

XXX. *Remarks on the Genus Argynnis of the 'Encyclopédie Méthodique, especially in regard to its Subdivision by means of Characters drawn from the Neuration of the Wings.* By EDWARD DOUBLEDAY, Esq., F.L.S. &c. &c.

Read February 4th and March 18th, 1845.

IT is now upwards of fifty years since Jones, in a paper read before this Society, pointed out certain variations in the neuration of the wings of the *Diurnal Lepidoptera*, which appeared to him to aid in dividing them into groups more natural than those of Linnæus or Fabricius. From that time, until the appearance in 1836 of the first volume of Dr. Boisduval's '*Spécies Générale des Lépidoptères*,' little attention had been paid to the characters to be derived from these variations, equally valuable for the purposes of subdivision into minor groups, as genera and subgenera, and for binding these together into larger natural groups.

In January 1842 M. Lefebvre laid before the French Entomological Society the results of his observations on this subject, and his discourse, published in the eleventh volume of the *Annals* of that Society, is by far the most valuable contribution to our knowledge of the alary system of *Lepidoptera* that has yet appeared.

De Haan in the magnificent work on the Dutch Colonies, Dr. Rambur in the '*Faune Entomologique de l'Andalousie*,' and Mr. Westwood in '*Humphreys's British Butterflies*,' have to a certain extent made use of characters drawn from the neuration of the wing of the *Rhopalocera*, but only to a limited extent, and by no means in a satisfactory manner. None of these authors, however, have fairly tested the value of these characters by a careful investigation of some large natural group, with a view to its subdivision into minor groups founded upon them, followed up by an equally careful examination of the structure of the legs, antennæ and palpi, and of the form of the larvæ.

Whilst re-arranging the *Rhopalocerous Lepidoptera* in the collection of the British Museum, my attention was particularly directed to this subject, more

especially in consequence of repeated perusals of M. Lefebvre's discourse, to which I am indebted for many important hints.

As far as I was able to carry my researches, I found the characters derived from the nervures of the highest importance, especially in the difficult family of the *Nymphalidæ*, where they are easier to detect and apparently of greater real value than those drawn from either the antennæ or the palpi, and often appear to confirm divisions founded on the form of the larvæ; as for instance, the variations in the structure of the subcostal nervure easily distinguish the genera *Helicodes*, *Charaxes* and *Apatura*, of which the larvæ are spined only on the head and are attenuated posteriorly, from *Marpesia*, *Nymphalis*, *Limenitis* and *Diadema*, of which the larvæ are more or less spined on the thoracic and abdominal segments, and nearly cylindrical: and relying on these characters in the absence of information as to the larvæ, I have placed *Agrias*, *Chlorippe*, *Prepona*, &c. with the former, and *Timetes*, *Amphirena*, *Victorina* and *Prothoë* with the latter, though in this I differ from my learned friend Dr. Boisduval, the 'facile princeps' of Lepidopterists past and present*.

A more extended study of this family would probably lead to its subdivision into four groups, which might be named *Argynnidæ*, *Nymphalidæ*, *Adoliadæ* and *Apaturidæ*, the last already separated by Dr. Boisduval, the first by M. Blanchard.

From the first of these divisions I have selected a small but natural group, the genus *Argynnis* of Godart, excluding however a few species, to show how easily and how naturally it may be subdivided by characters drawn from the nervures, especially from the subcostal.

As the term subcostal nervure will be used hereafter in a more limited sense than has always hitherto been given to it, it becomes necessary to point out what is to be considered as the true subcostal of the anterior wings, and the reasons for separating from it certain nervules hitherto always regarded as forming part of it. Whilst doing this I shall adhere strictly to M. Lefebvre's nomenclature, and shall chiefly refer for confirmation of my opinions to his plates.

* In a manuscript catalogue which I owe to his kindness he adopts the following arrangement: *Chlorippe*, *Apatura*, *Minetra*, *Meneris*, *Agrias*, *Amnosia*, *Timetes* (including *Marpesia*), *Autonema* (*Prothoë*, Hubn.), *Philognoma*, *Charaxes*, &c.

M. Lefebvre has pointed out that the nervules may be divided into superior and inferior, according to their position above or below a fold generally visible in the wings of Lepidoptera, to which he gives the name of *pli cellulaire*. To the nervules he proposes to give the names of first inferior, first superior, &c., choosing this fold as his starting-point for numbering them.

In the Diurnal Lepidoptera he gives the names of costal and subcostal nervures to the upper ones ; of median, submedian and internal to the lower ones. The costal nervure admits of no doubt as to its limits, but it has been often a matter of doubt to what nervure his first and second superior nervule ought to be referred, as sometimes they seem to belong to the subcostal, sometimes to the median. This point M. Lefebvre decides by giving them to the subcostal, because he considers them to be always above the cellular fold. He views the subcostal as generally emitting four nervules, of which either the second or third is often, if not always, branched.

In the *Heterocera* he finds "quelques nervules qui n'ont pu être consignées." These chiefly depend on a central nervure, which he calls the discoidal, which is sometimes above, sometimes below, the cellular fold.

Such is M. Lefebvre's theory of the wing. After a long examination of the wings of Lepidoptera, from *Papilio* to the last of the *Tineidæ*, I have arrived at a somewhat different conclusion, in which I have been confirmed by a hasty glance over other orders. I should not speak so confidently of the result of my labours, had I not submitted my observations to my friend Mr. Newport, who entirely coincided with my conclusions ; and thus, having the sanction of our best physiological and anatomical entomologist, I cannot be accused of presumption in differing from all those who have preceded me.

The theory which I would propound is this : that the normal structure of the wings in Insects is, to have two distinct sets of air-vessels or nervures, three belonging to the anterior half of the wing, three to the posterior ; that in those species in which the wings are in the most truly normal condition these nervures are all fully developed, and all subserve to their true functions ; that in descending from these we first find some of the nervures less developed, but still subserving to their functions, then becoming gradually atrophied, and at last disappearing altogether ; and that this gradation depends partly on the

rank which the species hold in the true system of nature, and partly on their economy.

It is not my intention now to follow out this theory further than so far as it applies to the Lepidoptera, more especially to the Rhopalocerous ones. I hope at some future time to enter fully into all its details.

The three upper nervures exist in the anterior wings of a large portion of the *Heterocera*, but the lowest or discoidal one is often wanting, though its nervules remain; in the *Rhopalocera* it is always wanting, and its nervules are united either to the subcostal or median nervures.

I must here refer to M. Lefebvre's third plate, where these nervules are the first superior and first inferior of figure 1, the first superior and first branch of the second superior in figure 3, and the first and second superior in figures 4 to 7. It will be seen at figure 5, which represents the wing of *Hyades Jai-rus*, that these nervules are united to the median by a curved disco-cellular nervure, but have no connexion whatever with the subcostal. In *Heliconia Melpomene* (fig. 6.) a short disco-cellular also unites them to the subcostal, and in *Vanessa Larinia* (fig. 3.) they are quite separated from the median, but united by a very short disco-cellular to the subcostal. In *Papilio* the upper of these nervules springs from the middle of the first portion of the disco-cellular; the other is united to the median by a continuation of the disco-cellular, which makes an angle with its upper portion, and has always been considered to be a part of the median; whence Jones and subsequent writers have stated that the true *Equites* or *Papilionidæ* had four branches to that nervure.

I must now refer more particularly to *Heliconia Selene* (fig. 7.). These nervules are there connected with both the median and subcostal, and from the transverse part, which M. Lefebvre would consider part of the disco-cellular, spring two short nervules, pointing inwards, and becoming gradually obliterated. These exist also in *Danaus* and some other genera, and it is surprising that they did not lead M. Lefebvre to suspect that they indicated a connexion with his discoidal nervure.

It is amongst the *Heterocera* that we must look for the normal state of the discoidal nervure. In these we find it sometimes a nervure of nearly equal solidity with the median or subcostal, but in others it appears to be only a tube of the same texture as the membrane of the wing; and then we find it

merely a faint line extending from the disco-cellular to the base, evidently not tubular.

Thus in *Castnia*, where it branches about the middle of the discoidal cell, the upper branch is often almost atrophied; in *Heleona militaris* it is in this state throughout its whole course; in *Urania* and *Leiocampa* its course is indicated by a line, which shows no symptoms of being tubular, and which in the latter genus does not reach the base. One step more and it has vanished from the wing, though sometimes in certain lights a faint trace of it may with difficulty be detected. A close examination of the wing will always show a partially atrophied disco-cellular, connecting these nervules of the discoidal with either the subcostal or the median nervules, even where one of them has been described as quite free.

We thus see the discoidal nervure becoming gradually atrophied until only its nervules remain; and as air must in some way penetrate into them, they are, when the parent trunk has vanished, attached to the nervure immediately above or below them, or to both.

Admitting the correctness of the above views, we have in the *Rhopalocera* a median nervure with constantly three nervules, above which are the two discoidal nervules, then the subcostal nervure generally offering five nervules, but sometimes only three. In the *Suspensi* the number of these nervules is almost invariably five, but in the *Succincti* it is more variable, especially in the *Erycinidæ*. Not unfrequently these nervules anastomose with the costal, as in some species of *Papilio* and *Danaus* and in *Hecale* *Clytemnestra*, &c. *Leptocercus* presents an almost solitary instance of a bifurcation of one of these nervules; but perhaps the more correct view of this would be to consider that two nervules coalesce at their base in a manner analogous to the union of the costal nervure with the first subcostal nervule in some species of *Danaus*.

The genus *Argynnis* of Godart always offers five subcostal nervules, never, I believe, anastomosing with the costal nervure.

If we remove from it three species, *Arg. Alcandra*, *Aceste* and *Lucina*, and add to it some of the *Cethosiæ*, it is, as I have already said, a most natural group. Perhaps a fourth species, *Arg. Metea*, ought to be excluded also, but I only know it from Stoll's figure, which leads me to believe it to be a *Dia-*
dema.

Long before Godart, Fabricius had divided this group into two genera, *Argynnis* and *Melitæa*, the latter placed immediately before *Helicopsis*, with nine genera between it and the former, his generic character being strangely incorrect. His first species, *M. Lucina*, is now removed to another family, but his generic names have been retained by both continental and British entomologists, though they differ as to the limits of the genera. Nature, however, is decidedly on the side of our continental brethren.

Hübner in his 'Verzeichniss' has made almost as many genera as there are species in this group, but his divisions are so unnatural that they can in no case be adopted.

Dr. Horsfield has founded the genus *Phalanta* on *Arg. Phalanta* and its allies. M. Blanchard has separated *P. Pantheratus* of Martyn, the *Arg. Briarea* of Godart, making it the type of his genus *Clothilda*. Mr. Westwood has proposed to divide our British species into five groups, founded chiefly on the form and colours of the wings, to which he gives no names.

The generic name *Agraulis*, proposed by Hübner, has been retained, but not in accordance with his limitation.

Several very natural groups have as yet not been taken notice of; to provide for these species I venture to propose the following sections, founded, as will be seen in a great degree, on the position of the subcostal nervules, the first being the genus *Agraulis*, properly so called.

In *Agraulis Vanillæ* and *Moneta*, the first subcostal nervule has its origin beyond the disco-cellular nervure, the first and second being more widely distant than the second and third, the third and fourth near together, the nervure making a considerable bend downwards after throwing off the third nervule. A short upper disco-cellular connects the first discoidal nervule with the subcostal; a much longer and curved disco-cellular connects the second discoidal nervule with the median beyond its second nervule. The discoidal cell of the posterior wings is open, and both the subcostal and median nervures are much curved. These two species are much more nearly allied to many species of Godart's *Cethosiæ* than to the typical species of *Argynnis*, though it is doubtful if these ought all to be placed in the same genus, as is done by Dr. Boisduval.

The second section will include *Argynnis Thaïs*, *Clagia* and their allies.

In these the first subcostal nervule has its origin a short distance before the very short upper disco-cellular; the second arises opposite or immediately before this nervule; the third is less distant from the apex than from the disco-cellular; and the fourth is thrown off very soon after the third. The lower disco-cellular is long, little curved, uniting with the median before its second nervule. The cell of the posterior wings is open, the median and subcostal nervures are but little curved. *Terinos Clarissa* of Boisduval really belongs to this group, notwithstanding its different colouring: *Terinos* may therefore be used as a subgeneric name for it.

Argynnis Iole will form the type of a third section, the first subcostal nervule arising a little before the point of contact between the upper discoidal and the subcostal nervures, for here there can scarcely be said to be an upper disco-cellular, the second about double the distance beyond the point of junction. The median nervule of the posterior wings is more curved than in the preceding section, but in other respects the structure of both wings is nearly similar.

A fourth section is the genus *Phalanta* of Dr. Horsfield, in which, notwithstanding their more rounded wings, *Arg. Erymanthis* and *Prosopis* must be included. Here the subcostal nervules are thrown off at nearly equal intervals, the first being immediately opposite the short upper disco-cellular. A slightly curved disco-cellular, of moderate length, connects the second disco-cellular with the median immediately opposite its second nervule. The subcostal and median nervules of the posterior wings are much curved, the discoidal cell being generally open; but in *Arg. Claudia* and a species from Congo closely allied to *Arg. Phalanta* it is closed by a very delicate disco-cellular.

Several species in the preceding sections show a tendency to an angular projection at the termination of the third median nervule of the lower wings; in *Arg. Egesta*, the type of the fifth section, they are absolutely tailed. In this species the first subcostal nervule precedes the short upper disco-cellular; the second is at rather more than an equal distance beyond it; the third at about two-thirds the distance between the base and the apex; the fourth shortly beyond it. The lower disco-cellular is straight, and joins the median nervule opposite to its second nervule. The posterior wings have the cellule closed, the subcostal and median nervures little curved.

In M. Blanchard's genus *Clothilda* the subcostal nervules are at nearly equal distances, the second being immediately opposite the scarcely visible upper disco-cellular. The third median nervule is bent nearly at a right angle at its junction with the lower disco-cellular, which is directed obliquely towards the outer margin. The discoidal cell of the posterior wings is closed; the subcostal, like the median nervule of the upper wings, is bent nearly at a right angle, where it is united to the disco-cellular; the latter is united to the median nervule opposite to its second nervule.

The seventh section includes Dr. Boisduval's section *Majores* of his genus *Argynnis*, with the addition of *Lathonia* and some other species, as *Niphe* and *Childrenæ* of the old world, *Aphrodite*, *Cybele* and *Diana* of the new. Here the first and second subcostal nervules have their origin before the very short disco-cellular; the third rather more than half-way between this and the apex; the fourth at about an equal distance from the third and from the apex. The lower disco-cellular is long, nearly straight, united to the median beyond its second nervule. The cell of the posterior wing is closed by a slender disco-cellular joining the median, which is there considerably curved, exactly opposite its second nervule.

The eighth section comprises the *Minores* of Dr. Boisduval, with the exception of one or two species, and also includes several species from the temperate regions of both North and South America. Our British species have been generally placed in the genus *Melitæa* by English entomologists, but the larvæ and pupæ, independent of other characters, point out their distinction from it. These species differ from those of the preceding section in having the first discoidal nervule united to the subcostal without the intervention of any disco-cellular, in having only one subcostal nervule before this point of junction, and in having the lower disco-cellular much longer. The disco-cellular of the posterior wings is much stronger, and joins the median beyond its second nervule.

The remaining species compose the genus *Melitæa*, properly so called. They differ from those of the preceding section in having a short upper disco-cellular to the anterior wings, and in having the cell of the posterior wings open, a character which, as was first pointed out by Herrich-Schæffer, serves to separate them from the other European forms of the genus *Argynnis* of Godart. There

is a difference in the degree of curvature of the subcostal of the posterior wings and in the American group, of which *Arg. Tharos* and *Ismeria* may be considered the types; the disco-cellulars of the anterior wings are almost atrophied.

The geographical distribution of these groups is interesting. The first is confined to the warmer parts of America; the second, to the tropical parts of Asia; the third, to tropical Africa; the fourth is tropical and subtropical in both the old and new world; the fifth is from tropical Asia; the sixth occurs in Mexico and the West Indies; the seventh has its station in the temperate regions of the northern hemisphere, though three species occur in the warmer parts of Asia; the eighth has its head-quarters in Europe and the temperate regions of North America, but reappears in Chili and the Falkland Isles.

The genus *Melitæa* has three divisions: one numerous in Europe; the second, of which *M. Phaëton* and *Chalcedona*, Boisd. are as yet the only species known, confined to Northern America; the third, numerous in species, extending from Hudson's Bay to high latitudes of the southern hemisphere.

EXPLANATION OF THE PLATE.

TAB. XLII.

- Fig. 1. *Agraulis Vanillæ*, Hübn.
- Fig. 2. *Terinos*, n. sp.
- Fig. 3. *Argynnis Iole*, Godart.
- Fig. 4. *Argynnis Hegesia*, Godart.
- Fig. 5. *Argynnis Egesta*, Godart.
- Fig. 6. *Clothilda pantherina*.
- Fig. 7. *Argynnis Cybele*, Godart.
- Fig. 8. *Argynnis Dia*, Godart.
- Fig. 9a. *Melitæa Cinxia*, Ochs.
- Fig. 9b. *Melitæa Phaëton*, Boisd.
- Fig. 9c. *Melitæa Ianthe*.



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