## **Biography**

Name: Marwa Nabil Moustafa Abd El-Hamid

**Degree awarded:** Ph. D. (Entomology).

**Departement:** Entomology.

**Faculty:** Science.

**University:** Ain Shams University.

**Date of Graduation:** May, 2000.

Occupation: Researcher assistant, Sericutural

Research Department, Plant Protection Research Institute

Agricultural Research Center

**Date of Appointement:** February, 2005.

**Date of registeration** 

For the Ph.D. Degree: March, 2010.

# Reiationship of Phenolic Compounds In Mulberry Leaves To The Productivity of The Silkworm, *Bombyx mori* L.

### **Board of Supervision:**

#### Prof. Dr. Akila Mohamed El Shafai

Professor of Entomology, Faculty of Science, Ain Shams University.

#### Prof. Dr. Souad Morsi Mahmoud

Professor of Entomology, Plant Protection Research Institute, Agricultural Research Center.

#### Prof. Dr. Amr Ahmed Moustafa

Professor of Biochemistry, Faculty of Agriculture, Cairo University.

#### Dr.Atef Ali El Banna

Assissant Professor of Entomology, Faculty of Science, Ain Shams University

### **Approval Sheet**

## Reiationship of Phenolic Compounds In Mulberry Leaves To The Productivity of The Silkworm, *Bombyx mori* L.

## Approved By:

#### Prof. Dr. Akila Mohamed El Shafei

Professor of Entomology, Faculty of Science, Ain Shams University

#### Prof. Dr. Souad Morsi Mahmoud

Professor of Entomology, Plant Protection Research Institute, Agricultural Research Center.

#### Prof. Dr. Osman Moustafa Assal

Professor of Entomology Faculty of Agriculture, Menoufia University.

#### **Prof. Dr. Ali Ahmed Yonis**

Professor of Entomology, Faculty of Science, Cairo University.

(Committee in charge)

Date: 23 / 2 / 2014

## ACKNOWLEDGMENT

Thanks are fully due to God, most gracious, most merciful, for helping me to complete this work.

It is great pleasure to express my deepest gratitude and appreciation to **Dr**. **Akila Mohammad El- SHafei** for her dedicated supervision and advice through the course of this investigation and her guidance in writing my thesis.

Whole hearted thanks are due to **Dr**. Souad Morsi Mahmoud for supervising this work, providing the necessary facilities, Interest through the course of the study and for her support.

Also, I wish to express my deep gratitude to **Dr. Amr Ahmed Moustafa** for his valuable guidance, sincer supervision, and unlimited help during the expermintal work.

My deepest thanks are due to **Dr. Atef Ali El banna** for his effective help and encouragement, sincere supervision and reviewing the manuscript.

## DIDICATION

I dedicate this work to whom my heart felt thanks; to my lovely Mother and my son Mahmoud for their support and I can't adequate words to express my feeling towards them.

## **CONTENTS**

	Page No.
INTRODUCTION	1
LITREATURE REVIEW	4
I.1- Chemical Composition of Mulberry leaves	4
I.2- Phenolic compound	9
II.1- Effect of mulberry leaves varieties on the	15
silkworm performance.	
II.2- Food utilization and nutritional parameters	30
II.3- Biochemical Analysis	
II.3.a- Glutamate Pyruvate Tarnsaminas enzymes	34
(GPT) and Glutamate Oxaloacetate Transaminase	
(GOT)	
II.3.b- 3 Phosphoglycerate dehydrogenase (3 PGD)	39
MATERIALS AND METHODS	42
I- Silkworm Strain	42
II- Mulberry Varieties	42
III- Rearing Technique	44
IV- Assays	47

I

V- Biological Studies	48
V-1- Larval Stage.	48
V.2- Pupal Stage.	52
V.3- Adult Stage.	56
VI- Chemical Studies	57
VII- Biochemical Analysis	
VIII- Statistical Analysis.	74
Results	75
I- Mulberry .	75
I.1- General analysis	75
I.2- Total phenolic compounds and antioxidant activity.	82
II-Silkworm	87
II.1- Effect of feeding mulberry varieties on silkworm larval stage.	87
II.2- Effect of feeding mulberry varieties on the	108
silkworm pupal stage.	
II.3- Effect of feeding mulberry varieties on silkworm adult stage.	125

IV- Effect of feeding mulberry varieties on	132
biochemical analysis of silkworm larvae.	
DISCUSSION	137
I- Mulberry leaves	137
1.1- Chemical analysis of mulberry leaves	137
1.2- Total phenolic compounds	146
1.3- Antioxidant activity of the different mulberry varieties	149
II.1- Effect of feeding mulberry varieties on	150
silkworm larval stage.	
II.2- Effect of feeding mulberry varieties on	159
silkworm pupal stage.	
II.3- Effect of feeding mulberry varieties on	165
silkworm adult stage	
II.4- Effect of feeding with mulberry varieties	167
on enzymatic activity	
1- SUMMARY	172
2- REFERENCES	179

## LIST OF FIGURES

Fig. No.	Title	No.
1	The five mulberry verities	43
2	Silkworm rearing and silkworm trays	47
3	Rotary tray of cocooning	47
4	Silkworm meeting and oviposition	56
5	Ethanolic extraction of plnts undaer investigation	60
6	Percent of total protein, total ash and total fiber of mulberry varieties	79
7	Percent of moisture content and total hydrolysable carbohydrate	80
8	Percent of total crude fat of mulberry varieties	81
9	Total phenolic compounds of the mulberry leaves	85
10	Antioxidant activity of the mulberry leaves.	86
11	Effect of feeding with five mulberry varieties on Larval duration of the silkworm, <i>Bombyx mori</i> L.	92
12	Effect of feeding with five mulberry varieties on weight of The larvea of the silkworm, <i>Bombyx mori</i> L. during larval instar.	93

13	Effect of feeding with five mulberry varieties on the growth rate of the silkworm, <i>Bombyx mori</i> L.	94
14	Effect of feeding with five mulberry varieties on Effective rate of silkworm,  Bombyx mori L.	97
15	Weight of Consumed and aproximat digested food of the 4 <sup>th</sup> instar larva feeding on five mulberry varieties	104
16	Percent of AD, ECI and ECD of the 4 <sup>th</sup> instar larva feeding on five mulberry varieties.	105
17	Weight of consumed and aproximate digested food of the 5 <sup>th</sup> instar larva feeding on five mulberry varieties	106
18	Percent of AD, ECI and ECD of the 5 <sup>th</sup> instar larva feeding on five mulberry varieties.	107
19	Effect of feeding on five mulberry varieties on cocoon weight and cocoon shell weight $( \circlearrowleft \text{ and } \hookrightarrow )$ of silkworm, $Bombyx\ mori\ L.$	111
20	Effect of feeding on five mulberry varieties on cocoon shell ratio of silkworm, <i>Bombyx mori</i> L.	112
21	Effect of feeding with five mulberry varieties on the Cocooning percentage and pupation ratio of silkworm, <i>Bombyx mori</i> L.	116
22	Effect of feeding with five mulberry varieties on the Pupal weight (♂ and ♀) of silkworm <i>Bombyx mori</i> L.	117

23	Effect of feeding with five mulberry varieties on the Absolute Silk Yield of silkworm <i>Bombyx mori</i> L.	118
24	Effect of feeding of the five mulberry varieties on the consumed food of 1000 larvae.	121
25	Effect of feeding of the five mulberry varieties on the fresh cocoon yield per 1000 larvae.	122
26	Effect of feeding with the five mulberry leaf varieties on the length of silk filament of silkworm <i>Bombyx mori</i> L.	127
27	Effect of feeding with the five mulberry varieties on the weight of reelable filament length of silkworm <i>Bombyx mori</i> L.	128
28	Effect of feeding with the five mulberry varieties on the size of reeled thread of silkworm <i>Bombyx mori</i> L.	129
29	Effect of feeding with the five mulberry varieties on the silk ratio of silkworm, Bombyx mori L.	130
30	Effect of feeding with the five mulberry leaf varieties on the fecundity of silkworm, <i>Bombyx mori</i> L.	131
31	Biochemical analysis of Transaminases(GPT & GOT) enzymes in heamolymph of 5 <sup>th</sup> instar larvae of silkworm race fed on five mulberry varieties.	135
32	Biochemical analysis of 3- Phosphoglycerate dehydrogenase) enzyme in heamolymph of 5 <sup>th</sup> instar larvae of silkworm race fed on five mulberry varieties.	136

## LIST OF TABLES

Table No.	Title	Page No.
1	General analysis of five mulberry varieties	78
2	The total phenolic compounds and antioxidant activity of the leaves of mulberry varieties	84
3	The effect of feeding of silkworm larvae on five mulberry varieties on larval duration, weight and growth rat	91
4	The effect of feeding with five mulberry varieties on Effective Rate of Rearing (E.R.R) of silkworm, <i>Bombyx mori</i> L.	96
5	Consumption efficiency of the 4 <sup>th</sup> instar larva fed on five mulberry varieties.	102
6	Consumption efficiency of the 5 <sup>th</sup> instar larva fed on five mulberry varieties.	103
7	The effect of feeding on five mulberry varieties on the cocoon weight, shell weight and shell ratio of silkworm, <i>Bombyx mori</i> L.	110
8	Effect of feeding with five mulberry varieties on the cocooning percentage, pupation ratio pupal weight and Absolute Silk Yield (A.S.Y%) of silkworm larvae <i>Bombyx mori</i> L.	115
9	The effect of feeding of the five mulberry varieties on the consumed food, fresh cocoon yield per 1000 larvae and the leaf cocoon ratio.	120
10	Effect of feeding with the five mulberry leaf varieties on the length, weight, size of silk filament, silk ratio and fecundity of silkworm, <i>Bombyx mori</i> L.	126
11	The biochemical analysis of (Glutamate Pyruvate Transaminase GPT and Glutamate Oxaloacetae Transaminase GOT and 3-Phosphoglycerate dehydrogenase) enzymes in heamolymph of 5 <sup>th</sup> instar larvae of silkworm race fed on five mulberry varieties	134

#### INTRODUCTION

The mulberry silkworm is an economically important insect in silk industry. It is development depending on increase in body weight and accumulation of biochemical constitute like protein, amino acid and enzymes like, protease, dehydrogenase and transaminase.

Silk, as one of the natural resources for human life has occupied a place of pride in the society. There have been incessant endeavors to improve the silk both in terms of quality and quantity and these have been a spectacular accomplishment of feats in the field of sericulture. One of the inputs that play a decisive role in the success of silk crop is mulberry variety (Biram Saheb et al., 2005).

Morus, commonly known as mulberry, is a group of monoecions trees / shrubs belongs to the family Moraceae. Mulberry, is cultivated for its foliage yield because its leaves are the only food source for silkworm, *B*ombyx *mori* L.

Different varieties of mulberry may have compositional differences and might lead to varying effects on growth and silk