## SCIENTIFIC BOOKS.

*Studies in Fossil Botany.* By Dunkinfield Henry Scott, Ph.D., etc. London, Adam and Charles Black, The Macmillan Company. 1900. Pp. 533. Illustrated. Price, $2.75.

The gathering force represented in the paleontological researches of the last quarter of a century is now finding expression in publications which not only summarize the results reached by individual investigators, but which coordinate them and thereby give them a positive value as contributions to our knowledge of the character and succession of plant life in past times. The closing years of the nineteenth century witnessed the issue of three important works by Potonié, Seward and Zeiller. The initial work of the twentieth century by Scott may well take rank with them, and it offers the most hopeful indication of what we may reasonably expect from the paleobotanical work of the future. All these works have the common characteristic that they approach the subject from the standpoint of modern phylogeny, and we may, no doubt, safely conclude that they represent the completion of that 'harmony between the botany of extinct and existing forms' which botanists have always regarded as most essential, but the realization of which has been long deferred. They place the whole subject of paleobotanical research upon an entirely new basis, and this branch of botanical inquiry is now emerging from a condition which may well be compared with the transition from the Old to the New School of Botany in 1860.

In presenting his 'Studies in Fossil Botany,' Dr. Scott does not wish us to infer that he is attempting to produce a manual or even a textbook; but his contribution is founded upon a course of lectures delivered in 1896, which he has now brought down to date, and the title clearly indicates that he avoids the particular field already occupied by Potonié, Seward and Zeiller, whose works follow parallel though dissimilar lines of treatment. The purpose of the author is expressed in the statement that the work is designed to present results which appear to be of fundamental importance, and he therefore confines his attention to a few of the leading groups of plants within which the greatest advances of recent years have been made, and where most tangible results have been secured. Other publications give greater detail respecting species, taxonomy and geological relations, but the present work acquires special importance and value because of the close insight into relationship disclosed by a detailed study of comparatively few types on the bases of ample material and remarkably well-preserved specimens. His presentation is a statement of facts rather than an exposition of views. We may not only sympathize with him in the hope that the paleontological record will no longer be ignored by students of the evolution of plants, but also express the conviction that in the future botanists will *not* ignore such evidence, simply because they can not afford to do so.

The material used is primarily that which Williamson gathered during his lifetime, together with such additional material as has come to the hands of Dr. Scott and others in more recent years. The author adopts Solms-Laubach's principle of 'the completion of the natural system' as his point of departure. He therefore discards all problematical forms and confines his attention solely to the relatively few types which contribute well-ascertained data. All discussions center in phylogeny, and the work stands as one of the best expositions of the importance which attaches to the study of fossil plants as a necessary means of completing such data.

After a brief discussion of the relations of plants in geological time and their methods of preservation, the author immediately proceeds to a consideration of the Pteridophyta and the lower Seed Plants, and in a very lucid and convincing manner places before the reader the essential facts in the structure, reproduction and relationships of those plants in which the paleontological progress of the past twenty years has centered. In the main, the illustrations are taken from Williamson's works, and a very striking and pleasing feature appears in a skilfully executed restoration of *Lyginodendron Oldhamianum* which is introduced as a frontispiece.

In the present condition of our knowledge, a classification of the Calamarieæ is difficult in

consequence of the fragmentary character of the material. For this purpose the fructification which, as also the stem, had a complexity of structure unknown in modern representatives of the Equisetineæ, affords the most satisfactory basis, and the system proposed by Weiss, in which he makes use of such external characters as scars, is shown to be of no value except for geological purposes. In *Calamostachys Casheana* the axis of the cone shows a secondary growth in the vascular system and thus gives a final negative to the view so strongly advocated by Brongniart, that secondary growth in the wood is a certain characteristic of the phanerogams. The Calamarieæ show no transitional forms with the Coniferæ, and can not be regared as their progenitors. In fact, our knowledge of these plants is at present so inadequate, that we can not regard them as anything more than a highly organized family of the vascular cryptogams closely allied to the Equisetineæ. But the question still arises if they show any affinities with any of the seed plants? If such affinity exists, it would probably appear in the direction of the Coniferæ or possibly of the Gnetaceæ. The anatomy of the stem certainly approaches the former, while the structure and simple form of the leaf are not without significance. It is also true that the relative positions of the sporangiophore and bract in *Paleostachys* have been compared with those of the ovuliferous and carpellary scales of the Abietineæ, but it is altogether probable that these examples are nothing more than interesting parallels in development which have no force in establishing relationships, and these latter must be sought in other directions, especially as there are no transitional forms connecting the two groups.

The Sphenophylleæ represent a group of the greatest phylogenetic interest, inasmuch as they occupy a position of which there is no representative among existing species. The genus *Sphenophyllum* constitutes a perfectly distinct group of which all the parts are well known in one species or another, and there is no longer room for the idea that these plants represent the foliage of a Calamite. Heterospory may have been present, but so far there is no direct evidence in support of such a view.

The remarkable cones known under the name of *Cheirostrobus pettycurensis* have as yet not been found in connection with other parts of the plant, so that it is impossible to determine the exact nature of the organism to which they belonged. So far as known, however, they were homosporous, but the material now available does not admit of final conclusions in this respect. It is nevertheless certain that these cones were of a remarkably complicated type, and while in the character of the sporangiophores, and in the insertion and structure of the sporangia they exactly agree with the Calamarian type, the anatomy of the axis shows them to approach the Lepidodendroid lycopods, whence we may conclude that they represent a synthetic type combining the characters of different groups of plants.

From these facts Dr. Scott draws the inference that the Sphenophyllaleæ were highly modified representatives of an ancient stock from which both the lycopods and the Equiseti have diverged, but our knowledge of these phyla rests at present entirely upon the evidence of fossil plants.

In *Lepidodendron*, the well-defined presence of ligules serves to indicate a connection with *Selaginella* rather than with *Lycopodium*, a view which would seem to gain additional strength from the observed heterospory of *Lepidostrobus Veltheimianus*. Another feature of exceptional interest is the fact that in some of the cones of Paleozoic lycopods, the origin of which has been fully traced, an integument is formed about the macrosporangium in such a way as to produce a seed like body which eventually becomes detached, as exhibited in the well-known *Cardiocarpon anomalum* of Williamson; and this development is repeated in *Lepidostrobus*, where the microsporangia are similarly invested by an integument. In this we obtain the first definite indication of those transitional forms which serve to connect the Cryptogams with the higher seed plants.

The earlier views of Brongniart, which placed the *Sigillarias* among the Gymnosperms, are shown to rest primarily upon the fact that the first described *Lepidodendron* (*L. Harcourtii*) is devoid of secondary wood growth, and emphasis is placed upon the now well-known

fact that the Sigillarieæ have not even a remote connection with those plants.

*Stigmaria* is held to represent a rhizophore, of which the stigmarian appendages would therefore be the roots. From this point of view these remains must be regarded as representing organs comparable with the rhizophores and roots of existing Selaginellas.

Dating from Silurian time, the ferns gained special prominence in the Carboniferous, where it is even yet difficult to separate the true ferns from fern-like plants. The author nevertheless adopts the conclusions of Bower and Campbell respecting the relative antiquity of the Eusporangiatæ and Leptosporangiatæ as amply justified by paleontological evidence, which also gives support to the classification of ferns by Bower on the basis of the development of the sorus and the output of the spores. In this, the division into Eusporangiate and Leptosporangiate is subordinated to the development of the sporangia with reference to time and place.

One of the most remarkable and significant results of paleontological research in recent years has been the recognition of the Cycadofilices as established by Potonié, thus forming a connecting link between the ferns and the Gymnosperms through the Cycads. Dr. Scott rightly places special stress upon an elucidation of the characters of this important group and shows:

1. That hitherto supposed forms of *Alethopteris*, *Sphenopteris* and *Neuropteris* types really represent the foliage of Cycadofilices.

2. The anatomical characters of the stem are in close agreement with those of the Cycadaceæ.

3. While the exact character of the fructification is not known with certainty, that which in all probability belongs to those plants is widely different from that of the ferns and approximates to that of the Cycads.

*Poroxylon* is shown to be a transitional form between the Cycadofilices and Cordaites through *Lyginodendron*. With respect to the Cordaiteæ to which he deservedly devotes a large measure of space, he fittingly summarizes prevalent views respecting this most important group when he says that "Further investigation will doubtless modify greatly our conception of the Cordaiteæ, and display a much greater variety among the members of this family then we are at present prepared for. But whatever the future may have in store for us in this respect, there can be no doubt that the revelation of the existence of this fourth family of Gymnosperms was a discovery of the first magnitude, which reflects the greatest credit upon the investigators to whom it was due, and profoundly modifies our whole conception of an important sub-kingdom of plants."

Among the Mesozoic Cycadales, the genus *Bennettites* gains special prominence and importance, not only because of the great perfection with which important structures are preserved, but because of the character of the fructification and the relatively high development attained by these plants. The stem structure agrees closely with that of the Cycadaceæ, though representing a more primitive type. On the other hand, the fructifications of the two groups are totally different, and the greater complexity attained in the Bennettiteæ points to a considerably higher degree of development. Thus in *B. Gibsonianus*, the seeds, many of which are to be found in a remarkable state of preservation, are dicotyledonous and exalbuminous, while the whole character of the fruit approximates to that of an Angiosperm. Here again we observe a repetition of that parallelism in development between various branches of the phylogenetic tree which was so well exhibited in *Cardiocarpus* and *Lepidostrobus*, and which goes far to sustain the idea so frequently suggested throughout the plant world, that in the general progress of development, the various branches are all extending forward in the same direction, whence arises a parallelism which indicates approximation to, without actual connection with, other yet higher phases of development; or, in other words, that deviation of a branch from the main line of descent involves certain inherent deficiences which, while permitting development in the same general direction, impose a definite limitation of such a nature that the phylum is incapable of further variation, and hence can not extend beyond a limit which is always much inferior to that attained by the main line.

The work throughout affords one of the best evidences among recent contributions of the

primary importance of anatomical characters as the basis of true relationship, and this book will do much toward dissipating the older and altogether fallacious idea that a classification of fossil plants based upon external characters alone is possessed of permanent value. While the external forms of plants or their parts may possess a certain value for taxonomic purposes, such characters are in all probability least reliable in the case of fossils where they depend so largely upon the modifying influence of conditions under which the plant has been preserved. They are therefore oftentimes most misleading, and although we may admit their general value as a provisional means of classifying remains which cannot be otherwise distinguished, they possess no scientific merit and should be abandoned as fast as more accurate data become available.

That this book will do much to stimulate a more active interest in this important line of research we cannot doubt, but its mission will be well accomplished if it does no more than to finally convince botanists of their real dependence upon data derived from a study of the extinct forms of plant life.

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McGILL UNIVERSITY,
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*A Contribution to the Study of the Insect Fauna of Human Excrement.* By L. O. HOWARD. Proc. Washington Academy of Sciences, Vol. II., pp. 541–604. 2 pls.

A brief summary of the results obtained by Dr. Howard in his study of the insects affecting human excrement was given in the *Popular Science Monthly*, January, 1901. We have now before us the detailed work, in which the insects concerned are fully discussed and in many cases figured.

No resident of this country is likely to forget the deplorable outbreaks of typhoid fever which occurred in the military camps at the time of the war with Spain. It appears that every regiment in the United States service in 1898 developed typhoid, while more than 80 per cent. of the deaths in camp were due to this disease. This condition of affairs naturally aroused a great deal of popular anxiety and indignation, while medical men bestirred themselves to discover the exact causes of the spread of the fever. As a result, it came to be generally believed that flies had a great deal to do with the spread of typhoid bacilli, and one of the most prominent medical investigators concluded that 'flies undoubtedly served as carriers of the infection.'

Admitting, then, the agency of flies in the spread of typhoid fever and other ills, the question naturally arose, 'What flies?' This question the medical men did not pretend to answer, and the way was clearly open for an entomologist to supply the desired information. Dr. Howard, who loses no opportunity to make the Division of Entomology serviceable to the public, at once began an investigation which has now resulted in the publication of exact and minute details to take the place of supposition and vague surmise. Not only were the insects frequenting human excrement carefully watched and recorded, but feces were collected in great numbers, and the species breeding in them ascertained. As had been anticipated, flies were found in plenty; in fact, no less than 77 different species were obtained, of which 36 were actually found breeding in the feces. In addition to this, 23,087 flies were caught in kitchens and pantries in different parts of the country, in order to see how many of the kinds visiting or breeding in human excrement also visited places where food was kept, and were likely to crawl over the food. It appears that the flies most commonly found breeding in human excrement are not those which frequently enter dwellings, but there are several species which are likely to pass directly from the excrement to places where food is kept, and so become a dangerous source of infection. This is true of the common house fly (*Musca domestica*), the vinegar fly (*Drosophila ampelophila*), the stable fly (*Muscina stabulans*) and a number of others.

The practical conclusions reached by Dr. Howard should become known to all municipal authorities. It is shown that human excrement is much more dangerous to the public health than dead animals or other refuse. Every care should be taken to provide for its removal from those places where flies can gain access to it, and those depositing it in by-ways and vacant