

TECHNOLOGIES FOR CROP PRODUCTION

Effects of media on the growth of differentiated protocorms of *Dendrobium* (American beauty × Caesar)

Khin Thida Myint¹, Khine Oo Aung², Yin Yin Nwe¹, Khin Soe² and Nyo Nyo¹

¹ Department of Horticulture, Yezin Agricultural University, Yezin

² Plant Physiology Division, Central Agriculture Research Institute, Yezin

Abstract

Five media were compared for their effects on the growth of differentiated protocorms of *Dendrobium* (American beauty × Caesar). After 17 weeks, growth was assessed and Lim-Ho medium was found to be superior in promoting subsequent growth.

Introduction

Orchids belong to the family Orchidaceae, which is the largest family among flowering plants. *Dendrobium*, a tropical orchid, having more than 1600 species, is the second largest genus in the orchid family. New hybrid of orchids can be obtained mostly by hybridization of orchid between genera or species. Normally it will take at least 4-5 years to know the outcome of the hybridization. Orchid hybridization plays an important role in producing more attractive flowers with wonderful color and desirable shape.

Orchid seeds lack endosperm and are fairly deficient in food reserves. In nature, germination, growth and differentiation of the seeds depend on infection by fungus mycorrhizal. Knudson (1922) successfully grew orchid seeds asymbiotically in the artificial medium in laboratory. Orchid seeds from the mature green or ripe fruits can germinate and survive on the artificial medium under aseptic condition. Within some weeks, the dust-like seeds turn green, form protocorms and develop to plantlets. Propagation of orchid is based on in vitro culture. Medium is one of the most important factors governing the rapid growth of protocorms. Trying to get rapid growth of protocorms is the key purpose in orchid seed culture with the great impact on the development of orchid industry. Many media have been developed for this purpose. The most efficient medium is different from specie to specie, in other words species specific. In Myanmar, up to now, Vacin & Went (1949) medium is commonly used and considered to be the best for orchid. Several kinds of media were used for different species in *Dendrobium* (George, 1987). The objective of this study is to clarify the most appropriate medium for the growth of protocorm of *Dendrobium* (American beauty × Caesar).

Materials and methods

The experiment was conducted at Plant Physiology Division C.A.R.I, Yezin starting from 9th October 2000. Six month old differentiated protocorms of *Dendrobium* (American beauty × Caesar), about 3mm in average height and 7.7mg in average fresh weight, were used as explants. Five kinds of media - modified Vacin & Went, 1949 (VW), Modified Knudson C (KC), Lim-Ho (1981), Modified Reinert and Mohr (RM) and Modified Morashige and Skoog, 1962 (MS) were used. Five explants were inoculated into a 250 ml conical flask containing 50 ml agar medium and 13 flasks were cultured for each treatment. The cultures were kept under 25±1°C, 16 hour photoperiod and 1000 lux light intensity for 17 weeks.

TECHNOLOGIES FOR CROP PRODUCTION

Number of leaves per plant, height of seedlings (mm), fresh weight of shoot (mg), the number of roots, root length (mm), fresh weight of root (mg) and shoot - root ratio were recorded.

Results

Number of leaves and height of seedlings

Effects of media on number of leaves and height of seedlings of *Dendrobium* hybrid are shown in figure 1. It was found that numbers of leaves per seedling was almost the same (not much different in all media). The highest seedlings were observed on Lim-Ho medium. The seedlings cultured on VW medium were the second in height.

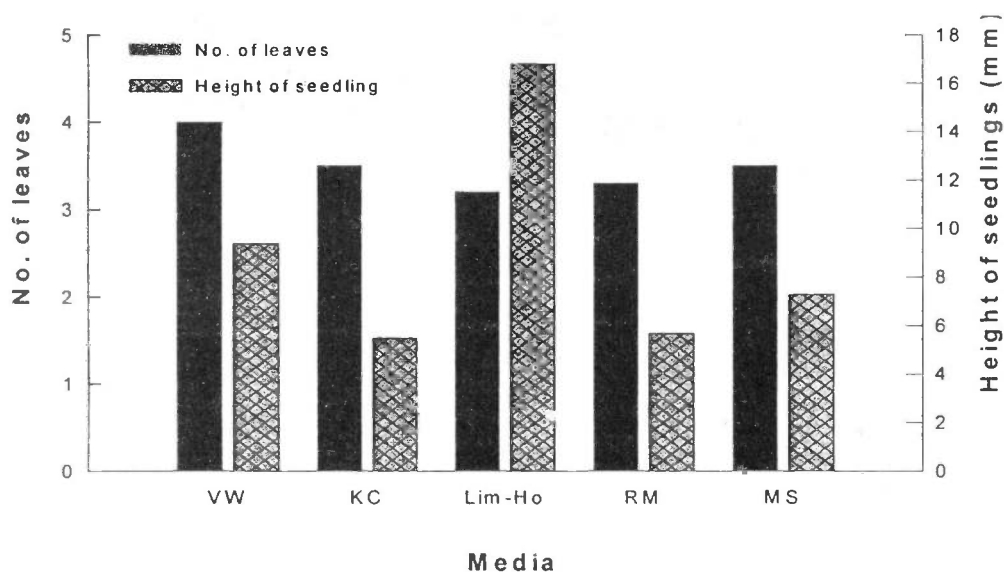


Figure 1. Effects of media on fresh weight of shoot of seedlings developed from differentiated protocorms of *Dendrobium* hybrid. Vertical bars represent standard error.

Fresh weight of shoots

Effects of media on fresh weight of shoots of seedlings developed from differentiated protocorms of *Dendrobium* hybrid are shown in figure 2. Shoots harvested from Lim-Ho medium showed the heaviest fresh weight while those on other media were recorded not so much different. Lim-Ho medium showed significant difference from others in fresh weight of shoot.

TECHNOLOGIES FOR CROP PRODUCTION

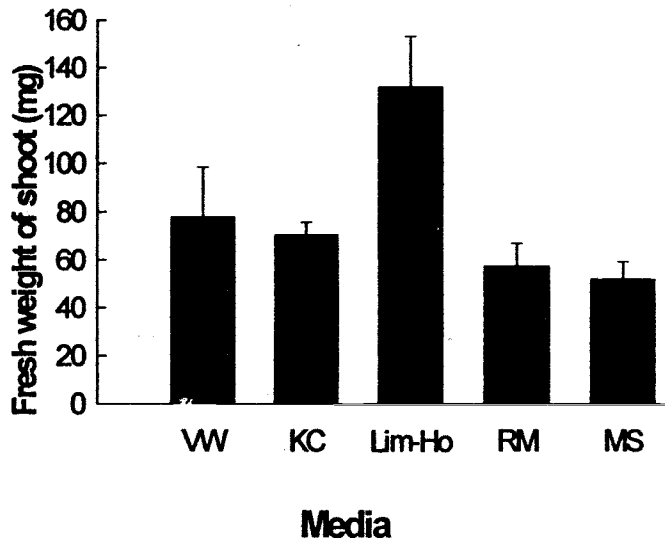


Figure 2. Effect of media on fresh weight of shoot of seedlings developed from difficiated protocorms of dendrobium hybrid. Vertical bar present standard error.

Root growth

Figure 3 describes the effects of media on number of roots, root length and diameter of root of seedlings. It was found that the seedlings cultured on Lim-Ho medium had the highest number of roots. The numbers of roots of the seedlings cultured on the other media except Lim-Ho were not quite different between each other. The longest roots were observed on MS medium followed by Lim-Ho, RM, KC and VW respectively. The roots which had the widest diameter were recorded on the seedlings cultured on Lim-Ho medium. The roots found on MS medium which had the longest length possessed the least diameter. According to these data it can be assumed that seedlings growing on Lim-Ho medium had better root system than those on the other media.

Fresh weight of roots

Effects of media on fresh weight of root of seedlings in *Dendrobium* hybrid are shown in figure 4. The maximum fresh weight of roots was measured from seedlings cultured on Lim-Ho medium while that on VW medium was recorded minimum.

TECHNOLOGIES FOR CROP PRODUCTION

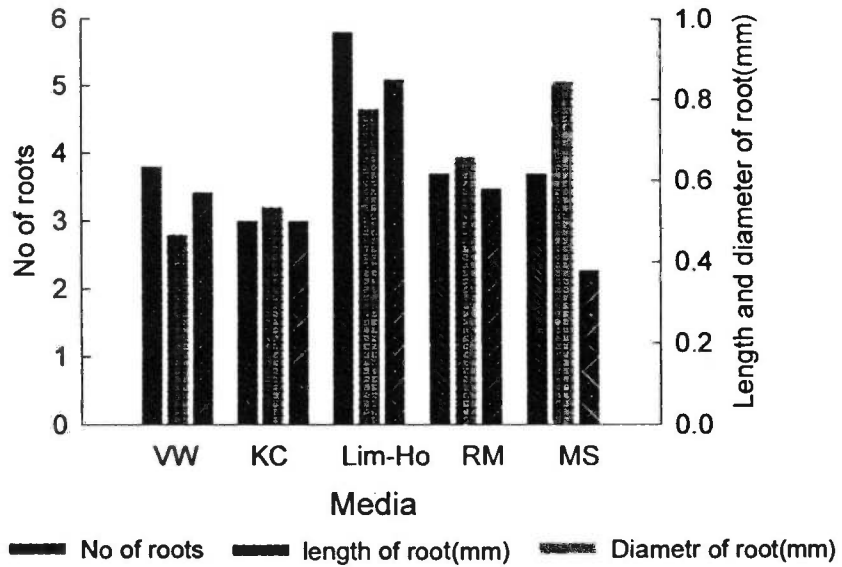


Figure 3. Effects of media on number of roots, length of root and diameter of root on differentiated protocorm of *Dendrobium* hybrid.

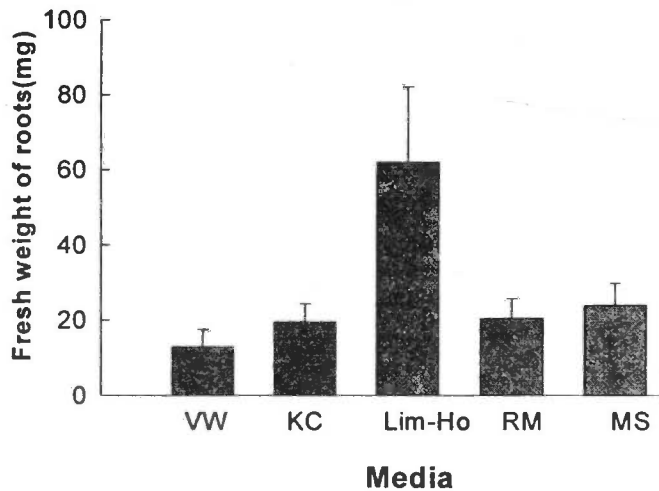


Figure 4. Effects of media on fresh weight of root of seedlings in *Dendrobium* hybrid. Vertical bars represent standard error.

TECHNOLOGIES FOR CROP PRODUCTION

Shoot – root ratio

Effects of media on shoot-root ratio of seedlings of *Dendrobium* hybrid were shown in figure 5. Shoot-root ratio of seedlings on Lim-Ho medium was 2.1 while that of VW was 6.0.

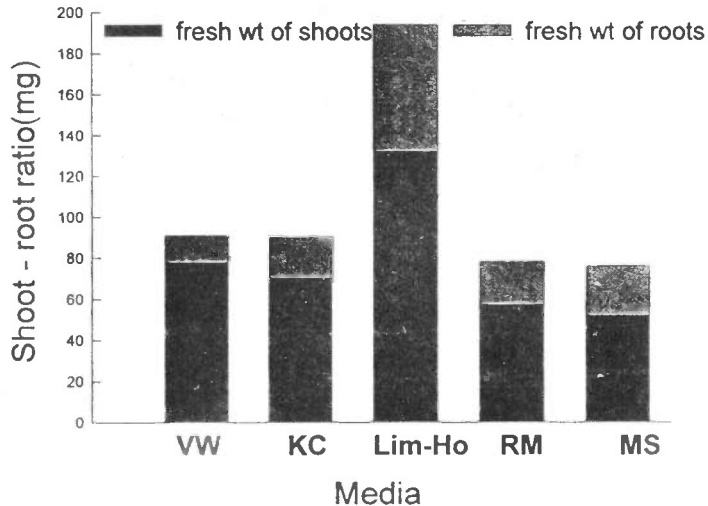


Figure 5 Effects of media on shoot - root ratio of seedlings of *Dendrobium* hybrid.

Discussion

In the number of leaves per seedling and fresh weight of shoots, Lim-Ho medium gave the best result among five kinds of media. VW medium came the second in these criteria. For root growth – number of roots per seedling, length of root, diameter of root and fresh weight of root – Lim-Ho was superior to the other media.

It can be clearly assumed that Lim-Ho medium was the most efficient one for not only shooting but also rooting of the differentiated protocorms. Lim-Ho medium includes 7.5% coconut water, 7.5% tomato juice and 75 gL⁻¹ banana homogenate. Espique and Valmayer (1980) reported that 100 ml L⁻¹ of tomato juice enhanced the germination of *Phalaenopsis*. Consisting organic complex additives – tomato and banana in Lim-Ho medium may be probably one of the reasons of promoting the growth of protocorms in *Dendrobium*. Further experimentation should be done to observe the effects of several complex additives –tomato, banana, apple, potato, coconut water, etc. with some commonly used media for subsequent growth of seedlings.

TECHNOLOGIES FOR CROP PRODUCTION

Conclusion

This study pointed that Lim-Ho medium was the best. Therefore, it can be recommend that Lim-Ho medium is the most efficient for rapid growth of differentiated protocorms of *Dendrobium* (American beauty x Caesar).

References

- Arditti, J, and Ernst, R. 1992. *Micropropagation of orchid*. pp 311-365. John Wiley & Sons, Canada.
- Arditti, J.1992. *Fundamental of orchid Biology*. John Wiley & Sons, Canada.
- Chris, C.H. 1950. *Orchid: Their description and cultivation*. Putnam & company, LTD. London.
- Espiquel, N. and Valmayor, H.L. 1980. Studies on the in vitro germination of *Phalaenopsis amabilis* Lindl. Blume. *Philippine Orchid Review* A (3):31-35.
- George, E.F., Puttock, D.J.M and George, H.J. 1987 *Plant culture media (volume 1)*. The Eastern Press Ltd., England.
- Kotomori. S and T. Murashige. 1965. Some Aspect of Aseptic Propagation of Orchids. *Amer.Orch.Soc.Bull.* 34:484-489.
- Romero, G. 1993. *The orchid family, A cultural handbook prepared by American orchid society*. Revised Edition.
- Scully, R. M.1971.Orchid Plant Sales and Breeding. pp 183-186. *Proc. 6th World Orchid Conf.*, Sydney.
- Teo, C. K. H. 1979. *Orchid for tropical gardens* FEP, International SDN. BH.D. Malaysia.
- Trigcano. R.. N. & Gray. D. J.1996. *Plant Tissue Culture Concept and Laboratory Exercises*. pp 47-57. CRC Press, USA.

Appendices

Lim-Ho (1982) medium

Component	Final concentration in culture medium (mg)
(NH ₄) ₂ SO ₄	500
KH ₂ PO ₄	250
KNO ₃	525
MnSO ₄ .4H ₂ O	7.5
MgSO ₄ .7H ₂ O	250
Na ₂ EDTA	37.24
Fe ₂ (SO ₄) ₃	27.84
Sucrose	20 g
Agar	10 g
Tomato juice	7.5%
Banana	75 g
Coconut water	7.5%

TECHNOLOGIES FOR CROP PRODUCTION

Modified Reinert – Mohr medium

Component	Final concentration in culture medium (mg)
NH ₄ NO ₃	400
Ca(NO ₃) ₂ .4H ₂ O	1000
MgSO ₄ .7H ₂ O	400
KCl	500
KH ₂ PO ₄	250
Na ₂ EDTA	22.4
Fe ₂ (SO ₄) ₃	10.7
H ₃ BO ₃	0.03
CuSO ₄ .5H ₂ O	0.001
MnSO ₄ .H ₂ O	7.5
ZnSO ₄ .7H ₂ O	0.03
Glycine	2
Niacin	0.5
Pyridoxine	0.5
Thiamine	0.1
Citric acid	151.1
Sucrose	20 g
Agar	10 g

Modified Murashige-Skoog medium

Component	Final concentration in culture medium (mg)
NH ₄ NO ₃	400
CaCl ₂ .2H ₂ O	220
MgSO ₄ .7H ₂ O	185
KNO ₃	1515
KH ₂ PO ₄	85
Na ₂ EDTA	37.3
FeSO ₄ .7H ₂ O	27.8
H ₃ BO ₃	3.1
CoCl ₂ .6H ₂ O	0.0125
CuSO ₄ .5H ₂ O	0.0125
MnSO ₄ .2H ₂ O	11.25
KI	0.415
Na ₂ MoO ₄ .2H ₂ O	0.125
ZnSO ₄ .4H ₂ O	4.3
Glycine	1
Niacin	0.25
Pyridoxine	0.05
Thiamine	0.05
Myo-Inositol	50
Sugar	30 g
Agar	10 g

TECHNOLOGIES FOR CROP PRODUCTION

Modified Knudson C

Component	Final concentration in culture medium (mg)
(NH ₄) ₂ SO ₄	400
Ca(NO ₃) ₂ .4H ₂ O	400
MgSO ₄ .7H ₂ O	100
KH ₂ PO ₄	100
Na ₂ EDTA	37.24
FeSO ₄ .7H ₂ O	27.84
AlCl ₃	0.03
H ₃ BO ₃	1.0
CuSO ₄ .5H ₂ O	0.03
MnSO ₄	0.1
KI	1.0
ZnSO ₄	1.0
Sucrose	2 g
Agar	10 g

Modified Vacin & Went medium

Component	Final concentration in culture medium (mg)
(NH ₄) ₂ SO ₄	500
Ca ₃ (PO ₄) ₂	200
KH ₂ PO ₄	250
KNO ₃	525
MnSO ₄ .4H ₂ O	7.5
MgSO ₄ .7H ₂ O	250
Na ₂ EDTA	37.24
Fe SO ₄ . 7 H ₂ O	27.84
Sucrose	10 g
Agar	10 g