

PHOTOHORMONAL STUDIES ON ASTER PLANT

BY

Naglaa Sayed Abou - Talh

THESIS

SUBMITTED IN PARTIAL FULFILMENT

OF THE REQUIREMENTS

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

Ornamental Horticulture

Department of Horticulture

FACULTY OF AGRICULTURE

AIN SHAMS UNIVERSITY

CAIRO — EGYPT

1989

APPROVAL SHEET

PHOTOHORMONAL STUDIES ON ASTER PLANT

by

Naglaa Sayed Abou-Talb

B. Sc. Agric. (Horticulture), Ain Shams Univ., 1974

M. Sc. Agric. (Horticulture), Ain Shams Univ., 1983

This thesis for Ph. D. degree has been
approved by :

Prof. Dr.H.A. Hassan. Hassan.A. Hassan
Prof. of Floriculture

Prof. Dr. M.B. Mostafa. M. B. Mostafa
Prof. of Floriculture,

Prof. Dr. N.R. Shedeed. M. R. Shedeed
Prof. of Floriculture

Date of examination : 17 / 6 / 1989



ACKNOWLEDGEMENT

The writer wishes to express her sincere thanks and deep gratitude to Prof. Dr. Mahmoud R. Shedeed, Professor of Floriculture, Faculty of Agriculture, Ain Shams Univ., for his supervision, valuable suggestions, progressive criticism, continuous encouragements during the course of the experiments and the preparation of the thesis.

Many thanks are due also to Dr. Mahmoud E. Hashim Associate Professor in the same Faculty for his supervision, fruitful help, continuous guidance, reviewed the thesis and valuable criticism throughout the course of this work.

PHOTOHORMONAL STUDIES ON ASTER PLANT

BY

Naglaa Sayed Abou-Talb

B. Sc. Agric. (Horticulture), Ain Shams Univ., 1974

M. Sc. Agric. (Horticulture), Ain Shams Univ., 1983

Under the Supervision of: Prof. Dr. Mahmoud R. Shedeed
Prof. Dr. of Floriculture, Fac. of Agric. Ain Shams Univ.

ABSTRACT

China aster are annual plants. They are grown in most parts of the world for attractive cut flowers, besides, they are of best keeping quality for home use. The main goal of this investigation is to study the effect of light treatments for different hours and periods and some growth regulators, i.e. gibberellic acid and kinetin on the growth and flowering of aster plants. Two experiments were carried out to reach the aim of this work.

First Experiment :

The experiment was designed to study the effect of light treatments for different hours and periods on the growth and flowering of the plant. The results indicate that there was earlier flowering, significant increase in plant height, number of branches and flowers, fresh and dry weight of flowers and the length and thickness of the flower stalk. In addition, there was an increase in the NPK percent, total carbohydrates, and DNA, RNA, while, decrease in the plant content of total phenols.

Second Experiment :

This experiment disclosed the effect of growth regulators GA_3 at the concentration; 0, 100, 150, and 200 ppm and kinetin at the concentrations, 0, 10, 50, and 100 ppm. The results indicated that there was earlier flowering with gibberellin and significant increase in plant height number of branches and flowers, length of the flower stalk and its thickness, dry and fresh weights, and NPK percent, total carbohydrate, RNA and DNA content. On the other hand, gibberellin treatments decreased the plant content of total phenols.

CONTENTS

	Page
INTRODUCTION.....	1
REVIEW OF LITERATURE.....	3
MATERIALS AND METHODS.....	34
RESULTS AND DISCUSSION.....	46
1. Effect of light treatments on the growth and flower- ing of aster plant.....	46
1. First planting date:.....	46
1. a). Number of days from planting till the apperance of flower colour.....	46
1. b). Number of days from planting till the flower opening.....	49
1. c). Plant height.....	53
1. d). Number of branches per plant.....	57
1. e). Number of flowers per plant.....	60
1. f). Fresh weight of inflorescense.....	62
1. g). Dry weight of inflorescense.....	64
1. h). Diameter of flower.....	68
1. i). Flower stalk length.....	69
1. j). Diameter of flower stalk.....	71
2. Second planting date:.....	75
2. a). Number of days from planting till the apperance of flower colour.....	75
2. b). Number of days from planting till the flower opening.....	79
2. c). Plant height.....	83
2. d). Number of branches per plant.....	86
2. e). Number of flowers per plant.....	88
2. f). Fresh weight of inflorescense.....	91
2. g). Dry weight of inflorescense.....	93
2. h). Diameter of flower.....	96
2. i). Flower stalk length.....	98
2. j). Diameter of flower stalk.....	102
3. Third planting date:.....	106
3. a). Number of days from planting till the apperance of flower colour.....	106

Cont.	Page
3. b). Number of days from planting till the flower opening.....	109
3. c). Plant height.....	113
3. d). Number of branches per plant.....	116
3. e). Number of flowers per plant.....	119
3. f). Fresh weight of inflorescence.....	122
3. g). Dry weight of inflorescence.....	126
3. h). Diameter of flower.....	128
3. i). Flower stalk length.....	133
3. j). Diameter of flower stalk.....	136
Effect of planting dates, day length and growth hormones on the vegetative and flowering characters of aster plants....	139
II. Effect of light treatments on the chemical composition.	143
- Nitrogen content.....	143
- Phosphorus content.....	146
- Potassium content.....	149
- Total carbohydrates.....	152
- RNA content.....	155
- DNA content.....	160
- RNA/DNA ratio.....	163
- Total phenols.....	165
- Endogenous growth hormones.....	169
1. Endogenous gibberellin and their inhibitors.....	169
2. Endogenous auxins and their inhibitors.....	174
Effect of planting dates, day length and growth hormones on the chemical content of aster plants.....	180
III. Effect of growth regulators on the growth and flowering of aster plants.....	184
a). Number of days from planting till the appearance of flower colour.....	184
b). Number of days from planting till the flower opening.....	185
c). Plant height.....	189
d). Number of branches per plant.....	191
e). Number of flowers per plant.....	192
f). Fresh weight of inflorescence.....	194
g). Dry weight of inflorescence.....	197
h). Diameter of flower.....	198
i). Flower stalk length.....	199
j). Diameter of flower stalk.....	201

Cont.	Page
IV. Effect of growth regulators on the chemical composition.....	203
- Nitrogen content.....	203
- Phosphorus content.....	206
- Potassium content.....	208
- Total carbohydrates.....	209
- RNA content.....	211
- DNA content.....	213
- RNA/DNA ratio.....	214
- Total phenols.....	215
Effect of both light period and growth regulators on some important vegetative and flowering characters of aster plants (comparison).....	216
SUMMARY.....	
REFERENCES.....	
ARABIC SUMMARY.	

LIST OF TABLES

No.	Page
1. The effect of exposing the aster plants to unnatural day length on the growth and flowering during the first planting date in the two seasons.....	48
2. The effect of light on the growth and flowering of aster plants during the first planting date in the two seasons.....	51
3. The effect of exposing the aster plants to unnatural day for different hours and weeks on the growth and flowering during the first planting date in the two seasons.....	54
4. The effect of exposing the aster plants to unnatural day length on the flowers characters during the first planting date in the two seasons.....	63
5. The effect of exposing the aster plants to long and short day length for different periods on the flowers characters during the first planting date in the two seasons.....	67
6. The effect of exposing the aster plants to unnatural day length for different weeks on flowers characters during the first planting date in the two seasons..	72
7. The effect of exposing the aster plants to unnatural day length on the growth and flowering during the second planting date in the two seasons.....	77
8. The effect of light on the growth and flowering of aster plants during the second planting date in the two seasons.....	80
9. The effect of exposing the aster plants to unnatural day for different hours and weeks on the growth and flowering during the second planting date in the two seasons.....	84
10. The effect of exposing the aster plants to unnatural day length on the flowers characters during the second planting date in the two seasons.....	95
11. The effect of exposing the aster plants to long and short day length for different periods on the flowers characters during the second planting date in the two seasons.....	99
12. The effect of exposing the aster plants to unnatural day length for different weeks on flowers characters during the second planting date in the seasons.....	104

LIST OF TABLES

Cont.

No.	page
13. The effect of exposing the aster planting to unnatural day length on the growth and flowering during the third planting date in the two seasons.....	108
14. The effect of light on the growth and flowering of aster plants during the third planting date in the two seasons.....	111
15. The effect of exposing the aster plants to unnatural day length for different hours and weeks on the growth and flowering during the third planting date in the two seasons.....	118
16. The effect of exposing the aster plants to unnatural day length on the flowers characters during the third planting date in the two seasons.....	124
17. The effect of exposing the aster plants to long and short day length for different periods on the flowers characters during the third planting date in the two seasons.....	129
18. The effect of exposing the aster plants to unnatural day length for different weeks on flowers characters during the third planting date in the two seasons..	132
19. Effect of light treatments on N, P, K and total carbohydrate (%) in aster plants.....	147
20. Effect of light treatments on RNA, DNA and total phynols in aster plants.....	157
21. Effect of GA ₃ and kinetin treatments on the growth and flowering of aster plants.....	188
22. Effect of GA ₃ and kinetin treatments on the flowers characters of aster plants.....	196
23. Effect of GA ₃ and kinetin on N, P, K and carbohyd- rate (%), RNA, DNA, and phenols levels in aster plants.....	205

LIST OF FIGURES

No.	Page
1. Distribution of endogenous gibberellins on chromatograms of the vegetative organs extracts of <u>Callistephus chinensis</u> (LDP) in the season of 1984 as affected by day length.....	170
2. Distribution of endogenous gibberellins on chromatograms of the vegetative organs extracts of <u>Callistephus chinensis</u> (LDP) in the season of 1984/85 as affected by day length.....	171
3. Distribution of endogenous gibberellins on chromatograms of the vegetative organs extracts of <u>Callistephus chinensis</u> (LDP) in the season of 1984/85 as affected by day length.....	172
4. Distribution of endogenous auxins/inhibitors on chromatograms of the vegetative organs extracts of <u>Callistephus chinensis</u> (LDP) in the season 1985 as affected by day length.....	176
5. Distribution of endogenous auxins/inhibitors on chromatograms of the vegetative organs extracts of <u>Callistephus chinensis</u> (LDP) in the season 1985 as affected by day length.....	177
6. Distribution of endogenous auxins/inhibitors on chromatograms of the vegetative organs extracts of <u>Callistephus chinensis</u> (LDP) in the season 1985 as affected by day length.....	178
7. Effect of day length for different periods, GA ₃ , and kinetin treatments at different concentrations on plant height.....	218
8. Effect of day length for different periods, GA ₃ , and kinetin at different concentrations on the flowering of aster plants.....	219
9. Effect of day length for different periods, GA ₃ , and kinetin at different concentrations on the length of flower stalk.....	220
10. Effect of day length for different periods, GA ₃ , and kinetin at different concentrations on number of branches.....	221
11. Effect of day length for different periods, GA ₃ , and kinetin for different concentrations on DKA content..	222
12. Effect of day length for different periods, GA ₃ , and kinetin at different concentrations on the RNA content.....	223

INTRODUCTION

China asters are annual plants native to China and Japan. They are grown in most parts of the world for cut flowers. It is considered an important cut and garden flower. The flowers have one of the best keeping quality for home use. There are big and small flowers with a great diversity of colour.

There are many essential factors affecting the growth and flowering of plants, one of these factors which controls flowering of plants is the photoperiod.

Many experiments in "electro horticulture" by Baily and others pioneer researchers showed that the flowering of several plants could be accelerated by lengthening the natural day light. At the sametime, this faster flowering was ascribed to a general acceleration of growth by additional light which causes alteration in flowering time as mentioned by many researal workers. Earlier in the last century Kelbs in Germany, came tanlizingly close to realizing the significance of day length when he made plants of Sempervivum flower by exposing them to several days of continuous light. Many plants which flower naturally in the autum were found to require exposure to days shorter than certain critical days length before they would flower. These are so called short day plants (SDP). The critical day length varied considerably between species from about sixteen hours to less

than twelve hours. Some plants had an absolute requirement for short day; as the Mamouth tobacco, but others merely flowered much faster in short days and have come to be referred to as quantitative short day plants. For both kinds, however, the shorter the day length, down to about eight hours, the faster the flowering as emphasised by many authors.

On the other hand, many spring and summer flowering plants such as radish, lettuce and hibiscus proved to be either absolute or quantitative long day plants (LDP), flowering faster the longer the day length up to sixteen hours or so.

Exposing plants to additional light or reducing the normal day light can be used to produce flowering at the desirable time of the year to cover the local and exporting demands. This method would be of great economic benefits and would increase the value of such treated cut flowers.

Besides the light treatments used, the work herein aimed to study the effect of some growth regulators as gibberellic acid (GA_3) and kinetin of different concentrations on the growth and time of flowering of aster plants.

REVIEW OF LITERATURE

I. Effect of supplementary light on the growth and flowering of *Callistephus chinensis* :

Line and Waston (1951), studied the influence of day length and temperature on the growth and flowering of *Callistephus chinensis*. They kept the young aster plants from December 6th to March 31st at 50°F and 65°F with ordinary light and ordinary light plus 5 hours of artificial light per day. They found that at 65°F long day treatment hastened flower bud initiation and bud appearance by 15 days and at 50°F. long day treatment hastened flower bud initiation by 30 days and bud appearance by 25 days.

Kofrank (1953), stated that several aster varieties were made to flower 3 months earlier than normal by planting seeds December, 27th or February 14th and giving 4 hours of supplementary light out-of-doors in California. First flower were cut March 13th, on the early planted lot, whereas normal flowering was at June 30th.

Tsukamoto et al. (1954), studied the effect of intermittent additional light in delaying flowering in short day plants and in forcing long day plants. Aster and Shasta daisies received 5 different light treatments, with Aster results were indefinite. With Shasta daisy the length of the period of illumination rather than the exact time at which light was given was all important.