THE CLASSIFICATION OF PLANTS, V.

JOHN H. SCHAFFNER.

In a previous paper the entire plant kingdom was classified into seven fundamental divisions or subkingdoms, representing the great successive stages in the evolution of plants as a whole. These groups do not show genetic relationships but simply steps in the upward evolutionary motion. But there is a principle of segregation operative in the organic kingdom as well as one of progression. The whole plant kingdom thus comes to be a series of greater and smaller divergent lines or branches. In a group of nonsexual organisms every line of descent is a single line which diverges from another line at a definite point, but in a sexual group, where interbreeding goes on freely, there is an interaction throughout the whole mass and the scheme of descent resembles an elongated net with greater and smaller meshes. The whole progressive network of descent of a group may, however, also be represented by a line. When individuals or groups of individuals arise which become sterile to other members of the general group a new line is segregated, so that for the larger groups the diagram of descent must be quite similar whether of sexual or nonsexual forms, even though the diagram for individuals is fundamentally different in the two cases.

As a convenient guide to memory, the scheme of relationships may be represented graphically by a tree with greater and smaller branches. Every branch thus recognized, whether large or small, is characterized by some peculiarity which remains dominant in all of the individuals and groups of the branch. Or in other words, as Bessey* has said: "Every phylum is the result of a development which differs from that which preceded it because of the incoming of a new dominant idea." The number of great branches or phyla recognized depends somewhat on the views of the particular systematist making the classification. It is not always easy to distinguish fundamental genetic characters from those which are merely progressive, and may be developed in various unrelated groups. Among the characters which do not represent genetic relationships, when considered by themselves, but which have been developed independently in various lines may be mentioned the following: Origin of sexuality, differentiation of gametes, passage from a unicellular to a filamentous condition, differentiation of the filament with base and apex, loss of chlorophyll with development of parasitism and saprophytism, development of unisexual gametophytes, loss of sexuality, origin of heterospory, development of complex leaf

* BESSEY, CHARLES E. The Phyletic Idea in Taxonomy. Science N. S. **29**: 91–100, 1909.

forms, development of woody stems, development of the annual habit, development of epigyny, development of cyclic flowers, coalescence of the perianth or of other organs, decrease in the number of floral parts, development of zygomorphy, increase or decrease in the number of ovules, the presence of alternate and opposite leaves, development of geophily, development of the various kinds of fruits, extra-floral nectaries, and a host of other important or trivial characters both morphological and physiological.

In the present attempt sixteen great phyla have been recognized. Recently Bessey† has published a paper entitled "A Synopsis of Plant Phyla" in which fifteen phyla are proposed. In general it may be stated that the writer agrees with Bessey's scheme and as far as possible his names have been adopted in the present paper. The sixteen phyla are as follows:

SCHIZOPHYTA	MYCOPHYTA
MYXOPHYTA	BRYOPHYTA
DIATOMEAE	PTENOPHYTA
CONJUGATAE	CALAMOPHYTA
GONIDIOPHYTA	LEPIDOPHYTA
PHAEOPHYTA	CYCADOPHYTA
RHODOPHYTA	STROBILOPHYTA
CHAREAE	ANTHOPHYTA

It will be seen that a uniform system of group endings is maintained except for three phyla each of which is represented by a single class. At present the writer is not prepared to give these groups distinctive names, although uniformity would have its advantages.

Although the Diatomeae and Conjugatae are commonly united as one phylum, there are fundamental differences between them which have not been cleared up satisfactorily and until further knowledge of their cytology is obtained a final union is not advisable. The fifth phylum, the Gonidiophyta (goné, generation and dim. term. idion, gonidium, a zoospore) includes all the green algae except the Conjugatae and Chareae, besides two classes of fungi, the Archimycetae and Monoblepharideae. The name, Archimycetae, should more properly be spelled Archaemycetae or simply with an e. This group connects with the lower green algae while the Monoblepharideae are closely related to the Siphoneae. Almost all of the Gonidiophyta, as the name indicates, are characterized by the presence of zoospores. The Chareae have practically nothing in common with the red algae. Their affinities are probably with the green algae but so far removed that they are here regarded as an isolated phylum.

† Univ. Studies 7: 275–373. 1907.

In the Mycophyta are included not only the higher fungi but also the Zygomycetae and Oomycetae. These two classes may have affinities with the Siphoneae in the Gonidiophyta but their exact relationships with these plants appear obscure at present and the gap is as great if not greater than that which separates them from the lower Ascomycetae. The Laboulbenieae may belong with the Rhodophyta.

For Bessey's "Pteridophyta" a new name, Ptenophyta (ptenós, feathered) is used, for the reason that "Pteridophyta" has become too well established as a term of much wider application in which sense it will still be needed when the phyletic scheme of classification is adopted. The Gneteae, which consist of three very distinct families, Tumboaceae, Ephedraceae, and Gnetaceae, are considered to be modified Strobilophyta, the same tendencies showing here as are to be discovered in several lines of the Anthophyta. The Ephedraceae are no doubt a distinct order, the other two families showing some relationships to each other.

The phyla with their classes and approximate number of species, may be characterized as follows:

1. **Schizophyta.** Fission Plants. 2,400 species.

Nonsexual, unicellular or filamentous fission plants of simple structure, with or without chlorophyll but never with a pure chlorophyll-green color.

Cyanophyceae.
Schizomycetae.
Myxoschizomycetae.

2. **Myxophyta.** Slime Moulds. 400 species.

Nonsexual unicellular plants without chlorophyll, having a plasmodium of more or less completely fused amoeboid cells and usually building up complex sporangium-like resting bodies.

Myxomycetae.

3. **Diatomeae.** Diatoms. 3,000 species.

Brownish-green unicellular or unbranched filamentous algae with diatomin and silicified cell walls consisting of two valves, and with or without a conjugation of the cells.

Diatomeae.

4. **Conjugatae.** 1,200 species.

Unicellular, or unbranched, filamentous, green algae without silicified cell walls, with zygospores produced by the conjugation of the cells.

Conjugatae.

5. **Gonidiophyta.** 2,000 species.

Unicellular, filamentous, or thalloid, sexual or nonsexual, plants, green in color or without chlorophyll, nearly all producing

OHIO NATURALIST. *Plate XXIII.*

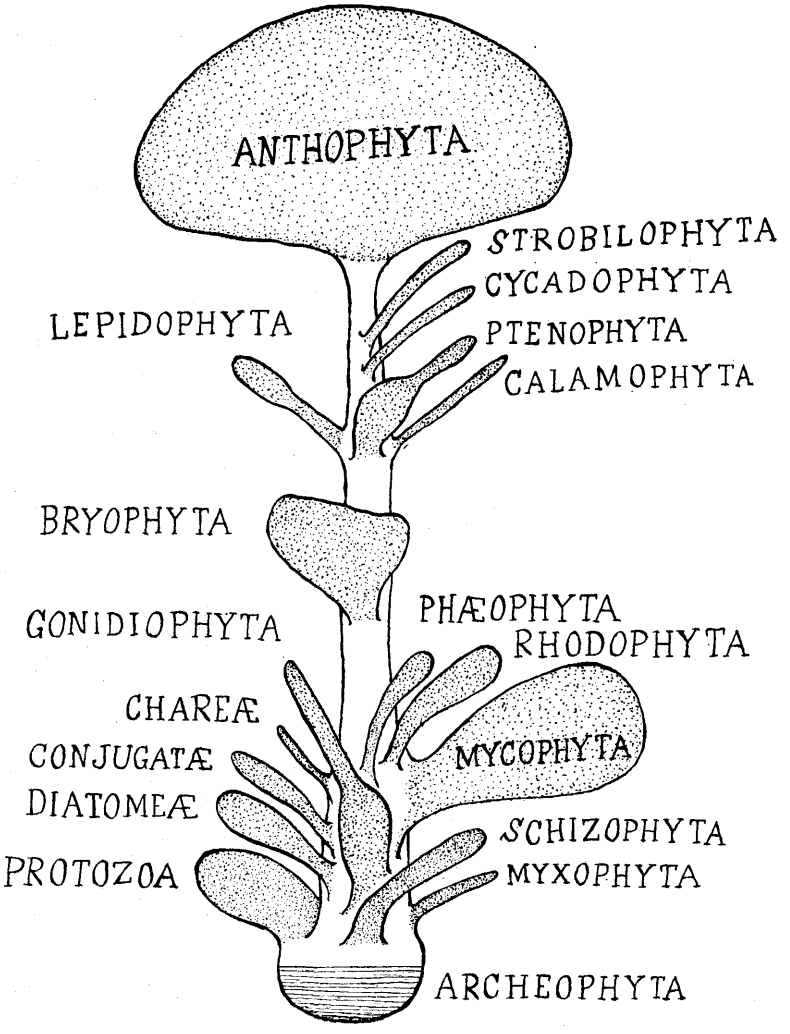

Diagram of the Plant Phyla.

nonsexual zoospores, the sexual forms having true isogamous or heterogamous gametes.

Pleurococceae.
Archimycetae.
Protococceae.
Hydrodictyeae.
Monoblepharideae.
Siphoneae.
Conferveae.

6. **Phaeophyta.** Brown Algae. 1,000 species.

Mostly marine algae with chlorophyll and phycophaein and with gametes, both isogamous and heterogamous, which are all discharged from the gametangia.

Phaeosporeae.
Cyclosporeae.
Dictyoteae.

7. **Rhodophyta.** Red Algae, 2,000 species.

Mostly marine algae with chlorophyll and phycoerythrin, having nonciliated sperms and stationary eggs.

Bangieae.
Florideae.

8. **Chareae.** Stoneworts. 160 species.

Filamentous, aquatic, green algae with globular antheridia containing sperm-bearing filaments, the sperms being biciliate; nonsexual spores absent.

Chareae.

9. **Mycophyta.** 47,000 species.

Plants with a septate or nonseptate mycelium, destitute of chlorophyll, with or without sexuality but never with typical gametes.

Zygomycetae.
Oomycetae.
Ascomycetae.
Laboulbenieae, 500 species.
Teliosporeae.
Basidiomycetae.

10. **Bryophyta.** 17,000 species.

Nonvascular plants with a definite alternation of generations, the egg produced in an archegonium, and the sporophyte permanently parasitic on the gametophyte.

Hepaticae.
Sphagneae.
Andreaeae.
Musci.
Anthocerotes.

11. **Ptenophyta.** 4,500 species.
Vascular seedless plants with comparatively large multiciliate sperms and usually with large, commonly compound leaves, the sporophylls not in cones.

Filices.
Hydropterides.
Isoeteae.

12. **Calamophyta.** 25 species.
Vascular seedless plants with jointed stems and small whorled leaves, with comparatively large multiciliate sperms, and with the sporophylls in cones.

Equiseteae.
Sphenophylleae.
Calamarieae.

13. **Lepidophyta.** 660 species.
Vascular seedless plants with simple, usually small leaves covering the stem, with small biciliate sperms, and with the sporophylls in cones or sometimes forming zones alternating with the sterile leaves.

Lycopodieae.
Selaginelleae.

14. **Cycadophyta.** 90 species.
Seed plants with open carpels permitting the pollengrains to fall into the micropyle, ovules with pollenchambers, sperms multiciliate.

Pteridospermae.
Cycadeae.
Cordaiteae.
Ginkgoeae.

15. **Strobilophyta.** 400 species.
Seed plants with nonmotile sperms, with open carpels and ovules without pollenchambers, and having the pollengrains falling upon the micropyle.

Coniferae.
Gneteae.

16. **Anthophyta.** Flowering Plants. 125,000 species.
Seed plants with closed carpels, with female gametophytes of eight or rarely sixteen cells, with nonmotile sperms, and having the pollen grains fall upon a stigma.

Monocotylae.
Dicotylae.