Charles Darwin found the kinship of the organic world, and even the horsebreeder awaits with impatience the result of breed experiment in potato bug and Kansas grasshopper, while Castle's twenty inbred generations of vinegar flies simulates the fate of the Bates short horn.

The guesses of Aristotle are being replaced by the laws of causation.

We are nearing the dawn of genetic science and let us utilize its light while approaching.

PRELIMINARY REPORT OF THE CHAIRMAN OF THE COMMITTEE ON BREEDING NUT AND FOREST TREES.

By GEO. B. SUDWORTH, *Washington, D. C.*

The report, this year, of the Chairman of the Committee on Breeding of Nut and Forest Trees must be largely an apology for studies either not begun or only partly completed. A complete survey and summary was presented at the Association's last meeting in Washington, of what has been accomplished in the past regarding the betterment of commercially useful forest and nut trees. It was hoped that upon the basis of certain conclusions brought out in this last year's study of published results, several lines of investigation could be gotten under way, and at least a tentative report of progress presented at this session's meeting. Practically, however, no time has been afforded in advance of this meeting, in which to formulate and to assign for study the suggestive topics already in hand.

Delay in getting the year's studies shaped up was largely due to the difficulty in settling upon a chairman for the committee on tree breeding, made necessary by the regretted retirement from that office of the previous year's chairman, Mr. Gifford Pinchot, whose onerous official duties at Washington made it impossible for him to longer serve as chairman.

THE PRESENT FIELD OF INVESTIGATION

Unlike the many herbaceous agricultural and garden plants, which yield comparatively immediate results under breeding experiments, forest trees will require a much longer term of years in which to determine the exact influence of pure breeding experiments. This view, at the outset, compels a division of the field of investigation into two parts:

First, lines of study which will yield the most immediate results; second, lines of study which, from the nature of things, can yield results only after a longer term of years.

The age in which we live is one of expediency, even in the field of investigative science. We feel, all of us, that somehow a short course must be found leading to tangible results, even though we grant that a large part of our scientific endeavor can yield valuable returns, be they negative or positive, only after long and painstaking study. Our thought in approaching a new problem seems to be "What can I draw from this that will be of some immediate use?" We take this view because lay people are coming every year to support and believe in scientific investigations only in proportion as they give up something of economic, of every day, use.

In taking up the work expected of the committee on tree breeding, a work which I shall call the economic possibilities of tree breeding, we have naturally felt that some part of the field could be made to yield, at least tentatively, a useful crop of ideas. All close students of plants have observed the almost innumerable variations which many different individuals of the same species undergo. Forest trees are, of course, no exception to this.

Therefore as problems for returns in the near future we have chosen such as the following:

(1) A study of the offspring from seed of individuals of commercial trees which, as species, are generally attacked by insects in their wood or foliage, to the detriment of their use, but which through occasional individuals show partial or perfect immunity.

Occasional forms of a number of leguminous timber trees, ashes, pine, spruces and chestnuts, are known to show such immunity.

(2) A study, similarly, of the offspring of individual trees which show immunity from attacks of certain injurious fungi. Species of *Abies*, *Pinus*, *Libocedrus*, *Fraxinus*, *Castanea* exhibit immunity in some of their forms.

(3) A study of the timber development of seminal offspring of individual trees which have been materially dwarfed under adverse climatic and soil conditions.

Results from this study should give comparatively early returns with a most useful bearing upon the exact value of seed, so often sold to innocent buyers, from badly dwarfed trees, from which seeds are often collected because easy of access. This practice is especially true with regard to commercially important species of *Abies*, *Pinus*, *Chamaecyparis*, *Cupressus*, as well as a large number of broad-leaved trees.

(4) A study of the vitality and timber development of seminal offspring from insect and fungus-infected mother trees.

As in the case of trees dwarfed through other influences, trees infested by insects and fungi are, as a result, stimulated abnormally to bear exceptionally large crops of seeds which are, for obvious reasons, collected and sold for forest planting purposes. An accurate knowledge of the exact value of such material is highly important to the forester.

(5) A study of the climatic adaptability of seminal offspring reared in a more northern climate than its parent, together also with a study of seminal offspring reared in a more southern climate than its parent.

We already know a good deal regarding these problems, but the exact influence, other factors being equal, which a milder or more rigorous climate may have upon seedlings suddenly made to subsist in either unaccustomed climate is still imperfectly understood, in so far as forest trees are concerned.

(6) A study of the possibilities of perpetuation by seed selection from certain individuals, of commercially valuable characters of wood.

A number of timber-trees, notably species of the genus *Magnolia*, *Populus* and *Juglans*, show remarkable variation and specialization in the amount and character of heartwood formed. Certain individuals of comparable age, size, and form of the same species, and often growing side by side, are frequently found to possess, in the case of one individual, a very large volume of highly valuable heartwood, while in another individual the amount of heartwood may be much less, its commercial quality inferior, and the trunk will contain a very large percentage of sapwood. *Magnoliaceous* trees exhibit remarkable forms with these radically different types of wood. The special influences which have operated to produce these opposite forms are conjectured but not known, and least of all do we know how far seed selection may be relied upon to perpetuate the desirable form.

(7) A study similarly of the possibility of perpetuating tree forms possessing curled and wavy woods. This problem may well include the much-mooted question of "Why is birds-eye maple, and how may it be reproduced?"

(8) A study of the transmissibility, through seed selection, of certain chemical constituents of commercial importance found in varying amounts in the barks and woods of trees.

Some individuals of species of the genus *Quercus*, *Acacia*, *Prunus*, *Rhamnus*, etc., are found to possess, for example as in *Quercus* and *Acacia*, exceptionally large percentages of tannin. Perpetuation of such highly specialized forms of trees is of great commercial importance, and a test of the possibilities of direct reproduction is to be sought first through seed selection.

There are many other problems to be taken up, which, directly in line with those just enumerated, should also be investigated first from the standpoint of seed selection.

HYBRIDS.

Unaided nature has given us not a few hybrid trees which possess commercial qualities distinctly superior to those of either parent. A thorough study, therefore, of this phase of natural and aided breeding for the betterment or for the origination of new forest tree forms is a most important part of this committee's work. One paper, to be presented here to-day, discusses the occurrence of useful hybrids trees in the Pacific region.

POSSIBILITIES OF REPRODUCTION BY BUDDING AND GRAFTING

This phase of tree breeding is likely to yield not only comparatively early results, but results which very probably can not be obtained through any other means. Its application is likely to prove the only practical means of reproducing such commercially valuable forest tree forms as "birds-eye maple," curly walnut, ash, etc.

Enough has been said in this preliminary statement to point out the enormous possibilities before the committee for immediate investigative work. The search for specialists willing and capable of taking up the problems outlined is a work, in the writer's opinion, which needs to be entered upon vigorously and at once. Otherwise, the work of the committee, already stimulative enough, will continue to be an effort in theory instead, as is the prime object of the Association, of an effort in the line of actual investigation.

NEED OF A PERMANENT COMMITTEE IN CHARGE OF TREE BREEDING.

In order that greater unity of effort may be centered upon the work outlined in tree breeding, the present chairman feels strongly the necessity of a committee whose term of service shall be reasonably permanent, at least extending over several years, which would permit sufficient continuity of direction and study under the same body to bring together complete results for the problems taken up. The efforts of an annually appointed committee, each year probably made up of different members, appear, in the writer's judgment, entirely inadequate for the prosecution of useful work.

It is believed also that in the interest of better defined effort, the chairman of this committee should have the privilege of forming sub-committees (of the whole) in whose hands related, but specially distinct, lines of study may be placed.

SPONTANEOUS HYBRIDS OF NATIVE CALIFORNIAN TREES.

BY WILLIS L. JEPSON, *Collaborator, United States Forest Service.*

There are in California 41 species of true conifers, 1 fan palm, 2 tree yuccas, 15 oaks, 2 chinquapins, 2 alders, 3 birches, 1 walnut, 3 poplars, 18 willows, 1 laurel, 1 buckeye, 3 maples, 4 arboreal Rosaceæ, 5 arboreal Leguminosæ, 1 arboreal dogwood, 1 suwarro, 1 madrone, 5 ashes, 1 chilopsis, and 1 arboreal elder. Of these the total number of species that may be considered timber-trees is 90. These figures indicate the census of well-separated species. Such bare statements, however, give no true or proper idea of the richness of the forest flora in number of forms. My studies upon these species in the matter of their geographical distribution with the attempts to define their limits in typical form has revealed an extraordinarily large number of well-marked types within each species which are plainly of very great biological and geographical interest, and doubtless in many cases will prove to be, eventually, of economic interest when subjected to study and especially experimental work in the nursery and tended forests. *These* are the types or forms most assuredly, not the botanical species, which will be the subject of detailed work in hybridizing and selection.

Some of these newly observed types are obviously adaptations to local conditions, others are perhaps sporting variants due to changes in the circumstances of the forest, others are believed to be the results of spontaneous hybridization. It is with this last group that I am at this moment concerned.

As preliminary to further detailed experimental work upon presumed hybrid types to be undertaken during the next flowering season, when as many reciprocal pollinations will be made as opportunity offers, I have during the fruiting period of 1908 gathered seed from a considerable number of presumably hybrid trees in order to secure a collection of seedlings for observation in the nursery during the season of 1909.

The following is a list of spontaneous hybrids, so far as at present known, of native trees in California, as determined by comparative morphological evidence, and to a certain extent by physiological features in the seasonal history of the tree.