

THE HISTORY AND DEVELOPMENT OF NEW GUINEA IMPATIENS

by

Joan Marie Benjamin

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 Public
Horticulture Administration

August 1990

SB413
.N48B468

TABLE OF CONTENTS

ABSTRACT	iv
INTRODUCTION	1
Chapter	
1. THE DISCOVERY OF NEW GUINEA IMPATIENS	4
Map 1: The Sunda Islands and Political Divisions of New Guinea	5
2. THE REDISCOVERY OF NEW GUINEA IMPATIENS	10
Map 2: Areas of New Guinea Visited by the Explorers	20
3. THE DEVELOPMENT OF NEW GUINEA IMPATIENS	26
4. NEW GUINEA IMPATIENS IN THE MARKETPLACE	46
5. CONCLUSION	57
BIBLIOGRAPHY	64
APPENDIX 1 LONGWOOD GARDEN'S PLANT EXCHANGE COOPERATORS	73
APPENDIX 2 A SUMMARY OF NEW GUINEA IMPATIENS CULTIVARS 1974-1990	76
APPENDIX 3 ORIGINAL NEW GUINEA IMPATIENS INTRODUCTIONS	82
APPENDIX 4 COMMERCIAL RECIPIENTS OF ORIGINAL NEW GUINEA IMPATIENS COLLECTIONS	87
APPENDIX 5 CULTIVAR NAMES USED AS OF DECEMBER 1975	90

ABSTRACT

New Guinea Impatiens is an important ornamental crop in the United States and Europe. In the United States they are quickly approaching the total market value of Geraniums and major growers feel their popularity has not peaked (Konjoian 1990; Drewlow, interview, 8 May 1990).

The history of these plants provides insight into ornamental plant development. Future development efforts may benefit from understanding the procedures that made New Guinea Impatiens a success.

New Guinea Impatiens were first introduced in Europe in 1886 and instantly became popular. By the early 1900s they had virtually disappeared from cultivation because of Begonia mite infestations (Hooker 1909). Plant explorers collected and distributed New Guinea Impatiens from 1886 until 1969 but the plant did not regain its lost status.

In 1970 a plant exploration trip co-sponsored by Longwood Gardens and the United States Department of Agriculture (USDA) rediscovered New Guinea Impatiens. Their cooperative venture became a turning point in the plants' development.

The two organizations were interested in the possible display uses of the plant and in discovering and distributing information about its breeding and culture. Universities and commercial growers were able to work with the plants because of the commitment of Longwood and USDA to share information.

Plant collectors, researchers, and breeders were involved in the advancement of New Guinea Impatiens in varying degrees. Only a handful of individuals were dedicated enough to promote and develop the plants.

New Guinea Impatiens became a success after nearly one hundred years of obscurity because of the cooperation between not-for-profit and commercial organizations, and the persistence and commitment of a few individuals.

INTRODUCTION

Plant enthusiasts were delighted when New Guinea Impatiens cultivars were introduced to the United States bedding plant market in 1974 (Martin 1984). Sultana Impatiens (*I. wallerana*) was already popular with gardeners, but New Guinea Impatiens offered brilliant, new flower colors, variegated leaves, and even some sun tolerance (Murphy 1978).

The first cultivars were developed quickly and with apparently little effort. The parent plants were brought from New Guinea in 1970 as the result of a collection trip co-sponsored by Longwood Gardens and the United States Department of Agriculture (USDA). By 1978, at least sixty cultivars of New Guinea Impatiens had been released. Their popularity helped Impatiens become the number one bedding plant in the United States, a position Impatiens have occupied continuously from 1982 to the present (Voigt 1989).

The popularity of New Guinea Impatiens continues to grow. In 1989 growers introduced nineteen new cultivars and produced approximately fifty million cuttings for sale in the United States and twenty million cuttings in Europe (Lyndon Drewlow, interview, 8 May 1990).

Historically, New Guinea Impatiens were far from an overnight success. Their current popularity represents over one hundred years of plant exploration and development. The discovery of New Guinea Impatiens was first documented in 1884 and the plants were introduced and sold to the European public as early as 1886. They were instantly popular as a hothouse crop and were described in the January 13, 1887 Journal of Horticulture, Cottage Gardener and Home Farmer as "an ornamental plant . . . likely to soon become even a greater favourite than I. Sultani." The success did not last. A catastrophic encounter with Begonia mites (Tarsonymus) caused them to disappear from the horticulture scene (Hooker 1909).

There were several plant exploration trips between 1886 and 1969 which resulted in the continued collection and distribution of New Guinea Impatiens. Despite the collectors' glowing reports (Schlechter 1915), the plants

did not become popular again until nearly one hundred years after their introduction.

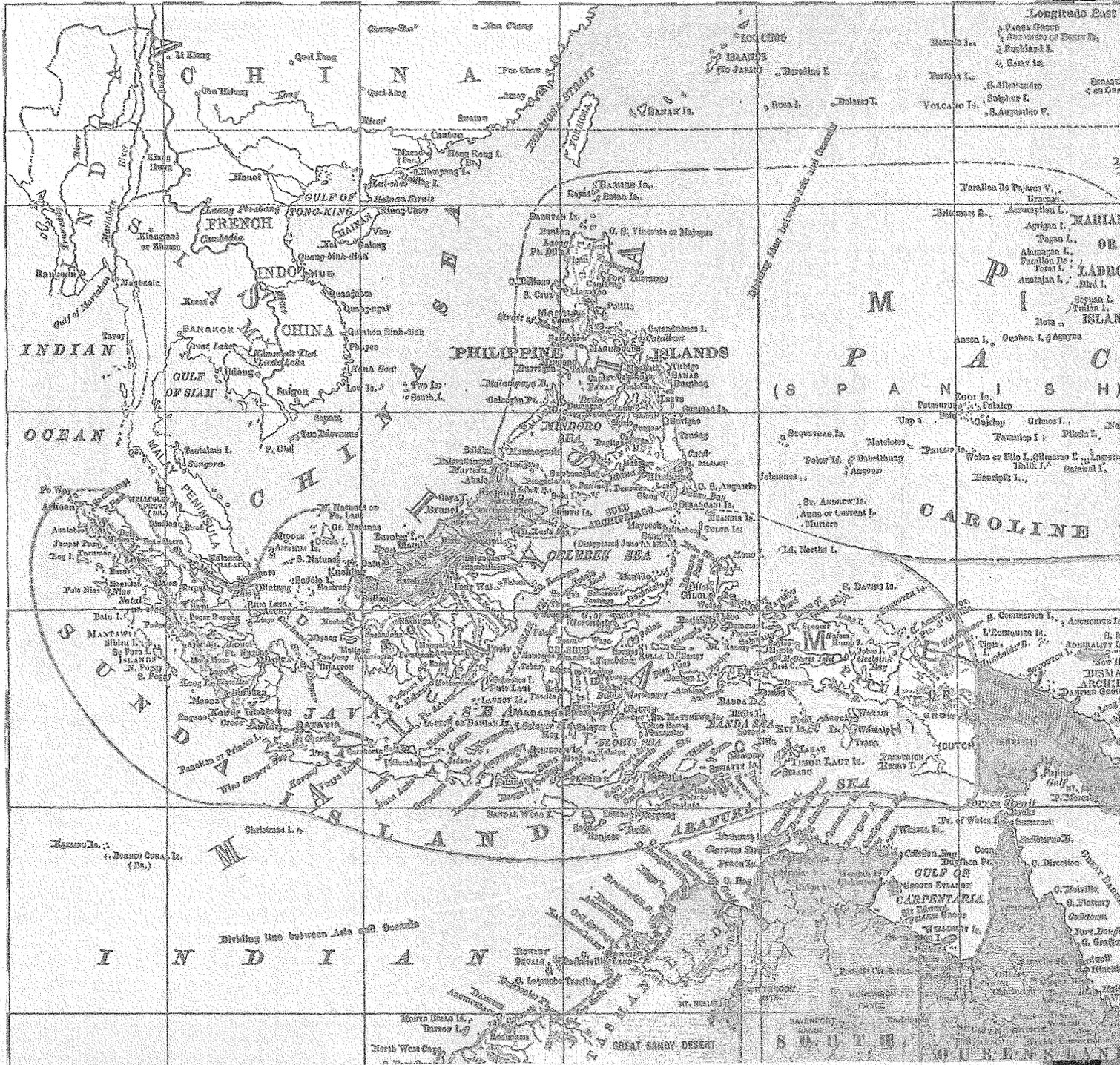
The purpose of this thesis is to document the history and development of New Guinea Impatiens, to determine how and why a plant introduced in 1886 became a success in the 1970s and 1980s. This plant history is also a record of the collectors, researchers, and plant breeders involved with the development of New Guinea Impatiens. Their efforts were responsible for the eventual success of the plants and their insight provides the means to evaluate New Guinea Impatiens' future.

CHAPTER 1

THE DISCOVERY OF NEW GUINEA IMPATIENS

In 1884 Kew Gardens received an herbarium specimen of an *Impatiens* plant from Dr. Schomburgk, "curator (director)" (Stafleu 1976) of the Adelaide Botanical Garden in Australia. The specimen was labeled as a native of the South Sea Islands and its discovery was credited to Lieutenant Hawker, R.N. (Hooker 1909). Two years later, William Bull, a famous London florist, introduced the plant as *Impatiens Hawkerii* in his Catalogue of New, Beautiful and Rare Plants. An entry in The Illustrated Dictionary of Gardening in 1901 narrowed the location of Lieutenant Hawker's discovery to the Sunda Islands (Nicholson 1901). (Map 1, page 5.) A more elaborate description of *I. Hawkeri* was published in Curtis's Botanical Magazine of 1909. The plant was then identified as a native of New Guinea and the author concluded that "in all probability the plant was first raised in Adelaide and thence transmitted to Mr. Bull, of Chelsea" (Hooker 1909).

Map 1: The Sunda Islands and Political Divisions of New Guinea



Immediately after William Bull introduced the plant, illustrations and enthusiastic descriptions of Impatiens Hawkeri appeared in garden journals and grower's publications in Belgium, England, Germany, Italy, and the Netherlands. The plant quickly became popular for use in the garden (Gardeners' Chronicle 1888) and "warm house" (T.B. 1887). Impatiens Hawkeri was available in Bull's catalogue and other plant catalogues for several years and then disappeared from the horticulture scene. Sir Joseph Hooker explained the plant's fate in Curtis's Botanical Magazine of 1909:

For a time it enjoyed considerable popularity, but it suffered so frequently from attacks of the Begonia mite (*Tarsonymus*) that it went almost entirely out of cultivation.

By the early 1900s New Guinea *Impatiens*' popularity had faded but the plants continued to excite the botanists who collected them. The political divisions of New Guinea around 1900 (Map 1, page 5) help explain the discovery and distribution of New Guinea *Impatiens* by European explorers. The Dutch claimed the western half of the island in 1828. In 1884, the Germans claimed the northeast part of the country and the British claimed the southeast section (Wheeler 1988). Representatives of all three countries explored New Guinea and collected

botanical specimens, including New Guinea Impatiens.
(Grey-Wilson 1980; Van Steenis-Kruseman 1950).

Several New Guinea Impatiens species were identified and introduced following the release of I. Hawkeri. By 1915, nine New Guinea Impatiens species were identified in German New Guinea alone: I. Dahlii, I. Herzogii, I. Lauterbachii, I. linearifolia, I. Mooreana, I. polyphylla, I. Rodatzii, I. Schlechteri, and I. trichura (Schlechter 1915; Schumann 1905). The number of species illustrates the variability among New Guinea Impatiens plants. Taxonomically they are a confusing group. By 1911 Sir Joseph Hooker concluded that I. Hawkeri and I. Herzogii were probably forms of the same species (Hooker 1911). German plant explorer, Von R. Schlechter reached a similar conclusion when he described I. Mooreana in Die Gartenwelt in 1915. He theorized that some of the nine species in German New Guinea represented habitat-variations of I. Herzogii rather than new species.

Explorers were fascinated by the exotic peoples, animals, birds, and plants of New Guinea. Several countries sponsored exploration and collecting expeditions between 1886 and 1969 (De Wit 1954; Van Steenis-Kruseman 1950). J. S. Womersley, Forest Botanist, at the Lae Botanic Garden in New Guinea described numerous

expeditions by botanists from America, Australia, England, France, Germany, the Netherlands, and Switzerland in a 1953 article titled, "A Brief History of Botanical Exploration of Papua and New Guinea." M. J. Van Steenis-Kruseman provided an even more exhaustive list of botanists who worked in New Guinea in Malaysian Plant Collectors and Collections in Volume 1 of Flora Malesiana. Herbarium specimens in the Gray Herbarium of Harvard University, Botanischer Garten und Botanisches Museum, Berlin-Dahlem, Herbarium Australiense, Canberra, Kew Gardens, Lae Herbarium, and Rijksherbarium, Leiden document New Guinea Impatiens collected during some of these expeditions as well as collections made by the Division of Botany, Department of Forests, Lae, New Guinea (Grey-Wilson 1980).

Foreign explorers and researchers had a great impact on the distribution and development of New Guinea Impatiens, but they were not the only participants. New Guinea natives also influenced the development of the plants. Natives selected New Guinea Impatiens from the wild and grew them in gardens and along paths. They traded plants between villages. A number of the plants collected in the twentieth century came from village gardens and paths. The native people often chose plants with "large, brightly coloured, flowers and those with

reddish, purple or variegated leaves" (Grey-Wilson 1980). The preferences of the New Guinea natives showed up in the specimens obtained by plant collectors. The New Guinea people may have influenced collections from the nineteenth century or even earlier. Evidence of gardening in New Guinea extends back 9,000 years (Wheeler 1988).

Despite the efforts and enthusiasm of plant collectors, New Guinea *Impatiens* did not easily regain the popularity they had achieved in the 1880s. It took nearly one hundred years before the plants generated widespread enthusiasm in the world of horticulture again.

CHAPTER 2

THE REDISCOVERY OF NEW GUINEA IMPATIENS

On January 4, 1970 two plant explorers set out on a ten week trip to explore New Guinea and collect ornamental plants. The trip was the twelfth of thirteen plant exploration trips sponsored by Longwood Gardens and the United States Department of Agriculture's, Agricultural Research Service, Horticulture Crops Research Branch. The two organizations agreed to co-sponsor ornamental plant collection trips in 1956. Longwood provided the necessary funds while USDA provided simplified entry to foreign countries, manpower, and the knowledge and authority to expedite plant quarantines (Tschanz 1977).

The purpose of these trips was to find and distribute ornamental plants which would improve the quality and range of available ornamentals. Collecting trips had already been made to Asia, Europe, Australia, and South America. Plants were collected from known sources such as botanical gardens and areas where useful

ornamentals had already been discovered. Collectors also explored unfamiliar territory, countries where ornamental plants were known to exist but were not available for exchange (Creech 1968).

In 1969 Longwood Gardens and USDA agreed to sponsor a trip to New Guinea. It was a logical choice. New Guinea was rich in ornamental plants but their existence was threatened by land development. USDA was particularly interested in New Guinea's large endemic population of tropical Rhododendrons. Researchers knew about the plants from botanical literature and wanted to expand available collections before it was too late. (Harold Winters, Longwood lecture, 28 July 1970; interview, 14 March 1989).

Treacherous terrain and hostile natives kept explorers from entering large parts of New Guinea until World War II. During the war, Australian and American troops battled the Japanese for control of the country. Roads and airstrips were built which made it possible to travel deeper into New Guinea than anytime in the past.

After the war, Australia governed New Guinea and brought about changes which made the 1970 trip possible and necessary. The Australian government worked to stop cannibalism and introduced health programs. More roads

and airstrips were built. As a result, population increased and the country became more accessible. More people meant less farm land. Natives moved further and further up the hills and mountains in search of suitable land for raising crops and pigs. Increased development made native plants easier to reach but crop farming, livestock, and lumbering threatened to destroy their habitats (Winters and Higgins 1970).

The decision to travel to New Guinea was made by Dr. John Creech, Chief, New Crops Research Branch, Crops Research Division, USDA, Beltsville, Maryland; and Dr. Russell Seibert, Director of Longwood Gardens, Kennett Square, Pennsylvania. Dr. Seibert proposed the idea of joint plant exploration trips in 1956. He realized that both organizations working together could accomplish goals that neither could tackle alone. Private organizations like Longwood could not get permission to travel to many foreign countries. They also had to deal with U.S. government restrictions. Plants entering the country were subject to a lengthy quarantine procedure which they did not always survive (Tschanz 1977). USDA's government status opened doors a private organization could not, but their funding priorities were for food crops, not ornamentals. A combination of Longwood's private funds

and the USDA's government role smoothed out most of the obstacles for both organizations.

Harold F. Winters, Research Horticulturist, New Crops Research Branch, USDA, Beltsville, Maryland and Dr. Joseph J. Higgins, Research Plant Physiologist, New Crops Research Branch, USDA, Glenn Dale, Maryland were chosen as plant explorers (Winters and Higgins 1970). As with previous trips, interested parties were notified that requests for plant materials would be considered. "Plant breeders, nurserymen, botanic gardens and arboretums, city foresters, and conservationists" submitted requests for review (Creech 1968). "Conferences were held between Longwood Gardens and the U.S.D.A. plant explorers" (Armstrong 1974) to work out details of the trip and set priorities. Rhododendrons were the main focus of the trip but requests that ranged from fireflies to fruits, were considered (Harold Winters, Longwood lecture, 28 July 1970).

Noted plant breeder, Claude Hope met with Winters and Higgins before the trip. Hope developed the Elfin Series of Impatiens wallerana which was introduced by Pan-American Seed Company in 1969 (Holden 1974). His interest in New Guinea Impatiens may have been the catalyst for adding the plants to the collecting wish list

(Harold Winters, interview, 30 November 1989; Claude Hope, letter to the author, 8 January 1990).

The plant explorers began research on the plants they would collect and made contacts to help them with their plant search. They did extensive research on Rhododendrons and studied additional plants requests as time allowed. Harold Winters checked the Index Kewensis for named species of Impatiens and looked for additional information at the National Agricultural Library. He found a few references to New Guinea Impatiens, including descriptions by K. M. Schumann, Karl Lauterbach, H. N. Ridley, and R. Schlechter of plants collected between 1866 and 1915 (Harold Winters, interview, 30 November 1989). The explorers contacted botanists and horticulturists in New Guinea and in other areas with knowledge of New Guinea plants.

Contacts outside of the country provided information about New Guinea flora. The explorers' journey started in Honolulu, Hawaii. They spent four days consulting with botanists at the Bishop Museum and horticulturists from the University of Hawaii. The next destination was New Caledonia where they collected plant samples for the Branch Cancer Screening program. The explorers made a second research stop in Brisbane,

Australia. They visited the Queensland Herbarium, which contained specimens of New Guinea plants, the Brisbane Botanic Garden, and "a nursery operated by 'Save the Trees,' a local organization dedicated to preservation of the native flora" (Winters and Higgins 1970). Once research preparations were completed, Winters and Higgins set out for Lae, New Guinea on January 17, 1970.

Contacts inside New Guinea were essential for a successful trip. In 1970, the eastern half of New Guinea was under the control of the Australian government. The western half of the island, was governed by the Republic of Indonesia and the explorers did not have permission to visit. Even if they had permission, a lack of roads and airfields would have made the trip impractical.

The explorers received considerable assistance and travel advice from the Australian government, particularly the staff of the Forestry Department in Lae, New Guinea. Don McIntosh, Acting Director of the Department of Forests allowed staff members to participate in field trips and assist with the preparation of plant materials. John S. Womersley, Chief of the Division of Botany, offered the explorers a base of operations and the technical assistance of Forestry personnel. Andrée Millar, Botanist and Curator of the Lae Botanical Garden

accompanied Winters and Higgins on three field trips. Botanist, Don Forman, of the Lae Botanical Garden assisted on two field trips. The Herbarium Keeper, Alec Dockrill dried and fumigated voucher specimens for the collectors while Ted Henty, Specialist on Grasses and Weeds, and John S. Womersley assisted in the identification of plant materials (Winters and Higgins 1970). The staff at Lae Botanical Garden was eager to help the explorers "make collections since they felt some species would probably become extinct because of lumbering and farming" (Joseph Higgins, TV interview, 6 March 1971). Without the help of these people and others, the collectors could not have obtained as many plants or sent as many back to the United States.

Air travel made exploration less complicated but it certainly was not easy. Four-wheel-drive vehicles were necessary for road travel and many places could only be reached by foot. The explorers collected mostly in the rugged mountains of the central and western highlands, but also visited the Huon Peninsula in the Saruwaged Mountain Range (Harold Winter, interview, 30 November 1989), a lower elevation rainforest area south of Lae (Harold Winters, Longwood talk, 28 July 1970), and a savannah region near Port Moresby (Harold Winters, interview, 30 November 1989).

They traveled in the dry season which was characterized by hot, dusty, humid conditions. The temperature reached 90°F. at lower elevations sites. Above 2,500 feet, the weather was cool and moist. On a trip to Mt. Wilhelm the explorers encountered 40°F. temperatures accompanied by a constant drizzle. Rugged terrain and unpredictable weather were not the only challenges. Chiggers, leaches, and other insects also were a problem (Harold Winters, interview, 14 March 1989).

Winters and Higgins enlisted the aid of native bearers to carry their gear and help collect plants. Joseph Higgins described the process in a letter to the Director of Longwood Gardens on March 18, 1970:

We chartered a plane in Lae for Mindik where we hired a dozen bearers to carry our 1100 lbs of gear to the village of Arigenang. After a half day's hike up & down and around many mountains we reached the village and were abandoned immediately by our bearers after receiving each of their 7 shillings, - our new natives gave us one of their village huts to stay in for the next several days.

The gear included a plant press and digging tools, collecting bags (Harold Winters, interview, 14 March 1989), compasses, camping gear, materials for recording data and for packing and shipping specimens (Murphy 1978). Bearers were paid with cigarettes, tobacco, or cash (Harold Winters, interview, 14 March 1989).

New Guinea natives were eager and capable plant collectors despite a language barrier. Over seven hundred different tribes occupy the eastern half of New Guinea representing over seven hundred different languages (Harold Winters, interview, 14 March 1989). In the villages the plant explorers visited, at least one person usually spoke Pidgin English, but this did not guarantee good communication. Pidgin makes use of English words but in strange and convoluted ways. Some Department of Forestry staff members spoke fluent Pidgin and their help was invaluable.

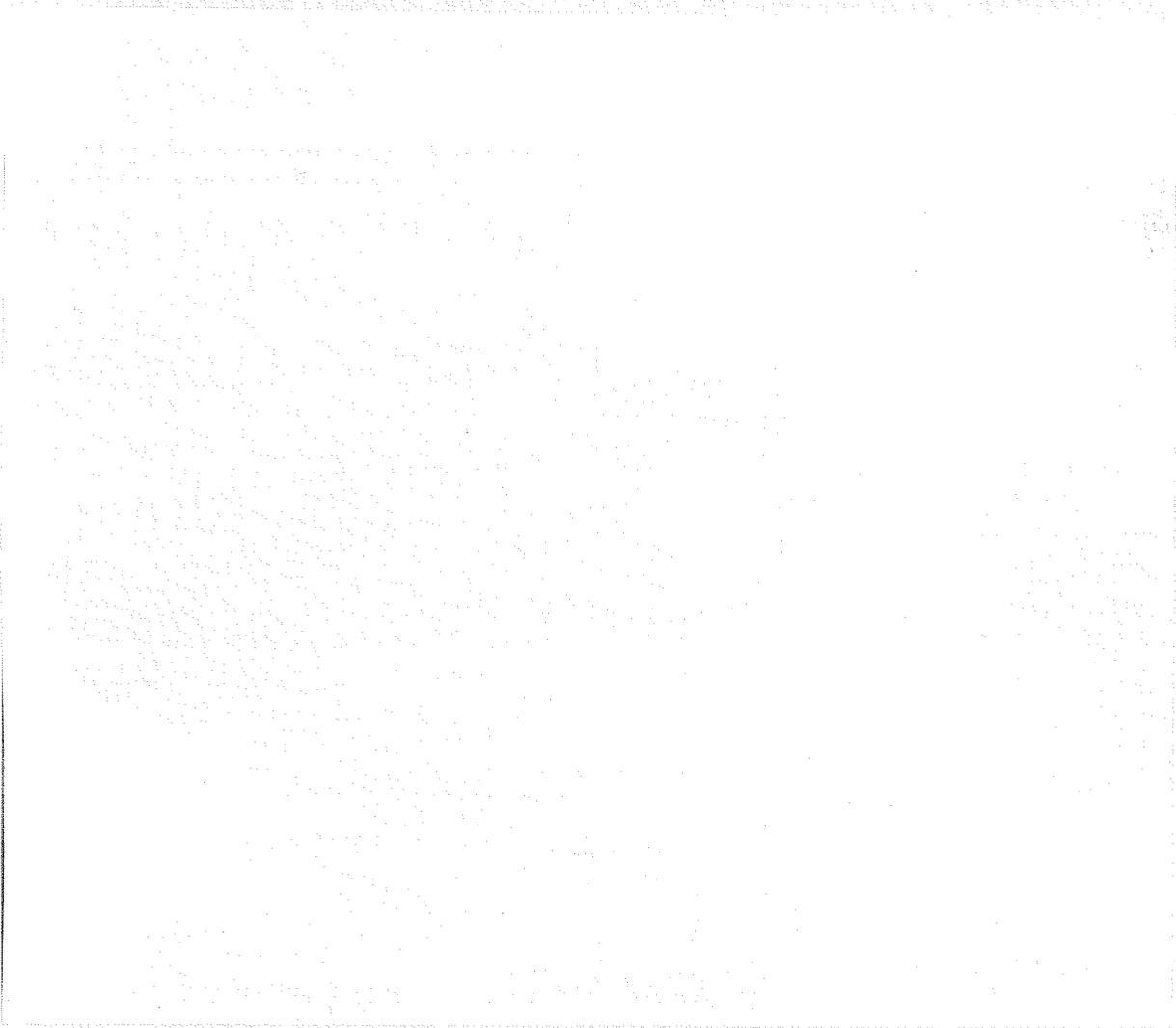
Winters and Higgins found that drawings could be useful. Natives could identify a plant from a picture and take the explorers to the location where it grew. Natives were able to collect plants in difficult locations, whether it required climbing trees or hacking through dense growth with machetes. The natives were acquainted with Andree Millar from previous trips and would begin collecting plants as soon as they saw her arrive (Harold Winters, Longwood lecture, 28 July 1970). The collectors would pay ten cents or one shilling for a good specimen (Joseph Higgins, TV interview, 6 March 1971). Sometimes the natives were so efficient, Winters and Higgins had difficulty keeping up with the volume of plants that had

to be pressed and packaged for shipment (Joseph Higgins, interview, 20 June 1989).

The explorers collected wild and cultivated forms of New Guinea Impatiens. Wild plants were found growing in forest clearings, on moist stream banks, and along the edges of foot paths and roads at elevations of 1,219 to 2,743 meters (Hyland 1972). They were collected from an area south of Lae on the road from Wau to Edie Creek, in the central highlands on the road from Arona to Goroka and in the area around Mt. Hagan (Map 2, page 20). Impatiens collected in the lower elevation, humid forest area near Wau and Edie Creek had many large, pale flowers. Collections from the highlands had fewer, smaller flowers but they were brilliantly colored. The foliage was often red or variegated (Murphy 1978; Harold Winters, interview, 30 November 1989).

Cultivated plants were found bordering village paths and gardens. Harold Winters noted that the native

Map 2: Areas of New Guinea Visited by the Explorers



© 1966 and 1967, by General Drafting Co., Inc.

and Western Publishing Co., Inc.

Used by permission.

people loved flowers and plants (interview, 14 March 1989):

They are natural gardeners and they raise ornamentals as well as food plants. The natives will take cuttings and put them around their houses or plant them at the edge of their gardens (interview, 30 November 1989).

The plants rooted easily in the moist climate (Winters 1973). The explorers also obtained plants from the Korn Farm Nursery where John C. Lowien, District Supervisor of Forests for the Mt. Hagen area, maintained a collection of New Guinea *Impatiens*.

Getting to the plants was difficult, but getting them back to the United States proved an equally challenging task. *Impatiens* stems and leaves are succulent and cuttings wilt easily. Ripe seeds burst from their pods and scatter. Higgins and Winters had the convenience of air travel and the advantage of modern packing materials but quick transportation and plastic bags could not guarantee the survival of fragile plants.

Cuttings were placed in plastic bags with holes punched in them to discourage rotting. The plants were packed in layers in cigarette boxes, which were sturdy and available. Newspapers were used to separate and protect layers of plants. Holes were punched in the boxes to aid air circulation. The plant hunters carried the specimens

with them until they reached a city like Lae, Mt. Hagan, or Port Moresby that was big enough to ship air freight (Harold Winters, interview, 30 November 1989).

The explorers took cuttings, and collected seeds when possible, to insure successful shipments. They provided instructions and proper mailing labels and permits, but even these precautions were not enough. Some shipments were unloaded and left behind at transfer points. Packages could reach USDA in four or five days but at times took as many as twenty days and the plants rotted. Only twenty five of fifty New Guinea *Impatiens* collections survived the trip to the United States. When they received word that plants had been lost, Winters and Higgins recollected what they could (Joseph Higgins, interview, 20 June 1989). They were not able to replace all of the missing collections.

They left New Guinea on April 1, 1970 and made stops at Manila, Philippines, Singapore, and Java. They collected additional plants and visited botanical gardens, agricultural, and horticultural research stations. In Tjibodas, Java they added *Impatiens platypetala* to their collection. On April 13 they departed for Hong Kong and the trip ended on April 14 (Winters and Higgins 1970).

The explorers gave the original set of *Impatiens* plants names associated with New Guinea. Some were Pidgin names that referred to places in New Guinea like 'Kundiawa.' Others were descriptive or referred to people. 'Palua Missus' was named in honor of Andrée Millar (Winters 1973) while 'Mr. Mausgrass' refers to the heavy beard and moustache developed by Joseph Higgins during the exploration trip (Joseph Higgins, interview, 20 June 1989). The plants were named in the hope that they would go immediately into commercial production. At least one producer did release the original plants to the public, but further development was needed for commercial success (Harold Winters, interview, 30 November 1989).

Taxonomic classification of the plants was a problem. Initially, ten plants were identified as belonging to either *I. Hawkeri*, *I. Herzogii*, *I. linearifolia*, or *I. Schlechteri*. Eleven other specimens were only identified as *Impatiens* species (Hyland 1972). It was obvious that more work was needed to sort out the taxonomic distinctions.

Impatiens have baffled taxonomists throughout the twentieth century but few botanists have worked on the problem. Professor Dr. O. Warburg revised the classification of *Impatiens* in German New Guinea in 1905

and came up with seven new species (Schlechter 1915). Sir Joseph Hooker published two works on the Impatiens of British India in 1874-5 and in 1904-6 (Jones and Smith 1966). The most recent work has been done by Dr. Chris Grey-Wilson, taxonomic botanist at Kew Gardens. Grey-Wilson studied the genus and has published works and revisions on Impatiens since 1977. In "Impatiens in Papuasia: Studies in Balsaminaceae: I", he concluded that New Guinea Impatiens "belong to a single hugely variable species." He distinguished fifteen groups among the species but felt they often represented "focal points of more or less continuous variation" and did not give them a taxonomic rank. In order to reduce confusion among cultivated plants, Grey-Wilson proposed that "each clone . . . be given a clear and distinctive cultivar name under Impatiens Hawkeri." He also recognized the need for additional research.

The 1970 plant exploration trip sponsored by Longwood Gardens and USDA was not the first plant expedition to collect New Guinea Impatiens and was certainly not the last. The Department of Forests, Lae has made numerous collections since 1970, and expeditions by foreign explorers have also continued. Several of these collections are documented by herbarium sheets at Grey's Herbarium, Harvard.

The Longwood/USDA trip did have a significant impact. Altogether Winters and Higgins gathered "840 live collections of seeds, plants and cuttings" (Winters and Higgins 1970). These included, Aroids, Citrus relatives, Ferns, Gesneriads, Gingers, Grasses, Hoyas, Impatiens, and Rhododendrons (Winters and Higgins 1970). Many of the collections looked promising, but the plants that caused the greatest sensation and have met with the greatest success are the New Guinea Impatiens.

CHAPTER 3

THE DEVELOPMENT OF NEW GUINEA IMPATIENS

Twenty five live New Guinea Impatiens collections were placed in quarantine at the USDA Plant Introduction Station at Glenn Dale, Maryland in 1970. The plants were inspected for insects and diseases and turned over to the Germplasm Lab at Glenn Dale where they were propagated to provide enough material for distribution (Harold Winters, interview, 14 March, 1989).

A sufficient number of plants were available for USDA and Longwood to work with in 1971. Dr. H. Marc Cathey, Chief of Florist and Nursery Crops at USDA took an interest in the plants. He requested clones of the plants for research at the Ornamentals Lab in Beltsville, Maryland (Cathey, interview, 1 May 1990). Dr. Cathey assigned Research Geneticist, Dr. Toru Arisumi, to work on the crop. Dr. Arisumi was not familiar with Impatiens but his background in genetics and plant breeding made him the logical choice to head up the project. When he first saw the plants in quarantine at Glenn Dale, Dr. Arisumi

thought they looked "tall, scraggly, and kind of interesting" (Arisumi, interview, 17 August 1989).

The mission of the Ornamentals lab was to help solve plant industry problems by providing basic research information (H. Marc Cathey, interview, 1 May 1990). Dr. Arisumi's goal was "not to create new varieties" but "to . . . get information" (Arisumi, interview, 17 August 1989). He needed to find out if other species of Impatiens were available, if the collection would cross and produce seed, how the plants related cytologically, and when they bloomed. He began studies on breeding behavior, genetics, and chromosome numbers and characteristics.

Longwood Gardens was the first organization, outside of USDA that received the New Guinea Impatiens collection. As co-sponsor of the exploration trip they were entitled to plants as soon as they became available. Dr. Robert Armstrong, Longwood's Geneticist received the plants in March of 1971 (Armstrong 1976) and was not impressed with what he saw. The plants looked "scruffy and didn't appear to have much potential" (Armstrong, interview, 24 October 1989). Those with the largest flowers were tall and coarse-looking, and the flower colors were pale. Some of the more compact plants had

brightly colored flowers and attractive foliage but the flowers were small (Armstrong 1976). Longwood could have worked on any of the plant materials brought back from New Guinea but chose the Impatiens because of their short life cycle. Results could be obtained more quickly than with woody plants (Armstrong, interview, 24 October 1989).

The original plants looked so lanky and unattractive that Dr. Armstrong briefly considered other projects (Murphy 1978). He thought their appearance might improve outside and moved them out of the greenhouse for a better evaluation (Armstrong, interview, 24 October 1989). The plants were grown in shade at first but did not appear to need the protection and were moved into full sun. The results were spectacular. The plants became bushy and some with green leaves developed variegated patterns. They did not flower much during the summer but burst into bloom in the fall. Dr. Armstrong moved them into the greenhouses for the winter and started making crosses (Martin 1984).

Very little was known about breeding New Guinea Impatiens so Dr. Armstrong used a shotgun approach, which meant breeding each plant in every combination possible. Some of the initial crosses looked good enough for release and the plants were vegetatively reproduced for

distribution. Although he knew the plants were not perfect, Dr. Armstrong hoped they would generate excitement and provide encouragement for other plant breeders (Armstrong 1974).

Longwood released ten plants to selected gardens and growers in 1974. Since the start of the joint exploration trips in 1956, Longwood had made excess plants available to interested individuals and organizations on an exchange basis. Public horticulture institutions, commercial growers, and private collectors exchanged plants with Longwood and became known as cooperators (Joseph Carstens, interview, 1 May 1990). (See Appendix 1, page 73.)

Dr. Armstrong named the first set of plants the Circus Series because of their gaudy flowers and leaves. The plants had names like 'Carousel', 'Harlequin' and 'Painted Lady' (see Appendix 2, page 76) and caused a lot of excitement when they were released. Gardeners and commercial growers were impressed with the variegated foliage and showy flowers (Martin 1984). The plants were not patented and growers were free to work with them and sell them.

In 1972 USDA released and distributed the original collection of plants to public and private institutions in

the United States. At least one grower, Mikkelsens Inc. in Ashtabula, Ohio released the original collection for sale to the public (Mikkelsens 1974), and commercial growers and universities began experimenting with the plants.

In the meantime, Dr. Arisumi's cytological studies at USDA provided information that would help researchers understand breeding problems. Dr. Arisumi discovered that most New Guinea Impatiens had the same number of chromosomes and would easily cross with each other. When Dr. Arisumi, Dr. Armstrong and other breeders tried to develop pure strains that would reproduce true from seed, they immediately ran into trouble. When New Guinea Impatiens were self pollinated, "vigor dropped and fertility dropped to the point where they died" (Armstrong, interview, 24 October 1989). Since seed produced plants are cheaper and more easily distributed than vegetatively produced plants, the inability to produce plants true from seed was a major obstacle.

Dr. Arisumi tried thousands of crosses in an attempt to solve the breeding problem. In the process he produced some plants that looked much better than the parents. These plants could only be reproduced by

cuttings but they looked good enough to introduce to commercial growers and the public.

The first USDA cultivars were released under the Rainbow Series. The plants were named A'Flame', 'Arabesque', 'Cheers', and 'Sprite' and were available to anyone who requested them. The plants were not very floriferous, but Dr. Arisumi thought they would be useful as breeding stock (Arisumi, interview, 17 August 1989). Two more cultivars, 'Aloha' and 'Pele' were added to the series in 1975 (USDA 1975).

Commercial growers did not take much of an interest in the plants at first, but homeowners were intrigued with them. Only one technician was available to help Dr. Arisumi care for the plants and make cuttings for distribution. Research was slowed down as they struggled to keep up with requests from the public (Arisumi, interview, 17 August 1989).

Dr. Arisumi and Dr. Cathey requested Impatiens species from all over the world to conduct additional tests and breeding experiments. The staff of the Germplasm Lab was responsible for locating the plants through literature searches and correspondence (Harold Winters, interview, 14 March 1989). USDA obtained Impatiens from East Africa, Madagascar, India, Malaya

(Arisumi and Cathey 1976) and the Celebes Islands. A particularly large collection was sent by Kew Gardens. Dr. Arisumi grew and experimented with the plants and discovered that New Guinea *Impatiens* would cross with Impatiens from Java and the Celebes Islands, but the hybrids were sterile.

The Celebes Islands specimens proved especially useful for breeding experiments. Dr. Arisumi was able to cross a Celebes Islands cultivar named 'Tangerine' with a New Guinea hybrid he developed. The result was a sterile hybrid which he was able to make fertile with colchicine treatments. Dr. Arisumi named the fertile plant 'Sweet Sue' and it was released in 1976 (Murphy 1978). It was followed by the release of three vegetatively reproduced cultivars in 1977, 'Pee Gee', 'Pink Cascade', and 'Pink Lady' which made up the Painted *Impatiens* Series (USDA 1977).

Dr. Arisumi conducted breeding experiments to see if the new germplasm could be used to improve existing varieties of Impatiens wallerana. This was not a new idea. In the November 1888 issue of the Gardeners's Chronicle, W. Harrow of Cambridge Botanic Gardens, mentioned the potential advantages of crosses between New Guinea *Impatiens* and Impatiens sultani (I. wallerana) from

Zanzibar. He was not able to make the cross and identified differences in the plants' pollen color and shape as possible reasons for the incompatibility (Harrow 1888). Dr. Arisumi had over eighty years of additional breeding and genetic research at his disposal but this was not enough to overcome the incompatibility between New Guinea and Sultana *Impatiens*. The plants would not cross.

New Guinea *Impatiens* did not flower well in the summer but bloomed spectacularly in the fall and winter. Dr. Cathey began studies to determine if flowering was photoperiodic, and his initial tests indicated that it was a factor. Later tests, including trials by Dr. Armstrong in air conditioned greenhouses at Longwood Gardens, proved that the plants were not day length sensitive but temperature sensitive. ". . .The plants grow and bloom best in temperatures 16-21°C (60-70°F). Temperatures of 32°C (90°F) or above definitely are very detrimental" (Armstrong 1976).

When USDA released the original collection to the public in spring of 1972, plant hobbyists and over one hundred universities and commercial plant breeders expressed interest in New Guinea *Impatiens* and were sent

collections of twenty three plants (Murphy 1978; USDA 1972) (See Appendix 3, page 82 and Appendix 4, page 87.)

The researchers who received the collections had their own goals and ideas about plant characteristics to develop. Plant breeders incorporated their own preferences into new cultivars. It was hoped that recipients would send results of their experiments to USDA but there was no formal agreement and many people did not return information (Creech, interview, 19 May 1989; Winters, interview, 30 November 1989). Harold Winters kept in touch with some of the people who received the original collections (Winters, interview, 30 November 1989). He provided encouragement and kept track of new developments (Robert Armstrong, interview, 24 October 1989).

Harold Winters' duties as Head of the Germplasm Lab kept him from working extensively with New Guinea Impatiens. Breeding programs were considered a function of the Ornamentals Group but Winters did keep an eye on the plants and conducted research as time allowed. He studied differences in flower longevity in plants grown in the greenhouses in Beltsville, Maryland in April of 1973. There was a considerable difference in the length of time flowers remained attractive. This kind of information was

valuable to plant breeders and the results of the comparison were published in 1977 (Winters 1977).

Winters noticed that one of the collections produced flowers with branched pedicels and made crosses that further developed the characteristic. Branched pedicels resulted in more flowers for Sultana Impatiens and Winters hoped the same would hold true for New Guinea Impatiens (Winters, interview, 30 November 1989). He produced positive results and the information was released in 1982 (Winters 1982).

Iowa State University requested plants for use in an honors student project but the plants looked so good that they also started a breeding program. Professor Jack Weigle and graduate students including Allen Beck and Dave Pasutti, tried to develop plants that would serve as bedding plants in Iowa. They studied the cytology and breeding behavior of the plants and produced cultivars that were partially successful. The plants did well if they had afternoon shade but could not tolerate full sun conditions (Weigle, interview, 15 May 1989). Iowa State released the Cyclone Hybrids in 1974 which included twelve cultivars with names like 'Star Fire' and 'Star Dancer' (Woodroffe 1975). Other universities became involved with research projects but not on the same scale as Iowa State

(Gortzig 1976; Garvey and Blessington 1981). No other universities developed and released cultivars.

Wiley Hinson of Norfolk Botanical Garden in Norfolk, Virginia received a set of plants and experimented with growing them as bedding plants. He planted seedlings under pine trees where they grew so well, they naturalized. Wiley Hinson also started a breeding program that concentrated on color, foliage and hardiness. He tried working with colchicine but could not determine the proper dosage of the mutagen to use to double chromosome numbers (Hinson, interview, 17 May 1989). At least thirty nine vegetatively reproduced hybrids were developed by Norfolk Botanical Garden for further breeding work including 'Orange Gem', 'Pink Doll', and 'Super Fuchsia'. (See Appendix 5, page 90.) Despite this initial progress, there was not much support for breeding work at Norfolk and the project was dropped after a few years (Hinson, interview, 17 May 1989).

A few commercial growers took an interest in the new plant and began working with the original collections and the USDA and Longwood releases. Claude Hope experimented with plants at his flower seed ranch, Linda Vista, in Costa Rica. His goal was to develop seed varieties but he ran into the same problems that Dr.

Arisumi and Dr. Armstrong encountered. Hope did develop several vegetatively reproduced cultivars as he tried to produce seed varieties. Selections from this group were named the Vista Series and were offered by the PanAmerican Plant Corporation in 1984 (Martin 1984). PanAmerican no longer carries the Vista Series because they did not adapt well to the climate in the United States (Jim Mikkelsen, interview, 11 June 1989) and because the growth habit was too upright (Heidi Tietz, interview, 26 July 1989).

Claude Hope eventually did develop a cultivar which would reproduce from seed. The plant was called 'Tangeglow' and was a cross between New Guinea Impatiens, 'Aiyura' and the Celebes Islands Impatiens, 'Tangerine'. Like previous hybrids, the plant was sterile but a fertile branch developed making seed production possible (Robert Armstrong 1976; Claude Hope, letter to the author, 9 May 1989).

Linda Vista was sold to Ball Seed Company in the early 1980s. It is now a part of Ball's Flower Seed Group which includes PanAmerican Seed and Denholm Seed. The divisions operate independently of each other and can market plants through companies other than Ball (Heidi Tietz, interview, 26 July 1989).

Claude Hope stayed on as Research Director at Linda Vista and continued his work with seed varieties. Few plants resulted from this research in the 1980s but PanAmerican did release one seed produced cultivar named 'Tango' which was a 1989 All American Selection Award Winner. Claude Hope retired in 1989 but research at Linda Vista continues.

A major development occurred in 1990 when PanAmerican introduced a seed produced hybrid group named the Spectra Series. The Series was bred by Alfonso Parada (Claude Hope, letter to author, 8 January 1990) through Claude Hope's breeding program (Dan Jacques, interview, 26 January 1990) and is a New Guinea Impatiens mix. It is available through Park Seed Company. The plants are described as a breakthrough although they do not represent a true strain. Flower and foliage colors and the size of the plants vary (Park Seed Company 1990), but they offer the hope of more seed produced introductions in the future.

Yoder Brothers, Inc. started working with the original New Guinea Impatiens collections as soon as they were released by USDA. Plant breeder, Walt Jessel worked with the plants for three years and made thousands of crosses. He developed plants that he considered

commercially viable but Yoder did not want to adapt production methods to accommodate New Guinea Impatiens and the research was abandoned (Walt Jessel, interview, 28 March 1990).

Jim Mikkelsen, President of Mikkelsens Inc. in Ashtabula, Ohio received and sold progeny of the original collection of plants and the cultivars developed by Longwood and USDA. He "saw tremendous potential in the size of the flowers, the color of the flowers" and for use as "hanging baskets and pot plants" (Jim Mikkelsen, interview, 11 June 1989). Jim Mikkelsen started a breeding program and enlisted the help of his Production Manager, John Ryan to develop floriferous plants with compact growth habits. The first plants were introduced quickly. Mikkelsen made as many as four sets of crosses a year (Jim Mikkelsen, interview, 11 June 1989) and had seven cultivars ready for release in 1975. A second group of plants, the American Heritage Series, was introduced for the Bicentennial and included ten plants with names like 'Betsy Ross' and 'Minuteman' (Mikkelsen 1976).

After working on Mikkelsen's first releases, John Ryan went to work for the California-Florida Plant Corporation. He continued breeding New Guinea Impatiens and further developed his own preference for taller

plants. The cultivars John Ryan produced were called the American Indian Series. Plants like 'Hopi', 'Cheyenne', and 'Ute' were released in 1978. New Guinea Impatiens were not a major crop for California-Florida and were not promoted extensively. John Ryan retained the patents to the plants and took them with him when he left California-Florida in 1985. He is now a co-owner of Springhill Greenhouses, and is working on improving the American Indian Series (Ryan, interview, 19 May 1989).

Breeding work continued at Longwood after their first New Guinea Impatiens cultivars were released in 1974. Dr. Armstrong developed ten more Circus Series cultivars which were released to cooperators in 1977. The plants were tested for use inside Longwood's conservatories and in plots outside. Their cultural requirements proved more stringent than Sultana Impatiens. New Guinea Impatiens needed more light, more water, and more fertilizer than the Sultanas and also cooler temperatures. Longwood did not use New Guinea Impatiens extensively because of the cultural requirements and because the flower and leaf colors did not fit in well with traditional displays. Longwood made a final release of six Circus Series cultivars in 1979 but the breeding program effectively ended in 1978. Commercial growers were working on the plants by then and it was Longwood's

policy not to compete with them (Robert Armstrong, interview, 24 October 1989).

Dr. Arisumi continued working with Impatiens species from around the world until his retirement in 1986. He wrote several papers on the cytology and breeding of the plants (Arisumi 1973, 1974, 1978, 1980, 1985, 1987) and developed an extensive collection of Impatiens species and hybrids at Beltsville. The Impatiens program was phased out when Dr. Arisumi retired. USDA wanted to move on to other crops. Dr. Arisumi's collection was dismantled and his notes and papers were not kept (Arisumi, interview, 17 August 1989). Some of Dr. Arisumi's plants were propagated and grown at the University of Maryland for electrophoretic research being conducted by Ph.D. candidate, Virginia Lerch. The rest were destroyed (Lerch, interview, 2 May 1989).

Iowa State's breeding program continues under the direction of Professor Weigle. Three new cultivars were released in 1979 and five more were released in 1989. The latest cultivars, 'Orangeade', 'Pinkie', 'Rainbow', 'Redhead', and 'Tinted Angel' are much more compact than earlier varieties. Professor Weigle is currently trying to develop New Guinea Impatiens that tolerate less light and drier conditions for use as house plants (Weigle,

interview, 15 May 1989). Other researchers at Iowa State have studied insect and shipping problems and genetics. Dr. Loren C. Stephens worked on In Vitro propagation and is currently working on the "cytological problems involved in the species hybrids when New Guinea (Impatiens) are crossed with close relatives" (Weigle, letter to author, 18 May 1989). Dr. Nancy Agnew and Dr. Richard Gladon are studying the plants' ethylene tolerance for improved shipping (Weigle, letter to author, 3 October 1989).

Jim Mikkelsen believed in New Guinea Impatiens from the beginning. Other breeders thought it would be too difficult to control propagation of the plants. New Guinea Impatiens were easy to grow from cuttings which made them easy to copy. Plant patents were not widely used yet and growers thought no one would honor them. They thought New Guinea Impatiens would never become a significant product compared to mums and other crops.

Jim Mikkelsen's feeling was "if you don't try you are not going to win" (Jim Mikkelsen, interview, 11 June 1989). Most commercial growers quickly lost interest but he consistently promoted and worked to improve the plants. In the process, Mikkelsens Inc. became the leading producer of New Guinea Impatiens. Jim Mikkelsen worked with plant breeders to develop characteristics like heat

tolerance, that would make the plants easier to grow. Three breeders have worked on the Mikkelsen plants since John Ryan's departure. Cornelius Van Den Berg and Mikkelsen's current breeder, Dr. Lyndon Drewlow were responsible for most of the developments after the American Heritage Series (Jim Mikkelsen, interview, 11 June 1989).

As a result of breeding work at Mikkelsens, the Sunshine Series was introduced in 1978. It featured plants with better growth habits, flowers and foliage. Cultivars were given names from the solar system. The public became familiar with plants like 'Zodiac', 'Constellation', 'Star Wars', 'Orbiter', 'Meteor', and 'Galaxy'. Nine cultivars were added to the Sunshine Series in 1982 and eight more were added for 1985 (Schram 1984).

Dr. Drewlow developed improved cultivars for the Sunshine Series after 1984 which included more floriferous plants and plant with bicolor flowers. He is currently working on even more floriferous plants and plants with double flowers. Field trials are held in full sun at Mikkelsens to test new cultivars survival under bedding plant conditions. Although the plants are much more tolerant of sun and drought than the first New Guinea

Impatiens, they still prefer afternoon shade and plenty of water.

Jim Mikkelsen retired in 1986 and the company is now run by his son and daughter-in-law, Ed and Diane Mikkelsen. The company is still the leading producer of New Guinea Impatiens and promotion and research are as important as when the plants were first introduced.

Three firms have recently entered the New Guinea Impatiens market. Paul Ecke Ranch, a poinsettia grower in Encinitas, California started selling Pure Beauty New Guinea Impatiens developed by Ludwig Kientzler of West Germany in 1987. They offer plants with large flowers and mostly bronze foliage which is preferred by European customers (Heidi Tietz, interview, 26 July 1989). Paul Ecke offered five new Kientzler cultivars for 1990, 'Deleas', 'Epia', 'Flambe', 'Melissa', and 'Saturina'.

Fischer Geraniums introduced seven cultivars to the United States market in 1990. Fischer is a West German firm that markets New Guinea Impatiens through a subsidiary in Homestead, Florida. The cultivars were developed by another West German firm named Bull. The Bull plants are vigorous with large flowers and foliage (Ball 1989), and like the Kientzler varieties, feature more solid colored leaves than variegated. Fischer has

also started their own breeding program (Jim Mikkelsen, interview, 11 June 1989).

Ball Seed Company developed its own cultivars which were released as the Celebration Series in 1990. The vegetatively propagated plants named 'Carnival', 'Carousel', 'Champagne', 'Parade', 'Jubilee', 'Salute' and 'Sparkler' were bred in Costa Rica at Linda Vista. They were tested at Ball's shade and full sun trial gardens in Illinois in 1989. These new plants show much more tolerance for heat and drought than older cultivars and "offer large flowers and interesting colors" (Ball 1989).

The developments that turned the relatively unknown New Guinea Impatiens into a popular bedding plant seemed to progress smoothly. As organizations or growers phased out production or lost interest, others carried on with new research, but like the introduction in 1886, there were problems. The public's first encounter with New Guinea Impatiens was not a success.

CHAPTER 4

NEW GUINEA IMPATIENS IN THE MARKETPLACE

The gardening public was introduced to New Guinea Impatiens in 1974 when Longwood's Circus Series cultivars were first offered by commercial growers. Garden magazines carried articles that raved about the plants and described their sun tolerance. The first cultivars were instantly popular but like the plants in the 1880s they quickly ran into trouble. Sultana Impatiens were already very popular and commercial growers and gardeners assumed that New Guinea Impatiens had the same basic cultural requirements and could be planted in full sun.

Longwood's success in Pennsylvania did not translate well to other parts of the country. New Guinea Impatiens could take higher light levels but only with cooler temperatures. They needed extra water to survive full sun conditions and required excellent drainage. They did not bloom well in the heat of the summer. When the plants did not thrive as promised, consumers lost interest (Robert Armstrong, interview, 24 October 1989).

Dr. Armstrong, Dr. Arisumi, Harold Winters, Jim Mikkelsen and other growers had seen what the plants could do under the right conditions. They believed the plants would be successful if given a chance. They publicized cultural requirements through articles (Armstrong 1976, 1977; Jim Mikkelsen 1976) and talks so growers and the public would have more success. They worked on new cultivars with better growth habits and more tolerance for heat and drought.

New cultivars from Longwood, USDA, Claude Hope, and Mikkelsens were better adapted as bedding plants but they still suffered in hot, dry conditions. Eventually through trial and education, growers and the public learned that New Guinea Impatiens needed more care than Sultana Impatiens. Although the plants did better with afternoon shade, Mikkelsens and others continued to recommend full sun in their planting instructions. This caused confusion and problems for years to come. Mikkelsen Inc. intends to change the full sun recommendation in the 1990s (Lyndon Drewlow, Ohio Florist's Short Course Lecture, 11 July 1989).

The first releases could not sustain consumer enthusiasm but new introductions kept gardeners from losing interest altogether. When Mikkelsens, Inc.'s

Sunshine Series was introduced in 1978 it was such an improvement over previous varieties that the public really took notice (Jim Mikkelsen, interview, 11 June 1989). Several growers were willing to market the plants but very few were involved in the development of new cultivars.

Mikkelsens Inc. was one of a small number of organizations that kept working with the plants after the 1970s. Longwood stopped their breeding program in 1978, Norfolk Botanic Garden and Yoder Bros. dropped out even earlier. Dr. Arisumi continued working with the plants at USDA until 1986 but was already receiving signals in 1984 that the program would end soon. Claude Hope continued working on seed varieties but results and introductions were slow in coming. California-Florida carried John Ryan's American Indian Series into the mid-1980s but only as a filler between other crops. They did not promote the plants and the Series did not become a major factor in the market.

Mikkelsens Inc. was the largest producer and promoter of New Guinea Impatiens after the initial developments. Dr. Drewlow considered the mid 1980s the turning point for New Guinea Impatiens production. Mikkelsen's peak production of cuttings per week doubled in 1985. By 1989 that number increased by five times

(Drewlow, interview, 13 July 1989) with thirty three cultivars of the Sunshine Series on the market (Mikkelsens 1989). Since the plants could only be reproduced from cuttings and did not ship well, Mikkelsens licensed other propagators as distributors and collected royalties on plants produced in the United States and Europe.

Mikkelsens licensed growers worldwide to market the Sunshine series in the United States, Canada, Europe, Australia, New Zealand, Israel, and Japan. The West German firm, Kientzler was an exclusive distributor for Mikkelsens in 1983. After two years, Kientzler started a breeding program of their own and entered the market. They used Mikkelsen cultivars as breeding stock but selected for different characteristics. The European market prefers solid colored leaves and large flowers. They also use New Guinea Impatiens as house plants. Kientzler is now the largest distributor of New Guinea Impatiens in Europe (Jim Mikkelsen, interview, 11 June 1989).

Other European companies started their own breeding programs to avoid royalty payments and marketing conflicts (Diane Mikkelsen, interview, 13 July 1989.) Fides in Holland was a Mikkelsen distributor which is now breeding plants. Other European breeders include the

German firms, Bull and Fischer, and an Israeli firm named Danziger Flower Farm (Jim Mikkelsen, interview, 11 June 1989). Danziger entered the European market in the fall of 1989 with the introduction of ten cultivars (Lyndon Drewlow, interview, 8 May 1990).

Impatiens became the best selling bedding plant in the United States in 1980. They were second behind petunias in 1981 then moved into the number one position to stay from 1982 to the present (Voigt 1989). New Guinea Impatiens were a part of the rise in popularity but it is difficult to tell how big a role they played.

The popularity of Sultana Impatiens was already growing when New Guinea Impatiens entered the bedding plant market. Sultana Impatiens may have given New Guinea Impatiens a boost early on since consumers associated the name Impatiens with the Sultanas. Conversely, the publicity over New Guinea Impatiens may have increased public interest in the Sultanas. Ed Mikkelsen believes "both types of Impatiens have been pushing each other along" (Ed Mikkelsen, interview, 13 July 1989) but until recently there has not been any proof.

Production numbers are a good measure of popularity for potted and bedding plants but there are few statistics available for New Guinea Impatiens. Mikkelsen

plant breeder, Dr. Drewlow estimates current production at fifty million plants per year in the United States and twenty million in Europe (Drewlow, interview, 7 May 1990). This is only a rough estimate but gives some indication of the importance of the crop. Up until 1988 New Guinea Impatiens were listed under the general heading of Impatiens in the Professional Plant Growers Association surveys and the Horticultural Census conducted by the Bureau of the Census. This made it nearly impossible to estimate the effect that New Guinea Impatiens had on the market.

An answer may soon be available. New Guinea Impatiens were included as a separate item on the 1988 Census of Horticultural Specialties jointly conducted by the Bureau of the Census and USDA's National Agricultural Statistics Service. The results of the study will not be available for another six months to a year but should provide essential information about the success of the plants.

In the 1980s many of the cultural problems New Guinea Impatiens faced were solved through breeding programs and public interest in the plants reached an all time high. Success seemed a foregone conclusion but there were still challenges ahead. Spider mites, two-spotted

mites, and cyclamen mites had always caused concern but the appearance of the Western Flower Thrip produced a panicked reaction among some growers.

Western Flower Thrip is the worst insect problem that New Guinea Impatiens has faced because it carries Tomato Spotted Wilt Virus (TSWV). The virus has been called "the No. 1 problem the greenhouse industry faces today" (Miller 1989). Infected plants may develop black ringspots or dead areas. They may become stunted and distorted and eventually die. There is no cure for infected plants and they must be destroyed to prevent the spread of the disease. Impatiens are very sensitive to the virus but so are many other ornamentals, including Gloxinias and Chrysanthemums (Miller 1989).

There are growers who blame New Guinea Impatiens for the spread of TSWV and have threatened to stop growing the plant. New Guinea Impatiens weren't the first plants to get the disease but because they are sensitive to it, they are easy to single out as culprits. Some plants like Geraniums do not show symptoms of Tomato Spotted Wilt Virus even though they are carriers. If clean New Guinea Impatiens are brought into a greenhouse, they may develop symptoms of TSWV from infected plants not showing symptoms. For this reason they are often blamed for

spreading the virus even though they are not always the carriers. Excess nutrients and other cultural problems can cause New Guinea Impatiens to mimic TSWV symptoms (Jim Mikkelsen, interview, 11 June 1989) which gives the plant industry a worse opinion of the plants than is warranted.

As the largest producer of New Guinea Impatiens, Mikkelsen's Inc. has taken extreme measures to insure healthy stock. They use fine screens over their greenhouse fans and airlocks between houses to keep Thrips out. They reversed the ventilation in their greenhouses so insects are blown away from entry points rather than drawn in. Anyone entering the greenhouses must disinfect their hands and shoes. Mikkelsen uses tissue culture and virus indexing to guarantee virus free stock (Lyndon Drewlow, interview, 12 July 1989). All of these measures are necessary to keep the confidence of propagators who purchase their cuttings. Other growers like Paul Ecke Ranch also take pains to insure virus free stock. Since their cuttings come from Kientzler in West Germany, Paul Ecke removes all New Guinea Impatiens from their greenhouses after the spring season and starts with fresh stock in the fall (Dave Hartley, interview, 22 May 1989).

Seed produced plants would provide an easy way to start virus free stock but the development of pure seed

strains is still a long way off. Seed produced cultivars like the Spectra Hybrids offer hope for the future but sanitation and keeping Thrips out of greenhouses will still be important methods of control.

Research is important to the future of New Guinea Impatiens. Some of the current projects at United States universities are listed below but much more work remains. Researchers at Virginia Polytechnic Institute, California Polytechnic Institute, and Dallas Botanic Garden conducted outdoor trials in 1989. The effects of growth regulators are being studied at Purdue, North Carolina State, and the University of Florida (Dave Hartley, interview, 11 July 1989). Growth regulators have not been used much with New Guinea Impatiens because cultivars react very differently. A product that slows the growth of one plant may increase the growth of another. Cytological studies are still being done at Iowa State to determine chromosome differences and electrophoretic studies are being conducted at the University of Maryland to learn more about the biochemical identification of New Guinea Impatiens.

New Guinea Impatiens have come a long way since the first crosses were made between plants from the original collections. New cultivars have elaborate

pedigrees and are more floriferous and popular than ever before. Growers are always looking for new developments and whether they include house plants from Iowa State, seed produced plants from PanAmerican, house plants or double flowers from Mikkelsens, new releases from Springhill Greenhouses, Ball Seed, Kientzler, Bull, Fischer, Fides, or Danziger Flower Farm, the future looks good for New Guinea Impatiens.

There may be a slump in popularity as growers learn how to handle Thrips and Tomato Spotted Wilt Virus, but growers who expect a slump also expect a rebound (Heidi Tietz, interview, 26 July 1989). New Guinea Impatiens represent a market of approximately fifty million dollars, a size approaching that of Geraniums (Lyndon Drewlow, interview, 8 May 1990). Producers will not give up on the plants easily.

Growers seem to have great success with the plants or miserable failures (Konjoian 1990). Those who succeeded with New Guinea Impatiens are very optimistic about the future. Those who experienced problems have had difficulties with cultural requirements and TSWV. There are propagators who intend to drop New Guinea Impatiens as a crop because of disease and insect problems. Successful propagators and the companies involved in breeding and

distribution do not have any intention of getting out of the business. Peter Konjoian of Konjoian's Greenhouses predicts that New Guinea Impatiens will become the fourth most valuable flowering potted crop in the United States before the end of the century. Konjoian's Greenhouses specialize in the production of New Guinea Impatiens and have successfully grown the plants since 1985 (Konjoian 1990). Ed Mikkelsen pictures a market five times the current size "if the growers, propagators, all the people involved can keep the disease and insects under control" (Ed Mikkelsen, interview, 13 July 1989).

Those who have had success with the plants feel that New Guinea Impatiens may still be at the beginning stages of development. Nineteen new cultivars were introduced for 1990. There may be a tremendous future ahead.

CHAPTER 5

CONCLUSION

New Guinea Impatiens could have suffered the same fate in the 1970s and 1980s as they did in the 1880s. Similar circumstances and developments occurred in both time periods but the results have been very different.

In the 1880s and 1970s plant breeders tried to cross New Guinea Impatiens with Sultana Impatiens. They thought this cross would provide the perfect Impatiens plant with variegated foliage, new flower colors, and a compact and free flowering habit. The cross never worked but New Guinea Impatiens became popular in their own right.

Sultana Impatiens were very popular in both time periods and may have contributed to New Guinea Impatiens initial success. The lack of statistical information makes it difficult to determine the relationship between the two species, but it seems likely that the plants contributed to each others advancement. The 1988 Census of Horticultural Specialties will help determine how

popular New Guinea Impatiens are compared to Sultana Impatiens.

Mites devastated plants in the nineteenth century and Thrips and Tomato Spotted Wilt Virus threaten plants in the twentieth century. In the 1880s New Guinea Impatiens quickly became popular and then died out because of the mite problem. In the 1970s the public was intrigued with the plants but lost interest because of cultural problems. Plantsmen kept promoting and learning about the plants and instead of vanishing they became more popular than ever. The battle with TSWV continues but promotion and education may again provide the solutions that keep New Guinea Impatiens from obscurity.

The difference between the 1880s and 1970s and '80s seems to be the dedicated group of plant collectors, researchers, and breeders who promoted the plants even during difficult periods. They did not give up when cultural problems and insects caused setbacks.

Communication between Longwood, USDA, plant breeders, and growers encouraged development. Enough information was shared to enable breeders to build on each others research. Not everyone received the same amount of information or support but all parties benefited when ideas and developments were exchanged. Growers and

researchers who needed encouragement did not always receive it. The growers who experimented with New Guinea Impatiens for a few years and then abandoned the research illustrate how easily the momentum could have been lost.

Most of the credit has to go to the people with the insight to anticipate horticultural trends and those with the tenacity to stick with a new plant, even in the face of discouraging circumstances and feedback from the plant industry. Dr. Seibert and Dr. Creech were instrumental in organizing the Longwood Gardens/USDA New Guinea exploration trip. Probably, neither organization would have had as successful a trip individually. The cooperation that resulted from this joint venture made later advances possible.

Neither organization was interested in the plant strictly for commercial production. Their priorities included disseminating the plants and information, and finding display uses for New Guinea Impatiens. If a commercial firm had made the exploration trip the plants and information might not have been released. Commercial firms protect their investment in new plants with secrecy while not-for-profit organizations like Longwood and USDA could share information without fear of competition.

Many collectors, researchers, and plant breeders participated in the development of New Guinea Impatiens. Not all were given credit for their work and perseverance. Not all of them are even known, but a few stand out because of the contributions they made.

Harold Winters and Joseph Higgins recollected plants when they learned that some did not survive the trip from New Guinea to the United States. They promoted the plants upon their return. Harold Winters worked with the collections and encouraged other breeders to work with them. Many explorers collected New Guinea Impatiens between 1886 and 1985 but no other collections had the impact of the 1970 collections.

Dr. Arisumi and Claude Hope devoted tremendous amounts of time and energy to breeding programs and research. They did not introduce large numbers of plants but paved the way for others. Dr. Arisumi's research on cytology provided the basic information necessary for seed-produced plants. In addition to research he produced the Rainbow and Painted Impatiens Series. Claude Hope probably provided the initial interest in New Guinea Impatiens through a conversation with plant explorers Winters and Higgins. He pursued his goal of seed produced plants long after other growers gave up. In the process

he produced the Vista Series and seed produced cultivars 'Tange glow' and 'Tango'. His work is the basis for seed produced plants of the future.

Dr. Armstrong stuck with the plants even though they did not look promising at first. Once he recognized their potential, he gave presentations and wrote papers expounding the virtues of New Guinea Impatiens.

"I think you have to believe in them. I was out there; in the beginning I thought I was the only one out there, giving talks . . . and sometimes I don't think they were very well received" (Armstrong, interview, 24 October 1989).

Despite unfavorable reactions, he persevered. His work resulted in the production of the Circus Series and laid the groundwork for future cultivars.

Jim Mikkelsen developed the plants when few other growers had any interest. He kept working on them even when the public lost interest. Jim Mikkelsen explained the promotion that made New Guinea Impatiens a major product for Mikkelsens.

"We've put more color work out, we've made more color brochures, we've talked about them more at the short courses. After all if we're the specialists, if we're the number one, we're the ones that should do it. And maybe that's why we're number one" (Jim Mikkelsen, interview, 11 June 1989).

Jim Mikkelsen responded with tenacity when other growers said patents would not work, or that New Guinea Impatiens

would never be an important crop. He had the insight to recognize potential and the confidence to act on his hunches. Plant breeders John Ryan, Cornelius Van Den Berg, and Lyndon Drewlow helped him achieve his goals. Each made important contributions. Jim Mikkelsen's son Ed Mikkelsen, and Ed's wife Diane share the senior plantman's vision and are carrying on his work.

New companies have entered the New Guinea Impatiens plant market recently but it will take time to see if they have the determination and ability to further the plants' development. Ball Seed, Bull, Danziger Flower Farms, Fides, Fischer, Kientzler, PanAmerican, Paul Ecke, and Springhill Greenhouses are all companies to watch. Their actions may help determine the direction of New Guinea Impatiens' future.

Technology has certainly played a part in the plants' success. Tissue culture and advanced breeding techniques have helped control disease and solve breeding problems. Technology by itself was not the ingredient that made success possible. Even with modern tools there are people who are ready to give up on New Guinea Impatiens because of Tomato Spotted Wilt Virus.

The key to the plants' success seems to be the people who believed in New Guinea Impatiens and who would

not give up working on them. In the 1880's there was certainly enthusiasm about New Guinea Impatiens but maybe they did not have the champions who were willing to devote themselves to the promotion and improvement of the plants. One person could not have done it, but many people working toward the same goals made the plant a success.

It took one hundred years from the time of New Guinea Impatiens first introduction until it became a success. Those involved have mentioned luck, being in the right place at the right time, perseverance, and hunches as factors in the development of these plants (Armstrong, interview, 24 October 1989) (Jim Mikkelsen, interview, 11 June 1989). All of these factors may have been involved.

The answer to why New Guinea Impatiens are popular now, after one hundred years of obscurity is really speculation. Articles in nineteenth-century magazines can not provide enough information for a definitive answer but Dr. Armstrong supplied an answer that sums up the element that appears to be the most important. "Maybe each of us had something to do with it in some critical part" (Armstrong, interview, 24 October 1989). Maybe New Guinea Impatiens became a success because a dedicated group of collectors, researchers, and plant breeders wanted them to succeed.

BIBLIOGRAPHY

- Arc. "Impatiens Hawkeri." Sempervirens 23 (4 June 1886): 178.
- Arisumi, Toru. "Morphology and Breeding Behavior of Colchicine-Induced Polyploid Impatiens spp. L." Journal of the American Society for Horticultural Science 98, no. 6 (November 1973): 599-601.
- _____. "Chromosome Numbers and Interspecific Hybrids Among New Guinea Impatiens Species." The Journal of Heredity 64 (1973): 77-79.
- _____. "Chromosome Numbers and Breeding Behavior of Hybrids Among Celebes, Java and New Guinea Species of Impatiens L." HortScience 9, no. 5 (October 1974): 478-479.
- _____. "Phenotypic Analysis of Progenies of Artificial and Natural Amphiploid Cultivars of New Guinea and Indonesian Species of Impatiens L." Journal of the American Society for Horticultural Science 100, no. 4 (July 1975): 381-383.
- _____. "Hybridization Among Diploid and Tetraploid Forms of New Guinea, Java, and Celebes Impatiens spp." Journal of the American Society for Horticultural Science 103, no. 3 (May 1978): 355-361.
- _____. "Chromosome Numbers and Comparative Breeding Behavior of Certain Impatiens from Africa, India, and New Guinea." Journal of the American Society for Horticultural Science 105, no. 1 (January 1980): 99-102.

- _____. "Rescuing Abortive Impatiens Hybrids through Aseptic Culture of Ovules." Journal of the American Society for Horticultural Science 110, no.2 (March 1985): 273-276.
- _____. "Cytology and Morphology of Ovule Culture-derived Interspecific Impatiens Hybrids." Journal of the American Society for Horticultural Science 112, no. 6 (November 1987): 1026-1031.
- _____, retired plant breeder. Interview by author, 17 August 1989, College Park, Maryland. Tape recording.
- Arisumi, Toru and H. M. Cathey. "About Our Cover, the New Guinea Impatiens." HortScience 11, no. 1 (February 1976).
- Armstrong, Robert J. "An Impatiens Circus, the Longwood New Guinea Hybrid Impatiens." American Horticulturist 53, no. 1 (Spring 1974): 14-18.
- _____. "New Guinea Impatiens Hybrid Response to Daylength, Temperature and Light Level." HortScience 10, no. 3 (June 1975): 340.
- _____. "New Guinea Impatiens Hybrid Response to Fertility Level and Container Size." HortScience 10, no. 3 (June 1975): 340.
- _____. "Introduction and Breeding of the New Guinea Impatiens." AABGA Bulletin 10, no.2 (April 1976): 36-38.
- _____. "The New Guinea Impatiens, Impatiens of Tomorrow!" The Bulletin, Pacific Tropical Botanical Garden 7, no. 3 (July 1977): 49-52.
- _____, research horticulturist for Longwood Gardens. Interview by author, 24 October 1989, Kennett Square, Pennsylvania. Tape recording.
- Ball, Victor, G., ed. GrowerTalks (July 1989): 77-80.
- Barraclough, Geoffrey, ed. The Times Atlas of World History. London: Times Books Limited, 1978.
- Carstens, Joseph, retired department head, horticulture for Longwood Gardens. Phone interview by author, 1 May 1990, Kennett Square, Pennsylvania.

Cathey, Henry M., director U.S. National Arboretum, former head of Ornamentals Lab, Beltsville, Maryland. Phone interview by author, 1 May 1990, Washington, D. C.

Creech, John L. "The ARS--Longwood Plant Explorations." Plants & Gardens 23, No. 3 (1968): 50-55, 86.

_____, retired interim director Western North Carolina Arboretum, former director U.S. National Arboretum, former Chief, New Crops Research Branch, USDA, Beltsville Maryland. Phone interview by author, 19 May 1989, Hendersonville, North Carolina.

De Wit, H. C. D. "Short History of the Phytography of Malaysian Vascular Plants." In Flora Malesiana, ed. C. G. G. J. Van Steenis, LXX-CLXI. Djakarta: Noordhoff-Kolff N.V., 1954.

Drewlow, Lyndon, Ohio Florist's Short Course. See Mikkelsen, Ed, "New Guinea Impatiens." 1989.

_____, plant breeder for Mikkelsens Inc. Interview by author, 12 July 1989, Ashtabula, Ohio. Tape recording.

_____, plant breeder for Mikkelsens Inc. Phone interview by author, 7 May 1990, Ashtabula, Ohio.

_____, plant breeder for Mikkelsens Inc. Phone interview by author, 8 May 1990, Ashtabula, Ohio.

Frodin, D. G. Guide to Standard Floras of the World. Cambridge: Cambridge University Press, 1984.

Garvey, Edward J., and Thomas M. Blessington. "New Guinea Impatiens Can Be Produced as Pot Plants." Florists' Review (6 August 1981): 16.

Gill, Evan R. Catalogue of Books Relating to New Guinea (but with special reference to Papua) in the Library of Evan R. Gill. Liverpool: Evan R. Gill, 1957.

Gortzig, Carl F. "Potted Florist Crops for Everyday Use." New York's Food and Life Sciences Quarterly 9, no. 4 (October-December 1976): 3-5.

- Grey-Wilson, C. "Impatiens in Papuasias. Studies in Balsaminaceae: I." Kew Bulletin 34, no. 4 (1980).
- Hartley, Dave, technical services for Paul Ecke Ranch. Phone interview by author, 22 May 1989, Encinitas, California.
- _____, technical services for Paul Ecke Ranch. Interview by author, 11 July 1989, Columbus, Ohio.
- Harrow, W. "Plant Notes." The Gardener's Chronicle 3rd ser., 4, no. 100 (November 24, 1888): 602.
- Hastings, Peter. Papua New Guinea; Prospero's Other Island. Sydney: Angus and Robertson (Publishers) PTY LTD, 1971.
- Higgins, Joseph J., Lae, New Guinea, to Dr. Russell Seibert, Kennett Square, Pennsylvania, Letter, 18 March 1970. Plant Records, Longwood Gardens, Kennett Square, Pennsylvania.
- _____. "Plant Exploration in New Guinea 1970." Text of interview for TV Channel 4, WRC, U. S. Department of Agriculture. "Across the Fence" 6 March 1971.
- _____, retired plant explorer. Interview by author, 20 June 1989, College Park, Maryland. Tape recording.
- Hinson, Wiley, retired plant breeder for Norfolk Botanical Gardens. Phone interview by author, 17 May 1989, Virginia Beach, Virginia.
- Hogg, Robert, ed. "Impatiens Hawkeri." Journal of Horticulture, Cottage Gardener, and Home Farmer 3rd series, 13 (18 January 1887): 92.
- Holden, John, manager Seed Department, Geo. J. Ball, Inc., West Chicago, Illinois, to Harold F. Winters, Beltsville, Maryland. Typewritten letter, 25 March 1974.
- Hooker, J. D. "Tab. 8247 Impatiens Hawkeri." Curtis's Botanical Magazine 4th series, 5 (1909).
- Hooker, J. D. "Tab. 8396 Impatiens Herzogii." Curtis's Botanical Magazine 4th series, 7 (1911).

Hope, Claude, retired research director, Linda Vista, Cartago, Costa Rica, former owner of Linda Vista, to author, Newark, Delaware, Typewritten letter, 9 May 1989

_____, retired research director, Linda Vista, Cartago, Costa Rica, former owner of Linda Vista, to author, Newark, Delaware, Typewritten letter, 8 January 1990.

Hyland, Howard. Plant Inventory No. 178. Washington, D.C.: United States Department of Agriculture, (August 1972): 76, 79, 82, 211, 217-219, 245-246.

"Impatiens Hawkeri." Ill. Gartenzeit Stuttgart 31, no. 18 (1887): 122.

"Impatiens Hookeriana." The Gardeners' Chronicle (December 15, 1888): 696.

Jacques, Dan, product development cultural researcher, PanAmerican Seed Company. Phone interview by author, 26 January 1990.

Jessel, Walt, plant breeder for California-Florida Plant Corporation. Former plant breeder for Yoder Brothers. Phone interview by author, 28 March 1990, Salinas, California.

Jones, Keith, and J. B. Smith. "The Cytogeography of Impatiens L., (Balsaminaceae)." Kew Bulletin 20, no. 1 (1966): 63-72.

Konjoian, Peter S. "New Guinea Impatiens: Feast or Famine?" Ohio Florists' Association Bulletin No. 723 (January 1990): 7-8.

Lea, D. A. M. and P. G. Irwin. New Guinea, the Territory and its People. Melbourne: Oxford University Press, 1971.

Lerch, Virginia, Ph.D. candidate at the University of Maryland. Interview by author, 2 May 1989, College Park, Maryland. Tape recording.

Martin, Tovah. "New Guinea Impatiens." Horticulture (August 1984): 32-36.

Mikkelsen, Diane, of Mikkelsens Inc. Interview by author, 13 July 1989, Ashtabula, Ohio. Tape recording.

Mikkelsen, Ed, "New Guinea Impatiens." Lecture by Ed Mikkelsen with Lyndon Drewlow, Peter Konjoian, and Dave Hartley, at the Ohio Florist's Short Course, 11 July 1989, Columbus, Ohio. Cassette 50A-50B. Repeat Performance, 1989.

_____, president of Mikkelsens Inc. Interview by author, 13 July 1989, Ashtabula, Ohio. Tape recording.

Mikkelsen, Jim. "New Guinea Hybrid Impatiens." Ohio Florists' Association Bulletin, no. 555 (January 1976): 2.

_____, retired president of Mikkelsens Inc. Interview by author, 11 June 1989, Fripp Island, South Carolina. Tape recording.

Mikkelsens Inc. "Plant Products" announcement (July 8, 1974).

_____. "American Heritage Impatiens" plant introduction brochure (1976).

_____. "Mikkel Sunshine New Guinea Impatiens" flier (1989).

Miller, Russell. "Identifying the Most Serious Problem We Face Today--TSWV." GrowerTalks (July 1989): 100-106.

Murphy, Wendy B. "Taming the Wild Impatiens." In The Time-Life Gardening Yearbook, 70-75. Morristown, New Jersey: Time-Life Books Inc., 1978.

Nicholson, George, A.L.S. The Illustrated Dictionary of Gardening, a Practical and Scientific Encyclopaedia of Horticulture for Gardeners and Botanists T to Z, and Supplement. no. 4. New York 1901.

Park Seed Company. Park Seed Flowers and Vegetable 1990 catalog. (1990).

Rand McNally & Company. Universal Atlas of the World. Chicago and New York: Rand, McNally & Company, Publishers, 1898.

- Richards, William, ed. "Impatiens Hawkeri." The Gardeners' Chronicle n.s., 25, no. 650 (12 June 1886): 760-761.
- Ridley, H. N. "Report on the Botany of the Wollaston Expedition to Dutch, New Guinea, 1912-12." Transactions of The Linnean Society, 9, no. 1 (1914): 23.
- Ryan, John, co-owner of Springhill Greenhouses. Former plant breeder for Mikkelsens Inc. and California-Florida Plant Corporation. Phone interview by author, 19 May 1989, Watsonville, California.
- Schlechter, R. "Impatiens Mooreana Schltr., Sine Neue, Wertvolle Gewachshauspflanze." Die Gartenwelt 19, no. 2 and 3 (1915).
- Schlechter, R. "Die Balsaminaceae Papuasien. Botanische Jahrbucher fur Systematik, Pflanzengeschichte und Pflanzengeographie." In Beitrage zur Flora Von Papuasien ed. C. Lauterbach, 114-120. 1917.
- Schram, Carol J. "Producing New Guinea Impatiens as Potted Plants." Ohio Florists' Association Bulletin No. 661 (November 1984).
- Schumann, K. "Die Flora des Deutschen Ost - Asiatischen Schutzgebietes." In Botanische Jahrbucher fur systematik, Pflanzengeschichte und Pflanzengeographie, ed. A. Engler, 204. 1888.
- Schumann, K. M., and Karl Lauterbach. Nachtrage zur Flora der Deutschen Schutzgebiete in Der Sudsee. 1905: 311-313.
- Seager, J. C. R. "Evaluation of New Guinea Impatiens Cultivars." Irish Journal of Agricultural Research 19 (1980): 111-118.
- Smith, Robin, and Keith Willey. New Guinea, A Journey Through 10,000 Years. Melbourne, Australia: Lansdowne Press PTY LTD, 1969.
- Stafleu, Frans. A. and Richard S. Sowan. Taxonomic Literature. 2d ed. Utrecht: Bohn, Scheltema & Holkema, 1976.

- Streimann, Heinar. The Plants of the Upper Watut Watershed of Papua New Guinea. Canberra, Australia: Australia Department of Territories and Local Government, 1983.
- T. B. "Garden Flora." Garden 31, no. 800 (19 March 1887): 256.
- Tietz, Heide, group manager of Ball Seed Company. Interview by author, 26 July 1989, West Chicago.
- Tschanz, Eric Nathan. "A History: The U.S.D.A.--Longwood Ornamental Plant Exploration Program." Thesis., University of Delaware, 1977.
- USDA. Notice to Plant Breeders and Nurserymen Relative to the Release of 23 Impatiens Introductions. Beltsville, Maryland: Agriculture Research Division, Plant Science Research Division, Feb. 23, 1972.
- . Notice to Cooperators Among Florists and Nurserymen of the Release of Two New Seedling Cultivars of the Rainbow Impatiens Series. Washington, D.C.: Agricultural Research Service, 1975.
- . Notice to Cooperators Among Florists and Nurserymen of the Release of Three New Seedling Cultivars of the Painted Impatiens Series. Washington, D.C.: Agricultural Research Service, 1977.
- Van Steenis, Dr. C. G. G. J. Flora Malesiana, Djakarta: Noordhoff-Kolff N.V. 1950.
- Van Steenis-Kruseman. "Malaysian Plant collectors and Collections." In Flora Malesiana, ed. Dr. C. G. G. J. Van Steenis, 3-639 Djakarta: Noordhoff-Kolff N.V. 1950.
- Voigt, Alvi O. PPGA News 20, no. 1 (January 1989).
- Warburg, Prof. Dr. O. In Nachtrage zur Flora der Deutschen Schutzgetiete in der Sudsee, ed. K. M. Schumann, and Darl Lauterbach, 311-313 1905.
- Weigle, Jack, professor of horticulture, Iowa State University. Phone interview by author, 15 May 1989, Ames, Iowa.

- _____, Ames, Iowa, to author, Newark, Delaware,
Typewritten letter, 18 May 1989.
- _____, Ames, Iowa, to author, Newark, Delaware,
Typewritten letter, 3 October 1989.
- Wheeler, Tony. Papua New Guinea, a Travel Survival Kit.
4th ed. South Yarra, Victoria, Australia: Lonely
Planet Publications, 1988.
- Winters, Harold. Longwood/USDA New Guinea Exploration Trip
Lecture at Longwood Gardens, 28 July 1970, Kennett
Square, Pennsylvania. Tape recording. Longwood
Gardens, Kennett Square, Pennsylvania.
- _____. "New Impatiens from New Guinea." American
Horticulturist 52 (1973): 16-22.
- _____. "Flower Longevity in New Guinea Impatiens."
HortScience 12, no. 3 (1977): 261-263.
- _____. "Branched Pedicels in New Guinea Impatiens."
HortScience 17, no. 3 (1982): 340-341.
- _____, retired plant explorer. Interview by author, 14
March 1989, Silver Spring, Maryland. Tape
recording.
- _____, retired plant explorer. Interview by author, 30
November 1989, College Park, Maryland. Tape
recording.
- Winters, Harold and Joseph Higgins. "Foreign Travel
Report", United States Department of Agriculture,
Agricultural Research Service, Crops Research
Division. 1970.
- Womersley, J. S. "A Brief History of Botanical Exploration
of Papua and New Guinea." The Papua and New Guinea
Agricultural Gazette 8, no. 2 (1953).
- Woodroffe, Fleeta Brownell. "Cyclone Hybrids Impatiens
Take Hurdles of Heat, Sun, Shade." American
Horticulturist 54, no. 1 (spring 1975).

APPENDIX 1

LONGWOOD GARDEN'S PLANT EXCHANGE COOPERATORS

(From the files of Dr. Robert Armstrong, research horticulturist, Longwood Gardens, Kennett Square, Pennsylvania.)

PROPOSED IMPATIENS DISTRIBUTION LIST

Director Bellingrath Gardens Theodore, Alabama 36582	Curator of Collections Royal Botanical Gardens Box 399, Postal station "A" Hamilton 20, Ontario, Canada
Mr. Ernest B. Chew San Diego Zoological Gardens Box 551 San Diego, Calif. 92112	Montreal Botanical Garden Attn: Yves Desmarais 4101 Est, Rue Sherbrooke Montreal 406, Quebec, Canada
Huntington Botanical Gardens Attn: Myron Kimnach 1151 Oxford Road San Marino, Calif. 91108	Denver Botanic Gardens Attn: Dr. William G. Gambill 909 York Street Denver, Colorado 80206
Botanical Garden Attn: Dr. Mildred Mathias Dept. of Botany 405 Hilgard Ave. Univ. of California Los Angeles, Calif. 90024	Fantastic Gardens Attn: Tom Mentelos 9550 Southwest 67th Ave. Miami, Florida 33156
Botanical Garden Attn: Anton M. Christ Dept. of Botany Univ. of California Berkeley, Calif. 94720	Parrot Jungle Attn: Nat de Leon 11000 S.W. 57th Ave. Miami, Florida 33156
Rancho Santa Ana Botanic Garden Attn: Dr. Lee Lenz 1500 North College Ave. Claremont, Calif. 91711	Callaway Gardens Attn: Fred C. Galle Horticulture Dept. Pine Mountains, Georgia 31822
California Jungle Gardens Attn: David Barry, Jr. 11977 San Vicente Boulevard Los Angeles, Calif. 90649	Honolulu Botanical Gardens Attn: P. R. Weissich Department of Parks and Recreation City and County of Honolulu 50 N. Vineyard Boulevard Honolulu, Hawaii 96817
Strybing Arboretum Attn: Roy Hudson McLaren Lodge Golden Gate Park San Francisco, Calif. 94117	Garfield Park Conservatory Attn: Dr. Charles E. Ackerman 300 N. Central Park Boulevard Chicago, Illinois 60625

- Saratoga Horticultural Foundation
Attn: Mr. W. Richard Hildreth
P.O. Box 308
Saratoga, Calif. 95070
- Los Angeles State and County Arboretum
Attn: Mr. Francis Ching
301 North Baldwin Ave.
Arcadia, Calif. 91006
- Botanical Gardens
University of Michigan
1800 North Dixboro Road
Ann Arbor, Michigan 48106
- Missouri Botanical Garden
Attn: Dr. Peter H. Raven
2315 Tower Grove Ave.
St. Louis, Missouri 63110
- Brooklyn Botanic Garden
Attn: Miss Elizabeth Scholtz
1000 Washington Ave.
Brooklyn, N.Y. 11225
- Director
New York Botanical Garden
Bronx, N.Y. 10458
- Eden Park Conservatory
950 Eden Park Drive
Cincinnati, Ohio 45202
- Norfolk Botanical Gardens
Attn: Wiley Hinson
Airport Road
Norfolk, Virginia 23518
- U. S. National Arboretum
Attn: Dr. John L. Creech
Washington, D.C. 20250
- Mitchell Park Conservatory
Attn: Stephen M. Gaydos, Jr.
524 South Layton Boulevard
Milwaukee, Wisconsin 53215
- Berkshire Garden Center
Attn: C. Roy Boutard
Stockbridge, Massachusetts 01262
- Hidden Lake Gardens
Attn: Fred Freeman
Michigan State University
Tipton, Michigan 49287
- W. Atlee Burpee Co.
Box 6929
Philadelphia, Penna. 19132
- Geo. W. Park Seed Co., Inc.
P.O. Box 31
Greenwood, South Carolina 29646
- Goldsmith Seeds Inc.
Gilroy, Calif. 95020
- Logee's Greenhouses
Danielson, Connecticut 06239
- Merry Gardens
Camden, Maine 04843
- Vaughan's Seed Co.
5300 Katrine Ave.
Downers Grove, Ill. 60515
- Wayside Gardens Co.
Mentor, Ohio 44060
- Oglevee Floral Company
152 Oglevee Lane
Connellsville, Penna. 15425

APPENDIX 2

A SUMMARY OF NEW GUINEA IMPATIENS CULTIVARS

1974-1990

NEW GUINEA IMPATIENS CULTIVARS

The following cultivars have been released in the United States and/or Europe. The breeder and date of introduction are listed if known.

LONGWOOD GARDENS

CIRCUS SERIES, Dr. Armstrong1974

'Bozo'
'Carousel'
'Cotton Candy'
'Harlequin'
'Lollipop'
'Big Top'
'Charmer'
'Orange Crush'
'Painted Lady'
'Stoplight'

1977

'Calliope'
'Cannonball'
'Fortune Teller'
'Chariot'
'Juggler'
'Magician'
'Ringmaster'
'Roustabout'
'Showboat'
'Trapeze'

1979

'Carnival'
'Headliner'
'Majorette'
'Rainbow' (Later changed to 'Roller Coaster' because Mikklsens, Inc. already had a cultivar named 'Rainbow'.)
'Ringmaster Improved'
'Skyrocket'

USDA

RAINBOW IMPATIENS SERIES, Dr. Arisumi1974

'A'Flame'
'Arabesque'
'Cheers'
'Sprite'

USDA CONTINUED

RAINBOW IMPATIENS SERIES, Dr. Arisumi1975

'Aloha'

'Pele'

1976

'Sweet Sue' (SEED VARIETY)

PAINTED IMPATIENS SERIES, Dr. Arisumi1977

'Pee Gee'

'Pink Cascade'

'Pink Lady'

IOWA STATE

CYCLONE HYBRIDS, Dr. Weigle, Allen R. Beck. D. W. Pasutti1974

'Artic Star'

'Blue Moon'

'Blue Velvet'

'Burgundy'

'Morning Star'

'Orange Chiffon'

'Orange Satin'

'Pink Satin'

'Purple Silk'

'Rainbow Star'

'Star Dancer'

'Star Dazzle'

'Star Fire'

'Summer Star'

'Tropical Sunset'

1989

'Orangeade'

'Pinkie'

'Rainbow'

'Redhead'

'Tinted Angel'

MIKKELSENS, INC.

MIKKELSEN HYBRIDS, Jim Mikkelsen, John Ryan1975

'Blue Butterfly'

'Fanfare'

'Golden Delight'

'Melody'

'Orange Glow'

'Pirouette'

MIKKELSENS, INC. CONTINUED

MIKKELSEN HYBRIDS, Jim Mikkelsen, John Ryan1975

'Red Magic'

AMERICAN HERITAGE SERIES, Jim Mikkelsen, John Ryan, Case Vandenberg1976

'Betsy Ross'
 'Brandywine'
 'Coppersmith'
 'Eagle'
 'Minuteman'
 'Monticello'
 'Patriot'
 'Red Coat'
 'Seventy Sixer'
 'Yankee Doodle'

SUNSHINE SERIES: Jim Mikkelsen, John Ryan, Cornelius Van Den Berg, Lyndon Drewlow1980-1989

'Antares'	'Orbiter'
'Astro'	'Pulsar'
'Aurora'	'Quasar'
'Cirrus'	'Radiance'
'Columbia'	'Rainbow'
'Comet'	'Red Planet'
'Constellation'	'Satellite'
'Corona'	'Skyrocket'
'Cosmos'	'Solared'
'Dawn'	'Starwars'
'Eclipse'	'Sunburst'
'Enterprise'	'Sundazzle'
'Equinox'	'Sunfire'
'Flare'	'Sunglow'
'Galaxy'	'Sunregal'
'Gemini'	'Sunset'
'Halo'	'Telestar'
'Meteor'	'Twilight'
'Milkyway'	'Twinkles'
'Mirach'	'Zenith'
'Nebulous'	'Zodiac'
'Nova'	

CALIFORNIA-FLORIDA PLANT CORPORATION

AMERICAN INDIAN SERIES, John Ryan1978

'Apache'	'Mohawk'
'Aztec'	'Mohegan'

CALIFORNIA-FLORIDA PLANT CORPORATION CONTINUED
AMERICAN INDIAN SERIES, John Ryan

1978

'Candy Penob'	'Navajo'
'Candy Ute'	'Osage'
'Cheyenne'	'Pawnee'
'Chickasaw'	'Penobscot'
'Chinook'	'Pink Cheyenne'
'Chippewa'	'Pink Penob'
'Creek'	'Pink Ute'
'Dark Penob'	'Pomo'
'Dark Pomo'	'Seneca'
'Delaware'	'Shawnee'
'Hopi'	'Shoshoni'
'Maya'	'Susquehana'
'Mic Mac'	'Ute'
'Mohave'	

PAUL ECKE RANCH
KIENTZLER SERIES

1987-1990

'Aglia'	'Jasius'
'Apollon'	'Marumba'
'Arctia'	'Melissa'
'Argus'	'Mimas'
'Aurore'	'Phoebis'
'Caligo'	'Saturnia'
'Celerio'	'Selenia'
'Delias'	'Sesia'
'Epia'	'Sylvine'
'Eurema'	'Thecla'
'Flambe'	'Vulcain'
'Isopa'	

LINDA VISTA
VISTA SERIES, Claude Hope

Spring 1983

'Vista 3'
 'Vista 10'
 'Vista 12'
 'Vista 13'
 'Vista 14'
 'Vista 33'
 'Vista 36'
 'Vista 37'
 'Vista 40'
 'Vista 41'
 'Vista 42'
 'Vista 43'
 'Vista 44'

LINDA VISTA CONTINUED
VISTA SERIES, Claude Hope
Spring 1983
'Vista 60'

DANZIGER FLOWER FARM
Fall 1989
'Danbel'
'Dandim'
'Daneye'
'Dankid'
'Danlight'
'Danor'
'Danova'
'Danrose'
'Danshir'
'Dark Thecla'

FISCHER
BULL SERIES
1990
'Adelene'
'Christine'
'Dark Twilight'
'Lena'
'Olga'
'Thilly'
'Veronika'

BALL SEED COMPANY
CELEBRATION SERIES
1990
'Carnival'
'Carousel'
'Champagne'
'Jubilee'
'Parade'
'Salute'
'Sparkler'

PANAMERICAN SEED, Claude Hope
'Tangeglow'
'Tango'

1990
SPECTRA HYBRIDS (FROM SEED), Alfonso Parada

APPENDIX 3

ORIGINAL NEW GUINEA IMPATIENS INTRODUCTIONS

UNITED STATES DEPARTMENT OF AGRICULTURE
 Agriculture Research Service
 Plant Science Research Division
 Beltsville, Maryland 20705

NOTICE TO PLANT BREEDERS AND NURSERYMEN RELATIVE
 TO THE RELEASE OF 23 IMPATIENS INTRODUCTIONS

The Plant Science Research Division of the U.S. Department of Agriculture hereby releases 23 introductions of Impatiens for scientific study, use by plant breeders and for propagation and sale by nurserymen. The introductions were collected in the highlands of New Guinea and Java by the 1970 Expedition sponsored jointly by ARS and Longwood Gardens of Kennett Square, Pennsylvania. They represent a wealth of genetic material totally unlike commercial varieties now grown in the United States.

All of the Impatiens introductions are distinctive for flower size or color, for leaf size, shape or color or for plant size. Flower diameter in some of the introductions has attained 7 cm. with spurs of equal length. Flower colors range from pure white through pastel shades of lavender and pink, and from pale orange to dark vermillion or scarlet. Leaf and stem color varies from green to intense dark red and in some introductions the leaves are beautifully variegated with white, yellow or pink. Although not completely identified they are directly suitable for cultivation as foliage or flowering varieties. The heaviest flowering occurs during winter and early spring on mature plants but some flowers are produced throughout the year. All are easily propagated by cuttings and some by seed. Preliminary tests indicate their suitability for summer planting outdoors in moist semi-shaded locations. They tolerate no more cold than older varieties. The 23 varieties are hereby named and released. The names are derived either from place names or descriptive terms in Pidgin English, the lingua franca of Australian Papua and New Guinea.

NEW GUINEA COLLECTIONS

Impatiens hawkeri, 'New Guinea Giants' - P.I. 354251, 354252, 354253.

Tall, vigorous plants with thick fleshy stems, some marked with red. Leaves green. Flowers flat, 5-6 cm. by 4-5.5 cm., spurs to 6 cm. long, pastel shades of lavender, pink or white.

Impatiens herzogii, 'Daulo Pass' - P.I. 349584.

Plants low growing, well branched. Foliage bronze-green. Flowers 3.5 cm. by 3.5 cm., pale orange with white eye.

2

Impatiens linearifolia, 'Longpela Lip'^{1/} - P.I. 354263.

Plants medium tall. Stems swollen at nodes, red at base. Leaves very narrow, wider at tips of branches, to 18 cm. long, undersurface red, metallic green above with red mid-rib and petiole. Flower 5 cm. by 5 cm., narrow petals, light pink with dark pink eye.

Impatiens linearifolia, 'Liklik Susa'^{1/} - P.I. 354266, 354267.

Semi-dwarf to tall. Stem fleshy, tinted red at swollen basal nodes, light red above. Leaves long strap-shaped at lower nodes, long-lanceolate at branch tips, dark green variegated with yellow along mid-rib. Flower round in outline, 3.3 cm. by 3.1 cm., pale pinkish salmon, small violet eye.

Impatiens schlechteri, 'Pikinini'^{1/} - P.I. 354258.

Dwarf. Stems with short internodes, fleshy, light red. Leaves medium green with mid-rib and petiole pink. Flower size medium, petals medium wide, dark vermilion with darker eye. Spur 5 cm. long.

Impatiens schlechteri, 'Naispela'^{1/} - P.I. 354259.

Semi-dwarf. Stem fleshy with short internodes, medium red. Leaves dark green with red veins. Flowers round, 4 cm., dark vermilion, dorsal sepal strongly keeled on reverse.

Impatiens schlechteri, 'Luluai'^{1/} - P.I. 354262.

Semi-dwarf. Stem fleshy with short internodes, reddish. Leaves light green. Petioles pink. Flowers 5 cm. by 4.5 cm. bright vermilion. Petals medium width, notched at tip.

Impatiens sp., 'Aiyura' - P.I. 349582.

Tall. Stem fleshy, usually showing red. Leaves large, green. Flowers 5.0 by 4.0 cm., shades of bright magenta with white eye. Petals narrow to broad. Spurs white, to 5 cm. long.

^{1/} In pronunciation Pidgin English resembles British English except that "a" is always pronounced ah, "e" as in pen, "i" as ee, and "u" as in put. It is unaccented.

3

Impatiens sp., 'Kassam' - P.I. 349583.

Tall. Stems somewhat fleshy, red. Flowers 5 cm. by 4.6 cm., light pink with darker pink outlining white eye zone. Petals notched at tip. Spur 6 cm. long, pink.

Impatiens sp., 'Patep II' - P.I. 349586.

Medium tall. Stem fleshy, reddish below. Leaves green. Flowers 4 cm. by 4 cm. in shades of bright magenta. Spur greenish white, pubescent, 4.5 cm. long.

Impatiens sp., 'Mindik' - P.I. 349588.

Tall. Stem fleshy, reddish to green below and at nodes. All parts free of pubescence. Leaves green. Flowers 5 cm. by 4.5 cm., white to pale pink. Spur 5.5 cm. long.

Impatiens sp., 'Kundiawa' - P.I. 354254.

Medium height. Stem slightly reddish. Leaves green. Flowers 5 cm., round, flat, intense vermillion with white to pale lavender eye. Spur 5 cm.

Impatiens sp., 'Mt. Kum' - P.I. 354255.

Tall. Stem less fleshy than others, dark red on lower part. Leaves dark green, irregular surface. Petiole red. Flower 4 cm. by 4 cm., round with widely overlapping petals, bright orange red with small violet eye. Spur slender 5.5 cm. long, red.

Impatiens sp., 'Korn Farm' - P.I. 354256, 354260.

Tall. Stem swollen at nodes, very dark red. Upper surface of leaves dark metallic reddish green, lower surface and petiole dark red. Flower round, flat, 6 cm. by 5.5 cm., light vermillion red with violet eye. Spur dark red, slender, 7 cm. long.

Impatiens sp., 'Redpela'^{1/} - P.I. 354257.

Tall. All plant parts very dark red. Flowers 4 cm. by 3.8 cm. dark red with orange overlay, dark violet eye, petals medium wide. Spur 6 cm. long, red.

4

Impatiens sp., 'Mt. Hagen' - P.I. 354261.

Medium height. Stem fleshy, red at the nodes. Leaves whorled, green with white variegation along the mid-rib. Flowers round, 4 cm. by 4 cm., petals wide, overlapping, medium salmon red with pinkish tones, pale lavender eye. Spur 4.5 cm.

Impatiens sp., 'Masta Mausgras'^{1/} - P.I. 354264.

Tall, vigorous. Dark red stems and petioles. Leaves large, glossy, reddish green, mid-rib pink, bordered with irregular yellowish variegations on upper leaves. Flower dull scarlet, 5 cm. by 5 cm. not opening flat. Spur slender, 5.3 cm. long.

Impatiens sp., 'Plaua Misis'^{1/} - P.I. 354265.

Semi-dwarf. Stem thick with short internodes, red. Leaves large, dark green to reddish, irregularly variegated white to pale pink. Flower 7 cm. by 6.5 cm., salmon pink shading lighter toward base of petals, dark eye zone. Petals somewhat reflexed with age. Spur 6 cm. long.

JAVA COLLECTION

Impatiens platypetala, 'Tjibodas' - P.I. 349629.

Somewhat procumbent to medium tall. Stems more slender than in New Guinea collections, green to red. Internodes short at base becoming longer on upright stems. Leaves green. Flowers light to dark magenta with darker markings on basal petals, 3.2-4.5 cm. by 2.0-4.0 cm. Spur white or pale magenta, 3.6-4.5 cm. long.

The Plant Science Research Division has none of these plants for sale. Limited quantities of cuttings will be available to qualified nurserymen and plant breeders during the late spring of 1972. Requests should be sent in writing to the U.S. Plant Introduction Station, Glenn Dale, Maryland 20769.

Hugo O. Graumann
 Director
 Plant Science Research Division
 Date Feb 23, 1972

APPENDIX 4

COMMERCIAL RECIPIENTS OF ORIGINAL NEW GUINEA

IMPATIENS COLLECTIONS

UNITED STATES DEPARTMENT OF AGRICULTURE
Agriculture Research Service
Plant Genetics and Germplasm Institute
Beltsville, Maryland 20705

July 1972

The following nurserymen have received propagation material of the New Guinea Impatiens collections.

These nurserymen should be able to supply rooted cuttings or plants to the public using the variety names under which the various collections were released. Some of the nurserymen have not had sufficient time to build substantial supplies and therefore will probably have only limited numbers of plants for sale.

The planting and care of New Guinea Impatiens is similar to that for other varieties. Consult your nurseryman for directions.

California

Peter Sluis, P. O. Box 580, Menlo Park, Calif. 94025.

Florida

Boynton Nurseries, Inc., 400-408 S. County Road, Palm Beach, Florida 33480.

Copeland's 49th Street Nursery, 5200 SW 49th Street, Fort Lauderdale, Florida 33314.

Culbreath Landscape Nursery, P. O. Box 10076, Tampa, Florida 33609.

Fairchild Tropical Garden, 10901 Old Cutler Road, Miami, Florida 33156 (Members only).

Fantastic Gardens, 9550 SW 67th Avenue, Miami, Florida 33156.

Planter & Patio Landscaping Service, Inc. 3020 S.W. 28th Avenue, Miami, Florida 33146.

Plant O Rama Nursery, 7790 S.W. 128th Street, Miami, Florida 33156.

Rainbow Garden Nursery, 2525 W. Main Street, Leesburg, Florida 32748.

Southern Nurseries, Route 2, Box 649, Dover, Florida 33527.

The Wayside, Suwannee River, Trenton, Florida 32693.

Georgia

Fred C. Galle, Callaway Gardens, Pine Mountain, Georgia 31822.

Hawaii

Olu Pua Gardens, P. O. Box 518, Kalaheo, Hawaii 96741.

Maryland

The Behnke Nurseries Co., Beltsville, Maryland 20705.
(Local only)

Missouri

Clarence Barbre, 302 Hillside Avenue, Webster Groves, Missouri
63119.

New Jersey

Parker Wholesale Florist, Inc., 1325 Terrill Road, Scotch Plains,
New Jersey 07076.

New York

Joseph Harris Co., Inc., Moreton Farm, Rochester, New York 14624.

Ohio

Mrs. Harold Dannemiller, 123 25th Street, N.W., Barberton, Ohio
44203 (Local only).

Yoder Brothers, Inc., Box 230, Barberton, Ohio 44203.

South Carolina

Geo. W. Park Seed Co., Inc., Box 31, Greenwood, South Carolina 29646.

Texas

Nortex Wholesale Nursery, Inc., 7700 Northaven Road, Dallas,
Texas 75030.

Virginia

Fredrick M. Benzinger, Rt. 1, Box 359, Ruckersville, Virginia 22968.
Eltzroth & Thompson Greenhouses, U.S. 29, 3.4 Miles South of I-64,
Charlottesville, Virginia 22901.
McGhee Nursery, 8520 Tidewater Drive, Norfolk, Virginia 23503.

APPENDIX 5

CULTIVAR NAMES USED AS OF DECEMBER 1975

(From the files of Dr. Robert J. Armstrong, research horticulturist, Longwood Gardens, Kennett Square, Pennsylvania.)

NEW GUINEA HYBRID IMPATIENS CULTIVAR NAMES
known to have been used as of December 1975

Name	User*	Name	User*
A'Flame	U.S.D.A.	Morning Star	N.F.
Aloha	U.S.D.A.	Orange Chiffon	I.S.U.
Arabesque	U.S.D.A.	Orange Crush	L.G.
Arctic Star	I.S.U.	Orange Gem	N.F.
Aurora	N.F.	Painted Lady	L.G.
Ballerina	L.G.	Pele	U.S.D.A.
Bandwagon	L.G.	Pink Doll	N.F.
Big Top	L.G.	Pink Frost	N.F.
Blue Velvet	I.S.U.	Pink Lemonade	L.G.
Bonny	N.F.	Pink Satin	I.S.U.
Bozo	L.G.	Pink Shell	N.F.
Brilliant	N.F.	Popcorn	L.G.
Carousel	L.G.	Popsicle	L.G.
Charmer	L.G.	Purple Silk	I.S.U.
Cheers	U.S.D.A.	Rainbow Star	I.S.U.
Comet Sport	N.F.	Snow	N.F.
Coral	N.F.	Sprite	U.S.D.A.
Cotton Candy	L.G.	Star Blaze	N.F.
Cotton Candy	N.F.	Starbrite	N.F.
Dwarf Starlette	N.F.	Star Burst	I.S.U.
Evening Star	N.F.	Star Dancer	I.S.U.
Fabulous	N.F.	Star Dazzle	I.S.U.
Fantasia	N.F.	Stardom	N.F.
Fire Cracker	L.G.	Star Fire	I.S.U.
Gemette	N.F.	Starfire	N.F.
Harlequin	L.G.	Starlite	N.F.
Hot Pants	N.F.	Star Trail	N.F.
Inferno	N.F.	Stop Light	L.G.
Improved Evening Star	N.F.	Summer Star	I.S.U.
Java Blood	N.F.	Sungoddess	N.F.
Lady Rose	N.F.	Super Fuchsia	N.F.
Laura	N.F.	Super Lavender	N.F.
Lavender Queen	N.F.	Super Pink	N.F.
Lavender Supreme	N.F.	Super Rose	N.F.
Lola	N.F.	Tangeglow	Hope
Lollipop	L.G.	Tops	N.F.
Meteor	N.F.	Torch	L.G.
Morning Star	I.S.U.		

*Hope = Claude Hope, Linda Vista, S.A., Apartado 100, Cartago, Costa Rica.

I.S.U. = Iowa State University, Ames, Iowa.

L.G. = Longwood Gardens, Kennett Square, Penna.

N.F. = Norfolk Botanic Gardens, Norfolk, Virginia.

U.S.D.A. = U.S. Department of Agriculture, Beltsville, Maryland.