

No. 64. The Development of the „Hortus Siccus”.

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The value of the great Historic Herbaria of the World - among which the Classical Rijksherbarium at Leyden, founded by BLUME, occupies a position of the first importance - seems scarcely to need emphasis in these days, when Botanists, working along so many different lines, find the collections stored in them so essential for the prosecution of their researches.

When these collections were originally inaugurated they were intended to be mainly a „*Hortus siccus*”, a depository of dried specimens representing the vegetation of a particular country or continent. With the widening of outlook, however, the connection of the flora of one region with that of another came to be recognised, and in the larger centres of botanical activity a Herbarium was gradually built up containing, as far as might be possible, collections representative of the vegetation of the world. With the aid of these collections the great „Florae” of the different regions of the World have been written, and from Holland, as from other countries, have emanated many early works of great importance to the Systematic Botanist and to the student of Plant Geography. Without these authentic records, as exemplified by the specimens which are the types of the scientific descriptions, the work of the Taxonomist would be of as little value as would be that of the Historian without the tabulated evidence contained in the actual historical documents.

Untill the latter part of the last century, botanists were fairly content with the collections that were being built up and they described new species from specimens, often only single individuals, which were being brought from all parts of the world. This careful documentation of the evidence was necessary and must still largely be followed when dealing with those regions, whose vegetation is but little known, and where exploration and critical collecting is a matter of considerable difficulty. With those regions however, where opportunities for intensive botanical study are easy and where scientific progress has made great progress, it is being realised that the functions of the Herbarium should be greatly extended, in order that it may serve, as fully as may be possible, modern needs both in the directions of pure and of applied botany.

The more perfect the records, the more possible it is to build securely upon them, and in order to illustrate this truism from the point of view of the Botanist, it is proposed to say something of the importance of herbarium records in such comparatively modern developments as the study of Genetics, Hybridisation and Ecology, as well as in those many questions of applied botany, where success depends upon exact identification.

There has been a tendency among those pursuing genetical studies to alienate themselves from the systematists, and as a result it has not always been considered necessary to preserve for future reference specimens of the plants with which they have commenced their experiments, nor have specimens of the first and other crosses been kept as permanent records, which in course of time renders impossible any reference to the past history of some newly-produced form.

It is now fortunately being appreciated that it is not possible for the geneticist to test the results of a fellow worker, or to keep a full record of his own work, unless he can be sure of the determination of the plant whose hereditary constitution was the subject of the research.

Comparisons have to be made between old and new material, for which purpose specimens must be kept in order that the phenotypic character and the combination of characters can be referred to. For a genetical institution, therefore, a herbarium is a necessity for the preservation of the original parents and their offspring, for it is possible that in the course of the research, reference may have to be made to some of the earlier results in order to look for points, which were overlooked and considered unimportant at the time, but which prove in the course of the work to be of particular significance.

This applies particularly to the geneticist and also to the ecologist, for when working with the living plants the investigator may be overwhelmed with the pressure of work in recording his observations and results; but with the preserved specimens set aside for future reference, accompanied by careful notes, errors can be detected and conclusions verified, after the living specimens have been dispensed with, and, when work in the field or breeding ground is no longer pressing, time permits of fuller descriptions being drawn up.

The value of such a well-ordered collection for demonstration purposes scarcely needs mention, for the specimens are always available for reference when the research has been completed.

The increasing recognition of the occurrence of Hybridism among plants demands equally that increasing attention must be paid to this subject in our herbaria. Illustrations can be drawn from the Floras of Great Britain and Europe, New Zealand and South Africa, where Dr. LOTSY has shed so much light on many puzzling botanical problems, and elsewhere.

In New Zealand, seventeen years ago, five hybrids only had been recorded, but now no less than 290 groups of wild hybrids are known, thanks to the labours of Dr. L. COCKAYNE and the other New Zealand Botanists he has inspired. In the

past any specimen differing from the recognised type of a species was considered as a variety, or described as a new species; but now with the recognition of the occurrence of the amazing number of hybrids in the Dominion, many so-called species are found to be of hybrid origin, showing relations more or less closely to one or other of the parents. For the proper elucidation of the complex nature of these „hybrid swarms“ ample preserved specimens are essential, and it is highly desirable that they should be kept in a special herbarium reserved entirely for the purpose.

In the case of hybrids, however, work in the Herbarium must be supplemented by careful study in the field, for however full the notes accompanying the specimens may be, it is essential to study the living plants in their environment, since many important points are frequently lost sight of in the dried specimens. To cite a case in point, the New Zealand flora exhibits a remarkable series of hybrids in the genus *Gaultheria* (*Ericaceae*). In some of the species and hybrids the calyx becomes fleshy as the fruit ripens, while in others it remains dry. In another species, in addition to the fleshy calyx, the fruit itself is a fleshy berry, and hybrids with this species tend to show a fleshiness in the fruit. Examination of dried specimens, however, fails to reveal these important characters with any clearness and careful studies of the living plants must be carried out, if the problems involved with the recognition of hybridity in the wild state are to be satisfactorily elucidated.

Moreover, in order definitely to prove that the supposed hybrids are the result of the crossing of two given species, it is necessary to carry out experiments in the field with the object of producing by hand pollination, under controlled conditions, similar offspring to those met with in the wild state. These modern tendencies not only bring the Herbarium botanist or taxonomist into closer relation with the workers on the living plant, but fortunately also indicate the desirability of the systematist supplement in his researches in the Herbarium by experimental work and by the prosecution of his studies in the open field. Every encouragement therefore should be given to the Systematist to travel and to visit the areas, whether it be New Zealand, South Africa or nearer home, where the wild hybrids which he has been studying are to be found, or which may afford opportunities of carrying out some further investigations on Ecological lines, for which line of study, research in the field is so essential.

No better application of funds, available for herbarium researchwork, can be made than by allocating a certain proportion of them for the purpose of enabling members of the staff to pay visits overseas, in order that they may study the actual plants and their associations in their native habitats, and so bring to bear on the many problems that are presented, the store of knowledge which they have acquired by detailed critical work in the Herbarium and Laboratory.

With regard to applied botany, the need of Herbaria with carefully annotated specimens is of paramount importance. It is well known that such plants of economic importance as those yielding Cinchona, Camphor, Rubber and New Zealand flax,

to cite a few examples, show considerable 'variation' and that one particular form may yield the desired product in greater abundance than does another, or again, one variety may be especially suitable for a given soil or climate. Reference to a Herbarium, in order to ensure that the desired form has been obtained before any commercial venture is commenced, is therefore, most necessary. If greater attention had been paid to the importance of ensuring that the plant or variety selected for plantation purposes was the correct one for the required purpose, much disappointment and financial loss might have been avoided.

The association of a Herbarium with a Botanic Garden has always been considered to be the ideal arrangement for with the aid of the Herbarium, the correct naming of the plants under cultivation in the Gardens can thereby be assured. The Garden also is a valuable adjunct for the systematist, as he is able to study, as living objects, the plants with which he is familiar as pressed specimens in the Herbarium, thus making his studies more vivid and giving him a more lively interest in his work.

With the more recent developments of botanical work however, the need and importance of the Garden to the Herbarium is being recognised more fully by the taxonomist, instead of as in the past the Herbarium being regarded as an asset for the garden.

It is now found essential not only to name the plants accurately, but to study the behaviour of certain genera or groups of species under varying conditions of soil, humidity, altitude, etc., and for these purposes, cultivation under controlled conditions is of great importance. To allow of such a broadening of the basis of the work of the ecologist and systematist, it is very desirable to establish an experimental garden in connection with the Herbarium, where individual plants can be studied under definite conditions, and where genetical experiments can be conducted as it is only by such means that questions of supposed varietal forms, which may be merely due to environment or which may prove to be due to hybridisation, can properly be investigated and solved.

It may therefore be stated that the cultivation of the plants which may be under investigation in the Herbarium, and their preservation in special cabinets, separate from the general collection, for the furtherance of the modern developments in the directions of Ecology, Hybridisation and Genetics, is the direction which will render our Herbaria of increasing importance for the progress of botanical research.