NEW AND LITTLE-KNOWN INSECTS FROM THE MIOCENE OF FLORISSANT, COLORADO

T. D. A. COCKERELL
University of Colorado

TRICHOPTERA

Phryganea wickhami n.sp.

♂ Upper wing as preserved uniform light reddish brown, with the venation distinct but not dark; length 22 mm., width $8\frac{1}{2}$; apex of wing to base of discoidal cell $13\frac{3}{4}$ mm.; length of discoidal cell 6 mm., of cellula thyridii not quite $7\frac{1}{2}$; venation normal for a male, the media with only three branches; R_1 apically with a very strong double curve. The shape of the wing is practically as in *P. latissima* Ulmer, from amber; the venation differs from that of the amber species as follows: R_2 leaving discoidal cell more basad, about $2\frac{1}{3}$ mm. before R_3 leaves it; separation of M_1 from M_2 at same level as separation of R_3 from discoidal cell; upper apical corner of cellula thyridii (separation of M_2 from M_3) only a short distance basad of separation of R_2 from discoidal cell; oblique basal side of cell between Cu_1 and Cu_2 longer; cell below Cu_2 smaller. In the characters of venation wherein *P. wickhami* differs from *P. latissima*, it agrees closely with *P. singularis* Ulmer, another amber species.

From the other Florissant species of *Phryganea*, *P. wickhami* is distinguished especially by the shape of the wings, which are not elongated as in *P. miocenica* Ckll., or with the apical margin truncate as in *P. labefacta* Scudder.

Miocene shales of Florissant, Wilson Ranch (H. F. Wickham). At the same place Professor Wickham found one of each sex of *P. labefacta*.

NEUROPTERA

Raphidia pulveris n.sp.

Anterior wing 11 mm. long, not quite $3\frac{1}{3}$ broad; costal area broad, with ten cross-veins; stigma about 2 mm. long, the lower side a little over 1 mm., oblique cross-vein very distinct; two cells on costa beyond stigma; subcosta ending nearly 1 mm. below base of

stigma; three discoidal and three cubital cells; no closed cells beyond the discoidals; upper discoidal beginning at about level of end of subcosta, and ending a short distance beyond middle of lower side of stigma; second discoidal more produced basally than in *R. rhodopica*, its base not invaded by fork R_2–R_3, which falls some distance beyond its end; cell in fork R–R_5 scarcely hexagonal, its lower median face very short; R_2 branched at level of end of lower side of stigma, its upper branch branching again with each of the branches forked near margin, its lower branch simple; R_3 forked close to wing-margin; R_4 simple at end, but R_5 forked; six forks on lower margin of wing, not counting R_3 or R_5; cells below Cu_1 (not the cubital cells of descriptions) nearly as in *R. rhodopica*, except that the anal cells are different in detail, two large ones joined by a very narrow isthmus.

Posterior wing about 10 mm. long; apical field practically as in anterior wing, base and costa differing as usual. The end of R_2 is different, the second division of the upper branch being simpler while the lower branch has a very long narrow fork; R_3 is simple at end; there are six marginal forks basad of R_5, as in the upper wing, but the first is so long that its corner joins the end of the third discoidal cell; an almost rectangular cross is formed near the middle of the wing where the cross-veins leave the media above and below.

Miocene shales of Florissant, Wilson Ranch (H. F. Wickham). The upper wing is the type; the lower wing is on a different slab, but, from its close resemblance to the upper, evidently belongs to the same species. In Rohwer's table in *Am. Jour. Sci.*, XXVIII, 534, this runs to *R. mortua* Rohwer, but differs by the much larger number of cross-veins in the costal area, subcosta joining costa nearer stigma, and marginal V-shaped cells much more numerous. It is no doubt allied to *R. mortua* and *R. exhumata* Ckll., but there are so many small differences that I can only consider it distinct. There is also much resemblance to *Archiraphidia tumulata* (Scudd.), but there are too many differences to regard it as a variety of that species.

Modern species of *Raphidia* show so much variation in the venation, even on the two sides of the same animal, that fossil

species distinguished by the structure of the wings must be regarded as more or less provisional. Possibly the material will never be sufficient to decide definitely whether we have too many or too few specific names.

Osmylidia requieta (Scudder)

Professor Wickham found a hind wing, 14 mm. long, at the Wilson Ranch.

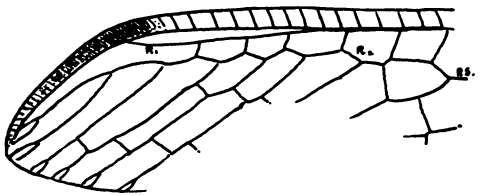

FIG. 1.—*Osmylidia requieta* (Scudd.), hind wing

PALAEOCHRYSA Scudder

The living genus *Allochrysa* Banks cannot be distinguished from this, unless we are prepared to recognize as generic characters which would split the known species into still other genera. *Allochrysa* contains three species: *Palaeochrysa virginica* (Fitch) of the Eastern United States; *P. parvula* (Banks), from Florida; and *P. arizonica* (Banks), from Arizona.

Palaeochrysa fracta n.sp.

Anterior wing about 15 mm. long, $5\frac{1}{2}$ broad; hyaline with dusky stigmatic region; venation pale ferruginous, probably green in life; radial sector originating far basad of "third cubital" cell; costal area broad, terminating about 6 mm. before tip of wing; at least 17 costal cross-veins; about 16 cross-veins between radius and sector, the cells very broad (high), the middle ones twice as high as long; "third cubital" divided by a straight vein in the middle, but the upper division strongly and acutely produced basally, so that the basal angle between the sections is practically a right angle; radial sector giving off 13 oblique branches below; media beginning to zigzag just after leaving "third cubital," its general course gently curved until it meets the radial sector two cells before the apical

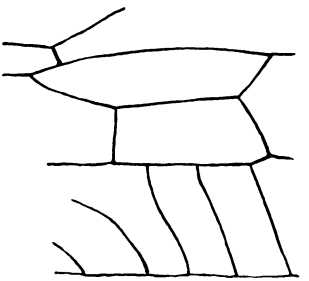

FIG. 2.—*Palaeochrysa fracta*. "Third cubital" cell and adjacent parts.

margin; three veins running from "third cubital" to hind margin; eleven forked veins on hind margin, the first at the tip of the radial sector, at apex of wing; eight simple veins from Cu_1 to hind margin before the first forked one, and one simple vein between the second and third forks.

Miocene shales of Florissant, Wilson Ranch (H. F. Wickham). Nearest to *P. vetuscula* (Scudder), which agrees in having the radial sector originating far basad; but the "third cubital" cell is different.

Palaeochrysa wickhami n.sp.

Anterior wing about 9 mm. long; hyaline, with dark venation; radial sector originating scarcely basad of lower basal corner of "third cubital" cell; costal area with eight cross-veins visible, but at least 10 were present; 9 or 10 cells between radius and sector, the middle ones about square (their shape entirely different from those of *P. fracta*), the basal one long; between R_s and M are seven oblique cells and a basal one of irregular shape (above the "third cubital"); between media and cubitus are nine cells; six simple nervures from cubitus to hind margin before the forked ones begin; "third cubital" divided straight across the middle, neither part much produced basally or apically; one nervure from near middle of "third cubital" to margin, and one meeting the nervure which bounds its outer side. The basal part of cubitus is straight, and the media is not dislocated.

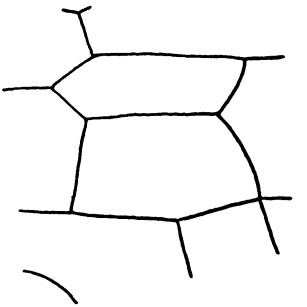

FIG. 3.—*Palaeochrysa wickhami.* "Third cubital" cell.

Miocene shales of Florissant, Wilson Ranch (H. F. Wickham). Remarkable for the small size and dark nervures; it might be a *Nothochrysa*, except for the forked veins going to hind margin. It differs from *P. vetuscula* not only in the much smaller size, but also in not having R_s originating far basad of the double cell, and also in having only one nervure from double cell to margin. In this last character, and also in the shape of lower part of double cell, it differs from *P. ferruginea* and *P. concinnula.*

HYMENOPTERA

Cryptocheilus hypogaeus n.sp.

♀. Robust, about 17 mm. long; anterior wings about 10¼ mm.; antennae thick, about 6½ mm. long, not curled up at end; legs apparently normal for the genus; metathorax with strong transverse grooves. Head and thorax black, abdomen dark, possibly brown in life; antennae with scape dark, flagellum ferruginous; femora dark, tibiae and tarsi probably ferruginous in life; wings with two transverse dark clouds, one at and just beyond the basal nervure, with a lobe extending apicad, the other, large and diffused, below the base of the marginal cell; the large pale area between the bands may have been orange or yellowish, a suggestion of this color remaining; apical region and margin of wing pallid. Venation ordinary; upper angle of second submarginal cell less than a right angle; outer border of third submarginal cell very faint, seen with difficulty. Claws rather short, with a single large sub-basal tooth, the outer side of which presents a gentle slope, instead of being vertical as Bingham figures for *Cryptocheilus nicevillii* (*Salius nicevillii* Bingh.).

The following wing-measurements are in microns. I give also some measurements which I made from the type of *Cryptocheilus laminarum* (*Salius laminarum* Roh.).

Length of marginal cell	2800 (*laminarum* 2640)
Lower side of marginal cell beyond third submarginal	800 (*laminarum* 800)
Greatest width of marginal cell	640
First submarginal on marginal	224 (*laminarum* 224)
Second submarginal on marginal	800 (*laminarum* 880)
Third submarginal on marginal	1200 (*laminarum* 896)
Third submarginal on third discoidal	640 (*laminarum* 720)
Second submarginal on third discoidal	640 (*laminarum* 690)
Second submarginal on first discoidal	352 (*laminarum* 432)
Lower end of basal nervure basad of transversomedial	720 (*laminarum* 560)
Length of transversomedial	400
Basal nervure on first submarginal cell	320
Basal nervure on first discoidal	720
Greatest (diagonal) length of first submarginal	2896
Greatest (diagonal) length of first discoidal	2960

In the hind wing, the approximating ends of the cubital and transversomedial are about 64 microns apart, the cubital more apicad, not more basad as it is in *Cryptocheilus sericosoma* (*Pompilus sericosoma* Sm.).

Miocene shales of Florissant, Wilson Ranch, a very beautiful specimen (H. F. Wickham). In Rohwer's table (*Psyche*, April, 1909) this runs nearest to *Cryptocheilus florissantensis* (*Hemipogonius florissantensis* Ckll.), but differs by the great inequality in the widths of the second and third submarginal cells above, and also by the lack of a dusky cloud on the outer margin of the wing. It is actually nearest to *C. laminarum*, which has a dusky band in the region of the basal nervure, although it is light and inconspicuous in the type. I hesitated at first whether to refer the insect to *C. laminarum*, but there are so many differences in the details of the measurements that I can only regard it as distinct.

It appears that in Miocene times *Cryptocheilus* was producing a number of closely allied species, exactly as in the modern fauna, and in all this time there is no evidence of any generic modification.

Janus disperditus Cockerell

Wilson Ranch (Wickham). Professor Wickham was so fortunate as to pick up the reverse of my original type!

Hemichroa eophila Cockerell

Wilson Ranch (Wickham). About 9 mm. long, anterior wing $7\frac{1}{2}$; thus smaller than the type, but otherwise similar.

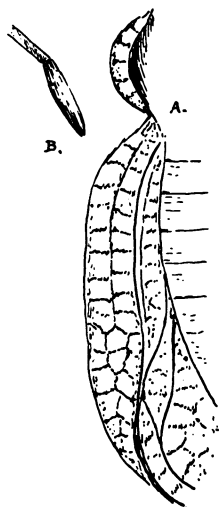

FIG. 4.—*Tingis florissantensis*. A. Side of thorax and elytron; B. end of antenna.

HEMIPTERA

Tingis florissantensis n.sp.

Length of body about 3 mm.; robust, black, of ordinary form; elytra extending perhaps half a mm. beyond abdomen; antennae not especially long, length about 1280 μ, the last joint about 240 μ long; pronotal lateral margins not much expanded,

with a single row of areolae; costal area of elytra with two rows of areolae, except at widest part, beyond middle, where are two sets of three areolae in a transverse series; general form and structure of elytra as in *Gargaphia*.

Miocene shales of Florissant (University of Colorado Expedition). An ordinary looking species, quite distinct from those described by Scudder. Scudder's genus *Eotingis* is singularly like the living *Celantia* Distant, from Ceylon, agreeing in practically everything except the structure of the thorax, which in the fossil genus lacks the vesicular enlargements.

DIPTERA

PROTOPHTHIRIA n.g. (Bombyliidae)

Similar to *Phthiria*, but proboscis stouter, less than twice length of antennae; abdomen much longer than thorax; face longer.

Protophthiria palpalis n.sp.

Length 8 mm., wing 6 mm., robust; head, thorax, and legs dark, probably black in life; shape of head (lateral view) much as in *Phthiria sulphurea*, but face longer (as long as antenna) and occiput more obtuse; antennae much as in *P. sulphurea*, the third joint broad basally and tapering at end, the end narrower than in *P. sulphurea* (antennae therefore quite different from those of *P. pulicaria*); no long hairs at end of antennae; face not hairy; palpi very well developed (990 μ long), formed as in *P. sulphurea*, but proboscis only extending about 480 μ beyond palpi; thorax (in lateral view) not greatly humped, much as in *P. sulphurea*, except that the scutellum is less promi-

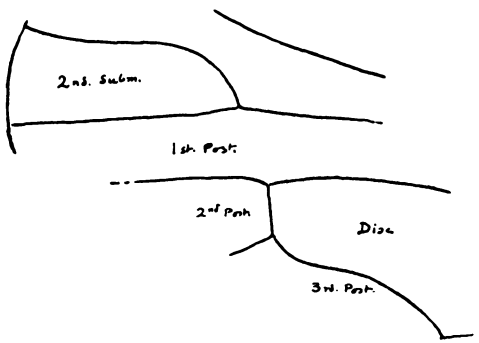

FIG. 5.—*Protophthiria palpalis*, part of apical field of wing.

nent, and there is little or no hair; abdomen thick, about 5 mm. long, with thin but conspicuous pubescence, the hairs quite long, and (as in *P. sulphurea*) especially abundant at end of sixth segment; legs long and slender, hind legs about 8 mm. long.

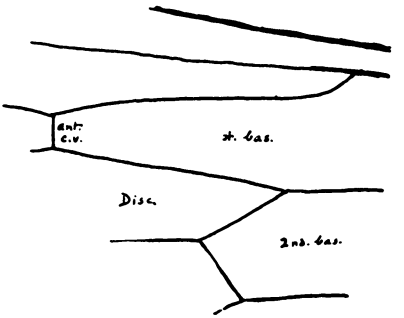

FIG 6.—*Protophthiria palpalis*, ends of basal cells.

Wings hyaline, the costa darkened; two submarginal and four posterior cells; anal cell closed at or almost at margin; second submarginal cell little expanded apically, and not angled above near base; second vein not turned backward at end; first posterior cell widely open.

The following measurements are in microns:

Second basal cell on discal, about	360
Second basal cell on fourth posterior	224
Separation of second and third veins to anterior cross-vein	1,200
Basal corner of discal cell to anterior cross-vein	880
Anterior cross-vein to base of second submarginal cell	1,840
Lower side of second submarginal cell, about	1,680
Transverse (vertical) diameter of second submarginal a little beyond middle	560

Miocene shales of Florissant, Wilson Ranch (Wickham). Among the Florissant fossils this comes nearest to *Lithocosmus*, but the form of the second submarginal and first posterior cells is quite different. The venation is essentially that of *Phthiria* and *Acreotrichus*, while the characters of the head are rather those of *Phthiria* than *Acreotrichus*, though differing from both.

ALOMATIA n.g. (Bombyliidae)

A genus of Lomatiinae with rather long and narrow abdomen; antennae close together, stout, the basal joint very bristly, the apical one elongate-fusiform, bare; wings with two submarginal and four posterior cells; anal cell closed at margin of wing; anterior cross-vein oblique, at about the end of first fourth of discal cell; end of

praefurca considerably (at least 480 μ) basad of anterior cross-vein; second vein bent upward, but its inner angle at end less than a right angle; second submarginal large, including apex of wing; first posterior widely open.

Alomatia fusca n.sp.

Length about 6 mm.; wing $4\frac{3}{5}$ mm.; head apparently pale, no long proboscis visible; thorax and abdomen dark, probably black in

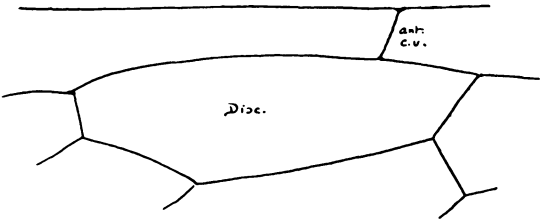

FIG. 7.—*Alomatia fusca*, discal cell

life, abdomen rather elongate, about 4 mm. long, less than 2 mm. broad near base; wings dark fuliginous.

The following measurements are in microns:

Lower side of second submarginal cell	624
Upper end of anterior cross-vein to basal corner of second submarginal cell	1,600
Lower end of anterior cross-vein to apex of discal cell	800
Lower end of anterior cross-vein to base of discal cell	272
Second basal cell on discal	192
Second basal cell on fourth posterior	160

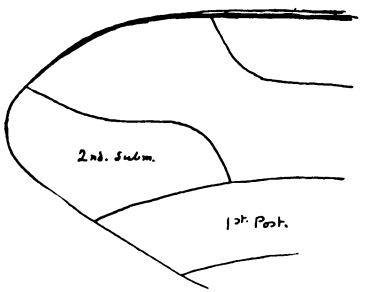

FIG. 8.—*Alomatia fusca*, end of wing

The vein separating the discal cell from the third posterior shows a single uniform gentle curve.

Miocene shales of Florissant, Wilson Ranch (Wickham). In my manuscript table of Bombyliid genera (based on venation) this runs to the vicinity of *Oncodocera*, *Lithocosmus*, and *Protophthiria*. It is, however, remarkable for the position of the anterior cross-vein. From *Protophthiria* it is also easily

known by the different termination of the second vein, and many other details. From *Lithocosmus* it is known especially by the first posterior cell being without apical contraction. In Verrall's table of Lomatiinae it runs closest to *Prorachthes*. The praefurca of *Alomatia* ends at least 240 μ basad of basal corner of discal cell, which is contrary to Verrall's diagnosis of Lomatiinae, but his own figure of *Lomatia lateralis* shows a similar condition. The antennae of *Alomatia* are curiously like those of *Thereva*.

FIG. 9.—*Alomatia fusca*, antenna.

PROTOLOMATIA n.g. (Bombyliidae)

A genus of Lomatiinae, related to *Lomatia*, to which it runs in Verrall's table of Lomatiinae. It differs in the long, parallel-sided abdomen, and the much less oblique anterior cross-vein. Among the fossil genera it is nearest to *Megacosmus*, the species of which are much larger, with broader abdomen, and have the end of the second vein curved strongly backward (not far from vertical in the new genus), and the side of the second basal cell on discal very long.

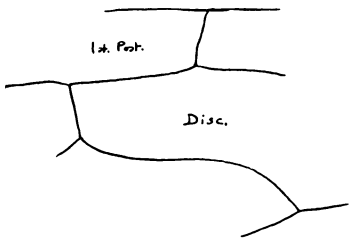

FIG. 10.—*Protolomatia antiqua*, apex of discal cell.

Protolomatia antiqua n.sp.

Length about 9 mm.; wing 6¾ mm.; body dark, slender; abdomen parallel-sided, its width 1¾ mm.; antennae slender, about 1200 μ long; thorax and abdomen without evident hair. Wings hyaline, faintly dusky; venation nearly as in *Lomatia lateralis*, but praefurca longer, anterior cross-vein much less oblique (about as in *Megacosmus secundus*), upper apical side of second basal cell shorter.

The following measurements are in microns:

Length of praefurca	512
First posterior cell on first submarginal	1,250
First posterior cell on second submarginal	1,150

Width of first posterior cell on outer margin of wing	288
Discal cell on first basal	1,360
Discal cell on first posterior	592
Second basal on discal	240
Second basal on fourth posterior	160
Anal cell on wing margin	400

Miocene shales of Florissant, Wilson Ranch (Wickham). The remarkably numerous and diversified Florissant Bombyliidae still fail to include any Anthracinae. Probably, as parasites, these Bombyliids took the place of the Tachinidae, which were rare if not wholly absent.

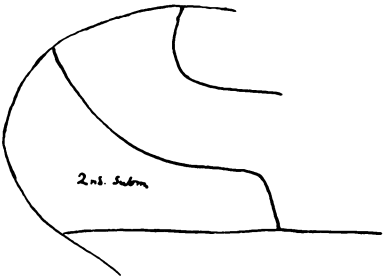

FIG. 11.—*Protolomatia antiqua*, apex of wing.

Asilus peritulus Cockerell

Wilson Ranch (Wickham). A wing, about 11½ mm. long.

Hirmoneura melanderi Cockerell

Wilson Ranch (Wickham). Total length 19 mm.; the abdomen long and tapering.

Syrphus willistoni Cockerell

Wilson Ranch (Wickham). Length about 10½ mm.; wing a little over 8½. Other specimens which I have referred to this species are considerably smaller; I believe that there are two species of this type, but at present I cannot satisfactorily separate them.