GENETIC STUDIES ON SOME LOCAL AND INTRODUCED GENOTYPES OF LENTILS

By

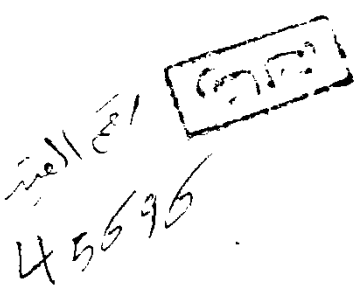
SABRY ABD ALLA MOHAMMED KHATTAB

A thesis submitted in partial fulfillment
of
the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Agricultural Science
(Agronomy)



Department of Agronomy
Faculty of Agriculture
Ain Shams University

1992

APPROVAL SHEET

GENETIC STUDIES ON SOME LOCAL AND INTRODUCED GENOTYPES OF LENTILS

By

SABRY ABD ALLA MOHAMMED KHATTAB
B. Sc. Agric., (Genetics) Ain Shams University, 1973
M. Sc. Agric., (Agronomy) Ain Shams University, 1985

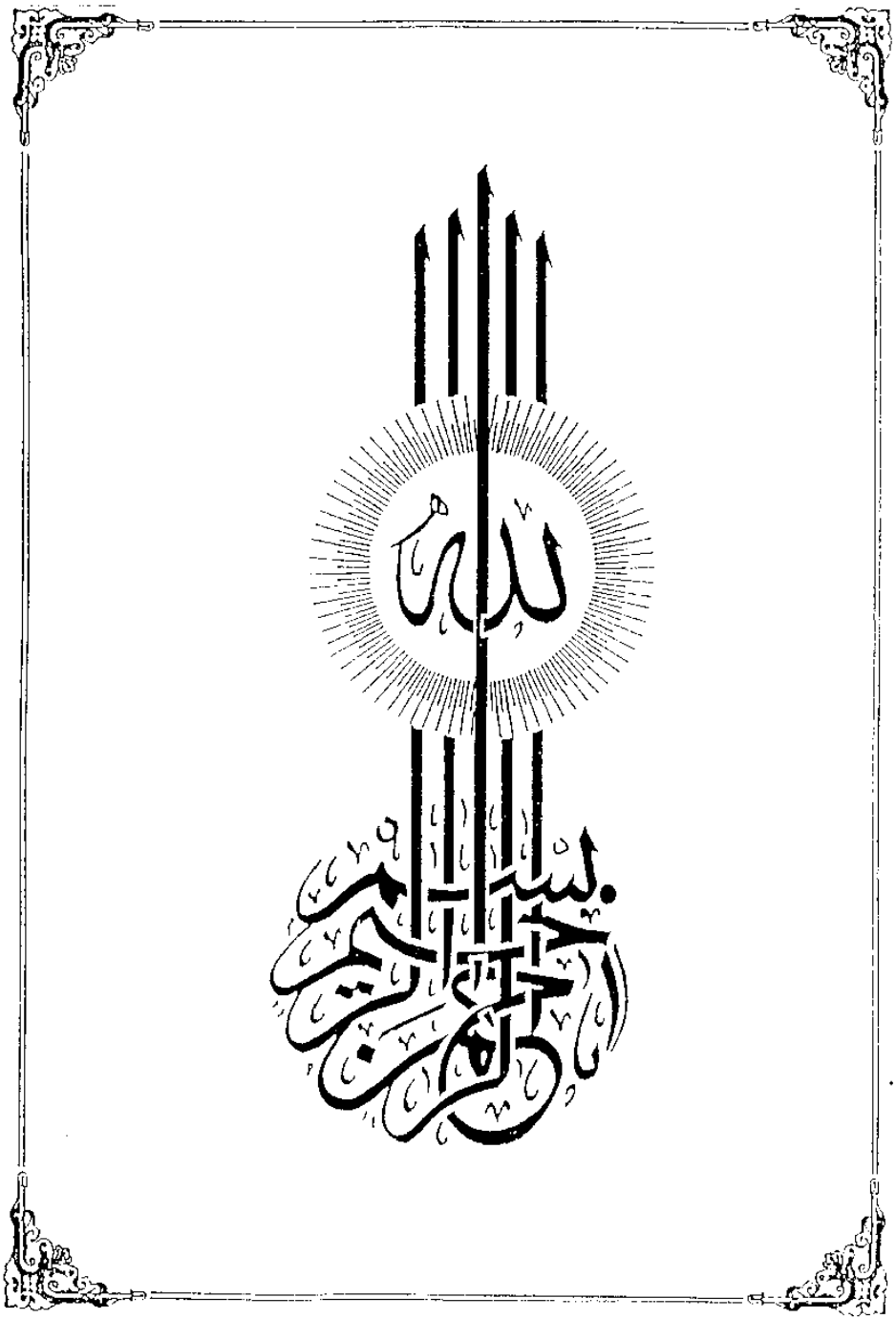
This thesis for Ph. D. degree has been approved by:

Prof. Dr. G.A. Morshed G. A. Morshed
Prof. of Agronomy, Al-Azhar Univ.

Prof. Dr. H.A. Khalil H. A. Khalil
Prof. of Agronomy, Ain Shams Univ.

Prof. Dr. A.M. Esmail A. M. Esmail
Prof. of Agronomy, Ain Shams Univ.

Date of examination : 17/12/1992



GENETIC STUDIES ON SOME LOCAL AND INTRODUCED GENOTYPES OF LENTILS

By

SABRY ABD ALLA MOHAMMED KHATTAB

B. Sc. Agric., (Genetics) Ain Shams University, 1973
M. Sc. Agric., (Agronomy) Ain Shams University, 1985

Under the supervision of:

Prof. Dr. K.A. El-Shouny
Prof. of Agron., Ain Shams Univ.

Prof. Dr. A.M. Esmail
Prof. of Agron., Ain Shams Univ.

ABSTRACT

Nineteen introduced genotypes and three local cultivars of lentil were evaluated during three successive growing seasons at two locations under two irrigation regimes (12 environments) for their, performance and yield stability, genetic variability and association among agronomic traits. Path analysis was also performed and contributions of studied variables to yield variation were detected at phenotypic and genotypic levels. Studied characters were; time to flowering, time to maturity, time from flowering to maturity, plant height, branches/plant, pods/plant, seeds/pod, seeds/plant, 100-seed weight, seed yield/plant, yield/plot, biological yield/plant and harvest index.

Combined analysis of variance revealed significant differences among genotypes in all studied traits except, biological yield. Most genotypes responded similarly over the two locations under the two irrigation regimes but responsed diffrently from one season to another indicating the importance of testing over years in lentil improvement. The genotypes ILL 4511, ILL 4513 and ILL 4612 were promising since they combined high yield and earliness. The exotic genotypes ILL 4511 and the local cultivar Giza 29 could be considered as stable genotypes. The characters showing the highest genetic coefficient of variation values were 100-seed weight, seeds/pod, pods/plant, seeds/plant, time to flowering and time to maturity while those showing the lowest values were time from flowering to maturity, plant height, branches/plant, seed yield/plant, yield/plot, biological yield and harvest index. Heritability estimates were high for 100-seed weight and seeds/pod, moderate for seeds/plant, pods/plant and time to maturity and low for other traits. Estimated expected genetic advance was very high for 100-seed weight followed by seeds/plant, pods/plant and seeds/pod but low for other traits. Seed yield/plant showed positive and significant associations with pods/plant, seeds/pod, 100-seed weight, biological yield and harvest index but negative and significant associations with time to maturity at phenotypic and genotypic levels. Path analysis revealed that 100-seed weight, pods/plant and seeds/pod had the highest contributions to yield variation either through its direct effects and (or) its indirect effects with other traits while, branching, plant height and time to maturity had minor contributions. Therefore, 100-seed weight, pods/plant and seeds/pod could be considered as main selection criteria in lentil improvement.

ACKNOWLEDGEMENT

I wish to express my sincere thanks and appreciation to Prof. Dr. Kamal A. El-Shouny and Prof. Dr. Ali M. Esmail, Professors of Agronomy Fac. of Agric., Ain Shams Univ., for their guidance, suggestions and assistance throughout the research program and for their invaluable criticism in the preparation of this manuscript.

Sincere thanks are due to Prof. Dr. Ibrahim M. Mahmoud, Prof. of Genetics and Plant Breeding at Genetics & Cytology Department, National Research Center, for encouragement and valuable advices during the completion of this work.

The writer is indepted to Dr. Kamal I. Mohammed, Lecturer at Agronomy Department, Fac. of Agric. Ain shams Univ., for his assistance in achieving the statistical analysis.

My thanks are also due to my mother, my sister, my wife, my daughter Highdey and my sons Mohammed and Abd-Allah for their patience, sacrifices and sincere encouragement.

CONTENTS

LIST OF TABLES

Cont.
No. Page

Cont.
No. Page

LIST OF FIGURES

LIST OF FIGURES

INTRODUCTION

Lentils (*Lens culinaris* Medik.) are one of the oldest food crops originated in the Fertile Crescent of the Near East. They are mentioned in the Bible and also listed in the Koran. Lentil seeds have been discovered in Egyptian tombs of the 12th Dynasty at Thebes (2400-2200 B.C.).

As a food, lentils provide available protein source which, coupled with their ability to thrive on relatively poor soils and under adverse environmental conditions, has ensured their survival as a crop species to the present day. In Egypt, lentil is considered the most important food legume crop after faba been and proved to be an important source of protein. It is important to have lentil in crop rotation because of its ability to fix the atmospheric nitrogen in association with rhizobial bacteria and thus enhances soil fertility. In addition, lentil straw is a source of fodder for feeding animals.

The cultivated area in 1964 was 85.000 fed., yielding an average of 4.16 ardab/fed. Since, 1977 the area and seed yield have been decreased to about 12.000 fed. with average production of about 2.9 ardab/fed. in 1982/83. The Egyptian government planned to reach about 100.000 fed. to achieve self-sufficiency. A report of food legume improvement in Egypt (2nd Conf., ARC. Egypt, 1984) summarized the problems of lentil in Egypt and mentioned that irrigation is one of

the major factors in lentil production and recommended 1-3 irrigations for lentil under Egyptian conditions. Rizk *et al.* (1984), described future work needed to improve lentil production in Egypt. They mentioned that there is a need to develop new varieties with early maturity, high yield and good seed quality. and emphasized the importance of screening breeding lines and introductions for adaptation to irrigation.

Therefore, the present study aims at evaluating some introduced genotypes of lentils under different environmental conditions i.e., locations, years and irrigation regimes, regarding, productivity, stability, genetic variability exists. heritability of agronomic traits and expected genetic gain from selection, correlations among yield and yield components and detecting the relative importance of agronomic traits that could guide the breeder in selection programs.

REVIEW OF LITERATURE

A significant genotype-enivronment interaction for a quantitative trait reduces the usefulness of genotype means over all environments for selecting and advancing superior genotypes to next stage of selection. The reliability of genotype performance across locations, years and irrigation regimes has an important consideration in plant breeding. Some genotypes are adapted to a broad range of environmental conditions, while others are more limited in their potential distribution. There are genotypes that perform similarly regardless of the productivity level of the environment and others whose performance is directly related to the productivity potential of the environment. Breeding for stable genotypes has received much attention recently. Several methods have been proposed for determining the stability of potential genotypes when they are tested over a series of environments.

Various authors have emphasized the usefulness of estimates of variance components as a basis for predicting the response of quantitative characters to selection in plant breeding. Progress under selection in breeding programs depends on the magnitude of heritability for the trait under selection. Genetic coefficients of variation together with a heritability estimate would seem to give the best picture of the amount of advance under selection.