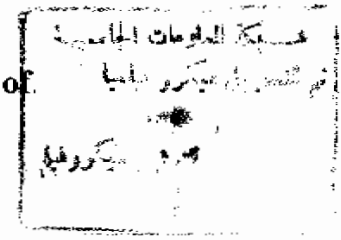
STUDIES ON BIOCHEMICAL CHANGES IN LIPIDS OF SOME MATURING AND GERMINATING OIL SEEDS

THESIS



Submitted for the Degree of Doctor of Philosophy

in

Science (Botany)

BY

Minar Mahmoud Mohamed Hassanein
(B. Sc. & M. Sc.)

Ain Shams University
Faculty of Science
Botany Department

1996

STUDIES ON BIOCHEMICAL CHANGES IN LIPIDS OF SOME MATURING AND GERMINATING OIL SEEDS

BY

Minar Mahmoud Mohamed Hassanein
B.Sc. IN SCIENCE (BOTANY-CHEMISTRY), 1980
M.Sc. IN BOTANY

Under the supervision of

Raifa A. Hassanein

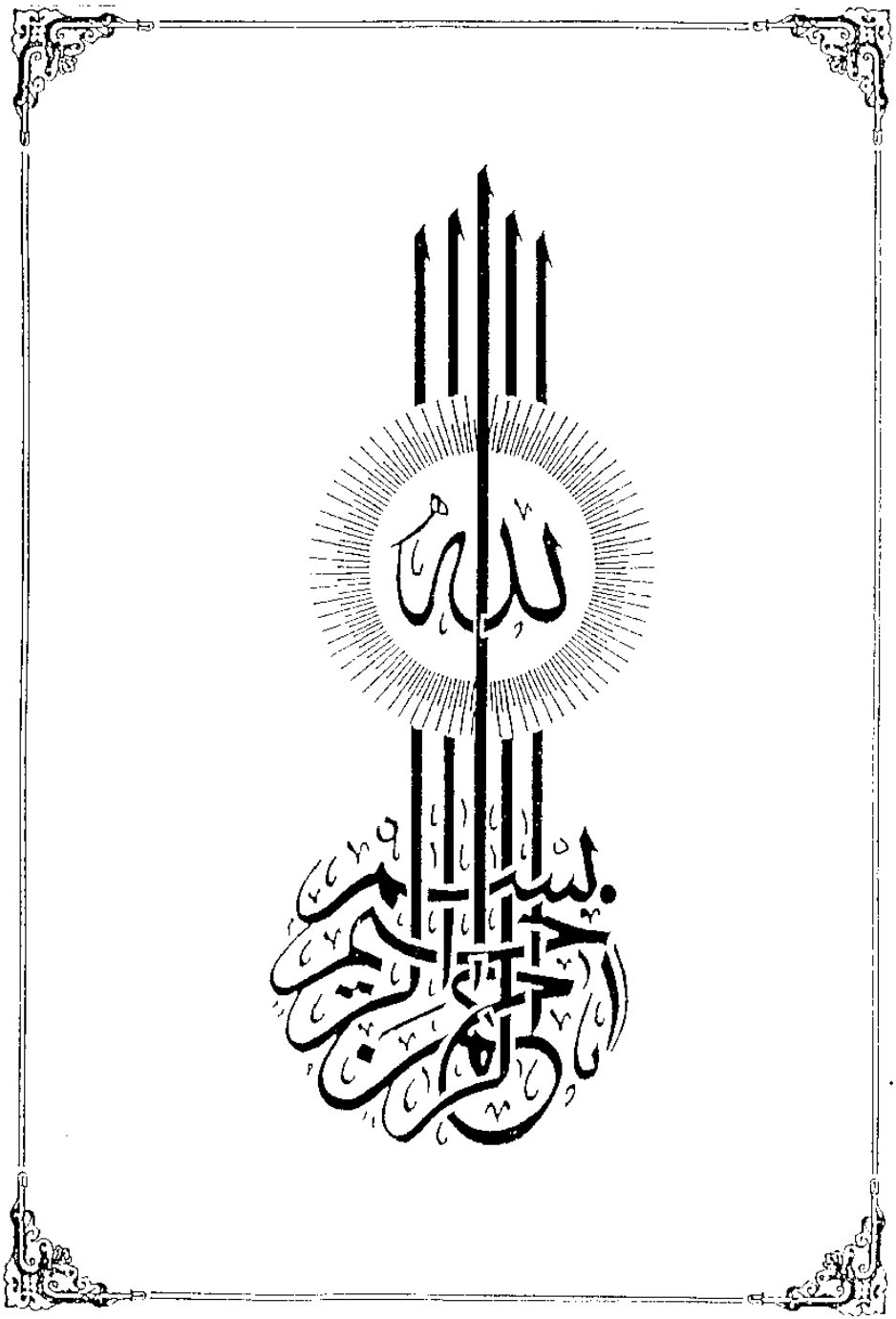
Prof. Dr. Raifa A. Hassanein.
Prof. Plant Physiology, Botany Dept.
Faculty of Science, Ain Shams Univ.

Prof. Dr. Mohamed M. H. EL-Mallah
Fats and Oils Res. Dept.,
National Research Centre-Cairo.

Safinaz El-Shami

Prof. Dr. Safinaz M. M. EL-Shami
Fats and Oils Res. Dept.,
National Research Centre-Cairo.

1996



APPROVAL SHEET

STUDIES ON BIOCHEMICAL CHANGES IN LIPIDS OF SOME MATURING AND GERMINATING OIL SEEDS

THESIS

Submmitted for The Degree of
Doctor of Philosophy

in
Science (Botany)

BY
Minar Mahmoud Mohamed Hassanein
B.SC (Botany- Chemistry), 1980
M.SC. (Botany), 1991

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

1 - Prof. Dr. Mohamed Amine Abou Sitate
Prof. Chemistry of Natural Products
Cario University, Fac. of Science

2 - Prof . Dr. Soheir Khalil Ibrahim
Prof. Plant Physiology.
National Research Centre

3 - Prof. Dr. Raifa A. Hassanein
Prof. Plant Physiology, Botany Dept.
Ain Shams University, Faculty of Science

4 - Prof. Dr. Mohamed Mahmoud El-Mallah
Prof. Chemisty of Fats and Oils
National Research Center

Date of examination / / 1996

Abstract

Minar Mahmoud Mohamed Hassanein.
Studies on biochemical changes in lipids of some maturing and germinating oil seeds.
Ph.D. Thesis, Fac. of Science,
Ain Shams Univ., Botany Dep., 1996.

In this study it was able to investigate the compositional changes of the different lipids (fatty acid, sterols, four sterol lipids, tocopherols,vitamin E and triglycerides) in maturing and germinating rape and cottonseeds. The three latter groups are of great importance in plants and have not been hitherto investigated by several investigators. It was found that there were marked changes in the amounts of lipids as well as in their compositional changes during maturation stages of each oil crop. Distinguishable changes in total amounts of lipids as well as their composition in germinating seeds (in cotyledon and axis) were also obtained under different conditions.

It was also found that GA_3 exerted very marked changes in the composition of different lipids in germinating rape and cottonseeds. In addition, salinity played a marked role in the seedling growth as well as the composition of their lipids. Advanced methods of analysis, recently developed, have been applied in the present investigation and accordingly helped too much in determining accurately the different individual lipid components even they were in minute quantities.

The lipid compositional changes in maturing and germinating seeds were interpreted in the frame of the known established metabolic pathways. On the basis of these changes in the different lipids in maturing seeds, the appropriate harvest time can be determined not only according to oil content of seeds but also to their lipid profiles during seed maturation as seed quality criterion. In addition, the compositional changes in the lipids of germinating seeds integrate with those occurring in maturing seeds during the plant life cycle of oilseed crops.

List of Abbreviations :

DAS	Days after sowing
DOG	Days of germination
FA	Fatty acid
TG	Triglyceride
MG	Monoglyceride
DG	Diglyceride
FFA	Free fatty acid
X	Linolenic acid
L	Linoleic acid
O	Oleic acid
P	Palmitic acid
S	Stearic acid
SG	Sterylglycoside
ASG	Acylated sterylglycoside
FSG	Free sterylglycoside
FS	Free sterol
AS	Acylated sterol
T	Tocopherol
GA_3	Gibberellic acid

Key words:

Gossypium barbadense c.v. Giza75 (cottonseed) - *Brassica napus* c.v.AD201/81Gi(rapeseed)Maturation - Germination - Lipids - Fatty acid, Myristic acid($C_{14:0}$), Palmitic acid ($C_{16:0}$)-Palmitoleic acid($C_{16:1}$)-Stearic acid($C_{18:0}$), Oleic acid ($C_{18:1}$)- Linoleic acid ($C_{18:2}$)-Linolenic acid ($C_{18:3}$) - Ecosanoic acid ($C_{20:0}$) - Ecosenoic acid ($C_{20:1}$)-Eicosadienoic($C_{20:2}$)-Docosanoic acid($C_{22:0}$)-Docosenoic acid ($C_{22:1}$)-Docosadienoic ($C_{22:2}$)-Tetracosanoic($C_{24:0}$)-Tetracosenoic acid($C_{24:1}$)-Triglyceride - Monoglyceride - Diglyceride-Free fatty acid-Sterol-Free and acylated sterol-Free and acylated sterylglycoside-Cholesterol-Avenasterol- Isofucosterol- Stigmasterol- Brassicasterol- Campesterol-Beta-sitosterol-7-stigmasterol-Tocopherols-Alpha-tocopherol-Beta-tocopherol-Gamma-tocopherol-Delta-tocopherol-Gibberellic acid-Salinity.

Acknowledgment

The author wishes to express her sincere thanks and appreciation to **Professor Dr. RAIFA AHMED**, Plant Physiology, Botany Department, Faculty of Science, Ain Shams University for her helpful advice, criticism and guidance throughout the preparation of this work.

The author is greatly indebted to **Prof. Dr. M. HASSAN EL-MALLAH**, Fats and Oils Res. Dept. NRC, Cairo for suggesting the topic of this thesis and for his supervision, valuable guidance in the chromatographic analysis and helpful discussions.

Thanks and appreciation are also given to **Prof. Dr. SAFINAZ EL-SHAMI**, Fats and oils Res. Dept., NRC, Cairo for her continuous guidance in analysis helpful criticism and continuous assisstance in editting and revision of this work.

Thanks are also given to **ASS. Prof. Dr. BAHAA ELDIN BASTAWY MEKKI**, Field Crops Res. Dept., NRC, Cairo for facilities during the collection of the seed samples.

Thanks are also expressed to National Research Centre, Cairo, Egypt for providing different facilities that make this work possible.

CONTENTS