

HERBICIDE RESISTANCE OF *Echinochloa crus-galli* (L.)
Burm., *Echinochloa colona* (L.) Link. AND *Lepidochloa*
obtusata (L.) Nees IN RICE FIELDS OF MELAYU

HARTINI BINTI MAHMUD

FAKULTI SAINS DAN TEKNOLOGI
KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA
2005

HERBICIDE RESISTANCE OF *Echinochloa crus-galli* (L.) Beauv, *Echinochloa colona* (L.) Link AND *Leptochloa chinensis* (L.) Nees IN RICE FIELDS OF
KELANTAN

By

Hartini Binti Mahmud

Research Report submitted in partial fulfillment of
the requirements for the degree of
Bachelor of Applied Science (Biodiversity Conservation and Management)

Department of Biological Sciences
Faculty of Science and Technology
KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA
2005

This project should be cited as:

Hartini, M. 2005. Herbicide resistance of *Echinochloa crus-galli* (L.) Beauv, *Echinochloa colona* (L.) Link and *Leptochloa chinensis* (L.) Nees in rice fields of Kelantan. Undergraduate thesis, Bachelor of Applied Sciences in Biodiversity Conservation and Management, Faculty of Science and Technology, Kolej Universiti Sains dan Teknologi Malaysia, Terengganu. 82p.

No part of this project report may be produced by any mechanical, photographic, or electronic process, or in the form of phonographic recording, nor may it be stored in a retrieval system, transmitted, or otherwise copied for public or private use, without written permission from the author and the supervisor (s) of the project.

1100036851



JABATAN SAINS BIOLOGI
FAKULTI SAINS DAN TEKNOLOGI
KOLEJ UNIVERSITI SAINS DAN TEKNOLOGI MALAYSIA

PENGAKUAN DAN PENGESAHAN LAPORAN
PROJEK PENYELIDIKAN I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: Herbicide Resistance of *Echinochloa crus-galli* (L.) Beauv, *Echinochloa colona* (L.) Link and *Leptochloa chinensis* (L.) Nees in Rice Fields of Kelantan oleh Hartini Binti Mahmud , no. matrik: Uk 6718 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Biologi sebagai memenuhi sebahagian daripada keperluan memperoleh ijazah Sarjana Muda Sains Gunaan (Pemuliharaan dan Pengurusan Biodiversiti) , Fakulti Sains dan Teknologi, Kolej Universiti Sains dan Teknologi Malaysia.

Disahkan oleh:

Penyelia Utama

Dr. Chuah Tse Seng
Pensyarah

Nama:

Jabatan Agroteknologi

Cop Rasmi:

Fakulti Agroteknologi dan Sains Makanan
Kolej Universiti Sains dan Teknologi Malaysia
21030 Kuala Terengganu.

Tarikh:

7/4/05

Penyelia Kedua (jika ada)

DR. CHA THYE SAN

Nama:

Pensyarah

Cop Rasmi

Jabatan Sains Biologi
Fakulti Sains dan Teknologi
Kolej Universiti Sains dan Teknologi Malaysia
(KUSTEM)
21030 Kuala Terengganu.

Tarikh:

7/4/2005

Ketua Jabatan Sains Biologi

Nama:

Cop Rasmi:

PROF. MADYA DR. NAKISAH BT. MAT AMIN
Ketua

Jabatan Sains Biologi
Fakulti Sains dan Teknologi
Kolej Universiti Sains dan Teknologi Malaysia
(KUSTEM)
21030 Kuala Terengganu.

Tarikh:

9/4/05

ACKNOWLEDGEMENT

In the name of Allah, The Most Gracious, The Most Merciful

Praise to the Allah Almighty for his blessings, which enable me to complete this thesis. First of all, I would like to express my deepest appreciation and very thankful to my main supervisor, Dr. Chuah Tse Seng for his invaluable guidance, constructive and support throughout this study. Sincere thanks are also due to my second supervisor, Dr. Cha Thye San for the advice, suggestion and comments.

Special appreciation to my beloved parents, my sisters and sisters' in-law, my brothers and brothers in-law for their unending love, support and encouragement to full fill this thesis. I would like to express my acknowledgement to my housemate, my coursemate (Biodiversity) and my collageus friends for their moral support.

It is my pleasure to thank to all officers from all locations who gave me information during doing my research especially to Kemubu Agriculture Development Authority (KADA). To the staff of Department Biology and mechanical, it owes all of them my sincerest gratitude. Last but not least, to all others who have contributed in one way or another to my work, I would like to say thank you for all the help and encouragement and may Allah bless all of you from the bottom of my heart.

TABLE OF CONTENTS

	PAGES
ACKNOWLEDGEMENT	ii
LIST OF TABLES	v
LIST OF FIGURES	vi
LIST OF SYMBOLS	vii
LIST OF APPENDICES	viii
ABSTRACT	x
ABSTRAK	xi
CHAPTER 1	INTRODUCTION
1.0	Intoduction 1
1.1	Objectives 3
CHAPTER 2	LITERATURE REVIEW
2.1	Weeds in paddy fields 4
2.1.1	<i>Echinochloa crus-galli</i> 6
2.1.2	<i>Echinochloa colona</i> 7
2.1.3	<i>Leptochloa chinensis</i> 8
2.2	Herbicides 13
2.2.1	Sethoxydim 17

2.2.3 Fenoxaprop	21
2.3 Why herbicide resistance evolves in paddy fields	22
2.3.1 Mechanism of resistance	23
2.3.2 Herbicide resistance cases in worldwide	24
2.3.3 Herbicide resistance cases in Malaysia	27
2.3.4 Screening for herbicide resistance	30
CHAPTER 3 METHODOLOGY	
3.1 Seed Collections	32
3.2 Herbicides	33
3.3 Seed processing and seed sowing	33
3.4 Screening for herbicide resistance (R) and susceptible biotype (S)	33
3.5 Planting confirmed R and S biotypes	34
3.6 Dose-response experiments	34
CHAPTER 4 RESULT	36
CHAPTER 5 DISCUSSION	49
CHAPTER 6 CONCLUSION	58
REFERENCES	61
APPENDICES	66
VITAE CURICULUM	82

LIST OF TABLE	PAGES
Table 2.2 (a) Number of herbicides groups arising from individual toxiphore	15
Table 2.2 (b) Herbicides groups site of action	16
Table 2.3.2 (a) Herbicides resistances cases globally for <i>Echinochloa crus-galli</i>	25
Table 2.3.2 (b) Herbicides resistances cases globally for <i>Echinochloa colona</i>	26
Table 2.3.2 (c) Herbicides resistances cases globally for <i>Leptochloa chinensis</i>	26
Table 2.3.3 (a) Herbicides resistances cases at rice fields in Malaysia	29
Table 4.1 Screening of sethoxydim resistance in <i>Leptochloa chinensis</i> , <i>Echinochloa crus-galli</i> , <i>Echinochloa colona</i> from rice fields at five different locations in Kelantan	38
Table 4.2 Screening of propanil resistance in <i>Leptochloa chinensis</i> , <i>Echinochloa</i> <i>crus-galli</i> , <i>Echinochloa colona</i> from rice fields at five different locations in Kelantan	38
Table 4.3 Screening of fenoxaprop resistance in <i>Leptochloa chinensis</i> , <i>Echinochloa crus-galli</i> , <i>Echinochloa colona</i> from rice fields at five different locations in Kelantan	39

LIST OF FIGURE	PAGE
Figure 2.1.1: <i>Echinochloa crus-galli</i> (L.) Beauv	10
Figure 2.1.2: <i>Echinochloa colona</i> (L.) Link	11
Figure 2.1.3: <i>Leptochloa chinensis</i> (L.) Nees	12
Figure 2.2(a): Structural formula for sethoxydim	21
Figure 2.2(b): Structural formula for propanil	21
Figure 2.2(b): Structural formula for fenoxaprop	22

LIST OF SYMBOLS

Ppm	Part per million
ml	Mililitre
%	Percent
Ha	Hectare
a.i.	Active ingredient
L	Litre
Cm	Centimetre
⁰ C	Centigrade degres
Kpa	Kilopascal
2, 4 D	2, 4 –dichlorophenoxy acetic acid
DCA	Dichloroaniline
AAA	Aryl aclamidase

LIST OF APPENDICES	PAGE
APPENDICES A	
Appendix A.1: Figure of <i>Echinochloa crus-galli</i>	66
Appendix A.2: Figure of <i>Echinochloa colona</i>	67
Appendix A.3: Figure of <i>Leptochloa chinensis</i>	68
Appendix A.4 :Figure of <i>Echinochloa oryzicola</i>	69
Appendix A.5: Figure of <i>Echinochloa glabrescens</i>	69
Appendix A.6: Figure of <i>Eleusine indica</i>	70
Appendix A.7: Figure of <i>Iscaehmun rugosom</i>	70
Appendix A.8: Figure of <i>Rottboellia cochinchinensis</i>	71
Appendix A.9: Figure of <i>Cyperus iria</i>	71
Appendix A.10: Figure of <i>Fimbristylis milacea</i>	72
Appendix A.11: Figure of <i>Sphenoclea zeylanica</i>	72
Appendix A.12: Figure of <i>Jussica linifolia</i>	73
Appendix A.13: Figure of <i>Mimulus orbicularis</i>	73
Appendix A.14: Figure of <i>Sagittaria guyanensis</i>	74
Appendix A.15: Figure of <i>Bacopa monnieri</i>	74

Appendix A.16: Figure of 100 %; discs retained their origin color (green)	75
Appendix A.17: Figure of 75 % of the leaf disc area remained green (pale yellow)	75
Appendix A.18: Figure of 50 % of the leaf disc area remained green (yellow)	76
Appendix A.19: Figure of 25 % of the leaf disc area remained green (pale brown)	76
Appendix A.20: Figure of 0 % for complete discoloration (brown)	77
Appendix A.21: Map Of Kelantan with nine districts	78
Appendix A.22: Map of Location KADA at Kelantan	79

APPENDICES B

Appendix B.1: Weed species reported as important in rice in various countries of the world	80
Appendix B.2: Name of weed species found in rice fields in Malaysia	81

ABSTRACT

Seed of weed species such as *Leptochloa chinensis* (L.) Nees, *Echinochloa colona* (L.) Link and *Echinochloa crus-galli* (L.) Beauv were collected from Kelantan state at five different locations of rice fields. All of these weed species were collected from PPK Kubang Sepat, PPK Alor Mas, PPK Nilam Puri, PPK Bakat Baru and Rantau Panjang. Whole plant assays at recommended dosage were conducted on these weed species with three herbicides namely propanil, sethoxydim and fenoxaprop in the greenhouse. *Leptochloa chinensis* biotypes from PPK Kubang Sepat and Rantau Panjang biotypes were resistant to both propanil and sethoxydim. *Echinochloa colona* from PPK Nilam Puri and *Echinochloa crus-galli* from PPK Kubang Sepat had developed resistance towards fenoxaprop and propanil, respectively. Subsequent studies involving leaf discs assay at the laboratory revealed that these resistant biotypes were two times more resistant compared to their respective susceptible biotypes.

KERINTANGAN TERHADAP HERBISID DI DALAM SAWAH PADI DI KELANTAN

ABSTRAK

Biji rumpai seperti *Leptochloa chinensis*, *Echinochloa colona* dan *Echinochloa crus-galli* dikutip dari lima lokasi sawah padi di negeri Kelantan. Kesemua spesies tersebut diambil dari PPK Kubang Sepat, PPK Alor Mas, PPK Nilam Puri, PPK Bakat Baru dan Rantau Panjang. Pegasaian tumbuhan dijalankan ke atas kesemua spesies rumpai dengan menguji tiga herbisid iaitu propanil, setoksidim dan fenokaprop pada dos yang disyorkan di rumah kaca. *Leptochloa chinensis* dari PPK Kubang Sepat dan Rantau Panjang adalah rintang terhadap propanil dan sethoxydim. *Echinochloa crus-galli* dari PPK Kubang Sepat didapati rintang terhadap propanil manakala *Echinochloa colona* dari PPK Nilam Puri pula adalah rintang terhadap fenoxaprop. Kajian lanjutan menggunakan pengasaan cakera daun menunjukkan bahawa biotip rintang adalah dua kali ganda lebih rintang berbanding biotip rentan.