Zeitschrift: Boissiera : mémoires de botanique systématique
Herausgeber: Conservatoire et Jardin Botaniques de la Ville de Genève
Band: 14 (1968)

Artikel: The botanic garden as an experimental station : from the collector to the horticulturist
Autor: Fletcher, H.R.
DOI: https://doi.org/10.5169/seals-895615

Boissiera 14: 57-64. 1969.

The botanic garden as an experimental station; from the collector to the horticulturist

H. R. FLETCHER

I'm afraid that I find myself in the very embarrassing position of not believing in the subject I've been asked to speak about. I admit, of course, that vast numbers of new plants, introduced by plant collectors, have first gradually been habituated or enured to a new and unnatural environment in botanic gardens and then have been distributed to horticulturists through the medium of botanic gardens, but I cannot admit that this fact entitled botanic gardens to be called experimental stations. If one accepts that what is commonly called the acclimatisation of plants, or the phenotypic adaptation of plants to a new environment, is an experimental process, then one must accept the fact that botanic gardens have been, and still are, experimental stations. But is the process of phenotypic adaptation really an experimental one ? In an endeavour to convince you that it is not, let me discuss for a moment the way in which so many Sino-Himalayan plants for instance–for these are the plants with which I am most familiar–have been acclimatised during the first half of this century.

During the last 20 years or so of last century, considerable amounts of seeds were sent to some European botanic gardens, from western China, by the French missionaries Delavay, Soulié, David, Farges. The seeds were sown in the usual fashion in the usual composts and if, and when, they germinated, the young plants were given hot-house treatment–and most of them promptly died. There was no experimentation involved; the gardeners simply treated the seeds and seedlings as they were accustomed to treating seeds and seedlings, and as they thought best. During the first half of this century pounds and pounds of seeds from the Sino-Himalaya were sent to botanic gardens in Britain–mostly to Kew and to Edinburgh–by E. H. Wilson, G. Forrest, F. Kingdon-Ward, R. Farrer, J. Rock, G. Sherriff, F. Ludlow, George Taylor, and others. Some of the seed was sown in botanic gardens and some of it distributed from botanic gardens to private gardeners and nurserymen–and sown by them. As far as I am aware, certainly in botanic gardens, no deliberately planned experimental work on the germination of all this seed was undertaken, experimental work of the like of the recent work at the Jodrell Laboratory at Kew on the germination of *Primula* seeds. For the most part standardised plants growing media were used; as far as I know, there was no attempt to vary the growing media to suit the requirements of different plants. There is of course the notable exception of the composts which were developed

at the John Innes Horticultural Institution, at the University of California, and at Cornell; but these institutions are concerned with horticultural research and are not botanic gardens. Whether it is desirable to subject thousands and thousands of plant species, which are far more individual in their requirements than are human beings, to the regime of a few standard composts, is a debatable matter. It seems to me that, in spite of the work at the John Innes and elsewhere, there is still abundant scope for experimental work on potting composts. But to return to the Sino-Himalayan seeds of the first half of this century.

Profiting from the mistakes of the early sendings of the French missionaries, if and when the seeds germinated, the seedlings were given cooler conditions, and thousands of young plants were raised. The collectors warned the botanic gardens and horticulturists that, as a general rule, plants raised from seeds gathered from below 9-10,000 ft. altitude in the Sino-Himalaya would either be doubtfully hardy or very tender and would require glasshouse conditions, whilst plants raised from seeds gathered from above 11-12,000 ft. altitude would no doubt be hardy and could be planted out of doors. Acting accordingly, horticulturists and gardeners did as they thought best; plants grown from seeds collected from above 11-12,000 ft. altitude were planted out of doors, sometimes in different parts of the garden. Sometimes the plants lived, and sometimes they died. Precious little comparative experimentation was involved. If the gardener happened to be lucky and hit the right conditions for the plant concerned, or if the botanic garden was situated in the appropriate climatic area, the plant lived. If the gardener was unlucky in his siting of the plant in the garden, or if the garden was in the wrong climatic area, the plant died. Surely has not our knowledge of what is called acclimatisation been thus empirically learned; learned as it were by trial and error, and not by experimental methods ? Has not acclimatisation been on the level of crude trial rather than on any precise experimentation ?

Surely from this point of view botanic gardens are in no wise different from private gardens, no matter how small, or from the plant nursery. If a botanic garden is an experimental station because it acclimatises plants, then so is the smallest private garden which is only a garden because the owner has habituated certain plants in a certain area of ground in a certain environment. Thus if all gardens are experimental because they acclimatise plants, I see little point in staking the claims of botanic gardens as experimental stations. But I cannot agree that all gardens, by their very nature, are experimental.

I am quite convinced that today, apart from certain experimental stations and certain plant nurseries, where the monoculture of a certain few plants is practised, the growing of plants is more of an art than of a science—and thus it has always been. In the past the best gardeners, or growers of plants in a particular environment, on the whole have not been scientists indoctrinated in scientific method. They have been men and women with a great love for plants and with an inborn feeling for the cultural and ecological requirements of a particular plant. It is the same today. I am not aware of many scientists trained in experimental methods having made their mark in the gardening world. But I am aware of many marvellous gardeners who have never received any training in experimental methods.

Today, I suppose that plant propagation may justifiably be said to be governed by some sort of experimental or scientific method. But this was not the case in the past. The best propagators were not trained in experimentation. Many

of them obtained spectacular results not because of some known scientific method but because they had an uncanny feeling or intuition of a plant's demands or of the demands of a particular plant organ. In the first half of this century, in the Edinburgh Botanic Garden, there was a propagator whose results were so spectacular that the professor of botany in the University of Belfast described them as "botanical wizardry". This man, Lawrence Baxter Stewart, was well known to my friend Sir George Taylor, and Sir George can tell you how far removed Stewart was from being a scientific minded worker, conscious of applying a planned experimental approach to his work. He had a very simple approach to his work, which was, as he himself said, "Know your plants and be able to go up to them and say 'Good morning so and so' ". Moreover, all Stewart's fingers were green, and by trial and error, and keen intuition, he discovered the means of propagating a vast number of plants from cuttings–and the time of year to do this. The same can also be said of those marvellous cultivators employed in the last half of last century, and the early years of the present century, by firms with world wide reputations such as the House of Veitch in Britain, Vilmorin, and Chenault in France, Späth, and Hesse in Germany, and others. Their common sense told them that the fundamentals of propagating plants from cuttings consisted in maintaining an adequate water supply in the cutting until it is able to absorb for itself, in applying stimulae to encourage the development of the new water-absorbing organs and to promote the development of the shoot, and in securing adequate temperature and aeration at the rooting end of the cutting. By processes of trial and error they met these requirements. Only in more recent years has experimentation been done on the precise control of growing conditions and such work in the main has not been done in botanic gardens but in horticultural experiment stations. That there is scope for such work in botanic gardens is very clear from the work which is now being carried out by the physiologists of the Jodrell Laboratory at Kew, who are working on various aspects of orchid culture.

Thus my contention is, that, from the point of view of the horticulturist, apart from a few isolated instances, botanic gardens have not been experimental stations at all. They have been test or trial gardens (they have also been much else of course) where first native plants and then plants introduced from overseas were tested and tried in a new environment and some finally acclimatised. Of course vast quantities of the plant material so acclimatised have been distributed by botanic gardens to the horticulturist. I need hardly remind you of the part played by the greatest Botanic Garden of all–Kew–in this regard, since the days of Sir Joseph Banks; I need hardly remind you of the part played in this regard by the Royal Botanic Garden, Edinburgh, during the first half of this century; nor of the part played in this regard by the Arnold Arboretum; these are but three instances from many.

On the other hand, other institutions, and people, have gone much further than botanic gardens; they have gone much further than the acclimatisation and the distribution of the plants raised from the plant collectors' seeds; some in fact–some nurseries, some private individuals–from the introduced material distributed to them from botanic gardens, have developed new material, by experimental hybridisation and other means, new material which has increased enormously the range of plants available to the horticulturist.

In the field of ornamental horticulture, has any botanic garden played a significant role in the development of a single major group of plants, a role even

remotely comparable to that played by the enterprising nursery or private individual ? In fact, has such a role ever been considered to be the function of a botanic garden ?

Has any botanic garden played a role comparable to that played by nurserymen and private gardeners in the development of the rhododendron, probably the second most popular group of woody plants of this century ? The American rhododendron species were in cultivation in Britain and Europe in the first half of the last century. In the middle of the last century, Kew, through Sir Joseph Hooker, gave to the horticulturists of Britain and Europe much of the rhododendron richness of the Himalaya. In the first thirty years of the present century, the Royal Botanic Garden, Edinburgh, through George Forrest and others, and the Arnold Arboretum through E. H. Wilson and J. Rock, gave to the horticultural world many of the rhododendron riches of SW China. But neither Kew, nor Edinburgh, nor the Arnold Arboretum did much more than try to cultivate and to distribute the material. It was left to a few nurseries and private individuals in Britain, Europe and America to grow this material and from it to breed thousands of new hybrids which have transformed the face of thousands of gardens.

Has any botanic garden played a role comparable with that played by nurserymen and private gardeners in the development of the rose, undoubtedly the most popular horticultural group of woody plants ? It wasn't botanic gardens which developed the Hybrid Tea Roses, and the Hybrid Polyantha Roses, and the Floribundas and the Grandifloras. Has any botanic garden played a role in the development of the modern lily comparable to that played by others ? It was not the botanic gardens which produced the present day lily hybrids which have transformed lily culture throughout the world. It was the enterprising gardener or nurseryman and the horticultural research establishment. It was not a botanic garden which raised the first orchid hybrid and thus set the scene for the raising of many many thousands of orchid hybrids; it was a plain, straightforward but highly intelligent gardener employed by the firm of Messrs. Veitch-John Dominy, who crossed *Calanthe masuca* with the pollen of *C. furcata* and raised *C.* × *dominii* in 1854. It was not a botanic garden which raised the first gladiolus hybrid about 1823–*Gladiolus* × *colvillii*–the forerunner of a race of early flowering gladioli which are now grouped under the name of Nanus hybrids; it was the nurseryman Colvill. It was not a botanic garden which raised *Gladiolus* × *gandavensis,* the first gladiolus of a larger flowered type, but the nurseryman Van Houtte in 1841. It was not a botanic garden which first hybridised the scarlet and yellow flowered South African *Gladiolus psittacinus*–but a young working gardener James Kelway. It is not the botanic gardens which have developed the modern tuberous *Begonia, Delphinium, Aster, Lupinus, Cyclamen, Polianthes, Phlox,* bearded *Iris, Hemerocallis,* sweet pea, carnation, daffodil, all the cultivars of *Primula malacoides, Primula sinensis,* and *Primula obconica* (in this connection it is as well to remember that the original F_1 diploid *Primula* × *kewensis* arose spontaneously, at Kew). No ! It is not the botanic gardens which have raised these new plants. They have been raised by the experimentally minded individual working either in a private capacity or employed by an enterprising nurseryman. It is they–and not the botanic gardens–who have performed the necessary hybridisation and selection responsible for the development of so many groups of plants popular today. It is they who have developed the material introduced by the collector and who have so enormously increased the range of plant material available to the horticulturist.

It has not been for lack of the necessary material in botanic gardens that such hybridisation and selection work has not been undertaken. The genetic material on which modern groups have been based has been present in the great gene pool which every botanic garden is or should be. But botanic gardens have been content simply to cultivate this material and not to use it for the experimental breeding of new types. At this point it is not inappropriate to point out the enormous scope in botanic gardens for the experimental breeding of new plants–if only the staff and facilities and the interest were available. Take the rose, for instance. Of the many rose species which are in cultivation in botanic gardens today, only 6 or 8 have gone into the genetic constitution of modern roses. The cytology of garden roses is now pretty well known and man now can juggle almost at will with the elements of heredity. If the botanic gardens were to incorporate into today's roses the blood of more of the rose species they cultivate, there is no telling what remarkable results would accrue. Certainly one result would be that botanic gardens would justify the title of experimental gardens or stations !

Of course it is not difficult to understand why botanic gardens, with the necessary gene pools at their disposal, have not played a major role in experimental hybridisation and in the development of new plants for the horticulturist. Most botanic gardens have to function on very limited finances and therefore on very limited gardening staffs. Moreover, for the most part, the area of land botanic gardens occupy also is very limited and usually is chock-full with plants both under glass and out of doors. Usually there is absolutely no accommodation available for the growing of thousands and thousands of hybrid seedlings which must be brought to the flowering stage. Botanic gardens simply have not had the necessary resources of money, staff and accomodation to permit of the utilisation of the plants they cultivate for such experimental purposes as hybridisation and the raising of new horticultural plants. And botanic gardens still do not have the necessary resources of money, staff and accomodation, for these purposes.

And neither have the botanic gardens had the scientific staff interested in this kind of work. Most botanic gardens have had greater complements of scientific staff, working minaly in the herbarium, than of skilled gardening or horticultural staff. The scientific staff has been interested mainly in orthodox herbarium taxonomy and not in the plants cultivated in the garden; in fact it has been indecent, almost, for the taxonomist even to touch a cultivated plant. Even today few herbarium taxonomists are horticulturists–or even good gardeners. And even today when the field of taxonomy has widened enormously and when many botanic gardens have attached to them, not only herbaria, but laboratories as well–with cytologists, geneticists, physiologists and chemists working in them–the experimental studies being undertaken are directed in the main towards fundamental investigations into evolution, cytogenetics and physiology rather than towards the production of new cultivars of ornamental plants for the horticulturist.

And so, I think we must face up to the fact that botanic gardens have not carried out extensive genetic manipulation of their materials to produce, for the horticulturist. "tailor-made" plants the like of the strains of grasses, cereals, and vegetables developed by the plant breeding stations, which are, in the true sense of the word, experimental stations. There are of course exceptions such as the breeding of red, orange and yellow *Delphinium* in Wageningen and the breeding of new *Viburnum, Lagerstroemia, Pyracantha* and *Hibiscus*, at the National Arboretum, Washington. And no doubt there are other exceptions. But as far as I know the

exceptions are few. The exceptions do show, however, that such work legitimately can be undertaken in botanic gardens. In case there should be any doubt about this it is just as well to remember that Gregor Mendel's labours took place in the monastic garden—a botanic garden—at Brünn, and that Bateson's early work on plant genetics was done in the Cambridge Botanic Garden.

If then the horticulturist really needs new ornamental plants, botanic garden experimentation could well be the means of supplying them in the future. In fact it is not so easy to see which other institutions will supply them. Certainly those who have supplied them in the past in large measure are no longer able to do so. Today, where woody plants at any rate are concerned, the large private gardens which have contributed so much new ornamental woody material in the past, no longer have the financial and man-power resources to undertake such work. Establishments which once employed forty gardeners are now fortunate if they can employ four. And again, due to the economic climate, the enlightened and enterprising nurseries which once on a day carried large stocks of a very wide range of plant material, much of it bred by themselves, now find that the small private gardener—the nurseries' best customer—makes little or no demands on this wide range of material but is content to rely on a few popular plants. Such nurseries to be economically viable now are having to grow more and more of fewer and fewer items. Never again will they be able to undertake the role they played at the beginning of the century in raising their own particular specialities. I know that it may be argued that there is no reason why they should do this, now that horticultural experimental stations have sprung up—all over the northern hemisphere at any rate. But few such stations are geared to ornamental amenity horticulture-they are almost entirely concerned with the commercial aspects of plants.

Therefore, as I see the problem, if the horticulturist really needs new ornamental plants, and if the botanic gardens are to supply them, there must needs be a radical re-orientation of thinking in regard to the functions of botanic gardens as they are at present conceived. Moreover, there must needs be considerable increases in staff, both horticultural and scientific, as well as considerable increases in finance and in glasshouse and other accomodation. Whether the utilisation of such additional resources for the production of new ornamental plants is necessary, or even desirable, in the present economic state of the world, is, of course, a matter for debate.

I have confined myself to the collector and the horticulturist and to ornamental plants because it is almost entirely such plants which the collector has sent to botanic gardens and which these gardens have distributed to the horticulturist (I am not unmindful of the part played by Kew in the distribution of other plants of an economic nature). And I am afraid that I have spoken for far too long on a matter in which, as I said at the start, I have little belief. Of course I am deeply aware of the fact that it may be argued that it is not belief that I lack, but knowledge; lack of knowledge of the experimental work which has been done in botanic gardens from the particular point of view of this talk. If this really be the case then I submit that the fault is not entirely mine; the fault is partly that of botanic gardens who have utterly failed, and still utterly fail, to intercommunicate with each other on almost every other matter save the exchange of seeds. It is my experience that the directors of botanic gardens fail lamentably in informing one another of the nature of their scientific work. At the present time the Secretary of the International Association of Botanic Gardens, and I, are

endeavouring to incorporate such information in a new edition of the International Directory of Botanic Gardens, and I am sorry to say that on the whole we have met with most disappointing results.

I have confessed to my belief that, in the future, there is great scope for experimental work in botanic gardens for the benefit of the horticulturist, when once some new thinking has been done on the functions of botanic gardens. But it will take a very great deal of new thinking before a phytotron is as common a botanic garden structure as is a glasshouse.

DISCUSSION

Hylander:

I think it is perhaps the most important of all functions of botanic gardens to keep the seed and plant material imported from natural habitats in an uncontaminated state, and also in some cases to preserve old graden plants, perennial or annual. We have many examples of such old plants which were grown for a very long time in European Gardens and are now impossible to get again. We have also many examples of fine wild species, e.g. perennial gentians and many other Himalayan of Chinese plants, which have been growing in botanic gardens and have hybridized there, so that we have lost that material on which the future should build for making new good varieties. I think that is much more important a function for a botanic garden than to rise new varieties.

Fletcher:

I agree entirely with what Dr. Hylander says, but I had to talk about the botanic garden as an "experimental station".

Stafleu:

I think that Prof. Fletcher in the second part of his new "Directory of Botanic Gardens" is listing exactly those collections which Dr. Hylander has in mind. It was indeed a little disappointing to find how few botanic gardens have such collections of "pure species", if I may use that ambiguous term.

Heine:

There is the famous example of a botanist who was working here at Geneva under Augustin-Pyramus de Candolle, who became one of the men who strongly marked the botanical research of the 19th century—and actually last year, as for

the Botanic Garden of Geneva, was his 150th anniversary. It is Carl Wilhelm von Nägeli who made his thesis here in 1839, as a very young man, on a subject which was to some extent "genetic" (as we would call it nowadays): "Die Cirsien der Schweiz" (1840). It was the first time that taxonomical research on hybrids was judged of sufficient scientific importance to be treated in a thesis. Later on Nägeli carried out experimental work on *Hieracium* (he eventually produced a monograph of sect. *Pilosella*). His interest in *Compositae,* particularly in ideas of hybridization, dates from his contacts with Geneva and from his work under Augustin-Pyramus de Candolle. At the Munich Botanic Garden, where he was appointed in 1857, he had an enormous collection of *Hieracium* which he used to collect during his holidays in Switzerland and other parts of Europe. Here we have an early example of the use of a botanic garden as an experimental station.

Fletcher:

I am not aware of many horticulturists being interested in *Hieracium.*

Stafleu:

Once one dives into history, I think it would be possible to give Dr. Fletcher a little encouragement, because there certainly have been more cases of experimental work in botanic gardens. Another example, even of horticultural interest, are species of *Nicotiana* on which Koelreuter did some interesting experiments. Of course it was really mainly horticulture Dr. Fletcher was aiming at. There are many more examples of scientific experiments.

Oliver:

I would like to draw attention to the work being done in the horticultural line by the National Botanic Garden, Kirstenbosch, at Cape Town. Some of the members here have visited these gardens and know that they are devoted entirely to the propagation and conservation of the indigenous flora. Much is being done to bring local species into general horticulture and to publicize the growing of local species. Similarly South African species are being distributed to botanic gardens throughout the world. Notable among these has been the recent introduction to horticulture of the composite *Ursinia geyeri.* Nothing is being done, however, with interspecific hybridization, as the species themselves are sufficiently good as horticultural subjects.

Adresse de l'auteur: Dr H. R. Fletcher, Royal Botanic Garden, Edinburgh 4 (Grande-Bretagne).