XLIII. *A Description of the superior Wing of the Hymenoptera, with a view to give a fuller and more certain Development to the Alary System of Jurine.* By W. E. SHUCKARD.

[Read March 2, 1835.]

Plate XVIII.

THE anterior or superior wings of the *Hymenoptera* were first applied by Jurine the elder of Geneva to their distribution into genera, from the relative disposal of some of the nervures with which they are observed to be more or less intersected. He had a strong partiality for this order, and feeling dissatisfied with the characters derived from the mouth made use of by Fabricius, as evidently tending to mislead,—for they even misled their celebrated author,—and as being difficult of access, and in unique insects dangerous to investigate, he was induced to seek for external characters which would prove more satisfactory in their results and not absolutely demand a skilful or practised hand in their inspection, a correct eye being all that was required; and after either a laborious examination, or by a lucky chance, or possibly led by the hint given by one of his predecessors, Harris or Kirby, who had both however neglected to elaborate the discovery, he found that the similarity of the neururation of the superior wings grouped these insects into divisions, the species whereof, in the majority of instances, agreed in general structure, habits, and œconomy. He however limited his use of these nervures to the longitudinal and transverse ones placed beyond the stigma of the wing, and forming the radial or marginal, and the cubital or submarginal cells, with the one or two recurrent nervures springing from the latter. This system has since been very generally followed, and almost exclusively used in that division of the aculeate *Hymenoptera* which comprises the *Fossores*, or burrowers, but in the other divisions it is sometimes of primary, and at others of subsidiary importance.

The appended comparative view of what other writers have done with respect to the neururation of the wing will show how far I have diverged from them, and they from each other. The inconvenience of some of the systems will be observed from several nervures and cells having double names, as well as from others being left unnamed, or named collectively, which tends to create both confusion and doubt.

Several circumstances concurred to lead me to a studiously careful inspection of the neuration of the superior wing throughout the order; and the result has been the discovery of a nervure which, by the degree of influence it exercises over several that are subservient to it, will, I expect, afford important assistance in reducing to order some of the yet comparatively chaotic tribes. Upon making this discovery my first object was to ascertain the name of this nervure, for I could not remember that any had been applied to it; and, as I had surmised, I sought in vain, for no full and detailed description of the wing has as yet been given; and I considered that before I proceeded with the elaboration of my discovery it would be both useful and desirable to give a full description of the reticulation of the nervures upon the superficies of the wing, and to apply individual names to such as had as yet been either neglected, or named in conjunction with others. I have taken the wing of *Gorytes mystaceus* as my type, for I consider it the most perfect in the order, and of which the rest are only modifications or aberrations. I candidly admit that I ought to have restricted myself to merely naming the hitherto anonymous portions, but I thought that if I did so it might tend possibly to confuse; I have therefore preferred incurring your censure by the recapitulation of what has been already done before me, that I might give greater lucidity and precision to my own views, and in consideration that a full description of this organ has never yet been given in one tablet.

The contour of the wing is formed by its anterior, apical, and posterior margins. The *anterior margin* is that portion which is situated anteriorly upon its expansion in flight, extending from its base to the distinctly visible extremity of the costal nervure, a little beyond the marginal cell; at its termination the *apical margin* commences, and extends to the *sinus* of the wing, which is the incision at the apex of the *posterior margin*, which latter extends from this sinus back to the base, and it is by this margin that the upper and under wings are connected in flight. The *costal* nervure is the first longitudinal nervure of the wing, and, as we have seen, extends upon the anterior margin to just beyond the extremity of the marginal cell. The second longitudinal nervure is the *post-costal*; this extends to the *stigma*, which is that thickened point or spot upon the wing placed upon its anterior margin at about two thirds of the distance between its base and extreme apex, and appears to me to be a dilatation of the costal nervure.

The third longitudinal nervure is the *externo-medial*, which proceeds in a direct line nearly parallel with the preceding for a little

more than half the length of the post-costal, or about one third of the entire length of the wing, and then leads off at an obtuse angle to join the post-costal just before its junction with the stigma. The *anal* is the fourth longitudinal nervure, which also extends from the base to the sinus at the apical extremity of its posterior margin: a transverse nervure unites the externo-medial and anal, and which I propose calling the *transverso-medial*. These nervures, which I consider the primary nervures of the wing, severally inclose what have hitherto been called collectively the basal or humeral cells, but to which I purpose applying different names (derived from the nervures which inclose them), that they may be the more readily distinguished from each other. The first, or that very narrow one between the costal and post-costal nervures, is the *costal* cell; the second is that placed between the post-costal and externo-medial nervures and which I call the *externo-medial* cell: that inclosed between the externo-medial and anal nervures parallelly, and terminated at its apex by the transverso-medial, is the *interno-medial* cell; and the cell seated between the anal nervure and the posterior margin of the wing is the *anal* cell.

From the interior margin of the stigma arises the *radial nervure*, which makes a curve and then joins the costal upon the margin of the wing: the lanceolate space thus inclosed forms what is called the *radial* or *marginal* cell. The *cubital nervure* is nearly parallel with the radial, and originates from the externo-medial near its junction with the post-costal; this extends to the apical margin of the wing just below its extreme apex. The space thus inclosed is divided by three transverse nervures, which I propose calling the *transverso-cubitals*, inclosing as many spaces forming so many cubital or submarginal cells, a fourth being formed in consequence of the cubital nervure extending to and joining the apical margin. The third nervure, originating from the primary nervures of the wing, is what I call the *discoidal* nervure,—(it is from this that I anticipate the chief results),—and which, commencing at the transverso-medial, extends in a direct line to the disc of the wing directly between the stigma and the sinus, when it makes a sudden curve at a right angle backwards and joins the anal nervure close to the sinus. From this discoidal nervure at the centre of its apical return another springs, forming what I call the *subdiscoidal* nervure, and which here extends to the posterior margin of the wing. From the cubital nervure two others originate; these are called the *recurrent* nervures, the first of which always inosculates at the angle of the discoidal nervure, and the second just beyond the centre of the subdiscoidal. By the reticulation of these four nervures several cells are formed

upon the disc of the wing; the first of these, which is inclosed between the discoidal and anal nervures, I call the *first discoidal* cell; the *second* is that placed between the externo-medial cubital, first recurrent, and discoidal nervures; the *third discoidal* cell is that inclosed by the second recurrent, subdiscoidal, discoidal, and first recurrent nervures. The space inclosed between the second recurrent, subdiscoidal, and cubital nervures, and the apical margin of the wing, forms the *first apical* cell, and there is a second only when the subdiscoidal nervure extends to the apical margin, by which and a portion of the discoidal cell it is inclosed.

This completes the description of the nervures and the cells of the wing. I will add a few observations, premising that I have never departed from the nomenclature of my predecessors but where, from the co- and sub-ordination of the nervures and cells it was requisite to do so to give the description greater precision.

The costal nervure (Latreille, Kirby, St. Fargeau,) is the radius of Jurine and Gravenhorst. It extends from the base of the wing generally to the extremity of the radial or marginal cell, and where this is open or incomplete, as in the females of *Tiphia*, it still extends nearly to where it would have been closed by the radial nervure, or to opposite the termination of the latter, as in *Stilbum*, *Leucospis*, &c.; but where there is no radial nervure it terminates at the stigma, as in *Meria*, and it generally dilates near its termination into a round opaque spot, which is the stigma of the wing, but which is occasionally obsolete. It derives its name from lying parallel when in repose with the sides of the insect.

The post-costal nervure of Latreille and Kirby is the cubitus of Jurine, and occasionally coalesces with the preceding. These two nervures inclose my costal cell, which is however wanting when they unite. In the genus *Lyda* the interior of this cell is occupied by a nervure springing from its base and terminating in a fork, the prongs of which join the limitary nervures; sometimes, as in *Lophyrus*, a transverse nervure cuts it asunder.

That the true course of the next nervure, the externo-medial, is that which it is described to take in the type,—namely, to run obliquely up to the post-costal in preference to its apparent course by inosculating sometimes at its salient angle with the discoidal and transverso-medial nervures, as in many of the *Securifera*, the normal and aberrant *Ichneumons* among the *Pupivora*, and several of the *Heterogyna* and *Fossores*,—is proved to be correct by the majority of those tribes, the whole of the *Diploptera*, and most of the *Mellifera*, in which it could not take the other course without an evident distortion, and is confirmed by its separate and distinct existence in

Neurospora *. The externo-medial cell inclosed by it is always a variously modified transverse triangle.

The transverso-medial nervure invariably inosculates at the salient angle of the externo-medial when the discoidal nervure springs from the same point or from the transverso-medial: but always when the discoidal nervure springs from the exterior of the externo-medial, which it generally distorts, as will be hereafter shown, the transverso-medial is regular, and generally directly transverse; this formation occurs in *Larra*, *Tachytes*, *Miscophus*, *Astata*, *Crabro*, &c. In the *Diptoptera* it is placed much nearer the base of the wing than in the other tribes. The cell, my interno-medial, to which this forms the closing apex is crossed transversely, and divided into two by a pseudo-nervure in the genus *Lyda*.

The anal nervure generally joins the posterior margin of the wing at its apex, where it terminates at the sinus; but in *Sphex* and some other genera its positive junction is obsolete, being merely slightly traced, and sometimes this union is entirely obliterated, as in *Scolia*.

The anal cell is occupied in many of the *Securifera* by either an undulating nervure as in *Cimbex*, *Pachylosticta*, *Sirex*, *Tremex*, &c., or by merely a transverse one as in *Cephus*, or by both as in *Lyda*.

These cells, to which I have given individual names, derived from their limitary nervures, are what constituted collectively Jurine and St. Fargeau's brachial cells, and Gravenhorst's humerals, and the basal cells of other writers. The nervures above described, by which they are inclosed, I consider the primary ones of the wing, as the existence of the rest is wholly dependent upon them.

The rest comprise the secondary nervures.

The marginal cell is cut transversely, chiefly in the *Terebrantia*, by one or two nervures which I call the transverso-radial; they can be named only in the order of their succession, their separate and distinct existence not being dependent upon their position or inosculature. We have but one instance of there being two, viz., in the genus *Xyela*: when there is but one transverso-radial nervure across the body of the cell there are two cells, as in many of the *Securifera*; but when this transverse nervure is removed closely to the apex of the radial cell, the latter is then called appendiculated, whether the portion thus separated be open, as in *Astata*, or closed, as in *Hylotoma*,

* This insect, which is unique in my own cabinet and as yet undescribed, is evidently allied to *Pazylomma*, Breh., the *Plancus* of Curtis. Their true situation appears to me to be between the *Ophiones* and *Adsciti*, where *Pelecinius* and *Stephanus* ought to come, for *Pelecinius* has certainly no connexion with the *Evaniales*, nor are the latter in their proper place unless the relative situation of the groups which follow be much remodelled.

Larra, Palarus, &c. The cubital nervure originates generally either towards the extremity of the externo-medial near the stigma, or from the centre of its bend upwards beyond the salient angle; but as a rare exception we find it in *Fænus* springing from the salient angle. When the first and second transverso-cubital nervures unite, prior to their junction with the radial nervure, the second submarginal cell is called petiolated, as in *Miscophus, Pison, Nysson, Cerceris, &c.*; when this happens to the second and third transverso-cubitals, it is the third submarginal cell which is petiolated, as in *Miscus*, but this formation is of very rare occurrence. The most important of the secondary nervures is what I have called the discoidal nervure, from the circumstance that no discoidal cell or recurrent nervure can exist without it; it originates sometimes from the point of union of the externo-medial and transverso-medial nervures, sometimes from the externo-medial itself after it has left the transverso-medial, and sometimes from the latter. It always shows a strong tendency to draw the nervure with which it inosculates outwards towards the disc at their point of contact, and it will be found, in conjunction with the other nervures, to yield very good subsidiary characters: it always returns upon the anal nervure, which it joins near the sinus. At its discoidal angle the first recurrent nervure invariably inosculates; and from near the centre of its posterior return springs the subdiscoidal nervure, upon which depends the existence of the second recurrent.

I have arranged my order of the discoidal cells differently to St. Fargeau, for I treat them in relation to their consequence; as we invariably see that where there is no discoidal nervure (which when it exists always incloses the first discoidal cell,) there is never a recurrent nervure, which always inosculates with it, forming the exterior of the second discoidal cell, and thus consequently subordinate to it; and proceeding upon the same principle we find that the third discoidal cell never exists but where there is a subdiscoidal nervure, with which the second recurrent nervure inosculates, forming the exterior boundary of that cell. The second recurrent nervure stands in the same subordination to the subdiscoidal as the first recurrent does to the discoidal, for it has never a separate existence, although the subdiscoidal nervure is sometimes found alone. It will be thus seen that I have not given the discoidal nervure undue importance, as upon its existence hangs that of the first recurrent, subdiscoidal, and second recurrent nervures, and consequently of all the discoidal, submarginal, and apical cells. By not taking this view, which careful investigation proves to be correct, St. Fargeau has unjustly charged Jurine with having erred in saying that a first recurrent nervure exists in his genus *Anomalon*; this is evidently

the fact, and St. Fargeau himself is distinctly in error, for otherwise in this genus the cubital nervure would originate from the discoidal, which can never be the case, as it is proved by analogy invariably to arise either from the base of the stigma, or just below from the exterior of the externo-medial nervure, which in that genus, and indeed throughout the normal *Ichneumons*, the anterior portion of the cubital nervure is deficient, thus merging the second discoidal in the first submarginal cell. This is the case also in the genus *Oxybelus* amongst the *Fossores*; in *Paxylomma*, *Chelonus*, several *Microctoni*, and *Aphidii*, amongst the aberrant *Ichneumones*; in *Helorus* amongst the *Oxyurites*; and by a peculiarity in this genus the above two cells are not separated from the externo-medial cell, owing to the upper half of the externo-medial nervure between its salient angle and the stigma falling back upon the anastomosis of the recurrent nervure with the salient angle of the discoidal nervure, thus inclosing a triangular portion of the second discoidal cell. And that this is correct is evidently proved by the existing remainder of that first portion of the cubital nervure, found most strongly in the approximate genus *Ophion*, as well as in *Trogus*, *Echthrus*, *Rhyssa*, and the majority of the genus *Ichneumon*; for there is decidedly no anomaly of structure in this tribe, but merely the suppression of that portion of the cubital nervure which would have formed half of the first cubital cell at the junction of the first recurrent nervure with it. The discoidal cells I have named in reference to their position and existence, being influenced by the discoidal nervure, and the apical cells from their situation upon the apical margin.

The following I consider their relative value in point of organization.

1. The primary nervures in their consecutive order.
2. The radial or marginal nervure.
3. The discoidal nervure.
4. The first recurrent nervure.
5. The cubital nervure and its transverso-cubitals.
6. The subdiscoidal nervure.
7. The second recurrent.

And that this is their true natural gradation I feel fully persuaded, and willingly invite the fullest, but at the same time candid and unprejudiced, investigation. I am fearful that the repetition of terms (which was important to the full elucidation of my views) may have proved tedious; I will therefore no longer detain you upon this subject, but will defer its practical application to our next meeting, when I hope to prove more fully the extent of its value, and which I expect to render more interesting than the present paper could possibly be, by the intercalation of desultory remarks upon several genera.