

tion of the alcoholic specimen of *Nautilus pompilius*, brought home by Mr. Bickmore, that the chambers contained air.

Section of Entomology. December 23, 1868.

Mr. E. Burgess in the chair. Twelve members present.

Mr. S. H. Scudder made the following remarks upon the arrangement of the families of Orthoptera.

About a year ago I attempted to show by the aid of Graber's researches, that the saltatorial Orthoptera rank higher than the non-saltatorial, because in the latter the primitive position of the wings is retained through life, while, in the former, both pairs of wings essentially change their position during the different stages of growth. I now propose, by a closer examination of the relative ranks of these families and of their mutual affinities, to determine the serial order in which they should be treated.

Let us first observe the views which various authors have held.

Linné, in the tenth edition of his *Systema Naturæ*, published in 1760, placed the Orthoptera and beetles in the same division (Coleoptera), dividing the former into three genera, Forficula, Blatta and Gryllus; the latter genus he subdivided into the following sections: Mantis, Acrida (*Truxalidæ*), Bulla (*Tetricides*), Acheta (*Gryllides*), Tettigonia (*Locustariæ*) and Locusta (*Acrydii*).

In 1764, in his *Museum Ulricæ Reginae*, he retained Forficula under Coleoptera, and removed the two other genera to Hemiptera, dividing them as before.

Two years later, in the twelfth edition of his *Systema Naturæ*, he retained nearly the same arrangement, but elevated the section Mantis to the rank of a genus, placing it between Blatta and Gryllus, and omitted Acrida altogether, merging the species formerly referred to that group in the section Locusta.

Geoffroy, in his *Histoire abrégée des Insectes*, published in 1764, divided the Coleoptera into three "Articles," in the second of which he placed Forficula, in company with Staphylinus, etc., and in the third the other orthopteran families, together with Thrips. He divided the third into five "orders," viz.: Blatta, Thrips, Gryllus (*Gryllides*), Acrydium (*Acrydii*), Locusta (*Locustariæ*) and Mantis.

In all the works of Fabricius, published between 1775 and 1793, he included these insects in his class *Ulonata*, dividing them artificially—by the structure of the antennæ—as follows:

- I. *Acrydium* (*Tetricides*).
 Gryllus (*Acrydii*).
- II. *Truxalis*.
- III. *Forficula*.
 Blatta.
 Mantis.
 Acheta (*Gryllides*).
 Locusta (*Locustariæ*).

But in the body of his works he always followed a different succession of genera, viz.: *Forficula*, *Blatta*, *Mantis*, *Acrydium*, *Truxalis*, *Acheta*, *Locusta*, *Gryllus*.

DeGeer, in the third volume of his *Histoire des Insectes*, published in 1773, applies the name of *Dermaptera* to this group, and divided it into the genera *Mantis*, *Locusta* (*Locustariæ*), *Acrydium* (*Acrydii*), *Gryllus* (*Gryllidæ*), *Blatta* and *Forficula*.

Latreille, in his *Précis des caractères génériques*, published in 1796, divided the *Orthoptera* into three groups, as follows:

- I. *Forficula*.
- II. *Blatta*.
- III. Fam. 1. *Gryllus* (*Gryllides*).
 Locusta (*Locustariæ*).
 Mantis.
 Fam. 2. *Truxalis*.
 Acrydium (*Acrydii*).
 Acheta (*Tetricides*).

In his subsequent works, he has uniformly maintained one succession of genera, but has greatly varied his larger divisions at different times. In 1801 and 1807 he arranged the *Orthoptera* under three unnamed sections, as follows:

- Sect. I. *Forficula*.
- “ II. *Blatta*.
- “ III. Fam. 1. *Mantides* { *Spectra* (*Phasmida*).
 } *Raptatoriæ* (*Mantides*).
- “ 2. *Gryllidæ*.
- “ 3. *Locustariæ*.
- “ 4. *Acrydiana*.

In 1810 he divided them into two sections, the first containing Forficulariæ, Blattariæ and Mantides, and the second Gryllides, Locustariæ and Acrydii. In 1817 he gave the name of Cursoria to the first division, and that of Saltatoria to the second. In 1825 he divided them again into three sections, differing materially from the three into which he first separated them, viz.:

- Sect. I. Forficulariæ.
 Blattariæ.
 Mantides.
 Spectra.
- “ II. Gryllides.
 Locustariæ.
- “ III. Acrydites.

In 1829 he returned to his arrangement of 1810, only dividing the Mantides into two families, as in the last scheme. This method of division was also pursued by Serville, in his *Revue des Orthoptères*, in 1831, and in his general work on the Orthoptera, published in 1839. Lastly, in 1831, Latreille separated the Forficulariæ from the other Orthoptera, under the name of Dermaptera.

Marcel de Serres, in 1809, divided them into five families: Labidoures (Forficulariæ), Blattes, Anomides (Mantides, including also Mantispa), Nemides (Phasmida) and Grylloides. The latter were again separated into five divisions: Taupegrillons (Gryllotalpa), Grillons (Gryllus, etc.), Dactylions (Xya), Locustaires (Locustariæ) and Acrydiens (Acrydii).

In 1811, Olivier, in the *Encyclopédie méthodique*, first gave the name of Orthoptera to the group, from which, however, he excluded Forficula, as a coleopteron. He presented no special classification of his own.

Lamarck, both in 1816 and subsequently, divided the Orthoptera into four families,—Locustaires (including Locustariæ and Acridii), Mantides (including Mantides and Phasmida), Gryllonides and Coureurs (including Blattariæ and Forficulariæ).

Macleay, in 1821, with his peculiar views of classification, allowed five families, arranged in a circle; beginning, for instance, with the Phasmida, the Blattaria were reached either directly, or through the medium of the Acrydina, Locustina and Gryllina, while the Dermaptera were conveniently termed an “osculant” group.

Duméril, in his *Considérations générales sur la classe des Insectes*,

published in 1823, divided the Orthoptera into four families: Forficules ou Labidoures, Blattes ou Omalopodes, Difformes ou Anomides (Mantides and Phasmida), and Grylliformes ou Grylloides (Locustariæ, Acrydii and Gryllides).

In 1830, Leach published his elaborate scheme in the ninth volume of Brewster's Encyclopædia, in which the families under discussion were arranged in three orders,—Dermaptera (Forficulariæ), Orthoptera and Dictyoptera (Blattariæ); his Orthoptera were divided as follows:

- Tribe I. Mantides.
 - Fam. I. Phasmida.
 - “ II. Mantida.
- Tribe II. Achetides (Gryllides).
 - Fam. I. Gryllotalpida.
 - “ II. Achetida.
- Tribe III. Locustides (Locustariæ).
 - “ IV. Gryllides (Acrydii)
 - Fam. I. Gryllida.
 - “ II. Acrydida (Tetricides).

Newman, in the second volume of the Entomological Magazine, published in 1834, considered the Orthoptera as a class, and divided them as follows:

- Strips Forficulina,
Order Forficulites.
- Strips Achetina (Gryllides),
Order Achetites.
- Strips Gryllina (Locustariæ),
Order Gryllites.
- Strips Locustina (Acrydii),
Order Locustites.
- Strips Spectrina (Phasmidæ),
Order Spectrites.
- Strips Mantina,
Order Mantites.
- Strips Blattina,
Order Blattites.

Burmeister, in 1838, in his Handbuch der Entomologie, separated the Dermaptera (Forficulariæ) from the other Orthoptera, and di-

vided the latter into Latreille's two sections of *Cursoria*,—families *Blattina*, *Mantodea* and *Phasmodea*, and *Saltatoria*,—families *Acridioidea*, *Locustina* and *Grylloidea*. The same arrangement was followed by DeHaan in 1842.

Westwood, in his Introduction to the modern classification of Insects, published in 1839-40, separated the *Forficulariæ* from the other Orthoptera under the name of *Euplexoptera*; and divided the Orthoptera into *Cursoria*,—family *Blattidæ*, *Raptatoria*,—family *Mantidæ*, *Ambulatoria*,—family *Phasmidæ* and *Saltatoria*,—families *Achetidæ* (*Gryllides*), *Gryllidæ* (*Locustariæ*) and *Locustidæ* (*Acrydii*).

Blanchard, in the third volume of his *Histoire naturelle des animaux articulés*, published in 1840, arranges them simply in seven families, as follows: *Forficuliens*, *Blattiens*, *Mantiens*, *Phasmiens*, *Locustiens*, *Grylliens* and *Acridiens*.

Fischer de Waldheim, in his *Orthoptères de la Russie*, published in 1846, separated the *Forficulines* from the other Orthoptera, and divided the latter (omitting the *Phasmida*, which did not occur in Russia, to his knowledge) into *Cursoria*,—including *Blattina* and *Mantodea* and *Saltatoria*,—including *Grylloidea*, *Locustina* and *Acridioidea*.

In 1850, Fieber divided the Orthoptera as follows:

Sect. I.	Fam. 1, <i>Blattoideæ</i> .
Sect. II.	
Subject. I.	
A	
a	Fam. 2, <i>Mantoideæ</i> .
b	“ 3, <i>Phasmoideæ</i> .
B	
a	
α	Fam. 4, <i>Acridioideæ</i> .
β	
*	Fam. 5, <i>Locustoideæ</i> .
**	“ 6, <i>Grylloideæ</i> .
b	
*	Fam. 7, <i>Scariphastæ</i> (<i>Gryllotalpidæ</i>).
**	“ 8, <i>Xyaridæ</i> (<i>Xya</i> , etc.).
Subject. II.	“ 9, <i>Forficuleæ</i> .

In 1854 he proposed a similar scheme, which I have not seen, but which Gerstæcker in his *Bericht* reports substantially as follows: the

Orthoptera are first divided into two tribes, Orthoptera genuina and Harmoptera (Forficulariæ). The Orthoptera proper are again divided into two sections, Sternopoda (Blattariæ) and Pleuropoda. The latter are subdivided into Gressoria,—families Mantodea and Phasmodea, Saltatoria,—families Acridiodea, Locustina and Grylloidea, and Fossoria,—families Gryllotalpina and Xyodea.

H. Fischer of Freiberg, in his Orthoptera Europæa, published in 1853, has exactly reversed Westwood's divisions,¹ and united the Mantides and Phasmodea under Fieber's name of Gressoria.

Lastly, Gerstæcker, in the second volume of Carus' Handbuch der Zoologie, published in 1863, divides the Orthoptera genuina, from which he excludes the Dermapoptera (Forficulariæ), into three primary divisions, Cursoria,—including the family Blattina, Gressoria,—including the families Mantodea and Phasmodea, and Saltatoria,—including the families Grylloidea, Locustina and Acridiodea. The Dermapoptera he places below them.

Without attempting to discuss whether the Pseudo-Neuroptera should be admitted into the ranks of the Orthoptera, or to prove that the Forficulariæ should not be considered a separate group equal in value to the other Orthoptera as a whole, I will simply point out the way in which these families seem to me to arrange themselves. Having placed the saltatorial group above the non-saltatorial, a much more difficult question arises in determining the order of the three saltatorial families; I am, however, strongly inclined to place the Gryllides and Locustariæ above the Acrydii, on account of the specialization of the organs for ovipositing in the females, and the more perfected structure and higher character of the organs of stridulation in the males. The intimate relation of these two families to each other, both in the features alluded to, and in the close resemblance of such allied forms as *Phalangopsis* and *Rhaphidophora*, shows that the Acrydii cannot be placed between them, and the only remaining question is the relative position of the Gryllides and Locustariæ. Dufour has shown how similar the internal anatomy of *Xya* is to that of many Acrydii, but this is an exceptional case among Gryllides, and should not be allowed too great weight; on the other hand, the great variety of form of almost any given organ among the crickets, compared with its relative uniformity of structure among Locustariæ, seems to indicate the higher character of the former. And I do not

¹ In my remarks in the previous volume of these Proceedings, p. 390, I had overlooked Fischer's statement, that the table given by him was to be considered a *dispositio ascendens*.

think it is without meaning that the crickets often live in company,¹ that they sing both in concert and during day and night, and are the closer attendants upon man; their stridulating organ, too, seems much more complicated and more extensive, and the pitch of their song is higher; that of the Acrydii again is lowest of all.

The eggs of Gryllides are laid either singly in the ground, in irregular clusters in subterranean passages, or uniformly, in a single row, in the pith of twigs; those of Locustariæ are never laid singly, but either in the pith of plants, in regular clusters in the ground, or in regular rows on stems of plants; those of Acrydii are always laid in clusters, rudely regular, in the ground.

Lastly, the close resemblance between the hind legs of Locustariæ and Acrydii shows that these families cannot be widely separated.

The non-saltatorial families present fewer difficulties. The wide and acknowledged separation of the Forficulariæ from all other Orthoptera, proves that it cannot intervene between any of the families, and must go to the bottom of the scale.

The Blattariæ are the nearest allies of the Forficulariæ, on account of their flattened shape, the form of the prothorax, etc. From the similarity also of their upper and under wings, their habits of concealment and nocturnal disposition, and their early appearance upon the earth in geological time, they must undoubtedly be ranked next above the Forficulariæ.

The specialization of their anterior legs marks the higher structure of the Mantides, but they show their affinity to the Blattariæ, and their inferiority to the Phasmida, in their flattened abdomen, the tendency of the prothorax to become broad and flat, the structure of the external genital organs, the position of the head and the exclusion of the eggs in a single cluster, enclosed in an ootheca.

The relationship of the Phasmida to the saltatorial Orthoptera is also shown in the cylindrical body, and, to some degree, in the structure of the external genital organs.

¹ It will naturally be objected to this that the Gryllides keep company beneath, or upon the *ground*, and are not given to flight; and that many Acrydii migrate high in the air, in immense swarms. As a whole, however, the swift and controlled flight of crickets is of a superior nature to that of Acrydii, which only use their wings as a parachute, to give greater effect to their leaps, or, at best, beat the air until they raise themselves sufficiently to be borne along by aerial currents; and the company they keep is only the result of their immense numbers and the instinct which leads each one to seek elsewhere the food which its own devastations have made so scarce. Furthermore, there are some Tittigideans which, at least to a certain extent, inhabit the water.

The Orthopteran families may then be placed in the following descending order: Gryllides, Locustariæ, Acrydii, Phasmida, Mantides, Blattariæ, Forficulariæ.

This order, if we omit the Forficulariæ and assume that Burmeister proceeded from the lower to the higher groups in his treatment of insects, is exactly the position assigned to them by that distinguished German entomologist.

January 6, 1869.

The President in the chair. Thirty-four members present.

Professor Carl Wedl of Vienna, Mr. John Cassin of Philadelphia, Hon. Lewis H. Morgan of Rochester, N. Y., and Dr. Burt G. Wilder of Ithaca, N. Y., were elected Corresponding Members.

The following gentlemen were elected Resident Members: Mr. Frederic Amory of Brookline, Mr. James W. Lovering of Cambridge, Mr. Charles F. Gerry of Hyde Park, Drs. Gustavus Hay, William W. Howard, Arthur H. Nichols, George L. Underwood and George F. Waters, and Messrs. H. J. Burton, Jr., James Chadwick, Benjamin F. Dwight, Augustus Hemmenway, George B. Knapp, Stephen C. Martin, Ernest Papendick, Frank H. Thomas and Solon Thornton of Boston.

The following paper was read:—

ON THE LAND-SLIDES IN THE VICINITY OF PORTLAND, MAINE.
BY EDWARD S. MORSE.

The occurrence of another land-slide in the vicinity of Portland, renders this area of considerable interest to the geologist, since this is the third slide that has happened in this region within the space of thirty-seven years. While studying the nature and causes of the recent slide, I became interested in the evidences of prehistoric land-slides, which have modified considerably the surface features of that district.