THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

No. 110. FEBRUARY 1927.

XVII.—*Fossil Insects from the Miocene of Colorado.*

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The insects described in the present paper were all collected by Mr. Geo. Sternberg in the Miocene shales of Florissant, Colorado, and are the property of the British Museum.

Diptera.

Rhabdomastix (*Sacandaga*) *præcursor*, sp. n. (Tipulidæ).

♂.—Expanse 13 mm.; wings 6 mm. long, clear hyaline, with brown veins; length about 6·7 mm.; antennæ about 2 mm.

Thorax produced and narrow anteriorly; abdomen with six broad brown rings, about as wide as the intervals between them, but the interval between first and second less (abdomen is marked as in *R. labefacta,* Scudd.); venation similar to that of the living *R. flava,* Alex., except as follows: subcosta ending a little earlier, at about beginning of last third of præfurca (it is almost the same in Alexander's original figure (1911), and probably his later figure (1919) is not quite correct); first radius ending about 320 μ before end of *R*2, the latter about as long as this interval, and striking costa at an angle of about 45°. In my first study of the fossil I thought

I saw a radial cross-vein, but later, with better light, failed to make it out; this vein is evanescent or absent in the living species. Discal cell longer, with broader base, its face on second basal about two-thirds as long as its face on first basal; second posterior cell (between branches of media) very narrow on discal, about or hardly a fifth of third posterior on discal. Third posterior cell long and not far from parallel-sided (style of *R. caudata*, Lundb.). The second anal has a strong double curve as in *R. flava*. Legs, as far as visible, dark brown.

This fossil is of exceptional interest, as Alexander (1919) says of *Rhabdomastix*: "The group is close to *Gonomyia*, but the male hypopygium has a very different structure, and is of a distinctly primitive type." The genus, with few species, occurs in Australia, New Zealand, and North and South America, and in 1923 I discovered a new species on the eastern coast of Siberia.

A review of the fossils ascribed to *Gonomyia* brings out the fact that four of them are evidently *Rhabdomastix**. The following key separates the fossil species of *Rhabdomastix* found in North America:—

	Second posterior cell with base extremely narrow	*præcursor*, Ckll.
	Second posterior cell with base broad	1.
1.	Præfurca strongly arcuate at base (Florissant Miocene)	*frigida* (Scudd.).
	Præfurca not thus arcuate	2.
2.	Wing over 8 mm. long (Florissant Miocene).	*labefacta* (Scudd.).
	Wing 7·5 mm. or less	3.
3.	Discal cell not nearly so long as second posterior (Florissant Miocene)	*primogenitalis* (Scudd.).
	Discal cell about as long as second posterior (Roan Mt., Colo., Eocene)	*scudderi* (Ckll.).

The Isle of Wight Oligocene *Gonomyia* do not belong here. Perhaps *Gonomyia* originated in the Eurasian area, and *Rhabdomastix* in America or the Southern Hemisphere. The latter must be considered the more primitive.

Tipula rigens, Scudder.

A good specimen, with reverse.

Limnocema sternbergi, sp. n. (Tipulidæ).

Length 9·5 mm.; body dark brown, the sutures of the abdomen marked by narrow hyaline bands; femora 6 mm.

* Dr. C. P. Alexander informs me that he is of the same opinion. He tells me that there are two living species of *Sacandaga* in Europe.

long, brown; wings 8 mm. long, hyaline, with pale bristly veins, no stigmatic spot; beginning of præfurca 3·4 mm. from base of wing.

Subcosta ending at level of end of præfurca; no radial cross-vein (I thought I could see it in the usual place with the binocular, but on using a higher power it disappeared); a cross-vein at right angles, going to margin, near end of $R\,2+3$, and 590 microns beyond end of $R\,1$ (this is delicate, but positively visible with high power; I assume that it can only represent the divergent end of $R\,2$); discal cell long, its base 240 microns basad of base of fourth posterior, its apex the same distance beyond basal end of second posterior; second posterior on upper side 2320 microns long; third posterior on margin 590, and fourth on margin 1010 microns; præfurca 1185 microns long, very strongly arched at base; base of fourth posterior cell 370 microns.

If this belongs to Scudder's extinct genus *Limnocema*, as it seems to do, then we must assume that the "marginal cross-vein near the extreme apex of wing" is really the end of $R\,2$, and the genus has in reality two submarginal cells. But in Scudder's species the vein referred to runs into $R\,1$, and not into the costa beyond its tip. In the living *Dicranota rivularis*, O.-S., the marginal cross-vein is present as usual, but also an apparent cross-vein, evidently $R\,2$, placed as in Scudder's species of *Limnocema*, running into the apical part of $R\,1$. The first basal cell being a little shorter than the second agrees with *Limnocema* rather than *Limonia*, in which genus I first thought the fly might fall. The anal angle of the wing is quite pronounced, about as in *Rhipidia bryanti*, Johnson.

Rueppellia vagabunda, sp. n. (Therevidæ).

Length 5 6 mm.

Head and thorax dark brown, abdomen paler, the sutures rather broadly hyaline; the abdomen is of the usual form (not slender and subclavate as in *Henicomyia*); antennæ not preserved; a hind leg shows femur and tarsus dark brown, tibia somewhat paler; the hind tibia is very long (1440 microns), much longer than the femur. Wing 3·6 mm. long, ample, hyaline, faintly reddish, with brown stigmatic area; veins pale. The body is not appreciably pilose, but essentially bare as in some modern forms. The venation agrees in all important respects with that of *Rueppellia semiflava*, Wied. (Verrall, 'British Flies,' Stratiomyidæ, &c., p. 543), but differs thus: radial vein straight, bent only at

its extreme tip, where it ends on costa about or slightly before midway between base and apex of second submarginal cell; discal cell long and narrow, the cross-vein above it 320 microns from the base and 530 from apex; second submarginal cell (cubital fork) not directed downward so much, its lower side reaching the wing-tip; fourth posterior cell extending beyond discal a distance greater than apical width of discal. The second submarginal has its base very slightly beyond level of end of discal.

The generic characters in the venation are the long (1170 microns) and parallel-sided cubital fork, its base rounded and obtuse (more so in the fossil than the recent species, and the course of the cubital vein in the fossil in a line with its lower branch); discal cell long, the anterior cross-vein before its middle; five posterior cells, the fourth closed some distance before margin; anal cell closed near margin.

The reference of this species to *Rueppellia*, based on a species found in Egypt, may not be valid, but I am at a loss to name any distinguishing generic characters. In the genus *Psilocephala* the venational differences easily parallel those between the living and fossil *Rueppellia*. Thus, as regards the radial vein, the living species resembles *P. tergissa*, Say, the fossil *P. festina*, Coq.

Bibio wickhami, Cockerell.

A good specimen, with wing 8 mm. long (6·75 mm. in type). The larger size does not indicate a different species; the living *B. albipennis*, Say, varies in wing-length from 5 to 9·5 mm.

HYMENOPTERA.

Euponera hendersoni (Cockerell).

In 1906 I described *Ponera hendersoni* from a specimen collected at Florissant. I left the type in the office of the Department of Biology, but it mysteriously disappeared. It is very satisfactory to find three specimens in the Sternberg collection. The species goes better in *Euponera* than *Ponera*; it differs in venation from *E. succinea* (Mayr), from Baltic amber, by having the second intercubitus practically in a straight line with the first section of the radius (below the stigma), this feature and the long marginal cell agreeing with *Diacamma*. The second cubital cell is longer than in *E. succinea*, and the nervulus is more remote from the discoidal, the distance being a little greater than

its length. The last character agrees with *Agræcomyrmex*, from Baltic amber. The middle tibiæ and basitarsi are without bristles, so the species does not belong (as does *E. succinea*) to the subgenus *Trachymesopus*. The wings are brownish.

Tetramorium peritulum, sp. n. (Myrmicidæ).

♂.—Length 4·3 mm.

Of the usual form, but head rather large; dark brown, the abdomen paler; anterior wings 4 mm. long, hyaline, with pale reddish veins; stigma pale. Venation as in *P. cæspitum*, L., but the discoidal cell somewhat smaller, and upper part of basal nervure less oblique, less nearly in a line with the lower part. The following measurements are in microns: length of marginal cell, 1600; length of cubital cell, 960; discoidal cell on first cubital 130, but its lower side 320; end of cubital cell to radio-cubital fork, 160.

I had to consider the possibility that this might belong to Donisthorpe's genus *Leucotaphus*, but though the structures at the base of the abdomen are not very clear, they seem to me to be as in *Tetramorium*. Donisthorpe rightly criticises my reference of the type-species of *Leucotaphus* (*L. gurnetensis*, Ckll.) to *Leptothorax*, but I had only the wings *.

Formica impacta, sp. n. (Formicidæ).

♀.—Length nearly 17 mm., anterior wing about 11 mm.

Robust, dark brown, the abdominal sutures broadly hyaline; head rather regularly oval, not broadened behind; mandibles massive, minutely denticulate; lower margin of clypeus entire, gently arched; wings hyaline, with dark brown stigma and brown veins. Venation essentially as in *F. rufa*, L., but radio-cubital fork rather wider, first part of radius much less oblique, cubital cell therefore much less produced apically; upper part of basal nervure more oblique, almost in line with lower part, which is not much longer than upper; discal cell less broadened basally; nervulus more oblique, and rather more remote from discal cell. The broader angle at end of cubital cell is the best character; Heer's Oeningen fossil *Formica* species are like the modern ones in this particular. This character, it must be said, indicates resemblance to *Lasius*, but so large an ant can hardly belong to that genus.

* I now think that my variety *a* (Proc. U.S. Nat. Mus. vol. xlix, pl. 65. f. 5) of *Leucotaphus gurnetensis* is to be separated; it is really more like *Lasius* in some respects. It may be called *L. permarcus*.

Braconidæ.

Microdus miocenicus, sp. n.

♀.—Length (not counting ovipositor) 5·2 mm.; abdomen 3 mm.; ovipositor 2·5 mm.; anterior wings about 3 mm.

Antennæ of moderate length, black, joints with delicate raised lines (I find the same in *Bracon exoratus*, Cresson, which I collected at Boulder, Colorado); head, thorax, and abdomen ferruginous; head short, not rostrate; thoracic dorsum darkened. Wings hyaline, with dark brown stigma. Abdomen claviform. Hind femora dark; hind tibiæ pale, the apical part abruptly black, their tarsi dark. Stigma large; marginal cell narrow, with the characteristic form of the subfamily; second cubital cell indistinct, but subtriangular and very broad; the basal nervure cannot be seen. At first sight there is apparently a large costal cell, but this is due to the costal margins of the two wings, one a little above the other. The broad second cubital and short head indicate *Microdus*. The genus *Earinus* is similar, but has a longer marginal cell, at least in *E. thoracicus* (Nees). According to Viereck, *Microdus* is to be called *Bassus*, following a type-designation by Curtis, but *Bassus* is generally used for a totally different insect.

Miocene of Florissant (*Sternberg*, 176 B).

This is the first fossil *Microdus*.

XVIII.—*Some Observations and Experiments on the Spine-Formulæ of* Cyclops. By A. G. Lowndes, M.A., F.L.S., Marlborough College.

Definitions.

By the term *spine-formula* is here meant the number of spines on the outer edge of the terminal joint of the outer ramus of the four pairs of swimming-feet taken in their respective order.

By a *spine* is meant a short and relatively stout process whose edges bear very definite denticulations along the whole or along a part of their length. The definition is necessary at this juncture in order that a distinction may be made between a spine and a seta. Setæ are processes that are relatively thin and pliable, and which bear fine hairs or *cilia* in the place of the denticulations of the spines.

A glance at the diagram will make this plain.

The diagram represents the four swimming-feet of *Cyclops robustus*, G. O. Sars, where P 1 represents the first swimming-foot and P 2 the second swimming-foot, etc.