Micropropagation of Orchids

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Over 800 genera and 25,000 species
Long lasting flowers
incredible range of diversity in size, shape and color
As ornamentals, herbal medicines and food (Arditti, 1992).
More than just a hobby, an international business covering around 8% of the world floriculture trade.
Orchids are marketed both as cut flowers and potted plants.
Largest exporters: Taiwan, Thailand, UK, Italy, Japan, New Zealand and Brazil.

Largest importer: United States.
Tissue culture techniques has helped orchids occupy a position as one of the top ten cut flowers.
Advantages of clonal propagation

- Seeds leads to the production of heterozygous plants.

- More than two years to reach the flowering stage.

- Plantlets identical to their parents.

- Uniform blossoms during predictable periods to meet market demands.
Micropropagation

“... the art and science of multiplying plants in vitro.”
Explants

• Shoot tip
• Leaf segment
• Flower bud
• Rhizome segment
• Root segment
Micropropagation pathway

1) Explant
2) Protocorm like bodies (PLB’s)
3) Proliferation of PLB’s
4) Plantlets with well developed shoots
Basal media

• **KC** medium (1946)
• **VW** medium (1949)
• **MS** medium (1962)
• **N69** medium (1969)
• **MPR** medium (1976)
Plant growth regulators and adjuncts

- **BAP**: 6-Benzyl Amino Purine
- **NAA**: 1-Naphthalene Acetic Acid
- **IAA**: Indole Acetic Acid
- **IBA**: Indole Butyric Acid
- **CW**: Coconut Water
- **AC**: Activated Charcoal
Shoot tip culture

First detailed protocol for *in vitro* production of *Cymbidium* orchid using meristem culture (Wimber 1963).
MS + 1 mg/l BAP + 150 mg/l CW for Vanilla orchid
From a single explant 100,000 plants in about 15 subcultures.
Not appropriate for the monopodial orchids. Leads to the growth arrest of mother plant.
Better for sympodial orchids like *Dendrobium* and *Cymbidium*.
Leaf segment culture

First well-documented report on production of PLBs from *Cymbidium* leaves (Wimber, 1965).
6 month old plant

Leaf explant

PLB's

6 month old plant
• MPR +66.6 µM BAP + 28.5 µM IAA (*Vanda spathulata*)

• ½ MS + 0.3-3 mg/l TDZ (*Oncidium*)
• medium nutrient composition
• plant growth regulators
• source of the leaf (*in vitro*/*in vivo*)
• part of the leaf taken
• the age of the leaf
Mass scale cultivation of commercially important orchid species is restricted because of the time and costs involved in standardizing the mentioned factors.
Inflorescence axis and flower bud culture

Effective donor organs for micropropagating orchids
Mass propagation of the monopodial orchid *Phalaenopsis*
Media composition

• MS + 0.5 mg/l NAA + 1 mg/l TDZ
• MS + 4.52 μM 2.4-D + 2.22 μM BAP
• MPR + 2 mg/l BAP
• VW liquid media + 20% coconut water
Problems

Exudation of phenolics

Remedy:
Activated charcoal, ascorbic acid
(Arditti and Ernst, 1993)
- Low survival rate at transplantation
Remedy:

• Acclimatization (gradually decrease humidity)
• Applying ABA (decrease transpiration)
• Increasing CO$_2$ concentration (Hazarika, 2003)
Somaclonal variation:
• plant growth regulators
• long periods of culture
• Decreasing concentration of plant growth regulators

• Using shoot tips
Conclusion

• Produces high quality plant materials.

• Explant propagated and not seed propagated.

• Cost efficient protocols for mass propagation.
References