

A third source of new plants has been the plant breeder. In the area of ornamental horticulture we have perhaps lagged behind other areas of horticulture and agronomy with the exception of certain plant groups such as iris, roses, rhodendrons, camellias and others.

These three sources of new plants, plant exploration, chance variation, and breeding will continue to be the ways in which we enrich our plant palette, but in new and exciting ways. Our speakers will now tell us of some of them.

MODERATOR LEISER. David Paterson, from Longwood Gardens, Kennett Square, Pennsylvania, will now start our symposium, speaking on plant exploration. David Paterson:

PLANT EXPLORATION

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If anyone had doubts as to the importance of the plant explorer to ornamental horticulture, a careful reading of the catalogs of nurseries, seed houses, and house plant growers would quickly dispel them. It is obvious that without their valuable work in introducing trees, shrubs, and flowering and foliage plants from all over the world, there would be no ornamental horticulture as we know it.

People have been bringing plants from one part of the world to another since the earliest days of civilization. The earliest recorded expedition specifically planned for plant hunting took place in 1495 BC before the establishment of Athens or Rome. Queen Hatshepsut of Egypt sent five ships to the Land of Punt (Somalia) to obtain living specimens of the tree which produces frankincense. Thirty-one living trees were brought back and established in the garden of the Temple of Amon at Thebes.

Sailors, soldiers, traders, and later missionaries and government officials often brought or sent home plants, both of economic and ornamental interest. Many of the explorers of the 17th and 18th centuries had naturalists accompany them on their adventures. Many collected specimens of animals, birds, and fish as well as plants. Sometimes the ships' doctor also carried on the naturalists' duties. In fact, often the botanical work was strictly an extra curricular

activity. One rather famous botanical explorer, William Dampier of England, engaged in piracy when not busy collecting plant specimens.

Although these gentlemen often collected quantities of seed and sometimes even live plant specimens, their main interests were scientific and their main contributions were to botany and to medicine.

It is the horticultural plant hunter, the man interested in introducing living plants to the garden, who interests us here. This is not to say that the distinction is easily made. Many of the botanical explorers sent in valuable plants, and the horticulturist prepared many herbarium specimens of scientific value.

The 18th, and particularly the 19th centuries (and the early decades of the 20th), were the halcyon days of the plant explorer. The invention of the Wardian Case in the 1830's alleviated the problem of shipping live plants, and the rates of survival became much more satisfactory. Prior to this invention the mortality rates had been astronomically high. One gentleman involved in shipping plants from China to England declared in 1819 "that 1,000 plants have been lost for one which survived the trip to England".

At any rate, from the late 1700's on, a vast array of brave and hardy men combed the world for plants to add to the beauty of the gardens of England, Europe, and America, and incidentally to add to the growth and well-being of the nursery industry. The adventures and hardships some of these men endured read like adventure fiction. Bodily injury, chase and capture by unfriendly natives, starvation, extreme loneliness were only a few of the hardships that these men were subjected to. Several died in the field, a few of them violently.

To recount fully the adventures of even one or two of these men would require much more time than could be allotted in a program such as this. However, it might be interesting to you as propagators, who are so in debt to these adventurers and dedicated horticulturists for the wide selection of plants you now work with, to sketch very briefly the accomplishments of a few plant hunters. Since most of us work in commercial nurseries or botanical gardens or similar institutions, an attempt will be made to show the role played by such organizations.

Amateur gardeners, either as individuals or as members of syndicates have sponsored many fruitful plant hunting expeditions. Plant societies in both Britain and the United States have also been responsible for financing plant explorations.

Peter Collinson, a Quaker linen draper of London, imported many seeds and plants from the American colonies. One of his correspondents, perhaps tiring of this extra activity, recommended John Bartrum, a Quaker farmer, amateur physician, and self-taught botanist, of Philadelphia as "a person whose business it should be to gather seeds and send over plants". By approximately 1735 the two had

settled into a regular business arrangement. Bartrum sent over boxes containing 100 species of seeds, mostly trees. Collinson distributed these boxes to patrons for five guineas each. Ultimately, Bartrum had orders for about twenty boxes a year. His major contributions to British gardens were: *Magnolia acuminata*, *Chionanthus virginicus*, *Epigaea repens*, *Leucothoe racemosa*, *Rhododendron maximum*, *R. nudiflorum*, *Iris cristata*, *Phlox divaricata*, *P. maculata*, *P. subulata*, *Lilium superbum*, *L. philadelphicum*, and many more.

In 1823 the newly formed Horticultural Society of London hired David Douglas of Scone in Scotland to go to North America to find new plants. Douglas made several trips for the Horticultural Society and brought back many seeds, dried specimens, and living plants. The details of his experiences, hardships, and disappointments read like a 19th century soap opera with overtones of high adventure. He came to a violent death in Hawaii in 1834. In his short and tempestuous career he made valuable contributions as a plant collector, explorer, geographer, and alpinist. He is particularly remembered for the Douglas-fir and the sugar pine.

In 1843 the Royal Horticultural Society sent Robert Fortune to China at the standard rate paid for plant hunters, 100 pounds a year plus an expense allowance. Because of the difficulties of travel and the hostility of much of the population to Westerners, he never traveled more than 30 miles from any treaty port. However, he was an excellent organizer and made extensive collections. Most of the collection was done by Chinese "engaged at a small daily remuneration." Included in the list of plants collected during this and later trips are: *Weigela*, *Deutzia scabra*, *Jasminum nudiflorum*, *Forsythia viridissima*, *Ilex cornuta*, *Lonicera fragrantissima*, *Viburnum dilitatum*, *Dicentra spectabilis*, and the amoena azalea.

Undoubtedly, one of the most important collectors was George Forrest, like Fortune, a Scot.

In 1904 Forrest traveled by way of Burma to Yunnan, which was to be his headquarters for 28 years. During this first journey he established the procedures he followed in all his subsequent explorations. He chose an area, established the best methods of collecting, trained a large and competent staff, established friendly relations with the Chinese, and combed the area for plants. On this trip he found among a number of valuable primulas: *P. bulleyana*, named for his principal backer; *P. beesiana*; *P. forrestii*; and *P. littonii*.

Forrest was interested in collecting plants for the specialist, the rock gardener, alpine enthusiast, and the gardener interested in primulas, rhododendrons, and the like.

In 1915 the Rhododendron Society was formed. Forrest made all his subsequent journeys with this society as the chief backer. He was offered a bonus for each new species he introduced. He made more

than 5,000 collections of rhododendrons and introduced so many new kinds that the whole genus had to be revised. Besides the introduction of rhododendrons, he will be remembered for *Camellia salvensis*, *C. cuspidata*, and the single form of *C. reticulata*, *Meconopsis* spp., *Lilium* spp. *Primula malacoides*, *Abies forrestii*, and *Malus yunnanensis*.

A great many nurseries have been involved in plant exploration. When one thinks of the contribution made by nurserymen to plant exploration, the name of Veitch immediately comes to mind. Let us just briefly mention one member of this famous family, several generations of which contributed personally to the collection of new and rare plants. John Gould Veitch was the great-grandson of the founder of the original firm at Exeter and the son of James Veitch who started the Chelsea Branch. Although he died at the early age of 31, his visit to Japan resulted in the introduction to Britain of such plants as *Lilium auratum*, *Magnolia stellata*, *Primula amoena*, *P. japonica*, *Ampelopsis veitchii* (now renamed *Parthenocissus*), *Cryptomeria japonica* 'Elegans', and *Juniperus rigida*.

In the 19th century the Veitch firm sent out such famous explorers as Charles Maries, who introduced *Daphne genkwa*, *Abies mariesi*, *Schizophragma hydrangeoides*, *Hamamelis mollis*, *Enkianthus campanulatus*, and *Viburnum plicatum* 'Mariesi'.

Others were sent to various parts of the world to bring back orchids, *Nepenthes* (tropical pitcher plants), and other exotics.

Perhaps the most famous of all plant explorers, Ernest Henry "Chinese" Wilson, got his first commission from Veitch's to find seed of the dove tree, *Davidia involucrata*.

One immediately thinks of botanic gardens and arboreta in connection with plant exploration. Let us examine briefly the contributions of a very few of the many men who collected for the Royal Botanic Garden at Kew and the Arnold Arboretum in Jamaica Plains, Mass.

Sir Joseph Banks, himself a botanical explorer on the famous voyages of Captain Cook, established a "mart and exchange of plants" at Kew. He trained many gardeners in the art of plant hunting and sent them to various parts of the world and distributed the resulting plants. Most were planted at Kew, but some went to botanic gardens in Jamaica, St. Vincent, and Ceylon. To name just one collector, Francis Masson collected twice in South Africa and on the Iberian peninsula, Madeira, the Canary Islands, the Azores, the West Indies, and finally in North America where he apparently froze to death in 1805. He introduced Cape heaths, Cape pelargoniums, the forerunners of the garden geranium, and several proteas and aloes.

In the mid-1800's Dr. Joseph Dalton Hooker made explorations to India and Sikkim undergoing many hardships and frustrations, some caused by terrain and weather, others by political situations. Together

with Dr. John Thomson, he collected and introduced many plants including species of *Primula* and *Meconopsis*. He found 43 species of rhododendron; *R. campylocarpum*, *R. ciliatam*, *R. cinnabarinum*, *R. falconeri*, *R. griffithianum*, *R. maddenii*, and *R. thomsonii* are just a sampling.

Arnold Arboretum. Dr. Charles Sprague Sargent made an important contribution to the Arnold Arboretum by his own plant explorations and introductions from Japan. He was particularly interested in trees and found many new species as *Malus sargentii* and *Prunus sargentii*; he became extremely interested in the flowering cherries of Japan and was later instrumental in introducing them to England and the United States. His introductions also include *Rhododendron schlippenbachii* (as a cultivated plant).

As has been mentioned earlier, Ernest Henry Wilson had collected plants in China for Veitch on two occasions. In 1906 he was invited by Professor Sargent to revisit China on behalf of the Arboretum and some private subscribers. This visit produced *Magnolia wilsonii*, *Lonicera nitida*, *Corylopsis willmottiae*, among many others. In 1909 he migrated to America and became a permanent member of the Arboretum staff and launched a new expedition in 1910.

The contribution he made to our plant lists is astounding. Imagine American nurseries without *Berberis candidula*, *B. gagnepainii*, *B. julianae*, *B. triacanthophora*, *B. verruculosa*, *Buddleia davidii*, 'Magnifica', *Buxus microphylla* var. *koreana*, *Cornus kousa* var. *chinensis*, *Cotoneaster apiculata*, *C. dammeri*, *C. salicifolia* var. *floccosa*, *Davidia involucrata*, *Evodia*, *Ilex pernyi*, *Juniperus conferta*, *Kolkwitzia amabilis*, *Malus theifera*, *Picea asperata*, *P. wilsonii*, *Pieris taiwanensis*, *Pyrus calleryana*, *Rhododendron ambiguum*, *R. discolor*, *R. keiskei*, Kurume azaleas, *R. williamsianum*, *Sarcococca hookeriana* var. *humilis*, *Stewartia koreana*, *Viburnum rhytidophyllum*. This is only a partial list, but enough to show how indebted we are to this famous plant collector. Mr. Wilson died in an automobile accident in 1930.

The United States government has been involved in plant introduction officially and unofficially since its early days. At one time the introduction of economic plants was a function of the Patent Office which sponsored one of Fortune's expeditions in 1854.

In 1898 the Section of Seed and Plant Introduction of the USDA was formed. David Fairchild was its director from 1903-1928. He was a prominent collector of economic plants, being responsible for the introduction of the soybean from Japan in 1898.

He hired Frank Meyer and Joseph Rock, two plant hunters who, although their primary purpose was the introduction of economic plants, did introduce many ornamentals. Meyer introduced *Aesculus chinensis*, *Rosa xanthina*, *Syringa meyeri*, *Juniperus squamata* 'Meyeri'. He was the first to find *Ginkgo biloba* growing in the wild, although it had long been known in cultivation.

Joseph Rock, an extremely versatile scholar and scientist, explored in Indochina, Taiwan, and Burma in addition to his work for the government. He also collected for the Arnold Arboretum and the Howard Museum of Comparative Zoology. He sent home nearly 500 species of rhododendrons. Many were not new introductions, but included many superior forms, not only important for their own sakes, but in hybridizing.

Frank Kingdon-Ward explored for plants for a nursery firm, private patrons and syndicates, and for the New York Botanical Garden. His journeys took him to Yunnan, Szechwan, Upper Burma, French Indochina, southeast Tibet, and in the Assam Himalaya, an area already explored by Hooker. Between 1909-1957 he introduced hundreds of species. He specialized on primulas and rhododendrons, but collected many other genera.

Plant exploration continues today. Since World War II many amateur growers and members of plant societies have been active in bringing in new plants.

Dr. Ira Nelson of the Louisiana Foundation for Horticultural Research made three trips to Latin America. His main interest was in plants for the deep south. Among his introductions was a yellow amaryllis from which a series of pastel colored flowers have been bred. He also introduced *Demerocostas uniflora* and *Passiflora coccinea*, the beautiful scarlet passion flower. His very promising and productive work was ended by a fatal automobile accident.

A professor and four graduate students from Wye College in England are raising money through subscription for an expedition to areas of Afghanistan that have never been explored. Though their main purpose is to collect herbarium specimens, they plan to send back bulbs, seeds, and succulent materials.

In 1956 the Longwood Gardens—USDA Plant Introduction Program was started for the introduction of ornamental plants. The restrictions imposed by Federal plant quarantine procedures, necessary as they are, and the difficulty encountered by individuals in getting cooperation from certain foreign governments, made this program seem worthwhile. Necessary negotiations are made through counterpart departments of the foreign governments and the United States, through the State Department.

The botanists and horticulturists involved have been either fulltime employees of the USDA or staff members of botanic gardens or other scientific institutions. These were on loan to the Plant Introduction Office and collected as collaborators or temporary employees of the USDA Agricultural Research Service. Longwood Gardens provides grants to maintain the plant explorers in the field.

Twelve explorations have been made. To —

Southern Japan	1956	by Dr. John Creech
Southern Europe	1957	by Dr. Fred Meyer
S. Brazil and Argentina	1958	by Dr. Llewelyn Williams
Australia	1958-1959	by Mr. George Spalding
Northern Europe	1959	by Dr. Meyer
Northern Japan	1960	by Dr. Creech
Nepal	1962	by Dr. Creech and Dr. Francis de Vos
Russia	1963	by Dr. Creech
Sikkim (West Bengal)	1964	by Dr. de Vos and Dr. Edward Corbett
Korea	1966	by Dr. Corbett and Dr. Richard Lighty
Taiwan	1967	by Dr. Creech
New Guinea	1969	by Dr. Harold Winters and Mr. Joseph Higgens

An exploration was planned for July, 1970, to collect plants in Siberia which would be appropriate to the Great Plains area of the U. S. and for re-vegetation of the "dust bowl" area. The trip was postponed until August 1. Just prior to that date the government of the U.S.S.R. again postponed it for a year. The reason given was that the Russian party Dr. Creech was to join had run into unusual drought conditions and collecting was impractical.

Every plant explorer likes to bring new and unknown plants into cultivation, and present plant hunters are bringing some in and will continue to do so for some time. An important goal of present and future plant explorations is often not clearly understood. That is the expansion of germ plasm pool of extant material for breeding for such characteristics as drought resistance, cold tolerance, good flowering and growing characteristics, and for disease resistance.

Many of our ornamental plants are descendants from one or a very few collections. Their future use could be much improved by breeding with similar plants collected from other latitudes or elevations.

Plant exploration has had an exciting and valuable history, has a viable present and a promising future.

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MODERATOR LEISER. Thank you very much, David. We, in the Department of Environmental Horticulture at U. C. Davis, are quite excited about the possibilities of bringing in more germ plasm, more variation. But once a new plant is introduced, the problem is to evaluate it and determine whether it is worthwhile, then get it into the trade. Perhaps those of us in educational institutions look at things quite a bit differently than nurserymen. Since there is a combined need for both plant evaluation and getting the plants into the trade, and since it is largely the nurserymen who will have to get the plant into the trade, they will have to do the plugging, advertising, and so on. Our next speaker, Bruce Briggs, is currently president of the Western Region and is vice-president-elect to the International organization. He will discuss the evaluation of new plant materials from the nurseryman's standpoint. Bruce.

EVALUATION OF NEW PLANTS

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In man's continuing search for new plants, there is an increasing need for more selective evaluation. There is no special merit in "newness" alone. Sometimes, we rather need a "new" look and evaluation of an "old" plant. Our greater mobility today now allows us to evaluate first hand the plant materials of other areas, to bring some back to adapt from other climates, and sometimes to discover improved variations within the species and new cultivars. Improved cultural practices and laboratory facilities give us greater controls over our immediate environment, so that new plant introductions can now take a course and a direction. We can work more directly toward selecting, shaping and breeding the plants required to fill the predicted needs.

As plantsmen, propagators and nurserymen, I feel that we have a special obligation to evaluate the "growing" as well as the "aesthetic" aspects of these new plants. As a practicing nurseryman, I consider the basic concerns are: 1) that the plant is capable of being propagated and grown commercially, and 2) that the plant has good sales appeal and potential market demand.¹

¹Ed. Note: Mr. Briggs showed a number of excellent colored slides of plant materials to illustrate these points.