

THIS THESIS MAY BE KEPT FOR  
ONE (1) MONTH UPON RECEIPT

*Land Program*

-----  
RETURN TO: COORDINATOR  
LONGWOOD GRADUATE PROGRAM  
153 TOWNSEND HALL  
UNIVERSITY OF DELAWARE  
NEWARK, DE 19717-1303

INSURE FOR: \$50.00

A HISTORY: THE U.S.D.A.-LONGWOOD ORNAMENTAL  
PLANT EXPLORATION PROGRAM

BY

Eric Nathan Tschanz

A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Master of Science in Ornamental Horticulture.

June, 1977

Copyright Eric Nathan Tschanz 1977

A HISTORY: THE U.S.D.A.-LONGWOOD ORNAMENTAL  
PLANT EXPLORATION PROGRAM

BY

Eric Nathan Tschanz

Approved: \_\_\_\_\_  
Dr. Russell J. Seibert  
Professor in charge of thesis on behalf of the  
Advisory Committee

Approved: \_\_\_\_\_  
Dr. Richard W. Lighty  
Coordinator, Longwood Program in Ornamental  
Horticulture

Approved: \_\_\_\_\_  
Dean of the College of Graduate Studies

## ACKNOWLEDGEMENTS

The author would like to thank the Longwood Program in Ornamental Horticulture for the graduate fellowship which has made the preparation of this thesis possible. I appreciate the cooperation I have received from the staff of Longwood Gardens and the U.S.D.A. I would also like to thank Margaret Hassert of the University of Delaware Writing Center for her help in editing the manuscript.

I am especially grateful to the members of my thesis committee, Dr. Donald Huttleston, Dr. Richard Lighty, and Dr. Russell Seibert, whose guidance and criticisms have improved this work.

Lastly, a special note of thanks to my wife, Deborah, for her typing, patience, and support.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS . . . . .	iii
ABSTRACT . . . . .	vi
INTRODUCTION . . . . .	1
CHAPTER	
I.    THE DEVELOPMENT OF GOVERNMENT-SPONSORED PLANT INTRODUCTION AND EXPLORATION . . . . .	2
History . . . . .	2
II.   THE U.S.D.A.-LONGWOOD ORNAMENTAL PLANT EXPLORATION PROGRAM . . . . .	6
The Necessity for a Joint Program . . . . .	6
The Origin of the Program . . . . .	8
The Program's Goals . . . . .	11
Interactions Between the Agencies . . . . .	12
The Mechanics of the Program . . . . .	15
Evaluation and Distribution . . . . .	22
Breeding and Research . . . . .	28
III.  THE EXPLORATIONS . . . . .	33
Southern Japan - 1956 . . . . .	33
Western Europe - 1957 . . . . .	35
Southern Brazil and Argentina - 1958 . . . . .	36
Australia - 1958-1959 . . . . .	37
Northern Europe - 1959 . . . . .	38
Northern Japan - 1961 . . . . .	39
Nepal - 1962 . . . . .	41
Russia - 1963 . . . . .	42
Sikkim (West Bengal) - 1965 . . . . .	44
South Korea - 1966 . . . . .	45
Taiwan - 1967-1968 . . . . .	47
New Guinea - 1970 . . . . .	48
Russia - 1971 . . . . .	49
IV.  RESULTS OF THE PROGRAM . . . . .	51

V. SUGGESTIONS . . . . .	55
FOOTNOTES . . . . .	62
APPENDIX . . . . .	77

## ABSTRACT

Our gardens contain many exotic plants imported in a variety of ways. The earliest ornamental plant exchanges resulted from the efforts of private individuals; John Bartram, Benjamin Franklin, and others, in the 1700s. The passage of the Treasury Circular Act of 1827, although offering no financial assistance, was the first governmental recognition of the importance of plant importation. Next, with the establishment of the United States Department of Agriculture (U.S.D.A.) in 1862, the government became active in seed and plant procurement and distribution. Later, during the early 1900s, plant exploration reached its peak with the legendary work of explorers such as Ernest H. Wilson, David G. Fairchild, and Frank N. Meyer. During the Depression and World War II interest and support waned and ornamental plant exploration came to a standstill, but in 1956 foreign plant exploration for ornamentals was revived with the establishment of the U.S.D.A.-Longwood Ornamental Plant Exploration Program.

Longwood Gardens, Inc., entered into an agreement with the Agricultural Research Service of the U.S.D.A. for the purpose of ornamental plant exploration in foreign countries. The cooperative contract described the arrangement between the two agencies: Longwood was to provide funds for the exploration, and the U.S.D.A. was to furnish the facilities and manpower for quarantine, propagation, evaluation and distribution, and associated scientific programs.

According to the agreement, the major goal of the program was to introduce new plants "which will have potential value to the future of ornamental horticulture. . ." This was accomplished by exploring in regions previously unexplored, by collecting plants for possible use in breeding programs, and by collecting plants from wild or cultivated sources for introduction directly into the field.

Before the plants could be released to the horticultural trade, there were procedures that had to be completed by the U.S.D.A. First, after the plants entered the country, they had to be processed through inspection

centers. Next, during quarantine, they were propagated and increased in numbers. Finally, they were evaluated and distributed by both Longwood and the U.S.D.A. to botanic gardens, arboreta, nurserymen, and agricultural stations for further evaluation before final release to the horticultural public.

From 1956 to 1970, as a part of this program thirteen explorations were made of various regions of the world, including the South Seas, the Far East, Asia, Europe, South America, and Australia. There were two reasons for the selection of areas to be explored. These were the amount of prior exploration and the presumed benefits from the types of plant material available there. Explorers were chosen for their expertise in certain plant groups and for their knowledge of a specific country or region.

These thirteen explorations produced over 10,000 plant introductions. Some of these plants were used in breeding programs, others were released after evaluation to the public, and still others will be evaluated and released in the future.



## INTRODUCTION

The U.S.D.A.-Longwood Ornamental Plant Exploration Program has had a great influence on American horticulture. John L. Creech, six-time explorer for the U.S.D.A.-Longwood Exploration Program and present director of the United States National Arboretum, in speaking of the program, states, "This program far exceeds any collecting by anyone at anytime."<sup>1</sup> Unfortunately, the program, as a program, has not been documented. Although some information on the explorations and their returns has been published, a complete summary and assesment of the total program is lacking.

Therefore, the purpose of this thesis is to document the history of the program, to summarize the explorations, to evaluate the impact of the program on American horticulture, to make suggestions for future similar programs, and to catalogue the plant material from each trip.

## CHAPTER I

### THE DEVELOPMENT OF GOVERNMENT-SPONSORED PLANT INTRODUCTION AND EXPLORATION

#### History

Plant exploration and introduction has played an integral role in the agricultural history of the United States. American plant explorer John Bartram (1699-1777) established an early plant introduction scheme by trading stock with his European counterparts, Peter Collinson, John Fothergill and Peter Kalm.<sup>1</sup> This private effort by a colonist was the inception of introduction and exploration programs in America. But as early as the presidential administration of John Q. Adams, with the passage of The Treasury Circular Act of 1827, the government became involved in foreign plant procurement. Although there was no financial assistance, this act requested United States foreign consuls to send agronomic seeds and plants to the United States for testing and distribution.<sup>2</sup>

In 1839 the first appropriation of money was made to the Agricultural Division of the Patent Office.<sup>3</sup> This grant of \$1000, issued for seed and plant introduction and distribution, was the first federal recognition of the importance of such a program. Henry L. Ellsworth, commissioner of the bureau, instituted the seed distribution program and expanded the program for the testing and experimentation of new crops. Under the Patent Office this program expanded; 80,000 seed packets were distributed in 1850, and it was apparently successful enough to merit an appropriation of \$25,000 in 1854.<sup>4</sup>

Finally, in 1862, the United States Department of Agriculture (U.S.D.A.) was established with Issac Newton as its administrator.<sup>5</sup> Newton was instructed to continue "to collect new and valuable seeds and plants . . . and to distribute them among agriculturists" and to "educate the public by collecting and presenting agricultural information."<sup>6</sup>

Near the end of the century the administrator of the U.S.D.A. was given cabinet rank, which increased its budget and scope of operation. As the new department grew,

the Section of Seed and Plant Introduction was created in 1898. The general charge of this section was:

...to bring into this country for experimental purposes any foreign seeds and plants which might give promise of increasing the value and variety of our agricultural resources.<sup>7</sup>

From this section, plant explorers--including Mark A. Carleton, Niels E. Hanson, Frank N. Meyer, and David G. Fairchild--were dispatched to foreign countries for plant exploration and importation. Again, the emphasis was placed on agronomic crops, and the collecting of ornamental crops was minimized. Under the direction of Fairchild (1903-1928), the Section of the Seed and Plant Introduction became a major positive force for plant exploration, introduction, and experimentation. He established the general framework for plant introduction as it existed during the U.S.D.A.-Longwood Plant Exploration Program.

The general purposes of the plant introduction program have remained the same since its conception, although the 1898 title, Section of Seed and Plant Introduction, became in 1953 the Section of Plant Introduction.<sup>8</sup> In addition, a complete system has developed, including plant inspection and quarantine, a printed inventory, in-

roduction and distribution procedures, breeding work, and evaluation. In 1972 the duties became the responsibility of the Plant Introduction Officer of the U.S.D.A.'s Germ Plasm Resource Laboratory.<sup>9</sup>

Because governmental emphasis has been on economic crops, private institutions and individuals have traditionally served the needs for ornamental crop exploration and introduction. In the early years of plant exploration, the Arnold Arboretum sponsored major explorations to the Far East, directed by well-known ornamental plant explorers, Charles S. Sargent, Ernest H. Wilson, William Purdom, and Joseph F. Rock.<sup>10</sup> Other gardens and arboreta have sporadically engaged in plant exploration. The most notable recent exploration program for ornamental crops has been the U.S.D.A.-Longwood Ornamental Plant Exploration Program.

## CHAPTER II

### THE U.S.D.A.-LONGWOOD ORNAMENTAL

### PLANT EXPLORATION PROGRAM

#### The Necessity for a Joint Program

Although the primary purpose of the plant exploration program under David G. Fairchild was to supply agronomic needs and to make botanical surveys, a number of ornamentals were collected and introduced.<sup>1</sup> During this period private expeditions, principally those of the Arnold Arboretum in this country and various English institutions, searched the Far East for new ornamental plants. These early expeditions, few as they were, resulted in an influx of new plants into America.<sup>2</sup> While interest and financial support declined during the Depression and private exploration came to a standstill with the beginning of World War II, the 1950s brought a renewed interest in ornamental plants, and leaders in the horticultural field realized the necessity of increasing the selection and quality of available plants.<sup>3</sup> A renewed ornamental plant exploration pro-

gram could satisfy these needs.

New problems and circumstances had developed since the early explorations, making it difficult to undertake such a program. Because of lack of funds, a governmental program was not feasible. The agricultural concerns of the country influenced Congress to financially support the introduction of economic crops. Little money was available for ornamental crop research and even less for ornamental plant exploration.<sup>4</sup>

The private sector also had its problems in mounting an ornamentals exploration program. Few institutions had the ability to budget the amount of money required to sponsor an expedition and to test and introduce the incoming material.<sup>5</sup> Due to changing political structures, it was difficult for a private individual to enter into and travel within many foreign countries.<sup>6</sup> In addition, the plant quarantine laws had become increasingly stringent, requiring permits for all plants entering the country and requiring all plants to be processed and handled through plant inspection centers.<sup>7</sup> The delay this procedure caused was often fatal for the plants.

It seemed clear that either a private or governmental exploration program was impossible. The only possibility of renewing ornamental plant exploration was through the establishment of a joint program between the government and a private agency; one providing strengths where the other had weaknesses.

#### The Origin of the Program

In 1906 Pierre S. duPont had purchased Longwood, an old, wooded estate in southeastern Pennsylvania.<sup>8</sup> Soon thereafter he began developing the grounds into a display garden that included fountains, conservatories, and outdoor gardens. With the death of duPont in 1954, the gardens became the responsibility of the trustees of Longwood Foundation, Inc. A substantial endowment provided for "the support, operation, and development of the Longwood gardens near Kennett Square, Pennsylvania."<sup>9</sup>

With these instructions, the trustees in 1955 employed Longwood's first director, Russell J. Seibert. He brought to Longwood his background as director of Los Angeles State and County Arboretum (1950-1955) and as an employee and plant explorer for the U.S.D.A. (1940-1950).<sup>10</sup>



Because of Seibert's previous employment, he realized the importance for horticulture of plant exploration, testing, and introduction. One of his early contributions as director of Longwood was the idea of combining Longwood's financial resources with the governmental mechanisms available to the U.S.D.A. for the purpose of a cooperative ornamental plant exploration.<sup>11</sup> In 1955 this concept was explained to Carl O. Erlanson, the head of the U.S.D.A.'s Section of Plant Introduction. The idea was enthusiastically accepted by Erlanson, who had been a plant explorer himself and had been influenced by the earlier collectors, Fairchild, Wilson Popenoe, and B. Y. Morrison, under whom he had worked.<sup>12</sup> Next, it was proposed to the trustees of the Longwood Foundation who accepted it. Seibert then joined forces with Erlanson to implement the program.<sup>13</sup>

This concept of a combined effort for ornamental plant exploration overcame the problems that had previously prevented such a program. Longwood Foundation would supply sufficient funds for a complete and continuing program. Through the facilities at Longwood, a program of testing, breeding, and distribution was to be carried on. Seibert realized the importance of an ongoing program;

therefore, the grants for these explorations were made renewable each year.<sup>14</sup>

Although the U.S.D.A. could not directly supply funds for these expeditions, they were willing to furnish manpower to organize the trips, to assist in quarantine, and to carry out programs based on them. As a governmental agency, the U.S.D.A. had the political connections necessary to obtain permission to enter into and explore in otherwise restricted countries. They could also arrange for foreign contacts to assist the explorers in plant collection. The U.S.D.A. worked closely with the quarantine center to expedite the entry and inspection of ornamentals. They also agreed to implement breeding, testing, and distribution programs with the materials received from these expeditions.<sup>15</sup>

Thus, the program originated by Seibert had the essential components from Longwood and the U.S.D.A., enabling it to organize and carry out a private-public ornamental plant exploration program which would have great impact on the field of horticulture.

### The Program's Goal

The general idea behind Longwood Garden's concept of a joint exploration program was to increase the number and variety of plants for American horticulture.<sup>16</sup> The goals stated in the cooperative agreement between the two agencies support Seibert's original idea. The agreement states:

...the Branch and the Cooperator desire to encourage the advancement of ornamental horticulture in the United States through the discovery and introduction of new or little known plants of the world which will have potential value to the future of ornamental horticulture and, therefore, to the rapidly increasing numbers of home gardeners and plant hobbyists.<sup>17</sup>

John L. Creech, six-time Longwood-U.S.D.A. plant explorer and presently director of the United States National Arboretum, has stated there were three underlying purposes in this program. One was to explore regions of the world where seed and plant exchange was not possible. Aided by governmental affiliation, these expeditions could collect and explore in many areas that had previously been off limits. Another was to increase the gene pool for breeding programs; new collections of plants could add to an established base for future improvements in breeding new

cultivars. The final purpose was to visit foreign arboreta, botanic gardens, and nurseries to collect improved plant cultivars that were only available from that source.<sup>18</sup>

Another underlying purpose, held by Longwood, was to test, breed, and evaluate plants for display purposes.<sup>19</sup> Through this effort, improved plants were to be made available to the horticultural field.

The principal goal stated in the agreement and the underlying purposes of the program were agreed upon by both Longwood and the U.S.D.A. as the basis for implementing this cooperative plant exploration program. The achievement of these purposes was necessary to fulfill the long-range goal--the introduction of new plants for American horticulture.

#### Interactions Between the Agencies

The legal document, Cooperative Agreement between Longwood Gardens of Longwood Foundation, Inc., and the U.S.D.A. Agricultural Research Service Horticulture Crops Research Branch,<sup>20</sup> laid down the basic framework of this combined program and specified what each agency was re-

quired to supply. It also described the contribution each party was to make to the program.

According to the document, Longwood was obligated only to supply funds. Grants up to \$16,000 were to be appropriated, as needed, to pay for the expeditions and related expenditures. Longwood's return was a share of all the material after it had been inspected, quarantined, and propagated by the U.S.D.A. The material came with no restrictions, but was "for such further propagation, evaluation, and display as the Cooperator (Longwood) finds desirable."<sup>21</sup> Therefore, Longwood could develop research and evaluation programs to achieve its goals.

The U.S.D.A. was required by this agreement to collect, import, inspect, propagate, evaluate, and distribute the new plants. They were also to conduct research and to provide the equipment and facilities for this research. A further responsibility was to publish a printed inventory of the plant material collected under this program.

With the obligations of each party understood, the framework of the program was established. Since this was

a cooperative program, the mutual decisions were arrived at by agreement between both agencies.<sup>22</sup> The country to be explored was one of these joint decisions. There were a number of factors involved in selecting a specific country or region to explore. The overriding factors were the plants and plant groups available, but other questions such as; when the country was last explored, how thoroughly it had been explored, how the plants growing there could be expected to perform in the United States, and the difficulty of travel and collection, were also considered in the selection.<sup>23</sup>

Likewise, the selection of the explorer was a decision to be agreed upon by both agencies. The explorers, often Longwood or U.S.D.A. employees, were chosen on the basis of their interest and knowledge of plant material, of specific plant groups, or of the country to be explored.

Another joint decision was the type of research to be carried out by the U.S.D.A. Generally, the improvement of plants through breeding and the introduction and evaluation of new plants were set as the goals of their research.

Therefore, the cooperative agreement stated the

major obligations of each agency and left many of the particular decisions for each trip to be made by mutual agreement. These decisions--the country and explorer to be selected and the type of research to be completed--were jointly reached by both agencies. Individuals from each institution--Erlanson, Creech, and Howard L. Hyland of the U.S.D.A. and Seibert, Everit L. Miller, and Walter H. Hodge of Longwood--all contributed their views, to make the final decision.<sup>24</sup> This was done through informal meetings and conversations and communications by mail and telephone.<sup>25</sup>

#### The Mechanics of the Program

After the selection of the country and explorer had been agreed upon by both agencies, it was then the U.S.D.A.'s responsibility to organize the expeditions. Besides pre-trip preparations, there were other undertakings--shipping, inspection and quarantine, and special and general distributions--that were carried out by the U.S.D.A.<sup>26</sup>

The pre-trip preparations that included the details necessary for a successful and efficient exploration were overseen by Hyland, Plant Procurement Officer of the

U.S.D.A. The handling of governmental and diplomatic negotiations were managed through his office.<sup>27</sup> Diplomatic attaches of the United States were notified of the exploration. They in turn secured permission for internal travel and plant collection within the foreign countries. The United States foreign embassies were also informed and assisted with communications and shipping and provided housing if needed. During the expeditions, the explorer became an employee of the government working for the Foreign Service.<sup>28</sup>

As Plant Procurement Officer, Hyland had developed worldwide contacts through previous exchange of seeds and plants. The itinerary was built around these contacts; university professors, botanic garden directors, agricultural station personnel, and interested private individuals. They assisted the explorers in plant collection and propagation and often provided base stations.<sup>29</sup>

Hyland also sent letters to United States arboreta and botanic gardens, requesting their needs for specific plant material of ornamental nature that might be collected during an exploration. The U.S.D.A. then compiled a master



list from these requests and from the pre-trip information assembled by the explorer.<sup>30</sup>

On the basis of the area to be explored, the foreign contacts available, and any foreign travel restrictions, Hyland then completed the itinerary and time schedule.

Another function of the U.S.D.A. was to oversee the shipping and handling of the stock. The shipping and handling of plant material had been a weak link in plant exploration since its beginning. Often rare and exotic plants were collected at great costs in the wild only to arrive at their destination dead or rotted. Two innovations, the invention of poly-films and the increased speed of transportation, helped remedy this problem for the U.S.D.A.-Longwood Exploration Program.<sup>31</sup>

Plants and cuttings packed in a slightly moist medium were wrapped with the new material, which allowed plants to breathe but not dry out, made longer shipping periods possible, and increased the percentage of plant viability. Even with the use of plastic films allowing longer shipping periods, it was still imperative to use the

fastest mode of transportation.

During the early explorations undertaken in this program, private and commercial transportation systems were used. This posed problems inherent in these systems, delays and slowdowns which increased the amount of dead material.<sup>32</sup> In later trips because of the program's governmental association, diplomatic pouches and governmental air transportation were utilized. Shipments in a diplomatic pouch had governmental priority and could bypass slow foreign customs and guarantee immediate passage to the United States. Air Force and Strategic Air Command planes were used to deliver the material to Washington, D. C.<sup>33</sup> The use of plastic films combined with the use of fast transportation meant most plants would arrive alive and healthier.

The plant materials were collected and shipped in many different ways: live plants, cuttings, rooted cuttings, scion wood, bulbs and seeds.<sup>34</sup> Bringing live plants into the United States in soil violates a quarantine law prohibiting the entrance of foreign soil into the country. Cuttings were easy to collect and package, but better

survival was attained by rooting the cuttings prior to shipping. If scion wood was sent, Hyland was notified, and he then located root stock for grafting. Bulbs and propagules shipped packed in moist material, were handled in the same manner as unrooted cuttings. Rotting and dessication were the main causes of plant loss.<sup>35</sup> Seed presented the least problems in shipping and handling. Its only drawback lay in the rather precise timing required to collect it after ripening but before dissemination. The method the explorers used when they encountered unripe seed was to hire a local person to collect and send the seed from marked plants after it had ripened.<sup>36</sup>

As the plants were processed through the inspection center, Hyland kept a close check on the condition of the plant material. By acting as an intermediary between the explorers and inspection center he was able to notify the explorers about the condition of the stock and suggest re-collection if a group arrived dead.<sup>37</sup>

Survival of the stock varied from one expedition to the next with the differences being attributed to the weather, handling, or to the type of material collected.

Even with the improved shipping and handling techniques used, only 60-70% of all the material survived to the point of distribution.<sup>38</sup>

The U.S.D.A. is required to comply with the Plant Quarantine Act when introducing plant material into the country. In these cases, however, a blanket permit was issued for the ornamental plants imported from the explorations. In general, there are fewer stringent quarantine regulations for ornamentals than for agronomic crops. Woody ornamentals are required by law to be quarantined for two growing seasons or two years with continued inspection and final authorization before release. During this quarantine period, it is permissible to increase the plants by propagation and use them in breeding programs, but distribution is not allowed.<sup>39</sup>

The Plant Inspection Station also inventoried the plants and assigned all viable plants and seeds a Plant Introduction number (P.I.#).<sup>40</sup> (This P. I. # remains with the plant and any subsequent asexual propagules for future inventory and identification purposes.) After the inventory and a preliminary inspection for diseases and pests,

the plants were immediately shipped to the Glenn Dale Plant Introduction Station in Maryland.

Following the inspection at Washington and quarantine at Glenn Dale, those plants judged healthy were then distributed to Longwood. However, if Longwood was particularly interested in a specific plant, a special permit could be issued to release it to them under quarantine.<sup>41</sup> There was no structured procedure used in allocating the plants to Longwood. Ideally, it was to receive a share of all materials; in actuality, it might receive a list from which to request plants, be sent a notice that a block of material was waiting to be picked up, or be shipped the total collection of plants.<sup>42</sup> If the U.S.D.A. had little interest in the material, the total collection was sent to Longwood. The Orchids, Psilotum, and other speciality items were shipped directly to Longwood from the Inspection Station. This practice sometimes presented a problem: it was occasionally not clear whether or not the plant at Longwood represented the sole plant of that accession in the country.<sup>43</sup>

Plants arrived at Longwood in the same variety of

ways they were shipped from abroad. Usually, the U.S.D.A. sent propagated or rooted material, but unrooted cuttings and scion wood were also received. Collections of seed were to be divided, with half appropriated for the U.S.D.A. and the remainder for Longwood. Longwood also received divisions, plants, bulbs, and other types of propagules.<sup>44</sup>

After the plants had been divided, both organizations concentrated their efforts on propagation and cultural information to enable them to increase the block of plants for further distribution, evaluation, and breeding programs.

#### Evaluation and Distribution

Both the U.S.D.A. and Longwood had developed their own distribution programs prior to the explorations. Plants from these expeditions, thought to have some potential or immediate horticultural value, were often placed on these lists for further distribution and evaluation by botanic gardens, arboreta, agricultural stations, and other institutions.

Longwood started its distribution in a small way only having twelve botanic gardens and arboreta on its

original mailing. This scheme originated by Seibert and administered by Longwood's taxonomist, Donald G. Huttleston, has grown to involve over seventy institutions and is still used to distribute material from the exploration program.<sup>45</sup>

The reasons specific plants are placed on the distribution list are tied closely with Longwood's evaluation policy. All plants new to Longwood are evaluated through an informal meeting with the director, Horticulture Department representatives, and staff members. A group of plants, generally in the flowering stage or at their ornamental best, are judged for their horticultural display worthiness to Longwood.<sup>46</sup> At this time a decision is made to discard the plant, to use it in a display or collection, or to grow it on further. If it is decided the plant has little value to Longwood, it is removed from their inventory. However, before discarding any plant from the explorations or any other P.I. numbered plant, the U.S.D.A. is notified.<sup>47</sup> If the U.S.D.A. desired the plant they would request its return. If, on the other hand, it is decided that the plant has botanical or horticultural value, the surplus plants are placed on the distribution list. Often a plant is evaluated as having horticultural

value and is increased in number especially for distribution.<sup>48</sup>

Other methods of plant distribution existed at Longwood. Generally, requests for plant material from non-commercial institutions would be honored. If Longwood personnel knew of someone doing research or collecting in a specific taxonomic group they would also ship them material.<sup>49</sup> Until the 1970s, Longwood's distribution did not involve commercial greenhouses or nurseries. There was a fear that favoritism would be claimed and Longwood, a non-profit organization, preferred to avoid this practice.<sup>50</sup>

Since Longwood is not a plant depository, there was a need to evaluate the U.S.D.A.-Longwood collections for Longwood's purposes of horticultural display value. Through this evaluation system, Longwood retained the plants of display value, and distributed them to institutions by way of its distribution list.<sup>51</sup> It also shipped potential breeding stock and other specific material to known cooperators.

According to the agreement, the U.S.D.A. was required to evaluate and distribute this material.<sup>52</sup> The



U.S.D.A. Inspection Station at Glenn Dale was responsible for the major portion of the distribution from these expeditions. The station horticulturist, was assigned to conduct the national distribution and evaluation program. After material was received from the inspection station, it was first propagated and then increased in numbers. In the same manner as at Longwood, the ornamental horticulture staff of Glenn Dale performed the preliminary evaluation which determined what plants were placed on the distribution-evaluation list.<sup>53</sup>

Glenn Dale carried out a variety of distribution programs somewhat more formal and larger in scope than Longwood's. Through their files they maintained four types of distribution lists: (1) general lists; (2) speciality lists; (3) limited lists; and (4) special request lists.<sup>54</sup>

The general list, the most extensive, included universities, agricultural stations, arboreta, botanic gardens, and commercial sources. Periodically, listings were sent out to these agencies describing the available plants, many of which were from the U.S.D.A.-Longwood Exploration Program. The special lists were sent out to

plant societies, plant breeders, and special plant collectors. Most of this stock--collections of hollies, rhododendrons, camellias, etc.--were used by the recipient for breeding and scientific research. The limited distribution list contained a small number of rare and exotic plants, often from this exploration program. Because of the limited number of these plants, this list was given to only a few organizations. Finally, as at Longwood, there was a special request list for qualified institutions and individuals.<sup>55</sup>

A cooperator receiving plants from the general distribution list was obligated to assist in evaluation. The U.S.D.A. regularly sent out evaluation forms requesting information on culture, measurements, and visual observations. By compiling the information from these forms a good deal could be learned about the adaptability of each plant. Unfortunately, the returns from the evaluation program were minimal. Many evaluation forms were never returned, and others were returned with incomplete information. Therefore, the evaluation program, lacking commitment from the recipients of the material, was not a total success.<sup>56</sup>

Limited success was achieved; some cooperators observed the plants closely and made valuable reports on specific plants. From this information a few plants were identified as having horticultural potential. These plants were sent back to the U.S.D.A. to be tested further and increased in numbers. Later, the U.S.D.A. re-released the plants with a cultivar name as a proven plant. Two examples of successful evaluation are Cotoneaster microphylla cv. Emerald Spray and Euonymus fortunei cv. Longwood. The Cotoneaster, originally distributed as a seedling (from seed collected during the Nepal 1962 expedition) was selected by Monrovia Nursery in California as having horticultural value.<sup>57</sup> After evaluating the Euonymus, Cunningham Gardens Inc. in Indiana recommended to the U.S.D.A. the naming and re-releasing of this plant.<sup>58</sup>

Because of the large amount of plant material imported during these explorations, there was a need for preliminary evaluation by the U.S.D.A. and Longwood before a wide spread distribution and evaluation scheme. After this distribution it was anticipated the secondary recipient would evaluate the material. The results from this secondary evaluation would help determine the horticultural

worthiness of the plant. Although the bulk of the material was placed on the distribution list for specific evaluation, some of the material was originally collected and later distributed for research and breeding purposes. Since two agencies distributed this material, it was received by a variety of institutions and organizations.

### Breeding and Research

One of the original purposes of the program was to introduce new breeding stock that would increase the genetic diversity of various ornamental species.<sup>59</sup> During an exploration many plants were selected not for their overall ornamental value but for a single trait, e.g., flower size, color, or potential for hardiness. These plants were intended for use in research and breeding programs, which both institutions, Longwood and the U.S.D.A., conducted.

Although the exploration program was initiated in 1956, no formal research or breeding was started at Longwood until 1960. At that time construction of the experimental greenhouse facilities had been completed, and the geneticist Richard W. Lighty had been hired. Longwood's policy in breeding, according to the Experimental Green-

house Summary, states that:

The plants to be improved are selected on the basis of their presumed potential value, the absence of similiar improvement being pursued elsewhere, and the value of the project plant to Longwood.<sup>60</sup>

With this established policy, Longwood's primary endeavor was to improve plants for display purposes. Through this breeding program, plants were improved for Longwood; however, the results often led to improved plants for the horticultural field in general.

One of the first programs developed at Longwood using plants from the U.S.D.A.-Longwood collections was the camellia breeding project. The intent of this program was to produce a plant with foliage and bud hardiness for the Philadelphia area. Numerous camellias from Creech's 1956 Japanese exploration, which exhibited hardiness traits, were utilized in the beginning of this project.<sup>61</sup>

Under the present experimental greenhouse geneticist, Robert J. Armstrong, additional breeding programs developed using the U.S.D.A.-Longwood collections. One project, the Hippeastrum breeding program, used the imported material but in a minor way.<sup>62</sup> The cream-colored Canna,

Canna X generalis (Canna hybrida) 'Moonlight' P.I. 293878, collected by Creech during the 1963 Russian exploration, has played a predominant role in Longwood's Canna breeding program.<sup>63</sup>

The major breeding program resulting from the U.S.D.A.-Longwood program developed the New Guinea Impatiens Hybrids. During the exploration to New Guinea, Harold F. Winters and Joseph J. Higgins had collected a number of tropical Impatiens. From these collections a program was established to increase flower size, and number in the already important Impatiens, and to improve the heat tolerance of these high altitude plants. Twenty named hybrids have resulted from this program. These Impatiens hybrids have been released by Longwood and distributed to commercial growers who will then market them to the public.<sup>64</sup>

Numerous research and breeding projects using the U.S.D.A.-Longwood collections have been implemented at the various branches of the U.S.D.A.

At the Glenn Dale Introduction Station, William L. Ackerman has conducted a program in the hybridization of

camellias. The objectives were to increase the cold hardiness and to produce large fragrant flowers. Edward W. Corbett, who handled the distribution of plants, worked on the genetics of flower color inheritance in Rhododendron japonicum and R. kaempheri populations from Creech's 1961 trip.<sup>65</sup>

Sammuel L. Emsweller used daylily species from the U.S.D.A.-Longwood collections in his research at the Beltsville Agricultural Research Center. The collection provided a source of germ plasm for extended flowering periods.<sup>66</sup> Winters is presently working on a breeding program, using his collections of Impatiens from the New Guinea exploration. Through the U.S.D.A. he has released seven named hybrids to commercial sources.<sup>67</sup>

The United States National Arboretum has carried forward a variety of breeding programs. The viburnum, holly, and crape myrtle breeding projects have all used plants originating from the U.S.D.A.-Longwood explorations.<sup>68</sup>

Although both Longwood and the U.S.D.A. used material from the collections to improve available plants and release new cultivars, the total impact this program has

had on the advancement of horticulture through breeding will never be known. Both agencies have introduced new plants through well-documented breeding programs. Considering the wide distribution of this material, the great variety of plants, and the probable loss of plant records, it would be difficult to evaluate the further significance this breeding stock has had on United States horticulture.



CHAPTER III

THE EXPLORATIONS

The U.S.D.A.-Longwood Plant Exploration Program has conducted thirteen explorations to twenty-three different countries from 1956 to 1971. The territories chosen have been widespread throughout the world, including regions of Europe, South America, Asia, Australia, the Far East, and the South Seas. There were stated reasons behind the selection of the country to be explored, the plants to be collected, and the explorer to be hired. The next thirteen sections will briefly summarize each of these explorations, their goals, and the returns to date.

Southern Japan - 1956

The country selected as the first venture for this cooperative plant exploration program was Japan. There were two basic reasons Southern Japan was selected for this September-to-December trip. First, it provided an opportunity to collect seed and thus complete the exploration of

the Yatsugatake Mountain area, which had been partially explored the year before by the U.S.D.A. The second reason was that Southern Japan was rich in broad-leaved evergreens. A final point was that there had not been any plant collecting in that region since E. H. Wilson's work for the Arnold Arboretum in 1914.<sup>1</sup>

The explorer selected for this expedition was John L. Creech. As a U.S.D.A. employee, he had collected in regions of this country the year before.<sup>2</sup> Because of his knowledge of plant exploration, of ornamental horticulture, and of parts of Japan, he was clearly the logical choice.

According to Creech, there were five major regions--the Yatsugatake Mountains, South Shikoku, Kii Peninsula, the islands of Yakushima and Tanegashima, and the Satsuma peninsula--where the bulk of the collecting was to be carried out. The trip was to conclude with visits to the major chrysanthemum exhibitions and certain horticultural institutions.<sup>3</sup>

From this first exploration 668 plants were introduced, half being from the wild. All were shipped as cut-

tings or as seed. Hollies, rhododendrons, and other broad-leaved evergreens were included as well as a collection of 219 chrysanthemum cultivars.<sup>4</sup>

#### Western Europe - 1957

In selecting the region for the second exploration, a completely different approach was taken. According to Fredrick G. Meyer, Western Europe and parts of England were selected "to obtain ornamental plants for introduction, heretofore not in general cultivation in the U.S."<sup>5</sup> This section of Europe contained comprehensive plant collections, resulting from past evaluation and breeding programs and numerous plant explorations completed over the last two centuries. Therefore, the main purpose of this exploration was to introduce cultivars not grown in the United States.<sup>6</sup>

On the basis of Russell J. Seibert's recommendation, Meyer, an employee of the Missouri Botanic Garden, was hired by the U.S.D.A. as the explorer for the European expedition. His knowledge of cultivated ornamentals coupled with his previous travel in Europe and his familiarity with the institutions and their personnel were the necessary credentials for the trip.<sup>7</sup>

During this exploration, which lasted from March to November of 1957, Meyer surveyed over eighty botanic gardens, arboreta, nurseries, private estates, and agricultural stations. Six countries--Scotland, England, France, Portugal, Italy, and Spain--were visited. Over 2,800 plant introductions resulted from this trip; the majority of them were new cultivars or species not available in the United States.<sup>8</sup>

#### Southern Brazil and Argentina - 1958

The third expedition centered on the sub-tropical regions of Southern Brazil and Argentina. The purpose of this exploration was to collect flowering sub-tropical plants that showed promise for outdoor use in Florida and Southern California and for conservatory use.<sup>9</sup> An effort was made to select plants from the wild in areas of high altitude. It was expected these plants would have a resistance to cooler temperatures. Other collections were secured from private, governmental, and other sources.<sup>10</sup>

Llewelyn Williams was the plant collector selected for this southern expedition. He was chosen because he was a botanist employed by the U.S.D.A., and well versed in

tropical American flora.<sup>11</sup>

This mission, from March to May of 1958, explored the Brazilian states of São Paulo, Paraná, Santa Catarina, and Rio del Sul and adjacent areas in Argentina. There were 1,100 introductions, of which one-half were seed.<sup>12</sup>

#### Australia - 1958-1959

The next exploration centered on the "down-under continent," Australia and its unusual endemic flora. The goal of this expedition was two-fold: to collect native species from the wild; and, to collect cultivars and hybrids from commercial sources.<sup>13</sup> It was expected these plants could be used in conservatory situations and be of value in the southwestern regions of the United States.<sup>14</sup>

The selection of the explorer for this expedition produced the first confrontation of this joint program. Briefly, the civil service regulations governing U.S.D.A. employees required a doctoral degree for plant explorers traveling abroad. The explorer suggested by Longwood, George H. Spalding, the superintendent of Los Angeles State and County Arboretum, did not meet this requirement; though he was well-qualified for such an undertaking

through his knowledge of the Australian flora. Seibert was convinced of Spalding's capabilities and eventually the matter was settled to the satisfaction of both parties.<sup>15</sup> Walter H. Hodge of Longwood accompanied Spalding for the first six weeks.

Because of Australia's immense size, the exploration was concentrated on specific areas of West Australia, South Australia, Victoria, the Australian Capital Territory, New South Wales, Queensland, and Brisbane which were expected to yield the most worthwhile material. From September 1958 to February 1959, over 400 introductions were shipped, practically all from wild sources and collected as seed.<sup>16</sup>

#### Northern Europe - 1959

Northern Europe, including England, France, Belgium, Germany, and the Netherlands, was selected as the area for the 1959 exploration. This trip had the same objectives as the Southern Europe expedition of 1957: to collect species, cultivars, and hybrids of plants not being grown in the United States. High priority was given to conifers and broad-leaved evergreens, particularly dwarf and elite

selections.<sup>17</sup>

Meyer was selected as explorer for this July-to-November expedition. With his knowledge of ornamental plants and his previous travels in Europe, Meyer was now a seasoned plant collector.<sup>18</sup>

As in 1957, most of Meyer's collecting was carried out in nurseries, botanic gardens, arboreta, private estates, and experiment stations. A new method of collecting was used which insured a higher return of viable plant materials. Plants were selected by Meyer, cuttings taken and then rooted by authorized nurseries.<sup>19</sup> The majority of the collections were received in the United States as complete plants. Over 1,200 plants were collected from 45 institutions. Unique conifers constituted the bulk of the collection.<sup>20</sup>

#### Northern Japan - 1961

The sixth expedition of the U.S.D.A.-Longwood Plant Exploration Program traveled to Japan. The colder climatic regions of Northern Japan, containing broad-leaved evergreens, were selected for exploration. Since the 1956 trip was basically planned for the collection of plants new to

United States horticulture, this expedition was formed with the collecting objectives of introducing a broad range of germ plasm for use in ornamental breeding programs. The introduced stock was expected to contribute traits that would improve the hardiness, habit, and flower size and color in broad-leaved evergreens.<sup>21</sup>

Creech was again chosen as the explorer for this expedition. His collecting experience in Japan on the 1955 U.S.D.A. trip and the 1956 U.S.D.A.-Longwood trip and his broad interest in this country made him the natural choice.

During this four-month exploration, April to July, Creech collected in four areas, Kyushu, Honshu, (Pacific side), Honshu (northern tip), and Hokkaido. A total of 347 introductions resulted directly from the trip, and arrangements were made to collect and send ripe seed from specific localities later. The mission's major accomplishments were collections of native azaleas, camellias, hollies, and day-lilies, all with potential for use in breeding programs.<sup>22</sup> Little of this material was available for general distribution, most being dispersed to breeders.<sup>23</sup> An important group of cultivated plants obtained was a collection of



"Hirado" azaleas, famous for their large showy flowers.<sup>24</sup>

Nepal - 1962

The seventh expedition of the program centered on the small kingdom of Nepal. Nepal had not been thoroughly explored by a plantsman since Joseph D. Hooker's travels of 1858 and though it had often been closed to foreign travel, the borders had recently been opened, making such an expedition possible.<sup>25</sup> While Nepal lies on the same latitude as Florida, the altitude of the Himalayas has led to a flora containing a broad range of temperate zone plants.<sup>26</sup> There are floristic similarities between this region and Inner Mongolia and Northern China, where plant exploration was impossible. The goal of this trip was the collection of plant material in the wild that could be introduced directly to United States horticulture or indirectly, through breeding programs.<sup>27</sup>

A new approach, using two explorers, was used for this exploration. Because of the lack of time and the poor means of transportation available, it was felt that this method would expedite collecting. Creech, an experienced and qualified explorer, and Francis DeVos, assistant direc-

tor of the United States National Arboretum, were selected for this trip. Since most of the travel was done on foot, the explorers were accompanied by a government official, two Sherpas, and fifteen porters.<sup>28</sup>

The two explorers made four major collecting forays, all in the western part of Nepal. The areas they explored were in the foothills of the Annapurna Range, along the Kali Gandaki and Mardi Khola rivers and in the hill country near Kathmandu.<sup>29</sup> The expedition produced over 200 introductions. Among the introductions considered particularly important were seeds from a potentially hardy Magnolia campbellii, a collection of orchids including several of the genus Pleione, and a specimen of the winter-flowering cherry, Prunus cerasoides.<sup>30</sup>

#### Russia - 1963

Russia was the next hunting ground selected for plant exploration. The trip was sanctioned by the Cultural Exchange Program agreed upon by both countries.<sup>31</sup> This approach, however, was less than satisfactory to the purposes of the program; the explorers were considered exchange delegates whose mission was to exchange horticult-

tural information with the Russian scientists. The Russian Ministry of Agriculture decreed there would be no visits to the collective farms but did allow some collecting in the wild. The exchange agreement was that two United States explorers were to visit Russia for forty-five days and three Russians were guests of the United States government for thirty days. This allowed a total of ninety days for each team.<sup>32</sup>

This expedition also employed two explorers, Creech of the U.S.D.A.'s New Crops Research Branch, and Donald H. Scott from the Small Fruit and Grape Investigation Branch. Creech was again chosen because of his exploration experience and background in ornamentals; Scott, funded by the U.S.D.A., was to make collections of the small fruits developed by the Russians.<sup>33</sup>

Since this was the first United States plant collecting expedition behind the Iron Curtain there were, as would be expected, problems. Time was short, and the inflexible schedule drawn up by the Russians often wasted time. Collecting in the wild or from gardens was limited, although, according to Creech, enough was collected "to

justify our effort."<sup>34</sup>

Only 140 introductions were brought back by the explorers, although many plants were marked for later shipment pending Russian approval. Numerous plants were later received. A number of fruits with presumed drought tolerance and hardiness were collected. Of immediate ornamental interest was a creamed-colored hybrid *Canna*, 'Moonlight' and the rare Russian lotus *Nelumbo caspicum*. Collections of *Crataegus microphylla* and *Acer stevenii*, previously not in cultivation in the United States were also introduced.<sup>35</sup>

Sikkim (West Bengal) - 1965

The Himalayan range in Sikkim was the next region selected for plant exploration. Unfortunately, upon arrival in Darjeeling, India, permission for plant collecting in either Sikkim or Nepal was denied; therefore, this exploration centered on the state of West Bengal.<sup>36</sup> The original purpose of the Sikkim expedition, a sequel to the 1962 Nepal trip, was to explore the more humid regions of the Himalayas. The explorers expected to place emphasis on rhododendrons and rare species of *Ilex*, *Rosa*, *Prunus*,

and Magnolia known to grow there.<sup>37</sup>

F. deVos and Edward G. Corbett, the explorers selected for the expedition, were both employees of the U.S.D.A.; deVos was the assistant director of the National Arboretum and Corbett a research horticulturist at the Glenn Dale Research Station.<sup>38</sup>

Although the Sikkim exploration had been thwarted, West Bengal proved to be a productive region for collecting. The returns from this April-to-June exploration were 195 introductions, 136 of them collected as seed. Seed from 13 species of Rhododendron were collected along with such plants as Enkianthus himalaicus, Buddleia colvillei, and Arisaema Hookeri.<sup>39</sup>

#### South Korea - 1966

The tenth expedition again selected a remote region of the world, South Korea, for plant exploration. This country had not been explored since the 1930s. Korea not only has a climate comparable to that of the Eastern United States but also contains many species that are allied with those growing there.<sup>40</sup> Plants from the genera Lilium, Syringa, Rhododendron, and Quercus were of primary

interest for collecting. Besides the peninsula of Korea, the Korean islands of Ullung-do and Cheju-do were also placed on the itinerary.<sup>41</sup>

Selected as explorers for the wilds of Korea were Richard W. Lighty and Corbett. Lighty, a geneticist and expert on the genus Lilium, was the first Longwood employee to participate in a complete exploration.<sup>42</sup> Corbett, a horticulturist at the Glenn Dale Research Station, had just returned the year before from collecting in West Bengal.<sup>43</sup> This team was assisted by Professor Tchang Bok Lee of the Seoul National University College of Agriculture.<sup>44</sup>

The returns from this exploration were more than 400 plant introductions. Plants of specific merit were a prostrate species of Caryopteris which had potential as a sun groundcover, a white form of Rhododendron mucronulatum, and Lilium hansonii, a plant introduced to the United States only once before.<sup>45</sup> This collection provided a number of new and interesting plants for American horticulture.

Taiwan - 1967-1968

Taiwan, selected as the eleventh region for plant collecting, had not been explored ornamentally since E. H. Wilson's trip in 1918. The island was known to have a rich flora, containing endemic plants as well as species common to mainland China and Japan.<sup>46</sup> The goals of this November-to-January trip were to introduce plants new to United States horticulture and to collect plants that would increase the pool of plant germ plasm. This was to be accomplished by collecting such materials as flowering cherries, camellias, azaleas, hollies, needled evergreens, and herbaceous plants.<sup>47</sup>

Creech, selected because of his knowledge of the plant material, was now on his fifth expedition of this program. Two taxonomists from the Taiwan National University, C. Hsu and T. Huang, and a full-time Japanese-trained plant collector, M. Koa, accompanied Creech on his field trips.<sup>48</sup> The major areas of collecting were centered in the regions of Mount Morrison, Wu-lai, Kna Kow, Mount Hohuan, Mount Tungpinghan, Sun-moon Lake, and Chaikai.<sup>49</sup>

Approximately 150 collections were made, primarily of broad-leaved evergreens and conifers. Significant collections of Rhododendron, Pieris, Juniperus, and Euonymus were procured. Of particular interest were the seeds and plants of the rare Taiwania cryptomerioides and a collection of Camptotheca acuminata (Nyssaceae) introduced for a cancer research program.<sup>50</sup>

#### New Guinea - 1970

The world's second largest island, New Guinea, was selected for the twelfth exploration of the series. The primary reason for selecting this area was that it has been, from the standpoint of ornamentals, one of the most neglected regions of the world. Much of the area was unknown to the West until after World War II.<sup>51</sup> The mission of this exploration was to introduce germ plasm from the wild and to collect cultivated ornamental plants. Specifically, a collection of Rhododendron species was sought for breeding purposes. Emphasis was also placed on foliage plants, herbaceous-flowering plants, shrubs and vines, and fruits and vegetables.<sup>52</sup>

Harold F. Winters was selected as the leader of



this expedition. Winters, a horticulturist at the New Crops Research Branch, Beltsville, Maryland, was knowledgeable in tropical botany and horticulture from previous experience in the tropics. Joseph J. Higgins, a plant physiologist for the U.S.D.A., was to accompany Winters.<sup>53</sup> These explorers also received assistance through a working relationship with the Division of Botany, Department of Forests in Lae.<sup>54</sup>

Besides the ten weeks spent in New Guinea, this January-to-April expedition stopped briefly at Hawaii, the Philippines, Indonesia, New Caledonia, Java, and Australia.<sup>55</sup> The total collection from this exploration exceeded 850 plants. The goal for rhododendron collections was well served by the 137 rhododendrons introduced. Collections of aroids, ferns, gesneriads, gingers, hoyas, and impatiens were also made.<sup>56</sup> The last genus, Impatiens, proved to be the most immediately valuable of the groups brought back.<sup>57</sup>

#### Russia - 1971

The final exploration of the U.S.D.A.-Longwood Plant Exploration Program journeyed again to Russia. As

a result of the United States-U.S.S.R. scientific exchange for 1970, Creech was allowed to accompany the Soviets in a Siberian plant collecting exploration.<sup>58</sup> The emphasis for the collecting was on plants potentially useful in stabilizing eroded areas, on species of Ulmus with a potential resistance to the Dutch Elm Disease, on species of Malus and Pyrus for possible street tree use and on a collection of germ plasm for the purpose of breeding woody ornamental plants resistant to disease, cold, drought, and pollution.<sup>59</sup>

Creech, still an employee of the U.S.D.A., was chosen as the explorer for this thirteenth exploration, his sixth for the U.S.D.A.-Longwood Plant Exploration Program.

Besides collecting in regions of Siberia, Creech also visited the Main Botanic Garden of the Academy of Sciences, the University of Moscow Botanic Gardens, the Shreder Botanic Gardens, the Nikilsky Botanic Gardens, and others.<sup>60</sup> This June-to-August trip produced over 210 plant introductions. Among them were collections of lilies, rhododendrons, junipers, and birches.<sup>61</sup>

## CHAPTER IV

### RESULTS OF THE PROGRAM

The sum of the results of this program cannot presently be evaluated; it will take many years before the final achievements of this program will be apparent. Pyrus calleryana 'Bradford', a 1919 introduction, is a case in point. This plant was introduced as seed from China for fire blight resistance and root stock studies. One vigorous seedling was observed and selected as having potential. But it was not until 1960 that it was named and introduced by the Crops Research Division, Agricultural Research Service. Only recently has it been accepted as a valuable street tree and made widely available. Thus, fifty years were required to realize the potential of this tree.<sup>1</sup>

One of the original purposes of the program was to introduce plants new to American horticulture.<sup>2</sup> The following are a few examples of introduced plants that have become commercially available from the U.S.D.A.-Longwood

Ornamental Plant Exploration Program.

The most important recent returns from the program are the 27 hybrid Impatiens. Both the U.S.D.A. and Longwood are conducting breeding programs with the original collection from the New Guinea exploration and have to date released these plants to commercial growers.<sup>3</sup>

John L. Creech introduced a collection of Chrysanthemum hybrids from his 1956 Japanese exploration. Although a number of these plants were grown commercially, one, 'White Spider Tokyo', has grossed over one million dollars in the florist trade.<sup>4</sup>

A group of thirty-three named Coleus cultivars introduced from Europe by Fredrick G. Meyer was reported as of considerable value to the florist and bedding trade.<sup>5</sup>

Another collection from Europe includes Cotoneaster dammeri 'Shogsholmen' and Cotoneaster X watereri 'Herbstfeuer' both spreading evergreen groundcovers that have been successfully introduced in the nursery trade.<sup>6</sup>

Creech reported that Eurya emarginata var. microphylla from his 1956 Japanese exploration is being

grown by nurseries in the southern United States.<sup>7</sup>

Juniperus conferta 'Emerald Sea' was collected in 1967 and released for cultivation in 1972. This salt-tolerant plant is of value for stabilizing coastal and inland areas.<sup>8</sup>

A plant collected as seed in Nepal in 1962 was later released after testing, by the U.S.D.A. as Cotoneaster microphylla 'Emerald Spray'. It is noted for its resistance to fire blight and unique arching habit.<sup>9</sup>

One plant was given a cultivar name in recognition of the support of Longwood Gardens. The hardy, vigorous groundcover Euonymus fortunei 'Longwood' was collected by Creech in Japan in 1961 and released in 1965.<sup>10</sup>

Although a number of these plants were introduced directly after evaluation, others were used for breeding purposes, resulting in an indirect influence on the field. It would be difficult at best to document the numerous breeding programs carried out by institutions other than Longwood and the U.S.D.A. that have used plants from this exploration program. It can be surmised that these plants

have had importance in other breeding programs because many plants were introduced that represented major horticultural groups.

The U.S.D.A.-Longwood Plant Exploration Program has clearly had an impact on American horticulture. From the numerous areas of the world explored, over 10,000 plants have been introduced; some of these plants are available today, others are being used in breeding programs, and still others will be available in the future.

CHAPTER V

SUGGESTIONS

From my research (reviewing the available material and interviewing the people involved) and by a critical evaluation, with hind-sight, of the total program, I have gained some insight into the establishment and management of a plant exploration program. If such a program were to be re-instituted by Longwood or another agency, these recommendations might be of value. The following information will emphasise some of the important facets of the U.S.D.A.-Longwood Program and highlight other aspects of importance.

First, because of the structure of the United States government, the stringent quarantine laws, and the regulations of foreign governments, it is imperative that any organized foreign plant exploration program have a link with the federal government, preferably with the U.S.D.A. This bond with the U.S.D.A., as used by Longwood, expedites

governmental negotiations, permits foreign travel and plant collecting in countries where travel would otherwise be restricted, and facilitates the shipping and plant quarantine process.

Once the necessary association is achieved with the U.S.D.A., it is then essential, for a cooperative program, to have a well defined and carefully thought-out agreement. Each agency must know its obligations and limitations and the program's goals, all based on a realistic appraisal of available resources. This should be spelled out in a specific contract that would define the absolute responsibilities of each agency. A cooperative contract that is detailed enough will outline the working relationships between both agencies.

After a well-defined program and a detailed contract, representatives from both agencies should meet formally at scheduled intervals to discuss the selection of the country to be explored, the plants to be collected, and the explorer to do the collecting. As with the U.S.D.A.-Longwood Program, there needs to be a goal or specific reason behind these major decisions.



In planning a continuing program, a two-to-four-year interval between explorations should be maintained. With an interval of this length, the overcrowding of the greenhouse facilities with plant material, as happened at both agencies during the U.S.D.A.-Longwood Program, would be avoided. With thirteen explorations in fifteen years, the backlogging of plants became a problem. The U.S.D.A. still has seeds stored from this program, because they lacked the time and facilities for germination. Russell J. Seibert realized the problem of overcrowded facilities, and, in a letter to Carl O. Erlanson he suggested the cessation of all trips for 1961-1962, to allow more time to process the present material.<sup>1</sup>

Another suggestion is that the explorers should be hired for a period two-to-three times as long as the actual trip. This extra time will provide the opportunity for comprehensive pre-trip preparations and for an extended period following each exploration for debriefing. Time should be allotted after the trip specifically for the documentation of the exploration and of the plant collection. The material from five early explorations previously published by the Agricultural Research Service can be

cited as valuable documentary works. Since most of the explorers under this program were U.S.D.A. employees, they were allowed some time for pre-trip and post-trip work.

The most important element of the program is the plant collecting. Emphasis should be placed on the specific collecting goals of the trip. The first evaluation of a plant should be made in the field, thereby limiting the total collection. There should be a specific reason for the collection of each plant. The need to limit the collections should be stressed to the explorers. Some of the U.S.D.A.-Longwood explorers limited collections to less than 500 plants; while others made collections in the thousands. The collection of plants for breeding purposes should be scrutinized. Only plants for a specific program, preferably one already started or a well defined one to be implemented should be collected; plants should not be collected for possible future breeding programs. Besides the problems associated with the propagation, evaluation, and distribution, that multiply as the number of plants increases, both institutions had the problem of inadequate resources for growing large numbers of plants for breeding purposes. If a large collection is anticipated, a greater

length of time between explorations will be required to handle the material properly.

No matter how well an expedition is organized and executed, the evaluation and distribution of the collection is most important for the attainment of the program's goal--to introduce new plants to the general horticultural public. The U.S.D.A.-Longwood scheme provided a dual evaluation and distribution program. I suggest the involvement of other agencies. A third and independent evaluation should be handled by a committee of horticulturists and informed nurserymen. This group should evaluate the plants according to a prescribed and controlled procedure.

Additional distribution could also be handled in cooperation with outside agencies such as the American Association of Botanic Gardens and Arboreta, and the American Nurserymen's Association. One important requirement of this distribution is that the recipients--botanic gardens, arboreta, agricultural stations, nurseries, and other institutions--be required to compile accurate records of the plant's performance. The results from these eval-

uations will help determine the adaptability of the plant, its potential horticultural worth, and the desirability of its release to the general public.

After the program's technical aspects are carried out, including the final evaluation and distribution, there needs to be a method to market the plants. First, a program to publicize the explorations and the returning plants should be implemented. Next, the present horticultural market should be expanded. Then, with the cooperation of plant societies, arboreta, botanic gardens, qualified nurserymen and florists, the product--a new plant--could be introduced and made available.

In addition to this process, a periodic review of the total program is needed by unbiased sources. They can gauge the effectiveness of the program, determine whether the goals are being accomplished, and make further suggestions.

While the U.S.D.A.-Longwood Ornamental Plant Exploration Program has resulted in a number of worthwhile plants and has stimulated American horticulture, a careful review of its procedures with the view of incorporating

some of the suggestions presented above might increase the efficiency and returns of future programs.

FOOTNOTES FOR THE INTRODUCTION

<sup>1</sup>Interview with John L. Creech, U.S. National Arboretum, Washington D.C., 22 June 1976.

FOOTNOTES FOR CHAPTER I

<sup>1</sup>Paul W. Meyer, "A Proposal for the Interpretation of John Bartram's Garden" (Masters thesis, University of Delaware, 1977), p. 3.

<sup>2</sup>Nelson Klose, America's Crop Heritage (Ames: Iowa State College Press, 1950), p. 3.

<sup>3</sup>Walter H. Hodge and Carl O. Erlanson, "Federal Plant Introduction--A Review," Economic Botany, October-December 1956, p. 301.

<sup>4</sup>Klose, America's Crop Heritage, p. 43.

HH <sup>5</sup>Hodge and Erlanson, "Federal Plant Introduction--A Review," p. 301.

<sup>6</sup>Ibid.

<sup>7</sup>Ibid., p. 302.

<sup>8</sup>Ibid., p. 303.

<sup>9</sup>Interview with Harold L. Hyland, Agricultural Research Center, Beltsville, Maryland, 27 January 1976.

<sup>10</sup>S. B. Sutton, The Arnold Arboretum: The First Century (Boston: Nimrod Press, 1971), p. 18-20.

FOOTNOTES FOR CHAPTER II

<sup>1</sup>Nelson Klose, America's Crop Heritage (Ames: Iowa College Press, 1950), pp. 120-129.

<sup>2</sup>B. J. Healy, The Plant Hunters (New York: Charles Scribner's Sons, 1975), pp. 169-193.

<sup>3</sup>Interview with Russell J. Seibert, Longwood Gardens, Kennett Square, Pennsylvania, 22 January 1976.

<sup>4</sup>Interview with Seibert, 30 October 1976.

<sup>5</sup>Interview with Seibert, 22 January 1976.

<sup>6</sup>Ibid.

<sup>7</sup>Ibid.

<sup>8</sup>George E. Thompson Sr., A Man and His Garden (Kennett Square, Pennsylvania: Longwood Gardens, Inc., 1976), pp. 17-19.

<sup>9</sup>Longwood Gardens (Kennett Square, Pennsylvania: Longwood Gardens, Inc., 1976).

<sup>10</sup>Interview with Seibert, 22 January 1976.

<sup>11</sup>Interview with John L. Creech, U.S. National Arboretum, Washington D.C., 22 June 1976.

<sup>12</sup>Interview with Seibert, 22 January 1976.

<sup>13</sup>Interview with Seibert, 30 October 1976.

<sup>14</sup>Ibid.



<sup>15</sup> Interview with Howard L. Hyland, Agricultural Research Center, Beltsville, Maryland, 27 January 1976.

<sup>16</sup> Interview with Seibert, 22 January 1976.

<sup>17</sup> U.S., Department of Agriculture, Cooperative Agreement between Longwood Gardens of Longwood Foundation, Inc. and United States Department of Agriculture, Agricultural Research Service, Horticultural Crops Research Branch, Document No. 12-14-100-761-(32) (1956).

<sup>18</sup> Harold F. Winters, "New Plant Introductions," Arboretum and Botanical Garden Bulletin 4 (January 1969): 29-32.

<sup>19</sup> Interview with Joseph Carstens, Longwood Gardens, Kennett Square, Pennsylvania, 10 January 1977.

<sup>20</sup> U.S., Department of Agriculture, Cooperative Agreement between Longwood and U.S.D.A., Document No. 12-14-100-761-(32) (1956).

<sup>21</sup> Ibid.

<sup>22</sup> Ibid.

<sup>23</sup> Interview with Creech, 22 June 1976.

<sup>24</sup> Interview with Seibert, 22 January 1976.

<sup>25</sup> Interview with Seibert, 1 February 1977.

<sup>26</sup> Interview with Hyland, 26 June 1976.

<sup>27</sup> Ibid.

<sup>28</sup> Interview with Creech, 22 June 1976.

<sup>29</sup> Interview with Hyland, 26 June 1976.

<sup>30</sup> Ibid.

<sup>31</sup> Interview with Seibert, 30 October 1976.

- <sup>32</sup>Interview with Seibert, 22 January 1976.
- <sup>33</sup>Interview with Hyland, 26 January 1976.
- <sup>34</sup>Ibid.
- <sup>35</sup>Ibid.
- <sup>36</sup>John L. Creech, "Preliminary Report to Longwood Gardens—Ornamental Exploration to Japan and Hong Kong," 1961, Director's Files, Longwood Gardens, Kennett Square, Pennsylvania.
- <sup>37</sup>Interview with Hyland, 26 January 1976.
- <sup>38</sup>Interview with William L. Ackerman, U.S.D.A. Inspection Station, Glenn Dale, Maryland, 22 June 1976.
- <sup>39</sup>Ibid.
- <sup>40</sup>Walter H. Hodge and Carl O. Erlanson, "Federal Plant Introduction-- A Review," Economic Botany, October-December 1956, p. 310.
- <sup>41</sup>Interview with Ackerman, 22 June 1976.
- <sup>42</sup>Interview with Carstens, 10 January 1977.
- <sup>43</sup>Interview with Richard W. Lighty, University of Delaware, Newark, Delaware, 18 February 1977.
- <sup>44</sup>Interview with Carstens, 10 January 1977.
- <sup>45</sup>Interview with Donald G. Huttleston, Longwood Gardens, Kennett Square, Pennsylvania, 10 February 1977.
- <sup>46</sup>Interview with Robert J. Armstrong, Longwood Gardens, Kennett Square, Pennsylvania, 17 February 1977.
- <sup>47</sup>Interview with Carstens, 10 January 1977.
- <sup>48</sup>Ibid.
- <sup>49</sup>Ibid.

- 50 Ibid.
- 51 Interview with Huttleston, 10 February 1977.
- 52 U.S., Department of Agriculture, Cooperative Agreement between Longwood and U.S.D.A., Document No. 12-14-100-761-(32) (1956).
- 53 Interview with Ackerman, 22 June 1976.
- 54 Ibid.
- 55 Ibid.
- 56 Ibid.
- 57 "U.S.D.A.-A.R.S., Notice of Release, Cotoneaster microphylla 'Emerald Spray'," 18 June 1971, Director's Files, Longwood Gardens.
- 58 Cunningham Gardens to U.S. Plant Introduction Station, 6 July 1965, Director's Files, Longwood Gardens.
- 59 Winters, "New Plant Introductions," p. 303.
- 60 "Summary of the Experimental Greenhouse of Longwood Gardens," Joseph Carstens Files, Longwood Gardens.
- 61 Interview with Lighty, 18 February 1977.
- 62 Interview with Armstrong, 17 February 1977.
- 63 Ibid.
- 64 Ibid.
- 65 John L. Creech, "Summary of Accomplishments, A.R.S.-Longwood Gardens Ornamental Exploration Program," November 1964, Director's Files, Longwood Gardens.
- 66 Ibid.
- 67 Harold F. Winters, "New Impatiens from New Guinea," American Horticulturist 52 (1973): 16-22.

<sup>68</sup>Ibid.

FOOTNOTES FOR CHAPTER III

<sup>1</sup>John L. Creech, Plant Explorations-Ornamentals in Southern Japan ARS-34-1 (Agricultural Research Service, U.S.D.A., 1957): 1.

<sup>2</sup>Interview with John L. Creech, U.S. National Arboretum, Washington D.C., 22 June 1976.

<sup>3</sup>Creech, Plant Explorations, p. 1.

<sup>4</sup>Walter H. Hodge, "The Longwood Gardens-U.S.D.A. Cooperative Program of Plant Introduction--A Critical Review," 10 July 1959, Director's Files, Longwood Gardens, Kennett Square, Pennsylvania, p. 3.

<sup>5</sup>Fredrick G. Meyer, Plant Explorations-Ornamentals in Italy, Southern France, Spain, Portugal, England, and Scotland ARS 34-9 (Agricultural Research Service, U.S.D.A., 1959): 1.

<sup>6</sup>Hodge, "The Longwood-U.S.D.A. Program," p. 3.

<sup>7</sup>Russell J. Seibert to Howard L. Hyland, 8 October 1956, Director's Files, Longwood Gardens.

<sup>8</sup>Meyer, Plant Explorations, p. 1.

<sup>9</sup>Hodge, "The Longwood-U.S.D.A. Program," p. 1.

<sup>10</sup>Llewelyn Williams, "Synopsis of Plant Exploration in Southern Brazil and Argentina," 28 May 1958, Director's Files, Longwood Gardens, p. 1.

<sup>11</sup>Interview with Howard L. Hyland, Agricultural Research Center, Beltsville, Maryland, 26 January 1976.

- <sup>12</sup>Hodge, "The Longwood-U.S.D.A. Program," p. 4.
- <sup>13</sup>George H. Spalding, Plant Explorations-Ornamentals in Australia ARS 34-33 (Agricultural Research Service, U.S.D.A., September 1962): 1.
- <sup>14</sup>Hodge, "The Longwood-U.S.D.A. Program," p. 4.
- <sup>15</sup>Interview with Russell J. Seibert, Longwood Gardens, Kennett Square, Pennsylvania.
- <sup>16</sup>Spalding, Plant Explorations, pp. 1-3.
- <sup>17</sup>Fredrick G. Meyer, Plant Explorations-Ornamentals in the Netherlands, West Germany, and Belgium ARS 34-32 (Agricultural Research Service, U.S.D.A., April 1963): 1.
- <sup>18</sup>Seibert to Hyland, 8 October 1956.
- <sup>19</sup>Howard L. Hyland, "Summary Report 1959-1960, New Crops-Longwood Ornamentals Project," Director's Files, Longwood Gardens, p. 1.
- <sup>20</sup>Meyer, Plant Explorations, p. 1.
- <sup>21</sup>John L. Creech, "Preliminary Report to Longwood Gardens-Ornamental Explorations to Japan and Hong Kong," 1961, Director's Files, Longwood Gardens.
- <sup>22</sup>John L. Creech, Ornamental Plant Explorations-Japan ARS 34-75 (Agricultural Research Service, U.S.D.A., May 1966): 5.
- <sup>23</sup>Creech, "Preliminary Report," p. 5.
- <sup>24</sup>Creech, Ornamental Plant Exploration, p. 2.
- <sup>25</sup>Francis deVos, "Plant Exploring in Nepal," Director's Files, Longwood Gardens, p. 11.
- <sup>26</sup>U.S.D.A., News Release, 171-63, 17 January 1963, Document No.3865, Director's Files, Longwood, Gardens.

<sup>27</sup>"U.S.D.A.-Longwood Gardens Ornamental Plant Exploration to Nepal," Director's Files, Longwood Gardens.

<sup>28</sup>John L. Creech, "U.S. Plant Scientists Explore the Himalayas" (Agricultural Research Service, March 1963), p. 2.

<sup>29</sup>deVos, "Plant Exploring," pp. 11-14.

<sup>30</sup>U.S.D.A., News Release, 171-63, 17 January 1963, Document No. 3865, Director's Files, Longwood Gardens.

<sup>31</sup>John L. Creech, Memorandum on U.S.S.R. Trip Report, 18 October 1963, Director's Files, Longwood Gardens.

<sup>32</sup>Ibid.

<sup>33</sup>Ibid.

<sup>34</sup>John L. Creech to Russell J. Seibert, 31 October 1963, Director's Files, Longwood Gardens.

<sup>35</sup>Ibid.

<sup>36</sup>Francis deVos to Russell J. Seibert, 22 June 1965, Director's Files, Longwood Gardens.

<sup>37</sup>"Plant Explorations-Sikkim Himalayas," Director's Files, Longwood Gardens, p. 1.

<sup>38</sup>"Itinerary on Proposed Foreign Travel for F. deVos and E. G. Corbett," Director's Files, Longwood Gardens.

<sup>39</sup>deVos to Seibert, 22 June 1965.

<sup>40</sup>"Plant Explorations-South Korea," Director's Files, Longwood Gardens, p. 1.

<sup>41</sup>"Summary of Korean Exploration," Director's Files, Longwood Gardens, p. 1

<sup>42</sup>Ibid.

<sup>43</sup>Ibid.

<sup>44</sup>"Plant Explorations-South Korea," Director's Files, Longwood Gardens, p. 1.

<sup>45</sup>Interview with Richard W. Lighty, University of Delaware, Newark, Delaware, 16 March 1977.

<sup>46</sup>John L. Creech, "Summary Trip Report-Plant Exploration to Taiwan," Director's Files, Longwood Gardens, p. 1.

<sup>47</sup>"Plant Exploration-Taiwan," Director's Files, Longwood Gardens, p. 1.

<sup>48</sup>Creech, "Summary Trip Report," p. 2.

<sup>49</sup>Ibid. pp. 1-3.

<sup>50</sup>Ibid. pp. 2-4.

<sup>51</sup>"Plant Explorations-Papua and New Guinea, Java," Director's Files, Longwood Gardens, p. 1.

<sup>52</sup>Harold F. Winters and Joseph J. Higgens, "Foreign Travel Report" (A.R.S.-Crops Research Division, U.S.D.A.): 1.

<sup>53</sup>"Plant Explorations-Papua and New Guinea, Java," p. 4.

<sup>54</sup>Harold F. Winters, "New Germ Plasm from New Guinea," Director's Files, Longwood Gardens, pp. 1-4.

<sup>55</sup>Winters and Higgens, "Foreign Travel Report," pp. 4-5.

<sup>56</sup>Ibid. pp. 1-3.

<sup>57</sup>Harold F. Winters, "New Impatiens from New Guinea," American Horticulturist 52 (1973): 16-22.

<sup>58</sup>"Plant Explorers to the Soviet Union," Director's Files, Longwood Gardens, p. 1.



<sup>59</sup>Ibid.

<sup>60</sup>John L. Creech, "Foreign Travel Report" (A.R.S.-  
Plant Science Research Division, U.S.D.A.), pp. 1-8.

<sup>61</sup>"Botanist Collects 290 Soviet Plants," New York  
Times, 9 January 1972.

FOOTNOTES FOR CHAPTER IV

<sup>1</sup>H. H. Fisher, Evaluation of Ornamental Plant Introductions ARS 34-128 (Agricultural Research Service, U.S.D.A., 1972): 3.

<sup>2</sup>Interview with Russell J. Seibert, Longwood Gardens, Kennett Square, Pennsylvania, 22 January 1976.

<sup>3</sup>Interview with Robert J. Armstrong, Longwood Gardens, 17 February 1977.

<sup>4</sup>Fisher, Evaluation of Ornamental Plant Introductions, p. 3.

<sup>5</sup>"Summary of Accomplishments, A.R.S.-Longwood Gardens Ornamental Exploration Program 1956-1964," Director's Files, Longwood Gardens, Kennett Square, Pennsylvania.

<sup>6</sup>Francis deVos, "New Plants from Explorations," Plants and Gardens, May 1964, p. 61.

<sup>7</sup>"Summary of Accomplishments, A.R.S.-Longwood Exploration Program 1956-1964," Director's Files, Longwood Gardens.

<sup>8</sup>"U.S.D.A.-A.R.S., Notice of Release, Juniperus conferta 'Emerald Sea'," 19 May 1972, Director's Files, Longwood Gardens.

<sup>9</sup>"U.S.D.A.-A.R.S., Notice of Release, Cotoneaster microphylla 'Emerald Spray'," 18 June 1971, Director's Files, Longwood Gardens.

<sup>10</sup>"U.S.D.A.-A.R.S., Notice of Release, Euonymus fortunei 'Longwood'," 17 September 1965, Director's Files

Longwood Gardens.

FOOTNOTES FOR CHAPTER V

<sup>1</sup>Russell J. Seibert to Carl O. Erlanson, 4 August 1961, Director's Files, Longwood Gardens, Kennett Square, Pennsylvania.

## APPENDIX

### ENUMERATION OF PLANT INTRODUCTIONS

The information below lists either the Plant Introduction (P.I.) numbers that have not been previously published in this manner or the reference citing where the P.I. numbers and corresponding collections have been published. Each number corresponds to a collection introduced by the U.S.D.A.-Longwood Exploration Program. A specific plant name and valuable collection information can be obtained by cross referencing these P.I. numbers with the P.I. numbers listed in the U.S.D.A.'s Plant Inventory Series.

#### Southern Japan - 1956

Published, John L. Creech, Plant Explorations-Ornamentals in Southern Japan ARS 34-1 (Agricultural Research Service, U.S.D.A., 1957): 24-48.

#### Western Europe - 1958

Published, Fredrick G. Meyer, Plant Explorations-Ornamentals in Italy, Southern France, Spain, Portugal, England, and Scotland ARS 34-9 (Agricultural Research Service, U.S.D.A., 1959): 102-180.

Southern Brazil and Argentina - 1958

246420 - 246460	247959 - 248145
246465 - 246475	248170
246601 - 246647	248491
246653	249150 - 249206
246668	249285 - 249419
246814 - 246925	249424 - 249525
247008 - 247020	249685
247122 - 247134	251779
247138 - 247271	253474

Australia - 1958-1959

Published, George H. Spalding, Plant Explorations-Ornamentals in Australia ARS 34-33 (Agricultural Research Service, U.S.D.A., September 1962): 68-158.

Northern Europe - 1959

Published, Fredrick G. Meyer, Plant Explorations-Ornamentals in the Netherlands, West Germany, and Belgium ARS 34-32 (Agricultural Research Service, U.S.D.A., April 1963): 68-158.

Northern Japan - 1961

Published, John L. Creech, Ornamental Plant Explorations-Japan ARS 34-75 (Agricultural Research Service, U.S.D.A., May 1966): 43-65.

Nepal - 1962

285310 - 285369	285465 - 285478
285371 - 285284	285480 - 285500
285386 - 285391	285506 - 285515
285410 - 285441	285517
285443 - 285463	

Russia - 1963

293752 - 293759	293854 - 293857
293761 - 293765	293859
293767 - 293813	293869 - 293870
293815 - 293832	293877 - 293878
293834 - 293848	293881 - 293898
293852	

Sikkim (West Bengal) - 1965

306378	307189 - 307377
--------	-----------------

South Korea - 1966

316364 - 316367	317353 - 317387
316400 - 316410	318512 - 318592
316592 - 316609	319162 - 319164
316611 - 316622	319240 - 319271
316628 - 316631	319272 - 319331
316640 - 316656	320396 - 320409
316688 - 316719	320886 - 320887
316958 - 316992	320896 - 320910
317188 - 317314	

Taiwan - 1967-1968

323942 - 323943	325581 - 325583
324940 - 325078	

New Guinea - 1970

347235	348924 - 348936
347255 - 347256	349273 - 349314
347642	349500 - 349631
347644	352554 - 352627
347646 - 347695	353391 - 353393
347721	354111 - 354316
347844 - 347845	354154 - 354428

355297 - 355307  
355309 - 355310

355384 - 355386

Russia - 1971

369164 - 369337

370273 - 370275