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The Numbers of Fungi

By G. W. MARTIN

In most reference and text-books on botany, the number of known species of fungi is given as from 75,000 to 100,000. The sources of these estimates are rarely cited but it may be inferred that most of them trace back, usually indirectly, to the number of descriptions compiled in the twenty-five volumes of Saccardo (8) which amounts to somewhat over 81,000, usually with a more or less generous allowance for the number of valid species described too late to be included in the last volume of that work, which appeared in 1931, and which have appeared since that time.

The Tulasnes (10) in the first volume of their monumental work, *Selecta Fungorum Carpologia*, published in 1861, quote approvingly a number of earlier references to the large number of species of fungi, of which a quotation from Fries's writings may be taken as representative: "Many botanists, looking at fungi from a distance, deem them a small province of the vegetable kingdom, although it is really the greatest, being analogous to that of insects among animals."¹

The most thoughtful estimate of the number of species of fungi published in recent times is that of Ainsworth and Bisby (1). They point out that many of the species listed by Saccardo are synonyms, based on host relations or on very minor differences, that a disproportionate number of species are known from single collections and that many of the rusts and members of the imperfect groups have probable or, in some cases, known perfect stages. As a result, they estimate the total number of known fungi as perhaps 34,000 and hazard the guess that this may represent about a third of the total number of species, which would then be something of the order of 100,000.

All that Bisby and Ainsworth say is true and pertinent to the argument. It may be pointed out, however, that at least some of Saccardo's specific entities have been shown, on the basis of critical study, to embrace two or more clearly defined species, that many well known but economically unimportant vascular plants have been little studied with reference to their fungal parasites and that our knowledge of non-parasitic fungi is grossly incomplete. In the

¹"Plurimi fungos e longinquo intuentes provinciam orbis vegetabilis judicant exiguam, quamvis facili sit vastissima, ut Insecta analoga inter animalia." Fries, *Syst. Orb. Veg.* 47. 1825.

latest printing of the Outline of the Fungi (6), as in previous editions, I refer to what has become a standard exercise in the course in mycology at the State University of Iowa, on the basis of which I have suggested that there may be reason to believe that the number of species of fungi may perhaps eventually be found to be not less than the number of species of vascular plants. It may be of interest to describe the results of such a study as made during the current year.

For the host species, the seventh edition of Gray's Manual (7) was used rather than the new eighth edition, since the names of host plants in Seymour's Host Index (9) are taken from that edition. Beginning with page 35 of the Manual, the third numbered species on each page at intervals of eight pages was selected. If the eighth page in any sequence proved to be occupied by a key or contained fewer than three numbered names beginning descriptions, the next page containing three numbered species was selected and the 8-page interval resumed. This resulted in a list of 100 species selected at random, beginning with *Phegopteris Dryopteris* on p. 35 and ending with *Circium virginianum* on p. 858. These were then divided into ten series in such a way that each of ten students compiled the parasitic fungi listed by Seymour on every tenth host species. Of the 100 hosts selected, 40 had no parasitic fungi listed as occurring on them; the numbers on the other 60 ranged from one to 89. The following table shows the distribution.

Number of Hosts	Number of Parasitic Fungi on Each Host	Total Number of Fungi
40	0	0
7	1	7
12	2	24
9	3	27
6	4	24
7	5	35
1	6	6
5	7	35
2	8	16
1	9	9
1	10	10
1	11	11
1	12	12
3	13	39
1	14	14
1	18	18
1	47	47
1	89	89
<hr/> 100		<hr/> 423

Of the 423 parasitic fungi on 100 host plants 11 species of fungi were listed on two or more hosts a total of 31 times, thus reducing the total of fungi by 20 to 403. Others are probable synonyms and even more are possible synonyms. Making all allowance for that fact, the total number of valid species represented in the list can scarcely be below 300. This is in general accord with previous samplings. The total has been as low as about the same number of fungi as hosts and as high as over five times the number of hosts. In most of the earlier enumerations a smaller number of hosts was selected; the one reported here may be regarded as based on a fairly representative sample. It is scarcely conceivable that no parasitic fungi occur on the 40 hosts on which none were listed.

Gilman and Archer (5) in their list of Iowa fungi parasitic on plants and Gilman (3,4) in his supplementary papers, list a total of 980 fungi attacking 1067 host species. The number of vascular plants occurring in Iowa is probably not over twice the number given, and it may safely be predicted that most of the remainder will prove to have parasitic fungi occurring on them. When to the vascular list is added the known species of non-parasitic fungi occurring in Iowa—Gardner (2) lists 935 species of Homobasidiomycetes alone, the great majority of which are non-parasitic—the total number of known fungi for that area would certainly be in excess of the number of vascular plants. Bisby and Ainsworth list the number of vascular plants in Britain as 2362 and estimate that the number of valid species of fungi occurring in the same area may be approximately 6000. These figures are in substantial agreement with those I have presented.

It is obvious that these estimates are all very tentative. Nevertheless, I cannot but believe that the suggestion that there are no more than 100,000 valid species of fungi is excessively conservative and that the total number may be of substantially the same order of magnitude as the number of species of vascular plants.

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