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X.

DICTYONEURA AND THE ALLIED INSECTS OF THE
CARBONIFEROUS EPOCH.

BY SAMUEL H. SCUDDER.

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THE recent discoveries of Mr. Charles Brongniart in the insect fauna of Commentry, France, have thrown a flood of light over the obscurities of the carboniferous epoch. Wings of a type which all writers had agreed were at any rate neuropterous, and referred to a special genus, Dictyoneura, are found by him attached to bodies which are clearly orthopterous, and of a specialized group, which one would scarcely have looked for in ancient times. Additional species now occur from time to time, and the number of forms referred to Dictyoneura is constantly growing. Others allied to them have been referred, and are still being referred, to other genera, and to still other divisions of Neuroptera.

Under these circumstances, and because a number of new American types need to be brought into their proper place, I have thought best to offer a brief synopsis of those carboniferous forms heretofore discovered, (with a few additional ones from this continent,) which may be referred to the ancient Phasmida.

Among them will be found nearly all the species heretofore referred to the Termitina from the European coal measures, for a careful study shows that the white ants were not at all represented in palæozoic times, so far as the forms yet discovered show. Most of those which have been considered Termitina belong rather here, (they have already in several instances been referred here,) while others belong to other groups of Neuroptera than Termitina.

A fuller memoir on this subject, with detailed descriptions and full illustrations, will be given at an early day.

The genera may be separated in the following manner:—

1. Wings moderately slender, scapular nervure branched . . . 2
1. Wings very slender or pointed, scapular nervure simple . . . 5

2. Wings very large, scapular vein beginning to branch in the middle of the basal half of the wing *Titanophasma*.
2. Wings generally much smaller than in the preceding genus, scapular vein first branching at, or beyond, or only a little before, the middle of the wing. (In some small species of *Dictyoneura* s. s. it branches unusually near the base.) 3
3. Scapular and externomedian veins first dividing near together before the middle of the wing; branches of the scapular vein arising from a single principal branch 4
3. Scapular vein first dividing beyond the middle of the wing, and usually far from the first forking of the externomedian vein; branches of the scapular vein arising from the main stem . . . *Litoneura*.
4. Internomedian vein simple *Dictyoneura*.
4. Internomedian vein forked *Polioptenus*.
5. Wings triangular, much broader next the base than beyond; the tip roundly pointed *Breyeria*.
5. Wings oblong-ovate, broadest in the middle, or as broad in the middle as next the base; the tip generally rounded, but sometimes pointed 6
6. Fore wings four, or less than four, times as long as broad; branches of veins oblique, curving down to and striking obliquely the lower margin of the wing, of which margin those of the externomedian vein occupy at least one third; anal area extending nearly to the middle of the wing; no intercalary veins . . . *Goldenbergia*.
6. Fore wings five or six times longer than broad; branches, either much curved, running at first longitudinally, and then becoming very oblique, striking the margin nearly at right angles, and with many intercalary veins; or more nearly resembling *Goldenbergia*, and without intercalaries; in both cases with rare dichotomosis *Haplophlebium*.
6. Fore wings four, or less than four, times as long as broad; branches of veins dichotomizing strongly, and running longitudinally, so that those of the externomedian vein occupy only a slight portion of the lower margin; no intercalary veins *Paolia*.

TITANOPHASMA Brongniart.

This is the larger type of the two whose bodies were found by Brongniart, one measuring as much as a fourth of a metre in length. The resemblance in every essential feature of the neururation of the wing of Brongniart's type to the largest-sized wings heretofore re-

ferred to Dictyoneura, shows that the latter certainly belong here. The species may be separated thus:—

1. (Hind) wing at least fifteen centimetres long; the first offshoots of the scapular branch emitting nervules on the outer side only; extremities of nervules rather strongly arched.

T. Fayoli Brongn. Commeny, France.

1. (Hind) wing hardly more than twelve centimetres long; the first offshoot of the scapular branch emitting nervules on the inner side only; extremities of nervules rather gently arched . . . 2
2. First offshoots of the scapular branch arising only a little beyond the middle of the wing, and some distance before the middle of the scapular branch; reticulation small and fine.

T. libelluloides (*Dict. libelluloides* Gold.).

Gersweiler, Auerswald (Saarbruck basin).

2. First offshoot of the scapular branch arising far beyond the middle of the wing, at about the middle of the branch; reticulation moderately large and coarse. Length 7 mm. . . *T. jucunda*, n. sp.

Near Pittston, Penn. (R. D. Lcoe, No. 2027).

LITONEURA (λίτὸς, νευρά), n. gen.

Here are placed the simplest forms in all the group, in which the veins are also comparatively few, simple, and distant. Three species are known:—

1. Wings small; fore wing not more than two and a half times longer than broad 2

1. Wings large; hind wing nearly four times as long as broad.

L. laxa (*Term. laxa* Gold.). Dudweiler (Saarbruck basin).

2. Some of the veins below the externomedian forking beyond the middle of their course . . . *L. obsoleta* (*Dict. obsoleta* Gold.).

Altenwald (Saarbruck basin).

2. None of these veins forking beyond the middle of their course.

L. anthracophila (*Dict. anthracophila* Gold.).

Gersweiler (Saarbruck basin).

DICTYONEURA Gold.

In restricting this generic term, which has been applied to nearly all the European species mentioned here, I have employed it for one of the groups which contains an original member of the division, as defined by Goldenberg, and have selected the one having the largest number of species, and in which the internomedian vein is simple.

The group originally contained three species, which are here divided among the three genera so far discussed. As restricted, the species are the following: —

1. Wings exceeding seven centimetres in length; the scapular branch originating at about the middle of the wing. *D. Schmitzii* Gold.
Altenwald (Saarbruck basin).
1. Wings not exceeding five centimetres in length; scapular branch originating much before the middle of the wing 2
2. Branches of scapular and externomedian veins very dissimilar; those of the latter much more numerous . . . *D. Humboldtiana* Gold.
Sulzbach (Saarbruck basin).
2. Branches of scapular and externomedian veins similar 3
3. Main scapular branch first forking far beyond the middle of its course *D. sinuosa* Kliv. (Saarbruck basin.)
3. Main scapular branch first forking before the middle of its course.
D. affinis (*Termes affinis* Gold.). Sulzbach (Saarbruck basin).

POLIOPTENUS (πολιός, πτηνός), n. gen.

A single species, *Dict. elegans* Gold., from Dudweiler, in the Saarbruck basin, is separated from the others to which it is allied, on account of its forked internomedian, which has here almost the importance of the externomedian. In other respects, it agrees in general features with *Dictyoneura*.

PROTOPHASMA Brongniart.

It was in founding this genus that Brongniart made known the relationship of the wings allied to *Dictyoneura*, heretofore considered neuropterous. The wing of *Protophasma*, as figured by Brongniart, however, differs plainly from any of the genera here distinguished, although it seems certain that his delineation of the neuration cannot be considered strictly accurate, as it is very anomalous, and probably distorted by its preservation. We have not attempted, therefore, to place it in our table, though the position of the genus is somewhere among those in which the scapular nervure is simple. A single species is known, *Prot. Dumasi* Brongn., Commentry, France.

BREYERIA De Borre.

Much discussion has arisen concerning the affinities of the single wing upon which this genus was founded, which will be found princi-

pally in the *Comptes Rendus* of the Belgian Entomological Society eight or nine years ago. De Borre at first considered it an orthopteous insect, and named it *Pachytylopsis*, together with another smaller form. Afterwards he separated it from the other under the above name, in maintaining Breyer's belief that it was lepidopterous. To this opinion he gained no adherents, and subsequently modified his views by calling it a member of the ancestral stock of *Lepidoptera*. The true position of the fossil will hardly be doubted by those who will examine the entire series here discussed. Two species are referred here:—

1. Wing scarcely more than twice as long as the greatest breadth; branches of the anal vein widely and rather abruptly divaricate *B. borinensis* De Borre. Mons, Belgium.
1. Wing fully three times as long as the greatest breadth; branches of anal vein approximate, gently divaricate.
B. elongata (*Dict. elongata* Gold.).
Dudweiler (Saarbruck basin).

GOLDENBERGIA, n. gen.

I venture to apply the name of one of the closest students of carboniferous insects to this group, comprising, as it does, a considerable number of species first made known by him, though then supposed to belong mostly to the *Termitina*. It is the most prolific of the European genera. The following are the species:—

1. Wings rapidly narrowing from within the middle outward, at most scarcely more than three times as long as broad 2
1. Wings gently narrowing from about the middle outward, and more, generally much more, than three times as long as broad . . . 3
2. Broadest portion of wing in the middle of the basal half, the lower margin beyond this slightly concave, making the wing falcate; veins very gently curved . . . *G. elongata* (*Dict. elongata* Gold.).
Dudweiler (Saarbruck basin).
2. Broadest portion of wing scarcely behind the middle, the lower margin outside of this gently convex, the apical portion of the wing not at all falcate; veins more curved than in the preceding.
G. nigra (*Dict. nigra* Kliv.). Frankenholz, Bavaria.
3. Fore wing equal throughout most of its extent; internomedian vein simple *G. Decheni* (*Termes Decheni* Gold.).
Altenwald (Saarbruck basin).
3. Wings oblong-ovate; internomedian vein forked 4

- 4. (Fore) wing slender, four times as long as broad; all the branches of the externomedian vein arising beyond the middle of the wing.
G. Heeri (*Termes Heeri* Gold.). Altenwald (Saarbruck basin).
 - 4. (Hind?) wing comparatively stout, about three times as long as broad; the basal branch of the externomedian vein arising before the middle of the wing . *G. formosa* (*Termes formosus* Gold.).
 Gersweiler (Saarbruck basin).
- G. Heeri* and *G. formosa* are probably distinct, but may be front and hind wing of the same species.

HAPLOPHLEBIUM Scudder.

We come now to two groups which are distinctly American, and into which all the American species save one (a Titanophasma) enter. This separation of the minor elements of the archaic Phasmid type is not a little remarkable. The wings in this genus are excessively slender. Two species are known to me:—

- 1. Wings about five times longer than broad; veins regularly and gently curved, equidistant and distant; no intercalaries.
H. Barnesii Scudd. Cape Breton.
- 1. Wings about six times longer than broad; veins strongly curved, especially as they approach the margin, not very distant, excepting toward the margin, and abundantly supplied with intercalaries. Length 6 mm. *H. longipennis*, n. sp.
 Pittston, Penn. (R. D. Lacey, No. 2008, 2014, 2020).

PAOLIA Smith.

This type, first brought to light thirteen years ago, has since been enriched by several unpublished forms. The wings are graceful in shape, and the neuration more flowing than in any other of the group. The discovery of the body is greatly to be desired. Most of the following species are new:—

- 1. Fore wings narrower than in the other series; anal nervules straight and nearly as longitudinal as the sweep of the general mass of nervules, with no terminal forks, and reaching no farther than the middle of the wing 2
- 1. Fore wings broader than in the alternative series; anal nervules more oblique than the others, the outermost (always?) strongly and suddenly curved at the basal fork, at the distal end reaching along the inner border by successive forkings to beyond the middle of the wing 3

2. Wings very large, reaching a length of nine centimetres ; externomedian vein beginning to fork far beyond the middle of the wing ; branches of internomedian vein superior to upper fork.

P. superba, n. sp. Mazon Creek, Ill. (L. M. Umbach).

2. Wings much smaller than the preceding, not exceeding four centimetres in length ; externomedian vein beginning to fork before the middle of the wing ; branches of internomedian vein terminal.

P. Lacoana, n. sp. Near Pittston, Penn. (R. D. Lacoë, No. 2015).

3. Upper branch of internomedian vein several times forked, commencing scarcely beyond the basal externomedian fork ; anal branches more ramose next margin than in the following species *P. vetusta* Smith. Paoli, Indiana.

3. Upper branch of internomedian vein forking only once, at a long distance from the basal externomedian fork ; anal branches comparatively simple. Length 5.5 mm. *P. Gurleyi*, n. sp. Orange Co., Indiana (W. Gurley).

Besides these, Brongniart mentions and names several species from Commentry, but without any exact indication of their relationship or any characterization. Facts concerning them will, doubtless, soon be forthcoming, as it is understood that he is engaged on the entire carboniferous insect fauna of Commentry.

Since presenting the above paper, Mr. Brongniart has kindly sent me drawings of the wings of his *Dict. Monyi* and *Dict. Goldenbergi*, the former an enormous wing about three decimetres long. They both fall in one genus, in the vicinity of *Goldenbergia*, but must be separated from that on account of the vast number of nervules, and the completely simple internomedian vein.