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REVISION

OF THE

AMERICAN FOSSIL COCKROACHES

WITH

DESCRIPTIONS OF NEW FORMS

BY

SAMUEL HUBBARD SCUDDER



WASHINGTON

GOVERNMENT PRINTING OFFICE

1895

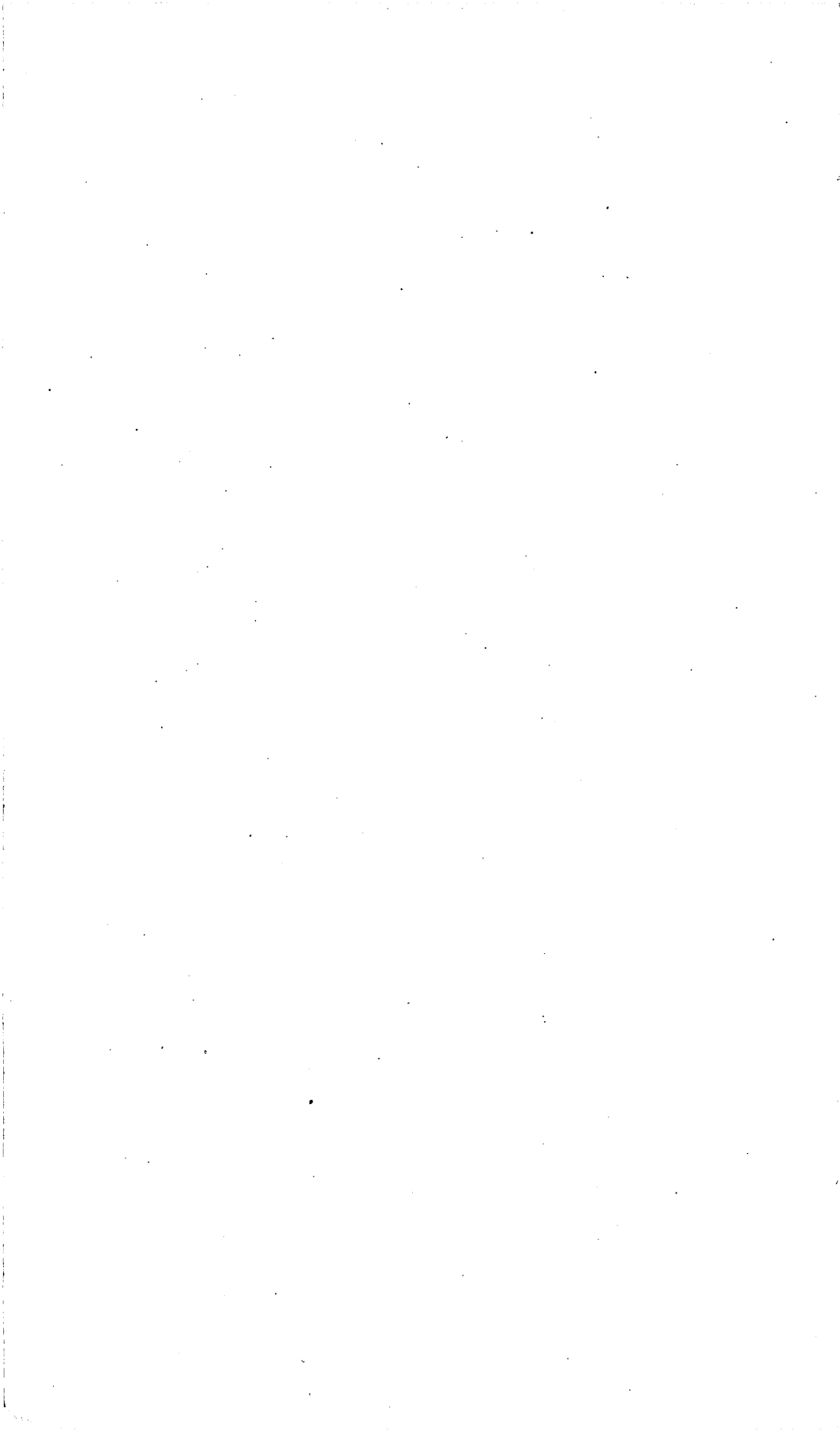
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LETTER OF TRANSMITTAL.

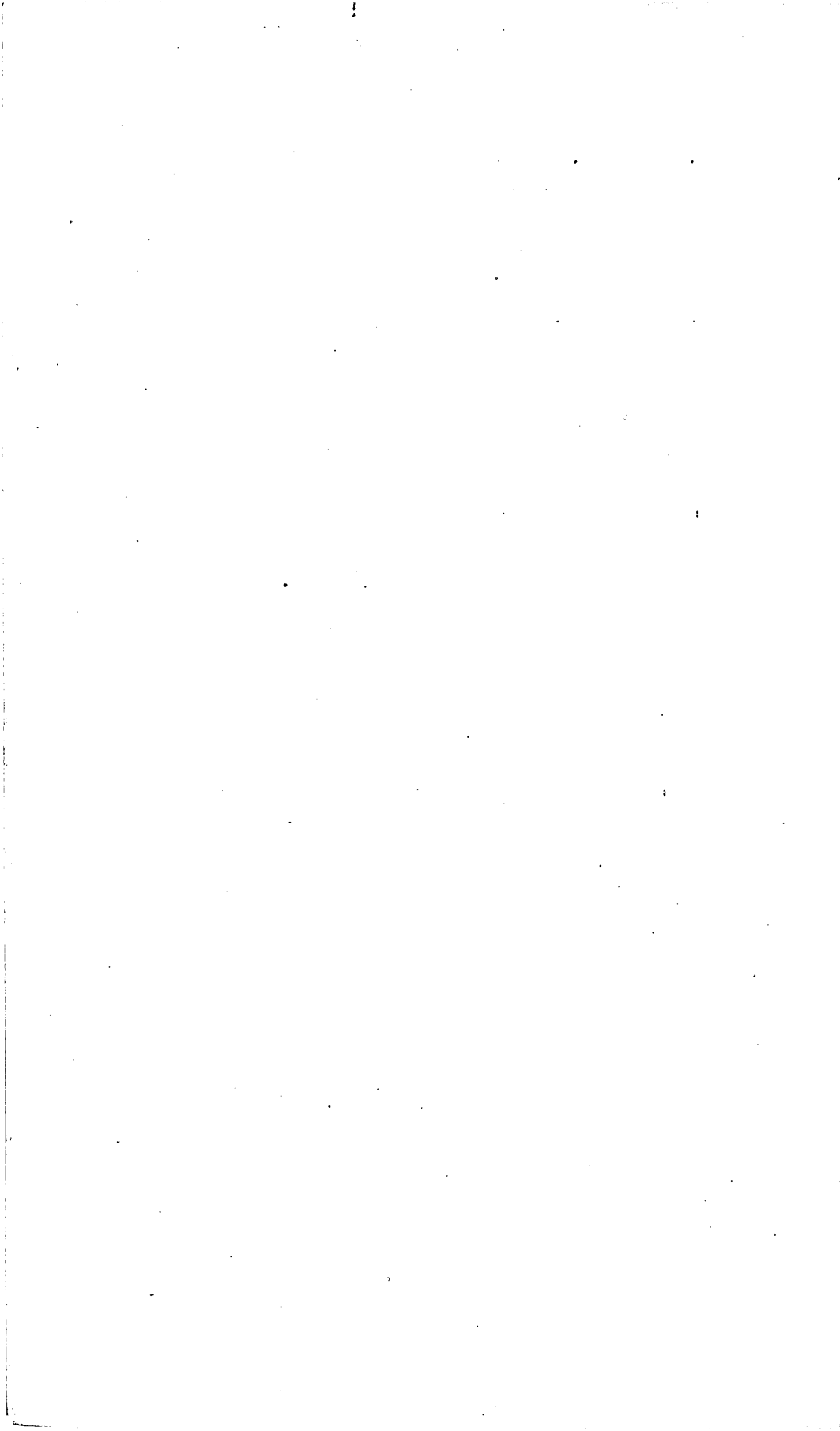
CAMBRIDGE, MASS., *November 7, 1893.*

SIR: I send herewith for publication as a bulletin, if acceptable to you, the manuscript of a paper, and drawings to illustrate it, upon the fossil cockroaches of North America. The paper was partially completed and most of the drawings were made at the termination of my connection with the Survey, and has since been finished in such leisure as I could command.

Yours, respectfully,

SAMUEL H. SCUDDER.

To the DIRECTOR U. S. GEOLOGICAL SURVEY,
Washington, D. C.



REVISION OF THE AMERICAN FOSSIL COCKROACHES.

By SAMUEL HUBBARD SCUDDER.

INTRODUCTION.

When, in 1879, I published my *Paleozoic Cockroaches*,¹ in which a revision of the species of the whole world was attempted, I had seen but nineteen specimens from North America, belonging to seventeen species and seven genera. To-day more than three hundred American specimens have passed under my eye, besides fifty from the Triassic rocks and a very few from the Tertiary series; and from the Paleozoic series alone there are here recognized one hundred and thirty-two species (not including some indeterminate forms) belonging to fourteen genera. As I have published from time to time in various places, but principally in the *Memoirs of the Boston Society of Natural History* (collected in Vol. I of my *Fossil Insects of North America*), a considerable number of species, and as a still larger number have since accumulated, thanks to recent exploitation of the Carboniferous deposits of eastern America, it has seemed advisable, in publishing the new forms, to bring together, either by reference or by description and figure, the whole body of information at present available, in order to gain a place for a new departure.

Accordingly, I have interpolated the descriptions of new forms in a systematic list of all the species yet recovered from the rocks and have added such tables as may enable one the more readily to determine any new material that may come to hand and to make comparisons with such as prove their nearest allies. With the publication of this essay, moreover, all the species hitherto described will have been figured. All the additions made at the present time belong to the Paleozoic forms. Several species before described are here figured for the first time.

NEW LOCALITIES FOR FOSSIL COCKROACHES.

The recent extension of our knowledge of our Paleozoic cockroaches is very largely due to the exploitations of two localities, one in West Virginia, through the instrumentality of Mr. R. D. Lacoe, of Pittston, Pa., the other in Ohio, through the labors of Mr. Samuel Huston, of Steubenville.

¹ Mem. Bost. Soc. Nat. Hist., III, 23-134, pl. 2-6; Foss. Ins. N. A., I, 43-153, pl. 2-6.

The West Virginia locality is at Cassville, Monongalia County, not far from Morgantown, and the specimens were found in rocks lying above the Waynesburg coal, in what is termed by Prof. I. C. White the Dunkard Creek series, and referred very positively by him and Prof. W. M. Fontaine to the Permian. The blattarian fauna as thus far determined is unquestionably younger than any known from the Pennsylvania and Illinois rocks, on which we have hitherto depended largely for our knowledge, and consists of a vast assemblage of forms, which will undoubtedly be increased by further search. They number fifty-six species, belonging to five genera, the bulk of them (thirty-six species) to *Etblattina*.

The Ohio locality lies at the edge of the township of Richmond, on Wills Creek, in the near neighborhood of Steubenville, Jefferson County, and though far less extensive and less thoroughly worked than Cassville, has already yielded twenty-two species belonging to three genera, of which the larger number (seventeen) belong to *Etblattina* and the others to the genera represented at Cassville by more than a single species.

It is a curious fact, to which I called partial attention when first describing some of them, that these species represent for the most part a distinct group of cockroaches of the genera *Etblattina* and *Gerablattina*, characterized by great length and slenderness of the internomedian area, by a remarkable openness of the neuration in the middle of the tegmina, and by their frequently exceptional length and slenderness. They comprise, indeed, nearly 75 per cent of the species in these two genera at Richmond, and hardly occur elsewhere excepting at Cassville, where they compose about 25 per cent of the species of these two genera. The only occurrence of a similar form in Europe is *Etblattina elongata* from the lower Dyas of Weissig, Saxony. The occurrence of this type of cockroaches is the characteristic feature of Richmond, and must place this fauna high in the series, as the stratigraphical evidence itself warrants. Its horizon, according to Mr. Huston, who alone has carefully explored the location, is in the Barren Coal-measures, a little above the crinoidal limestone.

It is remarkable that, notwithstanding the close relationship in general features of the two rich faunas of Cassville and Richmond, not a single species has been found common to the two. One species, indeed, I formerly regarded as found in both, but a closer study convinces me that there are in this case two very nearly allied forms, and they are accordingly separated in the present paper. Further than this, with one or two exceptions,¹ no American species has been found in two different places, and without exception the American species are completely distinct from the European.

¹One of these is *Etblattina balteata*, in which a fragment consisting of the anal area of the tegmina, from Bellaire, Ohio, is referred to one of the tegmina (without the anal area preserved) from Cassville, W. Va.

FAUNAL LISTS OF AMERICAN PALEOZOIC COCKROACHES.

The enlargement of our vision is, however, not entirely due to the new forms from Cassville and Richmond, but also to the increase in the number of species known from old horizons. Thus the Rhode Island coal field has now furnished a dozen species, including a new genus, while new localities in the Western Interior coal basin have increased their fauna to seven species, and certain additions have been made to other faunas already partially known. The following lists of faunas will prove of interest and show the geographical distribution of the species:

The Western Interior coal field.

<i>Promylacris harei</i> (Mo.).	<i>Ectoblattina occidentalis</i> (Kans.).
<i>Paromylacris clintoniana</i> (Mo.).	<i>Anthracoblattina americana</i> (Mo.).
<i>Ectoblattina clintoniana</i> (Mo.).	<i>Oryctoblattina laqueata</i> (Mo.).
<i>venusta</i> (Ark.).	

The Eastern Interior coal field (Illinois).

<i>Mylacris elongata</i> .	<i>Paromylacris ampla</i> .
<i>anthracophila</i> .	<i>triangularis</i> .
<i>gurleyi</i> .	<i>Lithomylacris simplex</i> .
<i>ampla</i> .	<i>Archimylacris paucinervis</i> .
<i>antiqua</i> .	<i>Ectoblattina mazona</i> .
<i>Promylacris testudo</i> .	<i>hilliana</i> .
<i>ovalis</i> .	<i>Progonoblattina columbiana</i> .
<i>rigida</i> .	<i>Oryctoblattina occidua</i> .
<i>Paromylacris rotunda</i> .	

The Acadian coal field.

<i>Mylacris bretonensis</i> .	<i>Archimylacris acadica</i> .
<i>heeri</i> .	<i>Petrablattina sepulta</i> .

The Rhode Island coal field.

<i>Mylacris packardii</i> .	<i>Ectoblattina gorhami</i> .
<i>Microblattina perdita</i> .	<i>exilis</i> .
<i>Ectoblattina illustris</i> .	<i>reliqua</i> .
<i>scholfieldi</i> .	<i>latebricola</i> .
<i>clarkii</i> .	<i>Gerablattina scapularis</i> .
<i>sp.</i>	<i>fraterna</i> .

The Appalachian coal field (Pennsylvania).

<i>Mylacris priscovolans</i> .	<i>Lithomylacris pittstoniana</i> .
<i>lucifuga</i> .	<i>pauperata</i> .
<i>carbonum</i> .	<i>Necymylacris laeoana</i> .
<i>pennsylvanica</i> .	<i>heros</i> .
<i>mansfieldi</i> .	<i>Archimylacris parallela</i> .
<i>ovalis</i> .	<i>Ectoblattina lesquereuxii</i> .
<i>Paromylacris pluteus</i> .	<i>Gerablattina fascigera</i> .
<i>Lithomylacris angusta</i> .	

The Barren Coal-measures at Richmond, Ohio.

<i>Etoblattina fossa.</i>	<i>Etoblattina hustoni.</i>
<i>strigosa.</i>	<i>hastata.</i>
<i>jeffersoniana.</i>	<i>marginata.</i>
<i>fasciata.</i>	<i>gracilenta.</i>
<i>ramosa.</i>	<i>stipata.</i>
<i>willsiana.</i>	<i>variegata.</i>
<i>maledicta.</i>	<i>Gerablattina apicalis.</i>
<i>benedicta.</i>	<i>richmondiana.</i>
<i>funesta.</i>	<i>minima.</i>
<i>exsensa.</i>	<i>Poroblattina longinqua.</i>
<i>tenuis.</i>	<i>ohioensis.</i>

The Dunkard Creek series at Cassville, W. Va.

<i>Etoblattina lata.</i>	<i>Etoblattina expugnata.</i>
<i>sagittaria.</i>	<i>obatra.</i>
<i>mediana.</i>	<i>imperfecta.</i>
<i>ovata.</i>	<i>secreta.</i>
<i>debilis.</i>	<i>invisa.</i>
<i>balteata.</i>	<i>occulta.</i>
<i>patiens.</i>	<i>defossa.</i>
<i>mucronata.</i>	<i>recidiva.</i>
<i>detecta.</i>	<i>Gerablattina inculta.</i>
<i>exigua.</i>	<i>perita.</i>
<i>residua.</i>	<i>diversinervis.</i>
<i>funeraria.</i>	<i>cassvici.</i>
<i>expuncta.</i>	<i>abdicata.</i>
<i>aperta.</i>	<i>concinna.</i>
<i>eakiniana.</i>	<i>uniformis.</i>
<i>accubita.</i>	<i>permanenta.</i>
<i>expulsata.</i>	<i>permacra.</i>
<i>gratiosa.</i>	<i>eversa.</i>
<i>macerata.</i>	<i>deducta.</i>
<i>immolata.</i>	<i>radiata.</i>
<i>mactata.</i>	<i>lata.</i>
<i>communis.</i>	<i>rotundata.</i>
<i>exsecuta.</i>	<i>ovata.</i>
<i>arcta.</i>	<i>Anthracoblattina virginienensis.</i>
<i>prædulcis.</i>	<i>Poroblattina gratiosa.</i>
<i>angusta.</i>	<i>fossa.</i>
<i>macilenta.</i>	<i>complexinervis.</i>
<i>rogi.</i>	<i>Petrablattina hastata.</i>

TABLES OF DISTRIBUTION OF AMERICAN AND EUROPEAN FOSSIL COCKROACHES.

The following table presents in a summary form the number of species of the different genera of cockroaches found in the American Paleozoic rocks in each of the different coal basins and in the two special localities in Ohio and West Virginia where the greatest number of species have been found. It summarizes the foregoing lists. The horizontal line separates the Mylacridæ and Blattinariæ.

Table showing the geographical distribution of the American Paleozoic genera.

Genera.	Western Interior (Missouri, Arkansas, Kansas).	Eastern Interior (Illinois).	Acadian (Nova Scotia, Cape Breton).	Rhode Island.	Appalachian (Pennsylvania).	Richmond, Ohio.	Cassville, W. Va.	Total.
Mylacris.....		5	2	1	6			14
Promylacris.....	1	3						4
Paromylacris.....	1	3			1			5
Lithomylacris.....		1			3			4
Necymylacris.....					2			2
Microblattina.....		1		1				1
Archimylacris.....		1	1		1			3
Etobblattina.....	3	2		8	1	17	36	67
Gerabblattina.....				2	1	3	15	21
Anthracoblattina.....	1						1	2
Progonobblattina.....		1						1
Oryctobblattina.....	1	1						2
Porobblattina.....						2	3	5
Petrabblattina.....			1				1	2
Total.....	7	17	4	12	15	22	56	133

The fact that, with the very considerable increase shown to have been made in the number of known species, hardly a single one of them has been found at two distinct localities, lends importance to the right determination of the horizon at which each species has been found and renders probable, with the further extension of our knowledge of their distribution, the advantageous use of these fossils in delicate discriminations of the age of rock deposits. Accordingly, as a first step in this direction, I have drawn up the succeeding table, showing the relative geological age of each of the American species, the species themselves being arranged systematically, but excluding from the list, as at present unimportant, the three Tertiary species. In this table I have roughly separated the species from the true productive Coal-measures, i. e., above the "Millstone Grit" and below the "Barren Coal-measures," into an upper and lower series, endeavoring as far as possible to make the latter correspond to the coals A-C, inclusive, of the Pennsylvania series, and where the reference was at all doubtful to indicate it in the table by a mark of interrogation instead of the usual cross.

Horizontal distribution of the American pre-Tertiary cockroaches.

Species.	Millstone Grit.	Lower Productive Coal-measures.	Upper Productive Coal-measures.	Barren Coal-measures.	Permian.	Trias.
<i>Myrlacris packardii</i>		?				
bretonensis			?			
elongata		x				
anthracophila		x				
gurleyi		x				
ampla		x				
priscovolans		x				
heeri			?			
antiqua		x				
lucifuga			x			
carbonum		x	x			
pennsylvanica		x				
mansfieldi		x				
ovalis		x				
<i>Promylacris harei</i>				x		
testudo		x				
ovalis		x				
rigida		x				
<i>Paromylacris rotunda</i>		x				
ampla		x				
triangularis		x				
clintoniana		x				
pluteus			x			
<i>Lithomylacris angusta</i>			x			
pittstoniana			x			
pauperata			x			
simplex		x				
<i>Necymylacris lacoana</i>		x				
heros		x				
<i>Microblattina perdita</i>		?				
<i>Archimylacris parallela</i>	x					
paucinervis		x				
acadica			x			
<i>Spiloblattina gardineri</i>						x
triassica						x
guttata						x
marginata						x
<i>Etoblattina clintoniana</i>		x				
lata					x	
sagittaria					x	
mediana					x	
fossa				x		
illustris		?				
ovata					x	
scholfieldi		?				
debilis					x	
strigosa				x		
clarkii		?				
venusta	?					
balteata				?	x	
patiens					x	
mucronata					x	
detecta					x	
occidentalis			?			
exigua					x	
sp. (R. L.)		?				
jeffersoniana				x		
residua					x	
funeraria					x	
expuncta					x	
gorhami		?				
aperta					x	
fasciata				x		
ramosa				x		
willisiana				x		
lesquereuxii			x			
maledicta				x		
benedicta				x		
funesta				x		
exsensa				x		
tenuis				x		
hustoni				x		
persistens						x
eakiniana					x	
accubita					x	
mazona		x				

Horizontal distribution of the American pre-Tertiary cockroaches—Continued.

Species.	Millstone Grit.	Lower Productive Coal-measures.	Upper Productive Coal-measures.	Barren Coal-measures.	Permian.	Trias.
<i>Ectoblattina expulsa</i>					×	
<i>gratiosa</i>					×	
<i>macerata</i>					×	
<i>immolata</i>					×	
<i>mactata</i>					×	
<i>communis</i>					×	
<i>sp. (Colo.)</i>						×
<i>hastata</i>						
<i>marginata</i>				×		
<i>gracilentata</i>				×		
<i>exsecuta</i>					×	
<i>arcta</i>					×	
<i>stipata</i>				×		
<i>prædulcis</i>					×	
<i>variegata</i>				×		
<i>billiana</i>		×				
<i>angusta</i>					×	
<i>macilentata</i>					×	
<i>exilis</i>		?				
<i>rogi</i>					×	
<i>expugnata</i>					×	
<i>obatra</i>					×	
<i>imperfecta</i>					×	
<i>secreta</i>					×	
<i>reliqua</i>		?				
<i>invisa</i>					×	
<i>occulta</i>					×	
<i>latebricola</i>		?				
<i>defossa</i>					×	
<i>recidiva</i>					×	
<i>Gerablattina inculta</i>					×	
<i>perita</i>					×	
<i>apicalis</i>				×		
<i>diversinervis</i>					×	
<i>richmondiana</i>				×		
<i>cassvici</i>					×	
<i>abdicata</i>					×	
<i>concinna</i>					×	
<i>uniformis</i>					×	
<i>permanenta</i>					×	
<i>permaera</i>					×	
<i>eversa</i>					×	
<i>deducta</i>					×	
<i>scapularis</i>		?				
<i>fraterna</i>		?				
<i>radiata</i>					×	
<i>lata</i>					×	
<i>rotundata</i>					×	
<i>ovata</i>					×	
<i>minima</i>				×		
<i>fascigera</i>	×					
<i>Anthracoblattina americana</i>		×				
<i>virginiensis</i>					×	
<i>Progonoblattina columbiana</i>		×				
<i>Oryctoblattina occidua</i>		×				
<i>laqueata</i>		×				
<i>Poroblattina longinqua</i>				×		
<i>gratiosa</i>				×	×	
<i>fossa</i>					×	
<i>meieri</i>						×
<i>arcuata</i>						×
<i>lakesii</i>						×
<i>ohioensis</i>				×		
<i>complexinervis</i>					×	
<i>Petrablattina sepulta</i>		×				
<i>hastata</i>					×	
<i>æqua</i>						×
<i>Neorthroblattina albolineata</i>						×
<i>lakesii</i>						×
<i>rotundata</i>						×
<i>attenuata</i>						×
<i>Scutinoablattina brongniarti</i>						×
<i>intermedia</i>						×
<i>recta</i>						×

With this may be compared the next table, in which I attempt a similar division of the described European species, separating them by the zones employed by Dr. H. B. Geinitz in his *Steinkohlen Deutschlands* (1865), his Zone I (which does not come into use here, and which I take to be the equivalent of our Millstone Grit), being the "Hauptzone der Lycopodiaceen;" II, "der Sigillarien;" III, "der Calamiten;" IV, "der Annularien;" V, "der Farren;" succeeded by the *Dyas* or Permian. I have been aided by Kliver's tabulation of the species found in the Saarbrück basin (*Palæontographica*, XXIX, 264-265), whose separation of the "upper" and "middle" coal formation falls, Dr. Geinitz informs me, near the middle of Zone IV. The Löbejün basin, he tells me, belongs by its sigillarians to the middle coal formation, but is at the same time scarcely separable from that of Wettin, which on its part closely agrees with that of Manebach, etc., and must be regarded as of the upper coal formation. In the following table I have placed all of the species from Löbejün and Wettin in Zone IV, and those of Manebach in Zone V, but classed them both as of the upper coal formation.

Finally, the following table may be of interest, in which a provisional attempt is made to correlate in a summary way the details of the foregoing tables. It indicates merely the presence of the different genera of fossil cockroaches in the several periods from which they are known, whether in Europe (by the letter E in the horizons in which they occur) or in America (by the letter A). It includes all the known described Palæoblattariæ of the world, with the addition of the fossil Neoblattariæ of North America only. The numerous Liassic forms of Europe are therefore omitted. For convenience the Mylacridæ are separated by a horizontal line from the Blattinariæ, and the Neoblattariæ from the Palæoblattariæ.

Geological distribution of the genera of fossil cockroaches.

Genera.	Millstone Grit.	Lower Productive Coal-measures.	Higher Productive Coal-measures.	Barren Coal-measures.	Permian.	Trias.	Tertiary.	Present epoch.
Mylacris.....		A	A					
Promylacris.....		A		A				
Paromylacris.....		A	A					
Lithomylacris.....		A	A					
Neomylacris.....		A						
Microblattina.....		A						
Archimylacris.....	A	A						
Spiloblattina.....						A		
Etolblattina.....	A ¹	A E	A	A E	A E	A		
Gerablattina.....	A	A E		A E	A E			
Anthracoblattina.....		A E		E	A E			
Hermatoblattina.....				E	E			
Progonoblattina.....		A E		E				
Oryctoblattina.....		A	E	A	E			
Poroblattina.....				A	A	A		
Petrablattina.....		A			A E	A		
Leptoblattina.....		E						
Neorthroblattina.....						A		
Scutinoblattina.....						A		
Zetobora.....							A	A
Homoeogamia.....							A	A
Paralatiindia.....							A	A

¹ Subject to correction as noted on pp. 60, 73.

THE RAPID INCREASE IN OUR KNOWLEDGE.

The relative increase of our knowledge of the Paleozoic cockroaches of Europe and America can best be shown by the following table, in which the number of species of each genus on each continent, as shown

in my first work on the subject and at the present time, are placed in separate columns:

Genera.	Europe.		America.		Total.	
	1879.	1893.	1879.	1893.	1879.	1893.
Mylacris.....	0	0	5	14	5	14
Promylacris.....	0	0	0	4	0	4
Paromylacris.....	0	0	0	5	0	5
Lithomylacris.....	0	0	3	4	3	4
Necymylacris.....	0	0	2	2	2	2
Microblattina.....	0	0	0	1	0	1
Archimylacris.....	0	0	2	3	2	3
Etoblattina.....	18	27	2	67	20	94
Gerablattina.....	10	11	2	21	12	32
Anthracoblattina.....	7	11	0	2	7	13
Hermatoblattina.....	2	3	0	0	2	3
Progonoblattina.....	2	2	0	1	2	3
Oryctoblattina.....	1	3	0	2	1	5
Poroblattina.....	0	0	0	5	0	5
Petrablattina.....	1	1	1	2	2	3
Leptoblattina.....	0	2	0	0	0	2
Total	41	60	17	133	58	193

While the total number of species has thus more than trebled, the European species have increased about 50 per cent while the American species have multiplied nearly eightfold. It should not be overlooked, however, that a very different result would unquestionably appear if the Commentry cockroaches, which Brongniart announced in 1889 had then been found to the number of more than 600, had been published. Unfortunately not a single one has yet been described.

This table shows also the genera which are known from Europe and America and permits a ready comparison between the representation of the genera on the two continents. It shows that in each Etoblattina and Gerablattina easily hold the first place and that Etoblattina is especially rich in forms, containing just about one-half the species of either continent. It also makes conspicuous a point to which I called attention in my first essay on Paleozoic cockroaches—that the Mylacridæ, comprising nearly 22 per cent of the species and five of the fourteen genera in America, are, so far as described forms are concerned, completely absent from Europe.

SOME CHARACTERISTICS OF MYLACRIDÆ.

This, however, it appears, is not a statement of the actual fact; for, in a brief note on Carboniferous cockroaches published in the Comptes rendus of the French Academy for February 4, 1889, Mr. Charles Brongniart states that Mylacridæ are as abundant as Blattinariæ at the famous locality at Commentry, France, although the latter only have hitherto been found fossil in other places in the European Coal-measures. Brongniart gives neither description nor figures in support of this statement, but points out from the uncommonly well-preserved specimens found at Commentry what he regards as further points of distinction between the Mylacridæ and Blattinariæ, drawn from the structure of the thorax: the prothoracic shield of the Blattinariæ being

well rounded and narrower than the body including the folded wings, while that of the Mylacridæ is broader than the stout body, and, instead of being rounded, is nearly in the form of a triangle, its base forward.

These distinctions can not be maintained for the American forms. Although specimens of either group showing anything more than the tegmina are rare in the American rocks, a few have been found and have been published, while still others are made known in the present paper. In no case do those show a prothorax wider than the folded wings, although in some, notably in *Promylacris testudo*, the prothorax is nearly as wide; nor in any of the Mylacridæ, where a subtriangular form is more common than in the Blattinariæ, is the broadest portion in advance of the middle, as must be the case if in the form of a triangle its base forward (il a presque la forme d'un triangle à base située en avant), but always behind it.

Stated broadly, the Mylacridæ are usually stouter bodied than the Blattinariæ (though the species of *Lithomylacris* are usually as slender as most Blattinariæ), and the prothoracic shield is usually, but not always, broader in proportion to its length in the Mylacridæ and is not unfrequently subtriangular, by the subangular projection of the middle of the front border, and of the extreme sides of the posterior margin. An excellent illustration of this is seen in *Paromylacris rotunda* and in *Promylacris rigida* (Pl. III, fig. 1), in which latter the form of the prothorax is very different from the transverse suboval of its congener *P. testudo*. A publication of the different forms of Mylacridæ alleged to be found at Commentry is therefore all the more to be desired, and it is much to be hoped that Mr. Brongniart will favor the world at an early day with further and fuller details regarding the superb collections in his hands. They can not fail to throw much light upon our knowledge of the earlier insects. The only specimens I have myself seen from Commentry (a photograph and a very perfect fore wing) are *Etoblattinæ*.

Before proceeding to the special description of the new American forms, there are a few matters which I will consider under separate heads, as follows:

1. The relative size of ancient cockroaches.
2. The features of a nearly complete body of a Carboniferous cockroach from Illinois.
3. The hind wings of Paleozoic cockroaches.
4. Possible mimicry in Paleozoic cockroaches.
5. The European species of *Etoblattina*, with description of a new form.
6. A list of the described European Paleozoic cockroaches.
7. The terminology of the neurulation.

I. THE RELATIVE SIZE OF ANCIENT COCKROACHES.

No one can handle many Paleozoic cockroaches without being struck by the fact that they are of large size. I drew attention to this in my *Paleozoic Cockroaches*, remarking that "while the average was considerably above that of existing cockroaches, none were much larger than some South American species of *Blabera*," whose tegmina sometimes attain a length of 60 to 70 mm. But in the present paper a fragment of a fore wing is described, which, when perfect, must have measured 80 mm. in length. In an estimate from the then known species of Paleozoic cockroaches, I stated that "the average length of the front wing appears to have been about 26 mm."

Since then the increase in the number of species in this country has been largely from the younger Paleozoic rocks, and if we were to add the Triassic *Palæoblattariæ*, of still smaller size, we should find that the average length of the fore wing in ancient American cockroaches, 133 species in all, was 23.2 mm. The *Mylacridæ* were larger, on the average, than the *Blattinariæ*, a fact due in great part to the younger cockroaches being all *Blattinariæ*, for the tegmina of 29 *Mylacridæ* average 27.5 mm., while those of 104 *Blattinariæ* average 22 mm. only. That even this last figure is larger than the average size of living cockroaches, one familiar with the latter would readily venture to assert; but to put it to a fair test, I have estimated the average size of recent species from the measurements given in Brunner's *Système des Blattaires* (1865), the last general work on the subject. About 380 species are included in this work, but of only 239 are measurements given of the length of the tegmina; where different measurements are given for the two sexes I have uniformly chosen that for the male as in general the larger; and where the measurements covered a range I have taken the exact mean. In this way I estimate the average length of the tegmina of living cockroaches to be 18.8 mm., which is markedly less than the size of the Paleozoic forms.¹

This, however, is by no means the whole of the story. I have further tabulated separately the length of the tegmina for the different American species from the Millstone Grit to the Trias, inclusive, and find that there is a marked and regular diminution in average size from one period to another, as will appear from the following measurements of the tegmina given in millimetres:

Millstone Grit (3 species), 26 to 38, average 31.

Lower Productive Coal-measures (39 species), 10 to 61, average 29.7.

Upper Productive Coal-measures (12 species), 16.35 to 33, average 26.4.

Barren Coal-measures (23 species), 9.75 to 31.5, average 23.4.

Permian (56 species), 8.25 to 28.75, average 16.9.

Trias (17 species), 6.3 to 24, average 13.

¹In making this estimate, though I recollected I had once made one of the same nature, I had forgotten its publication, and only after the above was written discovered it in my *Revision of Mesozoic Cockroaches*, where a slightly different result follows slightly different data; but I prefer to leave the above as it stands.

The only important doubt about the exact accuracy of this statement is that the fauna of the Rhode Island coal basin (consisting of 12 species) is included in the Lower, when it may perhaps belong to the Upper Productive Coal-measures. The average size of the Rhode Island species is 27.3 mm., and that of the species from the Lower Productive Coal-measures without them is 30.7 mm., while, if the Rhode Island species were added to the Upper series, it would increase the average of that to 26.8 mm.; but this would still not disturb the regular succession of averages. The average size of the 50 species from the Productive Coal-measures as a whole is 27.4 mm., or almost precisely that of the Rhode Island species alone.

I do not mean to maintain that the size of cockroaches has been steadily and continuously diminishing from the earliest times to the present, but only for that period of time which is here considered, and also, I may add, for the later Mesozoic rocks, for I have formerly shown that the average length of the tegmina of European Mesozoic (mostly Liassic) cockroaches was 12.5 mm., which is slightly less than that of the species from the American Trias. It is well known that the great mass of Mesozoic, and especially Liassic, insects were of small size, but the insects of the Tertiaries did not differ in this respect in any noticeable degree from those now living.

I have further tabulated the relative length of the tegmina in the different genera separately, both as a whole and in each of the periods in which they occur. They may be shown as follows, the figures being given in millimeters, and showing both range and average:

Average length of tegmina in the genera of American fossil cockroaches.

Genera.	Mill-stone Grit.	Lower Productive Coal-measures.	Upper Productive Coal-measures.	Barren Coal-measures.	Permian.	Trias.	In all.
<i>Myliacris</i>		26.50-42.00 Aver. 31.10	16.35-33.00 Aver. 25.60				16.35-42.00 Aver. 28.50
<i>Promyliacris</i>		19.00-29.00 Aver. 25.30		17.50			17.50-29.00 Aver. 21.70
<i>Paromyliacris</i>		21.00-42.00 Aver. 28.50	30.00				21.00-42.00 Aver. 26.60
<i>Lithomyliacris</i>		24.00	26.00-29.25 Aver. 27.20				24.00-29.25 Aver. 26.40
<i>Necomyliacris</i>		25.00-48.00 Aver. 36.50					25.00-48.00 Aver. 36.50
<i>Microblattina</i>		8.00					8.00
<i>Archimyliacris</i>	26.00	26.00-30.50 Aver. 28.25	23.00				23.00-30.50 Aver. 26.50
<i>Spiloblattina</i>						15.00-18.00 Aver. 16.40	15.00-18.00 Aver. 16.40
<i>Etoblattina</i>	29.00	14.25-61.00 Aver. 26.40	25.00-32.00 Aver. 28.50	14.00-31.00 Aver. 25.50	11.75-28.75 Aver. 17.60	12.00-20.00 Aver. 16.00	11.75-61.00 Aver. 21.30
<i>Gerablattina</i>	38.00	18.00-41.00 Aver. 29.50		9.75-25.00 Aver. 18.30	10.00-25.50 Aver. 16.60		9.75-41.00 Aver. 19.10
<i>Anthracoblattina</i>		30.00			12.00		12.00-30.00 Aver. 21.00
<i>Progonoblattina</i>		20.75					20.75
<i>Oryctoblattina</i>		19.00		21.00			19.00-21.00 Aver. 20.00
<i>Poroblattina</i>				11.00-22.00 Aver. 16.50	13.50-16.75 Aver. 15.60	10.00-19.00 Aver. 13.70	10.00-22.00 Aver. 15.10
<i>Petrablattina</i>		13.00			8.25	24.00	8.25-24.00 Aver. 15.10
<i>Neorthroblattina</i>						8.50-12.00 Aver. 9.60	8.50-12.00 Aver. 9.60
<i>Scutinoblattina</i>						6.30-7.00 Aver. 6.80	6.30-7.00 Aver. 6.80

This table shows that in general, especially where the species were numerous, the same rule holds remarkably under each genus, the average size decreasing with the lapse of time. The only noticeable exception is in the two divisions of the Productive Coal-measures, where, in the genera *Paromylacris*, *Lithomylacris*, and *Etoblattina*, the averages are reversed from what they should be under the rule. The other exceptions, as in *Oryctoblattina*, and in part in *Petrablattina*, and in *Archimylacris*, are where only a couple of species or so are concerned. The relative average size of the species of the different genera is also shown, and proves that the average size of every genus of *Mylacridæ* is larger than that of any of the other genera excepting only *Archimylacris*, which, as I have elsewhere pointed out, was the most antique type of all cockroaches. The table further lends support to the view that the Dunkard Creek series of rocks (at Cassville) are older than the Barren Coal-measures, and should be referred to the Permian, since in each of the three genera represented in both beds the average size of the species from the Dunkard Creek series is the smaller.

II. THE BODY OF A PALEOZOIC COCKROACH.

Pl. XII, figs. 8-11.

Through the kindness of Prof. Josua Lindahl, of the Illinois Museum of Natural History, I have been permitted twice to examine a very curious specimen, which I regard as the principal part of the body of a wingless cockroach from the Coal-measures of Illinois. It is entirely freed from the matrix, and, with the exception of the head and appendages of the body, represents the complete body of a cockroach, probably in very much of its original form. The proportions of the abdomen indicate that it was in all probability a female, but whether a larval form or a mature individual with the wings removed is quite impossible to say. If a female, the ovipositor, said by Brongniart to be characteristic of Paleozoic cockroaches, is broken away. Fig. 9 is presumed to represent the ventral and fig. 11 the dorsal aspect of the creature, partly from the form of the upper surface of the metathorax, as shown particularly in fig. 10, and from the fact that there are what are apparently scars at the position of the mesothoracic coxæ on the ventral surface, which, however, do not clearly appear in the figure. The abdomen is composed of eight complete segments, similar dorsally and ventrally, as may best be seen by fig. 10. The first segment encircles the whole body externally, and is not covered at the sides by the projecting margins of the metathorax, as in modern cockroaches. There are, however, several anomalies in the abdomen and difficulties to be explained. Fig. 11 represents the dorsal aspect with the only clear indications, as shown also in fig. 10, of the separation of the mesothorax and metathorax, but with a distinct indication throughout of the first abdominal segment, which scarcely shows on the ventral aspect (fig. 9),

and the difference in the separation of which from the metathorax on the dorsal and ventral surfaces is clearly shown in fig. 8. The second and seventh abdominal segments are the only ones which are clearly distinct upon both margins throughout the entire circuit of the body, as shown in all the figures. The third and fourth segments are clearly distinct on the dorsal surface, but on the ventral (fig. 9) the distinction between the third and fourth is lost, excepting on the right, where it is as distinct as above; possibly the remaining portion of the third segment may be broken away. Dorsally, the fifth segment is traversed by an oblique fold, which does not appear elsewhere, and makes an apparent separation of the segment into two subsegments. Similar indications, which only traverse a portion of the body, elsewhere appear, and the relation of the other parts to one another renders it clear that there is here no true subsegmentation. The apparent division of the eighth segment in fig. 10 is explained by the other figures, which show that this segment is made up in the original of a bundle of irregular bosses which may have terminated (as Brongniart describes for the better preserved specimens of fossil cockroaches from the Coal-measures of Commeny, France) with a long ovipositor, similar to those of our living Phasmidæ.

The abdomen is thus seen to differ from that of modern cockroaches in being composed of eight complete and tolerably uniform rings with no distinct separation, as may best be seen in fig. 10, into dorsal and ventral scutes, and in consequence there are as many ventral as dorsal, excepting only that the first segment is separated from the metathorax distinctly only on the dorsal surface, as is best seen in fig. 8. This may be the first step in a distinction between the dorsal and ventral surfaces as seen in modern cockroaches. But there is a further indication of something similar in the fold upon the dorsal surface of the fourth abdominal segment, indicating a division into subsegments at this point. In this case, however, the difference between the dorsal and ventral surfaces would appear to result from a division of one of the dorsal scutes rather than from a suppression of one of the ventral.

As it is impossible to determine to what genus this fragment may have belonged, or even to what family of ancient cockroaches, no name is given to it at present. It was obtained at Olney, Ill., by Mr. B. E. Phillips, and was presented by him to the Illinois Museum of Natural History, where it bears the number 4941.

III. THE HIND WINGS OF PALEOZOIC COCKROACHES.

Pl. XII, figs. 4-7.

By far the larger part of the remains of fossil cockroaches consist of the tegmina, but in a few instances the hind wings have been preserved, sometimes by themselves, sometimes in connection with the tegmina; and, as a few additional forms are illustrated in the present paper, it may be well to draw general attention to them more carefully than has yet been done.

On previous occasions I have mentioned the undoubted fact that the fore and hind wings of Paleozoic insects harmonized in neuration more completely than they do in living insects, and have also stated that even differentiation in texture, such as exists to-day in many groups (especially the lower), had scarcely begun, the neuration being always equally apparent in both wings. That this latter statement is not absolutely true for Paleozoic insects, that their fore wings were of somewhat denser texture or tougher consistency than the hind pair, must, I think, be conceded, when we note how extremely rarely the hind wings are preserved, as compared with the fore wings; nevertheless, when they are preserved, no such difference is discernible.

How rarely the hind wings of Paleozoic cockroaches are known may be quickly made apparent by the statement that up to the present time they have been figured for only three European species, two of *Etblattina* and one of an undetermined form (*Blattina latinervis*) and for five American, namely, one species each of *Promylacris*, *Paromylacris*, *Archimylacris*, *Oryctoblattina*, and *Etblattina*, to which are added in the present paper one each of *Mylacris* and *Etblattina*, and two others of independent wings, one of which may be referred to *Etblattina*, while the other, though nearly perfect, is very problematical. Those which are preserved in connection with other parts rarely show much beside the apical third, so that our knowledge of them is less advanced than it ought to be when they are thus so much more readily determinable. From this meager showing the following statements may be made, though they are offered with some hesitation, from the fragmentary material on which they are based:

It seems probable from the general harmony between the fore wings and the hind pair that a difference somewhat similar to that which exists between the fore wings of *Mylacridæ* and *Blattinariæ* will be found in the hind wings. In no case, however, have we yet found the costal margin of the hind wing preserved in any of the *Mylacridæ*; but in several of the *Blattinariæ* we see the mediastinal area stretching as a very narrow vittate field much more than half way to the apex of the wing, much narrower than is usual in the fore wing; while analogy would lead us to infer that in the *Mylacridæ* it was relatively much shorter and perhaps to a greater or less degree triangular. This is my sole reason for believing it probable that the wing figured on Pl. XII,

fig. 5, is one of the *Blattinariae*, to which is opposed the close resemblance it bears, in parts which allow of any comparison at all, to *Promylacris*, its excessive size, and the general composition of the fauna from which it comes, as will be stated later in the special description of this wing.

As a general rule the internomedian area, on the contrary, appears to have been broader than in the tegmina, and did not possess the special character of distinction from the mode of branching in the other areas which it had in the fore wing. In the latter, for instance, the branches of this area are generally much more delicate than in the other areas, and are usually more widely separated and very uniform. In all the hind wings where this area is preserved the branches are in no way more delicate than those of the other areas, while, with the exception of *Mylacris*, the branches are as close as elsewhere, and usually somewhat or considerably irregular. Curiously, in *Mylacris* the general appearance of this area is precisely as in the fore wing, differing apparently only in being narrower and tapering less rapidly. The other intermediate areas of the hind wing differ from their general character in the fore wing in having the branches more of an arborescent type, in which it is difficult to say what course the main vein with its irregular or regular breaking up takes, or on which side, if not on both, the principal branches are thrown off from the main stem. In general the division of the scapular and externomedian areas on the border is at or close to the apex of the wing, which seems always to lie, not at the end of the middle line of the wing, but somewhere in its upper half, so that the wing is less symmetrical in form than the fore wing.

Whether we shall ever be able to determine the characteristics of different genera in the hind wings may be deemed doubtful; certainly not until a vast deal more is known about them than now. Possibly when the rich *Blattarian* fauna of *Commentry* has undergone the investigation it awaits at the hands of Mr. Charles Brongniart, we shall be able to speak more hopefully, but at present the genus *Etoblattina* is the only one of which we have representatives of more than a single species.

In *Etoblattina* the hind wing is pointed-ovate, broadest beyond the middle, fully twice as long as broad, with very straight costa until the wing begins to narrow, and with a very full and rounded inner border, the apex being not far from the middle of the upper half of the wing. The mediastinal area is very narrow and reaches to the middle of the apical half of the wing or farther, with arcuate, very oblique branches. The scapular vein is very straight, throws off very oblique forking branches to the costal margin, first forking a little before the middle of the wing, and terminates at or above the apex. The externomedian vein is likewise straight, first branches as soon as or a little before the scapular, the branches forked or generally compound, rarely simple, and nearly or quite longitudinal; they seem to be indifferently inferior

or superior, but all either one or the other. The internomedian area is very broad, generally occupying fully half the breadth of the wing in its basal half, the main vein straight or nearly straight, running obliquely to the inner margin of the wing and ending just about as far toward the apex as the mediastinal vein; the branches are all inferior, closely crowded, nearly straight and oblique, and generally simple. Of the anal area nothing can be known from present specimens, excepting what is seen in the specimen figured on Pl. XII, figs. 6, 7, which will be mentioned in its description, later in this paper.

An exception to these characters is so great in a hind wing, which I have recently figured¹ and called an *Etoblattina*, that I am now inclined to think it can not belong to this genus, but perhaps to *Gerablattina*, also found in the same beds. It is again figured here in Pl. XII, fig. 4. These exceptions consist in the form of the wing, in which the apex (which is destroyed) apparently must fall about the middle of the wing, while the inner border is much less full; in the earlier forking of both scapular and externomedian veins, the former earlier than the latter; the more arborescent or apical branching of the externomedian vein, the branches of which are both superior and inferior, and in the different character of the internomedian area, which is by no means so broad as in all the *Etoblattinæ* known, and has only a few branching, very oblique veins. The anal area is here preserved, and is remarkable as being but a shorter form of the mediastinal type.

The hind wing of *Archimylacris*, so far as we know it, is again somewhat different. The form would appear to be the same as in *Etoblattina* and the mediastinal area similar but much longer. The scapular vein, however, is very different, and the few branches are distant, inferior, and include the apex at the margin, extending, indeed, farther below the apex than above it. The externomedian vein appears to be a repetition on a lesser scale of the scapular, but more can not be said.

The peculiar character of the internomedian area in *Mylacris* has already been mentioned. All that can be further said of the hind wing in this genus is that the externomedian vein (excepting that the branches are superior and not inferior) appears to be a repetition of the same area in the fore wing and to bear a similar relation to the internomedian area.

In *Paromylacris* the scapular and externomedian areas appear to be extremely similar to their condition in *Etoblattina*, the division line between them also falling at just about the pointed apex of the wing, which, so far as can be seen, has a similar form.

Probably the same is also true of *Promylacris*, though this is entirely uncertain from the slight fragment of the apex which is preserved, for, on the contrary, it may be entirely similar to the wings figured on Pl. XII, fig. 5.

¹ Bull. U. S. Geol. Surv., No. 101, pl. 2, Fig. k.

IV. POSSIBLE MIMICRY IN PALEOZOIC COCKROACHES.

Before finishing these introductory remarks I wish to draw attention to a topic unusual in such a connection. In studying protective resemblance and mimicry among living animals, the exceedingly common occurrence of these phenomena has often forced upon me the conclusion that they have not been limited in their scope to recent times, but must have existed in past epochs and even, to some extent at least, in very remote epochs. This is a natural conclusion from the universality of their present occurrence. Hardly an animal exists that does not actually owe its existence to some feature or features in its form or coloring. This statement will doubtless appear strong to those who are unacquainted with or have not considered the facts. Let me reenforce it in the words of its latest exponent, M. Félix Plateau, the well-known professor in the University of Gand:

The thesis I wish to sustain, in agreement with naturalists of high merit, would demonstrate that the phenomena [of mimicry] are general; that is to say, that there are hardly any animals which, in at least some one of the stages of their existence, do not have recourse to imitation; that in our own countries, in temperate Europe, in Belgium itself, the zoologist who is really an observer meets at every step cases of dissimulation which are every whit as striking as [ne le cédent en rien] those which tropical nature offers us.¹

The arguments I have used in my own essay on the subject² attempt to show that in the very nature of things protective resemblance must prevail in a world where creatures are the food of others, and where they escape destruction only when less easily or less frequently seen by their predaceous foes than their fellows. From this standpoint it would be difficult to refrain from the logical conclusion that protective resemblance was nearly or quite as much a feature of past life as it is of present.

Naturally, since coloring forms the most important or the most common part of protection, proof of such protection can not be derived from the fossils. But pattern of markings is also a conspicuous element of protection in existing types, and in a few fossils among insects we can detect markings of a precisely similar nature to some which in existing insects can be proved protective; but here habit and association are often necessary factors, and these can usually only be inferred in the extinct types, but inferred in some instances with considerable reasonableness. The examples which I have in mind are all drawn from Tertiary faunas; but I refer to the matter here since it seems to me fairly reasonable to look upon some forms of Carboniferous cockroaches as probably imitative and thereby protective. The first cockroach wing ever described was first described as a fern leaf, and in all or nearly all the localities where their remains have been found they are associated with fern-leaves in immense abundance. While searching for

¹ Bull. Acad. Roy. Belg. (3), XXIII, 92 [1892].

² Atlantic Monthly, Feb., 1889; Butt. east. U. S. and Canada, 710-720.

their remains in the Permian deposits at Cassville I was much struck by this resemblance and was repeatedly obliged to use the glass to determine whether it was the wing of a cockroach or the frond of a fern I had uncovered, and the instances are not rare where they agree completely in size. The general distribution of the nervures is to cursory view the same in each, and the form is often nearly identical. Only the differentiation of the anal area in the cockroach wing at once distin-



FIG 1.—*Gerablattina permanenta*.

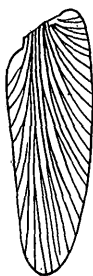


FIG. 2.—One of the pinnae of *Neuropteris odonopteroides*.

guishes them, but this is really a feeble point and would often be noticed only by an expert. To show how close the general resemblance is I place here side by side figures of a cockroach wing and a fern frond found associated in the same beds¹ and ask whether it is not plausible to suppose that the intimacy of the resemblance is due, as such an instance of associated organisms would now be regarded if the color agreed, to the action of selection in producing protective resemblance. The ordinary color of the tegmina of existing cockroaches is brown or testaceous, yet there are not wanting numer-

ous examples, at least in the tropics, where they are as green as the leaves of ordinary vegetation.

V. THE EUROPEAN SPECIES OF ETOBLATTINA, WITH DESCRIPTION OF A NEW FORM.

For the convenience of students a first essay is here made to tabulate the European species of Etoblattina, the genus of cockroaches most numerous represented in Carboniferous times, both in Europe and America. All the species described up to the present time are introduced, together with a new British species, a description of which is added. It will be seen that Deichmüller's var. *stelzneri* (regarded by him as a form of *E. flabellata*), and Geinitz's var. *dyadica* (regarded by him as another form of the same), are considered distinct species; and that *E. rollei* Deichm. is not included, this last being more probably a Gerablattina. *E. peachii* Woodw. is also omitted, as the tegmina are undeveloped, and therefore present no features which could admit it into the table. On the other hand, *Blattina intermedia* Gold., formerly described by me as a Gerablattina, has had new light thrown upon it by Kliver, showing it to be an Etoblattina, and it is accordingly introduced here.

¹Specimens showing far closer resemblance could easily be selected, but the time at my disposal when the illustration was needed did not admit of a better choice. The plant is from the roof shales of the Waynesburg coal, above the "roof coal" at Cassville and is copied from one of the figures in Fontaine and White's Permian Flora (Rep. Penn. Geol. Surv., PP). The insect comes from the shales which separate the "roof coal" from the main coal beneath, at the same locality.

Table of the European species of Etblattina.

- a*¹. Tegmina broad, at most but little more than twice as long as broad, the mediastinal area usually broad at base, here generally occupying a third or more of the tegmina.
- b*¹. Mediastinal area tapering gradually, and relatively long, more, often much more, than four times as long as greatest breadth.
- c*¹. Relatively slender, the tegmina distinctly more than twice as long as broad.
- d*¹. Apical margin divided between the scapular and externomedian areas.
- d*². Apical margin divided between the externomedian and internomedian areas 1. *E. labachensis*.
- c*². Tegmina broad, not more than twice as long as broad, the immediate apex occupied by the externomedian branches.
- d*¹. Tegmina less than twice as long as broad; mediastinal area reaching nearly to the middle of the distal half of the tegmina; externomedian vein first forking not before the middle of the tegmina 2. *E. intermedia*.
- d*². Tegmina twice as long as broad; mediastinal area hardly extending beyond the middle of the tegmina; externomedian vein first branching far before the middle of the tegmina 3. *E. propria*.
- b*². Mediastinal area tapering rapidly and relatively short, less, often much less, than four times as long as basal breadth.
- c*¹. Internomedian area long and numerously branched, falling but little short of the apex of the tegmina.
- d*¹. Humeral angle prominent, the tegmina less than twice as long as broad.
- d*². Humeral angle roundly excised, the tegmina more than twice as long as broad 4. *E. deichmülleri*.
- c*². Internomedian area relatively short and with few branches, falling far short of the apex of the tegmina.
- d*¹. Mediastinal vein with frequent branches; scapular branches few, mostly forked deeply or compound 5. *E. steinbachensis*.
- d*². Mediastinal vein with infrequent branches; scapular branches numerous, mostly simple or only apically forked 6. *E. primavera*.
- a*². Tegmina relatively slender, rarely less than two and a half times as long as broad, the mediastinal area usually rather slender and ribbon-shaped, not or scarcely broader at base than in the middle, and rarely occupying more than a fourth of the basal width of the tegmina.
- b*¹. Tegmina distinctly less than three times as long as broad.
- c*¹. Internomedian area long but far from attaining the apex of the tegmina, rarely prolonged by distinct sinuosity of the main vein.¹
- d*¹. Mediastinal area extending well beyond the middle of the tegmina.
- e*¹. Externomedian vein first branching beyond the middle of the tegmina.
- e*². Externomedian vein first branching far before the middle of the tegmina.
- f*¹. Tegmina of large or medium size, well rounded at apex; externomedian area expanded and on the margin as important as the scapular.
- g*¹. First scapular branch arising far before the succeeding, near the middle of the basal half of the tegmina; internomedian vein scarcely sinuate 7. *E. deanensis*.
- e*². Externomedian vein first branching far before the middle of the tegmina.
- f*¹. Tegmina of large or medium size, well rounded at apex; externomedian area expanded and on the margin as important as the scapular.
- g*¹. First scapular branch arising far before the succeeding, near the middle of the basal half of the tegmina; internomedian vein scarcely sinuate 8. *E. lanceolata*.
- e*². Externomedian vein first branching far before the middle of the tegmina.
- f*¹. Tegmina of large or medium size, well rounded at apex; externomedian area expanded and on the margin as important as the scapular.
- g*¹. First scapular branch arising far before the succeeding, near the middle of the basal half of the tegmina; internomedian vein scarcely sinuate 9. *E. carbonaria*.
- e*². Externomedian vein first branching far before the middle of the tegmina.
- f*¹. Tegmina of large or medium size, well rounded at apex; externomedian area expanded and on the margin as important as the scapular.
- g*¹. First scapular branch arising far before the succeeding, near the middle of the basal half of the tegmina; internomedian vein scarcely sinuate 10. *E. russoma*.

¹ This is only conjectural in *E. mantidioides*, but indicated by the parts preserved.

Table of the European species of Etoblattina—Continued.

- g². First scapular branch arising but little before the middle of the tegmina and at ordinary distance before the succeeding; internomedian vein strongly sinuate 11. *E. dyadica*.
- f². Tegmina of small size, subacuminate at apex; externomedian area compressed and on margin of much less importance than the scapular 12. *E. parvula*.
- d². Mediastinal area scarcely if at all surpassing the middle of the tegmina.¹
- e¹. Scapular and externomedian veins first branching at nearly the same point.²
- f¹. Primary offshoots of the externomedian vein numerous.
- g¹. Course of the externo-internomedian interspace gently oblique, arcuate 13. *E. manebachensis*.
- g². Course of the externo-internomedian interspace strongly oblique, sinuous 14. *E. ornatissima*.
- f². Primary offshoots of the externomedian vein only two or three in number 15. *E. anthracophila*.
- e². First branching of the externomedian vein far beyond that of the scapular 16. *E. mantidioides*.
- c². Internomedian area very long, nearly reaching the apex, or reaching the apical margin, often prolonged by distinct sinuosity of the main vein.
- d¹. Mediastinal area extending well beyond the middle of the tegmina.
- e¹. Scapular vein first branching far beyond the middle of the tegmina. 17. *E. johnsoni*.
- e². Scapular vein first branching before, often far before, the middle of the tegmina.
- f¹. All the internomedian branches simple or simply forked.
- g¹. Scapular vein first branching at some distance before the externomedian 18. *E. doleruii*.
- g². Scapular vein first branching but little before the externomedian.
- h¹. Mediastinal and scapular branches with normal obliquity; internomedian branches frequent, with normal obliquity. 19. *E. didyma*.
- h². Mediastinal and scapular branches very longitudinally oblique; internomedian branches exceedingly few and longitudinally oblique 20. *E. bituminosa*.
- f². Some apical branches of the internomedian vein compound. 21. *E. anaglyptica*.
- d². Mediastinal area hardly reaching the middle of the tegmina.
- e¹. Scapular vein in the middle of its course receding from the margin to reach the middle line of the tegmina 22. *E. leptophlebica*.
- e². Scapular vein in the middle of its course hardly receding from the margin and nowhere nearly reaching the middle line of the tegmina 23. *E. flabellata*.
- b². Tegmina distinctly more than three times as long as broad; internomedian area long and slender.
- c¹. Internomedian area not nearly reaching the apex of the tegmina, with no extension by the distal sinuosity of the main vein.
- d¹. Tegmina less than 20 mm. long; course of the main scapular vein distinctly sinuous, and at one point nearly reaching the middle line of the tegmina 24. *E. affinis*.

¹ This is conjectural but probable in *E. ornatissima* by the brief extent of the scapular area.² Conjectural again, but probable, with *E. ornatissima*.

Table of the European species of Ectoblattina—Continued.

- d². Tegmina more than 30 mm. long; course of the main scapular vein nearly or quite straight, at no point nearly attaining the middle line of the tegmina.
- e¹. Tegmina subequal on distal half (apparently; the only specimen is broken), the externomedian vein with regular offshoots from the middle of the tegmina outward..... 25. *E. euglyptica*.
- e². Tegmina tapering considerably throughout the distal half, the externomedian branches all arising close to the apex from two stems which unite at or before the middle of the tegmina.... 26. *E. elongata*.
- c². Internomedian area nearly reaching the apex of the tegmina by the distal sinuosity of the main vein.
- d¹. Externomedian vein first forking well before the middle of the tegmina, with many branches; distal portion of anal area with numerous branches..... 27. *E. stelzneri*.
- d². Externomedian vein first forking at some distance beyond the middle of the tegmina, with few branches; distal portion of anal area with few branches 28. *E. weissigensis*.

ETOBLATTINA DEANENSIS sp. nov.

Pl. XII, figs. 1, 3.

The fore wing has a very regular elongate oval form, tapering with considerable regularity beyond the middle third of the tegmina, the anal area by its fullness interfering a little with the regularity; it is a little more than two and a quarter times as long as broad; the costal margin has a very regular and moderately convex curve, while the inner margin, beyond the fuller and more convex anal area, is nearly straight; the tip is imperfect in the two specimens known. The veins originate slightly above the middle of the tegmina and at first all curve upward, but not so strongly as in *E. primæva*, to which this species is most nearly allied, so that the externomedian vein passes more nearly through the middle of the tegmina. The mediastinal vein passes in a scarcely sinuous course to somewhat beyond the middle of the front margin, emitting about half a dozen nearly straight, simple or deeply forked branches. The scapular vein is broadly and gently sinuous, extending to the apical margin a very little above the apex, begins to fork before the middle of the proximal half of the tegmina, and has four subequidistant branches, of which the first is compound, the others forked or simple. The externomedian vein first forks near the middle of the tegmina, where it divides into two very similar, weakly arborescent, longitudinal stems carrying about ten or a dozen veinlets to the apical and to the outer portion of the inner margin. The internomedian vein is very regularly and rather gently arcuate except for a slight apical sinuosity which carries it nearly to the apical sixth of the tegmina, and has about five nearly straight branches, some of the basal ones simply or doubly forked. The anal furrow is not very deeply impressed, very regularly but not very strongly arcuate, and ends at about the middle of the

tegmina. The anal veins consist of two sets, rather widely separated at the base, the inner set consisting of a several-branched main stem sub-parallel to the anal furrow, the outer to four or five simply or doubly forked, approximated, slightly divergent nervules, more nearly longitudinal than the other set.

The two specimens known, one with its reverse, are coal black; the one with its reverse is nearly perfect, having lost only the shoulder and the apical margin; the other specimen consists of two tegmina, of one of which only the base and the anal area is preserved and which lies partially concealing the reversed face of the other, of which the basal portion and considerable of the apex is lost. Excepting in the anal and internommedian areas the veins are pronounced, being deeply incised; in the internommedian area they are very delicate. Toward the apex of the tegmina an exceedingly delicate reticulation can be detected in the interspaces, which gives way in the center of the tegmina to a very close series of dulled cross-lines, and become in the scapular area parallel to the nearer margin.

Length of the tegmina, 38 mm.; breadth, 13.25 mm.

The two specimens differ from each other in hardly anything but the simplicity or complexity of the several branches of the main veins, particularly in the upper stem of the externommedian vein and the principal branches of the internommedian vein. In one, however, the costal margin appears to be distinctly more arcuate than in the other.

The species is plainly most nearly allied to *E. primæva*, from which it differs in its more elongate form, apical tapering, the lack of an extreme basal branch of the scapular vein, the far greater importance though later branching of the externommedian vein, the narrower and shorter internommedian area and its simpler apical branching, the more regular curve of the anal furrow, the entire system of anal veins, and the lower course of all the main veins through the middle area of the tegmina.

The specimen with reverse, fig. 1, comes from Foxe's bridge, in the Forest of Dean, Gloucester, England. The other was collected by F. Stock at Crump meadow, in the Forest of Dean. Both are in the collection of Mr. R. D. Lacoe, in which they bear the number 2132 a-b, c.

VI. A LIST OF THE DESCRIBED EUROPEAN PALEOZOIC COCKROACHES.

The species in this list are arranged alphabetically under each genus, but the genera are in a natural order. Several species, because too imperfectly known, are not mentioned, as they can not be placed. Such are *Blattina ligniperda* Kušta, from Lubná, Bohemia; *B. neuropteroides* Göpp. and *B. rarineris* Göpp., from an unnamed locality; *B. tischbeini* Gold., from Hirschbach, Germany, and *B. venosa* Gold., from Wenmetsweiler, Rhenish Prussia. *Etoblattina peachii* Woodw., from Kilmaurs, Scotland, is also omitted, as the undeveloped tegmina hardly allow it to be definitely placed.

A list of the described European Paleozoic cockroaches.

- Etoblattina** *affinis* (Gold.), Löbejün and Wettin, Saxony.
anaglyptica (Germ.), Wettin, Saxony.
bituminosa (Kušta)¹, Lubná, Bohemia.
carbonaria (Germ.), Wettin, Saxony.
deanensis Scudd., Forest of Dean, Gloucester, England.
deichmülleri (Gein.)², Weissig, Saxony.
didyma (Germ.), Wettin, Saxony; Manebach, Saxe-Weimar.
dohrnii Scudd., Wettin, Saxony.
dyadica (Gein.)³, Weissig, Saxony.
elongata (Gein.), Weissig, Saxony.
euglyptica (Germ.), Wettin, Saxony.
flabellata (Germ.), Wettin and Weissig, Saxony.
intermedia (Gold.), Wemmetsweiler, Rhenish Prussia.
johnsoni Woodw., Dudley, England.
labachensis (Gold.), Labach, Rhenish Prussia.
lanceolata (Sterz.), Lugau, Saxony.
leptophlebica (Gold.), Löbejün, Saxony.
manebachensis (Gold.), Manebach, Saxe-Weimar.
mantidioides (Gold.), Durham, England.
ornatissima Deichm., Grügelborn, Rhenish Prussia.
parvula (Gold.), Löbejün, Saxony.
primæva (Gold.), Saarbrücken, Rhenish Prussia.
propria Kliver, Saarbrücken, Rhenish Prussia.
russoma (Gold.), Löbejün, Saxony.
steinbachensis Kliv., Steinbachthal, Rhenish Prussia.
stelzneri (Deichm.)⁴, Weissig, Saxony.
weissigensis (Gein.), Weissig, Saxony.
- Gerablattina** *clathrata* (Heer), Manebach, Saxe-Weimar.
geinitzi (Gold.), Löbejün, Saxony.
germari (Gieb.), Wettin, Saxony.
goldenbergi (Mahr), Manebach, Saxe-Weimar.
mahri (Gold.), Manebach, Saxe-Weimar.
münsteri Scudd., Wettin, Saxony.
producta Scudd., Wettin, Saxony.
robusta Kliv., Wemmetsweiler, Rhenish Prussia.
rollei (Deichm.)⁵, Grügelborn, Rhenish Prussia.
scaberata (Gold.), Altenwald, Rhenish Prussia.
weissiana (Gold.), Brücken, Rhenish Bavaria.
- Anthracoblattina** *camerata* Kliv., Dudweiler, Rhenish Prussia.
dresdensis (Gein.-Deichm.), Klein Opitz, Saxony.
incerta Kliv., Dudweiler, Rhenish Prussia.
lubnensis (Kušta)⁶, Lubná, Bohemia.
porrecta (Gein.), Weissig, Saxony.
remigii (Dohrn), Cusel, Rhenish Bavaria.
rückerti (Gold.), Stockheim, Bavaria.
scudderi Gold., Wemmetsweiler, Rhenish Prussia.
sopita Scudd., Weissig, Saxony.
spectabilis (Gold.), Weissig? and Löbejün, Saxony.
wagneri Kliv., Löbejün, Saxony.
winteriana (Gold.), Dudweiler, Rhenish Prussia.

¹ *Blattina* (*Etoblattina*) *bituminosa* Kušta.² *Blattina* (*Etoblattina*) *carbonaria*, var. *deichmülleri* Gein.³ *Blattina* (*Etoblattina*) *flabellata*, var. *dyadica* Gein.⁴ *Etoblattina flabellata*, var. *stelzneri* Deichm.⁵ *Etoblattina rollei* Deichm.⁶ *Blattina* (*Anthracoblattina*) *lubnensis*, Kušta.

A list of the described Paleozoic cockroaches—Continued.

- Hermatoblattina kirkbyi* (Woodw.), Fifeshire, Scotland.
lebachensis (Gold.), Lebach, Rhenish Prussia.
wemmetsweilerensis (Gold.), Wemmetsweiler, Rhenish Prussia.
- Progonoblattina fritschii* (Heer), Manebach, Saxe-Weimar.
helvetica (Heer), Erbignon, Switzerland.
- Oryctoblattina arndti* Kušta, Těmošná, Bohemia.
oblonga Deichm., Weissig, Saxony.
reticulata (Germ.), Wettin, Saxony.
- Petrablattina gracilis* (Gold.), Lebach, Rhenish Prussia.
- Leptoblattina exilis* Woodw., Dudley, England.
insignis (Gold.), Dudweiler, Rhenish Prussia.

VII. THE TERMINOLOGY OF THE NEURATION.

In explanation of the terminology here used for the neuration of the tegmina and wings of Paleozoic cockroaches, and in which I have simply followed Heer, the accompanying figure of one of the tegmina of

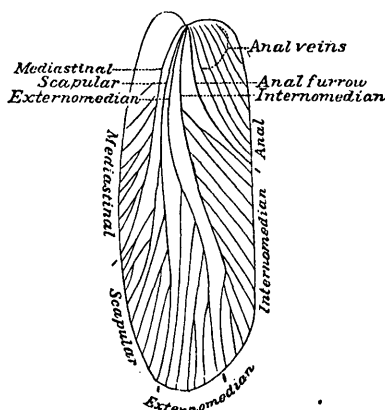


FIG. 3.—*Etoblattina mazona*, with the nomenclature of the parts.

Etoblattina mazona from the Carboniferous beds of Illinois is introduced, enlarged two diameters, with the veins at the base of the tegmina named, and the areas marked along the margin. These names are employed in all the descriptions.

TABLE OF THE GENERA OF AMERICAN FOSSIL COCKROACHES.

This table is also applicable to the European genera, for one Paleozoic genus not yet found in America is included in it, distinguished by an asterisk following it. *Leptoblattina*, exclusively European, is not included, as the neuration of the tegmina is too obscure to place it.

A.¹ All six of the main veins of tegmina independent (excepting sometimes in the basal fourth of the tegmina); anal veins impinging on the hind margin PALEOBLATTARIÆ.

B.¹ Branches of the mediastinal vein arranged in a radiate manner, mostly springing from a common point at the base of the tegmina; mediastinal area subtriangular, uniformly tapering apically.... MYLACRIDÆ.

Table of the genera of American fossil cockroaches—Continued.

- c¹. All or very nearly all the branches of the mediastinal vein arising close to the base of the tegmina.
- d¹. Mediastinal and scapular areas together occupying less than half the tegmina.
 - e¹. Scapular area larger than the mediastinal..... 1. *Mylacris*.
 - e². Scapular area smaller than the mediastinal..... 2. *Promylacris*.
- d². Mediastinal and scapular areas together occupying half or more than half the tegmina.
 - e¹. Tegmina narrow; externomedian area small and compressed, scarcely expanding apically..... 3. *Lithomylacris*.
 - e². Tegmina broad; externomedian area expanding apically 4. *Paromylacris*.
- c². A number of the apical branches of the mediastinal vein arising beyond the base of the tegmina, and scarcely partaking of the radiate arrangement of the others 5. *Necomylacris*.
- B². Branches of the mediastinal vein arising at regular intervals from a principal stem; mediastinal area generally band-shaped.... BLATTINARIÆ.
- c¹. Internomedian vein long, terminating beyond, rarely at, the middle of the outer half of the tegmina; scapular and externomedian areas together generally covering less than one half of the tegmina.
- d¹. Mediastinal area comparatively short, rarely exceeding, seldom equaling, two-thirds the length of the tegmina.
 - e¹. Externomedian branches inferior, so that the nervules divaricate on either side of the scapular-externomedian interspace .. 6. *Microblattina*.
 - e². Externomedian branches superior, so that the nervules divaricate on either side of the externomedian-internomedian interspace.
 - f¹. Scapular area extending beyond and embracing the extreme tip of the tegmina by the backward sweep of the main vein; externomedian area comparatively small 7. *Archimylacris*.
 - f². Scapular area not reaching tip of tegmina, the extremity of the main vein curving only upward; externomedian area comparatively large.
 - g¹. Externomedian and internomedian veins sinuous, distinctly diverging around a median stigma..... 8. *Spiloblattina*.
 - g². Externomedian and internomedian veins nearly straight, with little or no median repulsion 9. *Etoblattina*.
- d². Mediastinal area long, usually at least three-fourths the length of the tegmina, sometimes nearly reaching the tip.
 - e¹. Branches of scapular vein superior.
 - f¹. Externomedian branches superior, so that the nervules divaricate on either side of the externomedian-internomedian interspace.
 - 10. *Gerablattina*.
 - f². Externomedian branches inferior, so that the nervules divaricate on either side of the scapular-externomedian interspace.
 - 11. *Anthracoblattina*.
 - e². Branches of scapular vein inferior 12. *Hermatoblattina*.*
 - c². Internomedian vein short, terminating before the middle of the outer half of the tegmina; scapular and externomedian areas together generally covering more than half the tegmina.
 - d¹. Branches of externomedian vein inferior.
 - e¹. Principal veins closely crowded in the basal half of the tegmina; branches uniformly distributed all over the wing; scapular area terminating above the apex of the tegmina..... 13. *Progonoblattina*.

Table of the genera of American fossil cockroaches—Continued.

- e³. Principal veins widely separated in the basal half of the tegmina; branches much more closely crowded in some parts of the tegmina than in others; scapular area terminating below the apex of the tegmina..... 14. *Oryctoblattina*.
- d². Some or all of the branches of externomedian vein superior.
- e¹. Externomedian vein directed toward the distal half of inner border of tegmina; internomedian vein moderately long.. 15. *Poroblattina*.
- e². Externomedian vein directed toward and terminating at or but little beyond the middle of the inner border of tegmina; internomedian vein very short..... 16. *Petrablattina*.
- A². Two or more of the six principal veins of tegmina amalgamated through the whole or the greater part of their length; most of the anal veins impinging on the anal furrow or forming a fusiform bunch directed toward the tip of the furrow..... NEOBLATTARIÆ.
- B¹. Surface of tegmina distinctly divided into four fields, each occupied by a principal vein (Mesozoic genera).
- c¹. Tegmina diaphanous, rounded at tip, not strongly vaulted; anterior main vein sinuous, falling short of apex..... 17. *Neorthroblattina*.
- c². Tegmina coriaceous, more or less pointed at tip, strongly vaulted at base; anterior main vein straight, terminating at or below the apex.
18. *Scutinoblattina*.
- B². Surface of tegmina not distinctly divided into four fields, but either into three or the neururation greatly confused by adventitious folds (Cenozoic genera).
- c¹. Fore wings without a longitudinal fold; neururation normal.
- d¹. Internomedian branches mostly arising from a dichotomous division of two main stems 19. *Zetobora*.
- d². Internomedian branches mostly arising as simple inferior branches of two main stems 20. *Homoeogamia*.
- c². Fore wings with a longitudinal fold, interfering with the neururation.
21. *Paralatinidia*.

PALÆOBLATTARIÆ.

The geological range of this ancient type of cockroaches was formerly supposed to be limited to Paleozoic time and specifically to Carboniferous and Permian rocks; but it has since been shown that it occurs in some numbers in the Trias of Colorado, which now forms its upper limit; inferiorly it has been found scantily in the Millstone Grit, but there can be little doubt that its actual appearance on the earth was at a much earlier epoch.¹

Although our knowledge has been vastly extended within the past fifteen years and the number of known species has been multiplied nearly fourfold, principally from additions in this country, the number of genera has increased by only about two-thirds, and the number of primary groups remains the same. We are now acquainted with sixteen genera and about two hundred species, by far the larger part of which belong to one of the two principal divisions, the Blattinariæ.

¹ *Palæoblattina douvillei* Brongn., from the lower part of the Upper Silurian of Jurques, Calvados, France, regarded by Brongniart as a cockroach, appears to me from his figures to belong to the neuropteroid series, and therefore it is not considered here.

MYLACRIDÆ.

This group of Palæoblattariæ, with a single exception (*Promylacris harei*), found in the Barren Coal-measures, is confined to the true Productive Coal-measures, and, as far as definitely known, to American deposits. Brongniart, as pointed out above (p. 21), states that Mylacridæ are common in the Coal-measures of Commentry, in France, and there is no reason to doubt his statement, but the proof of it has not yet been published. Considering that they are unknown in Permian or later rocks, and seem to represent an older type than the Blattinariæ,¹ it is a little surprising that they have not as yet, like several genera of Blattinariæ, been detected in the Millstone Grit. Their known geologic range is therefore considerably more confined than that of the Blattinariæ, which extend from the Millstone Grit to the Trias. Five genera and twenty-nine species have so far been detected, with indications of others. By far the majority occur in the older true Productive Coal-measures, and below the Barren Coal-measures they are nearly as abundant in species as the Blattinariæ, though representing fewer genera.

1. Genus MYLACRIS.

Mylacris Scudd., Worth., Geol. Surv. Ill., III, 568-569.

This genus is confined, so far as known, to North America, and is the richest of the Mylacridæ in species, fourteen in number, being thus in fact nearly as rich as all the other genera of Mylacridæ combined. It has been found in four different coal basins—the Acadian, the Rhode Island, the Pennsylvania, and the Eastern Interior, in the last two of which it is richest in species. As far as known, it is mostly confined to the Lowest Productive Coal-measures, though one of the two species of the anthracite fields of Pennsylvania (near the base of the division), *M. carbonum*, is common to them and the Lower Productive Coal-measures, and affords almost the only instance where one of our Carboniferous species has been found, even in two separate localities.

Table of the species of Mylacris.

*a*¹. Mediastinal area slender, especially at base.

*b*¹. Scapular nervules longitudinal, very long, and not numerous.. 1. *M. packardii*.

*b*². Scapular nervules oblique, numerous, and not very long.... 2. *M. bretonensis*.

*a*². Mediastinal area broad, especially at base.

*b*¹. Externomedian nervules superior or apical.

*c*¹. Externomedian nervules distinctly superior.

*d*¹. Costal margin considerably arcuate on the basal third of the tegmina, so that the humeral shoulder is well rounded.

*e*¹. Tegmina almost or quite two and a half times longer than broad.

3. *M. elongata*.

*e*². Tegmina hardly if any more than twice as long as broad.

*f*¹. Mediastinal area reaching only to the end of the middle third of the tegmina; internomedian vein with numerous closely crowded branches.

4. *M. anthracophila*.

¹ See my Paleozoic Cockroaches. Mem. Bost. Soc. Nat. Hist., III, 31, 32; Foss. Ins. N. A., I, 51-51.

Table of the species of *Mylacris*—Continued.

- f*². Mediastinal area reaching well into the distal third of the tegmina; internommedian vein with few and rather distant branches. 5. *M. gurleyi*.
- d*². Costal margin very slightly arcuate on the basal third of the tegmina, so that the humeral shoulder is very pronounced.
- e*¹. Scapular area much less important than the externommedian, the tegmina rapidly narrowing in the apical half. 6. *M. ampla*.
- e*². Scapular area much more important than the externommedian, the tegmina much less rapidly narrowing apically. 7. *M. priscovolans*.
- c*². Externommedian nervules rather apical than superior.
- d*¹. Externommedian area occupying the apex of the tegmina. 8. *M. heeri*.
- d*². Externommedian area falling wholly below the middle line of the tegmina.
- e*¹. Mediastinal nervules comparatively few and distant; scapular vein forked at base. 9. *M. antiqua*.
- e*². Mediastinal nervules numerous; scapular branches all emitted from a single main branch. 10. *M. lucifuga*.
- b*¹. Externommedian nervules inferior.
- c*¹. Costal much more curved than inner margin.
- d*¹. Costal margin very strongly curved in the mediastinal area, which scarcely reaches to the middle of the tegmina. 11. *M. carbonum*.
- d*². Costal margin gently curved in the mediastinal area, which extends considerably beyond the middle of the tegmina. 12. *M. pennsylvanica*.
- c*². Costal and inner margins similarly and symmetrically curved.
- d*¹. Combined mediastinal and scapular areas as broad at the base as beyond. 13. *M. mansfieldii*.
- d*². Combined mediastinal and scapular areas much broader near the middle of the tegmina than at the base. 14. *M. ovalis*.

1. MYLACRIS PACKARDII

Pl. I, figs. 2, 3.

Mylacris packardii Scudd., Bull. U. S. Geol. Surv. No. 101, pp. 11-12, pl. 1, figs. *e. g.* (1893).

From the Lowest (?) Productive Coal-measures at Bristol, R. I.

2. MYLACRIS BRETONENSIS.

Blattina bretonensis Scudd., Can. Nat., VII, 271-272, fig. 1 (1874).

Mylacris bretonensis Scudd., Mem. Bost. Soc. Nat. Hist., III, 41-42, 300, pl. 5, fig. 1 (1879); Foss. Ins. N. A., I, 61-62, 264, pl. 5, fig. 1 (1890).

From the Productive Coal-measures of Sydney, Cape Breton.

3. MYLACRIS ELONGATA sp. nov.

Pl. I, fig. 6.

The tegmina are unusually slender for a *Mylacris*, the specimen at hand, though incomplete at both extremities, being certainly two and a half times longer than broad; it is subequal in width on the basal half, but on the apical half narrows somewhat rapidly by the stronger arcuation of the costal margin, the inner margin being almost straight except at the extreme base and perhaps the tip; the extreme apex is

broken. The veins originate below the middle of the base and curve somewhat strongly upward before assuming their final direction, which for most of them is subparallel to the outer margin obliquely inward toward the tip. The mediastinal area is rather narrow for a *Mylacris*, and more than usually elongated, tapering more gradually than usual, and reaching almost or quite to the end of the middle third of the wing; most of the nervules are simple throughout. The main scapular vein begins to branch by or before the middle of the basal half of the wing, and while branching is almost exactly straight and subparallel to the outer margin, coursing through the middle of the wing, but just before emitting its last branch it is gently arcuate and assumes a course parallel to the inner margin; it sends off six branches parallel to the mediastinal branches, all simple except one, which is very deeply forked. The externomedian vein runs parallel to the scapular until it branches just before the middle of the wing, and then bends slightly downward and terminates on the inner margin, throwing off four principal nervules, the first of which is doubly forked. The internomedian vein is gently sinuate and parallel to the externomedian throughout its course, terminating on the inner margin shortly before the tip; its branches are mostly simple, but may be doubly forked, and are strongly oblique and arcuate, with their convexities toward the tip of the anal furrow. Anal area reaching nearly to the middle of the wing, strongly tumid; the anal furrow strongly arcuate but nearly straight in its apical third; the anal veins consist of two sets, one occupying almost the entire half of that portion lying next the anal furrow, consisting of a main vein with two branches, one of them forked, all with a gentle arcuation in the same sense as the anal furrow; the other consisting of a crowd¹ of parallel, strongly oblique, and simple or simply forked veins gently oblique in a sense opposite to that of the anal furrow, and occupying the inner basal half.

Length of fragment, 34 mm.; probable length of tegmina, 36 mm.; width, 15 mm.

This clearly marked species resembles most closely *M. anthracophila* from the same beds. The general relation of all the principal veins is almost precisely the same, but it is distinctly separated from that species by its form, which is much more slender than in *M. anthracophila* and thus gives to the mediastinal area in particular quite a different form.

A single specimen and its reverse were found in the Lowest Productive Coal-measures at Mazon Creek by Mr. J. C. Carr, and are now in the collection of Mr. R. D. Lacoe, of Pittston, Pa., and bear in his collection the number 2014 a-b.

¹Only a few of them have been represented by the artist; they occupy the entire inner basal portion of the area.

4. MYLACRIS ANTHRACOPHILA.

Pl. 1, figs. 1, 4.

Mylacris anthracophila Scudd., Worth., Geol. Surv. Ill., III, 568-570, figs. 5, 6 (1868); Mem. Bost. Soc. Nat. Hist., III, 45-47, pl. 5, figs. 6-8 (1879); Foss. Ins. N. A., I, 65-67, 271, pl. 5, figs. 6-8 (1890).

From the Lowest Productive Coal-measures at Colchester, Ill.

5. MYLACRIS GURLEYI sp. nov.

Pl. I, fig. 5.

The single specimen preserved in a nodule represents two tegmina and a portion of one of the under wings in a nearly natural position, but as if embracing a solid substance next the under surface, so as to present a strongly convex appearance, the cross section forming indeed almost exactly a semicircle, as seen in the line above indicating it. Neither of the tegmina is preserved entire, the tip of both, but no great portion, being lost, showing that the form of the tegmina was subtriangular, very broad at base but tapering rapidly and equably beyond to an apparently narrowly rounded apex, the form thus not differing in any essential respect from that of *M. anthracophila*. The whole wing is slightly more than twice as long as broad. The mediastinal area varies in the two wings, in the right terminating just at the end of the fragment at about the middle of the apical fourth of the wing, but in the left wing at the beginning of the apical fourth; the area is filled with a large number of simple or forked, usually apically forked, more or less arcuate, slightly diverging branches, subequidistant throughout the entire area. The scapular vein runs nearly parallel to the costal margin, but is much straighter than it, and terminates on the right at the extreme apex of the wing, on the left wing at a slight distance before it; on the right wing it does not branch until beyond the apical third, and in fact has but a single branch, which is deeply forked, the three veins running in an almost straight longitudinal course to the upper apex of the wing; in the left wing, however, it has four simple or rather deeply forked branches, the vein beginning to branch near the extreme base of the wing, and the branches thrown off at equal distances along the vein; on the right wing, therefore, the interspace between the scapular and the externomedian vein runs almost exactly through the middle of the wing; it does so also on the left wing through the basal half of the same, but thereafter curves very slightly upward so as to terminate, as before remarked, above the tip. The externomedian vein is similarly different in the two wings; on the right wing it has an arcuate course and terminates on the inner margin at a considerable distance short of the end of the mediastinal area, and emits but three straight, longitudinal branches, the first beyond the middle of the wing; on the left wing it is much straighter and terminates on

the inner margin a long distance beyond the apex of the mediastinal area, and has but two branches, the first of which, arising but shortly beyond the basal third of the wing, is compound, while the second arises at the beginning of the apical third of the wing, the area occupying the apex of the wing, more, however, upon its inner than its costal side. The internomedian vein runs exactly parallel to the externomedian and is therefore more curved on the right than on the left wing, and has three or four simple or deeply-forked branches which arise at equal distances on the left wing but at very unequal distances on the right. The anal furrow is deeply impressed, but its apical portion is lost in both wings; it appears, however, to terminate beyond the basal third of the wing and to be strongly arcuate at the base, beyond nearly straight; the anal area is filled with a number of mostly simple branches, but on the right wing many of them originate at equal distances apart from the vein which runs subparallel and next to the anal furrow, while on the left wing it is one of the middle veins which is compound.

A broken portion of one of the hind wings is preserved, that of the right side, which seems to show that the externomedian and internomedian veins were somewhat similar to those of the fore wing, but that they had a straight, longitudinal course instead of being strongly arcuate, as in the fore wing, and the internomedian branches arise at equal distances apart.

This insect appears at first sight to show a greater difference between the neurulation of the two fore wings than any other species which has yet been described, but in reality the difference is almost entirely made up by the greater extent of the mediastinal area on the right wing and the consequent pushing of all the succeeding areas farther along to the final reduction of the internomedian area. It, and especially the left wing, resembles very closely *M. anthracophila* from the same region, but differs from it markedly in the much slighter importance of the externomedian vein, although the space occupied upon the margin by this area is scarcely less. Nevertheless, on account of the difference in venation of the two wings, I had a brief hesitation to recognize it as distinct from *M. anthracophila*, but until further remains are obtained it seems wiser so to regard it. Indeed, the range of variation in the species of ancient cockroaches is a question which, even with our present greatly extended knowledge of them, it is difficult to decide, and we must still await a larger amount of material before we can come to any safe conclusion.

Length of longest fragment of tegmina, 25 mm.; probable length of tegmina, 27 mm.; breadth, 13 mm.

A single specimen from the Lowest Productive Coal-measures at Mazon Creek, Illinois, showing obverse and reverse, was obtained by Mr. W. F. E. Gurley.

6. MYLACRIS AMPLA sp. nov.

Pl. II, fig. 1.

Two well-preserved tegmina lying nearly in place, but a little separated from each other by crushing; represent this species, besides which a few segments of the abdomen are perceptible. The tegmina are unusually broad and are pretty well preserved, only the apical portion of one and the apical outer marginal portion of the other being lost at the edge of the stone. The humeral shoulder is particularly well marked, almost exactly rectangulate, with the extreme angle rounded, while the outer margin, at least in its basal half, is gently emarginate and slightly recurved. The wing is somewhat less than twice as long as broad, with the inner margin apparently nearly straight, perhaps very gently convex; the outer margin gently convex in the basal half, rather strongly convex on the apical half, so that the wing narrows rapidly behind; the form of the tip, however, can not be determined. The main veins originate at about the middle of the base of the wing, and are gently arcuate or sinuate throughout most of their course. The relative importance of the different areas appears to vary distinctly in the two wings, and the mediastinal area is of grand importance, partly on account of its great lateral expanse at the base, partly from its long extension along the outer margin, for, on the complete right wing, where it appears to be more highly developed, it extends to beyond the middle of the apical half of the outer margin and is filled with radiating veins, many of them forked and apparently formed mainly of two clusters, an outer and basal, in which the forks originate near the middle of their course, and an inner, where they are variable. The mediastinal vein takes a sinuate course, and with the externomedian appears to be more variable than any of the others; together they occupy the apex of the wing, and apparently, to judge from one wing, may unite near the middle of the basal half of the wing and form one basal stem, or they may be entirely independent, one of the other, as in the opposite wing. In the former case, as is seen in the right wing in the drawing on the plate, the scapular vein is of small importance, having but three branches, one of them once forked near the tip and terminating somewhat before the tip of the wing, while the externomedian vein occupies the entire tip of the wing, terminating on the inner border opposite the extremity of the mediastinal area and filling the space with three or four compound or forked branches. On the left wing, however, the scapular vein is of decidedly greater importance, having at least four branches, the first of them compound, and it must terminate much nearer the apex of the wing (here broken) than can be the case upon the opposite side; while the externomedian, entirely independent from its very origin, divides into two branches at no great distance before the middle of the wing, each of which branches, and especially the lower, is compound; having a general effect similar to that of the same vein on the opposite

wing, but with more crowded neuration. The internomedian vein is obscure upon the right wing but clearly marked upon the left; its termination, however, is plainly similar in both; on the left wing it is seen to have four principal branches, of which the second, at least, is forked, while the other appears to be simple; its course is gently sinuate, having beyond its arcuation in the basal half a distinctly more longitudinal trend. The anal furrow is rather strongly and pretty uniformly arcuate and terminates very shortly before the middle of the wing; the anal area, which is rather strongly vaulted, is filled with a series of eight or ten veins, gently arcuate in the same sense as the furrow and either simple or united to one another close to their base. Little more can be said of the abdominal segments than that they are rather short and broad and appear to be perfectly smooth, showing no structure whatever.

Length of the longest fragment of the tegmina, 30 mm.; probable length of tegmina, 33 mm.; breadth, 17 to 18 mm.; breadth of the two tegmina as they lie upon the stone, 35 mm.; length of abdominal segments, 2 mm.

This species is more nearly related to *M. priscovolans* than to any other, but is remarkable for its extreme breadth, being much broader in proportion to its length than even in that species, but showing a somewhat similar length of the mediastinal area and distribution of the branches of the nervules therein. It differs in the much earlier origin of the branching of the externomedian vein and in general resembles *M. priscovolans* more by its left wing than by its right. The branch of the anal area is very different, as also the form of the wing.

The single specimen and its reverse, remarkably well preserved as to texture and of a fusco-castaneous color, are embedded in a nodule from the Lowest Productive Coal-measures, at Mazon Creek, Illinois, in the collection of Mr. R. D. Lacoe, where they bear the number 2021 *a-b*.

7. MYLACRIS PRISCOVOLANS.

Mylacris priscovolans Scudd., Mem. Bost. Soc. Nat. Hist., III, 307-308, pl. 27, fig. 9 (1884); Foss. Ins. N. A., I, 271-272, pl. 13, fig. 9 (1890).

From the bituminous coal shale of the Lowest Productive Coal-measures of Cannelton, Pa.

8. MYLACRIS HEERI.

Blattina heeri Scudd., Can. Nat., VII, 272, fig. 2 (1874).

Mylacris heeri Scudd., Mem. Bost. Soc. Nat. Hist., III, 43-44, pl. 5, fig. 11 (1879); Foss. Ins. N. A., I, 63-64, 264, pl. 5, fig. 11 (1890).

Productive Coal-measures of Sydney, Cape Breton.

9. MYLACRIS ANTIQUA.

Pl. II, figs. 5, 6.

Mylacris antiqua Scudd., Mem. Bost. Soc. Nat. Hist., III, 300-301 (1884); Foss. Ins. N. A., I, 264-265 (1890).

From the Lowest Productive Coal-measures at Mazon Creek, Illinois.

10. MYLACRIS LUCIFUGA.

Mylacris lucifuga Scudd., Mem. Bost. Soc. Nat. Hist., III, 301-302, pl. 27, fig. 8 (1884); Foss. Ins. N. A., I, 265-266, pl. 13, fig. 8 (1890).

From the roof shales of the E seam of coal at the Port Griffith switchback, near Pittston, Pa.

11. MYLACRIS CARBONUM.

Mylacris carbonum Scudd., Mem. Bost. Soc. Nat. Hist., III, 304-307, pl. 27, figs. 6, 7, 10 (1884); Foss. Ins. N. A., I, 268-271, pl. 13, figs. 6, 7, 10 (1890).

This is the only species of Paleozoic cockroach (with the possible exception of *Etolblattina balteata*) yet found in America at two distinct horizons, one of them being in the bituminous coal shale of the Lowest Productive Coal-measures of Pennsylvania, at Cannelton, the other in the higher series at the horizon of the E vein in the Empire mine at Wilkesbarre, in the same State. Some differences appear in the specimens from the two localities, and it is possible that when complete specimens are found it may be necessary to separate the older and younger forms.

12. MYLACRIS PENNSYLVANICA.

Mylacris pennsylvanica Scudd., Mem. Bost. Soc. Nat. Hist., III, 44-45, pl. 5, figs. 13, 14 (1879); *ibid.*, III, 302-304, pl. 27, fig. 11 (1884); Foss. Ins. N. A., I, 64-65, 266-268, pl. 5, figs. 13, 14, pl. 13, fig. 11 (1890).

From the bituminous coal shales of the Lowest Productive Coal-measures at Cannelton, Pa.

13. MYLACRIS MANSFIELDI.

Mylacris mansfieldi Scudd., Mem. Bost. Soc. Nat. Hist., III, 47, pl. 5, fig. 15 (1879); *ibid.*, IV, 377-378 (1890); Foss. Ins. N. A., I, 67, 272, 401-402, pl. 5, fig. 15 (1890).

From the same as the preceding.

14. MYLACRIS OVALIS.

Mylacris ovalis Scudd., Mem. Bost. Soc. Nat. Hist., III, 308-309, pl. 27, fig. 5 (1884); Foss. Ins. N. A., I, 272-273, pl. 13, fig. 5 (1890).

From the same as the last two.

2. Genus PROMYLACRIS.

Promylacris Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 34 (1885).

This genus, of which four species are known, has apparently a wider range than any of the other genera of Mylacridæ, having been found not only in the Lowest Productive Coal-measures in the Eastern Interior basin, where three species occur, but also, in a single instance, in the Barren Coal-measures of the Western Interior basin.

Table of the species of Promylacris.

- a*¹. Prothorax distinctly twice as broad as long. Scapular vein much more important than the externomedian.
*b*¹. Most of the scapular branches arising at regular intervals from the main stem. 1. *P. harei*.
*b*². About half the scapular branches clustered as offshoots of its basal branch. 2. *P. testudo*.
*a*². Prothorax distinctly less than twice as broad as long. Scapular vein not more important than the externomedian.
*b*¹. Prothorax more than half as broad again as long. Scapular vein far less important than the externomedian; anal veins simple..... 3. *P. ovalis*.
*b*². Prothorax less than half as broad again as long. Scapular vein not far less important than the externomedian; anal veins mostly forked..... 4. *P. rigida*.

1. *PROMYLACRIS HAREI* sp. nov.

Pl. II, fig. 3.

A single fore wing from which the anal area is lost and in which the details of the internomedian area are also lost; it is of a regular oval form, except for the straightness of the inner margin, the costal margin being strongly arcuate throughout and the tip broadly rounded; the whole wing is slightly more than twice as long as broad. The mediastinal area terminates at the middle of the costal margin and is filled at least in its outer two-thirds with radiating, straight, forked, rather closely crowded branches, of which some eight or ten reach the margin at equal distances apart. The scapular vein is strongly sinuous and in the basal half of the wing subparallel to the costal margin, terminating just above the extreme apex of the wing; it has half a dozen subequidistant branches, most of them deeply, sometimes doubly forked, the first arising far toward the base and not diverging from the main stem for some distance and then separating into three branches, the outermost apically forked; these branches are nearly straight, less crowded than those of the mediastinal area, oblique, the apical ones longitudinal. The externomedian vein runs parallel to the scapular and does not branch until beyond the middle of the wing, when it throws off three longitudinal branches to the outer margin, the uppermost deeply forked. The course of the internomedian vein and its branches can not certainly be determined, but it terminates shortly before the apex of the wing and has on the margin numerous oblique branches, apparently similar in all respects to those of the scapular area. The anal furrow is slightly impressed, in its apical portion nearly straight, and terminates exactly at the middle of the wing.

In the form of the wing, which is less tapering than usual, this species seems to be most nearly allied to *P. testudo*, but differs considerably from it in the character of its scapular branches.

Length, 17.5 mm.; breadth, 8.5 mm.

This interesting specimen, the only species of Mylacridæ known from above the Productive Coal-measures, was found by Mr. Sidney J. Hare,

a most enthusiastic searcher and student in natural history, about 170 feet above the base of the Upper Barren Coal-measures at Kansas City, Mo., and is named after him at the suggestion of Mr. R. D. Lacoe, in whose collection it bears the number 2087a.

2. PROMYLACRIS TESTUDO.

Pl. II, fig. 2.

Promylacris testudo Scudd., Mem. Bost. Soc. Nat. Hist., IV, 403, pl. 32, fig. 6 (1890); Foss. Ins. N. A., I, 379, pl. 24, fig. 6 (1890).

Through the kindness of Mr. R. D. Lacoe, I have had the opportunity of examining a second specimen of this species. It is somewhat smaller than the first, but has the same vaulted form, and in each case the figure represents the convex surface and not the concave cast. The first thing that will be noticed is that there is a similar difference in the venation of the opposite tegmina, only that the difference is reversed, the simpler form of branching of the scapular vein being seen on the left side in one specimen, on the right side in the other. The drawing of the mediastinal vein of the left wing in the present specimen is slightly incorrect in that the forking of the branches has been overlooked, it differing but little from that of the opposite wing. The costal margin is scarcely so convex as in the type; the mediastinal area is a little longer, terminating a little beyond the tip of the anal furrow. On each wing the branches of the scapular vein are divided into two sets just beyond the middle of the basal half of the wing, but on the left side, from the less numerous branches, the vein is less complicated than on the right, where the outer of the two at once forks into two sets of three or four branches each, and the inner divides farther out in very regular fashion into two ultimately forked branches, giving in all eleven veinlets to the margin; on the left side the outer divides into three superior branches, the inner, at first into two, the outer of which is simple, the inner of which sends from before its middle a forked superior branch, in all only seven veinlets at the margin. In the type, on the more complicated left side, by the apical forking of nearly all the branches, no less than eighteen veinlets are found upon the margin; the right side, being broken at the margin, the number of apical veinlets can not be determined, but it is probably from ten to thirteen. The externomedian vein differs from the type mainly in its later initial forking, which is decidedly beyond that of the scapular vein and but little before the tip of the anal furrow. The internomedian area is larger on the left than on the right wing, but does not differ essentially from the same area in the type. The anal furrow is entirely similar to that of the type (which is wrongly stated in the original description to terminate "a little beyond," instead of a little before, the middle of the wing), and as there the anal area is strongly vaulted, but its veins are less numerous, and one at least is deeply forked.

Length of the fragment, 13 mm.; probable length of tegmina, 15 mm.; breadth of closed tegmina, 12.5 mm.

The specimen is numbered in Mr. Lacoe's collection 2089*a*, and, like the original, comes from the Lowest Productive Coal-measures at Mazon Creek, Illinois.

3. PROMYLACRIS OVALIS.

Promylacris ovalis Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 34-35 (1885); Mem. Bost. Soc. Nat. Hist., IV, 403, 404, pl. 31, figs. 1-4 (1890); Foss. Ins. N. A., I, 379, 380, pl. 23, figs. 1-4 (1890).

From the Lowest Productive Coal-measures at Mazon Creek, Illinois.

4. PROMYLACRIS RIGIDA.

Pl. III, fig. 1.

Promylacris rigida Scudd., Mem. Bost. Soc. Nat. Hist., IV, 403, 404-405, pl. 31, fig. 6 (1890); Foss. Ins. N. A., I, 379, 380-381, pl. 23, fig. 6 (1890).

From the Lowest Productive Coal-measures at Braidwood, Ill.

3. Genus LITHOMYLACRIS.

Lithomyllacris Scudd., Mem. Bost. Soc. Nat. Hist., III, 48 (1879); Foss. Ins. N. A., I, 68, (1890).

This is the only genus of Myllacridæ which has been found more abundantly in the Younger than in the Older Productive Coal-measures, three out of the four species being confined to them in the Pennsylvania rocks, while the remaining species is found low down in the Older Productive Coal-measures in the Eastern Interior basin at Mazon Creek, Illinois.

Table of the species of Lithomyllacris.

*a*¹. Externomedian vein first forking at or before the middle of the tegmina.

*b*¹. Tegmina slender, fully three times as long as broad.

*c*¹. Nervules numerous and very crowded; scapular branches often forked.

1. *L. angusta*.

*c*². Nervules less numerous and neuration more open; scapular branches always simple.....

2. *L. pittstoniana*.

*b*². Tegmina relatively stout, being but little more than twice as broad as long.

3. *L. pauperata*.

*a*². Externomedian vein first forking well beyond the middle of the tegmina.

4. *L. simplex*.

1. LITHOMYLACRIS ANGUSTA.

Lithomyllacris angusta Scudd., Mem. Bost. Soc. Nat. Hist., III, 48-50, pl. 5, figs. 2, 3 (1879); Foss. Ins. N. A., I, 68-70, pl. 5, figs. 2, 3 (1890).

From the roof shales of the E seam of coal at the Port Griffith switch-back, near Pittston, Pa.

2. LITHOMYLACRIS PITTSTONIANA.

Lithomyllacris pittstoniana Scudd., Mem. Bost. Soc. Nat. Hist., III, 50-51, pl. 5, figs. 4, 10 (1879); Foss. Ins. N. A., I, 70-71, pl. 5, figs. 4, 10 (1890).

From the same locality and horizon as the preceding.

3. LITHOMYLACRIS PAUPERATA.

Lithomylacris pauperata Scudd., Mem. Bost. Soc. Nat. Hist., IV, 409-410, pl. 32, fig. 5 (1890); Foss. Ins. N. A., I, 385-386, pl. 24, fig. 5 (1890).

From the same locality and horizon as the last two.

4. LITHOMYLACRIS SIMPLEX.

Lithomylacris simplex Scudd., Mem. Bost. Soc. Nat. Hist., III, 51-52, pl. 5, fig. 5 (1879); Foss. Ins. N. A., I, 71-72, pl. 5, fig. 5 (1890).

From the Lowest Productive Coal-measures at Danville, Ill.

4. Genus PAROMYLACRIS.

Paromylacris Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 35 (1885).

This genus, containing five known species, is confined to the Productive Coal-measures and almost entirely to its lowest members, only one species occurring near Pittston, Pa., near the base of the upper of the two divisions into which I have tentatively divided the Productive Coal-measures. One of the others occurs in the Western Interior coal basin, within 50 feet of the base of the true Coal-measures, the others in the Eastern Interior basin in the Mazon Creek beds, Illinois.

Table of the species of Paromylacris.

- a*¹. Tegmina broadly and pretty regularly obovate, the apical not much less than the basal breadth.
- b*¹. Prothorax much more than twice as broad as long; anal furrow terminating at or before the middle of the tegmina..... 1. *P. rotunda*.
- b*². Prothorax much less than twice as broad as long; anal furrow terminating well beyond the middle of the tegmina..... 2. *P. ampla*.
- a*². Tegmina tapering strongly, the apical much less than the basal breadth.
- b*¹. Mediastinal area reaching well beyond the middle of the tegmina; externomedian veins very strongly arcuate 3. *P. triangularis*.
- b*². Mediastinal area not reaching the middle of the tegmina; externomedian veins very gently arcuate..... 4. *P. clintoniana*.

P. pluteus is not included in this table.

1. PAROMYLACRIS ROTUNDA.

Paromylacris rotunda Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 35 (1885); Mem. Bost. Soc. Nat. Hist., IV, 406-408, pl. 32, figs. 1, 2 (1890); Foss. Ins. N. A., I, 382-384, pl. 24, figs. 1, 2 (1890).

From the Lowest Productive Coal-measures at Mazon Creek, Illinois.

2. PAROMYLACRIS AMPLA.

Pl. III, fig. 4.

Paromylacris ampla Scudd., Mem. Bost. Soc. Nat. Hist., IV, 408, pl. 31, fig. 7 (1890); Foss. Ins. N. A., I, 384, pl. 23, fig. 7 (1890).

From the Lowest Productive Coal-measures at Braidwood, Ill.

3. *PAROMYLACRIS TRIANGULARIS* sp. nov.

Pl. III, fig. 3.

Represented by a somewhat confused mass of wings, out of which one of the tegmina can be easily distinguished throughout the most of its extent, the tip only broken; this has a remarkably triangular form, the front margin strongly arcuate at the base but beyond straight, the inner margin independently arcuate on the anal area and beyond, the whole wing tapering rapidly and regularly beyond the tip of the anal furrow. The whole wing is a little more than twice as long as its extreme breadth next the base. The mediastinal area is of great extent, terminating about the middle of the distal half of the wing, very broad at the base and gradually tapering, the branches of the vein mostly forked, sometimes doubly forked, and several of them originating beyond the base of the wing, as is the case with other species of *Paromylacris*, in which respect this genus approaches *Necymylacris*; the branches are strongly oblique and not very closely crowded; the mediastinal vein is very strongly sinuous, first forks immediately after its separation from the internomedian vein, with which it is united in the basal fifth of the wing, each of its forks again almost immediately subdivided, and their lowermost branches, very deeply forked, send at last about half a dozen nervules to the upper margin, the lowermost striking the tip of the wing; all these branches are but gently sinuous in the apical half of the wing and directed longitudinally upward; the externomedian vein is very similar to the scapular, forking immediately on its freedom from the scapular, each of its branches again forking in the middle of the wing, all having a strongly sinuous course, and after their final forking nearly longitudinal. The internomedian vein is likewise broadly sinuous, and terminates on the inner margin somewhat beyond a point opposite the tip of the mediastinal vein, the main branch having a sinuous course parallel to the lower branches of the externomedian vein; it has three or four simple or forked branches, separating fan-like upon the anal border. The anal furrow is very deeply impressed, very strongly sinuous, and terminates on the inner margin considerably before the middle of the wing; the only veins which can be seen in the anal area are those on the half which is removed from the anal furrow, and they are here straight and parallel.

Length of fragment, 17 mm.; probable length of tegmina, 21.5 mm.; breadth, 10 mm.

A single specimen and its reverse come from the nodules of Mazon Creek, Illinois, and are in the collection of Mr. R. D. Lacoe, bearing the number 2110 *a*, *b*. They come from the Lowest Productive Coal-measures.

4. PAROMYLACRIS CLINTONIANA sp. nov.

Pl. III, fig. 6.

A single well-preserved fore wing with the extreme base and apex destroyed. The form of the tegmina is not so distinctly triangular as in the preceding species, but it tapers with great regularity from the same point, mostly through the arcuation of the inner margin, the front margin being very gently arcuate, so that the tip must fall above the middle, which is very unusual. The mediastinal area is rather short, scarcely extending so far as the anal furrow; very broad at base, it rapidly narrows, and is filled with but few branches, most of which are forked close to the margin, and, as in the species of *Paromylacris* in general, one at least of the principal branches originates far beyond the base of the tegmina. The scapular vein is the most important in the tegmina, occupying with its branches a very considerable portion of its area. It is made up of two clusters which part at no great distance from the base of the tegmina, the uppermost bearing three long branches, part of which are forked next the margin, following the general course of the branches of the mediastinal area. The lower cluster subdivides into two sets at about the end of the basal third of the tegmina—the upper composed of three, the lower of four, long, gently arcuate, upturned, simple branches, which cover the remainder of the front margin as far as the tip of the tegmina; as a whole, the main scapular vein, or rather the main vein of the lower cluster, has a gently sinuous course through the middle of the tegmina, falling below it in its middle portion. The externomedian vein is formed of two slightly compound branches originating from a main stem, which first subdivides a little beyond the first forking of the lower cluster of the scapular vein. Its branches are very gently sinuous, nearly longitudinal, and terminate on the outer and inner borders of the tegmina. The internomedian vein is very gently sinuous, running in a nearly straight course after its basal arcuation to the middle of the apical half of the tegmina, and has five simple, in one case rather deeply forked, straight and oblique branches. The anal furrow is deeply impressed, sharp, and gently arcuate, and, what is most extraordinary, forks just before the tip, and terminates at about the middle of the tegmina. The anal veins are longitudinally oblique, deeply forked, straight or arcuate, rather distant, and subparallel to the basal half of the anal furrow.

This species is remarkable for the slenderness of the tegmina and the curious manner in which they taper by the stronger arcuation of the inner than of the front margin; it is more nearly allied to the preceding species than to any other, but departs widely from it in these respects.

Length of fragment, 15 mm.; probable length of tegmina, 21 mm.; breadth, 8 mm.

Obtained from a coal bank near Clinton, Mo., belonging to the Very Lowest Productive Coal-measures, found within 50 feet of their extreme base; it is in the collection of Mr. R. D. Lacoe, under the number 2151*a*.

5. *PAROMYLACRIS?* *PLUTEUS* sp. nov.

Pl. III, fig. 2.

A basal fragment of a fore wing appears to belong to a distinct species of *Paromylacris*, but is referred here doubtfully, as its reference depends largely upon the form of the wing, the larger part of the margin of which is conjectural. That it is one of the *Mylacridæ* is evident from the character of the preserved part of the mediastinal area. The direction of the inner margin beyond the anal area, with the direction and tendencies of the mediastinal and scapular veins, indicate that these two veins occupy at least one-half of the tegmina; while, if this were the case, the wing could hardly have had the slender form of *Lithomylacris*, as apparently also it had not the apically confined area of the externomedian vein. These points would indicate that it fell in *Paromylacris*, though it is not impossible that it is a *Necymylacris*, its next neighbor. In either case the structure of the anal area is different from anything known in this vicinity, and indicates a species hitherto unknown and of considerable size.

Assuming the margin to be correctly delineated, the mediastinal area probably extended to some distance beyond the middle of the tegmina, and the scapular area occupied the rest of the upper half of the tegmina, the main vein of the latter beginning to branch just beyond the basal fifth of the tegmina, where it is bent in its course. The externomedian vein runs parallel to the scapular, first branches before the middle of the tegmina, and apparently occupies on the margin almost half as much space as the scapular. The internomedian vein, of which more can be seen, runs in a very gently arcuate course and terminates far toward the tip of the tegmina, with three or four very inequidistant, deeply forked or simple, nearly straight or slightly arcuate, strongly oblique branches. The anal furrow terminates beyond the middle of the tegmina, and besides being strongly bent next the base is again gently bent beyond the middle of the remainder, being otherwise nearly straight; and by the fullness of this portion of the inner margin which has an independent curve, the whole area is subequal in breadth to near its rapidly tapering extremity; it is filled, at least away from the anal furrow, with numerous simple or deeply forked veins parallel to its sides, but arcuate apically. The whole area is fully three times as long as broad.

The species appears to fall in the near vicinity of *P. ampla*, but is smaller than it, and apparently has a larger development of the internomedian area and an earlier branching of the externomedian vein.

Length of fragment, 21.5 mm.; probable length of tegmina, 30 mm.; probable breadth, 16 mm.

A single specimen found in the Butter mine at Pittston, Pa., in the shale over the E coal or Pittston coal by Mr. R. D. Lacoe, in whose collection it bears the number 2040a.

5. Genus NECYMYLACRIS.

Necmylacris Scudd., Mem. Bost. Soc. Nat. Hist., III, 52-53 (1879); Foss. Ins. N. A., I, 72-73 (1890).

The two known species of this genus both occur in the Pennsylvania coal basin, in the Lowest Productive Coal-measures. No species have been added to the genus since its first description fourteen years ago.

Table of the species of Necmylacris.

Mediastinal vein short; internomedian vein arcuate throughout.....	1. <i>N. lacoana</i> .
Mediastinal vein long; internomedian vein straight through most of its course but little arcuate.....	2. <i>N. heros</i> .

1. NECYMYLACRIS LACOANA.

Necmylacris lacoana Scudd., Mem. Bost. Soc. Nat. Hist., III, 53-54, pl. 5, fig. 12 (1879); Foss. Ins. N. A., I, 73-74, pl. 5, fig. 12 (1890).

From the Boston mine, near Pittston, Pa., in the Lowest Productive Coal-measures.

2. NECYMYLACRIS HEROS.

Necmylacris heros Scudd., Mem. Bost. Soc. Nat. Hist., III, 54-56, pl. 5, fig. 9 (1879); Foss. Ins. N. A., I, 74-76, pl. 5, fig. 9 (1890).

From the roof shales of coal C in the Boston mine near Pittston, Pa., in the Lower Productive Coal-measures. By error in the original description it was referred to Cannelton, Pa., in a deposit just below vein C, and its discovery was credited to Mr. Mansfield, when it should have been referred to Mr. Lacoe, in whose collection it bears the number 2006. This error of location was unfortunately repeated in my Fossil Insects of North America, and in my Index to Known Fossil Insects (Bull. 71, U. S. Geol. Survey).

DESCRIPTION OF A FRAGMENT OF A GIGANTIC FORE WING.

MYLACRIDÆ (?) sp.

Pl. II, fig. 4.

The merest fragment of a fore wing, consisting only of the humeral lobe, is shown here to draw attention to an unknown species remarkable for its immense size and for the surface structure. It seems to be pretty certainly a cockroach, and appears to have rather the aspect of one of this group than that of one of the Blattinariae. The shoulder of the wing is apparently penetrated by a single straight vein without

branches, unless the doubly forked bent prominence may be an extreme basal branch. The entire surface is covered with little, circular, shallow punctures, about 0.28 mm. in diameter, slightly more deeply impressed at their margins than centrally, sparsely distributed with considerable uniformity, but rather more closely crowded toward the margin, where they lie at an average distance apart of four or five of their diameters. The fragment is 25 mm. long, but, being only the merest fragment of the shoulder of a fore wing, must represent one very much larger than the largest known species, or perhaps one 80 mm. long, at the least.

The specimen comes from the Lowest Productive Coal-measures of Mazon Creek, Illinois, and was sent me for examination by Mr. William Gurley.

BLATTINARIÆ.

This group of Palæoblattariæ was the prevailing type of cockroaches in Carboniferous times. In America they are found from the Millstone Grit (in scanty numbers, but some variety—two or three genera) to the Trias, where the species, mostly belonging to generic groups characteristic of the Trias, are only two or three times more abundant than in the Millstone Grit, though the culmination of the group is reached in the Permian. In Europe they have been discovered neither so low as the Millstone Grit nor so high as the Trias, but are found throughout the true Productive Coal-measures, as well as in the Barren Coal-measures (where they appear to have culminated) and in the Permian. This latter statement may require some revision when the numerous species found in the Productive Coal-measures at Commeny, France, are made known, just as a very different statement regarding the American rocks would have had to be made fifteen years ago.

Twelve genera and about 174 species are known, of which 10 genera and about 112 species come from America, and 8 genera and about 62 species from Europe, besides half a dozen undetermined species from the latter. Six of the genera are common to both worlds, 4 are peculiar to America (one of them to the Trias), and 2 to Europe. No species are known to occur on both continents.

6. Genus MICROBLATTINA (*μικρός*, Blattina, nom. gen.) gen. nov.

The apical half of a fore wing from the Rhode Island coal field presents such very striking peculiarities that they must be regarded as affording sufficient ground for distinct generic reference unless the unknown basal portion should show the veins to be connected in a very different way from what seems probable. It is as small as the smallest known Carboniferous cockroach, but probably of the normal form. The mediastinal area reaches but little beyond the middle of the tegmina and must be narrow. The scapular vein is simple and straight for more than half its length, and only when it reaches the end of the mediastinal area throws out numerous short branches to the margin. The

externomedian vein runs parallel to the scapular and terminates above the apex of the tegmina, emitting numerous inferior, long, straight and parallel, nearly longitudinal branches to the apical margin. The internomedian area is rather narrow, at least in the distal half of the tegmina, subparallel to the inner margin, reaches out as far or nearly as far as the scapular area, and is filled with less crowded, arcuate veins, their convexity apical. The anal area is not preserved.

It is barely possible that what I have here taken for the scapular vein may be an anterior branch of what is regarded as the externomedian, similar to what is found in some of the species of that strange genus *Oryctoblattina*; but the other parts of the tegmina below this are at decided variance with the peculiar characteristics of *Oryctoblattina*, and hardly allow room for the development of the lower veins. If my interpretation of the neururation is correct, *Microblattina* must find a place near *Etblattina*, but separated from it and its allies by the remarkable fact that the branches of the externomedian vein are inferior and not superior, just as in *Anthracoblattina*, where the mediastinal area is long.

A single species is known, coming from the Rhode Island coal field, which belongs in all probability to the Lowest Productive Coal-measures.

MICROBLATTINA PERDITA sp. nov.

Pl. III, fig. 5.

Unfortunately the basal half of the tegmina of this interesting species is destroyed, but the portion preserved shows that the tegmina were of slender ovate form, probably rather more than two and a half times longer than broad; the costal margin is very gently convex, the inner margin nearly straight, and the tip somewhat broadly rounded. The mediastinal area comes into the preserved fragment just enough to show that it was slender, with short, simple, arcuate branches, and that it reached somewhat beyond the middle of the tegmina, terminating somewhat abruptly. The scapular vein, as soon as it begins to fork (just before the extremity of the mediastinal area), approaches the margin less rapidly, increasing its length so that it extends nearly to the apex of the tegmina and crowds closely against the externomedian; its branches are very closely crowded, arcuate and simple, except for the forked basal branch. The externomedian vein first branches probably not beyond the end of the proximal third of the tegmina, and its parallel and straight branches shorten and become more crowded toward the extremity. Some of them are apically forked, and apparently what appear to be the basal ones, each of which is apically forked, are united at their base. What can be seen of the internomedian area is nearly riband-shaped, the main vein approaching the inner margin very gradually until just before its termination, when it curves down to it much as in the case of the mediastinal vein, and its branches, which are more

distant than those of other parts of the tegmina and mostly simple, take on the arcuation of this apical part of the vein. None of the anal area is preserved. The externomedian vein and its branches, except next the border, appear in strong relief, while all the others are delicately incised, particularly those of the internomedian area. The whole surface is uniformly black and there is no sign of any other sculpture.

Length of fragment, 4 mm.; probable length of tegmina, 8 mm.; breadth, 3 mm.

From the Lower (?) Productive Coal-measures of East Providence R. I.; in the collection of Mr. R. D. Lacoe, No. 2092a.

7. Genus ARCHIMYLACRIS.

Archimylacris Scudd., Daws., Acad. Geol., 2d ed., 388 (1868).

Archimylacris is one of the few genera found in the Millstone Grit as well as later; but, unlike the other genera occurring there, it is at no time a prevailing type, nor does it occur later than the true Productive Coal-measures, nor indeed above its lowest members in the Eastern Interior coal field, in which a single species occurs; the oldest species occurs in the Pennsylvania coal basin, the youngest in the Acadian coal basin. In the light of our present knowledge, therefore, *Archimylacris* may be looked upon as one of the most primitive types of cockroaches, for it has been found in the earliest beds that have yielded these insects, and no generic type has been extinguished at an earlier epoch than it. Of the genera existing as early as the Lowest Productive Coal-measures, all have been recovered in later rocks excepting *Microblattina* and *Necymylacris*, but these two genera are not known, like *Archimylacris*, at a still earlier epoch. The genus has not yet been recognized in the European rocks.

Table of the species of Archimylacris.

- a¹. Tegmina of nearly equal width throughout; anal area hardly extending beyond the basal third of the tegmina..... 1. *A. parallela*.
- a². Tegmina oval throughout, nowhere with parallel margins; anal area extending considerably beyond the basal third of the tegmina.
 - b¹. Tegmina fully two and a half times longer than broad, the mediastinal area distinctly tapering throughout its distal half..... 2. *A. paucinervis*.
 - b². Tegmina only twice as long as broad, the mediastinal area scarcely tapering before its extreme tip..... 3. *A. acadica*.

1. ARCHIMYLACRIS PARALLELA.

Archimylacris parallela Scudd., Mem. Bost. Soc. Nat. Hist., III, 85-87, pl. 6, fig. 6 (1879); Foss. Ins. N. A., I, 105-107, pl. 6, fig. 6 (1890).

From Campbell's Ledge, near Pittston, Pa., near the bottom of the Millstone Grit, where it was discovered by Mr. R. D. Lacoe, in whose collection it bears the number 2007. In the original description it was wrongly referred to the Lowest Productive Coal-measures at Cannelton, Pa., and as collected by Mr. Mansfield. The same error is unfortunately repeated in my Fossil Insects of North America and in my Index to Known Fossil Insects (Bull. 71, U. S. Geol. Survey).

2. ARCHIMYLACRIS PAUCINERVIS.

Archimylacris paucinervis Scudd., Mem. Bost. Soc. Nat. Hist., IV, 411-414. pl. 31, fig. 5 (1890); Foss. Ins. N. A., I, 387-390, pl. 23, fig. 5 (1890).

From the Lower Productive Coal-measures at Mazon Creek, Illinois.

3. ARCHIMYLACRIS ACADICA.

Archimylacris acadica Scudd., Daws., Acad. Geol., 2d ed., 388, fig. 153 (1868); Mem. Bost. Soc. Nat. Hist., III, 84-85, pl. 6, figs. 8, 14 (1879); Foss. Ins. N. A., I, 104-105, pl. 6, figs. 8, 14 (1890).

Found in shale overlying the roof of the main seam of coal at the East River, Pictou, Nova Scotia.

8. Genus SPILOBLATTINA.

Spioblattina Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 35-36 (1885).

So far as known this genus is peculiar to the American Trias, four species occurring in Colorado. It is very closely related to *Etoiblattina*, and especially to the species of that genus from the latest Carboniferous deposits with open neuration, and it is no doubt an offshoot from that genus, which existed side by side with it or comes of similar parentage with it.

Table of the species of *Spioblattina*.

- a*¹. Scapular vein as far as its penultimate branch almost completely parallel to the costal margin, not receding from it opposite the middle of the adjoining discal stigma.
- b*¹. Tegmina relatively slender, fully three times as long as broad.
- c*¹. Scapular faintly approaching the externomedian vein to inclose the stigma between them..... 1. *S. gardineri*.
- c*². Scapular in no way approaching the externomedian vein to inclose the stigma between them..... 2. *S. triassica*.
- b*². Tegmina relatively broad, not over two and a half times longer than broad.
3. *S. guttata*.
- a*². Scapular vein distinctly receding from the costal margin opposite the middle of the adjoining discal stigma..... 4. *S. marginata*.

1. SPILOBLATTINA GARDINERI.

Spioblattina gardineri Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 36 (1885); Mem. Bost. Soc. Nat. Hist., IV, 461-462, pl. 41, figs. 4, 6, 8, 10 (1890); Foss. Ins. N. A., I, 437-438, pl. 33, figs. 4, 6, 8, 10 (1890).

Trias of Fair Play, Colo.

2. SPILOBLATTINA TRIASSICA.

Spioblattina triassica Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 36 (1885); Mem. Bost. Soc. Nat. Hist., IV, 461-462-463, pl. 4, fig. 1 (1890); Foss. Ins. N. A., I, 437, 438-439, pl. 33, fig. 1 (1890).

Trias of Fair Play, Colo.

3. SPILOBLATTINA GUTTATA.

Spiloblattina guttata Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 36-37 (1885); Mem. Bost. Soc. Nat. Hist., IV, 461, 463, pl. 41, fig. 2, pl. 42, fig. 14 (1890); Foss. Ins. N. A., II, 437, 439, pl. 33, fig. 2, pl. 34, fig. 14 (1890).

Trias of Fair Play, Colo.

4. SPILOBLATTINA MARGINATA.

Spiloblattina marginata Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 37 (1885); Mem. Bost. Soc. Nat. Hist., IV, 461, 464, pl. 41, fig. 3 (1890); Foss. Ins. N. A., I, 437, 440, pl. 33, fig. 3, (1890).

Trias of Fair Play, Colo.

9. Genus ETOBLATTINA.

Etolblattina Scudd., Mem. Bost. Soc. Nat. Hist., III, 56-58 (1879); Foss. Ins. N. A., I, 76-78 (1890).

This might be termed the typical genus of Palæoblattariæ, or at least of Blattinariæ, for it was the prevailing type in the Carboniferous and Permian periods, containing very nearly one-half of the known Paleozoic cockroaches, and in America almost exactly one-half. Ninety-seven species have already been recognized—sixty-nine in this country and twenty-eight in Europe—yet a dozen years ago only two species were recognized in this country. The great increase is due to the discovery of the localities at Richmond, Ohio, and Cassville, West Virginia, at which places all but fourteen of the new American species have occurred. Even in the older rocks it holds a predominant position, being there equaled in number only by *Mylacris* in America, while in Europe it has nearly trebled the number of species belonging to *Gera-blattina* or *Anthracoblattina*, its nearest numerical neighbors. Its number in America is also trebled, or a little more than trebled, that of *Gera-blattina*, which follows it among Blattinariæ. Not a single species is common to Europe and America, nor in America has a single one been certainly found at two distinct localities.

In accordance with the fact of its predominance is that of its endurance, since in this country it has been recognized in every deposit which has yielded remains of cockroaches, from the Millstone Grit, where a single species occurs in the Western Interior coal field,¹ to the Trias, from which, in Colorado, two species have been recognized. This can not be said of any other genus of cockroaches. It reaches its culmination in the Permian, where it is found in astonishing abundance in the Dunkard Creek series of West Virginia, whence thirty-six species are known from the single locality of Cassville, Monongalia County. Every coal basin in this country from which cockroaches are known, except the Acadian, has furnished some species of this genus. In the true Productive Coal-measures they have been found most abundantly in the

¹This refers to *E. venusta*, found by Lesquereux in Arkansas deposits regarded by him as of this age, but according to the latest surveys it is more probable, Mr. Lacoe informs me, that the deposits belong to the Lower Productive Coal-measures, in which case the above statement must be modified.

Rhode Island basin (eight species); but in the Barren Coal-measures of eastern Ohio seventeen species occur, which is a number larger than that of all the species from the Productive Coal-measures from all American localities combined, indicating the ascendancy of the group.

At the same time, the deposits of the Barren Coal-measures and of the Permian rocks present a new type, already referred to in the Introduction and pretty easily recognized at a glance by the slenderness of the tegmina combined with an exceptional openness of the neuration in the middle of the tegmina, the latter feature somewhat recalling the Triassic *Spiloblattina*, though with a slightly different effect. So far as the present material shows, this type was the prevailing one in the Barren Coal-measures of this country, but seems to have been only less prevalent in the Permian. It was not peculiar to America, for it appears in the European Permian species, *E. elongata*. I have not attempted, as perhaps I should have done, to bring all these species together in the following table, but they are grouped to a certain extent in a subordinate manner.

In Europe, also, *Etolblattina* was the predominating type of cockroaches and has been found in every successive series of rocks in which cockroaches have been found, from the Lowest Productive Coal-measures to the Permian. It seems to have reached its climax in the upper Carboniferous deposits, corresponding largely to our Barren Coal-measures. For assistance in studying the European forms, I have added in the Introduction a section upon the European species of the genus, with a key for their determination.

The following table has been constructed with much difficulty; and while it brings in juxtaposition many of the nearly allied species in a natural manner, it separates at the same time whole series, which a more complete knowledge of the neuration from more perfect examples would have enabled me to arrange in a better order by their judicious mingling. It is offered only as a temporary convenience. The sequence of the species in the table is followed in the text and as far as possible in the plates.

Table of the species of Etoblattina.

- a¹. Relatively broad species; tegmina distinctly less than two and one-half times longer than broad.
- b¹. Mediastinal area less than two-thirds the length of the tegmina.
- c¹. Internomedian area terminating far short of the apex of the tegmina.
- d¹. Mediastinal area triangular, continuously tapering, reaching only the middle or a little beyond the middle of the tegmina.
- e¹. Scapular vein terminating at the very apex of the tegmina; externomedian vein first forking beyond the middle of the tegmina.
 - 1. *E. clintoniana*.
- e². Scapular vein terminating before the extreme apex of the tegmina; externomedian vein first forking far before the middle of the tegmina.
 - 2. *E. lata*.
- d². Mediastinal area vittate, tapering only at extremity, reaching far beyond the middle of the tegmina.

Table of the species of Etblattina—Continued.

- e¹. Externomedian vein first forking at about the middle of the tegmina, the branches mostly simple..... 3. *E. sagittaria*.
- e². Externomedian vein first forking near the end of the proximal third of the tegmina, the branches mostly forked.... 4. *E. mediana*.
- c². Internomedian area nearly reaching the tip of the tegmina.
 - d¹. Tegmina only twice as long as broad; veins rather numerous. 5. *E. fossa*.
 - d². Tegmina much more than twice as long as broad; veins very numerous.
 - e¹. Large species, the tegmina exceeding 50 mm. in length; mediastinal area reaching far beyond the middle of the tegmina. 6. *E. illustris*.
 - e². Small species, the tegmina less than 12 mm. long; mediastinal area only extending to the middle of the tegmina..... 7. *E. ovata*.
- b². Mediastinal area at least two-thirds as long as the tegmina.
 - c¹. Tegmina only twice as long as broad; mediastinal area not more than two-thirds as long as the tegmina..... 8. *E. scholfieldi*.
 - c². Tegmina considerably more than twice as long as broad; mediastinal area nearly or quite three-fourths as long as the tegmina.
 - d¹. Internomedian area terminating far before the tip of the tegmina.
 - e¹. Scapular and externomedian veins nearly united in basal third of tegmina; internomedian vein normal..... 9. *E. debilis*.
 - e². Scapular and externomedian veins clearly distinct throughout; internomedian vein peculiar.
 - f¹. Externomedian vein simple, unbranched; internomedian vein reinforced by a supplementary branched superior stem. 10. *E. strigosa*.
 - f². Externomedian vein abundantly branched; internomedian vein very strongly sinuate, the area apically very slender. 11. *E. clarkii*.
 - d². Internomedian area extending nearly to the tip of the tegmina,
 - 12. *E. venusta*.
- a². Relatively slender species, the tegmina two and one-half or more times longer than broad.¹
 - b¹. Tegmina distinctly less than three times as long as broad.
 - c¹. Internomedian area not or hardly attaining the apical margin.
 - d¹. Veins in center of tegmina much more widely separated than those on the apical margin.
 - e¹. Mediastinal area considerably more than two-thirds the length of the tegmina.
 - f¹. Internomedian branches distant and most of them forked.
 - 13. *E. balteata*.
 - f². Internomedian branches crowded and most of them simple.
 - 14. *E. patiens*.
 - e². Mediastinal area somewhat or distinctly less than two-thirds the length of the tegmina.
 - f¹. Scapular and externomedian veins first branching at very unequal distances from the base.
 - g¹. Externomedian and internomedian branches very crowded, more so than the branches of the other veins..... 15. *E. mucronata*.
 - g². Externomedian and internomedian branches, especially the latter, not crowded, and not more so than the others. 16. *E. detecta*.
 - f². Scapular and externomedian veins first forking side by side.
 - 17. *E. occidentalis*.
 - d². Veins in center of tegmina scarcely more widely separated than those on the apical margin.

¹In a few species the tegmina are barely two and one-half times, in a few others they are more than three times longer than broad.

Table of the species of *Etolblattina*—Continued.

- e¹. Mediastinal area less than three-fifths the length of the tegmina.
 f¹. Tegmina sparsely veined..... 18. *E. exigua*.
 f². Tegmina abundantly veined.
 g¹. Main scapular vein nearly straight..... 19. *E. sp.* (R. I.).
 g². Main scapular vein strongly arcuate.
 h¹. Scapular vein subparallel to the costal margin in the basal half of the tegmina; its branches oblique..... 20. *E. jeffersoniana*.
 h². Scapular vein forming a considerable angle with the costal margin in the basal half of the tegmina, its branches longitudinal..... 21. *E. residua*.
 e². Mediastinal area more than three-fifths the length of the tegmina.
 f¹. Anal furrow terminating hardly or not beyond the end of the proximal two-fifths of the tegmina.
 g¹. Veins of internomedian area not crowded; scapular and externomedian veins well separated from the base.. 22. *E. funeraria*.
 g². Veins of internomedian area crowded; scapular and externomedian veins united in the proximal fourth of the tegmina.
 23. *E. expuncta*.
 f². Anal furrow terminating scarcely short of the middle of the tegmina.
 24. *E. gorhami*.
 c². Internomedian area distinctly attaining the apical margin.
 d¹. Veins in center of tegmina widely separated.
 e¹. Mediastinal area less or scarcely more than one-half the length of the tegmina.
 f¹. Internomedian vein nearly straight, nearly all the branches simple.
 g¹. Internomedian area narrow, in the middle less than one-fourth the width of the tegmina..... 25. *E. aperta*.
 g². Internomedian area relatively broad, in the middle nearly one-third the width of the tegmina..... 26. *E. fasciata*.
 f². Internomedian vein strongly sinuate, many of the branches forked, often doubly forked.
 g¹. Mediastinal vein arcuate beyond base; scapular vein scarcely bent at the origin of the first two branches..... 27. *E. ramosa*.
 g². Mediastinal vein straight beyond base; scapular vein distinctly bent at the origin of the first two branches.... 28. *E. willsiana*.
 e². Mediastinal area nearly or quite three-fifths the length of the tegmina.
 f¹. Externomedian vein first branching close to the middle of the tegmina.
 g¹. Internomedian vein arcuate throughout, continually approaching the margin..... 29. *E. lesquereuxii*.
 g². Internomedian vein sinuous by a distinct apical extension, subparallel to the margin.
 h¹. The branches of the mediastinal vein mostly originate from the vein itself.
 i¹. Main scapular vein broadly sinuate; internomedian vein nearly reaching the very apex of the tegmina.
 j¹. Costal margin broadly arcuate; first two branches of scapular vein widely separated at origin..... 30. *E. maledicta*.
 j². Costal margin strongly arcuate; first two branches of scapular vein closely approximate at base..... 31. *E. benedicta*.
 i². Main scapular vein rigidly straight through most of its course; internomedian vein falling considerably short of the apex.
 32. *E. funesta*.
 h². Most of the branches of the mediastinal vein arise from its first branch, which imitates the mediastinal vein. 33. *E. exsensa*.

Table of the species of Ectoblattina—Continued.

- f*². Externomedian vein first branching well within the proximal half of the tegmina.
- g*¹. Mediastinal vein about three-fifths the length of the tegmina; scapular vein forking before the externomedian vein. 34. *E. tenuis*.
- g*². Mediastinal vein two-thirds the length of the tegmina; externomedian vein forking before the scapular vein. 35. *E. hustoni*.
- d*³. Veins in center of tegmina not widely separated.
- e*¹. Mediastinal area distinctly less than two-thirds the length of the tegmina.
- f*¹. Anal furrow striking the margin not beyond the end of the proximal third of the tegmina.
- g*¹. Internomedian area more than one-third the breadth of the tegmina in the middle of their distal half. 36. *E. persistens*.
- g*². Internomedian area less than one-third the breadth of the tegmina in the middle of their distal half. 37. *E. eakiniana*.
- f*². Anal furrow striking the margin but little before the middle of the tegmina.
- g*¹. Small species; tegmina with strongly convex costa; externomedian vein first branching before the tip of the anal furrow and well before the middle of the tegmina. 38. *E. accubita*.
- g*². Large species; tegmina with gently convex costa; externomedian vein first branching beyond the tip of the anal furrow and scarcely before the middle of the tegmina. 39. *E. mazona*.
- e*². Mediastinal area fully two-thirds the length of the tegmina.
- f*¹. Scapular vein first forking scarcely before the externomedian vein.
- g*¹. Mediastinal area scarcely if any more than two-thirds the length of the tegmina.
- h*¹. Internomedian area reaching the apex of the tegmina by the retroarcuation of the main vein. 40. *E. expulsata*.
- h*². Internomedian area reaching only the extreme limit of the apical margin of the tegmina, without noticeable retroarcuation.
- i*¹. Mediastinal branches excessively longitudinal and crowded; scapular branches mostly forked. 41. *E. gratiosa*.
- i*². Mediastinal branches normal and not crowded; scapular branches all simple. 42. *E. macerata*.
- g*². Mediastinal area almost or quite three-fourths the length of the tegmina. 43. *E. immolata*.
- f*¹. Scapular vein first forking at a noticeable distance before the externomedian vein.
- g*¹. Anal furrow striking the margin scarcely beyond the end of the proximal two-fifths of the tegmina.
- h*¹. Mediastinal area three-fourths the length of the tegmina, tapering rather abruptly. 44. *E. mactata*.
- h*². Mediastinal area scarcely if any more than two-thirds the length of the tegmina, tapering gently. 45. *E. communis*.
- g*². Anal furrow striking the margin scarcely before the middle of the tegmina. 46. *E. sp.* (Colo.).
- b*². Tegmina almost or fully three times as long as broad.
- c*¹. Mediastinal area less than two-thirds the length of the tegmina.
- d*¹. Internomedian vein more or less, often considerably, sinuate, much of the apical portion nearly or quite parallel to the inner margin, and rarely falling at all short of the apex of the tegmina.

Table of the species of Etoblattina—Continued.

- e*¹. Scapular vein forking before, generally long before, the externomedian; anal area normal.
- f*¹. Mediastinal area less than half as long as the tegmina. 47. *E. hastata*.
- f*². Mediastinal area more than half as long as the tegmina.
- g*¹. Costal margin nearly straight throughout the middle half¹.
- h*¹. Internomedian area scarcely narrowing in its proximal half. 48. *E. marginata*.
- h*². Internomedian area rapidly narrowing in its proximal half. 49. *E. gracilentia*.
- g*². Costal margin regularly arcuate throughout..... 50. *E. exsecuta*.
- e*². Scapular vein first forking later than the externomedian; anal area exceptionally long and narrow..... 51. *E. arcata*.
- d*². Internomedian vein nearly or quite straight, the area tapering almost regularly and falling considerably, sometimes far, short of the apex of the tegmina.
- e*¹. Internomedian vein terminating well beyond the middle of the distal half of the tegmina.
- f*¹. Main scapular vein strongly sinuous..... 52. *E. stipata*.
- f*². Main scapular vein nearly straight throughout.
- g*¹. Anal furrow striking the inner margin well beyond the end of the proximal third of the tegmina..... 53. *E. praeulcis*.
- g*². Anal furrow striking the inner margin far before the end of the proximal third of the tegmina..... 54. *E. variegata*.
- e*². Internomedian vein terminating at or before the middle of the distal half of the tegmina.
- f*¹. Externomedian vein strongly bent where first forked and thereafter very oblique..... 55. *E. hilliana*.
- f*². Externomedian vein gently bent where first forked and thereafter but little or scarcely oblique.
- g*¹. Tegmina scarcely tapering apically before the distal fourth, nearly equal in the middle half; internomedian area extending but little further than the mediastinal.
- h*¹. Tegmina more than three times as long as broad; internomedian area exceptionally narrow; externomedian vein first branching but little beyond the tip of the anal furrow. 56. *E. angusta*.
- h*². Tegmina less than three times as long as broad; internomedian area of normal breadth; externomedian vein first branching well beyond the tip of the areal furrow.... 57. *E. macilentia*.
- g*². Tegmina tapering from the middle, the middle half fusiform; internomedian area extending very much farther than the mediastinal.
- h*¹. Internomedian area in middle less than one-third the breadth of tegmina; anal area excessively slender..... 58. *E. exilis*.
- h*². Internomedian area in middle more than one-third the breadth of the tegmina; anal area normal..... 59. *E. rogi*.
- c*². Mediastinal area more than two-thirds the length of the tegmina.
- d*¹. Internomedian vein reaching nearly or quite to the apical margin of the tegmina.
- e*¹. Main veins separated in the center of the tegmina by hardly wider intervals than the branches near the apical margin.
- f*¹. Scapular and externomedian veins distinct throughout.

¹ This is not clear, but probable, in *E. marginata*.

from it when, beyond the middle of the tegmina, it first branches and is unimportant, having but a couple of branches, one simple, the other forked. The internomedian vein is gently arcuate, runs parallel to the externomedian and strikes the inner margin just before the distal tenth of the tegmina; it has five or six mostly simple sweeping branches. The anal furrow is rather strongly impressed, very regularly and strongly arcuate, and nearly reaches the middle of the tegmina; the anal veins are numerous, arcuate, crowded, mostly simple, and avoid the space adjoining the anal furrow.

Length of tegmina, 22.5 mm.; breadth at anal furrow, 10 mm. (broader at the middle of the anal area).

The surface of the tegmina, especially in the distal half and in the internomedian area, is covered by very delicate cross lines between the nervures, not very closely crowded.

This species, represented by a nearly perfect fore wing, is more nearly allied to the European *E. primavera* than to any of ours; it is about two-thirds its size and differs in its lesser breadth, the greater brevity of the mediastinal area, and the far later forking of the externomedian vein.

From the Lowest Productive Coal-measures at Gilkerston Ford, near Clinton, Mo., collected by David White, United States Geological Survey. No. 2182; original No. 412.

2. ETOBLATTINA LATA sp. nov.

Pl. IV, fig. 2.

Although the only known specimen of this species is imperfect by the loss of both extremities of the tegmina, they are apparently a little less than two and a half times as long as broad, the costal margin rather gently convex, the inner margin straight, and the apex well rounded. The mediastinal area is distinctly triangular and tapering throughout, terminating shortly before the distal end of the middle fifth of the tegmina, with few and distant, straight, very oblique, simple or forked branches. The scapular vein is broadly sinuate throughout, terminates at a little distance before the extreme apex of the tegmina, first branches within the basal fourth of the tegmina, and has about five nearly longitudinal, simple, forked, or doubly forked branches. The externomedian vein is also broadly sinuate, first forks opposite the tip of the anal furrow, and has four or more longitudinal, gently arcuate, simple or forked branches occupying the apical margin. The internomedian vein is feebly sinuate and probably terminates well before the extreme apex of the tegmina, and has six or seven mostly simple, strongly oblique, nearly straight branches, the first of which, deeply forked, originates far before the others, close to the very base of the vein. The anal furrow is deeply impressed, bent arcuate, and strikes the inner margin at about the end of the proximal third of

the tegmina; the anal veins are simple, very gently arcuate, and subequidistant. The anal and internomedian veins are finely traced in black on the surface of the tegmina, otherwise of the color of the dark stone; and there are straight and crowded delicate cross lines between all the nervures.

Length of fragment, 10.5 mm.; probable length of tegmina, 16 mm.; breadth, 6.75 mm.

This species is most nearly allied to *E. sagittaria*, a considerably larger species, but differs from it in the form of the tegmina, the triangular and not vittate form of the mediastinal area, the far earlier branching of the externomedian vein, and the considerable difference in the character of the internomedian area.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; No. 2099a.

3. ETOBLATTINA SAGITTARIA sp. nov.

Pl. IV, fig. 3.

The tegmina are twice as long as broad, have an ovate form, tapering rather regularly from about the middle of the anal area, with subacuminate rounded apex; the costal margin is gently arcuate, as is also the distal half of the inner margin. The mediastinal area is narrow, in its middle hardly a fifth the breadth of the tegmina, and ends with the middle fifth of the same; its branches are few, distant, simple, straight, and oblique. Scapular vein gently sinuate, subparallel to the inner margin and terminating almost at the very apex of the tegmina; it has five branches, the first arising within the proximal fourth of the tegmina, the second about the middle of the tegmina, these two forked or doubly forked, the remainder arising at regular intervals and simple; all are longitudinally oblique and gently arcuate. The externomedian vein is strongly sinuate, especially arcuate at base, first forks about the middle of the tegmina and has from three to five simple or forked, straight, longitudinal branches, arising at equal intervals in the distal half of the tegmina. The internomedian vein is strongly sinuate, parallel to the preceding but slightly approaching it distally, where the area is prolonged and attenuated, reaching the distal fifth of the tegmina; the seven or eight branches are mostly simple, slightly arcuate and oblique, the distal branches more strongly than the basal. The anal furrow is feebly impressed, very regularly and strongly arcuate and strikes the inner margin just beyond the end of the proximal two-fifths of the tegmina; the anal branches are few, subequidistant, arcuate, and simple. The surface of the tegmina shows no sign of cross-lining.

Length of preserved portion of tegmina, 11 mm.; probable length of tegmina, 12.8 mm.; breadth, 6.5 mm.

In its form and the apically attenuate internomedian area this species closely resembles *E. deanensis* of England, but differs strikingly from

it in both the mediastinal and externomedian areas. It nevertheless appears to be closer to that than to any other European species, though it more nearly approaches our *E. mediana*. Were it not for the apical attenuation of the internomedian area, it would bear a strong resemblance to a Petrablattina, on account of the simplicity and longitudinality of its straight externomedian branches.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; four specimens, Nos. 2100 *a, b, c, d*.

4. ETOBLATTINA MEDIANA.

Pl. IV, fig. 4.

Tegmina somewhat less than two and one-half times as long as broad, tapering rather rapidly on apical half, subacuminate at apex, the costal margin rather strongly arcuate, the inner margin nearly straight to the end of the internomedian area and then rapidly arcuate. Mediastinal area vittate, terminating at the distal end of the middle fifth of the tegmina with somewhat distant, nearly straight, strongly oblique, mostly simple branches. Scapular vein gently arcuate beyond the base, terminating well short of the apex of the tegmina, with only three distant inequidistant branches, the first arising far toward the base, apically doubly forked, the next near the middle of the tegmina and deeply forked, the third simple. The externomedian vein is of unusual importance and has a sinuous course to make room for the apical extension of the following vein; it first forks not far beyond the middle of the proximal half of the tegmina and has four inequidistant, apically arcuate branches, which fork at unequal distances from the margin, the last simple. The internomedian vein is sinuate by the apical extension of its attenuated tip and reaches to the distal fifth of the tegmina; its branches are few, distant, arcuate, simple or deeply forked, the proximal oblique, the distal nearly longitudinal. The anal furrow is very feebly impressed, greatly arcuate, and strikes the inner margin not far beyond the end of the proximal fourth of the tegmina; the anal area is not preserved. The surface of the tegmina is marked with closely crowded delicate cross lines between the nervures, and the latter are faintly and finely traced in black. The basal third of the tegmina is lost in the single specimen known.

Length of fragment, 12 mm.; probable length of tegmina, 17 mm.; breadth, 7.5 mm.

This species differs from *E. sagittaria* by the far greater importance of the externomedian area, but seems to be more nearly allied to it than to any other species.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; No. 2101 *a-b*.

5. *ETOBLATTINA FOSSA* sp. nov.

Pl. IV, fig. 5.

Tegmina scarcely more than twice as long as broad, the inner margin nearly straight, the costal rather strongly convex, the apex broadly rounded. Mediastinal area broad at base, rapidly narrowing beyond the middle, terminating just beyond the middle of the tegmina; the branches few, mostly simple, straight and very oblique. Scapular vein strongly sinuate, in the middle subparallel to the costal margin, terminating close to the apical margin, first branching in the middle of the proximal half of the tegmina, with few gently arcuate branches, but the proximal ones deeply forked or compound, and all longitudinally oblique. Externomedian vein rather strongly sinuate, first branching a little before the middle of the tegmina, the branches few but mostly doubly forked and longitudinally arcuate. Internomedian vein parallel to the externomedian, terminating a little before the extreme apex of the tegmina, two branches which are doubly forked thrown off in the proximal fourth of the tegmina, and only one or two (simple?) beyond. Anal furrow finely impressed, regularly arcuate but apically straight and nearly transverse, terminating beyond the proximal two-fifths of the tegmina. The surface is glistening, carbonaceous, and distinctly marked with crowded and very irregular delicate cross lines, in places becoming reticulate. The lower part of the tip of the tegmina is broken off from the only specimen known, and the shoulder of the base is lost, with the anal area.

Length of fragment, 12.4 mm.; probable length of tegmina, 14 mm.; breadth, 6.75 mm.

This species closely resembles the next two, but the neururation is much less close, and the branching of the internomedian vein very different, most of the area being taken up with the offshoots of the first two branches.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston, No. 182.

6. *ETOBLATTINA ILLUSTRIS*.

Pl. IV, fig. 11.

Etblattina illustris Scudd., Bull. U. S. Geol. Surv., No. 101, 12-13, pl. 2i (1893).

From the Lower (?) Productive Coal-measures of Pawtucket (?), R. I.

7. *ETOBLATTINA OVATA* sp. nov.

Pl. IV, fig. 6.

Tegmina of a very symmetrical long ovate form, somewhat more than twice as long as broad. Mediastinal area fully half as long as the tegmina, the branches of the vein not numerous, gently arcuate, and mostly simple. Scapular vein nearly straight, with only a gentle arcua-

tion at the extremities, subparallel to the costal margin and terminating scarcely before the extreme apex of the tegmina; its first branches in the middle of the proximal half of the tegmina, and has half a dozen very oblique and straight branches, simple or doubly forked. Externomedian vein straight and longitudinally oblique in its middle half, but arcuate at the extremities, terminating a little below the apex of the tegmina, thus occupying but an inconsiderable space on the margin; in the single specimen before me it first forks a little before the middle of the tegmina and has four branches, but the first is blind, the second deeply forked, the others simple, and all longitudinal. The internomedian vein is broadly sinuate, especially by the apical prolongation of the area, nearly to the apex of the tegmina, and is supplied with numerous branches, all, so far as can be seen, simple and arcuate, the proximal oblique, the distal longitudinal. The anal furrow is rather deeply impressed, strongly arcuate and probably mesially bent, terminating a little before the middle of the tegmina; the anal veins are numerous and crowded, strongly arcuate, and most of them very deeply forked. The carbonaceous black surface is indistinctly marked with rather close and irregular tremulous cross lines.

Length of fragment, 13 mm.; probable length of tegmina, 14.5 mm.; breadth, 6.25 mm.

This species is tolerably distinct from any of the known species of *Etolblattina*, but is perhaps most nearly allied to *E. illustris*, from which it differs in every known point of structure, and in particular in its feebly developed externomedian area, not to mention the extreme disparity in size, the present species having tegmina less than one-fifth as long as *E. illustris*.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2102a.

8. ETOBLATTINA SCHOLFIELDI.

Pl. IV, fig 7.

Etolblattina scholfieldi Scudd., Bull. U. S. Geol. Surv., No. 101, 15, pl. 2, fig. b (1893).

From the Lower (?) Productive Coal-measures of East Providence, R. I.

9. ETOBLATTINA DEBILIS sp. nov.

Pl. IV, fig. 8.

Tegmina oval, tapering from before the middle, about two and one-fourth times longer than broad, the costal border strongly convex, especially in basal half, the inner margin nearly straight, except at base and apex, and the apex probably well rounded. Mediastinal area vittate, about a fourth of the width of the tegmina, apically tapering gradually, and terminating scarcely beyond the distal end of the middle third of the tegmina, the branches tolerably numerous, straight, oblique or very oblique, and rarely forked. The scapular and externomedian veins run

so closely together in the proximal fourth of the tegmina as often with difficulty to be distinguished; beyond this the former is nearly straight and ends scarcely above the extreme apex of the tegmina; the branches are simple or deeply forked, nearly straight and oblique, the first originating sometimes as early as the middle of the proximal half of the tegmina. The externomedian vein, nearly as soon as it distinctly parts from the scapular, is straight and longitudinally oblique with three or four simple or forked straight branches parallel to the scapular vein. The internomedian vein is strongly arcuate at base, straight beyond, and terminates not far from the middle of the distal half of the tegmina; its branches are only three or four in number, but they are often deeply forked or doubly forked, nearly straight, and with a general oblique course. The anal furrow is very sharply depressed, very strongly arcuate before the straight apex, which strikes the inner margin at the end of the proximal two-fifths of the tegmina; the anal veins next the furrow are bent arcuate, the distant ones oblique and nearly straight, all simple, and the latter much more crowded than the former. The basal portion of the mediastinal vein is almost as much impressed as the anal furrow, and the interval between it and the scapular vein at the extreme base of the tegmina roundly ridged. The surface of the tegmina is of the color of the stone, but the internomedian and anal veins are finely traced in black; excessively crowded fine cross lining appears everywhere between the nervures, especially in the faintly vaulted anal area.

Length of largest fragment, 13 mm.; probable length of tegmina, 17 mm.; breadth, 7.5 mm.

This species somewhat resembles *E. strigosa*, especially in the close basal alliance of the scapular and externomedian veins, but it differs considerably from any species with which one would be disposed to compare it. One of the specimens (No. 2103 *c-d*) does not have the scapular and externomedian veins united to so great a distance as described.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; three specimens, Nos. 2103 *a-b*, *c-d*, *e*.

10. ETOBLATTINA STRIGOSA.

Pl. IV, fig. 10.

Etblattina strigosa Scudd., Proc. Bost. Soc. Nat. Hist., XXIV, 52-53 (1889).

From the Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone in the valley of Wills Creek, Richmond, Jefferson County.

11. ETOBLATTINA CLARKII.

Pl. V, fig. 10.

Etblattina clarkii Scudd., Bull. U. S. Geol. Surv., No. 101, 14-15, pl. 2, fig. *j* (1893).

From the Lower (?) Productive Coal-measures at Pawtucket, R. I.

12. ETOBLATTINA VENUSTA.

Blattina venusta Lesq., Second Rep. Geol. Ark., 314, pl. 5, fig. 11 (1860).

Etblattina venusta Scudd., Mem. Bost. Soc. Nat. Hist., III, 70-72, pl. 6, fig. 12 (1879); Foss. Ins. N. A., I, 90-92, pl. 6, fig. 12 (1890).

Frog Bayou, Arkansas, in deposits regarded by Lesquereux¹ as having from 200 to 300 feet of Millstone Grit above them, but which I am informed by Mr. R. D. Lacoe, basing his judgment upon the maps and reports of the later Arkansas surveys, more probably belong to the true Productive Coal-measures, or the upper "coal-bearing division" of Winslow. Final reports on the district have not yet been published, and another season's fieldwork may be required to furnish a complete demonstration. In the present paper I have assumed provisionally the accuracy of Lesquereux's determination, though the presumption is not in its favor.

13. ETOBLATTINA BALTEATA.

Gerablattina balteata Scudd., Mem. Bost. Soc. Nat. Hist., III, 110-112, pl. 6, figs. 9, 10 (1879); Rep. Second Geol. Surv. Penn. PP, 104, pl. 38, figs. 5, 5a (1880); Foss. Ins. N. A., I, 130-132, pl. 6, figs. 9, 10 (1890).

Etblattina balteata Scudd., Proc. Bost. Soc. Nat. Hist. XXIV, 46, 48 (1889).

From the Waynesburg coal (Lower Permian) of Cassville, W. Va.; and perhaps from Bellaire, Ohio, in the Barren Coal-measures in shales 20 feet below the Pittsburg coal.

The type of the species comes from Cassville. The fragment from Bellaire is composed of the anal area only, and it is quite impossible to tell whether it belongs to this or an allied species.

14. ETOBLATTINA PATIENS sp. nov.

Pl. IV, fig. 9.

Tegmina slender, nearly three times as long as broad, the costal margin not very strongly but very regularly arcuate, the inner margin nearly straight, the apex probably well rounded, tapering from the middle of the tegmina. Mediastinal area vittate, the vein parallel to the margin, apically tapering and reaching nearly to the middle of the distal half of the tegmina, the branches moderately numerous, oblique, straight, and simple. The scapular vein is unusually straight and terminates scarcely above the extreme apex of the tegmina; it divides in the middle of the proximal half of the tegmina into two longitudinal branches, each further subdivided only beyond the middle of the tegmina, the upper or first branch into a double fork, simulating the appearance of the apical part of the mediastinal vein, the lower or main stem with several inequidistant branches, some at least probably forked. Externomedian vein also very straight and longitudinally oblique, first forking before the middle of the tegmina, the branches distant, only

¹ See Geol. Mag., V, 177 (1868).

three or four in number, the first two oblique, the others compound. Internomedian vein similarly straight, though probably a little arcuate at tip (where it is broken in the only specimen seen), terminating probably a little before the apical margin of the tegmina, the branches rather numerous, subequidistant, increasingly oblique the farther from the anal area, arcuate and simple. Anal furrow delicately impressed, not greatly arcuate, terminating at the distal end of the proximal two-fifths of the tegmina. The surface of the tegmina is very broadly banded with black along the veins, between which run rather closely crowded, delicate, irregular cross lines, conspicuous only in the blackened portions.

Length of fragment, 13 mm.; probable length of tegmina, 18 mm.; breadth, 6.4 mm.

This species is closely allied to *E. balteata*, from which it differs principally in the far more numerous and simple internomedian branches, and in the earlier forking of the scapular vein; it is also related not distantly to the European *E. russoma* and probably has the apex, as there, well filled with numerous veinlets, but the costal margin is far less arcuate, and the main veins in *E. russoma* are not nearly so straight as here. It also shows many points of resemblance to our *E. occulta*.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2104 a-b.

15. ETOBLATTINA MUCRONATA sp. nov.

Pl. V, fig. 3.

A large part of the base is lost from the only specimen of this species seen, but the tegmina are apparently somewhat less than three times as long as broad, of a lanceolate form, the apical half tapering somewhat rapidly and regularly, the apex subacuminate and sharply rounded. The mediastinal area is triangular, apically attenuate, reaching nearly to the distal end of the middle fifth of the tegmina, first forking at about the end of the proximal third of the tegmina, with three or four arcuate, longitudinally oblique, deeply forked or doubly forked branches, the apical branch simple. Externomedian vein very feebly sinuate, first forking at about the middle of the tegmina, with four branches having a course similar to that of the scapular branches, simple or forked, the last multiforked. Internomedian vein very feebly sinuate, almost straight, terminating well before the apex, but at the edge of the apical margin, with very numerous, nearly straight, crowded, simple, oblique branches. The surface of the tegmina is uniformly blackish, with the feeblest possible signs of distant straight cross lines between the nervures. The anal area and furrows are lost.

Length of fragment, 9.5 mm.; probable length of tegmina, 13.5 mm.; breadth, 5 mm.

This species bears a certain resemblance to *E. expuncta*, but is of much slenderer form, more tapering apically, and has more oblique and more

complicated externomedian branches; the internomedian area is also longer in the present species; besides which there is in *E. expuncta* no such wide separation of the nervures in the middle of the wing as here.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; No. 2105 *a-b*.

16. ETOBLATTINA DETECTA sp. nov.

Pl. IV. figs. 12, 13.

Tegmina long ovate, considerably less than three times as long as broad, with the costal margin very strongly arcuate at base, nearly straight beyond the proximal third of the tegmina, the inner margin nearly straight, and the apex subacuminate, falling above the middle line of the tegmina. The mediastinal area is very slender and tapering, terminating well before the distal end of the middle third of the tegmina, with few very oblique, straight, simple branches. Scapular vein nearly straight, terminating near the beginning of the apical margin, first forking well before the middle of the tegmina with about four very inequidistant, longitudinal or longitudinally oblique, simple or deeply forked, sometimes doubly forked, straight or slightly arcuate branches. Internomedian vein distant from the externomedian, straight or sinuate, terminating at about the middle of the distal half of the tegmina with generally simple, rather distant, parallel, oblique, arcuate branches. Anal furrow very strongly and very regularly arcuate, rather deeply impressed, terminating not far from the middle of the proximal half of the tegmina; anal veins irregularly arcuate, inequidistant and subparallel, simple and moderately numerous. The surface of the tegmina is heavily banded with black along the nervures, so broadly as often to blend with the neighboring bands, and the interspaces are traversed pretty regularly and closely with distinct straight cross lines.

Length of tegmina, 16.5 mm.; breadth, 6.25 mm.

Two specimens are before me which differ considerably in the internomedian vein, which in one is straight and apically divaricate from the externomedian vein, and this latter forks relatively far from the base, while in the other specimen the internomedian vein is sinuous, apically convergent with the externomedian vein, and this latter forks relatively near the base. The latter specimen is nearly perfect; the former has lost a little of both base and apex.

This species is more nearly allied to the two preceding than to any others known to me, but is sufficiently distinguished from *E. mucronata* by its form and the relatively small number of internomedian branches, as well as by the earlier forking of the externomedian vein, and from *E. patiens* by the very different mediastinal area. It is, on the whole, nearer the latter.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; two specimens, Nos. 2106 *a-b, c*.

17. ETOBLATTINA OCCIDENTALIS.

Etblattina occidentalis Scudd., Mem. Bost. Soc. Nat. Hist., IV, 410-411, pl. 32, fig. 4 (1890); Foss. Ins. N. A., I, 386-387, pl. 24, fig. 4 (1890).

Lawrence, Kans. Dr. S. W. Williston, of the University of Kansas, tells me that the locality at which it was found, in the old fair ground near the city, is at about the middle of the true Carboniferous of Kansas, as nearly as he can make it out.

18. ETOBLATTINA EXIGUA sp. nov.

Pl. V, fig. 4.

Tegmina somewhat less than three times as long as broad, the inner margin straight, the costal margin strongly arcuate, but much less so in the apical half, the apex probably well rounded. Mediastinal area triangular, the vein being straight and terminating well before the distal end of the middle third of the tegmina; the branches are obscure but probably very longitudinally oblique and few in number. The scapular vein is broadly sinuate, terminating just above the extreme apex of the tegmina; it has but very few, three or four, very longitudinally oblique, feebly arcuate branches, mostly simple, their course parallel to the mediastinal vein. The externomedian vein is arcuate and has but two longitudinal branches, the first originating in the center of the tegmina and forked to its root, the other not far before the margin; probably all three of these are forked next the apical margin (broken in the only specimen). The internomedian vein is arcuate at first, straight apically, and terminates a little beyond the middle of the distal half of the tegmina; the branches are few in number and distant, the first one deeply forked, the others simple, straight, and oblique. The anal furrow is not very strongly arcuate, deeply impressed only in its basal half, and terminates a little beyond the end of the proximal third of the tegmina; the anal veins are few, distant, simple, parallel, subequidistant, and arcuate. The basal portion of the mediastinal vein is impressed as deeply as the anal furrow, while the basal portions of the externomedian and internomedian veins are borne on the summit of a ridge between them. The surface of the tegmina is blackish brown and all the nervures are bordered for fully a fourth of the distance to the neighboring nervures with black, more distinctly in the anal area than elsewhere; and there is a feeble very crowded straight cross lining between the nervules.

Length of fragment, 9.25 mm.; probable length of tegmina, 11.75 mm.; breadth, 4.2 mm.

This species is remarkable for the paucity of its neuration, and is not closely allied to any other species yet known.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoë; one specimen, No. 2107 a-b.

19. ETOBLATTINA sp.

Pl. V, fig. 2.

Etoblattina sp. Scudd., Bull. U. S. Geol. Surv., No. 101, 18, pl. 2, fig. h, (1893).

From the Lower (?) Productive Coal-measures of Pawtucket, R. I.

20. ETOBLATTINA JEFFERSONIANA sp. nov.

Pl. V, fig. 7.

The only specimen of this species is a fragment from the middle half of the tegmina, with striking neuration; probably the tegmina were about two and a half times as long as broad, with both costal and inner margins gently convex, indicating a very regular oblong-obovate form. On this hypothesis, the mediastinal vein extended considerably beyond the middle of the tegmina, nearly to the distal end of the middle fifth, and was vittate, tolerably broad, with rather distant, parallel, straight, oblique branches. The scapular vein is extraordinarily distant from the mediastinal, strongly and regularly arcuate, and terminates probably short of the apical margin; it first forks just beyond the middle of the proximal half of the tegmina, and has about five inequidistant branches, which are long, arcuate, and simple or deeply, rarely doubly, forked, having the same trend as the mediastinal branches. The externomedian vein is broadly arcuate, first forks a little within the proximal two-fifths of the tegmina, and has about four longitudinal branches, the earlier ones compound and gently arcuate, the later ones simple or forked and nearly straight. The internomedian vein is broadly sinuate, the area being apically and very gradually attenuate, and probably reaching beyond the scapular area, with branches which are gently arcuate, simple, oblique, and become more and more longitudinal, about as distant as the mediastinal branches. The surface of the tegmina is uniformly carbonaceous, and there is no sign of any cross lines.

Length of fragment, 15 mm.; probable length of tegmina, 23.5 mm.; breadth, 9.5 mm.

This species bears some resemblance to the European *E. ornatissima*, but from the imperfection of the latter the scapular areas can not be compared; it seems, however, to have been in this direction wholly unlike our species. *E. jeffersoniana* also somewhat resembles our *E. gratiosa*, but differs entirely in the length and character of the mediastinal area and the peculiarities of the scapular venation.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston; one specimen, Nos. 186 and 184.

21. *ETOBLATTINA RESIDUA* sp. nov.

Pl. V, fig. 1.

A portion only of one of the tegmina is preserved in the only specimen of this species seen, lacking the entire costal margin, but the greater part of the neuration is preserved and shows a peculiar species. The tegmina are apparently about two and a half times longer than broad with a nearly straight inner margin; the costal margin was probably somewhat strongly arcuate and the apex subacuminate, the tegmina tapering from before the middle. A fragment only of the mediastinal vein is preserved, showing the area to have been remarkably narrow, terminating before the distal end of the middle fifth of the tegmina. The scapular vein is rather strongly sinuate, and terminates somewhat before the apex of the tegmina; it first forks before the tip of the anal furrow, hardly beyond the basal fifth of the tegmina, and probably has five or six simple or forked, long, straight, and remarkably longitudinal branches. The externomedian vein is similarly sinuate, first forks but little beyond the scapular and has but two branches, the second emitted near the middle of the tegmina, the branches doubly forked or compound, gently arcuate and longitudinal. The internomedian vein is strongly sinuate, apically very attenuate, but fails even to reach the apical margin; it has seven or more rather distant branches, the proximal nearly straight, the distal arcuate and longitudinally oblique. The anal furrow is strongly arcuate, scarcely impressed, terminating at the end of the basal fourth of the tegmina, so that the area is remarkably abbreviated. The surface is uniformly black and the interspaces traversed by rather crowded delicate cross lines.

Length of fragment, 11 mm.; probable length of tegmina, 15.5 mm.; breadth of fragment, 5.25 mm.; probable complete breadth, 6 mm.

This species seems to be most nearly, but not closely, allied to *E. jeffersoniana*, but differs from it in form, in the narrowness of the mediastinal, scapular, and apical portion of the internomedian areas, and in the totally different formation of the scapular mode of branching.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoë; one specimen, No. 2131a.

22. *ETOBLATTINA FUNERARIA* sp. nov.

Pl. V, fig. 5.

Tegmina oval, two and a half times as long as broad, the inner margin straight before the apex, the costal margin strongly and pretty regularly convex, the apex probably well rounded. The mediastinal area is vittate, rather narrow, almost two-thirds as long as the tegmina, with rather few, inequidistant, straight or arcuate, simple, strongly oblique branches. The scapular vein is nearly straight but feebly and

very broadly sinuate, terminating at no great distance before the apex of the tegmina; it first forks at the end of the proximal third of the tegmina, and has five or six very oblique feebly arcuate branches, which are apically forked at a distance from the margin equal to the width of the mediastinal area. The externomedian vein, at first arcuate, is thereafter nearly straight, longitudinally oblique and apically faintly arcuate; it first forks just beyond the scapular vein, and in the middle of the tegmina has three longitudinally and gently arcuate forked or doubly forked branches. The internomedian vein is arcuate, very feebly except at base, and terminates long before the apex of the tegmina with five or six rather distant, simple, arcuate, oblique or longitudinally oblique branches. The anal furrow is strongly bent arcuate, strongly impressed, and terminates somewhat beyond the end of the proximal third of the tegmina; the anal veins are simple, at first distant and arcuate; then sinuate, then proximate and straight, in passing from the anal furrow. All the nervures, but especially those of the anal area, are strongly and rather broadly edged with black, giving the whole a funereal appearance, and in the anal and internomedian areas, and to a faint degree elsewhere, are distinct cross lines closely crowded and straight between the nervules.

Length of largest fragment, 14.5 mm.; probable length of tegmina, 17.5 mm.; breadth, 7 mm.

This species is of the type of *E. russoma* of Europe, from which it differs mainly in the characteristics of the scapular vein, and the small number of externomedian veinlets. It also resembles, in many points, some of our own species, such as *E. exsecuta*, from which it may be separated by its broader and less attenuated internomedian area, which feature, as well as the relatively greater breadth of the tegmina, separates it from *E. accubita* and *E. expulsata*.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoë; two specimens, Nos. 2108 a-b, c.

23. ETOBLATTINA EXPUNCTA sp. nov.

Pl. V, fig. 6.

Tegmina a little more than two and a half times longer than broad, ovate, with gently arcuate costal border, very gently arcuate inner border and probably well-rounded apical border. Mediastinal area vittate, apically attenuate, reaching slightly beyond the distal end of the middle third of the tegmina; the branches few, simple, straight, and longitudinally oblique. Scapular and externomedian veins apparently united in the proximal fourth of the tegmina, the scapular thereafter straight and terminating at the very apex; it first forks almost immediately after its freedom from the externomedian vein and before the middle of the tegmina, and has at least three longitudinally oblique gently arcuate branches, all arising before the middle of the distal half

of the tegmina and all deeply forked, the first very deeply and doubly forked. The externomedian vein is bent at parting from the scapular and is thereafter straight and oblique, and has four or five subequidistant, straight, simple, longitudinal branches. Internomedian vein arcuate at base, beyond straight, terminating in the middle of the distal two-fifths of the tegmina, with numerous and crowded, mostly simple, straight, oblique branches. The anal furrow is concealed in the only specimen seen by the slipping forward of the partially detached anal area, but the vaulting of the latter indicates that it was deeply impressed, pretty strongly arcuate, and terminated at about the end of the proximal third of the tegmina; anal veins numerous, gently arcuate, mostly simple, but some deeply forked. The surface of the tegmina is uniformly black, apparently delicately shagreened and there is no trace of cross lines.

Length of fragment, 11 mm.; probable length of tegmina, 15 mm.; breadth, 5.75 mm.

The species is somewhat allied to *E. mucronata*, but has an altogether different mediastinal area, with no such tapering form of the tegmina. *E. debilis* has the same basal union of the scapular and externomedian veins, but that species has much broader tegmina and very different internomedian branches. *E. russoma* is its nearest European ally, but it is very different from that species at nearly every point.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2109 a-b.

24. ETOBLATTINA GORHAMI.

Pl. V, fig. 8.

Etolblattina gorhami Scudd., Bull. U. S. Geol. Surv., No. 101, 17-18, pl. 2, fig. a (1893).

From the Lower (?) Productive Coal-measures of Pawtucket, R. I.

25. ETOBLATTINA APERTA sp. nov.

Pl. V, fig. 9.

Although only the middle half of one of the tegmina of the specimen on which this species is based is preserved, it retains nearly all the most characteristic features of the tegmina and is so remarkable that it can not be passed by. To judge by the margins preserved and by the course of the veins and their branches it had a tapering oval form, the tegmina considerably less than three times as long as broad, and probably tapering from near the middle of the proximal half apexward. The mediastinal vein appears on the fragment only by its tip, which reached but little beyond the middle of the tegmina, the branches very oblique. The scapular vein ran in a tolerably straight course not far above the middle line of the tegmina to a little beyond the center, when it curved strongly upward to the costal margin, which it struck not far

from the proximal end of the distal fifth of the tegmina; it probably first forked not far beyond the proximal fourth of the tegmina and had four considerably arcuate, oblique, simple or more or less deeply forked branches. The externomedian vein is nearly straight, very distant from the scapular, and has in the fragment only a single but very important and singular branch, which, unless there is a slight branch to the main vein near the tip, takes all the divarication that appertains to the main stem, for, curving in the same sense as the main scapular vein and slightly approaching it, it throws off, subparallel to the main stem, three longitudinal and arcuate simple or forked branchlets. The internomedian vein, too, is peculiar; it lies at an extraordinary distance from the externomedian vein, and soon after its freedom from the anal area runs completely parallel to the inner margin and at no great distance from it, the area being in the middle less than a fourth of the width of the tegmina, and probably terminates on the apical margin, where it curves around to meet its straight course; the branches are simple, distant, strongly arcuate and longitudinally oblique. The main veins are heavily and broadly, the branches narrowly, margined with black, and there is very faint sign of crowded cross lining between the nervures.

Length of fragment, 9 mm.; probable length of tegmina, 16 mm.; breadth, 6 mm.

This species is most nearly allied to *E. fasciata*, but differs from it in the still narrower internomedian area and the totally different neuration of the externomedian vein. I formerly¹ regarded it as the same, but there can be little doubt of its distinctness.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2066 a-b.

26. ETOBLATTINA FASCIATA.

Pl. V, fig. 11.

Etolblattina fasciata Scudd., Proc. Bost. Soc. Nat. Hist., XXIV, 47-48, 1889.

The second specimen described under this name in the above-mentioned paper (p. 48) was wrongly referred to this species and is here described as *E. aperta*, No. 25. No further specimens of the present species have been found.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County.

27. ETOBLATTINA RAMOSA sp. nov.

Pl. V, fig. 12.

The greater and nearly all the important part of one of the tegmina shows them to be of a lanceolate form, but with the costal far more strongly arcuate than the inner margin, with a probably strongly

¹ Proc. Bost. Soc. Nat. Hist., XXIV, 48.

rounded somewhat pointed apex, the whole about two and a half times longer than broad. The mediastinal vein is straight and subparallel to the arcuate margin in the middle of its course, and roundly bent toward the margin at the origin of its last offshoot, ending scarcely beyond the middle of the tegmina; the branches are distant, gently arcuate, strongly oblique and apically narrowly forked. The scapular vein is nearly straight, but apically slightly arcuate, terminating a little below the apex of the tegmina; it first forks a little beyond the proximal fourth of the tegmina and has four or five branches, which are strongly or longitudinally oblique, more or less sinuous, and deeply and sometimes doubly forked. The externomedian vein is nearly straight, but apically slightly sinuous and first forks scarcely before the middle of the tegmina, and has three or four inequidistant longitudinal branches, all simple or forked only apically if at all, together occupying only the narrow apical margin. The internomedian vein, at first straight, is afterward sinuous, retreating from and then advancing toward the externomedian vein, so as to leave a widened space between these main veins, much after the fashion of *Spiloblattina*, and terminating a little below the extreme apex of the tegmina; its branches are distant, longitudinally oblique and arcuate, all or nearly all more or less deeply, often doubly, forked or ramose. The anal furrow strikes the margin at about the end of the proximal third of the tegmina. The surface is black but with long, uncolored, fusiform patches in the wider interspaces, while in the blackened portions it is delicately, feebly, and minutely reticulate, the reticulations partially giving way in the internomedian area to tremulous cross lines.

Length of fragment, 16 mm.; probable length of tegmina, 25 mm.; breadth, 10 mm.

This species certainly bears a close general resemblance to *E. hastata* from the same beds, but has a much stouter form and more strongly sinuous internomedian vein, besides larger mediastinal and anal areas; the peculiarities of the branching of each vein is, however, very similar.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston, No. 108.

28. *ETOBLATTINA WILLSIANA* sp. nov.

Pl. V, fig. 13.

Tegmina lanceolate, tapering from the basal third, more than two and one-half times longer than broad, the costal margin rather strongly and pretty regularly arcuate, the inner margin scarcely arcuate, the apex subacuminate and strongly rounded. Mediastinal area long triangular, the vein very straight and terminating scarcely beyond the middle of the tegmina, the proximal branches transversely oblique and straight, the distal oblique or very oblique and arcuate, all

simple. Scapular vein broadly sinuate by the bending of the vein at the origin of the first two branches and its apical slight arcuation, terminating well before the apex of the tegmina; it has about half a dozen very oblique branches, the first branch arising near the middle of the proximal half of the tegmina and nearly continuing the basal course of the main vein; the distal branches are simple, the others deeply forked, doubly forked, or compound. The externomedian vein is gently sinuous, terminating below the apex of the tegmina, so that its branches occupy symmetrically the narrow apex; it has three distant longitudinal branches, the lower ones simple, the first, arising well before the middle of the tegmina, simple halfway to the tip, and then nearly opposite the second branch it is narrowly arborescent; it parts so narrowly from the main stem that the vein appears to have two narrowly divergent, unequal, forking branches. The internomedian vein is strongly sinuate, though straight in the middle of its course, and terminates as near the apex as the scapular vein; its branches are rather distant, all but the apical and some of the proximal forked or doubly forked, the proximal oblique and gently arcuate, the distal longitudinally oblique and arcuate. The anal furrow can not strike the inner margin far beyond the proximal third of the tegmina, but this portion is lost in the single specimen seen. The surface is carbonaceous black, with a loss of color in elongate patches in the interspaces, and the black portions are delicately and irregularly reticulate.

Length of fragment, 22.5 mm.; probable length of tegmina, 26.75 mm.; breadth, 10.25 mm.

This species is very closely allied to *E. ramosa*, but is distinguishable from it by the straightness of the mediastinal vein, the angularity of the scapular and the earlier forking and different mode of branching of the externomedian vein. Almost similar differences separate it from the straight veined *E. funesta*. In the peculiar formation of the externomedian area it bears some resemblance to the European *E. elongata*.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston, No. 176.

29. ETOBLATTINA LESQUEUREUXII.

Etolblattina lesqueureuxii Scudd., Mem. Bost. Soc. Nat. Hist., III, 67-69, fig., pl. 6, figs. 2, 3 (1879); Foss. Ins. N. A., I, 87-89, fig., pl. 6, figs. 3, 4 (1890).

From the roof shales of the D seam of anthracite at Yatesville, near Pittston, Pa.

30. ETOBLATTINA MALEDICTA sp. nov.

Pl. VI, figs. 1-3.

Tegmina oblong ovate, two and one-half or more times longer than broad, the costal margin broadly arcuate, the inner margin mostly straight, the apex well rounded. Mediastinal area rather narrow, vittate, the tip acuminate, ending distinctly beyond the middle of the

tegmina; the branches moderately numerous, rarely forked, very oblique, gently arcuate. Scapular vein broadly sinuate, ending a very little before the apex, first forking somewhat beyond the proximal fourth of the tegmina, with about five inequidistant branches, which are mostly deeply forked or doubly forked, arcuate, and longitudinally oblique, the first generally arising far before the others. Externomedian vein beyond the strong basal arcuation very broadly sinuate, first forking at about the middle of the tegmina, with three simple or forked branches, all nearly longitudinal, occupying at tip the apical margin only of the tegmina. Internomedian vein broadly sinuate (it is drawn too straight in fig. 2), terminating almost or quite as near the apex as the scapular vein, its branches not very numerous, arcuate and oblique, mostly simple, but occasionally deeply forked. Anal furrow rather strongly arcuate, delicately impressed, terminating at the end of the proximal two-fifths of the tegmina; anal veins simple, next the anal furrow strongly arcuate, beyond sinuate and more crowded. Surface of the tegmina carbonaceous black, with more or less fusiform brown patches in the interspaces, the black portions marked with crowded, more or less tremulous and irregular cross lines.

Length of largest fragment, 23 mm.; probable length of tegmina, 25 to 29 mm.; breadth, 9.5 to 11 mm.

This species is closely allied to *E. variegata* and *E. stipata*, but is of a stouter form, with the main veins more curved than in the former, and with less abundantly branched scapular and externomedian veins than in the latter. One of the specimens (No. 165) differs from the others in that the first branch of the scapular vein is compound and carries a much larger share than usual of the scapular system, much as in No. 163 (fig. 2), but in a still more aggressive manner.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston; seven specimens, Nos. 163, 164, 165, 170, 174, 181, 192.

31. ETOBLATTINA BENEDICTA sp. nov.

Pl. V, figs. 14, 15.

Tegmina about two and one-half times longer than broad, tapering from the end of the basal third, the costal margin very strongly arcuate, the inner margin nearly straight except at the extremities, the apex subacuminate but well rounded. Mediastinal area vittate, tapering only close to the tip, which reaches about to the distal end of the middle fifth of the tegmina; the branches rarely forked, slightly arcuate, and very oblique. The scapular vein is considerably sinuate and terminates well before the apex of the tegmina; it first forks a little beyond the basal third of the tegmina and has five or six branches, of which the first two arise close together; the branches are mostly forked

or compound, most of them considerably arcuate and very oblique indeed. The externomedian vein beyond its strong basal arcuation is nearly straight, but feebly arcuate in an opposite sense; it first forks near the middle of the tegmina and has three branches which are longitudinal, nearly straight, and in the apical fourth of the tegmina forked or compound. Internomedian vein strongly sinuate, much more strongly arcuate at base than apically, the area being apically attenuate and yet terminating far before the apex of the tegmina; the distant branches are more or less arcuate, simple or apically forked and oblique. The anal furrow is strongly arcuate, scarcely impressed, and terminates before the end of the proximal third of the tegmina; the anal veins are in no instance preserved. The surface is precisely as in *E. maledicta*.

Length of large fragments, 16 to 22 mm.; probable length of tegmina, 23.5 to 24 mm.; breadth, 9 to 10 mm.

This species is very closely allied to *E. maledicta*, and will possibly be found to be identical with it; it differs principally in the much stronger arcuation of the costal border, the briefer extension of the internomedian area, and the approximation at base of the first two branches of the scapular vein. It seems to be equally abundant with *E. maledicta*, and is with it the most common of the Richmond species. The different specimens agree remarkably in the neurulation of the scapular area, the greatest difference being shown in the two selected for illustration.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston; six specimens, Nos. 166 and 167, 168, 178, 179 and 191, 183 and 193, 199.

32. ETOBLATTINA FUNESTA sp. nov.

Pl. VI, fig. 4.

Tegmina nearly three times as long as broad, lanceolate, tapering apically from the middle, with broadly arcuate costal margin and feebly arcuate inner margin, the apex strongly rounded. Mediastinal area moderately broad, tapering, terminating at about the distal end of the middle fifth of the tegmina, with strongly oblique, rather distant and straight, simple or forked branches. Scapular vein exceedingly straight in more than its middle half, broadly arcuate apically, and ending just before the narrow apical margin; it first forks at about the end of the proximal fourth of the tegmina, and has half a dozen straight or sinuate, strongly oblique or longitudinally oblique branches, most of them forked, and sometimes compound. The externomedian vein beyond the base is rigidly straight, scarcely bent where first forked, and has but a couple of approximate branches, occasionally three, thrown off at the middle of the tegmina and beyond, both branches straight and longi-

tudinal, soon and almost simultaneously forked and probably again forked beyond. In contrast to these the internomedian vein is strongly sinuate (though nearly straight in its middle course), leaving a wide space between it and the externomedian vein, and terminates somewhat earlier than the scapular vein; its branches are not crowded, simple, or forked, mostly the former, gently arcuate and oblique. The anal furrow terminates short of the end of the proximal two-fifths of the tegmina. The surface of the tegmina is carbonaceous black, with large, elongate, pale patches in the larger interspaces, and there is feeble sign in a few places of delicate, not very crowded, cross lining.

Length of best fragment, 20 mm.; probable length of tegmina, 27 mm.; breadth, 9.5 mm.

The species is nearly allied to *E. tenuis*, from which it differs mainly in the later and different branching of the externomedian vein and the much more strongly sinuate course of the internomedian. It is a much slenderer species than the preceding, from which it differs in the straightness of the middle veins and in its slenderer form. There is a somewhat striking difference between two of the specimens in the straightness or sinuation of the scapular branches, and especially in the proximal.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Three specimens: Mr. S. Huston, Nos. 107 and 177, 180; United States Geological Survey, No. 2186.

33. ETOBLATTINA EXSENSA sp. nov.

Pl. VI, figs. 7, 8.

Tegmina slender and lanceolate, about two and one-half times longer than broad, to judge from the fragments preserved, which only show the central portions; the costal margin gently arcuate and the inner nearly straight. Mediastinal area vittate, tapering in its apical half, acuminate, reaching to about the distal end of the middle fifth of the tegmina, the veins very oblique, simple, and straight. Scapular vein faintly arcuate, terminating slightly before the extreme apex of the tegmina, first forking only a little before the proximal fourth of the tegmina, the first branch nearly longitudinal, and bearing most of the branchlets, which are similar to those of the mediastinal vein, but distinctly less oblique; the main vein forks again several times, the first at about the middle of the tegmina, the branches longitudinally oblique and forked (very likely compound). Externomedian vein nearly straight to about the middle of the tegmina, and then bent at the first fork, following a longitudinally oblique course toward the inner margin; it has two or more forked and, perhaps, compound branches. The internomedian vein is strongly sinuous, being straight and longitudinally oblique beyond the basal arcuation to near the middle of the tegmina, thereafter parallel or subparallel to the inner margin, and doubtless curving

down toward it apically; its distant branches have a varying obliquity and are arcuate, and, at least beyond the basal ones, mostly forked or doubly forked. The anal furrow probably terminates at about the end of the proximal third of the tegmina. The surface is black, with broader or narrower elongate brown patches in the interspaces, sometimes reducing the black to a narrow bordering to the nervures, though never closely approaching the margin of the tegmina; over the black portions can be seen a delicate, close, and tremulous cross lining.

Length of fragments, 9 to 11 mm.; probable length of tegmina, 25 to 27.5 mm.; breadth, 10.5 to 11 mm.

This species closely resembles *E. tenuis*, from which it differs principally in the great importance of the first scapular branch. It is similarly distinguished from the two preceding species.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston; two specimens, Nos. 161, 196.

34. ETOBLATTINA TENUIS.

Pl. VI, fig. 6.

Etolblattina tenuis Scudd., Proc. Bost. Soc. Nat. Hist., XXIV, 46-47 (1889).

This is the only one of our species with open and widely separated neurulation in the center of the tegmina which bears any very close resemblance to the single European species of that type, *E. elongata* (Gein.), from the Dyas, and it is very distinct from that.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County.

35. ETOBLATTINA HUSTONI.

Pl. VI, fig. 9.

Etolblattina hustoni Scudd., Proc. Bost. Soc. Nat. Hist., XXIV, 53 (1889).

From the same place as the last mentioned.

36. ETOBLATTINA PERSISTENS.

Etolblattina persistens Scudd., Mem. Bost. Soc. Nat. Hist., IV, 459-460, pl. 41, fig. 7; pl. 42, figs. 10,¹ 19 (1890); Foss. Ins. N. A., I, 435-436, pl. 33, fig. 7, pl. 34 figs. 10,¹ 19 (1890).

This and an imperfect fragment of another and unnamed species are the only post-Paleozoic *Etolblattinae* known.

Trias of Fair Play, Colo.

¹A most unfortunate error occurs in one of the plates of my paper on the "Triassic insects of Fair Play" (pl. 42 of the Memoirs of the Boston Society of Natural History, vol. 4; pl. 34 of my Fossil Insects of North America, vol. 1), caused by a rearrangement of the plate after the text was prepared without a corresponding change in the text; accordingly, the following changes should be made in the numbers attached to the figures on this plate: Fig. 9 should be numbered 13; fig. 10, 9; fig. 12, 10; fig. 13, 17; fig. 15, 12; fig. 16, 15; and fig. 17 should be numbered 16. The text and plate will then correspond.

37. *ETOBLATTINA EAKINIANA* sp. nov.

Pl. VII, fig. 1.

Tegmina subovate, less than two and one-half times longer than broad, the costal margin strongly shouldered and beyond that gently and regularly arcuate, the inner margin straight, the apex probably well rounded. Mediastinal area vittate, tapering through almost the distal half, reaching to the distal end of the middle fifth of the tegmina, the branches of the vein rather close, mostly simple, increasingly oblique. Scapular vein broadly arcuate, terminating at less than halfway from the tip of the mediastinal vein to the apex of the tegmina, with two very longitudinally oblique, simple, arcuate branches arising about opposite the end of the anal furrow. Externomedian vein gracefully and uniformly sinuate, of far more importance than the scapular, first forking before the end of the proximal fourth of the tegmina, the first branch forking near the origin of the second branch, each fork again dividing halfway to the margin; the other three branches arise near together near the middle of the tegmina, and are simple or forked, all the branches arcuate, less so from above downward, and all nearly longitudinal. Internomedian vein sinuate like the preceding, terminating but little below the apex, the simple branches not crowded as in the two previous areas, slightly arcuate, oblique, and increasingly so in the distal half of the area. Anal furrow strongly and regularly arcuate, strongly impressed, terminating at the end of the proximal third of the tegmina; anal veins arcuate, simple, not numerous. The surface of the tegmina is uniformly black, with faint traces of exceedingly close cross lining in the internomedian area.

Length of fragment, 13 mm.; probable length of tegmina, 15.25 mm.; breadth, 6.5.

The characteristics of the scapular vein easily separate this from other species in the vicinity. It is named for Mr. C. L. Eakin, of Wadestown, W. Va., who has done good service in the exploitation of the locality at Cassville, which has yielded so many remains of *Etolblattina*.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2111 *a-b*.

38. *ETOBLATTINA ACCUBITA* sp. nov.

Pl. VII, fig. 2.

Tegmina nearly three times as long as broad, tapering from the middle in each direction, but more sharply toward the base than toward the apex, the costal margin being very strongly and rather regularly arcuate, the inner margin nearly straight, and the apex probably well rounded. Mediastinal area vittate, terminating at the distal end of the middle fifth of the tegmina, the vein with few mostly simple,

nearly straight, strongly oblique branches. Scapular vein feebly arcuate beyond the basal sinuation, ending well before the apex of the tegmina, with three subequidistant, deeply forked or simple, longitudinally oblique branches, the middle one arising at the middle of the tegmina. Externomedian vein gracefully and rather strongly sinuate, with four mostly simple, slightly arcuate, longitudinal branches, the first arising scarcely later than the first scapular branch. Internomedian vein similarly arcuate, terminating slightly below the apex of the tegmina, the rather numerous branches mostly simple, very oblique, and feebly arcuate, the apical ones longitudinally oblique. Anal furrow less strongly arcuate than usual, terminating but little short of the middle of the tegmina; anal area destroyed in the only specimen seen. The surface is uniformly black, and there is everywhere the feeblest possible sign of close cross lining in the interspaces.

Length of fragment, 12 mm.; probable length of tegmina, 14.75 mm.; breadth, 5.25 mm.

The species is peculiar for the basal narrowing of the tegmina and the apparent length and slenderness of the anal area. It is not distantly related to *E. mazona* and other species, but differs at almost every point.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2112a.

39. ETOBLATTINA MAZONA.

Pl. VI, fig. 5. (See also fig. 3 on p. 31.)

Etolblattina mazona Scudd., Mem. Bost. Soc. Nat. Hist., III, 181, pl. 10 (1882); Proc. Bost. Soc. Nat. Hist., XXI, 392-396 (1882); Foss. Ins. N. A., I, 233, pl. 7a (1890).

From the Lowest Productive Coal-measures at Mazon Creek, Illinois.

40. ETOBLATTINA EXPULSATA sp. nov.

Pl. VII, figs. 3, 4.

Tegmina lanceolate, nearly three times as long as broad, tapering from the middle of the proximal half, the costal margin strongly arcuate, especially basally, the inner margin straight, the apex well rounded. Mediastinal area vittate, apically very attenuate, reaching the distal end of the middle third of the tegmina, the branches of the vein rather numerous, nearly straight, simple and very oblique, the apical longitudinally oblique. Scapular vein uniformly and rather strongly sinuate, ending a little before the apex, first forking at or a little beyond the end of the proximal third of the tegmina, the branches, five or six in number, mostly simple, feebly arcuate or sinuate, longitudinally oblique. Externomedian vein sinuate, more strongly arcuate at base than at apex, first forking just beyond the first scapular fork, with three longitudinal forked or doubly forked branches. Internomedian vein strongly sinuate, the area extended nearly to the tip by its apical prolongation

through a superior subramose offshoot from a little beyond the middle of the tegmina, the other branches mostly simple, arcuate, oblique, and more distant than the branches of other veins. Anal furrow strongly bent-arcuate, strongly impressed, and terminating a little beyond the end of the proximal third of the tegmina; anal area gently vaulted, the veins simple, strongly arcuate. The surface of the tegmina is blackish-brown, and the veins are marked and sometimes narrowly edged with black, while all the interspaces are traversed by very close straight or sinuate cross lines.

Length of one fragment, 14.5 mm.; probable length of tegmina, 16 mm.; breadth, 6 mm. Length of another fragment, 16.5 mm.; probable length of tegmina, 20 mm.; breadth, 7 mm.

This species is very closely allied to the next four or five species, but is sufficiently distinct from them all in the peculiar formation of the apical part of the internomedian area. The two principal specimens referred to here (and figured) differ a little in size and in the point of origin of the first scapular branch.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoë; three specimens, Nos. 2113 *a-b*, *c-d*, *e-f*.

41. *ETOBLOTTINA GRATIOSA* sp. nov.

Pl. VII, fig. 5.

Tegmina ovate, somewhat less than three times as long as broad, the costal margin strongly arcuate throughout, the inner margin straight, the apex well rounded. Mediastinal area vittate, apically very attenuate, reaching fully to the distal end of the middle third of the tegmina, the branches of the vein simple, nearly straight, exceedingly oblique. Scapular vein gracefully, pretty uniformly and rather gently sinuate, subparallel to the inner margin, ending somewhat before the apex; it first branches a little beyond the proximal fourth of the tegmina, and has about five branches which have a longitudinal sweep and are mostly simply deeply and narrowly forked. The externomedian vein is strongly arcuate at the base, feebly sinuate, nearly straight in the middle and gently arcuate apically, first branching just beyond the scapular vein, and with four longitudinal, nearly straight, mostly forked branches, the forks of varying depths. Internomedian vein feebly sinuate, apically arcuate with no sign of special extension, yet terminating nearly as far out as the scapular vein; its branches are more distant than those of the other areas, simple or deeply forked, oblique and nearly straight. Anal furrow strongly bent-arcuate, deeply impressed except apically, terminating a little beyond the proximal third of the tegmina; anal veins strongly arcuate, simple or profoundly forked. The surface of the tegmina is uniformly blackish, and the interspaces are filled with crowded, straight, delicate cross lines.

Length of fragment, 16.5 mm.; probable length of tegmina, 18.25 mm.; breadth, 6.75 mm.

This species is closely allied to *E. expulsata* and has many of its special peculiarities, such as the strongly arcuate costa and the separation of the oblique internomedian veins, as well as the general distribution of the branches; but it differs from it distinctly in the structure of the extremity of the externomedian area. It also bears a close general resemblance to *E. exsecuta*, especially in the mediastinal, scapular and anal areas, but it differs from it at almost every other point. It bears also a general resemblance to the European *E. didyma*, but differs in almost every detail.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2114 *a-b*.

42. ETOBLATTINA MACERATA sp. nov.

Pl. VII, fig. 6.

Tegmina two and three-quarters times longer than broad, ovate, tapering from the middle of the proximal half, the costal margin rather strongly arcuate, especially in the proximal half, the inner margin straight, the apex well rounded. Mediastinal area vittate, apically attenuate, reaching the distal end of the middle third of the tegmina, the vein with few and rather distant, nearly straight, very oblique branches. Scapular vein broadly sinuate, terminating a little above the apex, first forking a little beyond the proximal third of the tegmina, the branches entirely similar to those of the mediastinal area, except in their greater length. Externomedian vein strongly sinuate, with four inequidistant, longitudinal, sinuate branches, simple or deeply forked, the first arising a little beyond the first scapular fork. Internomedian vein sinuate, terminating long before the apex of the tegmina, with branches about as distant as those of the mediastinal area, the proximal ones simple, gently sinuate and oblique, the distal mostly deeply forked, arcuate, and very oblique. Anal furrow strongly arched, deeply impressed, terminating scarcely short of the end of the proximal two-fifths of the tegmina; anal veins simple, strongly arcuate, distant. Surface very dark, all the veins edged narrowly, the anal veins broadly, with black, which is traversed by closely crowded straight cross veins.

Length of tegmina, 19.5 mm.; breadth, 7 mm.

This species is very closely allied to several others; the relative sparseness and simplicity of the scapular and mediastinal branches separate it from *E. expulsata* and *E. gratiosa*, and the lesser length of the mediastinal area from *E. immolata*; in the similarly early origin of the first branch of the scapular and externomedian veins it is distinct from *E. communis*, while the same characteristic and the greater stoutness of the tegmina distinguish it from *E. obatra* and *E. secreta*; from *E. obatra* it is still further separated by its simpler neuration.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; two specimens, Nos. 2081 *a-b*, *c*?

43. *ETOBLATTINA IMMOLATA* sp. nov.

Pl. VII, figs. 7, 8.

Tegmina somewhat more than two and a half times longer than broad, ovate, tapering from about the middle, with rather strongly arcuate costal margin (more strongly arcuate in some than in others), nearly straight inner margin and probably a well-rounded apex. Mediastinal area vittate, tapering only at extreme apex, reaching nearly to the middle of the distal half of the tegmina, the vein with simple, rarely forked, strongly oblique, nearly straight, rather abundant branches. Scapular vein more or less strongly sinuate, terminating somewhat short of the apex of the tegmina, first forking a little before a point opposite the tip of the anal furrow, with four or five simple or deeply forked, more or less arcuate, longitudinally oblique branches. Externomedian vein rather strongly sinuate, first forking scarcely beyond the scapular vein, with about four longitudinally arcuate, simple or perhaps apically forked branches. Internomedian vein gracefully and rather gently sinuate, terminating a little short of the apex of the tegmina, with six or eight arcuate, generally simple, very oblique branches. Anal furrow strongly arcuate, deeply impressed, terminating at just about the end of the proximal two-fifths of the tegmina; anal area gently vaulted, the veins rather numerous, strongly arcuate next the anal furrow, nearly straight in the opposite region. Surface exactly as in *E. macerata*.

Length of largest fragment, 14 mm.; probable length of tegmina, 17.75 mm.; breadth, 6.5 to 7 mm.

This species is closely allied to the three preceding species, but is sufficiently distinguished from them by the greater length of the mediastinal area, in which it approaches the genus *Gerablattina*. From the two following species, to which it is also very closely allied, it differs in the nearly simultaneous origin of the first branches of the scapular and externomedian veins.

The two specimens placed here differ rather unusually at one or two points, especially the arcuation of the costal margin, the breadth of the mediastinal area, and the number of internomedian branches.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe, Nos. 2115 *a-b*, *c-d*.

44. *ETOBLATTINA MACTATA* sp. nov.

Pl. VII, fig. 9.

Tegmina two and three-quarters times longer than broad, ovate, the costal margin very regularly and gently arcuate, the inner margin nearly as arcuate, the apex doubtless strongly rounded. Mediastinal area vittate, tapering only beyond the middle of the tegmina, reaching almost to the middle of their distal half, the vein with moderately

numerous, mostly simple, very oblique, straight branches. Scapular vein rather strongly sinuate, terminating a very little before the extreme apex of the tegmina, first branching at the end of the proximal third of the tegmina, with four or five subequidistant, arcuate, simple or forked branches, which apically have the same direction as the distal mediastinal branches. Externomedian vein strongly arcuate, first branching considerably later than the scapular vein, with three simple or deeply forked (probably reforked apically), nearly longitudinal but arcuate branches, occupying on the margin only the narrow apex of the tegmina. Internomedian vein strongly and very gracefully arcuate, terminating as near the apex as the scapular vein, with five deeply forked or simple branches, the proximal ones nearly straight and oblique, the distal arcuate and longitudinally oblique. Anal furrow very strongly arcuate except apically, sharply incised, terminating at about the end of the proximal two-fifths of the tegmina; anal area slightly vaulted, the veins gently or (toward the furrow) strongly arcuate, simple. Surface blackish brown, all the veins marked in black and perhaps delicately edged with the same, the interspaces with closely crowded straight cross lines.

Length of fragment, 15 mm.; probable length of tegmina, 18.5 mm.; breadth, 7.25 mm.

This species is separated from those which immediately precede it, and to which it is closely allied, by the relatively wide intervals between the origin of the first scapular and externomedian branches. It is still more closely related to *E. communis*, from which the greater length of the mediastinal area clearly separates it. One can not but be struck, also, by the rather strong general resemblance this insect bears to *Gerablattina concinna* from the same beds, but besides the generic distinctions between them (which are here indeed feeble), it differs in almost every detail as well as in the form of the tegmina. Of the European species it is most nearly allied to *E. dohrnii*, but not at all closely.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacey; one specimen, No. 2116a.

45. ETOBLATTINA COMMUNIS sp. nov.

Pl. VII, figs. 10-17.

Tegmina ovate, somewhat more than two and a half times longer than broad, the costal margin gently and pretty regularly arcuate, the inner margin faintly arcuate, the apex strongly rounded. Mediastinal area vittate, apically acuminate, reaching nearly, sometimes quite, to the distal end of the middle third of the tegmina, the vein with relatively few, mostly simple, and nearly or quite straight, very oblique branches. Scapular vein faintly broadly sinuate, terminating shortly before the very apex of the tegmina, first forking at about the end of the proximal fourth of the wing, often a little after, rarely before it, the branches

three to five in number, the first generally widely separated from the second, mostly deeply forked, rarely doubly forked, but always some of them simple, and all longitudinally oblique and arcuate. Externomedian vein broadly sometimes strongly arcuate, rarely uniform, first forking some distance later than the scapular, the branches from two to four, usually four, in number, longitudinal, more or less arcuate, some of them simple, others deeply but narrowly forked, often doubly forked or even compound. The internomedian vein is gracefully sinuate, more strongly arcuate basally than apically, and ends not far from the apex but generally farther than the scapular vein; the branches are more distant than in the other areas and most of them are simple and very oblique, the distal more oblique than the proximal, but the first and some of the last are often deeply forked, and occasionally the area is apically filled by simple oblique branchlets from a longitudinally oblique preapical branch. Anal furrow strongly arcuate, impressed, terminating at a little beyond the proximal third of the tegmina; anal area gently vaulted, the veins simple and arcuate, not crowded. Surface blackish brown, all the veins marked and narrowly margined with black and the interspaces filled with crowded straight cross lines.

Length of tegmina, 16 to 21 mm.; breadth, 6 to 8 mm.

The species is sufficiently distinguished from *E. mactata*, its nearest ally, by the briefer extent of the mediastinal area; and from the four preceding species, to which it is also closely related, by the wider separation of the points of origin of the first scapular and externomedian branches. It differs in the same feature, as also in the length of the mediastinal area, from *Gerablattina uniformis*, to which its general resemblance is very striking. It appears to be the commonest species in West Virginia, where ten specimens have been found.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe, Nos. 2187 *a-b*, *c-d*, *e*, *f*, *g*, *h*, *i*, *j*, *k-l*, *m-n*.

46. ETOBLATTINA sp.

Etolblattina sp. Scudd., Mem. Bost. Soc. Nat. Hist., IV, 460, pl. 42, fig. 20 (1890); Foss. Ins. N. A., I, 436, pl. 34, fig. 20 (1890).

Triassic of Fair Play, Colo.

47. ETOBLATTINA HASTATA sp. nov.

Pl. VIII, fig. 1.

Tegmina lanceolate, tapering from a little beyond the middle of the proximal half, almost three times as long as broad, the costal margin very gently arcuate except at base and tip, where it is more strongly curved, the inner margin scarcely arcuate, the apex probably sharply rounded. Mediastinal vein straight until past the final branch, and then bent toward the margin, which it strikes before the middle of the

tegmina, with rather distant, simple or narrowly forked, arcuate, very oblique branches. Scapular vein straight, terminating scarcely above the very apex of the tegmina, first branching before the end of the proximal fourth of the tegmina, the branches not numerous, inequidistant, longitudinally oblique, irregular and deeply forked, sometimes compound. Externomedian vein also straight, nearly parallel to the scapular throughout its course, first forking far beyond the scapular at about the end of the proximal two-fifths of the tegmina, the few branches nearly longitudinal, inequidistant, and, so far as preserved, simple. Internomedian vein irregularly sinuate, falling not far short of the apex of the tegmina, in the distal half of its course subparallel to the inner margin, the branches distant, inequidistant, mostly deeply forked or compound, some simple, arcuate and very oblique. Anal furrow terminating before the end of the proximal third of the tegmina. Surface uniformly carbonaceous, covered with a delicate tremulous reticulation.

Length of fragment, 17 mm.; probable length of tegmina, 27.25 mm.; breadth, 9.5 mm.

This species is evidently not distantly related to the apparently stouter species, *E. fasciata*, but has a very different internomedian area.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston; one specimen, No. 106.

48. ETOBLATTINA MARGINATA.

Pl. VIII, fig. 2.

Etoblattina marginata Scudd., Proc. Bost. Soc. Nat. Hist., XXIV, 48-50 (1889).

From the same locality and horizon as the last.

49. ETOBLATTINA GRACILENTA sp. nov.

Pl. VIII, figs. 6, 7.

Tegmina almost exactly three times as long as broad, obovate, tapering but very little from about the end of the proximal third, the costal margin very strongly arcuate at base, beyond nearly straight to the rounded tip, the inner margin similarly straight, the apex rather broadly rounded. Mediastinal area narrow, vittate, but the feebly sinuate vein constantly approaching the margin in the apical half, reaching considerably beyond the proximal half of the tegmina, the branches of the vein not numerous, mostly deeply and narrowly forked, very strongly oblique. Scapular vein sinuate, much more strongly arcuate at base than beyond, where it is subparallel to the costal margin, with a varying but considerable number of inequidistant, longitudinally oblique branches, some of them arcuate, rarely simple, generally deeply forked, doubly forked or even compound, the first arising somewhat

before the end of the proximal third of the tegmina. The externomedian vein, pretty strongly arcuate at the base, is thereafter nearly straight and subparallel to the scapular vein, but gradually parts slightly from it in the distal half of the tegmina; it first forks a little before the middle of the tegmina and has but three or four deeply and narrowly forked or compound longitudinal branches. The internomedian vein, after the basal arcuation, runs in a straight longitudinally oblique course to a little beyond the middle of the tegmina, when it curves so as to run a short distance parallel to the inner margin and then curves down to it, ending somewhat before the apex; most of its inequidistant branches are broadly and deeply forked and are increasingly oblique. Anal furrow sharply and deeply impressed, strongly arcuate and terminating slightly within the proximal two-fifths of the tegmina; the anal area is vaulted, the veins few, inequidistant, simple, those next the furrow bent-arcuate and distant, the others close and sinuate. Surface carbonaceous with feeble signs of cross lining in the interspaces.

Length of largest fragment, 28 mm.; probable length of tegmina, 28 to 29.5 mm.; breadth, 9 to 9.75 mm.

This species is easily distinguished from both *E. hastata* and *E. marginata* by the situation of the main veins, and from at least the former by its very different form. In its larger features the neuration resembles that of *E. willsiana*, but it is abundantly distinct from that species in every detail.

The two specimens figured differ somewhat and particularly in the length of the internomedian area, the apical space given to the externomedian area, and the proximal branches of the scapular area, which in one are more numerous and simpler than in the other.

Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston; three specimens, Nos. 114, 198, and perhaps 105.

50. ETOBLATTINA EXSECUTA sp. nov.

Pl. VIII, fig. 4.

Tegmina long oval, almost three times as long as broad, tapering only from the middle, the costal margin strongly and very uniformly arcuate, the inner margin feebly arcuate, the apex pretty well rounded. Mediastinal area vittate, rather narrow, apically acuminate, terminating just before the end of the middle third of the tegmina, the branches of the vein rather few, straight, simple, and strongly oblique. Scapular vein gracefully and regularly sinuate, ending well before the apex of the tegmina, first forking just before the proximal fourth of the tegmina, with about four arcuate branches having the same trend as the mediastinal branches, simple or deeply forked. Externomedian vein strongly sinuate, more arcuate basally than apically, first forking but little beyond the scapular, with five or six sinuate, longitudinal, simple or apically

and narrowly forked branches, or with only two or three of such branches, one of them compound. Internomedian vein sinuate like the externomedian, terminating not very far short of the apex of the tegmina, with half a dozen branches, less crowded than those of the scapular and externomedian veins, arcuate and oblique, simple or deeply forked. Anal furrow strongly bent-arcuate, sharply impressed, terminating at the end of the proximal two-fifths of the tegmina, the anal veins simple, numerous, more distant, and strongly arcuate next, more crowded and straight or sinuate away from, the furrow. Surface uniformly blackish brown, with closely crowded, straight cross lines in all the interspaces.

Length of tegmina, 18.75 mm.; breadth, 6.5 mm.

This species is very closely related to *E. communis*, from which it differs in the stronger arcuation of the costal margin, its slenderer form, and the closer approximation of the first fork of the scapular and externomedian veins. It differs similarly from *E. macerata* except in the last-mentioned point, and that the scapular and externomedian branches are more crowded. It also bears a nearly similar relation to the still slenderer *E. secreta*, but it has a shorter mediastinal area and a less elongated anal area. From *E. expulsata*, to which it is also closely allied, it differs in its slenderer form, the much less arcuate costal margin, and the earlier forking of the scapular and externomedian veins.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; three specimens. Nos. 2120 *a-b*, *c-d*, *e*, besides two others probably belonging here.

51. ETOBLATTINA ARCTA sp. nov.

Pl. VIII, fig. 5.

Tegmina exceptionally long and slender, more than three and a half times longer than broad, about equally slender at both extremities, the costal margin more arcuate at base than next apex, nearly straight in the middle, the inner margin feebly arcuate at base, nearly straight beyond to the sloping tip, the apex subacuminate, very sharply rounded. Mediastinal area vittate, broad, tapering only at extreme tip, which reaches but little beyond the middle of the tegmina, the branches of the vein distant, simple, straight, oblique. Scapular vein broadly arcuate, in most of its course parallel to the costal margin, terminating at about the middle of the distal third of the tegmina, first forking scarcely before the middle of the tegmina, its branches wholly similar to the mediastinal. Externomedian vein strongly sinuate, first forking at the end of the proximal third of the tegmina, the branches longitudinally sinuate, very few in number but mostly deeply forked or compound. Internomedian vein gently and broadly sinuate, terminating not far below the apex of the tegmina, in its apical third subparallel to the margin, its five or six branches simple or forked, exceedingly oblique or

longitudinally oblique. Anal furrow with exceptionally slight and regular arcuation, impressed very sharply and very deeply indeed, terminating before the end of the proximal two-fifths of the tegmina; anal area exceptionally slender for its length, the veins few, simple and arcuate. Surface uniformly black, with signs of very feeble and close, often oblique, cross lining in the interspaces.

Length of tegmina, 18 mm.; breadth, 5 mm.

By its elongate straight form this species is very different from every other known, and it is hardly less remarkable for the imitation of the mediastinal by the scapular vein and the late forking of the latter.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2118a.

52. ETOBLATTINA STIPATA.

Pl. VIII, fig. 3.

Etblattina stipata Scudd., Proc. Bost. Soc. Nat. Hist., XXIV, 52-53 (1889).

From the Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County.

53. ETOBLATTINA PRÆDULCIS sp. nov.

Pl. VIII, fig. 12.

Tegmina lanceolate, three times as long as broad, tapering from the end of the proximal third almost as much on the inner as on the costal side, the costal margin gently and regularly arcuate, the inner nearly as much so, the apex very sharply rounded. Mediastinal area broad, tapering in nearly the distal half, terminating somewhat before the distal end of the middle third of the tegmina, the branches very oblique, nearly straight, simple or forked. Scapular vein very faintly arcuate beyond the base, terminating a little before the very apex of the tegmina, first forking at the end of the proximal third of the tegmina, with about five simple or forked, straight and long, very oblique branches. Externomedian vein feebly oblique and nearly straight beyond the base, with three longitudinal branches very distant in origin, the first arising before the first scapular fork and in the single specimen seen simple, the second arising near the middle of the tegmina and narrowly forked, the third doubly and very deeply forked. The internomedian vein is gently sinuate, though nearly straight beyond the basal arcuation, ending well before the apex of the tegmina with half a dozen moderately close, mostly simple, feebly arcuate, strongly oblique branches. Anal furrow regularly and rather strongly arcuate, moderately impressed, terminating a little beyond the end of the proximal two-fifths of the tegmina; anal veins simple, arcuate. Surface of tegmina dark brown, at least the anal and internomedian veins feebly and rather broadly

margined with black, and all the interspaces crowded with straight cross lines.

Length of fragment, 17 mm.; probable length of tegmina, 21.5 mm.; breadth, 7 mm.

This species bears a certain but not a striking resemblance in its neururation to the much stouter *E. mediana*, and a close relation in form and neururation to *E. rogi*; but from this latter the different character and extent of the externomedian area, as well as the longer mediastinal at once clearly separates it. Indeed the character of the externomedian area is quite different from that of any known species. In the character of the anterior half of the tegmina it is nearly related to *E. variegata*.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2119 *a-b*.

54. ETOBLATTINA VARIEGATA.

Pl. VIII, fig. 10.

Etolblattina variegata Scudd., Proc. Bost. Soc. Nat. Hist., XXIV, 51-52 (1889).

Two additional specimens of this species have been found in the original locality by Mr. Huston.

From the Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County.

55. ETOBLATTINA HILLIANA sp. nov.

Pl. VIII, fig. 11.

Tegmina oval, almost three times as long as broad, the costal margin strongly and regularly arcuate, the apex probably well rounded. Mediastinal area vittate, the vein straight nearly to the tip, which reaches the distal end of the middle fifth of the tegmina, the veins rather numerous, simple or forked, and less oblique than common. Externomedian vein broadly sinuate, much more strongly arcuate at base than apically, terminating not far before the apex of the tegmina, first forking at the end of the proximal third of the tegmina, with four or five strongly oblique, arcuate, simple, forked or multiple-forked branches. Externomedian vein very strongly sinuate in the middle of the tegmina, where the branches are thrown off straight and oblique, first branching a very little beyond the first scapular fork, with about five rather straight, longitudinal, simple, simply forked or doubly forked branches. Internomedian vein gently arcuate beyond the base, probably ending about the middle of the distal half of the tegmina, the earlier branches crowded, straight, simple, and oblique, the later more oblique, arcuate, and deeply forked. Anal furrow probably strongly arcuate and terminating not far from the end of the proximal third of the tegmina. Surface uniform, with scarcely the least sign of any cross lining.

Besides the larger part of two tegmina there is preserved a fragment of a pronotal shield which was probably of transverse oval form, much more strongly rounded in front than behind, broadest close to the posterior margin, and probably nearly half as broad again as long; its edge appears very delicately margined.

Length of entire fragment, 30 mm.; probable length of tegmina, 27.25 mm.; breadth, 9.5 mm.

This species is named after Mr. Homer D. Hill, of Morris, Ill., at the suggestion of Mr. Lacoe. Mr. Hill has been very persevering and successful in the search for fossil insects at Mazon Creek.

It does not seem to be very nearly related to any of our American species, but perhaps bears closer resemblance to *E. mazona* than to others; it shows some relation to the European *E. russoma*.

From the Lowest Productive Coal-measures of Mazon Creek, Morris, Grundy County, Ill. Mr. R. D. Lacoe; one specimen, No. 2070 a-b.

56. ETOBLATTINA ANGUSTA sp. nov.

Pl. VIII, fig. 8.

Tegmina very slender, two and a quarter times longer than broad, nearly parallel-sided in the middle third, tapering slowly beyond, the apex probably well rounded, the costal margin strongly convex only at base, the inner margin probably straight. Mediastinal area vittate but tapering constantly from the middle, the apex acuminate and reaching past the distal end of the middle third of the tegmina, the nearly straight simple branches of the vein changing from oblique to very oblique distally. Scapular vein straight or arcuate to its first fork (at the end of the proximal third of the tegmina), there bent and thereafter very broadly arcuate, in the middle as well as the proximal third of the tegmina subparallel to the costal margin, terminating scarcely before the very apex of the tegmina; there are about five long, nearly straight, simple or deeply forked branches. The externo-median vein is arcuate pretty regularly throughout, first forks opposite the first scapular fork, and has three or four longitudinal, gently arcuate, simple or forked branches. The internomedian vein is similarly arcuate, the area apically regularly attenuate, terminating but a little beyond the mediastinal vein at the distal end of the middle third of the tegmina, with four distant, straight, simple, strongly oblique branches. Anal furrow sharply impressed, terminating not far from the end of the proximal third of the tegmina. Surface blackish brown, the veins all edged rather broadly and indistinctly with black, the interspaces filled with crowded, straight, uniform cross lines.

Length of fragment, 13 mm.; probable length of tegmina, 16.5 mm.; breadth, 5 mm.

In the distribution of the neuration this species reminds one of the very much broader *E. funeraria*, but it differs in detail at every point.

It also resembles *E. hilliana* in a similar way. It is remarkable for the slenderness of the internomedian area, which is indeed hardly broader than the mediastinal.

From the Waynesburg coal (Upper Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2080 *a-b*.

57. ETOBLATTINA MACILENTA sp. nov.

Pl. VIII, fig. 9.

Tegmina scarcely less than three times as long as broad, ovate, tapering from well beyond the middle, the costal margin strongly convex at base, but beyond very faintly arcuate, not more so than (if as much as) the inner margin, the apex probably strongly rounded. Mediastinal area apically acuminate, reaching nearly to the distal end of the middle third of the tegmina, the branches of the vein straight, simple, very oblique. Scapular vein gently sinuate, terminating scarcely short of the extreme apex of the tegmina, first forking at about the end of the proximal third of the tegmina, with about four longitudinally oblique branches, the first doubly forked, the others simple and nearly straight. Externomedian vein nearly straight beyond the arcuate base, first forking somewhat, though not greatly, beyond the scapular vein, with about three longitudinal simple or deeply forked branches. Internomedian vein straight beyond the basal arcuation, terminating about the middle of the distal two-fifths of the tegmina, with straight, simple or forked, oblique branches. Anal furrow terminating not far from the end of the basal third of the tegmina, pretty regularly and strongly arcuate, situated at the depth of a depression; anal veins simple or occasionally deeply forked, arcuate, crowded. Surface uniformly black, with feeble signs of rather distinct straight cross lining in the interspaces.

Length of two fragments in juxtaposition, 10 mm.; probable length of tegmina, 12.25 mm.; breadth, 4.25 mm.

This species appears to be more closely allied to *E. angusta* than to any other, but differs much from it, not only in form but in the character of the externomedian and the width of the longer internomedian area.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va., Mr. R. D. Lacoe; one specimen, No. 2121 *a-b*.

58. ETOBLATTINA EXILIS.

Pl. IX, fig. 1.

Etblattina exilis Seudd., Bull. U. S. Geol. Surv., No. 101, 17, pl. 2, fig. *c* (1893).

From the Lower (?) Productive Coal-measures of East Providence, R. I.

59. ETOBLATTINA ROGI sp. nov.

Pl. IX, figs. 2, 3.

Unfortunately the basal third or more is lost from both the specimens of this evidently distinct species, and the precise form and proportions are necessarily conjectural, but the main features of the neururation are preserved. The tegmina are evidently almost or quite three times as long as broad, lanceolate, with almost equally and gently arcuate costal and inner margins, the apex subacuminate but rounded. The mediastinal area is broad and tapers regularly in the distal half, ending not far from the distal end of the middle fifth of the tegmina, the branches of the vein long, simple, straight, exceedingly oblique. Scapular vein very gently arcuate, terminating only a little before the extreme apex of the tegmina, first forking near the end of the proximal third of the tegmina, the branches simple, very deeply forked, straight, and longitudinally oblique. Externomedian vein beyond the basal arcuation straight and oblique, first forking not far from the first scapular fork, with four or five straight, longitudinal, simple or forked, occasionally doubly forked, apically arcuate branches. Internomedian vein like the preceding, terminating not far from the middle of the distal half of the tegmina, the branches mostly simple, straight, exceedingly oblique. Anal furrow ending just within the end of the proximal two fifths of the tegmina. Surface blackish-brown, the veins black and narrowly edged with black, the interspaces filled with distinct, closely crowded, straight cross lines.

Length of fragments, 12 to 15 mm.; probable length of tegmina, 18 to 20.75 mm.; breadth, 6.5 to 7.25 mm.

This species shows a certain resemblance to the similarly shaped *E. prœdulcis*, but has a shorter internomedian area and a very different externomedian area. In one specimen the scapular vein first forks a little before, in the other a little after, the internomedian vein.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; two specimens, Nos. 2122 *a*, *b-c*, besides two others probably belonging here.

60. ETOBLATTINA EXPUGNATA sp. nov.

Pl. IX, fig. 4.

Tegmina subovate, tapering from the middle, a very little less than three times as long as broad, the costal margin rather strongly and rather regularly arcuate, the inner margin nearly straight, the apex well rounded. Mediastinal area vittate; moderately broad, tapering only near tip, which reaches fully to the end of the middle third of the tegmina, the branches of the vein not very frequent, straight, simple, and oblique, the distal branches very oblique indeed. Scapular vein arcuate, terminating just short of the extreme apex of the tegmina,

the branches, four in number, arcuate, longitudinally oblique, and simple or deeply forked. Externomedian vein arcuate, more strongly basally than apically, first forking just after the scapular, with four nearly straight, simple or deeply or apically forked branches. Internomedian vein gently sinuate, terminating not long before the apex, but before the scapular vein, the branches distant, gently sinuate, mostly simple, oblique, and apically very oblique. Anal furrow regularly and strongly arcuate, very deeply and sharply impressed, especially in the basal half, terminating at about the end of the proximal two-fifths of the tegmina; anal area vaulted, prominently so at the upper base, the veins mostly simple, occasionally deeply forked, more or less arcuate. Surface uniformly black, the interspaces with crowded, straight cross lines.

Length of tegmina, 18.25 mm.; breadth, 6.5 mm.

Except in its much longer mediastinal area, this species closely resembles *E. communis*; its narrower form and less arcuate internomedian vein separate it from *E. mactata*, to which in its general neuration it is nearly allied; and it bears a great deal of resemblance to *E. secreta*, but has a shorter and broader internomedian area and different development of the mediastinal area; it differs similarly from the next species, *E. obatra*, to which it is very closely allied, but has a longer and slenderer anal area.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2085 *a-b*.

61. ETOBLATTINA OBATRA sp. nov.

Pl. IX, fig. 5.

Tegmina subovate, slightly more than three times as long as broad, broadest just before the middle, the costal margin considerably arcuate but less so in the middle half, the inner margin straight, the apex well rounded. Mediastinal area vittate, tapering in the apical third, reaching nearly to the distal end of the middle third of the tegmina, the branches of the vein mostly simple, arcuate, and excessively oblique. Scapular vein beyond the basal arcuation faintly arcuate, terminating just before the apex of the tegmina, first forking considerably within the proximal third of the tegmina, with about four deeply forked or simple, arcuate, longitudinally oblique branches. Externomedian vein beyond the probably strong basal arcuation nearly straight and oblique, first forking about opposite the end of the anal furrow, with three longitudinal or nearly longitudinal, apically forked or deeply doubly forked, nearly straight branches. Internomedian vein sinuate, being slightly arcuate at base, faintly arcuate at tip, ending not a great way before the apex of the tegmina at the edge of the apical border, the infrequent branches straight, the proximal oblique, the distal excessively oblique, and both simple or forked. Anal furrow strongly arcuate, sharply

impressed, terminating a little short of the end of the proximal two-fifths of the tegmina; anal veins arcuate and numerous. Surface uniformly black, with faint, moderately close cross lines in the interspaces.

Length of tegmina, 17 mm.; breadth, 5.25 mm.

In the general direction of the veins and extent of the areas this species shows a great resemblance to *E. exsecuta*, but the tegmina are much slenderer, the mediastinal branches far more oblique, and the externomedian neuration simpler. It bears almost a greater resemblance, both in venation and in the form of the tegmina, to *Gerablattina concinna*, but the mediastinal area is much shorter. From the preceding species, *E. expugnata*, to which it is closely allied, it differs in form, in the crowding and obliquity of the mediastinal branches, and in the more abbreviated and relatively broader anal area.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2123 a-b.

62. ETOBLATTINA IMPERFECTA sp. nov.

Pl. IX, fig. 8.

Tegmina ovate, three times as long as broad, tapering only on the apical third, the middle portion equal, the costal margin gently arcuate, the inner margin straight beyond the considerable arcuation of the anal area, the apex probably well rounded. Mediastinal area moderately narrow, vittate, tapering in less than the distal third, terminating but little before the middle of the distal half of the tegmina, the branches of the vein mostly deeply forked, exceedingly oblique and arcuate. Scapular vein gently and pretty uniformly sinuate, terminating just above the apex of the tegmina, first forking opposite the tip of the anal furrow; with about four gently arcuate, deeply forked or simple, longitudinally oblique branches. Externomedian vein gently sinuate, first forking opposite the scapular, and with but this single straight and deeply forked, perhaps compound, longitudinal branch. Internomedian vein arcuate, but nearly straight in the apical half, terminating but little before the very apex of the tegmina, as near it as the scapular vein; the branches are distant, the proximal simple and oblique, the distal forked or doubly forked, very oblique and gently arcuate. Anal furrow strongly arcuate, deeply impressed in basal half, and terminating at the end of the proximal two-fifths of the tegmina; anal veins few, arcuate, simple. Surface uniformly black, the interspaces with excessively faint, close, and straight cross lining.

Length of fragment, 12.5 mm.; probable length of tegmina, 16.5 mm.; breadth, 5.5 mm.

In the general features of its neuration this species agrees at all points with *E. obatra*, but the internomedian area is slightly longer, the externomedian area of much less importance, the costal margin not so convex and the anal area distinctly fuller. In the forking and greater

longitudinality of the mediastinal branches and the paucity of the externomedian neuration it is distinctly different from *E. secreta* that follows.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoë; one specimen, No. 2124 *a-b*.

63. ETOBLATTINA SECRETA sp. nov.

Pl. IX, figs. 6, 7.

Tegmina about three times as long as broad, ovate, broadest in the middle, but sometimes not tapering for some distance beyond, with rather strongly arcuate costal margin and straight inner margin, the apex probably well rounded. Mediastinal area vittate, not very broad, apically acuminate, reaching to about the distal end of the middle third of the tegmina, the branches of the vein not numerous, very oblique, sometimes exceedingly oblique, mostly simple. Scapular vein more or less sinuate, terminating just before the very apex, first forking at about the end of the proximal end of the tegmina, with five or six arcuate, mostly simple, sometimes deeply forked, exceedingly oblique branches. Externomedian vein sinuate, much more strongly arcuate at base than apically, first forking well beyond the scapular and not far from a point opposite the tip of the anal furrow, the three or four branches nearly straight and longitudinal, simple and deeply forked or occasionally doubly forked. Internomedian vein similar to the externomedian or slightly less sinuous, ending before the apex but reaching almost as far as the scapular, the branches rather distant, the first and sometimes the last deeply forked, the others mostly simple, straight or faintly arcuate, very oblique or apically exceedingly oblique. Anal furrow not very strongly arcuate, well impressed, terminating at about the end of the proximal two-fifths of the tegmina; anal area vaulted, especially next the basal half of the furrow, the branches relatively few and arcuate. Surface uniformly black, with rather crowded straight cross lines in the interspaces.

Length of fragment, 15 to 15.5 mm.; probable length of tegmina, 18.5 to 19 mm.; breadth, 6.25 to 6.5 mm.

This species is closely allied to *E. imperfecta*, from which it differs principally in the distance from the base at which the scapular and externomedian veins first fork, in the general character of the externomedian vein, and in the less crowded branching of the mediastinal vein. Similar differences separate it from *E. obatra*, while the slenderer mediastinal area and greater extension of the internomedian area distinguish it from *E. expugnata*. It is also nearly allied to *E. exsecuta*, but in that species the scapular and externomedian veins first fork side by side, and in the broader anal area the veins are more crowded. Its greater slenderness separates it from *E. communis*, with which it agrees almost completely in its neuration; the mediastinal area, however, is distinctly longer than in that species.

The two specimens figured differ considerably from each other in the form of the tegmina, the obliquity of the mediastinal branches, and the sinuosity of the scapular vein, but I am inclined to think they should be regarded as belonging to one species.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoë; four specimens, Nos. 2125 *a-b*, *c-d*, *e-f*, *g*, besides another presumably to be referred here.

64. ETOBLATTINA RELIQUA.

Pl. IX, fig. 10.

Etblattina reliqua Scudd., Bull. U. S. Geol. Surv., No. 101, 18-19, pl. 2, fig. *g* (1893).

From the Lower (?) Productive Coal-measures of Pawtucket, R. I.

65. ETOBLATTINA INVISA sp. nov.

Pl. IX, fig. 9.

Tegmina about three times as long as broad, ovate, largest a little before the middle, but with nearly parallel sides, the costal margin and inner margin equally and very gently arcuate in the middle two-thirds, the humeral angle probably strongly rounded, the apex well rounded. Mediastinal area moderately broad, vittate, rather rapidly tapering apically and reaching beyond the distal end of the middle third of the tegmina, the vein with few, oblique, simple branches. Scapular vein beyond the basal arcuation almost rigidly straight and terminating just short of the very apex of the tegmina; it first forks at the middle of the tegmina and has about five simple branches, like those of the mediastinal area. The externomedian vein, straight in its middle course, is broadly sinuate, first forking a little before the end of the mediastinal vein, and has three arcuate, apically longitudinal, simple, distant branches. The internomedian vein is broadly sinuate and terminates at some distance before the apex, the few branches distant, a little arcuate, the first probably deeply forked, the others simple. Anal furrow very elongate, but little arcuate and not greatly impressed, terminating beyond the proximal two-fifths of the tegmina. Surface gray, the veins all marked and broadly margined with black, in which margin only are seen straight and crowded cross lines in its interspaces.

Length of fragment, 16 mm.; probable length of tegmina, 17.5 mm.; breadth, 6 mm.

This species seems to be very different from the other open-veined *Etblattinae*, particularly in the late forking and unimportant character of the externomedian vein, carried to excess in *E. strigosa*; it has a certain general resemblance to *E. ramosa*, but has a far more simple neurulation, in which hardly a branch is forked.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoë; one specimen, No. 2126 *a-b*.

66. ETOBLATTINA OCCULTA sp. nov.

Pl. IX, fig. 13.

Tegmina nearly parallel sided, oval, about three times as long as broad, the larger part of the costal margin very gently arcuate, the inner margin nearly straight, the apex probably well rounded. Mediastinal area narrow, vittate, tapering only apically, reaching to the middle of the distal half of the tegmina, the branches of the vein tolerably numerous, gently arcuate, oblique or very oblique, almost invariably simple. Scapular vein arcuate at base, beyond the first fork (at the end of the proximal third of the tegmina) having a general straight course and ending a little way before the apex of the tegmina, the first branch arising far before the others, the others, four or five in number, subequidistant, simple or forked, arcuate and exceedingly oblique. Externomedian vein gently sinuate, first forking well beyond the scapular, the three or four branches distant, longitudinally oblique and simple or forked or perhaps compound. Internomedian vein strongly sinuate, especially basally, terminating a little way before the apex, probably as far or nearly as far as the scapular vein, the latter half of the area slender, the proximal half with very distant, oblique, arcuate, mostly simple branches. Anal furrow strongly arcuate, strongly impressed, terminating a little within the end of the proximal two-fifths of the tegmina; anal area slightly vaulted, the veins in the portion next the furrow distant and strongly arcuate, those distant from it crowded, gently and oppositely arcuate, all simple. Surface carbonaceous black with elongate gray patches between the veins, or it may be described as gray with very broad black margins to all the veins, often confluent, especially at the ends of the interspaces; the black portion is traversed by rather crowded straight cross lines.

Length of fragment, 17 mm.; probable length of tegmina, 26 mm.; breadth, 9 mm.

This species is somewhat related to *E. balteata*, but differs in its form and the particular character of each of the areas. From the next species, *E. defossa*, it differs particularly in the very different formation of the externomedian vein. The neurulation is strikingly similar to that of *Gerablattina diversinervis*, and the great length of the mediastinal vein makes it closely resemble a *Gerablattina*; it seems, however, to belong better here.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacey; one specimen, No. 2127 *a-b*.

67. *ETOBLATTINA LATEBRICOLA* sp. nov.

Pl. IX, fig. 11.

Tegmina nearly three times as long as broad, ovate lanceolate, with unusually subacuminate apex, the costal margin gently arcuate beyond the strongly rounded humeral curve, the inner margin gently arcuate beyond the anal furrow, the anal margin gently arcuate independently. Mediastinal area vittate, moderately narrow, tapering only beyond the middle of the tegmina, reaching nearly to the middle of the distal half of the tegmina, the branches of the vein oblique or very oblique, simple or apically forked. Scapular vein very gently and broadly sinuate, terminating but little before the very apex of the tegmina, first forking a little beyond the proximal third of the tegmina, the three equidistant branches considerably arcuate, longitudinally oblique, deeply and simply or doubly forked. Externomedian vein arcuate, first forking just beyond the scapular vein, the four or five branches longitudinal and straight, simple or deeply forked or compound, both the scapular and externomedian branches being very crowded in the apical fourth of the tegmina. Internomedian vein very gently arcuate, the area apically extended slightly so as to terminate almost as near the apex as the scapular vein, the branches distant, the proximal nearly straight, simple and very oblique, the distal more oblique and mostly forked. Anal furrow not very strongly but uniformly arcuate, somewhat strongly impressed, terminating a little before the end of the proximal two-fifths of the tegmina; anal area strongly vaulted next the furrow, the veins simple and arcuate. Surface black, with straight rather crowded cross lines on either side of the main veins in the central portions of the tegmina but not crossing the interspaces.

Length of tegmina, 17.5 mm.; breadth, 6 mm.

From the Lower (?) Productive Coal-measures of East Providence, R. I. Mr. R. D. Lacoe; one specimen, No. 2091 *a-b*.

68. *ETOBLATTINA DEFOSSA* sp. nov.

Pl. IX, fig. 12.

Tegmina elongate, probably more than three times as long as broad, ovate, the costal margin gently arcuate, the inner less so, the apex probably well rounded. Mediastinal area long and moderately wide, apically acuminate, reaching nearly or quite to the middle of the distal half of the tegmina, the branches of the vein distant, mostly simple and very oblique. Scapular vein nearly straight, apically faintly arcuate, terminating a little before the apex, the first branch arising far before the others, and all, four in number, simple or deeply or doubly forked, arcuate and longitudinally oblique. Externomedian vein first forking well before the middle of the tegmina and probably not far from the first scapular forking, this first externomedian fork and the main vein

parting like a longitudinal narrow fork and each fork very deeply forked, sometimes with a secondary deep fork, all longitudinal and sometimes arcuate. Internomedian vein in the apical half of its course subparallel to the inner border and, by means of a superior supplementary, deeply forked, arcuate, superior branch, extending the area nearly to the apex of the tegmina, the other branches distant, simple, arcuate, strongly oblique. Surface black, the interspaces with crowded, irregular, tremulous cross lines, forming in places almost an irregular reticulation.

Length of fragment, 14.5 mm.; probable length of tegmina, 28.75 mm.; breadth, 8.5 mm.

This species is closely allied to the preceding, but is apparently slenderer, and differs from it in many important features, and especially in the character of the externomedian vein. In this last characteristic it more nearly resembles *E. tenuis*, but in the character of the upper part of the tegmina it is very different from it.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2128 a-b.

69. ETOBLATTINA RECIDIVA sp. nov.

Pl. IX, fig. 14.

Tegmina probably about three times as long as broad, lanceolate, the costal margin gently convex, the inner nearly straight, the apex subacuminate, but well rounded. Mediastinal area terminating somewhat short of the distal end of the middle third of the tegmina, the branches of the vein very oblique and simple. Scapular vein very straight, terminating but little short of the apex, the first branch arising far before the others, rather deeply forked and bent at the fork; the others like this fork straight, very oblique indeed, and simple or forked. Externomedian vein probably nearly straight throughout and longitudinally oblique, first forking probably beyond the scapular and about at the end of the proximal third of the tegmina, the four or five branches straight, longitudinal and simple or forked. Internomedian vein beyond the basal curve nearly straight, but as a whole sinuate, terminating not much beyond the middle of the distal third of the tegmina, the branches rather distant, simple, arcuate, and oblique, or very oblique. Surface black, traversed by delicate, irregular and tremulous, crowded cross lines in all the interspaces.

Length of fragment, 8 mm.; probable length of tegmina, 19.5 mm.; breadth, 6.25 mm.

This species is perhaps as nearly allied to *E. hastata* as to any other of our species, but is very different indeed from it.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2129a.

ETOBLATTINA sp.

Pl. X, figs. 14, 15.

A single specimen with its reverse shows an unusually complete and excellently preserved hind wing, which must be referred to this genus. The wing is subovate, subacuminate at tip, with very gently arcuate costal and inner margins. The mediastinal vein runs parallel and close to the costal margin, with a few strongly oblique branches in an apical cluster, and a subbasal branch which runs between the main vein and the margin and is lost. The scapular vein is very straight, running to scarcely below the extreme apex of the wing, first branches a little before the middle of its course, and has four simple, forked, longitudinal branches. The externomedian vein is similarly straight, a little divergent from the scapular vein, first branches a little earlier than it, and has three long, simple, almost longitudinal branches. The internomedian vein is rigidly straight, and ends slightly further out than the mediastinal vein, with five parallel, straight, mostly simple or oblique branches. The anal furrow seems to differ from the other anal veins in there being a step in the membrane at this point, the vein itself, like the other anal veins, being more delicate than the internomedian branches next it and less deeply impressed; most of it can be traced, and, except for the points mentioned, it appears quite as a branch of the internomedian, being straight, except for an apical sinuation, and parallel to the internomedian branches; the other anal veins, of which only the apical halves appear, are similar in delicacy and direction, but gradually become more crowded, as is usual in the tegmina, and slightly arcuate; the furrow ends on the inner margin, slightly beyond a point opposite the first forking of the scapular vein. Surface uniformly blackish, the interspaces, at least near the apical margin, filled with not very close, straight but irregular cross lines.

Length of fragment, 10.5 mm.; probable length of wing, 14.5 mm.; breadth, 6.5 mm.

This is the only hind wing of an *Etblattina* known to me in which any part of the anal area is preserved.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2084 a-b.

ETOBLATTINA sp.

Pl. XII, fig. 2.

Etblattina sp. Scudd., Bull. U. S. Geol. Surv. No. 101, 13-14, pl. 2, fig. c (1893).

In the paper quoted I regarded this as a fragment of a fore wing from near the middle, somewhat allied to *E. primæva*. A renewed study shows that the costal curve is a natural one and that the fragment is rather the apical portion (with part of the tip lost) of a hind wing, in

which, possibly, the tip of the internomedian vein is included. It appears to belong to *Etoëblattina*, but its special relations are indeterminable.

From the Lower (?) Productive Coal-measures of East Providence, R. I.

ETOBLATTINA (?) sp.

Pl. XII, fig. 4.

Etoëblattina sp. Scudd., Bull. U. S. Geol. Surv. No. 101, p. 16, pl. 2, fig. *k* (1893).

For further remarks on this hind wing see p. 29.

From the Lower (?) Productive Coal-measures of Cranston, R. I.

10. Genus *GERABLATTINA*.

Gerablattina Scudd., Mem. Bost. Soc. Nat. Hist., III, 97-98 (1879); Foss. Ins. N. A., I, 117-118 (1890).

Next to *Etoëblattina*, from which this genus is but slightly differentiated, *Gerablattina* is the prevailing type of *Palæoblattariæ*, at least in this country. It appears first in the Millstone Grit—a single species in the Pennsylvania coal field—and it extends to the Permian, where it culminates, but it has not been recognized, like *Etoëblattina*, in the Trias. Nearly three-quarters of the twenty-one species of this country come from the Permian, and, indeed, from the single locality at Cassville, W. Va., three from the Barren Coal-measures of Ohio, and the remaining two from the Oldest Productive Coal-measures of Rhode Island. Its absence from all Western deposits is a little curious.

In Europe its standing is disputed by *Anthracoëblattina*, which there assumes exceptional importance. The ten species found there enjoy nearly the same geologic range as here and the same as *Anthracoëblattina*, *Hermatoblattina*, and *Etoëblattina* in Europe, namely, from the Lowest Productive Coal-measures to the Permian, inclusive, culminating, apparently, in the Upper Carboniferous deposits.

Table of the species of Gerablattina.

*a*¹. All the main veins independent from or almost from the base.

*b*¹. Tegmina relatively slender, considerably more than twice as long as broad.

*c*¹. Mediastinal area very narrow, in its middle at most hardly more than one-fifth the width of the tegmina; internomedian branches relatively distant.

*d*¹. Anal area relatively long; scapular vein first branching opposite or before the extremity of the anal area.

*e*¹. First internomedian branch very oblique, thrown off far before the end of the anal area..... 1. *G. inculta*.

*e*². First internomedian branch nearly transverse, thrown off scarcely before the end of the anal area..... 2. *G. perita*.

*d*². Anal area¹ relatively short; scapular vein first branching far beyond the extremity of the anal area.

¹ This point not known in *G. apicalis*.

Table of the species of *Gerablattina*—Continued.

- e*¹. Scapular area reaching the extreme apex of the tegmina.. 3. *G. apicalis*.
*e*². Scapular area not reaching the extreme apex of the tegmina.
*f*¹. Scapular vein first forking far before the middle of the tegmina, less abundantly branched than the externomedian.
 4. *G. diversinervis*.
*f*². Scapular vein first forking but little before the middle of the tegmina, and more abundantly branched than the externomedian.
 5. *G. richmondiana*.
*e*². Mediastinal area relatively broad, in its middle at least a fourth the width of the tegmina; internomedian branches relatively close.
*d*¹. All the mediastinal branches simple, or simply forked.¹
*e*¹. Internomedian area long drawn out, extending at least as far as, generally much farther than, the mediastinal area.
*f*¹. Internomedian area reaching, or almost reaching, the extreme tip of the tegmina.
*g*¹. Internomedian area band shaped, tapering but little, the branches numerous and relatively short..... 6. *G. cassvici*.
*g*². Internomedian area triangular, tapering much, the branches few and relatively long..... 7. *G. abdicata*.
*f*². Internomedian area falling distinctly, often considerably, short of the extreme tip of the tegmina.
*g*¹. Scapular and externomedian areas about equally important, each throwing at least half a dozen veins to the margin.
*h*¹. Tegmina very slender, fully three times as long as broad.
 8. *G. concinna*.
*h*². Tegmina less slender, not more than two and a half times longer than broad..... 9. *G. uniformis*.
*g*². Scapular and externomedian areas very unequally important, one or the other with at most three or four veins on the margin.
*h*¹. Anal area long, nearly reaching the middle of the tegmina; externomedian area unimportant..... 10. *G. permanenta*.
*h*². Anal area short, about one-third the length of the tegmina, scapular area unimportant..... 11. *G. permacra*.
*e*². Internomedian area rapidly tapering, barely or not reaching the middle of the distal half of the tegmina.
*f*¹. Anal area short and broad; general course of the scapular branches arcuate in a sense opposite to that of the anal furrow.
 12. *G. eversa*.
f^{1/2}. Anal area long and narrow; general course of the scapular branches longitudinal and straight..... 13. *G. deducta*.
*d*². Very nearly all the mediastinal branches forked and some of them compound.
*e*¹. Tegmina more than 40 mm. long; internomedian and mediastinal areas of very unequal length; scapular and externomedian areas of nearly equal importance; scapular branches only very slightly arcuate..... 14. *G. scapularis*.
*e*². Tegmina less than 20 mm. long; internomedian and mediastinal areas of equal length; scapular and externomedian areas of distinctly unequal importance; scapular branches considerably arcuate.
 15. *G. fraterna*.
*b*². Tegmina relatively stout, but little or not more than twice as long as broad.

¹ In *G. abdicata* only are they sometimes doubly forked at extreme tip.

Table of the species of Gerablattina—Continued.

- c¹. Scapular area important, first forking in basal half of tegmina, with half a dozen branches on margin.
 d¹. Main scapular vein striking the margin below the apex of the tegmina. 16. *G. radiata*.
 d². Main scapular vein striking the margin at the apex of the tegmina.
 e¹. Tegmina subequal in breadth, broadly rounded at apex; main externomedian and internomedian veins sinuous.
 f¹. Mediastinal area subequal throughout, the main veins sinuous. 17. *G. lata*.
 f². Mediastinal area narrowing throughout, the main vein straight. 18. *G. rotundata*.
 e². Tegmina greatly tapering in distal half, the apex subacuminate; main externomedian and internomedian veins straight beyond the arcuate base. 19. *G. ovata*.
 c². Scapular area unimportant, first branching far beyond the middle of the tegmina and with only three or four branches on margin. 20. *G. minima*.
 a². Externomedian and internomedian veins joined with the scapular in the basal sixth of the tegmina. 21. *G. fascigera*.

1. GERABLATTINA INCULTA sp. nov.

Pl. IX, fig. 16.

A single fore wing, not very well preserved and with the apical third lost, is all that represents this species. It is long obovate in form, nearly equal in breadth, except at the extreme end, largest in the middle, and probably about two and a half times longer than broad. The mediastinal area probably extended to the middle of the distal half of the wing, and is very narrow and equal, hardly more than a fifth the breadth of the wing; the branches of the vein are five or six in number, mostly thrown off from the proximal half of the vein, simple or simply forked and exceptionally longitudinal. The scapular vein recedes slightly from the margin in passing down the tegmina, and probably terminates at the apex; it has only two or three straight, longitudinal, sometimes very deeply forked offshoots from its only superior branch, which is thrown off at about the middle of the proximal half of the tegmina. The externomedian vein is a reversed repetition of the scapular, but branches at the middle of the tegmina only. The internomedian vein is very gently arcuate, first branches about as early as the scapular vein, has only four or five gently arcuate or straight simple branches, and extends as far as the mediastinal vein. The anal furrow is impressed moderately in only its proximal half, is bent slightly in the middle and otherwise considerably arcuate, terminating at the middle of the tegmina; the anal veins, seven or eight in number, are subparallel, successively more distant and more arcuate toward the anal furrow, and most of them simple. The surface of the tegmina is black and marked with exceedingly close cross lines at right angles to the veins they connect.

Length of fragment, 11.25 mm.; probable length of tegmina, 14.6 mm.; breadth, 6.6 mm.

The single specimen is from the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe, No. 2139a.

2. *GERABLATTINA PERITA* sp. nov.

Pl. IX, fig. 17.

The tegmina, of which only the basal portion of one is preserved, are apparently of an elongate and nearly equal form, to judge from the form of the base and the general course of the branches; certainly it must have been considerably more than twice as long as broad. The mediastinal area is exceedingly narrow, riband-like, but its exact extension can not of course be told; the vein runs parallel to the margin throughout its course, and in the middle of the wing can not occupy more than a fifth the width of the tegmina; the branches are rather distantly oblique, rather strongly arcuate, and simple. The scapular vein first forks at about opposite the tip of the anal furrow, the fork diverging somewhat strongly from the main branch, and neither the main stem nor the branch forks again in the fragment, or probably before the middle of the wing. The externomedian vein is rather strongly arcuate in the basal half of the tegmina, where it is entirely simple and is somewhat widely distant from the scapular vein. The internomedian vein is similarly or a little more strongly arcuate, diverging slightly from the externomedian before it begins to branch; it begins to throw off branches opposite the first forking of the scapular, and the two forks which are preserved in the fragment are somewhat distant and obliquely transverse. The anal area is but very slightly vaulted, the furrow strongly arcuate, terminating evidently at some distance before the middle of the tegmina; the veins are arcuate in the same sense, simple, and more and more crowded away from the anal furrow. The entire surface is traversed by finely incised, closely approximate, tremulous cross lines, and all the main veins and their main branches are broadly banded with piceous, leaving between them and along the outer edge of the main mediastinal vein (independent of its nervules) narrow colorless stripes.

Length of fragment, 9.5 mm.; probable length of tegmina, 17.5 mm.; width at extremity of anal furrow, 5.25 mm.

The single specimen and its reverse from the Waynesburg coal (Lower Permian) of Cassville, W. Va., are in the collection of Mr. R. D. Lacoe, under the number 2140 a-b.

3. *GERABLATTINA APICALIS* sp. nov.

Pl. IX, fig. 18.

Only the apical half, more or less, of one of the tegmina is preserved, so that the proportions of the same can not be definitely determined, but it was apparently of nearly the same proportions as the following species. The mediastinal area is not preserved in any portion of its

course, unless it be by the veins which are seen a little before the tip of the tegmina, but whose origin is lost. This would appear to be entirely uncertain, though it would seem as if the basal one belonged to this area, which would then correspond very closely in its extent with the following species; but in that case, to judge by the course of the scapular veins, the width of the mediastinal area must have been fully as great as there, if not greater. The scapular area, however, was of extraordinary extent, the main vein running in the apical half of the tegmina parallel to and at a great distance from the front margin and terminating exactly at the apex of the tegmina, throwing off in the apical portion three simple or deeply forked branches, having each a longitudinal course, and with no such sinuous curvature as is found in the next species. The main externomedian vein in the apical half of the tegmina runs again parallel to and at a wide distance from the scapular vein, terminating on the inner margin and sending to the apical portion of the same three simple, rather distant branches, the first of which is forked just before its tip; in the apical portion of its course the externomedian vein diverges slightly from the scapular and approaches apically the internomedian vein. This latter terminates on the apical half of the outer border, apparently very much in the same way as in *G. diversinervis*, the area appearing apically to be very much narrowed and possessing only simple, very distant and oblique branches; in the apical portion of its course the vein takes on a more longitudinal direction and thus approaches more closely to the externomedian vein, leaving between the two a constantly narrowing interspace much after the fashion of *Spiloblattina*. The entire surface of the fragment is black, excepting for dashes of the dark-gray color of the stone in the interspaces.

Length of fragment, 10.5 mm.; probable length of the tegmina, 20 mm.; apparent breadth near the middle of the tegmina, 8 mm.

Richmond, Ohio, from the Lower Barren Coal-measures, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, collected by Mr. S. Huston; No. 112.

4. GERABLATTINA DIVERSINERVIS sp. nov.

Pl. IX, fig. 15.

A single specimen of the tegmina with its reverse, showing the nearly complete wing, the apical portion only wanting, represents a species having a very elegant form, apparently nearly three times as long as broad, with the inner margin straight, the costal margin rather strongly and equally convex. The mediastinal area is riband-shaped and extends to the exact tip of the fragment or probably to well beyond the middle of the apical half of the wing; the area is narrow, in its middle hardly more than a fifth the width of the tegmina, the vein with oblique and increasingly oblique, simple, scarcely arcuate branches, numerous and subequidistant. The main scapular and externomedian veins are somewhat widely distant from each other and from the veins on either side

of them in the middle of the tegmina; the scapular is gently sinuous throughout its course, begins to fork a little beyond the basal third of the tegmina, and has four at origin strongly inequidistant, closely crowded, simple or simply forked branches, apically upcurved toward the margin of the tegmina and here no more distant from each other than the mediastinal branches; the outermost carry the scapular area only half way from the mediastinal area to the apex of the tegmina. The externomedian vein beyond its basal curvature is nearly straight throughout the greater portion of its course and emits three rather distant and at their origin widely distant, straight and longitudinal branches, simple or forked. The internomedian vein is gently sinuous throughout its course, rapidly narrows beyond its base, and extends to at least as far as, probably slightly farther than, the mediastinal area, and is furnished with seven or eight widely distant, gently arcuate, obliquely transverse, apically oblique, simple branches. The anal area is scarcely vaulted, the anal furrow deeply incised, strongly arcuate, terminating hardly beyond the middle of the basal half of the tegmina; the anal veins are few, irregularly arcuate in the same sense as the anal furrow, and rather widely distant. Along the whole all the veins and branches are broadly banded, in the mediastinal area narrowly banded, with piceous, in which the membrane of the tegmina is seen to be delicately, transversely, and numerous cross veined.

Length of fragment, which is broken slightly at the base as well as at the tip, 19 mm.; probable length of the tegmina, 25 mm.; breadth, 9 mm.

This species is closely allied to *G. perita*, but markedly different from it in the narrow extent of the scapular area, which is far from reaching the extreme apex of the tegmina.

The single specimen and its reverse came from the Waynesburg coal (Lower Permian) of Cassville, W. Va., and are in the collection of Mr. R. D. Lacey, with the number 2141 *a-b*.

5. GERABLATTINA RICHMONDIANA sp. nov.

Pl. X, fig. 1.

This species is represented by only a single specimen, rather imperfect, but showing nearly the whole of the costal margin. The tegmina are apparently about two and one half times longer than broad, with a rather strongly and regularly arcuate costal margin; the apex is lost, but was apparently much as indicated in the figure. The mediastinal area is vittate, slightly broader than in its allies, being nearly a fourth the breadth of the tegmina in the middle, and ends a little beyond the middle of the distal half of the tegmina, the vein with rather distant, nearly straight, and strongly oblique nervules. The scapular vein is broadly sinuous, first forks only a little before the middle of the tegmina, beyond which it has numerous compound branches, the low-

est of which strike the margin scarcely if at all above the extreme apex. The externomedian vein is broadly arcuate; its first visible branch arises a little beyond the middle of the tegmina, but it is here so much farther removed from the internomedian than from the scapular vein that probably an earlier branch, obscured from the imperfect preservation of the specimen, arises not far from opposite the first branch of the scapular vein; the behavior of the branches can not be seen from the imperfection of the specimen, but there is not room for the wide radiate arrangement of compound branches possessed by the scapular vein. The internomedian vein, only the proximal two-thirds of which can be traced, is broadly arcuate, and send out only a few distant, tolerably straight branches, the first of which is twice or thrice branched on the proximal side; it probably terminates about opposite the tip of the mediastinal vein. Only the merest fragment of the anal furrow can be seen, not far from the base, but it probably terminates not far from the end of the proximal third of the tegmina; none of the anal veins are preserved. There is no trace of banding or reticulation or cross lining on the surface.

Length of fragment, 20 mm.; probable length of tegmina, 25 mm.; probable breadth, 10 mm.

This species appears to be most nearly allied to *G. diversinervis*, but the tegmina are considerably stouter, with a more strongly arcuate costa, and it differs from all the preceding species, and more nearly resembles those which follow, in the greater relative width of the mediastinal area.

Lower Barren Coal-measures of Ohio, less than 100 feet above the Crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston, No. 169.

6. GERABLATTINA CASSVICI sp. nov.

Pl. X, figs. 2, 3.

This species is represented best by a nearly complete fore wing and its reverse, showing a form and proportions very similar to the preceding, the tegmina being apparently but little less than three times as long as broad, with a very strongly arcuate costal margin and a straight or nearly straight inner margin. The mediastinal area reaches well beyond the middle of the apical half of the tegmina, the main vein gradually approaching the apex during the apical half of its course, and supplied with rather numerous, strongly oblique, arcuate, and simple or forked branches. The scapular vein is very similar to that of the foregoing species, first branching well before the middle of the tegmina, and having three simple, forked, or compound branches, all of which have an upward curvature toward the costal margin, where the nervules are as closely crowded as in the mediastinal area, and the outermost of which extend the area of the scapular vein to scarcely more than half the dis-

tance from the mediastinal area to the apex of the tegmina. The externomedian vein beyond its basal curvature is nearly straight and passes with a gentle obliquity through the tegmina, subparallel to the costal margin, first forking just before the middle of the tegmina, and having in all four or five simple or simply forked, longitudinal veins, which occupy the apex of the tegmina. The internomedian vein runs in almost exact parallelism with, but at some distance from, the externomedian vein until the middle of the apical half of the tegmina, when, besides curving into a more longitudinal course, it sends from its upper margin a forked branch toward the tip of the tegmina, which it nearly reaches; the internomedian area, therefore, narrows very gradually, and has an exceedingly great extent, while the main vein has somewhat numerous, generally simple, but sometimes deeply forked, oblique, arcuate branches. The anal area is gently vaulted, the anal furrow deeply impressed, gently arcuate, and terminates but little before the middle of the tegmina; while the anal veins, similarly arcuate, are mostly simple and rather crowded, but especially so away from the anal furrow, where usually they are apically forked. In this species, too, all the veins and their branches are broadly banded with piceous, and where the veins or branches are closely approximate the banding of two or more adjoining stems may blend, and the wing is everywhere crossed in all the parts, whether piceous or otherwise, by fine, delicate, closely crowded cross lines.

Length of fragment, 21 mm.; probable length of tegmina, 25.5 mm.; breadth of same, 9 mm.

This species is closely allied to the preceding in many respects, but has a shorter, broader, and more tapering mediastinal area, much broader, more gradually tapering internomedian area, with much more crowded neurulation, and which extends far nearer the apex of the tegmina.

Two specimens and their reverses have been found in the Waynesburg coal (Lower Permian) at Cassville, W. Va., and are in the collection of Mr. R. D. Lacey, Nos. 2142 *a-b*, *c-d*.

7. GERABLATTINA ABDICATA sp. nov.

Pl. X, fig. 6.

The single specimen representing this species has lost the apical fifth of the tegmina and the anal area, but is otherwise well preserved. It is of a very regular, elongate ovate form, broadest in the middle, and somewhat less than two and one-half times as long as broad; the costal margin is very regularly and moderately convex, the inner margin very slightly convex. The mediastinal area is of normal width, and extends, decreasing in width only distally, some distance beyond the middle of the distal half of the tegmina; the vein has but five or six very longitudinally oblique and therefore long branches, simple or

apically forked, sometimes doubly forked. The scapular vein is regularly and considerably arcuate, terminates just above the apex of the tegmina, first branches a little before the middle of the tegmina, and has only three or four simple, deeply forked, longitudinal, gently arcuate branches. The externomedian vein runs subparallel to the last, through the middle of the wing, first forks at about the middle, has but two or three nearly straight and simple longitudinal branches which fall upon the apical margin. The internomedian area reaches as far out as the scapular vein, is scarcely sinuous, and has only four or five long arcuate branches, the basal apically forked, the others simple. The anal furrow is gently impressed, rather strongly and pretty regularly arcuate, and terminates at the middle of the tegmina. The surface of the tegmina is blackish and is marked rather feebly by very close incised cross lines, nearly straight, but inclined to be tremulous, at right angles to the adjoining veins.

Length of the fragment, 14 mm.; probable length of tegmina, 16.5 mm.; breadth, 6.75 mm.

This species differs from *E. cassvici*, to which it is most nearly related, in the far greater breadth of the basal part of the internomedian area and in the relative unimportance and lower level of the externomedian area.

One specimen from the Waynesburg coal (Lower Permian) of Cassville, W. Va., in the collection of Mr. R. D. Lacoe, No. 2143a.

8. GERABLATTINA CONCINNA sp. nov.

Pl. X, figs. 4, 5.

This species is represented by a single specimen and its reverse, showing overlapping wings and tegmina, of which little can be made out, excepting the nearly complete uppermost of the tegmina, and a second specimen of an incomplete fore wing. The tegmina are very slender, slightly more than three times as long as broad, with a rather strongly arcuate costal margin, causing the tegmina to be nearly equal in their basal, somewhat rapidly tapering in their apical half, the apex falling well within the middle of the tegmina, the inner margin being straight. The mediastinal area reaches to the middle of the apical half of the tegmina, is moderately broad, tapers very regularly and uniformly in its apical half, and is filled with strongly oblique, increasingly oblique, and simple or forked, rather long branches. The scapular vein first branches at or somewhat beyond the end of the basal third of the tegmina, has a nearly straight or gently sinuous course toward the apex of the tegmina after passing its basal arcuation, and has four or five, at their origin widely distant but still closely crowded, simple or deeply forked branches, which run in a nearly straight and longitudinal course to the apical fourth of the costal margin. The basal portion of the externomedian vein and its first branch, which is not forked until

shortly before the tip, run rather near to the main scapular vein, but after its first forking the externomedian vein has a straight and strongly oblique course to a point on the inner margin at some distance beyond the tip of the mediastinal area, and thereafter has three simple or deeply forked branches having a similar direction to that of the first fork. The internomedian vein is furnished with six or eight rather closely crowded, long, simple, oblique nervules. The anal area is considerably vaulted, the anal furrow deeply impressed, strongly arcuate, and terminates a little beyond the basal third of the tegmina; the anal nervules, six to eight in number, are gently arcuate in the same sense as the anal furrow, subequidistant and simple. The surface is uniformly black, gently vaulted in all the interspaces, excepting those of the internomedian and anal areas, with no banding and but very slight signs of any transverse striation.

Length of tegmina, 18.25 mm.; breadth, 5.9 mm.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va., in the collection of Mr. R. D. Lacoe, Nos. 2077 *a-b*, *c-d*.

9. GERABLATTINA UNIFORMIS sp. nov.

Pl. X, figs. 8-11.

Known by the tegmina only, which are about two and a half times longer than broad, with very gentle and uniform arcuation to the costal margin and straight inner margin, and probably a broadly rounded tip; the tip in all cases is broken. The mediastinal area is relatively broad and not very long, barely or not extending beyond the middle of the apical half of the tegmina, tapering only in its extreme portion, and filled with strongly oblique, infrequent, simple or forked, more or less arcuate branches. The scapular area must terminate just above the apex of the tegmina; first forking scarcely beyond the middle of the basal half of the same, it has four or five branches, all of which, mostly simple but occasionally deeply forked, have an upward gentle arcuation and on the costal margin are about as equally distant from each other as the mediastinal nervules. The externomedian vein is gently sinuous throughout its course, terminating beyond the middle of the apical third of the tegmina, beginning to fork nearly as soon as the scapular vein, and having in all only three simple or very deeply forked branches, all of which are nearly straight and longitudinal. The internomedian vein is exactly parallel to the externomedian, showing a gentle sinuosity throughout, and is furnished with six or seven simple or deeply forked, strongly oblique, and gently sinuous branches. The anal furrow is rather strongly arcuate, rather deeply impressed, and terminates some distance beyond the end of the basal third of the tegmina; the anal veins are simple and parallel to the anal furrow in its vicinity, where only they are preserved. The surface of the tegmina is uniformly black, approaching piceous, with very faintly perceptible, fine, closely crowded cross lines.

Length of the most perfect specimen (fragment), 13.5 mm.; probable length of tegmina, 17.5 mm.; breadth, 7 mm.

This species is nearly allied to the preceding, *G. concinna*, but is much less slender than it.

It is represented by four specimens from the Waynesburg coal (Lower Permian) of Cassville, W. Va., in the collection of Mr. R. D. Lacoe, all but one with reverses, which bear the numbers 2082 *a-b*, *c-d*, *e*, *f-g*.

10. GERABLATTINA PERMANENTA sp. nov.

Pl. X, fig. 12.

The tegmina are elongated, regularly and very gently tapering from near the base, and about two and three-quarters times as long as broad. The mediastinal vein extends to beyond the middle of the distal half of the tegmina, the rather narrow area gently narrowing, with half a dozen deeply forked or simple, longitudinally oblique branches, increasingly oblique distally. The scapular vein is at first straight, then bent at its first fork, at about the end of the proximal third of the tegmina, and, thereafter arcuate, crosses to the lower half of the tegmina and terminates a little below the apex; it has but three or four deeply forked, longitudinal, scarcely arcuate branches. The externomedian vein is very unimportant, first branching far beyond the middle of the tegmina and sending only three or four crowded nervules to the margin. The internomedian vein is nearly straight and oblique but apically arcuate, reaching at least as far as the mediastinal vein, with seven or eight equidistant, parallel, straight, simple, oblique branches, the apical ones more longitudinal and sometimes forked. The anal furrow is rather lightly impressed, slightly bent in the middle, and rather broadly arcuate, terminating just before the middle of the tegmina; the six or eight simple, subparallel, subequidistant anal veins are straight and longitudinally oblique, becoming gently arcuate as they approach the anal furrow. The surface of the tegmina is black, in places with distinct, close, incised cross lining.

The single specimen (with its reverse) shows a pair of crossed tegmina, of which only the more perfect, lacking only the extreme tip, is drawn.

Length of better fragment, 14.25 mm.; probable length of tegmina, 15.75 mm.; breadth, 5.7 mm.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe, No. 2144 *a-b*.

11. GERABLATTINA PERMACRA sp. nov.

Pl. X, fig. 13.

Tegmina elongate elliptical in form, about three times as long as broad, with very gently and regularly arcuate costal margin and the margin of the anal area a little full. Mediastinal area broadening beyond the base, the vein being broadly sinuate and terminating at

about the middle of the distal half of the tegmina; it has eight or nine simple, straight, oblique branches, more frequent in the distal than the proximal half. The scapular vein is very unimportant, although it first forks but little beyond the middle of the proximal half of the tegmina, for it further forks only just before the margin. The externomedian area is extensive; the vein first forks but little beyond the middle of the proximal half of the tegmina, and the two forks are of about equal importance; the upper, which must be regarded as the first branch, having three simple or forked inferior offshoots occupying the apex of the tegmina; the other two superior offshoots, one simple, the other deeply forked. The internomedian vein is very gently arcuate and reaches far beyond the middle of the distal half of the tegmina, and has only three or four longitudinally oblique, simple or forked branches. The anal furrow is very slightly impressed, somewhat strongly arcuate, and terminates scarcely beyond the proximal third of the tegmina; the anal veins are few in numbers, simple, equidistant, and arcuate, parallel to the anal furrow. The surface of the tegmina is blackish brown, and shows in places the feeblest possible signs of fine and close cross lining.

Length of fragment, 15.5 mm.; probable length of tegmina, 17 mm.; breadth, 5.65 mm.

A single specimen and its reverse collected by myself in the Waynesburg coal (Lower Permian) of Cassville, W. Va., shows the whole of one of the tegmina excepting the extreme base and the inner margin. No. 2187 and 2188, United States Geological Survey.

12. GERABLATTINA EVERSA sp. nov.

Pl. X, fig. 14.

The tegmina of this species are broadest at about the middle of the proximal half, and therefore taper apparently very slowly to the apex, and are presumably about two and one-half times longer than broad; but as in the only specimen known most of the margin is lost, much is conjectural in this respect. Assuming, what can not be far wrong, that our restoration of the outline is correct, the mediastinal area, which is of normal width and similar to that of the next preceding species, terminates at about the middle of the distal half of the tegmina and the vein has six or seven straight, longitudinally oblique, simple branches. The scapular vein must terminate about at the apex of the tegmina, being broadly arcuate, with only two or three longitudinal, broadly arcuate branches, the first of which, arising near the middle of the proximal half of the tegmina, is very deeply forked. The externomedian vein is nearly straight and oblique, with two or three broadly arcuate longitudinal branches, simple or forked. The internomedian vein runs in a straight, oblique course, parallel to the

last, to about the middle of the distal half of the tegmina, and has only four or five, mostly simple, arcuate, oblique branches, the area rapidly diminishing in diameter as the vein arises high up in the tegmina. The anal furrow is very strongly arcuate, rather sharply but very delicately incised, and terminates but little beyond the middle of the proximal half of the tegmina. The surface is black and shows no sign whatever of any cross lining.

Length of fragment, 11.5 mm.; probable length of tegmina, 15.4 mm.; breadth, 6.2 mm.

The single specimen shows but little more than half of one of the tegmina, with the shoulder, anal area, and a large part of the apex, with more than the distal half of both costal and inner margins, and, the under surface being exposed, is crossed by the veins of the overlying but imperfect hind wing. It comes from the Waynesburg coal (Lower Permian) of Cassville, W. Va., and is from the collection of Mr. R. D. Lacoe, where it bears the number 2145a.

13. GERABLATTINA DEDUCTA sp. nov.

Pl. X, fig. 15.

The tegmina, as restored, are long elliptical, of very regular outline, probably tapering as much basally as apically, and about three times as long as broad. The costal margin, beyond the extreme basal narrowing of the tegmina (which is exceptionally great), is very gently and regularly arcuate; the other margins are lost in the only specimen known. The mediastinal vein extends to the end of the fragment and certainly to far beyond the middle of the distal half of the tegmina; it has half a dozen arcuate and rather long, simple or forked branches, and is itself rather far removed from the margin. The scapular vein probably terminates exactly at the apex of the tegmina, first forks at some distance before the middle, with two main stems of about equal value, the branches being nearly longitudinal and on the margin about seven or eight in number. The externomedian vein first branches about opposite the scapular vein, and has only two or three branches, but the first branch is compound, its branchlets divergent, so that it occupies a considerable space and probably sends at least half a dozen branchlets to the margin. The internomedian vein is regularly arcuate, and terminates before the middle of the distal half of the tegmina, and has only four or five simple, equidistant, gently arcuate branches. The anal furrow is very gently impressed, roundly bent well beyond the middle, and strikes the margin at the end of the proximal third of the tegmina. The surface is dark brown and everywhere shows delicate cross lines between the veins, very closely crowded and straight.

Length of fragment, 11 mm.; probable length of tegmina, 13.7 mm.; breadth, 4.5 mm.

The single specimen lacks the anal area, the apical sixth of the tegmina and most of the inner margin for a fifth the width of the tegmina. It comes from the Waynesburg coal (Lower Permian) of Cassville, W. Va., and is in the collection of Mr. R. D. Lacoe, with the number 2146a.

14. GERABLATTINA SCAPULARIS.

Pl. X, fig. 7.

Gerablattina scapularis Scudd., Bull. U. S. Geol. Surv., No. 101, 19, pl. 2, fig. 7 (1893).

From the Lower (?) Productive Coal-measures of Pawtucket, R. I.

15. GERABLATTINA FRATERNA.

Pl. X, fig. 16.

Gerablattina fraterna Scudd., Bull. U. S. Geol. Surv., No. 101, 19-20, pl. 2, figs. d, e (1893).

From the Lower (?) Productive Coal-measures of Silver Spring, East Providence, R. I.

16. GERABLATTINA RADIATA sp. nov.

Pl. XI, fig. 1.

A single, nearly perfect fore wing, but with the tip destroyed. It is a little more than twice as long as broad, with widely radiating veins; the costal margin is strongly arcuate, especially on the proximal half, the inner margin nearly straight, and the tip probably roundly pointed. The mediastinal area extends almost to the end of the preserved portion and probably to the apical sixth of the tegmina, and the vein has few, remarkably longitudinal, mostly simple veins, though the middle ones arise from a longitudinal subbasal branch which simulates the main vein. The scapular vein is somewhat as in the genus *Archimylacris*, for it is strongly arcuate, throughout parallel with the costal margin, and terminates distinctly below the apex of the tegmina, though it apparently does not sweep upward at tip, to judge from the veins next the distal end of the specimen; it first forks at about the end of the proximal third of the tegmina, and has three or four longitudinal branches, simple, deeply forked, or compound. The externo-median vein, very strongly arcuate in the proximal third of the tegmina, is thereafter straight and has but three simple, subequidistant branches parallel to the main scapular vein, the first arising a little before the middle of the tegmina. The internomedian vein is straight beyond the proximal third of the tegmina and terminates only a little before the distal third of the same, with four straight oblique branches, the first very deeply forked, the others simple. The anal furrow is gently arcuate beyond the very strongly arcuate base and ends with the proximal third of the tegmina; the veins are few, simple, and bent arcuate. The veins are discolored with black on a blackish castaneous ground, and there is everywhere a feeble tracery of cross lines.

Length of fragment, 13.5 mm.; probable length of tegmina, 15.5 mm.; breadth, 6.75 mm.

This species is slenderer than those which here follow it, due to the tapering of the tegmina beyond the basal third, and is remarkable for the downward course of the scapular vein, which carries it below the apex of the tegmina.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2147a.

17. GERABLATTINA LATA sp. nov.

Pl. XI, fig. 2.

Represented by a single, almost perfect specimen of one of the tegmina; this is only twice as long as broad, of somewhat regular obovate form, the costal margin pretty regularly arcuate, the apex broadly rounded, the inner margin straight. The mediastinal area is tolerably broad and extends to beyond the middle of the apical third of the tegmina, tapering only in its extreme portion, where the mediastinal vein, hitherto parallel to the costal margin, curves rather strongly upward; the area is filled with simple or simply and not deeply forked, strongly oblique nervules, rather few in number but somewhat closely crowded by their obliquity. The scapular vein, first forking but little before the middle of the tegmina, is strongly sinuous, with four, at origin rather distant branches, which are arcuate and upcurved and mostly simple and closely crowded. The externomedian vein is even more strongly sinuous, with but three simple or forked branches, occupying on the apical margin from the extreme apex downward even less space than do the scapular nervules above the apex. The internomedian vein is similarly sinuous and parallel to the externomedian, and has seven generally simple, sometimes simply forked, oblique, nearly straight or gently arcuate branches, the area itself rapidly narrowing beyond the base. The anal area is very gently vaulted with a strongly impressed, arcuate, anal furrow, terminating at about the end of the basal two-fifths of the tegmina; the anal veins are few, distant, strongly arcuate, and subparallel to the anal furrow. The surface of the tegmina is uniformly piceous throughout, and well marked with pronounced but exceedingly delicate and closely crowded tremulous cross lines.

Length, 12.5 mm.; breadth, 6.25 mm.

Represented by one specimen from the Waynesburg coal (Lower Permian) of Cassville, W. Va., in the collection of Mr. R. D. Lacoe, bearing the number 2148a.

18. GERABLATTINA ROTUNDATA sp. nov.

Pl. XI, fig. 3.

This species, represented by a single specimen broken at base, closely resembles *G. lata* in general appearance, having precisely the same form except a straighter costal margin, and being of the same size. It is slightly more than twice as long as broad, with the costal margin straight in the middle half, the apex very broadly rounded, and the anal margin straight before the apical curve. The mediastinal vein is almost perfectly straight, so that the area is triangular and terminates barely before the middle of the distal half of the tegmina; the branches of the vein are rather few, mostly simple, straight and oblique. The scapular vein is gently sinuate and terminates exactly at the apex of the tegmina; it first forks just before the end of the proximal third of the tegmina, and by the middle of the tegmina has sent out three longitudinally oblique, simple, doubly forked, or compound branches, and itself forks once near the tip, so that nearly a dozen branches fall on the upper half of the rounded apical margin of the tegmina. The externomedian vein is similarly sinuate and emits three variably forked branches, farther from the base than the scapular branches, but nearly as numerous on the margin as they. Internomedian vein broadly arcuate but reaching out to the same distance as the mediastinal vein, with four or five simple, nearly straight, oblique branches, traced with exceptional fineness on the stone. Anal furrow not very deeply incised, straight beyond the arcuate basal portion, striking the margin not far before the middle of the tegmina; the anal area is obliterated. With the exception of the internomedian area, the veins are rather deeply incised and black, though not margined, and the whole of the surface of the tegmina is nearly black; there is a feeble sign or two of transverse cross lines in the apical part of the tegmina.

Length of tegmina, 10mm.; breadth, 4.9.

This species is readily distinguished from *G. lata*, its nearest ally, by the straight mediastinal vein and arcuate instead of sinuate internomedian vein.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe, No. 2149a.

19. GERABLATTINA OVATA sp. nov.

Pl. XI, fig. 4.

The only fragment preserved is broken at the base of the tegmina, but their shape can almost certainly be restored, showing them to have been of a very distinctly ovate form, about twice as long as broad, with the costal margin very regularly and rather strongly convex and the inner margin equally convex in the apical half, producing an ovate tip. The mediastinal vein is sinuous and terminates at about the

middle of the apical half of the tegmina, is rather distant from the margin, and has but four or five simple or simply forked and rather long, rather oblique branches. The scapular vein is rather strongly sinuous, terminates barely above the apex of the tegmina, begins to fork at some distance before the middle of the tegmina, and has four simple, in one case deeply forked, nearly straight but slightly sinuous, oblique branches. The externomedian vein, beyond the arcuate base, is nearly straight, begins to fork at about the middle of the tegmina, and has four simple or medially forked, straight, longitudinal branches. The internomedian vein is parallel to the externomedian, and terminates in the middle of the apical two-fifths of the tegmina, with five straight or gently arcuate, oblique, distant branches, of very unequal length, since the area rapidly narrows from base to apex. Only a little of the anal furrow can be seen, but it plainly terminates but a little way before the middle of the inner border. The surface of the tegmina is uniform in coloring and transversely cross lined, as in the preceding species.

Length of fragment, 13.5 mm.; probable length of tegmina, 14.5 mm.; width, 7 mm.

This species is closely allied to *G. lata*, but is of a distinctly different form from the tapering of the apical half of the tegmina, which is scarcely in the least perceptible in the preceding species; the veins again are more longitudinal and less arcuate, and the neuration is also more scant.

The single specimen, represented by obverse and reverse, comes from the Waynesburg coal (Lower Permian) of Cassville, W. Va., and is in the collection of Mr. R. D. Laccoe, bearing the number 2150 a-b.

20. GERABLATTINA MINIMA sp. nov.

Pl. XI, fig. 5.

The tegmina would be pretty regularly elliptical in form were it not for the square shoulder formed by the anal area, but, disregarding that, would taper more apically than basally. The costal margin is very regularly and considerably arcuate, but more strongly at base than at apex; the inner margin is nearly straight to the middle of the distal half of the tegmina and then is as arcuate as the costal margin, forming a bluntly subacuminate tip; the tegmina are scarcely more than twice as long as broad and exceptionally small for a Paleozoic cockroach, being indeed the smallest known in this country, except one Permian species. The mediastinal area is of excessive breadth, reaching almost to the middle line of the tegmina, at its widest expansion; the vein is rather strongly sinuate and reaches almost to the middle of the distal fourth of the tegmina; its branches are subparallel, oblique, gently arcuate, generally simple but sometimes deeply forked, and about a dozen in number. The scapular vein is insignificant and closely parallel to the mediastinal vein; it forks only just before the middle of

the distal half of the tegmina and has but two simple branches, occupying on the margin only half the narrow space lying between the end of the mediastinal area and the extreme apex of the tegmina. The externomedian vein is also sinuate in the same sense, first forks at about the middle of the tegmina, and has only three simple or forked branches, widely separated at base. The internomedian vein is compound; its principal portion is nearly straight, but at the middle of the tegmina it has a superior apically forked branch which extends its area farther out than the mediastinal area, the main stem having half a dozen rather distant, parallel, transversely oblique, nearly straight, constantly shortening branches. The anal furrow is distinctly impressed, but more by the moderate vaulting of the anal area than by its own incision, is very strongly and regularly arcuate, and strikes the margin at about the distal end of the second fifth of the tegmina; the anal veins are numerous, closely crowded, subsinuate, parallel, longitudinally oblique and mostly simple. The surface of the tegmina is black and in places, particularly in the internomedian area, there are the feeblest possible traces of excessively fine and closely crowded straight cross lines.

Length of tegmina, 9.75 mm.; breadth, 4.7 mm.

This species is most nearly allied to *G. ovata*, but the shape of the tegmina and the relative importance of the mediastinal and internomedian areas are very different.

The single specimen known, with its reverse, is completely preserved, and was obtained by myself in the Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Nos. 2183 and 2184, United States Geological Survey.

21. GERABLATTINA FASCIGERA.

Blattina fascigera Scudd., Proc. Bost. Soc. Nat. Hist., XIX, 238-239 (1878).

Gerablattina fascigera Scudd., Mem. Bost. Soc. Nat. Hist., III, 113-115, pl. 6, figs 1 2 (1879); Foss. Ins. N. A., I, 133-135, pl. 6, figs. 1, 2 (1890).

This is the oldest known Paleozoic cockroach.

From the Interconglomerate or Millstone Grit of Campbell's Ledge, near Pittston, Pa.

11. Genus ANTHRACOBLATTINA.

Anthracoblattina Scudd., Mem. Bost. Soc. Nat. Hist., III, 87-88 (1879); Foss. Ins. N. A., I, 107-108 (1890).

This is rather a characteristic European type of Blattinariae, for it there holds a second place, while of the fourteen known species only two are American. The geologic range is the same in the two countries, and though in Europe it culminates toward the close of the Carboniferous period, the culmination is in no sense striking, as it is in some genera. In our own country one of the species occurs in the

Lowest Productive Coal-measures of the Western Interior coal-basin in Missouri, the other in the Permian of West Virginia. The genus has not before been recognized in America.

Table of the species of Anthracoblattina.

Large species, the tegmina exceeding 25 mm. in length; scapular vein first forking far earlier than the externomedian..... 1. *A. americana*.
 Small species, the tegmina less than 12 mm. in length; scapular and externomedian veins first forking at about the same distance from the base.... 2. *A. virginienensis*.

1. ANTHRACOBLATTINA AMERICANA sp. nov.

Pl. XI, fig. 7.

The basal half or thereabouts of a large fore wing represents apparently a species of Anthracoblattina, a genus hitherto unknown in America; the form of the tegmina can, of course, not be told with certainty, but I have attempted to restore the probable outline from the curves of that portion of the costal and inner margins which is preserved and from the course of the principal veins. The tegmina are broad with a broad well-rounded shoulder and a gently arcuate costal and nearly straight inner margin; they are probably a little more than twice as long as broad, and the broadest portion is a little beyond the middle of the anal area. The mediastinal area is remarkably broad, occupying at the base of the wing fully one-half its width, narrowing at first, afterwards remaining nearly equal to a little before the middle of the wing, when it tapers somewhat rapidly, and probably terminates at the end of the middle third of the tegmina, the vein having thus a broadly sinuous course, and throwing off at regular intervals a series (four or five are visible) of long, straight, simple, oblique branches. The scapular vein runs at the extreme base as close as possible beside the externomedian vein, parts from it before the middle of the anal area, and thereafter runs at first parallel to the costal margin; it sends off its first branch before the end of the basal third of the tegmina, its second a little before the middle of the tegmina, the first forking before the origin of the second branch; more than this can not certainly be said from the imperfect nature of the fragment, but it would appear from the course of the veins beside it that it occupies on the costal margin all the portion lying between the mediastinal area and the extreme tip of the tegmina. The externomedian vein is strongly arcuate and first forks opposite the first fork of the first branch of the scapular vein, and from its course and that of the adjoining veins it apparently forks longitudinally in the apical half of the tegmina and occupies on the margin a space considerably less than that of the scapular vein. The internomedian vein runs exactly parallel to the externomedian, and apparently terminates somewhat beyond the middle of the outer half of the tegmina; in the portion which remains it

emits two compound, gently arcuate branches, each of them forking doubly before the middle of the tegmina. The anal furrow is deeply and sharply impressed, very strongly arcuate, almost bent at right angles in its proximal half, beyond nearly straight, terminating on the margin just beyond the basal third of the tegmina; the anal area is occupied by but few veins and these at considerable distance from the anal furrow; they are forked or doubly forked, and run in a longitudinally oblique direction, that nearest the anal furrow passing a little above the middle of the area and somewhat arcuate in the same sense as the anal furrow.

Length of fragment, 15.5 mm.; probable length of tegmina, 30 mm.; breadth, 14.5 mm.

The extreme width of the mediastinal area separates this at once from any of the European species of *Anthracoblattina*.

From a coal bank near Clinton, Mo., belonging to the Lowest Productive Coal-measures. Mr. R. D. Lacoe; one specimen, No. 2137a.

2. *ANTHRACOBLATTINA VIRGINIENSIS*.

Pl. XI, fig. 8.

A nearly perfect fore wing represents a second species, remarkable for the brevity of the internomedian area; the tegmina are smaller and stouter than usual in this genus, being but little more than twice as long as broad, obovate, probably with broadly rounded apex; the costal margin is scarcely arcuate except at the extremities. The mediastinal area is distinctly less than one-third the breadth of the tegmina, at first equal, but gradually approaching the margin in its distal half by the arcuation of the main vein, which reaches the border just before the middle of the distal half of the tegmina; there are about five longitudinally oblique, generally simple, nearly straight branches. The scapular vein is broadly sinuous, being at the base strongly, at the apex feebly, arcuate, terminating at the apex of the tegmina; it first forks well before the middle of the tegmina and has about four mostly deeply forked, feebly arcuate branches, which have much the direction of those of the mediastinal area. The externomedian vein forks fully as soon as the scapular vein and has more branches, the first of which is compound (the others not fully preserved). The internomedian area is exceptionally short for an *Anthracoblattina*, the main vein being rather strongly arcuate and terminating not far beyond the middle of the tegmina; it has four gently arcuate mostly simple branches. The anal furrow is strongly and very regularly arcuate, not very deeply impressed, and terminates not far from the end of the proximal third of the tegmina; the anal area is not preserved and the other parts of the immediate base are destroyed. The surface of the tegmina is finely, but not very closely, cross-lined, except in the internomedian and the basal portion of the externomedian area, where it is irregularly and not very delicately reticulate.

Length of fragment, 10.5 mm.; probable length of tegmina, 12 mm.; breadth, 5.4 mm.

This species differs from the European species, but perhaps to a less extent from the single other American species, in the brevity of the internomedian area. It is the smallest species of the genus, which contains some of the largest of Paleozoic cockroaches, but it is not much smaller than the European *A. remigii*, from Cusel.

From the Waynesburg coal (Lower Permian), of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2138 *a-b*.

12. Genus HERMATOBLATTINA.

Hermatoblattina Scudd., Mem. Bost. Soc. Nat. Hist., III, 115 (1879); Foss. Ins. N. A., I, 135 (1890).

This genus was founded upon a couple of species from the Coal-measures of Germany, and one has since been added from the Scottish coal field. It seems to be confined to the uppermost Carboniferous beds and the Permian. No American species have yet been detected.

13. Genus PROGONOBLATTINA.

Progonoblattina Scudd., Mem. Bost. Soc. Nat. Hist., III, 118-119 (1879); Foss. Ins. N. A., I, 138-139 (1890).

This genus was founded upon a couple of European species, one occurring at the very top of the Carboniferous series in Germany, the other lower down, but in the Productive Coal-measures of Switzerland. None have since been added in Europe, and until now none have been found in America, but we are here able to add a representative from this country. It comes from the Lowest Productive Coal-measures of the Eastern Interior coal field in Illinois. The American species, however, departs less widely than the European from the other Palæoblattariæ in the more normal extent of the internomedian area, which here reaches to the distal end of the middle third of the tegmina.

PROGONOBLATTINA COLUMBIANA.

Pl. XI, fig. 9.

The tegmina are of a graceful form, very elongate oval, but with the inner side for the greater part straight, broadest at the end of the proximal third, tapering gradually to a rounded, scarcely pointed apex; both tegmina are perfectly preserved, but the neuration of one is partly lost in unimportant places; the breadth is to the length about as 1:2.6. The costal margin is very regularly and considerably arcuate, the base ovately rounded and the inner margin straight for two-thirds the length of the tegmina, unaffected by the anal area. The mediastinal area is vittate, the vein extending slightly beyond the middle of the tegmina and the seven or more branches mostly simple,

but sometimes deeply forked, increasingly oblique distally. The scapular vein is strongly and pretty uniformly sinuous, terminating just above the apex of the tegmina; on one wing it begins to branch far toward the base of the tegmina as in the other species of the genus, but on the other it does not branch until about the end of the proximal third of the tegmina; yet in the former case, the right side, the vein is much less numerously branched than in the other, although at the same time more strongly sinuous, permitting by its recession from the margin space for a larger number of offshoots; but on this side, as also in the other species of *Progonoblattina*, the branches are more nearly longitudinal, by which they are reduced in number; on the left fore wing, on the contrary, they are decidedly oblique and excepting the compound basal branch are all simple. The main course of the externomedian vein is, of course, that of the preceding; it first branches not far from the middle of the tegmina, its branches slightly arcuate and nearly longitudinal, the first compound, the others simple. The internomedian vein is regularly and gently arcuate throughout, terminating at about the distal end of the middle third of the tegmina, and has five subequidistant, nearly straight, oblique branches. The anal furrow is strongly and regularly arcuate, deeply impressed, especially toward the base, and strikes the margin a little beyond the end of the proximal third of the tegmina; the half dozen anal veins are simple, arcuate, subequidistant, parallel.

The pronotal shield is also preserved, slightly distorted by pressure. It was apparently subtruncate at base, less than twice as broad as long, strongly convex in front; it appears also to have been considerably vaulted and to have had a large discal, transverse, quadratic impression, nearly twice as broad as long, and there is also trace of a fine margination around all but the base.

The impression of some of the legs, and especially of the hind pair, appears, but only enough to say that they were slender and of a normal length.

Length from front of prothorax to tip of closed tegmina, 26 mm.; of tegmina, 20.75 mm.; breadth of same, 8 mm.; of overlapping tegmina, 14.25 mm.; of prothorax, 9.75 mm.; length of hind femora, 6.5 mm.; breadth of same, 1.75 mm.; length of hind tibia, 4.5 mm.; of tarsi, 6.5 mm.

The single specimen known lies in a natural position, with all the exposed parts preserved, and occurs with its reverse in the center of a nodule from the Lowest Productive Coal-measures of Mazon Creek, Illinois. It was received for study from Mr. William Gurley.

14. Genus ORYCTOBLATTINA.

Oryctoblattina Scudd., Mem. Bost. Soc. Nat. Hist., III, 121-122 (1879); Foss. Ins. N. A., I, 141-142 (1890).

Five species of this genus are now known—three from Europe and two from North America. The European species are found in later rocks than the American, one occurring in Dyassic, the other two in Upper Carboniferous deposits. One of our two species, indeed, is found in the Barren Coal-measures of the Western Interior coal basin, in Missouri, but the other in the Lowest Productive Coal-measures of the Eastern Interior coal basin in northern Illinois. The type is a very peculiar one, and the resemblance of one of our species (the younger) to the European is very striking, although it is still very clearly distinct; it comes also from a similar horizon.

Table of the species of Oryctoblattina.

Scapular vein with its first branch running close and parallel to the mediastinal throughout.....	1. <i>O. occidua</i> .
Scapular vein before branching diverging widely from the mediastinal, only its first branch subparallel to the mediastinal.....	2. <i>O. laqueata</i> .

1. ORYCTOBLATTINA OCCIDUA.

Oryctoblattina occidua Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 37 (1885); Mem. Bost. Soc. Nat. Hist., IV, 414-415, pl. 32, fig. 3 (1890); Foss. Ins. N. A., I, 390-391, pl. 24, fig. 3 (1890).

Lowest Productive Coal-measures of Mazon Creek, Illinois.

2. ORYCTOBLATTINA LAQUEATA sp. nov.

Pl. XI, fig. 6.

Tegmina only. The tegmina are of an elongate oval form, broadest at the end of the basal third, considerably less than three times as long as broad; the costal margin is strongly arcuate, especially at base, the inner margin gently arcuate, the apex, which is broken, evidently falling about the middle line, perhaps a little below it. The mediastinal vein runs at no great distance from the margin, subparallel to it but gradually approaching it, at last somewhat abruptly, and terminates just beyond the middle of the tegmina; it has many simple, straight, slightly oblique branches, those in the basal half interrupted by a series of connecting cross veins which disturb their regularity. The scapular vein starts in close proximity to the mediastinal in the basal fourth, diverges rapidly from it and thereafter runs at a wide distance from but subparallel to it, terminating a little less than midway between the tip of the mediastinal vein and the apex of the tegmina, and in this last portion of its course, from just before the tip of the mediastinal vein, sends to the border numerous very crowded, straight, oblique, simple veins; just beyond its change of course the scapular vein throws off

a principal branch, which emits several inferior nervules at rather wide distances apart toward the apex of the tegmina; most of these branches are simple for the greater portion of their course, or they may be deeply forked, so that eight or nine nervules strike the margin; besides this, in the interspace between the main vein and its principal branch, there is thrown off from the upper side of the principal branch a short, widely diverging vein. The externomedian vein runs in a nearly straight, gently sinuate course at no great distance from the scapular vein and its lowest branch to the inner margin, at no great distance before the tip; it has but a single branch, originating opposite the first furcation of the principal mediastinal branch, but at its origin obscured by the reticulation of the tegmina and distinct only beyond the middle of the wing, at which it divides into two distally branching veins. The internomedian vein forks close to the base, its lower branch simple, straight, and running in close proximity to the anal furrow, its upper branch forking widely opposite the tip of the former; the space upon the margin between its forks as well as between these and the lower branch is filled with numerous oblique, straight, closely crowded branches similar to the upper branches of the main scapular stem. The anal furrow is sharply but not deeply impressed, gently arcuate at the base, beyond nearly straight; of the anal veins only a pair can be seen, parallel to the anal furrow and not closely crowded. The whole surface is covered with a minute but sharp reticulation of cross veins forming cells which are generally polygonal, but, by reason of the direct or nearly direct transversality of the cross veins, mostly quadrilateral in the scapular and anal areas and between the scapular and mediastinal veins, except in the interspaces between the straight, closely crowded, marginal branches of both the costal and inner borders, which are free.

This species is remarkably similar to and yet very distinct from *O. reticulata* of the German coal, and is another remarkable instance of the similarity of many forms in the European and American Coal-measures. The general resemblance is most striking, due to the sharp and minute reticulation of the tegmina, the multiplicity of the short branches which crowd the margin in certain spots, and the general form and relative importance of the scapular vein, with its branches almost wholly dependent on not the main vein but its principal branch. It differs in the very different form of the tegmina, the lack of an independent curve to the anal area, and in the wide basal branching of the internomedian vein. As will be seen, *O. laqueata* bears a much stronger resemblance to the European species than to *O. occidua*, the only American species hitherto known.

Length of fragment, extreme tip and base being lost, 17.5 mm.; probable length of wing, 21 mm.; breadth, 7.5 mm.

The single specimen, from the Coal-measures of Kansas City, Mo., was collected by Mr. Sidney J. Hare about 170 feet above the base

of the Upper Barren Coal-measures, and is in the collection of Mr. R. D. Lacoe, under the number 2136a.

15. Genus POROBLATTINA.

Poroblattina Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 38-39 (1885).

First described from the Triassic rocks of Colorado, where three species occur; it has now been found, not only in the Permian of West Virginia, where three more species are found, but even in the Barren Coal-measures of eastern Ohio, in which two other species are recognized, or eight species in all. It thus ranges from the Barren Coal-measures to the Trias, and, as far as yet appears, is an exclusively American type.

Table of the species of Poroblattina.

- a¹. Mediastinal area extending well beyond the middle of the tegmina; externomedian vein first forked beyond the extremity of the anal furrow.
 - b¹. Externomedian vein simple, or, if forked, divided only at extreme tip.
 - 1. *P. longinqua*.
 - b². Externomedian vein more or less and deeply forked.
 - c¹. Scapular vein terminating at or above the tip of the tegmina; internomedian vein and branches oblique and nearly straight.
 - d¹. Mediastinal area narrowing only near extremity, which reaches far beyond the middle of the distal half of the tegmina; scapular vein sinuous, its branches almost longitudinal. 2. *P. gratiosa*.
 - d². Mediastinal area narrowing throughout distal half and reaching only to middle of distal half of tegmina; scapular area arcuate, its branches distinctly oblique. 3. *P. fossa*.
 - c². Scapular vein terminating below the tip of the tegmina; internomedian vein and branches strongly arcuate. 4. *P. meieri*.
- a². Mediastinal area terminating distinctly short of the middle of the tegmina; externomedian vein first forked opposite the extremity of the anal furrow.
 - b¹. Scapular vein strongly sinuous, the proximal series of branches simple.
 - 5. *P. arcuata*.
 - b². Scapular vein gently sinuous, the proximal series of branches deeply forked.
 - c¹. Externomedian vein with few, distant, and simple branches.
 - d¹. Internomedian vein long, with numerous but distant branches.
 - 6. *P. lakesii*.
 - d². Internomedian vein short, with very few branches. 7. *P. ohioensis*.
 - c². Externomedian vein with numerous, crowded, and often forked branches.
 - 8. *P. complexinervis*.

1. POROBLATTINA LONGINQUA.

Pl. XI, fig. 12.

Although the single specimen at hand is very fragmentary and scarcely shows a natural border at any point, the portion preserved shows the larger part of the neurulation and its most essential features, which are somewhat strikingly different from those of any other species. Apparently the tegmina were of a slender ovate form, about two and a half times longer than broad, though this is conjectural. The medias-

tinal area is vittate and rather narrow, the vein with rather distant gently arcuate simple branches, and evidently ends well beyond the middle of the tegmina. The scapular vein is gently and very broadly sinuous, and retreats so from the costal margin as probably to terminate at some considerable distance below the apex of the tegmina, which is one of its striking peculiarities; it first forks a little before a point opposite the extremity of the anal furrow, and in the fragment has but two branches, both of which are or must be forked if not compound, and probably a third branch arises at a long distance from the second; all these branches are very longitudinally oblique. The externomedian vein is simple as far as it can be traced, which is through at least three-fourths of its course; it runs in a sinuous course, midway between and distant from the adjacent veins. The internomedian vein is similarly sinuous, and in the preserved portion has three (probably there are in all four or five) nearly straight and oblique distant branches. The anal furrow is feebly incised, arcuate, and scarcely bent in the middle, and terminates probably well beyond the middle third of the tegmina; anal veins not preserved. The internomedian veins are very delicate, the others rather coarse, and all are broadly bordered on each side with carbonaceous black, which in the internomedian area shows traces of delicate cross lines.

Length of fragment, 15 mm.; probable length of tegmina, 22 mm; breadth, 8.5 mm.

In the simple or only apically forked externomedian vein and the downward embayment sweep of the scapular vein, including the whole apex of the tegmina, this species differs strikingly from all its allies.

From the Lower Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston; one specimen, No. 111.

2. POROBLATTINA GRATIOSA.

Pl. XI, fig. 13.

The tegmina, in the single instance known nearly complete, hardly taper apically, but are slender, being fully two and one-half times longer than broad, the costal margin rather gently arcuate, the inner margin straight, the apex probably well rounded. The mediastinal area is vittate and tolerably broad, extending to not very far short of the apex of the tegmina; the vein has seven or eight similar, simple, strongly oblique, nearly straight branches. The scapular vein is somewhat sinuate and terminates at the very apex of the tegmina; it branches early, well before the tip of the anal furrow and within the proximal fourth of the tegmina; in all there are about five feebly arcuate, longitudinal, mostly simple branches, arising at somewhat unequal distances apart. The externomedian vein is very feebly sinuous, longitudinally oblique, with three straight, simple or forked, very longitudinally oblique branches

arising at very unequal distances apart, the earliest a little beyond the tip of the anal furrow. The internomedian vein is very broadly arcuate (too straight in the figure) and ends before the middle of the distal half of the tegmina, and has but three nearly straight, oblique, simple or simply forked branches. The anal furrow is lightly impressed, rather regularly and rather strongly arcuate, ending on the margin not a great way beyond the proximal fourth of the tegmina; anal area lost. The entire surface is uniformly carbonaceous black and marked with exceedingly delicate, closely crowded cross lines.

Length of fragment, 11 mm.; probable length of tegmina, 13.5 mm.; breadth, 5 mm.

The great length of the mediastinal area and the infrequent branching of the scapular and externomedian veins distinguish this species from *P. fossa*, its nearest ally. Its most striking peculiarity is the behavior of the externomedian vein.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoe; one specimen, No. 2134 *a-b*.

3. POROBLATTINA FOSSA.

Pl. XI, fig. 15.

Tegmina oblong ovate in form, much more than two and one-half times longer than broad, with regularly and considerably arcuate costal margin and nearly straight inner margin. The mediastinal vein is nearly straight, with a very gentle arcuation beyond the base, and reaches nearly to the distal end of the middle third of the tegmina; its branches are straight, simple, and very longitudinally oblique. Beyond the base the scapular vein is gently and broadly arcuate, striking the apex of the tegmina; it first branches within the proximal third of the tegmina, the branch doubly forked, and thereafter, about the middle of the tegmina, has three more simple or forked branches, all parallel to those of the mediastinal area. Beyond the base the externomedian vein is straight and oblique, with three or four forked or doubly forked longitudinal branches, the first thrown off at some distance beyond the origin of the first scapular branch. The internomedian vein, beyond its gently arcuate base, is straight, parallel to the internomedian vein, and strikes the margin at the distal end of the middle fifth of the tegmina; it has four or five straight, oblique, simple branches, the first sometimes forked. The anal furrow is regularly and considerably arcuate, but little impressed, and strikes the margin at about the end of the proximal third of the tegmina; anal area not preserved. The internomedian veins are lightly impressed and delicate, the others rather deeply and coarsely; the surface is uniformly blackish, and there is no trace of marking or other sculpture.

Length of better fragment, 14 mm.; probable length of tegmina, 16.5 mm.; breadth, 6 mm.

This species is most nearly allied to the preceding, from which it differs in the form and length of the mediastinal area, the more oblique and numerous scapular veins, the more strongly convex costal margin, and probably in the form of the apex of the tegmina.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacey; two specimens, Nos. 2083 *a-b*, *c*.

4. POROBLATTINA MEIERI.

Petrablattina meieri Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 38 (1885); Mem. Bost. Soc. Nat. Hist., IV, 465, pl. 42, fig. 17¹ (1890); Foss. Ins. N. A., I, 441, pl. 34, fig. 17¹ (1890).

This species was wrongly referred by me to *Petrablattina*.
Triassic of Fair Play, Colo.

5. POROBLATTINA ARCUATA.

Poroblattina arcuata Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 39 (1885); Mem. Bost. Soc. Nat. Hist., IV, 466, pl. 41, fig. 5 (1890); Foss. Ins. N. A., I, 442, pl. 33, fig. 5 (1890).

Triassic of Fair Play, Colo.

6. POROBLATTINA LAKESII.

Poroblattina lakesii Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 39 (1885); Mem. Bost. Soc. Nat. Hist., IV, 466, pl. 41, fig. 11 (1890); Foss. Ins. N. A., I, 442, pl. 33, fig. 11 (1890).

Triassic of Fair Play, Colo.

7. POROBLATTINA OHIOENSIS.

Pl. XI, fig. 11.

The apical third or more of the only specimen known is unfortunately lost, but the tegmina are very slender and must have been more than three times as long as broad; the costal margin is very slightly arcuate beyond the base and the inner margin straight, so that the tegmina taper very slightly and probably had a well-rounded apex. The mediastinal area is very brief and narrow and the main vein very slightly arcuate, ending but a little beyond the proximal third of the tegmina, with three or four longitudinally oblique, simple, and straight branches. The scapular is far the most important of the veins, with a sinuous course through the middle of the tegmina, terminating at the apex; it sends out a large number of branches, not very crowded, either simple or deeply forked, occasionally doubly forked, the first of which is emitted far toward the base of the tegmina or about opposite the middle of the anal area; the branches are more or less arcuate and oblique. The externomedian vein is broadly sinuous and oblique, and

¹ Erroneously marked 13 on plate. See note on p. 87.

in the part preserved shows but two branches, which are simple, but in all probability they fork in the apical portion, as there is abundant room for it. The internomedian vein runs parallel to the externomedian and strikes the inner margin not far from the middle of the tegmina; it is badly preserved and remarkably insignificant, but probably has one or two short oblique branches. The anal furrow is deeply impressed at base, but beyond only delicately incised, pretty regularly and not very strongly arcuate, and strikes the inner margin beyond the proximal third of the tegmina; the anal veins that can be seen in the portion most removed from the furrow are arcuate in a sense the reverse of that of the furrow, closely crowded, and most of them deeply forked. The scapular veins are as deeply incised as the anal furrow; the others are more delicate; the whole surface is black, and there is no sign of cross lining.

Length of fragment, 7.5 mm.; probable length of tegmina, 11 mm.; breadth at tip of anal furrow, 3.5 mm.

The tegmina are peculiar for the insignificance of the internomedian area and the contrast between the two lateral halves, as to the number and prominence of the nervules. It bears no special resemblance to any of the others.

From the Barren Coal-measures of Ohio, less than 100 feet above the crinoidal limestone, in the valley of Wills Creek, Richmond, Jefferson County. Mr. S. Huston; one specimen, No. 162.

8. POROBLATTINA COMPLEXINERVIS.

Pl. XI, fig. 14.

The last species of *Poroblattina* is represented by a single specimen of one of the tegmina, perfect in every part excepting insignificant fractures from the base and tip. The tegmina are of a very graceful subovate form, with well rounded outlines, nearly two and three-quarters times as long as broad; the costal margin is considerably and very regularly convex, the inner margin straight except at base and tip, the apex well rounded and subacuminate; the tegmina are crowded with nervules. The mediastinal area is short and narrow, terminating at the distal end of the second fifth of the tegmina, the vein with four or five oblique simple branches. The scapular vein is broadly and gently sinuous, terminating a little above the apex, with six or seven tolerably straight, oblique, generally forked branches, arising subequidistantly, the earliest about opposite the middle of the anal area. The externomedian vein is very peculiar; simple and arcuate until beyond the tip of the anal area, it appears here to throw off numerous branches on each side as it runs toward a point as far below the apex as the tip of the scapular vein is above it; but in reality it runs parallel to the internomedian vein (as in the other species of the genus), while one of its middle branches is complexly compound, spreading fan-shaped with numerous offshoots filling the lower apical portion of the tegmina, the

other branches before and after it being usually simply forked. The internomedian vein is broadly arcuate, though nearly straight in its middle half, and terminates somewhat beyond the middle of the tegmina; it has a number of feebly sinuous, straight and oblique, crowded branches. The anal furrow is deeply impressed, at least at base, and strongly arcuate, terminating on the inner margin scarcely beyond the proximal third of the tegmina; the anal veins are very numerous, mostly simple and arcuate, less so and more crowded away from the anal furrow. The anal and internomedian veins are delicately traced, the others more pronounced; the whole surface is carbonaceous black, and shows nowhere any sign of cross lines.

Length of tegmina, 16.75 mm.; breadth, 6.25 mm.

This species resembles the Triassic species more than do any of the other Paleozoic forms, but it differs widely from them and indeed from all the others in the crowded venation, and in the complicated distribution of the externomedian branches.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoë; one specimen, No. 2135 *a-b*.

16. Genus PETRABLATTINA.

Petrablattina Scudd., Mem. Bost. Soc. Nat. Hist., III, 123-124 (1879); Foss. Ins. N. A., I, 143-144 (1890).

This is a second genus found both in Paleozoic and Mesozoic rocks. One Triassic species formerly referred here really belongs in *Poroblattina* (*P. meieri*), but *Petrabl. aqua* from the same rocks undoubtedly belongs here. One of the other two American species, like the single European species, occurs in the Permian (of West Virginia); the other, on the contrary, is a far older form, coming from probably the Lowest Productive Coal-measures in the Acadian coal basin, near the upper limit of the Millstone Grit.

Table of the species of Petrablattina.

- a*¹. Mediastinal area reaching much beyond the middle of the tegmina; internomedian area wholly within the basal half of the tegmina..... 1. *P. sepulta*.
- a*². Mediastinal area reaching scarcely or not beyond the middle of the tegmina; internomedian area extending more or less into the distal half of the tegmina.
- b*¹. Scapular vein terminating at the tip of the tegmina; internomedian area reaching but little beyond the middle of the tegmina 2. *P. hastata*.
- b*². Scapular vein terminating far before the tip of the tegmina; internomedian area reaching well beyond the middle of the tegmina..... 3. *P. aqua*.

1. PETRABLATTINA SEPULTA.

Blattina sepulta Scudd., Proc. Amer. Assoc. Adv. Sc., XXIV, B, 111, fig. 2 (1876); Can. Nat., n. s., VIII, 89-90, fig. 2 [1] (1876).

Petrablattina sepulta Scudd., Mem. Bost. Soc. Nat. Hist., III, 125-126, pl. 6, fig. 7 (1879); Foss. Ins. N. A., I, 145-146, pl. 6, fig. 7 (1890).

From the very Lowest Productive Coal-measures of Sydney, Cape Breton Island.

2. PETRABLATTINA HASTATA.

Pl. XI, fig. 10.

The tegmina are of a subtriangular shape, about two and one-half times longer than broad, tapering rather rapidly almost from the base, the costal margin gently convex, the inner margin nearly straight. The apex is broken in the only specimen seen, but must have been more or less pointed, and probably rounded as represented in the figure. The mediastinal area is moderately broad and short, not extending to the middle of the tegmina, with five or six mostly simple, nearly straight, oblique branches. The scapular vein is broadly sinuous, running beyond the proximal third of the tegmina, through the middle of the same, and terminating at or scarcely above the apex; it branches early, before the end of the proximal third of the tegmina, the first branch simple, the others compound or forked, so that probably ten or twelve nervules strike the margin, and all are nearly longitudinal. The externomedian vein is strongly and pretty regularly arcuate, striking the inner margin scarcely beyond a point opposite the tip of the mediastinal vein, and having three simple or apically forked branches which are nearly longitudinal, but descend slightly toward the inner margin, the proximal branch arising well beyond the middle of the vein. The internomedian vein is parallel to the externomedian and has but two forked and arcuate branches. The anal furrow is similarly arcuate, rather deeply impressed, and strikes the margin a little beyond a point opposite the first branching of the scapular vein; the anal veins are numerous and rather deeply forked, more closely crowded proximally than distally, and, from forking, more crowded next the margin than away from it. The internomedian and anal veins, and especially the former, are very delicately traced, while the others are rather heavily impressed; the whole surface is uniformly coal black, and there is no trace of other sculpture than the venation.

Length of fragment, 6.5 mm.; probable length of tegmina, 8.25 mm.; breadth at end of anal furrow, 3.5 mm.

In the form of the tegmina *P. hastata* differs decidedly from either of the other species of the genus, but in its neurulation it agrees better with the Carboniferous than with the Triassic species; all three species are widely different. It is the smallest Paleozoic cockroach known from this country.

From the Waynesburg coal (Lower Permian) of Cassville, W. Va. Mr. R. D. Lacoë; one specimen, No. 2133 *a-b*.

3. PETRABLATTINA ÆQUA.

Petrablattina æqua Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 38 (1885); Mem. Bost. Soc. Nat. Hist., IV, 465, pl. 42, fig. 13¹ (1890); Foss. Ins. N. A., I, 441, pl. 34, fig. 13. (1890).

Trias of Fair Play, Colo.

¹ Erroneously marked 9 on the plate. See note to p. 87.

Genus LEPTOBLATTINA.

Leptoblattina Woodw., Geol. Mag., Dec. iii, Vol. IV, 58 (1887).

This is an exclusively European type of cockroach. Two species are known, one from the very oldest true Coal-measures, the other possibly from the same or slightly younger rocks.

DESCRIPTION OF THE HIND WING OF A GIGANTIC SPECIES.

BLATTINA sp.

Pl. X, fig. 16.

A single specimen of a hind wing of enormous size differs so much from any other known that I use for it, as a convenience merely, the old generic term *Blattina*, as applied to fossil cockroaches in general. It is nearly complete, and shows that the costal margin was gently and nearly uniformly arcuate, the inner margin very strongly and probably uniformly arcuate, the apex falling scarcely below the middle of the upper half of the wing and subacuminate but well rounded. The mediastinal vein is straight, runs very near to and parallel with the margin, and terminates almost at the distal end of the middle third of the wing; the area is broken so that only a couple of apical branches can be seen. The scapular vein is almost rigidly straight and terminates at some distance below the extreme apex of the wing, divides at the very root into two main branches which again fork in the basal fourth of the wing; the branchlets of both are superior, those of the upper stem much the more numerous and often compound, those of the lower feeding that part of of the margin lying below the apex and all longitudinal, those of the upper stem apically arcuate, especially in their terminal members. The externomedian vein is straight and runs through nearly the middle line of the wing, gradually passing into the lower half by its divergence from the scapular, first forks at about the end of the proximal third of the wing, and thereafter sends out arcuate sublongitudinal offshoots on either side indiscriminately, which do not fork before their middle. The internomedian vein is bent-arcuate, subparallel to the externomedian before that forks, is then bent, and ends a very little farther out than the mediastinal vein; it has only a couple of very oblique branches, the the distal one twice deeply forked. No anal veins can be traced. The interspaces near the apex show a somewhat irregular tremulous cross lining, not very crowded.

Length of fragment, 47 mm.; probable length of entire wing, 51 mm.; breadth of fragment, 24.5 mm.; probable complete breadth, 25.25 mm.

The complete correspondence of the long mediastinal area in this wing to that of *Etblattina* in the few examples known, and the strong probability that the area in question will be found to be very short and perhaps triangular in the *Mylacridæ*, lead me to believe that this wing should be referred to the *Blattinariæ* and not to the *Mylacridæ*. Its

excessive size, which shows it to belong to one of the largest fossil cockroaches yet discovered, would at first seem to recall the Mylacridæ, but it should not be forgotten that some species of Etoblattina, such as *E. didyma* and notably *E. illustris*, rival the largest Mylacridæ known. The only two species of Etoblattina known from the same fauna as this wing are of only about one-half its size. It plainly, therefore, belongs to a species, the tegmina of which are yet undescribed. Its variance from what we know of the hind wings of Etoblattina, however, prevent our placing it, at least for the present, in that genus, and it seems best to refer it simply to "Blattina," as a "magazine" genus.

From the Lowest Productive Coal-measures of Mazon Creek, Illinois. Mr. R. D. Lacoe, No. 2038a.

NEOBLATTARIÆ

With a few Triassic exceptions, this division embraces all the cockroaches which are known from later than Paleozoic times.

17. Genus NEORTHROBLATTINA.

Neorthroblattina Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 108-109 (1885).

A genus confined, as far as known, to the Triassic rocks. Four species have been found in central Colorado.

Table of the species of Neorthroblattina.

- a¹. Fore wings not more than two and one-half times as long as broad; mediastino-scapular vein terminating only a little before the tip of the tegmina.
- b¹. Internomedian vein beginning to fork long before the externomedian and of equal importance with it 1. *N. albolineata*.
- b². Internomedian vein beginning to fork scarcely or not before the externomedian and of less importance than it.
- c¹. Internomedian area terminating much farther from the apex of the tegmina than the mediastino-scapular 2. *N. lakesii*.
- c². Internomedian area reaching out toward the apex of the tegmina nearly as far as the mediastino-scapular 3. *N. rotundata*.
- a². Fore wings about three times as long as broad; mediastino-scapular area terminating long before the tip of the tegmina 4. *N. attenuata*.

1. NEORTHROBLATTINA ALBOLINEATA.

Neorthroblattina albolineata Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 109 (1885); Mem. Bost. Soc. Nat. Hist., IV, 467, pl. 42, figs. 2, 18 (1890); Foss. Ins. N. A., I, 336, 443, pl. 34, figs. 2, 18 (1890).

Triassic of Fair Play, Colo.

2. NEORTHROBLATTINA LAKESII.

Neorthroblattina lakesii Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 109 (1885); Mem. Bost. Soc. Nat. Hist., IV, 467, 468, pl. 42, figs. 9, 15¹ (1890); Foss. Ins. N. A., I, 336, 443, 444, pl. 34, figs. 9, 15¹ (1890).

Triassic of Fair Play, Colo.

¹Erroneously marked 10 and 16 on plate. See note on p. 87.

3. NEORTHROBLATTINA ROTUNDATA.

Neorthroblattina rotundata Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 109-110 (1885);
Mem. Bost. Soc. Nat. Hist., IV, 467, 468, pl. 42, figs. 7, 8 (1890); Foss. Ins. N. A.,
I, 336, 443, 444, pl. 34, figs. 7, 8 (1890).

Triassic of Fair Play, Colo.

4. NEORTHROBLATTINA ATTENUATA.

Neorthroblattina attenuata Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 110 (1885);
Mem. Bost. Soc. Nat. Hist., IV, 467, 468-469, pl. 42, fig. 1 (1890); Foss. Ins. N. A.,
I, 336, 443, 444-445, pl. 34, fig. 1 (1890).

Triassic of Fair Play, Colo.

18. Genus SCUTINOBLATTINA.

Scutinoblattina Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 110 (1885).

A second genus confined, as yet known, to the Trias and to central Colorado, where three species occur.

Table of the species of Scutinoblattina.

- a*¹. Mediastino-scapular and externomedian veins having a distinctly sinuous course
through the middle of the tegmina, both terminating below the apex.
*b*¹. Anal branches falling on the hind margin..... 1. *S. brongniarti*.
*b*². Anal branches falling on the anal furrow..... 2. *S. intermedia*.
*a*². Mediastino-scapular and externomedian veins taking a straight course through
the middle of the tegmina, both terminating at the tip 3. *S. recta*.

1. SCUTINOBLATTINA BRONGNIARTI.

Scutinoblattina brongniarti Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 110-111 (1885)
Mem. Bost. Soc. Nat. Hist., IV, 469, pl. 42, fig. 5 (1890); Foss. Ins. N. A., I 370,
445, pl. 34, fig. 5 (1890).

Triassic of Fair Play, Colo.

2. SCUTINOBLATTINA INTERMEDIA.

Scutinoblattina intermedia Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 111 (1885); Mem.
Bost. Soc. Nat. Hist., IV., 469, 470, pl. 42, fig. 4 (1890); Foss. Ins. N. A., I, 370, 445,
446, pl. 34, fig. 4 (1890).

Triassic of Fair Play, Colo.

3. SCUTINOBLATTINA RECTA.

Scutinoblattina recta Scudd., Proc. Acad. Nat. Sc. Philad., 1885, 111, (1885); Mem. Bost.
Soc. Nat. Hist., IV, 469, 470, pl. 42, fig. 3, 16¹ (1890); Foss. Ins. N. A., I, 370, 445,
446, pl. 34, figs. 3, 16¹ (1890).

Triassic of Fair Play, Colo.

¹Erroneously marked 17 on plate. See note on p. 87.

20. Genus ZETOBORA.

Zetobora Burm., Handb. Entom., II, 509-510 (1838).

An extant genus, recognized in the Tertiary rocks of Colorado.

ZETOBORA BRUNNERI.

Zetobora brunneri Scudd., Tert. Ins. N. A., 217, pl. 17, fig. 12 (1890).

Tertiary of Florissant, Colo.

19. Genus HOMŒOGAMIA.

Homœogamia Burm., Handb. Entom., II, 490 (1838).

A tropical American living type of cockroaches; also recognized in the Tertiary of Colorado by a single species.

HOMŒOGAMIA VENTRIOSUS.

Homœogamia ventriosus Scudd., Bull. U. S. Geol. Surv. Terr., I, 447 (1876); Tert. Ins. N. A., 218, pl. 17, fig. 8 (1890).

Tertiary of Florissant, Colo.

21. Genus PARALATINDIA.

Parlatindia Sauss., Rev. Mag. Zool., XXXI, 100-101 (1868).

A distinctively American type of living cockroaches, of which one fossil species occurs in the Tertiaries of Wyoming.

PARALATINDIA SAUSSUREI.

Paralatindia saussurei Scudd., Tert. Ins. N. A., 216, pl. 6. fig. 25 (1890).

Tertiary of Green River, Wyoming.

Bull. 124—10

PLATES

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PLATE I.

EXPLANATION OF PLATE I.

Figs. 1 and 4 are from the originals of the Illinois geological survey. Figs. 2, 3, and 5 were drawn by J. Henry Blake; fig. 6 by J. H. Emerton. All the figures are magnified two diameters, excepting figs. 1 and 4, which are of natural size.

Fig. 1. *Mylacris anthracophila*; pronotum. Colchester, Ill.

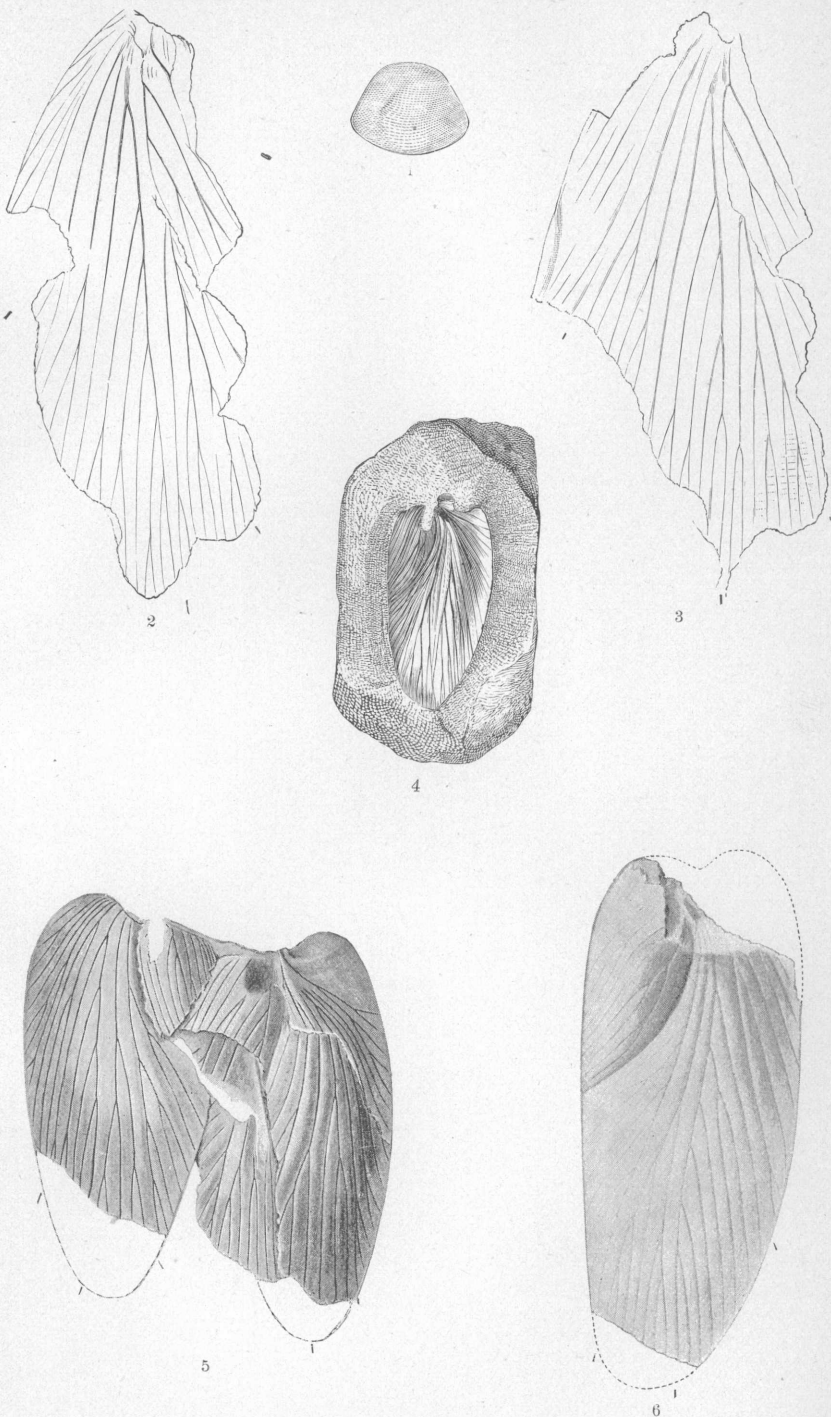
2. *Mylacris packardii*. Bristol, R. I.

3. *Mylacris packardii*. Bristol, R. I.

4. *Mylacris anthracophila*; one of the tegmina. Colchester, Ill.

5. *Mylacris gurleyi*. Mazon Creek, Illinois.

6. *Mylacris elongata* (2014). Mazon Creek, Illinois.



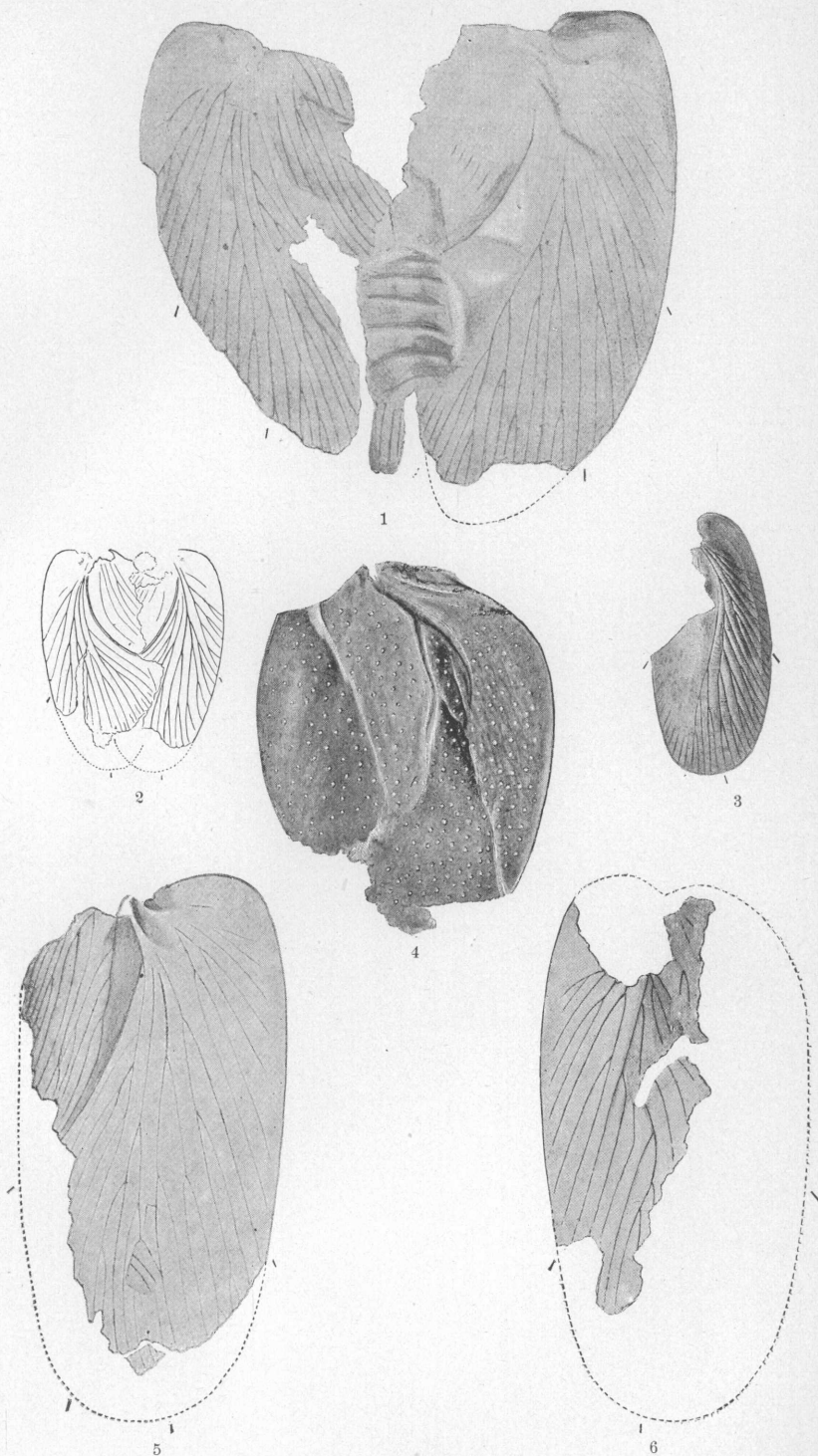
MYLACRIDÆ: SPECIES OF MYLACRIS.

PLATE II.

EXPLANATION OF PLATE II.

Figs. 2 to 4 were drawn by J. Henry Blake; the others by Katherine Peirson Ramsay. All are magnified two diameters.

- Fig. 1. *Mylacris ampla* (2021). Mazon Creek, Illinois.
2. *Promylacris testudo* (2089). Mazon Creek, Illinois.
3. *Promylacris harei* (2087). Kansas City, Mo.
4. *Mylacridæ* sp. Mazon Creek, Illinois.
5. *Mylacris antiqua* (2036*a*). Mazon Creek, Illinois.
6. *Mylacris antiqua* (2036*b*). Mazon Creek, Illinois.



MYLACRIDÆ: SPECIES OF MYLACRIS AND PROMYLACRIS.

PLATE III.

EXPLANATION OF PLATE III.

All the drawings are by J. Henry Blake, and magnified two diameters.

Fig. 1. *Promylacris rigida* (2086). Mazon Creek, Illinois.

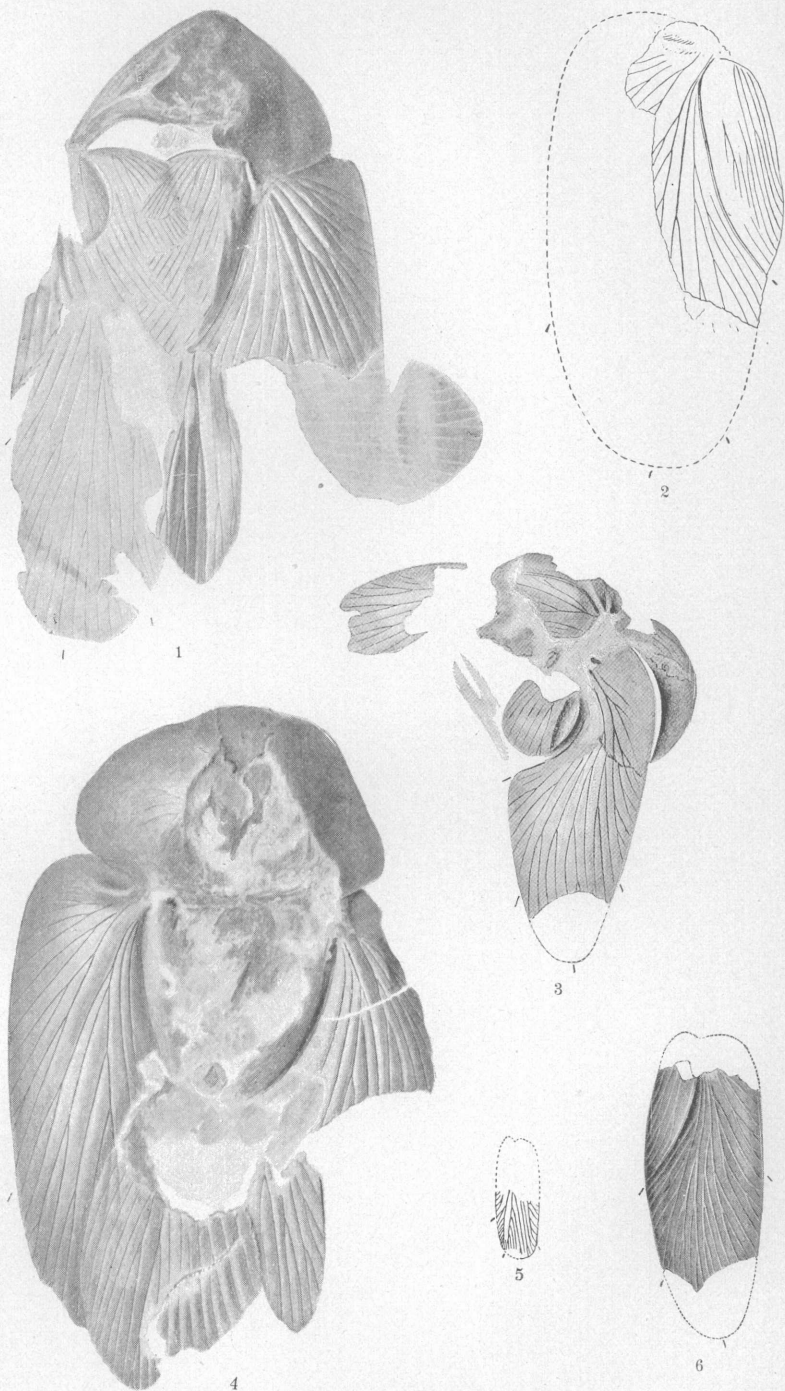
2. *Paromylacris* ? *pluteus* (2040). Pittston, Pa.

3. *Paromylacris triangularis* (2110). Mazon Creek, Illinois.

4. *Paromylacris ampla* (2088). Mazon Creek, Illinois.

5. *Microblattina perdita* (2092). East Providence, R. I.

6. *Paromylacris clintoniana* (2151). Clinton, Mo.



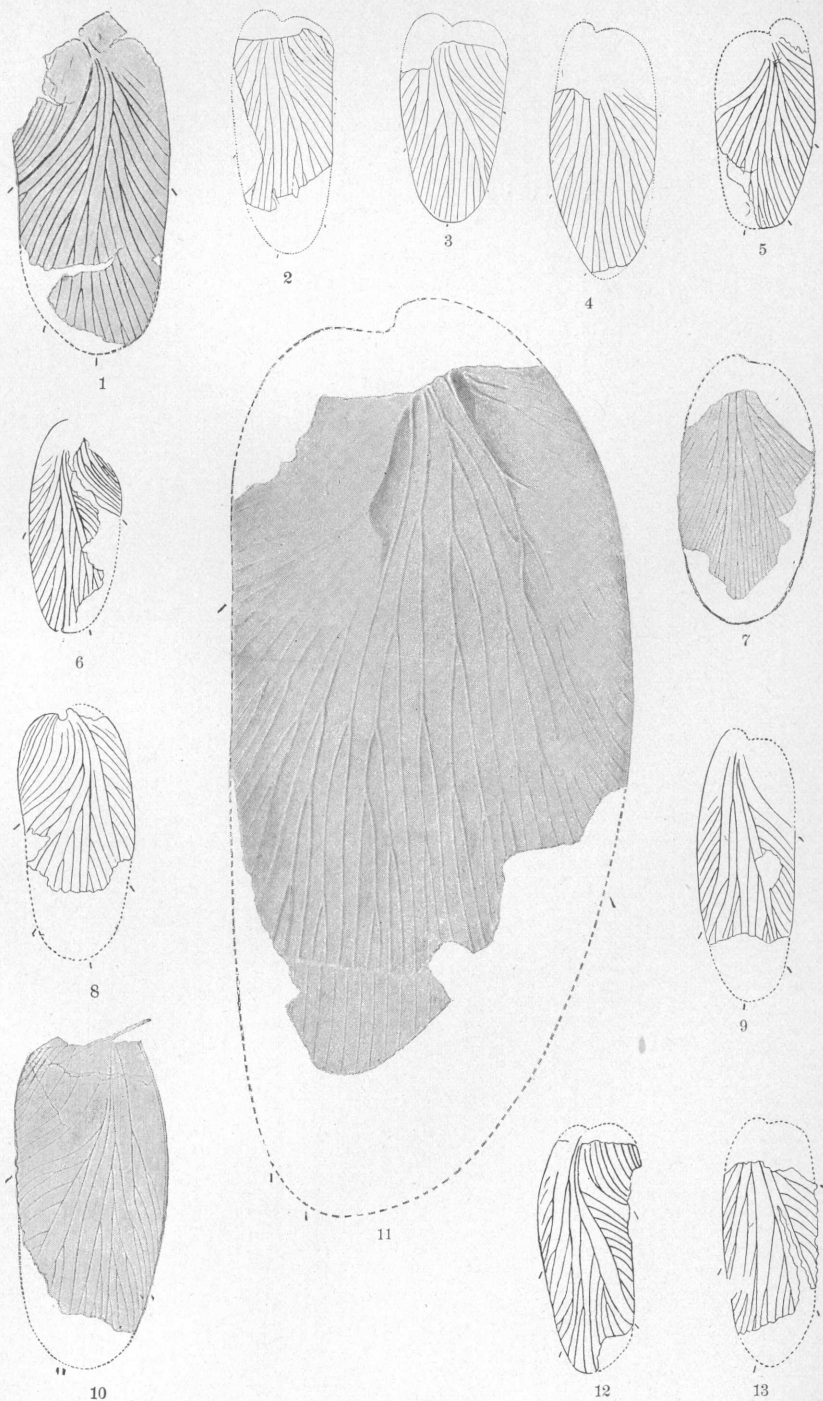
MYLACRIDÆ: SPECIES OF PROMYLACRIS AND PAROMYLACRIS.
BLATTINARIÆ: SPECIES OF MICROBLATTINA.

PLATE IV.

EXPLANATION OF PLATE IV.

All the drawings are by J. Henry Blake, excepting figs. 2 to 4 by S. H. Scudder, and fig. 10 by J. H. Emerton. All are magnified two diameters.

- Fig. 1. *Etoblattina clintoniana* (2182). Clinton, Mo.
2. *Etoblattina lata* (2099). Cassville, W. Va.
3. *Etoblattina sagittaria* (2100). Cassville, W. Va.
4. *Etoblattina mediana* (2101). Cassville, W. Va.
5. *Etoblattina fossa* (182). Richmond, Ohio.
6. *Etoblattina ovata* (2102). Cassville, W. Va.
7. *Etoblattina scholfieldi*. East Providence, R. I.
8. *Etoblattina debilis* (2103). Cassville, W. Va.
9. *Etoblattina patiens* (2104). Cassville, W. Va.
10. *Etoblattina strigosa*. Richmond, Ohio.
11. *Etoblattina illustris*. Pawtucket (?), R. I.
12. *Etoblattina detecta* (2106a). Cassville, W. Va.
13. *Etoblattina detecta* (2106c). Cassville, W. Va.



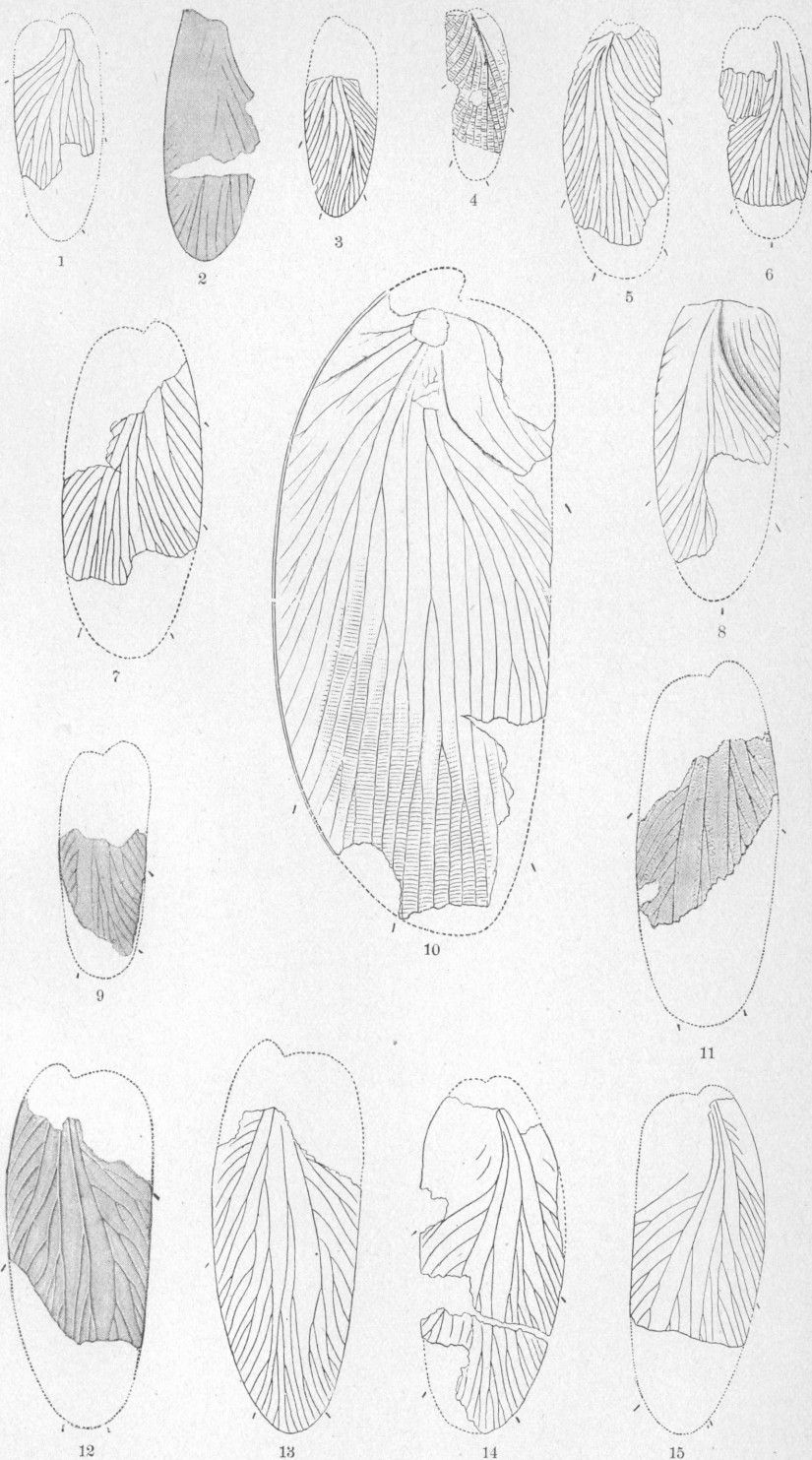
BLATTINARIÆ: SPECIES OF ETOBLATTINA.

PLATE V.

EXPLANATION OF PLATE V.

All the drawings are by J. Henry Blake, excepting figs. 9, 11, 12 by J. H. Emerton, and figs. 1 and 15 by S. H. Scudder. All are enlarged two diameters.

- Fig. 1. *Etolblattina residua* (2131). Cassville, W. Va.
2. *Etolblattina* sp. Pawtucket, R. I.
3. *Etolblattina mucronata* (2105). Cassville, W. Va.
4. *Etolblattina exigua* (2107). Cassville, W. Va.
5. *Etolblattina funeraria* (2108). Cassville, W. Va.
6. *Etolblattina expuncta* (2109). Cassville, W. Va.
7. *Etolblattina jeffersoniana* (194). Richmond, Ohio.
8. *Etolblattina gorhami*. Pawtucket, R. I.
9. *Etolblattina aperta* (2066). Cassville, W. Va.
10. *Etolblattina clarkii*. Pawtucket, R. I.
11. *Etolblattina fasciata*. Richmond, Ohio.
12. *Etolblattina ramosa* (108). Richmond, Ohio.
13. *Etolblattina willsiana* (176). Richmond, Ohio.
14. *Etolblattina benedicta* (183). Richmond, Ohio.
15. *Etolblattina benedicta* (178). Richmond, Ohio.



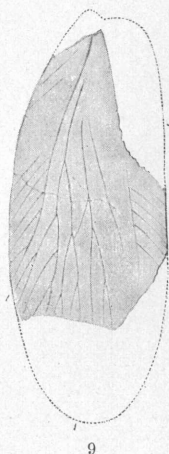
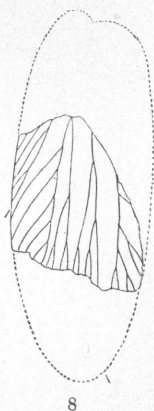
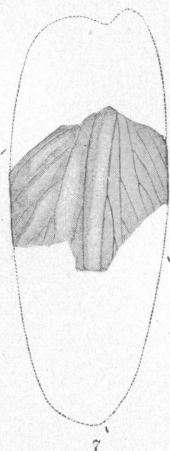
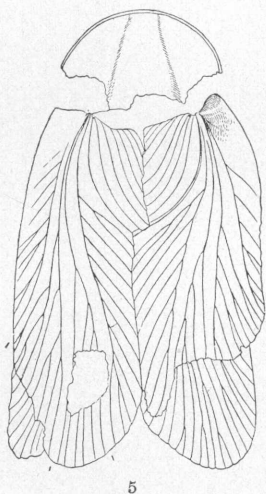
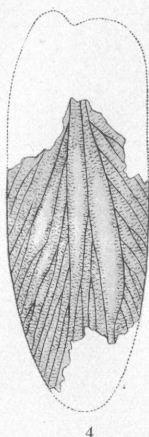
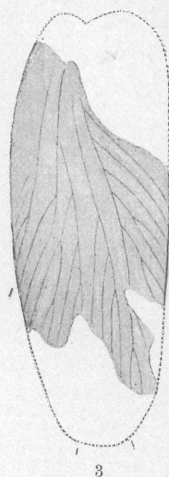
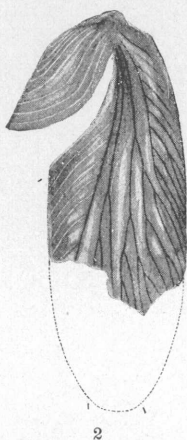
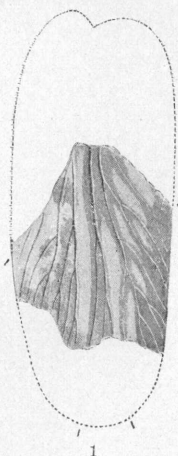
BLATTINARIAE: SPECIES OF ETOBLATTINA.

PLATE VI.

EXPLANATION OF PLATE VI.

All the drawings are by Katherine Peirson Ramsay, excepting figs. 4 and 6 by J. H. Emerton, and figs. 5 and 8 by J. Henry Blake. All are magnified two diameters.

- Fig. 1. *Etoblattina maledicta* (174). Richmond, Ohio.
2. *Etoblattina maledicta* (163). Richmond, Ohio.
3. *Etoblattina maledicta* (164). Richmond, Ohio.
4. *Etoblattina funesta* (107). Richmond, Ohio.
5. *Etoblattina mazona*. Mazon Creek, Illinois.
6. *Etoblattina tenuis*. Richmond, Ohio.
7. *Etoblattina exsensa* (161). Richmond, Ohio.
8. *Etoblattina exsensa* (196). Richmond, Ohio.
9. *Etoblattina hustoni* (122). Richmond, Ohio.



BLATTINARIÆ: SPECIES OF ETOBLATTINA.

PLATE VII.

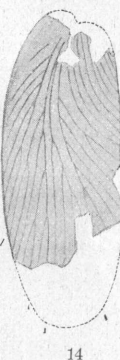
Bull. 124—11

161

EXPLANATION OF PLATE VII.

All the drawings are by J. Henry Blake, excepting figs. 6, 10, 14 to 17 by Katherine Peirson Ramsay, and fig. 13 by S. H. Scudder. All are magnified two diameters.

- Fig. 1. *Etoblattina eakiniana* (2111). Cassville, W. Va.
2. *Etoblattina accubita* (2112). Cassville, W. Va.
3. *Etoblattina expulsata* (2113a). Cassville, W. Va.
4. *Etoblattina expulsata* (2113c). Cassville, W. Va.
5. *Etoblattina gratiosa* (2114). Cassville, W. Va.
6. *Etoblattina macerata* (2081). Cassville, W. Va.
7. *Etoblattina immolata* (2115c). Cassville, W. Va.
8. *Etoblattina immolata* (2115a). Cassville, W. Va.
9. *Etoblattina mactata* (2116). Cassville, W. Va.
10. *Etoblattina communis* (2117h). Cassville, W. Va.
11. *Etoblattina communis* (2117c). Cassville, W. Va.
12. *Etoblattina communis* (2117o). Cassville, W. Va.
13. *Etoblattina communis* (2117a). Cassville, W. Va.
14. *Etoblattina communis* (2117e). Cassville, W. Va.
15. *Etoblattina communis* (2117g). Cassville, W. Va.
16. *Etoblattina communis* (2117f). Cassville, W. Va.
17. *Etoblattina communis* (2117i). Cassville, W. Va.



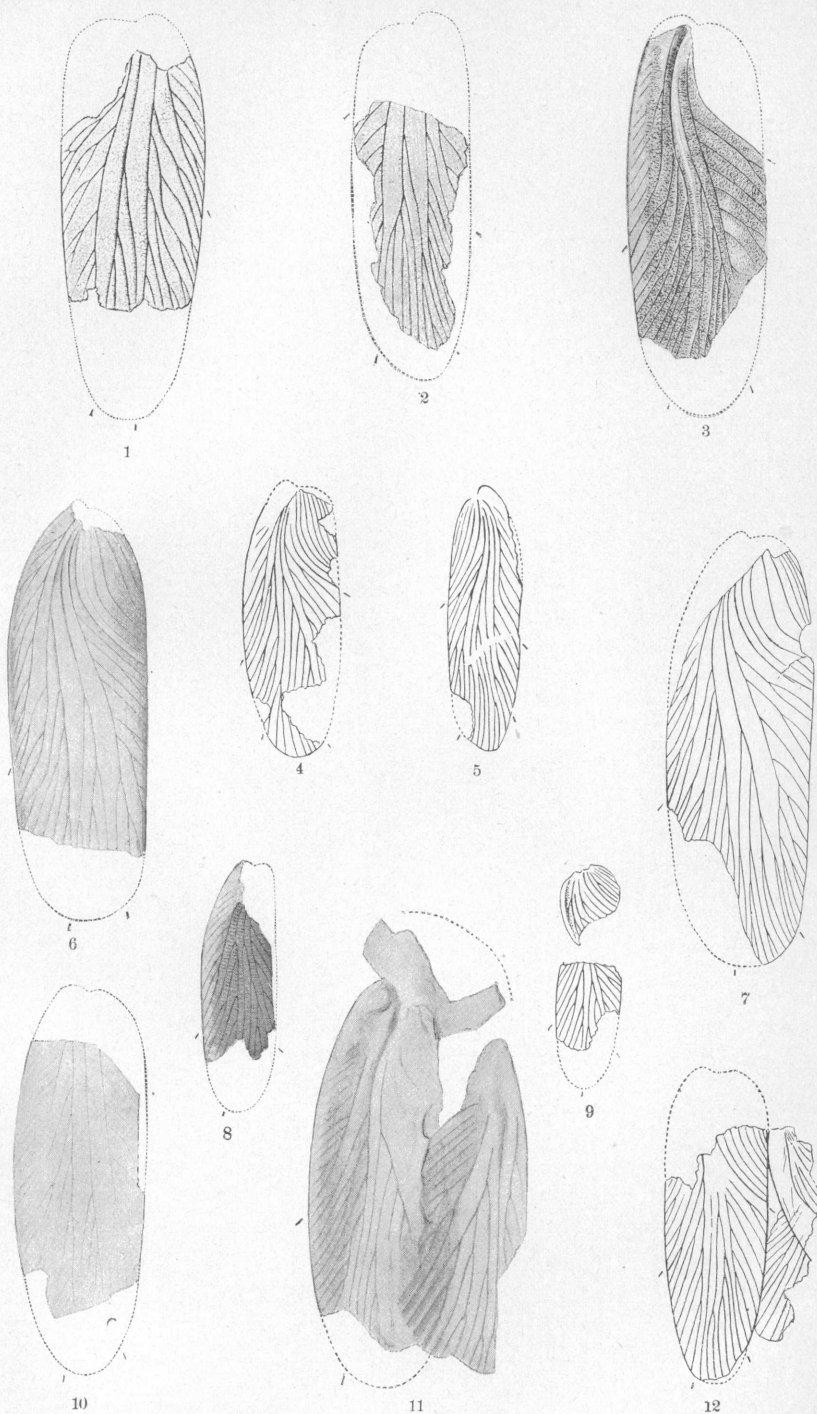
BLATTINARIÆ: SPECIES OF ETOBLATTINA.

PLATE VIII.

EXPLANATION OF PLATE VIII.

Figs. 4, 5, 7, 9, 12 are by J. Henry Blake; figs. 3, 8, 10, 11 by Katherine Peirson Ramsey, and figs. 1, 2, 6 by J. H. Emerton. All are magnified two diameters.

- Fig. 1. *Etoblattina hastata* (106). Richmond, Ohio.
2. *Etoblattina marginata* (117). Richmond, Ohio.
3. *Etoblattina stipata* (123). Richmond, Ohio.
4. *Etoblattina exsecuta* (2120). Cassville, W. Va.
5. *Etoblattina arcta* (2118). Cassville, W. Va.
6. *Etoblattina gracilentia* (114). Richmond, Ohio.
7. *Etoblattina gracilentia* (198). Richmond, Ohio.
8. *Etoblattina angusta* (2080). Cassville, W. Va.
9. *Etoblattina macilentia* (2121). Cassville, W. Va.
10. *Etoblattina variegata* (49). Richmond, Ohio.
11. *Etoblattina hilliana* (2070). Mazon Creek, Illinois.
12. *Etoblattina prædulcis* (2119). Cassville, W. Va.



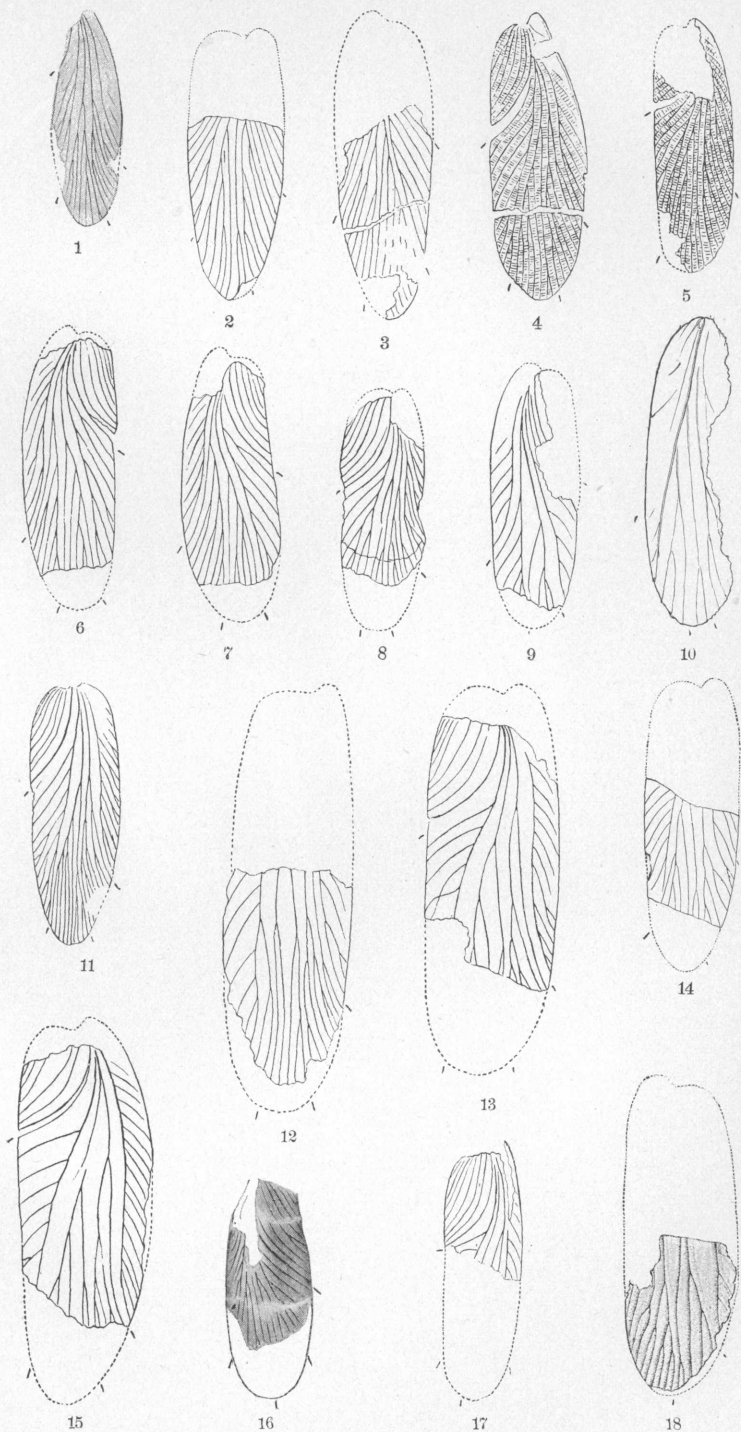
BLATTINARIÆ: SPECIES OF ETOBLATTINA.

PLATE IX.

EXPLANATION OF PLATE IX.

All the drawings are by J. Henry Blake, excepting figs. 2 and 14 by S. H. Scudder, and fig. 18 by J. H. Emerton. All are magnified two diameters.

- Fig. 1. *Etoblattina exilis*. East Providence, R. I.
2. *Etoblattina rogi* (2122*b*). Cassville, W. Va.
3. *Etoblattina rogi* (2122*a*). Cassville, W. Va.
4. *Etoblattina expugnata* (2085). Cassville, W. Va.
5. *Etoblattina obatra* (2123). Cassville, W. Va.
6. *Etoblattina secreta* (2125*a*). Cassville, W. Va.
7. *Etoblattina secreta* (2125*c*). Cassville, W. Va.
8. *Etoblattina imperfecta* (2124). Cassville, W. Va.
9. *Etoblattina invis*a (2126). Cassville, W. Va.
10. *Etoblattina reliqua*. Pawtucket, R. I.
11. *Etoblattina latebricola* (2091). East Providence, R. I.
12. *Etoblattina defossa* (2128). Cassville, W. Va.
13. *Etoblattina occulta* (2127). Cassville, W. Va.
14. *Etoblattina recidiva* (2129). Cassville, W. Va.
15. *Gerablattina diversinervis* (2141). Cassville, W. Va.
16. *Gerablattina inculta* (2139). Cassville, W. Va.
17. *Gerablattina perita* (2140). Cassville, W. Va.
18. *Gerablattina apicalis* (112). Richmond, Ohio.



BLATTINARIAE: SPECIES OF ETOBLATTINA AND GERABLATTINA.

PLATE X.

EXPLANATION OF PLATE X.

All the drawings are by J. Henry Blake, excepting figs. 3 and 5 by S. H. Scudder, and fig. 8 by Katherine Peirson Ramsay. All are magnified two diameters.

Fig. 1. *Gerablattina richmondiana* (169). Richmond, Ohio.

2. *Gerablattina cassvici* (2142*a*). Cassville, W. Va.

3. *Gerablattina cassvici* (2142*c*). Cassville, W. Va.

4. *Gerablattina concinna* (2077*a*). Cassville, W. Va.

5. *Gerablattina concinna* (2077*c*). Cassville, W. Va.

6. *Gerablattina abdicata* (2143). Cassville, W. Va.

7. *Gerablattina scapularis*. Pawtucket, R. I.

8. *Gerablattina uniformis* (2082*f*). Cassville, W. Va.

9. *Gerablattina uniformis* (2082*a*). Cassville, W. Va.

0. *Gerablattina uniformis* (2082*c*). Cassville, W. Va.

11. *Gerablattina uniformis* (2082*e*). Cassville, W. Va.

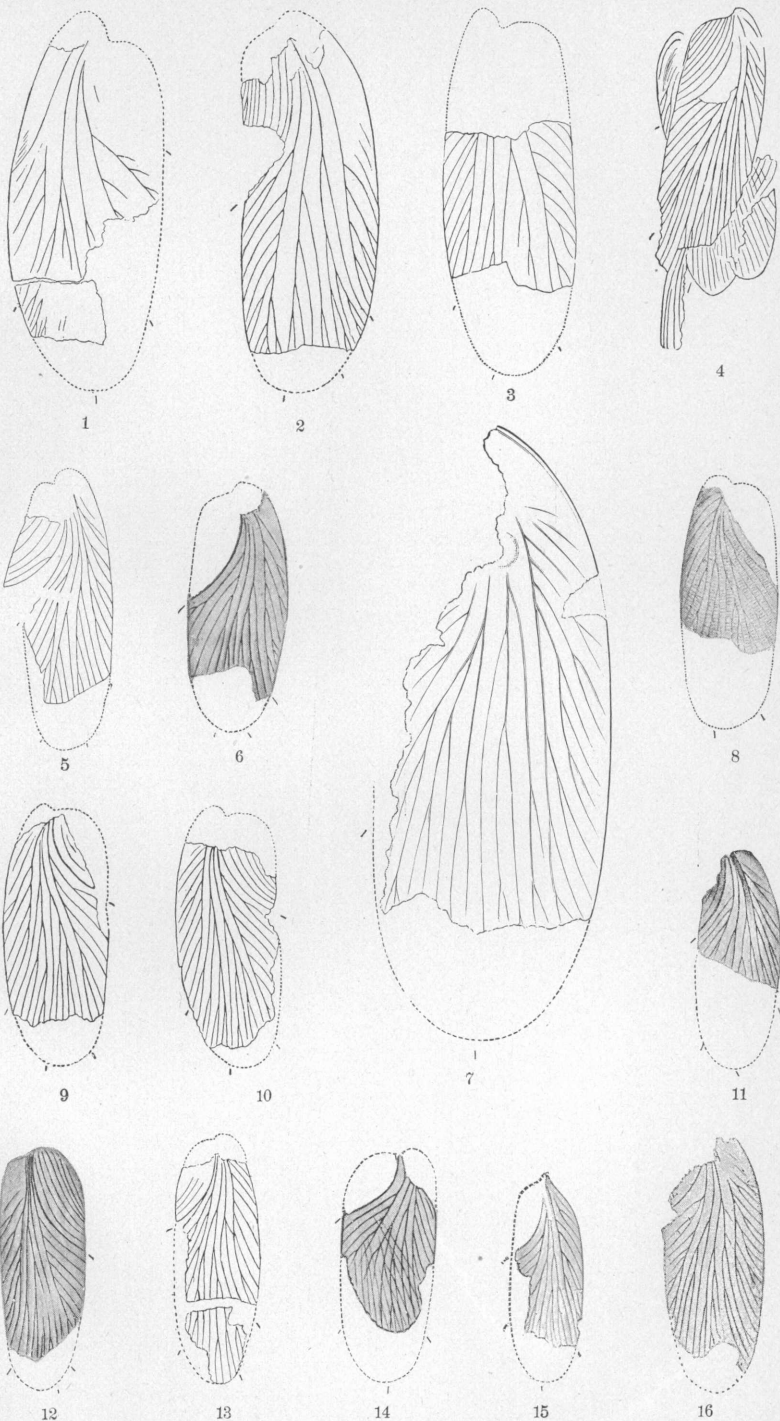
12. *Gerablattina permanenta* (2144). Cassville, W. Va.

13. *Gerablattina permacra* (2188). Cassville, W. Va.

14. *Gerablattina eversa* (2145). Cassville, W. Va.

15. *Gerablattina deducta* (2146). Cassville, W. Va.

16. *Gerablattina fraterna*. East Providence, R. I.



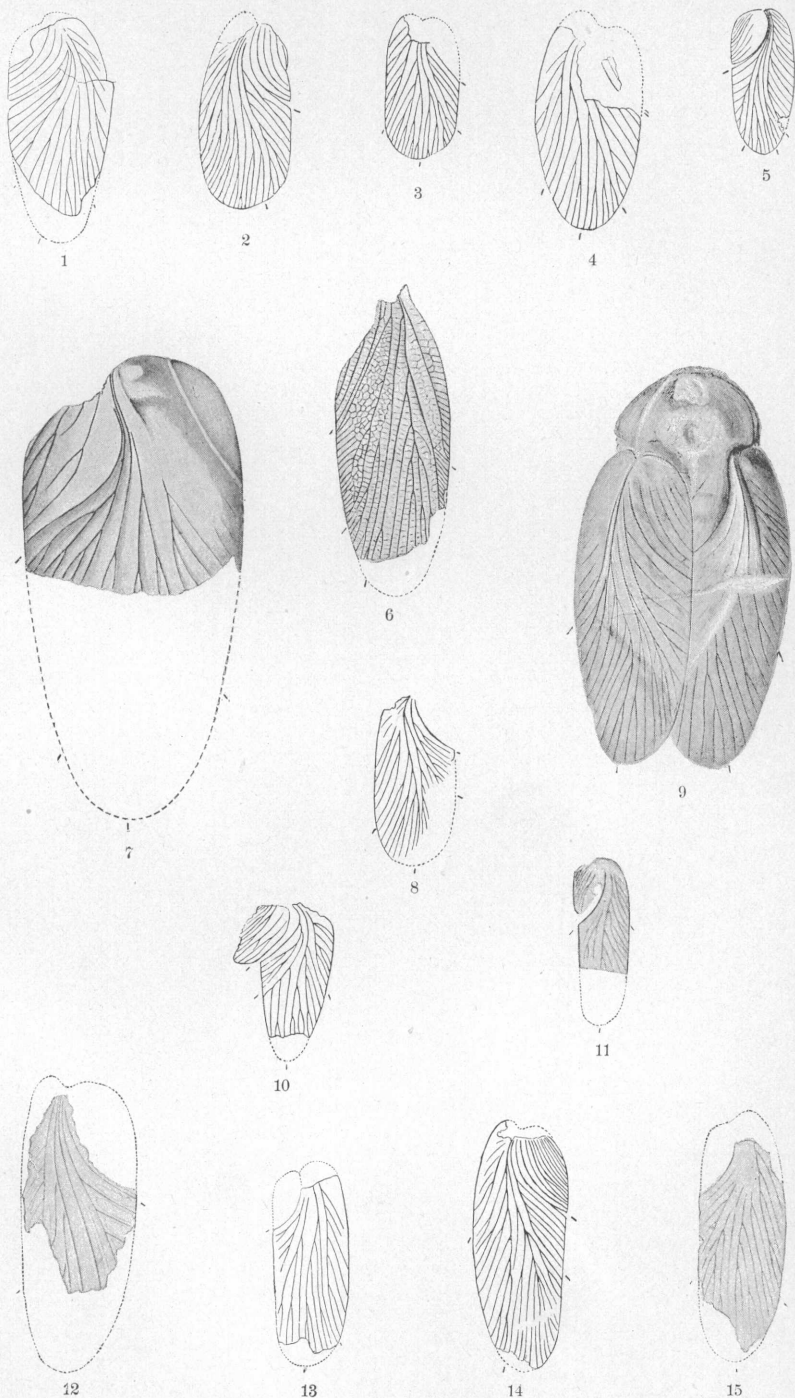
BLATTINARIAE: SPECIES OF GERABLATTINA.

PLATE XI.

EXPLANATION OF PLATE XI.

All the drawings are by J. Henry Blake, excepting figs. 1 and 13 by S. H. Scudder, figs. 11 and 15 by Katherine Peirson Ramsay, and fig. 12 by J. H. Emerton. All are magnified two diameters.

- Fig. 1. *Gerablattina radiata* (2147). Cassville, W. Va.
2. *Gerablattina lata* (2148). Cassville, W. Va.
3. *Gerablattina rotundata* (2149). Cassville, W. Va.
4. *Gerablattina ovata* (2150). Cassville, W. Va.
5. *Gerablattina minima* (2183). Richmond, Ohio.
6. *Oryctoblattina laqueata* (2136). Kansas City, Mo.
7. *Anthracoblattina americana* (2137). Clinton, Mo.
8. *Anthracoblattina virginensis* (2138). Cassville, W. Va.
9. *Progonoblattina columbiana*. Mazon Creek, Illinois.
10. *Petrablattina hastata* (2133). Cassville, W. Va.
11. *Poroblattina ohioensis* (162). Richmond, Ohio.
12. *Poroblattina longinqua* (111). Richmond, Ohio.
13. *Poroblattina gratiosa* (2134). Cassville, W. Va.
14. *Poroblattina complexinervis* (2135). Cassville, W. Va.
15. *Poroblattina fossa* (2083). Cassville, W. Va.



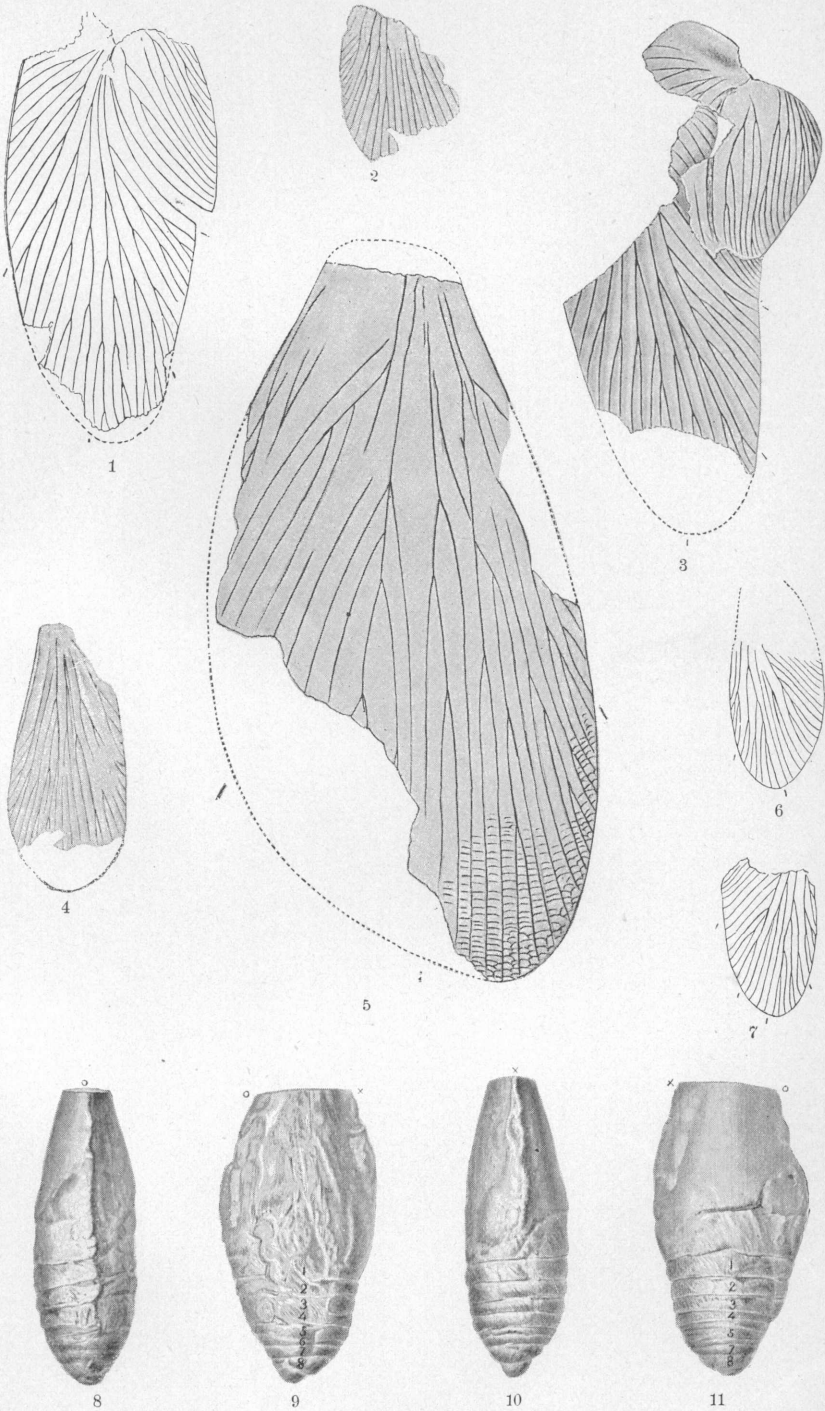
BLATTINARIÆ: SPECIES OF GERABLATTINA, ORYCTOBLATTINA, ANTHRACOBLATTINA, PROGONO-
BLATTINA, PETRABLATTINA, AND POROBLATTINA.

PLATE XII.

EXPLANATION OF PLATE XII.

All the drawings are by J. Henry Blake, excepting fig. 5 which is by Katherine Peirson Ramsay. All are magnified two diameters, excepting figs. 8-11 which are of natural size.

- Fig. 1. *Etoblattina deanensis* (2132*b*). Forest of Dean, England.
2. *Etoblattina* sp. East Providence, R. I.
3. *Etoblattina deanensis* (2132*c*). Forest of Dean, England.
4. *Etoblattina* sp.; hind wing. Cranston, R. I.
5. *Blattina* sp.; hind wing (2038). Mazon Creek, Illinois.
6. *Etoblattina* sp.; hind wing (2084*a*). Cassville, W. Va.
7. *Etoblattina* sp.; hind wing (2084*b*). Cassville, W. Va.
8. Body of cockroach; right-side view (4941). Illinois. (See p. 25.)
9. The same; ventral surface.
10. The same; left-side view.
11. The same; dorsal surface.



MISCELLANEOUS REMAINS OF COCKROACHES.

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