CHAPTER - III

ORCHIDS AND ANTHURIUMS –
THEIR CLASSIFICATIONS, USES, TECHNIQUES OF
PROPAGATION, CULTIVATION AND PRESERVATION

This chapter comprises three sections. Section - I deals with the uses of Orchids and Anthuriums, Section - II deals with the cultivation techniques and Section - III discusses the techniques of propagation and preservation.

SECTION - I

USES OF ORCHIDS AND ANTHURIUMS

A. Orchids

Orchids are being put to an array of uses. Most of them are used for decorative purposes. Some are used in the preparation of medicines; some as food and yet a few in small-scale industries.

Orchids having flowers of alluring colours and elegance, with innate long preservable qualities, is of the highest value as cut flowers. Some Orchid flowers last for a period ranging from one to three months if they remain attached to the plant, but as cut flowers they remain fresh in flower vases and shelves for comparatively a short period of one to four weeks. Because of their long lasting qualities, Orchids are used in the making of attractive corsages. One cut flower in a simple, little vase is a spot of beauty on the tea table, office table or the dining table. They are the most beautiful items for interior decoration.
Orchids have also been put to good use in some industries. “Some Orchids are used in small-scale cottage industries. A few species of Orchids are utilised for the production of ghee used in the manufacture of musical instruments and enamel wares. The stem of some Dendrobiums is used for making baskets in Philippines, Indonesia and New Guinea. Fresh bulbs of some are used as blackboard erasers. Beautiful bracelets are made by tribal people from the yellow pseudostems of dendrobiums and use them as ornaments”.¹

Several Orchids serve as food in different parts of the world. “The famous Vanillin used for flavouring ice-creams and delicacies throughout the world comes from the pods of an Orchid, Vanilla Planifolia, now grown commercially in Madagascar, Mexico, Tahiti and other places. Leaves of some Orchids are cooked with rice to have delicate and exotic flavour”.²

Orchids are also used as medicines. “In the Khasi hills, juice from the crushed leaves of Cymbidium Gigantecem is said to be utilised for clotting of blood in the wound, while powdered flowers of Vanda spathulata is used in Malabar for hysteria. The powdered root of Vanda tessellata is considered to be an antidote for poisoning. It is also used in rheumatic pains and abdominal complaints. Dendrobium fimbriatum has been used for liver upsets and nervous debility, while Dendrobium tesetifolium for headache and muscular pain. Indigenous system of medicine, particularly Ayurveda, has recently attracted modern scientists in finding out solutions for many challenging diseases. Orchids are being used in this system of medicine for over 3,000 years and some of the common drugs prepared from the plants are Riddhi, Vriddhi, Jeevak, Rishabhak,
Jeevanti, Munjatak, Amarkand and Rasna. Astavarg churna, Jeevaniyo, Dashko Mahakshay and 'Chyawan Prash finetus' are some of the compound drugs prepared from the Orchids, which are well known in Ayurveda".³

Many of the Orchid species contain alkaloids, which are important secondary metabolites. "Several Orchids are glycosidal plants. A few species of Orchids have been considered to induce sterility among the women. Some species of Orchids have religious influences over the native inhabitants in some parts of the world. In Malaysia, Cymbidium finlaysonianum was used as a talisman to keep the evil spirits away from the villages. In Moluccan Islands, it is believed that the seeds of Grammatophyllum Scriptum excite sensual love. Similarly, a few species are associated with festivals".⁴

B. Anthuriums

The name Anthurium is Greek in origin, meaning tail flower, referring of course to the flowering column. Many species of Anthurium are herbaceous epiphytes native to tropical America, brought into cultivation as ground or potted plants. The leaves are usually simple, large, attractively coloured and borne on long stalks. The flowering stalk is slender, ending in a fleshy column crowded with many unisexual flowers. There is a conspicuously coloured leafy bract subtending the fleshy column. This may be white, yellow, red, pink, orange or green. Anthuriums are popular foliage plants. They are also grown for their attractive flowering bracts, which are popular with the cut flower trade.
Anthurium flowers are also put to a variety of uses such as bouquet making, flower arrangement and production of dry flowers. All parts (leaves and stems) of Anthurium clarnewium are considered toxic causing swelling, pain and redness of lips, mouth, tongue and throat. Anthurium contains calcium oxalate and some unidentified compounds.

SECTION - II

CULTIVATION TECHNIQUES

A. Orchids

Orchids are found all over the world, except in the arctic region, where the harshest climate of permanent frost or unrelieved aridity prevails. Although some Orchids are found in steamy jungles, most of them grow in far more pleasant climates. In fact, Orchid family is one of the most widely adapted of all plant families. Orchids of one species or another grow all over the world, except in the most severe arctic and sultry desert regions.

a. Methods of Cultivation

Orchids can be cultivated in different ways. Among the various methods of cultivation, cultivation in coconut husks, in clay pots and on grounds, at open places under shady trees or in greenhouses. Cultivation in coconut husks is relatively cheaper when compared to other methods of cultivation since the medium holding the plants are coconut husks which are locally available at a very low price. Large-scale commercial cultivators very often prefer to cultivate Orchid plants in 6" and 8" pots, having sufficient air holes to enable aeration to the plants. Even though 8" pots are costlier than 6" pots, it has got several advantages over 6"
pots. Big sized pots enable luxuriant growth of the plants resulting in increased number of flowers having bigger sizes when compared to other methods. Unlike smaller pots, this method of cultivation does not require frequent re-potting which is a costly affair to a commercial cultivator. Besides these, relatively larger numbers of kiekies are obtained from Orchid plants grown in larger pots. Moreover, cultivation in clay pots can be carried out in any place irrespective of the topography of the region. Hence cultivation of Orchid plants in clay pots is more popular in the waterlogged areas of the State.

b. Light

Indirect sunlight is ideal for Orchids. Seedlings require less light than what the adult plants need. Very poor light tends to produce weak plants and unattractive flowers.

c. Humidity / Watering

Humid, warm atmosphere is essential for the growth of most of the tropical Orchids, which do not have a well-established root system. The plants should be watered 2 or 3 times a day and should not be allowed to dry up during hot climate. Plants in the process of active growth require more water. Similarly, plants in baskets require more water than those in pots. Care should be taken to water the plants with a fine spray by using standard nozzles so that the plants should not fall victims to powerful jets of water.

d. Pots

Orchids should be raised in small pots or containers according to the size of each species. Any kind of pots or other containers, which can hold the
medium and provide aeration, is suitable for the purpose. Plastic pots retain moisture longer than mud pots do.

e. Medium

The following materials serve as media for Orchid cultivation: coconut husks, brick chips and charcoal. It is advisable to use coconut husk because it is cheap and it retains humidity for a long time, promotes plant-growth and well suited to the environment. Epiphytic Orchids can be tied to blocks of wood shaving, preferably, rough barks as in the case of mango tree trunk or jack tree trunk.

Moreover, good air circulation must be provided. If the Orchids are grown in sheds, their sides should not be covered. It should be kept open to provide good air circulation system.

f. Variety - wise Classification of Orchids

There are two patterns of growth among Orchids. The Sympodial and Monopodial. The Sympodial type produces a fresh growth each year from the base of the existing growth. The monopodial type has one stem that grows taller and taller year after year. Flower spikes and roots grow from the leaf axles.

The following are the major classifications of Orchids.

1. Terrestrial
2. Epiphytic
3. Hybrids

1. Terrestrial: Terrestrial Orchids are those, which grow in the soil.
   
   e.g. Spathoglotis, Cymbidium, etc.
2. Epiphytic: Epiphytic Orchids are those, which grow on trees but are not parasites.
e.g. Dendrobium, Vanda etc.

3. Hybrids: Hybrids are those resulting from the cross between two different species or hybrids. The exporters mostly prefer hybrids because they give maximum yield and high unit value.
e.g. Dendrobium, Aranda, etc.

g. Common Names of Various Varieties of Orchids

Perhaps the most intriguing feature of Orchid flowers is their striking resemblances to various forms of animal life. There is the Bee Orchid, the Moth Orchid, the Butterfly Orchid, the Scorpion Orchid, the Spider Orchid, the Lizard Orchid, the Frog Orchid, the Dove Orchid, the Tiger Orchid and even the Man Orchid. Not being satisfied with simply modeling their floral parts after several of these animal shapes, the Orchid seems to have tried their hand at caricaturing funny action posters of some animals. The British Monkey Orchid, Orchid Simia, has a lip, which captures the several postures of frolic of a playful monkey. The flower of the Donkey Orchid of Australia instantly brings to our mind the picture of stubborn donkey's head. The lip of the Soldier Orchid, Orchids Militaries, gives us the unmistakable impression of a stuffy soldier earnestly on the march.

h. Prominent Genera Grown as Cut Flowers

A wide variety of Orchid genera are grown as cut flowers. The number will vary from country to country and also on the basis of climatic conditions. Listed below are some of the better-known genera.
a. Cattleya.
b. Cymbidium.
c. Phalaenopsis.
d. Dendrobium.
e. Vanda.
f. Ascocenda.
g. Arachnis and Aranda.
h. Oncidium Golden Showers.
i. Paphiopedium.

i. Type of Plant

Mainly 3 types of plants are used for commercial cultivation, such as Tissue cultured plants, cuttings (small plants) and Near Flowering Size plants (N.F.S). Seed germination is very difficult and it takes time to grow and mature. Moreover, seed germinated plants take 5-15 years to bloom. For these reasons tissue cultured plants, N.F.S. plants and cuttings are preferred.

1. Tissue Culture

It is a method by which thousands of plants can be grown in a relatively short period of time in which every new plant is exactly like the parent plant in every respect. But hardening of tissue-cultured plants requires great patience and caution. It is a high-tech method of mass multiplication of plants and requires costly equipments, laboratory facilities and scientific expertise.
2. **Cuttings (Small Plants)**

Tip cuttings can propagate most monopodial Orchids. Usually Orchid cuttings are much larger than the cuttings used for many floricultural crops. Cuttings can be potted and will grow without their being put in a propagation bed. Some monopodial and sympodial Orchids produce offshoots. Once four or more roots have taken shape, the offshoot can be snapped off, potted up and grown as any transplant with little retardation of growth. Cuttings are less risky compared to tissue-cultured plants. Moreover, they are less costly to rear than the cost needed for flowering size plants.

3. **Near Flowering Size (N.F.S) Plants:**

This type is less risky for cultivation than tissue cultured plants and cuttings, but costlier than the aforesaid two types. Because of high cost, only a few people prefer this. Majority of the commercial Orchid growers prefer plant cuttings because it is less risky and ensures quick returns on their investments.

**j. Source of Procurement**

In the olden days the only source of procuring plants was to import them with the help of friends and relatives abroad. But now a days the entire scene has changed. Now various alternative sources of procurement are available to the cultivators, viz., orchid clubs, cut flower societies, local nurseries, various agents, direct import, exchange of plants between friends and other cultivators, etc. Friends, local nurseries, agents and direct imports are the main sources of plant procurement of the cultivators.
k. **Place of Cultivation**

Orchids can be cultivated in open fields under any crop, terrace, shed and other structures. Green houses are not common in our State, because the climatic condition in the State itself is highly suitable for the cultivation of Orchids

1. **Terrace**: As the density of population in the State has been increasing day by day, the majority of people lack fields to grow Orchids. Many people reside in small houses and flats without any landed property. In such a situation, terrace is the only option for the people to grow Orchids since they dwell in small houses and flats, especially in urban areas. Proper shading is to be provided when Orchids are grown on terraces.

2. **Sheds**: Sheds are constructed to provide shade with a view to protect Orchids from direct sunlight. Sheds may be constructed in the fields or in terraces.

3. **Field (Open)**: Plants can be grown in pots and may be placed under the shade of trees or the plants may be hanged upon the branches of trees.

4. **Other Structures**: Other structures such as coconut trees, other trees, concrete pillars etc. are also used for growing Orchids.

I. **Technology for Cultivation**

Technology for cultivation is divided into three, viz., 'Low', 'Intermediate' and 'High Technologies'.

1. **Low Technology**

Low technology is adopted by most of the cultivators. Here instead of shade nets, iron stands, etc., cheaply available materials like coconut
leaves and wooden poles are used. Similarly, less costly medium for cultivation such as coconut husk, brick-chips etc. are used. Moreover, wooden stands may be constructed and pots are placed on it.

2. Intermediate Technology

Here even though modern techniques are used, the technology will be balanced between the high and the low. Shade net, iron stands etc. will be provided. Watering may be done with the help of sprayers and sprinklers. Sheds may also be provided. Brick-chips, charcoal etc. are used as the media for growing Orchids.

3. High Technology

High Technology is preferred only by a small section of the commercial cultivators. This group uses the most modern methods of cultivation. They make use of tissue-culture technology and hybridisations. Besides, for watering etc. mist watering may be done with the help of modern method of providing pipe connections to the ceiling of the shed and also by setting up mist chambers.

m. Manuring

In nature Orchids obtain their supply of major and minor inorganic nutrients like Nitrogen, Potassium, Calcium, Magnesium and Iron and traces of Manganese, Boron, Copper, Zinc, etc., from the bark of the tree on which they are growing and also from the atmosphere and decaying vegetative parts and bird-droppings. Taking into consideration the special need of different Orchids, a large number of fertilizer mixtures, both solid and liquid, are available in the market.
Liquid fertilizers are much more quickly absorbed and can be applied more frequently. Usage of fertilizer should also depend on the stage of growth.

Two types of fertilizers are now in use. They are natural fertilizers such as cow-dung, neem powder, coconut water, etc. and chemical fertilizers like Urea, Complex fertilizers, etc. Mix cow-dung and neem powder with water and dilute the mixture by adding more water and its clear solution is sprayed once in a week to get maximum yield. Similarly, diluted coconut water is also helpful to healthy growth of the plants. The widely used chemical fertilizer is the complex mixture by name 17: 17 17. 1 gm of complex mixture is dissolved in 1 litre of water and sprayed on the plants once in a week to get good results. When small plants grow, the ratio of the complex mixture can be changed to 30: 10: 10. It is done for the reason that at the later stage of growth small plants require more nitrogen. Now a days various chemical fertilizers such as ‘Green Care’, ‘Plantab’, etc., are available in the market.

n. Diseases and Pests

Like all other plants, Orchids are also prone to a number of diseases caused by fungi, bacteria and viruses and insect pest attacks.

1. Viral Diseases

Cymbidium Mosaic Virus produces mosaic spots on leaves of Cymbidium, commonly observed in our nature.
2. Fungal and Bacterial Diseases

Leaf spot, Black rot, Root rot, etc., are the common fungous diseases. Bulb rot is the common bacterial disease characterised by the yellowing of the pseudo bulbs, which later emit a foul odour.

3. Insect pests

Slugs, Snails, Cockroaches, Aphids, Mites, etc., are the common pests of the Orchids. Slugs, Snails etc, often eat growing tips of roots and shoots. Thrips may lay eggs in the young flower buds. Slugs and Aphids suck the sap from the plant.

B. Anthuriums

Anthuriums can also be cultivated in different ways. Cultivation in trenches, in clay pots at open places under shady trees or in greenhouses are the most common methods found in Kerala. Commercial Anthurium cultivators use 8" and 10" pots. Large-scale cultivators usually grow their plants in trenches under shade houses.

Best growth and flowering of Anthuriums depend on several factors like light levels, humidity / watering, potting medium, etc. Due to their epiphytic nature Anthuriums require well aerated soil mixes. However, the mixes need to provide sufficient moisture as well as support for the plant.

a. Light

Light is another factor determining the growth and yield of plants? At lower light levels the flower peduncles are found to be longer and the spathe are observed to be growing larger in size. In case of excessive lighting, leaves appear
to be bleached in the centers and may have brown tips. If the intensity of lighting exceeds the standard permissible limit, the plants may also produce many leaves but few flowers.

b. **Humidity / Watering**

Anthurium requires high humidity for their luxurious growth. Plants need watering at least twice a day. The frequency of watering is required to be increased during summer period. Mist irrigation system is ideal for spraying water to the entire plants in a controlled way. The interval between the number of watering should be in such a way that there is sufficient time for water to get evaporated.

c. **Medium**

Main media used for cultivation of Anthuriums include wood shavings, coconut pith, broken brick pieces, charcoal, coarse sand, etc. to retain sufficient moisture and to provide aeration to the plants in pots or trenches. An ideal medium is the one, which facilitates the plants to penetrate its roots firmly into the mix to fix the plants firmly and providing sufficient moisture, nutrients and aeration.

d. **Variety-wise classification of Anthuriums**

Like Orchids, Anthuriums are also categorised by botanists as follows:

1. Anthurium andreanum
2. Anthurium scherzerianum
3. Anthurium waroqueanum
4. Anthurium clarinervium
5. Anthurium veitchii
6. Anthurium crystallinum

Among the above-mentioned categories, only two varieties are flowering (A. andreanum and B. scherzerianum). Anthurium scherzerianum variety will flower only in extremely cold regions. The most popular commercial variety all over the world is Anthurium andreanum from which hybrid varieties are brought out for the commercial cultivation.

e. **Prominent varieties of Anthuriums grown as Cut Flowers**

Some of the prominent varieties of Anthurium grown in Kerala as cut flowers include the red varieties like Tropical Red, Can Can Red, Tinora Red, Dragun Tongue Red, Honeymoon Red, Duke of Edinberg Red; orange varieties like Kalympong Orange, Nitta Orange, Fla Orange, Sun Burst Orange; Pink varieties such as Thomsuri's Pink, Avo Lydia Pink, Coral Pink, Carre Pink; White varieties like Fla White, Lima White, Acropolis White, Uniwai White and Green varieties such as Midori Green, Chameleon Green, Mauna Kea Green, Aneane Green, etc.

f. **Place of Cultivation**

Even if Anthuriums are cultivated in pots or, vases, and trenches, growing of plants in trenches is suitable in the case of large-scale cultivation. In areas where there is a problem of water logging, cultivation in pots or vases is advisable.
9. Manuring and Fertilisation

Manuring of Anthurium plants is almost similar to that of Orchids. Frequent application of fertilizers and manures are necessary for Anthurium plants due to the porous nature of the medium. A 1-2% solution of complex mixture like 20:20:20 or 17:17:17 NPK along with one tea spoon Magnesium Sulphate can be applied once in a week. Among the major nutrients, nitrogen, potassium, phosphorus and calcium are found to have significant influence on the quality as well as yield of flowers. Under intensive hi-tech cultivation fertilisers can be applied daily through the system of mist irrigation. A commercial micro nutrient solution should also be given as a fine spray or mist 2-3 times a month. The organics like ground nut cake powder, neem cake powder, bone meal, etc. can be applied alternatively. Cattle urine can be diluted and given to the plants both at the base and as a spray.

h. Diseases and Pests

Anthurium plants are also susceptible to several diseases and pests. These include bacterial problems like Soft rot, Xanthomonas blight; fungal problems such as Anthracnose, Phytophthora leaf spot, Flower blight and Root rot; problems associated with nematodes like Burrowing nematode decline, Foliar nematode; insects and pest related problems such as Aphids, Fungus gnats, Mealy bugs, Mites, Scales, Shore flies, Thrips, White flies, etc.
SECTION III
PROPAGATION AND PRESERVATION

PROPAGATION OF ORCHIDS

Orchids like most floricultural crops may be propagated either sexually or asexually. The propagation and cultivation of Orchids was revolutionised by the discovery of Knudson (1922) who showed that Orchid seeds can germinate on a relatively simple medium containing sucrose. This became the standard procedure for germinating Orchid seeds. The earliest report of using tissue culture techniques in the clonal propagation of Orchid was that Rotar (1949) observing that plantlets could develop from buds of inflorescences in phalaenopsis, he cultured flower stalk modes *in vitro* and obtained some plantlets. The tremendous development made in Orchid industry through the wide applications of tissue culture techniques owes its credit to Morel (1960) who initiated meristem tip culture in *cymbidium*.

The Orchids represent the first floricultural crop successfully mass propagated through tissue culture technique. At present more than 69 genera and their hybrids are being multiplied through tissue culture techniques in countries like Thailand, Singapore and Hawaii (1992).

The methods of propagation of Orchids can be divided into three.

A. Seed Germination Technique.


C. Vegetative Propagation, which includes the following:
   i. Cuttings
   ii. Division
iii. Mericloning Germination Technique.

A. Seed Germination Technique

Orchid Seeds are very small. If put to sand it would take 50 seeds to make a line of 2.5 cm long. They lack endosperm and hence are difficult to germinate. Germination is possible only when certain fungi are present, which supply sugars to germinating seeds. In 1920's a scientist named ‘Knudson’ found out a solution for Orchid seed germination. This formula has been the basis for most of the solutions used to germinate Orchid seed today. A grower may either make use of his own medium or buy a prepared medium. The latter is simply mixed with water and autoclaved and is ready to use as soon as it cools and sewing should be done in a clean area. A variety of containers may be used. Old square milk bottles or new orange juice bottles are very popular, but container of any size can be used.

B. Tissue Culture (in vitro propagation) technique

This method is a highly skilled one where mass multiplication of plantlets are carried out in laboratory conditions and finally such plantlets are transferred to the natural conditions through the process of hardening of plants. Tissue culture technology in case of Orchids can be devided into various classes, based primarily on the type of materials used. They are:

a. Callus culture

Here the culture of cell masses on agar media, which is produced from a mother plant, is being carried out. Cells from Orchid plants are first cultured aseptically in a nutrient medium. The cultures are started by planting
a sterile tissue section of the plant on an agar medium. Within two to four weeks, a mass of unorganised cells (callus) is produced. Such a callus is then subcultured indefinitely by transferring a small piece to fresh agar medium. The procedure involves various stages, viz., Initiation, Regeneration, Multiplication, Elongation and Rooting. These procedures are the same also in the case of callus culture of Anthurium plants.

b. Cell Culture

In cell culture the culture of cells in liquid media in vessels is being carried out, which are usually aerated by hugitation.

c. Organ Culture

It involves the aseptic culture of embryos, anthers, ovaries, shoots or other organs of Orchid plants on a nutrient media.

d. Meristem Culture

Here the aseptic culture of shoot meristems or other tissues of Orchid plants on a nutrient media is being carried out for the purpose of growing complete plants.

e. Protoplast Culture

Here the aseptic isolation and culture of Orchid plant protoplasts from cultured cells or the plant tissues.

Among the various methods of tissue culture techniques, callus culture is quite popular.
C. Vegetative Propagation

(i) Cuttings:

Most Monopodial Orchids (Vanda and Arachnis) can be propagated through tip cuttings. Usually Orchid cuttings are much larger than the 7.5 - 10 cm. cuttings are used for many floricultural crops. Cuttings can be potted and will grow without they are being put in a propagation bed. Some monopodial and Sympodial Orchids produce offshoots. Those genera such as Dendrobium and Epidendrum produce offshoots in an axile of a leaf. Once four or more roots have formed the offshoot can be snapped off, potted up and grown as any transplant with little retardation of growth.

(ii) Division:

Cattleya and other Sympodial Orchids are propagated by division of the parent plant. This is usually accomplished on plants that have six or more pseudo bulbs. It is cut between the third and fourth pseudo bulbs and both sections are potted up as individual plants.

(iii) Mericloning:

Mericloning is a relatively new technique whereby, under aseptic conditions, one can have within a year one million plants identical to the parent plant. Like seedlings they will take years to flower.

PROPAGATION OF ANTHURIUMS

Anthurium plants are also propagated either sexually or asexually. Some of the common techniques of propagation of Anthurium plants are propagation through seeds, cuttings, and bud culture and in vitro through callus culture.
1. Seeds

Even though Anthurium plants can be propagated from seeds; this type of multiplication of plants is a lengthy process. It may take 3 years from seed to bloom. Each new plant grown from seed will be different in some way from each parent. Once pollination and fertilization is accomplished, the spadix gradually takes on a warty appearance. After 6 - 7 months, many mature, two carpelled, one or two seeded, yellow berries are formed. The yellow berries are collected and pressed lightly to squeeze 1 or 2 green seeds out of the pulp.

In planting, these seeds are scattered on finely shredded on pure river sand or other appropriate media like thin layers of cotton soaked in pure water and stored fewer than 75 – 80 per cent shade. The seeds germinate immediately and can be transplanted within 4 to 6 months. The seedlings can be expected to flower in about 1½ years after seeding, and 2½ to 3 years are often required for the majority of seedlings to flower. This technique is ideal for evolving exotic hybrid varieties of commercial importance.

2. Cuttings

Vegetative propagation, the asexual method of propagation, ensures that the offspring will be identical with the parent. One common vegetative propagation method of increasing a particular cultivar is topping. The plant is grown until some roots have developed near the stem top. The top with these new roots is then removed to produce a new plant. The remaining base
of the stem with roots will develop two or more side shoots (suckers). By repeating this procedure, large numbers of plants may be propagated. The tendency of a plant to produce suckers is not only inherent in the cultivar but is also influenced by the environment where the plants are grown. Another method of vegetative propagation is placing mature or large stems on their side in damp propagating media to encourage the production of new shoots.

When plants are propagated by seeds or tissue culture, the plantlets go through a juvenile phase followed by a generative or flower production stage.

3. Bud Culture

A procedure involving the use of tissue culture technique has been developed for rapid clonal propagation of Anthuriums. Aseptic cultures are initiated by excising vegetative shoots of approximately 1/13" at their base; disinfecting the excised shoots; rinsing the shoots in sterile water; and placing the shoots in MS medium. When a shoot has grown into a plantlet of 1 to 1.5" in length, miniature cuttings of two nodes each are prepared. The basal cuttings are further placed on MS medium of inorganic nutrients. On this medium, multiple shoots will be induced on the basal cuttings. The apical cuttings are maintained as a stock from which more basal cuttings can be obtained at a later stage.

When multiple shoots are grown into plantlets of sufficient size, they are also used as a source of basal cuttings to hasten the propagation process. Plantlets are rooted on agar medium of the same nutrient constituents of the
initial culture. Rooted plantlets are deflasked when they attain certain level of growth.

4. Callus Culture

Anthuriums can also be cultured by means of in vitro technique through callus culture. Callus culture involves induction of callous tissue (an unorganized mass of cells) from Anthurium explants (usually petiole or leaf explants with major vein). The explants are disinfected and subsequently placed on a modified MS medium. Once callus has formed, callus tissue is transferred later to modified media such as the media for regeneration, multiplication, elongation and rooting. Propagation of Anthuriums through the use of callus culture is more rapid than use of bud culture. However, the mutation rate may be greater for some cultivars. Limiting the number of in vitro cycles has been found to minimize plant variation.

Propagation of Anthuriums by use of somatic embryogenesis is being tested. Somatic embryos are thought to originate from one cell rather than from multiple cells (i.e. callus) and tend to have less genetic variation. Explants are placed on a modified MS medium for somatic embryo production. Somatic embryos are moved onto regeneration medium to form plantlets. This method, like callus culture, is a much more rapid means of micro propagation than bud culture.
PRESERVATION OF ORCHID AND ANTHURIUM FLOWERS

Preservation of Orchid Flowers

Compared to vegetables and fruits, plucked flowers are highly perishable. Marketing of good quality fresh flowers is an important matter in cut flower industry. To keep the freshness and to prolong the lifetime of flowers, various preservative solutions are used. These can be divided into three kinds.

(a) Bud opening solution

To make those plucked at bud stage, bud opening solution is used.

(b) Pulsing solution

To preserve buds or fully bloomed flowers, pulsing solution is used.

(c) Vase solution (it is used to preserve flowers in vases).

The contents of the aforesaid three solutions are the same ingredients. They differ only in quantity. The contents and the estimated cost of the three solutions are given in Table No. 3.1

<table>
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<tr>
<th>Sl. No</th>
<th>Preservative Solutions</th>
<th>Water (Litre)</th>
<th>Sugar (gm)</th>
<th>Silver Nitrate (gm)</th>
<th>Citric Acid (gm)</th>
<th>Estimated Cost (gm)</th>
</tr>
</thead>
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<tr>
<td>1</td>
<td>Bud Opening Solution</td>
<td>1</td>
<td>569 - 669</td>
<td>100 -200</td>
<td>230</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>Pulse Solution</td>
<td>1</td>
<td>569 - 719</td>
<td>50 -200</td>
<td>230</td>
<td>47</td>
</tr>
<tr>
<td>3</td>
<td>Vase Solution</td>
<td>1</td>
<td>719 - 749</td>
<td>20 -50</td>
<td>230</td>
<td>45</td>
</tr>
</tbody>
</table>

Source: Karshakan, Aug. 1994, pp. 33

The preservative solution must be stored in plastic containers rather than in metallic containers. The solution may be changed in an interval of 2-7
days. With the application of preservative solution, the lifetime of flower can be increased by 2-3 times.

**Preservation of Anthurium Flowers**

The cultivators and traders for enhancing the vase life of Anthurium flowers adopt various methods. Anthuriums can have a vase life of up to 3 weeks if properly treated. Even after a week of storage, vase life can be extended if proper techniques are used to handle the flowers. Usually the vase life problems are associated with bacterial contamination of the cut stem bases. Decrease in the vase life of flowers due to bacterial problems can be controlled to a certain extent by dipping the flower stems in a solution of 50 ppm hypochlorite immediately after harvesting. Use of deionised water for dipping the flowers will also enhance the vase life of Anthurium flowers. Pulsing the re-cut stems for 10 to 20 minutes in a solution of 1,000 ppm Silver nitrate and subsequent rinsing of the stems with fresh water after the treatment is also advisable. Dipping the whole flowers in an emulsion of Carnuba wax (3 per cent dilution of the wax is the recommended dosage) and placing the flower stems in water after drying up of wax is another method for increasing the vase life of flowers. Some traders use to soak heads of flowers in water at room temperature and then mist and cover them with a sheet of plastic, which may be beneficial, especially in hot, dry areas. Dipping flowers in fruit waxes can also help reduce water loss. After dipping, flower stems can be placed in water until wax dries.
REFERENCES


4. ibid., p. 165

5. Foja Singh, op. cit., p. 12