

**STUDIES ON THE MICROPROPAGATION OF
LILY (*LILIUM LONGIFLORUM*) BULBS**

BY

WARDA ABD EL-SAMEA ALY ALY

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 2001

**A thesis submitted in partial fulfillment
of**

the requirements for the degree of

MASTER OF SCIENCE

in

**Agricultural Science
(Ornamental Plants)**

**Department of Horticulture
Faculty of Agriculture
Ain Shams University**

2005

Approval Sheet

STUDIES ON THE MICROPROPAGATION OF LILY (*LILIUM LONGIFLORUM*) BULBS

BY

WARDA ABD EL-SAMEA ALY ALY

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 2001

This thesis for M. Sc. degree has been approved by:

Prof. Dr. Emam Mohamed Saber Nofal

Prof. of Ornamental Plants, Faculty of Agriculture,
Tanta University (Khafr El Sheikh)

Prof. Dr. Awaad Mohamed Kandeel

Prof. of Ornamental Plants, Faculty of Agriculture,
Ain Shams University

Prof. Dr. Mahmoud El Sayed Hashem

Prof. Emeritus of Ornamental Plants, Faculty of
Agriculture, Ain Shams University

Date of Examination: 5 / 10 / 2005

STUDIES ON THE MICROPROPAGATION OF LILY (*LILIUM LONGIFLORUM*) BULBS

BY

WARDA ABD EL-SAMEA ALY ALY

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 2001

Under the supervision of:

Prof. Dr. Mahmoud El Sayed Hashem

Prof. Emeritus of Ornamental Plants, Department
of Horticulture, Faculty of Agriculture, Ain Shams
University

Dr. Asmaa Mohamed Abdel Gayed

Assistant Prof. of Ornamental Plants, Department
of Horticulture, Faculty of Agriculture, Ain Shams
University

Dr. Faisal Mohamed Abdel-Aleam Saadawy

Senior Researcher, Horticulture Research Institute,
Agriculture Research Center

ACKNOWLEDGMENTS

First of all my obedience, devotion, deepest thanks and praise are due and fully extended-as always to **Allah**, who has created us and bestowed upon us a lot of blessings which we cannot enumerate and thank enough.

This work is dedicated to the soul of my Father may Allah be merciful to him.

I would like to express my gratitude to **Prof. Dr. Mahmoud EL Sayed Hashem** Professor of Ornamentals, Faculty of Agriculture, Ain Shams University, for suggesting the current study, his supervision, valuable guidance, kind support, continuous help during the whole work and revision of this manuscript.

Deep thanks to **Dr. Asmaa Mohamed Abdel Gayed** Assistant Prof. of Ornamentals, Faculty of Agriculture, Ain Shams University, for her supervision, scientific guidance and sincere intentions.

I would like to thank and show my sincere appreciation to **Dr. Faisal Mohamed Abdel-Aleam Saadawy** Researcher in the Horticulture Research Institute (HRI), Agriculture Research Center, Giza, for his supervision, constant encouragement, scientific remarks, following up during all stages of laboratory work, patience and the great efforts in the preparation of this thesis.

Gratitude and appreciation are due to **Prof. Dr. Assem Shaltot** Professor of Pomology, Faculty of Agriculture, Ain Shams University, for his scientific help and sincere advices.

Gratitude is also offered to all the staff member and fellow colleagues of the Department of Horticulture, Agriculture Faculty, Ain Shams University, especially members of the tissue culture laboratory belonging to seedling production project for their cooperation and assistance.

I am particularly appreciative to all members of my family for their moral support, understanding and repeated prayers.

ABSTRACT

Warda Abd El-Samea Aly Aly. Studies on the Micropropagation of Lily (*Lilium longiflorum*) Bulbs. Unpublished Master of Science Thesis, Ain Shams University, Faculty of Agriculture, Department of Horticulture, 2005.

Scales of the aerial bulbils on the flowering stem were the only successful explants to be taken from lily plants grown in the field as the first step to establish a tissue culture.

Only the basal parts of the *in vitro* grown leaves survived excision and inoculation on **Murashige and Skoog 1962** (MS) medium and showed a positive response by growth and proliferation in terms of multiple shoot production.

MS at full strength yielded the significantly heaviest and longest shoots, the greatest leaf number and the shoot content of total chlorophyll.

The highest shoot weight was scored by BA at 5 ppm. Plantlet weight, leaf number and weight, root number and length reached their significant highest values at 30 g of sucrose/l. At sucrose concentration of 60 g/l, root weight and bulb diameter, height and weight were significantly the greatest. The significantly highest number of roots was achieved at 5 ppm IBA.

The “Peat moss + Perlite” medium surpassed other media significantly in inducing the longest and heaviest plantlets, longest roots, the highest number of green leaves and shoot content of total chlorophyll.

Key Words: Lilium, lily, bulbs, bulbils, leaf explant, leaf base, MS strength, cytokinins, BA, Kin, bulb formation, sugar concentration, auxins, IBA, NAA, acclimatization, sand, peat moss, perlite.

CONTENTS

No.	Page
1. INTRODUCTION.....	1
2. REVIEW OF LITERATURE.....	3
3. MATERIALS AND METHODS.....	16
4. RESULTS AND DISCUSSION	21
I - Establishment Stage.....	21
Preliminary experiment.....	21
Exp. 1- Establishment Stage.....	21
1 - Effect of explant type on <i>Lilium</i> explants.....	21
Exp. 2- Effect of MS medium strength.....	25
2-1- Effect of MS medium strength on shoot number/explant.....	25
2 – 2 - Effect of MS medium strength on shoot weight.....	25
2 – 3 – Effect of MS medium strength on shoot length.....	25
2 – 4 - Effect of MS medium strength on leaf number	28
2 – 5- Effect of MS medium strength on shoot content of total chlorophyll.....	28
II - Multiplication Stage.....	32
Exp. 3 - Effect of cytokinin type and concentration on lilium explants.....	32
3-1- Effect of cytokinin type and concentration on shoot number.....	32
3-2- Effect of cytokinin type and concentration on shoot weight.....	40
3-3- Effect of cytokinin type and concentration on shoot length.....	43
3-4- Effect of cytokinin type and concentration on leaf number.....	48
3-5- Effect of cytokinin type and concentration on root number.....	52
3-6- Effect of cytokinin type and concentration on root length.....	55
3-7- Effect of cytokinin type and concentration on shoot content of total chlorophyll.....	55

No.		Page
	Exp. 4 - Effect of sucrose concentration in the medium.....	61
4-1-	Effect of sucrose concentration on plantlet weight.....	61
4-2-	Effect of sucrose concentration on shoot length.	64
4-3-	Effect of sucrose concentration on leaf number.	66
4-4-	Effect of sucrose concentration on leaf weight.	66
4-5-	Effect of sucrose concentration on root number.	69
4-6-	Effect of sucrose concentration on root weight.	69
4-7-	Effect of sucrose concentration on root length.	72
4-8-	Effect of sucrose concentration on bulb number.....	72
4-9-	Effect of sucrose concentration on bulb weight.	75
4-10-	Effect of sucrose concentration on bulb height	78
4-11-	Effect of sucrose concentration on bulb diameter.....	78
4-12-	Effect of sucrose concentration on scale number/bulb.....	78
4-13-	Effect of sucrose concentration on number of days to leaf yellowing and bulb formation.....	82
	III - Rooting Stage.....	86
	Exp. 5- Effect of auxin type and concentration on lilium explants.....	86
5-1-	Effect of auxin type and concentration on plantlet weight.....	86
5-2-	Effect of auxin type and concentration on shoot length.....	89
5-3-	Effect of auxin type and concentration on leaf number.....	92
5-4-	Effect of auxin type and concentration on root number.....	95
5-5-	Effect of auxin type and concentration on root weight.....	100
5-6-	Effect of auxin type and concentration on root length.....	103
5-7-	Effect of auxin type and concentration on root diameter.....	107
5-8-	Effect of auxin type and concentration on shoot content of total chlorophyll.....	110

No.		Page
	IV - Acclimatization Stage.....	116
	6-1- Effect of acclimatization media on survival %...	116
	6-2- Effect of acclimatization media on plantlet weight.....	116
	6-3- Effect of acclimatization media on plantlet length.....	118
	6-4- Effect of acclimatization media on number of green leaves/plantlet	118
	6-5- Effect of acclimatization media on number of yellow leaves.....	118
	6-6- Effect of acclimatization media on root number.....	122
	6-7- Effect of acclimatization media on root weight.	122
	6-8- Effect of acclimatization media on root length.	122
	6-9- Effect of acclimatization media on bulb weight.	126
	6-10- Effect of acclimatization media on bulb height	126
	6-11- Effect of acclimatization media on bulb diameter.....	126
	6-12- Effect of acclimatization media on scale number	126
	6-13- Effect of acclimatization media on shoot content of total chlorophyll.....	131
5.	SUMMARY AND CONCLUSION.....	134
6.	REFERENCES.....	141
7.	ARABIC SUMMARY.....	

LIST OF TABLES

No.		Page
Table(1)	Effect of explant type on <i>Lilium</i> explants.....	24
Table(2-1)	Effect of media strength on shoot number/explant.....	24
Table (2-2)	Effect of media strength on shoot weight (g) /explant	26
Table (2-3)	Effect of media strength on shoot length (cm)...	27
Table (2-4)	Effect of media strength on leaf number/explant	29
Table (2-5)	Effect of media strength on total chlorophyll content (mg/g shoot fresh weight).....	30
Table (3-1)	Effect of cytokinin type and concentration on shoot number/explant	33
Table (3-2)	Effect of cytokinin type and concentration on shoot weight(g) /explant	41
Table (3-3)	Effect of cytokinin type and concentration on shoot length (cm).....	44
Table (3-4)	Effect of cytokinin type and concentration on leaf number/explant	49
Table (3-5)	Effect of cytokinin type and concentration on root number/explant	53
Table (3-6)	Effect of cytokinin type and concentration on root length (cm).....	56
Table (3-7)	Effect of cytokinin type and concentration on total chlorophyll content (mg/g shoot fresh weight).....	58
Table (4-1)	Effect of sucrose concentration on plantlet weight (g).....	63
Table (4-2)	Effect of sucrose concentration on shoot length (cm).....	65
Table (4-3)	Effect of sucrose concentration on leaf number/plantlet.....	67
Table (4-4)	Effect of sucrose concentration on leaf weight (g) /plantlet	68
Table (4-5)	Effect of sucrose concentration on root number/plantlet.....	70
Table (4-6)	Effect of sucrose concentration on root weight (g) /plantlet	71

No.		Page
Table (4-7)	Effect of sucrose concentration on root length (cm).....	73
Table (4-8)	Effect of sucrose concentration on bulb number/plantlet.....	74
Table (4-9)	Effect of sucrose concentration on bulb weight (g) /plantlet	76
Table (4-10)	Effect of sucrose concentration on bulb height (cm).....	79
Table (4-11)	Effect of sucrose concentration on bulb diameter (cm).....	80
Table (4-12)	Effect of sucrose concentration on scale number/bulb.....	81
Table (4-13)	Effect of sucrose concentration on number of days to leaf yellowing and bulb formation.....	83
Table (5-1)	Effect of auxin type and concentration on plantlet weight (g).....	87
Table (5-2)	Effect of auxin type and concentration on shoot length (cm).....	90
Table (5-3)	Effect of auxin type and concentration on leaf number/plantlet	93
Table (5-4)	Effect of auxin type and concentration on root number/plantlet	96
Table (5-5)	Effect of auxin type and concentration on root weight (g) /plantlet	101
Table (5-6)	Effect of auxin type and concentration on root length (cm).....	104
Table (5-7)	Effect of auxin type and concentration on root diameter (mm).....	108
Table (5-8)	Effect of auxin type and concentration on shoot content of total chlorophyll (mg/g shoot fresh weight).....	111
Table (6-1)	Effect of acclimatization media on survival %.	117
Table (6-2)	Effect of acclimatization media on plantlet weight (g).....	117
Table (6-3)	Effect of acclimatization media on plantlet length (cm).....	119
Table (6-4)	Effect of acclimatization media on number of green leaves/plantlet.....	120
Table (6-5)	Effect of acclimatization media on number of yellow leaves/plantlet.....	121

No.		Page
Table (6-6)	Effect of acclimatization media on root number/plantlet.....	123
Table (6-7)	Effect of acclimatization media on root weight (g) /plantlet.....	124
Table (6-8)	Effect of acclimatization media on root length (cm).....	125
Table (6-9)	Effect of acclimatization media on bulb weight (g) /plantlet	127
Table (6-10)	Effect of acclimatization media on bulb height (cm)	128
Table (6-11)	Effect of acclimatization media on bulb diameter (cm).....	129
Table (6-12)	Effect of acclimatization media on scale number/bulb.....	130
Table (6-13)	Effect of acclimatization media on shoot content of total chlorophyll (mg/g fresh weight)	132

LIST OF FIGURES

No.		Page
Fig. (2-1)	Effect of media strength on shoot number/explant	24
Fig. (2-2)	Effect of media strength on shoot weight (g) /explant.....	26
Fig. (2-3)	Effect of media strength on shoot length (cm).....	27
Fig. (2-4)	Effect of media strength on leaf number/explant	29
Fig. (2-5)	Effect of media strength on total chlorophyll content (mg/g shoot fresh weight).....	30
Fig. (3-1-a)	Effect of cytokinin type on shoot number/explant	33
Fig. (3-1-b)	Effect of cytokinin concentration on shoot number/explant	36
Fig. (3-1-c)	Effect of interaction between cytokinin type and concentration on shoot number/explant	36
Fig. (3-2-a)	Effect of cytokinin type on shoot weight(g) /explant.....	41
Fig. (3-2-b)	Effect of cytokinin concentration on shoot weight(g) /explant	42
Fig. (3-2-c)	Effect of interaction between cytokinin type and concentration on shoot weight(g) /explant	42
Fig. (3-3-a)	Effect of cytokinin type on shoot length (cm).....	44
Fig. (3-3-b)	Effect of cytokinin concentration on shoot length (cm)	46
Fig. (3-3-c)	Effect of interaction between cytokinin type and concentration on shoot length (cm).....	46
Fig. (3-4-a)	Effect of cytokinin type on leaf number/explant	49
Fig. (3-4-b)	Effect of cytokinin concentration on leaf number/explant.....	51
Fig. (3-4-c)	Effect of interaction between cytokinin type and concentration on leaf number/explant	51
Fig. (3-5-a)	Effect of cytokinin type on root number/explant	53
Fig. (3-5-b)	Effect of cytokinin concentration on root number/explant.....	54
Fig. (3-5-c)	Effect of interaction between cytokinin type and concentration on root number/explant	54
Fig. (3-6-a)	Effect of cytokinin type on root length (cm).....	56

VIII

No.		Page
Fig. (3-6-b)	Effect of cytokinin concentration on root length (cm)	57
Fig. (3-6-c)	Effect of interaction between cytokinin type and concentration on root length (cm).....	57
Fig. (3-7-a)	Effect of cytokinin type on total chlorophyll content (mg/g shoot fresh weight).....	58
Fig. (3-7-b)	Effect of cytokinin concentration on total chlorophyll content (mg/g shoot fresh weight)....	60
Fig. (3-7-c)	Effect of interaction between cytokinin type and concentration on total chlorophyll content (mg/g shoot fresh weight).....	60
Fig. (4-1)	Effect of sucrose concentration on plantlet weight (g).....	63
Fig. (4-2)	Effect of sucrose concentration on shoot length (cm).....	65
Fig. (4-3)	Effect of sucrose concentration on leaf number/plantlet.....	67
Fig. (4-4)	Effect of sucrose concentration on leaf weight (g) /plantlet.....	68
Fig. (4-5)	Effect of sucrose concentration on root number/plantlet.....	70
Fig. (4-6)	Effect of sucrose concentration on root weight (g) /plantlet.....	71
Fig. (4-7)	Effect of sucrose concentration on root length (cm).....	73
Fig. (4-8)	Effect of sucrose concentration on bulb number/plantlet	74
Fig. (4-9)	Effect of sucrose concentration on bulb weight (g) /plantlet	76
Fig. (4-10)	Effect of sucrose concentration on bulb height (cm).....	79
Fig. (4-11)	Effect of sucrose concentration on bulb diameter (cm).....	80
Fig. (4-12)	Effect of sucrose concentration on scale number/bulb.....	81
Fig. (4-13)	Effect of sucrose concentration on number of days to leaf yellowing and bulb formation.....	83
Fig. (5-1-a)	Effect of auxin type on plantlet weight (g).....	87
Fig. (5-1-b)	Effect of auxin concentration on plantlet weight (g).....	88