

GENETIC STUDIES ON SOME MUTANTS OF BARLEY

BY

FARIEDA MOHAMED EL - SAIED

Athesis submitted in partial fulfillment

Of

the requirement for the degree of

DOCTOR OF PHILOSOPHY

in

Agricultural Science

(Genetics)

Department of Genetics
Faculty of Agriculture
Ain Shams University

1994



GENETIC STUDIES ON SOME MUTANTS OF BARLEY

BY

FARIEDA MOHAMED EL - SAIED

Athesis submitted in partial fulfillment

Of

the requirement for the degree of

DOCTOR OF PHILOSOPHY

in

Agricultural Science

(Genetics)

Department of Genetics

Faculty of Agriculture

Ain Shams University

1994



APPROVAL SHEET
GENETIC STUDIES ON SOME MUTANTS OF BARLEY

BY

FAREIDA MOHAMED EL - SAIED

B. SC. Genetics, Fac. of Agric., Ain Shams University (1977)

M. SC. Genetics, Fac. of Agric., Ain Shams University (1987)

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

Prof. Dr. A. M. Omar *A. M. Omar*

Prof. of Genetics, Fac. of Agric., Ain Shams University.

Prof. Dr. M. I. Nasr *M. I. Nasr*

Prof. and Head Department of Genetics, Fac. of Agric.

Manoufia University

Prof. Dr. S. H. Hassanein (Supervisor) *S. H. Hassanein*

Prof. of Genetics, Fac. of Agric. Ain Shams University

Date of examination : / / 1994

GENETIC STUDIES ON SOME MUTANTS OF BARLEY

BY

Farieda Mohamed El - Saied

B. Sc. (Agric.) 1977

M. Sc. Agric (Genetics) 1987

Ain Shams University

Under the supervision of :

Prof. Dr. S.H. Hassanein

Professor of Genetics.

Prof. Dr. A.Z. El- Abidin Salam

Professor and Head of the department of Genetics

ABSTRACT

The objectives of this investigation were to compare among nine mutants besides control barley cultivar Giza 119 under salt and drought stresses. Multiple comparisons among Giza 119 cultivar and mutants for different characters across salt and drought stresses, it can be concluded that similar mode of results was detected under salt as well as drought stress for germination percentage and eleven yield attributes. Frequently, M₆ and M₇ gave high records for grain yield, while M₄ showed the least

mean records under salt as well as drought stress. Because of being two-rowed, M₄ and M₈ was expected to give the lowest mean values for spike and grain yield measurements. On the other hand, mean records Giza 119 cultivar were apparently fluctuated for different characters under salt as well as drought stress.

As a conclusion, mutation treatments did not induce salt - or drought - tolerant genes. The results for protoplast viability under salt stress were more or less parallel to those of germination percentage as well as yield attributes. On the other hand, mutation treatments induced sexual genes for hordein proteins that were absent in Giza 119 cultivar. However, subsequent experimentations is needed to detect the difference in banding patterns of hordein protein when studied against stress conditions.

Key Words :

Barley ; Hordeum - vulgare ; Mutants ; Evaluation ; Salinity ; Drought - resistance ; Proteins - Hordein ; Protoplasts ; Crosses ; Conductivity test .

ACKNOWLEDGEMENT

The author wishes to express her deepest gratitude and sincere appreciation to Prof. Dr. EL SAYED HASSEN HASSANEIN, Prof. of Genetics, and Prof. Dr. A. Z. EL-ABIDIN SALAM, Prof. and Head Department of Genetics, Faculty of Agriculture, Ain Shams University, for suggesting the problem, faithful assistance, generous help, throughout the course of this study, valuable criticism and manuscript preparation.

Heart feeling thanks and gratefulness are extended to Dr. M. A. EL - GAYAR, who passed away before finishing this study.

I feel also obliged and grateful to Prof. D. SAIED ABDEL - GANY, Prof. and Head Department of Bio - Technological Sciences, Higher Institute of Agricultural Co-operation, for his continuous encouragement and his kind help and patience.

Contents

	Page
Introduction	1
Review of Literature	3
I - Effect of salinity	3
II - Effect of drought	11
III - Protoplast viability	18
IV - Electrophoretic studies	19
V - Viability of seeds	21
Materials and Methods	24
Results and Discussion	34
I - Effect of salinity	34
II - Effect of drought	58
III - Protoplast viability	84
IV - Electrophoretic studies	86
V - Viability of seeds	91
Summary	101
Literature Cited	105
Arabic Summary	120

List of Tables

	Page
Table (1) Physical properties of Maryut soil.	25
Table (2) Physiochemical properties of Maryut soil.	26
Table (3) Effect of salinity on germination percentage of barley cultivar Giza 119 and nine mutants.	36
Table (4) Effect of salinity on plant length (cm) of barley cultivar Giza 119 and nine mutants.	38
Table (5) Effect of salinity on number of plant tillers of barley cultivar Giza 119 and nine mutants.	40
Table (6) Effect of salinity on total number of spikes of barley cultivar Giza 119 and nine mutants.	42
Table (7) Effect of salinity on spike length (cm) of barley cultivar Giza 119 and nine mutants.	44
Table (8) Effect of salinity on number of grains per spike of barley cultivar Giza 119 and nine mutants.	46
Table (9) Effect of salinity on total weight of spikes g of barley cultivar Giza 119 and nine mutants.	48
Table (10) Effect of salinity on total weight of grain yield g of barley cultivar Giza 119 and nine mutants.	50
Table (11) Effect of salinity on weight of 100 grain g of barley cultivar Giza 119 and nine mutants.	52

Table (12)	Effect of salinity on total weight of straw yield g of barley cultivar Giza 119 and nine mutants.	54
Table (13)	Effect of salinity on root length (cm) of barley cultivar Giza 119 and nine mutants.	55
Table (14)	Effect of salinity on total weight of roots g of barley cultivar Giza 119 and nine mutants.	57
Table (15)	Effect of drought on germination percentage of barley cultivar Giza 119 and nine mutants.	59
Table (16)	Effect of drought on plant length (cm) of barley cultivar Giza 119 and nine mutants.	61
Table (17)	Effect of drought on number of plant tillers of barley cultivar Giza 119 and nine mutants.	64
Table (18)	Effect of drought on total number of spikes of barley cultivar Giza 119 and nine mutants.	66
Table (19)	Effect of drought on spike length (cm) of barley cultivar Giza 119 and nine mutants.	69
Table (20)	Effect of drought on number of grains per spike of barley cultivar Giza 119 and nine mutants.	71
Table (21)	Effect of drought on total weight of spikes g of barley cultivar Giza 119 and nine mutants.	74
Table (22)	Effect of drought on total weight of grain yield g of barley cultivar Giza 119 and nine mutants.	76

Table (23)	Effect of drought on weight of 100 grain g of barley cultivar Giza 119 and nine mutants.	77
Table (24)	Effect of drought on total weight of straw yield g of barley cultivar Giza 119 and nine mutants.	79
Table (25)	Effect of drought on root length (cm) of barley cultivar Giza 119 and nine mutants.	81
Table (26)	Effect of drought on total weight of roots g of barley cultivar Giza 119 and nine mutants.	83
Table (27)	Protoplast viability under different salinity concentrations for the barley cultivar Giza 119 and nine mutants.	85
Table (28)	Occurrence of hordein electrophoretic patterns according to their intensities in barley cultivar Giza 119 and nine mutants.	88
Table (29)	Viability of seeds measurement by electric conductivity test (EC- μ mhos).	93

List of Figures

	Page
Figure (1) Electrophoretic banding patterns of hordein for barley cultivar Giza 119 and nine mutants.	89
Figure (2) Multiple comparisons among barley cultivar Giza 119 and nine mutants for different characters studied regardless of salt concentration.	97
Figure (3) Multiple comparisons among barley cultivar Giza 119 and nine mutants for different characters studied across drought stress.	99

INTRODUCTION

INTRODUCTION

Barley (Hordeum vulgare) is a one of the most important cereal crops in the world. It is known to possess the ability to tolerate drought and salinity besides its lower requirements of nitrogenous fertilizers. Therefore, barley could be grown in soils under reclamation.

Mutation breeding is predominantly used in higher plants not only to produce high yielding varieties but also to obtain a collection of new mutations for gene bank activities. New genes can be obtained for conventional programs to be able to handle as a gene bank in a more efficient way (Hagberg et al ., 1963). Therefore, mutation breeding may help the plant breeder to find out genetic variability under stress condition for adapting it as a general method for plant improvement.

Salinity of arable land is an increasing problem in many irrigated, arid and semiarid areas of the world, beside being a significant factor in reducing crop productivity (Srivastava and Jana, 1984). Large areas in Egypt have been considered, agriculturally, unproductive. Evaluating plants for salt tolerance can be achieved by selecting plants possessing some desirable characteristics such as high yield components. The mechanics of screening whole plants for salt tolerance presents some problems. However, the following conditions must be considered : 1) saline soils contain a mixture of soluble salts; 2) salinity effects are nonspecific, so that the suppression of plant growth is related to the total concentration of salts in the root rhizosphere ; 3) plant salt - tolerance might change during the course of plant ontogeny, i.e. a plant might be tolerant during the seedling stage and become non - tolerant in the mature stage (Epstein et al.,

1979 ; Sayed, 1985) ; 4) salinity effects cannot be isolated from other environmental factors such as drought and heat. Due to short growth period of barely, it uses less water than other cereals, thus being more conserving of irrigation and drought conditions. A trial to minimize the water requirements of barely through the evaluation of some varieties grown under soil moisture stress was done to save water for the horizontal expansion.

The present work was carried out to investigate the effect of drought and salinity on plant growth, grain yield and its components of barely cultivar Giza 119 and its mutants.