



UNIVERSITI PUTRA MALAYSIA

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

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IN VITRO CULTURE OF MUSKMELON -
Cucumis melo var. BIRDIE

by

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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



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ABSTRACT

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

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May, 1989

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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 μ M and 1.0 - 50.0 μ M



benzylaminopurine (BAP), kinetin, or isopentenyl adenine (2iP) respectively, in the presence or absence of 5.0 μ M 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 μ M BAP.

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

Cotyledonary nodes were subcultured to media containing the same (3.0 μ M) 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 μ M 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 μ M 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 μ M 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
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Beberapa jenis eksplan dari biji benih F1 dan anak benih aseptik muskmelon Cucumis melo var. Birdie digunakan untuk memastikan 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 μM and 1.0 - 50.0 μM benzilaminopurin (BAP), kinetin atau isopentenil adenin



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

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

Nod kotiledon disubkulturkan ke medium yang mengandung kepekatan BAP yang sama (3.0 μM) 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 mengandung 0.5 μM 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 μM (IBA). Peratus



pengakaran paling tinggi (49%) diperoleh pada pucuk yang panjangnya melebihi 1.0 cm. Kajian lanjut ke atas induksi pengakaran menunjukkan peratus yang paling tinggi (85%) diperoleh 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
<u>Citrullus vulgaris</u> Schrad	Watermelon
<u>Cucumis sativus</u> L.	Cucumber
<u>Cucumis anguria</u> L.	West India gherkin
<u>Cucumis melo</u> L.	Muskmelon
<u>Luffa cylindrica</u> Roem.	Dish-rag gourd
<u>Lagenaria siceraria</u> (Mol.) Standl.	White-flowered gourd
<u>Cucubita pepo</u> L.	Winter squash, summer squash, pumpkin, marrow
<u>Cucurbita mixta</u> Pang	Winter squash, pumpkin
<u>Cucurbita moschata</u> Poir.	Winter squash, pumpkin
<u>Cucurbita maxima</u> Duch	Winter squash, marrow turban squash, pumpkin
<u>Cucurbita ficifolia</u> Bouche	Malabar gourd, fig-leaf gourd
<u>Sechium edule</u> 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 consistent 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.

