only in sand, and as its anterior tarsi are simple, although the posterior tibiæ are spinose, it may possibly be a parasite; but future observation will determine this point, as well as decide which may be treated as parasites among the sand-burrowers in general. But I think we may entertain little doubt as to the genera *Ceropales*, *Dolichurus*, and *Nysson* being assignable to that class, and *Gorytes mystaceus* is, I have no doubt, also a parasite, and has thus acquired a certain degree of celebrity by suggesting this discovery. Those which I have not named are all true *Fossores*, taking them as they appear in the published lists.

With respect to St. Fargeau's auxiliary character, the spines of the hinder tibiæ, which he considers as assisting the insect in conveying its prey, I have already indicated that I do not subscribe to, and for the following reasons: they are invariably placed on the outside of the limb, and the insect in carrying its burthen would necessarily clasp it with the inside; exclusively of the fact of my knowing only one genus that uses its posterior legs for this purpose. Were this, therefore, their sole use, it would be derived merely from the strength they might add to the member; but I conceive their chief importance is to assist the insect in burrowing, for although some species convey the particles of sand or earth out of their burrow by their mouth, and pile them at its entrance for the purpose of closing it after having deposited their progeny within, to secure them from the ingress of ants or their parasites (Note 4.), yet many species burrow like a fox, tossing the sand out behind them with their posterior legs; and in the same way those which nidificate in wood pass the particles beneath them, and eject them behind by means of the spines with which their tibiæ are armed, which fact I have frequently observed while watching the habits of *Crabro cephalotes*. Besides the evidently ill-adapted position of the spines for aiding the insect in carrying, I have noticed the genus *Oxybelus* alone, to

convey its prey by means of its hinder legs. *Pompilus* and *Ammophila* walk backwards, dragging it with their mandibles; and the perseverance with which they overcome all difficulties, and place it where they have selected their hiding-place, is remarkable. *Astata*, *Tachytes*, *Psen*, *Crabro*, *Mellinus*, and *Cerceris* fly boldly and directly forward with it in their mandibles, assisted by their fore legs. It would be desirable to ascertain if the several species are restricted to one kind of prey. As far as my observation goes I have found it to be the case, and generally that prey consists of larvæ, I suppose from their being more succulent, and yielding more nutriment than the perfect insect; and it is a remarkable circumstance that, however sanguinary and bold they may be in their attack upon their victims, I have never observed any but the species of the genus *Vespa* feeding upon their ravin, nor have I observed any but females make the attack. It would therefore seem that maternal solicitude alone prompts them in their apparent rapacity, for it is to the nectar of flowers that they resort for their own subsistence. They differ much with regard to their prey, as far as my observation goes: the prey of *Pompilus viaticus*, *fuscus*, *exaltatus*, and *gibbus* consists of different species of spiders; *P. niger* attacks a small sandy-coloured larva. *Ammophila hirsuta* and *vulgaris* I have detected dragging along large black spiders, very much swoln, I presume from the effects of the venom with which the insect renders them torpid. *Psen equestris* and *bicolor* bring home the larvæ of Homopterous insects, which differ; and it is a curious fact that the *bicolor* is gregarious and the *equestris* solitary in its habits. *Astata Boops* diminishes the numbers of the larvæ of *Pentatoma bidens*, for I have frequently taken it on Hampstead Heath with that prey. *Pemphredon unicolor* preys upon an *Aphis*. *Lyrops*, or more properly *Tachytes pompiliformis*, I have caught with the larva of a small Lepidoptera; *Oxybelus uniglumis*, with a small Dipterous perfect insect; *Crabro cribrarius* and *patellatus*, with Diptera also, as well *Mellinus arvensis*. *Cerceris læta*, according to Latreille, quoted by Mr. Curtis, preys on an *Andrena*, and *Philanthus Diadema* upon a species of *Halictus*.

These few observations will show what a field lies open for the observer, and what a harvest remains to be reaped.

I think I have sufficiently proved, what I set out with the intention of doing, that the discovery made by St. Fargeau does not admit of general application, and must be restricted to the *Fossiores* that nidificate in sand and earth; and that the use of the spines of the hinder tibiæ is certainly not to aid immediately in the conveyance of prey, although it generally accompanies the ciliation of the anterior tarsi, but may rather be considered as instruments for assisting the insect to burrow.

I have only further to remark, that the seemingly most trifling observation may become of paramount importance in teaching us the function of an organ, or by its intercalation with other observations may, like a link in a chain of circumstantial evidence, convey the strongest conviction, and give corroboration to what was previously built upon presumption alone.

I will conclude, but I must first apologize for having wasted so much of your time, and I fear entirely exhausted your patience; but I beg this may be imputed solely to my zeal for our science: and these cursory remarks will have attained their purpose should they stimulate our practical entomologists to record all,—even their most minute observations, and impart them to the Society, whether individually or, if so fortunate in their collection of these fugitive emissions, in a body. They will speedily accumulate, and enrich us with a series of facts which must in themselves give an importance to our proceedings, and add a stability to our lucubrations by fixing them upon the explicit confession of Nature herself.

NOTES.

Note 1. page 54.—The genera of British bees supposed to be parasitic are *Hylæus*, *Sphecodes*, *Nomada*, *Epeolus*, *Stelis*, *Cœlixys*, *Melecta*, and *Psithyrus* (first separated from *Bombus*, but not named, by Mr. Kirby; kept separated as Divisio 2. by Dahlbom in his Monograph of the Scandinavian Bombi, but raised into a genus with the preceding name by St. Fargeau in the fourth Number of the 'Annales de la Société Entomologique de France'). All that is known of the habits of the parasitic bees (and that is but very little,) rests upon mere conjecture, and to which I now contribute my mite. I have the strongest possible reason for supposing that *Nomada Schæfferella* is parasitic upon *Eucera longicornis*, for I have taken it several times this year entering the burrows of that bee, and nowhere else; but I hope to confirm this supposition next year by breeding it from the store laid up by the *Eucera*: and *Nomada ferruginata* is, I suspect, a parasite of *Andrena fulvescens*, for I have constantly taken it entering the cell of that insect. The *Nomada ruficornis* flies chiefly about hedge-rows, and is probably parasitic upon *Andrena Trimmerana* or *A. nitida*, which both burrow in hedge-banks as well as *A. cingulata*, thus differing from those which nidificate in bare sandy situations. I would throw out the suggestion that as some of the *Andrenæ* are distinguished from the rest by the greater density and length of their scopa and flocculus, it is probable that these latter chiefly may nourish parasites. I suspect we may have more than one species of the genus *Melecta*, for I have taken specimens differing widely in the colour of their hirsuties, infecting the nests of *Anthophora retusa*, *A. Haworthana*, and *Eucera longicornis*.

Note 2. page 55.—Mr. Bakewell of Nottingham has recently informed me that he has captured this insect while thrusting its abdomen into the cells of *Osmia cœrulescens*. I have taken *Melandria Caraboides* repeatedly doing so, this year, into the cell of *Chelostoma maxilloso*, and with the ovipositor exerted to its utmost length. I am not aware of this circumstance having been previously noticed. It