introductions? The somewhat haphazard but none the less important and skillful work of Albert Koebele, first for the United States government, afterwards for the State of California, and now for the Hawaiian government, is certainly an indication, taken in connection with what we have shown, that thorough experimental work with predaceous and parasitic insects promises, in especial cases, results of possibly very great value.

We wish no more destructive birds like the English Sparrow; we have no desire to make an American resident of the Indian Mongoos, nor have we any desire to import the Australian flying fox as a pet. Neither do we desire to allow any more European plants to escape from cultivation and emulate the Russian Thistle. But there are many absolutely beneficial insects of Palearctic regions which might flourish amongst us, and whose intentional introduction could not be harmful from any point of view, while they might be of the greatest service.

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*PHYLOGENY AND TAXONOMY OF THE ANGIOSPERMS.**

It is unnecessary for me to state at the outset, what is evident to every botanist, that it is as yet impossible to present a complete phylogeny of the angiosperms. Phytopaleontology is too young a science, and the materials with which it deals are as yet far too scanty to have given us direct evidence as to the phylogeny of all families of plants. No one can trace with great certainty from the fossil remains of plants yet discovered the genealogy of any considerable portion of the vegetable kingdom. It will be many a year before the direct evidence we so much desire will leave no considerable gaps to be filled by skillful interpolation. However, after making all due allowance for the imperfection of the record, there are many facts as to past vegetation which are well established. Thus we know that the earliest plants were simple, homogeneous-celled, aquatic organisms. We know that ferns and gymnosperms preceded angiosperms. We know that the angiosperms which first appeared were of lower types, and that the highest types known to-day were wanting until very late in geological time.

It is true, moreover, that we are not confined to the direct evidence furnished by the paleontological record. In the individual development of every plant (its ontogenesis) there is a recapitulation of its ancestral development (phylogenesis). A critical study of the development of the individual must throw light upon the past history of the species. When we know every step in the formation of each plant we shall be able to trace the phylogeny of every species. Here, again, we have to face the fact that our knowledge is still quite fragmentary and that on this account the results are not as definite as we could wish, and yet, when we bring together what we know of the ontogeny of plants here and there in the higher groups, we are able to make out with much certainty not a little as to their phylogeny. To the details regarding these results I will advert somewhat later.

There is still another line of inquiry open to us, namely, the morphological, in which account is taken of the varying development of homologous tissues, members and organs. Rightly interpreted, the results of morphological studies are of very high importance in determining genetic relationships. When differences in homologous parts are regarded as but the expression of variation from a common form they become indices of relationship, and when

*An abstract of the address of the retiring president, delivered before the Botanical Society of America, Toronto meeting, August 17, 1897.

these indices, obtained from all the tissues, members and organs of a group of plants, are judiciously considered they mark out lines of descent with great distinctness.

We have thus open to us three lines of investigation in the study of the phylogeny of plants, namely: (1) the historical, in which the materials are supplied by phytopaleontology; (2) the ontogenetic, in which the development of the individual supplies us with the necessary data; and (3) the morphological, in which the different development of homologous parts is our index of relationship. In this paper I propose to bring these three lines of investigation to bear upon the problem of the phylogeny of the angiosperms. * * * *

From all the foregoing we may pretty safely proceed to construct the hypothetical phylogeny of the angiosperms, to serve as the basis of their taxonomy. And let it be fully understood that this is not presented as final, or as entirely satisfactory; it is merely a working hypothesis which claims no other merit than that of an attempt at conformity to the suggestions, sometimes faint, sometimes doubtful, from paleontology, from embryology (ontogeny) and from morphology. That some of these suggestions have been misinterpreted or that others have been overlooked is altogther likely, but in this I beg the indulgence of systematists, who may well realize the difficulties surrounding the problem here undertaken.

HYPOTHETICAL PHYLOGENY OF ANGIOSPERMS.

The angiospermous phylum parted very early into two sub-classes, the Monocotyledons and Dicotyledons. This separation took place while the flower strobilus was still apocarpous, and before any of the strobilar leaves had undergone much if any modification. At this stage the vegetative characters of the sporophyte were so well established that no profound modifications have been undergone since.

The modifications which gave us the main lines of monocotyledons were, first, the fusion of the carpels with one another and the production of a syncarpium, and second, the progressive fusion of the syncarpium with the other strobilar leaves. These resulted in the phylum which begins with Apocarpæ and passes to Coronarieæ, Epigynæ and Microspermæ. In some Apocarpæ and many plants of the type of the Coronarieæ the perianth has been more or less reduced (by aphanisis), in some cases amounting to complete suppression, as in palms, aroids, and sedges and grasses.

The primitive dicotyledons were apocarpous plants which soon developed along two diverging lines, characterized in the one case by the tendency of the leaves of the strobilus to fuse with each other in a transverse direction (transverse symphysis), while in the other the tendency was to a fusion of the leaves in two directions (transverse and longitudinal symphysis). The phylum resulting from the predominance of transverse symphysis began with the apocarpous Ranales, soon developing into the syncarpous Caryophyllales and Malvales. The type of the Caryophyllales became slightly modified in the Primulales by the transverse symphysis of the inner perianth-whorl, resulting in gamopetaly.

In the Polemoniales the type of the Primulales began to undergo modification by aphanisis, resulting in a reduction of the microsporophylls to five, and the carpels in the syncarpium to two or three. Increasing aphanisis produced the Personales and Lamiales with their four or two microsporophylls and irregular perianth, and in the latter group with each carpel restricted to the production of but one or two macrosporangia.

The phylum in which both transverse and longitudinal fusion are well marked proceeds from the apocarpous roseworts to the syncarpous saxifrages of the Rosales,

to the Celastrales in which epigyny is sometimes attained, thence to the Umbellales, where epigyny is constant, and to the Rubiales in which gamopetaly has become a fixed character, culminating in the group of the Asterales with its greatly reduced bicarpellary syncarpium.

Early predominance of aphanisis in some members of the Ranale phylum soon gave rise to the apetalous laurels and nutmegs from the buttercup type. A somewhat later appearance of aphanisis gave rise to the willows, amaranths and buckwheat from the pink type, and the spurgeworts and nettleworts from the mallow type. Similarly, early predominance of aphanisis in the Rosale phylum gave rise to the apetalous plane-trees from the rosewort type, while its later appearance gave rise to the proteads, daphnads, oleasters, sandalworts and loranths from the holly type, and the walnuts, oaks and galeworts from the horsechestnut type.

Early predominance of symphysis gave rise to the peculiar group of the myrtles from the rosewort type, in which by later aphanisis came the hippurids, birthworts and vine-rapes. The Parietales and Polygalales are later developments more or less parallel to the Caryophyllales, while the Geraniales and Guttiferales stand in a similar relation to the Malvales.

TAXONOMY OF ANGIOSPERMS.

As a result of the investigation of phylogeny along the lines of paleontology, embryology and morphology, the following suggestions as to the classification of angiosperms are made:

The angiosperms are separable into two diverging sub-classes, the monocotyledons (Monocotyledoneæ) and the dicotyledons (Dicotyledoneæ), the first ranking structurally lower than the second. The monocotyledons are well divided by Bentham and Hooker into seven series, and these we may accept unchanged with the single exception that the waterworts (Hydrocharitaceæ) should probably be removed from the Microspermæ, to constitute an additional coordinate group. These eight groups, which appear to be deserving of no more than ordinal rank, should then be re-arranged so as to have the following sequence, namely: Apocarpæ, Coronarieæ, Nudifloræ, Calycinæ, Glumaceæ, Hydrales, Epigynæ, Microspermæ. Here it must be understood that the Nudifloræ, Calycinæ and Glumaceæ are separate orders radiating from the present order Coronarieæ, and that the Hydrales constitute a diverging order from the base of the Epigynæ.

The choripetalous and gamopetalous dicotyledons are divided by Bentham and Hooker into six 'series,' one of which, the Discifloræ, should be broken up and its families distributed elsewhere. The remaining 'series,' which appear to have the rank of orders, form two somewhat diverging genetic lines or phyla, each beginning with apocarpous, hypogynous, choripetalous plants, and both attaining syncarpy and gamopetaly, one remaining hypogynous, the other becoming epigynous. An attempt has been made to distribute all the apetalous plants, these having been assigned places in the lower two orders. Since gamopetaly has evidently been attained at more than one point, it is no longer desirable to retain the Gamopetalæ as a distinct group. It must constantly be borne in mind that these orders and their sub-orders, as well as the families, are diversely related to one another, sometimes serially, but more commonly divergently, as the twigs of a tree are related, now by direct extension, and then by lateral branching.

Class ANGIOSPERMÆ.

Sub-class MONOCOTYLEDONEÆ.
- Order Apocarpæ (3 families).
- Order Coronarieæ (8 families).
- Order Nudifloræ (5 families).

Order Calycinæ (3 families).
Order Glumaceæ (5 families).
Order Hydrales (1 family).
Order Epigynæ (7 families).
Order Microspermæ (2 families).
Sub-class DICOTYLEDONEÆ.
Order Thalamifloræ.
Sub-order Ranales (12 families).
Sub-order Parietales (12 families).
Sub-order Polygalales (4 families).
Sub-order Caryophyllales (13 families).
Sub-order Geraniales (11 families).
Sub-order Guttiferales (6 families).
Sub-order Malvales (11 families).
Order Heteromeræ.
Sub-order Primulales (4 families).
Sub-order Ericales (7 families).
Sub-order Ebenales (4 families).
Order Bicarpellatæ.
Sub-order Polemoniales (5 families).
Sub-order Gentianales (6 families).
Sub-order Personales (8 families).
Sub-order Lamiales (4 families).
Order Calycifloræ.
Sub-order Rosales (12 families).
Sub-order Myrtales (9 families).
Sub-order Passiflorales (6 families).
Sub-order Celastrales (13 families).
Sub-order Sapindales (8 families).
Sub-order Umbellales (3 families).
Order Inferæ.
Sub-order Rubiales (2 families).
Sub-order Campanales (3 families).
Sub-order Asterales (4 families).

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BOTANICAL SOCIETY OF AMERICA.

THE most successful meeting which this young but flourishing society has yet held has just closed at Toronto. Although only three years old, both the attendance at the meeting and the great variety and strength of the papers read would be worthy of a much older organization. Every facility was afforded to the Society, through the courtesy of the Local Committee of Arrangements for the meeting of the British Association. The sessions, presided over by Dr. John M. Coulter, were held in the lecture hall of the handsome Biological Building in which this department of the University of Toronto is quartered. Besides the members, there were present a considerable number of British, Canadian and United States botanists. Foreign botanists had been invited by the Council to sit as associate members of the Society for this meeting. Among those present were Professor H. Marshall Ward, Professor F. O. Bower, Mr. Harold Wager, Mr. J. Bretland Farmer and Mr. J. Reynolds Green.

The officers of the Society are elected by ballots distributed by the Secretary by mail, and returned to him by the members. The Council canvassed the vote for officers and announced at the first meeting of the Society that the following had been elected for the year 1898: President, N. L. Britton, of New York; Vice-President, J. C. Arthur, of Lafayette, Ind.; Secretary, C. R. Barnes, of Madison, Wis.; Treasurer, Arthur Hollick, of New York; Councillors, B. L. Robinson, of Cambridge, Mass., and F. V. Coville, of Washington.

A very cordial invitation was sent by the Director and Trustees of the Missouri Botanical Garden urging the Society to hold a meeting in the spring of 1898 at the Garden, as their guests. The Society was obliged reluctantly to decline this invitation, inasmuch as it desires to cooperate with the A. A. A. S. at its semi-centennial next August in Boston, and it was not felt expedient to hold two meetings so close together.

The proposal to amend the constitution so as to reduce the dues met with no favor. It was unanimously laid upon the table, as was also the proposition to establish one or more medals to be awarded for valuable research. The discussion over the last proposition brought out the fact that the Society prefers to expend such funds as it receives for the promotion of research rather than for its reward.

Nine new members were elected. To