THE STUDY OF FUNGI BY LOCAL NATURAL HISTORY SOCIETIES.*

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The following notes refer to the methods and possibilities of the study of Fungi by local Natural History Societies, and indicate some of the more promising lines of investigation which can be profitably taken up. It is quite true, in this as in other studies, that the path is beset with difficulties, both from the strictly utilitarian point of view and the more purely scientific one, but a more carefully organised study of this very large and important group, merits far more attention on the part of students of Natural History than has yet been accorded to it.

I think there can be no doubt that very valuable assistance can be given by Natural History Societies all over the country in the elucidation of some of the more important problems which arise. I need only refer here to the strikingly successful work of the Mycological Committee of the Yorkshire Naturalists' Union as an example of the kind of work which can be carried on by Local Societies. This Committee has been at work for more than twenty years, and during that time a number of the more important districts in Yorkshire have been systematically investigated, and in 1905 a list of some 2,626 species had been compiled, based upon no less than 16,700 records. Since then the list has been considerably increased; new records are continually being added both by individual observers and at The Annual Fungus Forays, and many new county and a few new British records are added each year. All groups of the Fungi are included in the list, but more attention has been given to the larger Fungi than to the microscopic forms in the study of which much remains to be done.

The total number of species known to occur in the British Fungus Flora is more than 5,000. This is doubtless far from being a complete list. Careful and systematic investigation would no doubt result in many more species being discovered. That of these considerably more than half have been found in

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Yorkshire alone, is a tribute to the earnestness and zeal of this Committee.

I mention the work of this Committee more especially because it seems to me that it is by far the most definite attempt which has been made to place the study of the Fungi of a given district on a systematic basis and because it indicates so clearly what valuable work can be done by a local Committee, when carefully organised and patiently carried on for a series of years ; but it must not be forgotten that work on similar lines has been carried out by other Natural History Societies, and by the British Mycological Society.

The charming coloured drawings* by Mrs. William Stebbing, Mrs. T. R. Stebbing, and Mr. Charles Crossland give some idea of the large variety and beauty of many of the forms and will, I feel sure, be a revelation to those who have paid little or no attention to this group of plants. The stereoscopic photographs* exhibited by Mr. Alfred Clarke show what possibilities are open to the student in the direction of accurate and life-like representation of the form and structure of Fungi, and of groups of Fungi in their natural surroundings and, together with the beautifully executed and artistic photographs,* which are the work of Mr. Peck, show how valuable photography may be in giving us faithful and accurate records for future reference. It is possible that before long the fascinating process of photography in colours will be called in to aid us in our studies and we shall then have not only permanent records of form and structure but also what is equally important to the student of Fungi, a permanent record of the extraordinary variation in colour of which so many species are susceptible.

The attention of Natural History Societies has been mainly directed towards recording lists of species for various localities. These have been compiled in various ways, sometimes a mere list of the names has been given ; others give details of the habitats and stations in which the species are found ; and sometimes the characteristics of the more important species have been added. The list published by the Yorkshire Mycological Society is arranged in accordance with the five County Divisions or vice counties of Yorkshire as employed by H. C. Watson in his *Topographical Botany*. It gives for each species the district, the habitat, the date when first found, and also some useful notes on the distribution of various forms, their biological characteristics, their edible or poisonous nature, and their economic importance in respect of diseases of crops and garden plants.

So far as the larger Fungi are concerned it is probable that

* Exhibited at the Conference.

we now have, as a result of the observations made by societies and individual observers in various parts of the country a fairly complete list of the species and varieties to be found in Great Britain. But there is still room for a more detailed study of the Counties and vice Counties and the preparation of a single list drawn up either on the lines of Watson's great work for flowering plants and ferns or possibly on a more natural basis of regional areas. This is one direction in which most useful work might be done. If the numerous Societies which are represented at this Conference would collaborate in a well organised survey of our Fungus Flora it seems to me that a most valuable list might be produced and material obtained for the elucidation of many important biological and ecological problems which have not yet been solved. But we want more information than is contained in Watson's Topographical Botany. If possible notes should be made for each species of its habitat, the nature of the soil, the geological formation; whether the species is parasitic or saprophytic, whether found regularly every year or sporadic only, whether it is a seasonal form only or found throughout the year, whether associated constantly with other Fungi or with definite plants or plant associations, or independent of these. Such observations might be undertaken by the various societies and sent to a Central Committee consisting of Mycologists in various departments, to be tabulated and statistically arranged. Just as the rainfall records are taken by observers all over the country and sent to the British Rainfall Association, so it seems to me systematic observations on the occurrence and distributions of the Fungi, carried out on a definite plan, in accordance with rules drawn up by a Committee of the leading Mycologists, might lead to extremely important results, and to the publication of charts and lists of great value.

There is ample scope for members of Natural History Societies in the study of the Micro-Fungi and their life histories; and much remains to be done among those imperfect forms which are probably only stages in the life cycle of a single species, and which are frequently regarded as distinct forms. The life histories of many of the species of Uredineæ for example have been successfully worked out by members of local societies.

The importance of examining Fungi in their natural surroundings cannot be overestimated. If we are to obtain solutions of some of the most interesting problems concerning the Fungi they must be studied as living organisms, and under all sorts of conditions. Observations on their form and structure must be made in order to throw light on their life histories, and the relations of the various forms to one another, and not merely from the point of view of classification. As far as possible they

must be studied under the conditions of experimental investigation. But good systematic work is necessary for the elucidation of biological problems and may prevent vagueness and aimlessness in their investigation. These are frequently the faults of over imagination and speculation, just as dullness and boredom are frequently the results of over much systematic work in which no attention is paid to the deeper problems of life and development.

In recording and comparing the species found in different districts many interesting lines of investigation would be opened up. The geographical distribution of the Fungi, and their relationships to one another and the environment have been scarcely considered. Many of our members who are experienced in the field could no doubt give a fairly complete list of the species to be found in the various plant associations such as a meadow, a moor, an oakwood, beech wood, pine wood, marsh, etc., but this has never, so far as I am aware, been systematically done.

How do the species in any given locality vary from year to year? What are the dominant species? What species occur only rarely? What species are common to more than one formation? How do the species vary in a given locality according to the seasons? In a pine wood, an oak wood, or any other formation, how do the species follow each other from one season to another? How is their succession connected with the environment? What are the conditions under which they appear? The nature of the soil, the water content, the temperature may all take a part in determining the species which prevail at any given time. What is the actual effect of a long dry Summer followed by a wet Autumn, or of a wet Summer and a dry Autumn, or of the various other combinations and samples of weather which are such conspicuous features of our climate. We have some rough ideas of the effects of these various factors but we have no precise or definite information concerning them.

A complete answer to such questions doubtless demands elaborate investigation, but even rough and ready methods would be valuable at the present stage, and would give us a clue to the more elaborate methods which it may be necessary to adopt to arrive at a satisfactory solution of the problems later on.

In common with all other plants the nutrition of the Fungi and the development of their form and structure are controlled by external conditions. What are the controlling forces and how do they act? The Fungi are extremely variable. To what extent may these variations be brought about in response to external stimuli? What are the controlling factors in all those changes of form and colour which are exhibited by so many of

the Fungi? What are the limits of variation in size of any given species? How is the variation in colour associated with the environment, the presence of light, moisture, food supply? To what extent have gravity, light, temperature, moisture and variation in nutrition the power to cause a modification of the Fungus form?

Gravity plays an important part in maintaining the pileus in the horizontal position which is, according to the researches of Professor Buller, necessary for the efficient distribution of the spores. In some species light appears to be of importance as a stimulus to the production of the pileus. There are, however, but few recorded observations on these important problems.

Variation in the food supply evokes a very definite modification in the Fungus body, as Klebs, many years ago, showed was the case with *Saprolegnia*, but experimental observations upon the more highly differentiated forms are much needed. Thus it has been shown that the tendency to fruit formation in some of these larger forms may be retarded by changing or weakening the food supply, and somewhat similar effects may be produced by variation in the supply of moisture. Temperature is also known to play an important part in modifying the form and development of the Fungus body. All these problems require further investigation, and it is particularly desirable that observations conducted in the field under the natural conditions of the environment and food supply should be made.

To turn to the more utilitarian aspect of the study of the Fungi. There is still much to be done in the study of Fungus diseases and their life histories. To plant breeders this is of the utmost importance and there is ample scope for largely increased observation in the field.

Then there is the question of edible and poisonous Fungi. This may be a small matter to many of us, but it seems to me that it is of sufficient importance to warrant a more attentive study. It is to be regretted that so large a quantity of excellent food in the form of edible species of Fungi should be allowed to lie and rot for want of a little knowledge to enable one to distinguish them from poisonous or injurious species. A very considerable number of species—Cooke says certainly 70 or 80 common species—may be safely eaten. Those who have never tried the common puff balls, various species of *Hygrophorus*, *Lactarius deliciosus* (The Delicious Milk-mushroom), *Tricholoma personatum* (Blewits), *Fistulina hepatica* (Beef-steak fungus), species of *Coprinus*, *Boletus edulis*, the Morel and many others, have yet much to learn as to the possibilities of this food supply.

It would be a most useful work if Natural History Societies would institute the examination and methods of discrimination

of the common species of edible and poisonous Fungi, by holding exhibitions and giving demonstrations of their structure and of the scientific characteristics by means of which they may be distinguished. As Dr. Cooke points out, 'there are no general rules capable of universal application; whereby edible may at once be distinguished from poisonous Fungi.' There are some general characteristics which may be helpful but, and again I quote from Dr. Cooke, "no method is so safe as that which consists in mastering the characteristics of a few species, especially when pointed out by one who is practically conversant with them, and increasing the number with experience."

When we remember the ubiquitous nature of the Fungi, their constant association with all kinds of putrefaction and decay, the part they play as fermentative agents in the production of diseases both of animals and plants, the ease with which they are disseminated through the air or carried about in various ways, their edible and poisonous qualities, their disastrous effects on timber, it is easy to understand how important such a systematic survey as I have suggested to you may be in helping us to a more complete and detailed knowledge of the problems which arise.

Here, in fact, is a piece of scientific investigation in which there can be no manner of doubt that Natural History Societies can take a very valuable share, a piece of work which in many of its aspects is certainly not too difficult nor too indefinite for amateurs, who are prepared to give some little time to the study. Many of the problems are precise and can be definitely stated, and if one of the results of this discussion is that delegates return next year with details of the formation of new Mycological Committees and of work already accomplished, I am quite sure the Conference will welcome them and we shall feel that our deliberations have not been in vain.

In the discussion which followed the reading of the paper the following took part:—Professor Potter, Miss A. L. Smith, Mr. Cheesman, Dr. H. C. I. Frazer, Mr. Stebbing, Sir Daniel Morris and others.