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TERTIARY INSECTS

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B Y

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width of the head. Fore tibiae slender, longer than and not half so stout as the fore femora. Abdomen very short and stout, tapering very rapidly behind.

Perhaps this genus is as nearly related to *Amphientomum* as to any other. A single species is at hand.

PAROPSOCUS DISJUNCTUS.

Pl. 5, Fig. 5L.

The single specimen unfortunately shows only an insignificant fraction of neuration, and therein no distinctive parts, but only those which are common to all genera of Psocidæ. So far as can be seen, the head, thorax, antennæ, and legs are absolutely naked. The plate wrongly shows the left antenna as the tarsus of the fore leg. The third joint of the antennæ is shorter than the width of the head between the eyes.

Length of body, 1.6^{mm}; breadth of head, 0.45^{mm}; of thorax, 0.75^{mm}; length of third antennal joint, 0.3^{mm}.

Fossil Cañon, White River, Utah. One specimen, No. 33, W. Denton.

Family EPHEMERIDÆ Stephens.

Our previous knowledge of Tertiary Ephemera is based entirely upon imago and almost entirely confined to the statements made by Pictet and Hagen nearly thirty years ago in their account of amber Neuroptera. Four species of *Baetis* and one each of *Potamanthus* and *Palingenia* were there described, and two years earlier mention is made by Hagen, by name merely, of a second species of *Palingenia*, but in the subsequent work it is referred to *Baetis*. Here also Pictet's *Palingenia* is considered as more closely related to *Baetis anomala*, for which in his monograph of the Ephemera Eaton establishes the genus *Cronicus*. Eaton also refers the *Potamanthus* to *Leptophlebia*. We have therefore from the amber three species of *Baetis*, one or probably two of *Cronicus*, and one of *Leptophlebia*. Besides these, Sendel figures a species which he classes "inter ephemeræ minores," and Burmeister says he has seen "zwei individuen der gattung Ephemera" in the Berlin Museum.

From the Tertiary rocks we have only a reference by Schlottheim to an insect from Oeningen, which he says may be an Ephemera or a Phry-

ganea, Heer's undescribed *Ephemera oeningensis*, and a reference to an Australian species by Wilkinson.

It is not worth while to enter here upon any discussion of the pre-Tertiary Ephemeridæ, but one of the most interesting of modern discoveries is Frie's gigantic *Palingenia feistmanteli* from the coal.

The American remains referred here are rather unsatisfactory, consisting of a single imago and five different species of larvæ and pupæ. The earlier stages have not before been noticed in a fossil state. The least satisfactory is the imago, which is so rudely preserved that only its three caudal setæ of equal length give any clue to its relationship. The larvæ and pupæ agree closely in structural features, and, excepting *E. interempta*, seem to belong to one genus. The stoutness of the tibiæ, which are of nearly equal breadth with the femora, and particularly the size of the fore tibiæ where preserved, indicate pretty clearly that they were burrowing in habit and belong in the neighborhood of *Ephemera* and *Palingenia*: their legs, however, though longitudinally hairy, are not laterally fringed, as appears to be the case with such larvæ so far as they are known; and the respiratory organs of the abdomen are too poorly preserved to offer any assistance: the legs, however, are evidently flattened, and hence I have placed them in *Ephemera* rather than in *Palingenia*. They seem, however, to indicate the existence here of a distinct type, for they differ from such larvæ as are known in the form of the body, which is unusually stout at the thorax and particularly in the mesothorax, tapering anteriorly to such a degree that the head is very small, and it is also not produced anteriorly, or to a slight degree only; the abdomen tapers also either throughout its length or from the middle posteriorly: the respiratory organs, if of the form and position in which they are found in *Ephemera* and *Palingenia*, would certainly be clearly seen, whereas no sign of them appears upon the upper surface of the abdomen: there are, however, certain indications laterally which may be referred to them, and if so this would be an additional distinction. The unfringed legs, in which femur, tibia, and tarsus are of nearly uniform diameter, indicate a further difference from known types. So little, however, is known of the early stages of this group that it will be impossible to indicate the nearer affinities of these fossil larvæ until further information of living forms is obtained. (September, 1883.)

EPIHEMERA Linné.

The species known only in the immature stages may be distinguished as follows:

Table of the species of Ephemera.

Outer caudal setæ fringed on both sides. Middle seta as long as the outer setæ.	
Setæ very much more widely fringed in the middle than toward either end; dorsal abdominal markings consisting of light blotches on a dark ground	1. <i>E. tabifica</i> .
Setæ only a little more widely fringed in the middle than toward the base or tip; dorsal abdominal markings consisting of light lines on a dark ground	3. <i>E. maciænta</i> .
Outer caudal setæ fringed on the inner side only, and very much more broadly in the middle than near the base or tip. Middle seta shorter than the outer setæ	2. <i>E. immobilis</i> .
Setæ of equal length and naked, or not noticeably fringed.	
Large species. Head less than half the width of thorax; dorsal abdominal markings of light lines	4. <i>E. pumicosa</i> .
Small species. Head considerably more than half as wide as the thorax; no dorsal abdominal marking	5. <i>E. interempta</i> .

1. EPIHEMERA TABIFICA.

Pupa.—This species differs somewhat in form from the other larger types, the abdomen being very nearly of equal size throughout and the thorax nearly twice as broad as it, while anteriorly the whole body tapers regularly, as in the succeeding species. The head is rounded quadrate, about half the width of the thorax. The legs are slenderer than in the succeeding species and short, the front pair no longer than the width of the thorax, the hind pair longer, being as long as the head and thorax together. The wing pads are blackish, about three times as long as broad, reniform in shape, the inner margin bent in the middle, and the basal halves of the inner margin of the two wings meeting to form an angle slightly less than a right angle, the apical half tapering to a rounded apex. The abdomen is long and slender, the apical joint more than half as broad as the basal, the dorsal surface blotched with large quadrate patches of lighter color than the ground, sometimes central, sometimes anterior and transverse, divided by a median line. The three caudal setæ are slender, less than half as long as the abdomen, equal, very broadly fringed on either side in the middle.

Length of body exclusive of setæ, 25^{mm}; breadth of thorax, 4.5^{mm}; of middle of abdomen, 2.6^{mm}; length of wing pads, 4.5^{mm}; of front legs, 4^{mm}; of hind legs, 8^{mm}; of setæ, 7^{mm}.

Florissant. One specimen, No. 13238.

2. EPHEMERA IMMOBILIS.

PL. 12, Fig. 5.

Larva.—This is the largest of the ephemerid larvæ, and is represented by a single specimen and its reverse. The body is stout, largest at the mesothorax and metathorax, tapering rapidly and somewhat rounded in front, tapering gently behind, the hinder half of the abdomen more rapidly than the basal half. The head is small, about as broad as the terminal segment of the body, transversely rounded oval, less than half as broad as the thorax, and symmetrical, being rounded in front as behind: the mandibles, not represented on the plate, are not so long as the head, moderately stout, nearly straight and tapering. The front legs are nearly as long as the thorax, the femora and tibiæ, which are of equal width, nearly or quite as broad as the length of the prothorax: the tibia is a little longer than the femur and about half as long again as the tarsus, which is also somewhat slenderer. The other legs are longer and a little stouter, but retain the same relations, excepting that the tarsus is much longer, half as long again as the tibia and toward the tip tapering. The thoracic branchiæ form a pair of triangular equilateral pads, their inner margins straight and attingent at the mediodorsal line, their outer margins convex. The dorsal surface of the abdomen is ornamented by a pair of approximated subdorsal, longitudinal, curved, white streaks, convexities outward, reaching the posterior but not the anterior border of each segment. The caudal setæ are of unequal length, the outer more than one-third, the middle one nearly one-fourth, the length of the body. They are fringed, the outer ones on the inner surface only, the middle one on both sides by a delicate fringe of hairs, which increases in breadth from either end toward the middle, where the fringe is from a third to a fourth the width of the last abdominal segment.

Length of body, 21^{mm}; breadth of thorax, 5^{mm}; of head, 2.4^{mm}; length of fore tibia, 2.25^{mm}; breadth, 0.6^{mm}; length of hind tibia, 2.75^{mm}; breadth, 0.8^{mm}; length of outer caudal setæ, 8^{mm}; of middle seta, 5^{mm}.

The species differs from the other larvæ here described by its greater size and the peculiar fringing of the caudal setæ.

Florissant. One specimen, Nos. 8824 and 8828.

3. *Ephemera macilenta*.

Pl. 12, Figs. 4, 10.

Larva.—The body is stout but not so stout as in the last species, which is only slightly larger than this; it tapers also in a similar manner but is not so rounded anteriorly. The head and mandibles are of similar form and size, but the head is not so distinctly separated from the thorax as in that species, being continuous with the general outline of the body. The legs are considerably shorter than in the preceding species, but while agreeing with them in general structure the femora are stouter in relation to the tibiae. The abdomen is similarly marked, but the stripes are shorter, reaching neither the anterior nor the posterior margins of the segments. The caudal setae are of equal length, nearly half as long as the body, and fringed on either side with short ciliae, scarcely longer than the breadth of the seta.

Length of body, 1.75^{mm}; breadth of thorax, 3.6^{mm}; of head, 1.85^{mm}; length of fore tibia, 1.9^{mm}; breadth, 0.35^{mm}; length of hind tibia, 2^{mm}; breadth, 0.35^{mm}; length of caudal setae, 7.5^{mm}.

The brevity of the legs and the uniform brief ciliation of the caudal setae distinguish this species from either of the other larvae here described.

Florissant. Five specimens, Nos. 232, 1137, 7280, 10423, 13526.

4. *Ephemera pumicosa*.

Pl. 12, Figs. 7 (pupa), 15, 16 (larva).

Larva.—This species is both smaller and slenderer than any of the larvae described above. It tapers in the same manner as the others, except in being more rapidly expanded at the thorax and in having the abdomen of more uniform width, a peculiarity seen also in the nymph referred to the same species. As in the other species, the head is of the same width as the extremity of the abdomen. The legs are poorly preserved in all the specimens, but seem to agree entirely with their appearance in the nymph. The abdomen is marked as in *E. immobilis*, but if anything with longer and straighter stripes. All the caudal setae are of similar length, slender, but rather short, being only about one-third the length of the body; they are furthermore distinguished from those of the other species by being naked, as far as can be seen, though one specimen seems to show an apical bristle on either side at the end of each joint of the middle seta.

Length of body, 17^{mm}; breadth of thorax, 4^{mm}; of head, 1^{mm}; length of caudal setæ, 6^{mm}.

Pupa.—The form is altogether that of the larva, but the legs are better preserved, showing them to be as long in this species as in *E. immobilis*, but to differ in their almost uniform slenderness throughout, the tarsi being scarcely narrower than the femora. The wing pads are distinctly marked in dark brown and are reniform in shape, of nearly uniform width and nearly three times as long as broad, the basal half of their inner edges meeting at less than a right angle, and the distal halves parallel and approximate along the mediodorsal line, the outer edges gently concave and the tips well rounded. The stone is broken at the tip of the body in the only specimen, so that the caudal setæ are not preserved.

Florissant. Five specimens, Nos. 233, 1070, 1516, 10385 (larvæ), 10660 (pupa).

5. EPIHEMERA INTEREMPTA.

This smallest of the ephemerids from Florissant, represented by a nearly complete pupa and the terminal segments of what may be either larva or pupa, and which appears to belong here, differs considerably in structural features from the others. The former only will be described.

Pupa.—The body is tolerably stout, largest at the thorax where it tapers forward toward the head, which is fully three-quarters its width. Posteriorly the abdomen remains in its basal half very nearly as broad as the widest part of the thorax, and only tapers rapidly a little before the tip, which is more rounded than usual and scarcely one-third as broad as the thorax. The head is rounded, a little broader than long; the legs only moderately stout, all the femora subequal and about as long as the head. The wing pads are subtriangular, tapering pretty uniformly to a rather broadly rounded tip about half as broad as the base, the inner margin bent close to the base, and the basal portions of the two pads forming an angle much broader than a right angle; they differ therefore altogether in form from the two species of which nymphs are known. The abdominal joints are more than twice as broad as long and wholly devoid of the markings which distinguish all the other species. The caudal setæ are about one-third as long as the abdomen, and unfringed. Only the base of the median seta is preserved in the type, but in the other specimen referred here it is as long as the lateral.

Length of body, 9.5^{mm}; width of head, 1.3^{mm}; of thorax, 2^{mm}; length of femora, 1.2^{mm}; of wing pad, 2^{mm}; of setae, 2.5^{mm}.

Florissant. Two specimens, Nos. 1582, obtained by the Princeton expedition, and 10706.

EPHEMERA EXSUCCA.

Pl. 12, Fig. 9.

A single specimen, very badly preserved, but showing unmistakably the caudal setae. The whole is preserved as I have seen no other specimen from Florissant, as if drawn on the stone with a pale blue pencil. The body is tolerably stout for an Ephemera, the abdomen tapering a little. The expanded wings are only partially preserved, but are apparently nearly as long as the body. The three caudal setae are very slender and of exactly the same length, a little shorter than the body. No ciliation can be detected on them.

Length of body, 9^{mm}; breadth of thorax, 2^{mm}; expanse of wings, 16^{mm}; length of caudal setae, 7^{mm}.

Florissant. One specimen, No. 5587. •

Family ODONATA Fabricius.

More than thirty years ago in his work in conjunction with de Selys on the European Odonata, Dr. Hagen contributed a chapter on the fossil species of Europe, in which about half of the species enumerated (thirty-nine in number) belonged to the Secondary and half to the Tertiary period. Since then no one has done more than Dr. Hagen to add to our knowledge, especially of the Secondary species. The time has hardly come, and the species known are as yet perhaps not sufficiently numerous, to enter on any study of the relation of the Secondary and Tertiary types; but it may be stated in a general way that, omitting all mention of larval remains, we now know nearly double the number then recorded, and the Tertiary species are considerably in excess. Of these the larger part belong to the Agrionina. (January, 1882.)

To enter into a few details, the strongly limited group of dragon-flies makes its appearance in the Lias in considerable variety and apparently as highly specialized as to-day, for no less than four tribes are present, the true Agrionidae and the Cordulidae alone being absent. Aeschnina are the

PLATE XII.

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EXPLANATION OF PLATE XII.

All the drawings were made by J. Henry Blake.

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| <p>Fig. 1. (329) ($\frac{1}{2}$) Cone of Sequoia, seen in cross-section; supposed when the plate was engraved to be a conoid myriapod.</p> <p>2. (416) ($\frac{1}{2}$) <i>Parotermea hageni</i>.</p> <p>3. (1247) ($\frac{1}{2}$) <i>Parotermea fodineae</i>.</p> <p>4. (1326) ($\frac{1}{2}$) <i>Ephemera macilentia</i>, larva.</p> <p>5. (8824) ($\frac{1}{2}$) <i>Ephemera tumobilis</i>, larva.</p> <p>6. (9910) ($\frac{1}{2}$) <i>Holotermea colandensis</i>.</p> <p>7. (10660) ($\frac{1}{2}$) <i>Ephemera puniceosa</i>, pupa.</p> <p>8. (4643) ($\frac{1}{2}$) <i>Taphiacris reliquata</i>.</p> <p>9. (5587) ($\frac{1}{2}$) <i>Ephemera exsiccata</i>.</p> <p>10. (1326) ($\frac{1}{2}$) <i>Ephemera macilentia</i>, larva.</p> <p>11. (339) ($\frac{1}{2}$) <i>Necropsylla rigida</i>.</p> | <p>Fig. 12. (1931) ($\frac{1}{2}$) <i>Eutermes meadii</i>.</p> <p>13. (2041) ($\frac{1}{2}$) <i>Parotermea insignis</i>.</p> <p>14. (400) ($\frac{1}{2}$) <i>Parotermea insignis</i>.</p> <p>15. (1546) ($\frac{1}{2}$) <i>Ephemera puniceosa</i>, larva.</p> <p>16. (233) ($\frac{1}{2}$) <i>Ephemera puniceosa</i>, larva.</p> <p>17. (31) ($\frac{1}{2}$) <i>Eutermes meadii</i>.</p> <p>18. (1633) ($\frac{1}{2}$) <i>Lepisma platymera</i>. Some of the abdominal joints are not indicated.</p> <p>19. (4643) ($\frac{1}{2}$) <i>Taphiacris reliquata</i>.</p> <p>20. (6649) ($\frac{1}{2}$) <i>Eutermes fossorum</i>.</p> <p>21. (340) ($\frac{1}{2}$) <i>Necropsylla rigida</i>.</p> <p>22. (11190) ($\frac{1}{2}$) <i>Parotermea fodineae</i>.</p> |
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THE FLORENTINE BASIN

MICROSCOPIC ANATOMY