ENCYCLOPEDIA OF KIMILSUNGIA

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President Kim Il Sung seeing newly bred Kimilsungia together with Sukarno, President of the Republic of Indonesia
(April 13, 1965)

Kimilsungia

Preface

Love of flower is a noble trait peculiar to man.

Flower brings fragrance, emotion and beauty to people. That is why they love it, and hope to live beautifully and pure-heartedly like it.

At the same time, they express their wish and desire, happiness and hope by means of it, and want to bring their life into full bloom, picturing themselves in it.

Kimilsungia, which was named by Sukarno, the first President of the Republic of Indonesia, reflecting the desire of the progressive people of the world, is loved by mankind not only because it is beautiful but also it is symbolic of the greatness of President Kim Il Sung.

The editorial board issues *Encyclopedia of Kimilsungia* in reflection of the unanimous will of the Korean people and the world's progressive people who are desirous to bloom Kimilsungia more beautifully and propagate it more widely on the occasion of the centenary of the birth of President Kim Il Sung.

The book introduces in detail how Kimilsungia came into being in the world, its propagation, Kimilsungia festivals and exhibitions held in Korea and foreign countries every year, events held on the occasion of the anniversary of the naming of the flower, and its biological features and cultivating techniques the Korean botanists and growers have studied and perfected.

And edited in the book are the typical literary works depicting Kimilsungia and some of gift plants presented to President Kim Il Sung by foreign countries.

In addition, common knowledge of flower is compiled.

The editorial board hopes this book will be a help to the flower lovers and people of other countries of the world who are eager to know and grow Kimilsungia.

Editorial Board

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Part I
Birth of Kimilsungia

Kimilsungia is the most beautiful flower of the orchid family C. L. Bundt, an Indonesian botanist, bred through persevering efforts.

Sukarno, the first President of the Republic of Indonesia, named it after President Kim Il Sung in reflection of the boundless reverence of the world progressive people for him.

Chapter 1
Birth of Kimilsungia in the World of Flowers

The birth of Kimilsungia was a token of boundless reverence of the progressive people for President Kim Il Sung.

Kimilsungia has left a special page in the history of flowers as it was dedicated to a great man.

Section 1. Voice of Praise of the Great Man

Kimilsungia is a beautiful flower of nature, but it is not merely an outcome of botanical development. It is a flower of praise of a great man that bloomed in the hearts of the entire humanity revering Kim Il Sung.

Kim Il Sung enjoyed the wholehearted praise of mankind for the immortal exploits he had performed for the Korean revolution and the cause of global independence.

Endless is the story of the great personalities of Kim Il Sung, and introduced here is only the remarks made by the heads of different countries who had met him.

In early 1949, Kim Il Sung paid an official visit to the former Soviet Union at the invitation of Stalin. Stalin hosted a banquet at the Kremlin in honour of him.

In his speech at the banquet, Stalin said:

"Comrade Kim Il Sung is an internationalist and a prototype of the communist movement, who defended with arms and at the cost of blood our Soviet Union from the imperialists' invasion in the East. It is attributable to the struggle of the genuine communists like Comrade Kim Il Sung that our Soviet Union can carry on socialist

construction in such peaceful conditions as today. Availing myself of this opportunity, I, in reflection of the unanimous wish of all the comrades and friends present here and of my own, propose to express our wholehearted thanks to Comrade Kim Il Sung with a round of applause."

Thunderous applause arose in the banquet hall.

There was a historic meeting in July 1957 in Pyongyang between President Kim Il Sung and Vietnamese President Ho Chi Minh. At that time, Ho Chi Minh earnestly said that Comrade Kim Il Sung was a great leader representing the 20th century, that he had learned during the short period of three days what he could not learn even in three years, and that he really wanted to stay longer in Korea to learn more from Kim Il Sung.

The feeling of reverence of Ho Chi Minh and the Vietnamese people for Kim Il Sung reached climax with the latter's visit to Vietnam in 1965 as a momentum.

There was a mass rally in Padin Square in Hanoi in welcome of Kim Il Sung.

Kim Il Sung delivered a speech before cheering Vietnamese people.

Ho Chi Minh was not scheduled to make a speech at the rally, but he took the floor. He said that Kim Il Sung was a peerless hero who had defeated two imperialist powers—the United States and Japan—and a great leader of building a new society, and that the Korean people were rushing forward at the speed of Chollima under Kim Il Sung's leadership enjoying the admiration of the world. And, suggesting that the participants give cheers to him who had inspired the Vietnamese people with the spirit of Chollima, he himself led the cheer. The sky over Hanoi resounded with thunderous cheers.

In June 1975, President Tito of the former Yugoslavia, one of the initiators of the non-aligned movement, met the delegation of the DPRK on a visit to his country, and said heartily that he liked Korea for its strong independence, and so he respected Kim Il Sung who was pursuing politics of strong independence. He added that he could not but admire Kim Il Sung's independent politics.

In June 1994, former US President Jimmy Carter visited Korea, and met

Kim Il Sung. On his way home, he had an interview with journalists and spoke highly of President Kim Il Sung, saying that he was greater than George Washington, Thomas Jefferson and Abraham Lincoln, major presidents of the USA, put together.

Sukarno, first President of Indonesia, also cherished deep reverence for President Kim Il Sung.

Sukarno was a statesman renowned in the international arena. He was not only the head of one country but also one of the initiators of the non-aligned movement.

He visited Korea in early November 1964.

Kim Il Sung gave detailed answers to the questions he raised at the talks and during his visits to several places, particularly the experience of building the self-reliant national economy, the question which he was most interested in.

Before returning home, Sukarno said that there was a myth of India, which says whoever whispers his or her wish under a tree named *Galpataru* will surely have it realized, and that he would like to stand under that tree wishing Kim Il Sung good health. Feelings of respect or admiration for a man can never be forced by power. A great man can neither be made on the recommendation nor with aspirations. Anybody who has performed tremendous achievements for the country and people and for mankind as well as for the time and history will make everybody follow and revere him of one's own accord.

Kim Il Sung paid an official visit to Indonesia in April 1965. The day of his arrival in Jakarta, capital city of Indonesia, was declared a holiday and hundreds of thousands of citizens in their best attire came out to the airport and streets.

Sukarno went so far as the ramp of the plane to greet Kim Il Sung. While Kim Il Sung was reviewing the honour guards of the three services and police force, Sukarno stood close to him, personally holding a large umbrella to shelter the President from the tropical sun. It was unprecedented in diplomatic etiquette.

Portraits of Kim Il Sung and posters welcoming him were seen at the airport, Independence Square and many other places.

The Indonesian people sang in Korean the *Song of General Kim Il Sung*,

immortal revolutionary hymn, waving the flags of both countries.

Sukarno also invited Kim Il Sung as a guest of honour to a session of the Provisional People's Consultative Assembly of Indonesia.

As the chairman of the assembly said in the opening speech that it was the first time in the Indonesian history that head of a foreign state attended the People's Consultative Assembly, and in the name of all the participants and the Indonesian people extended warm thanks to His Excellency Kim Il Sung whose attendance elevated the dignity and significance of the assembly to the highest, all responded with thunderous applause.

President Sukarno delivered a policy speech at the meeting. Repeating the word "Juche" in Korean several times, he pointed out that Juche should be established in Indonesia, too, and quoted President Kim Il Sung's instructions that in order to build a democratic, independent and sovereign state it is important to achieve economic independence of the nation, which is imperative to achieve political independence and keep existence. He continued to say that during his stay in Korea he received from Kim Il Sung a suit made of cloth obtained from stone and he kept it as a token of his respect for Kim Il Sung and as a suit symbolic of self-reliance.

Saying that Indonesia was going to take the course of building the self-reliant national economy, and become independent, Sukarno expressed that they were honoured by the presence of Kim Il Sung, creator of self-reliance and the daring and successful builder of a self-supporting national economy. Noting that the Korean people built the solid, self-supporting national economy so that they were independent of any forces both politically and economically, he encouraged his people to build a new, independent Indonesia following their example.

Sukarno entertained Kim Il Sung with utmost sincerity during his visits to local areas and always accompanied him, paying special attention to his safety.

Sukarno paid a congratulatory visit to Kim Il Sung on April 15, latter's birthday, and presented him with a sculpture depicting a general riding *Garuda*, a legendary lobster of Indonesia. He explained that the general on *Garuda* was just Kim Il Sung and *Garuda* was Chollima of Indonesia.

That day Sukarno had awarded the title of Honorary Doctor of Engineering to Kim Il Sung. By conferring that title instead of Doctor of Social Sciences, he highly appreciated Kim Il Sung who built the independent national economy and thus shattered the existing concept that the development of the machine-building industry was possible only in Europe.

It was in the middle of the banquet arranged in honour of many heads of state who participated in the celebration to mark the 10th anniversary of the Bandung Conference, when the *Song of General Kim Il Sung* was played with solemnity. In a moment, the venue was wrapped in sublime silence and all the attendants looked up to Kim Il Sung with profound respect and admiration. When Chinese Premier Zhou Enlai said to Sukarno sitting opposite to him that it was the song dedicated to Kim Il Sung, Sukarno replied that the song was familiar to him and Indonesian people.

Sukarno also arranged that Kim Il Sung was the first to write an autographic signature in celebration of the 10th anniversary of the Bandung Conference and to spade up the first shovel at the groundbreaking ceremony of a new building.

As President Sukarno cherished such ardent reverence for and absolute trust in Kim Il Sung, Kimilsungia was able to come into being in Indonesia.

Section 2. Cherishing the Desire of the Progressive People

As for the origin of names of flowers, the name of sunflower was derived from its characteristic feature, and hyacinth was named after a prince in the ancient Greek legend. And other flowers such as dahlia and gerbera took their names after the scientists.

It is well known all over the world that Kimilsungia was named after Kim Il Sung of the DPRK by Sukarno, first president of Indonesia, in reflection of the unanimous

wish of all the people.

On April 13, 1965, two days before the birthday of Kim Il Sung, Sukarno accompanied him to the Bogor Botanical Garden, situated in the foothills 200 metres high above sea level and dozens of kilometres away from Jakarta. Boasting of its 150-year-long history since 1817, the garden was noted in the world for its grandness in area and also called a “flower garden of Indonesia” as it was planted with more than 10 000 kinds of tropical plants.

Sukarno’s true intention of inviting Kim Il Sung to the botanical garden was not merely to show him the world-renowned garden itself. After looking around the open-air arboretum, Kim Il Sung visited the greenhouse. Beautiful flowers were in full bloom there. Among them the orchids were really fascinating. The Indonesian people loved orchids so feverishly that it was even said they were born in orchids and died in orchids with smile.

When Kim Il Sung approached a display-stand in the greenhouse, Sukarno took a pot of flowers from the director of the botanical garden and asked him if he liked the flower.

Butterfly-shaped elegant petals of pinkish-purple flowers bloomed on a crescent-shaped stalk, nodular stems tough like a bamboo and full-grown green leaves—they were so beautiful.

With bright smile on his face, Kim Il Sung appreciated the flower for a while and said that it was very beautiful.

Susanna Kassan, director of the botanical garden, was filled with joy to hear the praise of Kim Il Sung, because he had devoted his all to cultivating that flower for that day.

The florist who bred the flower was C. L. Bundt, who devoted his whole life to breeding new varieties. He was well-known in the country, who produced many varieties of flowers, most of them being orchids.

He believed that orchids were the most beautiful flowers from which could be bred the ideal flower for humankind.

After long and painstaking efforts to breed a new variety, he finally succeeded in

producing an unusual flower. So elegant and graceful was the flower that everybody found it fascinating.

C. L. Bundt, breeder of Kimilsungia

Bundt earnestly asked the director of the botanical garden, who was his friend and also a florist, to bring into full bloom the new variety of orchids he had produced and show Kim Il Sung who would pay a visit to Indonesia the beautiful flower.

The director was very glad at Bundt's proposal. Great devotion makes a flower come out even on a rock. The flower came into full bloom just before Kim Il Sung's visit as wished by Sukarno and the director.

They explained to Kim Il Sung that the flower was a new variety bred by an Indonesian florist.

Kim Il Sung expressed his thanks for showing him such fine flowers.

Then Sukarno said that the idea of Kim Il Sung was so great that it moved the world and that it was not too much to say that he had the whole world in his possession. Noting that he was the sun illuminating the era of independence and the benevolent father of all the people, Sukarno suggested that he wanted to name the flower Kimilsungia after the former's name.

The director of the botanical garden also earnestly asked Kim Il Sung to readily accept the offer. But Kim Il Sung declined modestly, saying that he had done nothing so special and there was no need to have a flower named after him.

Sukarno insisted that the former had already rendered enormous services to mankind, so he deserved a high honour.

It was the genuine feelings of Sukarno who was fascinated by the great personality of Kim Il Sung, and the reflection of the unanimous mind of the progressive people in high praise of him.

Sukarno also expressed his mind to the "young commander" who was accompanying Kim Il Sung and assisting him in his foreign activities. The "young

commander" who commanded such admiration from Sukarno was Kim Jong Il.

During a break in a luncheon at the Bogor Palace Kim Jong Il told Kim Il Sung that Sukarno insisted on naming the flower after him. But the latter changed the subject to such irrelevant issues as refurbishing the Pyongyang Botanical Garden and the performance given by the Indonesian artistes. Sukarno could not realize his wish, and Kim Il Sung continued his visit to the local areas.

When he came back to Jakarta, Sukarno repeatedly brought the matter to the Korean officials through his department chief of protocol. But the President modestly dissuaded the officials from accepting the offer.

Kim Jong Il decided to obtain the President's approval in this issue associated with the sincerity of mankind.

He said that Sukarno, by the authority of not just the president of a country but also the chairman of the Reception Committee of Kim Il Sung, suggested naming the flower after him, reflecting the desire of the people of the world as well as Indonesia.

And he added that others would give up most likely that much, but Sukarno would never withdraw his proposal until it was approved, judging from the fact that he suggested the issue again and again even after the return from his visit to local areas.

Kim Il Sung, considering the matter for a while, approved it in acknowledgement of the ardent desire of Sukarno and Indonesian people and as a token of their esteem for the Korean people.

This is how Kimilsungia came into the world.

It was on April 13 when the historic event was recorded in the world history of flower in the presence of Kim Il Sung.

The birth of Kimilsungia was the fruition of the fascination of humanity for President Kim Il Sung and the trust in him, the reflection of the will and aspiration of the times and mankind to give the name of the great man to the most beautiful flower, and also the ode to the immortal exploits he performed for the realization of the cause of global independence.

Section 3. How Kimilsungia Came to Korea

Kimilsungia came into the world in April 1965.

At that time President Sukarno promised that he would ensure that the technique of cultivating Kimilsungia would be completed and that it would be sent to Korea in one or two years. But the flower failed to come to Korea owing to the unexpected situation created in Indonesia. To make the matters worse, the director of the Bogor Botanical Garden disappeared without a trace and the whereabouts of the flower became unknown.

However, convinced that Kimilsungia would have been preserved and blown beautifully by the Indonesian people who deeply respected and revered President Kim Il Sung, Kim Jong Il sent officials to Indonesia in 1974 to find the flower.

Upon arriving in Indonesia, the officials began to trace Susanna Kassan, former director of the garden, and C. L. Bundt, the botanist.

When they finally found out the whereabouts of Kassan, they knew that he had worked as a hotel gardener in remote Bali Island and died of an incurable disease. They were told that Susanna Kassan writhed in agony even in his sickbed of failing to send Kimilsungia to President Kim Il Sung. Being afraid of not realizing his wish to make Kimilsungia flourish and send it to Korea and also leave it as a family heirloom, he had earnestly asked his son to send the flower to Pyongyang without fail instead of him.

On his deathbed, he wrote to Bundt, "… I am sorry to die without realizing my desire to make Kimilsungia flourish and bloom beautifully in Korea. However, I am sure that it will thrive and bloom beautifully in Korea.…"

His letter was conveyed to Bundt by his son. Later, he devoted himself to perfecting the cultivation technique of the flower, assisting the botanist as his father had wished.

The Korean officials went to Ujung Pandang to see Bundt, who was very glad to meet them.

He gave them the best Kimilsungia of all those he was growing, explained about its characteristic features, his cultivation methods and some matters to be attended in breeding, and gave them reference books on the orchid cultivation.

Informed of having found Kimilsungia in late December 1974, Kim Jong Il was very satisfied at seeing the flower after a decade and instructed them to bring the flower to Korea as soon as possible so that the President would be very happy to see the flower again.

He said that it would not be easy to transport the tropical flower in mid-winter to Korea but stressed the need to bring it as early as possible and make researches on its growth and propagation.

Thus, two plants of Kimilsungia arrived in Pyongyang in mid-January 1975. Kim Jong Il looked at the flowers.

Kimilsungia looked graceful and charming for its two butterfly-shaped petals, the lip in the centre and three sepals forming a sophisticated spatiality. The petals and sepals were all pinkish purple, and the latter white at the tip, adding a special charm to the flower.

Explaining to the officials that Kimilsungia was a beautiful flower of orchid family and was said to bloom beautifully for about 100 days, Kim Jong Il asked them what impression they got from the flowers. They answered that the flower was particularly beautiful so that they liked it at the first glance.

Orchids stand first among all flowers in beauty, and are known as a symbol of high principle and a mirror of clear conscience. They are also comprised of a large number of species, as they have reached the culmination of botanical evolution.

Foreigners who had seen Kimilsungia held Kim Il Sung in higher esteem and reverence, all fascinated by the deep meaning of the flower and its beauty.

Norodom Yubanat, King of Cambodia, said in April 2004, “Kimilsungia is an ardent, graceful, fresh and precious flower with limitless energy of mystery, the flower in the zenith of beauty”.

Every year new varieties of flowers are produced around the world. Thus, the International Society for Horticultural Science established a system of registering the newly-bred flowers.

The second session of the International Orchid Society was held in 1957 and decided that the international orchid-related society based in England examined and registered the plants of orchid family newly bred throughout the world. Following such procedures, Kimilsungia was registered by Guntur Sukarno Putera, son of President Sukarno.

Guntur was well aware that how ardently his father respected President Kim Il Sung.

After the President's return to Korea, Sukarno kept Kimilsungia in his mansion and watched the flower for a long while whenever he yearned after the President.

Guntur Sukarno Putera, who knew his father's mind better than anybody else, decided to register Kimilsungia and widely introduce it to the world and submitted the application to the international orchid-related society.

Guntur Sukarno Putera

On April 20, 1982, Kimilsungia was registered to the international orchid-related society in Britain. Kimilsungia was introduced as a Dendrobium KIMILSUNG FLOWER in the periodical issued by the society.

From then on Kimilsungia secured its unchallengeable status as a famous flower acknowledged by the International Society for Horticultural Science and a common treasure of mankind.

Flowers and Health

Flowers produce a beneficial effect on human body for their own colours, aroma and forms, to say nothing of beauty.

According to data, it is said that flowers add vigour to human life for they have a balance of the negative and the positive. It is advisable to decorate the room or office with rose or lily belonging to positive plants when a man is in a low mood (negative), but when he is in good mood (positive) *Angelica Porhyrocaulis Nakai et Kitag* and stellaria belonging to negative plants are appropriate.

Rose: It is effective in setting the nerves at ease. The aroma emitting from its petals also produces a splendid effect of controlling humidity. The aroma also helps make the kidney strong, refresh the mind, relieve fatigue and invigorate the energy.

Lily: It is efficacious for removing the symptoms of thirst and weariness, peculiar to diabetes. The method is simple. Put a bundle of lilies in the room, then the air is laden with the aroma of lilies, removing the feeling of indisposition. Therefore, when visiting a diabetic, it would be advisable to take the flowers.

Balsam: It has a marvelous effect on diarrhea and acts as an antidote. In particular, pink balsam is highly efficacious for protecting the spleen and lungs. When a bone of fish sticks on the throat, it will be soon removed if you eat its powdered seed. And if its extract is applied to the insect's bite, it will heal up quickly.

Chrysanthemum: Arrangement of its flowers in the room is good for curing a fever. It is efficacious for the treatment of headache, anemia and articular pain caused by fever. It also lowers hypertension and relieves an eye fatigue. When you are tired, the sweet fragrance of white chrysanthemum spread in the room lessens eye tiredness and stabilizes hypertension.

Sunflower: Its fried seeds prevent coronary arteriosclerosis. If you drink liquor mixed with its yellow petals, stress will be eased. And liquor mixed with its leaves and stem helps cure headache and eye fatigue, and allay fever. According to data, sunflower has been recognized as a highly effective remedy for treating lungs and liver, decreasing the amount of cholesterol in blood and killing ascarid in the body. The modern medical science has proved it to be very effective for the growth promotion. It also has a special efficacy on stomachache caused by stress.

Chapter 2
Kimilsungia Blooms All over the World

Almost half a century has passed since Kimilsungia was born in the world.

The Korean people and progressive people of the world are cultivating the flowers with high respect for President Kim Il Sung increasing with the passage of time.

Section 1. Enthusiasm in Cultivating Kimilsungia

When Kimilsungia arrived in Korea, Kim Jong Il looked at the flowers for a while, and said that they were the Kimilsungia which Kim Il Sung admired. He then said that seeing the flowers again in the homeland reminded him of the happenings at the Bogor Botanical Garden ten years ago like yesterday's.

Kimilsungia was transplanted at the Central Botanical Garden. The scientists and experts there made strenuous efforts to grasp the biological features of the flower and propagate it.

They faced many difficulties as they had no experience in cultivating the tropical orchids, and no such modern greenhouses for orchid cultivation or a tissue culture room. They also lacked scientific personnel and skilled workers for mass-cultivating the flower in a short period.

Kim Jong Il took measures in August 1978 to send the delegation of the botanists of the Central Botanical Garden to Indonesia in order to learn the matters in growing Kimilsungia and keep abreast of the global trend in the study and cultivation of orchids as well as to prove its pure breed and bring more plants of Kimilsungia for

research work.

During its stay in Indonesia, the delegation proved the botanical-morphological features of Kimilsungia with the help of C. L. Bundt, who gave them five more potted plants and technical references to make them acquire the method of tissue culture and cultivation of orchids.

On April 2, 1979, Kim Jong Il took measures to build a Kimilsungia greenhouse and tissue culture room at the Central Botanical Garden.

Within a short period of six months, the Kimilsungia greenhouse was built in the Central Botanical Garden befitting the base of the cultivation and propagation of Kimilsungia. The scientists and technicians made energetic researches into the reproduction and growth of Kimilsungia.

It was nearly a decade later in June 1988 that Kim Jong Il took detailed measures to reconstruct the Kimilsungia greenhouse and tissue culture room in a modern way and supply the project with necessary materials and equipment before any other objects. Therefore, the Kimilsungia greenhouse was reconstructed in a year and

Kimilsungia Greenhouse

opened late in June 1989. The dissemination of cultivation techniques and scientific research on Kimilsungia were promoted to a higher level.

Kim Jong Il saw to it that the research and dissemination bases of Kimilsungia were established in the biological branch of the State Academy of Sciences and every provincial botanical garden.

In early July 1981, he sent to the Central Botanical Garden and every provincial botanical garden the competent technological personnel to help them build Kimilsungia greenhouses and study and introduce the methods of cultivation and propagation to suit the local features.

He set the tasks for the Central Botanical Garden to expedite researches into the cultivation method of Kimilsungia as early as possible and disseminate them to the whole country, and for the biological branch to clarify the biological characteristics of the flower and thus put its cultivation and reproduction on a scientific basis.

The scientists at the Central Botanical Garden were engrossed in research work, giving full play to their creative power and collective wisdom. They succeeded in growing 20 000 plants of Kimilsungia on the occasion of the 70th birthday of President Kim Il Sung. Informed of the completed method of its reproduction, Kim Jong Il was much satisfied and highly appreciated it.

The scientists of the biological branch, too, pushed ahead with the research work to fully elucidate the biological characteristics of Kimilsungia—the growth, development, photosynthesis, vegetative physiology and morphological and anatomical structure. Based on the clarification of biological characteristics of the flower for the mass-propagation and cultivation, they set to a new task of blooming the flower all the year round. By tackling the research, they succeeded in blooming the flower again by treating with growth regulators the lateral bud on the old stem to reproduce peduncle, and invented various culture media and insecticides.

Much attention was also paid to preserving the characteristics of original breeds of the flower.

The scientists and technicians brought together in a systematic way the research successes achieved in scientific study of Kimilsungia and widely published the

cultivation methods through more than ten pamphlets including *Kimilsungia, Flower of Loyalty* and *Biology of Kimilsungia,* and over 90 treatises including *Research on the Tissue Culture of Kimilsungia* printed in the scientific magazines. Several science films like *Kimilsungia*, featuring the flower's biological characteristics and its cultivation methods were also produced.

After the sudden death of President Kim Il Sung, father of the nation, on July 8, 1994, the Korean people made up their mind to bloom Kimilsungia more beautifully with ardent yearning for him.

The DPRK Cabinet, commissions, ministries, national agencies and military organs took the lead in growing Kimilsungia, followed by the provinces, cities and counties all across the country.

The ground was broken in October 1998 for the Kimilsungia and Kimjongilia Exhibition Hall with a total space of over ten thousand square metres on the picturesque bank of the Taedong River. The hall opened in April 2002.

Hung on the front wall of the foyer 800 m^2 in area are the portraits of President Kim Il Sung and leader Kim Jong Il smiling brightly, surrounded with the pots of Kimilsungia and Kimjongilia, ornamental and flowering plants. The other walls of the foyer are dedicated to the writings of many foreigners including former Indonesian President Sukarno, Japanese horticulturist Kamo Mototeru, and members of the Association of Supporters for Propagation of Kimilsungia and Kimjongilia, who rendered remarkable services to the naming and cultivation of Kimilsungia and Kimjongilia and to the construction of the exhibition hall.

On display are their name plates engraved on stone. There is also a room dedicated to the history of the cultivation of the immortal flowers and the successes achieved in their dissemination and flower festivals. At the centre of the foyer is a "dancing fountain" that sprays the waterspout to the beautiful melody, welcoming the visitors. The escalators lead them to the exhibition halls on the second and third floors thousands of square metres wide in space where festivals of Kimilsungia and Kimjongilia are held in a grand way every year on the occasions of birth anniversaries of Kim Il Sung and Kim Jong Il.

There is a tissue culture room equipped with modern facilities, the mission of which is to produce the seedlings of Kimilsungia and Kimjongilia and send them to many places at home and abroad. The training courses for cultivation techniques of the flowers and meetings to exchange experiences are held here and the practices are given to the horticulturists and gardeners of the country.

The exhibition hall is always crowded with many people of all strata, youth and students, foreigners and overseas Koreans. The visitors get informations on the origin of Kimilsungia and Kimjongilia, their biological characteristics and cultivation methods.

In July 2002, the Korea Kimilsungia-Kimjongilia Federation was organized, which was reorganized in September 2003 as the Korea Kimilsungia-Kimjongilia Committee.

Since 2001 the quarterly periodical *The Immortal Flower* has been published for the dissemination of the cultivation techniques of Kimilsungia and Kimjongilia.

Many scientists engaged in the study of Kimilsungia were honoured with the academic degrees and titles and official commendations for the successes in their work.

Kim Jong Il sent several messages of thanks to the scientists at the Central Botanical Garden and biological branch of the State Academy of Sciences in high praise for their successes.

Kimilsungia has spread to many countries in Asia, Africa and Europe.

The Kimilsungia-Kimjongilia Study Centre was formed in the DPRK, which is further spurring the research work onto a new, higher stage.

The latest achievements made in the field of modern bioengineering are being introduced into the research to improve the quality and ecological features of Kimilsungia and Kimjongilia.

It is also coordinating all the researches in a unified way, while conducting the joint researches with other relevant organs at home and abroad. It also organizes and executes the works such as scientific seminar, introduction of new technologies, inventions, examination and the likes.

A room in the Kimilsungia and Kimjongilia Exhibition Hall

Stone plates from foreign personages of the world exhibited
in the Kimilsungia and Kimjongilia Exhibition Hall

Stone plate sent by the former Indonesian
President Sukarno

Stone plate sent by
Ratna Sari Dewy Sukarno

Section 2. Dissemination of Kimilsungia and Its Festival

With the construction of the Kimilsungia and Kimjongilia greenhouses briskly under way across the country and the growing enthusiasm of the Korean people to tend Kimilsungia at home and workplaces, there arose a social demand to organize a Kimilsungia show. It was also the earnest wish of the Korean army and people for the immortality of President Kim Il Sung.

Deeply fathoming the people's wish, Kim Jong Il took measures to have the Kimilsungia show held in Pyongyang on the occasion of April 15, 1999 (the Day of the Sun), 87th birth anniversary of Kim Il Sung.

The First Kimilsungia Exhibition was successfully held in the Pyongyang International House of Culture. Thousands of plants of Kimilsungia were displayed, and a great number of people visited the venue.

Minister of Tourism, Art and Culture of the Republic of Indonesia said in a congratulatory speech that President Kim Il Sung and Kim Jong Il paid a visit to Indonesia in 1965, during which the then President Sukarno named a flower newly bred by a horticulturist Kimilsungia out of his high reverence for and trust in President Kim Il Sung. Highly proud of the fact that the two plants of Kimilsungia have now multiplied to myriads, he hoped that more and nicer Kimilsungias would be exhibited in the future shows.

Vice-chairman of the Central Committee of the German Communist Party wrote in the visitors' book that Kimilsungia attracting the people was a joy and pride for the Korean and world people, for evoking boundless respect for and unforgettable memory of Kim Il Sung. Then he made sure that the flower would always be in full bloom not only in Korea but throughout the world and remind mankind of the life and exploits of Kim Il Sung.

The scale of Kimilsungia shows became larger every year and assumed an international one with the participation of many foreign countries, international and

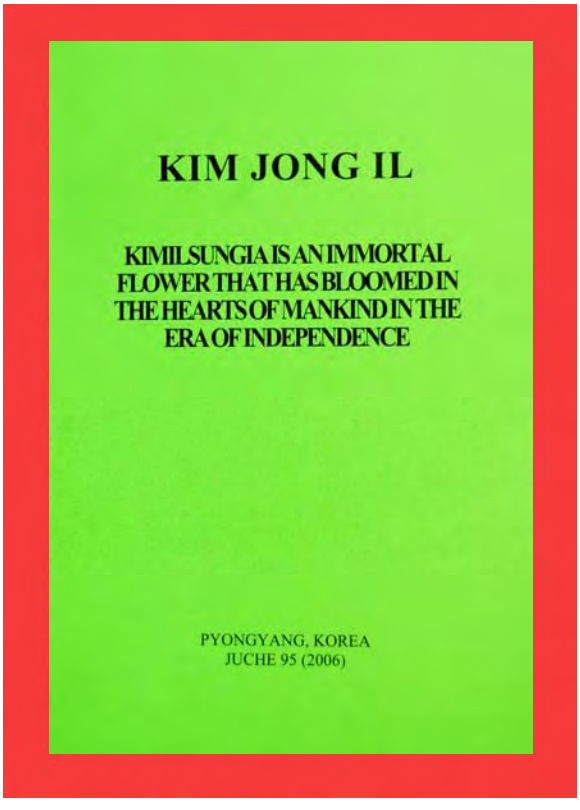
friendship organizations, and thus the show developed into the Kimilsungia festival from the 5th show, and the *Song of Festival of Immoral Flower* was composed and the flag of the festival designed afterwards.

Through the festivals Korean people fully demonstrated their firm determination and noble morality to hold President Kim Il Sung in high esteem as the eternal leader of the nation and remain loyal to the leadership of Kim Jong Il.

It was in the final stage of preparations for the coming Seventh Kimilsungia Festival.

Kim Jong Il made public his work *Kimilsungia Is an Immortal Flower That Has Bloomed in the Hearts of Mankind in the Era of Independence* on April 6, 2005, on the occasion of the 40th anniversary of the naming of Kimilsungia. In his work he comprehensively elucidated the historic position and significance of Kimilsungia as well as the ways and means to be held fast to in the cultivation and propagation and the festivals of Kimilsungia, symbol of dignity and glory of the Kim Il Sung's nation.

His work has become a programmatic guideline to be tackled in cultivating the flower as well as a treasure of the nation and the whole world through generations and in organizing the festival in a meaningful way to praise and revere the great man.



The Seventh Kimilsungia Festival opened in a grand way on the 40th anniversary of the naming of the flower. Over 10 000 pots of Kimilsungia were exhibited, thus making the visitors cherish deep in mind the revolutionary exploits of President Kim Il Sung who devoted his whole life to the country and people.

The festival was participated by

various units of military organs, ministries, national agencies, provinces, service personnel, people of all walks of life, youth and students of Korea, diplomatic missions and NGOs in Pyongyang, friendship and solidarity organizations and foreign individuals.

In particular, Kimilsungia and other rare flowers were exhibited by the Indonesian Embassy in Korea, and the delegations of the American Kimilsungia and Kimjongilia Association and the international horticultural exposition of the Ministry of Agriculture of Thailand.

The ambassadress of Indonesia said in a congratulatory speech that she, on behalf of the government of the Republic of Indonesia, expressed her thanks to leader Kim Jong Il and Korean people for the honour of participating in the Kimilsungia festival held in Pyongyang. She noted that she was very glad to attend the splendid event in which delegates of various nations of the world of different characters and individuality got together with a single heart to promote friendly relations in the atmosphere of harmony, solidarity and peace. Stressing that the cordial atmosphere of the festival was the reflection of long-standing friendship between the DPRK and the Republic of Indonesia, she said the people loving peace and justice wished Kimilsungia in full bloom forever.

Megawati Sukarnoputri, former President of Indonesia and the general chairwoman of the Central Leadership Council of the Fighting Democratic Party of Indonesia, attended the ceremonial functions of 40th anniversary of the naming of Kimilsungia, and wrote in the visitors' book after looking round the venue of the festival: "Kimilsungia is not a simple flower. It is associated with the sincerity of President Sukarno and the entire Indonesian people who revered the great President Kim Il Sung most fervidly and praised him highly. President Sukarno presented this flower to President Kim Il Sung who was visiting Indonesia 40 years ago, and named it Kimilsungia. Even now I look back on that day with deep impression. It is still kept in my memory. 40 years ago I was so glad to meet President Kim Il Sung and the respected Kim Jong Il that I danced before them. As it was the flower named after President Kim Il Sung, we could safeguard and make it bloom beautifully.

Kimilsungia and Kimjongilia are in good harmony, looking much more beautiful and fascinating. Kimjongilia is now in full bloom as much as Kimilsungia all over the world. I will do my best to propagate Kimilsungia and Kimjongilia more broadly as a flower amateur. I think it a great trust and honour to be recommended as the honorary chairwoman of the Association of Supporters for Propagation of Kimilsungia and Kimjongilia. I'll work hard for friendship between Korea and Indonesia and for the peace of the world."

Ratna Sari Dewy Sukarno, widow of former President of Indonesia Achmed Sukarno, left her deep impression on the festival: "I am deeply moved to see Kimilsungia in full bloom. It is because of the noble sense of moral obligation leader Kim Jong Il has shown to President Kim Il Sung and strong feelings of the Korean people who have boundless respect for their leaders. I deem it a great pleasure to work as the honorary chairwoman of the ASPKK. I am apprehensive of such an important and responsible work but I'll try my best."

The head of delegation of Kimjongilia Amateurs Association of Japan extended congratulations to the festival in celebration of the 40th anniversary of the naming of Kimilsungia, and said that they felt that it was a grand event to glorify the revolutionary exploits of President Kim Il Sung through generations.

Kimilsungia and Kimjongilia Exhibition held in October 2005 on the occasion of the 60th founding anniversary of the Workers' Party of Korea also presented a wonderful sea of flowers in high praise of the great men.

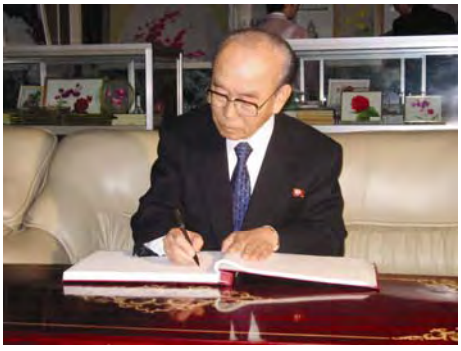
The Kimilsungia and Kimjongilia Exhibition Hall, the venue of the show, put on display more than 20 000 pots of Kimilsungia and Kimjongilia grown by the military organs, commissions, ministries and national agencies of the DPRK.

Tens of thousands of the DPRK visitors including the delegates to the celebrations of the 60th founding anniversary of the WPK, servicemen and working people, Wu Yi, vice-premier of the State Council of the People's Republic of China, Megawati Sukarnoputri, former Indonesian President, and other foreigners, overseas Koreans and hundreds of south Korean tourists who came to Pyongyang to see the mass gymnastics and art performance *Arirang* looked round the show.

Wu Yi said, "I have seen many world flower Expos but this is the first time to see such a grand exhibition of flowers named after their leaders. I wish to be a member of Kimilsungia and Kimjongilia Amateurs Association to devote my effort, though trifle, to giving wide publicity to Kimilsungia and Kimjongilia."

So Man Sul, chairman of the Central Standing Committee of Chongryon, made an entry in the visitors' book: "Looking round the exhibition of immortal flowers, I look back on the proud 60-year history of the WPK under the leadership of the peerlessly great men. The exhibition has a clear theme and is composed perfectly to suit a flower show. Kimilsungia and Kimjongilia could become the famous flowers of the times as they are given the names of the great men. They are everlasting with the names of the great men."

Wu Yi, vice-premier of the State Council of the People's Republic of China looks round the Kimilsungia and Kimjongilia Exhibition hall (October 2005)



So Man Sul, chairman of the Central Standing Committee of Chongryon makes an entry in the visitor's book

Magawati Sukarnoputri, former Indonesian President, visits the Kimilsungia and Kimjongilia Exhibition Hall (centre)

Members of the delegation of the Cuban Communist Party look round the Kimilsungia and Kimjongilia Exhibition hall

Entrance hall of the Kimilsungia and Kimjongilia Exhibition Hall
(on the occasion of the 80th anniversary of the formation of Down-with-Imperialism Union)

The exhibition held on the occasion of founding anniversary of the WPK was decorated with the flowers of Kimilsungia and Kimjongilia in good harmony with other flowers and plants, the uniqueness of which gave a deep impression on the visitors.

The Korea Kimilsungia-Kimjongilia Committee organized a flower show in the Kimilsungia and Kimjongilia Exhibition Hall in 2006 greeting the 80th anniversary of the formation of Down-with-Imperialism Union (DIU) from which the WPK took its historic root and the revolutionary cause of Juche started. Hundreds of pots of Kimilsungia and Kimjongilia were arranged in good harmony with other ornamental flowering plants in front of the painting of Kim Il Sung and Kim Jong Il in the entrance hall and the scale replicas of the Tower of the Juche Idea and the Party Founding Memorial Tower set up and some titles engraved on the flowers.

Every province, city and county in the country held exhibitions with tens of thousands of Kimilsungias and Kimjongilias in combination with various ornaments symbolic of the 80th anniversary of the formation of DIU, thus showing the revolutionary exploits of President Kim Il Sung and leader Kim Jong Il recorded in the history of the WPK through the flowers.

Kimilsungia is now being widely cultivated among the overseas Koreans.

In order to meet the ardent wish of the Korean residents in Japan including youth and students to grow Kimilsungia, the Central Botanical Garden sent the flowers to Korea University and senior middle schools under Chongryon.

Kimilsungia is now blooming in Japan everywhere Koreans live—from Hokkaido to the southern tip of the Japanese Islands. They are growing Kimilsungia with utmost sincerity.

The Korean residents in China cultivate Kimilsungia to exalt higher their national pride. In October 2006, they laid a "carpet" of Kimilsungia and Kimjongilia before the statue of President Kim Il Sung erected in the campus of the Jilin Yuwen Middle School, greeting the 80th anniversary of DIU formation.

While studying there in his teens, Kim Il Sung made strenuous efforts to bring up young communists of new generation, enlighten the masses and rally them into united revolutionary forces. He also pursued the progressive thoughts, organized the Young Communist League of Korea and Anti-Imperialist Youth League in Jilin and expanded them.

Hence the significance of the Kimilsungia and Kimjongilia Exhibition held in such a historic place.

The visitors looked round the exhibition with overflowing respect for the President.

Ri Chon Chu and his wife Kim Yong Nyo, members of the Association of Supporters for Propagation of Kimilsungia and Kimjongilia in China, said: "Present exhibition held in this historic place elevates our sense of pride and dignity as the Korean nation. It is also held in the critical situation when the anti-DPRK manoeuvres of the imperialists are becoming more undisguised, which strengthens our pluck that we are sure to win as long as we are led by Kim Jong Il."

Other Korean residents in China highly appreciated the immortal flowers as the most beautiful and meaningful flowers in the world, saying that it was their great pride and honour that the exhibition was held in the place where the statue of President Kim Il Sung stands.

Opening ceremony of Kimilsungia and Kimjongilia Exhibition held in Jilin Yuwen School, China

In December 2007, the Beijing Huashun Business Development Co., Ltd. of China and Korea Kimilsungia and Kimjongilia Cultivation and Propagation Centre stationed in Dalian held under the joint auspices the Kimilsungia and Kimjongilia Exhibition in Dalian, China, marking the 16th anniversary of Kim Jong Il's assumption of supreme commandership of the Korean People's Army (KPA) and the 90th birth anniversary of Kim Jong Suk, the anti-Japanese heroine.

Kimilsungia and Kimjongilia Exhibtion held in Dalian, China

Present at the opening ceremony were hundreds of people including Chai Guohua, son of Chinese anti-Japanese revolutionary martyrs Chai Shirong and Hu Zhenyi, and chairman of board of directors of Beijing Huashun Business Development Co., Ltd., Wang Wenbin, general manager of Dalian Chengkai Shipping Economic Trading Co., Ltd., Lu Xuegen, chairman of board of directors of Dalian Youai International Trading Co., Ltd., Yang Yong Dong, the then chairman of the Federation of Korean Nationals in China and DPRK consul general in Shenyang.

In his opening address Chai Guohua mentioned that Hu Zhenyi, veteran of the Northeast Anti-Japanese Allied Army and intimate comrade-in-arms of Kim Jong Suk, anti-Japanese heroine, had undying memory of the latter, and wished Kim Jong Il, great leader of the Korean people, good health. The chairman of the Federation of Korean Nationals in China said in his congratulatory speech that Kimilsungia represents the veneration of the entire Korean people for President Kim Il Sung, while Kimjongilia their conviction and will to build a prosperous and powerful socialist country under the leadership of Kim Jong Il, and expressed his confidence in that the flowers would be ever more flourishing all over the world.

The participants in the venue expressed their willingness to promote friendship

between the two countries through the propagation of the immortal flowers.

In December 2007, the opening ceremony of Hunchun Kimilsungia and Kimjongilia Greenhouse and the exhibition of the flowers were held in Hunchun, Jilin Province of China under the sponsorship of Yang Hongjun, manager of Hunchun Luoming Business Co., Ltd., and in December of the following year, the Second Hunchun Kimilsungia and Kimjongilia Exhibition was held in a grand way on the occasion of the 17th anniversary of Kim Jong Il's assumption of the KPA supreme commandership and the 91st birth anniversary of Kim Jong Suk.

The Second Hunchun Kimilsungia and Kimjongilia Exhibition, China

Displayed in the exhibition were scores of pots of Kimilsungia and Kimjongilia.

The opening ceremony was attended by the general manager of Hunchun Kimilsungia and Kimjongilia Greenhouse, vice-chairman of the Federation of Korean Nationals in China, Chinese figures of economic and social circles and Korean residents in Hunchun, Yanji and other cities of Yanbian region, the DPRK delegations of Korea Kimilsungia-Kimjongilia Committee and Kimilsungia and Kimjongilia Greenhouse of Rason City, the DPRK consul general in Shenyang, members of the DPRK missions in Yanji City and their families, totalling more than 150.

The general manager of Hunchun Kimilsungia and Kimjongilia Greenhouse introduced in his opening address that Kimilsungia was the flower newly bred by Indonesian botanist C. L. Bundt after strenuous efforts and named after Kim Il Sung by Sukarno in veneration of the great leader of the Korean people and Kimjongilia was the flower of Begoniaceae bred by Kamo Mototeru, a Japanese botanist, through his 20-year-long research and named after Kim Jong Il.

In April 2009, the Korea Kimilsungia and Kimjongilia Cultivation and Propagation Centre stationed in Shenyang, China, and Shenyang Jixing Foreign Economic Trading Corporation co-sponsored the Shenyang Kimilsungia and Kimjongilia Exhibition to Mark the Day of the Sun. Present at the exhibition were Zheng Chengji, general manager of Shenyang Jixing Foreign Economic Trading Corporation, Liu Jinsheng, chief of the Association of Private Businessmen of Liaoning Province, general manager of Shenyang Grand Science and Technology Co., Ltd., general manager of Zhonghua Insurance Company and other Chinese figures and Yang Yong Dong, chairman of the Federation of Korean Nationals in China, DPRK consul general in Shenyang and the consulate staff–more than 300 all together. The general manager of Shenyang Jixing Foreign Economic Trading Corporation, the chief of Association of Private Businessmen of Liaoning Province and the chairman of the Federation of Korean Nationals in China made congratulatory speeches at the exhibition. They unanimously said that Kimilsungia and Kimjongilia, gift plants bred by the foreign friends, named after and presented to the leaders of the Korean people would flourish all across the world and promote friendship between the DPRK and China.

On the occasion of birth anniversary of President Kim Il Sung and the 77th anniversary of the founding of the Korean People's Army, the First Dandong Kimilsungia and Kimjongilia Exhibition was held in Dandong in April 2009 under the auspices of Wang Dongping, general manager of Dandong Kimilsungia and Kimjongilia Greenhouse. Present at the opening ceremony were more than 500 people including the figures engaged in horticulture in Dandong and Dalian, DPRK consul general in Shenyang and his staff, members of the Association of Supporters for Propagation of Kimilsungia and Kimjongilia in Dandong and other figures of all walks of life. Exhibited there were 50 pots of Kimilsungia and 150 pots of Kimjongilia grown in the Dandong Kimilsungia and Kimjongilia Greenhouse. The general manager of Dandong Kimilsungia and Kimjongilia Greenhouse delivered the opening speech, which was followed by the congratulatory speeches of the general manager of Hunchun Kimilsungia and Kimjongilia Greenhouse and an official from the Korea Kimilsungia-Kimjongilia Committee. Saying that they were very glad to show their flowers at the exhibition

held to commemorate the birth anniversary of President Kim Il Sung and the founding anniversary of the Korean People's Army, they expressed their hope that the exhibition would add more significance to the "year of China-Korea friendship" and contribute to the promotion of friendship and the exchange of flowers between the two countries. Looking round the exhibition hall, the visitors admired that Kimilsungia and Kimjongilia were flourishing all over the world and expressed their determination to devote their all to cultivation and propagation of the flowers.

The Bogor Botanical Garden in Indonesia held a Kimilsungia exhibition and unveiled the monument to the visit of President Kim Il Sung and leader Kim Jong Il in April 2007, on the occasion of 95th birth anniversary of President Kim Il Sung and 42nd anniversary of the naming of Kimilsungia. Seen at the venue of the ceremony was the photo of President Kim Il Sung meeting with President Sukarno. On both sides of it were several pictures of the President meeting the working people of Korea and the prominent figures of foreign countries. In the centre of the venue was a beautiful fountain and full-blown Kimilsungias were on display around it, making the atmosphere of meaningful April more conspicuous.

The ceremony was attended by the vice-president of the Academy of Sciences of Indonesia, the general director of the Ministry of Culture and Tourism, president of Godwin-Austen Company and other people of Indonesia, and the visiting delegation of Korea Kimilsungia-Kimjongilia Committee. Vice-president of the Academy of Sciences of Indonesia and the head of the delegation of Korea Kimilsungia-Kimjongilia Committee unveiled the monument together, and the former delivered a congratulatory speech. Recalling the historic event of 42 years ago that President Sukarno had shown Kimilsungia to His Excellency Kim Il Sung in that very place, he said that the flower was bred by Indonesian botanist C. L. Bundt and registered to the international orchid-related society by Guntur Sukarno Putera, son of President Sukarno. He went on to say that the Indonesian people regarded it as their pride that Kimilsungia became the most favorite flower of the Korean people. The general director of the Ministry of Culture and Tourism of Indonesia said in the congratulatory speech that the exhibition showed well the close friendly relations

between Indonesia and the DPRK and prayed for immortality of Kim Il Sung, eternal President of the DPRK, and wished Kim Jong Il, great leader of the Korean people, good health. Then a congratulatory speech was made by the head of delegation of Korea Kimilsungia-Kimjongilia Committee and a letter adopted to Kim Jong Il in the name of all participants. The letter expressed their determination to grow Kimilsungia beautifully to be a common treasure of the world progressive people and a symbol of peace and friendship, and sincerely wished Kim Jong Il good health and happiness. After the ceremony, the visitors looked round the exhibition hall and the monument. The venue of the exhibition was crowded with visitors who deeply admired the beautiful Kimilsungia, and showed their high reverence for President Kim Il Sung.

The following day Indonesian newspapers *The Jakarta Post* and the *International Daily News* carried the detailed articles on the ceremony.

The Jakarta Post reported that the monument of the orchid greenhouse in the Bogor Botanical Garden was built in honour of the visit of President Kim Il Sung and leader Kim Jong Il to Indonesia and gave detailed accounts of how Kimilsungia came out to the world and friendly relations between the two countries developed.

The *International Daily News* dedicated a full page to a special edition for the Day of the Sun. The newspaper carried the portrait of Kim Il Sung at the centre of the upper part of the page with the pictures of Kimilsungia and the Arch of Triumph in Pyongyang on both sides under the titles of “Kimilsungia Is a Great Flower Named and Presented by Indonesian President Sukarno” and “Commemoration of 95th Birth Anniversary of President Kim Il Sung”. Edited in the lower part were the pictures showing the visit of President Kim Il Sung and leader Kim Jong Il to Indonesia in April 1965 and the articles titled “Bogor Botanical Garden Is the Native Place of Kimilsungia” and “Pyongyang Has World-Biggest Arch of Triumph”.

On April 18, 2007, an opening ceremony of Kimilsungia and Kimjongilia Greenhouse was held in a grand way in Puncak, Indonesia.

President of Godwin-Austen Company of Indonesia and head of delegation of Korea Kimilsungia-Kimjongilia Committee jointly cut the ribbon, and the former delivered a speech. Saying that they were honoured to have the opening ceremony of

Speeches are made at the opening ceremony

Monument to the visit of President Kim Il Sung and leader Kim Jong Il at the Bogor Botanical Garden

Indonesian people visiting the Kimilsungia exhibition hall

Kimilsungia and Kimjongilia Greenhouse in Puncak, Indonesia

the Kimilsungia and Kimjongilia Greenhouse following the opening ceremony of the Kimilsungia exhibition and the unveiling of the historic monument in the Bogor Botanical Garden some days ago, he stressed that the greenhouse was built by dint of boundless respect of the Korean and Indonesian peoples for President Kim Il Sung and that he would grow the flowers in full bloom in the future.

Clara Bundt, daughter of C. L. Bundt who bred Kimilsungia, made the speech. Expressing her delight of participating in the opening ceremony, she recollected with deep emotion those days of 42 years ago when her father had bred the flower and said that it was the greatest happiness and pride for the peoples of Korea and Indonesia and her own family to have Kimilsungia, symbol of friendship between the two countries.

Kimilsungia is in full bloom in Japan, too.

Koichi Shyoo, former chief of youth centre of Juche idea study group in Japan, did his best to successfully grow Kimilsungia in Japan. He prepared a temperature and humidity register and a cultivation diary to record the temperature and humidity and all other details everyday in three hours' interval. He received from the scientists of the Central Botanical Garden in Korea detailed lecture on the scientific and technical cultivation methods of Kimilsungia when he visited Pyongyang. Back in Japan, he succeeded in bringing the flowers into bloom and showed them to many people. And he initiated other members of the group into the cultivation methods of the flower, encouraging them to grow Kimilsungia.

Kimilsungia was widely cultivated and propagated in America by Ri Pyong Sang, chairman of the American Kimilsungia and Kimjongilia Association. He cultivated many Kimilsungias in the greenhouse of the Euclid Nursery and Landscaping he was running in California, US and distributed them to the Koreans in the US and Americans.

The Botanischer Garten und Botanisches Museum, Berlin-Dahlem, Germany showed Kimilsungia and Kimjongilia to hundreds of botanists from scores of countries and Berlin citizens by exhibiting them in the venue of an international seminar it hosted in June 2004 in celebration of its centennial anniversary.

Kimilsungia and Kimjongilia displayed at the 2006 Shenyang International Horticultural Exposition, China

The 2006 Shenyang International Horticultural Exposition was held on April 30, 2006, the grandest in scale in the 21st century.

It was attended by China, host country, and many other countries including the DPRK, Russia, France, the Netherlands, Italy, the United Kingdom, Germany, Canada, Australia and Thailand. Various species of flowering plants and tens of thousands of bonsais were exhibited in the garden plantation furnished with hundreds of structures and thousands of trees of many species.

The Korea Kimilsungia-Kimjongilia Committee laid up a 1 000 m^2-wide DPRK Garden in a unique way and displayed hundreds of pots of Kimilsungia and Kimjongilia with other flowers in the 10 000 m^2-wide Rose Garden. The DPRK Garden resounded with the *Song of General Kim Il Sung* and other songs praising great men. Fountains were dancing to the merry melodies of Korean folksongs in the pond, and a group sculpture was erected portraying two children flying pigeons together and five others surrounding them hand in hand, symbolic of friendship and peace of five continents. Passing through the festive gate at the entrance of the garden, parks were laid out matching with the natural environment. The visitors to the DPRK Garden unanimously admired Kimilsungia and Kimjongilia for their meaningfulness and beauty

Visitors to the Expo

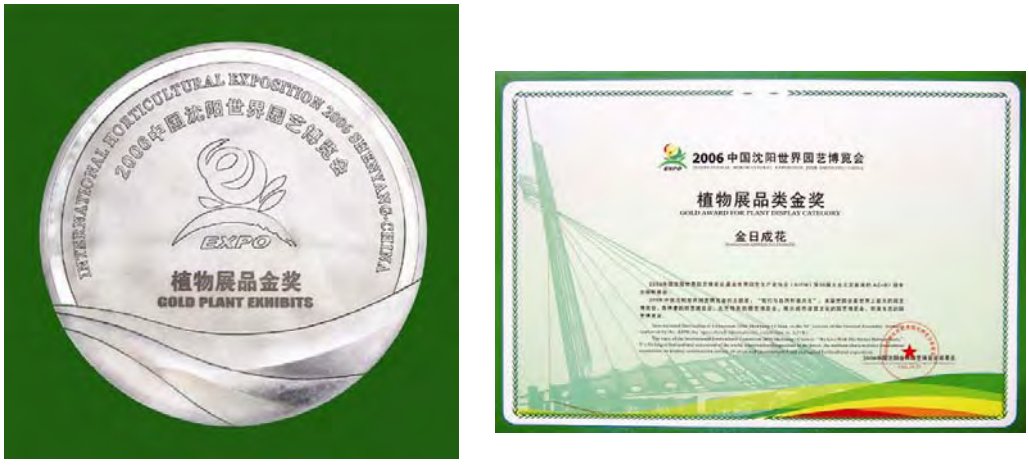
and the unique architecture of the garden rich in national style and modern aesthetic taste. They said that the Korean quarter was in good accord with the theme of the Expo and the aspirations of mankind for peace, friendship and love.

Faber Duke, President of International Association of Horticultural Producers and chairman of the international jury committee of the 2006 Shenyang International Horticultural Exposition, said in excitement that he had heard much of the flowers named after President Kim Il Sung and leader Kim Jong Il, and he was very happy to see the flowers with his own eyes, that he could understand how much President Sukarno and Japanese horticulturist revered them, and the more he saw the flowers, the more his heart swelled with admiration.

The chief of Shenyang Botanical Garden said that a great number of visitors stopped before Kimilsungia and Kimjongilia, sharing the admiration at their beauty and it was quite natural that those flowers would deserve the highest prizes.

A south Korean from Jeju Island said: “Kimilsungia and Kimjongilia are the most beautiful flowers in the world. Birth of these flowers is the pride and honour of our nation. The immortal flowers that are in full bloom transcending countries and nations, ideas and systems, political opinions and religious belief are the common treasure of humankind”.

The 2006 Shenyang International Horticultural Exposition, China awarded gold medals,



Kimilsungia is awarded gold medal, which is top prize, and its diploma at the 2006 Shenyang International Horticultural Exposition, China

Optimal prize (trophy), diploma and certificate awarded to the DPRK Garden

Group sculpture of children in the DPRK Garden and
the gold medal and certificate awarded to it

Festive gate of the DPRK Garden and the gold medal and certificate awarded to it

top prize of the Expo, to Kimilsungia and Kimjongilia respectively by the unanimous agreement of the jury and the organizing committee. It also awarded the optimal prize (trophy), diploma and certificate of honour to the DPRK Garden.

The opening ceremony of Guinea Kimilsungia Greenhouse was held in Conakry, capital of Guinea under the auspices of the Guinea-Korea Friendship Society on April 4, 2009, on the occasion of the Day of the Sun (April 15), President Kim Il Sung's birthday. Present at the ceremony were Riad Chaloub, general secretary of the Ministry of Information and Culture of Guinea and chairman of the Guinean National Committee of Studying the Juche Idea, Abdoulahi Conte, information adviser to President's Office, Musa Sile, member of Political Bureau of Unified Progressive Party and chief of its Latoma District Committee, Banou Keita, chairman of Guinea-Korea Friendship Society, Kamas Victor, chief of Conakry Juche Idea Study Group, members of the study group, and friendship society, pressmen, artistes and other people, and the DPRK ambassador and embassy staff in Guinea.

In his speech at the opening ceremony, chairman of Guinea-Korea Friendship Society said that the Guinea Kimilsungia Greenhouse was built and open in Guinea on the occasion of the Day of the Sun in token of boundless respect of the Guinean and world progressive people for President Kim Il Sung, founding father of socialist Korea, and expressed his determination to further flourish and widely propagate the flower in Africa.

General secretary of Ministry of Information and Culture said that the opening of Kimilsungia greenhouse amidst deep concern of Guinean people was an important occasion for bolstering the friendship and cooperation between the two peoples and that Kimilsungia would be flourishing more beautifully by the sincerity of Guinean people.

The Guinean TV reported the detailed news on the opening ceremony.

On October 9, 2010, the Guinean Kimilsungia and Kimjongilia Association was formed in the Guinea Kimilsungia Greenhouse. In the meeting Dr. Aly Gilbert Ifono, minister of Localization and Regional Development of Guinea, was elected honorary chairman; Riad Chaloub, general secretary of Ministry of Culture and the Arts, its chairman; Dr. Banou Keita, head of an office in the General Bureau of Agricultural Sciences under Ministry of Agriculture and the national officer of the World Food

Program, and Mamadou Saidou Bah, director of the Forest Conservation Bureau of Ministry of Environment, its vice-chairmen; and Abdoulaye Diallo, director of the Foreign Exchange Bureau of Ministry of Culture and the Arts, its general secretary. The pariticipants expressed their determination to grow Kimilsungia in full bloom and widely propagate the flower.

The 7th China Flower Expo was held in Beijing from September 26 to October 5, 2009, on the occasion of the 60th anniversary of founding of the People's Republic of China. The flower Expo is held at four years' intervals since 1987 with the purpose of demonstrating the successes made in the flower industry of China and promoting exchange and cooperation with other countries in floriculture. It is widely known as the biggest national flower festival in China or "Flower Olympics". It was participated by 27 countries including the DPRK, the Netherlands, Denmark and Germany, and 1 300 floricultural organizations from 31 provinces, autonomous regions and cities of China. Over 200 000 flowering plants of various species were on display.

The Korea Kimilsungia-Kimjongilia Committee exhibited hundreds of flowers.

The Korean show stand was set up at the centre of the international section in the indoor exhibition hall of the Expo covering an area of tens of thousands of square metres, and the DPRK flag and name were hanging over the stand. It exhibited pots of Kimilsungia and Kimjongilia against the background of a large electric photo of full-blown flowers under the clear, blue sky. From the first day of its opening, it was crowded with visitors. Those who visited the Expo to see world-famous flowers on show were so fascinated by beautiful Kimilsungia and Kimjongilia that they could hardly leave the place and expressed their high reverence for President Kim Il Sung and leader Kim Jong Il. The visitors to the Korean display numbered over 1.6 million during the Expo.

The organizing committee of the Expo awarded the top prizes and diplomas to Kimilsungia and Kimjongilia for their greatest popularity, and the top organization prize and diploma to the Korea Kimilsungia-Kimjongilia Committee. At the awarding ceremony, vice-chairman of Beijing Floricultural Association said that the organizing committee of the 7th China Flower Expo decided to confer the top prizes only on Kimilsungia and Kimjongilia and that those flowers elevated the dignity of the Expo.

Opening ceremony of the 7th China Flower Expo

Pots of Kimilsungia and Kimjongilia on display at the 7th China Flower Expo

Kimilsungia and Kimjongilia are awarded the best exhibition prize and certificate at the 7th China Flower Expo

The Korea Kimilsungia-Kimjongilia Committee is awarded the excellent organization prize and certificate at the 7th China Flower Expo

The 2011 Xi'an International Horticultural Exposition was held in Xi'an, Shanxi Province, China from April 28 to October 22, 2011. It was an A-class flower Expo that lasted 178 days with the participation of 27 countries including the DPRK, the Netherlands, Japan and Thailand, and the Chinese horticultural groups.

Before the opening of the Expo, the international orchid competition was held, co-sponsored by the International Association of Horticultural Producers and the preparatory committee of the flower Expo.

Kimilsungia won the gold award, top

Kimilsungia is awarded the top prize (trophy) and diploma at the international orchid competition of the 2011 Xi'an International Horticultural Exposition

prize of the competition, for its beauty, rareness and high popularity. The awarding ceremony was held in Xi'an on April 27.

The director of the Xi'an Botanical Garden said: "It deserves to be congratulated that Kimilsungia won the gold award of the competition, and Kimjongilia the gold award of exhibition. Kimilsungia is the most beautiful and excellent flower among the orchids, and Kimjongilia is the flower that evokes admiration. "The flowers named after the great men and exhibited by the DPRK will contribute to make the Expo more conspicuous and successful."

The permanent vice mayor of Xi'an City said: "Is this Kimilsungia which won the gold award at the international orchid competition? ... It is very beautiful. It is really wonderful that it is in full bloom for two months."

The great personalities of President Kim Il Sung have rooted deep in the hearts of world people with the passage of time as Kimilsungia is in full bloom all across the world.

Today the cultivation and propagation of Kimilsungia, flower that instills into people's mind pure affection and hope for a beautiful future, are becoming a worldwide trend amid the ever-growing expectations of and support from the world of horticulture.

Inflorescence

The term inflorescence denotes the arrangement of flowers on the floral axis.

Some plants bear single flowers, but many others bear flowers in clusters on the primary or lateral axes. Flowers adhere to the flower stalk directly or by peduncles. The mode of adherence of flower stalks to the stem differs according to plants. The peduncle corresponds to a branch, and comes forth from the axil of the leaf.

Inflorescences are divided into the indeterminate and determinate ones.

Indeterminate inflorescence

As the tip of the stalk continues to grow, flower opens first at its bottom. Flowers bloom in turn acropetally or centripetally. As the primary floral axis branches in the indeterminate inflorescence, flowers continue to open as long as the floral axis grows.

The indeterminate inflorescence is divided into simple inflorescence in which flowers bloom around the floral axis and compound inflorescence in which flowers bloom along the primary and secondary branches of the floral axis. Simple inflorescence is divided into raceme (radish, cabbage, shepherd's purse and others), spike (plantain, wheat, barley and others), spadix (arisaema japonicum, female flower of maize and others), catkin (willow, chestnut tree, actinidia arguta and others), corymb (cherry tree, pear tree and others), umbel (acanthopanax sessiliflorus, ginseng and others) and capitulum (sunflower and dandelion), according to its form. Compound inflorescence is divided into compound raceme (rice, grape and others) and compound umbel (carrot and others).

Determinate inflorescence

As the primary axis ends in a flower, the axis grows no more.

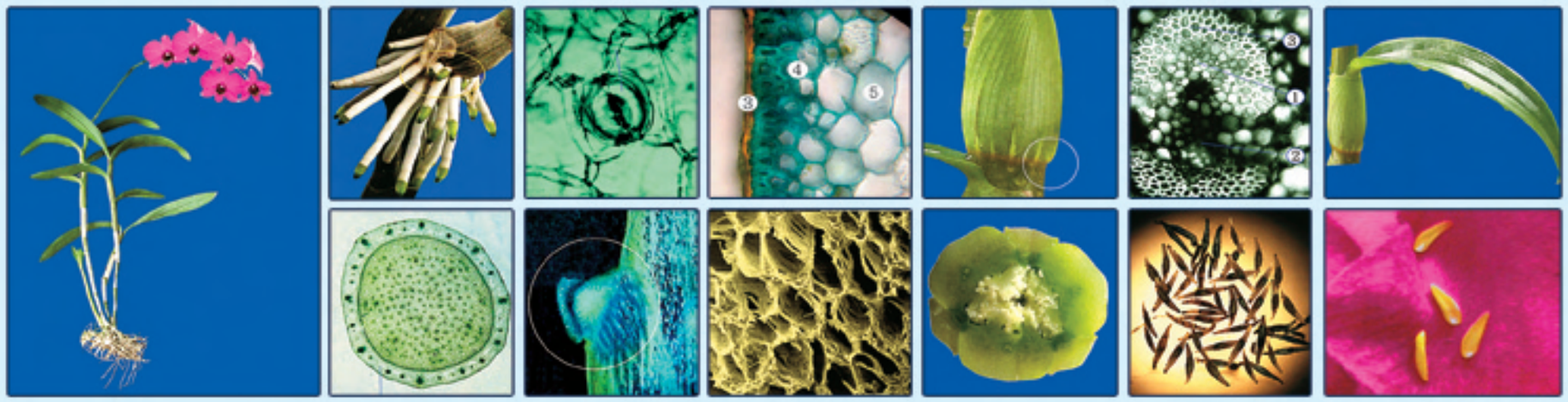
As lateral axes arise in the determinate inflorescence, one or several lateral branches which shoot out below the primary axis also end in flowers.

The flowers open basipetally or centrifugally. The determinate inflorescences are divided into uniparous cyme (helicoid cyme and scorpioid cyme), dichasium (china pink and others) and polychasium (Euphorbia pekinensis and others). Inflorescence evolved from raceme through spike to spadix and capitulum. On the other hand, the raceme is considered to have evolved to corymb and umbel, respectively.

Part II

Biology of Kimilsungia

This part deals with the biology of Kimilsungia and the major characteristics of the Orchidaceae.



Chapter 1
Breeding of Kimilsungia

Kimilsungia is a new hybrid belonging to the Orchidaceae.

This part introduces the Orchidaceae, the characteristics of original species which had been used for the breeding of Kimilsungia and ecological features of their original habitats and the breeding process.

Section 1. Introduction of the Orchidaceae

1. Classification and Distribution

In general, all flowering plants belonging to the Orchidaceae are called orchid.

The Orchidaceae comprises the largest number of species as a group of highly evolved plants. On the globe there are approximately 25 000–30 000 wild species of 800 genera of the Orchidaceae. Korea has 70 species of 40 genera including *Dendrobium*, *Cymbidium*, *Cypripedium* and *Orchis*.

Classification of orchids was begun by Carl Von Linné (1707–1778) who laid the scientific basis for modern plant taxonomy. He classified them into 21 species of eight genera in the first edition of his work, *Species Plantarum* published in 1753, and 102 species in the second edition published in 1762–1763.

On the basis of it, Lindley (1799–1865) regrouped 1 980 species of orchids into seven tribes according to characters of stamen and pollinium.

The ramification of the Orchidaceae was done later by several botanists like

Bentham, Pfitzer, Schlechter, Dressler and Dodson.

Now the most widely available classificatory system of orchids is the one proposed by Dressler and Dodson in 1960 who, basing themselves on the study of the phylogenic classification of the bygone days, classified the Orchidaceae into 42 subtribes, five tribes and two subfamilies.

Orchids are distributed all over the world except the Antarctic, Arctic tundra and desert areas. The area of their distribution ranges from 70° N lat. to 55° S lat.

Many orchid species are found in the area of low latitudes centring on the equator with high density of distribution. According to the data of orchid distribution, there are 6 800 species of 250 genera in Asian tropics, 3 131 species of 134 genera in African tropics, 8 266 species of 306 genera in American tropics, 664 species of 49 genera in the Eurasian continent, 153 species of 26 genera in North America and 602 species of 68 genera in Australia. (Dressler 1981)

Epiphytic orchid is distributed mostly in the area from 30° N lat. to 35° S lat. The tropical and subtropical areas of Asia, Africa and South America are the three major regions of distribution in the world where many cultivars have their origins.

The typical genera of orchids now under culture are *Dendrobium*, *Cymbidium*, *Phalaenopsis*, *Cattleya*, *Cypripedium*, *Vanda*, *Calanthe*, *Oncidium*, *Paphiopedium*, *Miltonia*, *Lycaste* and so on.

Kimilsungia is one of the cultivars belonging to *Dendrobium*.

Dendrobium, a Latin word, was derived from the Greek words for “dendron” (tree) and “bios” (live). It means living dependent on the tree. *Dendrobium* is the second largest genus in the Orchidaceae with 1 600 wild species.

In Korea, a wild species of *D. moniliforme* is found in the seaside areas of the South Sea of Korea including Jeju, Jin and Wan islands.

Orchids of *Dendrobium* are distributed over the coastal areas of South Sea of Korea, the southern part of the Japanese Islands and Taiwan of China to the north, and many Indonesian islands and Stewart Island of New Zealand (in 47° S lat.) to the south, and to the east, Samoa Island, many islands of Polynesia and Tahati Islands across Solomon Islands and Fiji Island, and to the west, the western part of

India.

As mentioned above, the *Dendrobium* plants grow in varied ecological conditions, ranging from the mangrove forest on the tropical seaside to the ridges of Himalayas covered with perpetual snow all the year round.

Dendrobium was divided into 41 sections by Schlechter in 1912, and the classificatory system is still used.

Kimilsungia was bred by crossing four original species: three are from *Phalaenanthe* section and one from *Ceratobium* section.

There are many rare species among the scores of sections of *Dendrobium,* but more than 30 species are highly prized for their ornamental value. They are categorized for practical use into following types.

Phalaenopsis Type (*Denpha* Type)

The typical species is *D. Phalaenopsis*, which needs high temperature and has a flower peduncle 50–80 cm long, with many flowers. Other species include the original species of Kimilsungia, like *D. phalaenopsis*, *D. superbiens* and *D. bigibbum* with wide petals, as well as *D. gouldii* and *D. unduladum* with narrow curled petals.

Nobile Type

The typical species is *D. nobile*. The floral bud differentiates in low temperature, and 2–4 flowers come into bloom at every node of the stalk where leaves fell. Widely grown are *D. nobile*, *D. aureum* and *D. moniliforme* with nearly upright stalk and *D. pendulum* and *D. perishii* with the pendulous stalk.

Formosanum Type

The stems and leaves of flowering plants of this type have black hairs and several big flowers bloom at the apex of the stalk.

The colour is white, and the efflorescence lasts more than a month. The typical ones are *D. formosanum*, *D. infundibalum*, *D. sanderae* and others. Besides there are special hybrid species.

Kimilsungia belongs to the *Phalaenopsis* type.

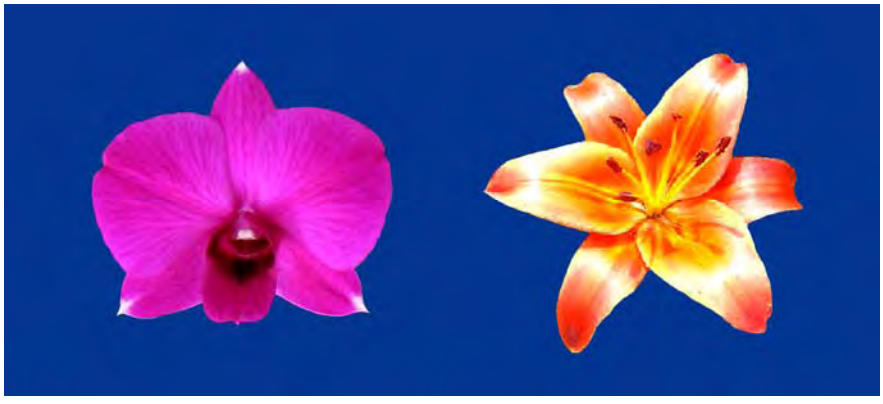
2. Characteristic Ecological Adaption

1) Flower

The flowers of the orchids were adapted to the entomophilous pollination and differentiated very complicatedly.

Like the flowers of monocotyledonous plants such as lily and daffodil, the flower system consists of three petals and three sepals, common to a trimerous plant but it has some features in its structure.

All the flowers are bisymmetrical. The bisymmetry is ascribable to labiate petal in the flower. (Photo 1)



A B

Photo 1. Shapes of flowers of Kimilsungia and lily
(A) bisymmetrical flower of Kimilsungia; (B) radial-symmetrical flower of lily

The shape of labellum (or lip) is varied according to the species. (Photo 2)

In Photo 2, (A) is the flower of *Cypripedium macranthum* cultivated for ornamental purposes.

The labellum is pouch-like 4–5 cm long, with a hole on the upper part and the column in the labellum.

(B) is *D. taurinum*, one of the original pure breeds of Kimilsungia, and (C) is the flower of *Cattleya*.

A B C D

Photo 2. Various shapes of labellum of orchid

(A) *Cypripedium;* (B) *D. taurinum;* (C) *Cattleya;* (D) *Calanthe*

The labellums are more colourful and brighter than other petals. In the middle part of the labellum, there are hairs or ridges of deep colour which allow bees to safely light on it.

(D) is the flower of the *Calanthe* including *Calanthe discolor* which grows in the forest and is planted in the park and garden for ornamental purposes.

The labellum of this flower is three-lobed, and the middle lobe is concave at the tip so that the whole of labellum resembles a flying butterfly. In the breeze, the peduncle of *Calanthe discolor* sways with the labellums of flowers, which reminds one of many butterflies gathering. This is believed to be the result of adaptation to the entomophilous pollination.

As regards the flower of orchids, stamen and pistil gather together to form a column protrusive inside the petals of flower.

Embryologically, the column is made up of six stamens and one pistil.

Pollen of orchids is in the state of a chunk.

The chunk is a gathering of pollen. It has a caudicle, and a sticky gland at its tip, which enables it to adhere to the head or back of the insects like bees flying into it.

The colour of flowers of orchids is diverse and splendid: white, red, orange, pink, yellow, green, blue, violet, purple and scores of intermediate colours which distinguish them from other flowers for the varied deepness and brightness.

2) Seed

The seed of orchids is characterized by the small size and abundance. It is the smallest of all the seeds of plants. It is 0.05–0.5 mm wide and 0.1–1 mm long, hard to see with the naked eye.

In general, one fruit contains 100 000–300 000 seeds. A fruit of *Cattleya* has 1 000 000–1 500 000 seeds.

Since the seed of orchids has an embryo and no albumen, the germination is possible only with the aid of mycorrhiza.

3) Stalk

All orchids have grass stalks. They are divided into monopodial and sympodial orchids by the form of the growth of the stalk. (Figure 1)

Typical of monopodial orchids are the orchids of *Vanda* and *Renanthera*. In the monopodial orchid, one stalk grows, leaves come out one after another and the root develops at the bottom.

The monopodial orchid shows good adaptation to the area of high temperature and humidity.

The sympodial orchids have several stalks.

They include the plants of *Dendrobium*, *Cymbidium* and *Cattleya*.

The first stalk grows, the second stalk arises from the lateral

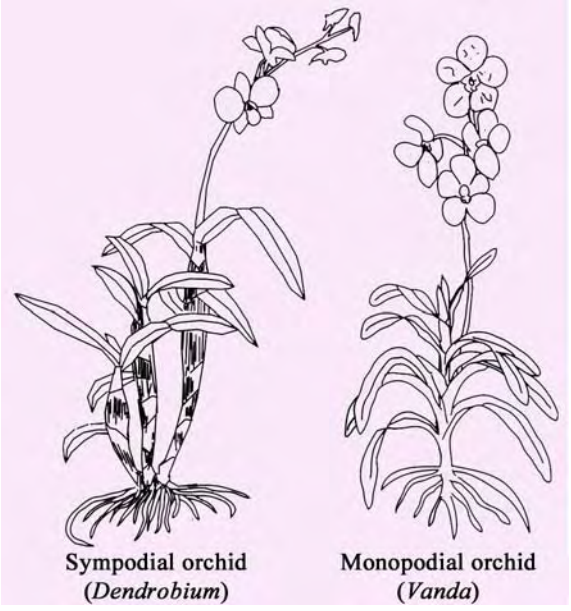


Figure 1. Forms of monopodial and sympodial orchids

sprout at the lower node of the first stalk and another new sprout at the lower node of the second stalk grows into the third stalk. Such a process repeats every year, resulting in several stalks in a plant.

They grow in the areas where rainy and dry seasons change each other every year and the difference in temperature is high by season.

Most sympodial orchids have fleshy stalks and leaves.

These fleshy stalks are called the pseudobulb, which stores much water in the rainy season.

4) Root

Among the orchids, there are terrestrial orchids that grow on the earth like other plants and epiphytic orchids that grow on the trunks of trees and rocks.

The terrestrial orchids grow in the safe environment, fertile and moist soil and mild climate. So they have thin roots and broad leaves.

Belonging here are most of the orchids of *Bletilla*, *Amitostigma*, *Cypripedium*, distributed in the Eurasian Continent and North America, and *Orchis* in the Eurasian Continent and northern Africa.

The epiphytic orchids grow in adverse ecological environments short of nutritive substance and humidity; they strike their roots firmly on the rocks or the trunks of trees and some roots hang in the air.

The roots are thicker than those of the terrestrial orchids. The epidermis of the root is coated by thick cell layers with elastic force like sponge, called the velamen.

The velamentous cells store much water when it rains and supply it to the interior cells.

At the same time, they play the role of protecting the aerial part of the root from a physical strike.

The epiphytic orchids, adapted to the dry season of the tropics and subtropics, have fleshy stalks and leaves capable of storing much water.

Most of them, that is, the species with the fleshy stalks and leaves, are the plants of CAM (Crassulacean Acid Metabolism). They are the biotypes adapted to the hot and dry climate.

Unlike other plants, they perform photosynthesis in a unique way; they open the stomates of the leaves at night, and absorb CO_2 to store it temporarily in the form of organic acid, and in the daytime they close them to stop the transpiration and synthesize sugar by means of CO_2 resultant from the breakdown of organic acid stored.

Kimilsungia and most of other species of *Dendrobium*, *Cattleya*, *Cymbidium*, *Maxillaria*, *Aerides* and *Lycaste* are epiphytic orchids. The roots of many orchids form the mycorrhiza in symbiosis with fungi.

3. Hybridization

In the original habitats of orchids, there exist many natural hybrids between their species.

Plants of a species produce a new hybrid in a few years. Such a phenomenon is little seen or rare in the plants of other families.

Artificial crossings occur among their genera or species, producing many intergeneric or interspecific hybrids.

All these hybrids have their fertility, leaving their second and third generations to posterity.

Such characters of orchids make it possible for the florists to get new and more beautiful flowers.

That is why they succeed in the cross not only between two genera but also between four to five genera to breed new hybrids.

The artificial interspecific hybrids of orchids were obtained from *Dendrobium*, *Cymbidium*, *Cattleya*, *Paphiopedilum*, *Miltonia* and *Vanda* of high ornamental value, and their number has already reached 100 000 during the 150 years since the first one was obtained by J. Dominy in 1856.

The number of artificial intergeneric hybrids of orchids has increased to about 200 recently since Veitch bred the first in 1861.

The crossings were carried on not only between two but between three, four or five genera.

The number of the three-intergeneric hybrids was greater than that of two-intergeneric ones.

4. History of Orchid Cultivation

Cultivation of orchids has a long history.

In the ancient East including Korea, they admired the orchids as the king of flowers and have cultivated them for the ornamental purposes around from 4th century B.C.

The ancient paintings by Koreans show that they cultivated the plum tree, chrysanthemum and bamboo as well as graceful orchid, regarding them as the most beautiful ornamental plants.

Among those orchids, *Cymbidium goeringii* and other orchids belonging to the modern genus *Cymbidium* were most widely cultivated with *Neofinetia falcate*, *Dendrobium moniliforme* and *Calanthe discolor*.

Those orchids were called the oriental orchid.

In Europe, Theophrastus (B.C. 370–285), a Greek botanist, was the first to refer to orchid as Orchis in his work *Equiry into Plants*.

The name was related to the oval twin subterranean tubers of many terrestrial orchids growing in the Mediteranean area of Europe.

There is a record in Britain that orchid was cultivated in Bahamas in 1731 and bloomed next year.

Since then, they collected various orchids from the tropics and subtropics of Southeast Asia, Latin America and Africa and began to cultivate them at the Kew Gardens (Royal Botanical Gardens at Kew).

Co. Loddiges & Son cultivated orchids for commercial purposes from 1822.

Section 2. Characteristics of the Original Species Used for the Breeding of Kimilsungia and Ecological Environment of Their Original Habitats

1. Characteristics of the Original Species

The characteristics of original species used in the breeding of Kimilsungia are as follows:

a) *Dendrobium phalaenopsis* and its variety *D. phalaenopsis* var. *schroederianum*

D. Phalaenopsis and its variety were used six times for breeding *D.* Ale Ale Kai (1958), the female parent of Kimilsungia. This species was published first by Fitzgerald in 1880.

As the flower resembles a butterfly, the epithet of its species *Phalaenopsis* was given. However, it is completely different from *Phalaenopsis*, so it is usually called *Denpha* in the flower world to avoid confusion.

The stalk is thin at the base and gets thicker gradually to be 30–60 cm long and 1 cm thick. It is fleshy and upright; the lower part is wrapped in a leaf sheath, and the upper part bears lush foliage.

The dark green leaves are hard and lanceolate, 12 cm long and 2 cm wide, and alternate.

One or two to three peduncles come out simultaneously from the nodes of upper part of the stalk. The peduncle is 40–50 cm long and bears many flowers ranging from 6 to 15.

The flowers are well arranged in two lines on both sides of the peduncle. The flower with round petals is 6–8 cm in diameter. The sepal is pointed at the tip and the labellum is long and pendulous.

The flower colours are varied from pink and peach to darkish red violet. Some

sepals and petals have small patterns. Some sepals are white.

The blooming period is indefinite, but in the place of origin, it usually is from August to November.

D. phalaenopsis that appeared in Europe in 1880 was introduced into Britain in 1855, soon genealogically split and some varieties were selected from them.

The typical one is *D. phalaenopsis* var. *schroederianum*. The varieties with white flower are *D. phalaenopsis* var. *schroederianum alba*, *D. phalaenopsis* var. *hololeucum* and *D. phalaenopsis* var. *phyllismore*.

D. phalaenopsis played a very important role in the hybrid breeding because its flower shape is good and the peduncle is so long that it is suitable for cut flower, and it was involved in successful crossings with several pure breeds of *Ceratobium* section.

b) *Dendrobium bigibbum*

Bigibbum, the epithet of its species type, meaning "two convexes" or "bisymmetry", was named for the peculiarity of its flower shape.

The stalk is thick clavate, 20–45 cm long and a little thin at the apex.

The leaf is lanceolate, 8 cm long and 2 cm wide and the margin of it is of violet colour. 4–10 leaves, fleshy and hard, are borne at the upper part of the stalk.

The peduncle grows arch-shaped, 15–30 cm long at the upper part of stalk, and bears 10–15 flowers composed of round petals.

The flower is five cm in diameter and its colour ranges from pink to red violet, occasionally white.

The petal is twice larger than the sepal and about 3.5 cm wide. The labellum is crimson and wide but sharp at the tip. The plant blooms all the year round.

D. bigibbum is similar to *D. phalaenopsis* in shape and colour.

c) *Dendrobium superbiens*

Superbiens, the epithet of its species type, meaning "graceful" in Greek expresses the elegant appearance of its flower.

The stalk is 80–120 cm long.

The leaf is oval and fleshy, 14 cm long and about 3 cm wide, with a purple line on

the sheath. The arch-shaped peduncle grows about 40 cm long, and bears as many as 9–25 flowers at regular intervals.

The flower is 4.5–5 cm in diameter. The petal is narrow at the base, gradually bending and broadening at the tip. Its colour is crimson violet. The sepal is wide, curling backwards and bending. The labellum is crimson violet and short, and curved backwards at the tip. It blooms in autumn.

This species is regarded as a natural hybrid between *D. bigibbum* of *Phalaenanthe* section and *D. discolor* of *Ceratobium* section. Another feature different from its parents is the purple line on the sheath and the sepal bent backwards. This species is quite viable and, in particular, produces many flowers and strong peduncle when crossed with *D. phalaenopsis*.

At present, the orchids of this species are available as cut flowers.

d) *Dendrobium taurinum*

Taurinum, the epithet of its species type, which means “little”, was so named for the small width of its petals.

The stem is 100–180 cm long and straight. The peduncle is ear-shaped and grows more than one metre long, and carries 20 flowers.

The sepal is white and the petal is dark violet or maroon, while the labellum is light violet. The two lateral petals twist and curl upwards and the sharp sepals are folded backwards, while the broad labellum pends downwards.

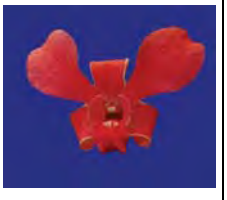
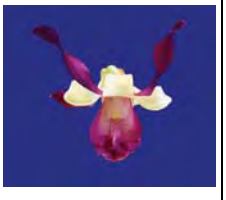
The species similar to *D. taurinum* are called the cane type because they grow strong, straight and high like bamboo or cane. They have made much contribution to improving *D. phalaenopsis* type.

Among the hybrids inheriting the character of the cane type, the well-grown hybrids produce several peduncles at the upper nodes of the stem, which grow and bloom simultaneously. And they develop strong root systems and grow aggressively.

Among the above-mentioned species, *D. phalaenopsis*, *D. phalaenopsis* var. *schroederanum*, *D. bigibbum* and *D. superbiens* belong to the *Phalaenanthe* section, and *D. taurinum* to the *Ceratobium* section.

The main features of original species of Kimilsungia are shown in the table below.

Table 1. Original Species of Kimilsungia and Their Main Characteristics

Flower Shape of Original Species and Its Botanical Name	Main Characteristics		Original Habitat
 *D. phalaenopsis*	Stem: 30–60 cm long, 1 cm thick Leaf: 12 × 2 cm, lanceolate Peduncle: 40–50 cm long Number of flowers: 6–12 Diameter of flower: 6–8 cm	Petal: round Sepal: sharp-ended Labellum: long in the middle Colour of flower: pink, red violet Duration of blooming: 3 weeks Blooming period: August–November	Sulawesi Island of Indonesia, Maluku Islands, Islands of Nusa Tenggara, New Guinea, northeast of Australia
 *D. bigibbum*	Stem: 20–45 cm long, 0.5–1.5 cm thick Leaf: 8 × 2 cm Peduncle: 15–30 cm long Number of flowers: 10–15 Diameter of flower: 5 cm	Petal: two times wider than sepal Labellum: round and wide at the tip Colour of flower: pink or red violet Blooming period: all the year round	Northeast of Australia, islands of the Torres Straits, Papua New Guinea
 *D. superbiens*	Stem: 80–120 cm long Leaf: 14 × 3 cm, oval and fleshy Peduncle: 40 cm long Number of flowers: 9–25 Diameter of flower: 4.5–5 cm	Petal: bending back, widening Sepal: curling backwards Labellum: bent backwards at the tip Colour of flower: dark red violet Blooming period: autumn	Northeast of Australia, islands of the Torres straits, New Guinea
 *D. taurinum*	Stem: 100–180 cm long, 2–2.5 cm thick, cone-shaped Leaf: 8–15 × 2–3 cm Peduncle: more than 100 cm long, ear-shaped Number of flowers: more than 20 Diameter of flower: 6.5 cm	Petal: twisted and rolled Sepal: long, white Labellum: light violet Colour of flower: dark violet, maroon Blooming period: summer	Forest east of Luzon Island and primeval forest of Mindanao Island of the Philippines

2. Ecological Environment of the Habitats of the Original Species

In general, the hybrids between various original species are outwardly different from one another, but they inherit the ecological features of their parents as they are. The original species exhibit adaptation to the ecological environment of their original habitats, which passes down to the posterity. Therefore, the scientific cultivation of Kimilsungia needs a good knowledge of the ecological environment of the habitats of its original species.

The original species of Kimilsungia are found in the tropics of Southeast Asia and Australia. The *Ceratobium* section occurs in the forest east of Luzon Island and primeval forests of Mindanao Island of the Philippines; the *Phalaenanthe* section, in the area from equator to 20° S lat.

The habitats of *D. phalaenopsis* that played the core role in the breeding of Kimilsungia include Sulawesi Island of Indonesia, Maluku Islands, Islands of Nusa Tenggara, East Timor Island, New Guinea and the tropics northeast of Australia. These plants grow on the branches of the coconut and palm trees in the low land and on twigs of big trees in the mountainous area.

The plants of *D. bigibbum* are found in Papua New Guinea, several islands of the Torres Strait and Cape York Peninsula northeast of Australia, while *D. superbiens* has a wider distribution. It not only shares the habitats with *D. bigibbum* but also occurs in west New Guinea.

The above-mentioned three species of *Phalaenanthe* section are found only in the regions east of the so-called Wallace's line, or the eastern and western boundary of Makassar Strait between Sulawesi and Kalimantan Islands of Indonesia. They are not found in the big western Islands like Java, Sumatra and Kalimantan Islands of Indonesia.

In a nutshell, the original species of Kimilsungia are distributed in the tropics between 20° N lat. and 20° S lat. centring on the equator. However, the annual climate of each habitat is different.

In the Philippines, home to *D. taurinum* of *Ceratobium* section, the northern and the middle parts including Luzon Island belong to the subtropical climatic zone as they are in the north of tropics, but the southern part comprising Mindanao Island belongs to the equatorial climate zone. Luzon Island in the Philippines is situated so near to the Asian Continent that its climate drops down to 18°C in winter under the influence of the cold continental seasonal wind, which causes big changes of temperature between winter and summer. And in the forest area east of Luzon Island, home to *D. taurinum*, the annual precipitation is 3 000–4 000 mm on the windward slope under the influence of monsoon which blows almost invariably from the subtropical anti-cyclone zone (30–35° N lat.) to the equatorial cyclone zone throughout the year.

The Mindanao of the Philippines belongs to the equatorial climate zone, so it is influenced by equatorial air mass formed by the action of tropical air mass moving to the tropics blown by the monsoon. Therefore, the temperature here is so high; the mean annual temperature is 26–28°C and the change in temperature is small, 5–6°C. In the equatorial climate area, the maximum day temperature is not so high because of the heavy evaporation. It is calm and fine in the morning but in the afternoon, it gets suddenly cloudy and the shower is inevitable and the coastal areas have the regular sea-to-shore wind. It belongs to the heaviest rainy zone with the annual precipitation of 1 500–3 000 mm. It has tall evergreen woodland, called the tropical rain forest.

The region east of the Wallace's line of Indonesia and the south of the equator, home to *D. Phalaenopsis* of the *Phalaenanthe* section, belongs to the hot, rainy and humid tropical forest climate zone.

The rainy and dry seasons are distinct in the islands of Nusa Tenggara, located on 10° S lat. It is dry from May to October but wet from November to April. Here daily temperature changes from 24°C to 34°C with little difference between winter and summer. But in mountainous areas, it is cool and sometimes cold.

As regards the southern part of Papua New Guinea and the northeast of Australia inhabited by *D. bigibbum* and *D. superbiens* as well as *D. phalaenopsis*, the climate is also characterized by the distinction between the rainy and dry seasons, due to influence by the tropical monsoon. The first rain falls in November, the outset of

summer with the high sun. The rainy season is from January to April and the dry season from July to October with the low sun.

The tropical areas including the northeast of Australia, the east slope of eastern mountain range and the coast of Cape York Peninsula, where *Dendrobium* grows abundantly, have the annual precipitation of 2 000–2 500 mm, but the islands of Papua New Guinea have a rainfall of 1 100 mm.

The islands of tropical broadleaved forests in these areas are tinged with deep green in the rainy season. But in the dry season, the leaves fall down, changing the colour of the forest to maroon.

The sunrays penetrating through leafless trees make liana thrive, turning the forest into a primeval forest. The annual change in temperature is 6–10°C greater than that of the equatorial climate zone.

What is remarkable in the ecological environment of the habitats of the original species of Kimilsungia is that most of them grow on the trees of primeval forest. In general, the temperature in the mountains falls by 0.4–0.5°C each time the elevation rises by 100 m, as compared to the plain.

Therefore, if they grow in the place 600–700 m high above the sea level, the temperature is 3–4°C lower than that of the plain. It is cool at dawn and the difference of temperatures between day and night is great.

All the climate data and environmental elements mentioned above indicate that all the original species of Kimilsungia grow in the high temperature conditions of tropics. Each of them has a certain growing cycle according to the seasonal change of climate in their habitats.

To take an example, *D. taurinum* of *Ceratobium* section in the subtropics has the cycle of growing in summer and hibernating in winter since it has been adapted to the temperature change between summer and winter, while the three species of *Phalaenanthe* section in tropical monsoon climate zone grow in rainy season and enter the state of torpor in the dry season.

One of the common features of their ecological surroundings is that there is little change in the sunshine duration in a year.

Section 3. Course of Breeding of Kimilsungia and Its Registration

1. Course of Breeding of Kimilsungia

Kimilsungia is a hybrid, produced through the complicated course of crossing primarily between four species of *Dendrobium* and a variety and then between ten hybrids obtained from the former.

Kimilsungia (*Dendrobium* **KIMILSUNG** FLOWER) was bred by crossing *D*. Ale

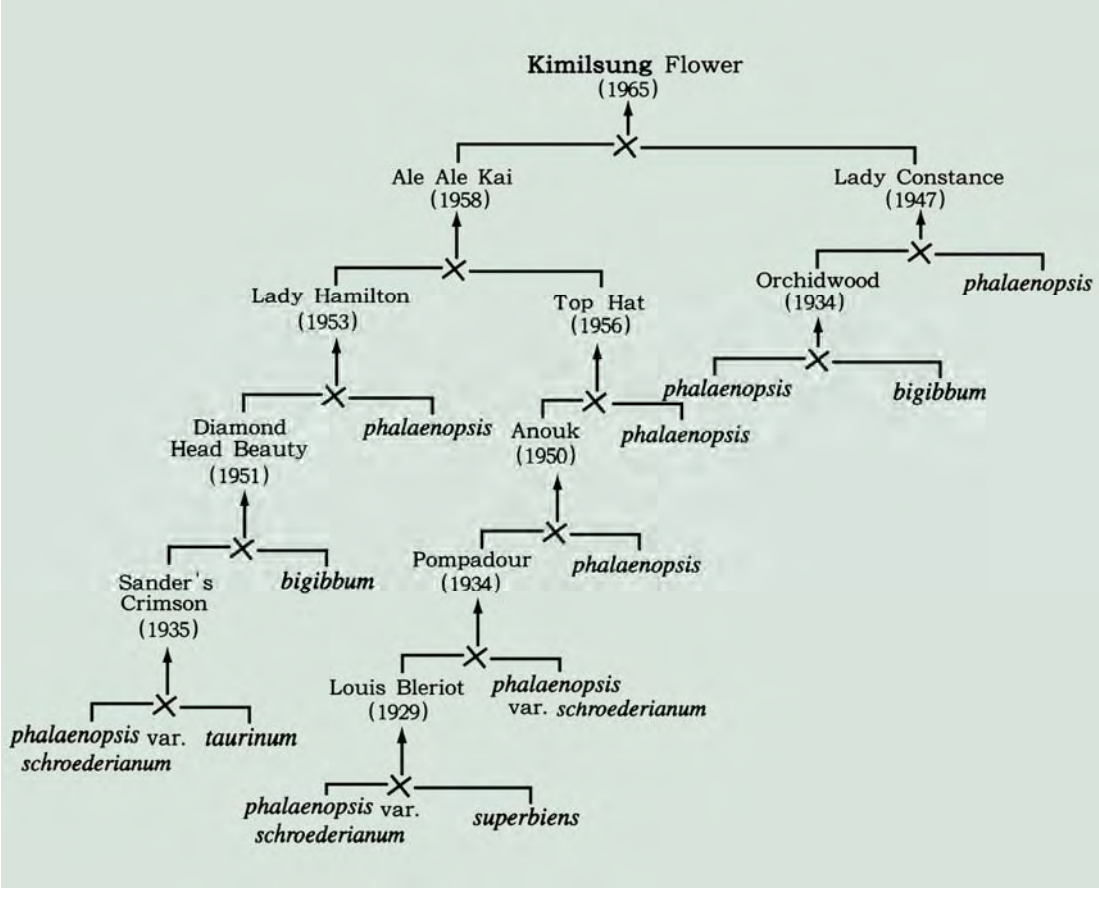


Figure 2. Course of crossing until the breeding of Kimilsungia

Ale Kai (female parent) and *D*. Lady Constance (male parent) by C. L. Bundt of Indonesia. The breeding of the female parent, *D*. Ale Ale Kai, and the male parent, *D*. Lady Constance, took nine rounds of crossings and 30 years since 1929 that witnessed the advent of *D*. Louis Bleriot. (Figure 2)

D. Ale Ale Kai, the female parent of Kimilsungia, was obtained through eight rounds of crossing, in which four original species, a variety and seven artificial hybrids were involved, and *D*. Lady Constance, its male parent, through two rounds of crossing between two original species and an artificial hybrid.

The breeding course of parent plants of Kimilsungia is as follows:

a) *D*. Ale Ale Kai (female parent)

D. Ale Ale Kai is from *D*. Lady Hamilton (female) and *D*. Top Hat (male).

D. Lady Hamilton

The breeding of this hybrid was initiated by Sander, a famous orchid grower, who devoted his life to registering and making the list of orchid hybrids. He bred *D*. Sander`s Crimson, an artificial hybrid, by crossing *D. taurinum* with *D. phalaenopsis* var. *schroederianum* in 1935.

In 1951 *D*. Diamond Head Beauty was produced by crossing *D. Bigibbum* with *D*. Sander`s Crimson by McCoy, and *D*. Lady Hamilton was bred by crossing the former with *D. Phalaenopsis* by Inoue in 1953.

The consequent *D*. Lady Hamilton combines harmoniously the trait of *D. phalaenopsis*, *D. phalaenopsis* var. *schroederianum* and *D. bigibbum* which have round and wide petals and big flower, and the trait of *D. taurinum* with a strong stalk and many flowers with petals fleshy and well shaped.

D. Top Hat

The breeding of this hybrid was started by Vacherot, a French horticulturalist, who bred *D*. Louis Bleriot for the first time in 1929 by crossing *D. superbiens* with *D. phalaenopsis* var. *schroederianum*.

So far, the breeding of *Dendrobium* focused on *D. nobile*, a low temperature plant. However, the successful breeding of *D*. Louis Bleriot opened the way to the breeding

of hybrids of *D. Phalaenopsis,* high temperature plants.

Vacherot undertook several crossings to add the excellent character of *D. phalaenopsis* var. schroederianum to *D.* Louis Bleriot, and got the famous *D.* Pompadour in 1934.

The hybrid grows big and strong, and the long peduncle bears over 20 big flowers of crimson violet.

Its pedicel is hard, and flowers last long, so it is popular as cut flower. It also is of great economic value.

Later, *D.* Louis Bleriot, *D.* Pompadour and others, bred in the greenhouse conditions in West Europe, returned to the tropics like Sulawesi and Java of Indonesia and Singapore, their original habitats, and were used as the starting material for breeding more beautiful hybrids. Even today they remain as crossing hybrids.

During World War II, orchid breeding was in stagnation all over the world; after the war, it went on with the breeding of *D.* Anouk by Vacherot in 1950.

D. Anouk is an artificial hybrid between *D. phalaenopsis* and *D.* Pompadour. In 1956, McCoy bred *D.* Top Hat, another artificial hybrid, by crossing *D. phalaenopsis* with *D.* Anouk.

As seen above, *D.* Top Hat was made through three crossings for 27 years since *D.* Louis Bleriot, the first artificial hybrid, was born.

D. phalaenopsis (including the variety) was used for four crossings, and *D. superbiens* only once in the first one.

Therefore, the breeding of *D.* Top Hat was a continuation of the work to add and fix the characters of *D. phalaenopsis*—round and wide petals and elegant flower shape—to the hybrid of *D. superbiens* with excellent properties.

In 1958, *D.* Ale Ale Kai, the female parent of Kimilsungia, was bred by Fukumura. It had had *D.* Lady Hamilton as its female parent and *D.* Top Hat as its male parent with the characters of *D. phalaenopsis*.

In this course the original species including *D. superbiens*, *D. taurinum* and *D. bigibbum* were used once and *D. phalaenopsis* and its variety, *D. phalaenopsis* var.

schroederianum, thrice.

Like this, *D. phalaenopsis* played a key role through its involvement of six times in all in the formation of the characters of *D*. Ale Ale Kai.

b) *D*. Lady Constance (male parent)

The breeding of this hybrid began with the breeding of *D*. Orchidwood, a hybrid between the two species, *D. bigibbum* and *D. phalaenopsis*, by Orchidwood, a breeder.

D. phalaenopsis and *D. bigibbum* have almost the same habitats and their shapes are alike each other. So they are often deemed similar species.

The difference between them, if any, lies in that *D. bigibbum* is shorter in height and smaller in flower size than *D. phalaenopsis* and the petal is twice wider than sepal and the labellum is of deeper crimson.

Such characters might have been passed down to *D*. Orchidwood through the crossing.

In 1947, *D*. Lady Constance was bred by Weber who conducted repeated crossing between *D. phalaenopsis* and *D*. Orchidwood.

Now that *D*. Lady Constance was bred by two rounds of crossing *D. phalaenopsis* with *D. bigibbum*, the characters of *D. phalaenopsis* are dominant.

Around 1960, *D*. Ale Ale Kai and *D*. Lady Constance were moved from Hawaii to Ujung Pandang of Sulawesi of Indonesia.

Here in March 1962, Bundt, an orchid breeder of Indonesia, pollinated *D*. Lady Constance to *D*. Ale Ale Kai and obtained the seeds. He sowed them and produced the first flower in 1965.

As aforesaid, Kimilsungia was bred through eleven crossings between four original species, a variety and ten artificial hybrids.

D. phalaenopsis played a main role in the course of breeding. It was used for the breeding of both parental types and was involved in the crossing five times. And its variety, *D. phalaenopsis* var. *schroederianum*, was also involved in the crossing thrice. These facts show that the *D. phalaenopsis* characters held the absolute position

in making hybrids.

Among ten artificial hybrids mentioned above, there are famous ones like *D*. Pompadour and *D*. Lady Hamilton, which are widely grown until now over 50 years after their breeding because of the beauty of the flowers and high economic value.

Among the hybrids obtained from the crossings between the male and female parents of Kimilsungia, the most beautiful plant with crimson violet petals and sepals and especially white-tipped sepal was selected and named Kimilsungia.

The chromosome number of Kimilsungia is 2n = 76.

2. Registration System of Orchid Hybrids and Registration of Kimilsungia

1) Registration System of Orchid Hybrids

Orchids, which hold a large proportion of flowering plants, have their own international registration system and naming conventions.

This is because the number of species are quite numerous and artificial hybrids are being made continuously.

It is one of the international customs to register man-made hybrids in the early days of their birth.

The first man-made hybrid was introduced by *Gardeners Chronicle* in 1858 and since 1895, Sanders Ltd. of Sander, a British orchidist, took on the task of keeping record of all species and hybrids.

In 1946, *Sander's Complete List of Orchid Hybrids* was published, which recorded all names of orchid hybrids registered so far. It was followed by *Sander's One-Table List of Orchid Hybrids* Vol. I and Vol. II, compiling the hybrids from 1946 to 1960, and then addendums were issued during 1961–1970, and from 1971, an addendum every five years.

In 1961, after a passage of about 50 years, the Register of Orchid Hybrids, the Royal Horticultural Society took over the job of the Sanders Ltd. and still works.

It organizes an international authority for the registration of orchid hybrids, which is responsible for the examination and registration of new orchid hybrids. In the application form are written the names of parents, the dates of crossing, sprouting and first blooming, external features (or colour picture of the hybrid is attached) and the grex epithet.

The applicant may be the breeder himself or the other person authorized by him. The International Authority for the Registration of Orchid Hybrids examines the contents of the form and, if the information is correct and the fact that the hybrid obtained by means of such hybridization is a novelty is confirmed, it admits it as a new hybrid, notifies it to the applicant and publishes it in the orchid magazine as well as in *Sander's List of Orchid Hybrids*, the list of orchid hybrids made with appropriate years as a unit. Then, the new hybrid wins an international recognition.

Keeping the records of artificial orchid hybrids among other cultivars is a complicated undertaking, and thus it is conducted through cooperation of breeders and botanists of different countries.

This job not only involves the arrangement of orchid cultivars but also provides the opportunity to heighten their scientific value as research materials available for the study of the science of breeding, genetics and evolutionism.

Such regular system of registration makes it possible to prevent the disorder in the name and lineage of the hybrids by tracing back to the original species and at the same time, is much helpful to evaluating the improved flower and cultivating them.

With a unified registration system, the hybrid naming convention has begun to take effect on the worldwide scale.

The Second Session of the International Orchid Society held in 1957 organized the committee of classification, naming and registration of orchids and adopted the orchid hybrid naming conventions, which was revised at the Eighth Session of International Orchid Society in 1975.

It is, of course, based on the former International Code of Botanical Nomenclature and International Code of Nomenclature for Cultivated Plants.

Scientific Name of Artificial Hybrid

This consists of generic name and grex epithet. If the generic names of its parents are the same, the hybrid's generic name follows that name, but if they are not, the generic name is made by combining those of its parents.

The grex epithet is different from that of the wild species in writing and naming. It is written as a proper noun or favourite name in English normal type with the initial as a capital letter.

Example: *Dendrobium* Fantasia
generic name grex epithet

In the case of a cultivar selected from a hybrid group, the name of the breed (individual name) is written in the single quotation mark.

Example: *Dendrobium* Fantasia 'Queen'

2) Registration of Kimilsungia

Kimilsungia was registered as *Dendrobium* KIMILSUNG FLOWER by the International Authority for the Registration of Orchid Hybrids on April 20, 1982, according to the International code of Nomenclature for Cultivated Orchids.

Later, Kimilsungia was introduced in *Sander's List of Orchid Hybrids, Addendum 1981-1985* published in 1985. In this list, its scientific name was written as **KIMILSUNG** FLOWER, the grex epithet of hybrid, in normal capital letter with the generic name omitted.

The international convention has it that, when registered or written in the list, any hybrid is usually written in capitals.

Actually when the scientific name is quoted, the initial letter of every word of grex epithet is written in capitals but the others in small letters.

In practice, Kimilsung Flower is used in the explanation of the content of the orchid hybrid list. At present, either of them is used according to the position and content of sentences.

Chapter 2
Morphology and Structure of Kimilsungia

Kimilsungia is an evergreen herbaceous plant with particular form and structure hardly seen in the plants in general.

It is because its original species grew in the special ecological environment, enduring the rainy and dry seasons and sticking to the branches of trees or the rocks in the tropical rain forest.

Section 1. Root

The root of Kimilsungia is similar in shape and structure to that of epiphytic orchid.

1. Shape

The root of Kimilsungia is fibrous root without the distinction between the main and lateral roots.

The fibril is thicker than that of the other monocotyledon, and does not get thin as it goes to the end. (Photo 3)

The root grows long and does not branch out. However, a wound at the tip or the halt of growth due to

Photo 3. Root system

some unknown reasons can give rise to rootlets, which resemble those of the mature root.

The root tip is dull but pointed and tinged with green colour up to a few millimetres or a few centimetres inside from it, and the root up to the base of the stem is enveloped

Photo 4. Root apex

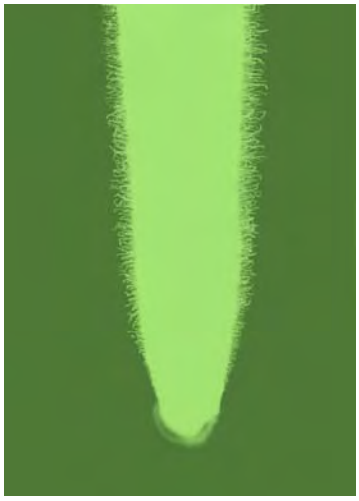


Photo 5. Root apex with root hairs

with white spongy parenchyma, i.e. velamen. (Photo 4)

The cells in the green and glossy root apex contain chloroplast for photosynthesis. In the humid conditions, the root hairs grow from young epidermal cells of the root apex. (Photo 5)

In the dry or oxygen-short conditions, the root hairs disappear so soon that it cannot be seen.

The formation of root hair is one of the important physiological indexes that show the state of growth of the root.

It has such a strong nature to grow towards the humid part that the contact of apex with the moist bark of trees or things promotes numerous root hairs to come from the epidermal cells and to be firmly attached to it. (Photo 6)

On the part of surface peridium, where the root hairs are attached to the other objects, velamen is absent or poorly developed if any.

As mentioned above, the root hairs play the role of absorbing water and nutriment

A

B

Photo 6. Roots attached

(A) root attached to the cortex of a tree; (B) root attached to a piece of a flowerpot

as well as attaching the root to the other objects firmly, so that the plant does not fall down from the substrate and stands straight and grows.

It is not until the sprouts come out and grow in some measure in spring that the root is differentiated from the third or fourth node at the base of the stalk. (Photo 7)

The lifetime of the root is more than two years at least.

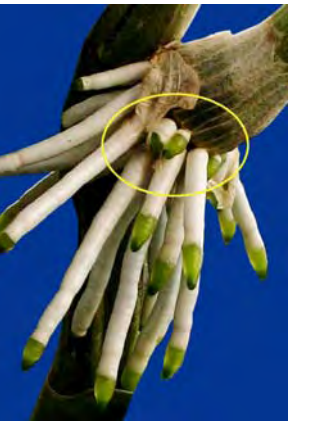


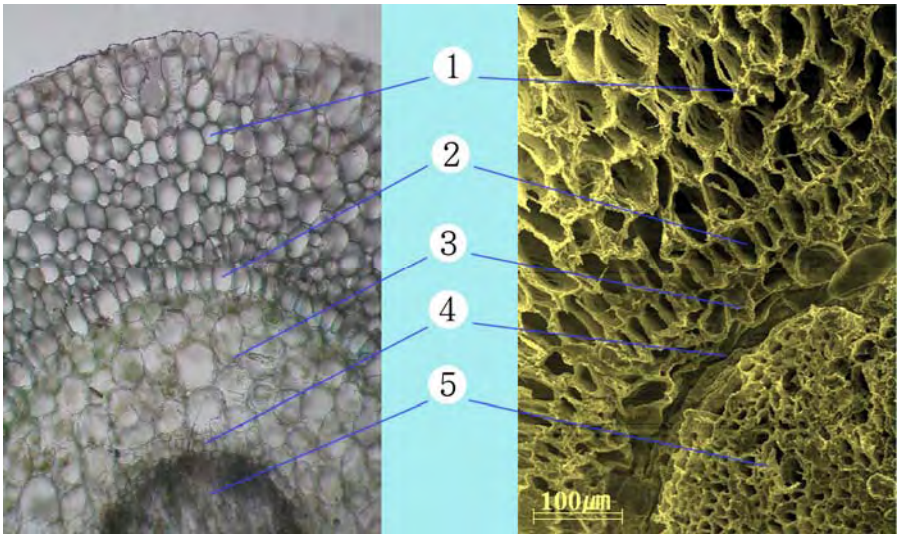
Photo 7. Root coming forth at the base of stalk

2. Anatomical Structure

The vertical section of the root of Kimilsungia is similar to that of other monocotyledon, but is different in that the outmost layer is velamen. In the transverse section of the root of Kimilsungia, the root is divided into velamen, the outermost layer, epidermis, cortex, endodermis and stele. (Photo 8)

The velamen, the outermost layer, is formed by the horizontal division of the dermatogen.

It usually consists of 10–13 layers of vacuolar cells. According to the degree of matureness of the root and the humidity of environment, the protoplasms of epidermal

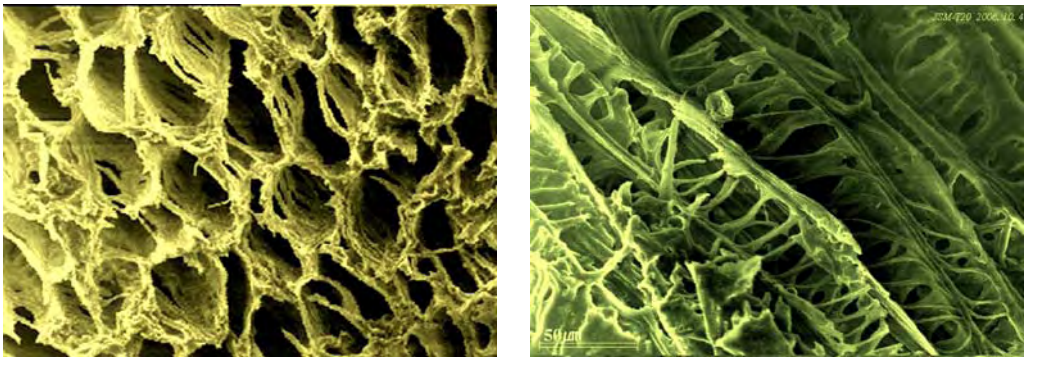


A B

Photo 8. Transverse section of the root

(A) biological microscopic photo; (B) scanning electron microscopic photo

1. velamen; 2. epidermis; 3. cortex; 4. endodermis; 5. stele



A B

Photo 9. Structure of velamen

(A) transverse section; (B) vertical section

cells gradually disappear and leave cell partitions alone, which form the velamen. (Photo 9)

This gets the velamen to be as elastic as sponge for the protection of the tissues inside from the mechanical impact. The velamen looks white as its partition of empty cell is dry enough to reflect the sunlight. If it is wet and the empty cell is full of water, the partition of cell gets wet to make the whole velamen transparent, which helps the

chlorophyll in the cell of cortex admit sunlight and make its white surface look a little green. The velamen not only protects the root but plays the role of passing the air, absorbing and storing water and supplying it to the stele of root.

The epidermis is a cell layer adjacent to the velamen, in which most cells are the dead ones suberized. They are divided into three kinds according to their shapes and functions. (Photo 10)

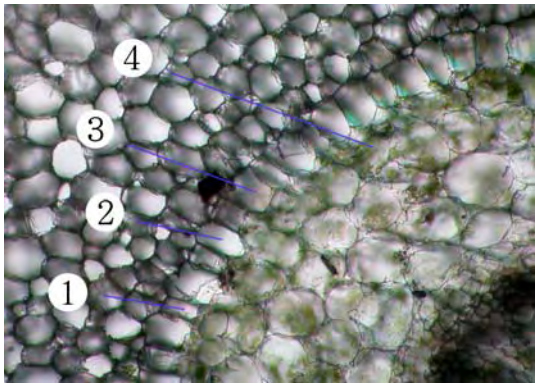


Photo 10. Epidermis of root and cells around it
1. transit cell; 2. guard cell; 3. cells of cramp type of "U"; 4. cells of the cortex

The cells of cramp type of "U" are big and dominant. Their cell partitions are thickly suberized in the type of "U", which increases the mechanical strength of the root and, at the same time, blocks the exchange of materials between inside and outside.

The transit cells are full of protoplasm and have thin cell partitions. They are small living cells, placed sparsely on the epidermis. Through these transit cells, water and nutriment soluble in it go into the root. Some cells of the type of "U" become guard cells responsible for the exchange of the air.

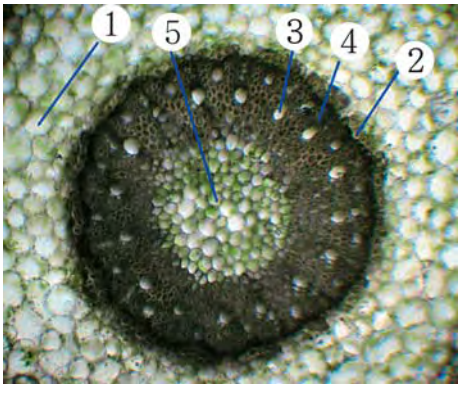


Photo 11. Transverse section of stele of root
1. cells of the cortex; 2. endodermis; 3. xylem; 4. phloem; 5. parenchyma cells

The cortex is able to carry on photosynthesis as it consists of the parenchyma cells containing chloroplasts. But the velamen is so thick that the photosynthesis is very slow when the root is not exposed to the air. Among the cells of the cortex, there are some heterotypical cells with the needle-bundle-shaped crystal of calcium oxalate. In some cases, fungus enters the cells of the cortex for symbiosis and forms mycorrhiza.

The endodermis is a layer of small box-

shaped cells that occupies the inmost part of the cortex. The tissue beneath the endodermis is stele. In the endodermis, cells with thick and thin partitions are arranged alternately. 4–5 endodermal cells with thick partitions lie at the phloem of the stele while 3–4 cells with thin partitions at the xylem. The structure of stele is similar to that of monocotyledon. The vascular bundle in the stele is radial. That is, the xylem is arranged in the radial direction and the phloem is placed in their intervals. (Photo 11)

Form of Flower

Flower is a special reproductive organ of angiosperm which is the modification of leaves at the receptacle. To take tulip for instance, the flower has pistil in the centre and stamens, petals and sepals around it in a regular way. It is trimerous.

Flowers of lily and daffodil are the same in structure, but those of cherry and camellia are pentamerous and that of rape is tetramerous.

And flowers of pea and wisteria are butterfly-shaped, those of bellflower and morning glory are tubular, those of cherry and camellia are polypetalous, and that of morning glory is monopetalous.

To summarize the forms of flowers, indeterminate flowers now do not exist, but there are radial (star-like) flowers and bisymmetrical flowers like orchid flowers. Generally speaking, it is considered that flowers whose different parts make an integral whole are more evolved than the flowers whose parts are detached from each other and that bisymmetrical flowers are more evolved than the radial flowers.

Sunflower is aggregation of many flowers. In its centre there are tubular flowers which are surrounded by petals, which resemble the sun and look like one flower.

Such flowers are called capitate flowers in the sense that they resemble a head.

Generally speaking, there are plants with monoclinous flowers which have both androecium and gynoecium, and those with diclinous flowers which have only androecium or gynoecium.

Azalea and daylily are plants with monoclinous flowers.

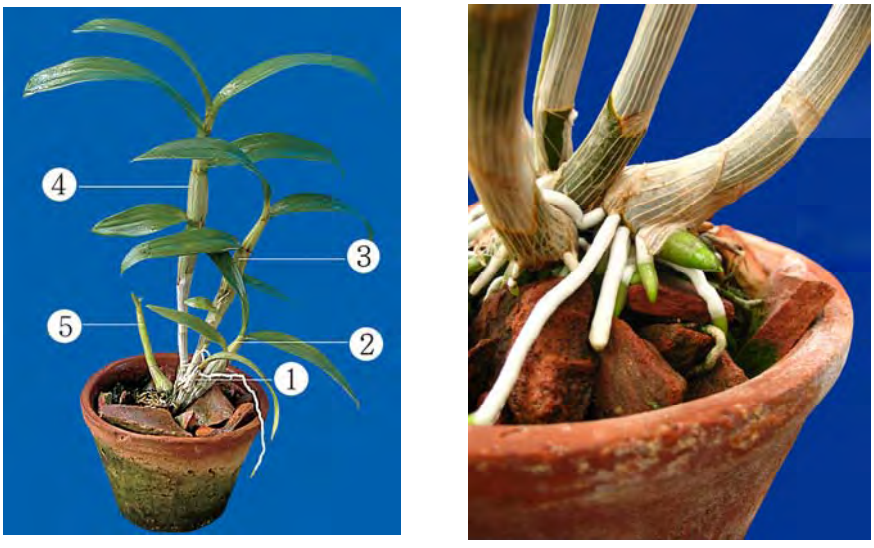
There are also dioecious plants whose male and female flowers bloom in different plants and monoecious ones whose male and female flowers bloom in the same plant.

Humulus japonica belongs to dioecious plant.

Section 2. Stem

Kimilsungia is a sympodial orchid. The stem, which grew up to a definite height, does not grow more and a lateral bud develops at the lower node, giving rise to a new stem.

Through the formation of the new stem, the plant takes shape and the peduncle is



A B

Photo 12. Stem of Kimilsungia and the formation of the plant
(A) growing of fifth stem; (B) sprouting at the lower node of stem
(1, 2, 3, 4 and 5 are the order of coming out of stems)

formed strong enough to support the flowers. (Photo 12)

1. Shape

The later stem is usually longer than the early one in Kimilsungia. Regardless of the sequence of the development, the stem is long clavated, thin at the base and top and relatively thick in the middle. (Photo 13)

Photo 13. Shape of stem

At the stage of blooming, the stem has normally 15–18 nodes, the lower ones of which are wrapped by the white thin paper-like sheath.

So short are 3–4 nodes at the base of its stem from which the roots come out.

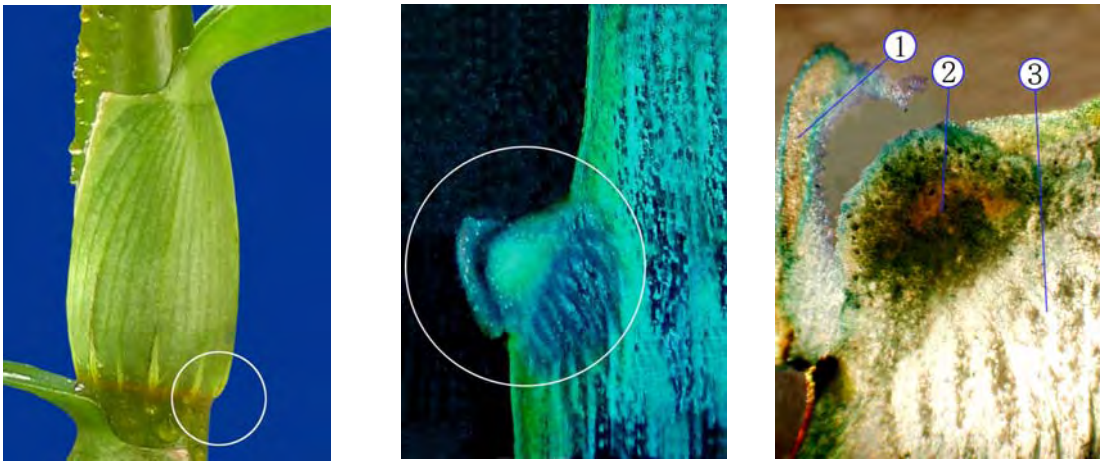
There is no lateral bud on those nodes. But 2–3 axils at the nodes above them have a lateral bud each. Next spring, the most developed one germinates to form a stem.

As it goes upwards, 6–7 internodes get long and the lateral buds leave their traces alone.

The traces are wrapped by the dry sheath so that they can be hardly seen with eyes. (Photo 14 [A])

The lateral buds appear again, going upwards. Often 7–8 of them are seen. Going upwards further, the lateral buds are more developed and seen clear. (Photo 14 [B])

A lateral bud consists of a growing point and scale leaves enclosing it. (Photo 14 [C])



A B C

Photo 14. Position of the lateral bud of stem and its longitudinal section
(A) position of the lateral bud; (B) longitudinal section of stem around the lateral bud;
(C) enlarged part around the lateral bud
1. scale leaves; 2. growing point; 3. vascular bundle

There grow leaf primordia beneath the growing point. They surround the growing point, which are called the primordial leaves. The scale leaf is a modification of the primordial leaf, the epidermis of which is cutinized and of maroon colour. The more the lateral buds develop, the greater the number of scale leaves is and the more protruding shape they have. One to five scale leaves cover the growing point according to the degree of development of the lateral buds.

The vascular bundle is formed beneath the growing point. Its number and size depend on the formation of scale leaves.

On the stem of Kimilsungia, the lateral buds at the lower nodes are differentiated into new sprouts, and those at the upper nodes tend to be reproductive to make peduncles.

In natural conditions, of lateral buds in the upper part of the stem, the most developed one or two at the top and one terminal bud or, in case of strong individuals, two of them are converted to reproductive ones and produce flowers. But when the conditions change, a new sprout grows from the lateral bud on the upper node.

2. Anatomical Structure

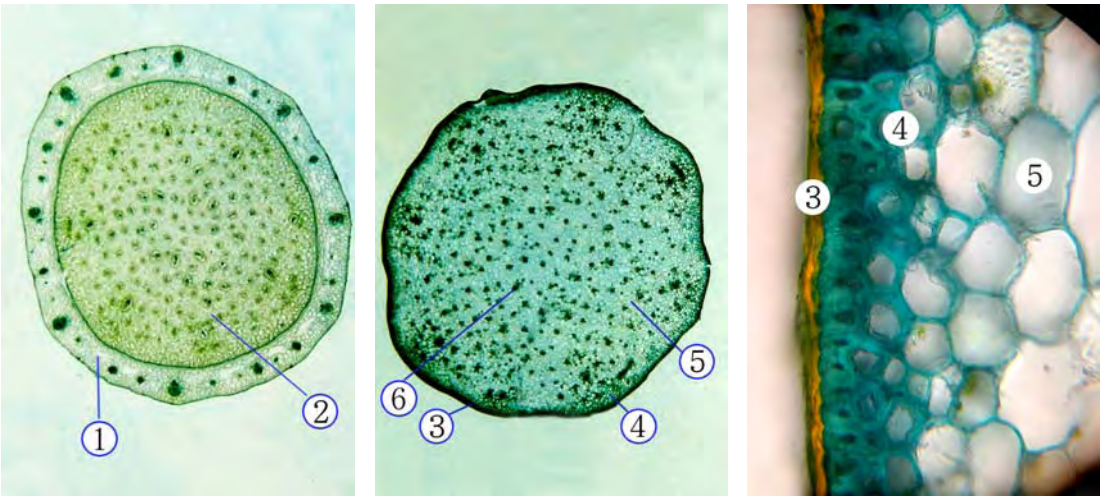
The anatomical structure of the stem of Kimilsungia is similar to that of other monocotyledon but shows some differences, too.

In the transverse section of the stem, it is divided into epidermis, mechanical tissue, main tissue and scattered vascular bundles. It resembles the stem of maize. (Photo 15)

On the outmost surface is a layer of yellow cutinized epidermis 9–14 μm thick. There is mechanical tissue (sclerenchyma) beneath the epidermis, where arranged are 3–4 layers of cells 20–40 μm thick around the stem. The walls of these cells are lignified and thick, nearly devoid of protoplasm.

The epidermis and mechanical tissue protect the interior of stem and restrain the transpiration from the stem surface.

The main tissue is composed of parenchyma cells, each of them 60–120 μm in



A B C

Photo 15. Transverse section of the stem

(A) transverse section of the young stem; (B) transverse section of the mature stem; (C) structure of cortex
1. sheath on the stem; 2. inside of the stem; 3. epidermis; 4. mechanical tissue (sclerenchyma); 5. main tissue; 6. vascular bundle

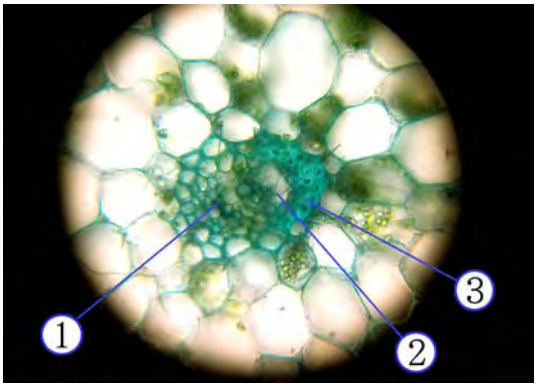


Photo 16. Vascular bundle of stem (x400)

1. xylem; 2. phloem; 3. mechanical tissue (sclerenchyma)
(Vascular bundle was dyed methyl green)

diameter. Those cells get bigger gradually going inward from outside.

Meanwhile, the chloroplasts are in the relatively small parenchyma cells on the surface side.

The deep-yellow green colour of the stem is resultant from the combination of the green colour of the chlorophyll in the chloroplasts and the yellow colour of the cutinized epidermis.

The large and small vascular bundles (Photo 16) are evenly arranged in the main tissue.

Towards the centre of the stem are heterotypical cells 2–4 times as big as normal ones, which contain the crystal of calcium oxalate.

Between the vascular bundles are parenchyma cells storing starch grains.

Section 3. Leaf

The leaves of Kimilsungia have the shape and structure adapted to both rainy and dry seasons in tropics like its original species.

1. Shape

Kimilsungia has the alternate phyllotaxis; a leaf puts forth alternately at every node of stem. The leaf consists of lamina and sheath like those of other orchidaceous plants. (Photo 17)

The lamina is lanceolate, thick and glossy.

In general, the initial six nodes from the base of the stem have no lamina; they have only sheath. Occasionally, small laminas are found in sheaths of the fourth to sixth nodes. The lower leaves with no lamina or with underdeveloped lamina have short

A B

Photo 17. Phyllotaxis and the shape of leaf

(A) alternate phyllotaxis; (B) shape of leaf; 1. lamina; 2. sheath

growing period of about two months owing to the incompletion of either lamina or sheath. When the vegetative growth gives way to the reproductive growth, the leaves wither one after another from the base and the laminas on the fourth to sixth nodes get dry to fall or wither but the sheaths alone dry up white and stick to the stem.

Those attached persist during the lifetime of stem and protect the latter from the high temperature and drying.

The leaves above the seventh node have well-developed lamina and sheath. These laminas are bigger than sheaths. The size of lamina reaches its maximum at the 13^{th} or 14^{th} leaves. Those are called the middle leaves.

Two or three leaves above the middle leaves have very short or inconspicuous sheaths. They are called upper leaves. The leaf at the apex of stem is smaller than two or three leaves beneath it but it grows bigger rapidly during the shift from the vegetative growth to the reproductive one.

The sizes of upper and middle leaves are 30–40 cm^2 and occasionally more than 50 cm^2. If there are ten leaves on the stem, the total foliar area is over 450 cm^2, which is sufficient for photosynthesis. The leaves in the upper and middle part of the stem live in green for 4–5 years and carry on photosynthesis. After 2–3 years of growth, the lower ones among those in the middle part gradually get old to fall and only the white sheaths remain on the stem. The shape and lifetime of leaf are much affected by the environment.

2. Anatomical Structure

In the transverse section of the leaf under microscope, the mesophyll tissue and the vascular bundle (vein of a leaf) containing chlorophyll are found between the upper and lower endodermises. (Photo 18)

The middle part of the mesophyll tissue, that is, the cells around the vascular bundles, are bigger than those beneath the upper and lower epidermises.

The vacuole occupies the greater part of the mesophyll cell and chloroplasts are distributed evenly in the protoplasm pushed to the cell partition.

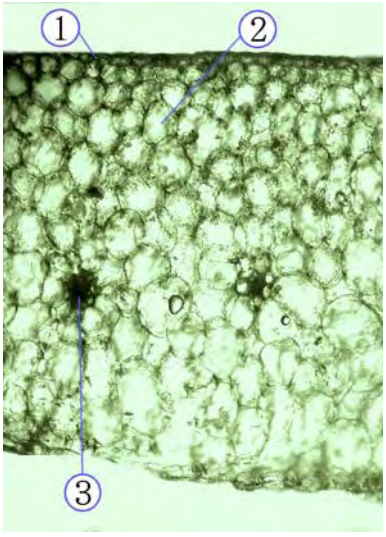


Photo 18. Transverse section of the leaf
1. epidermal cells; 2. mesophyll cells;
3. vascular bundles

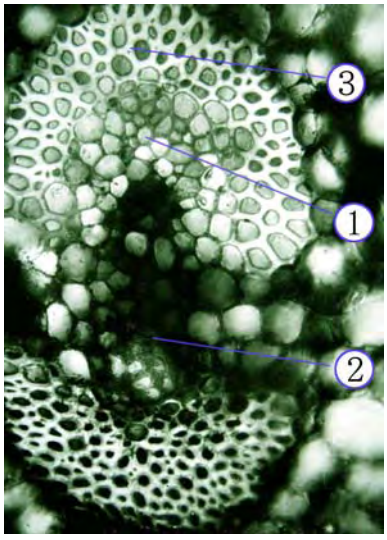


Photo 19. Vascular bundles in leaf
1. xylem; 2. phloem;
3. mechanical tissue

The vascular bundles of various diameters are arranged relatively evenly in the lengthwise direction of the leaf in the mesophyll tissue. As they go to the both edges from the centre of the biggest vascular bundle, the other ones of various sizes are distributed with the same number.

Each of them is wrapped by the mechanical tissues composed of the cells of sclerenchyma. The mechanical tissue is well developed, going to the upper and lower surfaces of the leaf. (Photo 19)

The bigger the vascular bundle, the greater the number of mechanical tissues around it.

In the mesophyll tissue there are also the heterotypical cells with a needle bundle-shaped crystal of calcium oxalate. (Photo 20)

The intercellular spaces in the

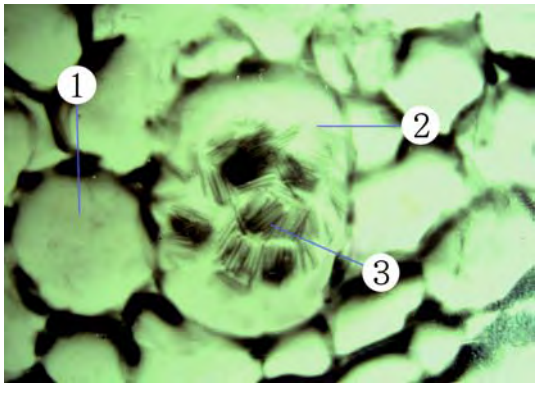


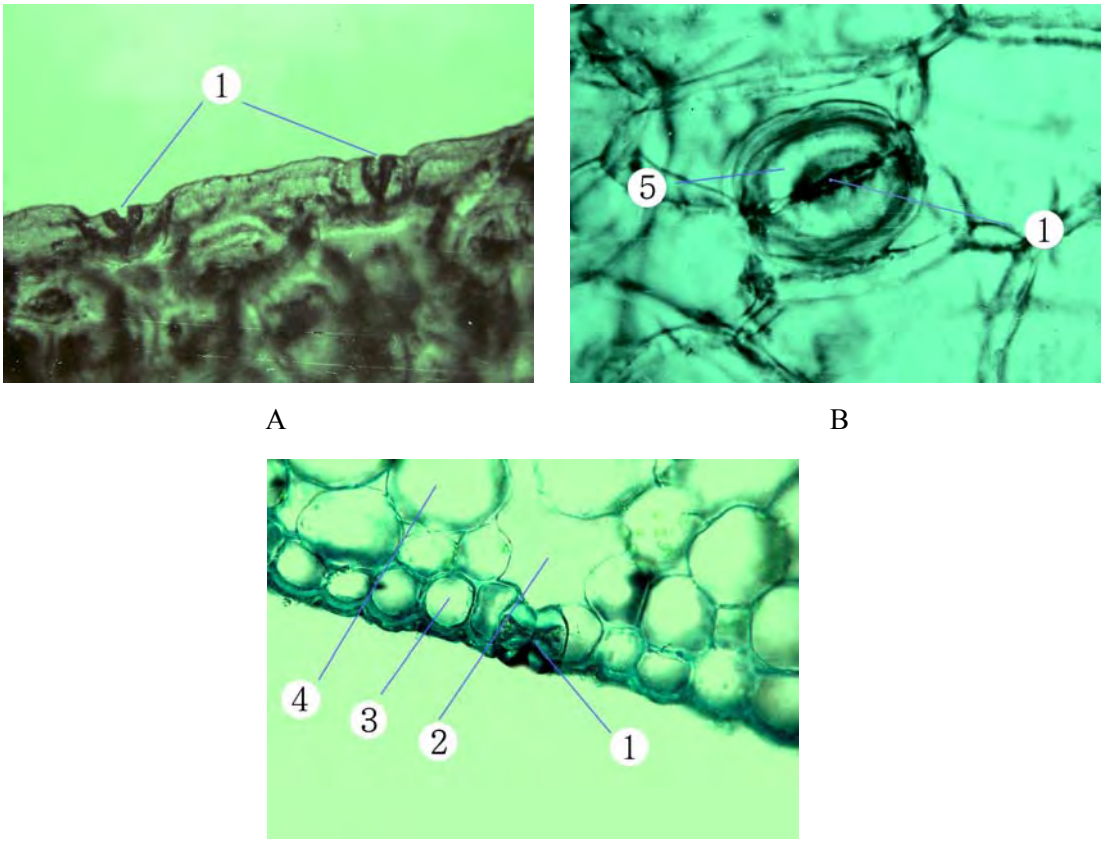
Photo 20. Heterotypical cells with needle bundle-shaped crystal of calcium oxalate (×400)
1. mesophyll cell; 2. heterotypical cell;
3. needle bundle-shaped crystal of calcium oxalate

mesophyll tissue are wider, going towards the lower side than to the upper side. This is ascribable to the presence of stomates in the lower epidermis. (Photo 21)

The stoma is placed on the same level as the leaf surface or a little pitted according to the age of leaf. It consists of two guard cells which contain chloroplasts as in the other plants.

The stoma measures about 40 × 50 μm and the number of stomates is 4 000–5 000 per cm^2 of the leaf area, which are less than in other plants.

The stoma is open mostly at night to take in the carbon dioxide and close during the day to prevent transpiration.



A B

C

Photo 21. Shape and structure of stoma in leaf

(A) stoma on the lower epidermis of leaf (×400); (B) shape of stoma (×400);
(C) longitudinal section of leaf

1. stoma; 2. air chamber; 3. epidermis; 4. mesophyll cell; 5. guard cell

Section 4. Flower

Most of the cultivated orchids are beautiful, but the flower of Kimilsungia is very pretty among them.

It owes its beauty to the harmonious and secure balance in the arrangement of floral parts as well as their unique colour.

1. Shape and Structure of Flower

One or two peduncles grow at the tip of mature stem of Kimilsungia and reach up to 40–50 cm in length when the floral buds differentiate and bloom. The anthotaxy is a centripetal inflorescence, in which one flower after another blooms acropetally from the base of the peduncle and a simple inflorescence, in which flowers bloom on a stem alone with no branch. It also is a racemose inflorescence, in which 10–15 flowers with pedicels of similar length are borne alternately on one peduncle.

The peduncle is bent like an arch, pressed by the weight of flowers. (Photo 22)

It takes 45–60 days from the sprouting of peduncle to the first blooming, and efflorescence lasts about two months. But the blossom fertilized begins to wither within 24 hours.

The flower resembles a butterfly that is flying up with its wings spread wide and its colour is crimson violet. The blossom is 6–8 cm in diameter. The flower is trimerous, consisting of three petals and three sepals,

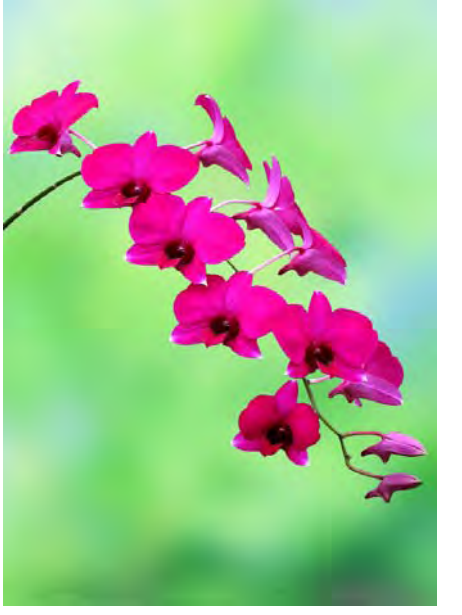
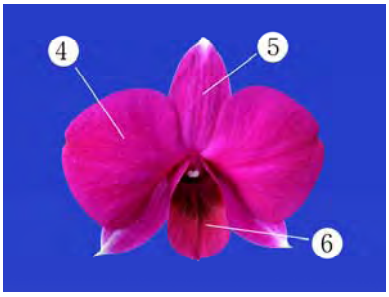


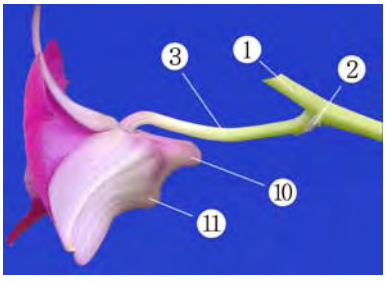
Photo 22. Anthotaxy of Kimilsungia

and is an androgynous one with a column composed of a stamen and a pistil. (Photo 23)



(A) flower viewed from the front

(B) vertical section of flower



(C) flower viewed from the side

Photo 23. Structural elements of flower

1. peduncle
2. bract
3. pedicel
4. petal
5. sepal
6. labellum
7. stamen
8. pistil
9. ovary
10. spur
11. claw

The sepals and petals of Kimilsungia are all crimson violet and lie almost on a plane. That is, the sepals and the petals look alike, which is quite different from other plants. The three lanceolate sepals are arranged in the form of triangle with the anther hood as its axis. Among them, the upward one is called upper sepal and the other two downward ones on both sides lateral ones. It is noteworthy that these three sepals have little white part on their tips.

Inside the sepals three petals are arranged between them, two of which are big and round. They should be called the lateral petals, but they are simply called petals. The labiate petal pending downwards at the centre is called labellum. Rather crimson and soft hairs cover its middle part so that they look prominent, making it possible for insects to alight.

The rear part of the flower with the lateral sepals and labellum looks queer. The base of labellum is protruded downward, forming a spur.

The labellum is on the downward extension of the column, enveloped by two lateral sepals. This part is called a claw. The spur looks like a long claw, but actually it is the downward extension of labellum.

The ovary is in the receptacle that is merged with the ovary partition, and the other elements of flower are put on the ovary. So it is the epigynous one. The thickness of the part where the ovary is merged with the receptacle is little distinguished from that of peduncle beneath it. On the surface of the receptacle, there are six round folds which disappear gradually, going towards the pedicel. The receptacle is white-pink in colour, but turns green while swelling when the flower is fertilized. That is, it develops into fruit.

There is a little leaf wrapping the pedicel on the peduncle. That is the floral bract. When the flower is in full bloom, it changes from blue to white, losing its vitality and leaves the form.

2. Anatomical Structure of Petal and Sepal

The transverse section of the petal shows that the epidermal cells are forming a rather thick layer to protect the inside. Beneath the epidermis, there is parenchyma that consists of cells with thin walls, and in the middle of it the vascular bundles are arranged in regular intervals. (Figure 3)

The stomates are present on the lower epidermis. The stoma of petal is less developed than that of leaf. Among the parenchyma there are big heterotypical cells which have needle bundle-shaped crystal of calcium oxalate. The shape and size of the vascular bundles of petal are similar to those of leaf, but the sclerenchyma is less developed.

The epidermal cells of petal are quite different in shape and colour from those of leaf. The latter are thickly cutinized and closely arranged while the former, in the cross section, are dull serrate and big, and arranged in a line.

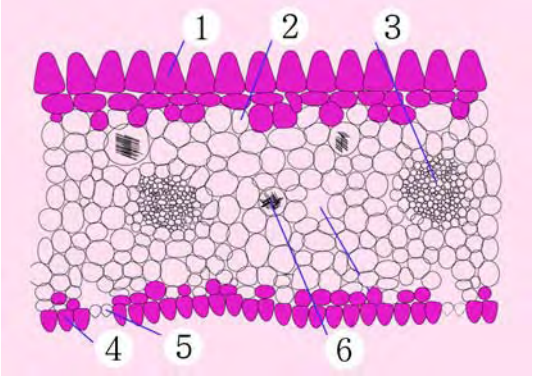


Figure 3.Transverse section of the petal
1. cells of the upper epidermis; 2. mesophyll cells;
3. vascular bundle; 4. cells of the lower epidermis;
5. stoma; 6. crystal of calcium oxalate

And the upper epidermal cells are twice or thrice as large as the lower epidermal ones. In fact, epidermal cells are bell-shaped. It can be proved by the fact that the bottom of each cell looks like a ring when the lower surface of petal stripped of the epidermis is seen through microscope.

There is anthocyan pigment, red system, in those bell-shaped cells. In view of the upper surface of petal, this pigment is present in the bell-shaped cells and some mesophyll cells of first and second layers under them.

As regards the lower surface of petal, this pigment is present mainly in the bell-shaped cells and in some mesophyll cells of first layer under it as well. That the upper surface of petal looks darker than the lower surface is because the bell-shaped cells of the former are bigger than those of the latter while the former has three layers of pigment cells but the latter only two layers.

The colour of flower depends on the kinds of anthocyanin in the anthocyan pigment, its rate and pH of cell sap, but subtly changes with the reflexion and dispersion of light and other physical effects related to the structure of petals.

The bell-like structure of epidermal cells of petal exerts great influence on the colour display.

For example, when the sunlight reaches the side of the bell-shaped cells, it makes shadow on the surface of epidermis, and the bigger the cells, the larger the shadow, and in turn, the darker the colour of flower.

The effect of the shadow is varied with the angle of the sunlight. The colour of flower gets deeper or darker depending on the degree of the shadow in petals. The lower surface of petal is always crimson and the upper surface changes its colour from crimson to darkish red when sunlight changes.

The change is ascribable, to some extent, to the size and bell-like structure of the epidermal cells.

The colour of flower is affected by the intercellular space (70–90 μm in diameter) in petal, too. This space is full of water and air that disperse the light penetrated. As a result, the colour of petal is seen clearly.

The transverse section of the sepal is similar to that of petal. But the bell-shaped

cells in the upper and lower epidermises of sepal are rather smaller than those of petal and slightly differ in the distribution of pigments. (Figure 4)

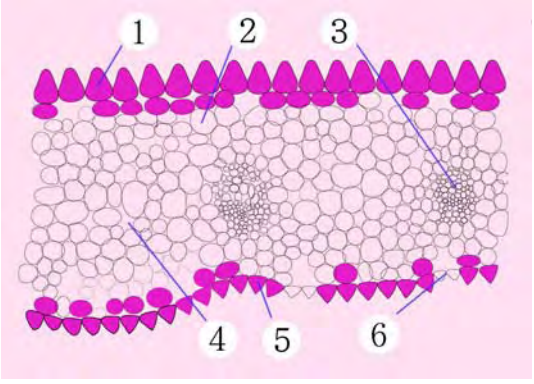
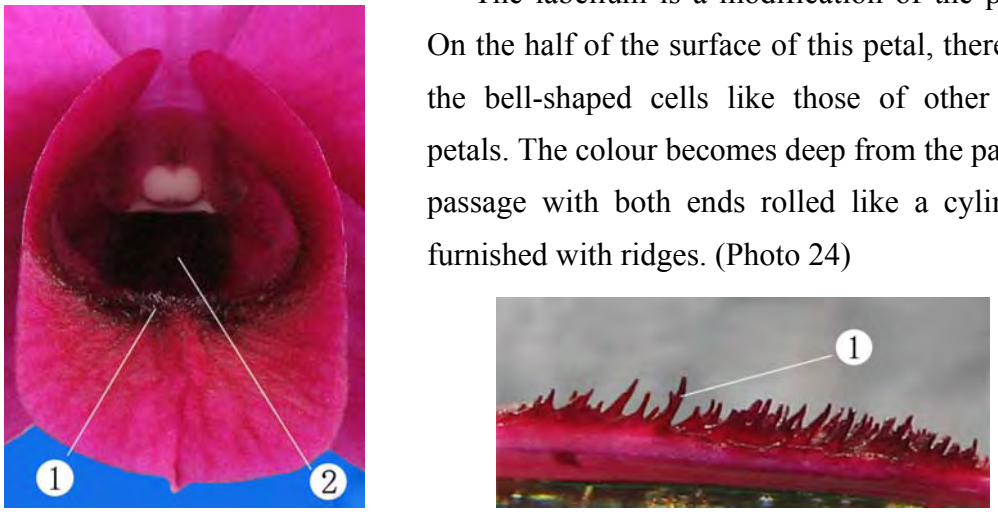


Figure 4. Transverse section of the sepal
1. upper epidermal cells; 2. mesophyll cells; 3. vascular bundle; 4. intercellular space of mesophyll; 5. lower epidermal cell; 6. stoma

As regards the upper surface of sepal, the pigment is present in the bell-shaped cells of epidermis and in some mesophyll cells of first layer under it. This is much similar to the distribution of the lower surface of petal. In the lower surface of sepal, the pigment is found only in the half of all the bell-shaped cells and little in the second layer under it. The intercellular space in sepal is greater and wider in comparison with that of petal. This makes the colour of sepal not so clear as the petal. That is, the colour of the upper surface of sepal is akin to that of lower surface of petal but the lower surface of sepal looks almost white.

The labellum is a modification of the petal. On the half of the surface of this petal, there are the bell-shaped cells like those of other two petals. The colour becomes deep from the part of passage with both ends rolled like a cylinder, furnished with ridges. (Photo 24)



A B

Photo 24. Shape of labellum and transverse section of the ridges
(A) labellum viewed from the front; (B) transverse section of the ridges
1. hairs or ridges made up of horn-like protruding cells; 2. passage

Going inward, part of the ridges is branched in the form of "V" and the white anther hood is seen overarching the passage.

The hairs or ridges of the labellum are products of epidermal cells that are transformed into horn-like ridges 270–350 μm higher rather than bell-shaped ones. They lie outwards at an angle of 60–80°, not at the right angle. They are cutinized like the bell-shaped cells and thus hard to break.

The deep colour of the ridges is ascribable to the fact that the horn-like ridges are bigger and contain much more pigments per unit area than the bell-shaped cells, and lie at a certain angle to produce a greater "shadow effect" above-mentioned. The insects recognize this and find their flower and get down without sliding by the help of ridges.

Normally the labellum is in its fixed position, but when an insect alights, it bends, loaded by the weight of the insect and when freed from it, it returns to the normal position of itself.

For instance, when a bee flies down on the ridges, the labellum lowers itself to open the passage wide and lays a suspending bridge so that the insect gets to the reproductive organs. When the bee flies away, it returns to its position to restore the original form.

The peduncle remains curled until the floral bud is formed with the differentiation of floral organ but revolves at an angle of 180°, disentangled when the flowers come to blossom.

This is the characteristic adaptation that offers the insects easy access to the ridges of labellum.

3. Shape and Structure of Column

A column stands inside the petals, which is one of the major features that define Kimilsungia as an orchid plant.

Like those of other orchids, the floral column of Kimilsungia is composed of a stamen and a pistil. (Photo 25)

In the column, the stamen structurally consists of white anther hood overarching the anther, anther lobe inside it, anther partition bounding them and pollinium, while the structure of pistil includes stigma and chin-shaped rostellum bounding it with the anther.

The rostellum is embryologically a modification of one piece of the tripartite stigma.

It prevents self-pollination and plays a certain role in attaching the pollen to the insects.

Photo 25. Structure of column
1. stamen; 2. pistil; 3. pedicel

1) Stamen

Stamen is found on the rostellum of the column.

The white small cap in the innermost of the column is the anther hood that protects pollinium in the anther. (Photo 26)

A B

Photo 26. Longitudinal section of stamen and anther hood
(A) longitudinal section of stamen; (B) anther hood
1. anther hood; 2. pollinium

This anther hood covers the whole anther. It withers turning bright-white and hardens when the flower blooms. And it has a small visor-like projection in front of the rostellum.

The epidermal cells of anther hood are transformed into cowl and have membrane of rhytidome so as to maintain its shape even after the whole flower organs withered.

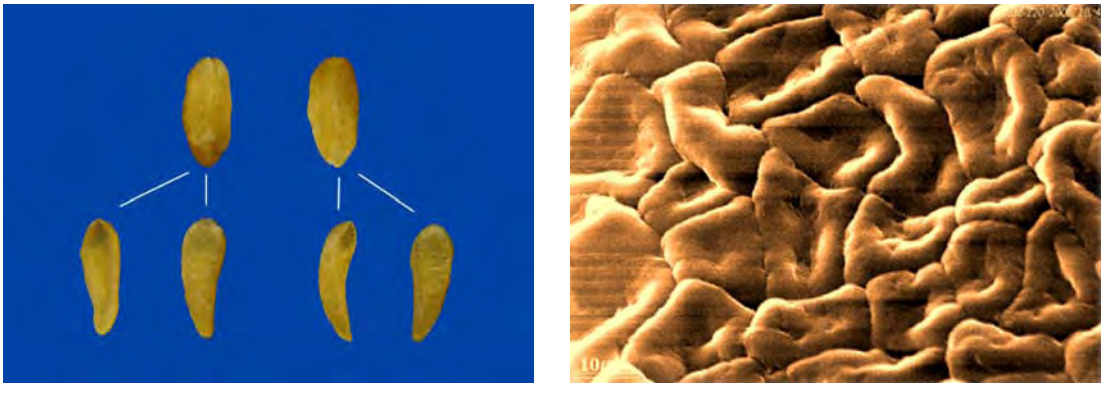
The two anther lobes, each having a yellow pollinium, are divided by a partition and the interior of the anther hood is also divided into two.

When a bee moves backward after sucking the honey on the flower, touching slightly the peak of anther hood with its back, it may take off the hood and pollinium bursts out.

The pollinium is divided into several pollen masses and whether they have the caudicle or not is the standard by which to define the orchids.

As for Kimilsungia, two pollinia that came out from two anther lobes get dry and each of them is divided into two so that there are four small pollen masses in all which have no caudicle.

The pollen mass is in chunk shape formed by coagulating scores of pollen tetrad. (Photo 27)



A B

Photo 27. Shape of pollinium and its surface structure
(A) pollinia burst out of anther and small pollen masses;
(B) surface structure of pollinium (scanning electron microscopic photo)

2) Pistil

Stigma is part of a depression slightly below the rostellum adjacent to anther, which is full of mucus.

It is white but gets pink as it goes outward. (Photo 28)

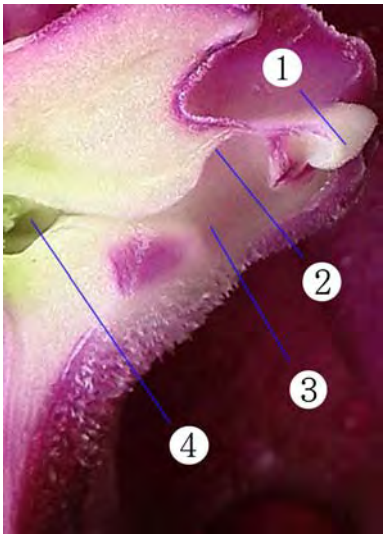
The mucus is formed before the blooming, that is, when bud gets flower colour, and fills the depression part of stigma.

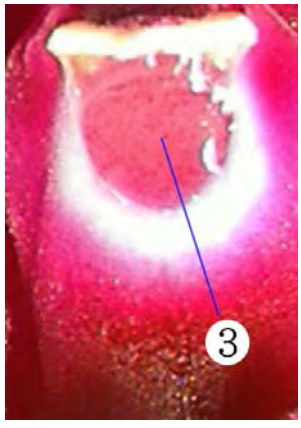
The pollinium is attached to the mucus when a bee with the pollinium on its back enters the narrow gap between labellum and column.

The mucus contains the nutriment necessary to swell the pollinium and sprout the pollen.

It consists of big oval mucus cells, which contain the starch, lipid and so on. It is the material of the mucus cells broken.

The ovary of Kimilsungia like other orchids grows 5–8 mm high in the receptacle at the eighth stage of bud differentiation prior to blooming.





A B

Photo 28. Vertical section of pistil (A) and stigma full of mucus (B)

1. rostellum; 2. stigma; 3. mucus; 4. ovary

At the time the young bud takes its full form while the petals and sepals get the flower colour with the growing thalamus.

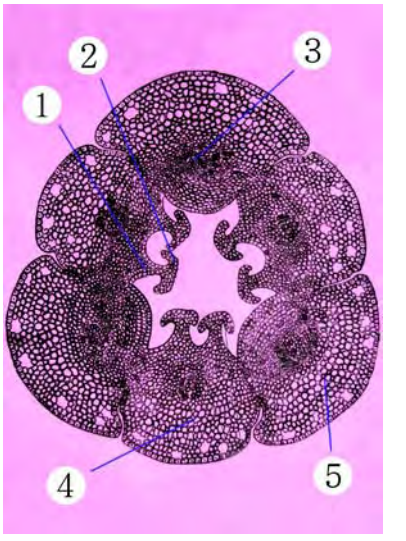
In the ovary, a cavity is formed first and then three real carpels to make the ovule and three false carpels (sterile carpel) incapable to do it are alternately arranged, resulting in a loculus composed of six carpels.

In the real carpel, the inner part is folded inward, producing the placenta at the tip prior to the formation of ovule.

That is, there arises the parietal marginal placenta. (Photo 29)

A

B



C

Photo 29. Shape of ovary
(A) surface of ovary;
(B) vertical section of ovary;
(C) transverse section of ovary
1. placenta; 2. ovule primordial cell;
3. vascular bundle; 4. real carpel;
5. false carpel

The primordial cell of ovule on the placenta is divided to make the ovule by the stimulation of a pollen tube when the pollination begins.

So the number of ovules on the placenta reaches hundreds of thousands per ovary.

(Photo 30) Seven to ten days after the pollination, the pollens germinate to grow into the pollen tubes, which enter the ovarian cavity, following the guiding tissue. In this course, generative cell in the pollen tube is divided into two sperms.

Photo 30. Formation of ovule on the placenta

At this time, the receptacle with the ovary swells, which reminds one of epigyny in which the ovary is under the other floral elements. This part alters its colour from soft pink to green.

4. Flower Formula and Diagram

As above-mentioned, Kimilsungia is an androgynous flower which has three petals, three sepals and a column, which is composed of a stamen and a stigma.

The ovary has a loculus with six carpels including three real ones and three false ones in alternate arrangement.

And the ovary is epigyny. On this basis, the flower formula can be written as follows:

$$\uparrow Ca_3\ Co_3\ [A_1G_1(\overline{6})]$$

Here ↑ means asymmetric flower, Ca the sepal, Co the petal, A the stamen, G the pistil and –, the mark above the number, epigynous flower. Meanwhile [ ] means the column, the integration of the stamen with the pistil. 6 on the side of mark of pistil shows that a loculus of ovary consists of six carpels.

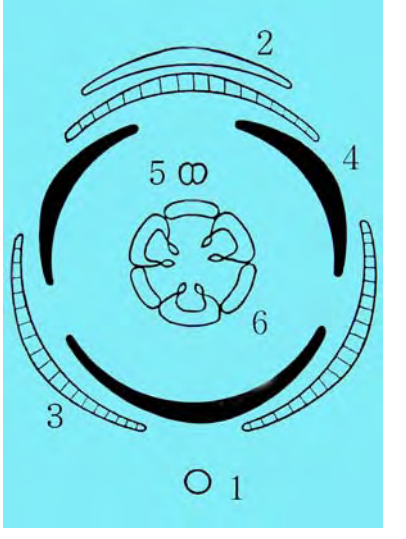


Figure 5. Flower diagram
1. peduncle; 2. floral bract; 3. sepal; 4. petal; 5. anther; 6. ovary

The flower diagram in Figure 5 gives the vertical view of the numbers of flower elements and their

arrangement.

As seen above, flower elements of Kimilsungia are arranged in good order.

Section 5. Fruit and Seed

1. Fruit

The fruit of Kimilsungia is dehiscent and clavate.

It is green ,with the surface striped with three long regular light green lines. (Photo 31)

The green part, the dominating part of fruit surface, is produced by the developing of the epidermis of real carpel, and the light soft green part, the minor part, by the developing of the epidermis of false carpel.

The tip of fruit bears the flower elements withered.

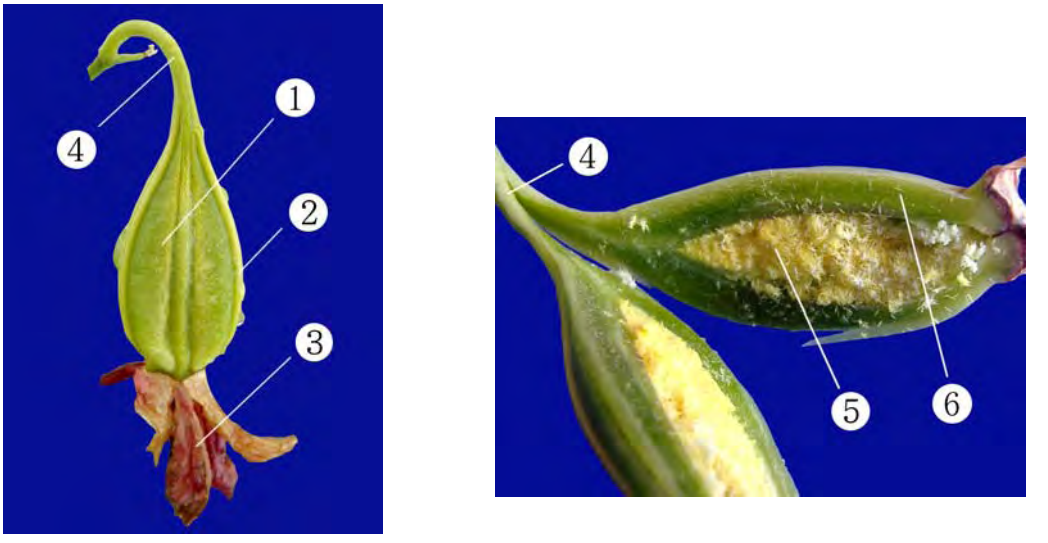


Photo 31. Shape and structure of fruit

1. pericarp developed from the epidermis of real carpel; 2. pericarp developed from the epidermis of false carpel; 3.dry petal; 4. fruit stalk; 5. seed; 6. pericarp

2. Seed

The seed of orchid is one of the smallest ones.

The same is true of the seed of Kimilsungia. Both tips are sharp and the middle is protruding, the length of which is 0.8–1.0 mm and the diameter in the middle is 0.25–0.3 mm. (Photo 32)

A B

Photo 32. Shape and structure of seed
(A) shape of seed; (B) structure of seed
1. husk of seed; 2. globular embryo

The seed is seen as a yellow chunk in a transparent white sac under the microscope. The sac is the fibrous seed hull. In the water it swells promptly forming the foramen like a net, laying bare the yellow chunk in the outer coat.

The chunk is an embryo, elliptical 0.35–0.40 mm long and 0.20–0.25 mm in diameter.

The seed gets so dry when it matures that it springs up rather than breaks or splinters when pressed by the edge of scalpel. The fruit contains quite a few seeds. There are more than 370 000 of them in a fruit and its gross weight is about 850 mg. A grain of seed weighs 2.33 μg approximately. So it can be blown far away by the wind. It has no albumen common to the other monocotyledons and the embryo is not differentiated.

Chapter 3
Growth of Kimilsungia

Kimilsungia has something in common with other orchids in seed germinating, forming the organs, blooming, forming of seed and fruit and period of growth, as well as some differences.

Section 1. Seed Germinating

The seed of Kimilsungia has no albumen, nutrition necessary for germinating, so it does not sprout in the ordinary soil unlike other plants.

In nature, the seed germination of orchids takes place in a unique way. Mycelia are in symbiosis with the root of orchid plant. The symbiont of the fungus and root is called mycorrhiza and the fungi (mycelioid fungi) mycorrhizal fungi.

When the seed falls around the mycorrhiza, the mycorrhizal fungus enters the seed. Then the seed begins to sprout, taking nutrient from the mycorrhizal fungus. Such seed germination by symbiosis with fungi is called the symbiotic germination.

It was not until the symbiotic germination was invented that the artificial method of seed sprouting was found. The year 1903 witnessed for the first time the successful seed germination of orchids in the culture medium of orchid stem homogenate. This is the aseptic sprouting which is done without the help of mycorrhizal fungus. In 1922, Knudson germinated the orchid seed successfully in the medium made of minerals, sugar, agar and water. In addition, the discovery of better mediums brought about a complete solution of reproduction problem by the orchid seed.

The seed of Kimilsungia, too, comes to sprout in the medium of a certain composition.

Section 2. Formation of Organs

1. Differentiation of Organs from the Seed

In fact, the seed germination of Kimilsungia, unlike that of other plants, takes place as the embryo development does because the seed is not differentiated into embryo and albumen like other orchids, but is a globular embryo.

The process of seed germination of Kimilsungia planted in the culture medium of Knudson (KC) is as follows:

The seed in the culture medium begins to swell by absorbing water after a week. At this time, the yellow globular embryo in the seed grows in the radial directions with cell division. About 20 days later, the seed coat splits and the globular embryo comes out. Since then, it gets green as the chlorophyll comes into being. The globular embryo, undertaken by the cell division, becomes like a small ball 1–1.5 mm in

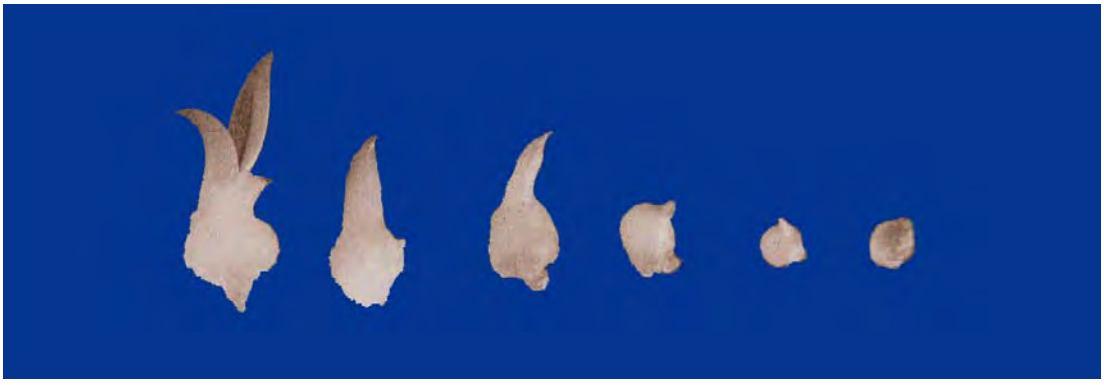


Photo 33. Formation of organs from protocorm

diameter. (first from right, Photo 33)

The ball-shaped tissue is called protocorm. Its formation is one of the main characteristics in the seed germination of orchids.

Sometimes scores of protocorm gather together to form a chunk 10 mm in

Photo 34. Shape of protocorm (left) and protocorm like body (right)

diameter. (left, Photo 34)

After a definite period, a growing point is formed on the tip of the protocorm.

It grows 3–4 mm within 30–40 days after the cultivation, and a foliar ridge is differentiated to come out around the growing point. Here also comes into being the chlorophyll. The foliar ridge plays the role of protecting the growing point. The stem is in differentiation under the growing point, and the node is differentiated there. (third from right, Photo 33)

Two months after the culturing, a coleoptile grows, from which the first leaf comes out 15 days later. (fourth and fifth from right, Photo 33)

Even in this period, the root does not form, and the nutrition is absorbed from the surface of the protocorm. On the lower part of protocorm, not tinged with green, many cells of root-hair shape (pseudo root hair) are differentiated, which absorb water and nutrition and support the protocorm. Since its cells have the chloroplasts, the protocorm proceeds with photosynthesis until the leaf is differentiated.

After the leaf appears, the protocorm continues to grow and a vascular bundle is formed under its growing point. At this stage, the protocorm is seen to have the functions of root, leaf and stem. So it is also called holocormus.

Three months after the culturing, the main leaves are two, and white thick root grows from the lower node of stem that is the opposite side of the leaf. This time the whole size of the plant is 7–10 mm. (first from left, Photo 33) In this way, there comes a full plant with root, stem and leaf.

2. Differentiation of Organ from Protocorm Like Body (PLB)

In general, a plant grows from a growing point inoculated like potato and grape, when the growing point on the stem apex is cultured. But in case of orchids like Kimilsungia, if the growing point on the stem apex (0.5–1.0 mm large) is cut and inoculated to the culture medium and cultured, it grows into a plant after 30–40 days, but the green round tissue masses appear in most inocula. The shape of this chunk is so similar to the protocorm formed in the sprouting of orchid that it is called a Protocorm Like Body (PLB). One or two PLBs come out first but increase day by day to be scores after 50–60 days, and occasionally there is a round chunk over 10 mm in diameter. (right, Photo 34)

The PLB is dark green in its early days. When it grows up 10–15 mm like a ball, it

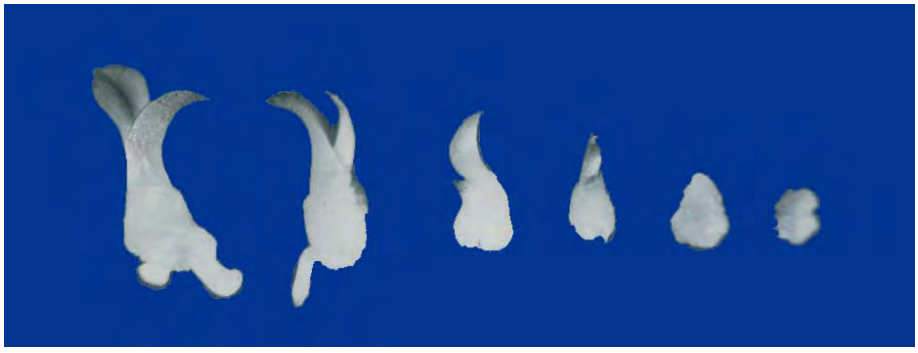


Photo 35. Formation of organs from PLB

does not grow more, forming 1–2 foliar ridge, deep green, on the upper part. (first from right, Photo 35)

At the lower part of foliar ridge, the growing points are already formed. PLB has its proliferation ability at this stage. That is, if a PLB separated from the PLB mass is planted in a new culture medium, new PLBs are formed from it, making a PLB mass again.

The subculture can be carried on with 30–40 days as a cycle. In this case, the proliferation multiple (multiplication constant) is 4–5. According to calculation, PLB

can be proliferated approximately as much as 2×10^8 in a year, but actually it is impossible because its multiplication decreases in speed and some of the PLBs get yellow as the subculture increases.

PLB should be put as it is in order to differentiate the organs from it.

40–50 days after inoculation in the medium for differentiation, the PLB grows a little and a coleoptile comes out of the foliar ridge (second and third from right, Photo 35), and the first leaf comes out 10–15 days later. (fourth from right, Photo 35) Continuously the second leaf appears, and 1–2 thick roots struck. (fifth and sixth from right, Photo 35)

Like this, the organ differentiation from PLB is much similar to that of protocorm. A difference is that PLB takes the root without forming the false root hair unlike protocorm, and its velocity is much faster in the organ differentiation and growth.

3. Formation of New Stem and Peduncle from the Lateral Bud

As seen above, Kimilsungia has well-developed lateral buds on the lower and upper parts of its stem, which are differentiated into the vegetative bud for sprout or reproduction bud for flower in a certain condition.

In Korea, in spring when the day gets long and room temperature goes up to over 15°C, the lateral bud sprouts from the lower part of the stem of the previous year. At this time, only the bud on the lower part sprouts, and the buds on the upper part are hardly out. If the stem from the lateral bud is injured to stop its growth or is cut, the other lateral bud in dormancy soon sprouts to form a stem.

This new stem that grows in spring from the lower part of the stem of the previous year ends its vegetative growth by the end of July. There are one terminal bud and two lateral buds above the last leaf of this stem.

The first lateral bud from the stem apex lies around the last leaf aside and the second one is on opposite side a little beneath it. The leaves on the nodes of these buds do not develop properly. That is why the two lateral buds are seen around the tip of stem above the last leaf. When the stem grows enough so as to form a peduncle, the

first lateral bud or terminal bud turns into a reproduction bud and forms a peduncle. In that case, as the peduncle grows, the terminal bud or the first lateral bud that does not turn into a reproduction bud is shoved aside atrophied.

When in good nutrition, one peduncle can come out from the first lateral bud or terminal bud and another one from the second lateral bud. Rarely, three peduncles happen to come out from two lateral buds and terminal bud.

A stem is formed when the lateral buds sprout on the lower part of the stem, and a peduncle when they sprout on the upper part of the stem even though they are the same lateral buds formed by the apical (growing point) meristem. This is related to the polarity of the plant.

The polarity, first of all, is closely related with the plant hormones. It proves that a peduncle sprouts when 6-BA (6-benzyl aminopyrine) lanolin ointment of a proper concentration is applied on the lateral buds of the upper part of old stem but the lateral bud is differentiated into a bud when applied with the 6-BA lanolin ointment of high concentration or put long in a place of high temperature and humidity (plant hormone can be changed in quality in plant itself). Experiment data show that the peduncle formation from the lateral bud on the upper part of the stem needs enough vegetative growth for the reproductive growth as well as a certain quantity of hormones like cytokinin stored.

Section 3. Development Period

In general, it is characteristic of sympodial orchid that a flower does not bloom if a bud of that year grows not to form the stem sufficient to make floral buds. Kimilsungia is a sympodial orchid, producing every year a new bud from the lateral bud on the lower part of the stem to form a new stem.

When the cultured seedlings are potted in greenhouse in spring, in a plant the stem does not grow but gets thick, and after one or two months a new bud comes out of the lower part of stem and forms the stem. This stem grows for two or three months and no

more. Around August and September, a new sprout comes out of its bottom and grows till late autumn to form a new stem.

That stem might grow bigger than its parent stem as it is provided with the nutrition of the latter, but it gets smaller than its parent stem when in the bad conditions such as the short length of day.

In some of the potted plants, a stem grows at first and stops its growth. In June or July, a new bud grows from its lower part. In this case, the new stem is bigger than those which formed new stems twice that year. These stems do not grow more and get dormant in late November when the temperature goes down.

In the beginning of March next year, a new bud grows from the bottom of the last stem of the previous year and forms a new stem. Around late July, this stem does not grow further but it is much bigger than that of the previous year. If it is big enough for the reproductive growth, then a peduncle grows at the tip of the stem in the beginning of August. Otherwise, a new bud grows from the bottom of the stem and forms a new stem. This stem is not bigger than its parent stem since it gets dormant in the end of November, too.

In the spring of the third year, a new thick bud comes out of the lower part of the last stem of the previous year and begins to grow fast. The nutrition stored in the parent stem is used in the growth of the new bud.

The new bud grows at first, forming lower leaves which are almost blade sheath without lamina totally depending on the nutrition supplied by the parent stem. That is, the new bud relies on heterotrophy at first.

When a new bud grows to form the middle leaf with stem and lamina, the stem is dependent on mixotrophy that uses the products of photosynthesis being supplied with the nutrition stored in the parent stem. When the middle leaves come out and the root grows in the nodes under the stem, the stem almost feeds on autotrophy and grows fast and its vegetative growth is over.

The floral bud is differentiated in the apex of the stem to form a peduncle in the beginning of August.

As the peduncle grows, floral primordia get differentiated and the flower begins to

bloom in late September or early October. The number of flowers is 5–8 in the first blooming year.

Like this, the plant of Kimilsungia can bloom in 2–3 years after the planting of the young seedling. But the blooming period can be delayed if the nutrition of the plant and the surrounding conditions are poor.

In general, from the middle of November the flowers begin to wither, started by the flower that had bloomed in the lower part of the peduncle. After the flower withered the plant gets dormant from December. In this period, only the peduncle gets dry, but the 6–7 leaves in the middle and upper part of the stem remain vivid and the root does not grow any more.

The original species of Kimilsungia are distributed in the range of 20° N lat. and S lat. and their development period is little affected by the length of day but is conditioned by the environment like temperature, humidity, etc. *D. taurinum* growing in the subtropical zone, one of the ancestor breeds, is in dormancy in winter of low temperature, but *D. phalaenopsis*, *D. bigibbum* and *D. superbiens*, in dry season as they grow in the monsoon area of the tropical zone. In other words, the original species of Kimilsungia are in forced dormancy according to the climate changes at their homes.

Like them, when cultivated in Korea located in the temperate zone, Kimilsungia also can be put into forced dormancy which seems to be much influenced by the shortening day length and the low temperature in autumn.

The dormancy goes on to the end of February of next spring. In the beginning of March, when the day gets longer and the temperature rises, the dormancy finishes, with a new bud growing from the lower part of the stem of the previous year, and a new vegetative growth begins. The stem loses almost its viability after 6–7 years.

So in Korea, the year-round growth of Kimilsungia is similar to other perennial plants in the temperate zone. But the difference is that every year the immature plant, whose stem does not grow enough to bloom, undergoes the vegetative growth and dormancy but the mature one with the stem grown enough to bloom undergoes the reproductive growth as well as the vegetative growth and dormancy.

Section 4. Blooming and Formation of Seed and Fruit

Generally, if a plant is to bloom, transition from the vegetative growth to reproductive growth is required and it begins with the formation of floral bud (reproductive bud). The formation of floral bud is the process of the forming of floral primordia like sepal, petal, stamen, and pistil at the growing point instead of leaf primordia. The formation of floral bud is also called the differentiation of floral bud. The process of completion of flower elements from the formed floral primordia is called the growth of floral bud. As the floral bud is differentiated and grows, the flower blooms.

1. Differentiation and Growth of Floral Bud

The differentiation and growth of floral bud of Kimilsungia begin with the formation of peduncle at the edge of the matured stem whose vegetative growth has finished. Floral primordia continue to be differentiated from this peduncle and form a raceme. So one peduncle gives rise to several floral primordia at different growing stages. The differentiation and growth of floral bud mean the stage of differentiation from the appearance of peduncle to the formation of the first floral primordium and also the process of completion of the flower elements (growth) from the first floral primordium. The floral primordium and the peduncle primordium are also called the floral bud.

1) Differentiation of floral bud and the stages of its growth

The stages of differentiation and growth of floral bud are mainly classified by the formation of flower elements. The differentiation and growth of floral bud of Kimilsungia are divided into nine steps—two steps until the differentiation of peduncles and seven steps until the formation of the first flower.

The main features of each step are as follows: (Photo 36)

First step (period of undifferentiation): In this period, the growing point on the terminal bud, which produces the leaf primordia at the edge of the matured stem, stops its growth and the growing point on the first lateral bud is covered with 4 or 5 scale leaves. It is not so easy to distinguish the forms of these two buds because their growing points are all small.

Photo 36. Course of forming flower elements (organs)

1. Floral bud in the period of undifferentiation (apex of leafless stem); 2. lateral bud in the period of formation of peduncle bud; 3. lateral bud dissected and enlarged in the period of formation of peduncle bud; 4. peduncle in the period of formation of floral primordium; 5. floral bud in the period of formation of sepal and petal; 6. floral bud in the period of formation of column; 7. column in the period of formation of anther; 8. column in the period of formation of stigma; 9. column in the early period of formation of pollinium 10. vertical section of column in the period of formation of pollinium; 11. column in the late period of formation of pollinium; 12. column in the period of blooming

In the case of old stem which formed the flower in the autumn of the previous year, the growing point of the second lateral bud is also covered with 4–5 scale leaves. If the old stem is in a good nutritious condition, it will have 1–2 more scale leaves, looking bulky around the bud.

Second step (period of formation of peduncle bud): The terminal bud at the edge of the mature stem or the first lateral bud and the second lateral bud (or third lateral bud) on the upper part of the old stem are differentiated into peduncle buds and begin to sprout. The scale leaves number 6–9 and the growing point swells and gets bigger. (Photo 36. 2 and 3) Many scale leaves are formed. Therefore, this stage is also called the period of the formation of scale leaf. If there is no environmental change when the peduncle begins to be formed, it will grow long specializing floral primordia. But if the appropriate environment is not provided, it may return to the state of the vegetative growth and grows into a stem.

Third step (period of formation of the floral primordium): The scale leaves differentiate into 8–10 and the peduncle grows up to 3–5 mm. (Figure 6) The primordia that are to be flowers differentiate inside the scale leaves of the lateral buds on the fifth or sixth and upper node. The floral primordia are symmetrically formed, one at each node. They are hemisphere-shaped just like growing points. (Photo 36. 4) The first floral primordium of the peduncle is formed 3–5 days after the formation of peduncle. The scale leaves are formed at the lateral buds at the edge of the peduncle and the primordia are differentiated inside them.

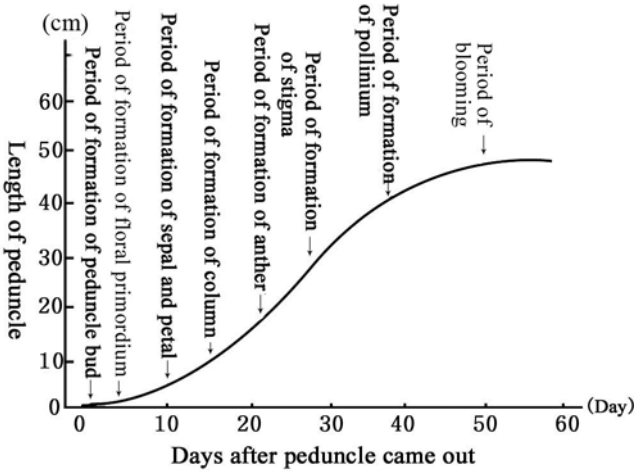


Figure 6. Relation between growing of peduncle and developing of floral bud

Fourth step (period of the formation of sepals and petals): The primordia of the sepals and petals differentiate from the floral primordia. First, the upper part of the

floral primordium becomes flat and broader, its central part is depressed and its ring-shaped edge is swollen. After three ridges which are to be sepals are formed, it is followed by the formation of three ridges which are to be the petals. (Photo 36. 5) At this time the three ridges, the primordia for petals, are formed at the inner side among the three ridges, the primordia for sepals. It takes place in 5–6 days when the length of the peduncle is less than one centimetre (one week after the peduncle starts to grow).

Fifth step (period of formation of column): A small disk-shaped structure which is to be a column is upheaved at the central part surrounded by three sepals and three petals. (Photo 36. 6) This process takes about a week and by this time the peduncle grows 3–4 cm. The full appearance of peduncle is clearly seen.

Sixth step (period of formation of the anther): Wrinkles are formed on the disk-shaped column in a vertical direction and the two-lobed anther is formed. (Photo 36. 7) The sepals and petals grow bigger and have the shape of flower bud, surrounding the column. The peduncle grows about 10 cm long.

Seventh step (period of formation of stigma): The stigma is formed. It is surrounded by two ridges supporting the anther and rostellum adjacent to the anther. (Photo 36. 8) The formation of the stigma takes about ten days, and in this period the peduncle grows two cm long every day and reaches the length of 20 cm.

Eighth step (period of formation of the pollinium): The pollinium is completed in shape and filled in the anther. The anther hood covers the anther and the stigma is filled up with mucus. (Photo 36. 9, 10 and 11) In this period the sepals and the petals are tinged with pigment, whose colour grows deeper. The pollen mass is formed as follows: First, every spore of tetraspore, which are formed by meiosis of the pollen parent cell, becomes pollen by mitosis. The pollen consists of the reproduction cell and vas cell. The tetraspore, in the long run, becomes tetra pollen. This matured pollen has the vas cell near the centre of tetra pollen and the reproductive cell far from it. It takes 30 hours from the meiosis of pollen parent cell to the completion of the matured pollen. Scores of tetra pollen gather together to form a small pollen mass. Last, the two small pollen masses are conglomerated to form a bigger pollen mass in each anther-lobe. The formation of pollen mass is an adaptive property for mass pollination. By

this time the hair-shaped ridges for ovule in future are formed in great numbers at the vertical section of the ovary (5–8 mm long), the bottom of receptacle where the petals and the sepals lie closely each other. (Photo 36. 10)

Ninth step (blooming period): In this period the petals in the flower bud rapidly grow up, and the three sepals combine into a flower bud and its joint part starts to burst out. By this time as the twisted ovary part starts to untwist, the flower bud rotates in 180° and the labellum lies downwards. The stigma, full of mucus, is swollen and the anther is completely covered with the anther hood and two dry support ridges fall down from the anther hood. By the slight touch, the anther hood is ready to be put off and the big pollen mass to be free from the anther-case. (Photo 36. 11 and 12)

The joint line of the three sepals that form the outer shape of the flower bud can easily burst out by the physical force made by the three petals growing rapidly inside. Thus the flower blooms.

2) Development of flowers in the peduncle

As the inflorescence of Kimilsungia is an indeterminate one in which the flowers bloom from the bottom of the peduncle, the flowers in different stages of development are to be arranged on one peduncle. The peduncle of Kimilsungia has over 30 nodes, and flowers usually bear at the nodes from the third to the sixth.

The number of nodes on the 1-cm-long peduncle is 5–6. Generally on the first or second node which was differentiated earlier are the floral buds which are in the formation stage of the floral primordia (third step) and in the formation stage of the sepals and petals (fourth step).

The number of nodes on a peduncle 2–5 cm long which are to bear flowers is 7–8.

The floral primordia of the first and second nodes are in the period of column formation (fifth step) and occasionally the anther is formed in the floral primordium of the first node. The floral primordia of the third and fourth nodes are at the stage of the formation of the sepals and petals.

If the peduncle grows 6–7 cm long, the floral primordia of the first and second

nodes will be at the stage of the formation of pollen, and since then a flower bud is apparently shaped. The floral primordia of the third and fourth nodes rapidly grow to get to the stage of the formation of the column or of the formation of the anther. Most of the floral primordia of the fifth and sixth nodes reach the stage of the formation of column. By this time the floral primordia of the ninth and tenth nodes differentiate.

When the length of peduncle reaches 10 cm, it grows 2 cm everyday and attains the length of more than 20 cm after ten days. By this time the floral primordia of the first and second nodes enter the stage of the formation of the stigma and the pedicels of the flower buds grow rapidly.

After about a month the peduncle grows up to 21–30 cm and bears 8–9 flower buds of full shape. The floral primordia continue to differentiate from the peduncles. The number of nodes of the peduncle on which the flowers can bear amounts to 15–16.

When the peduncle attains the length of 31–40 cm, the flower buds of the 1^{st}–5^{th} nodes get red-purple colour and the colour deepens gradually. The development of flower enters the stage of the formation of the pollen mass before blooming. When the peduncle grows more than 40 cm, the flower blooms from the big flower bud at the lowest bottom of the peduncle, rotating in a 180° arc. The peduncle continues to grow and the floral primordia differentiate.

Like this, the peduncle of Kimilsungia produces flowers in different stages at each node, and they go over to the higher stage of growth as the peduncle grows.

2. Effect of Environment on Blooming

1) Effect of day length and temperature on differentiation of floral buds

D. phalaenopsis is known relatively as a short-day plant whose specialization of the floral buds is done in the short-day condition and is delayed in the long-day condition. But there is a view considering its varieties as a plant disregarding the length of day because they bloom one after another if the stem is properly grown and the temperature goes up. Like this, the reactivity of floral bud differentiation to the

length of daytime according to temperature may differ from the original breed.

In the environment of Korea, Kimilsungia, like its main progenitor *D. phalaenopsis*, is a relative short-day plant. Such a character is clearly found when the mean temperature of day is in optimum but indistinctly in low temperature. In other words, Kimilsungia, which is high-temperature plant, shows the distinct reactivity to the day length within the range of optimum temperature for its growth. Under the low temperature condition, the temperature gives greater effect to the specialization of the floral buds than the day length. Under the condition of daily low mean temperature, a plant may grow ceaselessly until it reaches certain vegetative growth quantity or may stop its growth according to seasons. In this case, the specialization of the floral buds needs a long period. In the condition of the Korean climate, the period in which to adjust the blooming in consideration of the characteristics of reactivity of day length of Kimilsungia is 10–15 days.

2) Relation between the period of blooming and that of budding

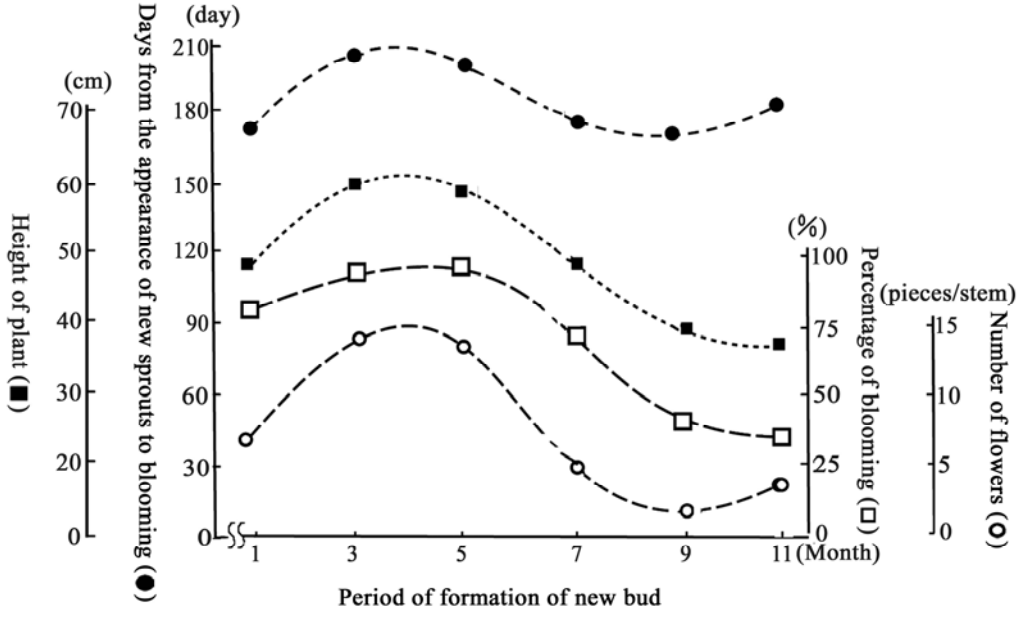


Figure 7. Height of the plant and characteristics of blooming according to the periods of coming out of new sprouts

It is possible to make Kimilsungia bloom all the year round in Korea where the length of day varies according to seasons, if the optimal temperature for its vegetative growth and the supplementary light are provided for greenhouse during autumn and winter.

Investigation into the vegetative growth and reproductive growth of new sprouts which came out in different periods was made by adjusting the temperature of greenhouse and applying 6-BA, the growth regulator.

The results are shown in Figure 7.

The plant whose sprouts come out in spring (March–April) grows bigger and bears more flowers than other plants whose sprouts come out in other seasons. At this time it attains the height of 60 cm and the flowers bloom on every peduncle. The number of the flowers on each peduncle is 14–15.

When the sprouts come out in summer (June–July), the vegetative growth takes place in autumn, so the plant is undergrown and the rate of blooming and the number of flowers per peduncle decrease by 50–60%, compared with the plant whose sprouts come out in spring.

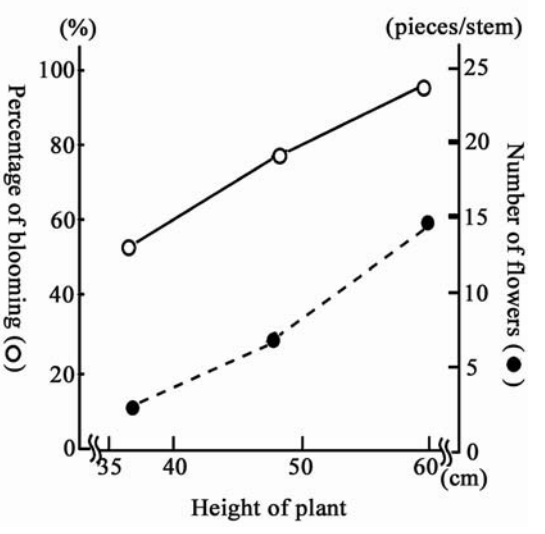


Figure 8. Relation between the height of the plant and blooming rate and number of flowers

When the sprouts come out in September-October, the stem grows by half and the stems which can bear flower are limited to 20–30%, compared with the plant whose sprouts come out in spring, and the number of flowers per peduncle is only two or three.

The Figure 8 shows that the blooming rate and the number of flowers per peduncle increase as the plant grows taller.

When the height of the plant is about 60 cm, the plant blooms and the number of flowers per peduncle increases.

3) Effect of temperature on the development of floral bud

Temperature has great effect on the development of the floral buds. Experiments on the development of floral bud according to the cultivation days were conducted in different temperatures. (Figure 9)

When the daily mean temperature is 24°C, the transition from the fourth stage (the period of the formation of sepal and petal) to the fifth stage (the period of column formation) of the development of the floral bud takes 5 days, but 10 days at 21°C, 20 days at 18°C. So in the condition of 24°C the development of the floral bud goes through five stages (from the fourth to eighth) during 25 days, but at 21°C only three stages, and at 18°C only one stage. And at 15°C the development of the floral bud is very slow, the peduncle getting green and at 12°C it completely stops, the peduncle getting red-maroon. Experiments show that the available daily mean temperature for the plant is over 15.8°C and the normal development of flower elements requires the temperature of over 21°C. If the temperature of 18°C, which is almost close to the lowest temperature for the growth of floral bud, lasts for 30 days, the development of peduncle and the specialization of the floral bud will be considerably restrained. But before the formation of floral bud the part of growing point is very safe in low temperature (16–21°C). So if one is to delay the blooming by providing low temperature, it should be done in the stage before the formation of floral bud.

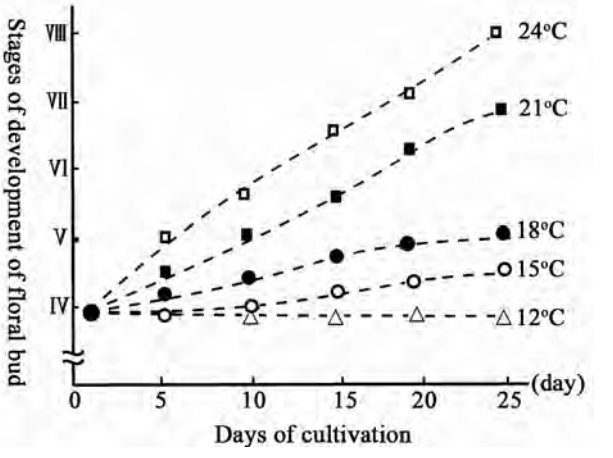


Figure 9. Effect of daily mean temperature and cultivation days on the development of floral bud of the plant in the stage of reproductive growth.

4) Effect of light on blooming

As for the greenhouse cultivation conditions in Korea from October to early December, the daily sunshine duration is short and its intensity is weak. So in this period the development of floral bud of Kimilsungia may greatly be affected by the deficiency of photosynthetic products. For example, if the interior of the greenhouse is exposed to the sunshine of 80% of total amount by a sunshade right before the first flower blooms, two or three floral buds around the apex of the peduncle will be underdeveloped, which will result in the decrease in the number of flowers and slowness in the speed of blooming. So it takes about two days for the flowers to bloom under the full sunshine, whereas in this sunshade condition it takes more than three days. The duration of flower shortens by 10–15 days and thus the flowers which had bloomed earlier begin to wither before all the flowers differentiated in one inflorescence bloom. Under the full sunshine condition, the duration of flowers of 50% in one inflorescence is 50 days, but under the above-mentioned sunshade conditions, it is only about 30 days. This shows that under the sunshine conditions of autumn and early winter in Korea sufficient light is needed for the proper differentiation of floral bud and the blooming.

3. Bearing of Seed and Fruit

The ovule of Kimilsungia is formed 20 days after pollination, when a cell shoots out of the lower layer of the epicarp of the placenta to form an ovular boss, which grows upright at first and bends 40 days after pollination. One cell on its top develops into a nucellus initial cell. After 50 days, the nucellus tissue develops and begins to be enclosed by the inner and outer integuments. As a result, an ovule forms and grows downward bending in the angle of 180^{o} to the direction of the ovular boss. The chalaza is on the top of ovule and the micropyle is at the bottom. Thus an anatropous ovule is formed over the placenta 58–60 days after pollination.

With the completion of the ovule formation, the interior differentiation begins. A female initial cell is differentiated in the integument under the nucellus on the top of ovule. The female initial cell has a larger nucleus and richer protoplasm than other cells. The cell itself becomes a megaspore mother cell. This cell undergoes meiotic

divisions to form an axial row of tetraspores, and among them three is degenerated while one of them grows to be a megaspore. This megaspore develops into an embryo sac megagametophyte which consists of one ovum, two synergids, a central cell with two polar nuclei and three antipodal cells by thrice mitosis in the nucellus tissue.

Fertilization begins 60–65 days after pollination. At this stage the pollen tubes which were formed through the germination of pollen come near the ovule through the placenta system passing through the ovary wall, and infiltrate into the micropyle immediately after the formation of ovule is finished. Two sperms in the pollen tube enter the embryo sac for fertilization. One sperm combines with an ovum to form a zygote and the other sperm combines with a central cell. The zygote has formal polarity. The nucleus is big and is formed at the top of zygote. The zygote is round at first, but soon changes into the shape of cocoon.

This zygote goes through the stage of maturity, remaining not fragmented for approximately 10 days. In this period some changes take place in the embryo sac. The synergrid and the antipodal cells gradually become extinct. The change in the fertilized central cell is quite obvious in this stage. The fertilized central cell is destroyed after several divisions or without any division. In this way the central cell becomes totally extinct at the early period when the development of an embryo begins. Thus, the albumen is not formed in the seed of Kimilsungia.

The ovule turns yellow as the chloroplast in protoplasm of embryo sac changes into chromoplast. The embryo sac expands to a certain degree and the round ovule grows upward and downward, gradually forming the shape of seed. (Photo 37) This is because the outer integument grows long upward and downward. Lignin begins to be deposited in the cell wall of the outer integument.

Photo 37. Seed-shaped ovule after fertilization

The zygote starts to form the early embryo 75–90 days after pollination. The

zygote is split into two cells by mitosis. One of them which is near the micropyle is fragmented crosswise, so there appear three cells in all. One cell near the micropyle might be divided crosswise once again. In this way three–four cells will be arranged in a line to form the proembryo. Out of them, one cell, which is at the farthest place from the micropyle, begins to be divided lengthwise. The group of cells which has been formed in this way gradually develops into the globular embryo, filling the embryo sac. Two–three proembryonic cells which are near the micropyle form a funiculus. One of them which is at the nearest place from the micropyle develops into a sucking cell with a big nucleus. This sucking cell is directly connected to an ovule which provides the globular embryo with the nutrients. 120 days after pollination, the development of embryo is finished but the globular embryo is not disintegrated into a coleoptile, an epicotyl, a hypocotyl, a radicle, etc.

At the last stage of embryo development, the inner integument and nucellus tissue are absorbed by the embryo, which is enclosed by yellow periderm 2–3 μm thick. This yellow colour is made by the carotinoid pigment as the chloroplast, which is in the protoplasm of embryo sac, changes into the chromoplast. The contents in the cells forming the outer integument are all absorbed by the embryo and the lignin is stored in the cell wall to become a net-like seed coat. The seed coat consists of one or two layers of transparent cells with lignin, so it is easy to observe the globular embryo through the microscope.

An ovary of Kimilsungia develops into a fruit. The ovary consists of three real carpels and three false carpels before fertilization. After fertilization, the real carpel with the parietal placenta grows rapidly. This is because the plant hormone like auxin, which is stimulus, is produced in plenty to accelerate the development as the seed is formed on the parietal placenta.

The epicarp of real carpel develops into green pericarp, while the epicarp of false carpel develops into light green pericarp. The part of flower receptacle with crumples before fertilization develops into a fruit and the part with no crumples becomes a fruit receptacle. After 180 days from pollination, the fruit gradually turns into a yellow and dry one, and the chalaza of true carpel and false carpel bursts out liberating the seeds.

Chapter 4
Features of Photosynthesis of Kimilsungia and Its Light Requirement

Kimilsungia, which is an epiphytic orchid, is a CAM (Crassulacean Acid Metabolism) plant like most kinds of tropical epiphytic orchids. Therefore, it has requirement for light, suitable for it.

Section 1. Daily Change in the Rate of Absorption of CO_2 by the Leaf, Content of Organic Acid and Resistance of Stoma

The rate of absorption of CO_2 by the leaf of Kimilsungia, its content of organic acid and the resistance of stoma change periodically everyday like other kinds of CAM plant. (Figure 10) During the night the leaf absorbs CO_2 dynamically. The absorption of CO_2 starts from 6 p.m., reaches its maximum rate at 3 a.m. and then begins to fall. When the atmospheric temperature falls down suddenly with the sunset, the resistance of stoma falls down and attains nearly the zero state during the period from the night to 9 a.m. next day. In other words, the stomata are opened. The content of organic acid of the leaf begins to increase as the absorption of CO_2 begins to proceed and reaches the maximum amount at 9 a.m. When the sun shines in the morning, the situation differs. In other words, the resistance of stoma increases (the stomata are closed), the absorption rate of CO_2 falls, and the content of organic acid reduces. The resistance of stoma reaches maximum from noon to 6 p.m. and the exchange of air is not made at all. However, during daytime the content of organic acid is rapidly reduced as the CO_2

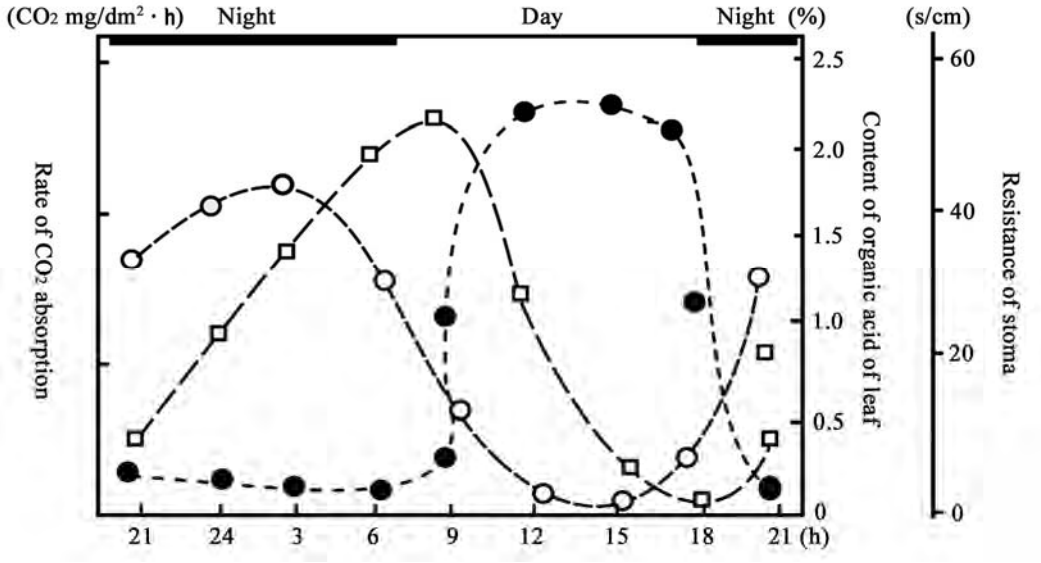


Figure 10. Daily change in the rate of absorption of CO_2 by the leaf (○), the resistance of stoma (●) and the content of organic acid(□)

which is produced by the dissolution of organic acid is used in photosynthesis. Therefore 40% of the accumulated organic acid is used by noon, more than 90% by 3 p.m. and most of it by 6 p.m. Towards sunset, the process adverse to the morning is progressed.

These changes in the physiological action show that Kimilsungia is a typical CAM plant. Kimilsungia has a very low rate of photosynthesis similar to other kinds of CAM plant. Kimilsungia's absorption rate of CO_2 is 2 mg per $dm^2 \cdot$ hour, i.e. one tenth of C_3 plant or C_4 plant. This shows that Kimilsungia is a very slowly growing plant.

As a perennial plant, Kimilsungia grows to a certain degree forming stems every year and forms the peduncle to bloom only after it accumulates nutrients in several stems. This is related to its leaves' low rate of photosynthesis.

Section 2. Relation between the Content of Organic Acid in the Leaf and the Internal and External Factors

The rate of photosynthesis of C_3 plant or C_4 plant is estimated by the amount of

CO_2 which a certain area of leaf absorbs or lets out per unit time.

However, since the carbon metabolism of CAM plant is conducted differently at night and in the daytime, it is not proper to estimate only absorption rate of CO_2 at night. That is because all the organic acid which has been accumulated during the night will be disintegrated and cannot be used in synthesizing organic substance like sugar when the next day is cloudy or low in temperature. The amount of CO_2 absorbed during the night is expressed as the amount of accumulated organic acid, whereas its utility degree during the daytime is indicated as the consumption rate of organic acid. Therefore, the effects of environmental factors on the carbon metabolism of Kimilsungia can be estimated by the change in the content of organic acid.

1. Position of Leaf and Accumulation of Organic Acid

The amount of accumulated organic acid of the leaves differs even in one plant according to their positions. The data obtained at 9 a.m. show that the second leaf from the top of the mature stem accumulates the largest amount of organic acid. The young leaf above it or the third or fourth more matured leaf accumulates less amount than the second leaf. And the leaf on the old stem and the young leaf on the new stem have also much less amount of organic acid. Hence, the most active leaf is the second leaf from the top of mature stem.

2. Night Temperature and Accumulation of Organic Acid

The process of absorbing CO_2 and accumulating it in the state of organic acid during night is largely influenced by temperature. (Figure 11)

The content of organic acid of leaf reaches maximum at 23°C at night and

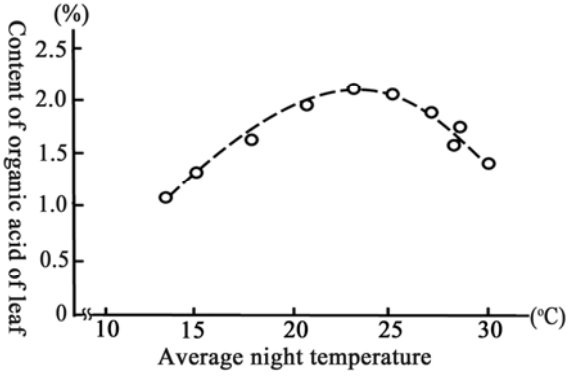


Figure 11. Effect of night temperature on the content of organic acid of leaf (measured at the second leaf from the top of mature stem)

it reduces at lower or higher temperature than it. Therefore, 23°C is the most suitable temperature to absorb CO_2 and convert it to organic acid at night.

3. Length of Night and Accumulation of Organic Acid

Investigation into the content of organic acid of the leaf at various lengths of night was made using the artificial lighting and sun blind. (Figure 12) The content of organic acid of leaf is maximum when the length of night is 12 hours. When the lengths of night are six and three hours, it is 25% and 40% less than that in 12 hours, respectively. It does not increase even if the length of night is extended over a period of more than 12 hours. This shows that the length of night of 12 hours is most suitable for accumulating organic acid in growing Kimilsungia.

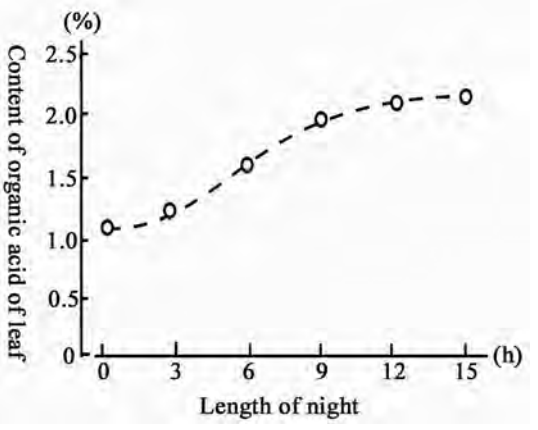


Figure 12. Effect of the length of night on accumulating organic acid of leaf
(when average night temperature is 22°C)

4. Light Intensity and Consumption Rate of Organic Acid

Light intensity has a great influence on the consumption rate of organic acid by the leaf. When it is low, the organic acid accumulated in the leaf is not all used in photosynthesis. For example, its 50% and 70% are consumed respectively when the light intensity is 3 000 and 5 000 lx respectively. The higher

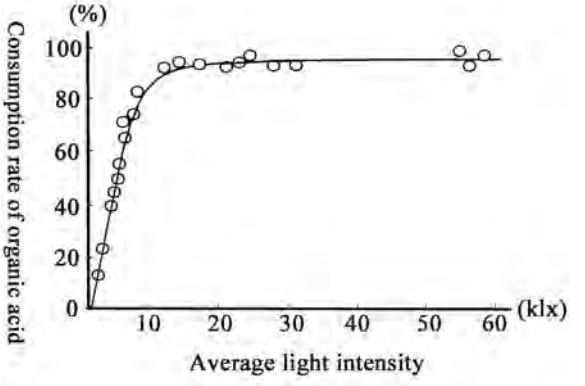


Figure 13. Effect of light intensity on the consumption rate of organic acid by the leaf

the light intensity, the higher the consumption rate of organic acid . In other words, in 15 000–20 000 lx, most of the organic acid accumulated in the leaf (about 95%) is used for photosynthesis. The consumption rate of organic acid is the same even in higher light intensity. (Figure 13)

These data show that the light intensity for maximum photosynthesis of Kimilsungia is 15 000–20 000 lx. This illuminance is much lower than the light saturation point of C_4 plant (more than 100 000 lx) or that of C_3 plant (30 000 or 50 000 lx). It is almost equal to the light saturation point of shade plant (10 000 lx). Therefore, Kimilsungia does not require strong light and can grow even in shade.

5. Day Temperature and Consumption Rate of Organic Acid

Temperature has a great influence on the consumption rate of organic acid by the leaf. (Figure 14)

More than 95% of the accumulated organic acid in the leaf is dissolved at the average day temperature of 28°C–30°C and its consumption rate falls at a higher or lower temperature than it. The consumption rate of organic acid is 95% at the average day temperature of 25°C, 65% at 20°C, and 35% at 15°C. The appropriate day temperature for the disintegration of organic acid and photosynthesis is 28–30°C under the condition of sufficient light. After all, the maximum photosynthesis of Kimilsungia requires the light intensity of 15 000–20 000 lx during the day, average day temperature of 28–30° C, night temperature of 23°C and length of night of 12 hours.

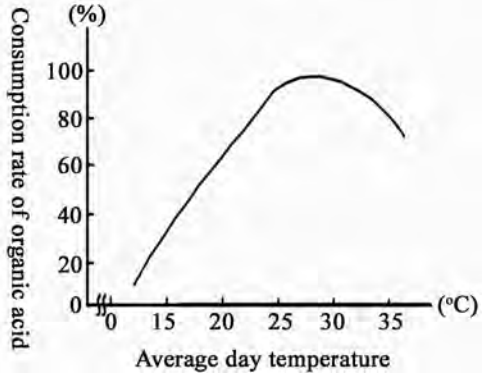


Figure 14. Effect of average day temperature on the consumption rate of organic acid (when the light intensity is 40 000 lx)

Photosynthesis in Kimilsungia is also hindered by the atmospheric humidity, the concentration of CO_2 in the air and the supply of inorganic nutrition. For example,

the strong resistance to drought does not mean that low humidity may be permitted. When the temperature falls and the humidity rises up to 60–70% at the sunset, the stomata of the leaf are opened to absorb CO_2, but under the condition of low humidity the stomata do not work well.

Section 3. Relation between the Formation of Shape and the Light Intensity

Most plants belonging to the *Dendrobium* genus have come to have ability to photosynthesize enough in a very weak light, growing in shade of the branches of tree for a long time. When gradually adapted to the strong light, they grow well even under the direct sunlight. Kimilsungia can also be adapted to the various light intensity.

1. Shapes of Stem and Leaf According to the Intensity of Sunlight

Light intensity has a great influence on the formation of the shape of plant. The stronger the light the stem is exposed to, the shorter and thicker it grows. That is, the plant stores more water and looks healthy. And the length of leaf shortens, compared with its width and its thickness widens. At this time the maximum area of the leaf and the non-leaf area per plant (the area of leaf per unit fresh weight) are reduced. In other words, the leaf can have thick fleshy tissue. Such fleshiness in the stems and the leaves of Kimilsungia is an important adaptive property of CAM plant to survive the long spell of drought and strong light while photosynthesizing.

2. Content of Pigment in the Leaf and Its Structural Change According to the Intensity of Sunlight

The content of photosynthesizing pigments and the density of stomata vary in the leaves, whose degree of fleshiness changes according to the intensity of sunlight.

The weak light reduces the total content of chlorophyll per unit area of leaf and, on the contrary, increases it per unit fresh weight. The total content of chlorophyll per unit dry weight is nearly independent of the light intensity. Therefore, the total content of chlorophyll per unit area of the leaf or per unit fresh weight according to the light intensity is related to the thickness of leaf. There is no change in the composition of chlorophyll (ratio of the content of chlorophyll a to that of chlorophyll b) according to the light intensity. As the leaf is exposed to intense light, the content of carotinoid, the auxiliary pigment of photosynthesis, increases and the density of stomata becomes higher. This is the adaptive character of leaf to prevent its temperature from going up through active transpiration. It explains the fact that the stronger light makes the leaf become thicker, reducing its area and storing a lot of water.

Like this, Kimilsungia adapts itself, changing the structural and physiological characters of its stems and leaves in accordance with the various conditions of light. This shows that Kimilsungia has both the adaptive property of CAM plant which grows in high temperature and on the dry land and the character of *Dendrobium* plants which are adapted to the shade.

3. Number of Flowers Forming According to the Intensity of Sunlight

The intensity of sunlight has a great influence on the number of flowers bearing on the peduncle. Although the plant exposed to strong light during the period of vegetative growth can have thick peduncle on the healthy-looking stem, the peduncle fails to grow long and the number of flowers it bears is also small. However, if weaker light than this is given, the peduncle will grow long and the number of flowers increases, but if it weakens to a definite limit, the number of flowers will decrease again.

This is because excessively strong or weak light given to Kimilsungia brings about a considerable reduction of the accumulation of carbohydrate out of some nutritive substances needed by the reproductive growth of plant.

Therefore, in order to increase the number of flowers of Kimilsungia, it is advisable to provide the light of 10 000–20 000 lx rather than strong light.

Chapter 5
Temperature Requirement of Kimilsungia

This chapter describes the temperature requirement of Kimilsungia according to the growing periods, day and night and seasons and its resistance to unfavorable temperature.

Section 1. Temperature Requirement by the Stages of Development

A new sprout of Kimilsungia which comes out in spring can develop into a bloom after a certain period of vegetative growth. The relations between the growth velocity of sprout and the average daily temperature in the vegetative growth are shown in Figure 15.

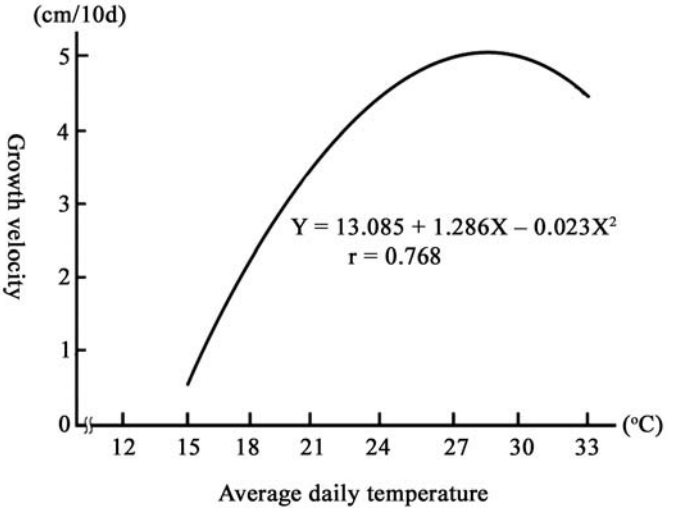


Figure 15. Relations between the average daily temperature and the development velocity of sprout

The new sprout grows only one centimetre for 10 days at the average daily temperature of 15°C, but it grows faster as the temperature goes up.

The growth velocity is the fastest at the average daily temperature of 26–28°C, but a higher temperature than this restrains the growth velocity. This shows that the

minimum average daily temperature is 15°C, while the optimum is 26–28°C during the period of vegetative growth. In this way, the period of vegetative growth varies according to the average daily temperature. When the average daily temperature is low, the period of vegetative growth is about 153 days; when it is high, about 105 days.

The period of vegetative growth differs considerably according to the average daily temperature, but the plants are quite alike in the height, length of stem and number of leaves after vegetative growth. The accumulated temperature during the period of vegetative growth (more than 0°C) varies greatly according to the temperature.

The lower the average daily temperature within the range of temperature available to grow, the longer the period of vegetative growth and the higher the accumulated temperature as the amount of temperature ineffective to vegetative growth increases. However, the effective accumulated temperature of more than 15°C out of accumulated temperature is about 1 300°C, similar in any case. The minimum average daily temperature of Kimilsungia in the reproductive growth period is 15.8°C, which is 0.8°C higher than that in the period of vegetative growth. This is because the resistance of reproductive organ to low temperature is weaker than that of vegetative organ. Kimilsungia requires about 455°C of effective accumulated temperature of more than 15.8°C from the formation of peduncle bud to the opening of the first flower.

Flowers and Mankind

If the history of the earth is supposed to cover a day, that is, 24 hours, the time of the birth of mankind is 23 hours and 59 minutes, that is, just one minute to 24 hours.

Since then more than two million years equal to one minute have passed, and the flowers had already existed on the earth in those days.

Along with the birth of ancient culture, several thousand years have elapsed again.

In this period humankind made efforts to obtain more beautiful flowers, with the result that the breeding technique such as the cross grafting has been invented and widely used. With the rapid progress of some realms of life sciences including genetics and cytology, modern breeding and culture techniques have been invented and introduced. Consequently, many species of beautiful flowers have been bred and disseminated, providing mankind with more beautiful and emotional life.

Section 2. Thermoperiodicity

Thermoperiodicity is divided into two—daily thermoperiodicity and yearly one.

Daily thermoperiodicity is the character by which a plant grows more rapidly in the periodically changing conditions of temperature in the daytime and at night, i.e. in the condition of lower temperature of night than that of daytime. The tropical plants have temperature difference of 3–7°C between day and night.

The maximum photosynthesis in Kimilsungia needs 28–30°C during the daytime and 23°C at night.

In this case, the difference of temperature between day and night is 5–7°C, not so big. This is indicative of the ecological conditions of the tropical zone where the original species of Kimilsungia are growing, i.e., the temperature difference between day and night is no more than 4–8°C throughout a year. Provided that the night temperature is 23°C and day temperature 28–30°C, the average daily temperature is 26 –28°C, which is the same with the optimal average daily temperature in the period of vegetative growth.

The yearly thermoperiodicity is not found in Kimilsungia, which has not been matured so as to bloom.

In Korea, situated in the temperate zone, Kimilsungia can be cultivated only in the greenhouse because it is a tropical plant.

Therefore, its yearly thermoperiodicity can vary according to the grower's intention of cultivation.

Section 3. Resistance to Unfavorable Temperature

Kimilsungia, originated from the original species in the tropics, is weak in resistance to low temperature and strong in resistance to high temperature.

1. Resistance to Low Temperature

The damage from low temperature above 0°C is called cold damage, and the damage from low temperature below 0°C, frost damage. Even if the temperature is more than 0°C, Kimilsungia is inflicted by the cold damage at low temperature.

Depending on the low temperature and its duration, the cold damage is manifested differently. When the temperature temporarily falls down to 13–15°C, the plant of Kimilsungia slows down its metabolic activities including photosynthesis, but does not suffer from damage; at the temperature below it, the plant suffers from the cold damage. When the temperature falls down to 7–10°C, the plant apparently does not suffer from damage, but it is inflicted by physiological damage. If the low temperature of 13–15°C lasts long, chlorophyll is destroyed, and leaves turn yellow and easily fall off from the stem at a slight touch. In serious cases, all the leaves fall off and only yellow stem remains. Resistance to low temperature varies according to the tissues. The lateral bud in dormancy has comparatively strong resistance to temperature. So the lateral buds sleeping in the low part of the stem whose leaves fell off due to the cold damage can develop in spring next year if the temperature is properly controlled.

Kimilsungia is frostbitten at the temperature below zero, maintaining the green colour. When the plant frozen in such a short time is put in greenhouse after gradually melting it, its leaves fall off and only its stem remains like the one inflicted by the cold damage. If the freezing damage is not serious, the new bud can come out from the low part of the stem and grow in spring next year.

2. Resistance to High Temperature

In cultivating Kimilsungia, it is good to shade 50–70% of the sunlight. And only when it is gradually trained under the direct sunlight, can its leaves and stem get fleshy and have heat resistance.

If the temperature goes up to 35–40°C owing to a clumsy control of the temperature

in greenhouse, the plant does not grow properly because of the metabolic lesion. By the effect of high temperature, the moves of protoplasm of cells are stopped, photosynthesis and the combination of RNA and protein restrained, and hydrolysis of protein accelerated. The most striking symptom of the damage by high temperature is found in the burning of leaves. (Photo 38) As mentioned above, the transpiration from the surface of the leaves almost stops because the stomata of the plant are closed during the daytime. If the plant is exposed to the sunlight, the temperature of the leaf may go up 10–15° C higher than the surrounding temperature. At this time, if the sunlight filters through a ventilation window or the crack of broken glass in an ill-ventilated greenhouse, the temperature of the leaf lying vertical to the sunlight can go up to 50°C or even up to 60°C. Then the leaf region is burnt in a moment. The chlorophyll of the damaged leaf is destroyed and protoplasm transformed; as a result, the leaf turns white and then black after several days.

Photo 38. Leaves burnt by the direct sunlight

Such damage may happen not only in summer but also before shading the greenhouse from the sun in spring or after removing the sunshade in autumn. Also it may occur in the leaves exposed directly to the sunlight when the plant is cultivated in the open air in summer. Once the tissues of leaves are burnt by the sunlight, they cannot be recovered and they remain burnt during the whole time, hanging on the stem.

To avoid the damage by high temperature, it is necessary to shade the greenhouse from the sun and to ventilate it properly so as to ensure that the maximum temperature does not exceed 32–35°C. When the blind makes shadow, the temperature of the leaf can be 7–13°C lower than when exposed to the direct sunlight and proper air-conditioning can lower it by 10–13°C.

Chapter 6
Requirement of Kimilsungia for Nutritive Elements

This chapter outlines the optimum salt concentration of culture solution, the nutritive elements whose lack is able to bring about the most serious symptoms, the quantity of the nutritive elements which are naturally supplied by water and culture medium and absorptive characteristics of nitrogen, phosphorus and potassium according to the period of growth.

Section 1. Optimum Salt Concentration

A one-year-old seedling was cultivated for eight months, supplying the Knudson solution of different concentration and using gravel as the material of culture medium to attach the root. The result showed that the development of the plant is optimal when the total salt concentration was 0.1–0.2%. The growth index was three times the contrast (the total salt concentration: 0%). (Figure 16) When the total salt concentration is lower than 0.1% or higher than 0.2%, both the height and growth indexes of the plant decrease. When it is 0.4%, the root rots, the leaves fall off and the bud comes out from the upper

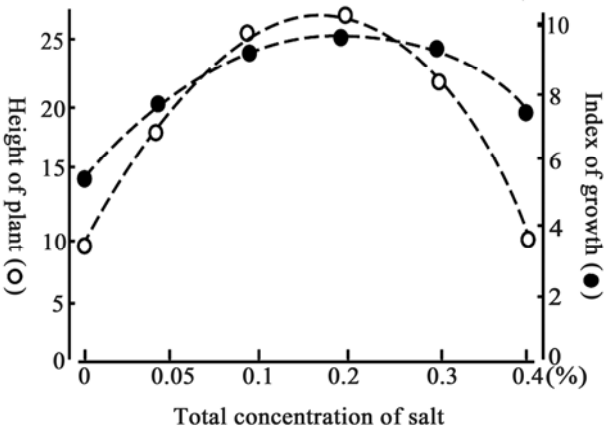


Figure 16. Effect of the total salt concentration of culture solution on the growth of one-year-old seedling
growth index = (height after cultivation – height at the time of starting cultivation) / height at the time of starting cultivation

node of stem. So the optimum salt concentration of nutrient solution is 0.1–0.2% in cultivating Kimilsungia. But in consideration of the economic benefit and a possible damage by the nutrient solution of high concentration, it would be good to make the optimum salt concentration be 0.1% (half the concentration of Knudson nutrient solution).

Section 2. Effect of the Individual Nutritive Elements on the Growth and Development

1. Nutritive Elements Whose Lack Brings About the Most Serious Symptoms

In Kimilsungia, every year the new bud comes out from the lower part of the old stem and develops into a new stem. The stem absorbs not only nutrient elements supplied from outside, but also from the old stem. Thus it is not so easy to find out symptoms of the shortage of relevant nutrient elements even if the plant is provided with nutrient solution devoid of individual nutritive elements. Experiments on the culture were conducted for two years without supplying individual nutritive elements. The result showed that the growing state and the number of flowers of the stem made by the new buds coming out

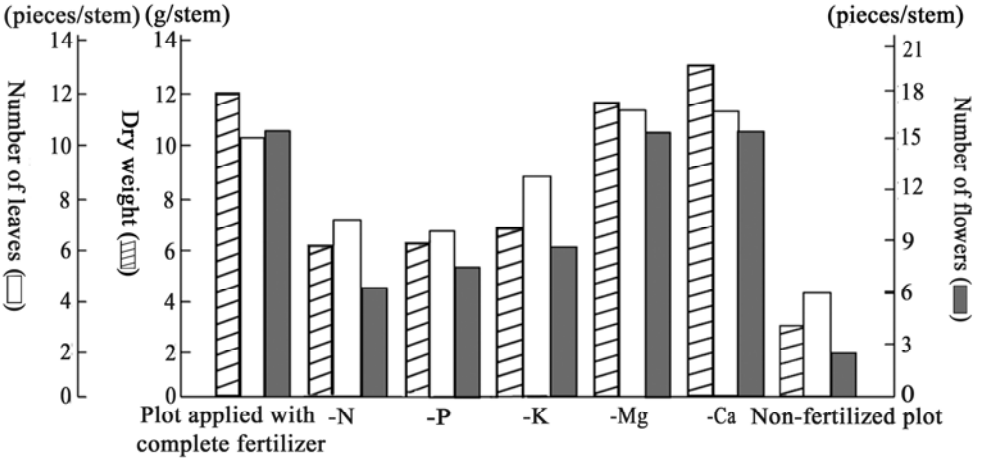


Figure 17. Growing state and number of flowers of the stem formed in the second year when the individual nutritive elements were not supplied for two years

from the stem, which grew up under the condition of shortage of nutritive elements last year, differed considerably according to the kinds of nutritive elements. (Figure 17) As seen in Figure 17, all the growth indexes of the experimental plots not provided with nitrogen (N), phosphorus (P) and potassium (K) are remarkably lower than the plot provided with all kinds of nutritive elements (complete nutrient plot). The dry weight of the plant in the –N plot is the smallest, being 50% of that of the complete nutrient plot and the next is –P plot and then –K plot. The number of the leaves also is small in –N plot and –P plot. This is related to the fact that the lower leaves, which came out earlier, dry up as the upper ones take nitrogen and phosphorus from lower ones. If anything among nitrogen, phosphorus and potassium is deficient, the number of flowers reduces considerably. In particular, the number of flowers in the –N and –P plots is no more than 50% of that of the complete nutrient plot. Unlike this, the growing state in the –Mg and –Ca plots is little different from that in the complete nutrient plot. This is due to the natural absorption of magnesium and calcium from the tap water and gravel used as a culture medium, almost as much as needed. Meanwhile, the plant in the fertilizer-free plot was small in the dry weight and the number of leaves, and bore 2–3 flowers because it was cultivated, supplying only water for two years. The shape, size and colour of the flower are similar to those of the flower of plant in the complete nutrient plot.

This shows that lack of nutritive elements reduces the number of flowers, but the flowers once bloomed keep the properties inherent to its species.

As mentioned above, in the growth and development of Kimilsungia, nitrogen and phosphorus are the elements whose deficiency brings about the critical symptoms and the next one is potassium. It is unnecessary to supply magnesium and calcium exclusively because any serious symptoms by their deficiency are not found.

2. Content of the Nutritive Elements of the Plant and the Level of Their Natural Supply

In order to properly establish the system of fertilization in cultivating Kimilsungia, it is necessary to know the content of the nutritive elements of the plant and the level of

their natural supply. According to the comparison of the contents of nutrients of the plants which grow absorbing the Knudson complete solution and the Knudson solution without individual nutritive elements each, the contents of P_2O_5 and nitrogen are a fifth and a half those of the plant in the complete nutrient plot, respectively, being the smallest, when phosphorus and nitrogen are not applied. (Table 2)

Table 2. Contents of the nutritive elements of the plant to which the individual nutritive elements are not supplied (percentage per dry weight)

Nutrients	N	P_2O_5	K_2O	MgO	CaO
N, P, K, Mg, Ca	1.31	0.22	0.47	0.10	0.20
-N	0.60	0.17	0.73	0.09	0.15
-P	1.45	0.04	0.61	0.12	0.20
-K	1.52	0.27	0.26	0.12	0.16
-Mg	1.28	0.22	0.44	0.08	0.15
-Ca	1.21	0.16	0.44	0.10	0.12

culture medium: gravel

When magnesium is not applied, the content of MgO of the plant reduces only by 20% of that of the plant in the complete nutrient plot, and when potassium and calcium are not supplied, their contents reduce by 45% and 40%, respectively. The natural supply of each nutritive element (taking into account the mass of the stem) is as follows: Phosphorus is 9.4%, the smallest, nitrogen 22.8%, and potassium 30.6%. (Table 3)

Table 3. Level of the natural supply of the nutritive elements

	N	P_2O_5	K_2O	MgO	CaO
Contents of nutritive elements of the plant in the complete nutrient plot (mg/stem)	158.5	26.6	56.9	12.1	24.2
Contents of nutritive elements of the plant which is not provided with relevant elements (mg/stem)	36.2	2.5	17.4	9.3	14.8
Level of natural supply (%)	22.8	9.4	30.6	76.9	61.2

culture medium: gravel

The levels of natural supply of magnesium and potassium are 76.9% and 61.2%, respectively, which are much higher than the other elements. This is because these elements contained in the tap water or the culture medium are absorbed. Judging from the fact that the dry weight, the number of leaves and that of the flowers of plant in the plot which was not provided with magnesium and calcium are no less than those of the plant in the complete nutrient plot, this means that these elements meet the physiological demand of the plant only through natural supply. So in cultivating Kimilsungia, attention may not be paid to the supply of elements like magnesium and calcium, but nitrogen, phosphorus and potassium should be supplied as much as required by the plant.

Section 3. Characteristics of the Absorption of Nitrogen, Phosphorus and Potassium According to the Periods of Development

1. Speed of Absorption

Kimilsungia, like other plants, absorbs nutritive elements at different speeds according to the periods of development.

When the total amount of individual elements absorbed by the plant for a year is considered to be 100, the absorption rates of nitrogen, phosphorus and potassium according to the periods of development are given in Figure 18.

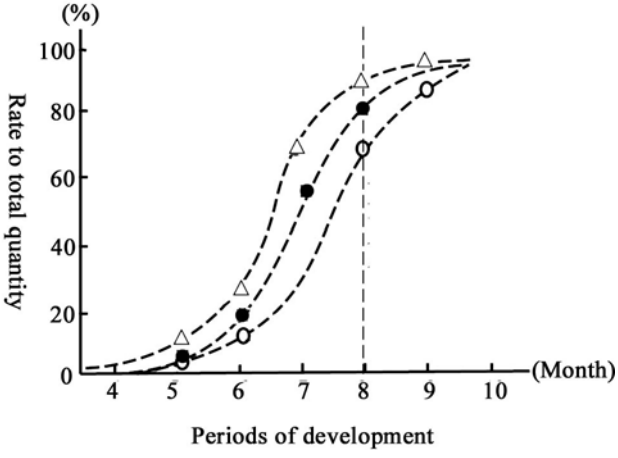


Figure 18. Absorption rates of nitrogen(●), phosphorus(○) and potassium(△) according to the periods of development

Absorption of these three elements is slow during the first period when new buds come out in spring, but during June–July it is speeded up and then slows again from August, the period of reproductive growth. During the period of the vegetative growth, 90% of the needed nitrogen and potassium is absorbed. But phosphorus is absorbed more slowly than nitrogen and potassium at first, that is, 68% during the period of the vegetative growth, and the rest during the period of reproductive growth.

2. Rates of Absorption

The rates of absorption of each element among the total absorption quantity of nitrogen, phosphorus and potassium according to the periods of development are given in Figure 19.

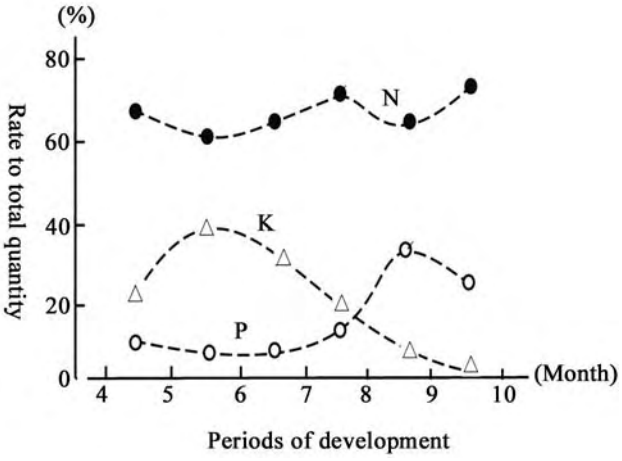


Figure 19. Rates of absorption of each element among the total absorption quantity of nitrogen, phosphorus and potassium according to the periods of development

The rate of nitrogen among the total quantity absorbed by the plant is over 60%, the highest always during the whole period of growth. During the period of vegetative growth potassium is absorbed at a rate higher than phosphorus; in the early period of growth, the rate of absorption of potassium goes up to 40%. But it gradually goes down and thus potassium is absorbed less than phosphorus during the period of reproductive growth. In the period of vegetative growth, the absorption rate of phosphorus is 5–10%, the lowest among three nutritive elements, but gradually increases from the end of its period; it is higher than potassium during the period of the reproductive growth, attaining the level of 30% at maximum.

Like this, the requirements for the nutritive elements vary during the periods of the vegetative and reproductive growth.

Part III

Cultivation of Kimilsungia

This part describes how to grow Kimilsungia in a small-size greenhouse and indoor and outdoor conditions.

Chapter 1
Propagation of Kimilsungia

Kimilsungia is propagated by seed, vegetative reproduction and growing point cultivation.

Section 1. Propagation by Seed

1. Selection of Seed

It is essential to get good seeds for the cultivation of Kimilsungia. To this end, first of all, good parent plants must be chosen. As Kimilsungia is one of the ornamental plants, the flower of high ornamental value must be chosen as parent plant. First, choose the flower of well-balanced shape. Avoid flowers with excessively replicate petal apex or narrow and sharp-edged petal, for they are ill-looking. Second, it is advisable to select the individual whose petals are big and crimson purple, with sepals white in their edge and many blossoms on a peduncle. Among those, again select the one with thick and long stem, many fresh leaves and robust root, i.e., the well-growing and healthy one.

The selection of the parent plant is followed by pollination. The second or third flower which is in bloom on the peduncle is suitable for it. Of course, the flower on the top of the peduncle is also eligible but it makes the parent plant consume so much nutrients for blooming many flowers, resulting in weakening the plant. In addition, if the fruit is borne at the end of long peduncle, it is inconvenient to keep the plant due to its drooping. Pollination should be done three to five days after its blooming. It is because its pollen and stigma get mature two or three days after blooming. It is possible to

pollinate a month-old flower after its blooming, but the heavier burden will be laid on parent plant with the passage of time to obtain a healthy seed. It is rational to pollinate in the morning. First, press down the labellum so that the style appears obviously, then raise white anther hood on the top of the style and bend it back with a pincette. And then, take out two masses of yellow pollen in it and dust them to the stigma. About 24 hours after pollination, the withering of the flower indicates that it was successful, but if not, it should be done once again. When the pollination is over, the peduncle over it should be cut so as to make nutrients for the growth of fruit concentrated.

About ten days after pollination, the ovary is seen growing up. It gradually grows and bears the complete shape of a fruit in green colour within four to five months. It usually takes five to six months from its pollination to the ripening of a fruit. During this period, it is necessary to ensure the same conditions as the one in the time of reproductive growth. If not so, the fruit does not grow properly, the seeds are unhealthy and the parent plant gets weak.

Pollination can be done anytime after blooming, but November is an agreeable season under the climate conditions of Korea. The reason lies in the fact that it is easy to choose the good parent plant as the flowers of Kimilsungia are in full bloom this month and the pollination in this season enables its fruit to be picked up by next April, its seeds cultured and the well-grown seedlings transplanted in the greenhouse next March or April favorable for its growth after culturing it for ten to twelve months.

2. Seedling Production by Seeds

1) Cultivation of seedling by symbiotic germination

As the seed of orchid plant has only an embryo but no albumen to feed it, it does not germinate of its own accord, though sown in the substrate. Only in the substrate with mycorrhizal fungi, the seed can be germinated with the aid of them.

The same is the case with Kimilsungia. There are mycorrhizal fungi in the old root of Kimilsungia and in the substrate near the long-grown root. The seeds sown in the

substrate with mycorrhizal fungi begin to be germinant. But the rate of germination is low as the tiny seeds scatter through the substrate space. To avoid this, a certain amount of sphagnum is taken out of the pot of the parent plant and torn into pieces to spread them out without a space on the sphagnum moss in the pot and sow the seeds. If the sphagnum is rotten excessively, it is important to replace it with new one and choose a third of the less rotten out of the decayed sphagnum to spread it on the new evenly. After three to six months the seeds are sown. But this method has some disadvantage that the tending of the seeds and parent plant should be carried on in a single pot in different ways. To overcome this point, there is a method of sowing and germinating the seeds in another pot without a parent plant.

In the method, the first flower pot is half filled with the fragments of pot or brick, and the mixture of new sphagnum moss and a handful of those of the pot in which the parent plant had long been cultivated is added to it evenly. Then the pot is kept damp for about one or two months so that a lot of mycorrhizal fungi are to be propagated in the sphagnum. Coarse cotton cloth like gauze is spread on the fungi and the seeds are sown so that they get into small meshes of the cloth and are well germinated.

After sowing the seeds, the pot is covered with glass and moved to the shade. When water is sprayed on the sphagnum and cloth to keep their humidity, there appears a green protocorm. Since then, the pot is moved gradually to the place exposed to the light of 3 000–4 000 lx. If the root begins to grow and leaves are stipate in the pot after putting forth three or four leaves, it is necessary to transplant them at regular intervals in a box or a pot with new sphagnum spread and grow the seedlings in the same way as a sapling is transplanted.

2) Cultivation of seedlings by aseptic germination

The seed-reproduction of an orchid plant by symbiotic germination decreases the germination rate and makes the seedling growth slow. It is because the mycorrhizal fungi do not provide the embryo with nutrients as much as the albumen. To make up for this shortcoming, the method of aseptic germination is applied, which provides the substrate

with nourishment such as albumen of seeds for the fast growth of saplings after germination. The application of this method increases the germination rate higher and the growing speed faster than the application of mycorrhizal fungi much affected by incidental factors.

Cultivation of seedlings by aseptic germination is conducted through the processes of seed-germinating and seedling-culture.

(1) Seed germination

Choosing of the culture medium

The KC medium is used generally in seed germination of an orchid plant and it is good for Kimilsungia, too. And it is possible to use the KC′ medium and MS medium with macronutrient of half concentration. It is also resultful to add the natural materials like potato and tomato juice to such a composite medium.

Disinfection and inoculation

The seed of Kimilsungia should be disinfected prior to inoculation. The disinfection methods are different from each other when the seeds come out of the dehiscent fruit and when they remain in the unripe fruit. When the fruit bursts, the seeds should be disinfected with bleaching powder. Generally, the seeds of orchid plant are disinfected for 10 minutes, being soaked in the 7% bleaching powder solution (the supernatant solution) and then inoculated. In this case the rate of germination is lower and its period is longer. So it is better to lower the concentration of bleaching powder solution to 2 or 3%. Even in this concentration, the seeds are well disinfected relatively. The method is: Put the seeds in the test tube with bleaching powder solution and shake it for three minutes and set the test tube to settle the seeds down.

Seed inoculation can be done in the way of taking out the sunken seeds and putting them in the culture medium with a platinum loop or a pipette.

In case of inoculating the seeds with the pipette, slant the test tube to empty out disinfectant solution and wash it with sterile water 3 to 5 times. And pour a certain volume of sterile water into the test tube before shaking it so that the seeds spread evenly. Then suck up the liquid through a pipette and put it into the culture medium.

When the seeds remain in the fruit, the disinfection of latter's epicarp alone is sufficient. The seeds of Kimilsungia, though yet immature, become able to germinate three or four months after pollination, and one month later, almost all its seeds have the ability for germination. Therefore, it is desirable to pick up the yellowish fruit one or two months before the bursting of ripe fruit, wash the fruit in tap water, and carefully scrub its surface with cotton soaked in 70% alcohol. And then soak it in the 7% bleaching powder solution for about 15 minutes for disinfection, put it on the sterilized petri dish and cut it longitudinally with a disinfected knife to expose the seeds. Then scoop up the seeds with the platinum loop and put them into a culture vessel. At that time, ripe seeds are so easy to separate each other and inoculate evenly, but immature ones are formed as a mass, which requires to disperse them with the platinum loop for their inoculation.

The immature seeds in the fruit are favorable for disinfection and other respects, but it is difficult to keep them for a long time. The ripe seeds kept in the refrigerator at 5°C are not so low in their germinating rate even after the lapse of one or two years.

Germination

The culture container of inoculated seeds is moved to the culture room and exposed to the light of 1 500–2 000 lx for 12–14 hours a day, keeping the temperature of 28–30°C in the daytime and 20–23°C at night. About a week after the inoculation, the seeds in absorption of water begin to swell out and bring about cell division massively.

About 20 days after inoculation, the round embryo comes out of the seed coat and chlorophyll appears, too. Such a green globular tissue is a protocorm. 30–40 days after inoculation, the protocorm grows 3–4 mm long and two months later, a coleoptile comes out and then 15 days later, the first main leaf appears. About three months after its culture, it grows to be a seedling with two leaves and roots. The period of its growth from the seed inoculated to the seedling differs considerably according to the composition of culture medium. Among them the potato culture medium is the best for seed germination.

(2) Culture of seedling

Seedling culture is a process to sow the seed in culture container and implant the

seedling with two leaves in a new one to grow bigger before potting it. It takes far longer than seed germination. And it is much affected by the culture medium during this period as the seedling requires much nutrients when it is growing.

Selection of culture medium

In general, KC or KC′ medium for seed culture is used for seedling culture of orchid plants. These mediums can be used for Kimilsungia. Meanwhile, potato culture medium and other mediums mixed with natural substances are also suitable for seedling culture. The medium of natural substances is made by mixing 20% solution of each natural material with inorganic salt of KC′ medium, 3% sugar, 1 mg/l α-NAA, 0.1 mg/l 6-BA and 0.8% agar. In case of transplanting young seedlings in these mediums and culturing them for five months, the height of plant body and width of leaf are 1.4 times bigger in the carrot juice medium and tomato juice medium, and two times bigger in the potato juice medium as compared with the KC′ medium.

As seen above, it is more favorable in various ways for seedling culture of Kimilsungia to use the potato juice medium than other mediums. The ideal composition of potato juice medium for its seedling culture is as follows: First, it is rational to use the potato juice of 20% concentration. The higher the concentration of potato juice in the medium, the better the seedling grows. When it is densified by 60%, the height of plant body is similar to that with 20–40% concentration, but the width of its leaf gets larger. However, as the concentration increases, the upper side of medium becomes hard, and it is difficult to transplant young seedlings. And 2% sugar is added to the potato medium, for raw potato includes 1–1.5% sugar but 0.2–0.3% of sugar concentration is contained in 20% potato juice medium. Although the total sugar content of medium increases by 0.8–0.9% in the process of sterilizing the culture medium, it is insufficient for the growth of seedling. It is optimal for the growth of seedling to add 2% sugar to 20% potato juice medium. When adding α-NAA and 6-BA of different concentration, the growth regulators, and when adding inorganic salt of KC′ medium to 20% potato medium, the marked effect was not obtained in the growth of seedling. That is why it is unnecessary to add much substances. 20% potato juice medium is too thin to transplant the young seedling, so agar must be added. What is the best to transplant and maintain the plant

body is to add 0.6% agar to 20% potato juice culture medium. In a word, the culture medium (hereinafter called potato juice medium) made of 20% potato juice, 2% sugar and 0.6% agar is most suitable for the culture of seedling of Kimilsungia. When Kimilsungia seedlings cultured for 180 days in the potato juice medium are compared with those in the KC´ medium, the growth of its seedling in the former was twice larger than in the latter. And in the KC´ medium, the growing speed of seedling was reduced during three to four months but in the potato juice medium, it did not so much during five months.

The advantages of potato juice medium to KC´ medium are as follows:

First, the former contains plenty of inorganic substances for seedling growth. Among them, nitrogen, phosphorus and potassium, major macronutrients, are 1.5, 1.4 and 9.1 times more than KC´ medium respectively. And the structure of potato juice culture medium is more suitable for the culture of seedling of Kimilsungia than that of KC´ medium. When the KC´ medium with 0.8% agar is sterilized in high pressure and cooled, transparent and even jelly is formed. But the potato medium is distinguished between upper and lower layers. Its upper layer is similar to the KC´ medium but the lower layer forms an opaque and uneven jelly. The potato starch consists of amylose easily soluble in hot water and amylopectin soluble in water only when heated under a certain pressure. These two substances are divided by the difference in molecular quantity and molecular structure and form a stratified structure while dissolved and cooled in the process of high-pressure sterilization. The upper layer with amylose and agar is good for transplanting and propping the seedling as its jelly intensity is similar to 0.8% agar-KC´ medium. But when the lower layer with amylopectin is cooled, it forms the 0.3–mm globular grains, which coagulate each other. Its

Photo 39. Seedlings grown in 0.8% agar-KC´ medium (left) and 0.6% agar-20% potato juice medium (right)

jelly intensity is 6 times lower than the upper layer, being squashy. The granular structure and jelly intensity of the lower layer provide the favorable condition for the growth of root. In fact, the roots grown in the potato juice medium were twice longer than those in 0.8% agar-KC′ medium and thicker. (Photo 39) Conclusively, it is thanks to the joint action of various substances in the potato juice medium that the seedling of Kimilsungia grows better in the potato juice medium without adding twelve kinds of inorganic salt and eight kinds of organic compounds than in the KC′ medium.

How to make one litre of potato medium is as follows. Boil 200 g of potato after washing clearly and peeling, and grind. Then mix it with 20 g of sugar and 6 g of agar and boil. And then add the distilled water to the boiled liquid to be one litre. Adjust pH of the mixture to 5.8 and put it into the culture container to sterilize it. It is possible to grind the raw potato and use it to make the medium half an hour later. Activated charcoal is not needed for the potato medium.

Culture

When the seed germinated 2–3 months after sowing it on the culture medium and the seedling has two leaves, the first transplanting is done. Then 2–3 months later, when the 2–3 leaves of seedling get mature and rooted, the seedling is moved to a new medium. 3–4 months after the second transplantation, the seedling, having 4–5 leaves and 5–6 roots, grows enough to be transplanted in the flowerpot. Generally, 7–10 months after sowing the seed, the healthy seedling is grown up. The medium for seedling culture is similar to that for the seed germination. Among the seedlings by seed propagation, there may occur abnormal individuals with different characters. In this case, they must be removed.

Section 2. Vegetative Propagation

In general, the individuals grown by vegetative propagation are not subject to genetic variations.

Kimilsungia can be grown by vegetative propagation and its forms and methods are varied.

1. Separating of Cluster

In Kimilsungia, a sympodial orchid, a new stem grows larger, absorbing the nutrients from the old stem. When this stem reaches a certain size, it blooms a flower. Before flowering, one or two small stems appear in a year under the greenhouse condition of the DPRK. Since the lifespan of its stem is 4–5 years, 3- or 4-year-old plant has 5–6 stems. Then the clustered stems create a bad growth environment and leaves vary in size and number, resulting in degrading the quality of the plant in the flowerpot. In this case it is rational to divide the plant into two. It is good to divide 4- or 5-year-old plant when 5–6 stems, healthy and aged, come out.

The separating of cluster is done by cutting the joint part of the stems at the bottom with a sharp knife or pruning shears. When the stems are six in number it is advisable to separate them by three and, if five, divide them into the part of three old stems and the part of two young stems. To leave many stems in the part of old stems is because they are small and aged, and are short of nutrition stored. When the joint part of stems of the plant in the pot is cut about a month before a new sprout comes out, new shoots come out from the two separated plants at the almost same period. And if any plant among the two starts to root from the bottom of the new stems, two plants should be pulled out from the pot and planted separately at the same time. Though the plants of Kimilsungia can be multiplied by the separating of cluster, it is not so effective. The plants may be increased if each stem is separated, but it may often delay their blooming for 2–3 years.

2. Planting of Sprout Cut from the Stem

1) Separating and planting of buds on the upper part of stem

While cultivating Kimilsungia, you can see that the dormant bud on the upper part of the old stem wakes up and grows into a stem, and the root develops at the bottom of the stem and hangs down in the air. This is called an upper bud or high bud. (Photo 40)

The upper bud usually forms in spring or in summer which is favorable for vegetative growth. At that time, when temperature and humidity in the greenhouse are high and plenty of nitrogen fertilizer is applied, and when the buds on the bottom of the stem are attacked by snails or some reason and the root is rotten, the buds at the upper part of the stem occasionally develop into the sprouts, instead of becoming the peduncles. The more and healthier leaves the stem of the parent plant has, the faster and larger the upper buds grow. When the upper bud is separated and planted, another whole plant is obtained.

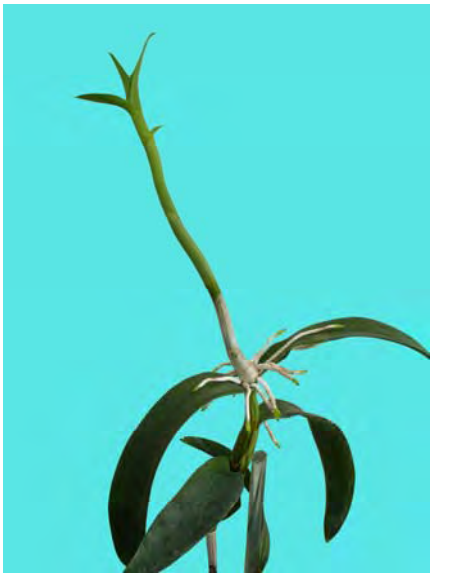


Photo 40. Upper bud

The upper bud is cut off and planted when it grows well and the plant is rooted enough. However, if the upper bud has smaller leaves than the parent stem and grows poor, it is advisable to split and plant the bud when a new bud forms under the upper bud and it starts to root at the bottom of it. It ensures the upper bud grows fast by absorbing all nutrients supplied by the parent stem and composed itself. The upper bud is taken off with the shears or hands.

This bud is planted and tended in the same way as the repotting.

2) Planting of stem cuttings

There are several dormant buds on the lower and upper parts of the stem of Kimilsungia. If these buds wake and grow, a new root grows at the bottom of the stem. A new individual can be obtained by cutting off and planting it. A stem with leaves or the leafless stems storing certain amount of nutrients can be used as reproduction materials. But the cutting of the stem with fresh leaves is not suitable for the multiplication of the plant and therefore, the stems whose leaves fell just before are used as propagation material.

The best period of layering of stem is spring when the flowerpot is changed. At that time, the stems for propagation are cut from the plants which do not need repotting as well as those for repotting. And then the stem is recut, being inclusive of 2–3 nodes. Then the cut pieces of the stem are put aslant in a box or big flowerpot spread with sphagnum and their lower part is covered with sphagnum 2–3 cm thick. In this case, the optimal temperature for vegetative growth must be ensured and the sphagnum be kept wet. One month later, one bud shoots out of almost every piece of stem and grows into a stem and a new root strikes at the lower part of the stem. (Photo 41)

Photo 41. Stem grown from the cut piece of stem

However, the budding rate in the middle pieces cut from the long stem is lower than that in the lower and upper pieces of the stem and if any, the budding is delayed. This is because the buds in the middle pieces of the stem are less developed than those in the lower or upper stem.

There are various ways to increase the germinating rate of buds in the pieces of stem. One is to tie the 15–20 stem-cuttings in a bundle, give their upper parts for buds a sort of heat treatment after alternately immersing them 3–4 times in water of 8–10°C and hot water of 35–40°C for 2 hours and then bury the lower part of the stem in the wet sphagnum for budding. The other is to apply 1% 6-BA lanolin ointment to the section of upper part of the stem or the well-grown bud or drop 6-BA alcohol solution between the buds of the stem. Another is to apply 0.5% 6-BA lanolin ointment to the buds and drop 6-BA alcohol solution in a state that the stem in the flowerpot is not cut. When a stem cut from ordinary plants is planted, the root strikes at its bottom and the dormant bud germinates to form a whole plant, but the orchid plants including Kimilsungia are weak in reproduction, so that this method is different from the planting of other stem cuttings.

Grafting is not so successful in Kimilsungia.

Section 3. Culture of Growing Point

The cultivation of growing point of Kimilsungia through a process of vegetative propagation will be dealt with separately as it needs equipment and reagents and culture process is complicated. Propagation of Kimilsungia by means of growing point culture is conducted in the same way as the other orchid plants. This method comprises three stages: Primary cultivation of growing point, multiplication and cultivation of protocorm-like body (PLB) and formation and cultivation of PLB organ.

1. Primary Cultivation of Growing Point

The primary cultivation of growing point is a process of forming PLB, a globular tissue mass by planting the growing point in the culture medium. This stage is the most essential in the tissue culture of Kimilsungia and requires high skill. It is because the formation rate of PLB in primary cultivation varies remarkably according to kinds of the medium, the methods of picking and inoculating the object, the way of cultivation and the level of experimenter's skill. Therefore, it is important to perform correct operations in every process of primary cultivation from the washing of container to the making of culture medium and inoculation.

Materials for culture

A young stem coming out at the base of the old stem is used as materials for culture. The survival rate of inoculated body varies according to its size. Its survival rate is 80%, being the highest when the young stem is about 10 cm long but declines below 50% when it is more than 20 cm long. It is because when the stem is 10 cm long, most of the buds on its lower part are healthy, their development being over. There are several buds at the base of the stem among which the second lateral bud from the base is fully developed, so in case that it is used as an inoculating object, the survival rate is more than 80%, being the highest. When the first and third lateral buds are used, its

rate is lower than the second. Also the apical bud at the apex of the stem and the fourth lateral bud from the base of the stem may be used. In this case, the survival rate is reduced further. The other buds are too undeveloped to be used as cultivation materials.

Disinfection of inoculation materials

First, the young stem is cut off from the old one to be used as inoculation materials and washed in tap water. Then, water drops are dried with a piece of filter paper and the sheath on the node is removed with a scalpel from the lower node. After this process, several well-developed lateral buds are clearly seen at the lower part of the stem, and the apical bud developed in a certain degree seen above it, together with smaller and inconspicuous lateral buds. This stem is soaked in 70% alcohol solution for about 30 seconds, and then in the solution of 7% bleaching powder for about 10–15 minutes for its disinfection. Addition of a drop of surface active agent to the antiseptic solution helps disinfection. The stem taken out of the antiseptic solution is washed twice or thrice with the sterile water and then moved to a petri dish with a piece of sterile filter paper spread on it.

Separation and inoculation of growing point

When the growing point is removed for reproduction, it is desirable to make the size of the inoculating individual bigger than the one prepared with a view to acquiring virus-free plants so as to raise its survival rate. The growing point is encircled with several leaf primordia. When removing off the growing point, the number of leaf primordium attached exerts an influence on their survival rate. It is rational to attach 2–3 leaf primordia to the growing point for the tissue culture of Kimilsungia. Less or more number of leaf primordia attached to the growing point results in a decrease of the survival rate. Therefore, it is good to set the size of the inoculating individual 0.5–0.7 mm, including the leaf primordia to be used in the growing culture of Kimilsungia. The growing point removed is put into a medium in a test tube, being smeared on the tip of knife. At this time the section of the growing point should be laid to be half-buried in the culture medium by sticking the knife tip into it. If the cross section is laid on the medium, it contacts with the air and turns into brown, thus reducing the survival rate.

Culture medium and culture condition

KC medium or KC′ medium or 1/2 MS medium is used. It is good to add such growth-regulating substances as 6-BA 1 mg/l and α-NAA 0.1mg/l to the medium. The test tube with the inoculating individual is transferred to a culture room and exposed to the light of 2 000 lx for 14–16 hours a day under the temperature of 23–27°C. After 10–15 days the growing point swells to form round tissue mass of dark-green colour. This round tissue is called protocorm-like body (PLB). With the division of its cells the PLB grows bigger but its tissue mass remains unchanged with no sprout or root until it forms a definite size.

2. Multiplying Culture of PLB

The multiplying culture of PLB means the process of culture to obtain more PLB from that formed at the primary culture stage.

1) The early multiplying culture of PLB

PLB is not completely formed during the period of primary culture in which the growing point is inoculated and cultured. The early multiplying culture is carried on to increase the number of PLB primarily by transplanting PLB to be formed during the period of primary culture to a new medium.

As the leaves and the stem often differentiate and die if PLB in the process of formation is not transferred to a new medium in time, it should be moved to a new medium a month after the inoculation. The early multiplying medium is made by adding 0.5–1.0 mg/l of 6-BA and 0.1–0.5 mg/l of α-NAA to the medium for the primary culture, instead of nicotinic acid and pyridoxine. This medium enables PLB to have proliferation ability, rather than differentiate into a sprout. But even when this medium is used, the rate of differentiation into a sprout is somewhat high. Therefore, at the early stage of forming PLB, the leaves and stem should be taken out of the medium to remove its leaf primordia and planted again in the solid medium. When the

lesion heals up 10–15 days after their transplantation, they are put in the liquid medium and cultured for about 10–15 days, shaking them at a speed of 180 r/min. If they are cultured for two or three months, transferring them alternately to the solid medium and liquid medium, a PLB mass with multiplying ability is obtained. The culture condition is the same as that of the primary culture.

2) Mass-multiplying culture of PLB

Any part of PLB has the ability of cell division. Thus, even though a minutely split PLB is put into the medium, PLB is formed again from almost all its pieces. The mass-multiplying culture of PLB is the process of obtaining lots of PLBs by multiplying the split PLB mass and then splitting them again.

PLB formed in the early multiplying culture is cut into pieces of 2–3 mm long, which are put into the medium. After 60–90 days when they are proliferated in some degree, they are split again. If PLB is cultured longer than this period after the first split, the speed of its multiplication slows down, its individual differentiation is undertaken or its death rate increases. Appropriate rounds of subcultures should be ensured. Four or five subcultures are recommended when growth regulators are applied and seven or eight subcultures in absence of them. Too many rounds of subcultures might cause a lot of modifications, decreasing the number of stand and seedlings and reduce the rate of multiplication. Culture can be carried on in the solid or liquid medium, and in this case, it is good to do alternately at intervals of 15 days. The early proliferation medium is used as it is. Growth stimulants may be or not be added to the medium. The environments of the culture room should be provided as in the earlier proliferation culture, but the intensity of light should be increased from 2 000–3 000 lx.

3. Organ-forming Culture of PLB

Organ-forming culture of PLB is the process in which PLB is separated into one or two pieces to plant and, the sprout and root are differentiated to be grown after the

amount of PLB required was obtained.

First, the lump of PLB should be cut into one or two pieces, and they are planted in the medium to form a sprout. To make PLB differentiate into a sprout, apart from multiplication, the medium is made by adding the microelement of the Nitsch medium to the medium of 1/4 KC inorganic salt. The sugar content of this medium should be lowered to 1–2%. Growth stimulants may not be put in the medium.

Since each PLB has already formed 1–3 growing points, a leaf and stem begin to come out from these points 40–50 days after their planting. When these sprouts grow about 10 mm long, they are cut and planted in the medium for root differentiation and seedling growing. The sprout should be cut lest a fragment of PLB should stick to a cut, otherwise, PLB swells or is differentiated into sprouts in the process of culture, which slows down the growth of the original sprout. The sprout-forming medium is used as it is, but sugar content should be increased to 3% and 0.5 mg/l of α-NAA added. When two or three leaves come out after two or three months, the seedling is transplanted to a new medium to grow it bigger. A potato medium also is available for a new medium. The culture of the sprout in a new medium for three or four months makes it grow into a whole seedling suitable for transplanting in a flowerpot. The culture environment should be provided with as in the mass-multiplying culture.

Time-Telling Flowering Plants

Generally, flowers bloom and wither according to seasons. But some flowers do according to time, through which man knows time.

Morning glory sounding the reveille towards the eastern sky when even the wild birds are still sleeping and yellow dandelion blooming on the wild path wakes up at dawn, whereas tree garden portulaca, a heavy sleeper, begins to unfold its petals when the meridian siren rings.

Shepherd's purse and clover which bloomed in the daytime begin to fold their small petals toward 6 p.m. against the background of the glow of sunset in the sky.

And chickweed begins to open its flowers towards 9 p.m., as if clearing the darkness.

Chapter 2
Cultivation of Kimilsungia in Greenhouse

Kimilsungia is mainly cultivated in greenhouse in the DPRK located at the temperate region. What is important in greenhouse cultivation is to provide a proper cultivation environment suitable to the ecological features of Kimilsungia.

Section 1. Substrate for Cultivation and Repotting

It is essential for the growth of Kimilsungia to choose a proper substrate for cultivation as well as suitable time and rational method for repotting.

1. Flowerpot and Culture Substrate

1) Flowerpot

An earthen flowerpot and other different flowerpots can be used for growing Kimilsungia.

Earthen pot: Being porous, it absorbs water well, and is ventilative and good in heat-exchange. Since it is heavier than a plastic pot, it is used in general to grow epiphytic orchid. The long use of an earthen pot makes the flow of air through its porosity interrupted owing to accumulation of salt and formation of fur on its surface, so that it is good to melt the salt from time to time and frequently wipe off the pot.

Plastic flowerpot: The pot made of vinyl chloride or polyethylene is convenient for keeping and easy to handle. And any fur is never formed on its wall in spite of a long

use, nor is the salt accumulated thickly like the earthen pot. As the surface of the plastic pot is smooth and not porous, the roots do not easily stick to it. Therefore, when repotting, a plant can be easily pulled out from the pot, not injuring the root. In the plastic pot the water slowly percolates downward through the soil and the substrate in it keeps moisture longer than that in the earthen pot. It is so light in weight that tall plants are apt to fall down and does not absorb moisture, for it is not porous. It is not also ventilative. It is advisable not to use a transparent plastic pot, if possible, because it allows the light to invite algae.

Porcelain flowerpot: Generally, a porcelain flowerpot is made of kaolin and the glaze is put on it. Therefore, it is bad in ventilation and thus it is hardly conductive of heat and moisture. In addition, it is not suitable for mass cultivation due to its high production cost and difficulty to use. With its good appearance, a plant shall be grown in the earthen pot or plastic one until the blooming stage and then the blooming plant is transplanted to the porcelain pot.

Besides, the containers of various materials are used in place of a pot.

2) Substrate for cultivation

The cultivation substrate for Kimilsungia should be as follows.

First, it should be a good water-preserver. It is desirable to use a substrate with a trait by which the water stored in it as well as in the surface of granules of the substrate can be moved up to its surface when it is dried. Then the roots of Kimilsungia keep the proper moisture all the time and its growth will get better.

Second, it should be good in draining and ventilation. Since the root of Kimilsungia needs adequate oxygen, porous substrate should be chosen to ensure good ventilation. The poor draining and ventilation make the root of Kimilsungia rot soon.

Third, it should not go bad easily but maintain its physical nature for a long time. An inorganic substrate can be used so long because its properties change due to the physical and chemical action, but this process goes on pretty slow. On the contrary, an organic substrate goes rotten quickly by the action of microorganism and other

chemical substances, so that its volume reduces and the conditions of ventilation and draining are getting bad. That requires to change the old organic substrate with a new one every two or three years.

Fourth, it should be convenient to maintain and take care of a plant. Culturists grow Kimilsungia, from its ecological and physiological characteristics, in a pot smaller than the size of the plant, unlike the terrestrial plants. The substrate fit for the growing of Kimilsungia should be heavy enough to support the plant. The substrates like sphagnum or charcoal are somewhat heavy enough to support the plant when they fully absorb water, but when dried, they get light and the pot is liable to fall down. Meanwhile, the substrate such as pebble is inconvenient to handle. So it is advisable to select a substrate suitable for supporting the plant in consideration of the characteristics of the substrate.

Fifth, the cultivation substrate should be subacid. In general, pH that enables a plant to utilize the nutrients of the substrate comparatively enough is 5.4–6.8. Kimilsungia grows well in the substrate whose pH is subacid or neutral.

Sixth, it should have a rich source and be easy to access. It is because more and more people want to grow Kimilsungia in many regions.

Besides, the substrate should be the one that the culturist has a good knowledge of, in the process of growing Kimilsungia and also the one which is exclusive of salt.

Now that there are, however, few natural cultivation substrates with such characteristics as mentioned above, several kinds of substrates can be mixed in a certain ratio or artificial ones are made in order to make up the deficiency of a substrate.

The substrates for cultivation of Kimilsungia are as follows:

Moss: *Sphagnum* spp. has been widely used as a cultivation substrate of orchid plants including Kimilsungia since a long time ago. Sphagnum is a 10-cm-tall plant which grows in marsh, at the foot of a mountain or relatively damp places in the forest. What is good for a substrate among the kinds of sphagnum is *S. cymbifolium*. Raw sphagnum is used as it is, while it is recommended to dry the collected sphagna and, when necessary, use them soaked in water. Such wet sphagnum is elastic and easy to

handle. Since *S. cymbifolium* is high in water absorption, its root is apt to be damaged by excessive moisture, when it is used alone. So it is desirable to mix it with fragments of earthen pot to use. This makes the damage by the excessive moisture diminished and more plants fostered up with the same amount of moss. Its defect is being rather quick in rotting.

The bark of a tree: The bark of fir tree is also desirable for the cultivation substrate. Included among the trees whose bark is used as a substrate are *Abies holophylla* and *A. nephrolepis*, etc. The bark of *Abies holophylla* is good in drainage and ventilation. In general, the bark is rotten in 14–18 months, while the bark of *Abies holophylla* is hard enough to use for more than two years. It is desirable to pass the partially rotten bark through a sieve before its use. The bark is cut into pieces 0.6–4 cm long. The pieces less than 1 cm long are used for young seedlings and those longer than 2.5 cm for a blooming plant. For a cultivation substrate, bark alone or mixture of bark and coarse moss or peat mixed in a ratio of 2:1 can be used to let it keep more moisture.

Peat: High-quality peat is used for a cultivation substrate. Peat has originated from the decay of sphagnum moss and other kinds of moss. High-quality brown peat is the least rotted, thus preserving almost all physical properties of sphagnum moss. Among the kinds of peat, high-quality peat has a remarkable capacity of preserving moisture and absorbs water as much as 60% of its volume. Sphagnum peat whose pH is 3.0–4.0 is strongest in acidity among all the kinds of peat. As the rate of its cation exchange is 7–13 mg/100 ml, it has a capacity of preserving fertilizer. However, peat does not drain well. In particular, the peat substrate put in plastic pot is hardly dried. Therefore, it is effective to mix fresh sphagnum or bark of a tree with peat in a proper ratio to improve its physical properties.

Fragments of earthen pot: The fragments of an earthen pot are porous, lighter than gravel in weight and high in water absoption. Its pH is nearly neutral and its cation exchange rate is 3.4–12 mg/100 ml, so it has a high capacity of keeping nutrients. A fragment of 1.5–4.0 cm is appropriate. Because the fragment accumulates salt in itself during the period of culture, it should be washed off with water once a month. The fragment alone or mixed with sphagnum and other organic materials may be used for

the cultivation medium. It is also used for draining material to be laid at the bottom of a flowerpot.

Gravel: Gravel can be used as a substrate during the period from the stage of a young seedling to a blooming stage. The large gravel should be used step by step in accordance with the size of the plant. The gravel of 1.5–2 cm in diameter is used for the blooming stage. The gravel substrate is good in drainage and ventilation, thus preventing the root from rotting. The plant cultivated in the gravel substrate should be watered more frequently than in other substrates. The shortcomings of gravel substrate are that it is heavy and is not well absorbent of water.

Porous clay: It is made of clay and foamed plastic granules. Soft clay and foamed plastic granules are mixed in a volume ratio of 1:1.5 and then their mixture is blunged again. Here, it is recommended that the foamed plastic granule is 2 mm in diametre. The kneaded mixture is put into a moulding machine with a cylindrical nozzle 15–20 mm in diametre, compressed and dried. Then the dried mixture is calcined at the temperature of 850°C. After that it is cut into pieces 15–35 mm long for a substrate.

Its advantage to others is that the porous clay substrate has a higher capacity of water preservation than fragments of an earthen pot and gravel. The effective moisture content of porous clay is twice higher than the scraps of an earthen pot and five times higher than gravel. Water drains away better in the porous clay substrate than in the sphagnum substrate but less than in the substrate made of the scraps of an earthen pot. Therefore, the porous clay substrate does not need watering so often as the substrate of earthen pot scraps. The pH of porous clay is 6.9–7.1, which is little different from that of the scraps of an earthen pot, and its cation exchange capacity is similar to the latter. Salt is accumulated in porous clay substrate during the culture period as in the scraps of an earthen pot. So it is necessary to desalt with water once a month.

As a culture substrate of the epiphytic orchids like Kimilsungia, coco fibre, perlite, polyethylene foamed plastic and charcoal may be used. These culture substrates drain well and are ventilative. Coco fibre is obtained by breaking the shell of coconut into fine pieces. Perlite, whose volume density is 100 g/dm^3, is light and ventilative. When perlite, a silicic volcanic rock, is crushed and heated up to 980°C, it swells and forms

numerous lumps filled with air. Therefore, water is absorbed in the surface of perlite, but in the inside of the lump. Perlite is very low in its cation exchange capacity and its pH is 7.5 as neutral. Polyethylene foamed plastic is a white synthetic product the inside of which is filled with air and ventilative. Its density is 25 g/dm^3 and it is very light. Besides, it does not absorb water and is very low in cation exchange capacity, and its pH is neutral. When polyethylene foamed plastic is used as a culture substrate for epiphytic orchids, it should be broken into granules or pieces 15 mm in diametre or scraps. In general, the foamed plastic is mixed with sphagnum substrate in the ratio of 1:1 before the use. Besides, charcoal, ash of coal, industrial by-products and other materials may be used.

2. Transplanting of Seedlings and Repotting

In order that young seedlings transplanted through the tissue culture or seed culture reach the earlier blooming stage, they must be repotted in time according to their growth period. The blooming plants also need the periodic repotting in expectation of more beautiful flower.

1) Preparation of tools and materials

A pincette, a bamboo stick, a bamboo knife, a pair of scissors and a hammer are used for transplanting of young seedlings and repotting.

The main materials are a culture container and a culture substrate.

It is advisable for cultivation of Kimilsungia to use an earthen flowerpot, cheap yet effective for growth of a plant. The earthen pots, new or old, should be soaked in water to clean out inorganic salt one or two days before using. The pot of porcelain or vinyl is enough to wash clean. When using sphagnum moss as a substrate they should be soaked in water, and squeezed tightly to make a fist-sized lump while sorting out leaves or branchlets. When a small plant is planted in the pot with substrate of earthen pot fragments, the fragment is broken into pieces 1.5–2.5 cm long and in case of big

one, to be 2.5–4 cm long. When a small plant is planted in the pot with porous clay substrate, it should be chopped into pieces to be 1.5–2 cm long but when a big one, to be 2–3.5 cm long. And they are dipped in water for two or three days to desalt and then taken out of the water before washing cleanly.

Props and strings should also be prepared. A disinfectant or a preservative is needed for the replacing of a flowerpot.

2) Transplanting of seedlings

The seedlings fully cultivated in the culture container should be transplanted. If too small ones are transplanted, their survival rate is low and they grow poorly. The suitable season for transplanting a seedling in Korea is spring, when the transplanted seedlings grow well due to the extended length of the daytime and appropriate temperature. In a greenhouse the transplanting of seedlings can be done at any time, but its growth is not so good as in spring.

The seedlings taken out of the culture container should be washed well to have pieces of agar-agar removed. Any agar-agar sticked to the root allows miscellaneous fungi to easily propagate to cause a disease. It is desirable to plant the washed seedlings, sorting out by size and by kinds.

A wooden box is suitable for a culture vessel. The box should be made appropriately to raise seedlings. A box, 6–7 cm high is rational. Its bottom should be made with narrow boards, leaving the space of 2–3 mm between them for water drainage and air ventilation. And the small fragments of flowerpot are laid 1–2 cm thick on the bottom of the box and the sphagnum moss pieces 1–2 cm long spread out. If sphagna are spread too thick, they do not dry in time after watering, which causes the seedlings' rot. A flowerpot instead of a wooden box can be used and, at that time, the fragments of a pot or a brick should be scattered at the bottom of a flowerpot, and sphagnum spread on them before planting the seedlings.

To plant a small seedling, it should be thrusted into sphagnum dug up with a stick. In case of a big long-rooted seedling, moss should be put in little by little between

roots at the root neck so that they can be spread extensively and the whole root wrapped up with sphagnum before planting seedlings one by one. When the transplanting of seedlings is over, sphagnum should be added to the space between seedlings and pressed with hand to let them stick to the roots. A wooden box or a flowerpot is set down in a shady and humid place for 15–20 days. When the substrate dries out, it should be watered with a sprayer. Here, the amount of water should be regulated so that the substrate can dry out in one or two days and the roots are kept from rotting due to overhumidity. It is desirable to maintain the temperature of 21–26°C. About 20 days later, a young seedling is under the normal care.

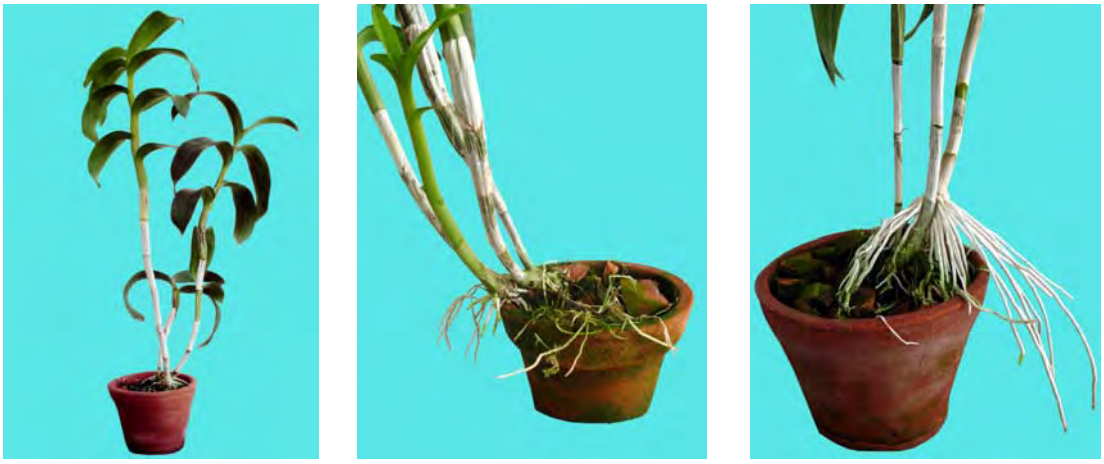
3) Repotting

Repotting is a process of providing the plant with good vegitative area, light and ventilation, etc. when several seedlings planted in the wooden box or in a flowerpot grow densely after about one year growth. (Photo 42)

Photo 42. Seedlings grown in a flat for one year

It is also done when a substrate like sphagnum drains poorly or is not so well ventilated because its prolonged use causes its rot or disorder of space structure, when the plant overgrows the flowerpot, a new sprout and its roots outgrow the pot and when the new aerial root is over the substrate. (Photo 43)

And repotting is necessary when a cluster of 5–6 stems needs separating. If a pot is not replaced in time, the plant's growth will slow, the root rot and many upper sprouts come out of the old stems, thus resulting in the weakening of the plant. The best time for repotting is when the plant begins to root from the bottom of the new stem. The repotting at the time enables the new root to grow free from any damage and stick to the substrate soon to absorb water and nutrients. The time of repotting, however, may not fall on April or May when it is good for the growth of Kimilsungia. In this case, repotting can be done, but its growth is stunted to some extent.



A B C

Photo 43. Plant at the stage of repotting
(A) when the plant overgrows the flowerpot;
(B) when the new stem is out the pot; (C) when the new root is over the substrate

The methods of repotting are as follows:

First, pull the plant out of a pot. The root of Kimilsungia sticks too fast to the wall of the pot to be pulled out as easily as a terrestrial plant. Then, take off its root from the pot wall with a bamboo knife and take out the plant with a substrate. Besides, its root can be taken off more easily by holding the pot in one hand and shaking 2–3 old stems together in the other hand about one hour after watering the pot. Whatever the method is, some roots may be torn off, which does not become serious hindrance to its growth. After taking out the plant, the substrate attaching to the root should be removed.

Second, rid the plant of the dead stems including those being more than one year old since their leaves fell down and nip off the dead roots. While proceeding cluster-separation, the sick, damaged leaves or some parts of them are cut off. The trimmed plants are kept in a shady and humid place, sorting out by size and when the keeping period is long, water should be sprinkled over them lest the root should excessively dry out.

Third, a pot should be chosen. First of all, the size of a pot is chosen according to the development of the root. The big plant needs the big pot. Only then, the supply of the vegetative area and water enough for the growth of the plant is ensured and the pot

does not topple down. When a small plant is transplanted to too big a pot, the roots are liable to rot, for the substrate remains wet so long, and at the same time the roots are hardly attached to the wall of the pot soon, so that the plant may sway when managed. A smaller pot is fit for the plant with thin stems or few healthy stems or underdeveloped root. The size of a pot depends on the kind of substrate, the materials of a pot. When the substrate like sphagnum moss and the vinyl or porcelain pot are used, a smaller pot is good. For selection of the size of a pot due consideration should be given to the conditions of the flower shelf and humidity of the greenhouse. When the shelf is made of lattice for good ventilation, a larger pot can be used but if it is made of cement or tile, a small pot is suitable. Experience shows that it is good to transplant one-year-old seedlings in earthen pot 6–9 cm in diametre.

Fourth, substrate for cultivation must be selected. The substrate which is suitable for growth of Kimilsungia and is easy to take nearby and is familiar to the cultivator must be chosen. It can be made from single material or mixture. The sphagnum which gets hardly dry or gets light after drying may be mixed with heavy pieces of a pot or porous clay. One way of mixing the substrates is to put the pieces of a broken pot or porous clay on the lower part of the pot and spread on them sphagnum 3–6 cm thick. This method ensures the balance of moisture between the lower and upper parts of the pot and makes the weight of the pot appropriate enough to support the plant. Another is to put the sphagnum pieces between the pot pieces or porous clay. This helps the plant to instantly escape from the excessive moisture as the pot pieces or porous clay absorb a large amount of moisture from sphagnum after watering and makes good ventilation for the substrate.

Fifth, careful attention must be paid to the following items in planting a plant in the pot. It is important to know the direction of a new bud coming out of the root neck of the plant. New sprouts come out mostly from the bottom of the stem that has grown in the previous year, taking the similar direction. In consideration of this direction, the whole plant must be placed biased to one side so that the new shoot is at the center of the pot. And the plant must not be buried too deep. Otherwise, not only the root neck rots easily but the following shoot does not come out straightly because of hard

substrate like broken pieces of a pot. And it blemishes the ornamental value of the plant and its tending is inconvenient, too. So it is advisable to set the root neck a little higher than the substrate.

And the height between the cultivation substrate and the upper edge of the pot must be lower than that of substrate used when a terrestrial plant is set out. It is because the pot for the terrestrial plant has the space to supply the water enough to soak the whole substrate but the cultivation substrate of Kimilsungia drains quickly after being watered. It is agreeable to ensure the height of about 1 cm in the small pot and 2–3 cm in the big one.

When planting the young seedlings in the earthen pot, the pieces of sphagnum must be put only between the roots and not covered around the root again. Then, most of the roots spread only in the lower part of the pot but not in the middle and upper parts and thus the space of substrate is not effectively used. After transplanting old stem must be tied to the prop with a string and the sphagnum pressed with hand to settle down the substrate.

When a big plant is repotted, the sphagnum substrate or its mixture with broken pot pieces may be used. The transplanting of a big plant in the sphagnum is done in the same method as that of small one. When it is transplanted in the substrate of broken pot pieces, the prop must be set up first and the pot pieces spread, in this case, more thickly in the part of the root neck. When the plant is put here, the root apexes tend downwards. Then the pot is filled with the pieces of broken pot and stirred to make them seated, and the old stem is tied to the prop with a string.

The way of transplanting in the substrate of porous clay is the same as in the case of the substrate of pot pieces.

After repotting the plant must be cared well in a definite period. The ordinary ornamental plants must be sufficiently watered to attach the root to the substrate after the repotting, but in case of Kimilsungia, it is improper to water much. It is because its roots damaged at the time of repotting stay under the condition of excessive wetness for a long time. So the substrate must be kept in the slightly dry condition.

And the flowerpot should be moved to the shade place, exposed to the light of

6 000–8 000 lx, with the atmospheric humidity a little higher than prior to the repotting and the temperature of 22–27°C lower than in the period of growth. And fertilizer should not be applied.

The higher temperature may increase the consumption of nutrients as the root takes a breathing in the weak light condition.

After 10–15 days under such conditions, the root grows enough to be attached to the substrate and the plant is under normal care.

Section 2. Arrangement of Flowerpot and Grooming of the Plant

1. Arrangement of Flowerpot

The prerequisite for the cultivation of Kimilsungia is to arrange the pots in a rational way according to stage of its growth.

It is related to the fact that its ecological requirement and amount of fertilizer required are different in every stage of its growth, and in particular, its reaction to the temperature is very acute. In other words, the plant needs the high temperature in the period of vegetative growth but the low temperature in the period of reproductive growth and the lower one in the dormant period. And new sprouts come out within one to three months, not simultaneously even in the same cultivating environment. According to their size, two new sprouts may come out in a year, instead of one and some plants will happen to be attacked by blights or suffer from mechanical damage. Therefore, it is good to classify and cultivate such individuals into three stages of growth, blooming and dormancy.

Flower pots can be divided according to the cultivation substrates, because they are different from one another in watering and fertilizing periods and their quantities.

It is also convenient for management of the plant to subdivide them according to their materials and sizes and the size of the plant.

2. Grooming of the Plant

After the pot arrangement, it is important to correct the different factors to be a hindrance to the growth of plants.

When a new stem in some individuals stretches sideways, it is necessary to set up a prop or tie it to an old stem with a string. And the position of the pot should be adjusted so that a new stem tends towards a shadow.

At the same time, the new stem must be tended lest it should bend and be pressed by the stems and leaves nearby, or a deformed leaf be produced.

In addition, dry, leafless stems or damaged leaves affected by the full lifetime, blights and unfavorable environment must be cut from the plant grown for over one year after repotting.

And when a leaf, which has become unbearable to its weight, is drooping, it should be fixed. (Photo 44)

Leaf drooping occurs at the end of vegetative growth, i.e. in summer.

A B

Photo 44. Drooping leaf (A) and fixed leaf (B)

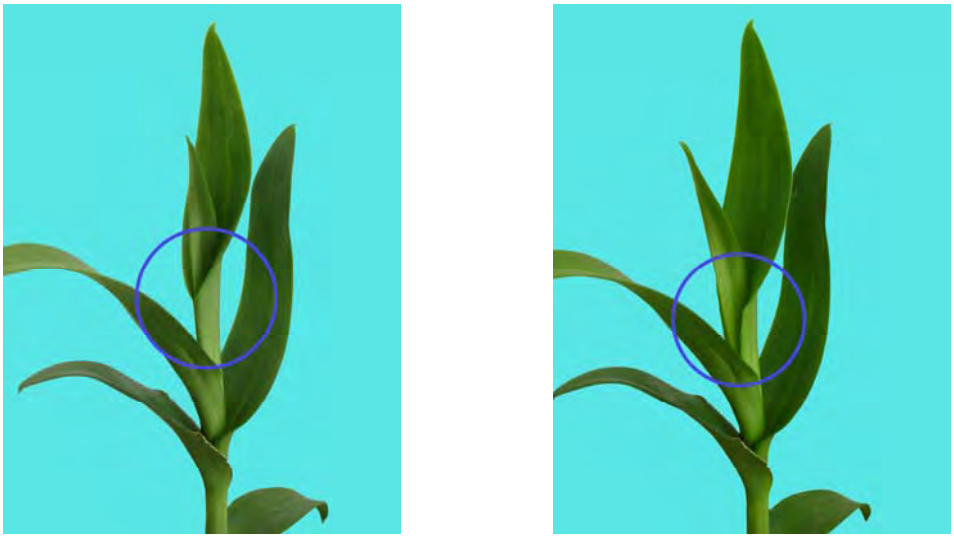
Generally, the large leaves on the uppermost part of the stem hang down. It makes the plant poor-looking and the leaves not perform their function properly.

If its drooping occurs, the temperature and humidity should be lowered, and sufficient light and good ventilation be provided, while reducing the amount of nitrogen fertilizer applied and increasing that of phosphorus and potassium fertilizers. And with the use of copper wire (about 1 mm in diametre) in the shape of Z or Σ, the drooped upper leaf is fixed to the desired place using the lower leaf. After a day, it takes its pose as fixed. Sometimes, the edges of leaves happen to stick completely to one another or only upper parts to be split.

The stems with such leaves do not grow properly and the leaves, too, become deformed. Therefore, the edges of these leaves should be split with hand or knife. (Photo 45)

When the root outgrows the pot in the plant grown for one year or more after repotting, the root apex is pushed inward.

This will prevent the root from stretching to other pots nearby, and causing obstacle to the handling.



A B

Photo 45. Leaves whose edges have been stuck (A) and split (B)

Section 3. Watering and Fertilizing

1. Watering

Watering should be done putting the stress on keeping moderate moisture of substrate. It is good to keep the substrate dry and wet at an interval of one or two days in consideration of the structural and functional characteristics of the root of Kimilsungia. It is difficult to control the moisture of substrate because it varies remarkably according to the environment and growing state of the plant as well as the quality and size of the flowerpot, the kind of substrate and watering time and quantity. Therefore, it is imperative to water, taking into account the different items as mentioned above.

The dry substrate needs watering. Although Kimilsungia is so resistant to drought, no watering until its substrate is completely dried may destroy the normal metabolism of the plant due to the shortage of water. In this case, its root is free from dry rot, but the velocity of its photosynthesis is reduced and its respiration quickened. After all, the plant gets weak, being destitute of nutrients. The colour of dry substrate is lighter than the wet. Moss is easy to break when touched, while pot pieces or porous clay give no wet feeling. These conditions provide correct judgment as to dryness of substrate and the need of watering. To make the substrate on the lower part of the pot dry within two or three days at least after watering is better than to saturate it. It is proper to dry the wet substrate within two or three days as much as possible. To this end, watering must be controlled so as not to make the substrate excessively wet.

It is good to water in the morning. The stoma of Kimilsungia gets open at night but the night is not good for watering. Watering at night makes the plant vulnerable to diseases as the greenhouse is low in temperature, high in humidity and shady, and the substrate does not dry quickly while its root stays wet long and the standing water in axil remains long. Watering in the morning makes the substrate dry in the daytime and keeps the pot in moderate humidity at night. When it is cloudy or going to rain,

watering should be done or avoided according to weather conditions. However, occasionally there are some cases out of these previsions. Unexpectedly, when it is cloudy or raining, the substrate should be dried fast as it is too wet. When the substrate is dry before evening it is good to water a little over its surface or spray.

Moisture required by substrate and its resistance to excessive moisture vary according to the vegetative stages, which needs to water suited to it. In Korea, Kimilsungia grows in spring when the percentage of sunshine is comparatively high on a monthly average and the sunshine duration is longer than other seasons but the relative humidity is low. That is why sufficient amount of water should be supplied to the substrate. Even in this condition its root is seldom rotten. In summer Kimilsungia grows fast and its vegetative growth is over. In this season the moisture the substrate requires and the resistance of root to excessive moisture are similar to those in spring, but the environmental condition is different. July and August are the rainy season with high humidity, long daytime and the lowest percentage of sunshine in a year. Therefore, in June that is not a rainy season, it is necessary to water like in spring but in the rainy season, water a little so as to facilitate the drying of the substrate. Autumn is the period of reproductive growth of Kimilsungia which needs full watering on substrate. At this time the substrate hardly dries because of the relatively high humidity and the low temperature in the greenhouse. It is rational to water much at first and a little next alternately. Winter is the season when Kimilsungia is to be in dormancy with the lowest demand for the moisture of substrate throughout the year. Particularly under such conditions that the temperature in the greenhouse is about 15°C at night and the hours of sunshine short, the root is liable to rot because it takes a long time to dry the substrate when plenty of water is given to it. Hence, in this season it is effective to water little by little. But in January when the peduncle puts forth after the treatment of floral bud, it is necessary to water like in autumn.

Kimilsungia needs the water of proper acidity (pH). Kimilsungia grows well in the substrate of weak acidity or of neutrality. Therefore, it is good to use such water for the growth of Kimilsungia. The clean rainwater or brook water, which is hypoacid or neutral, is fit to cultivate Kimilsungia. If the water in the limestone area is used for its

cultivation, its acidity must be adjusted as it is alkalescent and so might do damage to it.

It is essential to use the water which does not contain much amount of chemical elements harmful to the cultivation of Kimilsungia. Various kinds of substances are contained in natural water, among which some are indispensable for the growth of Kimilsungia, but on the contrary their excessive concentration exerts a harmful effect on its growth. So it is advisable to analyze the water before using.

The clean water is effective for its cultivation. The muddy water blocks the stoma and hinders the leaves from absorbing CO_2. And it prevents velamen from performing its function and makes it rotten earlier than when the clean water is supplied.

The temperature of the water for the plant must be almost the same with that of greenhouse. The water of far lower temperature stimulates the plant so much, thus destructing its normal metabolism. Now that such a phenomenon often happens in winter, much attention should be paid to using the water, the temperature of which becomes similar to that of the greenhouse by placing a water pail near the flowerpot stand.

2. Application of Fertilizer

Since watering of Kimilsungia is done every one or two days, the amount of individual nutritive elements is variably changed by washing. Therefore, it is necessary to apply different kinds of fertilizers based on full understanding of such change.

1) Kinds of fertilizers

Inorganic fertilizer

Nitrogen (N), phosphorus (P) and potassium (K) fertilizers are widely used to cultivate Kimilsungia. The ratio and quantity of the three macronutrient fertilizers may vary according to the cultivation purpose.

It is important to enhance the ornamental effect of the plants in the form of concentration or dispersion at the flower festival or flower exhibitions to be held on major anniversaries. Therefore, the plants must be bred to bear many flowers on a

peduncle with big stem. This requires high content of nitrogen out of the basic macronutrients during the period of their vegetative growth. The fertilizer of type of 14:8:6 ($N:P_2O_5:K_2O$) is usually applied. Some culturists use the fertilizer of type of 21:17:17, as well. Another one is to cultivate a plant indoors for ornamental purposes. For cultivation of such a plant, consideration shall be given to size of both pot and plant, and the length of peduncle to be harmonized each other. To this end, it is recommended to use fertilizer of type of 12:12:12 in the period of vegetative growth. And the type of 10:12:12 with high content of phosphorus and potassium is fit for the early reproductive growth. Besides, macronutrients like Mg and Ca are so much in water and substrate that there is no need to apply them separately. However, when fertilizer containing sulphur or organic fertilizer is not used, the symptoms of shortage of sulphur may occur. At the time it is advisable to spray the solution of 0.1% $MnSO_4 \cdot 4H_2O$ or $ZnSO_4 \cdot 7H_2O$ or $FeSO_4 \cdot 7H_2O$ on the leaves.

Seven microelements (Fe, Mn, Zn, Cu, B, Mo, Cl and Ni) are plentiful in water and substrate. But the quantity of microelements that the plants can absorb depends largely on the pH of water and substrate; these plants are short or superfluous in some nutritive elements. In case of deficiency in microelements, the solution of fertilizers containing nutritive elements neccessary for their cultivation should be sprayed on the leaves.

Organic fertilizer

Organic fertilizers can be used on the basis of the analysis of nutritive elements by raw materials or preparatory fertilizing-test result because their nutrient elements differ according to the raw materials and their processing method. At present, organic fertilizers used for the cultivation of Kimilsungia are excrement of chicken, soybean cake, rape cake, bone powder, potato juice, microbiological fertilizer, etc.

Carbon dioxide (CO_2) fertilizer

The density of CO_2 in the air is not adequate for the photosynthesis of plants. When their photosynthesis is activated at peak, the density of CO_2 (the saturation point of CO_2) ranges from 1 000–2 300 ppm in condition of sufficient light. Since in nature the density of CO_2 is 0.038% (380 ppm), plants are always short of CO_2. Therefore, if CO_2 in the air is densified, the photosynthesis of plants will be activated, helping them

improve in their number, quality and size. A CO_2 generator can be used for densifying CO_2 in the greenhouse. It produces CO_2 by burning natural gas, petroleum or propane gas. At the time the plant may be damaged if CO or ethylene is produced due to incomplete combustion or if gas to be burnt includes excessive sulphur element. To avoid that, it is essential to ensure the purity of the gas to be burnt and supply sufficient oxygen for perfect combustion. Liquid CO_2 is also used for this purpose. There is another way to increase the density of CO_2 in the air. During the night its density can be increased by C_3 and C_4 plants set in the greenhouse, which are not CAM plants. As Kimilsungia, unlike C_3 and C_4 plants, absorbs CO_2 only at night, the density of CO_2 in the greenhouse becomes low. When the outside temperature is high at night, the air inside the greenhouse should be replaced with that of high-density CO_2 from outside. To densify CO_2 in the greenhouse in the cold season, it is necessary to set C_3 and C_4 plants in the greenhouse. The flower stands made in a lattice form will allow plenty of light to come down to the bottom of the greenhouse through them, creating the favourable condition for the growth of C_3 and C_4 plants. Actually the ornamental plants grow well without particular care under the lattice-form pot stands. The cultivation of other plants as well as Kimilsungia in the same greenhouse is another way to raise the density of CO_2. In this case, careful attention should be paid to arrange the plants so as not to shade Kimilsungia.

2) Application of fertilizer

Since the culture substrate of Kimilsungia is porous, the water will quickly leak out and the substrate dry soon. If the solid fertilizer is put on the substrate, the time of its wet state is too short to melt it much and the concentration will get higher only around the fertilizer, doing harm to the plant. Solid fertilizer may be used but liquid one is more effective.

It is rational to spray the liquid fertilizer overhead, which is helpful to the growth of plant because of cleaning leaves as well as fertilizing. The fertilizer whose concentration is 0.1% is suitable. If the concentration of fertilizer is raised up to 0.2%, the plant may grow better, however it may be damaged by fertilizer, if not careful.

It is good to apply fertilizer diluted in water, combining the watering. But it is

permitted to fertilize and water separately. In case of fertilizing separately, its period should be set definitely. If not, the substrate cannot keep the required amount of fertilizer all the time because frequent watering washes away its elements. So it is rational to fertilize the sphagnum substrate once a week and the porous mud substrate or pot pieces substrate twice according to characteristics of the substrates. The weekday for fertilizing should be fixed if possible, but if the substrate seems too humid, it may be brought forward by one day or put off one day.

Fertilizer is also applied by foliar spray. When the plant is short of a certain nutritive element, the spray of compound of that element over the leaves makes it possible to absorb nutrients quicker than through the roots. Foliar spray, especially that of the nitrogen fertilizer, is a promoter of photosynthesis. In the leaf carbohydrate is formed as a primary product of photosynthesis. The plant should convert it into nitrogen compound such as amino acid and protein so that the concentration of carbohydrate gets low for the effective photosynthesis. The foliar spray of nitrogen fertilizer supplies to the leaves nitrogen necessary for making nitrogen compound. It is good to spray it to Kimilsungia in the early evening when its stomata are open.

3) Damage from fertilizer and prevention

Excessive application of fertilizers prevents the root of the plant from growing properly and causes its root to easily decay and the leaves to turn dark blue. And its flowers and stems are apt to be deformed. Oversupply of nitrogen fertilizer withers up flowers soon, gets the plants to be damaged by blight and weakens resistance to unfavorable environment. Damage from fertilizer occurs when its solution on the axil gets thick by evaporation. It is advisable to spray fertilizer solution of low concentration, watering the plant simultaneously or to give fertilizer solution of 0.1% concentration once or twice a week according to kinds of substrates. Damage may be also caused by applying fertilizer to the substrate with excessive amount of salt. The sphagnum substrate contains less salt than the porous clay or pot-pieces substrate. So the porous clay or pot pieces for substrates should be desalted once a month.

Section 4. Control of Light, Temperature and Air in the Greenhouse

1. Control of Light

As Kimilsungia needs dim light for the shade plants, the high light intensity should be lowered and the length of day and night also be adjusted properly. It has glossy green leaves when grown in the suitable light, but if the light is strong, the leaves become thick and if weak, the leaves become thin, drooping down.

1) Light adjustment

The maximum light intensity for photosynthesis of Kimilsungia is 15 000–20 000 lx. So the light intensity should be lowered in summer and even in winter in some cases. It is adjusted with a sunshade. A reed blind, loose texture, polyethylene film, polyester film, or polyester film coated with aluminum provide good protection against the sun. The light intensity can be controlled by covering and uncovering the greenhouse with doubled or trebled sunshade.

When the natural light intensity is low, it is necessary to raise it. In a fabricated greenhouse, the rafter protects the 10% of sun light, glass 7% and dust on the glass up to 20%. Rainy or cloudy days may be short of light intensity. In order to ensure sufficient light for the plants in such days, it is essential to design a greenhouse so as to be fully exposed to the natural light. It is also necessary to dust off glass in time. Nevertheless if the light is deficient, artificial light may be applied. But it is not so easy to provide the light of 15 000–20 000 1x, the light saturation point.

Lighting hours must be adjusted, too. Kimilsungia grows well in the condition the length of day and night is 12 hours each.

2) Daily light control

As is known after the sunrise in the morning, the light intensity gradually goes up and reaches its peak at noon and goes down at the sunset. If the actual light intensity in the greenhouse reaches over 20 000 lx, it is desirable to shade it from the sun and if it gets lower than this, it is necessary to remove a sunshade.

3) Annual light control

Like other plants, Kimilsungia goes through its growing stages at one-year intervals and each stage needs the different light intensity according to its age.

In Korea Kimilsungia sprouts in March or in early April and is in vegetative growth until late August, during which it needs sufficient light for its full growth. From March to the late August, a shade should be provided to make the light intensity reach its saturation point. In particular from May to early September when the daytime temperature in the greenhouse goes up excessively, it is advisable to put up the shade outside the greenhouse, apart from the glass for good ventilation, so that the heat of shade material does not allow to be conducted to the glass.

The early September to early December is the period of reproductive growth. As the atmospheric temperature falls, the shade should be installed inside the greenhouse. The light intensity should be maintained as in the period of vegetative growth until the peduncle grows and the first flower comes out and afterwards, be lowered to 6 000–8 000 lx so as to extend the period of flower viewing. The daytime in December is less than 10 hours. This length of the daytime is fit for the blooming of Kimilsungia, a relatively short-day plant, but may be insufficient for peduncle's growth or for the increase in the number of blossoms. However, there's no need for additional lighting.

When the flowers fade and fall or when the peduncles are cut, the plant goes into dormancy. This period generally lasts from December to early March. The daytime is about 9 hours and 30 minutes in this period, so the intensity of natural light falls down

to 40 000 lx. As the leaves of Kimilsungia continue to do photosynthesis during the dormancy, it is important to raise the light intensity up to the saturation point. There's no need to provide additional lighting simply because the length of daytime is short, for the dormancy lasts more than three months and during this period the consumption of nutrients for breathing is small while the plant is able to store nutrients enough for new sprout growing. The annual light control mentioned above is for two- or three-year-old plants. But it is different for premature plants of one or two years. They are weaker in resistance to the light and other environment than big plants and more favorable to grow length-wise than to grow thick, which requires to reduce the light intensity. In order to adjust stages of growth for the purpose of blooming Kimilsungia on some occasion, it is necessary to effectively ensure the light intensity and the length of daytime in accordance with each stage of growth.

2. Control of Temperature

Kimilsungia needs the temperature of 28–30°C during the daytime and 23°C during the night. It is, therefore, essential to control the temperature in the greenhouse for its optimal growth.

1) Method of controlling the temperature

The high temperature undesired for the growth of Kimilsungia should be lowered. As the daytime temperature rises mainly by sunlight, it should be intercepted outside the greenhouse. When its inside temperature is higher than the atmospheric one, it is advisable to ventilate the greenhouse or to sprinkle water on its floor. Sprinkling or spraying of underground water is more effective. The sprinkling of cold water on the glass of its roof makes the temperature fall considerably. The low temperature unfit for the growth of Kimilsungia should be raised by the heating devices. And the heat accumulated during the daytime can be used when the temperature is low as in the solar heated greenhouse. In addition, a heat-keeping device or a shade is installed in

the greenhouse to raise its low temperature. The temperature in the daytime should be raised up to 25°C at least, even though it is impossible up to 28°C. In the condition of sufficient light, the consumption rate of organic acid for 6 hours is more than 95% at the mean daytime temperature of 28–30°C, and about 90% at 25°C. However, as the daytime is more than 12 hours on average in the period ranging from mid-March to mid-September, the main growth period, the consumption rate of organic acid at 25°C nearly equals to that at 28–30°C. This shows that when the temperature of 28°C is not maintained, even that of 25°C for a short period is enough for the proper growth of the plant.

The temperature in the greenhouse should be controlled gradually. The rapid change in temperature has serious effects on metabolism of the plant and inflicts a damage to it. In order to prevent it, the growing space should not be made too small in winter. Also a large amount of heated water should be stored in the greenhouse to keep humidity and relieve any rapid change in temperature. When the air-conditioner is used, the plant should not be exposed direct to the warm or cold wind.

2) Daily control of temperature

The temperature changes day by day. The change in temperature in the greenhouse almost accords with that of sunlight but not in the time. The lowest temperature towards sunrise goes up as the time goes by and reaches maximum level at 1 or 2 p.m. and then goes down gradually until before sunrise. Therefore, in accordance with the change in the daily temperature, the temperature inside the greenhouse should be ensured properly lest it rises too high or drops too low.

First, the temperature should be ensured to obtain the maximum photosynthesis. At night, 23°C is suitable for the plants to accumulate organic acid but it can be controlled according to the light intensity and temperature in the daytime. If the light and temperature are not fully provided in the daytime, it is advisable to drop the night temperature to 23°C for CO_2 accumulated in the nighttime might not be consumed to the full.

Second, it is necessary to make the difference of temperature between day and night by 5°C. It is because Kimilsungia had origin in the tropics with little difference

in the temperature between night and day (3–6°C) and the difference between the temperature fit for accumulating the organic acid at night and that favorable for its consumption in the daytime is about 5°C.

3) Annual control of temperature

Kimilsungia is adapted to the region with little change of temperature throughout the year, so the big difference in temperature is not suitable for its growth. But when the features of demand for the temperature according to the growing stages are properly used, it is possible to grow Kimilsungia healthy with an aid of little amount of artificial heat.

In Korea the demand for the temperature of Kimilsungia is the highest (effective accumulative temperature is 1 300°C) in the period of March to September, during which the temperature needed to it is nearly provided by the sun. Only in March and April, Kimilsungia may suffer from the low temperature, when some additional heat is required. The difference in its growing period according to the conditions of temperature is 40–50 days, but there is little difference in its size in this period. Therefore, in March and April it is not necessary to raise the temperature in the condition of its full growing period. In June to August the plant might be damaged by high temperature in the daytime while the high temperature in the daytime and at night may bring about the unwanted growth. If the condition of the greenhouse is unfavorable, it is better to grow Kimilsungia outside.

The reproduction period of Kimilsungia is generally from August-September to October-November. In this period the plant needs the temperature of more than 15.8°C and the effective accumulated temperature of 455°C. Since the temperature suitable for reproductive growth is over 21°C, measures should be taken to raise the temperature in the greenhouse from late September. If it rises too much high in the period of reproductive growth, the flower will get small, its colour be obscure and its lifetime become short. And the flowers opened first will wither up or get discoloured when the fresh flowers are blooming at the uppermost part of the peduncle. So in the peduncle's growing period the temperature should be kept at 26°C in the daytime and 21°C at

night and after blooming, it should be lowered to 20–22°C in the daytime and to 17–18°C at night in order to keep the flowers long. In the period of the late autumn to winter when the plants are in dormancy the temperature goes down. To cope with it a proper measure should be taken lest they are damaged. In this period Kimilsungia demands the lower temperature than in the period of spring to summer. It is because all the growing processes are almost stopped and the leaves alone carry on slight photosynthesis to provide the plant with nutrients. The amount of stored nutrients exerts a considerable effect on the growth of new sprouts. Accordingly, the proper temperature must be ensured so that plenty of nutrition is stored. It is 20±1°C in the daytime and 15±1°C at night. The daytime temperature is mostly arranged by the sun's heat.

When the daytime temperature is rising to over 20°C, it is unnecessary to try to lower the temperature. It is because such high temperature for several hours hardly does harm to the plant. But if the temperature of over 20°C lasts long everyday, new shoots might come out earlier. In this case it is necessary to drop the temperature. Though the temperature at night drops to about 9°C for a few hours, there is no damage to the plant but its long duration may affect the plant. When the light, being cloudy for a few days, is insufficient and the temperature in the daytime is low, it is necessary to raise the temperature at night to 18–19°C, not to 15°C in order to prevent leaves from getting yellow.

Since Kimilsungia sprouts in March in Korea, if new sprouts are to come out, the temperature should be risen gradually to over 15°C, to be effective accumulative temperature of 360°C. To this end, it is advisable to rise the temperature in the greenhouse, taking advantage of the rise of atmospheric temperature from February, instead of in December and January.

3. Control of Air

1) Control of humidity

The proper humidity for the growth of Kimilsungia is 60–80%. The greenhouse equipped with no humidifier faces frequently the cases that the humidity level is below

60% or above 80%. Since Kimilsungia is a plant which requires high temperature, the temperature in the greenhouse should be risen to 28–29°C, or even to 32°C in the daytime. The relative humidity at such temperature is less than 40–50%, not 60%. When the heating system works in winter, the temperature is more than 25°C and humidity is below 50%. But sometimes it might be 80%. According to the meteorological report, the average humidity in Pyongyang is 82% from July to August, the raining season, and the relative humidity is more than 80% at noon for 58.7 days in a year. In the early morning and night, as well as in winter, the dormant period of Kimilsungia, the humidity level in the greenhouse tends to be 80%.

Therefore, humidity in the greenhouse must be controlled when it is higher or lower than that required by Kimilsungia. The relative humidity can be readily heightened using a sprayer. Another method is to plant different kinds of plants under the lattice pot stands. Non-CAM plants can considerably raise humidity because they open stomata in the daytime and transpire. One of the effective methods is to keep the floor of the greenhouse wet by sprinkling water. When the outdoor humidity is higher than the indoor, ventilation is recommended to increase internal humidity of the greenhouse. Excessive relative humidity might be dropped by ventilation. The ventilation has a high effect when the humidity of the outside is lower than that of the inside of the greenhouse. However, it also is effective when the humidity levels of the both sides are equal. It is because the circulation of the air accelerates the speed of the transpiration in the plants. High relative humidity can be dropped by raising the temperature in the greenhouse and making the light flow into the greenhouse as much as possible. This makes the relative humidity fall down in accordance with the rise of temperature in the greenhouse.

2) Ventilation

The original pure breeds of Kimilsungia were adapted to fresh forests. Therefore, ventilation is essential for artificial cultivation of Kimilsungia. The ventilation is needed when the temperature inside the greenhouse is extremely high and stunts the growth of the plant. It also is required when the culture medium of the pot is too wet or the atmospheric

humidity of the greenhouse is too high and when the fresh air conducive to the growth of the plants is provided to the greenhouse. It is effective to ventilate it at night when CO_2 content of the atmosphere outside the greenhouse increases. Besides, the ventilation makes the plant healthy and prevents the pests and diseases. The ventilation should be done in due consideration of different factors, because the elimination of an unfavorable factor by means of it may cause the plant to suffer from another factors.

Ventilation can be done by using an exhauster or by opening vents or doors. At that time the circulation speed of air should be moderate. If it is too fast, normal metabolism of the plants will be destroyed by the rapid change of environment and the plants will wither due to dehydration. In order to reduce the speed of air flow, several vents with an equal space must be laid so as to disperse the air flowing from outside. When the door is open, thin reed blind or cloth should be hung by the pot stand near the door lest a strong wind gets directly to the plant.

In order to drop the temperature or to rise the humidity by means of ventilation, it is effective to use the air of the basement or the dormant room that has low temperature and high humidity. The growing of the plant and the control of greenhouse condition according to seasons, growth stages and cultivation processes are summarized.

Table 4. Cultivation of Kimilsungia according to seasons

Classification \ Season / Month		Spring			Summer			Autumn			Winter		
		3	4	5	6	7	8	9	10	11	12	1	2
Growth stage		sprouting	stem-growing				peduncle-growing		blooming		dormancy		
Cultivation spot		greenhouse			outdoor					greenhouse			
Temperature (°C)	Effective accumulated temperature	359		1 300			455						
	Provided temperature		18<			30>			18<			15<	
Light intensity (lx)				15 000–20 000					6 000–8 000		15 000–20 000		
Relative humidity (%)		60–80 (40–50 for about 3 hours during the day)											
Watering		watering after the drying of substrate											
Fertilizing					fertilizing						no fertilizing		
Ventilation		opening roof-window			full-opening			opening window					

Table 5. Growth stage and care according to cultivation processes

Classification	Temperature (°C)		Light intensity (lx)	Relative humidity (percent)	Fertilizing	Watering	Duration (day)
	Night-day	Effective accumulated temperature					
Planting cultured seedling (acclimatization)	21–26±1		4 000–6 000	60–80		Watering after drying	15–20
Cultivating one-year plantlet	22–27±1		8 000–10 000	60–80, for about 3 hours by day 40–50	+	〃	1 year
Right after repotting	22–27±1		6 000–8 000	〃		〃	10–15
Sprouting	15–28	359±6.5	15 000–20 000	〃		〃	30–40
Stem-growing	23–29±1	1 300	〃	〃	+	〃	150±20
Peduncle-growing	21–26±1	455	〃	〃	+	〃	60±5
Blooming	21–26±1		〃	〃	+	〃	50±10
After blooming	17–21±1		6 000–8 000	〃		Watering the medium alone after drying	60±20
Dormancy	15–20±1		15 000–20 000	〃		Watering after drying	80±20
From the 6-BA treatment to the formation of peduncle	23–29±1		〃	〃		〃	10–15

Medicinal Flowering Plants

As they contain medicinal ingredients, medicinal flowering plants can be used as they are or in the processed form for the prevention and treatment of diseases.

These plants include cattail, peach blossom, tassel, violet, safflower, pyrethrum, daphne, pink, linden, sweet brier, *Styphnolobium japonicum*, magnolia, acacia, lily bell, honeysuckle, etc.

Nectaries or glands that send out honey or essential oil are commonly found in the ovary, on the protruding part of the receptacle or under the petal.

When flowers are to be used as medicine, petals in full bloom (pyrethrum and safflower), buds (mistletoe, santonia and *Styphnolobium japonicum*), corollas (safflower) or pistil (corn floss) should be picked. Their gathering should be done on a fine day, and then dried in a well-ventilated place.

Chapter 3
Outdoor and Indoor Cultivation of Kimilsungia

Kimilsungia can be cultivated outdoors and indoors when good conditions are provided.

Section 1. Outdoor Cultivation

Original breeds of Kimilsungia grow attached to the trunks of trees in the tropical regions, so they are well adapted to the outside conditions. Plenty of epiphytic orchids are still growing in the tropics.

In the temperate regions Kimilsungia is raised in greenhouse, but in the hot summer its outdoor culture is possible.

1. Advantage of Outdoor Cultivation in Summer

The outdoor cultivation of Kimilsungia in summer is advantageous in many respects.

First, the outdoor growing reliably prevents the plant from damage by high temperature. The temperature in the greenhouse is always higher than the outside due to the greenhouse effect. The temperature rises to 30–35°C not only in summer but also on the clear days of spring and autumn, which may bring about impediment to metabolism of the plants.

Second, Kimilsungia can bask in more sufficient light on cloudy days outdoors than in the greenhouse. Since there's no shade-producing structure in the outside unlike greenhouse, the light deficiency is no longer a problem for the outdoor growing.

Third, the outdoor growing can provide relatively sufficient humidity needed for growth of the plant. In rainy season the atmospheric humidity is usually higher than inside the greenhouse, so that the open-air cultivation prevents the plant from the root rot and the damage by harmful insects thanks to a constant flow of the air. During the outdoor cultivation period from June to September, few days have the fall of humidity under 30%, causing no damage due to drought at all.

Fourth, air circulation is more brisk out of doors than inside a greenhouse, providing enough CO_2 for the growth of Kimilsungia.

Fifth, the outdoor growing is easier and more economic than in the greenhouse and is good for the health of a gardener. Cultivation areas are not limited in the open air. This makes it possible to distribute plants for convenience's sake and dispense with hard labor under the high heat and humidity.

2. Creation of Bed

The following preparations must be made to cultivate Kimilsungia in the open air.

First, it is important to take a right place for outdoor cultivation. The bed must be sunny and well-ventilated.

Second, the creation of bed must take into account the ecological needs of Kimilsungia.

At the beginning, the pot stands are installed. It is reasonable to lay them 60–70 cm above the ground. This will protect the plants against the high heat from the surface of the ground during the midday and splashes of muddy water that affect the plants and substrate. And it provides good ventilation and protects the plants from harmful insects. The pot stands can be installed under the perch of grape or pumpkin and under the shade of big trees. In that case it is hard to control light as desired and the plants can be damaged by harmful insects moving from shade plants.

Next, sunshades should be installed. They must be placed more than 40–50 cm above from the top of the plant lest the heat from the shade devices affects the plants by ensuring that they can be opened or closed with ease.

Besides, vinyl sheets should be arranged to protect the bed from raining. They are kept beside the sunshade because they are used only when it rains frequently or for a long time.

It is advisable to prepare the insect-preventing curtains since different insects strange to greenhouses can attack Kimilsungia or pollinate when its flowers are open to make them fall early.

3. Management of Bed

First, it is essential to fix the period of the outdoor cultivation to provide the temperature favourable for the growth of Kimilsungia.

Next, the humidity of the cultivation substrate must be controlled to suit the outdoor condition.

Since in the open air the substrate dries faster than in the greenhouse, it is rational to water it enough and then spray both of substrate and plants in the evening in consideration of the humidity of the substrate and weather.

When it is raining, it is good to expose the plants to rain for about an hour to desalt the substrate and wash away dusts from the plants. When it rains frequently or for days, vinyl sheets can be used to avoid over-dampness.

A sunny garden needs more fertilizer than a greenhouse.

The plants in the bed must be moved into the greenhouse when the temperature drops below a suitable temperature for their growth.

Section 2. Indoor Cultivation

All the conditions of the living room or office are created in favour of the people who live in, not in favour of the plants.

Therefore, if Kimilsungia is to be grown at home, it is important to know the adaptability of the plant and grow it in accordance to it.

1. Light Condition and Its Control

The light condition of the room is worse than the greenhouse's. In winter when the light condition is unfavourable the intensity of sunlight through the windows of houses and offices facing south reaches 8 000–20 000 lx and more than 8 000 lx lasts about 8 hours. During this season, the light intensity through the windows facing north and northwest is usually 2 000–7 000 lx. However, in winter Kimilsungia is dormant and

Table 6. State of Kimilsungia grown up in rooms under different light conditions

Orientation of the room	Light intensity (lx)	Height of plant (cm)	Number of leaves (piece)	Length of peduncle (cm)	Date of bloom (date)	Number of flowers (piece)	Diameter of flower (cm)
Southern	8 000–20 000	45.0	10	39	Sep. 20	12	6.8
Northern	2 000–7 000	42.0	9	35	Oct. 1	9	6.8

not severely influenced by light. As the light condition of the room improves better from spring to autumn than in winter, the plant grows well. From spring the duration of light intensity of over 20 000 lx inside the room increases and therefore, it is necessary to hang a curtain or put other bigger plants for shade. Such light condition allows Kimilsungia to grow harmoniously. Kimilsungia can be grown even in the house with unfavourable light condition, facing north.

2. Temperature Condition and Management

The room temperature is maintained usually between 18 and 25°C, which are comparatively favourable to grow Kimilsungia. If the temperature of the room is unfavourable for its growth, it is advisable to move the flowerpots to the most favourable one of several rooms. And the pots should be placed at least 10 cm off the window pane so that the plant can avoid the damage from the rapid temperature change of the glass.

3. Humidity Condition and Management

The humidity of the air is always lower indoors than outdoors and in the high-storeyed building than the single-storeyed house. In the DPRK, the average atmospheric humidity is 67–72% in winter. In this case it is 30–70% in single-storeyed houses facing the south and 20–60% in high-storeyed buildings. The relative humidity of the living room is low for Kimilsungia which requires humidity of 60–80%. For the rooms with low humidity it is agreeable to put a fish globe or several flowerpots to raise humidity. However, Kimilsungia is so strong in resistance to drought, the humidity of the room at a low level has no trouble in growing it. It is better to increase the watering quantity and frequency and use plastic pot or ceramic pot or big earthenware pot rather than earthenware pot of standard size as the substrate dries more quickly in rooms than in the greenhouse or in the open air. The tap water is kept in pail in the room for a while till its temperature becomes equal to that of the room before using. When the pots are kept long in the room, dust can be settled on the plants. It is recommended to wash it away with a sprayer in the toilet several times every month.

4. Other Management

The nutrition of Kimilsungia in the room is the same as that in the greenhouse but needs less fertilizer due to insufficient light and low humidity. No special ventilation is needed. CO_2 gas produced by the breathing of the people is used for photosynthesis.

As the room is usually exposed to the reflected light, the buds turn to the direction of the sunshine. So the pots should be turned in the opposite direction once in several days to make the buds grow straight up. As the young seedling blooms after 2–3 years, it is advisable to grow two-year-old seedlings to put forth its flowers in the first year. In order to bloom Kimilsungia in February or April at home or in the office, the growth stage must be adjusted and the proper conditions provided. What is important here is to adjust temperature. When the temperature is too low, the 6-BA treatment should be given ahead of schedule.

Flowers and Fruits

Generally, a plant bears flower and fruit to leave its filial generation behind.

Once it bears fruits, an annual or biennial plant withers, leaving only seeds behind. But perennial plants bear flowers and fruits several times as their lifetime is comparatively long.

Flower is a reproductive organ of angiosperm, and fruit forms after the ovary is developed by means of fertilization. After fertilization, the ovarian wall becomes the skin of fruit and the ovule in ovary develops into seed.

Fruit contains one or several seeds.

It is classified into some types on the basis of the texture of the pericarp. The fruit with thick pericarp is called fleshy fruit, and that with thin pericarp dry fruit. The former is divided into drupe (peach), berry (grape) and pome (pear), and the latter into indehiscent fruit (dandelion, rice plant and maple) and dehiscent fruit (bean and violet).

All those mentioned above are simple fruits which are formed in flowers with one pistil, whereas compound fruits are formed in flowers with over two pistils, to which strawberry, rose and the like belong.

There are also real fruits formed by the development of ovary and spurious fruits formed with the help of other floral parts (sepal, stamen and receptacle).

The seed grows into next generation after germination of embryo and plays the most important role in the survival of plants.

The outmost layer of seed is enveloped by its coat and, in the middle of it, the embryo and albumen developed from the fertilized egg cells appear.

The embryo consists of cotyledon, hypocotyl and epicotyl. The albumen supplies nutritive substances to embryo during its germination. The seeds of some plants have no albumens, which are called albumen-free seeds (Rosaceae, Compositae and Leguminosae) owing to their immaturity.

In these seeds, the seed leaf supplies nutritive substances to embryo during its germination. The albumen of seed mainly stores starch (rice plant and maize) and also fat (oil vegetable and castor-oil plant).

Chapter 4
Control of Blooming of Kimilsungia

With the proper use of growth characteristics of Kimilsungia and the physiological action of growth regulators anyone can obtain beautiful flowers at a certain time he or she desires.

Section 1. Control of Blooming

In general, the ornamental plants bloom at any time if they are provided with such ecological conditions as effective accumulated temperature, light intensity required and length of day. With the proper use of the structural and functional characteristics of the plants, you can obtain flowers from an individual plant more than twice, instead of once. The same is true of Kimilsungia.

1. Control of Sprouting

Kimilsungia is relatively a short day plant and when its growth is over it blooms without undergoing a low-temperature stage. What counts for much is that the stem must reach the size big enough to support the flower.

The matured Kimilsungia blooms seven or eight months after it has sprouted. So if the sprouting is to be controlled, can flowers bloom at a desired time. It can be done in various ways.

1) Control by temperature

In most Kimilsungia greenhouses in Korea the plants usually sprout between March and April which are the most favourable period for their growth. However, it is possible to make them sprout at any season by adjusting the temperature of the greenhouse. A rise in temperature makes the plant sprout earlier, and vice versa.

The above-mentioned method is employed mainly in winter and spring. It is related to the fact that it is difficult to provide the favourable temperature for the dormancy to Kimilsungia. If it is to bloom from February to June the plant must enter the dormancy in summer. In summer, it is very hard to lower the temperature of the greenhouse because of sultry weather. In order to begin to put out new sprouts in autumn with a view to blooming from February to June, the vegetative growth should be encouraged in autumn and winter. In this period, the supplementary illumination for photosynthesis as well as the adjustment of the temperature of the greenhouse must be conducted to accelerate the vegetative growth of the plant as the day length gets shorter and the light intensity decreases in Korea. In case that the temperature alone is adjusted without the supplementary illumination, the growth rate of the stem in this period reduces to 50–60% as compared with that in summer. This results in diminishing the number of blooming individuals and flowers of each plant by half. Therefore, the method of adjusting the temperature is effective for germinating between January and May and for blooming between August and next January.

2) Control by cutting off the bud

Usually, the lower part of the old stem has 2–3 lateral buds which can grow enough to be a new shoot. Of them, the most developed lateral bud begins to sprout and others go into the dormant state. If this bud gets damaged by any factor, another in dormancy takes the place of it. If this bud is cut off, new shoot comes out after about 15–20 days. If the second one is removed, the third comes out. But the latter can come out only from a big and healthy plant. Meanwhile, new shoots can grow from the lower part of the newly-cut stem. In order to remove the bud the new stem must be cut with pruning shears or knife, leaving 0.5–1 cm of the lower part of it. This can delay the development

of the new sprout. This method is used when the blooming is going to begin one or two months ahead of schedule because of the earlier sprouting, and usually applied between March and July.

Cutting off the buds is done only when it is necessary. It is because the nutrient of the old stem is exhausted for the growth of the new shoot and therefore the later bud is weaker than the former. So this should be done only once or when the buds are young.

3) Control by growth regulators

Usually, the buds in the dormant stage hardly sprout. They can sprout through the application of growth regulators. They include kinetin (KT), the type of cytokinin, 6-benzol-aminopyrine (6-BA) and gibberellins. However, 6-BA is the most effective of them for the sprouting of Kimilsungia.

There are various methods to apply it to the plants. Of them the most effective method is the injection of 6-BA solution and the applying of 6-BA lanolin ointment.

The injection of 6-BA solution is done as follows. First, prepare 6-BA solution. 6-BA in powdery state is soluble in thin acid, alkali or alcohol of high concentration but is insoluble in water. The solution is made by dissolving powdered 6-BA in ethyl alcohol with sterilizing effect. To make 100 ml of 0.5% 6-BA alcoholic solution, 0.5g of 6-BA is dissolved in 74 ml of 95% ethyl alcohol and then 26 ml of water is added to it. The alcohol concentration is about 70%.

6-BA solution is injected into the plant by a syringe whose needle is less than 0.5 mm in diameter. If its diameter is bigger than this, a mass of plant tissue would block the hole of a needle at the time of injection. The amount of solution for injection should be 0.1 ml. In order to inject exact quantity, the syringe should be thin and have a scale. 6-BA solution stimulates not only the nearest bud to the injected spot but also the rest of buds at the lower part of the stem. The best developed one sprouts first, followed by others in turn. According to the degree of the growth 1–3 buds will develop at the lower part of the stem, which shows the high efficiency of the injection. A certain number of sprouts out of them is left and others cut off.

To wake dormant buds at the lower part of the stem, it is also recommended to apply 6-BA lanolin ointment. The melting point of lanolin is 31–43°C. Its major ingredients are cholesterin and isocholesterin. Lanolin is widely used in the pharmaceutical and cosmetics industries. Refined lanolin is odorless viscous substance. Lanolin is divided into anhydrous lanolin and hydrous one containing water of about 25%. The refined hydrous lanolin is often used to make 6-BA lanolin ointment. 6-BA is slowly dissolved in the refined hydrous lanolin that contains a certain amount of water and is acid. To make the ointment, 6-BA should be added to hydrous lanolin at its melting point and mixed with it. The proportion of 6-BA to lanolin must be adjusted to 0.5%. This ointment is applied to the lateral buds. The most developed bud at the lower part of the stem is chosen and the scales around it are removed to bare the lateral bud. A groove is made on the epidermis below the lateral bud and apply the lanolin ointment on it. The treated bud alone may develop.

The bud develops at the temperature favorable for vegetative growth 10–15 days after the treatment with 6-BA solution or 6-BA lanolin ointment. The above-mentioned method enables the buds to develop in a shorter time than the temperature-oriented method. This method can be applied to any species of the plants in dormant stage. However, if 6-BA treatment is given to the plant which has gone into the dormant stage a short while ago, a new bud may develop, but it grows poorly owing to the lack of nutrients stored by the parent body.

2. Control of the Growth

Flowers can be obtained at the desired time by adjusting the temperature and the length of daytime in growing period.

1) Control by temperature

The simultaneously coming buds may vary in the period of vegetative growth according to the given temperature. Kimilsungia finishes its vegetative growth only

when their effective accumulated temperature reaches 1 300°C and the average temperature 15°C. If the average temperature is kept high every day, the effective accumulated temperature required can be attained in a shorter period, thus hastening the vegetative growth. On the contrary, the lower average temperature will extend the period. The range of shortening the growing period by changing the temperature is about 50 days, provided that the normal vegetative growth of the plant is ensured.

The period of reproductive growth can also be shortened by the temperature. During the period from the appearance of peduncle to the blooming of the first flower the effective accumulated temperature should be over 15.8°C and 455°C respectively. The time it takes to get the value of this accumulated temperature can be shortened or prolonged by adjusting the daily average temperature. In this case the range is about 15 days. If one peduncle bears ten flowers, the period of blooming can be shortened by 10–15 days by changing the temperature. Consequently, the whole period of reproductive growth can be reduced by 25–30 days through the change of temperature. In conclusion, the whole growing period can be reduced by 75–80 days by means of temperature control.

2) Control by the temperature and the length of day

The growing period of Kimilsungia can be reduced by changing both the temperature and the length of day. If the length of day is shortened to 9 hours at the high temperature, the flower buds will differentiate about 15 days earlier than when it is 16 hours. The blooming date can be advanced by three months by varying the temperature and the length of day during the growing period from the budding at the lower part of one-year-old stem to the blooming. The period of three months indicates the difference between the two growing periods when the poles-apart daily average temperatures within the limit of temperature for growth and day lengths are provided. However, the range of controlling by means of temperature and duration of daytime is, in fact, less than half the period since the optimal temperature and length of day are provided to plants under cultivation.

3. Control of the Differentiation of Floral Bud

The dormant lateral buds on the upper part of the stem can be grown into peduncles by treating with growth regulators such as 0.5% 6-BA lanolin ointment or 0.5% 6-BA solution.

To obtain the flower at a desired time, it is important to set an appropriate time for treatment.

The peduncle usually comes out at the latest 10–15 days after it has been treated by 6-BA solution or ointment. The period from the initial formation of a peduncle to the appearance of the first flower is 45–60 days. The interval between the blooming of the first flower and the second on one peduncle ranges from 2 to 3 days according to the temperature.

A culturist can, based on his experience, estimate how many flowers will bloom on one peduncle. When one peduncle is supposed to have 10 flowers, it takes 75–105 days for all the flowers to bloom after the application of 6-BA. Therefore, the timetable for 6-BA treatment must be made in consideration of this. The method of application of 6-BA lanolin ointment is as follows:

First, the lateral bud for treatment is chosen. Generally, there are one terminal bud and two lateral buds above the last leaf at the apex of the stem, and one lateral bud on each axil going downwards. The presence of two lateral buds at the apex of the stem is ascribable to the fact that the leaf on that part is not fully matured. If the terminal bud or one of the lateral buds grows into a peduncle in autumn, the other bud will naturally be shriveled and can no longer function as a bud. Therefore, the remaining lateral bud and the lateral bud above the axil usually grow well. The better developed of these two is chosen. Once the choice of the bud is made, it is skinned with a knife 3–4 mm downward, beginning from 3–5 mm above its centre. Then the bud appears clearer to reveal the degree of its development. Next, a groove 4–6 mm long, 1–3 mm wide and 1–3 mm deep is made on the stem 3–6 mm down from the centre of the bud. In this case a groove must be made near the bud if it was peeled off too little, but far away

from the bud if too much. The thicker the stem is and the more freshly the bud forms and the higher the concentration of 6-BA is, the farther away the groove should be from the bud.

If the lower leaf near the bud makes it hard to treat the bud, a groove may be cut on the bud, but the effect of its treatment can be decreased.

After peeling off the bud and making a groove, 6-BA lanolin ointment is applied to the area from its peeled part down to the groove. In this case the groove must be filled with ointment. If ointment is applied too little, lanolin condenses, giving rise to spaces. Therefore, it is good to apply ointment 1–2 mm thick. If it is questionable whether the peduncle is formed or not at the bud treated, several other buds should be treated simultaneously so that the peduncle would develop from any one of them.

The formation of the peduncle is checked seven to ten days after the treatment, or else, another bud is treated again, then the flower comes into bloom almost in time. If the growing peduncle becomes round instead of elongated and gets green before it becomes 1 cm long, it means that the bud stopped growing, and therefore, another bud should be chosen instantly to treat. If the bud is well developed, the formation of the peduncle is almost 100% successful, but if not, the rate of its formation is very low. The older the lateral bud, the lower the possibility of its formation. Particularly, more than one-year-old bud is less successful in its formation. Wrong treatment may not only hamper the development of peduncles but also produce a lot of deformed flowers.

After the treatment, it is important to take good care of the plant. For 10–20 days during which the peduncle becomes 1–2 cm long, the temperature of the greenhouse should be maintained at 28–30°C in the daytime and 23–25°C at night so that the buds can quickly develop. If the temperature is to be raised to over 32°C and the light intensity to 20 000 lx to speed up the budding, the peeled-off part of the bud might get damaged first since it is weaker than the other parts. Moreover, too high temperature in the greenhouse enhances the effect of 6-BA treatment with the same concentration, resulting in a lot of malformed flowers. Another thing is that the buds may not grow into peduncles but into sprouts if the temperature and humidity are kept excessively high day and night.

The dormant lateral bud can be grown into a peduncle by means of 6-BA injection. The application of the injection is akin to that employed for developing the lateral bud on the lower part of the stem. In order to grow the dormant bud into a peduncle, 6-BA solution should be injected into a bud-free internode between second and fourth leaves. (Photo 46)

When the solution is injected into the upper part of the stem, both the needle of the

A B

Photo 46. Injection of 6-BA solution (A) and the lateral bud developing after injection (B)

syringe and the solution go more smoothly into the upper part than the lower. That is because the lower part of the stem is hard due to the densely arranged nodes, while the upper part is soft thanks to the long internodes. 6-BA solution is injected when the end of the needle reaches the middle of the stem. To make the stem absorb the solution to the full it is advisable to give the plant a little or no water the day before injection.

6-BA injection method mentioned above and 6-BA lanolin ointment-applying method are different from each other in many respects.

First, in the latter method a peduncle would come from the treated bud alone. But in the former method most of the buds grow into peduncles. Then only the healthy peduncles are spared and the rest cut off. The former method is not so good: the plant would suffer from the wound and waste nutrients for nothing, and the spared peduncle would produce less number of flowers.

Second, in the latter method the ability and skill of the caretaker are required to

choose the bud but in the former, such skills are not needed. Hence, the speed of the treatment is almost twice faster than the former.

Third, the peduncle with full-blown flowers may fall after the ointment application, because of the withering of the grooved part under the bud. And the damage on the stem and the black lanolin film will degrade its ornamental value. But such things seldom occur in injection mode. These two methods have their merits and demerits, so the cultivators must choose them according to their purposes.

The mode of controlling the differentiation period by treating the bud with 6-BA solution or 6-BA ointment is better than that of controlling the budding period, by which A-class Kimilsungia can be obtained in April and February. In this method the old stems that produced flowers in the previous year are used. Consequently, the stems are big and the flowers are similar to or more beautiful than those blooming in autumn. And it is possible to fix punctually the time of the formation of the peduncles.

In addition, by dint of such treatments, the plants which failed to bloom last autumn due to the lack of vegetative growth can produce flowers and even those whose stems are only 10 cm long bear 8–12 flowers.

Section 2. Blooming in Different Seasons

Floriculturists employ various methods to make it possible to enjoy the full-blown Kimilsungia at any time, regardless of seasons.

1. Blooming in Spring

In spring fresh buds begin to develop in most of the Kimilsungia greenhouses in Korea.

In order to bloom flowers in spring it is necessary to sprout the plants between July and September, ensuring their sufficient vegetative growth and let them enter the

reproductive growth stage between December and next February. But in view of the climatic conditions in Korea it is quite impossible. Therefore, it is more rational to bloom in spring by giving 6-BA treatment to the buds of the stem that bloomed last autumn and in early winter than by preparing fresh buds. This enables the stems that have grown in favorable conditions to be used to bloom safely in autumn, winter and following spring. If it is to bloom flowers in March, April and May, the 6-BA treatment should be given in mid-December of previous year, mid-January and mid-February, respectively. The plant should be tended as in the control of differentiation period by 6-BA treatment. The method of blooming in spring by the 6-BA treatment is very economic and reliable as the flowers can be successfully bloomed, provided that the necessary conditions are ensured with no additional light.

2. Blooming in Summer

Two methods are employed for blooming in summer. One is to ensure the successful budding. Budding should begin between mid-October and mid-December. In this case, the challenge is to ensure vegetative growth in winter.

Another is to give 6-BA treatment to the old stems so that they put forth peduncles. The treatment should be given between mid-March and mid-May. But it is not so easy to maintain low temperature lest buds develop from the lower part of stem until this period. That is why in Korea the method of reducing the differentiation period of the floral bud is adopted to produce flowers in June and July, and the above-mentioned method or the method of ensuring the budding in August is employed according to the conditions of the greenhouse. Whichever method is employed, in Korea it is the most difficult to bloom in summer, particularly from mid-July to August.

3. Blooming in Autumn

The most effective method to bloom in autumn is to adjust the budding period. To this end, the fresh bud should be formed between mid-January and mid-March.

4. Blooming in Winter

In order to bloom Kimilsungia in winter, it is good to combine the method of ensuring the budding and that of shortening the period of floral bud differentiation. Blooming between December and mid-January depends on the method of sprouting between mid-April and early May, while the blooming between late January and February relies on the method of 6-BA treatment to make the peduncle develop in mid-November. In order for the plant to sprout in April or May, it is rational to use the plants that bloomed in April with the help of 6-BA treatment. The plant whose peduncles were removed in September or early October may be given 6-BA treatment in November. This kind of plant accumulates nutrients in the stem for over a month after the removal of peduncles, so that the stem can produce equally graceful flowers.

Section 3. Ways to Improve Quality of Flower

The quality of flower indicates the shape and colour of the flower as well as its number and size. The shape and colour of Kimilsungia are invariable regardless of cultivating method, but its number and size vary with it. Here are some methods to increase the number and size of flower.

1. Ensuring the Growth of the Fresh Stem to the Maximum

The fresh stem should be taken good care of to get the more flowers. The number of the flowers is almost proportionate to the stem size. In order to grow the stem big, firstly the budding time should be properly chosen. When it sprouts in March and April, the stem grows biggest. While it grows, it is important to pay due attention to environmental and nutritional management as well as to prevention of blights. Next, big and healthy old stems should be spared in plenty. That is because, though the

leaves of old stems photosynthesize less than those of the new ones, they produce organic substances and supply them to new stem for its growth.

2. Creation of Environment Suitable for Dormancy Period

What is most important in ensuring the environment is to maintain the temperature.

The greenhouse temperature should be properly kept during the dormancy so that many flowers may bloom after the 6-BA treatment. By the time of its treatment, the plant should accumulate enough nutrients and no lateral bud should develop at the lower part of the stem. This necessitates nothing but the control of temperature. During the blooming period, the stem wastes much of the nutrients accumulated before, but it will restore all the nutrients after a month through photosynthesis at the temperature of 21–26°C. Therefore, the 6-BA treatment given a month after the fall of the flower or the removal of peduncle makes it possible to produce the flower whose quality is never inferior to the previous one. If it is to bloom in February, the 6-BA treatment is to be given in mid-November. The plant eligible for it is the one with flower fallen or peduncle removed before mid-October. But in order to obtain flowers in early July, the 6-BA treatment should be given in the middle of April. The plant with flower fallen or peduncle removed at the end of November needs a dormant period before receiving a 6-BA treatment in the middle or end of April the next year. During the dormant period, it must decrease the consumption rate of nutrients by breathing while maintaining the storage as much as possible and resist the formation of bud at the lower stem. Then, it is necessary to keep the temperature of the greenhouse low at 15±1°C and 20±1°C at night and day respectively. As mentioned above the control of the greenhouse temperature according to the length of the period of dormancy is essential for producing beautiful flowers.

3. Increasing the Number of Flowers on the Stem

The number of flowers can be increased by making several peduncles develop on

one stem. The quality of flower is usually affected by the number of flowers on one stem. But the number of flowers on it is limited. In indeterminate inflorescence the interval between blooming of the lowest flower and the next flower is usually two or three days according to the temperature. And the efflorescence of a flower lasts around 60 days under the favorable condition. Therefore, even if many flowers grow on one stem, only 20–30 of them will be in bloom at a time and others will fall or remain as flower buds. Actually, it is impossible to have such a many flowers on one stem.

Tens of thousands of Kimilsungia have been so far displayed in Kimilsungia Festivals held in commemoration of the birthday of President Kim Il Sung**,** but the maximum number of flowers on one stem was 29. The average number of flowers in bloom on one stem was 18–20 and others were flower buds. And the flowers more than 40 days old faded in colour and showed wilt. Those many flowers were too heavy for a long peduncle to support without recourse to a supporter and the imbalance between the plant body and peduncle impaired the ornamental value.

As can be seen, one-stem-for-one-peduncle method is not a solution to the further increase in the number of flowers. The only way is one-stem-for-several-peduncles. Stems usually have 3–4 buds that can grow into peduncles, and these buds can be treated with 6-BA to shoot more peduncles. However, simultaneous treatments do not make several peduncles grow at the same time. Normally in one stem the upper buds grow better than the lower ones. But in some cases both the upper and lower buds grow well, and sometimes the lower buds are better than the upper ones. If the better-developed buds are given 6-BA treatment, peduncles will appear in 5–7 days, but in case of the poor buds it will take 10–15 days. As mentioned above, if the simultaneous treatment of 6–BA solution is given to some buds at different growth stages, the early-formed peduncles will grow big and have many flowers, while the lately formed ones fail. This will break the balance between the peduncles and make the plant ill-looking. In order to make several peduncles each of which has equal number of flowers develop simultaneously, the lateral buds on one stem should be treated with 6-BA at different times. Then the 6-BA lanolin ointment treatment should be given, instead of the treatment of 6-BA injection.

The plant whose stem is at least 50 cm high is good to look at when several peduncles grow on. Three buds are selected to produce three peduncles on the stem. Of them, the least-developed bud is treated first. When the treated bud begins to swell, the second best-developed bud is done, followed by the best-developed one two to four days later. As a result, three peduncles will occur almost at the same time and also produce similar number of flowers respectively.

When several peduncles develop on one stem, the number of flowers on each stem will decrease but the total number will increase, adding much more ornamental value to the plant. To take an example, one stem with three peduncles had 44 flowers in total.

4. Maintaining Suitable Temperature after the Formation of Peduncle

After the peduncles develop, it is necessary to provide them with suitable temperature to obtain big flowers. In the greenhouse of the high temperature, the flowers bloom early but their size is small. To produce big flowers it is essential to make sure that the temperature of the greenhouse does not exceed 26±2°C in the daytime and 22±2°C at night. When the day and night temperatures rise by 2°C higher than above-mentioned temperatures the size of the flowers will decrease by 15%. However, it makes no difference to the number of flowers.

Weather-Forecasting Flowering Plants

Calamus lotus:

It is in full bloom on the eve of a downpour of rain in summer and autumn.

Autumn chrysanthemum:

It is called an excellent forecaster of frost as the first frost hits within ten days after its first flowering.

Plum tree:

In the warm weather of winter it opens its flowers early, which forecasts that the coming spring will be cold, but in the cold weather of winter it blooms late, which denotes that the next spring will be warm.

Chapter 5
Diseases and Pests Harmful to Kimilsungia and Their Prevention and Control

Section 1. Major Diseases

As it is a perennial plant, Kimilsungia is susceptible to various kinds of diseases in the process of cultivation. Common diseases are bacterial soft rot, alternaria leaf spot, cylindrosporium leaf wilt, anthracnose, dry root rot and other virus diseases.

1. Bacterial Soft Rot

Pathogen: *Erwinia carotovora*

Character: It is a Gram-negative and anaerobic rod-type germ with 2–8 flagella and 1.5–2.0 × 0.5–0.7 μm in dimensions. It forms a grey-white round or amoeboid colony in the agar-agar. As it is highly capable of decomposing pectin, it dissociates and softens the tissue cells of plants. The favorable temperature for growth is 10–43° C and optimum temperature is 25–30°C. It lives in the substratum for a long period of time and adheres to the host plant with the aid of spluttering droplets in the time of watering to invade

Photo 47. Young stem affected by bacterial soft rot

through water pore, stoma and damaged part.

Symptoms: At the beginning, dark green specks appear on the leaves which gradually expand. The leaf and the whole stem, if affected, rot, reeking of unpleasant odour. The disease is more common in the new stem than the old one and especially in the rainy season.

Prevention and Control: The disease can be prevented through the proper management of temperature, humidity and ventilation in the rainy season. It is required the plants be tended with care to avoid damage and watering avoided for several days after transplanting. The affected plant and its culture medium should be burnt up immediately. At the early stage of the infection, spray the antibiotics such as streptomycin and polyoxin 3–4 times a week. It is also efficacious to spray several times a 1 to 10–20 solution of the extracts of wild bergamot, garlic and honeysuckle.

2. Alternaria Leaf Spot

Pathogen: *Alternaria* sp.

Character: The mycellium has a septum and branches. It is colorless and 4–6 μm thick. There is a conidiophore, which has 2–3 septums and is 40–60 × 5.7–6.3 μm in dimensions. The conidium is grenade-shaped, elliptical and multicellular with vertical and horizontal septums. It is brown or dark brown and 66–129 × 10–22.5 μm in size. It

A B

Photo 48. Leaves affected by alternaria leaf spot
(A) early symptoms; (B) late symptoms

is readily formed at the temperature between 15°C and 20°C. The hyphae or conidia are carried by air and insects to plants. They are active in plant that grows weak due to the improper conditions of temperature, humidity and ventilation or the lack of fertilizer.

Symptoms: At first a light brown or dark brown tiny mottles appear on the leaf and gradually enlarge into round or oval black spots. (Photo 48)

In some cases, they become yellow spots with dim periphery. They are usually 3–4 mm across. The surface of the ill leaf is distinguished from the healthy leaf by a depression. The mottle rarely gets mixed with the adjacent one to form a larger one.

Prevention and Control: It is imperative to create appropriate temperature, humidity and ventilation conditions in the greenhouse and exterminate the noxious insects in it. The diseased leaves should be picked off and burnt up. At the early stage of the disease, spray the solution of zineb, thiram, ferbam, captan, Topsin-M and chlorothalonil 3–4 times a week. It is also efficacious to spray a 1 to 15–30 solution of the extracts of *carpesium abrotanoides*, skullcap, weeping willow and calamus.

3. Cylindrosporium Leaf Wilt

Pathogen: *Cylindrosporium* sp.

Character: The conidium is filamentous or cylindrical and slightly curved and 20–45 × 1–2 μm in size. It is colorless and has two or three horizontal septums. It grows well at the temperature of 16–25°C. The conidiophore is colorless or cream-colored, thread-like and 20–25 μm long. It is closely arranged in close bundles and in layers. Conidia and hyphae winter attached to the stems and leaves. Next year they invade mainly the leaves of young stem. The disease occurs from summer to early September, mostly on the young plant

Photo 49. Young stem affected by cylindrosporium leaf wilt

that has grown adversely owing to the oversupply of nitrogen fertilizer.

Symptoms: The spot spreads inward from the margin of the leaf and the leaf withers turning yellow. The part of citatrix is clearly distinguished from the healthy one by a dark brown line. (Photo 49) In serious cases, the diseased leaf withers up and falls in the end.

Prevention and Control: It is essential to grow young plant to be healthy by providing sufficient amount of nutrients. When watering, care should be taken lest droplets splutter on the leaves. The diseased leaves must be picked off and burnt up. Young leaves should be disinfected with mancozeb and daisen. At the early stage of disease, it is advisable to spray disinfectants such as zineb, chlorothalonil, captan, Topsin-M and Piram two or three times at intervals of 7–10 days. It is also good to spray a 1 to 10–20 solution of the extracts of peach tree, garlic, calamus, palmachristi and *Acanthopanax sessiliforum* more than thrice at weekly intervals. At the same time, it is necessary to exterminate the pests in the greenhouse.

4. Anthracnose

Pathogen: *Colletotrichum gloeosporoides*

Character: The conidium spot is brown or black and 100–300 μm in diameter. The conidiophore is of short rod-type and 18–25 × 4–4.5 μm in size. The conidium is colorless, single-celled, oval and 16–25 × 3.5–6 μm in dimensions. It grows at the temperature of 10–38°C, the optimum temperature for its growth being 25–28°C. It will die at 50°C and the optimum temperature for germination is about 26°C.

It winters in the impaired part in the form of a hypha or a spore and occurs in the following year; in the greenhouse conditions it appears all year round. Carried by the rainwater outdoors and by sprayed water in the greenhouse, the conidium attacks the soft part of the plant. The pathogen lies dormant at the plant and when the organism gets weak, it forms the spot and spreads the conidia.

Symptoms: Anthracnose occurs on the leaf. At first, a light green or yellowish green round, small spot appears at the tip or the edge of the leaf and then it gradually spreads

(A) early symptoms

(B) symptoms on the leaf tip

(C) late symptoms

(D) complication of anthracnose with some other disease

Photo 50. Leaves affected by anthracnose

to the whole leaf. The old spots combine with one another to become larger indeterminate spot. The colour changes to maroon or dark maroon. The spot is oval, which is 3–5 mm (15 mm at maximum) in diameter and a bit harder and swollen than the surrounding part. In serious cases the whole leaf dries up and falls and the stem withers in the end.

Prevention and Control: It is essential to grow healthy plants through proper management of environment and nutritional care. Thorough extermination of harmful insects and regular sterilization are also required. The diseased leaves should be removed and burnt up. At the early stage of the disease, spray zineb, chlorothalonil, phenathimol, captan and thiram on the leaves two or three times at intervals of 7–10 days. It is also efficacious to spray a 1 to 10–20 solution of the extracts of perilla, garlic, water pepper, peach and *culhamia simplex* more than thrice at weekly intervals.

5. Dry Root Rot

(A) young plant which died of dry root rot

(B) plant affected by dry root rot

(C) roots of plants affected by dry root rot

Photo 51. Symptoms on plants affected by dry root rot

It is caused by *Pythium* spp., *Fusarium* spp., and *Rhizoctonia* spp. The pathogens grow in a large number in the substrate containing a lot of plant residues and half-decayed organic materials. They thrive when the conditions of temperature, moisture, ventilation and pH of the substrate are unfavorable.

Symptoms: The roots get rotten and the leaves and stems wither turning yellow. If serious, the leaf soon becomes yellow and falls, but when it is slowly affected, the plant only withers standing green.

Prevention and Control: Proper watering should be done lest the culture medium be kept wet long and the greenhouse should be ventilated frequently. The flowerpots and substrate should be sterilized before use and organic fertilizer be properly applied. Once the disease breaks out, the attacked plants and the substrate should be burnt up. The sow bugs and black-winged fly that damage the roots should be exterminated and the contaminated water not be used for cultivation.

At the early stage of disease, the disinfectants such as zineb, amoebicide, mancozeb and chlorothalonil should be applied 2–3 times at the intervals of seven days.

6. Virus Diseases

The plants of *Dendrobium* genus to which Kimilsungia belongs are susceptible to *Cymbidium mosaic virus, Dendrobium mosaic virus, Cucumber mosaic virus* and *Dendrobium vein necrosis virus*.

Symptoms: As there are different kinds of viruses that cause the diseases, the symptoms are varied. Symtoms include white mottles, pitted spots and mosaic patterns and a number of dark mottles on the whole leaf.

The sick plant will impair the ornamental value and be deformed, while growing, but seldom die. (Photo 52)

A B

Photo 52. Plants affected by virus diseases
(A) white mottles on the leaves; (B) black mottles on the whole surface of a plant

Prevention and Control: The sick plants should be removed as soon as found. The noxious insects (aphides, mites, scale insects, thrips, etc.) which transmit the virus diseases should be thoroughly exterminated.

The substrate such as sphagnum, pebbles and the pieces of pots must be sterilized to the letter before use and, once infected, be abandoned. The plant selected for fertilization must be germ-free.

Section 2. Pests

Pests such as red spider, snails, sow bugs, thrips and scale insects inflict damage to Kimilsungia.

1. Red Spider

Pest: *Tenuipalus zhizhilashviliae*

Character: The body is oval and has four pairs of legs. Usually the colour of the body is red and may change to transparent white, reddish brown, yellow, while growing.

The female is 0.2–0.4 mm long and the male is a little smaller than that. (Photo 53)

On the front of the head is a mouth-part fit for piercing the plant and sucking sap.

Its egg is 0.15 mm in diameter and oval. The newly-laid egg is colourless but, by the time of hatching, they become red. The hatched larva has three pairs of legs at first but gradually four pairs after moulting. A female lays 8 eggs a day on average and 60 to 100 eggs during a generation. An egg hatches 3–5 days after it is laid and it takes 8 to 12 days for the young insects to reach the adult stage. In summer, it takes only 10 days for them to form a generation and consequently the adult insect, larva and egg

A

B

Photo 53. Red spider
(A) female; (B) male

are found at the same time on the affected part. (Photo 54) In the greenhouse it reproduces 10–15 generations in a year without dormancy. It multiplies in a large number when it is hot and dry.

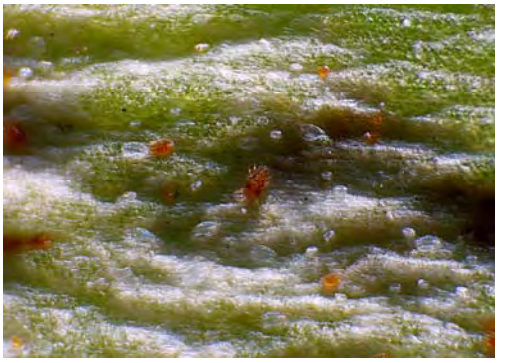


Photo 54. Female red spider, its eggs and moult

The optimum temperature and humidity for growth are about 22°C and below 50%. When the humidity rises, the rate of reproduction is reduced considerably. When the humidity is 80% it stops eating and over 90% it does not reproduce.

Photo 55. Leaf damage caused by red spider

Symptoms: A number of white mottles are seen on the lower surface of the leaf. If seriously affected, the entire lower side of leaf becomes white and the upper side gets grey. (Photo 55) When viewed with the microscope all cells of the diseased plant are necrosed, deprived of the chlorophylls and shriveled. To the naked eye, the impaired leaf looks dull and pale and the surface is rough in comparison with the normal leaf. The red spider hampers the growth of the plant and, furthermore, affects the formation of fresh buds and blooming. It sucks sap and discharges sweet substance, causing secondary disease, the sooty mold. In addition, it carries many other plant viruses.

Prevention and Control: It is necessary to make sure that the humidity of the greenhouse does not fall below 50% through efficient management of its environment. When the humidity of the greenhouse is maintained at 60–80% from April to June and from September to November, it is possible to check the explosive multiplication of mites. It is also good to frequently sprinkle water on the leaves during the hot and dry season. When the insects are found on the leaves, solutions of miticides such as

dichlorvos and dimethoate should be sprayed twice or thrice at intervals of 3–4 days. As the mites most quickly become resistant to the insecticides, the alternative use of miticides is efficacious. Recently, some adhesive materials are effectively used in killing mites instead of chemicals.

2. Snail and Slug

A species of snail and two species of slug are now found in the greenhouse of Kimilsungia.

1) Snail

Pest: *Zonitoides arborea*

Photo 56. Eggs of snail

Character: The shell of adult snail is 4.2–4.5 mm in diameter, 2.1–2.7 mm high, and of glossy yellowish brown colour. It is thin and transparent. The dextral shell is composed of 4 to 5 whorls and the umbilicus is about 0.6–0.7 mm across. Its body is light grey and it has big and black tentacles.

The new-hatched snail's shell is 1mm in diameter, about 0.5mm high and has two and a half whorls. The new-laid egg is of glossy white colour, which gradually turns brown. It is 1.0 × 0.9 mm in size. The egg capsule is limy and several eggs are stuck together by mucus. (Photo 56)

Snails are found in the greenhouse all year round. They thrive from April to May when the monthly mean temperature is between 22°C and 24°C. The adult snails are active at the temperatures of 15–30°C and the humidity of 80–100% but do not move in the humidity below 70%. An adult snail lays 60–150 eggs and 6–14 times a year.

They hatch 14–18 days after they are laid and it takes 80 to 100 days for the larvae to attain the sexual maturity. Snails are found in large in the moss substrate but seldom in the pebble or other porous substrates.

Photo 57. Young seedlings damaged by snail

Symptoms: The snail gnaws the bud, young leaf, flower and root. The most serious damage is sustained by the bud; when affected it stops growth. And the next most serious damages are found in young seedlings at the acclimation stage. It is because the leaf tissue is considerably weak and sphagnum is widely used as substrate. (Photo 57)

Prevention and Control: Pebble, pieces of bricks and other porous materials should be used as substrate.

It is also recommended to weed out and remove in time the rotten wood or plant residue from the greenhouse. If snails are found in large one will spray 1–2 g of 5% metaldehyde solution per 1 m^2. Since the snails prefer the acid soil, it is efficacious to spread 20–30 g of calcium hydroxide or calcium nitrogen per 1m^2 on the ground of the greenhouse.

2) Slug

Pest: *Incilaria confuas* and *Deroceras varians*

Character:

Incilaria confuas

The adult is 6 cm long and light brown in colour, which changes to a great extent according to its habitat. The dorsal part has two dark brown lines. Two pairs of tentacles are on the head. A shield-shaped mantle covers the dorsal part of the upper body, and there is an opening at the right side that supplies oxygen to the lungs,

opening and closing at regular intervals. An adult slug lays about 40 eggs in clusters once a year between March and June in moss or under the plant or stone.

The egg is spherical, transparent and 2–3 mm in diameter. The hatched larva resembles the adult. It still has the trace of degenerated shell on its dorsal part. (Photo 58)

Photo 58. Slug under the pot

Deroceras varians

The adult is 2–3 cm long and dark grey and translucent. It lays about 300 eggs in the moss twice in a year—spring and autumn. The larva hatched in spring grows to be adult and lay eggs in autumn.

Symptoms: The slug damages as much as *Zonitoides arborea.* However, as the former consumes much more, it causes more damage. As it releases much mucus when it moves, its developmental intensity can be guessed through the mucus.

Prevention and Control: The preceding remedies against *Zonitoides arborea* can be applied.

3. Sow Bug

Pest: *Armadillidium vulgare*

Character: It is small, long round and its dorsal part is purplish blue and its abdomen white. The adult sow bug is 10–15 mm long and has distinct segments and seven pairs of legs. When touched, it contracts its body like a ball, which distinguishes it from other species of sow bugs.

The young resembles the adult. It is small and light-coloured. The egg is white, ball-shaped and 2 mm in diameter. Sow bug usually lives under the wooden boxes, paving blocks, flowerpots and other humid places.

Photo 59. Squat sow bug

Photo 60. Sow bug in the substrate

It is weakly resistant to cold. In mid- or late April it mates and lays 20–30 eggs. About two weeks after the young hatch out from them. They usually spend daytime hiding in packs in wet and dark places and in the evening infiltrate the substrate causing much harm to the plants. (Photos 59 and 60)

Symptoms: It gnaws the bud, soft leaf and root, causing the affected parts to get rotten by various germs. It is found mainly in sphagnum moss when it is used as the culture medium.

Prevention and Control: The cutting boxes, compost and pots should not be piled in the greenhouses as they can be good habitats for sow bugs. By taking advantage of their habit of hiding under something, the gathered insects can be caught a while after putting some wheat flour, potatoes and vegetable pieces on the ground and covering them with straw sacks. Luring insecticide containing metaldehyde can be sprayed on the routes that insects usually use.

Insects hiding in the culture medium of pots can be killed by soaking pots into the water or into the dilute liquid of the chemicals for a while.

4. Thrips

There are three species of thrips harmful to Kimilsungia in the greenhouse: *Thrips hawaiensis, Scitrothrips dorsalis* and *Thrips tabaci*

Character: It is small yellowish shuttle-shaped, around 0.6–1.4 mm long. The head is rectangular and bears dark red-colored ommatae or stemmas. The mouth part has a proboscis and the short antennule has 6–19 segments. The edges of wings are densely covered with long hairs. The tarsus ends in a pair of claws, between which is an empodium. Resembling the adult, the young are small and wingless. (Photo 61) The egg is cream-colored and oval, about 0.3 mm in size. The thrip spends winter as an adult and lays about 25 eggs inside the tissue of plants from late April. 3–6 days later, larvae hatch out and grow up eating cortical tissues, thus causing damage to plants.

Photo 61. *Thrips tabaci*

Symptoms: The thrip makes wounds to the leaves, flowers and peduncles and sucks out the sap from them. The pillaged part is discolored and the plant grows abnormally and thus loses the ornamental value. In particular, the damage is especially serious in the flower; if attacked, flower buds fail to bloom nicely and flowers wither early.

Prevention and Control: Sterilization of flowers around the greenhouse should be done regularly. And the windows and doors of the greenhouse should be furnished with nets to keep off wild insects. Humidity must not be dropped below 60%. When the insects are found, smithion or methylnitropos and sulfuric acid nicotine should be sprayed.

5. Mealybug and Scale

There are three species of mealybugs that damage Kimilsungia.

1) Mealybug

Pest: *Pianococcus citri* and *Pseudococcus longispinus*

Character:

Pianococcus citri

The body of the female adult is oval and rosy or bluish and looks white as it is covered with white powdery wax. It is about 4mm long and 2.8 mm wide. On the periphery of the body are 18 pairs of short waxy filaments (protrusions), of which the last pair are the longest. (Photo 62)

Photo 62. *Pianococcus citri*

Pseudococcus longispinus

The adult female is long and round and almost even. Its bluish or yellow body is covered with white powdery wax. It is 3.5 mm long and 2 mm wide and is covered with 17 pairs of thin and long waxy filaments around the body, among which those two pairs on the back look like long tails. A pair of them are longer than the body. Larva at second or third nymphal stage is rosy. (Photo 63)

Photo 63. *Pseudococcus longispinus*

2) Scale

Pest: *Coccos hesperidum*

Character: The adult female is even and egg-shaped and 3–4 mm long. The form of its body is different markedly according to the growing period and the host plant. It is yellowish green or greenish brown. The thorax is a little cutinized. Its egg is yellowish rosy. There is much difference between the female and the male. Sexual difference shows from the second nymphal stage.

The female insects discharge wax to make pouch and lay eggs in it and protect them. The number of eggs varies slightly in accordance with species and host plants but approximately amounts to hundreds or thousands of eggs. (Photo 64)

Symptoms: Mealybug and scale adhere to leaves, leaf sheath, peduncle, flower bud, pedicel and stem and suck sap from them. Attacked plants wither, with flower buds failing to bloom and flowers get smaller. (Photo 65)

Photo 64. *Coccos hesperidum* attacks the leaf

It sucks the sap and excretes the sweet material, which incurs the secondary disease, sooty mold. *Pianococcus citri* and *Pseudococcus longispinus* attack peduncles, pedicels and flowers while *Coccos hesperidum* injures the leaves. They are not indigenous to Kimilsungia; they are occasionally moved from other species of flowers.

Photo 65. Scale damages the peduncle

Prevention and Control: The plant quarantine and preliminary survey should be conducted on a regular basis.

The possible host plants of the mealybug and scale should be thoroughly quarantined from Kimilsungia.

When discovering the insects, kill them by disinfecting the plant with hygienic cotton. When they are found en masse, disinfect the plants by spraying the systemic insecticide for several times. Adhesive materials applied to the stems can prevent the insects from climbing.

History of Flowers

3.5 billion years have elapsed since the birth of the earth in the universe, and one hundred million years since the appearance of flowering plants on it.

The history of man began two million years ago, but that of flower far earlier than the former.

The then flower was poor-looking, having no petals and sepals. It was a flower organ of gymnosperms rather than a flower.

The flower in the true sense of the word came into being in the form of angiosperms. Even such angiosperms had only pistils and stamens without petals and sepals at the first stage of their appearance. Such flowers are found even now in abundance. Maize and other anemophilous flowers can be cited as examples.

Their petals, sepals and beautiful colours developed from the entomophilous flowers which began the action of reproduction with the help of insects.

In rose, orchid and many other flowering plants, pollens of stamens were deposited on the anthers of pistils with the help of insects. In these flowers, beautiful petals and sepals came into being to allure insects, while protecting stamens and pistils.

They gradually began to diffuse aroma and secrete nectar.

Generally speaking, large, beautiful and deep-coloured flowers had no aroma, whereas small, light-coloured or white flowers diffused aroma. It was because flowers evolved in two directions in order to allure insects: one, making their form and colour beautiful, and the other, diffusing aroma.

As insects began to carry pollens, flowers began to develop their shapes rapidly so that pollens could be easily carried. Soft and thin petals came to have bright colours and be more attractive due to their glossy and reflective effects.

The insect-pollinating flowers evolved from the shapes of flower in which the receptacle is long and petals arranged spirally, as can be seen in the large-flowered *Magnolia Kobus*, into one in which many petals are arranged on one plane and the difference between calyx and petal is not distinct, as in the flower of buttercup, and then into one in which the differentiation of petal and calyx is distinct and stamens and pistils are arranged nearly on the same plane, which can be considered the standard of modern flowers.

Through the long-standing process of evolution, plane-shaped flowers developed into three-dimensional ones and later into new species of flowers like an aconite and garden balsam, whose shapes are symmetrical to their stalks.

Part IV
Kimilsungia Festival and Functions to Mark the Anniversary of the Naming of Kimilsungia

President Kim Il Sung is respected by not only the Korean people but also the world progressive people. It is the will of the Korean service personnel and civilians to hold him in high esteem forever and glorify his immortal exploits generation after generation. Reflecting their will and respect of mankind for him Kimilsungia blooms across Korea and many other parts of the world.

Pyongyang, the capital of the DPRK, hosts Kimilsungia festival or exhibition every year on the occasions of the Day of the Sun, birthday of Kim Il Sung and other major celebration days. Colourful functions also take place on the denomination day of Kimilsungia.

Chapter 1
Kimilsungia Festival

Kimilsungia festival held in Korea is the flower festival worth recording in history for its scale, form, content and standard. There are many flower exhibitions and horticultural expositions famed for their large scale and long history in the world, but Kimilsungia festival is characterized by high praise for the peerless great man. It is dedicated to its grandness and meaningfulness. The First Kimilsungia Exhibition was held in 1999, and it was developed into Kimilsungia festival in 2003 from the fifth exhibition. During the festival different functions like a presentation of scientific and technological papers on Kimilsungia and art performance are held and the festival hall is visited by the Korean service personnel and people, foreigners and overseas Koreans.

This chapter deals with Kimilsungia festivals held so far in Korea and the impressions of foreigners and overseas Koreans on the festivals.

Emblem of Kimilsungia Festival

Flag of Kimilsungia Festival

Flag of Kimilsungia and Kimjongilia Festival

First Kimilsungia Exhibition

On April 10, 1999, the First Kimilsungia Exhibition opened in a grand manner in Pyongyang on the occasion of the 87th birth anniversary of President Kim Il Sung.

The flower of the sun symbolic of the image of the great man, President Kim Il Sung who authored the Juche idea and shed light on the road the mankind should take, Kimilsungia was in full bloom reflecting the wish of the people who revere him.

Poster

The exhibition was held at the Pyongyang International House of Culture.

On display in the exhibition hall were pots of beautiful Kimilsungia brought into full bloom by many units, working people of all strata, service personnel, youths and students of Korea and the Indonesian Embassy in the DPRK.

Present at the opening ceremony were Korea's Party and government officials, officials concerned, working people in Pyongyang and service personnel. Foreigners and overseas Koreans were invited there.

Followed by the opening speech, Maruzuki Usman, Minister of Tourism, Art and Culture of the Republic of Indonesia delivered a congratulatory speech. He said that he welcomed sincerely the splendid and meaningful exhibition which was held on the occasion of the auspicious day and added: President Kim Il Sung accompanied by the leader Kim Jong Il paid a historic visit to Indonesia in 1965; a university of Indonesia conferred the title of honorary doctor of engineering on him, which was the expression of intense respect for him; during his stay in Indonesia Kim Il Sung visited the Bogor Botanical Garden; in the botanical garden there was a beautiful flower of orchid family newly bred by a botanist of the garden; President Sukarno suggested to name the flower after Kim Il Sung as a token of his reverence for and trust in him; the

Indonesian people were really satisfied with the fact that the two pots of Kimilsungia multiplied into tens of thousands of plants, and he hoped more beautiful Kimilsungia would be exhibited in a greater number in the future.

After the opening ceremony, the participants looked round the exhibition.

During the exhibition, senior officials of the Party and government, anti-Japanese revolutionary fighters, senior officials of ministries and national agencies, service personnel, working people, youths and students of Korea, overseas Koreans visiting the homeland and foreign diplomats in Korea and foreigners, totalling over 260 000, visited it.

On April 12, a presentation of the experiences in Kimilsungia cultivation was held at the Pyongyang International House of Culture.

The exhibition was closed on April 19, postponed for two days.

Impressions

So Man Sul, the then first vice-chairman of the General Association of Korean Residents in Japan (Chongryon)

"I was deeply impressed with the sincerity the people at home devoted to every single blossom, artistic talent shown in each drawing and embroidery piece and the reverence of the entire Korean people for President Kim Il Sung and leader Kim Jong Il.

The President is alive forever in the hearts of the entire Korean nation along with Kimilsungia."

First secretary of the Central Committee of Russian Revolutionary Communist Youth League

"It is really pleasant and significant for me to visit the exhibition. I saw many very beautiful Kimilsungia blossoms exhibited. I take off my hat to the Korean people for their reverence for President Kim Il Sung."

Ogami Kenichi, secretary-general of the International Institute of the Juche Idea

"Beautiful Kimilsungia and Kimjongilia blossoms are the proud look of the Korean people who have overcome hardships and are following the road of a new victory, united firmly around Comrade Kim Jong Il, and they instill in the people great confidence and pleasure of victory in the hope-filled 21st century."

A. Kovalyov, professor of the Moscow University of Russia

"I am pleased to see the First Kimilsungia Exhibition held on the occasion of the Day of the Sun. It left deep impression on me and clearly showed the invariable love of Korean people for the great Comrade Kim Il Sung.

I wish the diligent and excellent Korean people a great success."

Mirzohoziyev Mirzomahmadi, first vice-minister of Culture of the Republic of Tajikistan

"I was moved too deeply to suppress my emotions to see this show.

Really the Korean people regard their reverence for the leader as a top concern. They are the symbol of beauty.

Long live the prosperous Korea and Korean people!"

Izuhara Reiko, singer of Nagoya, Aichi Prefecture, Japan

"This is first time for me to see Kimilsungia and I think it is an excellent flower. As an orchidaceous plant, this is very graceful. I think it perfectly reflects the personality of President Kim Il Sung. I'm sure some day I will grow it by myself."

Vladimir Alexandrovich Dombrovsky, military attaché of the Embassy of the Russian Federation in Korea

"We were deeply impressed to see the Kimilsungia exhibition.

The very beautiful flowers symbolize the respect of the Korean people for Comrade Kim Il Sung. The flowers many units exhibited here bespoke this.

We believe the reverence of the Korean people for their leader will be eternal like the flowers in full bloom."

Song Renhong, vice-general manager of Dandong Company of the Liaoning International Trade Corporation, China

"I hope the Korean people will hand down the beautiful Kimilsungia from generation to generation and build their country as beautiful as Kimilsungia, united firmly around General Kim Jong Il and displaying the spirit of independent sovereignty and self-reliance."

Wang Riguang, member of the Chinese experts delegation of UNDP

"Seeing the exhibition, I felt the reverence of the Korean people for President Kim Il Sung.

At the same time, we pay our sincere tribute to Comrade Kim Il Sung.

We wish the China-Korea friendship to last forever."

A. Valiev, pressman of the ITAR-Tass

"The First Kimilsungia Exhibition is another sign of the respect of the Korean people for Comrade Kim Il Sung.

This time foreign pressmen looked round the exhibition with deep interest. We hope such exhibition will be held often and successfully in the future."

Dilawar Ali Kahn, representative of UNICEF office in the DPRK

"A pleasing and memorable experience.

The flowers are more beautiful, for they are named after the peerless great man. We wish the beautiful Kimilsungia to bloom in all parts of the world."

Wan Yongxiang, ambassador of the People's Republic of China to the DPRK

"I think it honourable to visit the Kimilsungia exhibition hall on the occasion of the 87th birth anniversary of President Kim Il Sung. Orchid is symbolic of nobleness and gracefulness.

China-Korea friendship will bloom beautifully as Kimilsungia.

I wish President Kim Il Sung eternity.

First Kimilsungia Exhibition

(April 10–19, 1999)

Speeches are made at the opening ceremony

Display booth of the Indonesian Embassy in Korea

A visitor describes his impression on the exhibition

Second Kimilsungia Exhibition

The Second Kimilsungia Exhibition opened on April 12, 2000, at the Pyongyang International House of Culture.

Poster

The exhibition was spectacular with over 3 300 pots of Kimilsungia cultivated by many units, working people of all strata, service personnel, youths and students of the DPRK. Also on display were pots of Kimilsungia in full bloom sent by the Embassy of the Republic of Indonesia in the DPRK.

Present at the opening ceremony were senior officials of the country's Party, government, ministries and national agencies, working people of various strata and service personnel. Cultural delegation of the government of the Republic of Indonesia led by the State Minister for Tourism and Arts, Buharin Apendi, Indonesian ambassador to the DPRK and embassy members, overseas Koreans and the delegations from various countries took part in the ceremony.

After the opening address, the head of cultural delegation of the government of the Republic of Indonesia made a congratulatory speech.

Then the congratulatory message from Megawati Sukarnoputri, the then vice president of Indonesia, was read. The exhibition was visited by the Korean people, overseas Koreans, foreigners from different countries, diplomatic representatives in Korea, numbering over 200 000.

The exhibition was closed on April 17.

Impressions

Do Thi Hoa, ambassador of the Socialist Republic of Vietnam to the DPRK

"I'm glad to visit the exhibition held on the occasion of the Day of the Sun.

President Kim Il Sung made an immortal contribution to the friendship between Korea and Vietnam. The Vietnamese people will not forget his exploits forever.

The respected President will be alive in the hearts of Vietnamese people forever."

Damdiny Byambaa, Mongolian ambassador to the DPRK

"I was deeply moved to see the show of the flower given the name of Comrade Kim Il Sung, the great leader of the Korean people. I'm firmly convinced that the name of the great President will be in the hearts of the human beings forever as these beautiful flowers grown in many countries of the world."

Ibrahim Abu Mualek, chargé d'affaires ad interim of the State of Palestine to the DPRK

"It is an honour for me to visit on the Day of the Sun the exhibition of flower named after Comrade Kim Il Sung who is always with us.

I was moved by the reverence for him and working spirit of the Korean people. I believe the name of President Kim Il Sung will be handed down from generation to generation as Kimilsungia is in our hearts forever."

Bitar Zorg, head of the Mongolian government delegation

"Korea, land of morning calm,
It is the land of Comrade Kim Il Sung.
Forever will it be prosperous,
As it is near to the sun.
Long live the Day of the Sun when Kimilsungia is in full bloom."

Kim Myong Hui, actress of the Kumgangsan Opera Troupe of Chongryon

"Kimilsungia in full bloom symbolizing the greatness of Generalissimo Kim Il Sung reminds me of his bright smile. Seeing beautiful Kimilsungia, a plant of orchid family, which normally blooms in the autumn, brought into full bloom in April in the spring, I feel keenly the reverence of the people in the homeland for him. I made up my mind to have Kimilsungia cultivated in Japan. The President will be alive forever in our hearts

together with beautiful Kimilsungia.”

Zenasenko Alexandr Mikhailovich, delegate of the Russian Aeroflot Company in Pyongyang

“The Kimilsungia exhibition held on the occasion of the birthday of President Kim Il Sung is very impressive. All the Kimilsungia blossoms exhibited represent the most sincere reverence for him of their cultivators.

I think the exhibition greatly encourages the Korean people in their struggle to implement the plan for building a prosperous and powerful socialist country initiated by leader Kim Jong Il. Thanks to leader Kim Jong Il who is leading the struggle.”

Nai Pina, head of the delegation of Cambodian People’s Party

“I was deeply moved to look round the Kimilsungia exhibition hall. We think that this exhibition is a demonstration of the reverence of the Korean Party and people for His Excellency Generalissimo Kim Il Sung. He is alive forever in the hearts of all the members of the Workers’ Party of Korea and the Korean people.”

Mahmadov Bobohon, minister of Culture of the Republic of Tajikistan

“It was a great pleasure for me to see the Kimilsungia exhibition hall. I wish this exhibition to be developed more and more with the DPRK.

This exhibition demonstrates the respect of the Korean people for President Kim Il Sung and leader Kim Jong Il.”

Rahmawati Sukarnoputri from Sukarno Education Foundation of Indonesia

“I think it very honourable to visit the Kimilsungia exhibition hall together with the delegations from Sukarno Education Foundation and Bunkarno University.

What impressed me more is the fact that this flower was bred in Indonesia and named by President Sukarno during President Kim Il Sung’s visit to Indonesia.

This flower reminds the viewers, first, of Indonesia and then the friendly relations between Indonesia and the DPRK forged by the leaders of the two countries.”

Second Kimilsungia Exhibition

(April 12–17, 2000)

Display booth of the Embassy of the Republic of Indonesia in Korea

A visitor describes his impression on the exhibition

Third Kimilsungia Exhibition

The Third Kimilsungia Exhibition was held in a grand way on April 12, 2001, on the occasion of the first Day of the Sun of the new century at the Grand People's Study House situated in downtown Pyongyang. Exhibited were over 3 500 pots of Kimilsungia, the crystal of admiration for the great man.

Poster

Present at the opening ceremony were the senior officials of the Party and government, working people and service personnel of Korea. Invited there were the delegation of Chinese Horticulture Association, delegation of Forest Bureau of Beijing, China, Indonesian cultural delegation, Gurush Sukarno Art Troupe, Indonesian ambassador to the DPRK and his staff members, delegation of home-visiting Koreans in Japan, delegation of the Federation of Korean Nationals in America and other foreigners and overseas Koreans.

Following the opening address, Gurush Sukarnoputri, the head of the Indonesian Gurush Sukarno Art Troupe, made a congratulatory speech.

The visitors to the exhibition numbered over 480 000 and there was a presentation of experiences in Kimilsungia cultivation on April 17 at the Grand People's Study House.

The exhibition was closed on April 19.

Impressions

Ri Kwang Yong from *Joson Sinbo,* organ of Chongryon

"Visiting the Kimilsungia exhibition hall held on the occasion of the first Day of the Sun of the new century, I've learned a lot from the people of the homeland who brought the flower into full bloom out of reverence for President Kim Il Sung in spite

of the unusual serious cold. Although I am living in a foreign land, I will cultivate the respect for Generalissimo Kim Il Sung and General Kim Jong Il as intense as that of the people in the homeland."

Wang Xiaoming, anti-Japanese fighter, and his family

"The sea of beautiful flowers is a symbol of respect and love.

The bright light will illumine the way ahead of human beings forever."

Araki Sakae, a member of the delegation of the Japanese Society for Studying Kimilsungism

"Visiting the Third Kimilsungia Exhibition hall I felt more keenly the warm heart of the Korean people and the people of Indonesia and other countries toward President Kim Il Sung. I think his love for the people made Kimilsungia in full bloom.

I was moved by the reverence of the Korean people for President Kim Il Sung and His Excellency General Secretary Kim Jong Il."

James Johnson Alo, director of the American Friendship Ensemble

"As the director of the American Friendship Ensemble, I would like to express my appreciation to the great leader Kim Jong Il. We are honoured to be invited to such a beautiful festival. Your capital city, Pyongyang, is a grand city with many beautiful sites and buildings. It is our prayer that one day our two countries will be friend, and our two peoples can join hands in friendship and love."

Kim Kang Ung, head of the eastern branch of the Federation of Korean Nationals in America

"I cannot restrain my emotions while visiting my homeland, the country of a great people. I keenly felt that all the people do their best to build a prosperous and powerful country, united single-heartedly around the great General Kim Jong Il. I believe that the entire people of the homeland will advance dynamically in their struggle to carry out the instructions of President Kim Il Sung, having the great General Comrade Kim Jong Il at the head."

Third Kimilsungia Exhibition

(April 12–19, 2001)

Visitors describe their impression
on the exhibition

Presentation of experiences in the cultivation of Kimilsungia

Fourth Kimilsungia Exhibition

The Fourth Kimilsungia Exhibition was held in a grand way on April 14, 2002, on the occasion of the 90th birth anniversary of President Kim Il Sung.

Poster

The Kimilsungia and Kimjongilia Exhibition Hall built in a unique style on a picturesque place on the Taedong River flowing through the centre of Pyongyang can fully facilitate international flower shows, to say nothing of domestic ones. As the Fourth Kimilsungia Exhibition is the first to be held in the newly-built Kimilsungia and Kimjongilia Exhibition Hall, it attracted particular public interest.

On display in the exhibition hall were over 5 500 pots of Kimilsungia and other various nice flowers cultivated by different organs, working people, youths and students of Korea. Pots of Kimilsungia sent by foreign organizations and embassies in the DPRK were also displayed. Present at the opening ceremony were the Korea's Party and government officials, relevant officials, builders of exhibition hall, working people in Pyongyang and service personnel, a delegation of Chongryon visiting the homeland on the occasion of the Day of the Sun, delegation of the Federation of Korean Nationals in China, delegation of the Federation of Korean Nationals in America, delegation of the Joint Secretariat of the Pan-national Alliance for Korea's Reunification (alliance of reunification movement organizations of Koreans in the north, south and abroad), overseas Koreans, Indonesian ambassador to the DPRK and his staff members and foreign individuals. After the opening ceremony, the attendants looked round the exhibition hall. The exhibition hall was crowded with visitors everyday and their number amounted to over 400 000. A presentation of experiences in Kimilsungia cultivation was held in the Kimilsungia and Kimjongilia Exhibition Hall on April 17.

The exhibition was closed on April 19.

Impressions

Dr. Rudiger Claus, director of the International Institute of Journalism, Berlin-Brandenburg

"Thousands of Kimilsungia blossoms in the exhibition hall show that President Kim Il Sung, the founder of the DPRK, is alive in the hearts of the people. And those wonderful flowers are the witness to the single-hearted unity of the Korean people."

Von. Oupir, member of the Folklore Music Troupe of Belgium

"Congratulations on the beautiful and meaningful exhibition. I came to know and saw the most beautiful flowers in the world. I felt the reverence of the Korean people for President Kim Il Sung."

Ogami Kenichi, secretary-general of the International Institute of the Juche Idea.

"The Kimilsungia exhibition in celebration of the birth anniversary of President Kim Il Sung fully sets off the beauty of Kimilsungia and grips our hearts as firmly as the President attracted the peoples of the world.

Kimilsungia will be glorified forever with the President."

Kauko Hakinen, representative of UNFPA in Korea

"This exhibition is wonderful, like a travel to the beauty. It has been nice to learn that Kimilsungia comes originally from Indonesia. It is almost unbelievable how these two flowers have been developed. This exhibition also shows and reflects the unity of the Korean people."

Jose Reinaldo Jazbalm, vice-chairman and International Secretary of the Central Committee of the Communist Party of Brazil

"Kimilsungia is in full bloom across the DPRK by its children, youths and diligent and creative people of Korea. Kimilsungia is a flower symbolic of immortal achievements of President Kim Il Sung who devoted his whole life for the people and

the world. It is blooming in the hearts of our people, too."

Tran Van Hieu, counsellor of the Embassy of the Socialist Republic of Vietnam in the DPRK

"It is a pleasure and honour to visit Kimilsungia exhibition hall today. It is the expression of the deepest reverence of the Korean people for their leader. We sincerely wish President Kim Il Sung to live in the hearts of the Korean people forever."

Krasae Chanawongse, minister to the Prime Minister's Office of Thailand

"It is a great pleasure to see the Kimilsungia exhibition full of reverence for President Kim Il Sung and leader Kim Jong Il.

We can enjoy the beauty of flowers as well as the high respect of the Korean people for their good leaders. We all have learned a lot from this visit."

Colin Arthur Balt, expert of UNDP

"This is an excellent display of the love and devotion of the Korean people to their founder, on this special day. I am most honoured to be able to witness such love of a people."

Doctor Vishwanath, chief director of the International Institute of the Juche Idea

"It is a great honour to visit the Kimilsungia exhibition hall. The participation of several countries of the world, the DPRK's provinces, ministries and organs shows the love and respect the great leader has earned as sun on earth, which shall continue to inspire the entire humankind as does the flower named after him.

The great leader President Kim Il Sung is always with us."

Boris Lozuko, head of a Music Troupe of Belarus

"We were greatly impressed with the exhibition. This is an expression of the reverence of the Korean people for President Kim Il Sung and at the same time a token of the level of art and diligence of the Korean people. We wish the DPRK to attain prosperity under the wise leadership of leader Kim Jong Il."

Fourth Kimilsungia Exhibition

(April 14–19, 2002)

Visitors describe their impression on the exhibition

Foreigners look round the exhibition hall

Fifth Kimilsungia Festival

The grand Fifth Kimilsungia Festival opened on April 11, 2003, in Pyongyang.

As the public interest in and expectation for the Kimilsungia exhibition grew with each passing day, its scale got enlarged and its form and content enriched, the exhibition was developed into a festival from the fifth exhibition.

Poster

On display were over 5 500 pots of Kimilsungia brought to bloom by military organs, ministries and national agencies, provinces, individual soldiers, working people, youths and students of Korea. Also exhibited were the Kimilsungia flowerpots sent by foreign diplomatic missions to the DPRK, international organizations and the friendship and solidarity organizations of different countries.

The chairman of the Festival Organizing Committee made the opening speech. He said that as required by the Korean people and the progressive people of the world, the Kimilsungia exhibition was developed into the Kimilsungia festival, an international flower festival in which many countries of the world, international organizations, friendship organizations, overseas Koreans as well as the Korean people participated. Then he noted that the exhibition hall was refurbished with the stone plates inscribed with the names of the figures of floricultural, political, academic and social circles of different countries who made contributions to the breeding and propagation of Kimilsungia and their writings in praise of the great man. At the end of his speech he emphasized that he was sure the Fifth Kimilsungia Festival would serve as an occasion to add to the meaningfulness of the April holiday and consolidate the international friendship. His speech was followed by the reading of the congratulatory message from the President of Indonesia to the Festival Organizing Committee.

Sri Hastanto, vice-minister of Culture and Tourism of the Republic of Indonesia

delivered a congratulatory speech. He said to the effect: Kimilsungia which made its debut when President Kim Il Sung, accompanied by leader Kim Jong Il, had visited Indonesia in 1965 is now in full bloom in many parts of the world; he sincerely wished a well-run festival and greater success in the propagation and cultivation of Kimilsungia.

After the opening ceremony the attendants looked round the festival hall decorated with the Kimilsungia and other rare flowers. Every exhibition stand reflected the firm determination of the people to have President Kim Il Sung in high esteem forever and devote themselves to the better cultivation of Kimilsungia. During the festival, the festival hall was crowded every day with visitors, numbering over 650 000.

There was a presentation of scientific and technological papers on Kimilsungia cultivation at the exhibition hall on April 13. The festival was closed on April 21.

Impressions

Wu Donghe, ambassador of the People's Republic of China to the DPRK

"Beautiful flowers welcome visitors warmly
They, too, look at them, smile on the face,
The flowers have to themselves the love of all people
Endless is the procession of visitors."

Jose Roarosas, member of the National Executive Committee of the Mexican Workers' Party

"I came to know well that the Korean people cultivate Kimilsungia carefully as well as their respect for Kim Il Sung. Korea is rich in flowers. It presented the peoples of the world with the most beautiful and immortal flower. There are many countries called lands of beautiful flowers but the flowers of Korea are more beautiful and more fragrant because they are grown by hearts, not by hands.

We are returning home with many photos, but we were able to gain access to your noble spiritual world, much more precious than the photo. The Korean people whom President Kim Il Sung and Chairman Kim Jong Il have brought up are really good."

Shaher Mohamed Abdullah, ambassador of the State of Palestine to the DPRK

"We attended the Fifth Kimilsungia Festival held on the occasion of the Day of the Sun and saw Kimilsungia and Kimjongilia grown by the Korean people with care. They represent their reverence for the great President and the affectionate feeling between the leader and the people. We are firmly convinced that the cause of Korea will be realized without fail under the wise guidance of leader Kim Jong Il."

Andrey Gennadievich Karlov, ambassador of the Russian Federation to the DPRK

"I admired the exhibits of the Fifth Kimilsungia Festival. I think this festival demonstrates the reverence of the Korean people for Comrade Kim Il Sung, President of the DPRK, and Comrade Kim Jong Il, Chairman of the National Defence Commission of the DPRK and their high international dignity."

Ogami Kenichi, secretary-general of the International Institute of the Juche Idea.

"The look of beautiful Kimilsungia in full bloom doubles the significance of the Day of the Sun and adds to the festive mood of the day. Kimilsungia not only attracts us with its beauty but also decorates the brilliant way of the cause of Juche and infuses optimism into people following along the road of Juche. May President Kim Il Sung be immortal."

Kwon Sun Hui, head of the delegation of Koreans in Japan

"Looking round the festival hall, I felt keenly that Kimilsungia is the most famous flower in the world which conveys the boundless adoration and warm reverence of the people of our homeland and the world for President Kim Il Sung. Now our country is united in one mind around the respected General and overflowing with optimism of exhibiting Kimilsungia in full bloom even in the serious situation in which the US invades the sovereign countries arbitrarily. This gives us pride and self-confidence that our land is an impregnable fortress no enemy can attack, as well as confidence in victory, strength and courage."

Abazhan Mahabov, deputy head of National Ensemble of Uzbekistan

"Really spectacular! Kimilsungia is so beautiful. Such festival can be found nowhere else. All of us feel it keenly seeing the excellent flowers."

Do Thi Hoa, ambassador of the Socialist Republic of Vietnam to the DPRK

"In this festival hall, Kimilsungias named after President Kim Il Sung, the great leader of the Korean people, are in full bloom in the meaningful April when all kinds of flowers are blooming. During the past scores of years, Kimilsungia has become a more beautiful flower thanks to the sincerity of the people of Korea and the rest of the world who respect and long for the President. I wish sincerely that President Kim Il Sung will be alive forever in the hearts of the entire Korean people and other revolutionary people of the world and believe that Kimilsungia will bloom more beautifully with the passage of time to pass on his achievements from generation to generation."

Grigori Duziobak, head of the Mikhail Gozenko Krasnoyarsk National Siberian Dance Troupe of Russia

"All the members of the Mikhail Gozenko Krasnoyarsk National Siberian Dance Troupe of Russia were deeply moved by the splendour of the exhibition. Very good flowers were displayed for President Kim Il Sung and leader Kim Jong Il. We came to know the boundless reverence of the world people as well as the Korean people for the great leaders, seeing the nice flowers. We wish the DPRK the best success in every field."

Fransisco Panades Rubio, secretary of the Central Committee of the October 8 Revolutionary Movement of Brazil

"Extending our friendly greetings to the great leader Comrade Kim Jong Il, the Workers' Party of Korea and the Korean people, on the occasion of the Day of the Sun, we pay our regards to the staunch fighting spirit the Korean people displayed in the struggle against the enemies of mankind by dint of the great unity and to the brilliant examples they set in the struggle to build a happy, peaceful and beautiful world. The good examples and fighting spirit encourage the Brazilian people and other progressive people of the world."

Kim Chol Ok from Haerbin City Branch of the Federation of Korean Nationals in China

"Kimilsungia defies any comparison with anything and any other flower in the world. The great leader Comrade Kim Il Sung will be alive forever in the minds of 70 million compatriots together with the flower."

Fifth Kimilsungia Festival

(April 11–21, 2003)

Opening ceremony

"The world will sympathize with the greatness of Korean people who bloom Kimilsungia and Kimjongilia, flowers of reverence, in the face of hardships."

Nada Takashi, representative of the Ehime Modern Korean Problem Institute of Japan

Member of the corps of military attaché in Korea describes his impression on the festival

Presentation of a scientific and technological paper on the cultivation of Kimilsungia

Sixth Kimilsungia Festival

The Sixth Kimilsungia Festival opened on April 13, 2004, in Pyongyang.

On display in the festival hall were over 7 000 pots of Kimilsungia sent by more than 60 units including the military organs, ministries and national agencies, provinces and working people, service personnel and students of Korea. Also exhibited there were pots of Kimilsungia cultivated by over 30 foreign diplomatic missions to the DPRK including that of Indonesia and international organizations, more than 20 friendship and solidarity organizations and overseas Koreans including those in China. Congratulatory messages were sent to the festival by the political and social figures of many countries.

Poster

The opening speech was followed by the congratulatory speech of Tamrin B. Bahri, vice-minister of Culture and Tourism and head of the cultural delegation of the government of the Republic of Indonesia. He said that it was an honour for Indonesia to participate in the Kimilsungia festival every year and that the current festival was more significant as it was held in the 40th year since the establishment of diplomatic relationship between the two countries. Then he wished the festival to be successful and friendly relations between the two countries to be developed further. The festival hall was visited by the senior Party and government officials, service personnel, working people, youths and students of Korea, foreign diplomatic missions in the country and international organizations, the corps of military attachés, the corps of economic and commercial attachés, foreign guests including party and government delegations and overseas Koreans including the delegation of Chongryon. The visitors amounted to over 650 000. A presentation of experiences in Kimilsungia cultivation was held at the Kimilsungia and Kimjongilia Exhibition Hall on April 14.

The closing ceremony of the Sixth Kimilsungia Festival took place on April 22.

Impressions

Tamrin B. Bahri, head of the cultural delegation of the government of the Republic of Indonesia.

"Kimilsungia is very beautiful. Looking round the festival hall furnished with Kimilsungia in full bloom, I felt more keenly the yearning of the Korean people for the great leader. Our embassy participated in the current Kimilsungia festival with Kimilsungia it cultivated with special care, for Kimilsungia is a flower symbolic of the friendship between Indonesia and Korea. May Kimilsungia flourish and bloom more nicely."

Ohiro Sunao, head of the delegation of Japanese Kimjongilia Amateurs Association

"Kimilsungia was bred by an Indonesian and Kimjongilia by a Japanese but both are in Korea. This means the minds of the world people who revere President Kim Il Sung and Comrade Kim Jong Il are united into one. Participating in such a meaningful festival, I make up my mind to do my best to propagate the immortal flowers."

Giraldo Abreu Morales, military attaché of the Embassy of the Republic of Cuba in the DPRK

"Such a wonderful reality cannot be unfolded without a leader-worship spirit.

As Comrade Kim Il Sung is so great, he is alive in the hearts of the people; people's deep respect for their leader created the sea of beautiful flowers."

Shaher Mohamed Abdullah, ambassador of the State of Palestine and head of corps of diplomats to the DPRK

"We visited the Kimilsungia festival hall on the occasion of the birth anniversary of President Kim Il Sung. It shows the boundless reverence of the Korean people for him and leader Kim Jong Il. We are sure his wish is being realized under the leadership of Kim Jong Il. Availing ourselves of this meaningful opportunity, we wish President Kim Il Sung to be immortal and leader Kim Jong Il to be healthy and lead Korea to achieve reunification and prosperity."

Phan Sarad, cultural delegate of Cambodia participating in the 22nd April Spring Friendship Art Festival

"I was moved to see Kimilsungia and Kimjongilia permeated with the reverence of people of Korea and the rest of the world for President Kim Il Sung and Comrade Kim Jong Il, the great leaders of the heroic Korean people. The Korean people will achieve prosperity in near future under the wise guidance and scrupulous care of Kim Jong Il. Yours sincerely."

Sudirman, head of an Indonesian Art Troupe

"Today we were struck with admiration to see the Sixth Kimilsungia Festival. At the sight of many diplomatic missions of different countries and international organizations participating in the festival, we realized the might of the foreign policy of the DPRK developing friendship relations with foreign countries. We wish the friendship and cooperation between Indonesia and Korea to continue to develop."

Yokobori Masagazu, secretary-general of Japanese-Korean Academic and Educational Exchange Association

"Kimilsungia fully deserves the honoured name of President Kim Il Sung, a great thinker and theoretician and revolutionary of the 20th century. It seems to evince his warmth and magnanimity. Thick and upright of stem and red of Kimjongilia are symbolic of the firm spirit and passion of the General Secretary Kim Jong Il with which to implement the instructions of the President. I came to know well the reverence of the Korean people for their leader from their efforts to treasure and carefully tend the flower."

V. M. Gorzeyev, head of a Russian Ballet Troupe

"Nowhere in the world can be found such a spetacular festival. It is surprising and admirable. The feeling of love of people is the hymn to their leaders. I want to cultivate these flowers in my country following the reverence of the Korean people for their leaders. We realized that there is no bound in the love and reverence of Korean people for their leaders. Kim Il Sung will be alive in the hearts of the Korean people and the progressive humankind as the eternal leader of the Korean people."

Norodom Yubanat, senior personal adviser to the King of Cambodia

"I warmly congratulate Kimilsungia and Kimjongilia, the most beautiful flowers in the world."

Hoshigenko, director of the P.S. Frunc Co., Ltd. in Japan

"I felt so much enjoying the festival of beautiful flowers. I want to see it again."

Egon Joroneman, official of Austria Travel Agency

"We were fascinated by Korea and the most beautiful Kimilsungia festival."

Jean Marie Ramblai, head of a delegation of the organization of French Juche idea study groups

"President Kim Il Sung is the sun of all the people. I think it honourable for me to be an adherent of the Juche idea created by him. He is really the great leader of the people. President Kim Il Sung is always with the people as there is the Kimilsungia and Kimjongilia Exhibition Hall. I wish sincerely Kimilsungia and Kimjongilia to be in full bloom all over the world."

Mahumoud Masoud Amer, on behalf of those in charge of the affairs of culture and friendship at embassies in the DPRK

"Today, on April 13, 2004, we visited the Kimilsungia festival hall and admired the beautiful flowers. This festival hall is a wonderful one which is rare to be seen in the world. We highly appreciate the efforts made in furnishing this festival hall.

Glory and immortality to President Kim Il Sung."

Vladislav Nikolaevich Prokopenko, military attaché of the Embassy of the Russian Federation in the DPRK

"Warm spring wind blows from Mt. Paektu, a sacred mountain, to embrace the Korean people. The leader of the Korean people is immortal. His sunny image mirrors in Kimilsungia giving joy and happiness to the people. I wish the Korean people happiness and success in their struggle."

Sixth Kimilsungia Festival

(April 13–22, 2004)

Opening ceremony

Ri Chon Chu and Kim Yong Nyo, members of the Association of Supporters for Propagation of Kimilsungia and Kimjongilia, making an entry in the visitor's book

Seventh Kimilsungia Festival

The Seventh Kimilsungia Festival opened on April 13, 2005, in Pyongyang.

The festival was more meaningful as it was held in the year which marked the 40th anniversary of the naming of the Kimilsungia, which was recorded as a significant event in the annals of the Korean nation and the world floricultural circles. Displayed in the festival hall were over 10 000 pots of Kimilsungia grown by ministries and national agencies, provinces, service personnel, working people and youths and students of Korea and sent by the Indonesian Embassy in the DPRK and other foreign individual figures and overseas Koreans.

Poster

Present at the opening ceremony were the senior officials of the Party, government, ministries and national agencies, service personnel, working people and youths and students of Korea. And invited there were Megawati Sukarnoputri, the former President of Indonesia and general chairwoman of the Central Leadership Council of the Fighting Democratic Party of Indonesia, and her party, Ratna Sari Dewy Sukarno, widow of former Indonesian President Achmad Sukarno, and her party who were on a visit to Korea to participate in the function of 40th anniversary of denomination of Kimilsungia and the Seventh Kimilsungia Festival, the delegations of many countries and international organizations, delegations of overseas Koreans and the Indonesian ambassador to the DPRK and his staff members.

Following the opening speech, the Indonesian ambassador to the DPRK delivered a congratulatory speech on behalf of the Indonesian government. In his speech he expressed thanks to His Excellency Kim Jong Il for his invitation to the festival and recalled that Kimilsungia was the flower former Indonesian President Sukarno named 40 years ago when President Kim Il Sung was on a visit to Indonesia, adding that the peace- and justice-loving people wish this flower to be in full bloom forever. At the

end he conveyed the greetings of Indonesian President Susilo Bambang Yudoyono to the Korean people and wished the festival to be successful and the long-standing friendly relations between the two countries to develop in such a way as to be conducive to the peace of the world. Largest in size and quite fresh in form and content, the Seventh Kimilsungia Festival was literally the sea of Kimilsungia, representing respect and yearning for the great man. During the festival, service personnel, working people, youths and students as well as the senior officials of the Party and government and officials of ministries and national agencies of Korea—about 750 000 in all—visited the festival hall. Foreign diplomats, military attachés, economic and commercial attachés of the embassies in the DPRK and members of foreign delegations and art troupes, overseas Koreans and foreign individuals also visited it.

The closing ceremony was held at the Kimilsungia and Kimjongilia Exhibition Hall on April 22.

Impressions

Abudullah Hamidi Benam, military attaché of the Embassy of the Islamic Republic of Iran in the DPRK and head of corps of military attaché to the DPRK

"While looking round this festival hall, I became aware of the warm heart of all the Korean people. The Korean people participated here out of their reverence for President Kim Il Sung. He devoted all his life to the liberation of the country and brought freedom and independence to the Korean people. That is why they remember him forever and commemorate his birthday. I extend greetings to all the participants in the festival and at the same time wish the Korean people greater success in their struggle to reunify the country and build a prosperous nation under the wise leadership of Marshal Kim Jong Il."

Javed Ahmedi Ansari, secretary-general of the Society for the Study of Self-reliance of Pakistan

"I have seen many flower shows but never such one as Kimilsungia festival.

Kimilsungia is a flower gifted not only to the Korean people but to the peoples of the world. Numerous people are visiting here with the feelings of reverence and love. This festival is an A-class one in its beauty, scale and the number of visitors."

Md. Yusoff Bin Md. Zain, Malaysian ambassador to the DPRK

"On this auspicious occasion of the Day of the Sun celebrations, may I express my sincere felicitations and best wishes to the government and people of the DPRK. May the close friendly relations existing between Malaysia and the DPRK be further strengthened."

Dana Ziyaseva, information official of UNESCO Office in Beijing

"Dear comrades! The exhibition is very beautiful.
All the flowers are excellent. I hope to see them next year, too."

Quan Haomin, Hong Kong International Industry Development Co., Ltd.

"The great President Kim Il Sung left home at tender age.
Bleeding for the country in the anti-Japanese struggle,
He spent his youth
So the beautiful flower of the sun was in full bloom.
He is alive in our hearts forever.
I wish the respected General Kim Jong Il to be in good health forever."

Jiang Xin, senior special correspondent of the *Asia Weekly* in Hong Kong

"Kimilsungia is the most beautiful in the world and Kimjongilia is the brightest in the world."

Members of a delegation of the Moscow State Academy Philharmony

"April gifted us a pleasure of access to all beautiful flowers in the world. Those two species of beautiful flowers that sing the praises of the great Comrade Kim Il Sung and the great leader Comrade Kim Jong Il are wonderful. The flowers symbolize the life and love in this land. Glory to Comrade Kim Jong Il, great leader and great general! Glory to the Korean people!"

Honda Koichi, member of a Japanese Congratulatory Group of the Day of the Sun

"Sincere congratulations on the Day of the Sun. A flower brings peace and hope. I felt here the love of President Kim Il Sung for the people, which is likened to flower. They say whoever loves flower loves nature and the people and tries his best for peace. I was deeply moved to see all the people of the country admiring the flower of the great man."

Members of a delegation of the Uzbekistan Moranbong Art Troupe

"It seems that we came here from Uzbekistan to see this really wonderful and impressive sight. Everything is excellent. This is the first time for us to see such beautiful and distinguished flowers. They decorate the festival hall beautifully. The enthusiastic and beautiful looks of Kimilsungia and Kimjongilia symbolize the great strength of the Korean people. We will keep the feelings to these flowers in our hearts wherever we are."

Neria Sanhyo, president of the Philippines-DPRK Friendship Society

"I love flowers. I have deep respect and tribute to the beloved leaders of the DPRK—President Kim Il Sung and General Kim Jong Il.

Long live!

With the deepest respect and friendship."

Ri Ki Sok, head of a delegation of Koreans in Japan for celebrating the Day of the Sun

"Kimilsungia is the flower in praise of the leader and greets the 40th anniversary of its birth. May the flower be in bloom more beautifully and more fragrantly, with the rays of the sun in the new era of Songun revolution led by the respected General Kim Jong Il!"

Serena Marchioni, delegate of "Gamadi" Organization of Italy

"Whenever we think Comrade Kim Il Sung, we will always remember this beautiful flower and present him with papaver, the flower symbolic of the Italian communists."

Mahmoud Mohamed Osman Atik, military attaché of the Embassy of the Arab Republic of Egypt in the DPRK

"This beautiful flower is the great flower honoured to be named after President Kim Il Sung, who enjoyed the affection of the people of Korea and the world. The flower will be immortal because it was given the name of Kim Il Sung who founded the DPRK and laid the foundation for peace in northeast Asia and the rest of the world. This festival shows the love and respect of the Korean people for their leader who devoted all his life for the construction of a powerful and prosperous country. Regards to President Kim Il Sung, leader Kim Jong Il and the great Korean people."

Minatoyama Tsutoru, head of Korea-visiting group of the Japanese Kimjongilia Amateurs Association

"Congratulations on the festival held to mark the 40th anniversary of Kimilsungia denomination. We feel the Kimilsungia festival is a meaningful and grand one geared to glorifying the immortal achievements of the great President Kim Il Sung. We were deeply impressed by the trustworthiness of the Korean people."

Yang Xilian, military attaché of the Embassy of the People's Republic of China in the DPRK

"Although 40 years have passed since Kimilsungia was born, it is flourishing in the land of Korea with great vitality. This flower reflects the reverence of the people for their leader and symbolizes the development of the cause of the Korean revolution. The sight of the flower on the occasion of 93rd anniversary of the birth of President Kim Il Sung gives us the feeling as if we met him again and intensifies our yearning for him."

Ibrahim Abu Mualek, first secretary of the Embassy of the State of Palestine in the DPRK

"It is my happiness to celebrate the auspicious holiday, birthday of President Kim Il Sung, with the friendly Korean people and visit Kimilsungia festival hall. Comrade Kim Il Sung, eternal President, will be alive in the hearts of our Palestinian people as the well as the Korean people. I would like to take this opportunity to extend my greetings to leader Kim Jong Il from the bottom of my heart and wish him good health and the heroic Korean people progress and prosperity."

Seventh Kimilsungia Festival

(April 13–22, 2005)

Display booth of the organizing committee of the international horticultural exposition under the Ministry of Agriculture of Thailand

"Thousands of flower petals fluttering
It resembles fiery red glow.
The voices of admiration resound
Over the sea of green leaves.
Did fairies bring this wonderful sight of spring here?
Did the reverence of all people for the President
Bring the flower into red bloom?
Sacred red flower whole country sings the praises of."

Wu Donghe, ambassador of the People's Republic of China to the DPRK

Megawati Sukarnoputri,
former Indonesian President making an entry in the visitor's book

Ratna Sari Dewy Sukarno, wife of the first President of the Republic of Indonesia, is looking round the exhibition hall

Ratna Sari Dewy Sukarno is awarded the certificate of the honourary chairwoman of the Association of Supporters for Propagation of Kimilsungia and Kimjongilia

Kimilsungia and Kimjongilia Exhibition in Celebration of the 60th Anniversary of the Founding of the Workers' Party of Korea

Grand Kimilsungia and Kimjongilia Exhibition in Celebration of the 60th Anniversary of the Founding of the WPK opened at the Kimilsungia and Kimjongilia Exhibition Hall in Pyongyang on October 6, 2005.

Poster

Over 20 000 pots of Kimilsungia and Kimjongilia were displayed in the exhibition hall.

Senior officials of Korea's Party, government, ministries and national agencies and working people's organizations, representatives for the functions in celebration of the 60th anniversary of the WPK, service personnel, working people from all walks of life, youths and students—200 000 in all—visited the exhibition. Congratulatory groups and delegations of overseas Koreans which came home to participate in the celebration events also visited it.

Among the visitors were the Chinese governmental delegation headed by Wu Yi, member of the Political Bureau of the Central Committee of the Communist Party of China and vice-premier of the State Council of the People's Republic of China, Megawati Sukarnoputri, former Indonesian President, and general chairwoman of the Fighting Democratic Party of Indonesia and her party, delegation from the Congolese Workers' Party, delegation from the Mexican Workers' Party, delegation from the Youth Movement of Belgian Workers' Party and many other foreign delegations and delegates.

The festival was closed on October 13.

Impressions

Megawati Sukarnoputri, former Indonesian President and general chairwoman of

the Fighting Democratic Party of Indonesia

"This wonderful display of flowers gives me a great pride in being honorary chairperson of the Association of Supporters for Propagation of Kimilsungia and Kimjongilia. The exhibition is more distinguished and wonderful than that in last April. The sincerity and devotion of the Korean people including the workers here are really amazing."

M. D. Vetrov, counsellor of the Embassy of the Russian Federation in the DPRK

"I express my thanks for inviting me to the Kimilsungia and Kimjongilia exhibition in celebration of the 60th anniversary of the founding of the WPK. Kimilsungia and Kimjongilia which the Korean people grew with great care make the 60th anniversary of the Party founding more significant and meaningful."

Giraldo Abreu Morales, military attaché of the Embassy of the Republic of Cuba in the DPRK

"I have seen many flower exhibitions but the Kimilsungia and Kimjongilia exhibition is the best in scale and content, defying any comparison. Especially the exhibition booth in which the Marshal Star is depicted with flowers is unique, which can be seen only in Songun Korea led by the great Comrade Kim Jong Il.

This exhibition is a great success won by the army and people loyal to the Supreme Commander Comrade Kim Jong Il and single-heartedly united around him."

Kim Un Sil, head of the congratulatory group of the Koreans in Australia

"This is my third visit to the homeland. Each time I felt that our General is the best and our homeland is the best.

I felt the same when visiting the festival hall in April this year and saw a look of the prosperous homeland in this exhibition held on the occasion of the 60th anniversary of the founding of the WPK. Although I live in Sydney far away from the homeland, I will always cherish the homeland where the great General is and make efforts for the prosperity of my country."

Kimilsungia and Kimjongilia Exhibition in Celebration of the 60th Anniversary of the Founding of the Workers' Party of Korea

(October 6–13, 2005)

Head of the delegation of the Workers' Party of Belgium describes his impression on the exhibition

"The beautiful flower will be in bloom in my heart forever representing my love for the great leader Kim Il Sung."

Zhang Jinlu, bereaved daughter of Zhang Weihua, a Chinese anti-Japanese revolutionary martyr

"In October, in golden fall
Kimilsungia and Kimjongilia are in full bloom.
For their beauty and fragrance
They are known the world over."

Wang Maojie, head of the Chinese delegation No. 101

Pyongyang-Visiting Group from south Korea is looking round the Kimilsungia and Kimjongilia Exhibition Hall

Eighth Kimilsungia Festival

The Eighth Kimilsungia Festival opened on April 13, 2006, in Pyongyang.

Present at the opening ceremony were the senior officials of the Korea's Party, government, ministries and national agencies, officials concerned and working people in Pyongyang, the Indonesian cultural delegation, the staff members of Indonesian Embassy in the DPRK, delegation of Koreans in Japan, delegation of Koreans in China, delegation of Koreans in America, delegation of Japanese region and delegate of southeast Asian region under the Association of Supporters for the Propagation of Kimilsungia and Kimjongilia and the delegation of the Japanese Kimjongilia Amateurs Association.

Poster

At the opening ceremony the inaugural report was made. Following it, Sri Hastanto, head of Indonesian cultural delegation and general director of the Ministry of Culture and Tourism of Indonesia delivered a congratulatory speech. In the speech he, on behalf of the Indonesian government and people, expressed heartfelt thanks to the respected His Excellency Kim Jong Il and the Korean people for providing every convenience for their participation in this friendly festival and said that it was a great honour and happiness to participate in the festival overflowing with reverence, admiration, and feeling of friendship and solidarity. Then he conveyed the greetings from Indonesian President Susilo Bambang Yudoyono to the Korean people and added that he wished the friendly relations between Indonesia and the DPRK would further develop in the future. The attendants looked round the Eighth Kimilsungia Festival hall with deep emotion. The Central Standing Committee of Chongryon arranged an excellent exhibition stand decorated with a hundred and scores of pots of Kimilsungia permeated with the yearning and boundless reverence of the Korean

nationals in Japan for President Kim Il Sung. Set up on the stand fringed with rare ornamental plants was the model of the Korea University in Japan which greeted the 50th anniversary of its founding. The exhibition booth of the Indonesian Embassy in the DPRK was adorned with over 20 pots of Kimilsungia and pots of rare tropical plants against the background of two photos—one of President Sukarno showing Kimilsungia to President Kim Il Sung on latter's visit to his country and the other of leader Kim Jong Il meeting President Megawati Sukarnoputri, general chairwoman of Central Leadership Council of the Fighting Democratic Party of Indonesia.

Also exhibited were over 10 pots of Kimilsungia sent by the Cambodian Embassy in the DPRK, those sent by scores of foreign diplomatic missions in the DPRK including the Embassies of the Kingdom of Sweden, Federal Republic of Germany and United Kingdom of Great Britain and Northern Ireland, People's Office of the Socialist People's Libyan Arab Jamahiriyia, Spain-headquartered Korea Friendship Society and friendship and solidarity organizations and foreign individuals.

The festival hall was crowded with visitors every day during the festival. Among visitors were Norodom Sihamoni, King of Cambodia, diplomatic missions, corps of military attaché, corps of economic and commercial attaché in the DPRK, delegations of Juche idea study organizations from different countries, participants in the 24th April Spring Friendship Art Festival, delegations of Koreans in Japan and other overseas Koreans. A presentation of experiences in Kimilsungia cultivation was held on April 14 at the Kimilsungia and Kimjongilia Exhibition Hall.

The closing ceremony was held on April 20.

Impressions

Choe Un Bok, vice-chairwoman of the Federation of Korean Nationals in China

"I attended the Kimilsungia festival as a member of the delegation for celebrating the 94th birth anniversary of President Kim Il Sung, sun of the world people. Seeing beautiful Kimilsungia we felt as if President Kim Il Sung welcome us with a beaming smile on his face. Kimilsungia looks like the great leader President Kim Il Sung who

is always with the world people, whereas Kimjongilia in full bloom represents our General Kim Jong Il safeguarding the justice and independence of the world. We will do our best for the reunification and prosperity of the country by adhering to the immortal Juche idea authored by the President and upholding the Songun idea of General Kim Jong Il."

Ho Jong Man, senior vice-chairman of Chongryon

"Kimilsungia in full bloom exhibited by Chongryon is indicative of its members' intense reverence for and absolute worship of the great President Kim Il Sung and the respected General Kim Jong Il."

K. V. Vnukov, first director of Asia Bureau of the Ministry of Foreign Affairs of the Russian Federation

"I looked round the Kimilsungia festival hall which showed how deeply the people respected DPRK President Kim Il Sung who had made a great contribution to the development of Russia-Korea relationship.

Congratulations to the friendly Korean people on the Day of the Sun."

Norodom Sihamoni, King of Cambodia

"I and my party are very glad to visit the Kimilsungia festival hall today. Kimilsungia festival is historic in that it shows special relations between His Excellency Generalissimo Kim Il Sung and the leaders of many countries in the world. It also demonstrates the might of the Korean people single-heartedly united around him."

Wang Zhecai, military attaché of the Embassy of the People's Republic of China in the DPRK

"Tens of thousands of flowers open in spring holiday of April.

Kimilsungia is in full bloom enjoying the love of people.

It reminds us of Kim Il Sung

Forward to the future with confidence.

May Korea be strengthened and
The flower of China-Korea friendship be in fuller bloom.”

Elena Ivanova Barimova, head of Bulgarian Musicians’ Group

“A wonderful festival. It is an unforgettable spectacle which I see for the first time. I wish the Korean people to reunify the country as soon as possible.”

Hanawa Fujio, head of a Japanese delegation for celebrating the Day of the Sun

“When one says the flower garden of Juche, one seems to mean this festival hall. Although they say flowers on this earth are all beautiful, they are incomparable with Kimilsungia. Kimilsungia is not only a beautiful flower but also the flower representative of the independent era and the flower of pioneer of the era. That’s why Kimilsungia loved by all people roots deep in my mind.”

Phan Trong Thai, ambassador of the Socialist Republic of Vietnam to the DPRK

“Glory to the Kimilsungia festival held in spring when various flowers are blooming! The Korean people will bloom into tens of millions of flowers under the rays of the eternal sun.”

Naulak Tuan Khankhup, ambassador of the Republic of India to the DPRK

“It is a great privilege and honour to attend this wonderful Kimilsungia festival on this auspicious occasion of the Day of the Sun. It is a befitting display of the deep love, respect and reverence of the Korean people for the great leader Kim Il Sung who had done so much for his country and his people.”

Zhang Qi, grandson of Zhang Weihua, Chinese anti-Japanese revolutionary martyr, and Yue Zhixiang, his maternal grandson

“Beautiful Kimilsungia blossoms remind us of the days when we spent with the great President. We miss him. His bright smile lingers before our eyes. The great leader President Kim Il Sung is alive in our hearts forever.”

Eighth Kimilsungia Festival

(April 13–20, 2006)

Opening ceremony

Norodom Sihamoni, King of Cambodia, looking round the festival hall

Ninth Kimilsungia Festival and Kimilsungia and Kimjongilia Exhibition in Celebration of the 75th Anniversary of the Founding of the Korean People's Army

The Ninth Kimilsungia Festival was held on April 13, 2007, in Pyongyang.

On display in the festival hall were over 10 000 pots of Kimilsungia grown by Korea's ministries and national agencies, service personnel, working people and youths and students, as well as those sent by the Indonesian Embassy in the DPRK and other foreign delegations, foreign friendship and solidarity organizations and individual figures. Present at the opening ceremony were the cadres of Korea's Party, government, ministries and national agencies, officials concerned, service personnel, working people of various strata and youths and students.

Poster

It was also attended by the delegation of Koreans in Japan headed by Nam Sung U, vice-chairman of the Central Standing Committee of Chongryon, and other delegations of overseas Koreans. The Indonesian cultural delegation, Indonesian ambassador to the DPRK and his staff members were invited. And among the attendants were the honorary chairpersons of the Association of Supporters for Propagation of Kimilsungia and Kimjongilia (ASPKK), Ratna Sari Dewy Sukarno, director of the Dewy Sukarno Office in Japan and her party, and chairman of the American Kimilsungia and Kimjongilia Association, delegation of Chinese Dandong Kimjongilia Greenhouse, delegation of the Japanese Kimjongilia Amateurs Association and the delegations and delegates of the ASPKK in different countries and regions. The chairman of the Organizing Committee of Kimilsungia and Kimjongilia Festival made the opening speech, which was followed by a congratulatory speech of Sapta Nirwandar, head of the Indonesian cultural delegation.

On April 17, a presentation of experiences in the cultivation of Kimilsungia and Kimjongilia was held in the Kimilsungia and Kimjongilia Exhibition Hall.

The Ninth Kimilsungia Festival was closed on April 19.

On April 22, 2007, the Kimilsungia and Kimjongilia Exhibition in celebration of the 75th anniversary of the founding of the KPA was held in a grand way. The Embassy of the People's Republic of China in the DPRK exhibited several pots of Kimilsungia and Kimjongilia against the background of the national flags of China and Korea and the photo of President Kim Il Sung meeting President Mao Zedong reflecting the reverence of its members and Chinese people for President Kim Il Sung and their determination to further consolidate the China-Korea friendship. The exhibition was visited by the officials of Korea's Party, government, ministries and national agencies, anti-Japanese revolutionary fighters, service personnel, working people of all strata and youths and students, overseas Koreans and foreigners. The exhibition was over on April 27.

Impressions

Pak Jae Ro, head of the elders delegation of Chongryon

"On the occasion of 95th birth anniversary of President Kim Il Sung, we, the elders delegation of Chongryon, visited the festival hall with deep emotion. We were moved by the sincerity which the people, army and various organs at every level at home have devoted to the flowers. We think that their reverence for the great leader brought the flowers into such a wonderful bloom. Their beauty is beyond imagination. It is an honour and happiness for Chongryon to participate in this festival together with the people at home. The Kimilsungia and Kimjongilia Exhibition Hall is the best in the world."

Dinh The Hyunh, editor-in-chief of the Vietnamese newspaper *Nhan Dan* Publishing Company of Vietnam

"We, the delegation of *Nhan Dan* Publishing Company of Vietnam, are very pleased to visit the Kimilsungia festival hall on the occasion of 95th birth anniversary of President Kim Il Sung. The display of the beautiful flower named after Comrade Kim Il Sung, the great leader of the Korean people, is really impressive. President Kim Il Sung is a close friend of the Vietnamese people. We are sure that Kimilsungia will flourish more in Korea and other parts of the world."

Igor Nikolaevich Pavlov, military attaché of the Embassy of the Russian Federation in the DPRK

"I am satisfied to visit the Ninth Kimilsungia Festival. The theme of festival and every exhibition stand made a deep impression on me. I wish the Korean people who greet 95th birth anniversary of President Kim Il Sung a greater success in the cause of reunification of their country and the struggle to build a prosperous and powerful country under the wise leadership of Kim Jong Il."

Ueki Masaharu, head of the delegation of the Japanese Society for Studying Kimilsungism

"The exhibition is permeated with the sincerity of the Korean people who have brought into full bloom the flower in April which normally blooms in September. Our delegation will inform more Japanese people of ideas and achievements of President Kim Il Sung."

Marat Mohan Adikari, permanent member of the Standing Committee of the Nepal Communist Party (United Marxist-Leninist)

"I'm glad to visit the Kimilsungia festival hall. It overflows with the Korean people's respect for President Kim Il Sung. Comrade Kim Il Sung regarded 'believing in the people as in heaven' as his motto. He passed away but he will be alive in the hearts of the people forever."

Ogami Kenichi, secretary-general of the International Institute of the Juche Idea.

"As the ideas and achievements of President Kim Il Sung are shining in the world inspiring people to prosperity and victory, so Kimilsungia is blooming beautifully. The excellent festival hall proves the eternality of President Kim Il Sung. I congratulate the Korean people on the 95th birth anniversary of President Kim Il Sung and wish the respected General Secretary Kim Jong Il a good health."

Torbon Byorkman, head of the delegation of Sweden-Korea Friendship Society

"I, on behalf of the delegation of Sweden-Korea Friendship Society, express my thanks to you to invite us to such a wonderful flower exhibition. It is significant to remember the leader by means of flowers. Even the president of a superpower will not be in the memory of his people like President Kim Il Sung."

Ninth Kimilsungia Festival

(April 13–19, 2007)

Opening ceremony

Display booth of the Embassy of the Republic of Indonesia in Korea

Ratna Sari Dewy Sukarno, honourary chairwoman of the Association of Supporters for Propagation of Kimilsungia and Kimjongilia

“A wonderful flower exhibition!
I have never seen such a nice flower.
It is my great joy to see such a flower.
Long live the Democratic People’s Republic of Korea!”

Yayat Sudrajyat, military attaché of the Embassy of the Republic of Indonesia in China

Art performance in celebration of the festival

Kimilsungia and Kimjongilia Exhibition in Celebration of the 75th Anniversary of the Founding of the Korean People's Army

(April 22–27, 2007)

Poster

Tenth Kimilsungia Festival

The grand Tenth Kimilsungia Festival opened on April 11, 2008, in Pyongyang .

The festival hall was decorated with over 13 000 pots of Kimilsungia sent by many organs, service personnel, working people, youths and students of Korea, diplomatic missions to the DPRK, international organizations, foreign friendship and social organizations, foreign businesses, foreign individuals and overseas Koreans.

Poster

Present at the opening ceremony were the officials of Korea's Party, government, ministries and national agencies, working people in Pyongyang, delegations of the ASPKK from different countries and regions of the world and overseas Koreans. Following the opening address, the head of Indonesian cultural delegation made a congratulatory speech. He said that Indonesian people still remembered vividly His Excellency President Kim Il Sung's historic visit to Indonesia in 1965 and President Sukarno's suggestion to name a newly-bred flower Kimilsungia, and that he was satisfied with the fact that the friendly relations between the two countries were promoted and consolidated. He added that the special relations between Kim Il Sung and Sukarno served as a firm foundation for friendship between the two countries and the Indonesian government had always supported the DPRK in its stand toward the international problems.

The Indonesian Embassy in the DPRK, which had participated in the Kimilsungia festival every year, exhibited 15 pots of Kimilsungia in a unique way against the background of the photo of former Indonesian President Sukarno showing Kimilsungia to Kim Il Sung on his official and good-will visit to his country in April 1965.

The Chinese and Cambodian Embassies in the DPRK displayed Kimilsungia with the photos of Kim Il Sung meeting Mao Zedong and Norodom Sihanouk.

Also on display in the hall were Kimilsungias sent in the name of the diplomatic

missions to the DPRK, international organizations and solidarity and friendship organizations. The exhibition stand of the Maecenases of the Century, Russian International Charity Fund, was particularly attractive. The charity fund arranged its exhibition booth with scores of Kimilsungia pots with the portraits of Kim Il Sung and Kim Jong Il. In the past it had sent to the DPRK the sculpture "Angel", its logo, and the commemorative name plates engraved on the monuments built in many regions of Russia.

The festival was visited by the senior officials of the Party and government, anti-Japanese revolutionary fighters, unconverted long-term prisoners repatriated from the south to north Korea, service personnel, officials of ministries and national agencies and working people's organizations, working people and youths and students of Korea. Among the visitors were also the diplomatic missions, the corps of military attaché, the corps of economic and commercial attaché of the embassies in the DPRK, the foreign delegations including the delegation of the Maecenases of the Century, Russian International Charity Fund, and guests, the delegation of Chongryon and other overseas Koreans' delegations. The closing ceremony took place on April 18.

Impressions

Ri Ki Sok, vice-chairman of the Central Standing Committee of Chongryon

"Nowhere in the world can be found such a festival overflowing with reverence and yearning of the Korean and other progressive people in the world for our leader. I read the unstained, pure mind of the people from this beautiful flower. The flowers like the blazing sun draw the tears of yearning for the leader. I will glorify our Chongryon true to the instructions of the leader, cherishing the azure sky of the homeland in my mind."

S. P. Fatak, chairman of the Indian Society for the Study of Kim Jong Il's Works

"The most beautiful spectacle, that one cannot even dream of. It is indeed breath-taking and mind-boggling. Great is the Koreans' aesthetic sense and sensitivity towards beauty. This mixture or combination of beauty and strength is really amazing. I greet and felicitate the Korean people and express special gratitude to President Kim Il Sung and His Excellency Kim Jong Il."

Hong Song Juk, member of the Society for Supporting the Art Troupe of Korean Nationals in America

"I saw such a wonderful flower festival for the first time in my age of 70. This festival is indeed the reflection of warm heart of the Korean people to President Kim Il Sung. He is a great man whom all Korean compatriots recognize. Look! Even foreigners, as well as Korean people and overseas Koreans, participate in this festival. I feel a pride and self-confidence as a Korean looking round the festival hall. The festival imbues us overseas Koreans with fervent love for the homeland. I hope sincerely the Kimilsungia and Kimjongilia festival will develop into a more excellent one."

Cha Sang Bo, vice-chairman of the Federation of Korean Nationals in China

"The reverence of our people and the progressive people of the world who are determined to have Generalissimo Kim Il Sung as the eternal sun of Juche brought Kimilsungia into full bloom. Kimilsungia, a pride of our 70 million fellow countrymen, will be in full bloom all over the world."

Zile Singh, ambassador of the Republic of India to the DPRK

"The Kimilsungia festival is very fascinating and refreshing. In the company of flowers, we pay homage to great leader and eternal President H.E. Kim Il Sung. The DPRK nation and history will remember President Kim Il Sung forever."

Ng Eng Hua, managing director of BAT Company in Singapore

"I am very impressed with tens of thousands of beautiful flowers presented by the people of Korea. The greatness of these flowers will continue to flourish and be perpetual in the prosperity of the great Korean people."

Rubtsova Eyvgenia, member of the Russian Society for the Propagation of Kim Jong Il's Works

"Korean people show their genuine, fervent love for President Kim Il Sung and leader Kim Jong Il through this festival. The flower festival is indeed wonderful.

This is the result of the wise leadership of the great Comrade Kim Jong Il."

N. V. Pereyaslov, secretary of the Management Board of the Russian Writers' Union

"I think it honourable to visit such a wonderful festival. I have visited horticultural expos held in different countries of the world. But I have never seen such a festival full of yearning and reverence for their leader like this Kimilsungia festival. I felt the ideological sentiment of the Korean people and the great force of single-hearted unity from each flower and each ornament on display. I will tell the Russian people all about this festival and Korean people's reverence for their leader."

Abrel Hifid Merabuhan, representative of the Economic Cooperation Office of Libya

"We visited the Kimilsungia festival hall on the occasion of the Day of the Sun. We admired the excellent and noble artistic talent of Koreans. The harmonious arrangement of flowers shows fully the high level of artistic talent of the Korean people. The elaborate art works add beauty to the festival."

Peotniv, representative of the Airline Company of Russia

"I am deeply moved to visit this flower festival.

This flower festival dedicated to the great leader Comrade Kim Il Sung is a noble symbol of the reverence of the Korean people for President Kim Il Sung."

Iwai Shinichi, member of the Japanese Kimjongilia Amateurs Association

"It is a great joy for me to participate in this flower festival for the third time as of 2008. I'm picturing the bright future of humankind, seeing the beautiful Kimilsungia and Kimjongilia every year."

Chorn Hay, ambassador of the Kingdom of Cambodia to the DPRK

"I think it is a great honour and joy for me to participate in the Kimilsungia festival this year. Our participation will contribute to the further development of eternal friendly relations between the two countries set up by His Excellency Generalissimo Kim Il Sung, the eternal great leader of the Korean people, and His Excellency Norodom Sihanouk, the Great King of the Kingdom of Cambodia. The reverence of Korean people for him is boundless and beyond any comparison. He is the eternal Sun shedding light on the road the Korean people should follow. Long live the eternal friendship between the Cambodian and Korean peoples!"

Tenth Kimilsungia Festival

(April 11–18, 2008)

Opening ceremony

Display booth of the Maecenases of the Century, Russian International Charity Fund

Display booth of the Embassy of the Republic of Indonesia in Korea

Visitors writing their impression on the exhibition

Kimilsungia and Kimjongilia Exhibition in Celebration of the 60th Anniversary of the Founding of the Democratic People's Republic of Korea

The exhibition opened on September 5, 2008, in Pyongyang .

On display were Kimilsungias and Kimjongilias brought into bloom by the Korean service personnel and people, overseas Koreans, diplomatic missions and international organizations in Pyongyang, and delegates of friendship and solidarity organizations.

Poster

Present at the opening ceremony were the officials of Korea's Party, government, ministries and national agencies, service personnel of the KPA, working people in Pyongyang and overseas Koreans. And invited there were the Chinese delegations including the delegations of the Dandong Kimilsungia and Kimjongilia Greenhouse and Hunchun Kimilsungia and Kimjongilia Greenhouse.

The participants looked round the exhibition hall with deep emotion. The exhibition hall was crowded everyday by visitors. Officials of Korea's Party and government, service personnel, working people, youths and students in Pyongyang as well as the foreign diplomats, the delegates of international organizations, the corps of military attachés of the embassies in Korea and other foreigners and overseas Koreans visited the Kimilsungia and Kimjongilia exhibition hall. The visitors included Zhang Jinquan, son of Zhang Weihua who is a Chinese anti-Japanese revolutionary martyr, Korean anti-Japanese revolutionary veterans resident in China, and the families of Chinese anti-Japanese revolutionary martyrs and Chinese people related with the anti-Japanese revolutionary struggle. The exhibition was closed on September 12.

At the closing ceremony, exemplary units were awarded the top prizes and diplomas. The special prizes and diplomas went to the Central Standing Committee of Chongryon and the Hunchun Kimilsungia and Kimjongilia Greenhouse in China.

Impressions

Pae Ik Ju, head of the delegation of cadres of Chongryon

"I keenly feel how warm and sincere the respect of our people and world people for the great man is. History will remember and praise the two great men, President Kim Il Sung who was the founding father of our socialist Korea and General Kim Jong Il who is leading Korea to a thriving nation as the successor to the former's cause of nation-building. Chongryon and Koreans in Japan will march with the homeland forever. The homeland and Chongryon led by the great General Kim Jong Il will be ever-victorious."

Kang Yu Son, teacher of the Faculty of Literature and History of Korea University of Chongryon

"The beautiful Kimilsungia reminds us of smiling President Kim Il Sung and Kimjongilia seems to be the warm bosom of General Kim Jong Il. It seems to me as if the reverence of the world people for him filled up the exhibition hall."

Im Jong Hyok, head of the Home-Visiting Group of Students of Korea University of Chongryon

"We are here on this meaningful day. Deeply moved to see the beautiful flowers which the people of the homeland have grown with great care. Back to Japan, we will grow flowers of reverence for President Kim Il Sung and leader Kim Jong Il."

Chalenue Warintharasak, Laotian ambassador to the DPRK

"The exhibition of Kimilsungia and Kimjongilia reflects the single-hearted unity of the Korean people. Kimilsungia and Kimjongilia are world-famous beautiful flowers."

Rosarida, secretary of the national committee of the October 8 Revolutionary Movement of Brazil

"Kimilsungia and Kimjongilia are very beautiful. As the names of Comrade Kim Il Sung and Comrade Kim Jong Il shine brightly, so Kimilsungia and Kimjongilia add more glamour to this exhibition hall. We warmly congratulate the organizers of this wonderful exhibition."

Kimilsungia and Kimjongilia Exhibition in Celebration of the 60th Anniversary of the Founding of the Democratic People's Republic of Korea

(September 5–12, 2008)

Opening ceremony

"All of beauties of Korea are exhibited here. Thank you for your kind invitation to see it. I hope these flowers will bring beautiful peace to the globe."

Vera Konnyuhova, journalist of the Russian newspaper *Vladivostok*

A visitor writing her impression on the exhibition

Eleventh Kimilsungia Festival

The Eleventh Kimilsungia Festival opened on April 13, 2009, in Pyongyang .

The festival hall was literally a flower sea, decorated with over 20 000 pots of Kimilsungia and the other rare flowers sent by Korea's ministries and national agencies, working people, youths and students, overseas Koreans, diplomatic missions to the DPRK, international organizations, foreign solidarity and social organizations and individuals.

Poster

Present at the opening ceremony were officials of Korea's Party, government, ministries and national agencies and working people's organizations, and the working people in Pyongyang, as well as the delegation of Korean nationals in Japan on its visit to their socialist homeland and other overseas Koreans. The cultural delegation of Indonesian government headed by Wardiyatmo, general secretary of Ministry of Culture and Tourism, Daulat Hotma Audison Pasaribu, Indonesian ambassador to the DPRK and the embassy members were invited.

The opening ceremony was also attended by the honorary chairpersons of the ASPKK, Ratna Sari Dewy Sukarno, director of the Dewy Sukarno Office in Japan and Ri Pyong Sang, chairman of the American Kimilsungia and Kimjongilia Association, the delegation of the Dandong Kimilsungia and Kimjongilia Greenhouse in China, the delegation of the Hunchun Kimilsungia and Kimjongilia Greenhouse in China and the delegations of Chinese region under the ASPKK. After the opening ceremony, the participants looked round the festival hall with deep emotion. In the booth of Chongryon located in the middle of the hall were laid hundreds of pots of Kimilsungia, cultivated by Koreans in Japan with sincerity, with the picture of beaming Kim Il Sung among the Korean students in Japan as the background. Displayed in the exhibition were Kimilsungias sent by the diplomatic missions to the DPRK, international organizations and foreign

friendship organizations, which represented their reverence for Kim Il Sung and friendly feelings to the Korean people. The Indonesian Embassy made its booth in a unique way and arranged the flowers harmoniously by pooling the efforts and wits of its members.

The Chinese Embassy, Russian Embassy, Cuban Embassy and other diplomatic missions to the DPRK, missions of international organizations including WFP and WHO, Mongol-Korea Friendship Society, India-Korea Friendship Society, Egypt-Korea Friendship Society and other friendship and solidarity organizations, too, exhibited Kimilsungia. Officials of Korea's Party, government, ministries and national agencies, working people's organizations, anti-Japanese revolutionary fighters, service personnel, working people and youths and students in Pyongyang visited the festival hall. Among the visitors to the festival were the delegations of Chongryon, Federation of Korean Nationals in China, Federation of Korean Nationals in Canada, Federation of Korean Nationals in America and other overseas Koreans. The diplomatic missions to the DPRK, the corps of economic and commercial attaché, the corps of military attaché, the representatives of international organizations, officials concerned with culture and friendship at the embassies of many countries and foreign guests including participants in the 26th April Spring Friendship Art Festival visited the festival hall. The festival was closed on April 20.

Impressions

Re Tien Ti, vice-minister of Culture, Sport and Tourism of the Socialist Republic of Vietnam

"We saw really beautiful flowers in the Kimilsungia festival in celebration of the birth anniversary of President Kim Il Sung. The flowers show the beauty of Korea and show that President Kim Il Sung and leader Kim Jong Il are the really great men. I wish the Korean people and Korea to be beautiful forever as the flowers in this festival hall."

Ting Aihua, section chief of the Hologuse Investment Company of Singapore

"We, tourists of Singapore, have an unforgettable memory of the visit to the festival hall. What left the greatest impression on us are the noble spirit of your people and the worship and reverence of the people of many countries of the world for your leader. This exhibition is worth visiting. Thanks."

Dr. Saber Bilul, head of the Politics Faculty of Damascus University, Syria

"It is a great joy to visit the Kimilsungia festival hall. Many Koreans and foreigners are here. This is the evidence to their reverence for President Kim Il Sung.

I express my regards to him, eternal President of the DPRK."

Zhang Qi, grandson of Zhang Weihua, Chinese anti-Japanese revolutionary martyr

"The ideas and the brilliant achievements of the great leader President Kim Il Sung will shine as the flower flourishes. He will be alive in our hearts forever."

M.V. Joseph, head of the delegation of UNICEF

"This festival of flower named after President Kim Il Sung is the only one that can be seen in the world. The festival will last long in my memory."

Wardiyatmo, general secretary of Ministry of Culture and Tourism of Indonesia

"I visit Pyongyang of the DPRK for the first time as head of the Indonesian cultural delegation to participate in the Eleventh Kimilsungia Festival and the 26th April Spring Friendship Art Festival. I am proud to take part in this festival.

I extend my deep thanks to the organizing committee of this event."

Pradip Kumar, official of the Cooperation Mission of the European Union in the DPRK

"It is indeed a beautiful exhibition of flowers and what is more beautiful than the flowers is the people's respect for the great leader. This is one of the most spectacular sights and I look forward to visiting the festival hall once again."

Anatoly Klikov, first secretary of the Maritime Provincial Committee of the Youth League of Russia

"I saw the boundless reverence of Korean people for Comrade Kim Il Sung through the beautiful flower festival. Many units, working people, service personnel and foreign diplomats exhibited Kimilsungia and Kimjongilia which they had brought into full bloom beautifully with sincere efforts. I am proud to participate in this flower festival. I wish the Korean people a great success in the struggle to reunify their country."

Eleventh Kimilsungia Festival (April 13–20, 2009)

"Kimilsungia is representative of the spirit of Korean people who are armed with the Juche idea evolved by President Kim Il Sung and united into one and Kimjongilia, of the unequalled courage and personality of the great General Kim Jong Il. The flowers will be in full bloom in the hearts of our people, overseas Koreans and the peace-loving people of the world."

Choe Un Bok, head of congratulating group of the Federation of Korean Nationals in China

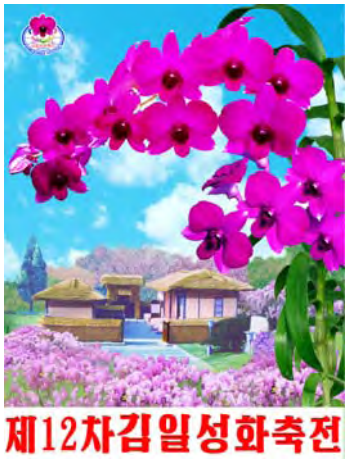
Display board of the Embassy of the Republic of Indonesia in the DPRK

Visitors making an entry in the visitor's book

Twelfth Kimilsungia Festival

The Twelfth Kimilsungia Festival opened in Pyongyang in a grand way.

Displayed in the festival hall were a lot of Kimilsungia cultivated by Korea's ministries and national agencies, army units, working people, youths and students in Pyongyang, overseas Koreans, the Indonesian Embassy in the DPRK, diplomatic missions, foreign friendship and solidarity organizations, and the members of the ASPKK. The opening ceremony was held on April 12, 2010.



Poster

The officials of Korea's Party, government, ministries and national agencies and the working people in Pyongyang attended it. Also present there were Nam Sung U, head of the delegation of Chongryon and vice-chairman of the Central Standing Committee of Chongryon and other overseas Koreans.

And there invited were the Indonesian cultural delegation headed by Wardiyatmo, general secretary of Ministry of Culture and Tourism, Pitri Riyanti, ambassador chargè d'affaires ad interim of the Republic of Indonesia to the DPRK and his staff members, Ratna Sari Dewy Sukarno who is honorary chairwoman of the ASPKK and director of the Dewy Sukarno Office in Japan and her party, Abudlei Diallo, delegate of the Guinea Kimilsungia Greenhouse and other foreign guests.

Lots of people visited the festival hall every day.

The Kimilsungia festival was closed on April 19, 2010.

In the closing ceremony, the best units were awarded top prizes.

The special prizes went to the Central Standing Committee of Chongryon, Embassy of the Indonesian Republic in the DPRK and the Guinea Kimilsungia Greenhouse.

Impressions

Liu Hongcai, ambassador of the People's Republic of China to the DPRK

"We will remember forever President Kim Il Sung, a close friend of the Chinese people and the great leader of Korean people."

Ahganu Rezai Pur, military attaché of the Embassy of the Islamic Republic of Iran in the DPRK

"We, military attachés of the embassies in the DPRK, visited the Kimilsungia festival hall. We are here every year and every time we were impressed with the excellence and grace of the festival. Whenever I visited the festival hall, I felt the reverence of the Korean people for His Excellency President Kim Il Sung.

I wish Comrade Kim Jong Il, the leader of Korea, to be in good health and President Kim Il Sung to be immortal."

Rajendra Aryal, member of UNFAO

"The flower exhibition is spectacular, better than exhibitions in other countries. I wish this grand festival a success."

Ramon Rimerez Lopez, member of Parliament of Mexico

"I was deeply impressed by the festival. It shows the will of the Korean people to glorify the cause of Comrade Kim Il Sung.

Kimilsungia imbues all the people of the world with confidence that socialist world where all the people live happily can be built by dint of independence, creativeness and consciousness, while glorifying the ideas and the cause of Comrade Kim Il Sung."

Kim Mi Suk, head of the Art Troupe of the International United Confederation of Koreans

"Our Moranbong Art Troupe warmly congratulates all the people in the homeland

on the Day of the Sun.

We wish our great homeland bright future and prosperity.

Thank you for your invitation to this wonderful Kimilsungia festival which gave us great joy and impression. We, overseas Koreans living far away from the homeland, always cherish the great leader President Kim Il Sung in our hearts.

We firmly believe in the bright future of our homeland and we are striving for the reunification of our nation and will do in the future, too."

Choe Su Bong, head of the Art Troupe of Koreans in China

"Today is the Day of the Sun, the most auspicious national holiday.

All the members of the Art Troupe of Koreans in China participating in the Second April Spring People's Art Festival visited the Twelfth Kimilsungia Festival hall with reverence for the great leader President Kim Il Sung.

Kimilsungias exhibited by foreigners, overseas Koreans and the Korean people are a token of their will to glorify the immortal revolutionary exploits accomplished by the great leader for the Korean nation and history."

Prof. Choe Bronya, chairwoman of the Russian region headquarters of the Pan-national Alliance for Korea's Reunification

"We are deeply impressed by this festival held in celebration of the birth anniversary of President Kim Il Sung. This is a great event.

Long live President Kim Il Sung!

Long live the Sun of mankind!"

Kim Ji Hyong, general manager of the Peace Motors Corporation

"I was moved to see the Kimilsungia the people grew with sincere efforts.

I will contribute to the peaceful reunification of the country keeping the look and colour of beautiful Kimilsungia in my heart."

Twelfth Kimilsungia Festival

(April 12–19, 2010)

Visitors making an entry in the visitor’s book

Chapter 2
Functions to Mark the Anniversary of the Naming of Kimilsungia

Kimilsungia was born of the respect of the progressive people of the world for President Kim Il Sung. Korea hosts colorful functions to mark the day of the naming of Kimilsungia which was so great an event as to be recorded in the annals of the Korean nation and floriculture circles of the world.

1. Functions to Mark the 30th Anniversary of the Naming of Kimilsungia

1) Meeting

On April 12, 1995, a meeting was held at the Grand People's Study House in the DPRK to mark the 30th anniversary of the naming of Kimilsungia.

The birth of Kimilsungia is a great joy and event for the Korean people and other progressive people of the world. The Korean people celebrated the 30th anniversary of the naming of the Kimilsungia with the sincere yearning and reverence for President Kim Il Sung. Present at the meeting were Korea's Party and government officials and the employees of the Central Botanical Garden.

A grateful message from the Central Committee of the Workers' Party of Korea to the employees of the Central Botanical Garden was read.

It was followed by the report and speeches. Those who took the floor mentioned that Kimilsungia came into being in April 1965 reflecting the aspiration of the

progressive people revering and following President Kim Il Sung and that the scientists, technicians and workers of the Central Botanical Garden had solved the scientific and technical problems arising in the reproduction of Kimilsungia and preservation of its progenitor and developed a method of ensuring Kimilsungia bloom in any season, and sent over a hundred thousand of Kimilsungia plantlets to all parts of the country. They added that Kimilsungia had become a flower loved by not only the Korean people but also the progressive people all over the world and spread over many countries and regions of the world and that the officials and employees of the Central Botanical Garden should improve the method of cultivating Kimilsungia so as to disseminate it more widely at home and abroad and pass it on from generation to generation as a national treasure.

2) Academic Seminar on Kimilsungia

An academic seminar on Kimilsungia was held at the Central Botanical Garden on April 11, 1995, under the auspices of the then General Federation of Science and Technology of Korea.

Present at the seminar were the officials concerned, biological researchers and technicians. Presented were following papers: “Study on the Optimal Medium for Multiplying Kimilsungia by Tissue Culture”, “Study on the Characteristics of Photosynthesis of Kimilsungia”, “Study on the Bud-Differentiation of Protocorm Like Body (PLB) of Kimilsungia”, “Study on Having Kimilsungia Bloom at Any Season” and “Study on the Composition of Computer-Controlling System in the Kimilsungia Greenhouse and Its Introduction” and others.

The seminar reviewed the successes and experiences in research into Kimilsungia and at the same time helped to introduce them.

The participants were determined to bring scientific methods of cultivating Kimilsungia to perfection and disseminate them throughout the country while consolidating the achieved successes so as to pass Kimilsungia on through generations as a national treasure and to please the flower lovers and people.

3) Kimilsungia Exhibition

On April 10, 1995, Kimilsungia exhibition was held at the Central Botanical Garden on the occasion of 30th anniversary of the naming of Kimilsungia. The front wall of the exhibition hall was hung with the portraits of President Kim Il Sung and leader Kim Jong Il.

Displayed in the exhibition were over 600 pots of Kimilsungia and 53 pots of Kimjongilia and rare and beautiful flowers like amaryllis and azalea sent by heads of state of many countries of the world, prominent figures and friendship organizations.

Officials concerned and working people in Pyongyang saw the flowers.

It was the first flower show held in Korea and served as an important occasion in setting off the beauty and uniqueness of Kimilsungia and promoting its cultivation and propagation.

2. National Academic Seminar to Mark the 35th Anniversary of the Naming of Kimilsungia

On April 11, 2000, a national academic seminar was held at the Grand People's Study House in Pyongyang to mark the 35th anniversary of the naming of Kimilsungia.

Present at the seminar were officials concerned, Kimilsungia researchers, horticulturalists, officials and working people in the capital and localities.

Presented in the ceremony were following essays: "Inorganic Substrate for Cultivating Kimilsungia", "On the Characteristics of Photosynthesis of Kimilsungia", "On Propagating Kimilsungia by Seed Culture", "On the Treatment of Biological Agents to Time the Blooming of Kimilsungia for the Day of the Sun", and "On Controlling Temperature to Time the Blooming of Kimilsungia for the Day of the Sun".

Those who took the floor said that Kimilsungia was not a simple flower of nature but a flower of the independent era representative of the greatness of President

Kim Il Sung and a flower blooming in the hearts of mankind who revered him. They introduced with concrete data and visual aids the results in their research including methods of massive reproduction of Kimilsungia by the method of cell engineering, having it bloom in any season and cultivating it by different inorganic media. Then they stressed the need for scientists to devote their wisdom and energy to research work to enable Kimilsungia to bloom more beautifully.

3. Functions to Mark the 40th Anniversary of the Naming of Kimilsungia

1) Publishing of the Work of Leader Kim Jong Il *Kimilsungia Is an Immortal Flower That Has Bloomed in the Hearts of Mankind in the Era of Independence*

The Workers' Party of Korea Publishing House issued Kim Jong Il's work, *Kimilsungia Is an Immortal Flower That Has Bloomed in the Hearts of Mankind in the Era of Independence,* in a booklet form on April 6, 2005, on the occasion of the 93rd birth anniversary of President Kim Il Sung and 40th anniversary of the denomination of Kimilsungia.

In the work he recalled with deep emotion the days when he had visited Indonesia with President Kim Il Sung. He wrote that the visit of President Kim Il Sung to Indonesia was significant in strengthening the unity and cooperation with the newly-emergent countries.

Then he said that Indonesian President Sukarno had suggested over and over again that a rare and beautiful flower bred by a botanist with painstaking efforts be named after President Kim Il Sung, that that was how a flower named after a great man came into the world and that this was an expression of high regard prominent figures and people of the world paid to President Kim Il Sung who had rendered such brilliant services to mankind.

The author described how Kimilsungia had come to Korea: he sent relevant officials to Indonesia to trace the flower as the flower had failed to come to Korea for

several years due to the change of political situation in Indonesia.

He said that in order to adapt Kimilsungia grown in the tropics to the climate and soil conditions of Korea and propagate it, a researchers' group was organized and provided with the latest equipment and materials as well as many seedlings of pure breed and that thanks to their effort Kimilsungia was now cultivated everywhere.

He continued that the Korean people, cherishing a great pride and honour in having an immortal flower named after President Kim Il Sung as a national treasure, should cultivate it well to ensure that it would be handed down through generations and cultivated in every part of the world.

Then he stressed the need to keep the existing Kimilsungia greenhouses in a modern way as required by the new century, cultivate the flower in a scientific and technological way and step up scientific research into the flower so as to complete the method and techniques for cultivating the flower on a mass scale on the basis of recent successes in modern biological engineering.

The work inspired the Korean people with more pride and honour as the Kim Il Sung nation.

After the publication a brisk mass drive to cultivate Kimilsungia was conducted in Korea.

2) National Meeting

Marking the 40th anniversary of the denomination of Kimilsungia, the national meeting was held on April 12, 2005, at the People's Palace of Culture.

Present at the meeting were officials of Korea's Party, government, ministries and national agencies, those participating in the Seventh Kimilsungia Festival, and the working people in Pyongyang.

It was also attended by Megawati Sukarnoputri, the former President of Indonesia and her party, who came to Korea to participate in the functions in celebration of the 40th anniversary of the denomination of Kimilsungia and the Seventh Kimilsungia

Festival, Ratna Sari Dewy Sukarno, widow of the Indonesian ex-President Sukarno and her party, foreign guests, overseas Koreans, and the members of the Indonesian Embassy in the DPRK.

A vice-president of the Presidium of the Supreme People's Assembly of the DPRK delivered the report.

He said that the 40th anniversary of the denomination of Kimilsungia was marked in the situation in which the entire people were bringing about a tangible progress and innovation in all fields of socialist construction by pushing ahead with the general onward march of Songun revolution under the leadership of Kim Jong Il, that the Korean people keenly felt once again how great man they had had as their leader and were full of the determination to accomplish the revolutionary cause of President Kim Il Sung, that the birth of Kimilsungia 40 years ago was the special event in the 5 000-year long history of Korean nation and a great felicity of the Korean nation and humankind and that it was thanks to the high reverence of the Korean people and progressive people of the world missing President Kim Il Sung that Kimilsungia was in full bloom all over the world.

National meeting to mark the 40th anniversary of the naming of Kimilsungia

He continued that they should build a thriving socialist nation and consummate the Juche revolutionary cause, cherishing a national pride in having Kimilsungia as a national treasure.

He stressed that Kimilsungia and Kimjongilia were a source of pride of the Korean nation and so they should be cultivated more widely and be propagated around the world through the flower exchanges with the peace-loving people of the world and international flower shows and horticulture expositions.

3) National Academic Seminar

A national academic seminar was held on April 14, 2005, at the Grand People's Study House to mark the 40th anniversary of the denomination of Kimilsungia.

Present at the seminar were the chairman of the Korea Kimilsungia-Kimjongilia Committee, the president of the State Academy of Sciences, scientists and technicians in the biological field including those at Kim Il Sung University, horticulturalists and workers in the field of cultivating Kimilsungia in Pyongyang.

It was also attended by Ri Pyong Sang, chairman of the American Kimilsungia and Kimjongilia Association.

At the beginning of the seminar, Kim Jong Il's work, *Kimilsungia Is an Immortal Flower That Has Bloomed in the Hearts of Mankind in the Era of Independence*, was read.

At the seminar the four papers on the biological characteristics and cultivation of Kimilsungia were presented orally and five in writing.

Speeches titled "Characteristics of Photosynthesis of Kimilsungia and Decision of Cultivation Environment on Their Basis", "On the Pure Line Cultivation of Kimilsungia", "On Improving Quality of Kimilsungia Which Is to Bloom on the Day of the Sun", "On Timing the Blooming of Kimilsungia for the Day of the Sun and Other Occasions."

The seminar served as an important occasion in cultivating and propagating Kimilsungia widely.

4) National TV Forum

A national TV forum titled "Our Leader Is Alive Forever Along with the Flower of the Sun" was held at the Kimilsungia and Kimjongilia Exhibition Hall on April 12, 2005.

Present at the meeting were officials and horticulturalists, who were exemplary in cultivating Kimilsungia and in the flower festivals, the members of the ASPKK, foreigners and overseas Koreans who visited Pyongyang to participate in the celebrations of 40th anniversary of the denomination of Kimilsungia and the Seventh Kimilsungia Festival.

An official of the Korea Kimilsungia-Kimjongilia Committee made a speech, in which he said that as the mankind sincerely respect President Kim Il Sung Kimilsungia would spread wider with the passage of time and the Kimilsungia festival would be held in a grand way as an international flower festival.

He was followed by Gurush Sukarno, son of former Indonesian president Sukarno, who said that when President Kim Il Sung had visited Indonesia 40 years ago, his father, attracted by his guest's great personality and immortal exploits for the cause of global independence, ensured that a rare and beautiful flower bred by a botanist was named after President Kim Il Sung.

He went on to say that he was a teenager 40 years ago but he even now remembered the bright smile of the generous and benign President Kim Il Sung and that he came to Pyongyang to participate in the Seventh Kimilsungia Festival and 23rd April Spring Friendship Art Festival with the beautiful Kimilsungia grown at the Bogor Botanical Garden and the *Cantata to Marshal Kim Il Sung*, a Korean song, in the year that greeted the 40th anniversary of the historic visit of President Kim Il Sung to Indonesia and 40th anniversary of the denomination of Kimilsungia.

Next an official of the Presidium of the Supreme People's Assembly of the DPRK took the floor. He said that the flower reminded him of the historic days 40 years ago when it was named Kimilsungia and stressed that it was leader Kim Jong Il who had

Stamps issued to mark the 40th anniversary of the naming of Kimilsungia

National TV forum on the occasion of the 40th anniversary of the naming of Kimilsungia

ensured Kimilsungia had rooted and bloomed in Korea and came to be known to the world as a particularly celebrated flower.

An officer of the KPA said that the service personnel cultivated Kimilsungia with care while safeguarding the country and that they would stand at the van in cultivating Kimilsungia and preparing for the festivals in the future, too.

The scientists of the biological branch under the State Academy of Sciences and the Kimilsungia and Kimjongilia Research Centre mentioned the successes achieved in the research into Kimilsungia through the strenuous efforts of the past 40 years.

The workers in the fields of cultivation and propagation of Kimilsungia said that they had cultivated Kimilsungia with boundless reverence for President Kim Il Sung to participate in the Kimilsungia festivals.

Wang Dongping, general manager of the Dandong Kimilsungia and Kimjongilia Greenhouse of China, and other Chinese said that President Kim Il Sung was the great leader respected by not only the Korean people but also the world people including the Chinese people and added that they had cultivated Kimilsungia in their greenhouses and homes with boundless respect for President Kim Il Sung and participated in the Kimilsungia festival every year.

At last Hentrati Sukendar Munthe, ambassadress of the Republic of Indonesia to the DPRK, said the Indonesian Embassy in the DPRK had participated in the Kimilsungia festivals from its first one reflecting the reverence for and confidence of the Indonesian people and the progressive people of the world in President Kim Il Sung and the festival was praised as the flower one full of admiration for the great man.

The forum proceeded in an atmosphere full of reverence and admiration for the great man.

Part V

Works of Literature and the Arts on the Theme of Kimilsungia, Gift Plants Presented to President Kim Il Sung

Attractive and meaningful Kimilsungia is suggestive of the greatness of President Kim Il Sung and evocative of the people's longing for him.

Therefore the Korean people made Kimilsungia the theme of poems and songs and delineated its beautiful look in films and other forms of artistic works.

Progressive figures and people from many other countries presented President Kim Il Sung with rare and beautiful plants out of their feelings of admiration for him.

This part introduces typical literary works depicting Kimilsungia and some of the gift plants presented to President Kim Il Sung.

Chapter 1
Works of Literature and the Arts on the Theme of Kimilsungia

1. Novel

Full-length non-fiction ***Kimilsungia and the World***

This novel, published in 2010, deals with the substantial events happened in the course of nearly half a century since the birth of Kimilsungia.

The story is in the following vein: Indonesian President Sukarno shows a newly-bred orchid flower of noble and elegant colour and extraordinary beauty to President Kim Il Sung on a visit to Indonesia and suggests to name it after his name from the bottom of his heart. Due to the unexpected situation created in Indonesia, Kimilsungia is doomed to oblivion, but it comes to Korea from Indonesia after a decade. The story continues to say that the Korean people make strenuous efforts to propagate it across the country and Gunter Sukarno Putera, son of President Sukarno, devotes his heart and soul to have it registered to the international orchid-related society.

Also introduced are the Kimilsungia festivals held grandly in Korea and Kimilsungia awarded the gold award, the top prize, at the 2006 Shenyang International Horticultural Exposition, China, allegedly “Flower Olympics” of the new century. In addition there is also an impressive scene where Clara Bundt, the only daughter of Kimilsungia breeder C. L. Bundt, gives rein to her exited feelings, longing for President Kim Il Sung in front of Kimilsungia displayed at the opening ceremony of the Kimilsungia and Kimjongilia Greenhouse held in Puncak, Bogor City, Indonesia in April 2007.

The novel introduces some publications of foreign countries on the great personalities of President Kim Il Sung and scientific and theoretical problems raised in the breeding and propagation of Kimilsungia.

Through the artistic delineation of Kimilsungia, it will make a tangible contribution to introducing the great figure of President Kim Il Sung who devoted all his life to attaining the prosperity of Korea, the happiness of its people and the victory of the cause of making the whole world independent.

2. Poems

Flower of the Sun

The poem tells that Kimilsungia deserves to become the flower of the sun. It was composed in 2005.

First, it describes artistically that Kimilsungia is not an ordinary flower rooting in mountains and fields, but the flower born with the reverence of mankind and that the flower reminds one of the image of President Kim Il Sung.

As the sun shines every nook and corner of the world, so Kimilsungia is in full bloom all over the world and it gives one a joy and enthusiasm of life as well as confidence in dignified life and makes one's love and wish realized, the poem sings.

In the last part, it emphasizes that Kimilsungia will be in full bloom on the globe eternally in the profound reverence of the people for Kim Il Sung.

Kim Jong Il and Kimilsungia

The poem written in 2005 speaks highly of the feats of leader Kim Jong Il who put his heart and soul into finding out Kimilsungia which had been on the verge of oblivion and propagating it all over the world.

In its forepart, the poem calls back with deep emotion a series of noteworthy happenings associated with Kimilsungia, greeting the 40th anniversary of the naming of

Kimilsungia, and sings that naming a newly-bred flower after President Kim Il Sung in praise of his feats is an expression of the highest adoration of the people for him.

The poem at its climax says that Kimilsungia could be found after a lapse of ten years by leader Kim Jong Il, believing that it would survive somewhere even in a raging wind of times, and is now in full bloom all over the world.

Kimilsungia, the Flower of All the People

The poem was indited in 1999. It says that Kimilsungia is in full bloom over the world.

In its forepart, it sings with pride that Kimilsungia is the flower permeated with the feelings of reverence of humankind for Kim Il Sung, mentioning that lots of Kimilsungias are sent to the Kimilsungia festival held in Pyongyang from different parts of the world.

The poem extols that although a flower, they say, opens with shining light of spring, Kimilsungia is a flower of love that sheds the warm light on the hearts of the people.

At the last part, it sings that Kimilsungia is the flower of mankind, the flower of the world, which blooms in all seasons and in all parts of the world.

Flower of Yearning

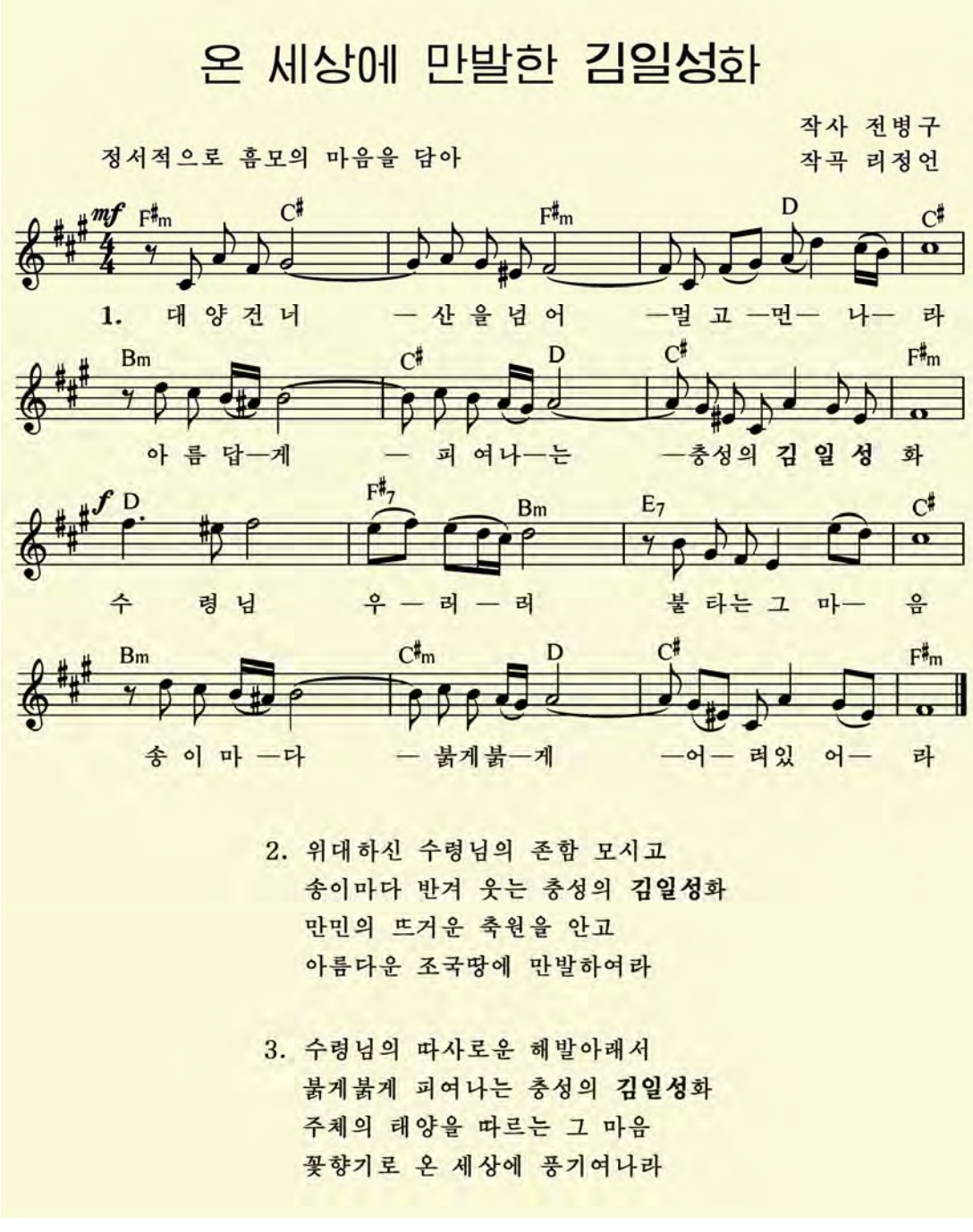
The poem, composed in 2005, shows the ardent feelings of the Korean people who are burning with the yearning for President Kim Il Sung, who devoted all his life for their happiness, at the sight of Kimilsungia in glorious bloom.

It describes lyrically that the more Kimilsungia wet with morning dew is seen, the more the yearning for Kim Il Sung grows with the passage of time.

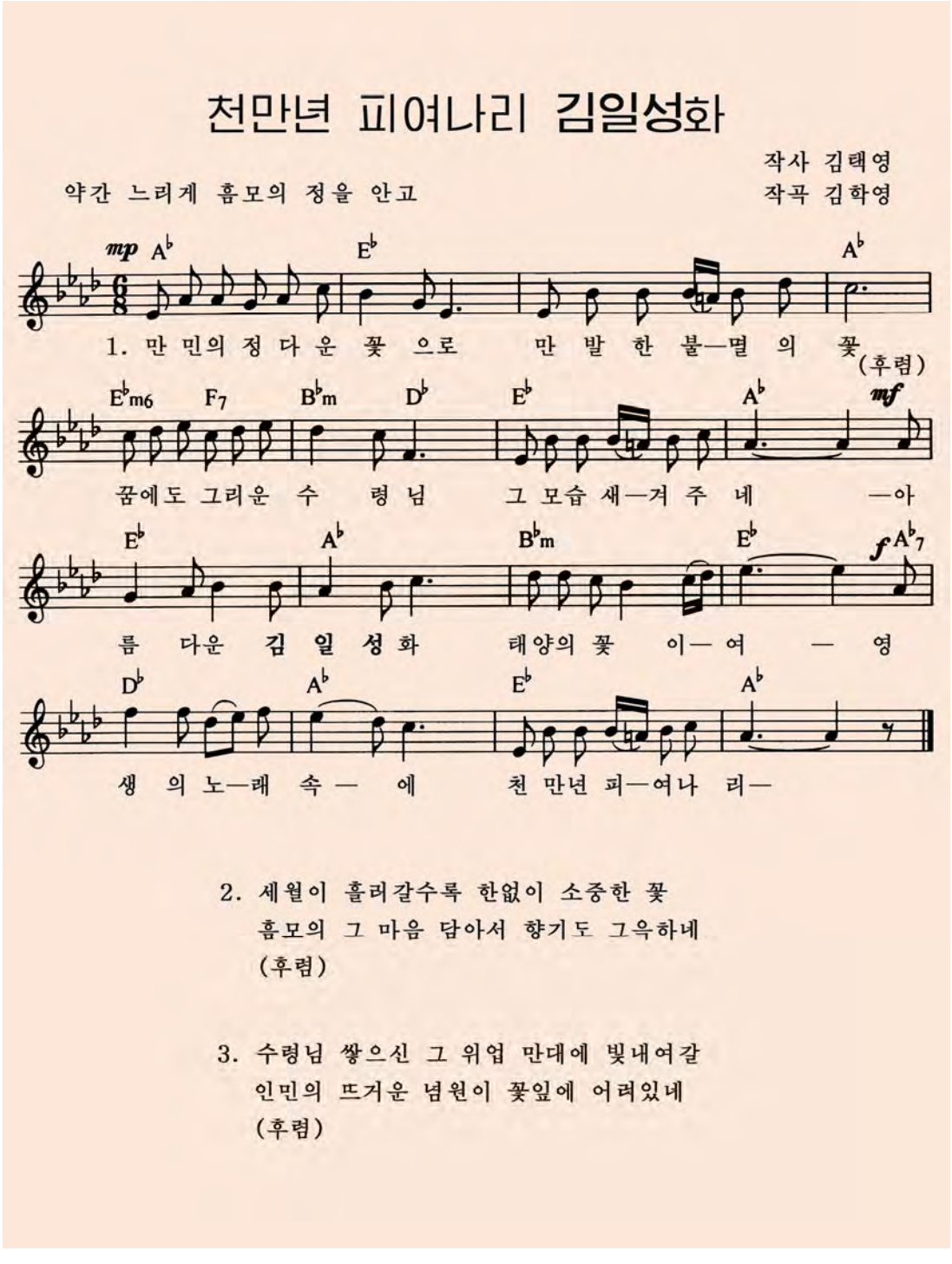
In the last verse, the poem, stressing that the feelings of the Korean people would not be so heart-stricken if President Kim Il Sung, who had dedicated to them, would be relaxed even for a moment of his life, says that Kimilsungia deep-rooted in their hearts will bloom forever.

3. Songs

Kimilsungia in Full Bloom All over the World



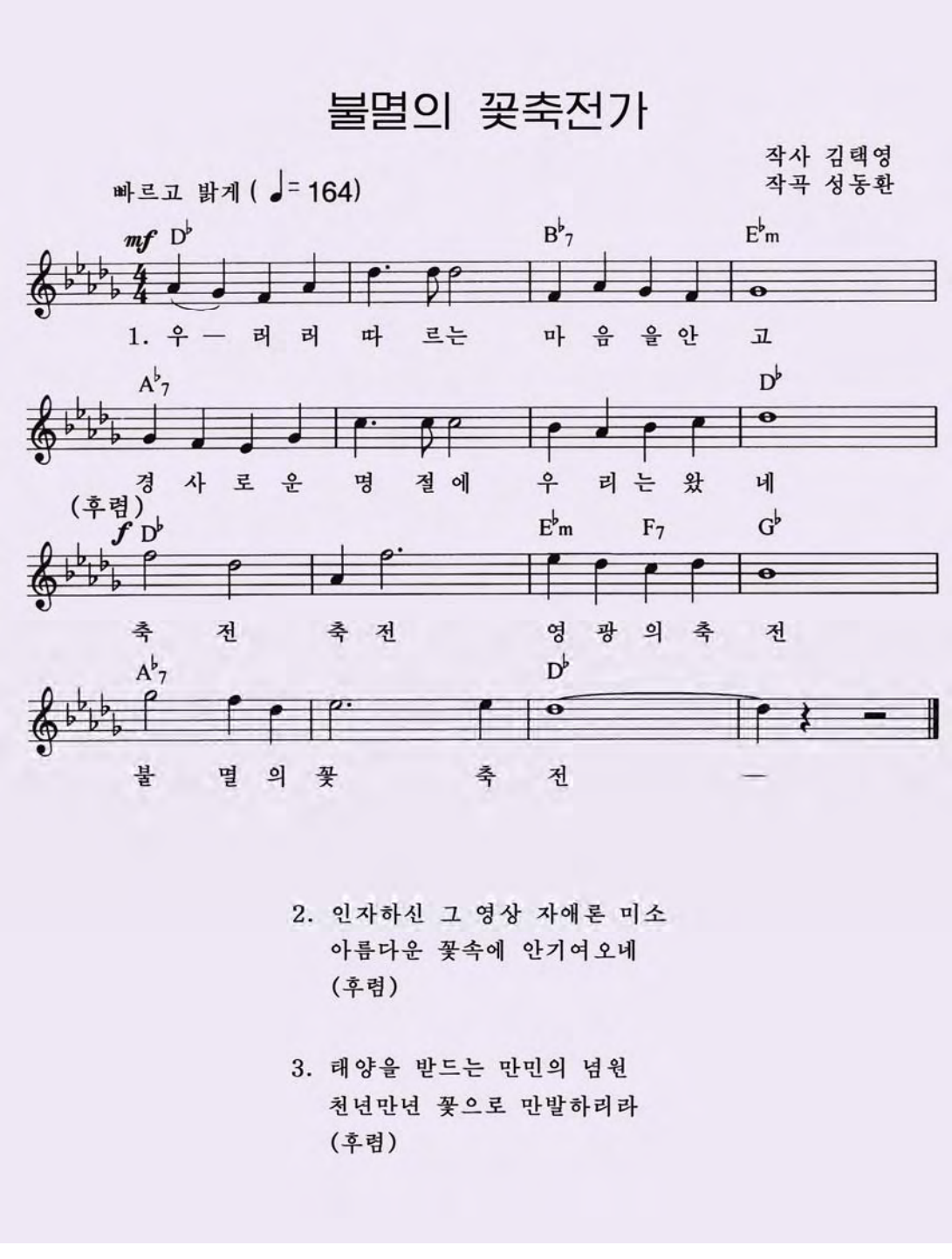
Kimilsungia Will Be in Bloom Forever



2. 세월이 흘러갈수록 한없이 소중한 꽃
흠모의 그 마음 담아서 향기도 그윽하네
(후렴)

3. 수령님 쌓으신 그 위업 만대에 빛내여갈
인민의 뜨거운 념원이 꽃잎에 어려있네
(후렴)

Festival Song of the Immortal Flower



4. Films

Documentary and science films dealing with Kimilsungia are produced and put on the screen in the DPRK.

Typical are documentary films *First Kimilsungia Exhibition, Second Kimilsungia Exhibition* and *Immortal Flower in Full Bloom in the Hearts of Mankind* and science film *Kimilsungia*.

Science film ***Kimilsungia***

The film was produced in 1983 by the then Korean Science and Education Film Studio.

The film presents in detail the splendour of Kimilsungia which is in full bloom with the reverence of the Korean people and the world progressive people for President Kim Il Sung.

It also displays the shape, structure and characteristics of the flower, the process of its vegetation and the production of its seedlings by the method of cell engineering.

While explaining different ecological conditions suited to the growth of Kimilsungia, including cultivation of its young seedlings until the time of blooming, it shows that the flower freshens the air of a room during night as the flower has a distinctive characteristic of opening stomata of its leaves to absorb CO_2 only at night and closing in the daytime for the photosynthesis.

With the use of a slow motion shot, the film shows a mystical shape of Kimilsungia coming into blossom one after another at three-day intervals on the peduncle and gives a glimpse of cheerful aspect of the people preparing a bouquet and a basket of flowers with Kimilsungia at home and schools.

Through a slow motion shot, the film shows the beauty of the flower clearly by capturing the exact moment of its blooming, thus leading the audience to an emotional world.

5. Dance

Kimilsungia in Full Bloom All over the World

The dance depicts artistically the loyalty of the Korean people who hold President Kim Il Sung in high esteem and follow him and the feeling of reverence of the progressive people of the world for him through graceful, soft rhythms.

It was produced in 1981. Thirteen girl dancers are on the stage. The background music is the song *Kimilsungia in Full Bloom All over the World.* Their elastic movements depict the noble and loyal hearts of the Korean people who uphold and follow President Kim Il Sung while their rhythmic movements represent the reverential feeling of the progressive people of the world who are growing Kimilsungia in all regions of the globe. The formative portrayal of the full-blown Kimilsungia by the dancers expresses the conviction that the wish of President Kim Il Sung and the desire of progressive people of the world advancing vigorously along the road of independence will surely come true. All its rhythms are well harmonized with melody to promote the profundity and vividness of depiction.

6. Art Works

Many art works worthy of a national treasure portraying Kimilsungia have been produced in Korea, giving a pleasure and optimism to the people at home and abroad.

Major works are introduced below.

Korean painting *Kimilsungia*

Embroidery *Kimilsungia*

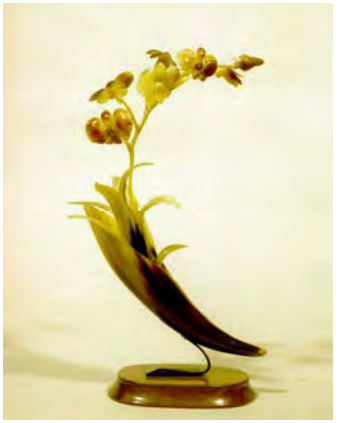
Metal work *Vase*
decorated with Kimilsungia
made of silver thread

Metal work
Flower basket decorated with
Kimilsungia and Kimjongilia

Metal work *Vase*
inlaid with Kimilsungia

Stone work *Kimilsungia*
in full bloom all over the world

Mother-of-pearl work
Vase inlaid with Kimilsungia



Bone work *Kimilsungia*

White porcelain *Vase*
inlaid with Kimilsungia

Double-faced embroidery *Kimilsungia*

7. Introductory Presentations

Various kinds of presentations introducing Kimilsungia are published in the DPRK.

Magazine ***The Immortal Flower***

It is a quarterly published by the Korea Kimilsungia-Kimjongilia Committee since 2001. It carries articles on the greatness of President Kim Il Sung, successes and experiences achieved in growing and propagating Kimilsungia and scientific and technological materials essential for its cultivation.

Included in it are many of articles such as common knowledge of different species of flowering plants, activities of the Associations of Supporters for Propagation of Kimilsungia and Kimjongilia, introduction of Kimilsungia festivals held in the DPRK, novels, poems and songs portraying Kimilsungia created at home and abroad.

Folders and pamphlets introducing Kimilsungia and Kimjongilia

Chapter 2
Gift Plants Presented to President Kim Il Sung

The Central Botanical Garden in Pyongyang is home to many gift plants presented to President Kim Il Sung by foreign heads of state, preeminent persons, horticulturists and other people. The gift plants include rare and beautiful species of trees and flowering plants. The gift plants given to President Kim Il Sung until 1993 amount to some 1 630 species.

They are tended with care in the Central Botanical Garden. Thanks to the efforts of the researchers and horticulturists there, they have been widely propagated in Korea.

Metasequoia glyptostroboides

It was presented by Yang Yong, commander of the former Chinese People's Volunteers Army.

A deciduous lofty conifer belonging to the Taxodiaceae, it is native to China.

Its maximum height is 35 m and diameter at the height of bosom is 2 m. The leaves looking like the teeth of a comb grow in two rows on the sides of the branch. It is androgynous, the flower blooms in late March –early April and the fruit ripens in October. It is propagated by seed and stem-cutting. It is planted along the street or in the park and

garden because of its good appearance and strong resistance to insects like pine caterpillar. The wood is used as materials for furniture and pencils, while the leaf for dye.

Olive (*Olea europaea*)

It was presented by Hafez Al Assad, former President of Syria on September 20, 1975.

It is a broad-leaved evergreen subshrub belonging to the Oleaceae. The original habitat is southern Europe. The leaf is elliptical and lanceolate. It is an androgynous plant. It blooms in March–April. 2–5 pendulous male flowers hang on branch apex and roughly oval female flowers number 1–5. The fruit ripens in October. It is propagated by seed. Because of the clean and graceful appearance, it is potted for ornamental purposes. The timber is used as materials for furniture, musical instrument and shipbuilding. The oil from the fruit is used for cooking.

Aronia melanocarpa

It was presented by Gerhardt Schröder, manager of the Seed and Sapling Farm in Berlin, former East Germany, on October 17, 1985.

Native to North America, it is a deciduous broad-leaved shrub belonging to the

Rosaceae. It grows 1–2 m high. The leaf is oval or obovate. The white flower opens up in May and dark purple fruit ripens between August and September. It is propagated by seed and stem-cuttings. As its foliage and flower are beautiful, it is planted in gardens. Its fruit is widely used in medical treatment as it contains much vitamins and physiological active material.

Picea pungens cv. *Glauca*

This plant was presented by Dr. Karl Hammer of the German Institute of Genetics on October 1, 1989.

An androgynous plant, it is an evergreen lofty conifer belonging to the Abietaceae. It grows 30–45 m high. The flower opens between April and May. The cone is cylindrical in shape and turns brown, pending downwards, when the seeds are ripe.

It is propagated by grafting. The stock is the seedlings of spruce or *Picea Koraiensis*. It is planted in parks, gardens and pleasure grounds as it has the silver green foliage and graceful shape.

Plumeria rubra

This plant was presented by Maisuk Saisompang, member of the Central Committee of the People's Revolutionary Party of Laos and chairman of Laos-Korea Friendship Society, on April 1, 1992. An evergreen broad-leaved short tree belonging to the Apocynaceae, it grows 4.5 m high. The leaf is obovate or elliptical. Light yellow flowers are borne at the ends of branches in corymbs. The tree is propagated by stem-cuttings and layering.

It is planted in a pot for ornamental purpose.

Copper beech (*Fagus sylvatica*)

It was presented by Erich Honecker, General Secretary of the Central Committee of the Socialist Unity Party of former East Germany and chairman of the Council of State on April 10, 1987. He presented President Kim Il Sung with 1 000 saplings of the tree.

It is a deciduous broad-leaved tall tree belonging to the Fagaceae. The place of origin is Europe. It grows 30–40 m high. The leaf is elliptical or round in shape and its margin has indentations and white fine hairs. It is an androgynous plant. The flower blooms in June. Hard brown fruit ripens in September–October. It is propagated by seed. As the tree looks magnificent, it is planted in the park, garden and pleasure ground.

Pyongyang white apricot (*Prunus armenica* cv. *Krasnoshekii*)

It was sent to President Kim Il Sung from Ukraine of the former USSR on November 6, 1984.

That year President Kim Il Sung passed Kiev on his way back home after his visit to the USSR. When his train pulled in, the citizens of Kiev presented him with a basket of early apricots. He tasted the apricot and said to his entourage that it tasted delicious.

Informed of it, the Central Committee of Communist Party and the Government of Ukraine presented him with saplings of apricot of seven species including the one whose fruits

he tasted. As it flourished in Pyongyang, the capital of the DPRK, he suggested it be renamed “Pyongyang white apricot”.

It is a deciduous broad-leaved tall tree belonging to the Amygdalaceae. It grows 3–5 m high. The leaf is dark green and oval. The leafstalk is dark red. It blooms in mid-April and the fruit ripens between late June and mid-July. The tree is propagated by grafting. The fruit weighs 50–60 grams each and tastes sweet and a little sour, so it is used for dessert or as materials for canning or making jam.

Red oak (*Quercus rubra*)

It was presented by the Forest Science Institution of Bulgaria on September 14, 1990.

A deciduous broad-leaved tall tree belonging to the Fagaceae, it is native to Canada and the United States. It grows about 25 m high. The leaf is obovate, with a 3- to 7-lobed margin. Its leafstalk is red and 2.5–5 cm long. It blooms in April–May and acorn ripens in October. The tree is propagated by seed. Its leaf turns beautifully reddish in autumn and so it is used as an ornament garden plant. It is also planted in cities and industrial areas as it is strongly resistant to gas, dust and soot. The wood is used in construction and furniture-making, its bark being the source of tannin.

Cauliflower (*Brassica oleracea* var. *acephala*)

This was presented by W. L. Boss, director of the Ocean Freight Transportation Company of the Netherlands on December 29, 1976.

It is a perennial or biennial belonging to the Brassicaceae. The colour of the leaf ranges from white to pink, violet red and their mixture according to species and its shape is plain or wrinkled.

Yellow flowers open in April–May the year after planting. Yellow fruit ripens in June–July. It is propagated by seed.

It is planted in a pot for ornamental purpose or cut flower.

Silver fir (*Abies concolor*)

It was presented by the employees of the Gorvlyana Electronic Conversion Elements Factory of Bulgaria on November 9, 1984

President Kim Il Sung visited Bulgaria in June 1984. At that time, seeing silver firs growing in the garden of the guesthouse where he stayed, he said that they looked good.

When he visited the factory in Sofia in company with Todor Zhivkov, the then President of Bulgaria, he personally planted a silver fir to commemorate his visit to the factory.

An evergreen conifer belonging to the Abietaceae, the tree is native to North America.

It grows 40–45 m high. Its crown resembles a cone. Silver green in colour and with a little pointed or rounded margin, the leaf has two white lines of stomata on the lower side. It is androgynous. The tree blooms in May and the cone is

initially green or green purple and turns to grey brown gradually.

It is propagated by seed or grafting.

It is planted singly or in group in parks and pleasure grounds.

Tulip (*Tulipa gesneriana* cv.)

It was presented by Watanabe Kotaro, mayor of Niigata, Niigata Prefecture, Japan, on July 3, 1974.

When he had visited Pyongyang and met him in July 1972, he presented several species of tulips to President Kim Il Sung wishing him to enjoy them.

It is a bulbous herb belonging to the Liliaceae. It grows 40–60 cm high. The leaves are alternate and broad -lanceolate and a little twisted in shape.

Usually a plant bears one cup-shaped flower whose colour is different from species to species. The fruit is long and roughly triangular and contains 50–100 round, flat and brown seeds.

It is propagated by seed and tuberous root.

It is planted in gardens as the flower is beautiful.

Bonsai black pine (*Pinus thunbergii*)

It was gifted by Shitaka Takeshi, director of the Yamamoto Co., Ltd. of Japan, on April 13, 1979, on the occasion of the 67th anniversary of the birth of President Kim Il Sung.

While mountaineering 20 years before, he had happened to find a tree of quizzical shape on a cliff. He had carried it home and grown it in a pot ever since.

It had won the first prize in a bonsai exhibition held in Japan.

It is an evergreen lofty conifer belonging to the Pinaceae. In nature, it grows about

40 m high and 2 m in diameter.

The dark green and stiff leaves are arranged in pairs on the twig. The tree blooms around April.

It is propagated by seed in the main.

It is planted in the park and garden and its bonsai is prized for its ornamental value.

Agathis robusta

This tree was presented by Ding Za Huen, member of the Presidium of the Ha Nam Dinh Provincial Committee of the Communist Party of Viet Nam and chairman of the Ha Nam Dinh Provincial People's Committee on May 14, 1987.

An evergreen lofty conifer belonging to the Araucariaceae, it is native to Queensland, Australia. It grows 45 m tall. The leaf is long elliptical and pointed at the tip. The fruit is oval, 15 cm long and 10 cm in diameter.

It is propagated by seed and stem-cuttings.

The potted tree is used for ornamentation.

Podocarpus macrophyllus

It was presented by Tanaka Eitaro, director of the Taito Trading Corporation of Japan, and Tanaka Hisahiro, director of the Taito Marine Transportation Corporation, on April 6, 1977.

An evergreen lofty conifer belonging to the Podocarpaceae, the tree is native to

Japan. The leaves are thick, leathery and needle-like, arranged densely on the twig. It is a dioecious plant. A female flower blooms at each axil. The male flower is 5 cm long. The fruit is dark purple and covered with white powder. It is propagated by seed and stem-cuttings.

It is used as an ornamental plant because of its verdant foliage.

Rose (*Rosa hybrida* cv.)

It is one of the gift plants presented to President Kim Il Sung by the Cabinet of the former People's Republic of Poland on October 22, 1984.

It is a deciduous broad-leaved shrub belonging to the Rosaceae. The stem grows straight, covered with triangular prickles. The leaf is pinnate, the odd leaflet always being at the apex and others in pairs and alternate. The colour of flowers is different from species to species. It is propagated by grafting.

It is planted in the garden and park as the flower is beautiful and fragrant.

Taxodium mucronatum

It was presented by the Mexican Committee for Supporting the Reunification of Korea on August 22, 1987.

An evergreen lofty conifer belonging to the Taxodiaceae, it is native to Mexico.

The leaves are arranged in a tuft on the twigs. Many male flowers are borne in raceme and female flowers resemble a round cone.

It is propagated by seed and stem-cutting.

Its bonsai is used for ornamentation.

Trachelospermum asiaticum var. *publescens*

This plant was gifted by Luccio Luzato, chairman of the Italian International Liaison Committee for the Reunification and Peace in Korea and his wife on April 13, 1982.

Native to Asia, it is an evergreen broad-leaved creeper belonging to the Apocynaceae. The leaf is oval, thick and glossy. White and fragrant flowers open in pinwheel shape from the axils. It bears a long pod, which bursts out when ripe to liberate seeds covered with a long hair. It is propagated by seed or stem-cuttings.

For the excellent harmony between the flower and foliage, it is potted for ornamental purpose.

Adenium obesum

This was presented by Kaysone Phomvihane, President of the People's Democratic Republic of Laos, and his wife on April 1, 1992.

Native to south Africa, it is an evergreen broad-leaved shrub belonging to the Apocynaceae. It grows 2 m high.

The leaf is elliptical and glossy. The flower is light pink and borne in umbel.

It is propagated by stem-cuttings and layering.

It is potted for the ornamental purpose as its shape and flower are beautiful.

Populus × sowietica Pyramidalis

It was presented by P. I. Rapin, deputy director of the Botanical Garden under the Academy of Sciences of the former USSR on October 20, 1984.

A new hybrid, it is a deciduous broad-leaved tree belonging to the Salicaceae. It grows about 20 m high. The leaf is heart-shaped, with glossy upper surface and silver-white lower side, densely covered with white downs. It bears no flower.

It is propagated by grafting, stem-cuttings and root-separating.

Because of fine appearance, it is planted in the park, pleasure ground and street for ornamental purposes.

Cedrus libani

It was presented by the members of Nabatiyah Branch, Duweriye Branch and Slu Branch of Lebanon Committee for Studying Kimilsungism on April 15, 1977.

Native to Lebanon, the tree is emblazoned on the national flag of Lebanon.

An androgynous and evergreen tree, it belongs to the Abietaceae. The branches spread almost horizontally and the leaf is 1.5–3.5 cm long and rectangular.

It is propagated by stem-cuttings.

The potted tree is prized for ornamental value.

Yarrow (*Achillea millefolium*)

This plant was presented by A. M. Rabinovich, director of the Medicinal Botanical Garden under the Medicinal Plant Institute of the former USSR on September 14, 1990.

It is a perennial grass belonging to the Asteraceae. It is native to Far East and northern part of Siberia, Russia. It grows 80–90 cm high. The leaf is sessile, elliptical, lanceolate and 2- or 3-lobed. It blooms from June to August. White globular flowers are borne in a corymb. Fruit ripens yellow from August to October. It is propagated by seed or root-separating.

It is used as hemostat, anodyne and vasodilator.

Syringa vulgaris

It was presented by Gustav Hussak, President of the former Czechoslovak Socialist Republic on February 12, 1989.

A deciduous broad-leaved tree belonging to the Oleaceae, it is native to southeastern Europe. It grows 5–6 m high. The leaf is dark green and oval, the lower part of which is heart-shaped. Fragrant white and purple flowers bloom in a panicle between April and May Fruits are dehiscent and ripen between September and October. It is propagated by stem-cuttings or root-separating. It is planted in the park, garden, pleasure ground and street for ornamental purpose as the flower is beautiful and fragrant. The essential oil extracted from its flowers is used as a material for making perfume of high quality.

Kigelia africana

It was presented by Zimbabwean President Robert G. Mugabe on November 16, 1988.

A broad-leaved evergreen tall tree belonging to the Bignoniaceae, it is native to the tropical west Africa.

It grows 18 m high. The leaves are unequally pinnate, the odd leaflet at the apex and others in pairs. The flower is red brown, bell-shaped and the fruit of short cylinder shape hangs on the long fruit stalk.

It is propagated by seed and layering.

Because of peculiarity of the fruit shape, the potted young tree is prized for ornamental purposes.

Streptocarpus hybridus

It is presented by Slabomir Hein, academician and head of Botanical Institute of the Academy of Sciences of former Czechoslovakia, on May 27, 1987.

It is an evergreen perennial flower belonging to the Gesneriaceae. The leaf is lanceolate, thick and fleshy. One to three white flowers open on the peduncle grown from the axil. Fruits are dehiscent, cylindrical and a little twisted. It is propagated by seed and leaf-cuttings.

The flower being beautiful, it is used as an ornamental potted plant or cut flower.

Camphor tree (*Cinnamomum camphora*)

This tree was presented by Zhang Zhiming, director of South Garden of the Beijing Botanical Garden of China on September 19, 1993.

An evergreen broad-leaved tall tree belonging to the Lauraceae, it is native to China, Japan and India. The height is around 20–40 m. The leaf is elliptical and pointed at the end. Flowers open in a panicle on the peduncle grown from the axil in May–June. Berry ripens black between September and November. It is propagated by seed or stem-cuttings. The essential oil extracted from the plant is used for medical treatment as it contains various useful elements like camphor and the wood for construction, sculpture and the manufacture of musical instruments.

Platycerium bifurcatum

This plant was presented to President Kim Il Sung on the occasion of the 75th anniversary of his birth by Dr. Kazimiez Schepanek, director of the Botanical Garden under the Jagiellonian University in Cracow of Poland, on April 13, 1987. An evergreen plant belonging to the Polypodiaceae, it is native to Australia, New Guinea and New Caledonia. It has two types of fronds: one is round and the other, cotyledon, resembles an antler. It is propagated by little plant split or spore. As the fronds look good, it is hung on the wall or from the ceiling for ornamentation.

Angraecum sesquipedale

This flowering plant was presented by Didier Ratsiraka, Madagascan President on September 7, 1978. When he came to Pyongyang to take part in the celebrations of the 30th anniversary of the founding of the DPRK, he presented six rare species of plants including *Angraecum sesquipedale* to Kim Il Sung with a congratulatory letter. An evergreen plant belonging to the Orchidaceae, it is native to Madagascar. The overlapping and leathery leaves are arranged alternately. The white flowers are borne in raceme on the peduncle grown from the axil. It is propagated by root-separating. As its flower is beautiful, it is used as an ornamental plant.

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