Technical Bulletin No. 14

Production Technology of

Aerides odoratum, Coelogyne nitida & Zygopetalum intermedium

D. Barman, H. Pokhrel, P. Mohanty, Rampal, M. Adhikari, L.C. De, N. K. Meena, N. Sailo and R.P. Medhi

राष्ट्रीय आर्किड्स अनुसंधान केन्द्र
(भारतीय कृषि अनुसंधान परिषद्)
पाक्योङ - ७३७१०६, सिक्किम, भारत
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Compiled and Edited by

D. Barman, P.Mohanty, H. Pokhrel and N. G. Debnath

Published by

Dr. R. P. Medhi
Director, National Research Centre for Orchids
Pakyong- 737106, Sikkim

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Front: *Aerides odoratum*

Back: *Aerides odoratum, Coelogyne nitida and Zygopetalum intermedium* respectively

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Foreword

The flowers of orchids are known for their uniqueness in shape, size, color and fragrances are exquisitely attractive; normally remain fresh for longer period of time in comparison to other flowers. The economic importance of orchids lies mainly in their ornamental value but many orchids are used in fragrance and flavor industry. Most of the people are not familiar and unaware about the scent of orchids. It is said that more than three- fourth of all orchids are scented as large number of orchids produces scent to attract pollinating agents. Floral scent present is due to some volatile essential oils or 'essences' as they are called, are highly concentrated substances extracted from various floral parts. Essential oils of orchids may be extracted by hydro-distillation, steam distillation, extraction with low boiling solvents and with liquefied gases. Similarly numbers of natural products are important in many aspects of life, imparting taste, aroma and color to most of our foods and providing pharmacoactive chemicals having varied use in perfumery, cosmetics and toiletries, pharmaceutical and nutraceutical industry, aromatherapy and several other value added products.

This technical bulletin covers the technique of identification and production technology of some fragrant orchids like *Aerides odoratum, Coelogyne nitida* and *Zygopetalum intermedium*. The authors have put their best effort to make the bulletin explanatory and handy. It has been scripted in such a way that it can be easily understandable.

It gives an immense pleasure to bring out this bulletin on "Production technology of *Aerides odoratum*, *Coelogyne nitida* and *Zygopetalum intermedium*" and hope this bulletin will useful to the orchid growers, scientists, students as well as entrepreneurs interests in growing fragrant orchids.

April, 2013
NRC for Orchids,
Pakyong, Sikkim

Dr. R.P.Medhi
Director

Preface

Fragrant orchids are a pleasure for their sweet fragrance and exotic appearance. Though floral scent is used by the plants for its survival mechanism, nowadays fragrance in orchids is achieving new importance as this characteristic adds to the aesthetic appeal of the flower spikes besides determining the consumer choice as well as market price.

Orchid fragrance is due to the presence of volatile aromatic oils produced in minute quantities on floral parts from sepals, petals, calluses, basal spurs to petioles. The oily fragrant substances change into vapour form enabling the flowers to smell. But not all orchid fragrance can be sensed by humans, only some of the odoriferous compounds released by a flower are detectable by human sense of smell.

Floral scent emission shows diurnal rhythm and is controlled by internal biological clock. Some orchids emit scent at morning while others develop fragrance at late noon, evening or night. Orchid fragrance is a chemical messenger between the plant and its pollinator; night pollinated flowers have peak emissions at night while the situation is reversed in day pollinated flowers. Both quantity and quality of the released scent often shows a close correlation with time of the day, flower age and weather conditions. The pleasant scented orchid flowers are often compared to fragrance of other flowers like rose, hyacinth, jasmine, freesia, lily, narcissus, sweet pea or with easily identified scents like lemon, chocolate, vanilla, orange, coconut, cardamom, musk, honey, mint etc.

I sincerely thank Dr. R. P. Medhi, Director, NRC for Orchids for his encouragement and support for writing this bulletin. I profusely thank Prof. S.N. Puri, V-C and Mission Leader (NAIP); Dr. P.K.Srivastava, Dean and Principle Investigator; Dr. S. N. Yadav, Associate Professor and Co PI, CAUPHT, Ranipool; Dr. Rajendra Gupta, Chairman, CIC(NAIP) for their continuous encouragement to bring publication of these unexploited crops. My sincere thanks are also for the farm workers who nurtured these orchids as their baby.

This bulletin covers package of practices of *Aerides odoratum, Coelogyne nitida* and *Zygopetalum intermedium.*

I hope it will be helpful for the orchid growers in cultivating aromatic orchids scientifically and can increase their production qualitatively and quantitatively.

D.Barman

Principal Scientist and CCPI (NAIP)

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Aerides odoratum: the Cat's-tail Orchid

Introduction

Aerides odoratum also known as the **Cat's-tail Orchid** or the **Fox Brush Orchid**, belongs to the family Orchidaceae. It is a group of tropical epiphyte orchids that grow mainly in the warm low-lands of the tropics of Asia that are highly prized in horticulture for their racemes of showy, intensely fragrant, and colorful flowers.

Habitat and distribution

This species is widespread through the Chineses Himalayas, western Himalayas, eastern Himalayas, north-east India (Assam, Meghalaya, Sikkim, Manipur), south-India, Bangladesh, Andaman Islands, Nepal, Myanamar, Thailand, Laos, Cambodia, Vietnam, Penninsular Malaysia, Borneo, Sumatra, Java, Sulawesi and the Philippines. They occur in broadleaf evergreen lowland forests, as a large to giant sized, highly variable, hot to cool growing epiphyte at elevations of

200 to 2000 meters high up in trees in bright sun with very stout, drooping, branching stems carrying fleshy, incurved, broad, pale green leaves. As its name implies it is highly fragrant and blooms in the late spring through fall on up to 3, sharply pendant, to 2' [60 cm] long, many [to 30] flowered, cylindrical inflorescence that arise out of the leaf axils and as developing can be very sticky and giving rise to many, waxy, very fragrant flowers.

Description of the plant

Aerides odoratum is a monopodial epiphyte. They form pendulous racemes with many long-lasting and fragrant, waxy flowers, in white with purple or pink edges. Epiphytic. **Stem** 17 – 45 cm long, stout, enclosed in leave sheaths, and remnant of leave sheaths, branches. **Leaves** 6 – 12, 9 – 30 x 1.5 – 4.5 cm, oblong, tapering somewhat to the blunt unequally and obtusely bilobed apex, slightly contracted towards 2 – 3 cm long, stem clasping, tubular, sheaths, flat, keeled. **Inflorescence** 1 – 3 supra-axillary, erect or slightly deflexed, 22 – 34 cm long peduncle 10 – 12 cm long erect, terete, smooth, with 4 – 5 , 5 – 6 mm long tubular distant sheaths; rachis 12 – 19 cm long ridged, smooth, deflexed, with many pedicellate flowers; pedicellate-ovary 1.1 – 1.9 cm long, with twisted ridges, smooth, pale-purpulish white; flora bracts 3 – 6.5 mm, triangular, acute deep brown, adpressed to the pedicel. **Flowers** 2 – 2.4 cm across, (measured from sepal petal to petal), white with purplish shade, glabrous. **Sepals** sub-equal, yhinly fleshy, spreading, white with shade of purple at the tips and also with slight toudh of dirty yello; the dorsal sepal 1 – 1.3 x 0.7 – 0.95 cm, elliptic

ovate, sub-acute, slightly arched over column; the lateral pairs 1.1 – 1.2 x 0.9 – 1 cm, ellipitic-ovate, subacute, slightly falcate, the broad base adnate to the foot of column. **Petals** 1 – 1.1 x 0.62 – 0.7 cm, ellipitic-oblong, obtuse, spreading, colors same as sepals. **Lip** 1.2 – 1.5 x 0.4 – 0.6 cm long, 3-lobed glabrous, white with scattered purple spots, adnate to the short foot of column; the spur large, ca 1 cm long infundibuliform, curved forwards and upward; its tip obtuse, pale green with a few purple spots; the lateral lobes erect deep, truncate oblong with naterior arose margine; the apical lobe narrowly tringular, constricted at the middle, and curved upward to a narrow bifurcated tip, lying between the edges of lateral lobes. **Column** 2 – 3mm long, oblong white; foot ca 9 mm long, perpendiculat to column, oblong, white. **Anther** 3.5 – 4 x 3 – 3.5 mm, tringular depressed, beaked, white; pollinia 4, 0.9 – 1, globose, yellow, caudicle ca 1 mm long, liner, translucent with transluent white quadrate gland at base, fragrant. Capsule 3 – 3.5 x 1 – 1.2 cm, fusiform, with 3 sharp ridges and 3 flat narrow dands; pale yellow, smooth; Rostellum beaker, deeply notched at the apex.

Cultivation

Most *Aerides* species are considered easy to grow. Their flowers are long-lived and highly perfumed— traits which make them popular in horticulture as cut flowers and potted plants. *Aerides odoratum* kept as houseplants, are best grown in hanging baskets, teak containers or net pots, which affords the roots freedom to extend into the air. They prefer to be grown in media that is well drained such as tree fern fibers (for small plants), medium fir bark, or sphagnum moss. This growing

method however usually requires full sunlight and warm temperatures where the roots must be watered frequently. The plants do not possess pseudobulbs but do possess leathery, drought resistant leaves. The plants have large root systems similar to Vandas and require similar care. Many of these species have a monopodial vine-like growth habit, and the plants can quickly become quite massive. These plants prefer consistent conditions day to day in cultivation to avoid dropping their bottom leaves.

They are best accommodated in large wooden baskets bare root, which allows for the large aerial root systems, and their care is almost identical to species, although they tend to prefer intermediate to warm conditions. Disturbing or damaging the roots of large, mature Vandaceous orchid plants, and in particularly, Vanda and Aerides species can result in the plants failing to flower and going into decline for a season or more. These plants do not tolerate disturbance or damage of their root systems in cultivation when they become mature. Offshoots - known as keikis are formed easily. They may be left on the pla t or may be removed with a sharp knife when each young pl has several roots of its own. If removed, it is best to paint the s of removal with a fungicide to prevent infection. *A. odoratu* plants are propagated by cutting them into pieces, with roots attached to each piece. Some kinds, however, are shy in throwing up young shoots, and this makes these sorts very scarce. The ***Aerides odoratum*** division is the most easy to increase. If the plants ever get into an unhealthy condition, the best way is to cut off the bottom of the plant, and give fresh moss, with plenty of water at the roots."

Water

Most growers underwater the *A. odoratum*. They are difficult to over-water. Most or all need to be grown in open baskets or on plaques. These plants need daily watering for ten to fifteen minutes. Water requirement for A. odoratum is very high because like Vandas their roots take water and nutrient at a very slow rate. Secondly many of the orchids are hanging in empty

air and not attached to media. Maximum absorption occurs when the root contacts and adheres to media of some type. So twice as much water and fertilizer should be provide to these plants.

Fertilizer

Aerides odoratum being an epiphytic orchid grows mostly wild and depends on minerals arising from the breakdown of bark, droppings of birds and the very low amounts that have dissolved in rain water. So, in the controlled condition external fertilizers are required in a minute form. The main elements supplied by fertilizers are nitrogen, phosphorus and potassium and the composition of these fertilizers are available in the market in different ratio. Fertilizers should be applied as a foliar spray in two different doses 20:20:20 NPK @0.2% during vegetative growth and 10:20:30@ 0.2% NPK during reproductive stage. Calcium, Magnesium and micronutrients are also applied during productive stage @ 0.1%.

Light and temperature

odoratum can grow in hot, bright tropical climates. The best growth is obtained by growing in a shade house. However, very good results can be obtained by growing them in an area where they receive morning sun. *Aerides* prefers a good deal of light, slightly more than cattleyas, slightly less than vandas. A brightly lighted place – short of sunburning the plant is best, and induces profuse flowering. Hanging under a patio roof with an Eastern exposure is ideal. Remember, the more light they get, the more fertilizer and water they need. One can attach them to

a paling fence using an old stocking where they may get shaded from the midday sun and the afternoon sun by an overhanging tree. So long as they get that morning sun. Plants which are lush and dark green are not receiving enough light. These plants prefer warm humid conditions, with abundant, freely moving air. They should not be subjected to temperatures below 10° C for any length of time. Protection is needed in this area in the winter.

Potting

When the season of rest is over, many Orchids will require re-potting but in our practice we have not confined ourselves to that time only no season can absolutely be determined on as the proper one for this operation. The months of February and March-that is, after the resting season just before they begin to grow-are very suitable for potting some of them, or for those orchids which start at a later period of the year this operation may be retarded. Those that do not require potting should be top-dressed with good fibrous peat and moss, the old growing media being removed from the surface without breaking the roots of the plants. This operation affords the means of getting rid of many insects which harbor in the old growing media or crocks. The pots should be thoroughly cleansed from the mould, moss, and dirt, which are too often seen covering them. Cleanliness is one of the greatest aids in the successful growth of orchids. Previously to potting, the plants should not receive any water for four or five days.

The chief point to be attended in all potting is that the pots should be well drained, the best material for drainage being

broken pieces of pots on charcoal. Before potting, be particular to have the pots perfectly clean and dry, inside and out, and the broken potsherds should be washed. After this is done, select the point in accordance with the size of the plant, but do not give too much pot-room. Some plants require shifting once a year, while it may not be necessary to shift others oftener than once in two or three years. If a plants becomes sickly or soddened with wet, the best way to bring it back into a healthy state is to turn it out of the pot or basket, and wash the roots carefully with some clean tepid water, cutting off such of them are dead; and then to repot it, not giving it much water till it begins to make fresh roots. The best pots are those in ordinary use. Some use plastic pots, but they are not as good for Orchids as those made of clay.

The best material to be used in potting the Aerides orchids, when grown in pots, is a mixture of good rough fibrous peat and live sphagnum moss. The best material to be used for basketing the Aerides, and similar growing kinds, is sphagnum moss and broken pieces of pots. The basket should be suited to the size of the plants; it should not be too large, for it will not last more thana few years if made of wood, by which time, probably, the plants will require shifting into a larger one.

Propagation: *Aerides odoratum* is propagated vegetatively by

Pruning: Due to monopodial nature *Aerides odoratum* grow indeterminately and become very tall and unmanageable and therefore need to be pruned. It produces aerial roots along the stem. Thus cutting the apical region bearing 2-3 aerial roots gives new plant, which can establish very easily when planted

in the media. Removal of apical region normally does not affect the basal region which subsequently produces new shoots.

Flowering

Aerides odoratum blooms in the month of March- May. Flowers having color white with purple or pink edges. Flowers have long lasting fragrance.

Harvesting

To understand the correct stage of harvesting is most important because it influences the keeping quality attraction of the harvested spike and yield for the next year. The spikes should be harvested when all the flowers are open. While harvesting utmost care should be taken to see that pollen caps of the flowers remain intact. The spike needs to cut at the base of the stalk. The cut surface should be smooth and never be crushed. A

sharp knife or secateurs is required to sterilize time to time with antibiotic fungicide solution to avoid transmission of diseases.

Value Addition

A. Cut flower: Cut flowers are the plants parts including the blooms or inflorescences and some attached plant materials, but not roots and soil. Fresh cut flowers of *A. odoratum* are used for decorative purposes such as vase arrangements and bouquets at formal events; designs for weddings and funerals; gifts on occasions such as Mother's Day, Valentine's Day, Forgiveness day, at the time of recovering from illness, and as religious occasion such as in Dipawali, Christmas and Easter; and informal displays to beautify homes and public places.

Packaging of cut flowers: Packaging plays a major role in flower quality opening ability. Proper packaging of cut flowers is must for ensuring good quality at the retailer or customer end even after long transportation or storage duration. Un- pac ed cold stored flowers often exhibit deterioration in flower qual y.

Types of packing: The packaging of cut flowers e generally of two types:

1. Internal packaging: This type of packing consists of direct packaging of the cut flowers with a single or double film to a ter the cell metabolism. The different types of packaging fi ns have different air permeability rates. Hence, depending upon the requirement, the flower type, storage temperature and duration, the packaging film should be selected. The various types of packaging films are polypropylene, low density

polythene, high density polythene, butter paper etc.

2. External packaging:

A. Cut Flower : External packaging is done for protecting the cut flower from physical injuries or bruises during the transport system. The Corrugated Fiber Board (CFB) boxes of different sizes with or without vents are found to be highly beneficial for the external packaging of the cut flowers. The CFB boxes possess good physical strength depending upon the number of layers used in the CFB sheet. The cut flower packaged in the CFB boxes should be stacked in up-ward direction to avoid geotropic bending of cut flowers.

B.Potted plants: *A. odoratum* is also used as potted plant. Potted flowering plant consists of plants grown in pots for their showy flowers. Potted plants are advantageous to those who live in flats and have no space for growing plants in the ground. Potted plants can be kept in various places viz. supermarkets, garden centres, offices, malls, house verandas, window gardens, corridors etc. Potted plants should have the following characteristics:

- Leaves should be attractive, well developed, well shaped and the root system should be healthy. Plants should not be pot-bounded considering the overall form of the plant in relation to the container size.

- The foliage should be free from insect pest, diseases, nutrient deficiencies and physical and chemical injuries

C. Flower ornaments: Only growing of flowers in the garden do not made satisfaction to the grower unless they are used for interior decoration, making bouquets, wreaths, garlands, gajra, veni, rangoli and even for worshipping. For making ornaments sweet scented flowers of *A. odoratum* are preferred. Bouquets made by arranging of flowers with different and various colours in bamboo baskets or conical shape cut cartoon and covered with cellophane paper after flower arrangement looks attractive. For bouquets making flower stalks of *A. odoratum* can be used along with ferns or thusa or some other attractive foliage plants which have beautiful appearance.

Pests

The Aerides should be kept perfectly free from insects, especially the different kinds of scale. There is a small kind in particular which is apt to infest them, and which, if allowed to increase, will speedily make the plant look yellow and unhealthy. It may be kept under by washing with warm water and soft soap, applied with sponge, and left on the leaves for some twenty four hours, when all remains of the soap should be removed with clean water. They also subject to the attacks of the red Thrips, especially on the young leaves; this can be kept down by frequent applications of tobacco powder or steaming.The black Thrips sometimes attacks the older leaves and disfigures them very much; they should be eradicated by frequent steaming and sponging. Curled leaves with brown marks and deformed buds with burnt margins are the main symptoms of damage. Pest infestation increases in dull weather.

Diseases

Leaf Spot: Symptom: Symptoms starts usually on the under surface of leaf as small yellow spots. Soon the infected tissues become necrotic, dark brown or black and sometime sunken.

Control : □ Good sanitation. □ Spraying with Bavistin @ 0.1% at periodical interval.

Anthracnose:

Symptoms: Initial symptom appears as the small oblong to circular oval, sunken and reddish brown to dark brown or gray coloured spots. On the spots black, raised dots are found with target board appearance. The disease also infects floral spikes and leaf sheaths.

Management

- □ Avoidance of plants to over exposing to direct sunlight.
- □ Spraying of captain @ 2g/ liter or Carbondazim (Bavistin) @ 1 g/l at 15 days intervals.

Leaf tip die back:

Leaf tips turn brown beginning at the apex and proceeding towards the base.

Management

Removal of dead tips. Spraying with Bavistin or Dithane Z 78 or Indofil @1g/l at 15 days interval effectively control the diesease.

Coelogyne nitida: The shining orchid

Introduction

The coelogynes are surely one of the most attractive and variable genera in the orchid.The *Coelogyne* orchid genus gets a lot less attention than it deserves. The species are generally robust, easy to grow, and freely produce delicately coloured, often fragrant flowers. Coelogyne are lesser known orchids, they have never become really popular with growers or received much attention from orchidologists. The plants have beautiful, scented flowers, can tolerate drought and neglect, and rapidly develop into massive, impressive specimens. The common scented species are *C.cristata, C. flaccida, C. nitida, C. corymbosa, C. pantlingii, C. hitendrae*, of this region. The best-known species come from foothills of the Himalayas, where the elevation produces cool temperatures. *Coelogyne nitida* is a cool-growing species originating in the Himalayan region of India and Southeast Asia. It requires a decided rest period during winter during which it receives no feed, very little water (enough to prevent pseudobulbs shrivelling), cool to cold temperatures

and high light. These conditions seem to aid flowering in spring for some growers, though others report that more constant conditions can also produce regular flowering.The flowering period is from April to May.

Description of the plant

Shining Coelogyne is an evergreen, epiphytic orchid. **Pseudobulbs** 6 – 10 x 1.0 – 2.5 cm, cylindric, furrowed, smooth, with 4 – 5, 2 – 3 cm long, scarious sheaths at base, partly covering the Pseudo-bulbs, stout, sheathed rhizome at an interval of 1.0 – 2.5 cm. **Leaves** 2, lamina 18 – 29 x 2–3 cm, narrowly oblong, acute, narrowed to the 5 – 8 cm, channeled petiole. **Inflorescence** 1 – 2, 13 – 20 cm long, erect, from the base of old pseudobulb; peduncle 7 – 10 cm long, erect, stout, terete, smooth, with several large imbricating sheaths; rachis 6 – 10 cm long, terete, smooth, with 6 – 8 pedicellate flowers; ovary 2 – 2.5 cm long, terete, smooth, flora bracts 2.5 – 3 cm long, oblong, convolute, sheathing, caducous. **Flowers** 3 – 4 cm across, (measured from petal to petal), white, fragrant. **Sepals** sub – equal, spreading, pure white dorsally keeled at base, 7 – nerved (not very distinct); dorsal sepal 2.3 – 2.5 x 0.95 – 0.52 cm, liner – lanceolate, sub-acute, pure white, 7-nerved. **Lip** 1.9 x 1.3 – 1.5 cm, oblong, 3- lobed, the lateral lobes erect, large rounded, incurved with sirrulate margins; white with brownish

lines, with two elondated blotches of yellow margined with brown at thean terior end; the apica lobe ovate-cordate, obtuse or slightly notched at the apex, margin entire, with deflexed apex, with 2 united, cordate, obliquely tipped spots at the base of apical lobe; the disc with 3-lamellae, the two lateral ones longer and ends at the middle of apical lobe. **Column** 1.4 – 1.5 x 0.4 – 0.5 cm, broadly winged at apex. Anther *ca* 2.5 x 2.8 mm, ovate, 2-chambered; Pollinia 4, 1.6 x 0.5 mm broadly oblong, compressed, sessile on a orbicular disc, yellow. **Capsule** 4 – 4.4 x 0.25 – 0.32 cm, narrowly clavate, yellowish – green.

Climatic requirement and management

Coelogyne nitida is a cool-growing species originating in the Himalayan region of India and Southeast Asia.It is generraly found in sub-tropical to temperate climate ranging an altitude of 900m to 2600m.

Light

For many plants that prefer partially shady conditions, filtered light is ideal. Good planting sites are under a mid to large sized tree that lets some light through their branches or beneath taller plants that will provide some protection. Houseplants requiring bright light should be placed within 2 feet of an eastern or western exposure window or within 2 to 5 feet of a southern exposure window. The provision of sufficient light is essential during cultivation of *Coelogyne* for the development of suitable foliage and roots. Excessive light intensities will result in burning of the foliage. Inadequate light intensities result in untidy and poor quality plants with an inadequate spray and

insufficient root development. *Coelogyne* plants grow well in the high light levels and most of the species prefers moderately bright light of 500 to 2500 fc. The light level of 2000-3000 fc is recommended for the cool growing species such as *Coelogyne cristata, C. mooreana, and C, mossiae* and *C. nitida*.

Temperature

Temperature requirements vary from species to species. High-elevation plants like cool temperatures, others will do better with intermediate temperatures. Most of the *Coelogyne* are cool-growing; during the wet season, temperatures can be as warm as 21-24°C, but during the dry season it should be cooler, such as in the 10-20°C during the day, dropping 6-8°C at night. Again, temperature ranges vary somewhat with species, but many can cope with short freezes. Summer days average 18-19°C, and nights average 13-14°C, with a diurnal range of 4-5°C. Plants adapt to warmer afternoon temperatures if humidity is kept high, if air movement is strong, and if the plants are able to cool down in the evening.

Shade Management

For *Coelogyne nitida* cultivation in hotter place, a shade net with more than 75% shading is required. Preference is given to the use of two nets: a fixed net providing 70% shading and a second movable net offering 25% shading. The movable net can be closed during sunny period and at the middle of the day, thereby avoiding excessive light and subsequent scorching of the leaves. Use of shade nets also helps in areas where the rainfall is heavy. This will result in a drier crop and a reduced

incidence of disease.

Humidity

Coelogyne nitida prefer 85-95% relative humidity most of the year, dropping 75-80% from late autumn into spring. High relative humidity in combination with high temperatures increases the risk of bacterial diseases. Efforts should be made maintain the relative humidity within the 60 to 80% range. Misting the water along the benches and the paths raises the humidity levels and the same time reduces the temperature.

Culture condition

Fertilizing

Fertilizers are most useful as a boost to help an already healthy orchid grow better. Plants produce their own food from sunlight, carbon dioxide, and water-the miracle of photosynthesis more efficient. Plenty number and types of fertilizers on the market are available and each package comes with a lot of about why it is better than another. Fortunately, the choice is not nearly as complicated as some manufacturers seem to make it. Annuals and perennials may be fertilized using: 1.water-soluble, quick release fertilizers; 2. Temperature controlled slow-release fertilizers; or 3. organic fertilizers such as fish emulsion. Water soluble fertilizers are generally used every two weeks during the growing season or per label instructions. Controlled, slow-release fertilizers are worked into the growing media ussually only once during the growing season or per label directions. For organic fertilizers such as fish

emulsion, follow label directions as they may vary per product. 1/4-1/2 recommended strength applied weekly during periods of active growth. Most growers use a balanced fertilizer during most of the growing season. They often switch to a fertilizer lower in nitrogen and higher in phosphorus in autumn to promote better blooming the next season and to allow the new growths to harden before winter. In order to prevent salt buildup, the medium should be leached every few weeks during periods of heavier fertilizer applications. This is especially important in areas with heavily mineralized water. Leaching is performed by first watering the plant normally to dissolve any accumulated salts. Then, an hour or so later flushing the media with water equal to about twice the volume of the pot. If roots are not functioning well, they cannot absorb the fertilizer, and if the orchid does not use the fertilizer, its salts can accumulate in the orchid potting material. This buildup of fertilizer salts can further dhydrate and damage the remaining roots.For successful Coelogyne growing spraying of NPK (20:10:10) @0.05% (0.5g/l) at 15days interval and Calcium nitrate @ 0.05%,Magnesium sulphate @0.1% and micronutrient containing Iron sulphate 0.05%, Boric acid 0.05%, and Zinc sulphate 0.05%, at bimonthly interval boost up the vegetative growth. The fertilizer dose will be changed during flowering phase. During second year onwards spraying of NPK (10:20:20) @0.05% (0.5g/l) at 15days interval is advocated along with the secondary and micronutrients.

Water Management in Orchids

Coelogyne nitida prefer weakly acid water with a pH value of

around 5 or 6. Proper watering in one of the most essential elements for healthy orchids. Damage to orchids is usually a result of over watering. Over watering refers to the frequency of watering and not to the volume of water applied at any one time. *Coelogyne nitida* require proper amounts of water, good drainage and ventilation. One of the best methods of preserving the medium in good condition is to have frequent air exchange throughout can be achieved by a thorough watering which drives fresh water through to take oxygen into the pot and prevent souring. Light watering can hasten the deterioration of the medium. When applying water, a heavy dose is advocating and allowing them to dry out considerably.

Watering :

Green houseplants that require normal watering should be watered so that growing media is completely saturated and excess water runs out the bottom of the pot. Never water just a little bit; this allows mineral salts to build up in the media. The key to normal watering is to allow the top inch or two of potting media to dry out between waterings. Check frequently as certain times of the year may dictate that you water more frequently. Also, some plants that require normal watering during the growing season, may require less during the winter months when they are dormant. Cultivated plants should be watered heavily while actively growing, but the medium must not be allowed to become stale or soggy. Water should be reduced after new growths mature in autumn. Improper watering is probably the most common cause of *Coelogyne nitida* death. Learning how and when to water *Coelogyne*

nitida is one of the more challenging aspect of growing them. Several factors affect how often you should water.

The type of pot the potting media in which the orchid is placed affect how often *Coelogyne nitida* must be watered. Both clay and plastic pots can be used to grow orchids; they merely have different watering requirements. Potting material, such as bark, dries out much more slowly in plastic pots than in clay pots. With plastic, the potting material dries from the top down, so even though it may be dry on top, it may be damp 1 in. (2.5 cm) below the surface. With clay pots, the potting materials dries out more uniformly because clay pots are porous, so they breath and allow water to evaporate through the sides. Orchids in plastic pots will require watering less often than those in clay pots. For *Coelogyne nitida* that usually do best with constantly slightly damp media, plastic pots are good choice. If one prefer the weight or look of clay pots, one can double pot one's plants by inserting a plastic pot into clay one. Potting materials vary dramatically in terms of the amount of water they retain. Sphagnum moss, for example, is a water-absorbent plants harvested from bogs and is frequently uaed as a potting material for *Coelogyne nitida* . This material usually stays wet much longer than bark, which is not as water-retentive. Fresh potting material, requires much more frequent watering for the first week until it gets properly wetted or noistenes. As it gets older, it retains water longer. An overgrown or pot-bound orchids will dry out much more quickly than a plant that has plenty of space in the pot. When pot space is limited, less potting material is able to hold into the waer, so the overgrown plant quickly uses it up. Plants and potting materials exposed to low humidity dry

out more quickly than those in humid air, because more moisture is lost from the plant and the media when the air is dry. Wamer temperatures also increase water evaporation, because the plants are growing quicker in warmer temperatures and require more water. If *Coelogyne nitida* are grown in a cooler temperature, they need not be watered as often as those grown in wamer or dryer conditions. The more ventilation your orchids receive, especially if air is vented to the outside or if the air is hot and dry as in most centrally heated homes, the quicker the water in the potting material evaporates. Gentle air movement is ideal, since it will keep the air fresh without drying out the plants or potting material excessively.

Planting

Growing media

Plants may be mounted on cork or a tree-fern slab providing humidity is high and plants are watered several times a day during the hot, bright weather. Most growers prefer to use baskets or pots, however, and open baskets lined with sphagnum moss generally produce excellent results. The medium should be open and fast draining but still hold considerable moisture. Growers have found that most Coelogyne species should be disturbed as seldom as possible. The plants grow best if repotted only when absolutely necessary. Growers report that transplant shock may delay blooming for as long as 3 years, and some suggest that thinning old bulbs by cutting them out may be preferable to repotting. Shredded tree-fern fiber mixed with about 10% perlite, 10% chopped sphagnum and 10% charcoal produces excellent

results and breaks down very slowly. When repotting is required, it should be done only when new root growth is evident, usually immediately after flowering. In our condition, coco-chips, tree-bark, chopped sphagnum or green moss and brick/stone chips (1:1:1:1) can be used successfully for growing *Coelogyne nitida*.

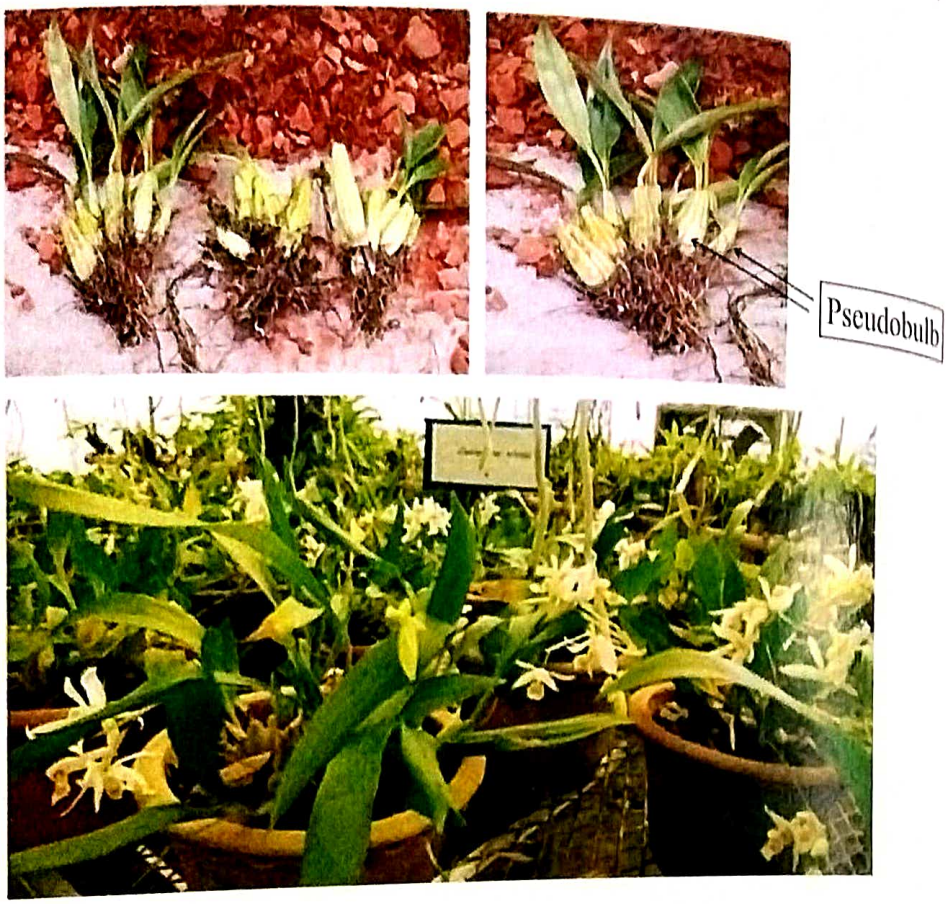
Repotting

Potting *Coelogyne nitida* orchids, a conditions requires where roots can be exposed therefore, tight pots and close-contact soil mixes do not work well and will induce rot. A mixture of cocochips,treebark,chopped sphagnum or green moss and brick/stone chips (1:1:1:1) will serve the purpose. Make sure that pot has a drainage hole. Even better, select an orchid pot, which has vertical slits down sides. Hold orchid over pot so that crown is just below the rim of the pot. *Coelogyne nitida* can be grow on a mound or slab of bark. Until roots attach, tie orchid in place with fishing line. Constant humidity is a must.

Propagation: *Coelogyne nitida* is propagated vegetatively by dividing the pseudobulbs.

Dividing the pseudobulbs: This method is applicable to the sympodial orchids like Coelogyne nitida, in which new growth arrises from several growing points on a rhizome. In fact it is necessary to divide a large overgrown specimen to maintain in a manageable size. Best time for dividing is just before the onset of new growth or immediately after flowering is over. There should be atleast 3 or 4 pseudobulbs in each division. A piece of rhizome with a few pseudobulbs should cut off and

potted separately in orchid potting mix. Normally the divisions should contain some back-bulbs along with new growth. Back-bulbs supply food to the new growths when required and help the division to establish without much shock.



Flowering

The blooming season of *Coelogyne nitida* is from April - June. Flowers having color white with long lasting fragrance.

Problems

Pests

Spider mites: Spider mites are small, 8 legged, spider-like creatures which thrive in hot, dry conditions (like heated houses). Spider mites feed with piercing mouth parts, which

cause plants to appear yellow and stippled. Leaf drop and plant death can occur with heavy infestations. Spider mites can multiply quickly, as a female can lay up to 200 eggs in a life span of 30 days. They also produce a web which can cover infested leaves and flowers.

Prevention and Control: Keeps the plants weedfree and remove infested plants. Dry air seems to worsen the problem, so make sure plants are regularly watered. Always check new plants prior to bringing them home from the garden or nursery. Removal and destruction of the infested plant parts (leaves/flowers) will help to reduce further multiplication of mites. Clean cultivation, proper ventilation, balanced fertilizers dose and irrigation should apply to curtail the mite population. If the mite population (infestation) is severe then the plants should be sprayed with plain water twice a day to check the infestation until the arrangementof suitable insecticide is done. Initially the plants will be sprayed with neem oil 0.03 EC (Azadirachtin) 5 ml/lit of water to reduce the mite population. If required the plants can be sprayed with any one of the following insecticides i.e. dicofol 18 EC or ethion 50 EC or propargite 57 EC or bifenhrin 10 EC (talstar) or avermectin 1.8 EC (avid) @ 0.05% or imidacloprid 17.8 SL (confidor) at 0.003% alternatively and spray should be repeated at 10-15 days interval to provide effective control against mite.

Mealybugs

Small, wingless, dull-white, soft-bodied insects that produce a waxy powdery covering. They have piercing and sucking mouth parts that suck the sap out of plant tissue. Mealybugs

often look like small pieces of cotton and they tend to congregate where leaves and stems branch. They attack a wide range of plants. The young tend to move around until they find a suitable feeding spot, then they hang out in colonies and feed. Mealybugs can weaken a plant leading to yellow foliage and leaf drop. They also produce a sweet substance called honeydew (coveted by ants) which can lead to an unattractive black surface fungal growth called sooty mold.

Prevention and Control: Isolate infested plants from those that are not infested. Removal and destruction of infested plant parts is required. Proper distance should be maintained within the plants to reduce the pest infestation.Spraying if insecticides like malathion 50 EC or endosulfan 35 EC at 0.05% or imidacloprid 17.8 SL (confidor) @ 0.003% to curtail the mealybug population. Generally two sprays are required with any one of the above mentioned insecticides at 10 to 15 days interval. Encourage natural enemies such as lady beetles in the garden to help reduce population levels of mealybugs.

Aphids

Aphids are small, soft-bodied, slow-moving insects that suck fluids from plants. Aphids come in many colors, ranging from green to brown to black, and they may have wings. They attack a wide range of plant species causing stunting, deformed leaves and buds. They can transmit harmful plant viruses with their piercing/sucking mouthparts. Aphids, generally, are merely a nuisance, since it takes many of them to cause serious plant damage. However aphids do produce a sweet substance called honeydew (coveted by ants) which can lead to an unattractive

black surface growth called sooty mold. Aphids can increase quickly in numbers and each female can produce up to 250 live nymphs in the course of a month without mating. Aphids often appear when the environment changes - spring & fall. They're often massed at the tips of branches feeding on succulent tissue. Aphids are attracted to the color yellow and will often hitchhike on yellow clothing.

Prevention and Control: Keep weeds to an absolute minimum, especially around desirable plants. As soon as the pest appears on the new spikes or flower buds before opening the flowers, the plants should be sprayed with tobacco leaf extract (10 ml/l) or neem oil 0.03 EC. (Azadirachtin) 5 ml/lit. of water to reduce the aphid population. If aphid population appear again then the plants should be treated with insecticides like endosulphan 35 EC or malathion 50 EC or acephate 75 SP at 0.05% or imidacloprid 17.8 SL (confidor) at 0.003% in 10-15 days interval. Lady bugs and lacewings will feed on aphids in the garden. There are various products - organic and inorganic - that can be used to control aphids.

Production technology for *Zygopetalum intermedium*

Introduction

The term Zygopetalum (zi-go-pet-a-lum),is derived from the Greek word zygon: yoke and *petalon*: petal or sepal; referring to the 'holding together' of the flower segments by the callus. These alphabetically challenged orchids are recent arrivals on the horticultural scene, providing wonderful, scented flowers, in shades of green, brown and purple. They are part of the *Odontoglossum alliance* and require similar conditions. They originate from tropical Central and South America, especially Brazil. There are about 20 species found naturally from which many hybrids have been developed.

Distribution

Tropical South America, Brazil, Paraguay, Argentina, Peru and Bolivia.

Description of the plant

They are both epiphytes and terrestrials. They are compact clump-forming evergreen plants with large egg-shaped pseudo-bulbs from which 1 to 5 leaves form and the flowering spikes are produced. Because these orchids produce leathery strap-like leaves, they are often classified as "soft orchids. The leaves are apical and usually oblong. The pseudobulbs are conical or ovoid, deciduous, and produce 24 inch long inflorescences. The blossoms are usually 2 to 3 inches in diameter, racemose and grow laterally along the leaves. These blooms are known for the waxy look and feel and for their fragrance. Flowers come in a variety of colors, including green, purple, raspberry and burgundy. Flower size is 3" (7 cm). Ovoid– Conical pseudobulbs carrying 3 to 5 apical, oblong or elliptic-lanceolate, acute or acuminate, plicate leaves that blooms at a lateral, racemose, 2' [60 cm] long, longer than leaves, few [4 to 5] flowered inflorescence with fragrant, waxy, long-lived flowers and prominent bracts equaling the length of the ovaries.

Culture condition

They are generally considered to grow best at intermediate temperatures but will withstand summer heat if shaded correctly and well-watered and can take some cool nights in winter if kept drier than usual. Wet and cold is usually fatal and the unsightly leaf spotting we sometimes see on the leaves of both hybrids and species in the genus can usually be traced to free moisture on the leaves at night when temperatures are lower than optimal.

Flowering

The flowering season is usually during the autumn to spring with flower spikes growing from the new bulbs. Individual flower stems may last for 4 to 6 weeks.

Successful flowering requires low temperatures and restricted watering during the winter, whilst maintaining relatively high humidity and very good ventilation.

Temperature

Intermediate conditions are required for zygopetalum with a nighttime temperature of 13°C-16°C and a daytime temperature of 18-24°C. In summer, the maximum temperature should be around 24-27°C; if they are kept higher than this for any length of time they may not flower. In winter, the temperature should be kept above 12°C; if they are allowed to get colder than this extra care should be taken to water less.

Light

Good light in winter but during the summer months they need to be shaded from direct sunlight. A north facing windowsill is ideal. If you notice a red pigmentation to the leaves this may be an indication that the plant is getting too much light.

Water

During the summer, media needs to evenly moist; this is the growing period when the plants are producing new growths. In the winter, keep plants on the dry side and water sparingly.

however, does not allow the pot to become so dry that the bulbs start to shrivel as this indicates the plant is stressed and using up its reserve energy. Plants grow most actively during the summer when they should be watered once a week. The autumn is the time of year when the pseudo-bulbs are ripening and, to encourage flowering, plants can be kept on the dry side until they start to flower. Water more often when in flower. Clean rainwater is preferred by the plant but you can use filtered tap water if necessary.

Feed

Zygopetalum benefit from a weak solution of orchid feed, especially in the summer when it is best to feed every other watering. Use a balanced orchid fertilizer, such as liquid 20-20-20 formulation at half label recommendation year round has proven to work well. During the winter, feeding once a month should be sufficient. The organics can be a useful source of trace elements too. Avoid feeding with high nitrogen levels as this can make the foliage brittle and stretched.

Air Humidity

Relatively high levels of humidity are needed, (about 50-60%,) so moist air is essential; they also require good air circulation (not drafts) to prevent botrytis or bacterial/fungal infection. The plant can be placed on a tray of moist pebbles to help with local humidity or keep in a room where humid air is present such as a bathroom, kitchen, utility room or conservatory.

After Flowering

Cut off old flower stems near to the base. Next seasons flowers will develop from new pseudo-bulbs.

Growing structure

Plants should be protected from all sorts of weather damages for production of market worthy spikes. Green house with all sides open is suitable for Zygopetalum cultivation. Zygopetalum can be grown in cost effective cooled green house with automation system of temperature, light, humidity and aeration.

Growing medium

The main purpose of growing media is to hold the plant in place and supply sufficient amount of nutrients and water. Zygopetalum likes a slightly acidic potting media/mix. Sand, coarse peat and pine tree bark or shavings may be added to improve the water retention in inland location. Z. intermedium usually does not grow with large grade barks but can be with more water. A healthy growing media containing leaf mould, charcoal, coconut husk, rotten logs (2:1:1:1) is found to be beneficial. The growing media needs to be sterised with formation (20m/l) for 3 days before using. The pH of the media should be acidic and it ranges from 5.5 to 6.5.

Bench

It is always wise to keep the pots on the benches to provide proper aeration and check the soil born diseases. Height of the bench should not be more than 2 feet 6 inch and breadth not

more than 3 feet otherwise it will be inconvenient for cultural operations.

Pots

The most commonly used are earthen or plastic pots. The pot should have sufficient number of holes for aeration to root zone and draining out excess water. Earthen pots are best as compared to plastic pot as it provide cool climate for root zone. The size of pot depends on growth and size of the plants. One year old plant (6 -7 inches size) should be planted in 4-inches size pot. Thereafter, it needs to be transferred in to 6-inches pot.

Preparation of potting media

Sterilization of media is an integral part. Most of the diseases get entry through media itself. Potting media requires sterilization and mixing homogenously before filling in the pots. The commonly used method for sterilization are heating and chemical treatment. The media needs to be cut smaller sized pieces and mixed thoroughly before sterilization. Some media require soaking over night e.g. coconut husk to leached out undesirable chemicals.

Potting

The potting should be done during active growth phase. Crocks or bricks chips should be placed at the bottom of the pot. The plant then placed centrally and sterilized media need to be placed all around the plant. Care should be taken to avoid any large unfilled cavities while potting.

Repotting

Z. intermedium generally needs to be repotted about every three years under normal conditions. It should be repotted just after the old blooms have fallen off. If the old mix is broken down, the plant should be repotted as soon as possible to minimize root rot. Broken down mix tends to hold too much water and will reduce the air movement around the roots which often causes the older roots to die back. Pot bound Zygopetalum may be under watered which can reduce the vigor and blooming capability. Compost seldom remains in good condition for more than two years. Zygopetalum will benefit from repotting every other year or when the plant is too big for its pot. The best time to do this is spring when the new roots and shoots are developing but before flowering spikes have developed.

When dividing and repotting, try to keep divisions with 2 or 3 green bulbs and perhaps one back bulb if you can. Select a pot large enough to allow 3 years growth. Clean the old potting mix from the roots and remove any dead or damaged roots. Spread the roots over the mound of mix and work mix in among the roots. Do not ball the roots in the centre of the pot. The lower 1/3 of the bulbs should be covered with mix. Tap the pot firmly on potting stick. The mix should be tight in the pot, not loose.

Propagation

Zygopetalum intermedium is propagated vegetatively by:

Dividing the pseudobulbs: This method is applicable to the sympodial orchids like *Zygopetalum intermedium*, in which

new growth arrises from several growing points on a rhizome. In fact it is necessary to divide a large overgrown specimen to maintain in a manageable size. Best time for dividing is just before the onset of new growth or immediately after flowering is over. There should be atleast 3 or 4 pseudobulbs in each division. A piece of rhizome with a few pseudobulbs should cut off and potted separately in orchid potting mix. Normally the divisions should contain some back-bulbs along with new growth. Back-bulbs supply food to the new growths when required and help the division to establish without much shock.

Back-bulbs: Pseudobulbs in sympodial orchids those have completed flowering and shaded leaves after reaching maturity serve the purpose of further multiplication. The backbulbs upon separation from mother plant, produce new growth from certain growing points (called as eyes). Soaking in plain water, nutrient solution or growth regulator solution is beneficial for quick sprouting. An alternative to this method is placing the backbulbs in plastic bags. Either bags are sealed after blowing sufficient amount of air inside. Moist sphagnum moss can be used for wrapping the backbulbs or can kept at base to ensure minimum water loss from the bulbs.

Pests

Scale: Scale insects suck the sap from the leaves, petioles, pseudobulbs, flowers. It causes loss of vigour and deforming the infested plants. Heavy infestation leads to yellowing of plants, leaf drop and stunting of new growth. Some scale insect also secretes sticky honey dew which attracts sooty mould.

Control measure:

(i) Proper sanitation of green house and adjacent area.

(ii) Selection of scale free planting materials.

(iii) Pruning and burning of affected plant parts.

(iv) Rubbing of scurf encrustation with brush or cotton swab dipped in 70% Isopropyl alcohol or methylated spirit.

(v) Spraying of monocrotophos 0.05% or acephate 0.05% or Carbaryl 0.2% help in reduction of infestation.

Aphids: Aphids are the major insect pest in orchids. Mainly yellow and black aphids are prevalent in Zygopetalum. Both nymphs and adults suck the cell saps usually from spikes, buds and flowers. Irregular shaped spots appear on the surface of petal and sepals. Like scale, aphids also exude honey dew on which sooty mould developed. High humidity and cloudy weather make faster population.

Control Measure:

i. Proper sanitation of growing area including green house reduce populations.

ii. Spraying of tobacco leaf extract (10 ml/l) or neem oil 0.03 E.C (5ml/l) reduce the infestation.

iii. In case of heavy infestation, spraying of malathon 50EC 0.05% or imidacloprid17.8SL 0.3% in 10-15 days interval is effective.

Snail:

Snails are soft bodied animal. Both young and adult feed on roots and leaves of Zygopetalum generally snail prefers shady and dark conditions and feed only on night.

Control Measure:

i. Clean cultivation and timely weeding of green house and surrounding prevent the snails attack.

ii. Manually collected and supplication of 5% salt solution is most effective method of control the snail.

iii. Cabbage leaves can be used as bait at the surrounding area to minimize the population.

Diseases

Black leaf spot:

The diseases appeared as black spot on leaves particularly during cold wet winter months.

Control:

i. Proper spacing of plant and watering early enough the day so that plant can dry out before dark.

ii. Avoidance of overhead watering during winter

iii. Application of Mancozeb @ 1g/l is effective for controlling of black spot.

Yield and harvesting

To understand the correct stage of harvesting is most important because it influences the keeping quality attraction of the

harvested spike and yield for the next year. The spikes should be harvested when all the flowers are open. While harvesting utmost care should be taken to see that pollen caps of the flowers remain intact. The spikes need to cut at the base of the stalk. The cut surface should be smooth and never be crushed. A sharp knife or secateurs is required to sterilize time to time with antibiotic fungicide solution to avoid transmission of diseases.

Post harvest operation

The harvested spikes need to dip immediately in a bucket of water till they are packed. In order to improve the quality of flower spike and vase-life, the cut spikes are given pulsing with sugar (2-4%).

Packing sheds and packaging

Flower should not be packed in green house to avoid risk of contamination. Usually the ambient temperature of packing sheds should be 12 to 15°C, as such cool stores are not necessary. However if cool store is provided then temperature should not be below 10°C, otherwise flower injury may occur.

The flowers should be checked before they sleeved. Cushioning material should be put in the back of the sleeve to avoid any injury during transport. The ideal export box would be two piece boxes like used for Cymbidiums. Each stem in the box should be put in the tube containing water, thus stem has water supply during transport. Instead of small water tube, cotton wrapping also served the purpose. In this case a piece of cotton needs to soak in water. After squeezing the cotton is to be

wrapped all around the spike. Then a piece of polythene is tied with rubber band. Before the lid is placed boxes are spread with an aerosol insecticide. This would ensure final precaution against any possible insects in the box.

Post harvest life

A well grown Z. intermedium will have a vase life of 5-6 weeks at the consumer ends, provided proper handling was maintained after harvest. A number of floral preservatives are also in use to prolong the shelf-life of the flower. A combination of biocide, sugar and hormone remarkably enhance the post harvest life of the Zygopetalum.

Value Addition

Cilindra: a gift of a glass flute containing a flowering mini Zygopetalum.

Stylish setting: Festive packaging for special occasions like birthday.

Dry flowers: The flowers of Z. intermedium can be preserved by drying for use in flower arrangement and dried flower crafts. They can be dried best using silica gel for microwave drying or by freeze drying. After drying they are used in vases and baskets and some time in shadow boxes.

Ornaments: Women of different ethnic group used this orchid coated with gold or platinum as an ornament.