PSYCHE.

THE EPHEMERIDAE AND VENATION NOMENCLATURE.

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That consummation devoutly to be wished, the agreement among entomologists on a rational nomenclature for the veins of the wings of insects seems to be a probability of the near future. Just at present one of the moot points is presented by the wings of the Ephemeridae. * Redtenbacher in his elaborate study of wing-venation chose, rather unhappily it now seems, the Ephemerid wing as type of the existing generalized wing. In this wing, in addition to the usually distinct and easily recognized five principal longitudinal veins (exclusive of the anal veins), viz.: costa (marginal vein) subcosta, radius, media and cubitus, there are two other apparently equally important and fundamentally distinct longitudinal veins, one lying between radius and media, the other between media and cubitus. These two veins are called by Redtenbacher IV and VI, the already named five being designated by him, beginning with costa, as I, II, III, V, VII. Redtenbacher, believing these veins to be incident to the racial insect wing sought to find them in all the orders of insects. * Comstock, adopting in the main Redtenbacher's nomenclature, explains the presence of these two veins (IV and VI), naming them pertinently premedia and postmedia, differently from Redtenbacher. Professor Comstock pointed out that the veins in question were wanting in the wings of paleozoic insects, and stated his belief that the veins have been secondarily acquired among the May-flies by a straightening out of the zigzag lines between two series of cells. That is, they are essentially *venae spuriae*. † Spuler, studying the ontogeny of the lepidopterous wing found no indication of the two veins, and suggested a system of nomenclature which omits any reference to veins IV and VI of Redtenbacher as independent longitudinal veins. Spuler's conclusions and system are accepted by ‡ Dr.

* Redtenbacher, Josef., Vergleichende Studien über das Flugelgeader der Insecten, Ann. d. k. k. naturhistorischen Hofmuseums, Wien, Bd. I. s. 153–232, t. IX–XX, 1886.

* Comstock, J. H., Evolution and Taxonomy, in The Wilder Quarter Century Book, pp. 37–114, figs. 1–33, pl. I–III, 1893.

† Spuler, A., Zur Phylogenie und Ontogenie des Flügelgeäders der Schmetterlinge. Zeitsch. f. wiss. Zoologie, Bd. LIII, s. 597–646, t. XXV, XXVI.

‡ Packard, A. S., On a Rational Nomenclature of the Veins of Insects, especially those of Lepidoptera, *Psyche*, May, 1895.

Packard. In his most recent *writing on the matter, Professor Comstock states that in his present opinion it would be well not to recognize premedia and postmedia as belonging to the group of principal longitudinal veins.

As a note, perhaps of interest, I offer a brief account of certain observations recently made on Ephemerid wings. A comparison of the figures of Redtenbacher and Comstock show that although both refer to a premedial and a postmedial vein they differ in their interpretations of what constitutes these veins and their respective branches (see figures 1 and 2, after Redtenbacher and

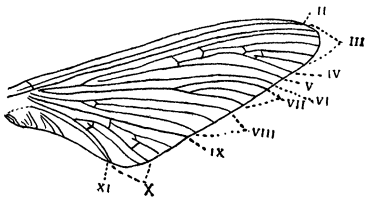

Fig. 1.

Comstock, respectively). What Professor Comstock defines to be vein IV and its branches includes part of Redtenbacher's vein III and all of his veins IV, V, VI, and their branches. Vein V of Comstock is Redtenbacher's vein VII, and Comstock's veins VI and VII are included by Redtenbacher among the anal veins. † Scudder's description of the venation of the Ephemeridae agrees with Comstock's in that both make radius (scapularis of Scudder, after Heer) a simple (unbranched) vein, but Scudder does not recognize any independent longitudinal veins

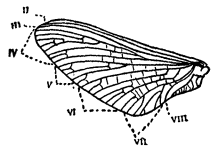

Fig. 2.

between radius and media or between media and cubitus. Comstock's veins IV and V are Scudder's externo-median, and his veins VI and VII are Scudder's interno-median. That is, Scudder makes premedia a branch of media, and postmedia a branch of cubitus.

None of these interpretations of the Ephemerid venation seems to me the correct one! The presumptuousness of this statement should be less offensive when we recall the fact that no two of the three already offered interpretations agree. A characteristic of radius noticeable in generalized wings and strenuously preserved in the specialized wings, is its branched condition. Just as sub-costa is characterized by its uniformly unbranched condition (excepting in the wings of a few very generalized insects, as the Blattidae), and media is characterized by its tendency to lose its basal half, so radius and cubitus are characterized by the persistence of their branches. Radius in its mode of branching also shows

* Comstock, J. H., The Venation of the Wings of Insects, pp. 75–91, in The Elements of Insect Anatomy, by Comstock and Kellogg, 1895.

† Scudder, S. H., The Pretertiary Insects of North America, pp. 5–6, 1890.

a recognizable consistency. Broadly stated, the manner of the branching is this: the stem forks rather near its base, the upper branch, which either does not fork again (in more specialized wings) or gives off a few branches (a more generalized condition) appearing to be more directly a continuation of the basal trunk than the lower branch, which usually displays a "branching away" character, and which is almost always repeatedly forked and branched. This repeatedly forking lower branch is the radial sector of authors. In the more generalized venation the sector branches from the radial stem near its base, and is many-forked. The modifications which the sector and its branches exhibit, due to the specializing tendency of the wing toward narrowness with accompanying coalescence and disappearance of vein branches are the reduction in the number (coalescence) of the branches and the movement of the point of origin of the sector farther and farther away from the base of the wing.

Now although the Ephemerid wings are in point of specialization in advance (shown by the reduction of the hind wing, and the specialization of the thorax) of the general rank of the family among insects (paired genital openings, etc.), the wings have by no means reached that degree of specialization where radius has become an unbranched vein. In fact, radius in the Ephemerid wing is, to my mind, in very generalized condition. The many-branched radial sector departs from the stem very near its base, so near indeed, that by a slight modification it has become apparently entirely distinct from radius, and, in some May-flies even apparently joined at its base with media. Such an apparent or even real dissociation of a branch from its original stem and re-association with another vein is not an uncommon phenomenon in the modification of venation; note among the Lepidoptera the association of the branches of media, after the base of media has disappeared, with radius and cubitus.

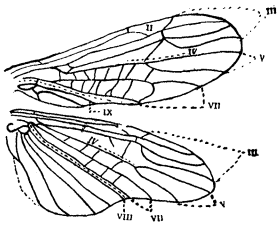

Fig. 3.

Nor is this condition of radius and its sector unique with the May-flies. Among Neuropteroid insects in general the sector usually arises near the base of the radial stem (Odonata, Sialidae *et al.*), and not unfrequently is apparently dissociated from the radial stem, and re-associated with media, as in certain Odonata and Perlidae, and, among unrelated forms, in Embia, Fulgora *et al.* In some cases the base of media is intimately united (coalesces) with the base of radius, as in Nemura (see figure 3). In fact the crowding together of the vein stems at the base of the wing brings about much distortion and modification of these one-time mutually independent and co-important trunks.

I would also designate the two veins called by Redtenbacher VI (postmedia of Comstock) and VII, simply as vein VII. Cubitus as well as radius is characterized by the persistence of its branches. As defined by Redtenbacher cubitus in the Ephemerid wing has lost all of its branches. This is extreme specialization. In my opinion cubitus in the Ephemerid wing forks at the very base producing the effect of two independent longitudinal veins. The same effect is shown in Nemura (see figure 3, especially hind wing) and is interpreted by * Redtenbacher exactly as I would interpret the similar condition in the Ephemeridae. Nemura, indeed, in the condition of both radius and cubitus is very like the Ephemerid wing and it is interesting to note Redtenbacher's interpretation (fig. 3) of the venation of this wing. No longer constrained by the rigid limits which the application of the theory of original convex and concave veins entailed we can now hardly justify the acceptance of two such variant interpretations of two such essentially similar wings.

In my view, therefore, the veins of the Ephemerid wing should be homologized as indicated in † figure 4. The interpretation does away with any recognition of veins IV (premedia) and VI (postmedia) as independent veins, either as original principal veins (Redtenbacher) or as *venae spuriae* (Comstock).

More convincing than the argument from analogy for the correctness of this

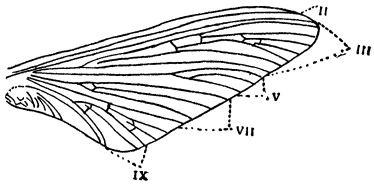

Fig. 4.

interpretation is the observed fact that the tracheal trunk (original basis of the vein) of the radial sector can be distinctly traced, at least in observed instances, as a primary branch of the radial tracheal trunk, although the chitinous envelop of the sector's tracheal branch, which gives the vein its visibility to the naked eye, is not present at the base of the sector. In studying the venation of certain Blattid wings I found that the wing could be so mounted that the tracheal trunks (or, more accurately, probably, the *"*Rippenstränge*," relicts of the original tracheal trunks and identical in course with them), the foundations of the present visible veins, could frequently be seen and traced. At the base of any wing the thick chitin envelop of a vein is often obsolete although the tracheal trunk persists. In a mounted wing of Hexagenia sp. I have plainly observed the branching trachea of the sector arising from the radial trunk at

* I recognize, of course, that Redtenbacher's interpretations are influenced always by the convex and concave vein theory.

† Evidently, if this interpretation is correct and veins IV and VI are not elsewhere found as original principal veins, the veins should be numbered as follows: I = costa, II = subcosta, III = radius, IV = media, V = cubitus.

* Korschelt, E., and Heider, K. Lehrbuch der vergleichenden Entwicklungsgeschichte der wirbellosen Thiere, p. 864, 1890.

an appreciable distance from the base of radius. This wing also shows the unity at the base of the wing of the two main branches of cubitus.

In the examination of a considerable number of wings from various orders of insects I have noted that anal veins arise from certain tracheal trunks or often apparently from one main trunk which divides at the base of the wing into several or many branches or rays; and that this main anal trunk is distinct from the main trunk or trunks which run into the pre-anal area of the wing, and which are the foundations of the principal longitudinal veins of the pre-anal area. In the wing of Hexagenia the veins corresponding to those veins marked "anal" in figure 4 are supplied with tracheae from one main trunk, the anal area trunk, while the first vein in front of these anal veins (called by me part of cubitus) does not receive a branch from this main anal trunk.

ON THE NEST AND PARASITES OF *PROSOPIS VARIFRONS* CRESSON.

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This bee and *Ceratina dupla* are the most common ones that tunnel in the shoots of the elder and mustard in this locality. The cells are built in stems which the parent herself has hollowed out, and measure on an average 4 lines long, by 2 or 3 wide. They are lined with a thin, transparent layer of silk which is spun by the parent bee, and are filled three-fourths full with the light yellow semi-fluid bee-food. The egg is laid on top of this mass, and the cell is closed by the same silken tissue which, in its turn, forms the base of the succeeding cell. The last of the series, when finished, is further protected by a layer of pith of variable depth. The cells are probably normally built contiguously, but a few sometimes have partitions of pith, which may be the work of more than one bee.

Two broods at least are produced annually. By splitting the twigs containing the cells I was enabled to watch the larvae pass through their various stages, and in a series gathered on May 5 at Manzana, in the Antelope Valley, all of which were apparently newly constructed, the food was consumed in 8 days after the hatching of the egg. The larvae at this stage are quite active, and in their restlessness a few of them burst through the lining of the cell on the exposed side and made their escape. During this period of activity they void a small quantity of excrement which, being limited to one end of the cell, simulates an artificial partition between the cells.

In from four to six days after the food was consumed they passed into the pupa stage, and on June 9th with two exceptions all had taken their flight, the time occupied in passing