



**UNIVERSITI PUTRA MALAYSIA**

***BIOTYPE AND INSECTICIDE RESISTANCE STATUS OF *Bemisia tabaci*  
(GENNADIUS) POPULATIONS IN MALAYSIA***

**MOHAMMAD SHADMANY**

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**BIOTYPE AND INSECTICIDE RESISTANCE STATUS OF *Bemisia tabaci*  
(GENNADIUS) POPULATIONS IN MALAYSIA**

**By**

**MOHAMMAD SHADMANY**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in  
Fulfillment of the Requirements for the Degree of Master of Science**

**February 2013**

## **DEDICATION**

**I Lovingly Dedicate This Thesis to My Parents, for Their Immeasurable Supports  
in All Steps of My Life.**

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

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**February 2013**

**Chair: Prof Dzolkhifli Omar, PhD**

**Faculty: Agriculture**

*Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) is one of the most destructive pests of mainly vegetables and ornamental crops around the world. It is a cryptic species complex with at least 32 species being discovered so far. Two of the species namely B and Q are well-known invasive biotypes in this complex which upon introduction to a region can establish and partially or completely displace endemic biotypes. Both invasive biotypes are renowned for insecticide resistance potential with the Q-type being even more resistance prone than B biotype. Biotypes status of this pest in Malaysia has not been studied thoroughly and only very limited information are available thus far. Cases of poor control of this pest coupled with frequent population explosions despite application of insecticides have been reported in Malaysia in the past which can be due to high insecticide resistance development. This study aimed to reveal cryptic species status of *B. tabaci* in some regions of Malaysia and to evaluate insecticide resistance status of some populations against important classes of insecticides used to control them. For biotype identification, samples were collected from 10 states on different hosts and

biotypes were determined using mitochondrial cytochrome oxidase subunit 1 (mtCO1) marker . In addition to the previously identified biotype for this region, Asia 1, three other biotypes namely Q, China 2, and Asia II 7 are reported for the first time in Malaysia. Biotypes other than invasive one show the genetic diversity of *B. tabaci* in the region. The most important finding of this study is the identification of the invasive Q biotype from Cameron Highlands, Pahang and Kundasang, Sabah. The invasive biotype can have serious negative consequences for the vegetable and ornamental production industries of the country. For insecticide resistance assessment, six populations from different states of Malaysia were selected, biotype labeled and their adults were bioassayed with five insecticides namely profenofos, cypermethrin, imidacloprid, diafenthiuron, and pymetrozine using leaf dip method. All populations for this study were Asia 1 biotype except Cameron Highlands which was Q biotype. The mortality was recorded and data were subjected to probit analysis to establish the median lethal concentration ( $LC_{50}$ ). The Q-type *B. tabaci* population from Cameron Highlands showed the highest level of resistance for all insecticides except cypermethrin. The lowest  $LC_{50}$  was 76.2 ppm of profenofos while the highest was 1631.9 ppm of diafenthiuron. The resistance ratio was then calculated based on the most susceptible population among all populations. Very high level of resistance that can compromise field efficacy was detected in population from Selangor against diafenthiuron (resistance ratio of 185) and population from Cameron Highlands against diafenthiuron (resistance ratio of 354.7) and pymetrozine (resistance ratio of 192.9). Identification of very high level of insecticide resistance especially in the Q biotype from Cameron Highlands necessitates modification of the current management approaches.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**BIOTIP DAN STATUS KERESISTANAN POPULASI *Bemisia tabaci*  
(GENNADIUS) (HEMIPTERA: ALEYRODIDAE) TERHADAP RACUN  
SERANGGA DI MALAYSIA**

Oleh

**MOHAMMAD SHADMANY**

**Februari 2013**

**Pengerusi: Prof Dzolkhifli Omar, PhD**

**Fakulti: Pertanian**

*Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) adalah salah satu perosak yang paling penting terutamanya sayur-sayuran dan tanaman hiasan di seluruh dunia. Ia merupakan kompleks spesies dengan sekurang-kurangnya 32 spesies yang ditemui setakat ini. Dua spesies iaitu B dan Q adalah terkenal sebagai biotip invasif di kompleks ini di mana apabila memasuki sesuatu rantau ia mampu membiak dan sebahagian atau sepenuhnya menggantikan biotip endemik. Kedua-dua biotip invasif ini terkenal dengan potensi keresistance terhadap racun serangga dan jenis-Q mempunyai keresistance lebih tinggi daripada biotip B. Status biotip perosak ini di Malaysia tidak dikaji dengan teliti dan hanya maklumat yang sangat terhad sahaja boleh didapati setakat ini. Walaupun racun serangga digunakan, kes pengawalan yang tidak memuaskan ke atas perosak ini ditambah pula dengan populasi yang tinggi berkembang dalam masa yang singkat telah dilaporkan di Malaysia pada masa lalu. Ini mungkin disebabkan oleh perkembangan keresistance terhadap racun serangga yang tinggi. Kajian ini bertujuan untuk

mendedahkan status spesis *B. tabaci* di beberapa kawasan Malaysia dan untuk menilai status koresistans beberapa populasi terhadap racun serangga, ke atas kelas racun serangga yang penting yang digunakan untuk mengawal mereka. Sampel telah dikumpulkan dari 10 buah negeri pada perumah yang berbeza dan biotip telah ditentu menggunakan penanda 'mitochondrial cytochrome oxidase subunit 1' (mtCO1). Di samping biotip yang telah dikenal pasti di rantau ini, Asia 1, tiga biotip lain iaitu Q, China 2, dan Asia II 7 telah dilaporkan buat kali pertama di Malaysia. Biotip selain jenis invasif menunjukkan kepelbagaian genetik *B. tabaci* di rantau ini. Penemuan yang paling penting dalam kajian ini adalah pengenalan biotip invasif Q di Cameron Highlands, Pahang dan Kundasang, Sabah. Biotip invasif boleh memberi kesan negatif yang serius kepada industri sayur-sayuran dan tanaman hiasan negara. Untuk penilaian koresistans terhadap racun serangga, enam populasi dari negeri yang berlainan di Malaysia telah dipilih. Biotip dilabel dan bioassai ke atas serangga dewasa dengan lima racun serangga iaitu profenofos, cypermethrin, imidacloprid, diafenthiuron, dan pymetrozine menggunakan kaedah celup daun telah dijalankan. Semua populasi untuk kajian ini adalah biotip Asia 1 kecuali dari Cameron Highlands iaitu biotip Q. Kematian direkodkan dan data didedahkan kepada analisis probit untuk mendapat 'median lethal concentration' (LC<sub>50</sub>). Populasi jenis-Q *B. tabaci* dari Cameron Highlands menunjukkan tahap koresistans yang tertinggi untuk semua racun serangga kecuali cypermethrin. LC<sub>50</sub> terendah ialah 76.2 ppm bagi profenofos manakala tertinggi adalah 1631.9 ppm bagi diafenthiuron. Nisbah koresistans kemudiannya dikira berdasarkan populasi yang paling rentang di kalangan semua populasi. Tahap koresistans yang sangat tinggi telah dikesan di kalangan populasi dari Selangor iaitu terhadap diafenthiuron (nisbah koresistans 185), populasi dari Cameron Highlands terhadap diafenthiuron (nisbah

keresistanan 354.7) dan pymetrozine (nisbah keresistanan 192.9). Pengenalpastian tahap keresistanan terhadap racun serangga yang sangat tinggi terutama pada biotip Q dari Cameron Highlands memerlukan pengubahsuaian ke atas pendekatan pengurusan serangga semasa.





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I certify that a Thesis Examination Committee has met on 07 February 2013 to conduct the final examination of Mohammad Shadmany on his thesis entitled “Biotype and Insecticide Resistance Status of *Bemisia tabaci* (Gennadius) Populations in Malaysia” in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998.

The committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

**Hafidzi bin Mohd Noor, PhD**

Associate Professor  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Chairman)

**Nur Azura binti Adam, PhD**

Senior Lecturer  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Internal Examiner)

**Lau Wei Hong, PhD**

Lecturer  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Internal Examiner)

**Idris Abd Ghani, PhD**

Professor  
Faculty of Science Technology  
Universiti Kebangsaan Malaysia  
(External Examiner)



---

**SEOW HENG FONG, PhD**

Professor and Deputy Dean  
Scholl of Graduate Studies  
Universiti Putra Malaysia

Date:

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirements for the degree of Master of Science. The members of the Supervisory Committee were as follows:

**Dzolkhifli Omar, PhD**

Professor  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Chairman)

**Rita Muhamad, PhD**

Professor  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Member)

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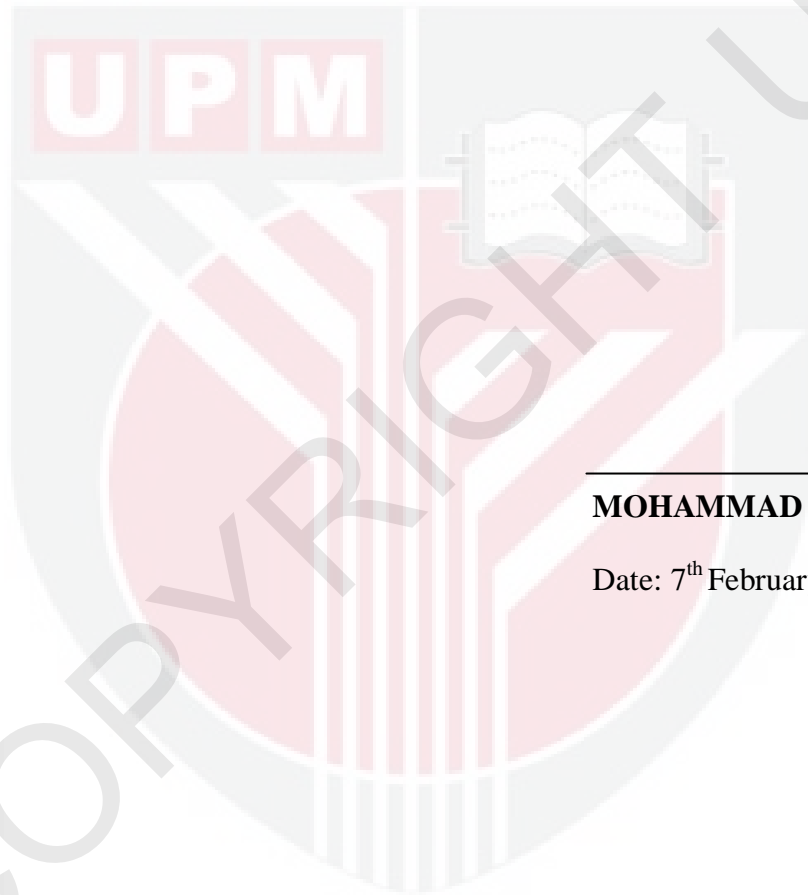
**BUJANG BIN KIM HUAT, PhD**

Professor and Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date:

## DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



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**MOHAMMAD SHADMANY**

Date: 7<sup>th</sup> February 2013

## TABLE OF CONTENTS

		Page
	<b>ABSTRACT</b>	iii
	<b>ABSTRAK</b>	v
	<b>ACKNOWLEDGEMENTS</b>	viii
	<b>APPROVAL</b>	ix
	<b>DECLARATION</b>	xi
	<b>LIST OF TABLES</b>	xiv
	<b>LIST OF FIGURES</b>	xv
	<b>LIST OF ABBREVIATIONS</b>	xvi
	<b>CHAPTER</b>	
1	<b>INTRODUCTION</b>	1
2	<b>LITERATURE REVIEW</b>	5
	2.1 <i>Bemisia tabaci</i> Biology, Ecology, and Damage	5
	2.2 Problem in Whiteflies Systematics	8
	2.3 <i>Bemisia tabaci</i> Species Status	9
	2.4 Methods Used to Identify Variation in <i>B. tabaci</i> Complex	14
	2.5 Problems Associated with the Use of Molecular Markers in <i>B. tabaci</i> Identification and Classification	20
	2.6 <i>Bemisia tabaci</i> Biotype Status in Malaysia	21
	2.7 Insecticide Resistance Mechanisms	22
	2.7.1 Identified Mechanisms of Resistance in <i>B. tabaci</i>	23
	2.8 Current Status of Insecticide Resistance in <i>B. tabaci</i>	26
	2.8.1 <i>Bemisia tabaci</i> Resistance Status in Malaysia	28
	2.9 Insecticide Resistance Monitoring, Detection, and Documentation	29
	2.9.1 Examples of Monitoring and Documentation Projects	33
	2.10 Insecticide Resistance Management	34
	2.10.1 A Case of Successful <i>B. tabaci</i> Resistance Management	34
3	<b>BIOTYPE IDENTIFICATION OF <i>B. TABACI</i></b>	36
	3.1 Introduction	36
	3.2 Materials and methods	37
	3.2.1 Sampling	37
	3.2.2 DNA Extraction	39
	3.2.3 mtCO1 Gene Amplification	39
	3.2.4 Sequencing	41
	3.2.5 Data Analysis	42
	3.2.6 Sequence Alignment	42
	3.2.7 Biotype Labeling and Phylogenetic Tree	43

	Construction	
3.3	Results and Discussion	44
	3.3.1 Biotpe Identification and Phylogenetic Tree Construction	44
	3.3.2 Pairwise Distance Analysis	44
	3.3.3 Phylogenetic Analysis	47
	3.3.4 <i>Bemisia tabaci</i> Biotpes	48
3.4	Conclusion	56
4	<b>INSECTICIDE RESISTANCE STATUS OF <i>B. TABACI</i></b>	57
	4.1 Introduction	57
	4.2 Materials and methods	58
	4.2.1 Insecticide Resistance Documentation	58
	4.2.2 Sampling	58
	4.2.3 Insect Culture	59
	4.2.4 Insecticides	60
	4.2.5 Bioassay	61
	4.2.5.1 Leaf Dip Bioassay Method	61
	4.2.6 Data Analysis	63
	4.3 Results and Discussion	65
	4.3.1 Profenofos	68
	4.3.2 Cypermethrin	68
	4.3.3 Imidacloprid	69
	4.3.4 Diafenthuron	69
	4.3.5 Pymetrozine	70
	4.3.6 Insecticide Resistance	71
	4.4 Conclusion	82
5	<b>SUMMARY, CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH</b>	83
	<b>REFERENCES/BIBLIOGRAPHY</b>	88
	<b>APPENDICES</b>	110
	<b>BIODATA OF STUDENT</b>	122