THE CLASSIFICATION OF PLANTS, II.

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The three series of plants (Thallophyta, Archegoniata, and Spermatophyta) fall into smaller groups which also represent a succession of higher and higher stages of progressive development. If the theory of evolution as accepted at present is substantially correct, it becomes evident that some forms of plant life remained in the lowest condition from the beginning while others advanced to higher and more complex stages. Why did large numbers of species develop and continue until the present time without advancing to any appreciable extent from the starting point? The question can be answered by assuming that groups of organisms varied and were specialized in a direction which interfered with further progress upward but not with further variation along subordinate lines. Other groups varied in a direction which led to higher possibilities without imposing a barrier while still others passed back from a higher to a lower condition.

Based on the conception of vertical or progressive evolution, the development of the plant kingdom may be arranged somewhat as follows:

1. Genesis of living organisms.
2. Primordial organisms or Archeophyta, supposed to have been naked, amoebid cells of the simplest structure.
3. Transition to encysted and wall cells of the types found in the lowest plants of the present time.
4. Nonsexual plants consisting of simple cells, masses, or filaments.
5. Development of sexuality or of conjugating organisms.
6. The lower types of sexual plants.
7. Gradual development of the higher and more complex types, many with a simple alternation of generations.
8. The higher Thallophytes.
9. Transition to typical land plants and adaption to aerial conditions.
10. The lowest plants with a typical antithetic alternation of generations and with a simple parasitic sporophyte.
11. Gradual development of a more complex sporophyte.
12. The higher plants with a well developed dependent sporophyte.
13. Transition to plants with an independent mature sporophyte.
14. Plants with homosporous sporophytes with true roots, leaves, and fibro-vascular tissue.
15. Development of heterospory.

16. Archegoniates with heterosporous sporophytes and greatly reduced unisexual gametophytes.

17. Development of the seed habit and siphonogamic fertilization.

18. Seed plants with open carpels without stigmas and with much reduced parasitic gametophytes.

19. Development of closed carpels with stigmas and beginning of the conjugation of polar cells with further reduction of the female gametophyte.

20. The highest seed plants, representing the extreme of progressive development.

Taking the living plants which are delimited by definite transition gaps, readily distinguishable, we can recognize seven great groups. These are represented in the above scheme as follows: First group, No. 4; second group, Nos. 6, 7, 8; third group, Nos. 10, 11, 12; fourth group, No. 14; fifth group, No. 16; sixth group, No. 18; seventh group, No. 20.

The transition from the first to the second group is very gradual and it may sometimes be difficult in practice to place certain species properly, but the progression from nonsexual to sexual plants is so fundamental and apparently so important for all further advance that this may be regarded as the most important step taken in the entire plant kingdom. The changes in the life cycle and in the conditions of heredity are very far reaching. It is also important to have this group defined for purposes of general discussion.

The seven groups may be called subkingdoms. A subkingdom may then be defined as a group which represents a definite stage of evolution in the plant kingdom and which can be delimited from higher or lower groups by a distinct break or hiatus or by a definite transition involving a progressive change in the life cycle of the individual.

It becomes necessary to select names for these subkingdoms. Unfortunately the larger groups have not received any very extensive consideration from systematists. No definite system is here attempted but the names given below have for the most part been used in connection with the groups which they represent.

I. PROTOPHYTA. Protophytes.
II. NEMATOPHYTA. Nematophytes.
III. BRYOPHYTA. Bryophytes.
IV. PTERIDOPHYTA, HOMOSPORAE. Homosporous Pteridophytes.
V. PTERIDOPHYTA, HETEROSPORAE. Heterosporous Pteridophytes.
VI. GYMNOSPERMAE. Gymnosperms.
VII. ANGIOSPERMAE. Angiosperms.

The first and second subkingdoms are Thallophyta; the third, fourth, and fifth are Archegoniata; and the sixth and seventh are Spermatophyta.

It is often convenient to separate the chlorophyll-bearing Thallophytes from those without chlorophyll. Thallophytes with chlorophyll are Algae. Thallophytes without chlorophyll are Fungi. Protophytes with chlorophyll are Protophyceae. Protophytes without chlorophyll are Protomycetes. Nematophytes with chlorophyll are Gamophyceae. Nematophytes without chlorophyll are Eumycetes.

The seven subkingdoms may be characterized as follows:

I. PROTOPHYTA. Protophytes. 3,000 known living species

Plants without sexuality, representing direct descendants from primitive nonsexual organisms; typically unicellular, the cells free, in colonies, in plasmodial masses, or in simple or branched filaments which are free or fixed and in the more highly specialized forms with definite base and apex; nonmotile, or having locomotion either by means of flagella, cilia, or pseudopodia, or by the general contraction of the cell; holophytic or phagophytic; with chlorophyll or without; reproduction by simple fission, by zoospores, or by walled or encysted spores by means of which the plant survives dessication.

II. NEMATOPHYTA. Nematophytes. 57,000 known living species.

Plants which have developed sexuality, some type of conjugation being present except in some groups which are supposed to have undergone degeneration from sexual ancestors; the more highly developed forms frequently with a primitive alternation of generations; plant body usually filamentous, either simple or branched, free or fixed, but in some groups unicellular, coenobioid, or a complex solid aggregate; chlorophyll present or absent, the great majority of species without chlorophyll living in aerial conditions as parasites or saprophytes, those with chlorophyll usually being hydrophytes.

III. BRYOPHYTA. Bryophytes. About 14,000 known living species.

Plants, usually of small size, in which there is a typical sporophyte but this never having an independent existence, being supported on the gametophyte in a parasitic condition during its entire life; without true vascular tissue, true roots, or leaves, but sometimes with true stomata; always homosporous. Gametophyte comparatively large, consisting of a thalloid frond or a stem-like, scaly frond, usually preceded by a filamentous proembryo, the protonema, which develops from the spore.

IV. PTERIDOPHYTA, HOMOSPORAE. Homosporous Pteridophytes. 2,800 known living species.

Plants in which the herbaceous or tree-like sporophyte, after the juvenile stage, has an independent existence with true fibro-vascular tissue, roots, and leaves, and with a terminal growing point; homosporous and either eusporangiate or leptosporangiate. Gametophyte usually rather large, normally hermaphrodite although often unisexual; thalloid and green but sometimes tuberous and subterranean and without chlorophyll.

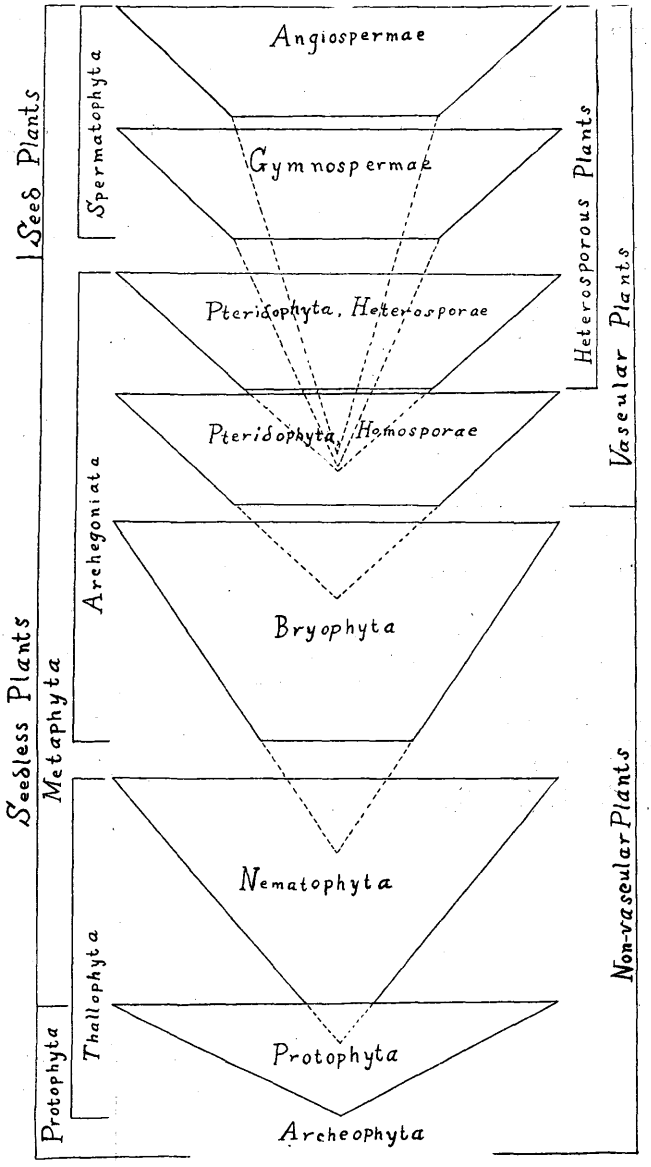

Diagram showing relationships of the Plant Subkingdoms.

V. PTERIDOPHYTA, HETEROSPORAE. Heterosporous Pteridophytes. 635 known living species.

Plants in which the sporophyte, in the living species, is herbaceous and after a brief embryonic stage has an independent existence with true fibro-vascular tissue, roots, and leaves; heterosporous, with microspores and megaspores which give rise to greatly reduced male and female gametophytes respectively; eusporangiate or leptosporangiate. Gametophytes always unisexual, with little or no chlorophyll, living on food stored in the spore and developing entirely inside of the spore wall or protruding only slightly through the side, the nonsexual spores often germinating before being discharged.

VI. GYMNOSPERMAE. Gymnosperms. 450 known living species.

Plants in which the sporophytes are woody perennials with open carpels (megasporophylls) without a stigma and hence with naked ovules and seeds, the pollen (male gametophyte) falling directly on the micropyle of the ovule (megasporangium); flowers monosporangiate, usually developing as cones but sometimes very simple; female gametophyte with numerous cells but without polar cells and thus without true endosperm as in the Angiosperms; male gametophyte much reduced but usually with vestigial vegetative cells; male cells two, either nonmotile sperms or developed as spirally coiled multiciliate spermatozoids.

VII. ANGIOSPERMAE. Angiosperms. 125,000 known living species.

Plants in which the sporophytes are of diverse habit, from minute annual or perennial herbs to large trees; ovules in a closed carpel (megasporophyll) or set of carpels provided with an ovulary and with a stigma for the reception of the pollen (male gametophyte) which must develop a long pollentube, usually passing through the open cavity of the ovulary, before reaching the micropyle; flowers more commonly showy and highly specialized and more commonly bisporangiate; female gametophyte greatly reduced, normally with eight cells two of which, the polar cells, conjugate to form the definitive cell from which the endosperm is developed; male gametophyte consisting of three cells two of which are nonmotile sperms, one used for fertilization and the other in many cases uniting with the definitive cell thus producing a triple fusion.