EOCENE INSECTS FROM THE ROCKY MOUNTAINS.

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The insect fauna of the Rocky Mountain Eocene is of peculiar interest and importance. We know very little of the insects of the later Mesozoic. From the Cretaceous, excluding objects regarded as egg-masses, galls, etc., we have records of nineteen species of insects, of which four are North American, coming from Manitoba, Montana, Colorado, and Tennessee respectively. Of the nineteen Cretaceous species, no less than fourteen are Coleoptera, the others being referable to the Homoptera (Cicadidae and Fulgoridae). Trichoptera, Blattoidea, and Odonata. No doubt the modernization of insects and the development of most of the existing families took place during the later part of the Mesozoic, but we have so little knowledge of the in ect-fauna that we can only infer what may have taken place. Below the Cretaceous, we find Locustidae (sens. lat.), Gryllidae, Gomphidae, Epallagidae, Mycetophilidae, Bibionidae, Psychodidae, Tipulidae, Nemestrinidae, Nepidae, Belostomidae, Naucoridae, Notonectidae, Corixidae, Fulgoridae, and Jassidae; that is to say, families of Orthoptera, Odonata, Diptera, Heteroptera, and Homoptera which are still living. The numerous Coleoptera are also doubtless at least in part referable to existing families. Thus the Mesozoic insects are very modern in appearance when compared with those of the Paleozoic; but it is not until we come to the Eocene that we find an extensive fauna of essentially modern type, including a number of genera still living. The records of Eocene insects, outside of the Rocky Mountains, are very few. Eleven, nearly all beetles, are recorded from Greenland; one beetle from Grinnell Land; seven species from Italy; four from England;[1] 23 species altogether. An odonatid larva (*Austrolestidion duaringae* Tillyard) from Australia is perhaps Eocene, possibly Cretaceous. Thus, were it not for the Rocky Mountain Eocene, we should be without a satisfactory Tertiary insect-fauna lower than the Oligocene, the time of the Baltic amber. From the Eocene rocks, generally classed as of Green River

[1] Since this was written I have received and described twenty-seven additional British Eocene insects. The material belongs to the British Museum.

age, in Colorado, Wyoming, and Utah, no less than 244 species of insects have been described, the great majority by Scudder.[1] In the present paper 35 are added, bringing the total to 279. This is an extensive series, but is but a beginning. Hundreds of additional specimens have been collected, mainly by Scudder and Winchester, and from their reports it is certain that many thousands could readily be obtained. It is true that the great majority of specimens remaining unidentified are small, obscure or imperfect; but while many will have to be discarded, diligent study will greatly increase the list of species, especially among the beetles. New collections will always contain only a small percentage of really fine specimens, but where the materials are so abundant, many beautiful things may be confidently expected. The best of the Eocene insects are as well preserved as those of Florissant, with the spots and other markings clear and distinct.

The time has not yet come for a detailed summary of the Rocky Mountain Eocene insect fauna, but a few points may be noted. We have as yet no really large insects (the largest are dragon-flies), and the specimens average smaller than at Florissant (Miocene) or in the existing fauna. Beetles are very numerous, especially the Otiorhynchidae (Brachyrhinidae or Psallidiidae), with 32 species. There are in all 119 Coleoptera described. Orthoptera are represented by five species, Odonata by seven. No Lepidoptera have been found; two specimens which looked like moths proved on close examination to be Trichoptera. Diptera are numerous, and include some of the higher families, such as Syrphidae, Anthomyiidae, Oestridae, etc. Several Dipterous genera are identical with those now living. The Hymenoptera are mostly parasitic, including very characteristic Ichneumonidae and Braconidae. No bees have been found. The most striking feature is the abundance of Fulgoridae (26 species), many of these broad-winged and moth-like, elegantly spotted or banded. These Fulgorids have a tropical facies, and closely resemble those now living in the Indo-Malay region. It is noteworthy that 19 species of Fulgoridae are recorded from the Jurassic, so the family is evidently not only ancient, but its diversification took place very early. There was formerly a difference of opinion between H. Osborn and Kirkaldy as to whether the Fulgoridae were primitive or represented a more modern specialization of the Homopterous type. The paleontological evidence certainly appears to favor Osborn's view, but it must be said that they became highly specialized at a relatively early date. In the Rocky Mountain Eocene landscape, gay and

[1] Five species of beetles come from the Lower Eocene of North Park, Colorado. They are represented by elytra only, and occur in the Coalmont formation.

pretty Fulgoridae must have flitted about in abundance, looking like moths. If there were also genuine moths and butterflies, they must have been rather scarce, or some would have been found among the hundreds of specimens examined. There is somewhat of a mystery surrounding the ants, which certainly did not abound as they did at Florissant. Scudder described a few species, but from very poor materials. I have before me a few supposed ants, but in no case can the precise characters be made out. A really satisfactory Eocene ant is still lacking.

From the typical Green River beds of Wyoming about 140 species of insects are known. Although the Colorado-Utah series is assigned to the Green River [1] it can hardly be contemporaneous with the Wyoming rocks, as the insects of the latter are essentially distinct. Only fifteen species are at present recognized as common to the Wyoming Green River, and the Colorado-Utah series. These are five Curculionidae, six Otiorhynchidae, two Calandridae, and one each of Sciomyzidae (Diptera) and Formicidae. It is not certain that closer scrutiny and better materials will not rather decrease than increase these numbers. Of course it is possible that the differences may be due in part to different ecological conditions, though there is no distinct evidence pointing in this direction.

It must also be added that the several localities in the Colorado-Utah field are probably not all contemporaneous, and it is very likely that we may eventually recognize a number of distinct horizons.

Dr. F. H. Knowlton writes me that he has looked over Mr. Winchester's fossil plants from the Cathedral Bluff region, and although he has not had time to examine them minutely, very few seem to be identical with those of the Wyoming Green River. Most of the species are apparently new. Doctor Knowlton is also convinced that there are several distinct horizons represented in Mr. Winchester's material. The insects now described come from two sources. In recent years Mr. Dean E. Winchester obtained a fair collection, rich in new species, while investigating the oil shales for the United States Geological Survey. Much earlier Dr. S. H. Scudder collected "on the crest of the Roan Mountains near the head of East Salt Creek in Western Colorado, and on the buttes bordering the White River near the Colorado-Utah boundary."[2] Owing to the failure of his health, Scudder was not able to complete the description of the rich materials he obtained, and they have remained untouched to the present day. I am extremely indebted to Dr. R. S. Bassler for the photographs illustrating this paper, as well as for many courtesies.

[1] Winchester, Bull. 641-F, U. S. Geol. Survey, p. 140.

[2] Tertiary Rhynchophorous Coleoptera of the United States, p. 7.

ODONATA.

Family AGRIONIDAE (CALOPTERYGIDAE).

EOCALOPTERYX, new genus.

Only the apical part of wing is preserved, but it nearly agrees with *Agrion* (*Calopteryx*), having the same dark fuscous color and white stigma, small cells, and numerous short veins in the marginal area. It differs in having the stigma well defined, with a strong border, and perfectly regular, except that it is somewhat convex below. Beyond the stigma is a single cell, then five pairs of cells, and last two single cells. In the apical region, about four little veins reach the margin in a distance of 1 mm. In outline, the end of the wing is not nearly so broad and obtuse as in *Agrion*, but has the shape of *Pseudophaea*. The stigma, however, is short, whereas in *Pseudophaea* and other related genera it is very long. It is not often that an extinct genus appears to be the immediate ancestor of a living one; but the present insect may fairly be regarded as ancestral to *Agrion*.

Type.—*Eocalopteryx atavina*, new species

EOCALOPTERYX ATAVINA, new species.

Plate 32, fig. 2.

Breadth of wing, 8 mm., from apex, 8 mm.; stigma, 2.6 mm. long, very oblique, the side on costa 2 mm.; depth of stigma, about 0.7 mm. Although the part of the wing preserved appears superficially dark fuscous all over (except the stigma), the cells (especially in the region below the stigma) have more or less hyaline centers, giving the wing a spotted effect under a lens. This is not true of the modern *Agrion*, but may be observed in *Pseudophaea*.

Type.—U.S.G.S., 888, Green River, Wyoming. (Scudder collection.)

Holotype.—Cat. No. 66549, U.S.N.M.

PROTAMPHIPTERYX, new genus.

Antenodal cross-veins six, of which only the first two (which are heavier than the others) cross the subcostal space; arculus remarkably basad, midway between first and second antenodals; postnodals very numerous, 21 visible in specimen, separating cells which are mostly not much broader than high; postnodals not meeting the cross-veins of the series below; subnodus extremely oblique, in a line with lower part of nodus; M_s separating from M_{1+2} half way between level of second and third antenodals; M_2 leaving M_1 far beyond nodus, at level of middle of seventh postnodal cell; doubling of cells between M_1 and M_2 beginning at level of twelfth postnodal cell; a short distance beyond level of nodus, M_3 is conspicuously nearer to

M_s than to M_4, but cells between M_3 and M_4 are not doubled in this region. Other parts of wing unknown.

Type.—Protamphipteryx basalis, new species.

PROTAMPHIPTERYX BASALIS, new species.

Plate 32, fig. 3.

Wings hyaline, with dark veins; base of wing to nodus 9 mm.; nodus to twenty-first post nodal, 13 mm.; base to arculus 3 mm.; arculus to origin of M_s 1.7 mm.; nodus to separation of M_2, 3.3 mm.; first antenodal from base of wing 2.5 mm.

Type.—U.S.G.S., 812 and reverse, 755. Green River, Wyoming. (Scudder collection.)

Holotype.—Cat. No. 66550, U.S.N.M.

I hesitated at first, whether to place this in the South American genus *Amphipteryx,* but it may be separated by its remarkably basal arculus; the smaller number of antenodals, with only two continued across the subcostal space; and the much shorter cells between M_3 and M_4 at a level a little beyond the nodus, these cells being in fact higher than wide. It is unfortunate that the stigma is unknown.

Family COENAGRIONIDAE (AGRIONIDAE).

EOPODAGRION, new genus.

Rather small dragon flies related to *Megapodagrion*, but having a very oblique brace vein at the lower basal end of stigma; subnodus almost vertical; subquadrangle not so long and narrow, and the cell below it extending considerably basad of its basal end. Eleven cross nervures in costal region between nodus and stigma; stigma on lower side bounding two cells.

Type.—Eopodagrion scudderi, new species.

EOPODAGRION SCUDDERI, new species.

Plate 32, fig. 4.

Wing about 23 mm. long; hyaline, with fuscous nervures, the stigma dilute fuscous. Base to nodus about 8 mm.; stigma to nodus nearly 12 mm.; all the costal cells between stigma and nodus are conspicuously broader than long; antenodal cross nervures not well preserved, but I am confident that there are only two. The following measurements are in microns: Stigma on costa, 1,280; stigma on lower side, 1,200; basal side of stigma, 560; length of fifth costal cell beyond nodus, 1,040; lower side of subquadrangle, 1,330; basal side of subquadrangle, 290; lower apical face of subquadrangle, 175; origin of M_3 basad of subnodus, 1,200. The quadrangle is not preserved.

Type.—U.S.G.S. 1133, on the same piece of reddish rock as the type of *Callospilopteron*, almost touching it.

Green River, Wyoming (Scudder collection).

Holotype.—Cat. No. 66551, U.S.N.M.

This differs from *Podagrion abortivum* Scudder by the shorter stigma, but the difference is similar to that between the anterior and posterior wings of *Megapodagrion*, though rather more pronounced. If Scudder's insect was a hind wing, the present one may possibly represent the anterior wing of the same species. I have given it a different name, since it is not a *Megapodagrion* (*Podagrion*), and the characters principally relied upon for its classification are not visible in Scudder's type. Scudder's insect may stand provisionally as *Eopodagrion* (?) *abortivum*.

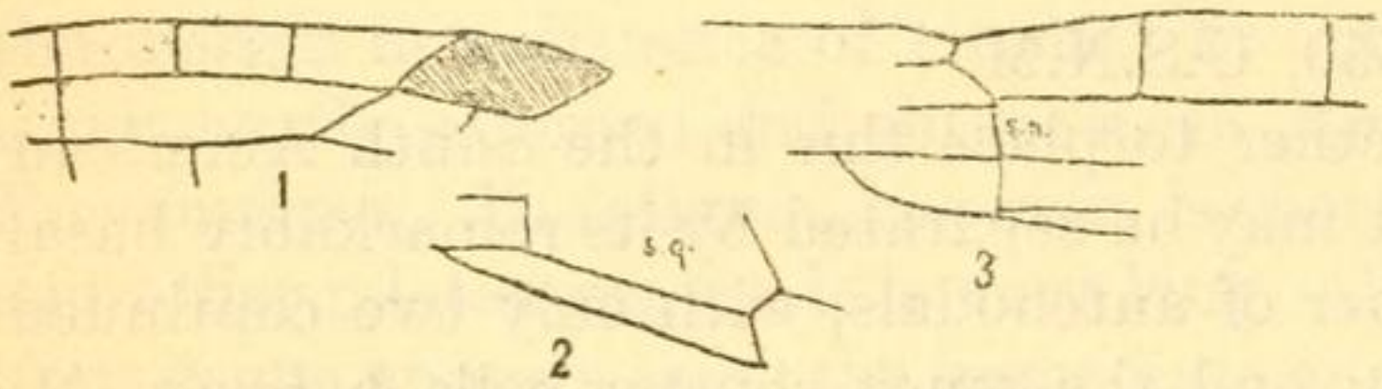


FIG. 1.—EOPODAGRION SCUDDERI. 1. STIGMA AND ADJACENT PARTS. 2. SUBQUADRANGLE (*s.q.*) AND CELL BELOW IT. 3. NODUS (*s.n.*, SUBNODUS).

Tillyard[1] regards my subfamily Dysagrioninae as a synonym of his Megapodagrioninae, but my name has priority, a fact which he apparently does not consider of any consequence. The vertical subnodus seems really to be a primitive character[2] in spite of Mr. Williamson's opinion expressed in 1908.[3]

TRICHOPTERA.

Family LIMNEPHILIDAE.

LIMNEPHILUS (sens. lat.) EOCENICUS, new species.

Plate 32, fig. 5.

Anterior wing, 10 mm. long and 3 broad; pallid, more or less strigose or speckled; apex obtuse, outer margin obliquely descending; the whole form and appearance as in modern *Limnephilus*, but the venation can not be made out. The wing is singularly like that of a moth, but under the microsope it is possible to see groups of hairs, precisely as in *Limnephilus*. The only discrepancy is in the fringe, which appears to have been longer than in *Limnephilus*, and more like that of *Oxyethira*, which has a quite differently shaped wing.

Type.—U.S.G.S. 1242. Roan Mountain, Colorado (Scudder).

Holotype.—Cat. No. 66552, U.S.N.M.

It is a singular thing that no true Limnephilidae are found in Baltic amber. The family occurs in the Miocene of Florissant, and

[1] The Biology of Dragon flies, 1917, p. 316.
[2] Idem, p. 55.
[3] Amer. Journ. Sci., vol. 26, p. 73.

as now appears probable in the Colorado Eocene. May we suppose that it first developed in America, and subsequently extended to Europe? It is richly developed in the modern American fauna.

Family HYDROPTILIDAE.

HYDROPTILA (sens. latiss.) PHILEOS, new species.

Plate 32, fig. 6.

Male.—Length, 3.5 mm.; anterior wing, 3.9 mm. long and nearly 1 mm. wide; posterior wing, 3 mm. long and about 0.9 mm. wide; width of abdomen about 1 mm. Antennae far (about 400 μ) apart, about 50 μ thick, much shorter than wings. Dark brown, the wings uniform pale sepia, hairy.

Eocene (Green River) shales, "Cathedral Bluffs south of Little Tommies Draw at point where samples were taken" (Winchester, 17–5.) Colorado.

Holotype.—Cat. No. 66553, U.S.N.M.

At first sight this seems to resemble some small Rhyacophilid, such as *Chimarrha aterrima* Hagen; but the wings, while not excessively narrow, are pointed at end, as in the Hydroptilidae. On the other hand, the end of the abdomen is almost exactly like that of the amber species *Rhyacophila profusa* Ulmer, and is not like that of any living or fossil Hydroptilid known to me. The wings are distinctly more pointed than in *R. profusa*, and except for being less elongated, have nearly the outline of those of *Agraylea spathifera* Ulmer. It is therefore somewhat uncertain whether the insect is really a Rhyacophilid or a Hydroptilid. It very possibly represents an extinct genus, but as the venation can not be seen, it is difficult to define it.

HOMOPTERA.

Family FULGORIDAE.

HAMMAPTERYX (?) LEPIDOIDES, new species.

Plate 32, fig. 7.

Anterior wings about 16 mm. long and 8 broad; costal margin very gently arched, except toward the base, where it rapidly descends; apex very obtuse; outer margin gently convex; costal field dilutely brownish, apical and outer margin fuscous to a depth of about 2 mm., excepting a small hyaline apico-marginal spot; in this field the veins appear colorless on a dark ground; and the dark area (except toward the anal angle) includes the outer series of transverse veins (which are about 1.3 mm. from the margin), which circle around the apical field and appear to become continuous with the subcosta; subcosta at about 7 mm. from base of wing or tegmen running very slightly over 1 mm. from costal margin; veinlets reaching the margin very

numerous, about 30 from the hyaline spot to the very obtuse anal angle, and of these very few are branched. Discal region with a pair of round dark spots, nearly 3 mm. apart, the lower more broad. A third dark spot where the radius breaks up into small veins, about 1.5 mm. from the costo-apical margin.

Green River shales back of house at Smith's Ranch, in the vicinity of Cathedral Bluffs, Colorado (Winchester 17.3, U.S.G.S.).

Holotype.—Cat. No. 66554, U.S.N.M.

This is much larger than *H. reticulata* Scudder, and differs in that the subcosta does not bend upward to the costal margin, but runs along parallel with it, in the manner of the living genus *Scolypopa* Stal. Indeed it is not evident that the insect is to be separated from *Scolypopa;* but as this genus is not a member of the present North American fauna and *Hammapteryx* was based on a very similar insect from the Green River shales of Wyoming, I provisionally place the new species in Scudder's genus. There is also a general resemblance to the living genus *Phrommia* Stal.

The specific name is given because the tegmina look like fish scales. The two inner dark spots evidently correspond with those of *Hilavrita trimaculata* Distant, from Ceylon, but they are rather more basad in the living species.

HAMMAPTERYX (?) CERYNIIFORMIS, new species.

Plate 32, fig. 8.

Anterior wings or tegmina about 12.5 mm. long and 8 broad; closely related to *H. lepidoides*, and evidently congeneric with it, but the markings are different. The spot near the end of the radial field is large and has on its inner side a semicircular hyaline spot, the whole effect being that of an asymmetrical ocellus; about 2 mm. below this spot is a vertical slender dark streak about 2 mm. long; 7 mm. from the apex of the tegmen is a very conspicuous but narrow transverse dark fuscous band, terminating above just below the subcosta.

Type.—U.S.G.S.; Winchester's 17.3, Green River shales back of house at Smith's Ranch, near Cathedral Bluffs, Colorado, Aug. 7, 1917. Collected by D. E. Winchester and H. R. Bennett.

Holotype.—Cat. No. 66555, U.S.N.M.

This insect is surprisingly similar to the living oriental *Cerynia maria* (White), even to the black stripes on the tegmina, though these are not arranged in the same manner. About 16 mm. from the tegmen is a hind wing which appears to belong to the same insect. It differs from that of *Cerynia* in having a large closed discal cell such as Distant figures for *Atracis emersoniana* (Walker) or *Gaja inconspicua* (Kirby); as in the *Gaja*, the apical middle of the cell emits a vein, but the apical face is angular instead of truncate. This hind wing is on the piece of rock containing the reverse of the type.

LITHOPSIS DELICATA, new species.

Plate 33, fig. 1.

Tegmen (the only part preserved), 9 mm. long and 2.80 wide, broadly rounded apically, lower margin faintly concave. Subcosta running parallel with costa, about middle of tegmen 400 μ from it, emitting many very oblique veins; radius running parallel to subcosta, a little nearer to it than the subcosta is to costa, about 3.2 mm. from apex of tegmen, bending obliquely upward to meet the subcosta; at the point where radius meets subcosta a straight vein proceeds to the distal margin; from the middle of the oblique end of radius another straight vein goes to the margin, parallel with the first; and a third (branching near end) continues in a line with stem of radius; below this are nine veins running to margin from the transverse (gradate) line; none of these are branched.

Eocene shales, back of house at Smith's ranch, "shale of Green River formation with thin beds oil-shale interbedded," near Cathedral Bluffs, Colorado. (Winchester and Bennett's 17.3.)

Holotype.—Cat. No. 61556, U.S.N.M.

The tegmen is much narrower than that of *L. fimbriata* Scudder, but agrees nearly with *L. elongata* Scudder from Green River, Wyoming. It differs from *L. elongata* in the broadening of the apical end, which in the Wyoming species is narrower than the basal. The characters of the venation are not well known in *L. elongata*. It is not impossible that the present insect should be referred to *elongata*, but the indications are that it is probably distinct.

Compared with modern genera, it seems to belong to the Issinae or to the Tropiduchinae. It is singularly like the Tropiduchine *Vanua vitiensis* Kirkaldy, as figured by Kirkaldy.

LITHOPSIS SIMILLIMA, new species.

Plate 33, fig. 2.

Tegmina about 9 mm. long and 3.9 wide; middle costal region straight; apex very broad and obtuse; subcosta running 0.5 mm. from costa, terminating about 6 mm. from base; apical part of radius sending many long oblique veins to costa; radius on basal half of wing much nearer to radial sector (subradius) than to subcosta; media branching about 3 mm. from base and on one side (but not on the other) the lower branch soon forks again; cubitus forking 4 mm. from base; anal rather abruptly directed downward at level of cubital fork and ending 4.5 mm. from base.

Type.—U.S.G.S 334. Roan Mountain, Colorado (Scudder).

Holotype.—Cat. No. 66557, U.S.N.M.

This may not be distinct from *L. fimbriata* Scudder, from Green River, Wyoming; but the course of the anal (second anal) is not

as in Scudder's figure and the costal margin is evenly curved, instead of being obtusely subangulate at about the end of the basal third. There is at least a strong probability that the insect is specifically distinct.

DETYOPSIS, new genus.

Fulgoridae with broad maculated tegmina, the shape and structure very nearly as in the oriental genus *Detya* Distant. Oblique veins from subcosta to costa numerous (in the typical species about four in 1 mm. of length); radius (in the typical species) about as far from subcosta as the latter is from costa; radial sector forking considerably before middle of wing; media freely branched, apparently much as in *Detya;* subapical field (as in *Detya*) reticulated by rather numerous cross-veins; veins reaching outer margin simple, in the type species nearly four in 1 mm. From *Varcia* Stal, which occurs in the neotropical region, this differs by the denser venation.

Type.—Detyopsis scudderi, new species.

DETYOPSIS SCUDDERI, new species.

Plate 33, fig. 4.

Length of tegmina, 11.7 mm.; width, 5.5 mm.; color pale fuscous, with a broad wavy hyaline band across the middle of the disk, broadest on costa, narrower and more or less G-shaped below, the inner margin edged with darker brown; apical margin with two large hyaline spots, an upper and a lower, with an obscure small third one between. The median band corresponds in position with that of *Scamandra diana* Distant, from the Malay region. There is some resemblance to the much smaller *Aphana rotundipennis* Scudder, but the costa is much less arched than in that species.

Type.—U.S.G.S. 305 and (reverse) 273. Roan Mountain, Colorado (Scudder).

Holotype.—Cat. No. 66559, U.S.N.M.

DETYOPSIS PACKARDI, new species.

Plate 33, fig. 3.

Length of tegmina, 10 mm.; width, 4.2 mm.; similar to *D. scudderi,* but tegmina narrower, with the region between costa and subcosta only half as broad; median hyaline band very oblique and equally broad throughout as far as the sutural vein, its upper part bent nearly at a right angle; apical region with three marginal hyaline spots, not very large or conspicuous, one on costa, one on outer margin, and one near the anal angle, these corresponding with the spots in *Detya fusconebulosa* Distant, but the third spot (second on outer margin) of *Detya* is absent.

Type.—U.S.G.S. 1180. Roan Mountain, Colorado (Scudder). Named after Dr. A. S. Packard, who collected many fossil insects in the Green River shales.

Holotype.—Cat. No. 66558, U.S.N.M.

PROTOLIARUS, new genus.

Small Fulgoridae resembling *Oliarus*, but with no distinct thoracic keel and no stigmatic spot. The veins are not spotted, as they are in *Cixius*. The tegmina have a short but evident subcostal nervure, running close to the costa for a short distance; radius soon emitting the media, and immediately afterwards dividing into two main branches, of which the uppermost bends downward near the apex of the tegmen (stigmatic region of *Oliarus*), emitting a series of veins to the margin; media bifurcating before middle of tegmen, its lower division branching more than once again; cubitus running parallel with sutural, and close to it, branching near middle of tegmen; sutural (first anal) as in recent forms; the other anals inclosing a long pointed cell, as is usual in recent forms. The hind wing is only partly preserved, but the part visible is figured.

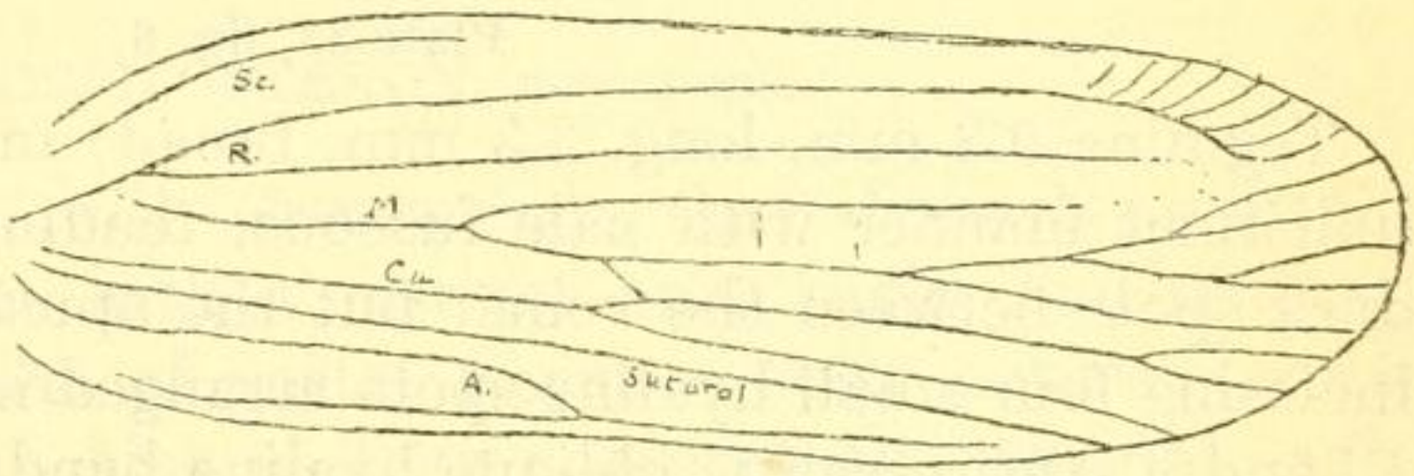


FIG. 2.—PROTOLIARUS HUMATUS. ANTERIOR WING.

Type.—*Protoliarus humatus*, new species.

PROTOLIARUS HUMATUS, new species.

Plate 33, fig. 5.

Length, 5 mm.; tegmina, 5.5 mm. long and 2 mm. wide, extending slightly over 2 mm. beyond abdomen.

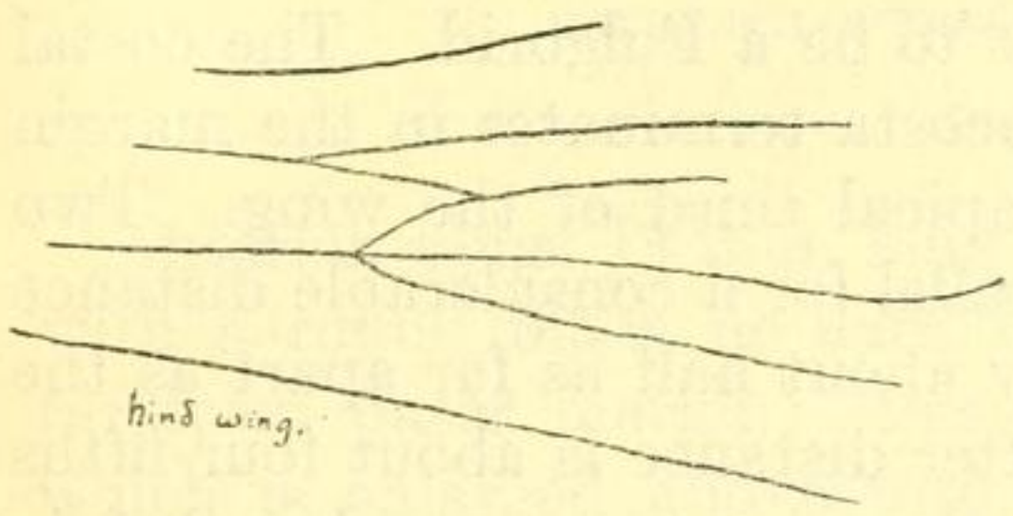


FIG. 3.—PROTOLIARUS HUMATUS. VENATION OF PART OF HIND WING.

Type.—Green River shales (Eocene), back of house at Smith's Ranch, in the vicinity of Cathedral Bluffs, Colorado. (Winchester 17.3, U.S.G.S.)

Holotype.—Cat. No. 66560, U.S.N.M.

This may possibly be congeneric with Scudder's *Oliarites*, but it seems to be distinct. The characters of *Oliarites* are imperfectly known, and its status as a genus can not be precisely determined.

SCOPARIDEA, new genus.

Tegmina shaped and spotted much as in the Lepidopterous genus *Scoparia*, the costa nearly straight except at base, the apex obtuse, the outer margin oblique; subcosta leaving costa nearly 1 mm. from base, and entering it about 1.3 mm. beyond, thus inclosing a very narrowly lanceolate cell (a condition approached in *Cixius*); radius parallel with costa, but a considerable distance (about 6 mm. in the

type species) from it, its apex depressed and emitting numerous delicate oblique veins to the costal margin (the general effect, as well as the maculation, suggestive of certain Lophopinae); subradius or radial sector running parallel with the radius, and about as far from it as from the media; apical region and outer margin with very numerous parallel delicate veins, about five in 1 mm. measured transversely. There is no regular series of gradate veins, such as occur in *Eofulgorella*.

Type.—Scoparidea nebulosa, new species.

SCOPARIDEA NEBULOSA, new species.

Plate 33, fig. 6.

Tegmina 9.3 mm. long, 3.3 mm. broad; maculate in a nebulous or indistinct manner with pale fuscous, tending to alternate light and dark spots between the veins; but the apical 2.5 mm. dark fuscous, inclosing four small hyaline spots arranged in the form of a reversed L, and a subcrescentic oblique hyaline band about 1 mm. long, having its upper end on the costa. The inner margin of the dark area is very irregular, and incloses a large dissected hyaline spot which is only connected with the general pallid field of the wing by a narrow isthmus. There is also a hyaline spot near the anal angle.

Type.—U.S.G.S. 1166. Roan Mountain, Colorado (Scudder).

Holotype.—Cat. No. 66561, U.S.N.M.

DILAROPSIS, new genus.

A genus known only from the anterior wing, which has the outline and general appearance of that of some neuropterous insect related to *Dilar*, but the anal region shows it to be a Fulgorid. The costal margin is gently convex, and the subcosta terminates in the margin a little before the beginning of the apical third of the wing. Two branches of the radius run nearly parallel for a considerable distance below the subcosta, but they are only about half as far apart as the first is from the subcosta, and the latter distance is about four-fifths of the distance of the subcosta from the wing margin. Just before the forking of the radius to form the two branches just described, the media diverges at an angle of about 45° and soon emits two branches, the lower continuous with the stem, the upper parallel with the second division of the radius. Numerous veins proceed to the outer margin, without forking near the end.

Type.—Dilaropsis ornatus, new species.

DILAROPSIS ORNATUS, new species.

Plate 34, fig. 1.

Anterior wing about 12 mm. long and 5 broad; fuscous, especially the apical third, which is conspicuously darker than the disk. Four

large hyaline spots, about equidistant, on costa; three hyaline spots, successively larger from above down, on outer margin, the first about 1.5 mm. from apex; three broad oblique bands, more or less broken into spots, and not conspicuous (owing to the pallid ground), across the disk of the wing; there is perhaps a fourth band near the base.

Type.—Green River shales back of house of Smith's Ranch, in the vicinity of Cathedral Bluffs, Colorado. (Winchester 17–3, U.S.G.S.)

Holotype.—Cat. No. 66562, U.S.N.M.

Among living Fulgoridae this recalls the species of *Ricania*, but the wings are differently shaped.

CALLOSPILOPTERON, new genus.

Anterior wings broad, with obtuse ends, shaped much as in the Neuropterous *Dilar*, but with a distinct anal angle, and without the subbasal enlargement of costal region; apex obtuse; veins very numerous, not branching as they approach the margin; subcosta ending beyond middle of wing, but before beginning of last third, its apical end bending downward and emitting three very oblique veins, beyond which are seven or eight very oblique veins to the margin, arising from the radius. The genus is noteworthy for the reduced costal region, with consequently very oblique veins leaving the subcosta and radius; also for the relatively short subcosta. The wings carry an ocelliform spot near the outer margin, something like the spots on the hind wings of *Psychopsis*.

Type.—*Callospilopteron ocellatum*, new species.

CALLOSPILOPTERON OCELLATUM, new species.

Plate 33, fig. 7.

Anterior wings 13 mm. long and about 6.4 mm. wide; fuliginous, with a round black or dark fuscous spot, about 1 mm. wide, not far from outer margin; this spot having a pale circle around it, which is enlarged above into a more or less distinct hyaline spot surmounting the dark one. The dark spot is 3 mm. below the costa and about 2.5 mm. from apex of wing. Three simple veins pass from the spot to the margin, and below this are about 13 parallel simple veins running to margin, between the spot and the anal angle. The subcosta ends about 8.7 mm. from base of wing.

Type.—U.S.G.S. 1133. Green River, Wyoming (Scudder collection).

Holotype.—Cat. No. 66563. U.S.N.M. The spot on the wings is strongly suggestive of that on the oriental *Melandeva ocellata* Distant, but it is not in the same place. The venation is very different from that of *Melandeva*.

Family CERCOPIDAE.

CERCOPIS (sens. latiss.) CEPHALINUS, new species.

Plate 34, fig. 2.

Length to tip of tegmina about 12 mm.; tegmina 9 mm. long and about 2.7 mm. broad; head about 3.5 mm. wide, the inner corners of eyes 2 mm. apart; clypeus about 2 mm. long, each side with about 12 transverse ridges, all strong; scutellum about 2 mm. long. Head dark fuscous; tegmina rather pale, with the lower margin and base broadly pale brown; the middle of the costa with a pale brown longitudinal band, followed by a pale spot, after which (beginning 3.2 mm. from apex) is a broad marginal band, about 1 mm. broad, extending to apex. The venation can not be clearly made out, but there is no strong reticulation in the apical field. The preservation of the ventral side of the head is remarkble, showing the ridged clypeus (the two sides separated in the middle), the orbits, the narrow submentum and the broad mentum. Compared with *C. astricta* Scudder, from the Green River shales of Wyoming, this has the tegmina much narrower apically, and also differs in the markings.

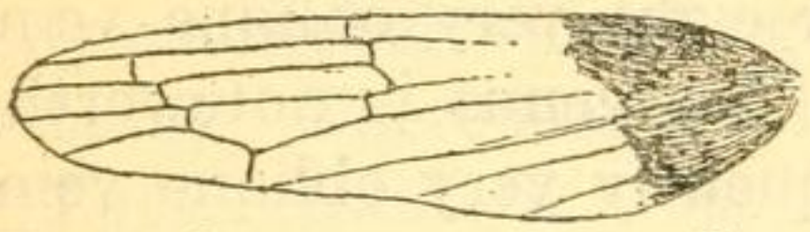


FIG. 4.—CICADELLA SCUDDERI. TEGMEN.

Type.—Eocene shales; back of house at Smith's Ranch, "shale of Green River formation with thin beds oil-shale interbedded." Colorado, Aug. 7, 1917. (S. E. Winchester and H. R. Bennett, 17-3.)

Holotype.—Cat. No. 66564, U.S.N.M.

Family CICADELLIDAE (JASSIDAE authors).

CICADELLA (sens. lat.) SCUDDERI, new species.

Plate 33, fig. 8.

Tegmen about 6 mm. long and 1.5 broad, formed as in *Cicadella;* venation as shown in the figure. About the basal 1.4 mm. is opaque and pure black; the rest is dilute fuscous with dusky veins, the region just beyond the black suffusedly paler.

Type.—U.S.G.S. 113. Roan Mountain, Colorado (Scudder).

Holotype.—Cat. No. 66565, U.S.N.M. Very easily recognized by the black basal area.

ERYTHRONEURA EOCENICA, new species.

Plate 33, fig. 9.

Body and tegmina each 4 mm. long, formed as in modern species; head dark fuscous, obtuse anteriorly; eyes further apart than the diameter of one, but somewhat closer than is the usual modern forms; thorax fuscous; scutellum pallid with two large black

spots as in living species; abdomen dilute fuscous, pallid basally; tegmina dusky, with two broad hyaline transverse bands, the first consisting of a large subquadrate patch, separated from an elongate mark below it by a dark line, but the second mark more widely separated from a narrow band along the lower margin. The second band, beginning 2 mm. from base of tegmen, consists of two large elongated patches, separated by a dark bar. There is also an obscure hyaline spot in the costoapical region. The insect is remarkably similar to living species, especially perhaps to the Japanese *E. apicalis* (Matsumura).

Type.—U.S.G.S. 1127. Roan Mountain, Colorado (Scudder).

Holotype.—Cat. No. 66566, U.S.N.M.

DIPTERA.

Family TIPULIDAE.

CYLINDROTOMA VETERANA, new species.

Plate 34, fig. 3.

Wing 9.5 mm. long; width nearly 3 mm.; discal cell about 1.9 mm. long, its apex about 2 mm. from apex of wing. Compared with Needham's figure (after van der Wulp),[1] if we make the correction indicated by Brunetti,[2] there is very close agreement. The wing is more slender and more pointed apically than in Needham's figure of *C. distinctissima* Meigen; the subcosta runs closer to the costa, being separated by a very fine linear interval; the lower branch of radius (radial sector) comes off *before* the middle of the wing; the marginal cell is much longer, its length about 3.9 mm., and ends about 1.2 mm. beyond level of end of first basal cell; the uppermost branch of media forks exactly as in *C. distinctissima*, with its upper branch strongly arched at base; the discal cell is longer than in *C. distinctissima*. The anal angle of the wing is subrectangular, more prominent than in *C. distinctissima*, approaching the condition of *Idioplasta*. The apex of the first basal cell is formed as in the Indian *C. quadricellula* Brunetti, not as in *C. distinctissima*, except that the lower apical face (on discal cell) is at least twice as long as the other, which is not at all the case in the Indian species.

Type.—U.S.G.S. 77. Roan Mountain, Colorado (Scudder).

Holotype.—Cat. No. 66567, U.S.N.M.

GONOMYIA SCUDDERI, new species.

Plate 34, fig. 4.

Wing about 6.5 mm. long and 2.3 mm. broad, unusually short and broad for a Tipulid; greyish-hyaline, without spots; veins pale

[1] N. Y. State Museum Bulletin 124, pl. 15, fig. 4.

[2] Fauna of British India, Diptera Nematocera, p. 360.

brown. Venation in general as in the Florissant (Miocene) *G. primogenitalis* Scudder, but discal cell much longer. The second basal cell is longer than the first, as in *G. bryanti* Alexander, from Java; but the wing differs from *G. bryanti*, and agrees with the American *G. sulphurella* Osten Sacken, in the base of the submarginal cell. The following measurements are in microns: first basal cell on first marginal, 1550; length of discal cell, 910; second posterior on third posterior, 1040.

Type.—U.S.G.S. 82. Roan Mountain, Colorado (Scudder collection).

Holotype.—Cat. No. 66568, U.S.N.M. A stout-bodied fly, with four black bristles on the scutellum, and the abdomen not bristly, but extremely delicately pilose, is so placed that the above wing looks as if it were attached to it. The actual wings belonging to the body are lost.

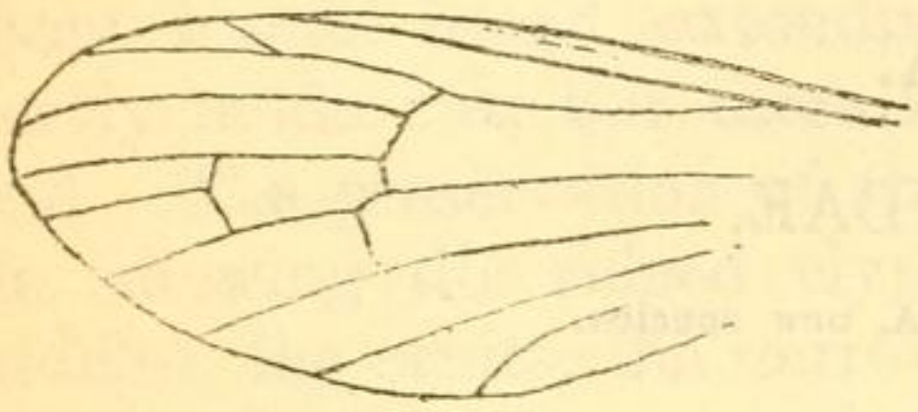


FIG. 5.—GONOMYIA SCUDDERI. WING.

Williston and Needham write *Goniomyia*, but *Gonomyia* is the original spelling.

CYTTAROMYIA FENESTRATA Scudder.

Type.—U.S.G.S. 1095. White River, Colorado (Scudder collection). The wing is 9 mm. long. The original type came from White River, Utah.

Family CULICIDAE.

CULEX WINCHESTERI Cockerell.

Plate 35, fig. 2.

Culex winchesteri COCKERELL, Nature, March 20, 1919, p. 44.

Female, 5.2 mm. long; wing about 4.2 mm.; proboscis 3 mm., distinctly curved; palpi about .4 mm.; thorax about 2 mm. long; abdomen stout, its apex obtuse.

Type.—U.S.G.S., Winchester 17–3. Shales back of house at Smith's Ranch, in the vicinity of Cathedral Bluffs, Colorado.

Holotype.—Cat. No. 66569, U.S.N.M.

Family MYCETOPHILIDAE.

DIOMONUS PALAEOSPILUS, new species.

Plate 34, fig. 5.

Length about 7.85 mm.; length of wing 7.6 mm., the dark spot 3 mm. from base; head small, its width slightly over 1 mm.; thorax large, about 2.65 mm. wide; antennae cylindrical, the joints much longer than wide. Head and thorax dark brown (probably nearly

black in life); abdomen apparently pallid except at base; antennae fuscous; wings hyaline, somewhat dusky, with a large dark spot, and the apical field suffusedly dusky. The venation is shown in the figure.

Type.—Green River (Eocene) shales, Sec. 33, T. 4 S., R. 100 W., Colorado (Winchester 17.6, U. S. Geol. Survey).

Holotype.—Cat. No. 66570, U.S.N.M.

This ancient insect represents a type which has come down to modern times generically unaltered; large size, spotted wings, and all. It is much the largest of the Eocene Mycetophilidae.

PALAEOPLATYURA (?) EOCENICA, new species.

Plate 32, fig. 1.

Female.—Length 5.4 mm.; head small, narrow, its width about 0.6 mm.; antennae with very short joints; abdomen 3.5 mm. long and 1.5 mm. broad; wings 5.1 mm. long and about 1.4 broad, the very obtuse apex extending about 1 mm. beyond end of abdomen. As preserved, the head and abdomen are fuscous, the thorax pale ferruginous, the wings clear hyaline. The radius is thick, and about the middle of the wing is 240 μ from costa. The radial sector leaves the radius at a greater distance from the base than is usual.

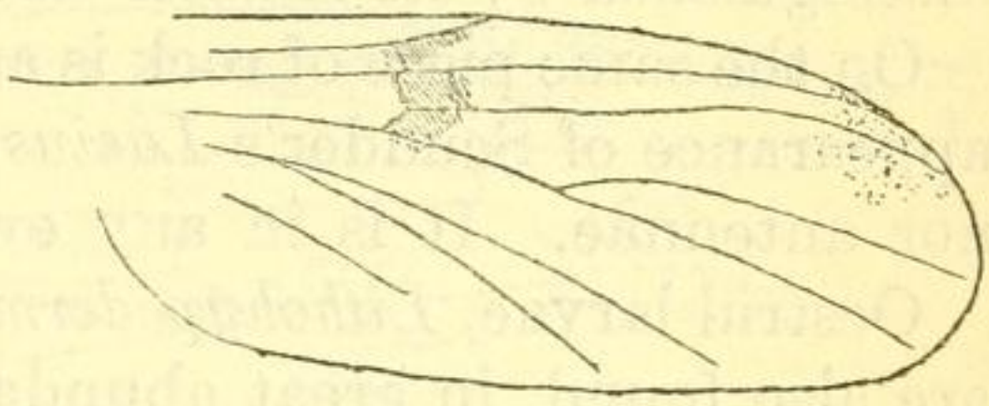


FIG. 6.—DIOMONUS PALAEOSPILUS. WING.

Green River shales back of house at Smith's Ranch, in the vicinity of Cathedral Bluffs, Colorado. (Winchester 17.3, U.S.G.S.)

Holotype.—Cat. No. 66548, U.S.N.M.

Family BIBIONIDAE.

PLECIA WINCHESTERI Cockerell

Several specimens from Winchester's locality 17–5 (Cathedral Bluffs, south of Little Tommies Draw, "at point where samples were taken") appear to belong to this species, but the exact details of the venation can not be made out. They are females, with the usual broad abdomen. The length of the insect is from 7.5 to 8.5 mm. The thorax is pallid (probably pale ferruginous in life), and the head and abdomen are dark. Thus the coloration of the body agrees with that of the living *Plecia fulvicollis* Fabricius, and the wings also are about as dark as in that species.

The new locality is about 25 miles from the type locality of *P. winchesteri.*

Family BLEPHAROCERIDAE.

PHILORITES PALLESCENS, new species.

Plate 34, fig. 6.

Length (excluding proboscis) 3 mm.; proboscis stout, directed forward, about 1 mm. long; wings about 3.5 mm. long. Dark fuscous or black, the legs brown; wings dilute brown.

Type.—U.S.G.S., Winchester F. 17–4, spring at head of Little Duck Creek, Colorado; collected by D. E. Winchester and H. R. Bennett.

Holotype.—Cat. No. 66571, U.S.N.M.

This is preserved in exactly the same position as the type of *Philorites johannseni* Cockerell, the position of the wings, one elevated the other depressed, evidently resulting from pressure on the elevated thorax. The details of the venation of *P. pallescens* can not all be made out, but the strong R_1 and R_{4+5} leaving it, are as in *P. johannseni*, and the media is also very distinct. In general, the flies are so similar that they are surely congeneric, but *P. pallescens* is readily distinguished by its smaller size and much paler wings.

On the same piece of rock is an apparent ant, of the size and general appearance of Scudder's *Lasius terreus;* but it has neither wings, legs nor antennae. It is in any event not a *Lasius*.

Oestrid larvae, *Lithohypoderma ascarides* (*Musca ascarides* Scudder) are also found, in great abundance, at Station F 17–4.

Family ASILIDAE.

ASILOPSIS, new genus.

Small flies apparently related to Asilinae or Laphriinae; marginal cell closed far from end of wing; base of marginal obtuse, and the part basad of basal end of first submarginal much longer than that apicad of it; first basal on first submarginal scarcely longer than anterior cross-vein; discal cell elongated, with anterior cross-vein far toward the base; two submarginal cells, the second less than half as long as first; second posterior cell somewhat swollen toward base; fourth posterior apparently open.

Type.—*Asilopsis fusculus*, new species.

ASILOPSIS FUSCULUS, new species.

Plate 35, fig. 3.

Wing (the base not preserved) probably about 9 mm. long; uniform dilute fuscous, except that there is a darker cloud in apical part of marginal cell; the following measurements are in microns: apical petiole of marginal cell, 1760; base of first submarginal to base of marginal, 2480; first basal on first submarginal, 160; discal on first posterior, 1570; first basal on fourth posterior, 1920.

Type.—U.S.G.S., 1076. White River, Colorado. (Scudder collection.)

Holotype.—Cat. No. 66572; U.S.N.M.

This insect is of particular interest, since all the rather numerous Asilidae from Florissant are referable to existing genera. The very long apical petiole of marginal cell, and base of submarginal so near the anterior cross-vein, will at once distinguish it. The dark cloud in the apical part of marginal cell is suggestive of Leptidae, and is not an asilid character. It is possible that if we had the whole fly a distinct family would be indicated, and on the wing alone it seems justifiable to establish a subfamily Asilopsinae.

Family THEREVIDAE.

EOTHEREVA, new genus.

Bare rather elongate flies, similar to *Thereva* in general appearance, but with very long slender antennae, the second joint somewhat longer than the other two together; third longitudinal vein simple, arched, ending slightly above wing-tip, therefore no cubital fork; first longitudinal vein simple and relatively short, as in Therevidae; a very distinct stigmatic infuscation, bounded below by the second longitudinal vein; five posterior cells, the fourth at least contracted, perhaps closed, but indistinct apically; discal cell small and narrow, the anterior cross-vein equally distant from its base and apex; anal cell probably open, perhaps widely so, but its lower side can not be made out.

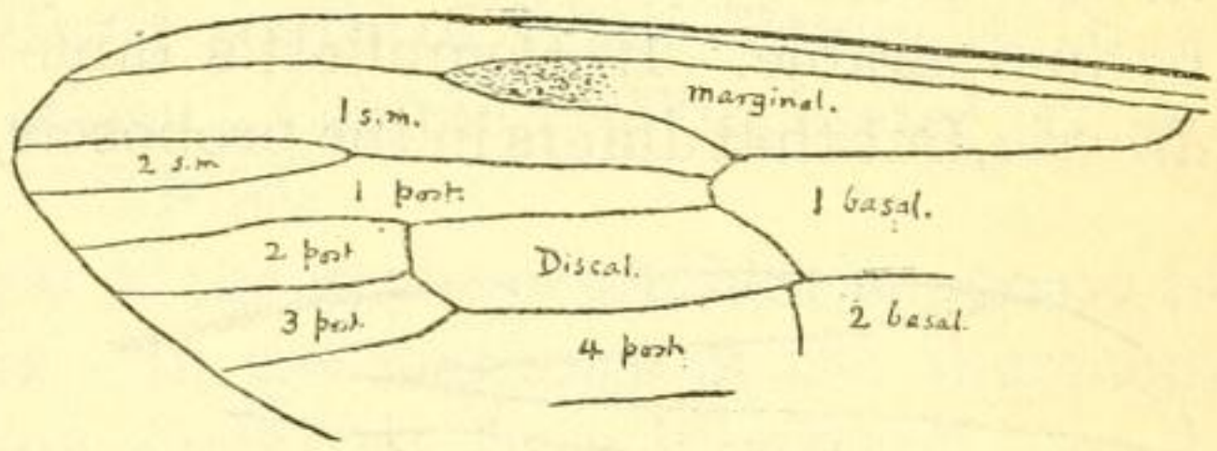


FIG. 7.—ASILOPSIS FUSCULUS. PART OF WING.

Type.—*Eothereva simplex*, new species.

EOTHEREVA SIMPLEX, new species.

Plate 35, fig. 4.

Length 6 mm., of which 3.4 mm. is abdomen; wings about 5.5 mm. reddish hyaline, the stigmatic region darker; antennae about 1.5 mm. long, the first joint 240 μ, the second 880 μ, the third 560 μ. Anterior cross-vein 480 μ from base and apex of discal cell; end of second longitudinal vein to end of third, measured in a straight line, about 1600 μ. Body as preserved pale reddish.

Type.—U.S.G.S. 21, Roan Mountain, Colorado. (Scudder.)

Holotype.—Cat. No. 66573, U.S.N.M.

Certainly a Therevid, but peculiar for the absence of the cubital fork, about which there is no doubt. The long slender antennae are also distinctive.

Family EMPIDIDAE.

PROTOEDALEA, new genus.

A genus of Ocydromiinae; with short antennae, the last joint thick and obpyriform; thorax moderately elevated; abdomen cylindrical; hind legs not spiny or otherwise modified; wings ample, broad basally, much as in *Oedalea*; first radial branch ending far beyond middle of wing (as in *Phyllodromia delicata* Meunier, from Baltic amber), second ending not far beyond it, third ending slightly below tip of wing (a little above in *P. delicata*), and unbranched; discal cell large, narrowly truncate at end, emitting in all three veins, the first apparently incomplete; anal cell not quite so long as second basal, squarely truncate at end, its end making an angle with end of second basal. Differs from *Oedalea* by the simple legs and longer discal cell, but it is closely related. It is also near to *Anthalia*, to which it runs best in Melander's table in Williston's North American Diptera but there is no visible proboscis. It is also near *Euthyneura*, differing in the antennae; Coquillett considered *Anthalia* and *Euthyneura* to be inseparable. In Coquillett's table it appears to run best to *Sciodromia*, but that differs in the proboscis, and has long and narrow wings.

Type.—*Protoedalea brachystoma*, new species.

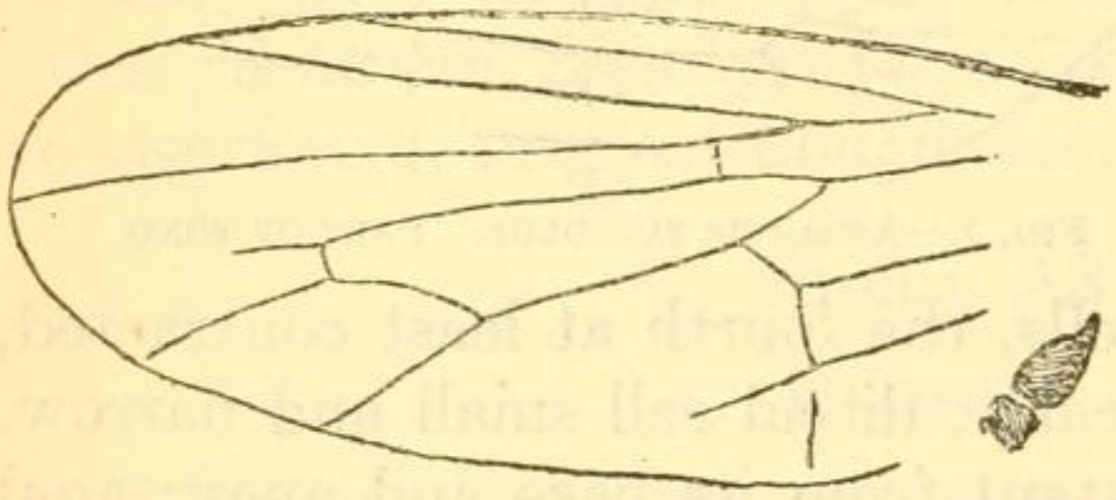


FIG. 8.—PROTOEDALEA BRACHYSTOMA. WING AND ANTENNA.

PROTOEDALEA BRACHYSTOMA, new species.

Plate 35, fig. 5.

Male.—Length, 4.4 mm.; dorsum of thorax convex, but not high; abdomen cylindrical, about 3.6 mm. long; wings 4 mm. long, dusky. Dark fuscous, probably black in life, with venter of abdomen, except apically, pallid. Scanty long hairs on under side of abdomen. No stiff or dark bristles on costa. Proboscis not exserted; eyes apparently contiguous; bases of antennae apparently contiguous. The following measurements are in microns:

Length of hind tibiae, about 1,360; length of hind basitarsi, about 560; width of abdomen about 720; diameter of head about 880; length of discal cell 1,650; discal on second posterior 95; discal on third posterior (not allowing for curve) 480; basal corner of third posterior to apical corner of second basal 960; oblique apical side of second basal 175; apical side of anal 208.

Type.—Green River (Eocene) shales, above rich shale in Camp Gulch, near Roan Creek, Colorado, Sept. 26, 1917 (Winchester 17–8. U.S.G.S.)

Holotype.—Cat. No. 66574, U.S.N.M.

Family SYRPHIDAE.

SYRPHUS LITHAPHIDIS, new species.

Length, about 8.2 mm.; head and thorax 4 mm.; length of wing 6.8 mm. Head and thorax dark fuscous (doubtless black in life); wings hyaline; abdomen pallid with broad dark bands on hind margins of segments, and a broad dark median band, evanescent on the apical half. Venation in general as in modern *Syrphus*, except that the subcostal cell is not nearly so slenderly tapering at the apex, the end of the first vein being somewhat like that figured by Williston[1] for *Paragus tibialis*, though this does not agree well with an actual specimen of *P. tibialis* before me. There is a distinct though not dark cloud filling the apical part of the subcostal cell, as in modern *Syrphus*. The following wing-measurements are in microns: End of auxiliary vein to end of first about 1,600; submarginal cell on first basal about 800; last posterior on second basal about 320; tip of anal to wing margin about 240. The general form and appearance entirely agree with *Syrphus*.

Eocene shales, "Cathedral Bluffs south of Little Tommies Draw at point where samples were taken," Colorado (Winchester 17–5).

Holotype.—Cat. No. 66585, U.S.N.M.

The name is derived from that of the genus of aphides supposed to occur in the Green River shales. In the markings of the abdomen, this closely resembles *S. willistoni* Cockerell, from Florissant.

Family ANTHOMYIIDAE.

ANTHOMYIA (s. lat.) WINCHESTERI, new species.

Plate 35, fig. 6.

Thorax about 3 mm. long, fuscous, with fine hairs and large black dorsal bristles; abdomen about 3 mm. long and 2.7 wide, reddish fuscous, segments 2 to 4 broadly suffused with black basally, except at sides; surface of abdomen with abundant small hairs; segments 2 to 4 with also each a transverse row of black bristles about 560μ long. Legs with fine hairs and bristles, those on tibiae hardly as long as diameter of tibia. The thoracic bristles are not all preserved, but the achrostichal and dorsocentrals were present and very large, the largest about 1,280μ long; there were apparently two large humeral bristles on each side. The abdominal bristles are not preserved on the reverse impression, which shows only fine hairs in the middorsal region; from this alone one might have obtained a quite erroneous impression.

Wings nearly 7 mm. long and 3 wide, dusky, but without spots; costa black, but veins very pale.

[1] N. A. Diptera.

Winchester (U.S.G.S.) 17–8. Green River Eocene. Above rich shale in Camp Gulch, Colorado; Sept. 26, 1917.

Holotype.—Cat. No. 66575, U.S.N.M.

Resembles *A. burgessi* Scudder from Quesnel, British Columbia, but is much larger. It is similar in form to the living *Hyetodesia lucorum* Fallen, with similar long black bristles and short hair on thorax, and similar wings; but it differs by the shorter bristles of abdomen, and the very much shorter leg bristles.

COLEOPTERA.

Family CICINDELIDAE?

Genus CICINDELOPSIS, new genus.

Elytron long and narrow, parallel-sided except at ends; obtuse apically, without any distinct inner apical angle; humeral angle rounded; surface neither punctured nor striate. Color-markings as described under the species.

Type.—*Cicindelopsis eophilus*, new species.

CICINDELOPSIS EOPHILUS, new species.

Plate 35, fig. 7.

Elytron 8 mm. long and 2 mm. wide, with dark markings on a colorless background. The outer margin is narrowly dark, and is separated by a slender pale line from a parallel dark line indicating the epipleura. The large markings are three, as follows. The basal mark, beginning as a broad band at the base of elytron (but not from the humeral region), extends downward, becoming narrower and gently curving outward, to end in a large subcircular patch, the outer edge of which touches the epipleural line; at its lower end this patch extends into a small rounded lobe, and the end of this is 3 mm. from base of elytron. The second mark rises about the middle of the elytron as a subquadrate patch, with one face on inner margin, having attached to its end a large claviform mark directed obliquely downward, its very obtuse end (which is slightly over 5 mm. from base of elytron) not reaching epipleural line; this clavate mark has a small lobe above at its base, and another on its outer face. The third mark is broadly set on the outer margin near the base, and presents a rounded lobe extending downward from its inner apical corner.

Type.—U.S.G.S. 528. White River, Colorado (Scudder collection). In Eocene rock of Green River Age.

Holotype.—Cat. No. 66576, U.S.N.M.

This elytron strongly suggests a Cicindelid, but most (not all) Cicindelids are distinctly punctured, have broader elytra, and have a distinct inner apical angle. The Collyrinae, however, have narrow elytra shaped essentially as in *Cicindelopsis*. The pattern impresses

one as being characteristically Cicindelid, and I can not find anything much like it elsewhere, as for instance among the Cerambycidae, where I sought hopefully for some time. In the form of the basal mark there is even a suggestion of certain Heteromera, as for instance *Dircaea venusta* Champion, from Tasmania; but this apparently has no significance. When we come to compare the existing Cicindelidae, there is nothing very close, but the plan of the pattern is similar. The third mark, on the outer margin, is not characreristic of the Cicindelidae, but may be derived from the condition seen in *Cicindela guttata* Wiedemann. The basal mark is more or less evident in many species. The matter is of more than ordinary interest, because of the total absence of Cicindelidae in the Florissant (Miocene) shales. In Europe, also, Edm. Reitter found no Cicindelidae in Baltic amber (Oligocene); and although W. Horn reported our American *Tetracha carolina* Linnaeus in Baltic amber, it must surely have been a fake specimen, of which many are unfortunately extant. *Cicindelites armissanti* Meunier, from the Oligocene of France, is declared by W. Horn not to be a Cincindelid.

Family CARABIDAE.

CARABITES EOCENICUS, new species.

Plate 36, fig. 1.

Elytra black, 9 mm. long and 3 broad, with eight fine but very distinct striæ, not counting the marginal one; the abbreviated inner basal stria is represented only by a faint groove running parallel with and extremely near to the margin of the rather large scutellum, the sides of which are about 1 mm. long. Striae not punctured, nor are there any surface or submarginal punctures. About the middle of the elytra 1 mm. measured transversely, includes three interspaces. There is a feeble short stria basally between the first and second.

Type.—U.S.G.S. 627. White River, Colorado (Scudder collection). Differs from *Carabites exanimus* Scudder, by having one stria less, and no concavity of the outer margin toward the apex.

Holotype.—*Cat.* No. 66577, U.S.N.M.

Compared with *Pterostichus*, this shows little difference except the absence of the submarginal punctures. In *Pterostichus* the first (innermost) stria is deplaced sideways near the base, and is separated by a ridge from the abbreviated inner basal stria. In the fossil the first stria is continuous in a straight line until it passes into the groove along the scutellar margin, described above. A short stria between the first and second evidently represents the basal end of the first as seen in *Pterostichus;* and the inner basal stria of *Pterostichus* is homologous with the basal end of the first stria in the fossil. I find that in the living *Pterostichus menetriesii* Motschulsky, from Yuma, the first stria is practically continuous with the inner basal,

and the condition is essentially as in the fossil. In *Harpalus*, also, the condition is as in the fossil.

HARPALUS VETERUM, new species.

Plate 36, fig. 2.

Length 8 mm.; elytra 5 mm. long and 2 broad. General form and appearance as in *Harpalus;* the elytra with eight delicate striae, not counting the marginal one; these sharp and not at all punctured. Mandibles stout; eyes 1 mm. apart, rather small for *Harpalus;* thorax short and broad; scutellum rather large, but its apical angle conspicuously less than in *Harpalus erraticus*.

Type.—U.S.G.S. 143. Roan Mountain, Colorado (Scudder).

Holotype.—Cat. No. 66578, U.S.N.M.

Family CHRYSOMELIDAE.

LEMA (?) PERVETUSTA, new species.

Plate 36, fig. 3.

Elytron about 6.5 mm. long, 3 wide; of the form usual in the genus, but rather wide; surface as preserved with pustuliform spots due to some secondary deposit, but there is some evidence that there were rows of punctures. Markings consisting of large black areas, covering most of the surface, separated by two narrow transverse colorless bands; there is also a broad humeral dark stripe. The epipleura is colorless below the humeral area, and the dark blotches do not quite extend to the inner margin, which, however, is narrowly edged with dark. The transverse light bands (about 0.5 mm. wide) are not quite alike; the first is abruptly turned upward (basad) at each end, on the inner side being separated from the marginal area by a lobe of the second dark patch. The second stripe is oblique, its lower end outward.[1]

Type.—U.S.G.S. 1299. Roan Mountain, Colorado (Scudder).

Holotype.—Cat. No. 66579, U.S.N.M.

The fundamental pattern of the elytra of the Chrysomelidae is very ancient, and reappears in many of the subfamilies. The persistence of similar tendencies is well shown by the duplication of the same patterns by numerous neotropical species of *Lema* and *Diabrotica;* genera not closely related. The three dark bands or areas may be broken into spots, or may be modified to form longitudinal stripes. The pattern of the present insect, with the three dark bands so enlarged as to give the effect of two light bands on a dark ground, is not common. I believe I have seen it in a neotropical *Lema*, but can not now cite the species; it occurs also in *Cryptocephalus* and *Dermorhytis*.

[1] Since the above was put in type, I have found the reverse (U.S.G.S. 1300), which shows that the elytron was fully 8 mm. long, with three pale bands, and a fourth large dark patch in the apical region.

Lema vetusta Heer, fossil in the Miocene of Oeningen, is said by Heer to be allied to *L. merdigera*. The latter species belongs to *Crioceris*, so the fossil must be called *Crioceris vetusta*. The elytra, as shown in the figure, have neither bands nor spots.

HYMENOPTERA.

Family ICHNEUMONIDAE.

PHYGADEUON (sens. lat.) PETRIFACTELLUS, new species.

Plate 36, fig. 4.

Head and thorax black, their combined length 2 mm.; metathorax gibbous in profile (much more so than in the recent members of the same tribe with which I have been able to compare it); abdomen petiolate, the petiole (two segments) short, hardly 1 mm. long, black; beyond this the abdomen is ovate, about 1.5 mm. long, apparently ferruginous in life, blackened just beyond the petiole (base of third segment); ovipositor very distinctly exserted, but short, about .05 mm. Wings broad and ample, faintly dusky, stigma and nervures ferruginous; aerolet pentagonal, closed; venation as shown in the figure. End of stigma to end of marginal cell 800μ; lower side of third discoidal cell, 720μ.

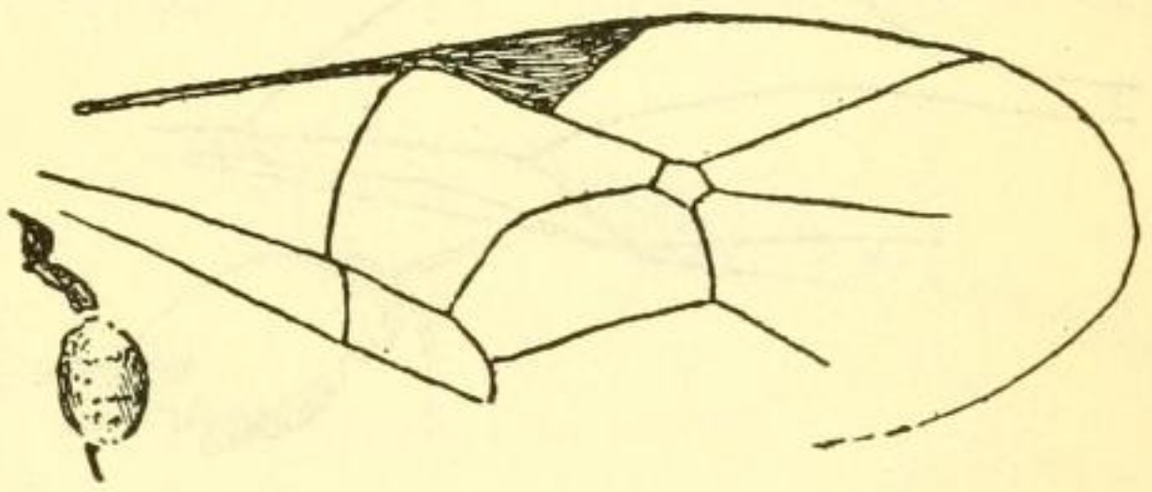


FIG. 9.—PHYGADEUON PETRIFACTELLUS. ABDOMEN AND WING.

Type.—U.S.G.S. 1115 and (reverse) 1117. White River, Colorado. Scudder collection.

Holotype.—Cat. No. 66580, U.S.N.M.

It is impossible to refer this to any of the restricted modern genera, but there are apparently no grounds for the recognition of a new genus. It seems to belong to the Phygadeuonini, but the brevity of the ovipositor is suggestive of Stilpnini.

EOPIMPLA, new genus.

A genus of Pimpline Ichneumonidae, characterized by the relatively large size (the largest of the known Eocene forms), with broadly petiolate abdomen and normal terebra; the venation normal in most respects, apparently without an areolet, the stigma large; the basal nervure bent or angled near upper end, its lower end practically meeting the transverso-medial; *the first brachial cell much produced apically, its apical side extremely oblique, emitting the subdiscoideus almost at the lower* (*apical*) *corner*. The hind wing is imperfectly preserved, but it can be seen that the upper apical angle of the mediellan

cell is relatively large, not strongly acute as in many genera. The really diagnostic characters are italicised. The bend in the basal nervure seems to be a normal feature; if so, it is another useful character.

Type.—*Eopimpla grandis*, new species.

EOPIMPLA GRANDIS, new species.

Plate 36, fig. 7.

Female.—Length about 14.5 mm. (excluding ovipositor); length of thorax about 4.25 mm.; anterior wing from base to end of stigma about 8 mm., probable total length of wing about 12 mm.; length of stigma about 1.8 mm.; lower end of basal nervure to transverse-cubital about 4.5 mm., and lower end of basal to basal corner of marginal cell 3 mm.; width of petiole of abdomen about 1 mm. Head and thorax black; abdomen so far as visible light ferruginous, the base of petiole fuscous; terebra (only partly preserved) dark; antennæ pallid; wings hyaline, with ferruginous nervures and stigma.

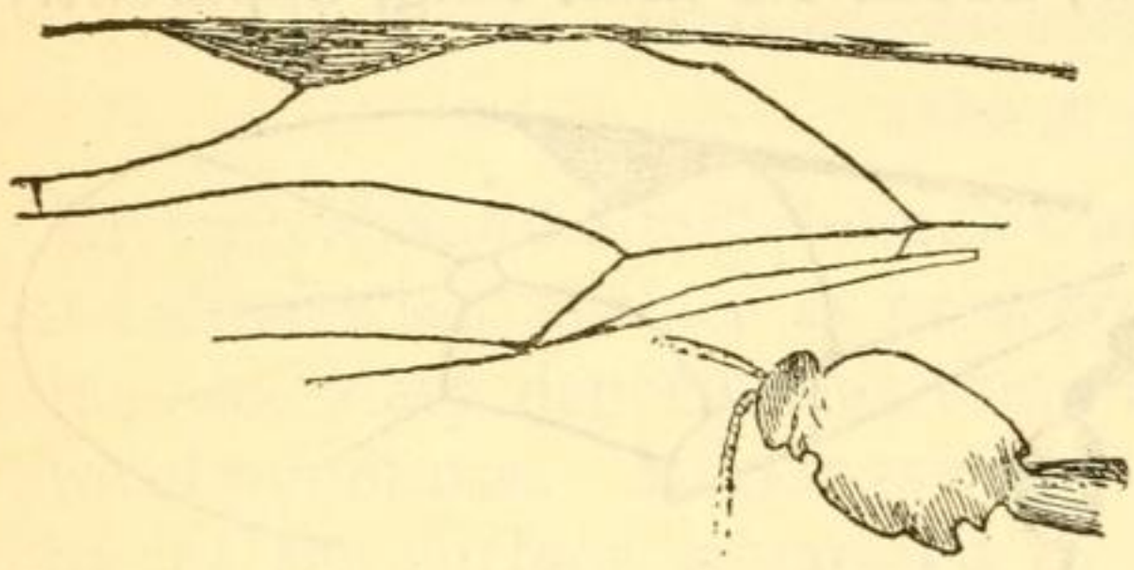


FIG. 10.—EOPIMPLA GRANDIS. PARTS OF BODY AND WING.

Type.—Green River (Eocene) shales, "Cathedral Bluffs South of Little Tommies Draw, at point where samples were taken." (Winchester 17–5, U.S.G.S.) The fly *Dicranomyia primitiva* Scudder (pl. 35, fig. 1) comes from the same place.

Holotype.—Cat. No. 66581 U.S.N.M.

The shape of the end of the first brachial cell is approached in *Ischnocerus*, and the end of the cell with the subdoscoideus recalls the arrangement found in certain ants.

PIMPLA EOCENICA Cockerell.

Plate 36, fig. 8.

Pimpla eocenica COCKERELL, Entomologist, vol. 52, 1919, p. 122.

Head and thorax 3.5 mm. long, abdomen about 4.5 mm.; terebra projecting 1.95 mm. beyond abdomen. Anterior wing 6.5 mm. long; width (depth) of marginal cell 655μ; length of basal nervure 690μ; width (depth) of stigma 400μ; length of areolet 512μ.

U. S. G. S., Winchester's F 174. Spring at head of Little Duck Creek, Colorado.

Holotype.—Cat. No. 66582, U.S.N.M.

Family BRACONIDAE.

EOBRACON, new genus.

Small species with well developed wings; head and thorax ordinary; mandibles not clearly seen, but certainly not as in Alysiidae; antennae

long and slender, the last joint somewhat enlarged, claviform; abdomen shaped as in Cheloninae, without visible sutures, the base sessile but narrow, the apex enlarged, rounded, very obtuse; a long straight ovipositor.

Stigma large; two *inclosed* submarginal cells, the outer side of the second extremely weak; transverse medial nervure not meeting the basal. Second submarginal cell large and quadrate.

Type.—Eobracon cladurus, new species.

EOBRACON CLADURUS, new species.

Plate 36, figs. 5, 6.

Length (excluding ovipositor) 4 mm.; abdomen 2 mm.; ovipositor 2.5 mm.; anterior wing 4 mm. long. Head and thorax fuscous (probably black in life); abdomen colorless, with the apex dark fuscous; antennae a little over 3 mm. long, rather more than basal half colorless, the apical part fuscous, the apical joint elongate, swollen. Wings faintly dusky; stigma fuscous; nervures pale brown, second transverso-cubital almost obsolete.

Type.—U.S.G.S. 1106, and reverse 1112. White River, Colorado (Scudder collection).

Holotype.—Cat. No. 66583, U.S.N.M.

The venation is not unlike that of *Diospilus repertus* Brues, from the Miocene of Florissant, but the abdomen is very different. The genus appears to belong to the Cheloninae, but to differ from all those now living.

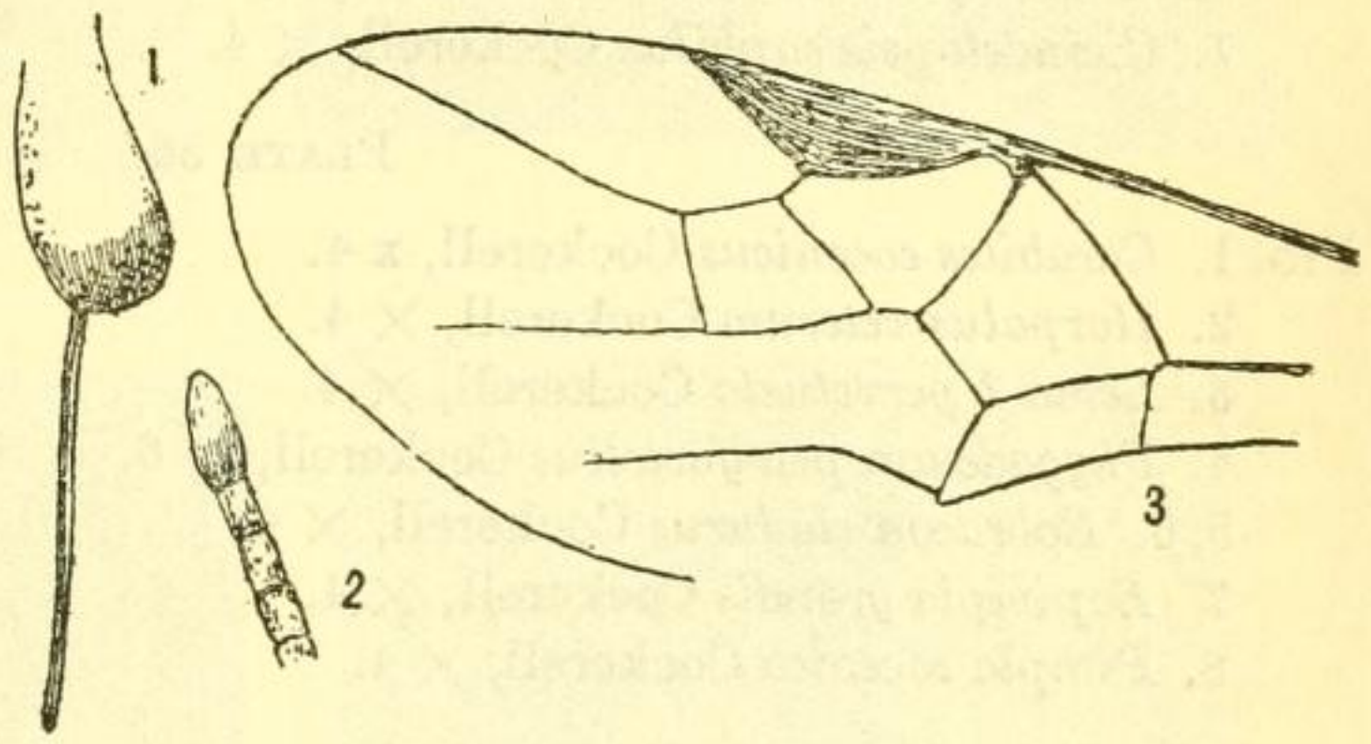


FIG. 11.—EOBRACON CLADURUS. 1. ABDOMEN. 2. END OF ANTENNA. 3. WING.

DESCRIPTION OF PLATES.

PLATE 32.

FIG. 1. *Palaeoplatyura ? eocenica* Cockerell, × 6.
2. *Eocalopteryx atavina* Cockerell, × 3.
3. *Protamphipteryx basalis* Cockerell, × 2.
4. *Eopodagrion scudderi* Cockerell, × 3.
5. *Limnephilus eocenicus* Cockerell, × 4.
6. *Hydroptila phileos* Cockerell, × 6.
7. *Hammapteryx ? lepidoides* Cockerell, × 2.
8. *Hammapteryx ? ceryniiformis* Cockerell, × 4.

PLATE 33.

FIG. 1. *Lithopsis delicata* Cockerell, × 6.
2. *Lithopsis simillima* Cockerell, × 4.
3. *Detyopsis packardi* Cockerell, × 4.
4. *Detyopsis scudderi* Cockerell, ×

FIG. 5. *Protoliarus humatus* Cockerell, × 6.
6. *Scoparidea nebulosa* Cockerell, × 4.
7. *Callospilopteron ocellatum* Cockerell, × 3.
8. *Cicadella scudderi* Cockerell, × 6.
9. *Erythroneura eocenica* Cockerell, × 6.

PLATE 34.

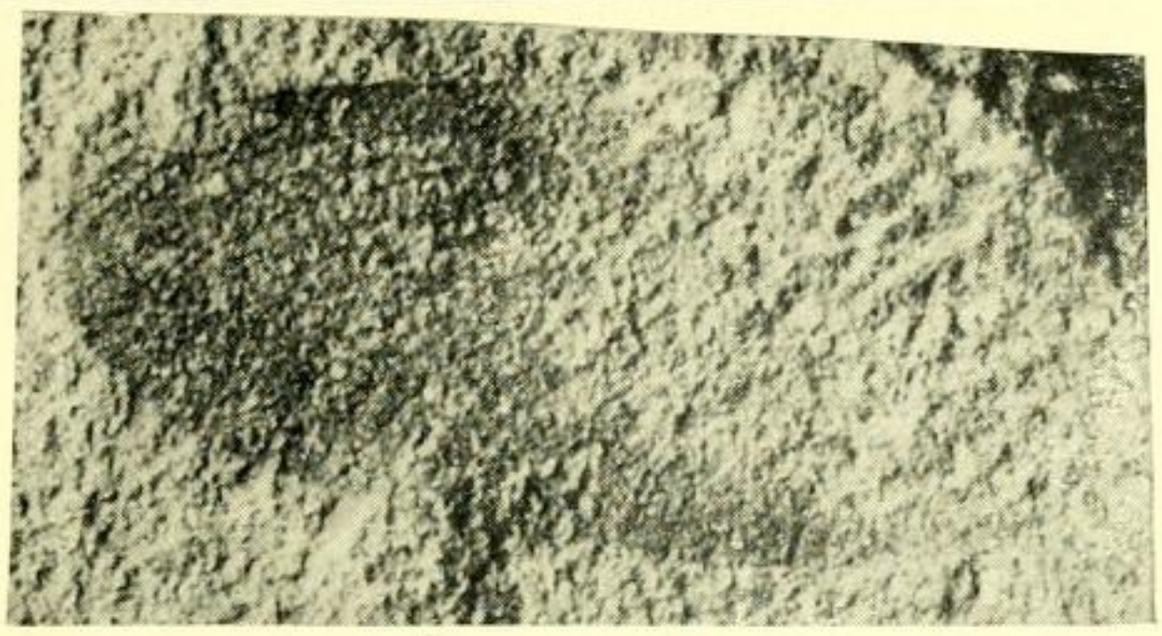
FIG. 1. *Dilaropsis ornatus* Cockerell, × 6.
2. *Cercopis cephalinus* Cockerell, × 4.
3. *Cylindrotoma veterana* Cockerell, × 4.
4. *Gonomyia scudderi* Cockerell, × 4 (wing only).
5. *Diomonus palaeospilus* Cockerell, × 4.
6. *Philorites pallescens* Cockerell, × 4.

PLATE 35.

FIG. 1. *Dicranomyia primitiva* Scudder, × 4.
2. *Culex winchesteri* Cockerell, × 6.
3. *Asilopsis fusculus* Cockerell, × 6.
4. *Eothereva simplex* Cockerell, × 4.
5. *Protoedalea brachystoma* Cockerell, × 6.
6. *Anthomyia winchesteri* Cockerell, × 4.
7. *Cicindelopsis eophilus* Cockerell, × 4.

PLATE 36.

FIG. 1. *Carabites eocenicus* Cockerell, x 4.
2. *Harpalus veterum* Cockerell, × 4.
3. *Lema ? pervetusta* Cockerell, × 4.
4. *Phygadeuon petrifactellus* Cockerell, × 6.
5, 6. *Eobracon cladurus* Cockerell, × 4.
7 *Eopimpla grandis* Cockerell, × 4.
8. *Pimpla eocenica* Cockerell, × 4.



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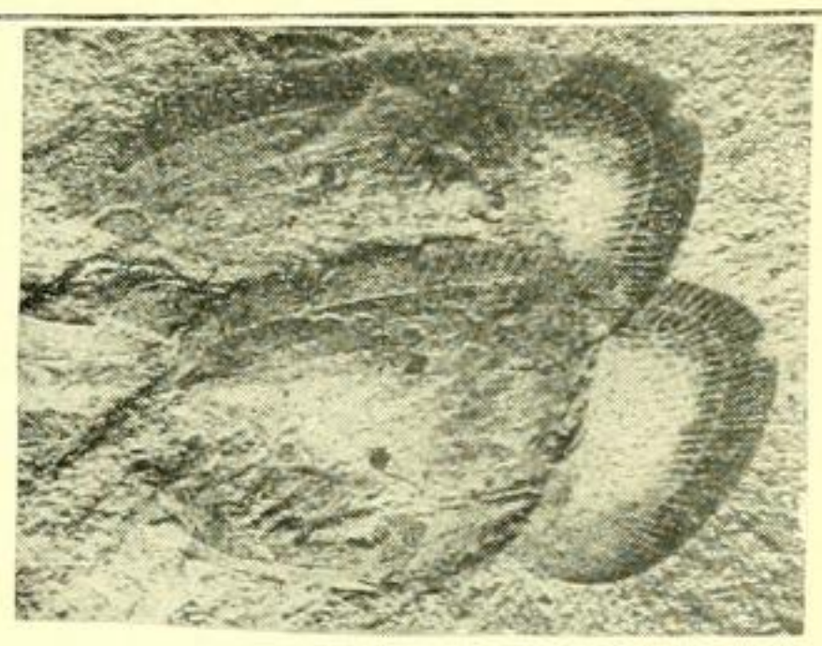

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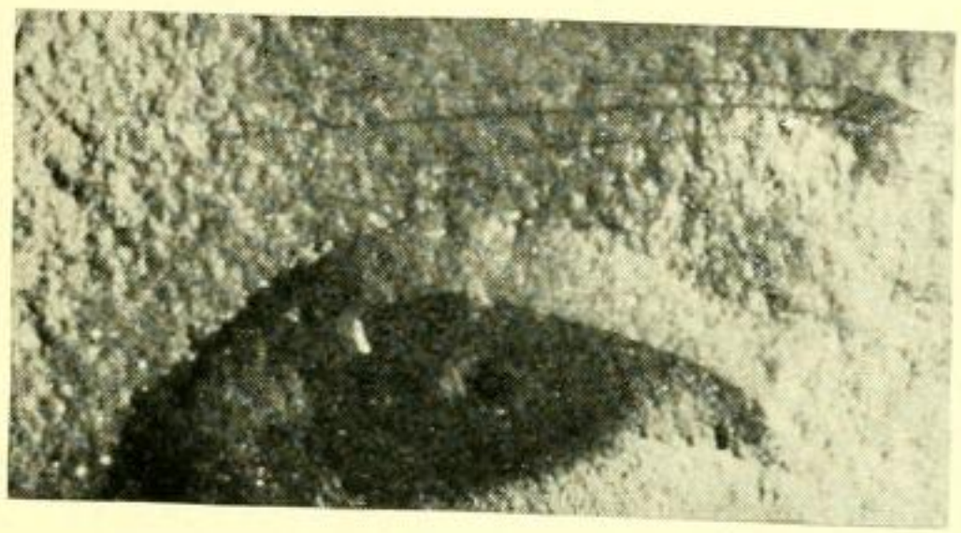

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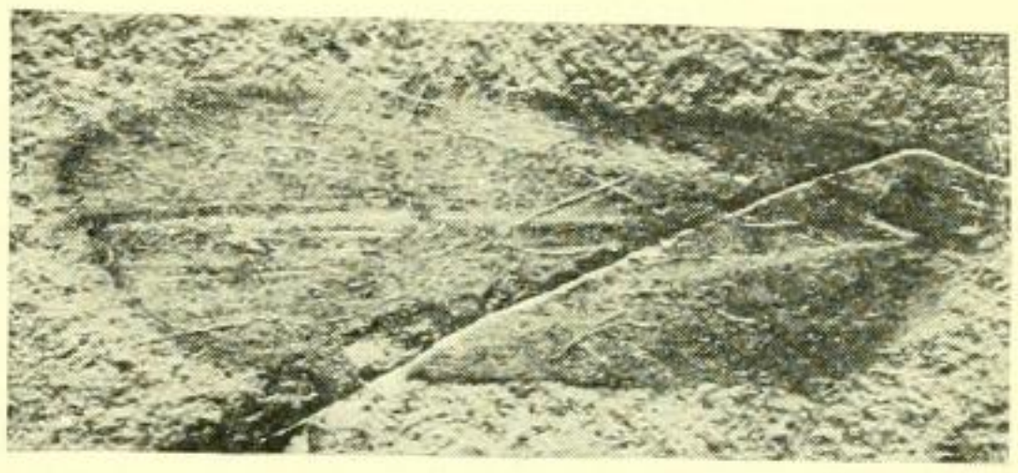

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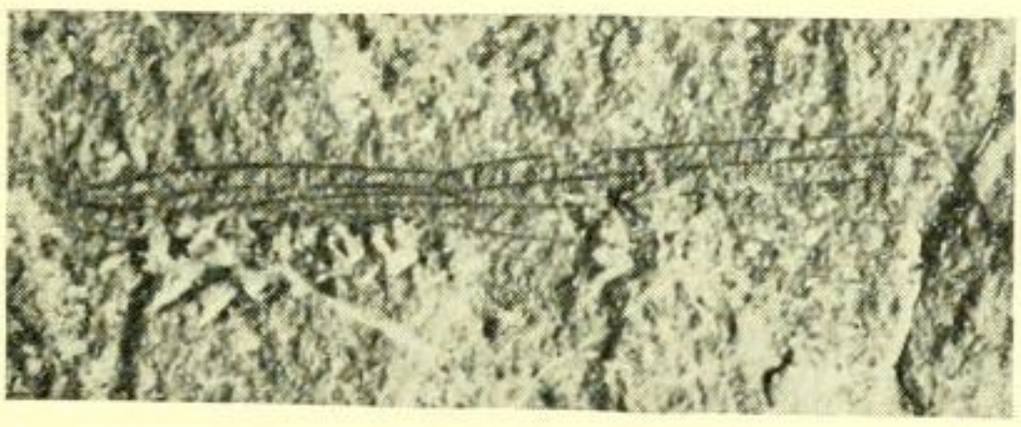

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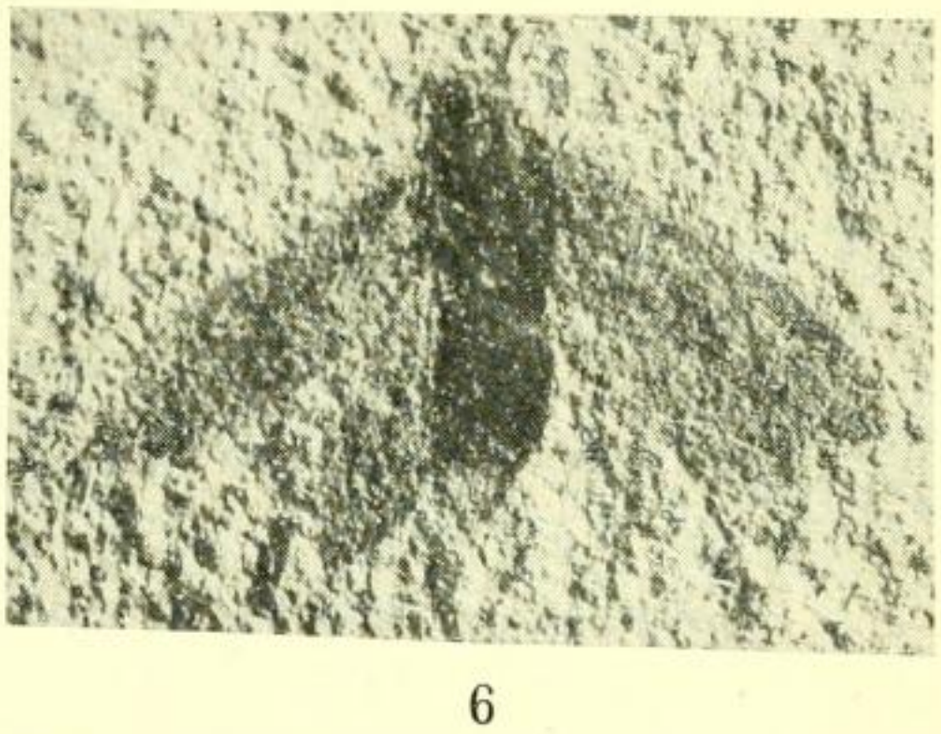

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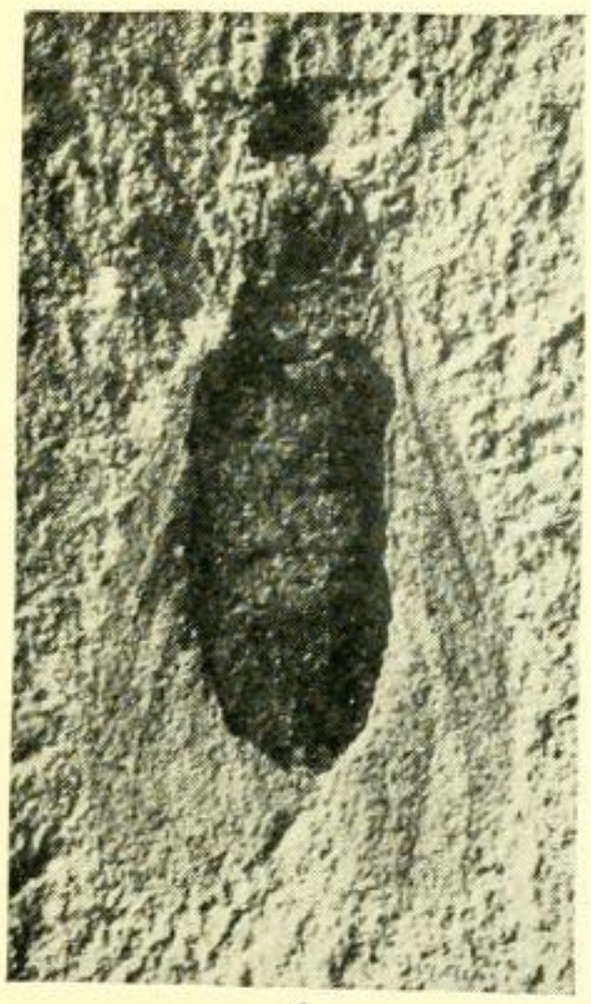

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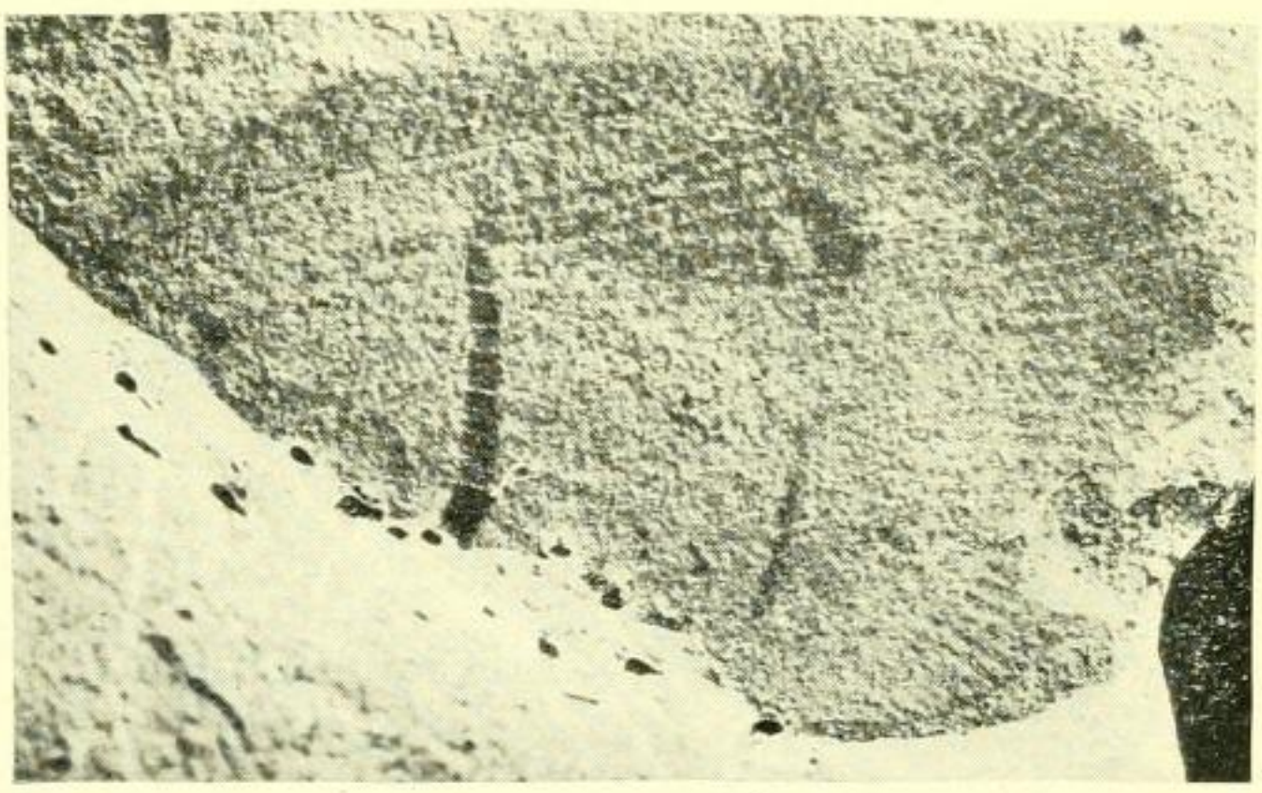

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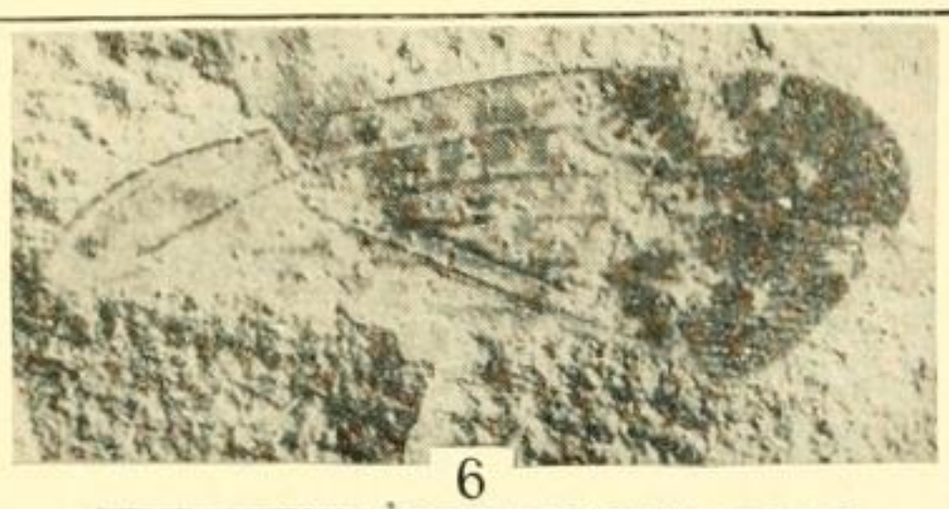
EOCENE INSECTS FROM THE ROCKY MOUNTAINS.

FOR EXPLANATION OF PLATE SEE PAGE 259.



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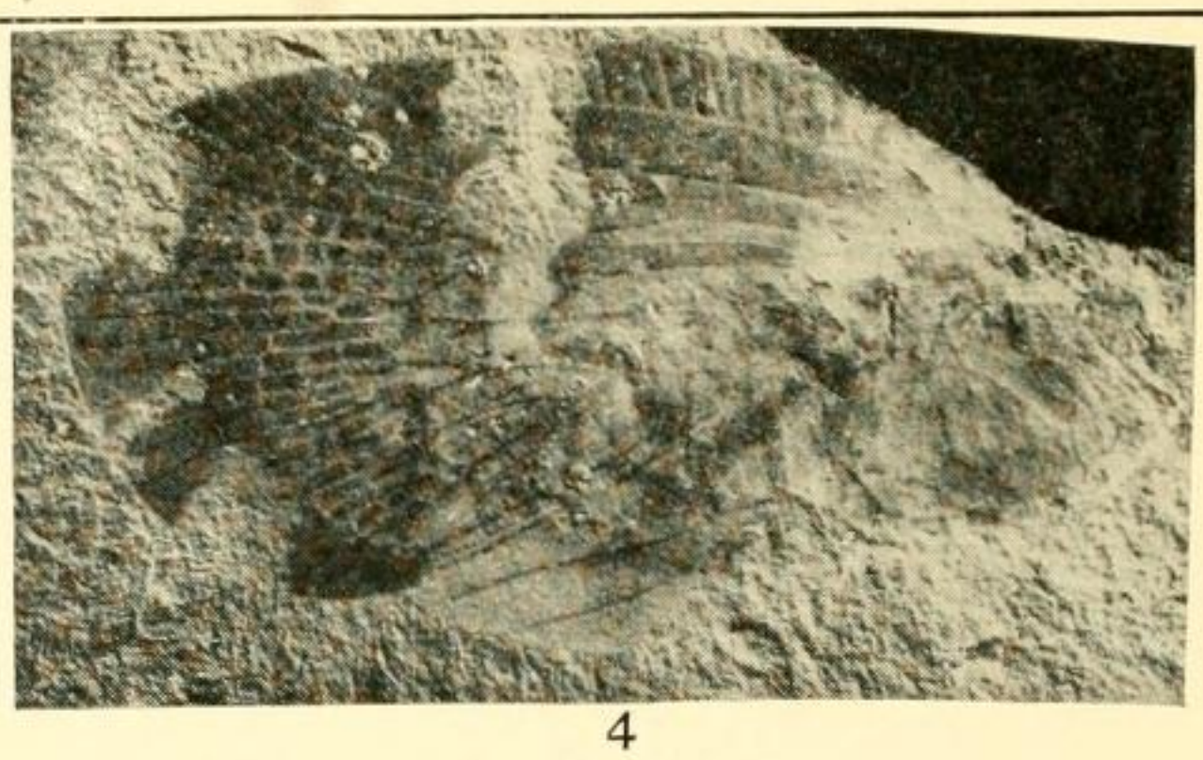

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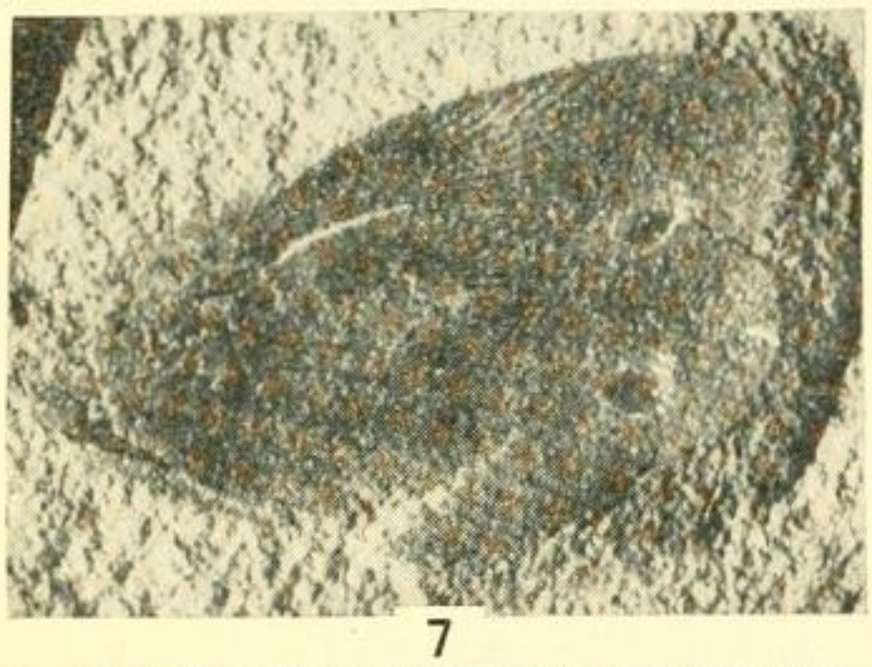

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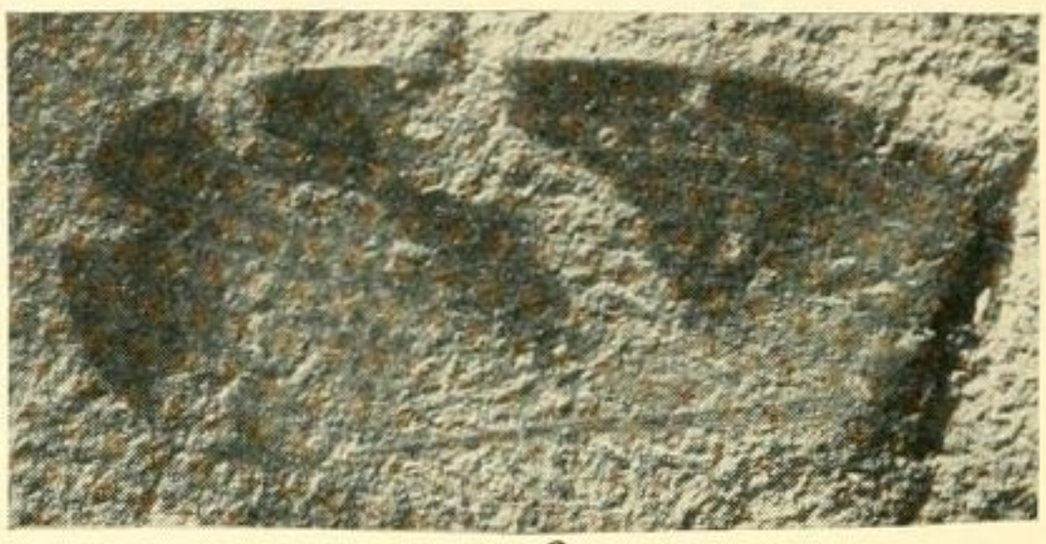

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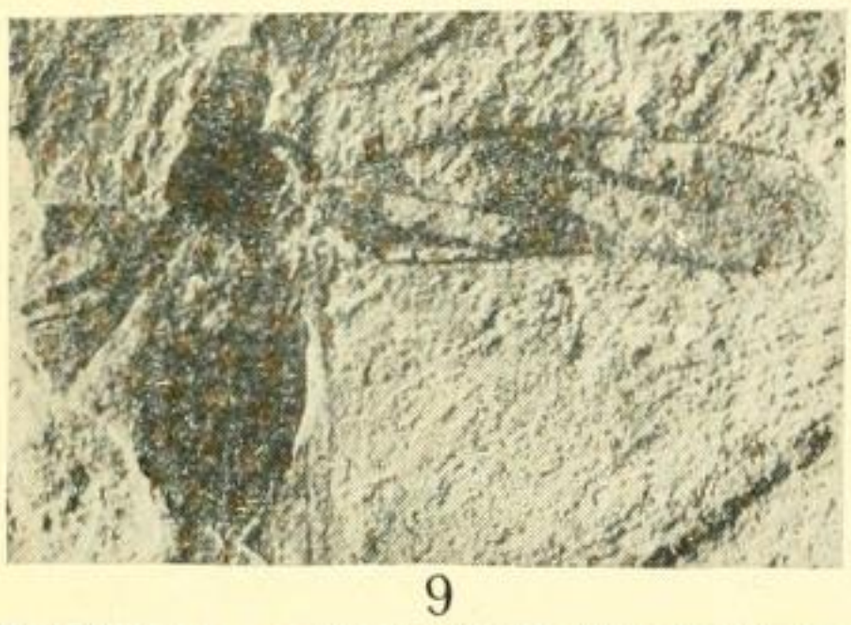

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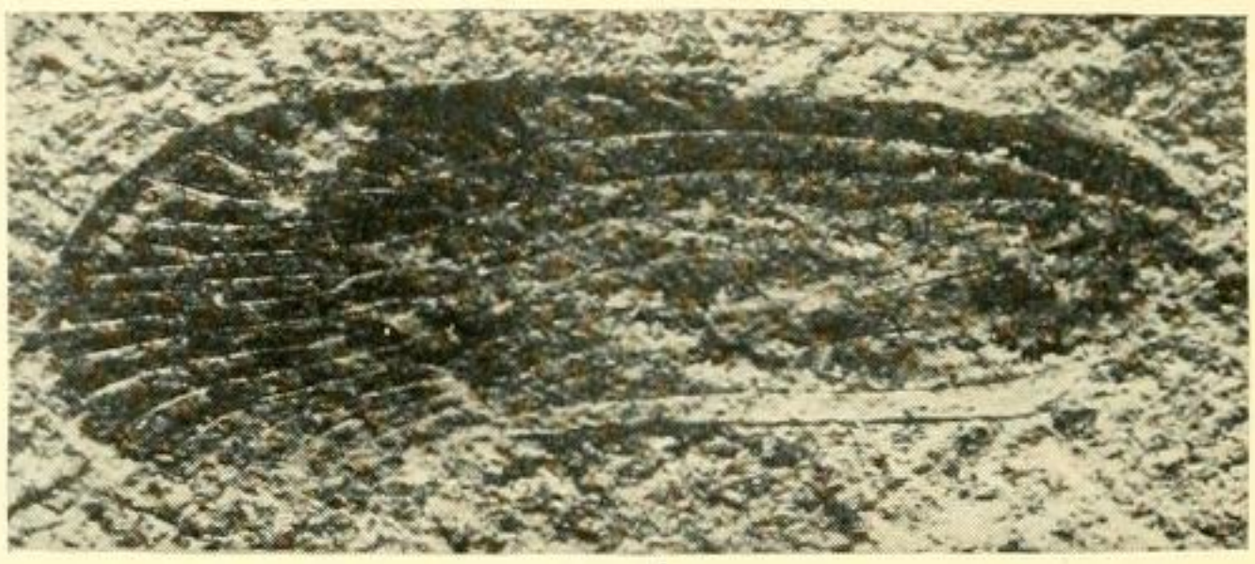

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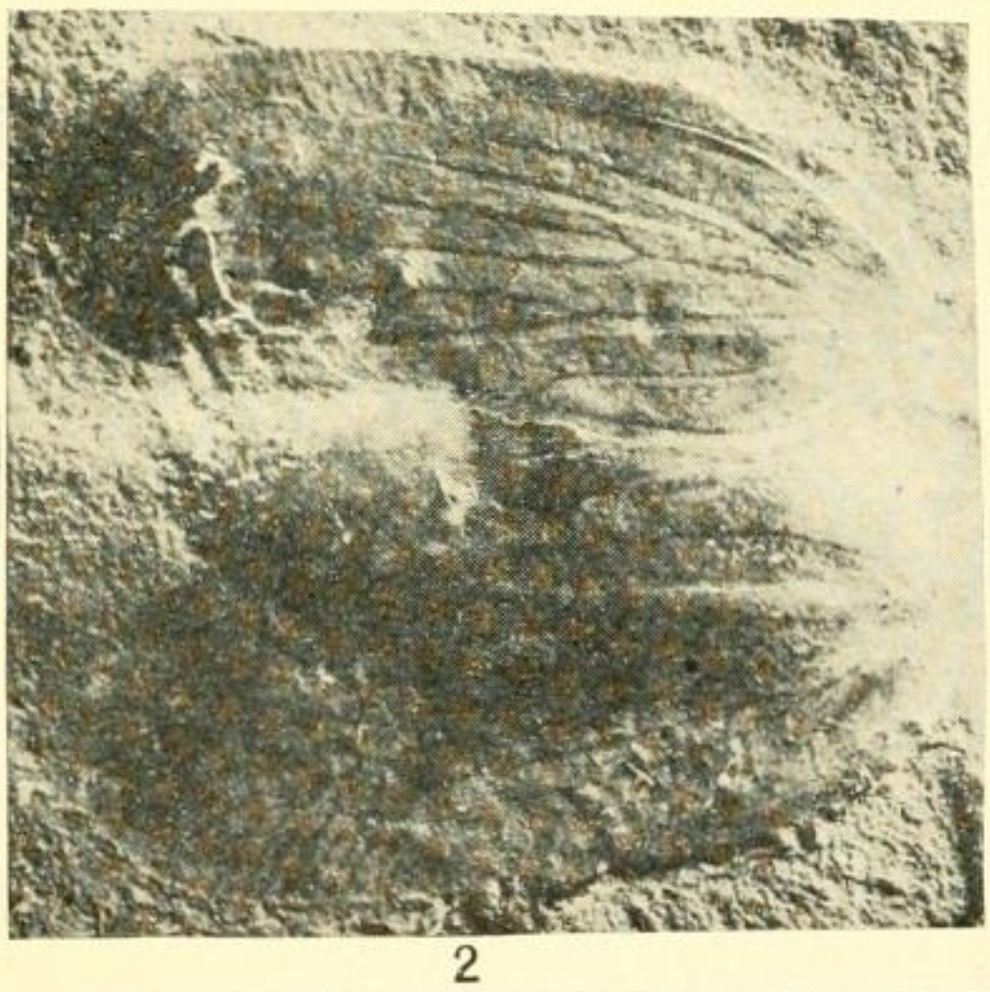

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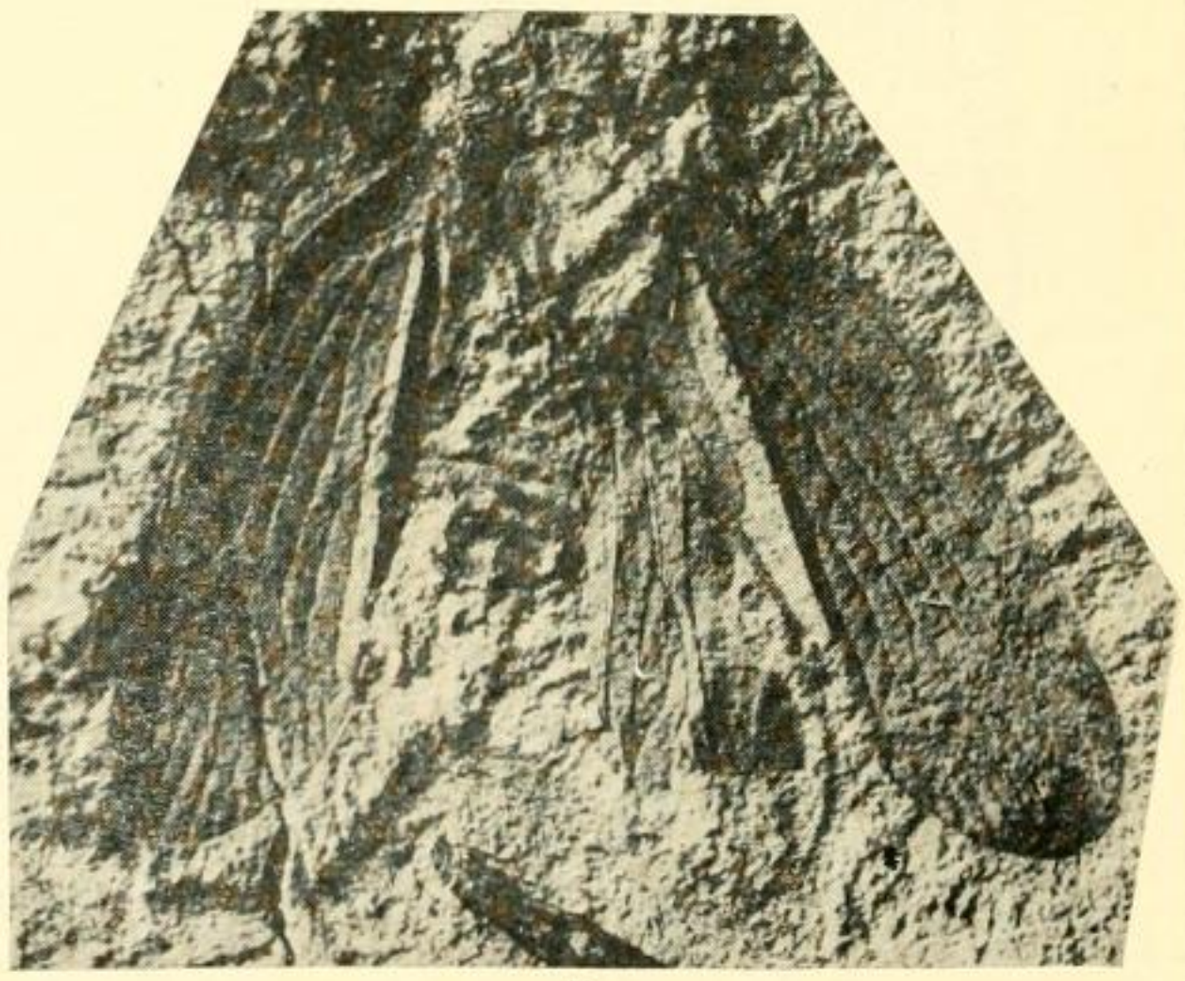

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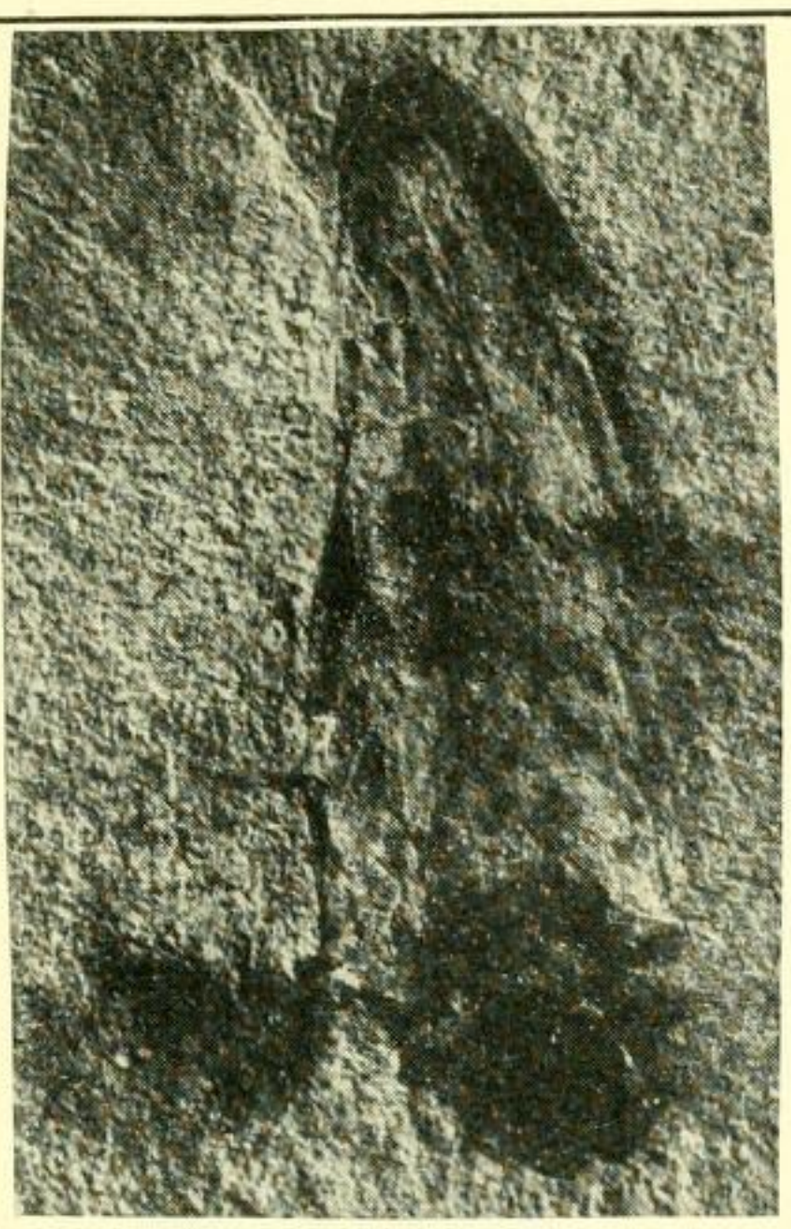
EOCENE INSECTS FROM THE ROCKY MOUNTAINS.

FOR EXPLANATION OF PLATE SEE PAGES 259 AND 260.



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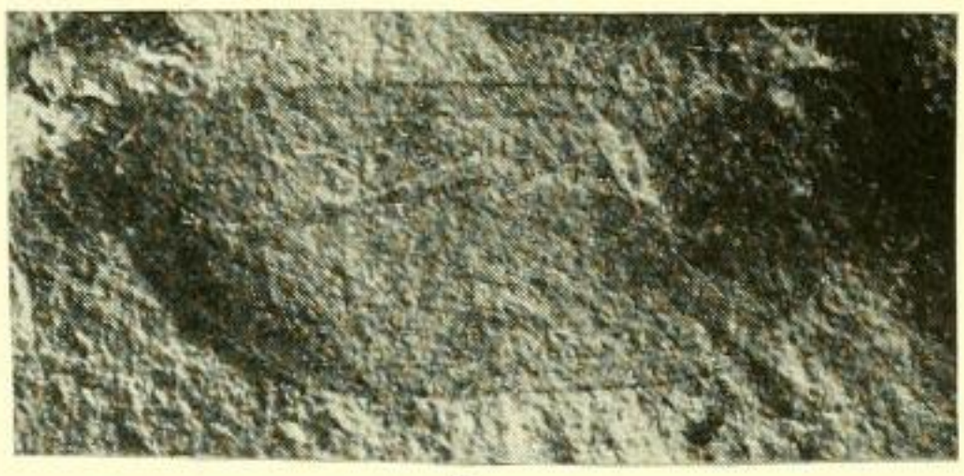

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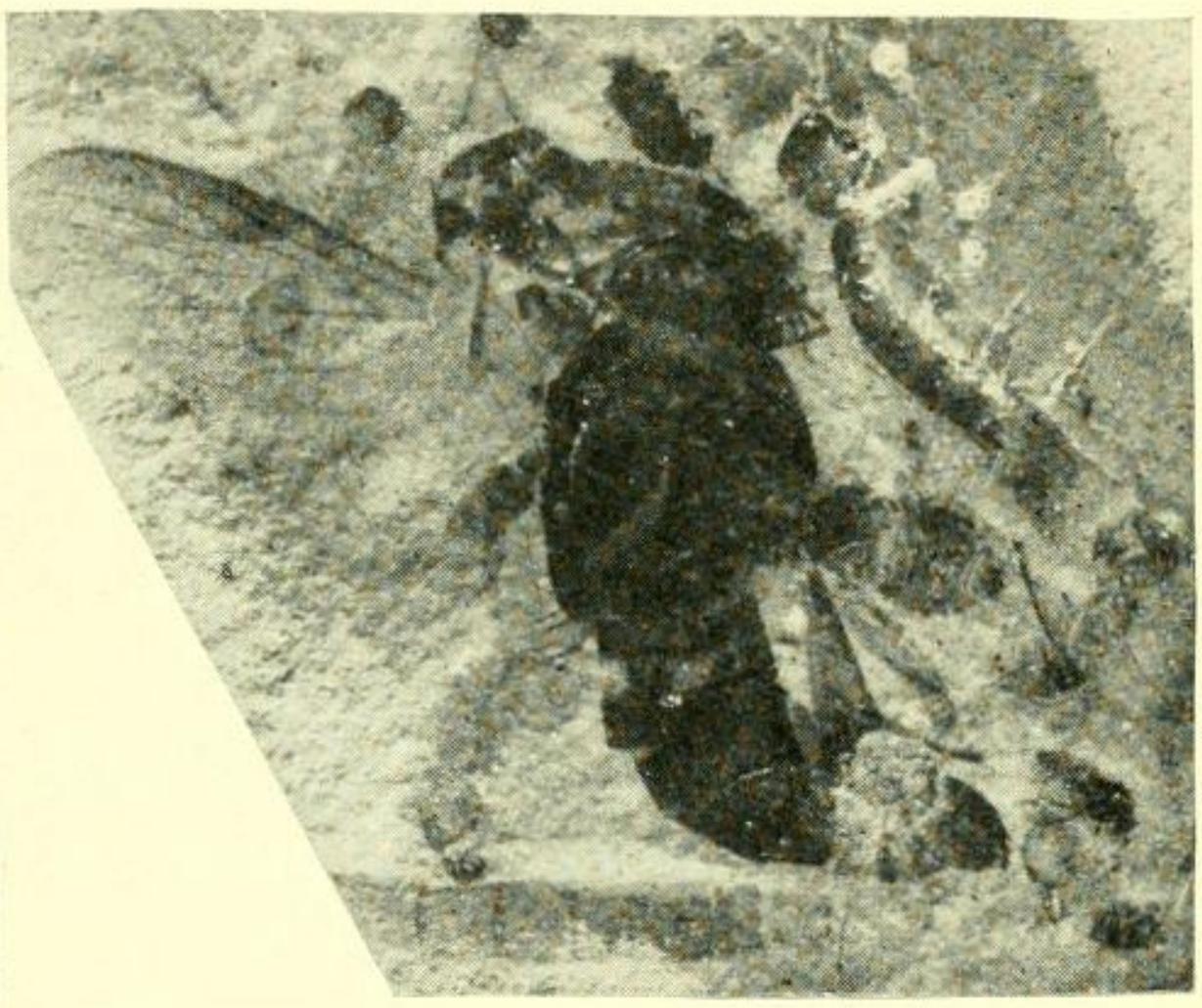

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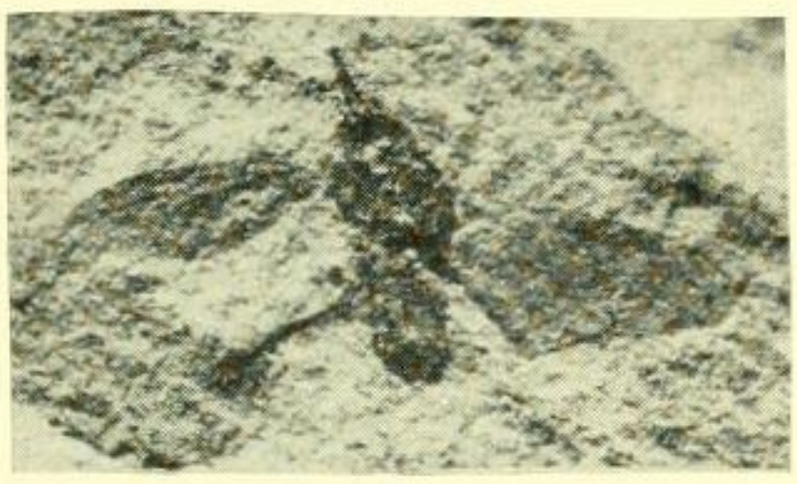

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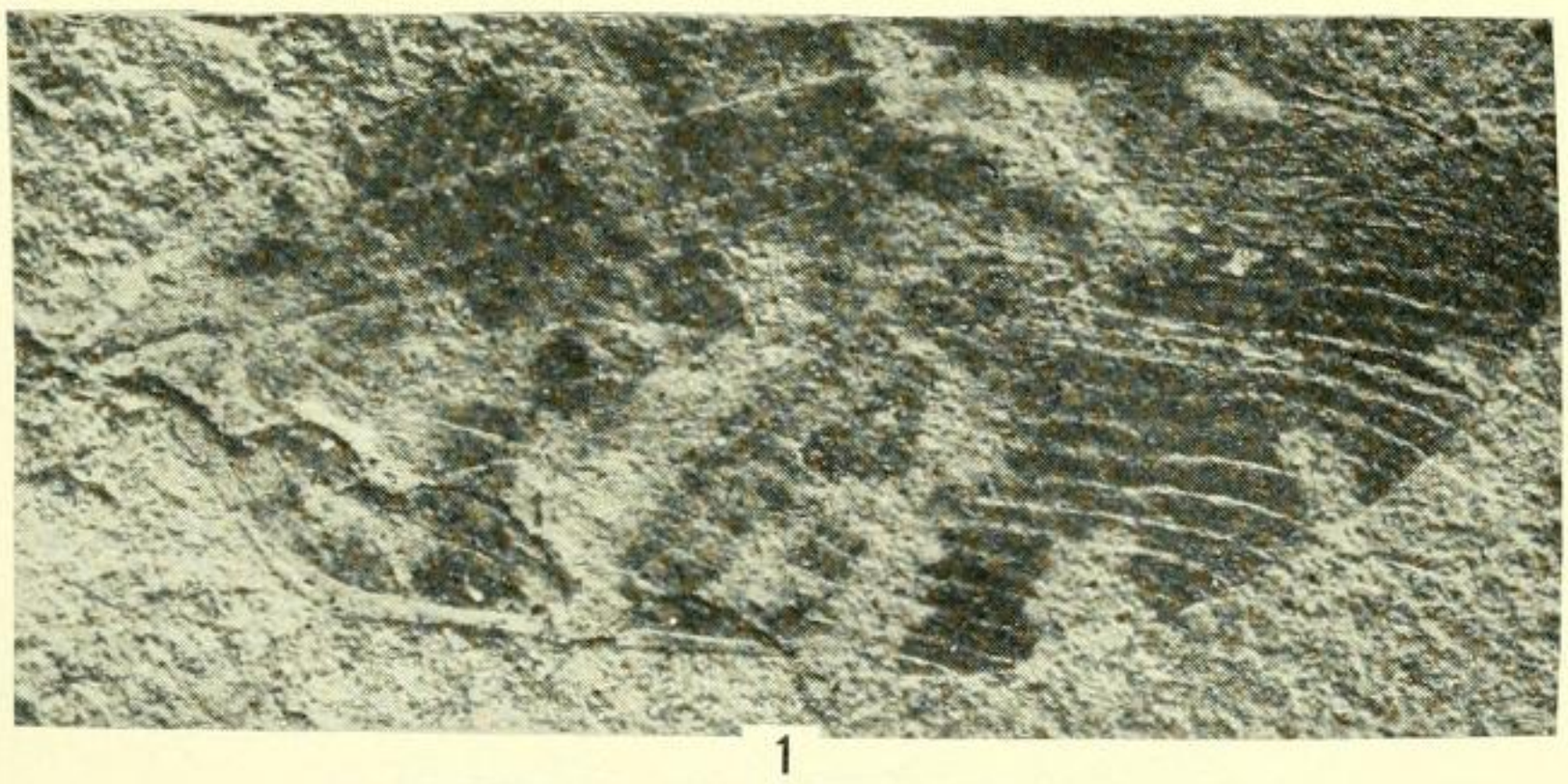

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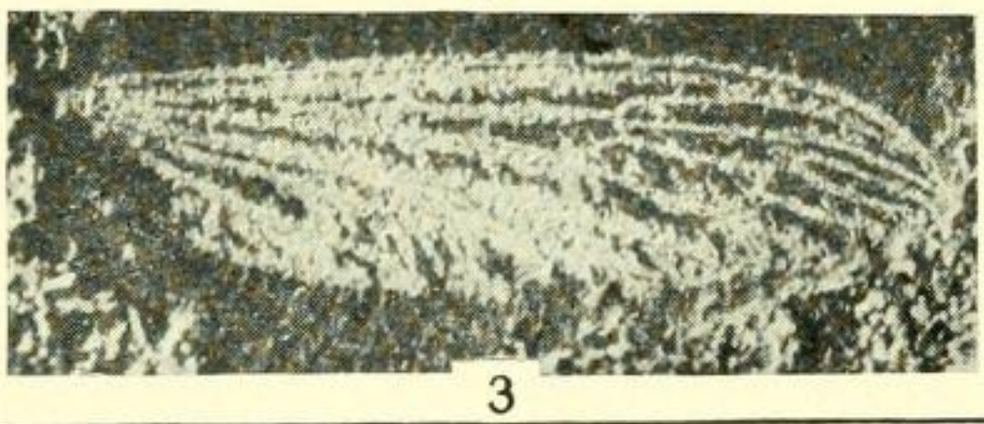

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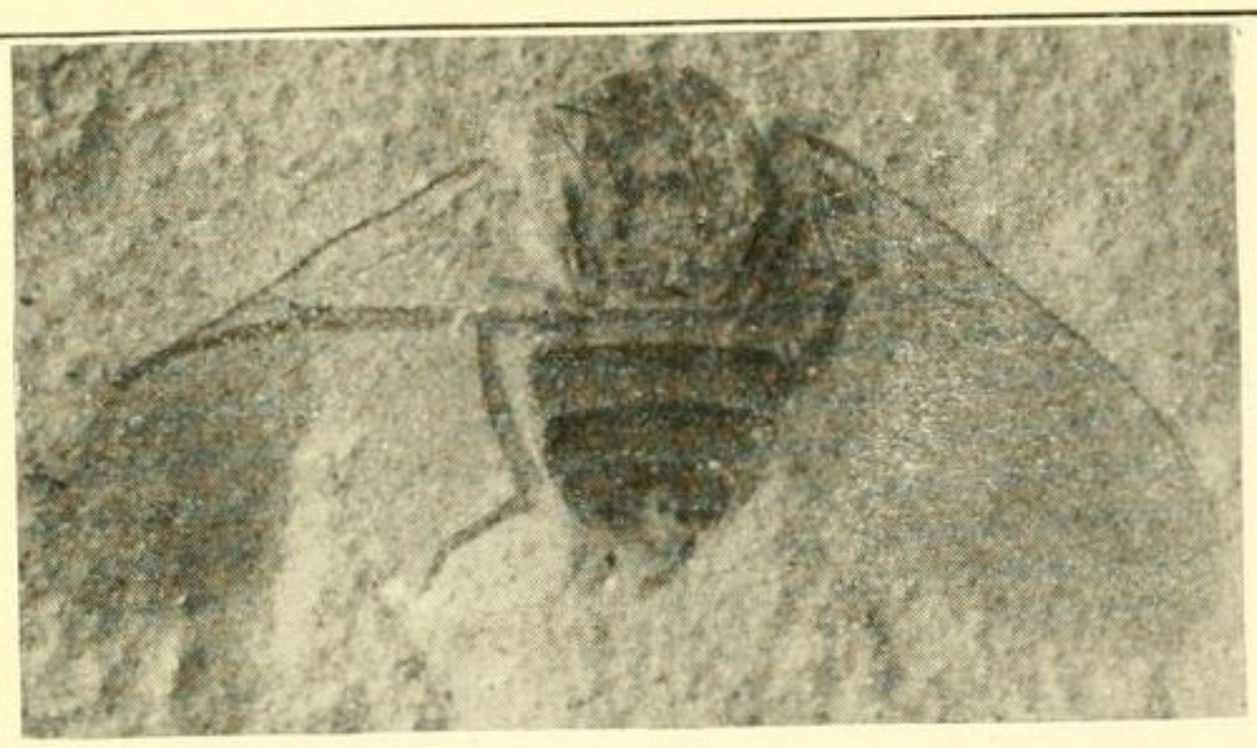
EOCENE INSECTS FROM THE ROCKY MOUNTAINS.

FOR EXPLANATION OF PLATE SEE PAGE 260



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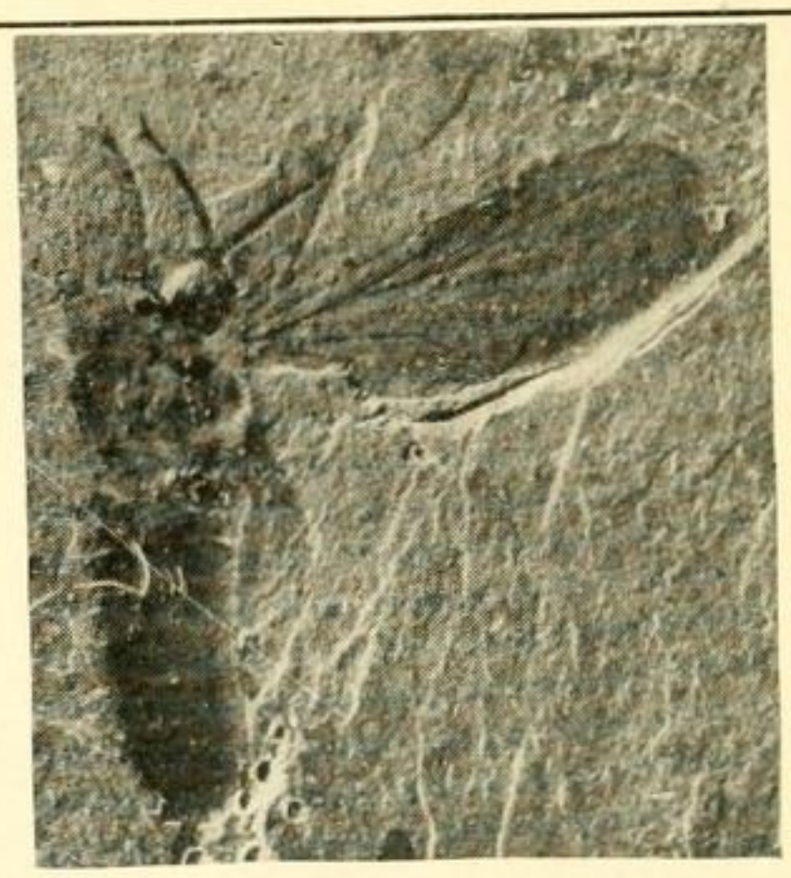

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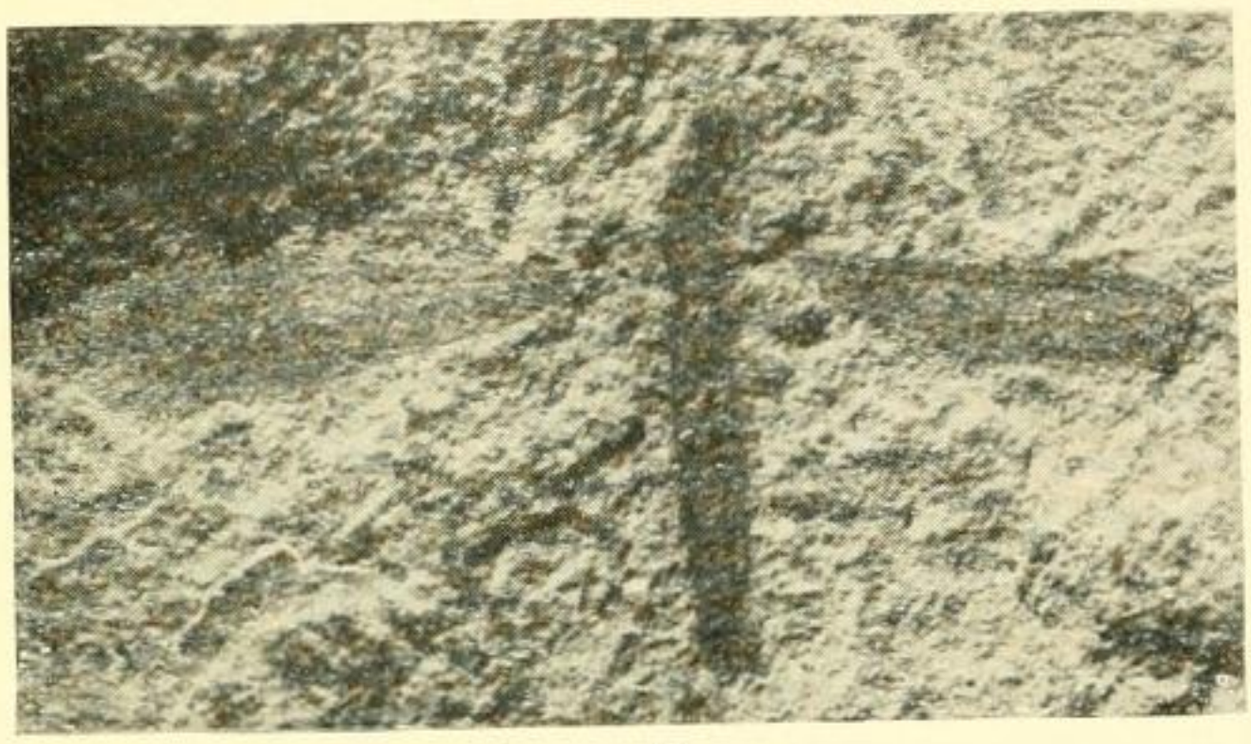

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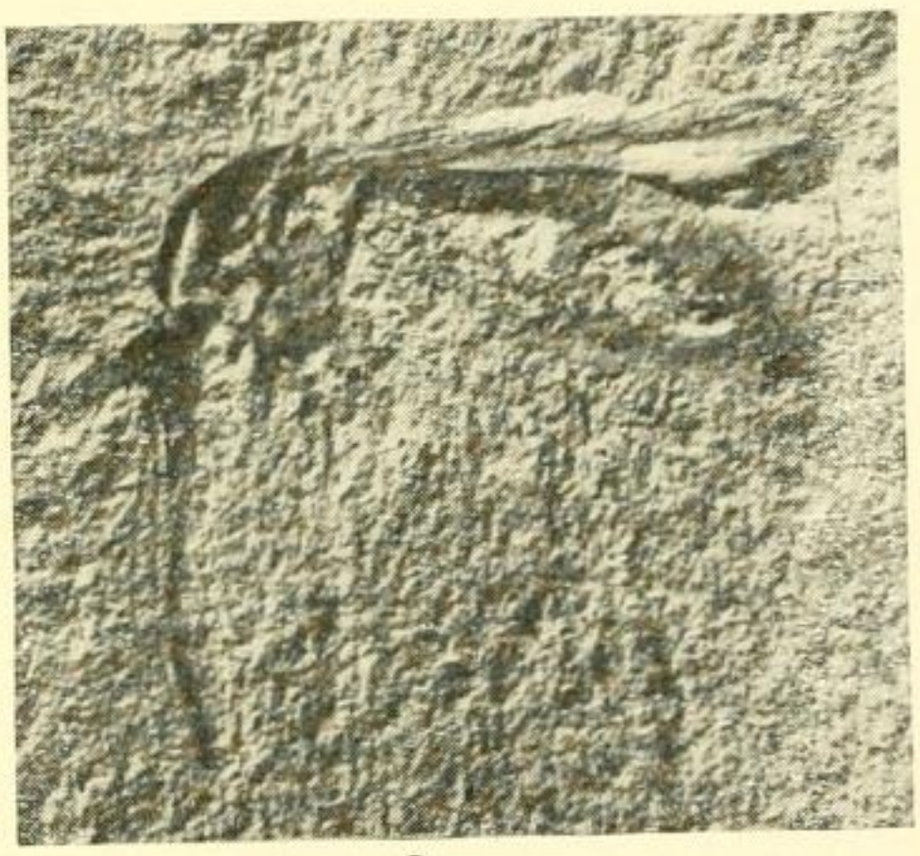

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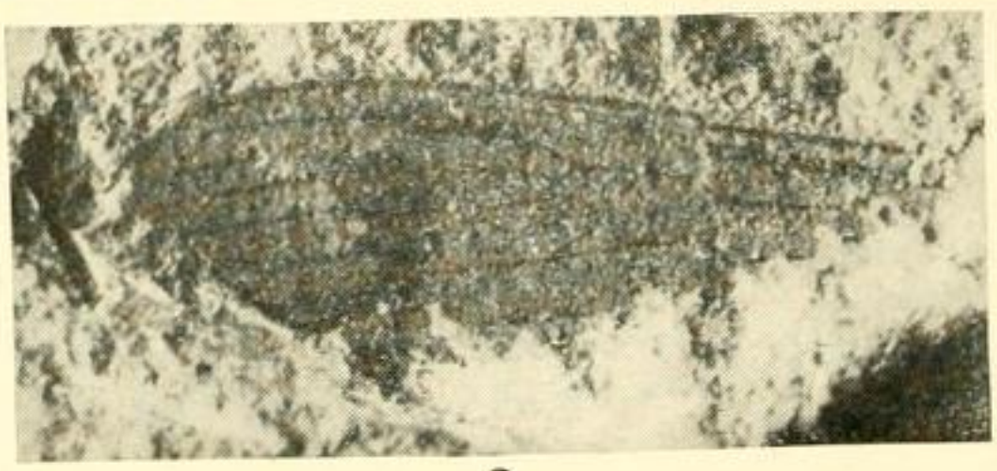

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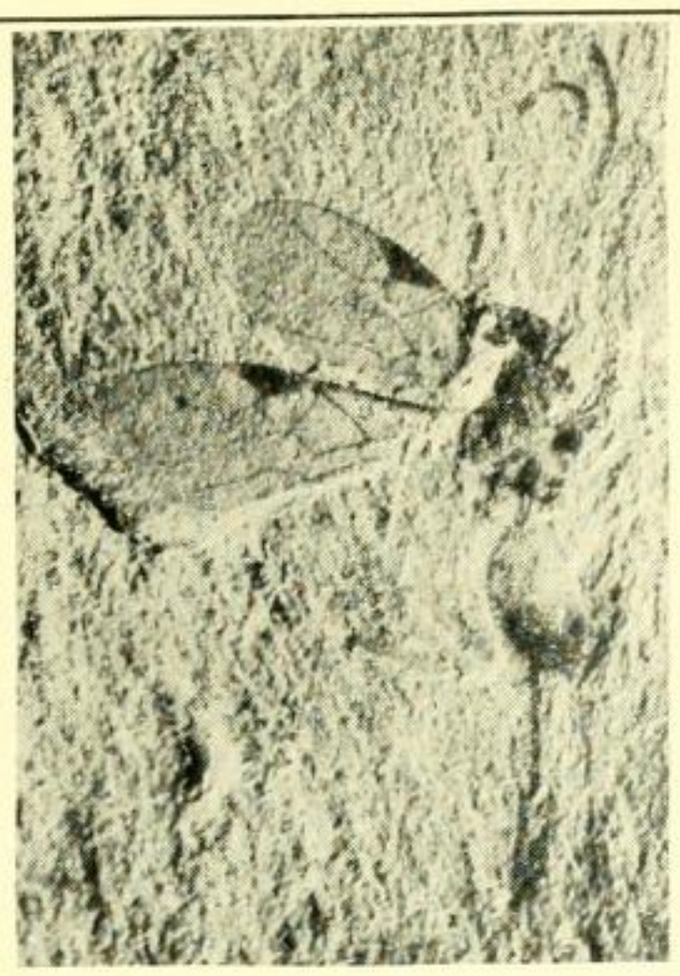
EOCENE INSECTS FROM THE ROCKY MOUNTAINS.

FOR EXPLANATION OF PLATE SEE PAGE 260.



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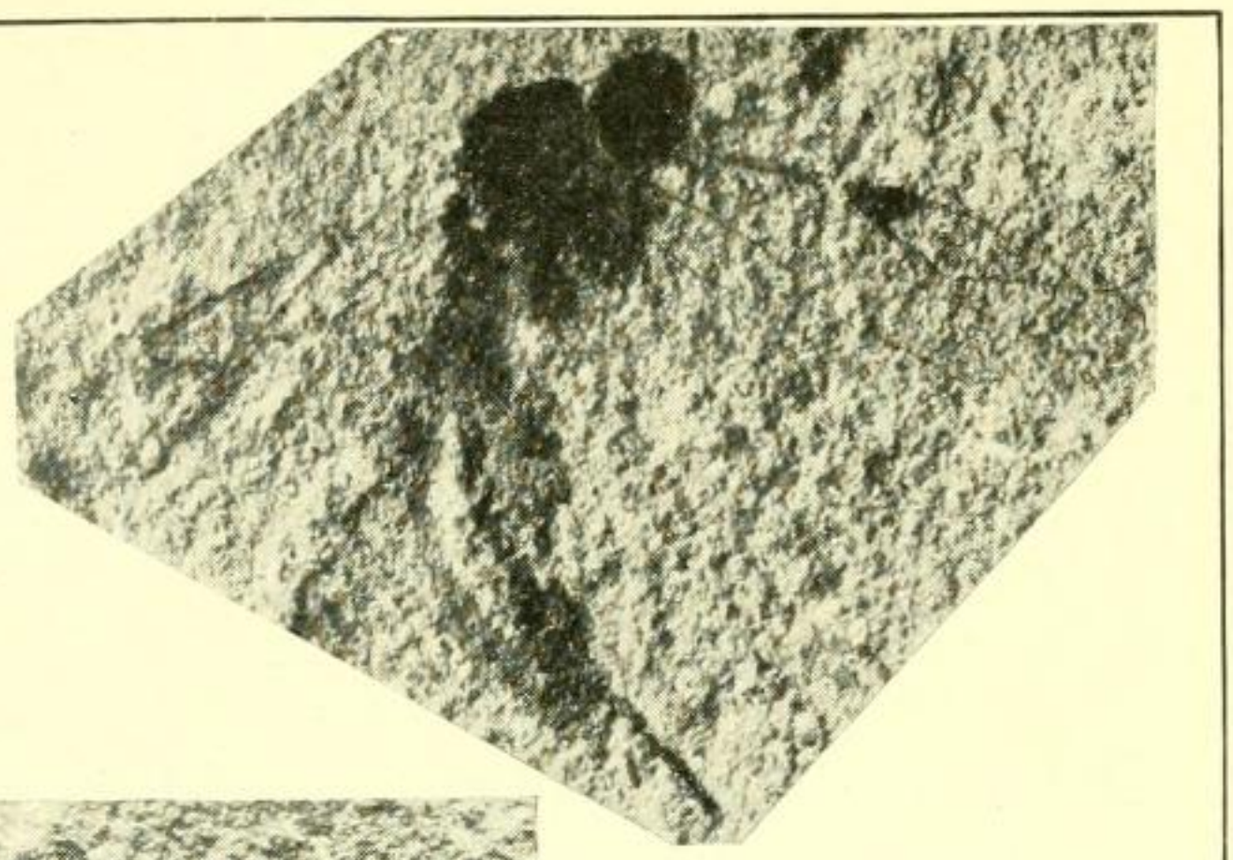

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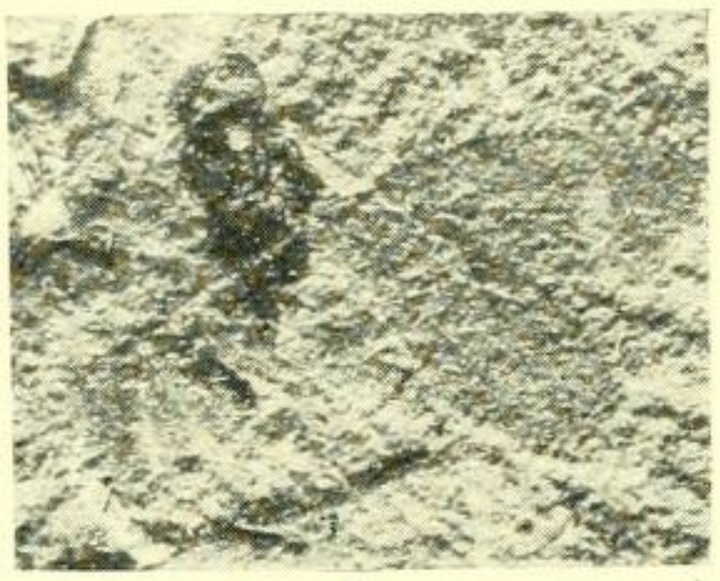

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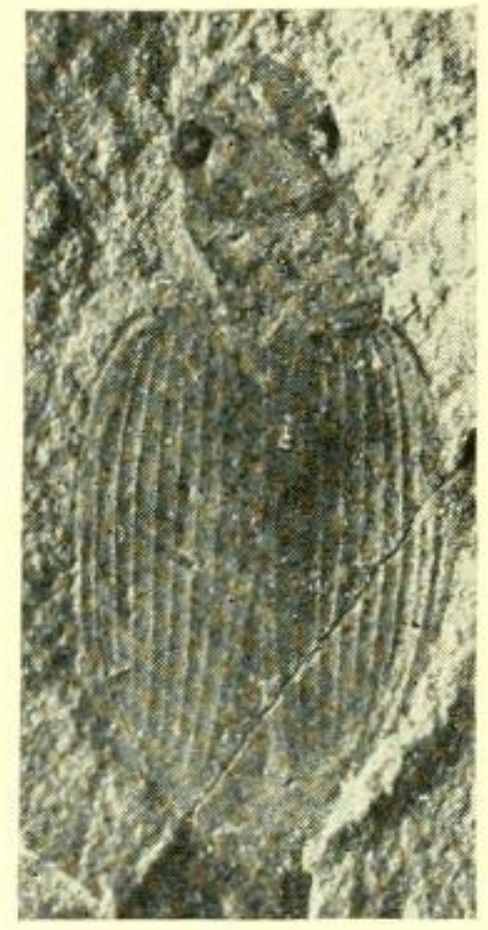

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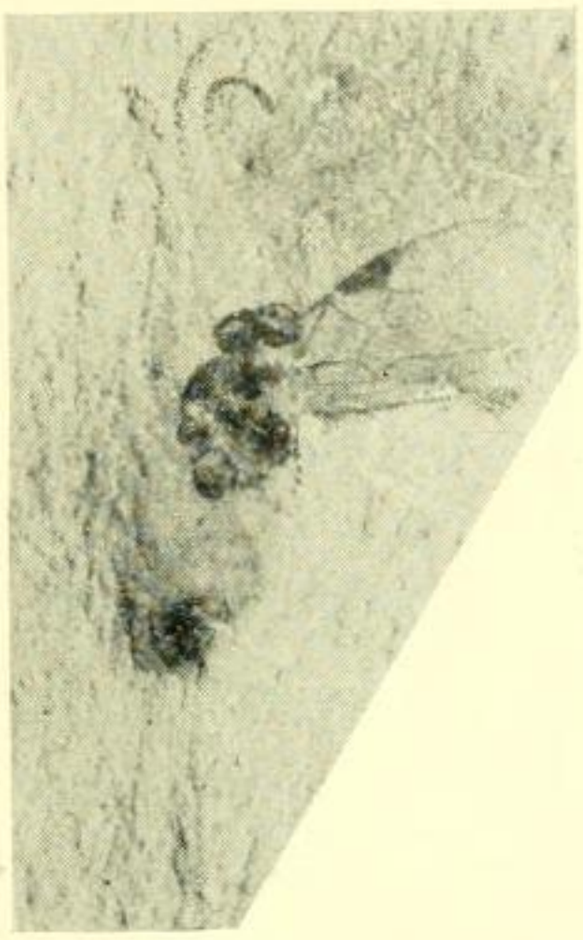

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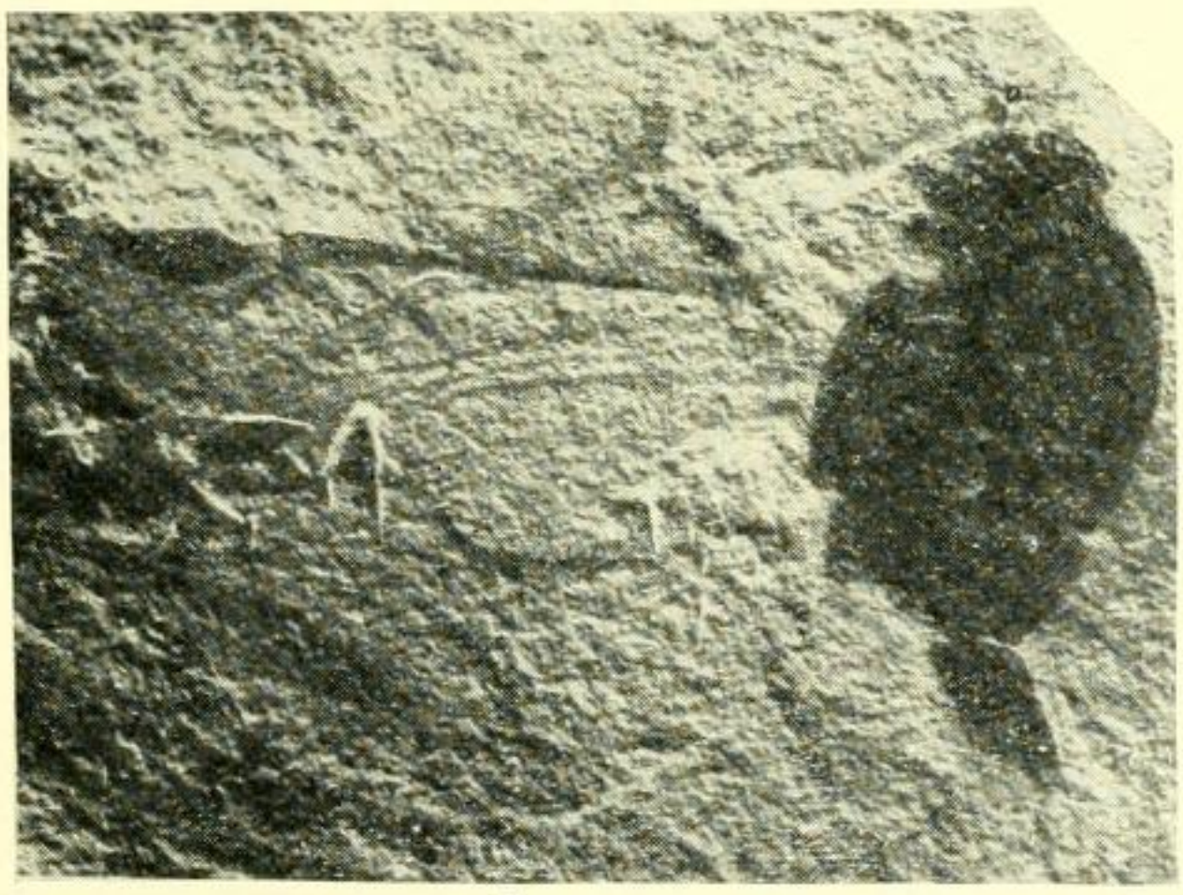

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EOCENE INSECTS FROM THE ROCKY MOUNTAINS.

FOR EXPLANATION OF PLATE SEE PAGE 260.