UNIVERSITI PUTRA MALAYSIA

IN VITRO CULTURE OF MUSKMELON - Cucumis melo var. BIRDIE

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FSMB 1989 1

IN VITRO CULTURE OF MUSKMELON - *Cucumis melo* var. BIRDIE

by

ZULAINI ISMAIL

Thesis submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science in The Faculty of Food Science and Biotechnology, Universiti Pertanian Malaysia

May 1989

DEDICATED

TO

My Husband, Md Akhir
who has been a constant source of
inspiration for me throughout this study

AND

My Mother, Senah
for her patience and understanding

ACKNOWLEDGEMENTS

It pleases me to have the opportunity of expressing my sincere gratitude to Universiti Pertanian Malaysia and in particular the Faculty of Food Science and Biotechnology for supporting this research as part of a full-time post graduate programme.

I am extremely grateful and greatly indebted to my supervisor Associate Professor Dr. Zaliha Christine Alang, Biotechnology Department, Faculty Food Science and Biotechnology, for her dedicated efforts, stimulating discussions, active participation and constant encouragement throughout the planning and execution of this research.

I take this opportunity also to thank to Associate Professor Khalip Raffar, Deputy Dean, Faculty of Agriculture and Associate Professor Dr. Lim Eng Siong, Department of Agronomy and Horticulture, Faculty of Agriculture, Universiti Pertanian Malaysia for their expert advice in some parts of this study.

I am grateful to Assistant Professor Dr. S. Hisajima, Institute of Applied Biochemistry, University of Tsukuba, Japan, for useful discussions on progress of this study.

My sincere appreciation is extended to Encik Abdul Ghani Hashim, Faculty of Science and Environmental studies for his professional photografic work; Mr. Ho Oi Kuan, Faculty of Veterinary Medicine and Animal Science, for technical assistance in the Scanning Electron Microscopy work; Mr. How Peng Guan, Agronomy Department for technical assistance in the preparation of the histological slides; staff of the Nursery Unit, Faculty of Forestry and staff of the Hydroponic Unit, Faculty of Agriculture, for their help in the planting out study.

To all of the Central Tissue Culture Research Laboratory staff and all of my friends, I express my sincere gratitude for their assistance and help throughout this study.

Lastly, I wish to thank to ALLAH for allowing me to finish this study.

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Abstract of thesis submitted to the Senate of Universiti Pertanian Malaysia in partial fulfilment of the requirements for the degree of Master of Science.

IN VITRO CULTURE OF MUSKMELON - CUCUMIS MELO VAR. BIRDIE

By

ZULAINI ISMAIL

May, 1989

Supervisor : Dr. Zaliha Christine Alang

Faculty : Food Science and Biotechnology

Several explants from F1 hybrid seeds and aseptically-germinated seedlings of muskmelon Cucumis melo var. Birdie, were tested for their capacity for plant regeneration through direct organogenesis in vitro.

Excised cotyledons and embryos from imbibed, ungerminated seeds were cultured on Murashige and Skoog (MS) medium containing 1.0 - 5.0 uM and 1.0 - 50.0 uM

benzylaminopurine (BAP), kinetin, or isopentenyl adenine (2iP) respectively, in the presence or absence of 5.0 uM gibberellic acid (GA_3). Embryo explants produced callus on all media tested, and only 39% of cotyledon explants produced buds on medium containing 2.0 - 3.0 uM BAP.

Unimbibed, testaless seeds were germinated aseptically on MS medium in the presence of 1.0 - 50.0 uM BAP, kinetin or 2iP. On medium containing 3.0 uM BAP , 68% of cultures produced small buds in the region of the cotyledonary node within three weeks. The addition of GA_3 (5.0 uM) or naphthalene acetic acid (NAA) (0.1 - 1.5 uM) did not increase the percentage of cultures which produced buds.

Cotyledonary nodes were subcultured to media containing the same (3.0 uM) or lower concentrations of BAP for two weeks and then to MS basal medium for another two weeks to allow further bud development and shoot elongation. The highest number of shoots per cotyledonary node (9.7) was obtained when the first subculture medium contained 0.5 uM BAP.

Individual shoots less than 1.0 cm, 1.0 - 2.5 cm and more than 2.5 cm in length, were tested for rooting

ability in the presence of 3.0 uM IBA. The highest percentage rooting (49%) occurred in shoots more than 1.0cm long. Further studies on root induction showed that the highest percentage of rooting (85%), occurred when shoots 1.0 - 2.5 cm long were cultured in the light, on filter-paper bridges in liquid, half-strength MS medium containing 2.0 uM NAA, without charcoal.

Complete plantlets were successfully transplanted to the glasshouse and grown in hydroponic culture. The plants flowered and produced normal fruit.

ABSTRAK

Abstrak tesis yang dikemukakan kepada Senat Universiti Pertanian Malaysia bagi memenuhi sebahagian daripada syarat-syarat untuk memperolehi Ijazah Master Sains.

IN VITRO CULTURE OF MUSKMELON

- CUCUMIS MELO VAR. BIRDIE

Oleh

ZULAINI ISMAIL

Mei, 1989

Penyelia : Dr. Zaliha Christine Alang

Fakulti : Sains Makanan dan Bioteknologi

Beberapa jenis eksplan dari biji benih F1 dan anak benih aseptik muskmelon Cucumis melo var. Birdie digunakan untuk mempastikan keupayaan kehidupan semula tumbuhan melalui organogenesis terus secara in vitro.

Kotiledon dan embrio dari biji benih yang dipedap air, dikultur ke atas medium Murashige dan Skoog (MS) mengandungi 1.0 - 5.0 uM and 1.0 - 50.0 uM benzilaminopurin (BAP), kinetin atau isopentenil adenin

(2iP) masing-masing, dengan kehadiran atau tanpa 5.0 uM asid giberelik (GA_3). Embrio menghasilkan kalus di atas semua medium yang digunakan dan hanya 39% dari kotiledon menghasilkan tunas di atas medium yang mengandungi 2.0 dan 3.0 uM BAP.

Biji benih tanpa testa yang tidak dipedap, dicambahkan secara aseptik di atas medium MS dengan kehadiran 1.0 - 50.0 uM BAP, kinetin atau 2iP. Pada medium yang mengandungi 3.0 uM BAP, 68% kultur menghasilkan tunas-tunas kecil dikawasan nod kotiledon dalam masa tiga minggu. Penambahan GA_3 (5.0 uM) atau asid asetik naftalin (NAA, 0.1 - 1.5 uM) tidak meningkatkan peratus kultur yang menghasilkan tunas.

Nod kotiledon disubkulturkan ke medium yang mengandungi kepekatan BAP yang sama (3.0 uM) atau kurang, selama dua minggu dan kemudiannya ke medium asas MS selama dua minggu lagi untuk penerusan pembentukan tunas dan pemanjangan pucuk. Bilangan pucuk per nod kotiledon yang paling tinggi (9.7) diperolehi apabila medium subkultur pertamanya mengandungi 0.5 uM BAP.

Keratan pucuk-pucuk kurang dari 1.0 cm, 1.0 - 2.5 cm dan lebih dari 2.5 cm panjang, telah diuji untuk pengakaran dengan kehadiran 3.0 uM (IBA). Peratus

pengakaran paling tinggi (49%) diperolehi pada pucuk yang panjangnya melebihi 1.0 cm. Kajian lanjut ke atas induksi pengakaran menunjukkan peratus yang paling tinggi (85%) diperolehi apabila pucuk 1.0 - 2.5 cm dikulturkan di dalam cahaya, di atas jambatan kertas turas di dalam medium cecair, setengah kepekatan medium MS mengandungi 2.0 uM NAA, tanpa charcoal.

Planlet telah dipindahkan ke rumah kaca dan dibesarkan dalam kultura hidroponik. Pokok tersebut telah berbunga dan menghasilkan buah yang normal.

CHAPTER 1

INTRODUCTION

The family Cucurbitaceae consists of about 90 genera and 750 species, almost equally divided between the New and Old World (Whitaker and Davis, 1962). The cultivated species of this family (Table 1) are not nearly as significant in man's economy as the cereals or the legumes, but they are important crops in the tropics, subtropics, and milder portions of the temperate zones of both hemispheres.

In 1980, commercial planting of cultivated cucurbits occupied 1.35 million ha. in more than 70 countries; of these 39.1% were pumpkins, squash, and gourds, and 60.9% cucumbers and gherkins.

Cultivated cucurbits have many diseases in common, which cause reduction in yield and quality. In some instances, a single organism is the causal agent, or different host species. Virus diseases that attack cucurbits are also numerous and widespread, and evoke tremendous crop losses. They are extremely difficult to

control; though various control measures have been attempted, none has yet proved really successful. Detailed information can be found in the treatise by Whitaker and Davis (1962).

Table 1

The Botanical and Common Names of Some Cultivated Species of the Cucurbitaceae.

Latin name	Common name
Citrullus vulgaris Schrad	Watermelon
Cucumis sativus L.	Cucumber
Cucumis anguria L.	West India gherkin
Cucumis melo L.	Muskmelon
Luffa cylindrica Roem.	Dish-rag gourd
Lagenaria siceraria (Mol.)Standl.	White-flowered gourd
Cucubita pepo L.	Winter squash, summer squash, pumpkin, marrow
Cucurbita mixta Pang	Winter squash, pumpkin
Cucurbita moschata Poir.	Winter squash, pumpkin
Cucurbita maxima Duch	Winter squash, marrow turban squash, pumpkin
Cucurbita ficifolia Bouche	Malabar gourd, fig-leaf gourd
Sechium edule SW.	Chayote

Source

Jelaska S., (1986)

The main objectives of breeding programmes are thus not only to increase yield and quality, but also to select cultivars resistant to pests and diseases. This is especially important in the absence of effective chemical control.

Cucurbits in Malaysia

Many types of Cucurbits can be grown in Malaysia, including watermelon, cucumber and muskmelon.

Muskmelon is a crop well suited for production especially in hydroponic culture provided that adequate pest and disease control measures are taken. However, there is no local production of muskmelon seeds, and imported hybrid seeds are expensive - costing between 10 and 30 cents each, depending on the cultivar and seed source. The seed cost makes up between 5 - 10% of the cost of production under hydroponic culture and much more under conventional cropping methods.

A breeding program is currently in progress at U.P.M. for the production of local hybrid seeds in order to reduce the cost of seeds and to select varieties well suited to local tropical conditions. Each melon fruit is capable of producing about 300 seeds and each plant is allowed to produce two fruit. On the basis of the present average cost of seed, hybrid seeds produced from one plant would fetch a retail value of M$100. The present hydroponic unit at UPM is planted with over 1,500 muskmelon plants per glasshouse.

In the production of hybrids, breeding lines remain the exclusive property of seed companies, and a fresh supply of hybrid seed has to be purchased from the supplier for each planting. It would thus be prudent to develop local breeding lines from the muskmelon germplasm available in Malaysia. A collection of about 50 source populations is currently being used to develop local breeding lines. Unfortunately, conventional breeding procedures for eventual combination into hybrids takes many generations. It is essential that the parental lines be genetically pure in order that they may be sexually maintained for the production of hybrids of consistant performance. If the parental lines can be maintained asexually, the breeding programme could be shortened tremendously. Besides enabling the testing of locally-produced heterozygous material, it would also allow the selected parents to be maintained indefinitely without loss of vigour.

Conventional vegetative propagation of muskmelon is slow and usually limited to the number of shoots available from a single parent plant, whereas micropropagation is capable of producing a large number of plantlets from a single plant.