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A few words in conclusion, even at the expense of seeming prolix: What is the true position of the PTEROPHORIDÆ? We British entomologists are apt to take the position of groups for granted, and to create imaginary links of exotic species to fill up any gap however wide; the leap, therefore, from the *Nepticulidæ* to the *Pterophoridae*, has, for this reason, passed unquestioned, yet surely no one could really believe this to be a true sequence in classification. In the list above, *Ohrysocorys* is classed amongst the plumes, and if this be its true position (and for such opinion I have the high authority of Mr. Stainton to back me), it is certainly a strong connecting link to the *Tineina*, yet my own views of the affinities of the *Pterophori* would be, in spite of this, that they were rather an aberrant group of the *Pyrilidæ* than of the *Tineina* (that is, taking the term *Pyrilidæ* in its widest meaning), and of these, that the genus *Ohilo* was their nearest ally: but there is so much that is anomalous in the whole group that this is said rather with the view of opening a difficult question than of giving a positive opinion. Heterodox as it must appear, I have often dared to think that there was something essentially wrong in our classification of the *Lepidoptera*; as a large group they stand between *Trichoptera* on the one hand, and either *Diptera* or *Hymenoptera* on the other. With the *Trichoptera* we have at least two true points of connection, namely, through the *Psychidæ*, and again through *Cataclysta* and *Acentropus*: on the other side the relationship is more doubtful; yet to me, considering that the mandibulate mouth exists in the embryonic or larval state of the *Lepidoptera*, and considering further how nearly the larva of the *Tenthredinidæ* approach to those of *Lepidoptera*, the connection seems more close between that group and the *Hymenoptera*, than the *Diptera*. If this be so, the *Sesiidæ*, though confessedly one of the most mimetic groups among the *Lepidoptera*, have a true homological resemblance rather than a mere mimetic analogy with *Hymenoptera*, and it would follow almost as a corollary that instead of beginning with *Ornithoptera*, *Teinopalpus*, and *Papilio*, we should commence with *Trochilium*, and instead of finishing with the *Pterophori*, we should end our lists with the *Psychidæ* or *Acentropus*. But the reader must remember that he must lay the burden of this heresy on my back, and not on that of the author, whose monograph has been just brought before his notice.

Edgbaston, Birmingham, November, 1869.

ON THE ECONOMY OF THE *CHRYSIDES* PARASITIC ON *ODYNERUS*
SPINIPES.

BY T. ALGERNON CHAPMAN, M.D.

The species of the genus *Ohrysis* are, so far as is known, parasitic on wasps and bees; those which are attached (apparently, exclusively) to *Odynerus spinipes* being *O. neglecta* and *bidentata*, which are common wherever *O. spinipes* abounds. *O. ignita*, the most abundant species of the genus, appears to lay her eggs in the nests of almost any kind of wasp to which she can obtain access, and occasionally visits those of *O. spinipes*, but is abundant in the nests of *Odynerus parietum*. *O. fulgida* has also been recorded (by Mr. F. Smith) as attached to *O. spinipes*; but I have never met with it, and suspect that it is the proper parasite of some other and rarer species of *Odynerus*, and that its occurrence with *O. spinipes* is accidental, in the same sense as that of *O. ignita* may be said to be so. I may remark, that I was quite unprepared to find *O. ignita* so rare as a parasite of *O. spinipes*; as, though often to be seen about the burrows of that insect nearly as plentifully as *O. neglecta* or *bidentata*, out of more than a hundred *Ohrysis* cocoons collected last winter, I found only one of *O. ignita*; and this summer I have seen only three of its cocoons in the cells of *O. spinipes*. The destruction caused by *Ohrysidæ* amongst the young brood of *O. spinipes*, roughly measured by the cocoons collected last winter, is in the proportion of one to three of those of the wasp; the proportion of *O. neglecta* to *O. bidentata* being as three to two.

On July 17th, I observed a nest of *O. parietum* with one cell open and containing a nearly complete supply of Lepidopterous larvæ. A *Ohrysis ignita*, flying about, settled beside the cell; and, after a brief examination with her antennæ, wheeled round, and, introducing her abdomen into the cell, rested for about twenty seconds, doubtless in the act of oviposition. I now regret that I did not then examine the contents of the cell, in order to ascertain the fate of the egg of *O. parietum*. Three-quarters of an hour later, *O. parietum* had closed the cell with the usual earthen pellets. Two days afterwards, I examined this cell, when I found a larva of *O. ignita* a quarter of an inch long, together with the Lepidopterous larvæ stored by the wasp, but there was no trace of either egg or larva of the latter. On the 23rd, six days from the date of oviposition, the *Ohrysis* larva had eaten all the store, and was full-fed. I obtained evidence, by finding the exuvium, of its having cast its skin three times, whilst under observation; and, from the analogy of *O. bidentata*, I believe it had done so four times

altogether. The stored larvæ had all been eaten, their heads alone remaining, just as when eaten by the wasp grub. The larva then spun a cocoon, which I know to be typical of *C. ignita*. This was the only occasion on which I had a feeding larva of *C. ignita*, and the rapidity with which it fed up astonished me. None of my *C. neglecta* or *bidentata* fed up so rapidly; but the warm sunny wall on which *O. parietum* had built her nest may partly account for this, my larvæ of the other two species having been kept comparatively cool.

C. neglecta begins to emerge from the pupa state at the same time as *O. spinipes*, namely, about the middle of May; and, by the first week in June, all of both species have emerged. On examining a bank colonised by *O. spinipes* at this period, the cocoons of the previous year are found empty; but, if the day be dull, *C. neglecta* will often be found hiding away in the empty cocoons of *O. spinipes*, and usually a pair together. When the sun is out, *O. spinipes* is busy constructing her canals and granular tubes, and *C. neglecta* is actively running and flying about the burrows. *C. bidentata*, however, is not to be seen; and, on closer examination, it will be found that of this parasite the cocoon of the previous year still contains the perfect insect, which does not emerge until the last of the *spinipes* brood are coming out, nearly three weeks later than *C. neglecta*. I have not seen the egg of the latter, and do not know how or where it is laid; but it supplants that of *O. spinipes*, as, a few days after the mother wasp has closed her cell, stored with green grubs, it contains a young larva of *C. neglecta* busily eating that store, and no trace remains of the egg or larva of the *Odynerus*. Early in July, the larvæ of *O. spinipes* and *C. neglecta* are to be found full-fed, and spinning their cocoons. As the season advances, the later stored cells appear to escape the attack of *C. neglecta*; for, in the middle of July, whilst *O. spinipes* is still busy in storing, there are comparatively few specimens of *C. neglecta* to be seen. On the other hand, *C. bidentata* is now abundant, though its oviposition has hardly begun. Towards the end of July, *O. spinipes* and *C. neglecta* are represented only by odd specimens, which have survived the mass of their brethren, though *C. bidentata* is still to be found somewhat plentifully.

C. bidentata, when about to deposit her eggs, searches for a full-grown larva of *O. spinipes*, at, or immediately after, the period of spinning. *O. spinipes*, in the completion of her burrow, fills up the mouth with clay long before the most accessible cells can contain full-grown larvæ; but it happens, that, in a large proportion of cases

(about half), the wasp meets with some accident, and her burrow remains uncompleted, the cell last constructed being thus only protected by the wall of clay that was to serve as a party wall between it and the succeeding one, had the wasp lived to complete her work. Such slightly protected cells are those chosen by *C. bidentata* for her oviposition. I once found satisfactory evidence of *C. bidentata* having burrowed through half-an-inch of the clay stopping placed by the wasp over one of these cells. The parasite was in the burrow, covered with the dust brought down into it by her excavation to form an entrance,—a passage too small for the wasp to enter, but just large enough for herself; and in the cell thus reached by her were to be seen her eggs freshly deposited. On another occasion, a *C. bidentata* alighted on a spot I was examining, and where I had partially exposed some cocoons of *O. spinipes*; she commenced to carefully investigate them with her antennæ, and now and then to scratch away some earth partly covering them; she did not, however, deposit any egg, possibly because the inmates of the cocoons were not in proper condition.

When a cocoon contains eggs of *C. bidentata*, there is often to be found, at its upper end, a minute aperture, through which the ovipositor of the *Chrysis* has been thrust; at other times, this aperture is wanting, simply, I believe, because the larva of *O. spinipes* had not done spinning her cocoon when the *Chrysis* deposited her eggs within it. There is nearly always a small spot outside on the yellow silken top of the cocoon, as if the *Chrysis* had attacked it first with her jaws; and those containing *C. bidentata* may be selected by this mark from a number of cocoons of the *Odynerus*. One of the most remarkable points of their history is, that *C. bidentata* does not deposit one egg only in the cocoon of the *Odynerus*, but actually drops in from six to ten eggs. These do not appear to be placed in any particular position, but simply fall on the enclosed larva; and the excess in number may obviate the destruction caused by the latter, especially when its movements are still active, before the completion of its spinning operations. In the instance above noted, where I found *C. bidentata* in the burrow of *O. spinipes*, the cocoon of the latter contained five eggs in good condition. The wasp larva had ceased to spin, but had not yet shrunk to those smaller dimensions which it rapidly assumes soon after that period. In various other instances, I found two healthy eggs of *C. bidentata*, but often only one, the shrivelled cases of from four to eight others being found with the healthy eggs. I never found any evidence of the hatching of two eggs of *C. bidentata* in the same cell;

which, though it seems a likely, would certainly be an awkward, occurrence. *O. bidentata* remains longer than *O. ignita* in the egg-state. Of a number reared by me from the egg, most were hatched two days after they were collected, but one remained for three days, and another did not hatch until the fifth day, and from the time of hatching the larvæ were eleven days in becoming full-fed. The eggs of *O. bidentata* are 1.5 millimetres in length, white, cylindrical, and very slightly arched; those of *O. spinipes* are larger, 2.5 millimetres in length, yellow in colour, and more arched. I failed to detect the egg of *O. neglecta*, principally, I believe, because the interval between its being deposited and hatching is so short, and also because I did not quite know where to look for it. It probably resembles that of *O. bidentata*, and is to be found at the time the cell is closed up by *O. spinipes*, and for only a few hours afterwards; but of this I was not aware at the proper season.

The young larva of *O. bidentata* seizes that of *O. spinipes* with its jaws, pinching up a fold of skin, and contrives to extract fluid nutriment from it, without, apparently, making any aperture in the skin, until it approaches to mature growth itself. I have very carefully examined larvæ of *O. spinipes* that were thus half sucked away (I cannot say eaten), and I could find no mark at the spot whence I had just removed a larva of *Chrysis*. I have several times squeezed the *Odynerus* larva firmly, without any fluid exuding; even when squeezed almost to bursting, on only one occasion did a drop of clear fluid exude. Nor is the *Chrysis* larva particular as to where it seizes the *Odynerus*; any point that may offer itself to its jaws being seized.

When the devourer is nearly full-grown, and the victim is very flaccid, a process that may be called eating takes place, and the *spinipes* larva almost entirely disappears. The manner in which the larvæ of *O. neglecta* and *ignita* and of *O. spinipes* itself eat the little green grubs is precisely similar; when young, they merely suck the juices of several, and sometimes return to and finish these when they are larger, but they may often be found neglected when the larva is full-grown.

The larva of *O. bidentata* casts its skin four times during its growth, at tolerably regular intervals, of about two days. I have twice seen this process in operation: the skin splits down the back of the anterior segments, and the corneous covering of the head splits into two lateral halves, which remain attached to the skin when the shedding is completed. As compared with the larvæ of the *Lepidoptera* and *Coleoptera*, they feed up so rapidly, that one marvels how they have time to change their skins so often; many a *Lepidopteron* requiring four or five days

for the process of once changing its skin, whilst *O. ignita* is fed up in six days, during which it has found time to change its skin four times. I was also struck with the similarity between the larva of *Chrysis* and that of *Odynerus*; a similarity that seems to be a true and not a superficial one. Throughout its existence, the larva of *spinipes* is yellow, its viscera are tolerably visible through the integument, especially portions of a yellow tortuous duct in the lateral dorsal region from the fifth segment backwards. In *Chrysis*, the larva is white, and its interior is more masked by masses of white fat. The first spiracles, which, though usually situated in the second (the head being the first), belong properly to the third segment, are in *Chrysis* at the anterior margin of that segment; but, in *O. spinipes*, they are actually in the second segment. The form of the head and parts of the mouth are very similar in both. This resemblance between the two larvæ is closer than that between the larvæ of *spinipes* and of the common wasp (*Vespa vulgaris*); and, in those points in which the larva of *Chrysis* least resembles that of the *Odynerus* (e.g., form of jaw, distinctness of viscera as seen through the skin, and colour), it resembles *Vespa vulgaris* more than *O. spinipes* does. I have not been able to seize any characters to distinguish the larvæ of *O. ignita*, *bidentata*, and *neglecta* from each other.

O. neglecta spins a compact oval cocoon from 5 to 10 millimetres in length, of a greyish-white and blackish silk, in layers, similar to the cocoons of various ichneumons, *Ophion* for example; this is surrounded by a looser layer of brown silk, similar to that which loosely fills up the rest of the cell of *O. spinipes*, and some remains of the little green grubs are always to be found at the bottom of the cell. The cocoon of *O. ignita* is rather longer than that of *O. neglecta*, of a much slighter texture, and with hardly any loose silk about it.

The cocoon of *O. bidentata* is contained in that of *O. spinipes*, the cocoon proper occupying the lower half of the cell, and its roof being an almost mirror-like diaphragm of brown gummy silk stretched across the centre of the cocoon of the *Odynerus*, the walls of which, above the diaphragm, are also covered by a thin layer of silk spun by the larva of *Chrysis*; the lower part of the cocoon is in contact with the *Odynerus* cocoon all round, and contains in its walls three vertical whitish patches, rather thicker than the rest of the cocoon, which, when removed from that of the *Odynerus*, is translucent.

Like the larva of *O. spinipes* and other hibernating Hymenopterous larvæ, that of *Chrysis* shrivels to a certain extent after it has spun its

cocoon, the skin becoming loose and being thrown into very fine folds; the head is bent forwards, and the lateral and sub-dorsal prominences, which in the tense shining skin of the full-fed larva can hardly be detected, are very distinct.

Passing the winter as larvæ, they remain in the pupa state less than three weeks before emerging, often however, if the weather be cold, remaining perfect inside the cocoon for many days. *O. ignita* and *O. neglecta* escape by cutting off circular lids from their cocoons; *O. bidentata* cuts out the diaphragm of its cocoon, and makes a circular hole in the top of the *spinipes* cocoon.

I may note here a distinction in colouring between the male and female of *O. neglecta*, which, as it is not noted in Mr. Smith's excellent Monograph of the group in the 'Entomologist's Annual' for 1862, may possibly not have been previously recorded; viz., that in the male the marginal sulcation of the third abdominal segment is blackish or purplish from the margin almost up to the row of fossulets; whereas in the female the darker colour is confined to a line on the extreme margin of the segment.

It is, perhaps, worth pointing out, as bearing on the doctrine of the survival of the fittest, that *O. bidentata* destroys those larvæ of *O. spinipes* that probably most strongly inherit the weakness, whatever it may have been, that led to the death of their parent.*

Abergavenny,
September, 1869.

Occurrence in Britain of Bledius spectabilis, Ktz.—In a note at p. 281 of the second vol. of the "Insecten Deutschlands," Dr. Kraatz has described, in a few lines, under the name of *spectabilis*, a species of *Bledius* closely allied to *B. tricornis*, Herbst, and found abundantly in Greece. Some little time since, however, M. Fauvel challenged the correctness of this new species, stating both that it was a southern variety of *B. tricornis*, and that Dr. Kraatz had mistaken the true *tricornis* of Herbst. Dr. Kraatz, upon this, returned to the question in the Berl. Ent. Zeit., 1868, p. 346; re-affirmed the validity of the two species; and established their synonymy (about which there has been much confusion) in a most satisfactory manner.

Bledius tricornis has been for a long time in the British catalogue, and I have now the pleasure of making known that *Bledius spectabilis*, Kr., is also a British species; and at the same time of shewing, from its geographical distribution, that it cannot be a southern form of *B. tricornis*. I have found *B. spectabilis* in great

abundance in the salt marshes at Dumfries, also near Edinburgh, at Brighton, and at Weymouth. *B. tricornis* I have never found but on one occasion, viz., at Deal, in the spring of 1863, when I had the pleasure of taking it in some numbers during a collecting expedition, in which I was accompanied by Mr. Frederick Smith and his son Mr. E. A. Smith. I imagine, therefore, from my own experience, that the greater portion of the *B. tricornis* of our British collections will be found to be *B. spectabilis*, Kr. The two species, though exactly alike in point of colour, are easily enough distinguished when the males are examined; for *B. spectabilis* is considerably the larger of the two, and more sparingly punctured on the thorax and elytra, and its male has on each side of the head a short pyramidal elevation, which can in no sense be considered a horn; while in *B. tricornis* this elevation is replaced by a short but distinct horn. When these characters have been perceived in the male sex, the females of the two species are easily separated by the differences in size and punctuation.

The synonymy, as given by Dr. Kraatz (quite correctly, I believe), runs thus:—

<i>tricornis</i> , Herbst, Ol., Kr.	<i>spectabilis</i> , Kr.
<i>tricornis</i> , Er. (Col. Marc.).	<i>tricornis</i> , Er. (Gen. et spec.).
<i>nuchicornis</i> , Muls.	<i>tricornis</i> , Muls., Fauvel.

As far as M. Fauvel is concerned, I have verified the synonymy by sending him a specimen of *B. spectabilis*, taken by me in Scotland, and obtaining from him its name as *B. tricornis*. What the insect is that he understands as *B. spectabilis* I have no idea (neither, judging from the above synonymy, has Kraatz); but it would be interesting to know.—D. SHARP, Eccles, Thornhill, Dumfries, Nov. 10th, 1869.

[My own short series of *B. tricornis*, from Deal, is apparently correctly named. But I find next to them three specimens, obtained lately from Mr. Brewer, solely on account of their large size, and taken by him on the Norfolk coast, I believe, which are evidently *B. spectabilis*. In addition to the characters mentioned above for that species, I observe that in these three the thoracic horn of the ♂ is much longer than in *tricornis*; the thorax is less bulky in proportion to the elytra, with the sides rather straighter, the contraction behind not quite so rounded, and two irregular smooth discal spaces, starting from each side of the middle line and directed backwards, much more elevated and decided than in *tricornis*; and the black colour of the elytra more confined to the base. It will be observed, that, in this larger insect, the frontal horns exhibit a diminution of size, so that it cannot be considered a more highly developed form of *tricornis*.—E. C. R.]

Occurrence in Britain of Myllena glauca, Aubé.—Some time ago, I took in *Sphagnum*, on Wimbledon Common, a *Myllena*, which I could not satisfactorily refer to any of our recorded species, and which so distinguished an authority in that genus as Mr. Matthews also failed to identify. Hoping to be able to name it after that gentleman, I sent it for examination to M. A. Fauvel, who returned it as *M. glauca*, Aubé, which M. Fauvel has recently, in 'L'Aboille,' identified with *M. elongata*, Kraatz. Subsequently to this determination, Dr. Sharp has observed to me that the *elongata* of Matthews is specifically distinct from Kraatz's subsequently described insect of the same name; remarking that the former is common

* The opponents of that doctrine might, however, reasonably urge that the majority of the causes of incompleteness of the ordinary number of *Odynerus*' cells would, in all probability, be direct and incapable of transmission; such as the death by violence of the parent during the work (she being then peculiarly liable to injury, on account of her engrossment in the cares of maternity), the non-adaptability of the soil for a proper nidus, a failure of adequate food for the larva, a sudden accession of tempestuous weather preventing further mason-work, &c.—Eps.