

THE AMERICAN NATURALIST

VOL. XLIV

July, 1910

No. 523

A CONSIDERATION OF THE "SPECIES PLANTARUM" OF LINNÆUS AS A BASIS FOR THE STARTING-POINT OF THE NOMENCLATURE OF CRYPTOGAMS¹

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At the Congress held in Vienna in 1905 it was voted to adopt Linnæus's "Species Plantarum," 1753, as the starting-point of the nomenclature of flowering plants and the question of the starting-point for that of cryptogams was referred to the congress to be held at Brussels in May, 1910. The adoption of the "Species Plantarum" was endorsed practically by so large a proportion of phanogamic botanists that its acceptance came as near being universal as could ever be expected in such a case. It may be assumed therefore that the "Species Plantarum" is well adapted to serve as a basis for the nomenclature of phanogams. Were it true that it is as well, or nearly as well, adapted to serve as a basis for the nomenclature of cryptogams, there would be no hesitation on the part of cryptogamists in adopting it also. If it is not, there is no reason why they should feel under any obligation, for the sake of a merely formal uniformity in nomenclature, to follow in the steps of other botanists.

In the first place we may ask why it is that the "Species

¹ Invitation papers read at the sixteenth annual meeting of the Botanical Society of America.

Plantarum" should be considered to be well adapted to the requirements of phænogamic botanists. The fact that it was the first work in which the binomial nomenclature was methodically applied is a sufficient reason why no work issued prior to 1753 should have been adopted as a basis of nomenclature, but that fact alone is not a sufficient reason for the adoption of the "Species Plantarum" itself. An examination of that work shows also other merits which should recommend it. It is an admirable summary by the leading systematist of his day of several hundred genera and some thousands of species found not only in Europe but also in North America and other more remote parts of the world. In fact, on glancing over its pages one is surprised at the large field covered by Linnæus and the large number of exotic species which are included in the work. In the numerous editions of the "Species" issued at intervals of a few years until as late as 1830, some under the title of "Systema Vegetabilium" and "Systema Plantarum," the Linnæan traditions were handed down with additions and annotations by well-known botanists, so that there is no gap separating the original edition from the date of the appearance of the first volume of De Candolle's "Prodromus" in 1824. It should also be borne in mind that under the careful guardianship of the Linnæan Society of London, the Linnæan herbarium is still in existence and accessible to botanists. It is therefore not difficult to see that for a basis of nomenclature of flowering plants the "Species Plantarum" was well chosen.

If we turn now to the cryptogams of the "Species" we find a very different state of things. To those who have not examined the "Species" with reference to this point it might seem that the cryptogamists for the sake of uniformity might be willing to make some sacrifice. For such persons a comparative examination of the phænogams and cryptogams in the "Species" may be of interest. For this purpose I have prepared a table showing the number of genera and species in the two groups.

The number of genera can be determined without difficulty. The counting of the species is less easy since in some cases it is not quite certain whether under a given name Linnæus intended to indicate a species properly speaking or merely a form or variety. In my enumeration I have included only those forms clearly designated as species, omitting subspecific forms. That the enumeration here given is conservative is shown by the fact that, while according to the "Codex Linnæanus" the total number of species in the "Species Plantarum" is 5,938, the total of my list is 5,247, divided as follows:

	Genera.	Species.
Phænogams.....	1,049	4,630
Cryptogams.....	50	617
Total.....	1,099	5,247

Of the 50 genera and 617 species, 16 genera and 189 species are Filices and there are in addition 24 species of the genus *Lycopodium* which was placed by Linnæus in Musci. Among the Filices are to be found numerous characteristic species of America and the tropics and in this respect the treatment of the group by Linnæus is quite comparable with his treatment of phænogams. For nomenclatorial purposes the Filices and *Lycopodium* are even at the present day treated in the same manner as phænogams, and it is a well-known fact that it is the custom to unite the vascular cryptogams and the phænogams in floristic works. So far as we are now concerned the higher cryptogams need not enter into the discussion, but from the nomenclatorial standpoint must be classed with phænogams and there are therefore left 404 species and 44 genera for all the Bryophytes and Thallophytes described in the "Species Plantarum." But even in this small number is included the genus *Spongia* under Algæ with 11 species, of which at least the greater part are not even plants in any sense. Furthermore, among the Bryophytes and Thallophytes there are almost no extra-European species and of the European species a great

proportion are northern. In short, although as far as phænogams are concerned the "Species Plantarum" includes characteristic representatives of different parts of the world, as far as the Bryophytes and Thallophytes are concerned it represents only a limited European flora.

The question may perhaps be asked by those who have not studied specially any group of non-vascular cryptogams: Although the number of non-vascular cryptogams in the "Species Plantarum" is very much smaller than that of phænogams, is it not perhaps the case that the ratio represents approximately the relative size of the two groups in nature? It has been the custom to state that the phænogams outnumber the cryptogams, some even saying that they are much more numerous. Such statements are based solely on an enumeration of described species and fail to give information as to the probable actual number of species. It is not possible to give figures on the subject which are up to date and the statistics of even a few years ago are of slight value, for it is only within a few years that the study of cryptogams has been pursued in other parts of the world than Europe or, to a less extent, North America. We can probably obtain a more correct opinion if we consider probabilities. The number of known species of Musci and Hepaticæ has been very much increased in the last few years, and although the bryological flora of Europe and North America is now so well known that no very large number of new species is to be expected there, in other parts of the world and especially in the tropics, it is evident that the work of exploration conducted by trained specialists will bring to light a very large number of new species. The same is true of lichens. In algæ a very great increase of species is less to be expected, partly for the reason that the region of growth of marine algæ, pelagic species excepted, is more limited than that of land plants. But even in algæ, it is probable that the known species will be considerably increased.

The fungi offer a better field for comparison than other groups. It is certainly true that the number of described species is decidedly smaller than that of phænogams. Are we then to conclude that there are fewer fungi in the world than there are phænogams? By no means, for there is a possible inference which may be drawn from a knowledge of the distribution of fungi to which, it seems to me, great weight should be given. Year by year the number of known parasitic fungi goes on increasing and, although we can not assume that probably every phænogam has its parasite, the proportion which have is constantly increasing. We also know that some species have not only one but many parasites and, as a rule, the species which from their economic value have been most carefully studied are the hosts of many fungi. As an instance I may mention the species of the genus *Vitis*, on which several hundred species of fungi are known to grow, some, to be sure, found also on other plants, but a large number peculiar to this genus. When all genera have been studied as carefully as *Vitis* we shall undoubtedly find that the number of parasitic fungi in existence is enormous. If to the parasitic we add the thousands of saprophytic fungi, it may well be asked whether eventually it will not prove to be true that the number of species of fungi is as great as that of phænogams. It seems to me that it should be plain to every one that if in the "Species Plantarum" the proportion of phænogams to cryptogams is about ten to one, we must admit that although the work is sufficiently comprehensive to serve as a basis for the nomenclature of the former, it is entirely inadequate in the case of the latter.

I have referred to the restricted range of the species of cryptogams described by Linnæus and to their small number. If we go farther and examine the character of the descriptions themselves we find that they are in many cases vague and unintelligible, which is nothing more than might have been expected in that day before the scientific study of the group had really begun. The Algæ

in particular are from the modern point of view a strange medley. The genera *Jungermannia*, *Targionia*, *Marchantia*, *Blasia*, *Riccia* and *Anthoceros* I have in my enumeration included in Bryophytes where they properly belong, although they were placed by Linnæus in Algæ as well as the genus *Lichen* with 80 species. The genus *Tremella* with 7 species was also included in Algæ, although as far as the scanty descriptions can be identified, 3 are species of fungi, 3 algæ and one a lichen. Some of the 12 species of *Byssus* are algæ, but the majority it is impossible to recognize. Of the 11 species of *Spongia* nearly all are animals.

Of the later editions of the "Species Plantarum" the fourth, according to some the fifth, has a partial revision of the fungi by Link and of the mosses by Schwaegrichen, but as these parts were not published until 1824-30 and do not follow in any way the original edition of Linnæus, so far as priority of nomenclature is concerned, they need not be considered here. Of the "Systema Plantarum," Reichard, 1780, and the "Systema Vegetabilium" by Gmelin, 1796, by Persoon, 1797, and Sprengel, 1827, it can be said that although they include more species than the original edition of Linnæus they are open to the same objection and, as will be seen later, the dates of their publication are so near those of far better works that their nomenclatorial value is of trivial importance. If I have dwelt at what may seem too great length on a consideration of the value of the "Species Plantarum" as a basis of nomenclature, it has been for the purpose of trying to make clear to those to whom uniformity in nomenclature seems to be of the first importance, why it is that to expect cryptogamists to adopt the "Species" on the same basis as do phænogamists is unreasonable. To the latter the "Species" represents a fundamental treatise; to the former a very meager and unsatisfactory list of plants belonging to groups of which, in the time of Linnæus, there was really no exact knowledge.

One would be glad to adopt as a basis of nomenclature some one work which bears the same relation to cryptogams as does the "Species Plantarum" to phænogams, but there has never been any such work and there never will be, for a very good reason. The phænogams form a homogeneous group. The cryptogams do not, but consist of a number of different groups, and the fundamental works relating to them appeared at different dates, all, however, considerably later than 1753. The specialists who study bryophytes, lichens, algæ and fungi are entirely justified in adopting different works as a basis of nomenclature. The question they should ask is: What was the first work on bryophytes, on lichens, on algæ, on fungi, in which those groups were scientifically and comprehensively treated?

It is not possible to enter at this time on a general consideration of this point. Although that part of Linnæus's "Species" which relates to bryophytes appears to have greater value than that which relates to thallophytes, since for one reason his citations of Dillenius's figures help one to understand to what plants the brief descriptions were applied, it must certainly be admitted that Hedwig's "Species Muscorum," of which the first volume appeared in 1801, is the fundamental work on mosses and that Hedwig, with whom the scientific study of mosses began, may be called the Linnæus of bryology. Acharius stands in the same relation to lichenology, and it is a question to be settled by lichenologists whether the "Lichenographia Universalis" of 1810 or the earlier "Methodus" is to be given the preference. For algæ, the "Systema Algarum" of C. A. Agardh has been suggested. It is, however, out of the question to refer more in detail to the groups just mentioned, but it will be sufficient if we consider the case of fungi somewhat more minutely, although the subject is perplexing and complicated even to those more particularly interested in this group and probably wearisome to others.

In the "Species Plantarum" 1,073 pages are given to

phænogams, 15 pages only are given to fungi, including *Agaricus* 27 species, *Boletus* 12, *Hydnum* 4, *Phallus* 2, *Clathrus* 3, *Elvela* 2, *Peziza* 8, *Clavaria* 8, *Lycoperdon* 9 and *Mucor* 11. To these must be added 3 of the species of *Tremella* placed by Linnæus in algæ, making 89 fungi in all. Of these not one is extra-European and only 8 are cited as growing in Italy or southern Europe. To consider that a work of such a limited scope should serve as a basis of nomenclature of a group whose species are numbered by thousands seems to me preposterous. All that we can say of the fungi in the "Species Plantarum" is that they show plainly that in 1753 next to nothing was known of that large group, and one may be pardoned for saying that in what Linnæus wrote about fungi he was not a Linnæus. We must search elsewhere for a fundamental work on the subject. In the later editions of the "Species" and the "Systema Vegetabilium," as I have said, the treatment of fungi is not in any way satisfactory, and it was not until about fifty years after the publication of the "Species" that there appeared anything which could be called a general and comprehensive work on the species of fungi. If mycologists were asked who exerted the greatest influence in placing systematic mycology on a firm basis they would say Elias Fries and the "Systema Mycologicum," of which the first volume appeared in 1821, had an influence in shaping the study as no other work has had. In saying this I do not wish in any way to underrate the value of the "Synopsis Methodica Fungorum" of Persoon, issued in 1801, but of the two I think that the "Systema" is the one which has had decidedly the greater influence in shaping the progress of descriptive mycology. In its three volumes together with the two volumes of the "Elenchus" which is a part of the "Systema," we find for the first time an account of the mycological flora of a considerable portion of the world rather than an account of certain orders of fungi, mainly of Europe. In the "Epicrisis" of 1836-38, the "Summer Vegetabilium Scandinaviæ," 1849, and the

"Hymenomyces Europæi," 1874, we have important revisions and commentaries by Fries of his earlier work. The "Icones Selectæ Hymenomycetum" include 200 plates executed under his supervision of species which cannot well be studied by dried specimens alone. The herbarium of Fries is still at Upsala and the "Scleromyceci Leuciæ," a collection of 450 small parasitic species, is to be found in herbaria in Europe and this country and has been the subject of critical commentaries by several botanists. The fact that the volumes of the "Systema" did not appear in the same year does not appear to me to present a serious practical difficulty, as Volume I containing Hymenomyces appeared in 1821 (except *Solenia*, *Cyphelia* and the Tremellinæ, in Vol. II, 1822), Volume II, section 1, with Discomycetes appeared in 1822, Volume II, section 2 (p. 275), with Gasteromyces (Angiogasters) and Pyrenomycetes in 1823, Volume III, sectio prior with Gasteromyces, Myxomyces and Perisporiaceæ in 1829, and Vol. III, sectio posterior (p. 261), with Fungi Imperfecti in 1832.

The "Synopsis" of Persoon, although to be preferred to any previous work, is considerably less extensive in the number and range of the species given than the "Systema," the number in the latter being about two and a half times as great and, in general, the "Systema" presents a decidedly more modern way of treating the group. A fuller consideration of the comparative merits of the "Systema" is out of the question in this place as it would require more time than can be allowed and because the details are such that they could not be readily followed except by mycologists who have studied the question minutely. I have no right to encroach further on your patience and need only, in conclusion, repeat that the "Species Plantarum" is quite unfit to serve as a basis for the nomenclature of fungi, and that the "Systema" of Fries seems to me to be better adapted for the purpose than any other work. In any case, to go back earlier than the "Synopsis" of Persoon would only tend to perpetu-

ate the present uncertainty and confusion, and would open the door to those who, regarding nomenclature as an end in itself and not merely a means by which the necessary evil of naming plants can be reduced to a minimum, devote time and labor to the undesirable task of unearthing names which are at the best uncertain, at the sacrifice of names which have been in universal use for many years, and whose meaning is perfectly clear. To my mind the object should be, not to attempt to seek perfection in authority and priority—a hopeless task—but rather to select the best solid basis in some comprehensive work. Even then, there is the question of *genera conservanda* and I believe that, whatever work or date is adopted, it will be most desirable to adopt a list of *genera conservanda*. There is nothing illogical in this and practically there are great advantages unless one believes in the theory that mere changing of names is a merit in science. That theory I certainly do not accept, but hold that the fewer changes of names the better.

It has been my misfortune never to have found anything perfect. Some of my friends have perfect systems of classifications of books, of herbaria or of plants. In trying to apply perfect methods I always recall a visit in company with Sir Joseph Hooker to an establishment not a thousand miles from here. The person in charge said, “We think we have a perfect museum case which we would like to show you.” “Yes,” said Sir Joseph, “I am always glad to see what I have never seen. But what do you keep in the case?” A key was produced, but by no amount of coaxing or forcing could the case be opened. “Yes,” said Hooker, “I presume that it is perfect, but I prefer cases which open.” The same remark would apply to a good many systems. They are perfect until we try to find out what is in them.