

ART. XXXIII. — *Types of Permian Insects*; by E. H. SELLARDS.

[Continued from vol. xxii, p. 258, Sept. 1906.]

PART II.—PLECTOPTERA.

Ephemeroidea have been until very recently unknown from Permian deposits. The group is scantily represented in the Russian Permian, according to Handlirsch, by one imperfectly preserved wing and three larval forms.* That Ephemeroidea were present in considerable numbers during Permian time is, however, clearly indicated by the collections made from the Kansas Permian. True Ephemeroidea make up a conspicuous element in the insect fauna of these deposits.

Protereismephemeridae, new family.

The insects of this new family are true Ephemeroidea. In the general shape of the wings and the body, as well as in the manner of holding the body, they very much resemble many of the modern large Ephemeroidea. The prothorax and head are of medium size; the thorax is large and arched; the mesothorax and metathorax are equal in size or nearly so; the abdomen is long and slender and terminates in streamers. The wings are elongate with rounded inner border; the two pairs are equally developed, or nearly so. The venation of the wing is of a fixed and characteristic type, indicating a well established family. The subcosta, as is usual with Ephemeroidea, lies close to the border and extends to the apex of the wing. The radius is strong at the base and extends parallel to the subcosta to the apex. The radial sector is very uniform throughout the family. Its divisions, as is true also of other veins of the wing, are by sets of threes, the typical number being three sets of three veins each, or nine branches to the sector in all. The first division of the sector is commonly

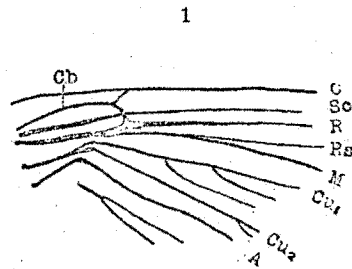


FIG. 1. Arrangement of veins at the base of the wing as seen in the type genus of the family *Protereismephemeridae*. Veins drawn to scale from nature. C, costa; Sc, subcosta; R, radius; Rs, radial sector; M, media; Cu₁, first division of the cubitus; Cu₂, second division of cubitus; A, first anal; Cb, costal brace. Enlarged 6 times.

* Über einige Insektenreste aus der Permformation Russlands. Mémoires de L'Académie Impériale des Sciences de Pétersbourg, (ser. 8) vol. xvi, No. 5, 1904, pp. 6-7; Die Fossilen Insekten, Lieferung III, pp. 386-387, 1906.

somewhat in front of the middle line of the wing. The two lower branches resulting from this division are simple; the upper division, after continuing simple a distance of four or five millimeters, breaks into a second set of three veins, of which the two upper are simple; the lower, continuing simple a variable distance, ultimately breaks into a third set of three veins. The middle vein of these sets of three lies on the fold, is usually weaker, and has the appearance of an interpolated vein. Its attachment is variable, sometimes with the upper

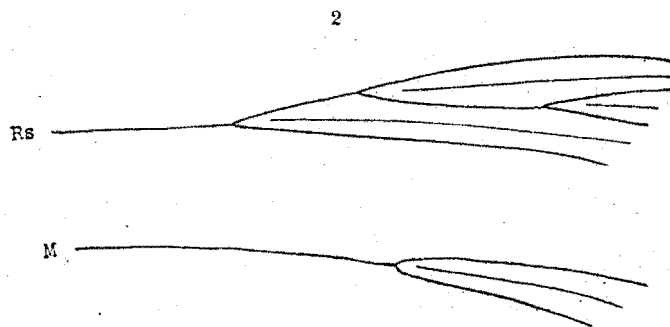


FIG. 2. The radial sector (Rs) and the media (M), as typically developed in the family *Protoreismephemeridae*. The attachment of the middle vein of the sets of three is variable.

division, sometimes with the lower, or, rarely, directly between the two. In all genera and species thus far made known the radius conforms to this general type. The attachment of the sector is usually with the media. The media is equally constant and characteristic. This vein continues simple to or beyond the middle of the wing, where it breaks into a set of three veins, all of which remain simple. The interpolated vein lies in the furrow, the outer branches and the media itself lying on a fold. The attachment of the interpolated vein is variable with the different genera. The media, usually carrying the sector, is fused at the base with the radius. Cubitus₁ and cubitus₂ separate just at their basal origin. Each is typically three branches, but in some species additional branches appear at the border. The first anal is a strong, simple, deeply impressed vein, with an abrupt characteristic downward curve at the base.

A strong brace occurs at the base of the wing. The vein forming the brace is without doubt the costa combined with a strong cross vein. This vein arises at the base of the wing

between the border and the subcosta. It extends, following an arched course, between the subcosta and the border, a distance of two to four millimeters (variable with the different genera), where it divides. The stronger division turns with a uniform curve across the subcosta and ends on the radius, thus forming the brace. The weaker division turns upward, reaching to and quickly joining the costal border. This structure is also seen in the wings of many modern Ephemeroptera genera, where it is apparently a disappearing character. As a convenience of reference I suggest for this structure the term *Costal brace*.

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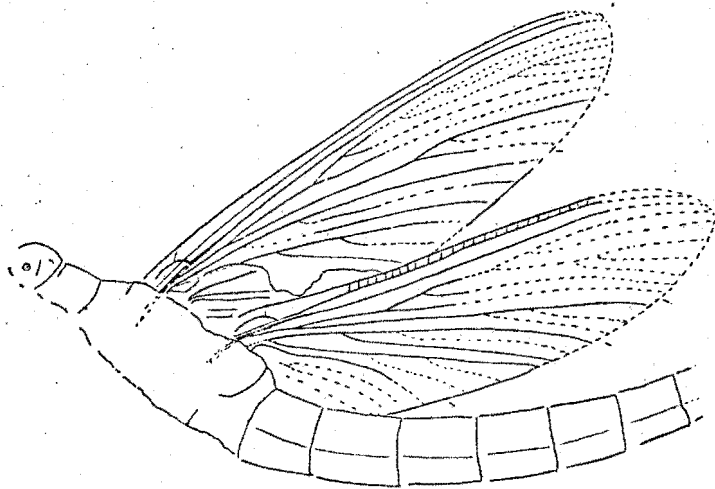


FIG. 3. Type specimen of the genus *Protereisma*. Head, thorax, and first seven segments of the abdomen preserved. The wings are preserved complete except at the tips. The wings are thin and flat. The venation is made more indistinct by the fact that the four wings lie together. The dotted veins and the tips of the wings restored from a second specimen of the same species. Enlarged 4 times.

Protereisma gen. n.

The genus *Protereisma** is regarded as the type genus of the family. The wings are thin, elongate, and but slightly corrugated. The costal border is straight, the inner border rounded. The greatest width is near the middle line of the wing. The venation conforms to the type described for the family. The middle vein of the sets of three arises from the upper division. This feature together with the but slightly corrugated membrane gives a more lax appearance to the wing

* *Protos*, first; *Ereisma*, brace.

than is the case with most other genera of the family. The radius is thickened at the base. The costal brace is strong. Cross veins are numerous, but weak. The abdomen is long, being fully twice the length of the thorax.

Protereisma permianum n. sp. Text figure 3.

This, the type species of the genus, is large, and is to be recognized by the long cubitus, reaching beyond the middle of

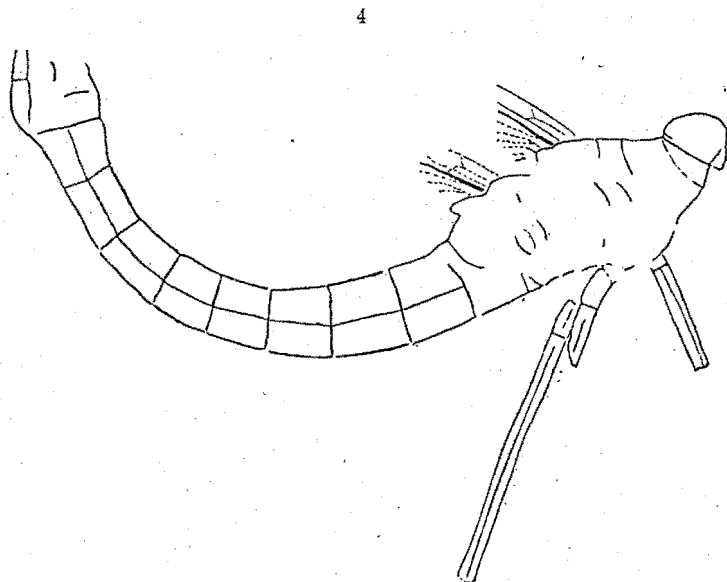


FIG. 4. A male specimen of the genus *Protereisma*, probably *P. permianum*, or the related *P. latum*. Head, thorax and abdomen preserved; also the bases of the wings and parts of the legs. The forceps are thick and strong. Enlarged 4 times.

the wing. The cross veins are numerous, but so weak as to be but indistinctly preserved.

Length of the front wing, 20^{mm}; width, at the middle, 6^{mm}.

Length of hind wing, 18 to 19^{mm}; breadth, 5 3/4^{mm}.

Length of abdomen, 20^{mm}; total length of body, 28 to 30^{mm}.

Protereisma minus n. sp. Text figure 9.

This is a small species. The wing is thin and flat, the veins thin; the cross veins numerous, but weak. The cubitus is short, not reaching beyond the middle of the wing.

Length of wing, 16^{mm}; width, 4 2/3^{mm}.

Proterocisma latum n. sp.

A third species of this genus is present in the collection. The front and hind wings in the type specimen lie together. The wing membrane is of a brownish color. The wings of this, as of the other species of the genus, are but slightly corrugated, the cross veins weak.

Length of front wing, 25^{mm}; width, 7 1/2^{mm}.

Length of hind wing, 22^{mm}; width, 6^{mm}.

Protechma acuminatum gen. et sp. n. Text figure 8.

The shape of the wing of this genus is characteristic, the apex being much more slender and pointed than in any other genus of the family. The wing membrane is corrugated, although not strongly so. The media joins the radius well in front of the costal brace. The interpolated veins of the sector arise from the lower branches. The middle division of the sector forks well toward the apex. The cross veins are of medium strength.

Length of the wing, 20^{mm}; width, 5 1/2^{mm}.

Prodromus rectus gen. et sp. n. Text figure 10.

The wings of this genus are corrugated, but not strongly so. The costal border is straight, the apex rounded; the inner border slightly rounded. The cross veins of the wing are comparatively strong. The forking of the middle division of the sector is shallow. The interpolated veins of the sector arise from the lower divisions. Cubitus, is five branched at the border. Cubitus, is partly obscured in the specimen illustrated. A second specimen of the species, however, has this area of the wing preserved. Cubitus, is seen in this second specimen to give off two branches early, as is usual for the family.

Length of wing, 18^{mm}; width, 5^{mm}.

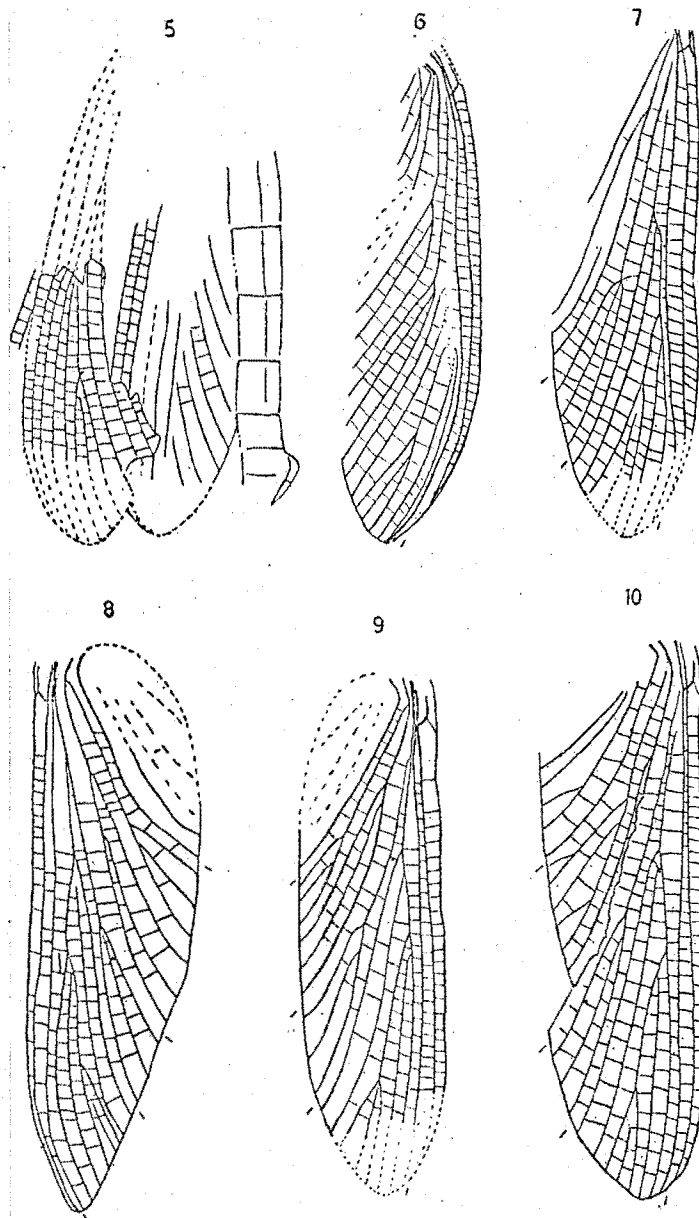
Bantiska elongata gen. et sp. n. Text figure 7.

Wings corrugated, costal and inner borders straight, costal brace thin. The interpolated veins of the sector arise from the superior divisions; the middle radial sector branch is deeply forked. The interpolated vein of the media arises from directly between the two outer branches. The cross veins of the wing are numerous, regularly placed and of medium strength.

Length of wing, 16 to 17^{mm}; width, 5^{mm}.

Rekter arcuatus gen. et sp. n. Text-figure 6.

The wings of this species are characterized by their unusually arched form. The costal brace is thin and lies close to the



costal border. The forking of the median division of the radial sector is shallow; the interpolated vein arises from the

upper branch. The media divides early and turns abruptly toward the inner border at the point of division; the interpolated vein arises from the upper branches very close to the fork. Cubitus branches very tardily as compared with other genera of the family. The wing membrane is not strongly corrugated; the cross veins are uniformly and regularly placed.

Length of wing, 16 $1/2^{mm}$; width, 4 or $4\ 1/2^{mm}$.

Rekter (?) *extensus* sp. n. Text figure 5.

The species illustrated by text figure 5 is placed doubtfully in the genus *Rekter*. The part of the front wing seen is strongly arched. The wings are probably longer than are the wings of *R. arcuata*, and the median branch of the sector is much more deeply forked. The terminal seven segments of the abdomen are preserved. The abdomen is very slender, the segments much longer than wide. The cross veins of the wing are somewhat more numerous than those of the type species of the genus. The hind wing of the specimen illustrated has suffered lateral crushing, obscuring the venation in the central part of the wing.

Length of front wing, estimated, 16 or 17^{mm} ; width, 4 to $4\ 1/2^{mm}$.

Dromeus obtusus gen. et sp. n.

The genus *Dromeus* is proposed for a small Ephemeroidea of this family. The wing is corrugated, the cross veins numerous and regularly placed. The middle branch of the sector is deeply forked, the interpolated vein attached to the upper division. The wing of the type species is much smaller than that of any other described species of the family. The genus

Explanation of Figures.

FIG. 5. *Rekter extensus* sp. n. Apical parts of the wings and the terminal segments of the abdomen preserved. The abdomen is unusually slender. The forceps are slender. Two segments of the forceps are seen. The abdomen is viewed from the side. The wings are but slightly longer than the abdomen. Enlarged 4 times.

FIG. 6. *Rekter arcuatus* gen. et sp. n. The basal attachment of the radial sector is obscured. The second anal is displaced, lying across the first anal. Enlarged 4 times.

FIG. 7. *Bantiska elongata* gen. et sp. n. A genus with wings strongly corrugated and resembling in general form the Odonates. The radial sector is, as a result of lateral crushing, crowded close to R_1 , obscuring the cross veins. Enlarged 4 times.

FIG. 8. *Prolechma accuminatum* gen. et sp. n. The wing has suffered slight lateral crushing, bringing the middle veins of the radial sector close together. Enlarged 4 times.

FIG. 9. *Proterocisma minus* sp. n. Enlarged 4 times.

FIG. 10. *Prodromus rectus* gen. et sp. n. The wing membrane, as indicated by the jagged line, is broken from lateral crushing. Enlarged 4 times.

is easily recognized by the regularly and uniformly rounded apex of the wing.

Length of wing, estimated 12^{mm}; width, 4^{mm}.

Pinctodia curta gen. et sp. n. Text figure 11.

The genus *Pinctodia* is based upon two specimens each preserving the body and parts of the wings. The head is rather large. The thorax is of the arched, humped form common to the family. The abdomen is proportionally short, being somewhat less than twice the length of the thorax.

The segments of the abdomen are broader than long.

Length of front wings probably not less than 15^{mm}.

Length of hind wing not less than 14^{mm}.

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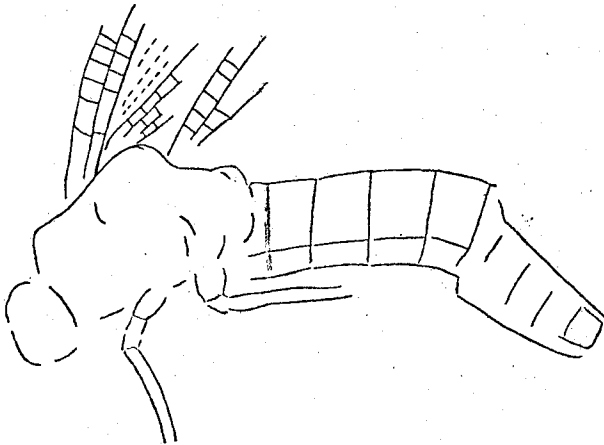


FIG. 11. *Pinctodia curta* gen. et sp. n. Head, thorax, abdomen, base of wings, and two legs preserved. The thorax and first five segments of the abdomen are seen from the side. Between the fifth and sixth segments the abdomen is broken and turned so that the remainder of the abdomen is viewed from above. The abdomen is relatively short and thick as compared with other genera of the family. The cross veins are indistinct. Those shown are in part restored. The wings are much macerated, the impression of the stronger veins only remaining. Enlarged 5 times.

Scopus gracilis gen. et sp. n. Text figure 12.

This genus has a very long, slender abdomen; slender, thin, delicate wings; and apparently rather long legs. The abdomen of the type specimen is preserved complete; the segments are longer than broad. Two segments of the forceps are seen, indicating a male. The caudal setae are apparently slender. The wings, notwithstanding their thin texture, are strongly corrugated. The cross veins are numerous but weak. The

interpolated veins of the sector arise from the upper division. The media is deeply forked; the cubitus is long. The costal brace is rather long. The slender body and wings give to this genus much resemblance to the Zygopterous Odonates.

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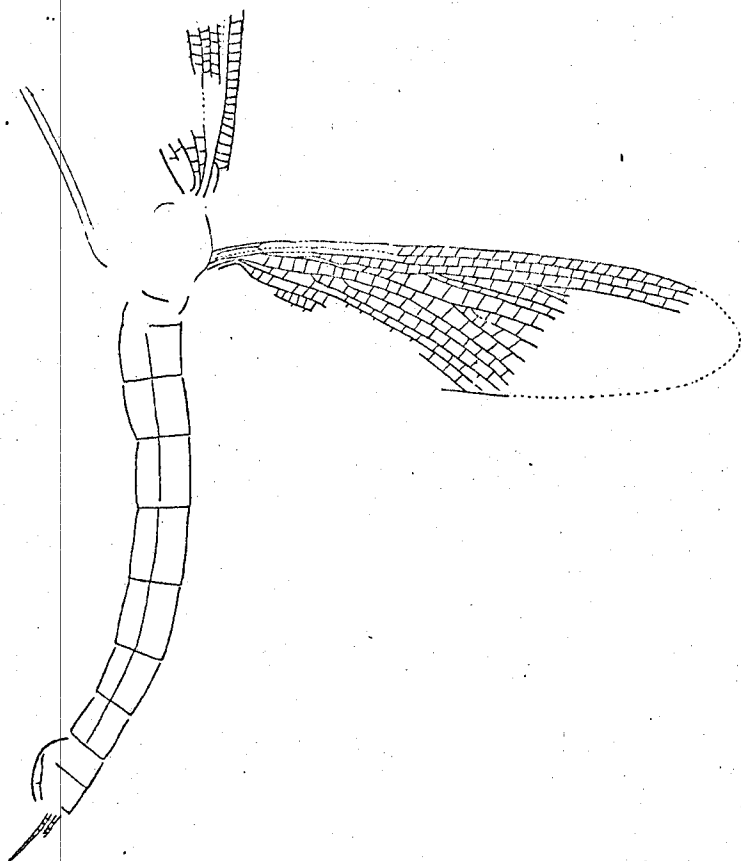


FIG. 12. *Scopis gracilis* gen. et sp. n. A genus with very slender, long abdomen, and with delicate corrugated wings. Male specimen; two segments of the forceps are seen. The caudal setae are apparently slender. Their preservation, however, is not very distinct. Other specimens, not illustrated, but belonging with the group of genera with slender abdomen, have caudal setae of the average size and of some considerable length. The segments in the median area of the abdomen of this genus are approximately one and one-half times as long as broad. Enlarged 4 times.

The delicate wings of the type specimen have suffered lateral compression, partly obscuring the radial area at the base of the wings. The subcosta and radius have the appearance

of uniting at the base. This is doubtless due to crushing by which the radius is pushed partly over the subcosta. The subcosta is restored in the drawing as seen in other genera of the family.

Length of abdomen, 16^{mm} . Length of wing, 17^{mm} ; width, $4\frac{1}{2}^{\text{mm}}$.

Therates planus gen. et sp. n.

An aberrant genus probably indicating a subfamily of the Proterocismiphemeriidae is represented by two specimens, one showing the basal three-fourths, the other the basal one-half of the wing. The wings are slender, thin and but feebly cor-

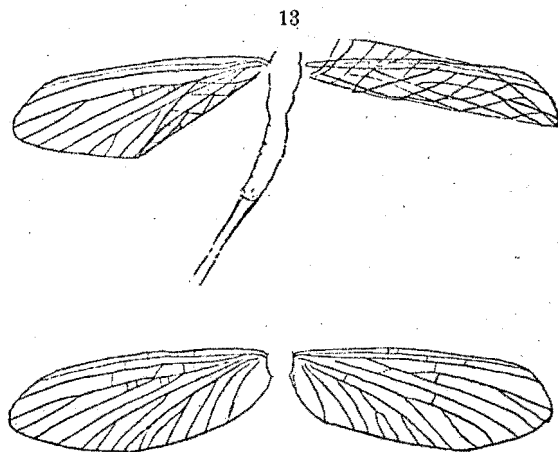


FIG. 13. *Doter minor* gen. et sp. n. Body, caudal setae, and one pair of wings preserved. The inner half of the right wing is folded across the outer half. In the left wing a small part only of the inner border, including the anal area and a small part of the cubital area, is folded across the rest of the wing. The wings are shown beneath in the figure as they would appear with the folds straightened out. In the counterpart of the specimen the segments of the abdomen are somewhat more distinctly seen. The segments are short, being somewhat wider than long. The dotted vein in the right wing connecting the radial sector with the media is not observed in the specimen, being either lacking or obscured by the folded wing. It is restored as seen in the left wing. Enlarged 5 times.

rugated. The costal brace is strong and reaches 3 to $3\frac{1}{2}^{\text{mm}}$ from the base. The costal border is straight; the inner border is gradually rounded to the slender basal attachment. The media is strong and fuses with the radius back of the costal brace, not in front of the brace as in other genera described. The cubitus approaches very close to the radius, lying either

against or partly under that vein. The first anal is strongly curved at the base as in the case of other genera of the family. Cross veins are numerous but weak. The radius is much thickened at the base.

The special peculiarity of this genus is the late origin of the media, and the close approach of the cubitus to the radius.

Width of the wing, $4\frac{1}{2}^{\text{mm}}$; length, partly estimated, 15^{mm} .

Doter minor gen. et sp. n. Text figure 13.

The genus *Doter* is proposed for a small insect the relationship of which has not been fully determined. The genus clearly can not be referred to the Protereismephemeridæ, the venation being altogether different. It is possible that the genus will be found to fall within the Protephemeridæ. The body is small and slender; the abdomen is of equal width throughout or nearly so; the segments are short, being wider than long. The abdomen is terminated by two caudal setæ. Two wings only are preserved on the type specimen. These are proportionally large, longer than the abdomen, and of an ovate shape, the inner border full and rounded. A costal brace such as is seen in the Protereismephemeridæ is lacking. The subcosta and the radius are either united at the base or lie so closely together as to give the appearance of being united. The sector is three branched. The media is simple. Cubitus, is three branched, cubitus, five branched. Two anal veins are seen beyond the cubitus. The wing membrane is thin and clear and the veins distinct. Cross veins occur but are not numerous.

Length of the wing, 7^{mm} ; width, $2\frac{1}{2}^{\text{mm}}$.

Total length of body, (not including setæ), 4^{mm} .

Notwithstanding the presence of fully developed hind wings, the relationship of the Protereismephemeridæ is much closer with the Ephemeridæ than with the earlier and somewhat doubtfully constituted groups of Palephemeridæ and Protephemeridæ. The venation agrees essentially with that of the more generalized of the modern Ephemerids. The wing is similarly, although often not so strongly, corrugated. The main veins are readily identified with the corresponding veins in the wings of modern forms.

The conclusions of Comstock and Needham* regarding the homologies of the main veins of the wings of Plectoptera find support from a study of these earliest known true Ephemerids.

* Amer. Nat., vol. xxxiii, p. 117, 1899.

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